FINAL REPORT

TO THE

STATE OF CALIFORNIA AIR RESOURCES BOARD

RESEARCH DIVISION

SACRAMENTO, CALIFORNIA 95812

AN INTERINDUSTRY ANALYSIS OF INDUSTRIAL AIR POLLUTANTS

FOR THE

STATE AND SUBSTATE REGIONS OF CALIFORNIA

Prepared Under Agreement #A7-143-30

The statements and conclusions in this report are those of the contractor and not necessarily those of the California Air Resources Board.

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CONVERSION FACTORS

English to Metric System of Measurement

Quantity	English unit	Multiply by	To get metric equivalent
Length	inches (in)	25.4	millimetres (mm)
		.0254	metres (m)
	feet (ft)	.3048	metres (m)
	miles (mi)	1.6093	kilometres (km)
Area	square inches (in^2)	6.4516×10^{-4}	square metres (m^2)
	square feet (ft^2)	.092903	square metres (m^2)
	acres	4046.9	square metres (m^2)
		.40469	hectares (ha)
		.40469	square hectometres (hm^2)
		.0040469	square kilometres (km^2)
	square miles (mi^2)	2.590	square kilometres (km^2)
Volume	gallons (gal)	3.7854	litres (l)
		.0037854	cubic metres (m^3)
	million gallons (10^6 gal)	3785.4	cubic metres (m^3)
	cubic feet (ft^3)	.028317	cubic metres (m^3)
	cubic yards (yd^3)	.76455	cubic metres (m^3)
	acre-feet (ac-ft)	1233.5	cubic metres (m^3)
		.0012335	cubic hectometres (hm^3)
		1.233×10^{-6}	cubic kilometres (km^3)
Volume/Time (Flow)	cubic feet per second (ft^3/s)	28.317	litres per second (l/s)
		.028317	cubic metres per second (m^3/s)
	gallons per minute (gal/min)	.06309	litres per second (l/s)
		6.309×10^{-5}	cubic metres per second (m^3/s)
	million gallons per day (mgd)	.043813	cubic metres per second (m^3/s)
Mass	pounds (lb)	.45359	kilograms (kg)
	tons (short, 2,000 lb)	.90718	tonne (t)
		907.18	kilograms (kg)
Power	horsepower (hp)	0.7460	kilowatts (kW)
Pressure	pounds per square inch (psi)	6894.8	pascal (Pa)
Temperature	Degrees Fahrenheit (F)	$\frac{1F - 32}{1.8} = 1C$	Degrees Celsius (°C)

1. Abstract

Regional interindustry economic models were developed for the four major air basins of the State of California for the year 1976. The models show a possible 154 detailed economic sectors for each basin. Primary air emissions data provided by the Air Resources Board for each of five critical pollutants (CO, HC, NOx, SOx, TSP) were processed and selectively merged with fuel combustion data derived for each sector of a statewide model. These data were subsequently adjusted to conform to air basin emission totals by major economic categories for each pollutant. The statewide emissions totals derived for each detailed input-output sector were converted to a set of pollution coefficients in tons of pollutant emitted per million dollars of product or service delivered. Similar procedures were applied to each of the air basins. These direct coefficients were related to the sectors of each regional model in a manner which permitted the direct and indirect industry linkages to be analyzed. The direct and indirect and induced emissions generated per million dollars of product or services delivered to consumers were calculated and ranked, and compared for the state and for each air basin. The methods used are probably the best that can be devised for placing consistency checks on primary air emissions data and for estimating the environmental impacts of regional economic development proposals as required by the Clean Air Act of 1977.

2. Acknowledgements

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3. Executive Summary

The purposes of the present study were essentially twofold. The principal purpose was to demonstrate the usefulness of regional inter-industry analysis for investigating and quantifying the direct and indirect air pollution impacts which may result from changes in regional levels of industrial production. A second purpose of the study was to relate available primary and secondary source data on air pollution emissions to detailed sectors of the California economy as a whole and to those of the major air basins. The available air emissions data were used to develop air pollution coefficients (pollutants dispersed in tons per million dollars of product output) for the state and for the air basins for five critical classes of pollutants. 1) SOx - sulphur oxides; 2) NOx - nitrogen oxides; 3) CO - carbon monoxide; 4) HC - hydrocarbons; 5) TSP - total suspended particulates.

In any industrialized economy, questions of environmental improvements or environmental degradation are fundamentally related to economics. State and regional air quality control programs are established for a variety of pollutors in order to preserve or attain the ambient air quality standards. For efficient air quality planning and comprehensive program impact analysis, the linkages between air pollutant emissions and economic activity must be identified and evaluated. Such economic impact analyses are required by the Clean Air Act of 1977 and can be facilitated by input-output studies.

Interindustry, or input-output, economics describes the form of economic analysis which has as its basis the study of the technological relations of industrial production. The foundation of the interindustry system is the input-output table. A typical input-output table shows how the output of each industry is distributed among other industries as inputs for further processing. The table also shows the output going to final consumption, or use, in various categories.

An input-output table is essentially a double entry accounting system in which the rows show the product output distribution to other industries and to final use, while the columns show the purchases made by each industry from all other industries to produce its product. The entries in the table

are usually in dollar values and represent the actual physical purchases of goods and services taking place in the economy during the accounting period. If additional data are available on the physical units of inputs and outputs associated with the production processes such as man-years of labor, acre-feet of water, or tons of wastes emitted, it is possible to transform an input-output table into an interactions table showing these physical relationships on an interindustry basis. Thus, the input-output method of analysis, when applied to a regional economy, can be used to reveal the emissions directly resulting from a specific economic activity as well as the "indirect" emissions generated by other industries as they supply needed inputs on an interindustry basis.

It is often a relatively straightforward matter to identify the new industrial growth patterns taking place within a regional economy, for example, the expansion or introduction of a large automobile assembly facility. It is not necessarily a straightforward problem to assess the total impact of the new facility on regional ambient air quality standards. Although the direct emissions of the facility must be considered under the existing regulatory framework, the potential may exist for significant increases in "indirect" emissions resulting from the increased activity in the local steel, petrochemical, and electric utility industries as they increase their production to serve the needs of the new assembly plant.

A comprehensive interindustry air resource model can delineate and quantify the increases in direct and indirect emissions and allow for the reassessment of control strategies on the support industries such that the induced economic activity does not result in a degradation of the air environment.

In order to accomplish the purposes of the study regional interindustry transactions tables for the year 1976 were constructed for the following air basins:

1. South Coast
2. San Diego
3. San Joaquin Valley
4. The San Francisco Bay Area

A 157 sector input-output model of the California State economy was constructed for the base year 1976 by staff members of the California State Department of Water Resources. This Statewide model was then disaggregated regionally by DWR into the 12 hydrologic basins of the State.

For purposes of constructing the regional interindustry models for air basins, the Department of Water Resources data on final demands and gross outputs were used wherever possible, with modifications. In the majority of cases, both air and hydrologic basins are comprised of counties.

In the present study the South Coast Air Basin Model was constructed by aggregating the DWR data on production and final demands for the Los Angeles and Santa Ana hydrologic basins and then subtracting from this aggregation the gross outputs and final demands estimated for Ventura County. Since San Diego County is coincident with the San Diego Air Basin the County data were used without change to develop the air basin input-output model. The San Joaquin Air Basin Model was prepared by modifying the Department of Water Resources data for the Tulare Lake Hydrologic Basin and adding the demands and output data for the four counties of Madera, Merced, Stanislaus and San Joaquin. Finally, to structure the San Francisco Air Basin Model, the DWR data on final demands and gross outputs for the San Francisco Hydrologic Basin were taken to be adequately representative of the air basin boundaries and were used without modification.

Air pollutant emission coefficients were then developed in tons of pollutants emitted per million dollars of gross output for each of the sectors of the four air basins and of the California State economy as a whole.

To develop the coefficients, numerous sources of emissions data were consulted but ultimately the primary data compiled by the California Air Resources Board and local agencies were used with certain adjustment and control procedures. The procedures used are the best that can be devised without resorting to an extensive analysis of the primary data along with the abatement practices prevailing in each air basin. The procedures have merit in that they attempt to capture the differences in emission levels among air basins.

The adjusted emission coefficients derived for detailed sectors were used in conjunction with each air basin input-output model and the direct plus indirect plus induced emissions were calculated and ranked for each of the five pollutants. The rankings indicate in tons per million dollars of deliveries the total pollutant load generated in the air basin economy directly and indirectly for each industry. The values of the emission coefficients derived for the various industries seem to be reasonable in terms of orders of magnitude. The rankings indicate rather clearly those industries with the higher pollutant levels per million dollar of product deliveries. With all industries on a comparable basis, the disparities in emission levels in many instances are pronounced.

From the empirical results some observations may be made. First, for each pollutant, the sectors with the highest associated total emission rates will vary between basins. Second, in each basin (and in the statewide economy as well) the ranking of the economic sectors by total emissions differs from the rankings by direct emissions. Third, the ratio of total to direct emissions for a particular sector will vary across basins due to variations in direct emission rates and differences in industrial structure.

The ranking of the direct and indirect emission coefficients and subsequent interbasin comparisons place consistency checks on the basic emission data which cannot be achieved with other methods. The results serve to highlight the need for improvements in the emission inventory data gathering and processing methods.

Although it has not been done in the study, the emission coefficients could be related to employment and income levels for each basin and additional coefficients derived which ranked each industry in terms of employment or income generated per ton of pollutant emitted. In this manner those industries which generate the lowest income and employment levels per ton of pollutant emitted could be analyzed in greater detail as part of a broader policy analysis concerned with the potential growth pattern of the respective air basins.

The Clean Air Act, as amended, August 1977, states that an applicable implementation plan shall include an identification and analysis of the

air quality, health, welfare, economic, energy, and social effects of the plan (Sec. 172). Complying with these requirements is difficult because of the lack of adequate data. This is especially the case when the data relate to indirect effects.

The models developed in the present study provide data which are directly useful for air quality management decision making. The input-output models, when coupled with an econometric forecasting model, can estimate growth factors for 152 California industries which can then be used to help estimate future emission levels and ambient air quality.

4. Recommendations

The present study made use of a Statewide input-output model for 1976 developed by the State Department of Water Resources primarily for water planning analysis. The sectoring of the model was designed to emphasize the agricultural industries and other water intensive industries. The Air Resources Board emissions inventory data are gathered at the 4-digit Standard Industrial Classification level of detail. It would be appropriate to retain the detail available for the primary emissions data and match these with input-output models similarly structured at the 4-digit SIC level of detail. When proposals are made for plant sitings or plant expansion they are not made for a complex mix or group of 4-digit SIC codes. They are made for a single 4-digit industry and the environmental impacts should be calculated for that industry alone. The present model is too aggregated for obtaining detailed impacts for any specific 4-digit industries. A major recommendation is to restructure the air basin models with the principal air polluting sectors being shown at the 4-digit SIC detail.

A second but equally important recommendation is to process and analyze the 4-digit SIC emissions inventory data and form a series of direct pollution coefficients for each air basin. These should be ranked and compared and the results analyzed statistically to determine interbasin and statewide differences among the important polluting industries at the 4-digit level of detail.

A third recommendation is that the necessary technical competence for carrying out of this type of research be developed by Air Resources Board staff members.

5. Introduction

In 1973 Professor Wassily Leontief of Harvard University was awarded the Nobel Prize in Economics for his development of input-output economics. As an outgrowth of Leontief's work, detailed input-output (I-O) models revealing the structural relationships within the U.S. economy are routinely prepared for each census year by the Department of Commerce. At the sub-national level the input-output approach has rapidly developed to become a cornerstone of regional economics (1,2,3). Because the technique allows the analyst to trace in considerable detail the reverberations of an initial stimulus to the economy, the technique has become essential to comprehensive economic and environmental impact analyses (4,5,6).

6. Input-Output Models

(i) I-O Models: What Are They?

A regional input-output model provides a sharply focussed still-life picture of a regional economy. It reveals, as generally no other approach does, the ways in which the various sectors of the region's economy are meshed together and are linked to the potential sources of economic stimuli: the so-called 'final demands' of household consumption, private capital formation, government purchases and exports.

The number of sectors into which the regional economy is divided depends on several factors including the purpose to which the model is to be put and the resources at the disposal of the analyst constructing the model. The I-O model of the metropolitan St. Louis region contains fewer than 30 sectors while the greater Philadelphia I-O model possesses approximately 500. To gain a better understanding of the basic I-O model let us focus our attention on the simple, hypothetical 3-sector model of Figure 1, keeping

in mind that generally no analyst would set out to construct an I-O model of so few sectors--too much information regarding the structure of the economy would be lost at such a high degree of aggregation.

Figure 1

Hypothetical Transactions Table ($\$10^6$)

Purchasers / Sellers		Intermediate Sales: Agriculture	Intermediate Sales: Manufacturing	Intermediate Sales: Services	Final Sales: Households	Final Sales: Investment	Final Sales: Government	Final Sales: Exports	Total Output
Intermediate Purchases	Agriculture	10	5	5	10	5	10	25	70
	Manufacturing	20	30	25	5	5	5	10	100
	Services	5	10	10	35	5	10	5	80
Final Purchases	Imports	5	15	5					
	Value Added	30	40	35					
Total Outlay		70	100	80					

The first aspect of this picture of the economy to note is that the production sectors in the model (in this case, Agriculture, Manufacturing and Services) encompass the entirety of the economic activity in the region. Each of the sectors is represented as both a seller and a purchaser. That is, each sector buys inputs from, and sells its output to, each of the other sectors. It is from this double-entry accounting feature that the model derives its name "input-output."

The data shown in the model represent the economic transactions that have occurred over a particular period, generally of one year duration. These data yield significant information for each sector's sale and purchase linkages with the rest of the economy. Reading along the row of, say, the Manufacturing sector we see that during the year for which the model was constructed, the Manufacturing sector sold $20 million to Agriculture (e.g., farm machinery), $30 million to Manufacturing (e.g., frames from the steel industry to the auto industry), and $25 million to services (e.g., electronic computers). In addition to these intermediate sales--sales of product which will undergo further processing within the region, Manufacturing also made significant final sales--sales which will not undergo further regional processing. The sector sold $5 million to Households (e.g., autos), $5 million to Investment (e.g., inventories), $5 million to Government (e.g., office equipment), and $10 million to Exports (e.g., construction equipment to the rest of the country and to, say, France). Total sales (intermediate plus final) of the Manufacturing sector sum to $100 million.

As the rows reveal the sales distribution of the various sectors, the columns reveal the purchase patterns. Again looking at Manufacturing, it can be seen that this sector purchased $4 million from Agriculture (e.g.,

raw foodstuffs), $30 million from Manufacturing (e.g., steel frames by the auto industry), $10 million from Services (e.g., accounting services), $15 million from Imports (e.g., forest products produced outside the region), and $40 million from Value Added (e.g., wages). Total inputs to Manufacturing are $100 million, a figure identical to the Total Output of the sector. Total Output (Sales) is equal to Total Input (Purchases) for each of the three sectors because of the following identity:

Total Sales Revenue = Total Costs + Profit

The Transactions of Figure 1 account for all sales revenue and costs for each particular sector and for the residual, balancing item of profits which is part of Value Added. (Value Added is composed principally of wages and salaries, profits, rents, interest, dividends and business taxes.)

In the above manner the input-output transactions table presents a snapshot of the structure of the economy, highlighting the interrelationships between the various sectors of the economy. Although this picture by itself contributes significantly to our understanding of the workings of the economy, the usefulness of the I-O model extends far beyond this contribution.

(ii) I-O Models: What They Can Do

The I-O model can prove to be invaluable to impact analysis and to forecasting. It can readily be shown that the model will allow us to predict the effects throughout the economy of changes in the output of any one sector. Suppose at the national level there is an increase in the demand for Chevrolets. To fill this order (or to replace inventories if the order is filled from existing stocks), General Motors will have to buy, among other items, steel, glass and rubber. To make these deliveries to GM, the Steel sector will have to purchase inputs from the Coal Mining and Iron Ore Mining sectors;

the Glass sector will have to increase its inputs from the Stone & Clay and Primary Nonferrous Metals sectors and the Rubber sector must increase its purchases from the Chemicals and Fabricated Metals sectors. (Of course the I-O model would also tell us that each sector affected by the initial GM order would require inputs of power and transportation and warehousing and a variety of other goods and services as well.)

In turn, each of these sectors supporting the increased production of steel, glass and rubber will have to buy a wide range of inputs, which will initiate further rounds of transactions between sectors. Added to these reverberations of intersectoral sales and purchases is the increased consumption of households which results from the increased wage bill in the economy. Among the increased purchases by households may well be additional automobiles which would initiate the particular chain reaction just described all over again. However, these reverberations or rounds of spending will eventually end because in each round portions of the money circulating will "leak" from the economy as import purchases and savings.

In short, each purchase from a particular sector by a firm or by a final consumer initiates a series of reverberations throughout the economy. What the input-output model does is to trace through the maze of reverberations or interactions to show, when the rounds of spending have come to an end, what the increased output of each sector will be, given the initial increase in one of the final demand categories. (If final demand decreases, the I-O model will reveal the decreased output for the economy sector by sector.) Further, if the relationship between each sector's output and emission of air pollutants is known, the value of the input-output analytic approach to environmental analysis becomes increasingly evident. Let us

return to this point after looking more closely at the workings of the basic I-O model.

To illustrate how the I-O approach performs the systems analysis of a change in one of its sectors, let us look again at our hypothetical 3 sector model. Let's assume that the Government purchases of the output of the Manufacturing sector has increased by $10,000 and let us trace the effects upon the sales (and subsequently on the air emissions) of each of the 3 sectors of the regional economy. As a first step in the analysis, let us construct from the transactions table of Figure 1 a table of direct requirements, as shown in Figure 2.

Figure 2

Table of Direct Requirements Per Dollar of Total Outlay

	Ag.	Man.	Serv.
Ag.	.14	.05	.06
Man.	.29	.30	.31
Serv.	.07	.10	.12

Each column of coefficients is determined by dividing the first 3 elements in a particular column of the transactions table by the Total Input figure of that column. For example, the coefficients in the Agriculture column were calculated as 10/70 = .14, 20/70 = .29 and 5/70 = .07. Each of these coefficients shows the amount of input required from the row sector for the column sector to product a dollar of output. Hence on the average Manufacturing requires 5 cents of inputs from Agriculture for every dollar of output produced. The coefficients in each column thus represent the "recipe" for each column sector's output. If we make the critical assumption that these recipes do not change over the period of analysis (a point

to which we shall later return), we can perform the systems analysis described above, which reveals the accumulated effect on each sector of a stimulus (positive or negative) to any one of the sectors.

In our illustrative case of a $10,000 increase in government purchases of output from Manufacturing, the Manufacturing sector will first expand its output by $10,000 to meet this increase in final demand. To do so the sector will have to make the following purchases:

	Man. $10,000
Ag.	10,000 x .05 = $ 500
Man.	10,000 x .30 = 3,000
Serv.	10,000 x .10 = 1,000

However, in order to produce this supporting output, each sector will require the following inputs:

Ag.: $500	Man.: $3,000	Serv.: $1,000	Total
Ag. 500 x .14 = $ 70	3000 x .05 = $150	1000 x .06 = $ 60	$ 280
Man. 500 x .29 = 145	3000 x .30 = 900	1000 x .31 = 310	1,355
Serv. 500 x .07 = 35	3000 x .10 = 300	1000 x .12 = 120	455

These requirements will set off a third round of spending as follows:

Ag. $280	Man.: $1,355	Serv.: $455	Total
Ag. 280 x .14 = $39.20	1355 x .05 = $67.75	455 x .06 = $27.30	$134.25
Man. 280 x .29 = 81.20	1355 x .30 = 406.50	455 x .31 = 141.05	628.75
Serv. 280 x .07 = 19.60	1355 x .10 = 135.50	455 x .12 = 54.60	209.70

These rounds of spending will continue with each round becoming increasingly weaker in its impact. The total increase in sales for each sector resulting from the initial stimulus to the Manufacturing sector of $10,000 in government purchases can be estimated from the model by summing the

increases in sector sales in each round:

Agriculture: \$500 + 280 + 134.25 + ... = \$1000

Manufacturing: \$10,000 + 3000 + 1355 + 628.75 + ... = \$15,5000

Services: \$1000 + 455 + 209.75 + ... = \$1900.

Although the approach is very straightforward, it is a very tedious and time consuming one, but one which, of course, the computer does very quickly and efficiently.[1] With the aid of a computer generated matrix inversion, as described in Section (iv) of this introduction, a table of total requirements can be constructed. From this table we may read directly the total (direct plus indirect) impact on each sector of a unit change in the final demand for any one particular sector. The table of total requirements for our hypothetical example is shown in Figure 3.

Figure 3

Table of Direct Plus Indirect Requirements

Per Dollar of Delivery to Final Demands

	Ag.	Man.	Serv.
Ag.	1.21	0.10	0.12
Man.	0.57	1.55	0.60
Serv.	0.16	0.19	1.22

Reading down the Manufacturing column of the table shown as Figure 3, we note that for a one dollar increase in the final demands for Manufacturing, Agriculture's sales increase by \$0.10, Manufacturing sales increase by \$1.55, and sales by the Service sector increase by \$0.19.

The above input-output approach or systems analysis can readily be extended to the examination of air pollutant emissions. Suppose, for example, that we wish to be able to predict the increased amount of nitrous oxides

emitted into the air basin of a particular region as a result of a stimulus to that region's economy. Assume that for our 3 sector economy the relationship between tons of NOx emitted per million dollars of output is as follows:

Agriculture	15
Manufacturing	20
Services	0

From these emission coefficients and the total requirements data of Figure 3, we can see that a million dollar increase in the demand for, say, Agriculture will result in an increase in NOx emissions in the region in the order of 1.21 x 15 + 0.57 x 20 + 0.16 x 0 = 29.55 tons.

To emphasize the value of the systems or general equilibrium approach of the I-O technique we have deliberately (and a bit unrealistically) chosen to assign an NOx emission coefficient of zero to the Service sector. Given these coefficients, a superficial analysis of a $1 million increase in the final demand for Services would conclude that no increase in NOx would be forthcoming since the sector is perfectly "clean." However, from our knowledge of the interrelationships of this clean sector with the other not-so-clean sectors of the economy, we know that some increase in NOx emissions will indeed occur. Again from the emission coefficients and from the results in Figure 3 we may formulate estimates of what that increase will be: 0.12 x 15 + 0.60 x 20 + 1.22 x 0 = 3.0 tons.[2] Although the direct impact in terms of NOx emissions of the increase in final demand for the Service sector is zero, the indirect impact (the impact generated via the intersector sales-purchase relationships) is significantly greater than

zero. As will be seen in the body of this report, for several regional economic sectors the indirect air pollutant emissions as revealed by the I-O model exceed the direct.

(iii) I-O Models: What They Cannot Do

The principal assumptions of the input-output model are 1) homogeneous activity in each sector; 2) constant returns to scale (i.e., if output is to increase by a certain percentage, all inputs must be increased by the same percentage) and 3) constancy of the direct requirements coefficients (and the emission coefficients if the latter are incorporated). It is the assumption of constant coefficients that is the crucial assumption of the model. The direct requirements or economic coefficients may change over time due to technological progress, changes in the relative prices of substitutable inputs, changes in the product mix of a particular sector (contrary to assumption #1 above, any one particular sector may be composed of activities with differing input patterns) and, at the subnational level, the location of new firms.

The basic I-O model as it has been described in the Introduction and as it has been employed in the study of air emissions herein reported is not designed to forecast phenomena, such as technological change, which result in changes in the model's economic coefficients. Although considerable research has been undertaken to develop techniques to update the model's coefficients (7,8,9), such updating procedures require substantial additional inputs to make appropriate adjustments to the model.

In regard to pollutant emissions two assumptions are generally made. First, given that the coefficients are based on average emissions per unit of output, it is assumed that any increase in output does not alter the

established relationship between emissions and output--the relationship is assumed to be linear and homogeneous of the first degree. Second, it is assumed that other sources of change in the emission coefficients, such as technical advances, do not occur within the period of analysis. As is the case with the I-O direct requirements coefficients, any significant influences on the values of these coefficients must be analyzed independently. The model as utilized herein is related to stationary emission sources and those transportation activities related to production.[3] Consideration of emissions emanating from sources related to household activities are not included.

Finally, it should be noted that the model may be used for forecasting purposes by projecting the model's exogenous variables (the final demand categories of household, investment, government and exports). However, given accurate economic and emission coefficients, the model's results will only be as valid as are the final demand projections. For this reason the I-O model is sometimes joined with econometric forecasting models that generate projections of the final demand categories. In some such cases the econometric models will also provide forecasts of price changes which bear directly on potential changes in the I-O direct requirements coefficients.

(iv) Mathematical Summary of the I-O Model

As previously shown, the I-O model records each sale in the economy as "intermediate" or "final". Total sales or output of any sector of an n-sector model can thus be expressed as:

$$\sum_{j=1}^{n} x_{ij} + y_i = x_i \qquad (i=1,\ldots,n) \qquad (1)$$

where x_{ij} = the value of the output of sector i purchased by sector j,

y_i = the final demand for the output of sector i, and

x_i = the value of the total output of sector i.

The economy is thus conceptualized by n linear equations, each equation expressing the transactions of a particular sector with the processing sectors, and with final demands (sales). Equation (2) represents the major portion of our first table, the Transactions Table. As such, it is merely a set of balance equations or accounting identities. To complete the mathematical description of the Transactions Table we write:

$$\sum_{j=1}^{n} x_{ij} + p_j = x_j \qquad (j=1,\ldots,n) \qquad (2)$$

where p_j = final purchase (purchases of imports and other factors) by sector j.

$$x_i = x_j \qquad \text{for all } i=j \qquad (3)$$

The second Table of the I-O model, the Table of Direct Requirements can be expressed as the matrix (a_{ij}) where

$$a_{ij} = \frac{x_{ij}}{x_j} \qquad (i, j=1,\ldots,n) \qquad (4)$$

Substituting (4) into (1) yields

$$x_i = \sum_{j=1}^{n} a_{ij}x_j + y_i \qquad (i=1,\ldots,n) \qquad (5)$$

which may be expressed more compactly as

$$X = AX + Y \qquad (6)$$

where

$$x = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} ; \qquad A = \begin{bmatrix} a_{11}a_{12}\cdots a_{1n} \\ a_{21}a_{22}\cdots a_{2n} \\ \vdots \quad\quad \vdots \\ a_{n1}a_{n2}\cdots a_{nn} \end{bmatrix} ; \qquad Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} \qquad (7)$$

It may now be shown that total output minus intermediate demand equals the net output of the system or final demand.

$$X - AX = (I-A)X = Y \qquad (8)$$

where I is an n x n identity matrix. Given the exogenous or final demands on the economy, it is possible to solve the system for total outputs,

$$X = (I-A)^{-1}Y \qquad (9)$$

where $(I-A)^{-1}$ is the third table of the I-O model, the Table of Direct Plus Indirect Requirements, which is frequently written in transposed form, $(I-A)^{-1}_T$, for convenience of reading tabular information.

(v) Summary

The input-output model of a particular economy is designed to reveal the interrelationships between the various sectors of that economy. Because the model provides estimates of the change in the output of each

and every sector in the economy resulting from an economic change in any one of the sectors, it is often invaluable to economic impact analysis. With the addition of air emission coefficients to the model, the changes in total emissions in a regional air basin emanating from a change in any one sector's production can also be estimated on a sector by sector basis. The crucial assumptions of the input-output approach to the analysis of air emissions are the constancy of the I-O model's economic and emission coefficients.

7. Regional Input-Output Modeling

(i) Regional Trading Patterns - Central Place Theory

If an input-output analysis is to be applied to a given geographic region, certain basic conditions must be met. The fundamental assumption that the regional industries trade with one another should be fulfilled. This can generally be determined from data relating to the regional trading areas delineated by the Bureau of Economic Analysis (BEA), U.S. Department of Commerce. The U.S. has been divided geographically into 173 trading areas, or groups of counties, defined as BEA Economic Areas. These delineations were made on the basis of "central place theory with its emphasis on cities as the hubs around and within which integrated economic activity concentrates..." (10). A grouping of these areas, or any logical portion, or hub, would qualify as a meaningful input-output region for analytical purposes. The nature of the regional input-output model as outlined in Section 2 is such that it not only traces the flows of goods and services among the local industries but also provides estimates of trade flows in to and out of the local area for the various sectors of the model.

The composite trading area which constitutes the State of California is made up of eight BEA economic areas. These are BEA areas: 164-San Diego; 165-Los Angeles-Long Beach; 166-Fresno; 167-Stockton; 168-Sacramento; 169-Redding; 170-Eureka; 171-San Francisco-Oakland. A map showing the California counties and BEA economic areas is presented as Figure 4.

(ii) Modifying National Technical Coefficients to Represent Local Interindustry Structure

If the trading conditions among the local industries are satisfac-

FIGURE 4

California BEA Economic Areas

torily met, the ensuing task is the application of modified or scaled or adjusted national technical coefficients in order to simulate the inter-industry structure of the local economy. This problem has been studied in depth and at least eight different approaches for modifying national coefficients have been systematically evaluated by Morrison and Smith (11). The so-called RAS (12) method has been ranked first in overall qualifications. The Simple Location Quotient (SLQ) method ranked second in three out of five possible tests. However, the RAS method (13) can only be used if gross trade flows by detailed sector can be estimated independently for the region under study.

The California state input-output table for 1976 was constructed on the basis of both the SLQ and RAS approaches. The input-output tables for the four air basins were based principally on the SLQ method.

The SLQ method requires three major data items as inputs for structuring the regional input-output model. These are: (1) a detailed national inter-industry transactions table which has been transformed to a gross domestic base. The table should include a value added vector which has been decomposed to show Employee Compensation, Property Type Income, and Indirect Business Taxes; (2) a column vector of regional gross domestic outputs; (3) the regional final demand vectors. The latter are typically: Personal Consumption Expenditure (PCE); Capital Formation (GPFCF); Federal Government Expenditures (FGE); State and Local Government Expenditures (S&LGE); and Foreign Exports (FE).

If national coefficients are to be used as a basis for developing regional technical coefficients, it is necessary to maintain much of the sec-

tor detail provided by the national tables (14). Walderhaug (15) has stressed the need for maintaining such detail. Karaska (16) and Drake et al. (17) found that the variation in input-output coefficients increased with the level of aggregation.

To illustrate the need for detail, particularly in the manufacturing sectors, the Food and Kindred Products sector SIC 20 may be used as an example. The 2-digit SIC Food and Kindred Products sector consists of forty-eight 4-digit codes, ranging from abattoirs to the preparation of spices and extracts. Each have widely differing inputs. If the national coefficients for the aggregated Food and Kindred Products sector are applied to estimate inputs for, let us say, a local bakery or confectionary, the chances for error are obvious. In order to minimize errors of this type, the detail of the input-output sectoring provided by the national table was substantially maintained at the state and county level for the current modeling effort.

(iii) Empirical Considerations

In empirical work in the U.S. the sectors of the national input-output tables are developed on the basis of Standard Industrial Classifications - (SIC) codes. These codes identify individual industries (enterprises) rather than activities. So that the tables may more nearly approximate the assumptions of the basic input-output model, transfers of secondary and joint products are made among the industries. The majority of the 400 sectors of the typical U.S. national model are defined at the 4-digit SIC code level of detail.

(iv) Methodology for the Construction of Regional Input-Output Tables

In general, regional economic accounts can be established by two approaches. The first is usually considered to be more precise but it is difficult to carry out and to establish a concordance with other regions and with the nation as a whole. This first method can be considered as an "upward movement" beginning with the available accounting data of local firms and family expenditure data and aggregating these to form a set of accounts for the region under study. The second approach is more coherent but is usually felt to be less precise. This latter approach can be thought of as a "downward movement" from the national level to the region. The techniques for developing comprehensive intranational models encompassing all regions of the national economy involve elements of both approaches being employed simultaneously. At the local level the available secondary data on production, income and earnings are assembled. At the national level the detailed income and product data are arrayed. By choosing the most suitable regional measures the technique seeks to allocate the national totals of production and demand by sector to regions in order to establish the appropriate detail of a regional economic accounting scheme. The simultaneous use of these two approaches while maintaining the maximum degree of detail feasible, yields the best possible set of regional accounts consistent with one another and with the national totals (18). Such a procedure was followed for the present modeling effort using the available 1976 national, state, and county data sets.

The most recent official input-output table for the U.S. economy is for 1967[4]. Although the technical coefficients of the 1967 table may

be satisfactory for some current studies, there is a general discomfort about the reliability and validity of research of this type when it is based on a table that is, in fact, some twelve years old.

Several research groups have devoted substantial time and resources to these so-called "updating" problems relating to input-output tables. The most satisfactory updating technique appears to be accomplished by using the RAS method pioneered and popularized by Professor J.R.N. Stone of Cambridge, England (19). This method has been applied to U.S. national input-output tables with encouraging results (20). The present modeling work on the California economy could draw heavily on such related national and regional input-output research being sponsored for other specific purposes (21).

The updating of the official 1967 national table to 1976 and the development of a number of computer programs for manipulating national and regional economic data sets provided the underpinning for the development of the structural models of the California economy.

Essentially, the national 1967 input-output table was updated to 1976 using Bureau of Labor Statistics, Division of Economic Growth estimates of gross domestic output (22) and similar data on final demand (23). The overall table was benchmarked to agree with U.S. Department of Commerce published data on Gross National Product and its components for 1976 (24).

After completing the update of the national table the next task was to allocate the national production totals established for the individual sectors of the 1976 U.S. table to California state industries, and also

to develop state-wide final demand estimates. Basically, the state data for 1963 developed under the multiregional input-output program funded by the Economic Development Administration (25) were updated using various proxy measures for scaling the 1963 data up to 1976. The results were made to conform with the national data so that state estimates would be consistent with national 1976 totals as in the original 1963 research effort.

The California state production totals for 1976 were verified and benchmarked with available control totals such as statewide income, earnings and employment, and were then allocated to California counties using procedures similar to those used in the nation-to-state allocations. Fundamentally, it was necessary to construct final demand estimates and gross domestic output estimates for all California counties. These estimates were based on Bureau of Economic Analysis county income and earnings series by major source (26) and modified County Business Patterns (CBP) payroll and employment data (27).

The employment and payroll data provided by the county, state, and national summary files of the 1972 County Business Patterns can be used as basic proxy measures for allocating national gross domestic output first to states and then to counties. These could then be updated using 2- and 3-digit data for 1976. In using the County Business Patterns data, the assumption is made that production worker payrolls can serve as a basis for estimating levels of industrial output for counties and states. If this assumption is rejected then virtually no readily available economic measures exist at the 4-digit Standard Industrial Classfication (SIC) detail

for counties which can be used to estimate levels of industrial production. To give strength to the basic assumption, however, a recent study of U.S. payroll data by Browne (28) points to the fact that regional differences in wage rates are considerably less than might be inferred by casual observation.

The County Business Patterns data are unique in that production employment and payrolls are shown in detail, with employment in the so-called administrative and auxiliary units (sales or headquarters offices) being shown separately as a lump sum category for each county.

The importance of the CBP data format cannot be minimized. If an analysis of industrial structure or resource use is undertaken on the basis of the reported SIC employment without regard to its true nature in terms of occupation (production versus non-production) then the opportunity arises for major errors. In the absence of County Business Patterns type data it would be necessary to revert to some method in which the bona fide industrial activity of each reporting unit could be verified.

The County Business Patterns data suffer from the defect that non-disclosure regulations require the Bureau of the Censuses to withhold certain payroll and employment data. Statistical techniques have been devised and implemented in earlier studies (29) which use totals for a broader level of SIC detail along with summing and balancing methods to obtain the best estimates for the missing data. In some instances machine readable business directory data can be merged with the County Business Patterns files to obtain the maximum level of reliable data detail for counties. These procedures were used in the present study to provide a comprehensive set of

data for California counties.

The state and local input-output models were developed using a computer program based on the SLQ technique. When the provisional SLQ models were obtained, trade flow data derived from independent sources were used in conjunction with the RAS technique to further adjust the models (30).

(v) Accuracy and Related Matters in Regional Models

At the national level, census data are used to develop the interindustry transactions which are in turn reconciled with the data of the National Income and Product Accounts. Below the national level, for states and regions, the counterpart of the U.S. income and product accounts do not exist and census data on industry sales and purchases by geographic region are more limited. Because of this lack of data, regional interindustry economic research has developed slowly and is characterized by several distinct approaches. The essential difference in these approaches lies in the relative emphasis given to survey techniques and the use of primary data as opposed to the reliance on secondary data sources and methods for deriving regional estimates of interindustry flows of goods and services by indirect means. Although the controversy within the economics profession over the relative merits and cost-effectiveness of "survey" versus "non-survey" techniques is still unsettled there is increasing evidence that secondary data sources, if properly exploited, can serve as a basis for constructing regional input-output tables that are satisfactory for most analytical purposes (31) (32) (33).

For some states and regions where it was felt that as high a degree of accuracy as possible might be warranted in the preparation of a regional

table, proposals have been made and extensively funded for gathering data as comprehensively as possible from local enterprises. Arrow and Hirsch have commented specifically on this procedure (34).

> Very few manufacturers of any scale keep accurate accounts in a manner which permits them to summarize readily their annual shipments by geographical destination. In addition, many types of manufacturers cannot know what the destination of their product is. For example, a peach canner who sends his shipment to a warehouse in Los Angeles cannot know whether those peaches will be consumed there, shipped to the East Coast, or exported abroad. As a matter of fact, at the time the canner is making his shipment, no decision may have been reached about the final disposition....The data used in national tables comes from the purchaser of the inputs rather than the shipper. These data are harder to come by but clearly more reliable in that they require no guessing by the respondent.

The fundamental problem is one of estimating, or simulating, the inter industry flows of goods and services among the sectors of a regional economy. In the so-called survey approach, which Arrow and Hirsch address, the task is to obtain sufficient primary data from regional firms to permit the establishment of a local table of interindustry transactions.

In the non-survey approach the task is one of modifying national technical coefficients to simulate the interindustry flows of the local economy using secondary data sources.

In order to deal with the questions of accuracy and validity that are sometimes raised in connection with the data contained in regional input-output tables a certain perspective must be given.

When dealing with matters of accuracy it is necessary to have an absolute standard against which comparisons can be made.

If Arrow and Hirsch are correct in their statements as cited above then for any regional economy of modest dimensions, the real, or actual, inter-industry flows may be unknown and for practical purposes unknowable, even with the use of the most advanced survey techniques, because of the basic data problems inherent in the accounting practices of most industries.

The non-survey approach relies on quantitative methods that have been tested by researchers working on small-area input-output models under controlled conditions in which the real, or actual, interindustry flows for the local economy could be established. Some eight possible methods for simulating known interindustry flows were tested and the results compared with the known flows (35). The non-survey techniques which ranked the highest can then be applied with some greater measure of confidence in regional I-O studies where actual flows cannot be established by other methods.

Under these circumstances, however, the analyst obviously cannot say that the derived flows or coefficients are accurate within certain tolerance levels. In reality they give a first approximation to the actual regional economic structure based on the best available data and methods.

8. The California Input-Output Models - 1976

(i) The Statewide Model

The economy of the State of California is broadly diversified and accounted for approximately 11% of U.S. Gross Product in 1976. California Gross State Product for 1976 was estimated as $186.2 billion, the counterpart U.S. figure is $1706.5 billion.

In the input-output accounting scheme Gross Product consists of the sum of all final demands less imports. The following values have been abstracted from the California table of interindustry flows which is presented in Appendix 1.

	(Millions of Dollars)
Personal Consumption Expenditures	121975.906
Capital Formation	25298.500
Federal Government Expenditures	15588.869
State and Local Government Expenditures	28239.386
Exports	54215.520
Total Final Demand	245318.181
Less Imports	59076.131
Gross State Product	$186,242.05

The California transactions table given in Appendix 1 shows a total of 164 rows, or sectors. 156 of these are considered to be within the processing quadrant of the input-output table. Of the 156 sectors shown

in the processing quadrant six are null, but were apparently retained because of the format, or structure, of the national table used to create the California model.[5] Additionally, the Government Industry and Special Industries sectors are also null except for the Value Added entries. These sectors are typically removed from the model before forming the inverse or undertaking further manipulations.

The competitive imports sector may also be treated exogenously leaving 153 specific sectors, of which, it should be repeated, six are null. There are thus 147 active sectors in the California statewide model. Four of these null sectors appear in Agriculture (Tobacco, Dried Peas, Sugar and Vegetables not elsewhere classified (NEC), Oil Crops (NEC). Among the non-agricultural sectors, Coal Mining, and Tobacco Manufactures are absent.

The so-called "Dummy Industries" have been included to maintain the definitions and conventions used by BEA in constructing the U.S. input-output table. The "Dummy Sectors" are defined at the national level as Office Supplies and Business Travel, Entertainment and Gifts, and Scrap and By-Products. As artificially constructed for the I-O model, these sectors have no direct employment or pollutants associated with them but do interact with the other sectors of the economy indirectly. Sector 156, - "Special Industries" is defined by BEA to contain "Rest of the World Industry" and "Household Industry".

The Leontief inverse for the statewide model is not shown but the column sums of the inverse are calculated and ranked. These are shown as Table 1. This inverse shows 154 sectors. The Special Industries and

Table 1

CALIFORNIA 1976
154 SECTOR INVERSE

25 MAR 79

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
1	DAIRIES	2.48184	52	MEAT PRODUCTS	3.56779	1
2	BROILERS, CHICKENS AND EGGS	3.32097	2	BROILERS, CHICKENS AND EGGS	3.32097	2
3	TURKEYS AND OTHER POULTRY	3.15371	53	DAIRY PRODUCTS	3.18345	3
4	CATTLE AND CALVES	3.11000	154	DUMMY INDUSTRIES	3.17928	4
5	HOGS	2.35300	88	PRIMARY NONFERROUS METAL PRODUCTS	3.15546	5
6	SHEEP, LAMBS, AND WOOL	3.02326	3	TURKEYS AND OTHER POULTRY	3.15371	6
7	MISC. LIVESTOCK	2.88310	4	CATTLE AND CALVES	3.11000	7
8	APIARY PRODUCTS	3.02069	55	GRAIN MILL PRODUCTS	3.08686	8
9	COTTON	2.48511	6	SHEEP, LAMBS, AND WOOL	3.02326	9
10	WHEAT	2.27569	8	APIARY PRODUCTS	3.02069	10
11	RICE	2.24356	76	CLEANING AND TOILET PREPARATIONS	2.95114	11
12	BARLEY	2.34763	113	MOTOR VEHICLES	2.88654	12
13	CORN	2.31900	7	MISC. LIVESTOCK	2.88310	13
14	HAY AND PASTURE	2.31013	54	CANNED AND FROZEN FOODS	2.88118	14
15	OATS	2.39560	72	AGRICULTURAL CHEMICALS	2.86530	15
16	SORGHUM GRAIN	2.30296	57	SUGAR	2.86400	16
17	GRASS SEED	2.03366	18	FOOD, FEED GRAINS, NEC	2.84881	17
18	FOOD, FEED GRAINS, NEC	2.64981	140	ADVERTISING	2.82339	18
19	TOBACCO	1.00000	74	PLASTICS MATERIALS AND SYNTHETIC FIBERS	2.81918	19
20	WALNUTS	1.65039	115	OTHER TRANSPORTATION EQUIPMENT	2.80204	20
21	ALMONDS	1.81563	62	TEXTILE PRODUCTS	2.78572	21
22	NONCITRUS FRUITS	2.01475	77	PAINTS AND ALLIED PRODUCTS	2.78474	22
23	CITRUS FRUITS	2.03592	104	SERVICE INDUSTRY MACHINES	2.76692	23
24	FRUIT AND TREE NUTS, NEC	1.85016	73	GUM AND WOOD CHEMICALS	2.76151	24
25	VEGETABLES	1.94161	90	HEATING APPARATUS AND PLUMBING FIXTURES	2.74484	25
26	DRIED BEANS	2.09131	89	METAL CONTAINERS	2.70700	26
27	DRIED PEAS	1.00000	91	FABRICATED STRUCTURAL STEEL	2.70156	27
28	MELONS	1.54828	60	MISC FOOD PRODUCTS	2.70063	28
29	SUGAR BEETS	1.81414	143	MOTION PICTURES	2.67508	29
30	HOPS	1.97615	58	CONFECTIONARY PRODUCTS	2.65078	30
31	POTATOES	2.12122	96	ENGINES, TURBINES AND GENERATORS	2.63360	31
32	SWEET POTATOES	1.68401	80	LEATHER TANNING AND PRODUCTS	2.61333	32
33	VEGETABLES + SUGAR, NEC	1.00000	71	INDUSTRIAL CHEMICALS	2.61229	33
34	SAFFLOWER	2.07811	64	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	2.61209	34
35	OIL CROPS, NEC	1.00000	139	WATER AND SANITARY SERVICES	2.59660	35
36	GREENHOUSE AND NURSERY PRODUCTS	1.75949	97	FARM MACHINERY	2.58268	36
37	FORESTRY AND FISHERY PRODUCTS	2.15885	95	OTHER FABRICATED METAL PRODUCTS	2.56738	37
38	AGRIC., FORESTRY, FISHERY SERV	2.19149	107	HOUSEHOLD APPLIANCES	2.56713	38
39	METALS MINING	1.96265	85	WOODEN CONTAINERS	2.55994	39
40	COAL MINING	1.00000	69	PAPER + PAPERBOARD PRODUCTS	2.54668	40
41	CRUDE PETROLEUM	1.81306	78	PETROLEUM REFINING AND RELATED PRODUCTS	2.54001	41
42	NATURAL GAS + N.G. LIQUIDS	2.18906	79	RUBBER AND PLASTICS PRODUCTS	2.51944	42
43	STONE + CLAY MIN + QUARRY	1.98333	63	LOGGING CAMPS + SAWMILLS	2.51637	43
44	CHEM + FERT MINERAL MIN	1.79265	66	HOUSEHOLD FURNITURE	2.50937	44
45	NEW CONSTRUCT, RESIDENT	2.28293	109	RADIO AND TV RECEIVING SETS	2.49702	45
46	NEW CONSTRUCT, NONRESIDENT	2.31407	9	COTTON	2.48511	46
47	NEW CONSTRUCT, PUBLIC UTILITY	2.39149	114	AIRCRAFT	2.48698	47
48	NEW CONSTRUCT, HIGHWAYS	2.09976	1	DAIRIES	2.48184	48
49	NEW CONSTRUCT, ALL OTHER	2.02638	93	METAL STAMPINGS	2.48105	49
50	MAINT. AND REPAIR CONSTRUCTION	1.81240	56	BAKERY PRODUCTS	2.46578	50
51	ORDNANCE + GUIDED MISSILES	2.29311	98	CONSTRUCTION + MATERIAL HANDLING EQUIP	2.46320	51
52	MEAT PRODUCTS	3.56779	67	OFFICE FURNITURE AND FIXTURES	2.46064	52
53	DAIRY PRODUCTS	3.18345	86	BLAST FURNACES AND BASIC STEEL PRODUCTS	2.44925	53
54	CANNED AND FROZEN FOODS	2.88118	122	WATER TRANSPORATATION	2.44291	54
55	GRAIN MILL PRODUCTS	3.08686	87	IRON AND STEEL FOUNDRIES AND FORGINGS	2.42907	55

Table 1 - Cont.

CALIFORNIA 1976 — PAGE 2
154 SECTOR INVERSE — 25 MAR 79

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
56	BAKERY PRODUCTS	2.46578	100	SPECIAL INDUSTRIAL MACHINERY	2.42205	56
57	SUGAR	2.86400	101	GENERAL INDUSTRIAL MACHINERY	2.41044	57
58	CONFECTIONARY PRODUCTS	2.65078	119	JEWELRY, SPORTING GOODS, ETC.	2.40259	58
59	BEVERAGES AND FLAVORINGS	2.24541	103	COMPUTERS AND OFFICE EQUIPMENT	2.40001	59
60	MISC FOOD PRODUCTS	2.77063	15	OATS	2.39560	60
61	TOBACCO MANUFACTURERS	1.00000	47	NEW CONSTRUCT, PUBLIC UTILITY	2.39149	61
62	TEXTILE PRODUCTS	2.78572	115	SHIP AND BOAT BUILDING AND REPAIRING	2.37436	62
63	LOGGING CAMPS + SAWMILLS	2.91437	5	HOGS	2.35000	63
64	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	2.61209	12	BARLEY	2.34763	64
65	WOODEN CONTAINERS	2.55454	112	MISC ELECTRICAL PRODUCTS	2.34028	65
66	HOUSEHOLD FURNITURE	2.50927	13	CORN	2.31900	66
67	OFFICE FURNITURE AND FIXTURES	2.46364	46	NEW CONSTRUCT, NONRESIDENT	2.31407	67
68	PAPER + PAPERBOARD PRODUCTS	2.54068	14	HAY AND PASTURE	2.31013	68
69	NEWSPAPERS	1.88882	16	SORGHUM GRAIN	2.30296	69
70	OTHER PRINTING AND PUBLISHING	2.17496	117	CLOCKS AND SCIENTIFIC EQUIPMENT	2.30204	70
71	INDUSTRIAL CHEMICALS	2.61229	75	DRUGS	2.29756	71
72	AGRICULTURAL CHEMICALS	2.86330	51	ORDNANCE + GUIDED MISSILES	2.29311	72
73	GUM AND WOOD CHEMICALS	2.76151	92	SCREW MACHINE PRODUCTS	2.29073	73
74	PLASTICS MATERIALS AND SYNTHETIC FIBERS	2.81918	45	NEW CONSTRUCT, RESIDENT	2.28283	74
75	DRUGS	2.29756	10	WHEAT	2.27669	75
76	CLEANING AND TOILET PREPARATIONS	2.95114	54	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	2.27315	76
77	PAINTS AND ALLIED PRODUCTS	2.78474	128	ELECTRIC COMPANIES AND SYSTEMS	2.25803	77
78	PETROLEUM REFINING AND RELATED PRODUCTS	2.54051	99	METAL WORKING MACHINERY	2.25263	78
79	RUBBER AND PLASTICS PRODUCTS	2.51944	85	MISC STONE AND CLAY PRODUCTS	2.24861	79
80	LEATHER TANNING AND PRODUCTS	2.61333	59	BEVERAGES AND FLAVORINGS	2.24543	80
81	GLASS	1.96210	106	ELECTRICAL INDUSTRIAL APPARATUS	2.24511	81
82	CEMENT AND CONCRETE PRODUCTS	2.15745	11	RICE	2.24356	82
83	STRUCTURAL CLAY PRODUCTS	1.93446	42	NATURAL GAS + N.G. LIQUIDS	2.18986	83
84	POTTERY AND RELATED PRODUCTS	1.76613	70	OTHER PRINTING AND PUBLISHING	2.17496	84
85	MISC STONE AND CLAY PRODUCTS	2.24861	108	ELECTRIC LIGHTING AND WIRING	2.17334	85
86	BLAST FURNACES AND BASIC STEEL PRODUCTS	2.44929	111	ELECTRONIC COMPONENTS	2.17065	86
87	IRON AND STEEL FOUNDRIES AND FORGINGS	2.42507	37	FORESTRY AND FISHERY PRODUCTS	2.16685	87
88	PRIMARY NONFERROUS METAL PRODUCTS	2.15946	82	CEMENT AND CONCRETE PRODUCTS	2.15745	88
89	METAL CONTAINERS	2.70700	105	ELECTRIC TRANSMISSION EQUIPMENT	2.13306	89
90	HEATING APPARATUS AND PLUMBING FIXTURES	2.74484	102	MACHINE SHOP PRODUCTS	2.12458	90
91	FABRICATED STRUCTURAL STEEL	2.70156	31	POTATOES	2.12122	91
92	SCREW MACHINE PRODUCTS	2.29073	38	AGRIC., FORESTRY, FISHERY SERV	2.10149	92
93	METAL STAMPINGS	2.48105	40	NEW CONSTRUCT, HIGHWAYS	2.09076	93
94	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	2.27319	127	RADIO AND TELEVISION BROADCASTING	2.08923	94
95	OTHER FABRICATED METAL PRODUCTS	2.56738	34	SAFFLOWER	2.07813	95
96	ENGINES, TURBINES AND GENERATORS	2.63300	134	INSURANCE	2.04860	96
97	FARM MACHINERY	2.58268	23	CITRUS FRUITS	2.03692	97
98	CONSTRUCTION + MATERIAL HANDLING EQUIP	2.46320	17	GRASS SEED	2.03366	98
99	METAL WORKING MACHINERY	2.25263	49	NEW CONSTRUCT, ALL OTHER	2.02638	99
100	SPECIAL INDUSTRIAL MACHINERY	2.42205	137	HOTELS AND LODGING PLACES	2.01910	100
101	GENERAL INDUSTRIAL MACHINERY	2.41044	142	AUTOMOBILE REPAIR	2.01778	101
102	MACHINE SHOP PRODUCTS	2.12458	22	NONCITRUS FRUITS	2.01475	102
103	COMPUTERS AND OFFICE EQUIPMENT	2.40000	26	DRIED BEANS	2.00131	103
104	SERVICE INDUSTRY MACHINES	2.76692	43	STONE + CLAY MIN + QUARRY	1.98333	104
105	ELECTRIC TRANSMISSION EQUIPMENT	2.13306	129	GAS COMPANIES AND SYSTEMS	1.98263	105
106	ELECTRICAL INDUSTRIAL APPARATUS	2.24511	30	HOPS	1.97615	106
107	HOUSEHOLD APPLIANCES	2.56713	113	COMMUNICATION EQUIPMENT	1.96434	107
108	ELECTRIC LIGHTING AND WIRING	2.17334	81	GLASS	1.96310	108
109	RADIO AND TV RECEIVING SETS	2.49702	133	BANKING AND FINANCIAL INTERMEDIARIES	1.96298	109
110	COMMUNICATION EQUIPMENT	1.96434	39	METALS MINING	1.96265	110

Table 1 - Cont.

CALIFORNIA 1976
25 MAR 79
1976 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
111	ELECTRONIC COMPONENTS	2.17365	123	AIR TRANSPORTATION	1.55327	111
112	MISC ELECTRICAL PRODUCTS	2.34028	28	MELONS	1.94828	112
113	MOTOR VEHICLES	2.88654	152	STATE AND LOCAL GOVT ENTERPRISES	1.94302	113
114	AIRCRAFT	2.40698	25	VEGETABLES	1.94161	114
115	SHIP AND BOAT BUILDING AND REPAIRING	2.37436	83	STRUCTURAL CLAY PRODUCTS	1.93446	115
116	OTHER TRANSPORTATION EQUIPMENT	2.80204	69	NEWSPAPERS	1.88882	116
117	CLOCKS AND SCIENTIFIC EQUIPMENT	2.33234	120	LOCAL TRANSIT AND INTERCITY BUSES	1.87307	117
118	JEWELRY, SPORTING GOODS, ETC.	2.40259	24	FRUIT AND TREE NUTS, NEC	1.85946	118
119	RAILROADS	1.81841	20	WALNUTS	1.85039	119
120	LOCAL TRANSIT AND INTERCITY BUSES	1.87207	144	AMUSEMENT AND RECREATION SERVICES	1.82898	120
121	TRUCK TRANSPORTATION	1.69688	29	SUGAR BEETS	1.81514	121
122	WATER TRANSPORTATION	2.44291	119	RAILROADS	1.81841	122
123	AIR TRANSPORTATION	1.95327	21	ALMONDS	1.81690	123
124	PIPELINE TRANSPORTATION	1.77969	41	CRUDE PETROLEUM	1.81306	124
125	TRANSPORTATION SERVICES	1.36084	50	PAIN. AND REPAIR CONSTRUCTION	1.81240	125
126	COMMUNICATION, EXCEPT RADIO AND TV	1.28282	138	PERSONAL AND REPAIR SERVICES	1.79904	126
127	RADIO AND TELEVISION BROADCASTING	2.08623	44	CHEM + FERT MINERAL MIN	1.79365	127
128	ELECTRIC COMPANIES AND SYSTEMS	2.25803	124	PIPELINE TRANSPORTATION	1.77969	128
129	GAS COMPANIES AND SYSTEMS	1.98263	146	HOSPITALS	1.77917	129
130	WATER AND SANITARY SERVICES	2.56660	64	POTTERY AND RELATED PRODUCTS	1.76613	130
131	WHOLESALE TRADE	1.54476	36	GREENHOUSE AND NURSERY PRODUCTS	1.75549	131
132	RETAIL TRADE	1.33613	147	OTHER MEDICAL SERVICES	1.73090	132
133	BANKING AND FINANCIAL INTERMEDIARIES	1.96258	139	MISCELLANEOUS BUSINESS SERVICES	1.70040	133
134	INSURANCE	2.04963	121	TRUCK TRANSPORTATION	1.69688	134
135	OWNER OCCUPIED REAL ESTATE	1.11634	32	SWEET POTATOES	1.68401	135
136	REAL ESTATE	1.51563	148	EDUCATIONAL SERVICES	1.57413	136
137	HOTELS AND LODGING PLACES	2.01510	131	WHOLESALE TRADE	1.54476	137
138	PERSONAL AND REPAIR SERVICES	1.79504	149	NONPROFIT ORGANIZATIONS	1.52742	138
139	MISCELLANEOUS BUSINESS SERVICES	1.70040	136	REAL ESTATE	1.51563	139
140	ADVERTISING	2.82339	151	OTHER FEDERAL GOVT ENTERPRISES	1.40589	140
141	MISC PROFESSIONAL SERVICES	1.43679	141	MISC PROFESSIONAL SERVICES	1.43979	141
142	AUTOMOBILE REPAIR	2.01778	145	DOCTORS AND DENTISTS	1.42571	142
143	MOTION PICTURES	2.67509	125	TRANSPORTATION SERVICES	1.36084	143
144	AMUSEMENT AND RECREATION SERVICES	1.82898	132	RETAIL TRADE	1.33613	144
145	DOCTORS AND DENTISTS	1.42571	150	POST OFFICE	1.29161	145
146	HOSPITALS	1.77917	126	COMMUNICATION EXCEPT RADIO AND TV	1.28282	146
147	OTHER MEDICAL SERVICES	1.73090	135	OWNER OCCUPIED REAL ESTATE	1.11634	147
148	EDUCATIONAL SERVICES	1.57413	33	VEGETABLES + SUGAR, NEC	1.00000	148
149	NONPROFIT ORGANIZATIONS	1.52742	35	OIL CROPS, NEC	1.00000	149
150	POST OFFICE	1.29161	40	COAL MINING	1.00000	150
151	OTHER FEDERAL GOVT ENTERPRISES	1.40589	27	DRIED PEAS	1.00000	151
152	STATE AND LOCAL GOVT ENTERPRISES	1.94302	19	TOBACCO	1.00000	152
153	NONCOMPETITIVE IMPORTS	1.00000	153	NONCOMPETITIVE IMPORTS	1.00000	153
154	DUMMY INDUSTRIES	3.17928	61	TOBACCO MANUFACTURERS	1.00000	154

END OF DATA

Government Industry are not included in the Leontief Inverse since, as noted above, they are null except for the value added entries.

The entries in Table 1 show that a number of the agricultural sectors have large output multipliers which indicate that they are highly interrelated with other sectors of the economy. Those sectors with the smallest output multipliers interact the least with other sectors in the economy.

(ii) The Air Basin Models

(a) Overview

A map showing the California Air Basins is presented as Figure 5. In the present study four principal air basins were selected for analysis. These are:

San Diego

South Coast

San Joaquin

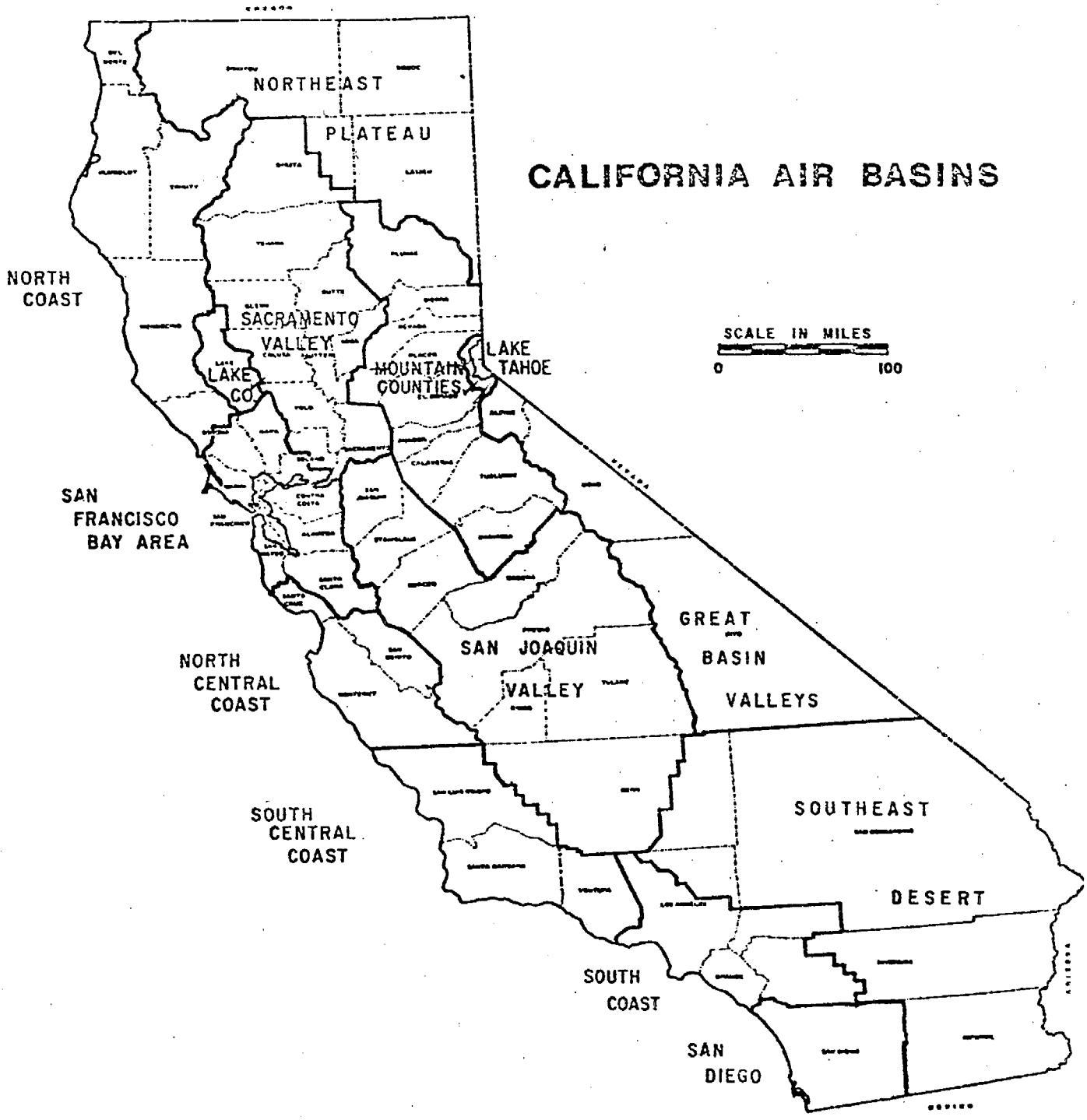
San Francisco Bay Area

In the majority of cases the air basins are drawn along county boundaries. The exceptions require that county economic data be apportioned into subcounty areas. This is a non-trivial undertaking since the county is the basic economic unit for which secondary source data are prepared.

The regional components of the Department of Water Resources Multiregional Input-Output model for the State of California are the twelve

Figure 5

State of California
AIR RESOURCES BOARD



June, 1977

hydrologic basins. These basins are shown in Figure 6. For purposes of structuring the Air Basin input-output models the Department of Water Resources data on final demands and gross output were used, where possible, with certain modifications.

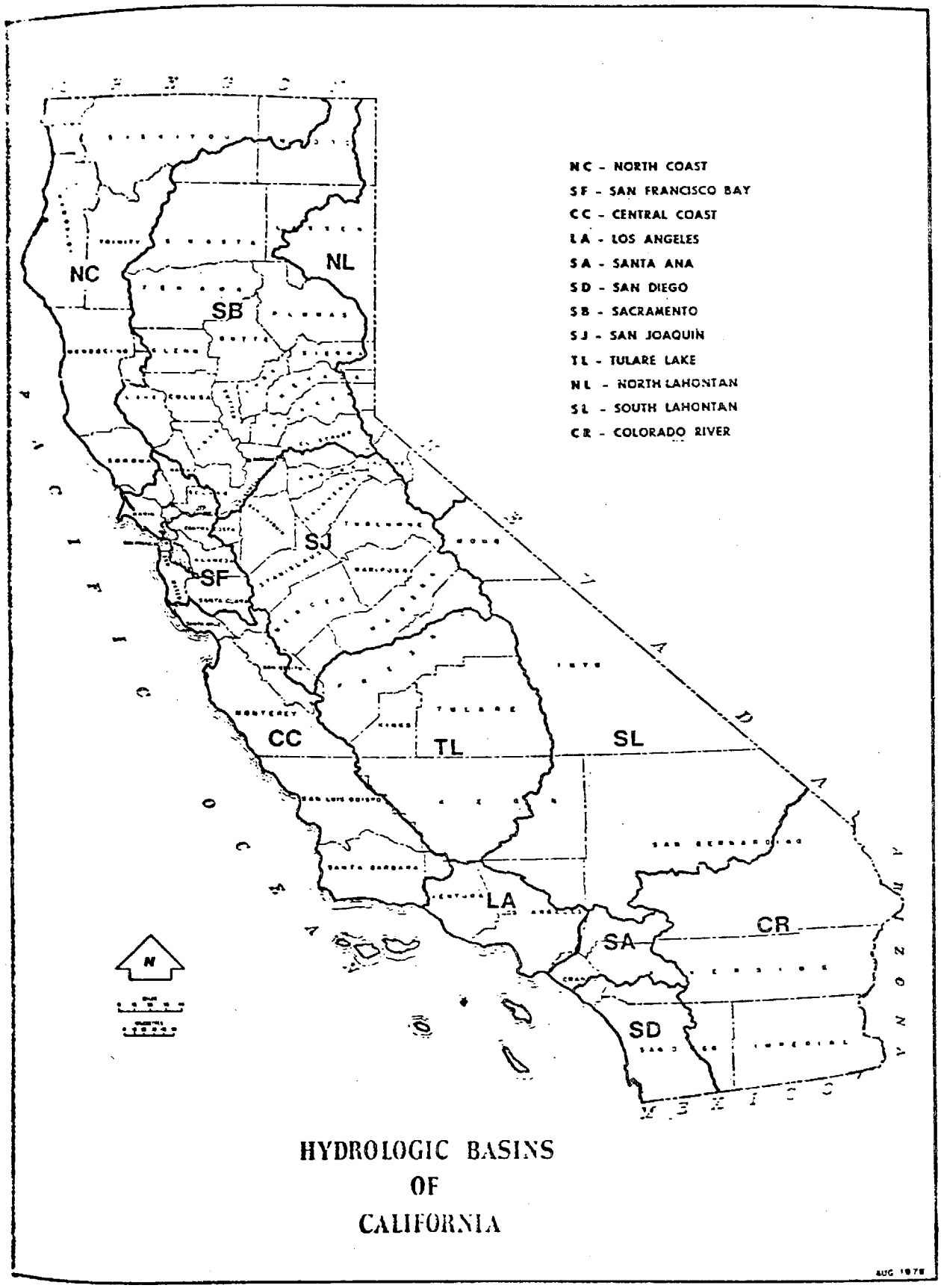
a) The data on final demands and gross outputs for the San Francisco Bay hydrologic basin were taken to be adequately representative of the air basin boundaries and were used without modification to structure the San Francisco Air Basin Model.

b) The Department of Water Resources data prepared for the Tulare Lake Basin were modified by adding the demands and outputs for the four counties: Madera, Merced, Stanislaus and San Joaquin in order to prepare the San Joaquin Valley Air Basin Model.

c) The Department of Water Resources data for the Los Angeles and Santa Ana hydrologic basins were added together and the Ventura county data were then subtracted from this in order to develop the South Coast Air Basin Model.

d) Since San Diego County is coincident with the San Diego Air Basin the County data were used to develop the Air Basin Model.

Figure 6


NC - NORTH COAST
SF - SAN FRANCISCO BAY
CC - CENTRAL COAST
LA - LOS ANGELES
SA - SANTA ANA
SD - SAN DIEGO
SB - SACRAMENTO
SJ - SAN JOAQUIN
TL - TULARE LAKE
NL - NORTH LAHONTAN
SL - SOUTH LAHONTAN
CR - COLORADO RIVER
NC
NL
SB
SJ
SF
CC
TL
SL
LA
SA
CR
SD
N
HYDROLOGIC BASINS
OF
CALIFORNIA

(b) The San Diego Air Basin

Gross County Product for San Diego County in 1976 was estimated at $12.1 billion or 6% of the Statewide total. Exports were $4.5 billion and imports were $6.3 billion. The Air Basin Input-Output Model is shown as Appendix 2.

Of a possible 147 active sectors present at the state level, the San Diego County economy has only 122 of these. The sectors not present in the county economy are:

1. Sheep, Lambs, and Wool
2. Misc. Livestock
3. Cotton
4. Rice
5. Corn
6. Oats
7. Sorghum Grain
8. Grass Seed
9. Food, Feed Grains, NEC
10. Walnuts
11. Almonds
12. Fruit and Tree Nuts, NEC
13. Melons
14. Sugar Beets
15. Hops
16. Sweet Potatoes
17. Safflower
18. Metal Mining

19. Crude Petroleum

20. Natural Gas + N.G. Liquids

21. Chem. + Fertilizer, Mineral Mining

22. Sugar

23. Metal Containers

24. Fabricated Structural Steel

25. Pipeline Transportation

The output multipliers for the county economy are shown in Table 2.

(c) South Coast

The South Coast Air Basin Gross Product for 1976 is estimated at $91.2 billion with imports of $24.4 billion and exports totaling $31.9 billion. The Gross Product of this basin comprises about 49% of the State total. The flow table for the Air Basin is shown as Appendix 3.

Of a possible 147 industries present at the state level 141 are present in the economy of the South Coast Air Basin. The industries not present are:

1. Rice

2. Sorghum Grain

3. Food, Feed Grains, NEC

4. Fruit and Tree Nuts, NEC

5. Hops

6. Safflower

The output multipliers for the economy are shown in Table 3.

Table 2

SAN DIEGO 1976 — PAGE 1
1x2 SECTOR INVERSE — 26 MAR 79

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
1	DAIRIES	1.17002	99	WATER AND SANITARY SERVICES	2.21038	1
2	BROILERS, CHICKENS AND EGGS	1.31769	109	ADVERTISING	2.07483	2
3	TURKEYS AND OTHER POULTRY	1.26921	112	MOTION PICTURES	2.03027	3
4	CATTLE AND CALVES	1.17725	122	DUMMY INDUSTRIES	1.99839	4
5	HOGS	1.11557	79	RADIO AND TV RECEIVING SETS	1.78084	5
6	APIARY PRODUCTS	1.23150	94	AIRCRAFT	1.77094	6
7	WHEAT	1.41266	73	COMPUTERS AND OFFICE EQUIPMENT	1.76548	7
8	BARLEY	1.49712	96	RADIO AND TELEVISION BROADCASTING	1.71220	8
9	HAY AND PASTURE	1.49334	26	CANNED AND FROZEN FOODS	1.71190	9
10	NONCITRUS FRUITS	1.44310	102	BANKING AND FINANCIAL INTERMEDIARIES	1.69698	10
11	CITRUS FRUITS	1.45597	48	CLEANING AND TOILET PREPARATIONS	1.66524	11
12	VEGETABLES	1.42815	128	FRAGRANCE	1.62680	12
13	DRIED BEANS	1.44448	106	HOTELS AND LODGING PLACES	1.58014	13
14	POTATOES	1.40811	27	DAIRY PRODUCTS	1.57521	14
15	GREENHOUSE AND NURSERY PRODUCTS	1.36837	25	ORDNANCE + GUIDED MISSILES	1.56121	15
16	FORESTRY AND FISHERY PRODUCTS	1.35374	121	STATE AND LOCAL GOVT ENTERPRISES	1.55653	16
17	AGRIC., FORESTRY, FISHERY SERV	1.21390	50	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.54639	17
18	STONE + CLAY MIN + QUARRY	1.41093	87	COMMUNICATIONS EQUIPMENT	1.54179	18
19	NEW CONSTRUCT, RESIDENT	1.32396	47	DRUGS	1.53076	19
20	NEW CONSTRUCT, NONRESIDENT	1.31936	81	ELECTRONIC COMPONENTS	1.52351	20
21	NEW CONSTRUCT, PUBLIC UTILITY	1.26239	90	LOCAL TRANSIT AND INTERCITY BUSES	1.51900	21
22	NEW CONSTRUCT, HIGHWAYS	1.33732	69	PAINTS AND ALLIED PRODUCTS	1.49928	22
23	NEW CONSTRUCT, ALL OTHER	1.27773	8	BARLEY	1.49712	23
24	MAIN. AND REPAIR CONSTRUCTION	1.20823	44	AGRICULTURAL CHEMICALS	1.49391	24
25	ORDNANCE + GUIDED MISSILES	1.56121	9	HAY AND PASTURE	1.49334	25
26	MEAT PRODUCTS	1.31717	45	GUM AND WOOD CHEMICALS	1.49205	26
27	DAIRY PRODUCTS	1.57521	54	CEMENT AND CONCRETE PRODUCTS	1.48987	27
28	CANNED AND FROZEN FOODS	1.71190	64	ENGINES, TURBINES AND GENERATORS	1.48799	28
29	GRAIN MILL PRODUCTS	1.28959	42	OTHER PRINTING AND PUBLISHING	1.47889	29
30	BAKERY PRODUCTS	1.27133	82	WATER TRANSPORTATION	1.46852	30
31	CONFECTIONARY PRODUCTS	1.34733	67	CLOCKS AND SCIENTIFIC EQUIPMENT	1.46697	31
32	BEVERAGES AND FLAVORINGS	1.33629	11	CITRUS FRUITS	1.45597	32
33	MISC FOOD PRODUCTS	1.41006	35	LOGGING CAMPS + SAWMILLS	1.45242	33
34	TEXTILE PRODUCTS	1.42201	13	DRIED BEANS	1.44448	34
35	LOGGING CAMPS + SAWMILLS	1.45242	10	NONCITRUS FRUITS	1.44316	35
36	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.44196	67	FARM MACHINERY	1.44001	36
37	WOODEN CONTAINERS	1.22923	43	INDUSTRIAL CHEMICALS	1.43783	37
38	HOUSEHOLD FURNITURE	1.31909	12	VEGETABLES	1.42815	38
39	OFFICE FURNITURE AND FIXTURES	1.30435	113	AMUSEMENT AND RECREATION SERVICES	1.42551	39
40	PAPER + PAPERBOARD PRODUCTS	1.27929	34	TEXTILE PRODUCTS	1.42081	40
41	NEWSPAPERS	1.32468	7	WHEAT	1.41266	41
42	OTHER PRINTING AND PUBLISHING	1.47889	16	STONE + CLAY MIN + QUARRY	1.41093	42
43	INDUSTRIAL CHEMICALS	1.43783	37	MISC FOOD PRODUCTS	1.41006	43
44	AGRICULTURAL CHEMICALS	1.49391	24	POTATOES	1.40811	44
45	GUM AND WOOD CHEMICALS	1.49205	26	STRUCTURAL CLAY PRODUCTS	1.40729	45
46	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.54639	17	AIR TRANSPORTATION	1.40062	46
47	DRUGS	1.53076	19	MISC STONE AND CLAY PRODUCTS	1.39193	47
48	CLEANING AND TOILET PREPARATIONS	1.66524	11	ELECTRIC TRANSMISSION EQUIPMENT	1.37398	48
49	PAINTS AND ALLIED PRODUCTS	1.49928	15	GREENHOUSE AND NURSERY PRODUCTS	1.36837	49
50	PETROLEUM REFINING AND RELATED PRODUCTS	1.31953	70	ELECTRICAL INDUSTRIAL APPARATUS	1.36696	50
51	RUBBER AND PLASTICS PRODUCTS	1.33272	116	OTHER MEDICAL SERVICES	1.36590	51
52	LEATHER TANNING AND PRODUCTS	1.29472	59	IRON AND STEEL FOUNDRIES AND FORGINGS	1.36586	52
53	GLASS	1.31776	89	RAILROADS	1.36330	53
54	CEMENT AND CONCRETE PRODUCTS	1.48987	126	MISCELLANEOUS BUSINESS SERVICES	1.36115	54
55	STRUCTURAL CLAY PRODUCTS	1.40729	68	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.36100	55

Table 2 - Cont.

SAN DIEGO 1976 — PAGE 2
122 SECTOR INVERSE — 26 MAR 79

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

SECTOR	COLUMN SUM	RANK	SECTOR	COLUMN SUM	RANK
56 POTTERY AND RELATED PRODUCTS	1.26774	70	SPECIAL INDUSTRIAL MACHINERY	1.35524	56
57 MISC STONE AND CLAY PRODUCTS	1.39193	16	FORESTRY AND FISHERY PRODUCTS	1.35374	57
58 BLAST FURNACES AND BASIC STEEL PRODUCTS	1.34870	117	EDUCATIONAL SERVICES	1.35277	58
59 IRON AND STEEL FOUNDRIES AND FORGINGS	1.36386	87	SHIP AND BOAT BUILDING AND REPAIRING	1.35266	59
60 PRIMARY NONFERROUS METAL PRODUCTS	1.27379	115	HOSPITALS	1.35094	60
61 HEATING APPARATUS AND PLUMBING FIXTURES	1.32811	98	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.34870	61
62 SCREW MACHINE PRODUCTS	1.26117	31	CONFECTIONARY PRODUCTS	1.34730	62
63 METAL STAMPINGS	1.24046	77	HOUSEHOLD APPLIANCES	1.34324	63
64 CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.27988	107	PERSONAL AND REPAIR SERVICES	1.34075	64
65 OTHER FABRICATED METAL PRODUCTS	1.27744	22	NEW CONSTRUCT, HIGHWAYS	1.33732	65
66 ENGINES, TURBINES AND GENERATORS	1.28799	111	AUTOMOBILE REPAIR	1.33720	66
67 FARM MACHINERY	1.23921	32	BEVERAGES AND FLAVORINGS	1.33629	67
68 CONSTRUCTION + MATERIAL HANDLING EQUIP	1.36193	118	NONPROFIT ORGANIZATIONS	1.33376	68
69 METAL WORKING MACHINERY	1.32838	91	RUBBER AND PLASTICS PRODUCTS	1.33272	69
70 SPECIAL INDUSTRIAL MACHINERY	1.35524	69	METAL WORKING MACHINERY	1.32838	70
71 GENERAL INDUSTRIAL MACHINERY	1.32341	81	HEATING APPARATUS AND PLUMBING FIXTURES	1.32811	71
72 MACHINE SHOP PRODUCTS	1.32474	72	MACHINE SHOP PRODUCTS	1.32474	72
73 COMPUTERS AND OFFICE EQUIPMENT	1.26343	41	NEWSPAPERS	1.32468	73
74 SERVICE INDUSTRY MACHINES	1.31294	19	NEW CONSTRUCT, RESIDENT	1.32396	74
75 ELECTRIC TRANSMISSION EQUIPMENT	1.37390	71	GENERAL INDUSTRIAL MACHINERY	1.32141	75
76 ELECTRICAL INDUSTRIAL APPARATUS	1.30696	68	JEWELRY, SPORTING GOODS, ETC.	1.32245	76
77 HOUSEHOLD APPLIANCES	1.34324	50	PETROLEUM REFINING AND RELATED PRODUCTS	1.31953	77
78 ELECTRIC LIGHTING AND WIRING	1.25593	29	NEW CONSTRUCT, NONRESIDENT	1.31936	78
79 RADIO AND TV RECEIVING SETS	1.28084	38	HOUSEHOLD FURNITURE	1.31909	79
80 COMMUNICATION EQUIPMENT	1.24129	2	BROILERS, CHICKENS AND EGGS	1.31749	80
81 ELECTRONIC COMPONENTS	1.32351	26	MEAT PRODUCTS	1.31717	81
82 MISC ELECTRICAL PRODUCTS	1.27811	74	SERVICE INDUSTRY MACHINES	1.31294	82
83 MOTOR VEHICLES	1.28583	117	MISC PROFESSIONAL SERVICES	1.31212	83
84 AIRCRAFT	1.27099	53	GLASS	1.31076	84
85 SHIP AND BOAT BUILDING AND REPAIRING	1.35266	60	OTHER TRANSPORTATION EQUIPMENT	1.30991	85
86 OTHER TRANSPORTATION EQUIPMENT	1.30991	125	REAL ESTATE	1.30514	86
87 CLOCKS AND SCIENTIFIC EQUIPMENT	1.26697	39	OFFICE FURNITURE AND FIXTURES	1.30436	87
88 JEWELRY, SPORTING GOODS, ETC.	1.32245	52	LEATHER TANNING AND PRODUCTS	1.29472	88
89 RAILROADS	1.30357	3	TURKEYS AND OTHER POULTRY	1.28921	89
90 LOCAL TRANSIT AND INTERCITY BUSES	1.31903	83	MOTOR VEHICLES	1.28583	90
91 TRUCK TRANSPORTATION	1.27051	29	GRAIN MILL PRODUCTS	1.28549	91
92 WATER TRANSPORTATION	1.40452	100	WHOLESALE TRADE	1.28289	92
93 AIR TRANSPORTATION	1.40062	97	ELECTRIC COMPANIES AND SYSTEMS	1.28204	93
94 TRANSPORTATION SERVICES	1.25465	64	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.27988	94
95 COMMUNICATION EXCEPT RADIO AND TV	1.17426	40	PAPER + PAPERBOARD PRODUCTS	1.27959	95
96 RADIO AND TELEVISION BROADCASTING	1.21220	82	MISC ELECTRICAL PRODUCTS	1.27811	96
97 ELECTRIC COMPANIES AND SYSTEMS	1.28204	23	NEW CONSTRUCT, ALL OTHER	1.27771	97
98 GAS COMPANIES AND SYSTEMS	1.19694	65	OTHER FABRICATED METAL PRODUCTS	1.27744	98
99 WATER AND SANITARY SERVICES	2.21938	60	PRIMARY NONFERROUS METAL PRODUCTS	1.27379	99
100 WHOLESALE TRADE	1.28289	35	BAKERY PRODUCTS	1.27130	100
101 RETAIL TRADE	1.20109	91	TRUCK TRANSPORTATION	1.27051	101
102 BANKING AND FINANCIAL INTERMEDIARIES	1.09698	56	POTTERY AND RELATED PRODUCTS	1.26774	102
103 INSURANCE	1.02887	21	NEW CONSTRUCT, PUBLIC UTILITY	1.26239	103
104 OWNER OCCUPIED REAL ESTATE	1.4323	62	SCREW MACHINE PRODUCTS	1.26117	104
105 REAL ESTATE	1.30514	70	ELECTRIC LIGHTING AND WIRING	1.25593	105
106 HOTELS AND LODGING PLACES	1.23814	95	TRANSPORTATION SERVICES	1.25465	106
107 PERSONAL AND REPAIR SERVICES	1.34075	114	DOCTORS AND DENTISTS	1.25372	107
108 MISCELLANEOUS BUSINESS SERVICES	1.36115	36	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.24096	108
109 ADVERTISING	2.07483	6	APIARY PRODUCTS	1.23158	109
110 MISC PROFESSIONAL SERVICES	1.31212	83	METAL STAMPINGS	1.24046	110

Table 2 - Cont.

SAN DIEGO 1976 PAGE 3
122 SECTOR INVERSE 26 MAR 79

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

SECTOR	COLUMN SUM	RANK	SECTOR	COLUMN SUM	RANK
111 AUTOMOBILE REPAIR	1.33729	37	WOODEN CONTAINERS	1.22925	111
112 MOTION PICTURES	1.32927	120	OTHER FEDERAL GOVT ENTERPRISES	1.22915	112
113 AMUSEMENT AND RECREATION SERVICES	1.42551	17	AGRIC., FORESTRY, FISHERY SERV	1.21390	113
114 DOCTORS AND DENTISTS	1.25372	24	MAINT. AND REPAIR CONSTRUCTION	1.20820	114
115 HOSPITALS	1.35054	101	RETAIL TRADE	1.20189	115
116 OTHER MEDICAL SERVICES	1.36597	96	GAS COMPANIES AND SYSTEMS	1.19694	116
117 EDUCATIONAL SERVICES	1.35277	4	CATTLE AND CALVES	1.17725	117
118 NONPROFIT ORGANIZATIONS	1.33374	95	COMMUNICATION EXCEPT RADIO AND TV	1.17426	118
119 POST OFFICE	1.15045	1	DAIRIES	1.17052	119
120 OTHER FEDERAL GOVT ENTERPRISES	1.22915	119	POST OFFICE	1.15045	120
121 STATE AND LOCAL GOVT ENTERPRISES	1.54650	5	HOGS	1.11557	121
122 DUMMY INDUSTRIES	1.99839	124	OWNER OCCUPIED REAL ESTATE	1.04820	122

END OF DATA

Table 3

LOS ANGELES 1976
141 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
1	DAIRIES	1.42457	131	MOTION PICTURES	2.46172	1
2	BROILERS, CHICKENS AND EGGS	1.96294	141	DUMMY INDUSTRIES	2.45720	2
3	TURKEYS AND OTHER POULTRY	1.86509	118	WATER AND SANITARY SERVICES	2.33120	3
4	CATTLE AND CALVES	1.29267	124	ADVERTISING	2.26200	4
5	HOGS	1.26162	64	CLEANING AND TOILET PREPARATIONS	2.24720	5
6	SHEEP, LAMBS, AND WOOL	1.39339	43	CANNED AND FROZEN FOODS	2.12255	6
7	MISC. LIVESTOCK	1.54423	102	AIRCRAFT	2.11766	7
8	APIARY PRODUCTS	1.54311	92	SERVICE INDUSTRY MACHINES	2.11636	8
9	COTTON	1.97345	76	PRIMARY NONFERROUS METAL PRODUCTS	2.10990	9
10	WHEAT	1.69992	71	HEATING APPARATUS AND PLUMBING FIXTURES	2.08705	10
11	BARLEY	1.70773	50	TEXTILE PRODUCTS	2.01421	11
12	CORN	1.70369	101	MOTOR VEHICLES	2.01223	12
13	HAY AND PASTURE	1.73911	110	WATER TRANSPORTATION	2.01114	13
14	OATS	1.68171	97	RADIO AND TV RECEIVING SETS	2.00740	14
15	GRASS SEED	1.61107	91	COMPUTERS AND OFFICE EQUIPMENT	2.00457	15
16	WALNUTS	1.57228	95	HOUSEHOLD APPLIANCES	1.98627	16
17	ALMONDS	1.55374	9	COTTON	1.97585	17
18	CITRUS FRUITS	1.60929	104	OTHER TRANSPORTATION EQUIPMENT	1.96895	18
19	DECIDUS FRUITS	1.60237	2	BROILERS, CHICKENS AND EGGS	1.96294	19
20	VEGETABLES	1.63799	79	FABRICATED STRUCTURAL STEEL	1.93044	20
21	DRIED BEANS	1.62650	83	SPECIAL INDUSTRIAL MACHINERY	1.92025	21
22	MELONS	1.64168	84	ENGINES, TURBINES AND GENERATORS	1.90685	22
23	SUGAR BEETS	1.53143	115	RADIO AND TELEVISION BROADCASTING	1.90274	23
24	POTATOES	1.58209	122	INSURANCE	1.89947	24
25	SWEET POTATOES	1.41669	35	NEW CONSTRUCT, NONRESIDENT	1.89248	25
26	GREENHOUSE AND NURSERY PRODUCTS	1.60107	46	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.87759	26
27	FORESTRY AND FISHERY PRODUCTS	1.61215	89	GENERAL INDUSTRIAL MACHINERY	1.87214	27
28	AGRIC., FORESTRY, FISHERY SERV	1.23365	40	AGRICULTURAL CHEMICALS	1.87035	28
29	METALS MINING	1.46030	3	TURKEYS AND OTHER POULTRY	1.86509	29
30	CRUDE PETROLEUM	1.49302	63	SOAPS	1.86446	30
31	NATURAL GAS + N.G. LIQUIDS	1.55323	135	CLOCKS AND SCIENTIFIC EQUIPMENT	1.86420	31
32	STONE + CLAY MIN + QUARRY	1.61399	85	FARM MACHINERY	1.86223	32
33	CHEM + FERT MINERAL MIN	1.49512	36	NEW CONSTRUCT, PUBLIC UTILITY	1.86056	33
34	NEW CONSTRUCT, RESIDENT	1.75706	59	INDUSTRIAL CHEMICALS	1.85512	34
35	NEW CONSTRUCT, NONRESIDENT	1.49264	65	PAPER AND ALLIED PRODUCTS	1.85195	35
36	NEW CONSTRUCT, PUBLIC UTILITY	1.86054	55	OFFICE FURNITURE AND FIXTURES	1.85083	36
37	NEW CONSTRUCT, HIGHWAYS	1.71772	68	LEATHER TANNING AND PRODUCTS	1.84303	37
38	NEW CONSTRUCT, ALL OTHER	1.66776	40	ORDNANCE + GUIDED MISSILES	1.84556	38
39	MAINT. AND REPAIR CONSTRUCTION	1.54627	61	GUM AND WOOD CHEMICALS	1.84267	39
40	ORDNANCE + GUIDED MISSILES	1.84556	116	ELECTRIC COMPANIES AND SYSTEMS	1.84134	40
41	MEAT PRODUCTS	1.35383	49	MISC FOOD PRODUCTS	1.84098	41
42	DAIRY PRODUCTS	1.50475	106	JEWELRY, SPORTING GOODS, ETC.	1.83795	42
43	CANNED AND FROZEN FOODS	2.12255	83	OTHER FABRICATED METAL PRODUCTS	1.83760	43
44	GRAIN MILL PRODUCTS	1.74109	77	METAL CONTAINERS	1.82949	44
45	BAKERY PRODUCTS	1.76506	130	MISC ELECTRICAL PRODUCTS	1.80404	45
46	SUGAR	1.15643	54	HOUSEHOLD FURNITURE	1.80211	46
47	CONFECTIONARY PRODUCTS	1.76742	87	METAL WORKING MACHINERY	1.80054	47
48	BEVERAGES AND FLAVORINGS	1.43450	121	BANKING AND FINANCIAL INTERMEDIARIES	1.79280	48
49	MISC FOOD PRODUCTS	1.84098	59	OTHER PRINTING AND PUBLISHING	1.78950	49
50	TEXTILE PRODUCTS	2.01421	62	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.78505	50
51	LOGGING CAMPS + SAWMILLS	1.43665	125	HOTELS AND LODGING PLACES	1.78467	51
52	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.52394	75	IRON AND STEEL FOUNDRIES AND FORGINGS	1.78228	52
53	WOODEN CONTAINERS	1.49326	103	SHIP AND BOAT BUILDING AND REPAIRING	1.77634	53
54	HOUSEHOLD FURNITURE	1.80211	47	CONFECTIONARY PRODUCTS	1.76742	54
55	OFFICE FURNITURE AND FIXTURES	1.85083	53	ELECTRONIC COMPONENTS	1.76066	55

Table 3 - Cont.

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
56	PAPER + PAPERBOARD PRODUCTS	1.74911	45	BAKERY PRODUCTS	1.76006	56
57	NEWSPAPERS	1.55971	94	ELECTRICAL INDUSTRIAL APPARATUS	1.75922	57
58	OTHER PRINTING AND PUBLISHING	1.78950	82	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.75254	58
59	INDUSTRIAL CHEMICALS	1.85512	56	PAPER + PAPERBOARD PRODUCTS	1.74911	59
60	AGRICULTURAL CHEMICALS	1.87035	34	NEW CONSTRUCT, RESIDENT	1.74706	60
61	GUM AND WOOD CHEMICALS	1.84267	93	ELECTRIC TRANSMISSION EQUIPMENT	1.74188	61
62	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.78585	96	ELECTRIC LIGHTING AND WIRING	1.74122	62
63	DRUGS	1.86446	44	GRAIN MILL PRODUCTS	1.74108	63
64	CLEANING AND TOILET PREPARATIONS	2.24720	13	HAY AND PASTURE	1.73611	64
65	PAINTS AND ALLIED PRODUCTS	1.85155	73	MISC STONE AND CLAY PRODUCTS	1.72229	65
66	PETROLEUM REFINING AND RELATED PRODUCTS	1.69668	140	STATE AND LOCAL GOVT ENTERPRISES	1.71934	66
67	RUBBER AND PLASTICS PRODUCTS	1.70155	37	NEW CONSTRUCT, HIGHWAYS	1.71772	67
68	LEATHER TANNING AND PRODUCTS	1.84303	90	MACHINE SHOP PRODUCTS	1.71304	68
69	GLASS	1.80596	11	BARLEY	1.70973	69
70	CEMENT AND CONCRETE PRODUCTS	1.65600	81	METAL STAMPINGS	1.70603	70
71	STRUCTURAL CLAY PRODUCTS	1.56302	49	BEVERAGES AND FLAVORINGS	1.70460	71
72	POTTERY AND RELATED PRODUCTS	1.47397	12	CORN	1.70369	72
73	MISC STONE AND CLAY PRODUCTS	1.72229	67	RUBBER AND PLASTICS PRODUCTS	1.70155	73
74	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.66687	103	LOCAL TRANSIT AND INTERCITY BUSES	1.70104	74
75	IRON AND STEEL FOUNDRIES AND FORGINGS	1.78228	66	PETROLEUM REFINING AND RELATED PRODUCTS	1.69668	75
76	PRIMARY NONFERROUS METAL PRODUCTS	2.10390	19	CITRUS FRUITS	1.69287	76
77	METAL CONTAINERS	1.92949	14	OATS	1.68871	77
78	HEATING APPARATUS AND PLUMBING FIXTURES	2.30705	111	AIR TRANSPORTATION	1.68712	78
79	FABRICATED STRUCTURAL STEEL	1.93044	130	AUTOMOBILE REPAIR	1.68232	79
80	SCREW MACHINE PRODUCTS	1.68128	18	NONCITRUS FRUITS	1.68029	80
81	METAL STAMPINGS	1.79603	80	SCREW MACHINE PRODUCTS	1.68128	81
82	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.75254	93	COMMUNICATION EQUIPMENT	1.67039	82
83	OTHER FABRICATED METAL PRODUCTS	1.83760	74	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.66687	83
84	ENGINES, TURBINES AND GENERATORS	1.90695	70	CEMENT AND CONCRETE PRODUCTS	1.65600	84
85	FARM MACHINERY	1.86223	22	MELONS	1.64369	85
86	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.87759	38	NEW CONSTRUCT, ALL OTHER	1.64276	86
87	METAL WORKING MACHINERY	1.89054	20	VEGETABLES	1.63790	87
88	SPECIAL INDUSTRIAL MACHINERY	1.92128	27	FORESTRY AND FISHERY PRODUCTS	1.63215	88
89	GENERAL INDUSTRIAL MACHINERY	1.87214	21	DRIED BEANS	1.62650	89
90	MACHINE SHOP PRODUCTS	1.71304	32	STONE + CLAY MIN + QUARRY	1.61399	90
91	COMPUTERS AND OFFICE EQUIPMENT	2.03457	15	GRASS SEED	1.61107	91
92	SERVICE INDUSTRY MACHINES	2.11636	69	GLASS	1.60596	92
93	ELECTRIC TRANSMISSION EQUIPMENT	1.74188	10	WHEAT	1.59982	93
94	ELECTRICAL INDUSTRIAL APPARATUS	1.75922	24	POTATOES	1.59209	94
95	HOUSEHOLD APPLIANCES	1.99627	126	PERSONAL AND REPAIR SERVICES	1.58006	95
96	ELECTRIC LIGHTING AND WIRING	1.74122	16	WALNUTS	1.57228	96
97	RADIO AND TV RECEIVING SETS	2.00740	42	DAIRY PRODUCTS	1.56475	97
98	COMMUNICATION EQUIPMENT	1.67039	71	STRUCTURAL CLAY PRODUCTS	1.56302	98
99	ELECTRONIC COMPONENTS	1.76066	57	NEWSPAPERS	1.55971	99
100	MISC ELECTRICAL PRODUCTS	1.83304	107	RAILROADS	1.55521	100
101	MOTOR VEHICLES	2.01223	31	NATURAL GAS + N.G. LIQUIDS	1.55323	101
102	AIRCRAFT	2.11766	17	ALMONDS	1.55074	102
103	SHIP AND BOAT BUILDING AND REPAIRING	1.77634	109	TRUCK TRANSPORTATION	1.54747	103
104	OTHER TRANSPORTATION EQUIPMENT	1.96195	7	MISC. LIVESTOCK	1.54623	104
105	CLOCKS AND SCIENTIFIC EQUIPMENT	1.86420	39	MAIN. AND REPAIR CONSTRUCTION	1.54527	105
106	JEWELRY, SPORTING GOODS, ETC.	1.83795	134	HOSPITALS	1.54425	106
107	RAILROADS	1.55521	8	APIARY PRODUCTS	1.54311	107
108	LOCAL TRANSIT AND INTERCITY BUSES	1.70104	23	SUGAR BEETS	1.53943	108
109	TRUCK TRANSPORTATION	1.54747	132	AMUSEMENT AND RECREATION SERVICES	1.52621	109
110	WATER TRANSPORTATION	2.01114	52	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.52394	110

Table 3 - Cont.

LOS ANGELES 1976
141 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM
111	AIR TRANSPORTATION	1.68312
112	PIPELINE TRANSPORTATION	1.52356
113	TRANSPORTATION SERVICES	1.30387
114	COMMUNICATION EXCEPT RADIO AND TV	1.20957
115	RADIO AND TELEVISION BROADCASTING	1.40274
116	ELECTRIC COMPANIES AND SYSTEMS	1.84134
117	GAS COMPANIES AND SYSTEMS	1.23464
118	WATER AND SANITARY SERVICES	2.33120
119	WHOLESALE TRADE	1.41275
120	RETAIL TRADE	1.25574
121	BANKING AND FINANCIAL INTERMEDIARIES	1.72740
122	INSURANCE	1.89997
123	OWNER OCCUPIED REAL ESTATE	1.05991
124	REAL ESTATE	1.40154
125	HOTELS AND LODGING PLACES	1.70667
126	PERSONAL AND REPAIR SERVICES	1.59306
127	MISCELLANEOUS BUSINESS SERVICES	1.52219
128	ADVERTISING	2.26700
129	MISC PROFESSIONAL SERVICES	1.34116
130	AUTOMOBILE REPAIR	1.68232
131	MOTION PICTURES	2.46172
132	AMUSEMENT AND RECREATION SERVICES	1.62121
133	DOCTORS AND DENTISTS	1.34345
134	HOSPITALS	1.44425
135	OTHER MEDICAL SERVICES	1.51697
136	EDUCATIONAL SERVICES	1.44040
137	NONPROFIT ORGANIZATIONS	1.43054
138	POST OFFICE	1.20982
139	OTHER FEDERAL GOVT ENTERPRISES	1.28998
140	STATE AND LOCAL GOVT ENTERPRISES	1.71234
141	DUMMY INDUSTRIES	2.45720

END OF DATA

	SECTOR	COLUMN SUM	RANK
112	PIPELINE TRANSPORTATION	1.52356	111
127	MISCELLANEOUS BUSINESS SERVICES	1.52219	112
135	OTHER MEDICAL SERVICES	1.51697	113
26	GREENHOUSE AND NURSERY PRODUCTS	1.50307	114
30	CRUDE PETROLEUM	1.49082	115
33	CHEM + FERT MINERAL MIN	1.44512	116
72	POTTERY AND RELATED PRODUCTS	1.47397	117
29	METALS MINING	1.46030	118
53	WOODEN CONTAINERS	1.45326	119
136	EDUCATIONAL SERVICES	1.44040	120
61	LOGGING CAMPS + SAWMILLS	1.43665	121
1	DAIRIES	1.42467	122
25	SWEET POTATOES	1.41660	123
119	WHOLESALE TRADE	1.40275	124
124	REAL ESTATE	1.40154	125
137	NONPROFIT ORGANIZATIONS	1.40054	126
5	SHEEP, LAMBS, AND WOOL	1.39539	127
41	MEAT PRODUCTS	1.35393	128
133	DOCTORS AND DENTISTS	1.34845	129
129	MISC PROFESSIONAL SERVICES	1.34016	130
46	SUGAR	1.34613	131
113	TRANSPORTATION SERVICES	1.30387	132
4	CATTLE AND CALVES	1.29267	133
139	OTHER FEDERAL GOVT ENTERPRISES	1.28998	134
28	AGRIC., FORESTRY, FISHERY SERV	1.28965	135
5	HOGS	1.26162	136
120	RETAIL TRADE	1.25574	137
117	GAS COMPANIES AND SYSTEMS	1.23464	138
138	POST OFFICE	1.20982	139
114	COMMUNICATION EXCEPT RADIO AND TV	1.20957	140
123	OWNER OCCUPIED REAL ESTATE	1.05991	141

(d) San Joaquin Air Basin

The San Joaquin Air Basin consists of: San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare, Kings and portions of Kern County. The Gross Product for the air basin economy is estimated at $14.0 billion with imports of $10.1 billion and exports totalling $6.9 billion. The Basin economy accounted for some 7% of Gross State Product.

Sectors not present in the San Joaquin economy are:

1. Hops
2. Household Appliances

The output multipliers are shown in Table 4.

Table 4

SAM JOAQUIN 1x70
149 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM
1	DAIRIES	1.86283
2	BROILERS, CHICKENS AND EGGS	2.27731
3	TURKEYS AND OTHER POULTRY	2.16365
4	CATTLE AND CALVES	2.25516
5	HOGS	1.63899
6	SHEEP, LAMBS, AND WOOL	2.08442
7	MISC. LIVESTOCK	1.97147
8	APIARY PRODUCTS	2.14173
9	COTTON	1.77721
10	WHEAT	1.75091
11	RICE	1.68724
12	BARLEY	1.77851
13	CORN	1.72002
14	HAY AND PASTURE	1.73210
15	OATS	1.67556
16	SORGHUM GRAIN	1.73583
17	GRASS SEED	1.56960
18	FOOD, FEED GRAINS, NEC	1.80901
19	WALNUTS	1.66689
20	ALMONDS	1.64750
21	DECIDUOUS FRUITS	1.52403
22	CITRUS FRUITS	1.53396
23	FRUIT AND TREE NUTS, NEC	1.46307
24	VEGETABLES	1.47598
25	DRIED BEANS	1.52760
26	MELONS	1.47701
27	SUGAR BEETS	1.44794
28	POTATOES	1.64177
29	SWEET POTATOES	1.39561
30	SAFFLOWER	1.59517
31	GREENHOUSE AND NURSERY PRODUCTS	1.38428
32	FORESTRY AND FISHERY PRODUCTS	1.54089
33	AGRIC., FORESTRY, FISHERY SERV	1.58935
34	METALS MINING	1.33363
35	CRUDE PETROLEUM	1.31770
36	NATURAL GAS + N.G. LIQUIDS	1.57863
37	STONE + CLAY MIN + QUARRY	1.47463
38	CHEM + FERT MINERAL MIN	1.39837
39	NEW CONSTRUCT, RESIDENT	1.58929
40	NEW CONSTRUCT, NONRESIDENT	1.46317
41	NEW CONSTRUCT, PUBLIC UTILITY	1.47017
42	NEW CONSTRUCT, HIGHWAYS	1.54455
43	NEW CONSTRUCT, ALL OTHER	1.41455
44	MAINT. AND REPAIR CONSTRUCTION	1.25968
45	ORDNANCE + GUIDED MISSILES	1.36608
46	MEAT PRODUCTS	2.40012
47	DAIRY PRODUCTS	2.59719
48	CANNED AND FROZEN FOODS	1.98597
49	GRAIN MILL PRODUCTS	2.19169
50	BAKERY PRODUCTS	1.92576
51	SUGAR	2.35800
52	CONFECTIONARY PRODUCTS	1.95787
53	BEVERAGES AND FLAVORINGS	1.67963
54	MISC FOOD PRODUCTS	1.85237
55	TEXTILE MILL PRODUCTS	1.54250
56	APPAREL	1.54250
57	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.74316
58	WOODEN CONTAINERS	1.73418
59	HOUSEHOLD FURNITURE	1.57424
60	OTHER FURNITURE	1.54250
61	PAPER + PAPERBOARD PRODUCTS	1.66946
62	PAPERBOARD CONTAINERS	1.54250
63	OTHER PRINTING AND PUBLISHING	1.62916
64	INDUSTRIAL CHEMICALS	1.78593
65	AGRICULTURAL CHEMICALS	1.86648
66	GUM AND WOOD CHEMICALS	1.65403
67	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.72593
68	DRUGS	1.54250
69	CLEANING AND TOILET PREPARATIONS	1.69124
70	PAINTS AND ALLIED PRODUCTS	1.64660
71	PETROLEUM REFINING AND RELATED PRODUCTS	1.83649
72	RUBBER PRODUCTS	1.54250
73	LEATHER PRODUCTS	1.54250
74	GLASS PRODUCTS	1.54250
75	CEMENT AND CONCRETE PRODUCTS	1.66328
76	STRUCTURAL CLAY PRODUCTS	1.54250
77	POTTERY AND RELATED PRODUCTS	1.54250
78	CONCRETE, GYPSUM, PLASTER PRODUCTS	1.54250
79	CUT STONE AND STONE PRODUCTS	1.54250
80	MINERAL WOOL	1.54250
81	PRIMARY NONFERROUS METAL PRODUCTS	1.75866
82	PRIMARY IRON AND STEEL PRODUCTS	1.54250
83	METAL CANS AND SHIPPING CONTAINERS	1.54250
84	CUTLERY, HAND TOOLS, AND HARDWARE	1.54250
85	PLUMBING AND HEATING	1.54250
86	FABRICATED STRUCTURAL METAL	1.54250
87	SCREW MACHINE PRODUCTS	1.54250
88	METAL FORGINGS AND STAMPINGS	1.54250
89	COATING AND ENGRAVING	1.54250
90	ORDNANCE AND GUIDED MISSILES	1.54250
91	FARM MACHINERY	1.54250
92	CONSTRUCTION AND MATERIALS HANDLING MACH	1.54250
93	METALWORKING MACHINERY	1.54250
94	SPECIAL INDUSTRY MACHINERY	1.54250
95	GENERAL INDUSTRIAL MACHINERY	1.54250
96	MACHINE SHOP PRODUCTS	1.54250
97	OFFICE AND COMPUTING MACHINES	1.54250
98	SERVICE INDUSTRY MACHINES	1.54250
99	ELECTRIC INDUSTRIAL EQUIPMENT	1.54250
100	HOUSEHOLD APPLIANCES	1.54250
101	ELECTRIC LIGHTING AND WIRING	1.54250
102	RADIO AND TV RECEIVING SETS	1.54250
103	COMMUNICATION EQUIPMENT	1.54250
104	ELECTRONIC COMPONENTS	1.54250
105	BATTERIES, X-RAY, ENGINE ELECTRICAL	1.54250
106	MOTOR VEHICLES AND EQUIPMENT	1.54250
107	AIRCRAFT AND PARTS	1.54250
108	OTHER TRANSPORTATION EQUIPMENT	1.55976
109	SHIPS AND BOATS	1.54250
110	RAILROAD EQUIPMENT	1.54250
111	MOTORCYCLES, BICYCLES, PARTS	1.54250
112	LOCAL TRANSIT AND INTERCITY BUSES	1.59434
113	SCIENTIFIC AND CONTROLLING INSTRUMENTS	1.54250
114	WATER TRANSPORTATION	1.73071
115	OPTICAL, OPHTHALMIC, PHOTOGRAPHIC	1.54250
116	MISC MANUFACTURING	1.54250
117	RAILROADS AND RELATED SERVICES	1.54250
118	TRUCKING AND WAREHOUSING	1.54250
119	TRUCKING SERVICES FOR AGRICULTURE	1.54250
120	ELECTRIC COMPANIES AND SYSTEMS	1.84152
121	GAS COMPANIES AND SYSTEMS	1.54250
122	WATER AND SANITARY SERVICES	2.18375
123	COMMUNICATIONS, EXCEPT RADIO AND TV	1.54250
124	RADIO AND TV BROADCASTING	1.54250
125	WHOLESALE TRADE	1.54250
126	RETAIL TRADE	1.54250
127	FINANCE AND INSURANCE	1.54250
128	REAL ESTATE AND RENTAL	1.54250
129	HOTELS AND LODGING PLACES	1.54250
130	PERSONAL AND REPAIR SERVICES	1.54250
131	BUSINESS SERVICES	1.54250
132	ADVERTISING	2.27263
133	AUTO REPAIR AND SERVICES	1.54250
134	MISC BUSINESS SERVICES	1.54250
135	MOTION PICTURES	1.61425
136	AMUSEMENT AND RECREATION SERVICES	1.54250
137	OFFICE BUILDINGS	1.54250
138	OTHER CONSTRUCTION	1.54250
139	MEDICAL AND EDUCATIONAL SERVICES	1.54250
140	FEDERAL GOVT ENTERPRISES	1.54250
141	FEDERAL GOVT PASSENGER TRANSPORT	1.54250
142	FEDERAL GOVT FREIGHT TRANSPORT	1.54250
143	FEDERAL GOVT ELECTRIC UTILITIES	1.54250
144	STATE AND LOCAL GOVT ENTERPRISES	1.56455
145	DUMMY INDUSTRIES	1.87257
146	OFFICE SUPPLIES	1.54250
147	SCRAP AND USED GOODS	1.54250
148	INDUSTRY NOT SPECIFIED	1.54250
149	HOUSEHOLD INDUSTRY	1.54250

Table 4 - Cont.

1963 JUNE/JAN 1976
149 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
56	LOGGING CAMPS + SAWMILLS	1.42233	42	NEW CONSTRUCT, HIGHWAYS	1.54455	56
57	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.74386	55	TEXTILE PRODUCTS	1.54250	57
58	WOODEN CONTAINERS	1.73415	32	FORESTRY AND FISHERY PRODUCTS	1.54099	58
59	HOUSEHOLD FURNITURE	1.57424	22	CITRUS FRUITS	1.53396	59
60	OFFICE FURNITURE AND FIXTURES	1.46800	25	DRIED BEANS	1.52760	60
61	PAPER + PAPERBOARD PRODUCTS	1.66946	129	HOTELS AND LODGING PLACES	1.52540	61
62	NEWSPAPERS	1.42520	21	NONCITRUS FRUITS	1.52403	62
63	OTHER PRINTING AND PUBLISHING	1.62916	126	INSURANCE	1.51785	63
64	INDUSTRIAL CHEMICALS	1.78593	78	MISC STONE AND CLAY PRODUCTS	1.51371	64
65	AGRICULTURAL CHEMICALS	1.80648	60	DRUGS	1.50696	65
66	SOAP AND RUBB CHEMICALS	1.69403	119	RADIO AND TELEVISION BROADCASTING	1.49792	66
67	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.72553	73	LEATHER TANNING AND PRODUCTS	1.49262	67
68	DRUGS	1.50696	60	OFFICE FURNITURE AND FIXTURES	1.48800	68
69	CLEANING AND TOILET PREPARATIONS	1.69124	82	METAL CONTAINERS	1.48252	69
70	PAINTS AND ALLIED PRODUCTS	1.64660	125	BANKING AND FINANCIAL INTERMEDIARIES	1.48238	70
71	PETROLEUM REFINING AND RELATED PRODUCTS	1.03649	26	MELONS	1.47701	71
72	RUBBER AND PLASTICS PRODUCTS	1.42343	24	VEGETABLES	1.47598	72
73	LEATHER TANNING AND PRODUCTS	1.49262	37	STONE + CLAY MIN + QUARRY	1.47463	73
74	GLASS	1.46955	115	AIR TRANSPORTATION	1.47054	74
75	CEMENT AND CONCRETE PRODUCTS	1.66328	41	NEW CONSTRUCT, PUBLIC UTILITY	1.47017	75
76	STRUCTURAL CLAY PRODUCTS	1.41715	111	RAILROADS	1.46973	76
77	PETROLEUM AND RELATED PRODUCTS	1.32626	79	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.46956	77
78	MISC STONE AND CLAY PRODUCTS	1.51371	74	GLASS	1.46955	78
79	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.46956	19	WALNUTS	1.46638	79
80	IRON AND STEEL FOUNDRIES AND FORGINGS	1.46115	40	NEW CONSTRUCT, NONRESIDENT	1.46317	80
81	PRIMARY NONFERROUS METAL PRODUCTS	1.75866	23	FRUIT AND TREE NUTS, NEC	1.46307	81
82	METAL CONTAINERS	1.48252	80	IRON AND STEEL FOUNDRIES AND FORGINGS	1.46115	82
83	HEATING APPARATUS AND PLUMBING FIXTURES	1.44411	101	RADIO AND TV RECEIVING SETS	1.46092	83
84	FABRICATED STRUCTURAL STEEL	1.39995	96	COMPUTERS AND OFFICE EQUIPMENT	1.46050	84
85	SPECIAL MACHINE PRODUCTS	1.36337	110	JEWELRY, SPORTING GOODS, ETC.	1.46011	85
86	METAL STAMPINGS	1.38110	27	SUGAR BEETS	1.44734	86
87	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.38216	20	ALMONDS	1.44750	87
88	OTHER FABRICATED METAL PRODUCTS	1.44454	88	OTHER FABRICATED METAL PRODUCTS	1.44454	88
89	ENGINES, TURBINES AND GENERATORS	1.39326	83	HEATING APPARATUS AND PLUMBING FIXTURES	1.44411	89
90	FARM MACHINERY	1.39155	62	NEWSPAPERS	1.43520	90
91	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.35791	113	TRUCK TRANSPORTATION	1.43015	91
92	METAL WORKING MACHINERY	1.33269	72	RUBBER AND PLASTICS PRODUCTS	1.42343	92
93	SPECIAL INDUSTRIAL MACHINERY	1.41176	56	LOGGING CAMPS + SAWMILLS	1.42233	93
94	GENERAL INDUSTRIAL MACHINERY	1.38390	76	STRUCTURAL CLAY PRODUCTS	1.41715	94
95	MACHINE SHOP PRODUCTS	1.41401	43	NEW CONSTRUCT, ALL OTHER	1.41455	95
96	COMPUTERS AND OFFICE EQUIPMENT	1.46050	104	MISC ELECTRICAL PRODUCTS	1.41411	96
97	SERVICE INDUSTRY MACHINES	1.37505	95	MACHINE SHOP PRODUCTS	1.41401	97
98	ELECTRIC TRANSMISSION EQUIPMENT	1.34950	93	SPECIAL INDUSTRIAL MACHINERY	1.41176	98
99	ELECTRICAL INDUSTRIAL APPARATUS	1.35473	136	AMUSEMENT AND RECREATION SERVICES	1.41010	99
100	ELECTRIC LIGHTING AND WIRING	1.37055	103	ELECTRONIC COMPONENTS	1.40694	100
101	RADIO AND TV RECEIVING SETS	1.46092	105	MOTOR VEHICLES	1.40136	101
102	COMMUNICATION EQUIPMENT	1.28512	84	FABRICATED STRUCTURAL STEEL	1.39995	102
103	ELECTRONIC COMPONENTS	1.40694	38	CHEM + FERT MINERAL MIN	1.39837	103
104	MISC ELECTRICAL PRODUCTS	1.41411	134	AUTOMOBILE REPAIR	1.39761	104
105	MOTOR VEHICLES	1.40136	109	CLOCKS AND SCIENTIFIC EQUIPMENT	1.39566	105
106	AIRCRAFT	1.34990	69	ENGINES, TURBINES AND GENERATORS	1.39326	106
107	SHIP AND BOAT BUILDING AND REPAIRING	1.35537	90	FARM MACHINERY	1.39155	107
108	OTHER TRANSPORTATION EQUIPMENT	1.55976	116	PIPELINE TRANSPORTATION	1.38700	108
109	CLOCKS AND SCIENTIFIC EQUIPMENT	1.39566	31	GREENHOUSE AND NURSERY PRODUCTS	1.38428	109
110	JEWELRY, SPORTING GOODS, ETC.	1.46011	94	GENERAL INDUSTRIAL MACHINERY	1.38390	110

SAN JOAQUIN 1976
145 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM
111	RAILROADS	1.46973
112	LOCAL TRANSIT AND INTERCITY BUSES	1.50494
113	TRUCK TRANSPORTATION	1.43015
114	WATER TRANSPORTATION	1.73071
115	AIR TRANSPORTATION	1.47054
116	PIPELINE TRANSPORTATION	1.38703
117	TRANSPORTATION SERVICES	1.16939
118	COMMUNICATION EXCEPT RADIO AND TV	1.14750
119	RADIO AND TELEVISION BROADCASTING	1.46792
120	ELECTRIC COMPANIES AND SYSTEMS	1.24152
121	GAS COMPANIES AND SYSTEMS	1.34611
122	WATER AND SANITARY SERVICES	2.18375
123	WHOLESALE TRADE	1.27309
124	RETAIL TRADE	1.16562
125	BANKING AND FINANCIAL INTERMEDIARIES	1.48238
126	INSURANCE	1.51785
127	OTHER OCCUPIED REAL ESTATE	1.06807
128	REAL ESTATE	1.28379
129	HOTELS AND LODGING PLACES	1.52540
130	PERSONAL AND REPAIR SERVICES	1.30710
131	MISCELLANEOUS BUSINESS SERVICES	1.30373
132	ADVERTISING	2.27263
133	MISC PROFESSIONAL SERVICES	1.24021
134	AUTOMOBILE REPAIR	1.39761
135	MOTION PICTURES	1.61425
136	AMUSEMENT AND RECREATION SERVICES	1.41038
137	DOCTORS AND DENTISTS	1.22446
138	HOSPITALS	1.38309
139	OTHER MEDICAL SERVICES	1.37005
140	EDUCATIONAL SERVICES	1.32197
141	NONPROFIT ORGANIZATIONS	1.29751
142	POST OFFICE	1.13062
143	OTHER FEDERAL GOVT ENTERPRISES	1.16876
144	STATE AND LOCAL GOVT ENTERPRISES	1.56455
145	DUMMY INDUSTRIES	1.87257

	SECTOR	COLUMN SUM	RANK
138	HOSPITALS	1.38309	111
87	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.38216	112
86	METAL STAMPINGS	1.38118	113
97	SERVICE INDUSTRY MACHINES	1.37905	114
100	ELECTRIC LIGHTING AND WIRING	1.37895	115
139	OTHER MEDICAL SERVICES	1.37005	116
45	ORDNANCE + GUIDED MISSILES	1.36608	117
85	SCREW MACHINE PRODUCTS	1.36337	118
91	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.35791	119
107	SHIP AND BOAT BUILDING AND REPAIRING	1.35537	120
99	ELECTRICAL INDUSTRIAL APPARATUS	1.35473	121
106	AIRCRAFT	1.34590	122
29	SWEET POTATOES	1.34961	123
98	ELECTRIC TRANSMISSION EQUIPMENT	1.34950	124
121	GAS COMPANIES AND SYSTEMS	1.34811	125
34	METALS MINING	1.33360	126
92	METAL WORKING MACHINERY	1.33265	127
77	POTTERY AND RELATED PRODUCTS	1.32628	128
140	EDUCATIONAL SERVICES	1.32197	129
35	CRUDE PETROLEUM	1.31770	130
130	PERSONAL AND REPAIR SERVICES	1.30710	131
131	MISCELLANEOUS BUSINESS SERVICES	1.30373	132
44	MAIN. AND REPAIR CONSTRUCTION	1.29668	133
141	NONPROFIT ORGANIZATIONS	1.29751	134
102	COMMUNICATION EQUIPMENT	1.28512	135
128	REAL ESTATE	1.28379	136
123	WHOLESALE TRADE	1.27309	137
133	MISC PROFESSIONAL SERVICES	1.24021	138
137	DOCTORS AND DENTISTS	1.22446	139
117	TRANSPORTATION SERVICES	1.16939	140
143	OTHER FEDERAL GOVT ENTERPRISES	1.16876	141
124	RETAIL TRADE	1.16562	142
118	COMMUNICATION EXCEPT RADIO AND TV	1.14750	143
142	POST OFFICE	1.13062	144
127	OWNER OCCUPIED REAL ESTATE	1.06807	145

END OF DATA

(e) San Francisco Bay

The San Francisco Bay Air Basin economy consists essentially of the nine counties: San Mateo, Santa Clara, Alameda, Contra Costa, San Francisco, Marin, Napa, and the western and southern portions of Solano and Sonoma counties respectively.

Gross County Product is estimated at $45.6 billion with imports of $15.2 billion and exports of $14.4 billion. This basin accounted for approximately 29% of California State Product.

Sectors not present in the Bay Area economy are:

1. Cotton
2. Rice
3. Grass Seed
4. Food, Feed Grains, NEC
5. Citrus Fruits
6. Fruit and Tree Nuts, NEC
7. Melons
8. Hops
9. Sweet Potatoes
10. Chem & Fertilizer, Mineral Mining

The output multipliers for the economy are shown in Table 5.

Table 5

SAN FRANCISCO 1976
137 SECTOR INVERSE

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
1	OILSEEDS	1.31651	127	MOTION PICTURES	2.47121	1
2	BROILERS, CHICKENS AND EGGS	1.73551	137	DUMMY INDUSTRIES	2.46190	2
3	TURKEYS AND OTHER POULTRY	1.66259	42	SUGAR	2.21435	3
4	CATTLE AND CALVES	1.24597	60	CLEANING AND TOILET PREPARATIONS	2.17485	4
5	HOGS	1.19184	126	ADVERTISING	2.16550	5
6	SHEEP, LAMBS, AND WOOL	1.33252	114	WATER AND SANITARY SERVICES	2.14154	6
7	MISC. LIVESTOCK	1.39834	56	AGRICULTURAL CHEMICALS	2.11595	7
8	APIARY PRODUCTS	1.38112	58	PLASTICS MATERIALS AND SYNTHETIC FIBERS	2.03232	8
9	WHEAT	1.61626	87	COMPUTERS AND OFFICE EQUIPMENT	2.01989	9
10	BARLEY	1.74087	39	CANNED AND FROZEN FOODS	2.01819	10
11	CORN	1.73602	61	PAINTS AND ALLIED PRODUCTS	2.01408	11
12	HAY AND PASTURE	1.78095	93	RADIO AND TV RECEIVING SETS	2.01068	12
13	OATS	1.72629	43	CONFECTIONARY PRODUCTS	1.97057	13
14	SORGHUM GRAIN	1.76015	57	GUM AND WOOD CHEMICALS	1.96399	14
15	WALNUTS	1.50292	97	MOTOR VEHICLES	1.94039	15
16	ALMONDS	1.56143	106	WATER TRANSPORTATION	1.93670	16
17	NONCITRUS FRUITS	1.69279	119	INSURANCE	1.92435	17
18	VEGETABLES	1.63636	72	PRIMARY NONFERROUS METAL PRODUCTS	1.90610	18
19	DRIED BEANS	1.62073	80	ENGINES, TURBINES AND GENERATORS	1.90452	19
20	SUGAR BEETS	1.56180	111	RADIO AND TELEVISION BROADCASTING	1.89561	20
21	POTATOES	1.57006	55	INDUSTRIAL CHEMICALS	1.88763	21
22	SEEDLINGS	1.61231	81	FARM MACHINERY	1.88398	22
23	GREENHOUSE AND NURSERY PRODUCTS	1.44300	79	HEATING APPARATUS AND PLUMBING FIXTURES	1.86109	23
24	FORESTRY AND FISHERY PRODUCTS	1.54474	73	METAL CONTAINERS	1.84923	24
25	AGRIC., FORESTRY, FISHERY SERV	1.22245	59	DRUGS	1.84450	25
26	METALS MINING	1.49501	75	FABRICATED STRUCTURAL STEEL	1.84446	26
27	CRUDE PETROLEUM	1.50471	84	SPECIAL INDUSTRIAL MACHINERY	1.83660	27
28	NATURAL GAS + N.G. LIQUIDS	1.42094	82	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.82665	28
29	STONE + CLAY MIN + QUARY	1.60562	117	BANKING AND FINANCIAL INTERMEDIARIES	1.81487	29
30	NEW CONSTRUCT, RESIDENT	1.65667	45	MISC FOOD PRODUCTS	1.80449	30
31	NEW CONSTRUCT, COMMERCIAL	1.79505	54	OTHER PRINTING AND PUBLISHING	1.80040	31
32	NEW CONSTRUCT, PUBLIC UTILITY	1.75393	44	BEVERAGES AND FLAVORINGS	1.79765	32
33	NEW CONSTRUCT, HIGHWAYS	1.69123	99	SHIP AND BOAT BUILDING AND REPAIRING	1.79182	33
34	NEW CONSTRUCT, ALL OTHER	1.59891	85	GENERAL INDUSTRIAL MACHINERY	1.78995	34
35	MAINT. AND REPAIR CONSTRUCTION	1.47835	103	OTHER TRANSPORTATION EQUIPMENT	1.78636	35
36	ORDNANCE + GUIDED MISSILES	1.72065	31	NEW CONSTRUCT, NONRESIDENT	1.78505	36
37	MEAT PRODUCTS	1.34417	101	CLOCKS AND SCIENTIFIC EQUIPMENT	1.78252	37
38	DAIRY PRODUCTS	1.57369	12	HAY AND PASTURE	1.78095	38
39	CANNED AND FROZEN FOODS	2.01839	95	ELECTRONIC COMPONENTS	1.76740	39
40	GRAIN MILL PRODUCTS	1.66015	88	SERVICE INDUSTRY MACHINES	1.76361	40
41	BAKERY PRODUCTS	1.59023	14	SORGHUM GRAIN	1.76015	41
42	SUGAR	2.21435	32	NEW CONSTRUCT, PUBLIC UTILITY	1.75393	42
43	CONFECTIONERY PRODUCTS	1.97057	79	OTHER FABRICATED METAL PRODUCTS	1.75049	43
44	BEVERAGES AND FLAVORINGS	1.79765	10	BARLEY	1.74887	44
45	MISC FOOD PRODUCTS	1.80449	71	IRON AND STEEL FOUNDRIES AND FORGINGS	1.74178	45
46	TEXTILE PRODUCTS	1.54402	121	HOTELS AND LODGING PLACES	1.74136	46
47	LODGING CAMPS + SCHOOLS	1.29725	82	PAPER + PAPERBOARD PRODUCTS	1.74012	47
48	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.51837	11	CORN	1.73602	48
49	WOODEN CONTAINERS	1.47261	2	BROILERS, CHICKENS AND EGGS	1.73551	49
50	HOUSEHOLD FURNITURE	1.55624	13	OATS	1.72629	50
51	OFFICE FURNITURE AND FIXTURES	1.66925	34	ORDNANCE + GUIDED MISSILES	1.72065	51
52	PAPER + PAPERBOARD PRODUCTS	1.74012	91	HOUSEHOLD APPLIANCES	1.71155	52
53	NEWSPAPERS	1.37375	98	AIRCRAFT	1.70210	53
54	OTHER PRINTING AND PUBLISHING	1.80040	41	BAKERY PRODUCTS	1.69823	54
55	INDUSTRIAL CHEMICALS	1.88763	136	STATE AND LOCAL GOVT ENTERPRISES	1.69573	55

Table 5 - Cont.

COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
56	AGRICULTURAL CHEMICALS	2.11595	17	NONCITRUS FRUITS	1.69279	56
57	GUM AND WOOD CHEMICALS	1.96399	33	NEW CONSTRUCT, HIGHWAYS	1.69123	57
58	PLASTICS MATERIALS AND SYNTHETIC FIBERS	2.03232	70	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.68828	58
59	DRUGS	1.94453	66	CEMENT AND CONCRETE PRODUCTS	1.68823	59
60	CLEANING AND TOILET PREPARATIONS	2.17483	93	ELECTRICAL INDUSTRIAL APPARATUS	1.68812	60
61	PAINTS AND ALLIED PRODUCTS	2.01408	94	COMMUNICATION EQUIPMENT	1.68734	61
62	PETROLEUM REFINING AND RELATED PRODUCTS	1.50526	112	ELECTRIC COMPANIES AND SYSTEMS	1.68576	62
63	RUBBER AND PLASTICS PRODUCTS	1.56467	51	OFFICE FURNITURE AND FIXTURES	1.66925	63
64	LEATHER TANNING AND PRODUCTS	1.53811	83	METAL WORKING MACHINERY	1.66768	64
65	GLASS	1.49288	3	TURKEYS AND OTHER POULTRY	1.66259	65
66	CEMENT AND CONCRETE PRODUCTS	1.68823	96	MISC ELECTRICAL PRODUCTS	1.66224	66
67	STRUCTURAL CLAY PRODUCTS	1.42971	77	METAL STAMPINGS	1.66224	67
68	POTTERY AND RELATED PRODUCTS	1.40030	43	GRAIN MILL PRODUCTS	1.66016	68
69	MISC STONE AND CLAY PRODUCTS	1.60115	83	NEW CONSTRUCT, RESIDENT	1.65647	69
70	BLAST FURNACES AND BASIC STEEL PRODUCTS	1.68828	89	ELECTRIC TRANSMISSION EQUIPMENT	1.65527	70
71	IRON AND STEEL FOUNDRIES AND FORGINGS	1.74178	86	MACHINE SHOP PRODUCTS	1.64538	71
72	PRIMARY NONFERROUS METAL PRODUCTS	1.90610	18	VEGETABLES	1.63036	72
73	METAL CONTAINERS	1.94623	78	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.62220	73
74	HEATING APPARATUS AND PLUMBING FIXTURES	1.96109	19	DEFED PENS	1.62079	74
75	FABRICATED STRUCTURAL STEEL	1.84446	104	LOCAL TRANSIT AND INTERCITY BUSES	1.62054	75
76	SCREW MACHINE PRODUCTS	1.62013	107	AIR TRANSPORTATION	1.62013	76
77	METAL STAMPINGS	1.66224	76	SCREW MACHINE PRODUCTS	1.62010	77
78	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	1.62220	9	WHEAT	1.61726	78
79	OTHER FABRICATED METAL PRODUCTS	1.75049	126	AUTOMOBILE REPAIR	1.61498	79
80	ENGINES, TURBINES AND GENERATORS	1.90452	22	SCRELOWER	1.61231	80
81	FARM MACHINERY	1.98338	29	STONE + CLAY MIN + QUARRY	1.60542	81
82	CONSTRUCTION + MATERIAL HANDLING EQUIP	1.82465	102	JEWELRY, SPORTING GOODS, ETC.	1.60357	82
83	METAL WORKING MACHINERY	1.66768	69	MISC STONE AND CLAY PRODUCTS	1.60115	83
84	SPECIAL INDUSTRIAL MACHINERY	1.83063	34	NEW CONSTRUCT, ALL OTHER	1.59831	84
85	GENERAL INDUSTRIAL MACHINERY	1.78005	50	HOUSEHOLD FURNITURE	1.59674	85
86	MACHINE SHOP PRODUCTS	1.64538	92	ELECTRIC LIGHTING AND WIRING	1.59570	86
87	COMPUTERS AND OFFICE EQUIPMENT	2.01989	15	WALNUTS	1.58292	87
88	SERVICE INDUSTRY MACHINES	1.76341	53	NEWSPAPERS	1.57375	88
89	ELECTRIC TRANSMISSION EQUIPMENT	1.65527	98	DAIRY PRODUCTS	1.57369	89
90	ELECTRICAL INDUSTRIAL APPARATUS	1.68812	21	POTATOES	1.57006	90
91	HOUSEHOLD APPLIANCES	1.71155	64	RUBBER AND PLASTICS PRODUCTS	1.56467	91
92	ELECTRIC LIGHTING AND WIRING	1.59590	29	SUGAR BEETS	1.56190	92
93	RADIO AND TV RECEIVING SETS	2.01068	16	ALMONDS	1.56163	93
94	COMMUNICATION EQUIPMENT	1.68734	103	RAILROADS	1.54569	94
95	ELECTRONIC COMPONENTS	1.76743	24	FORESTRY AND FISHERY PRODUCTS	1.54474	95
96	MISC ELECTRICAL PRODUCTS	1.66224	98	TEXTILE PRODUCTS	1.54400	96
97	MOTOR VEHICLES	1.94039	54	LEATHER TANNING AND PRODUCTS	1.53811	97
98	AIRCRAFT	1.70210	105	TRUCK TRANSPORTATION	1.51903	98
99	SHIP AND BOAT BUILDING AND REPAIRING	1.79182	48	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.51837	99
100	OTHER TRANSPORTATION EQUIPMENT	1.78536	128	AMUSEMENT AND RECREATION SERVICES	1.51615	100
101	CLOCKS AND SCIENTIFIC EQUIPMENT	1.78252	62	PETROLEUM REFINING AND RELATED PRODUCTS	1.50526	101
102	JEWELRY, SPORTING GOODS, ETC.	1.60357	130	HOSPITALS	1.50498	102
103	RAILROADS	1.54569	27	CRUDE PETROLEUM	1.50471	103
104	LOCAL TRANSIT AND INTERCITY BUSES	1.62054	122	PERSONAL AND REPAIR SERVICES	1.49779	104
105	TRUCK TRANSPORTATION	1.51901	108	PIPELINE TRANSPORTATION	1.49677	105
106	WATER TRANSPORTATION	1.93670	26	METALS MINING	1.49501	106
107	AIR TRANSPORTATION	1.62013	65	GLASS	1.49288	107
108	PIPELINE TRANSPORTATION	1.49677	123	MISCELLANEOUS BUSINESS SERVICES	1.48829	108
109	TRANSPORTATION SERVICES	1.31259	131	OTHER MEDICAL SERVICES	1.48574	109
110	COMMUNICATION EXCEPT RADIO AND TV	1.21116	35	MAIN. AND REPAIR CONSTRUCTION	1.47806	110

Table 5 - Cont.

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137 SECTOR INVERSE

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COLUMN SUMS OF THE INVERSE AND THEIR RANKING

	SECTOR	COLUMN SUM		SECTOR	COLUMN SUM	RANK
111	RADIO AND TELEVISION BROADCASTING	1.09561	49	WOODEN CONTAINERS	1.47261	111
112	ELECTRIC COMPANIES AND SYSTEMS	1.60576	23	GREENHOUSE AND NURSERY PRODUCTS	1.44300	112
113	GAS COMPANIES AND SYSTEMS	1.24101	132	EDUCATIONAL SERVICES	1.44010	113
114	WATER AND SANITARY SERVICES	2.14154	67	STRUCTURAL CLAY PRODUCTS	1.42961	114
115	WHOLESALE TRADE	1.39072	28	NATURAL GAS + N.G. LIQUIDS	1.42094	115
116	RETAIL TRADE	1.24975	133	NONPROFIT ORGANIZATIONS	1.40311	116
117	BANKING AND FINANCIAL INTERMEDIARIES	1.91497	68	POTTERY AND RELATED PRODUCTS	1.40030	117
118	INSURANCE	1.92435	7	MISC. LIVESTOCK	1.39834	118
119	OWNER OCCUPIED REAL ESTATE	1.05946	120	REAL ESTATE	1.39163	119
120	REAL ESTATE	1.39163	115	WHOLESALE TRADE	1.39072	120
121	HOTELS AND LODGING PLACES	1.74136	9	APIARY PRODUCTS	1.38112	121
122	PERSONAL AND REPAIR SERVICES	1.49779	125	MISC PROFESSIONAL SERVICES	1.35826	122
123	MISCELLANEOUS BUSINESS SERVICES	1.48829	37	MEAT PRODUCTS	1.34417	123
124	ADVERTISING	2.16550	6	SHEEP, LAMBS, AND WOOL	1.33292	124
125	MISC PROFESSIONAL SERVICES	1.35826	129	DOCTORS AND DENTISTS	1.33167	125
126	AUTOMOBILE REPAIR	1.61488	1	DAIRIES	1.31651	126
127	MOTION PICTURES	2.47121	109	TRANSPORTATION SERVICES	1.31259	127
128	AMUSEMENT AND RECREATION SERVICES	1.51615	47	LOGGING CAMPS + SAWMILLS	1.29725	128
129	DOCTORS AND DENTISTS	1.33167	135	OTHER FEDERAL GOVT ENTERPRISES	1.27296	129
130	HOSPITALS	1.53498	116	RETAIL TRADE	1.24975	130
131	OTHER MEDICAL SERVICES	1.48574	4	CATTLE AND CALVES	1.24597	131
132	EDUCATIONAL SERVICES	1.44010	113	GAS COMPANIES AND SYSTEMS	1.24101	132
133	NONPROFIT ORGANIZATIONS	1.40311	25	AGRIC., FORESTRY, FISHERY SERV	1.22245	133
134	POST OFFICE	1.20266	110	COMMUNICATION EXCEPT RADIO AND TV	1.21116	134
135	OTHER FEDERAL GOVT ENTERPRISES	1.27296	134	POST OFFICE	1.20266	135
136	STATE AND LOCAL GOVT ENTERPRISES	1.69573	5	HOGS	1.19184	136
137	DUMMY INDUSTRIES	2.46180	119	OWNER OCCUPIED REAL ESTATE	1.05946	137

END OF DATA

9. Basic Emissions Data for Use with the Input-Output Models

(i) Overview

At the outset of the project, it was anticipated that the California State Air Resources Board emissions inventory data might not provide detail for every sector of the proposed input-output models. With this in mind the more generalized air pollution data sources were reviewed to cover such an eventuality. Moreover, it was realized that emissions data for the combustion of fuels, by fuel type, could be derived for the majority of the input-output sectors at least on a statewide basis.

(ii) Strategic Environmental Assessment System

The United States Environmental Protection Agency has sponsored the development of the Strategic Environmental Assessment System (SEAS) (36). A copy of the model description and printout of the data were obtained from the Project Officer in Washington, D.C. Module Number 7 of the National Economic Modules is titled National Residuals: estimates of annual tonnage of air, water, and land pollution from stationary sources on a nationwide basis. The regional module Number 10 is designated Regionalization: Regionalization of national economic, pollutant and abatement cost data.

After a comprehensive review of the available SEAS data was carried out, it was concluded that the detail was insufficient for use with the California input-output Air Basin Models.

(iii) EPA Bulletin AP 42 Data

Copies of Bulletin AP 42, "Compilation of Air Pollutant Emissions Factors" Parts A and B (37) were obtained from the U.S. Environmental Protection Agency. The Bulletin provides emission data for a complete range of industrial processes and the service and transportation industries. Each of the industries covered in the Bulletin is defined by complete process descriptions. However, no Standard Industrial Classification (SIC) codes are assigned to the industry descriptions.

These data were reviewed and the industry descriptions in the 1972 SIC code manual (38) were compared with the process descriptions given in Bulletin AP 42. In this manner four digit SIC codes were assigned to each industrial process described. The emission data are given in tons of pollutant per ton of product output (or other physical measure i.e. barrels, etc.) The emission factors in tons were thus assembled by four-digit SIC codes.

Mr. Werner Schink, State of California, Department of Water Resources, provided a set of conversion factors obtained from the U.S. Department of Transportation which could be used to convert the dollar value of product in 1976 dollars to tons of physical product for each input-output sector, thus permitting the direct application of the AP 42 factors to input-output sector data. These final conversions were not made since the Air Resources Board emission inventory computer tapes became available to the project and it seemed more appropriate to exploit these primary data to the fullest

before resorting to the use of the more generalized Bulletin AP 42 data.

(iv) Fuel Combustion Data

In developing the statewide input-output model, the data for the energy sectors were regionalized on the basis of energy use data available for California.

The California Energy Resources Conservation and Development Commission (ERCDC) sponsored a study relating to potential energy shortages (39). This study, prepared by Arthur D. Little, Incorporated, Cambridge, Massachusetts, provided detailed energy use in California by fuel type for each economic sector. The estimates of fuel use by 4-digit SIC in the manufacturing sectors were based on national average use data modified to California totals on the fuel supply side. These data were updated from 1975 to 1976 and then further disaggregated to give additional detail for all sectors of the input-output model. This was accomplished by means of a series of BTU conversion factors available for each fuel type.

By converting fuel type to BTU's the total BTU energy requirements of a given sector could be maintained while the average input by fuel type could be adjusted to meet California totals for major sectors. Coal is not used in California except by the steel industry. Similarly, oil and natural gas use by individual industries based on national averages could be adjusted to agree with the known California supply totals for these industries. In this way the national average BTU inputs were adjusted to conform to the California fuel use pattern for the base year. Fuel types and conversion factors are given in Table 6 presented below.

Table 6

Fuel Type	BTU's Per Unit	Conversion Factor
1. Gasoline	5.25×10^6 BTU/BBL	42 Gal/BBL
2. Kerosine (jet fuel)	5.76×10^6 BTU/BBL	"
3. Distillate	5.825×10^6 BTU/BBL	"
4. Residual Oil	6.28×10^6 BTU/BBL	"
5. Coke	21.2×10^6 BTU/Ton	Ø
6. Other Refined Oil Products	6.1×10^6 BTU/BBL	42 Gal/BBL
7. Natural Gas	1,032 BTU/Cu. ft.	Ø
8. Liquid Petroleum Gas	4.011×10^6 BTU/BBL	42 Gal/BBL
9. Electricity	Ø	Ø
10. Coal	26.2×10^6 BTU/Ton	Ø

The fuel use estimates for each input-output sector of the statewide model were subsequently used to derive the total emissions of the five critical pollutants for each sector.

Data from the National Emission Data System (NEDS) (Appendix C, Bulletin AP 42) were selected from the Source Classification Codes and Emissions Factor listings. These factors are shown in Table 7. The factors were used to convert the fuel use estimates by sector to total emissions. The converted data were arrayed by input-output sector and could be compared with the emissions inventory tape data.

Table 7

Fuel Type	Unit	Pounds Emitted per Unit				
		Part	So_x	No_x	HC	CO
1. Gasoline	1000 Gal. Burned	6.50	5.30	102.	161.	3940
2. Kerosine	1000 "		6.20			
3. Distillate	1000 "	33.5	144.	469.	37.5	102
4. Residual Oil	1000 "		159.			
5. Coke	Per Ton Burned	2.00	38.0	15.0	.2	2.0
6. Other R.O.P.	1000 Gal. Burned	5.00	140.	67.8	5.51	15.4
7. Nat. Gas	10^6 Cu. Ft.	14.0	940.	413.	42.0	115.
8. L.P.G.	1000 Gal. Burned	1.75	86.5	11.7	.30	1.55
9. Electricity	Ø			Ø		
10. Coal	Ton Burned	5.00	38.0	15.0	.30	1.50

(v) California Air Resources Board Emissions Inventory Data

In July of 1978 the Air Resources Board provided two computer tapes containing the emissions inventory data for 1976. The tapes contained approximately 44,000 records of variable length in an heirarchical structure. The data related to some 6,000 individual California firms. Among the relevant data for the current study the tapes provided the name and address, County and Air Quality Control Region of each firm. The 4-Digit Standard Industrial Classification codes were provided for each minor product. Total employment for each establishment was also given. Pollutant outputs for each of the five critical pollutants emitted were supplied in tons per year for each SIC code.

(vi) Air Basin Summary Emissions Data

The Air Basin Summary Emissions Data were provided by the Air Resources Board for each of the fourteen California Air Basins. These summary sheets provided estimates by major category of the level of pollutant output for the five critical pollutants in tons per day. Estimates for several years were furnished. A typical data sheet is shown as Table 8.

TABLE 8

SAN DIEGO AIR BASIN SUMMARY
PARTICULATE MATTER EMISSIONS (TONS PER AVG DAY)

STATIONARY SOURCES	INVENTORY YEAR 1972	1975	1980	1985	1990	1995
PETROLEUM						
PRODUCTION						
REFINING						
MARKETING						
SUBTOTAL						
ORGANIC SOLVENT USERS						
SURFACE COATING						
DRY CLEANING						
DEGREASING						
OTHER						
SUBTOTAL						
CHEMICAL						
METALLURGICAL	0.2	0.2	0.2	0.2	0.3	0.3
MINERAL	17.1	19.4	22.4	25.7	29.5	33.4
FOOD AND AG PROCESSING	1.5	1.6	1.8	2.0	2.2	2.4
PESTICIDES						
WOOD PROCESSING						
COMBUSTION OF FUELS						
POWER PLANTS	5.0	8.5	14.4	14.4	14.1	12.2
OTHER INDUSTRIAL	0.5	0.6	0.8	0.9	1.1	1.3
DOMESTIC AND COMMERCIAL	0.7	0.7	0.8	0.9	1.0	1.1
ORCHARD HEATERS						
SUBTOTAL	6.2	9.8	16.0	16.2	16.2	14.6
WASTE BURNING						
AGRICULTURAL DEBRIS	0.1	0.1	0.1	0.1	0.1	0.1
FOREST MANAGEMENT						
RANGE IMPROVEMENT	0.1	0.1	0.1	0.1	0.1	0.1
DUMPS						
CONICAL BURNERS						
INCINERATORS						
OTHER						
SUBTOTAL	0.2	0.2	0.2	0.2	0.2	0.3
MISCELLANEOUS AREA SOURCES						
WILD FIRES	1.0	1.0	1.0	1.0	1.0	1.0
STRUCTURAL FIRES	3.0	3.4	3.8	4.3	4.7	5.2
FARMING OPERATIONS	3.9	4.1	4.5	4.6	4.8	5.2
CONSTR. AND DEMOL.	59.7	67.8	83.4	99.7	119	142
UNPAVED ROADS	14.2	14.2	14.2	14.2	14.2	14.2
UTILITY EQUIP: MOWERS, ETC	0.1	0.1	0.1	0.1	0.1	0.2
SUBTOTAL	81.9	90.5	107	124	144	167
TOTAL, STATIONARY	107	122	148	168	192	218
MOBILE SOURCES						
MOTOR VEHICLES-ON ROAD						
LIGHT-DUTY PASSENGER	8.4	8.9	6.8	6.5	7.3	8.1
LIGHT-DUTY GAS TRUCKS	1.3	1.6	1.3	1.3	1.5	1.8
MEDIUM-DUTY GAS TRUCKS	0.1	0.2	0.2	0.2	0.2	0.2
HEAVY-DUTY GAS TRUCKS	0.8	1.0	1.4	1.3	1.1	1.1
HEAVY-DUTY DIESEL TRUCKS	1.4	1.7	2.3	2.8	3.3	3.9
MOTORCYCLES						
SUBTOTAL	12.1	13.4	12.0	12.2	13.5	15.1
JET AIRCRAFT	3.9	4.4	5.0	5.6	6.2	6.8
PISTON AIRCRAFT						
RAILROADS	0.1	0.1	0.1	0.1	0.1	0.2
SHIPS	0.8	0.9	1.1	1.2	1.3	1.5
OTHER OFF-ROAD VEH	1.0	1.2	1.3	1.5	1.6	1.8
TOTAL MOBILE SOURCES	18.0	20.0	19.5	20.6	22.8	25.3
TOTAL, ALL SOURCES	125	142	167	189	215	244

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10. Developing the Emission Coefficients for Input-Output Sectors - Statewide Model

(i) Preparing the Emissions Inventory Tape Data

The emissions inventory data tapes were converted to a fixed length record format and the relevant pieces of information on SIC codes, employment, firm name and address, county, air quality control region, and pollutant discharges were extracted and written on a separate computer tape. These data were flagged where potential problems were apparent i.e. missing SIC codes, incomplete or missing pollutant codes. These problem entries were inspected and where possible obvious additions or corrections were made. In some instances only two or three digit SIC codes were punched. The correct four-digit SIC codes could be inferred by the name of the firm or by its principal product code. Where pollutant codes appeared to be obviously mispunched they were compared with other firms within the same SIC category to determine the proper codes. The corrected data were re-entered into the tape for further processing.

A map of the SIC codes for each input-output sector was established and the four-digit SIC codes of the emissions inventory data were bridged or mapped into the sectors of the statewide model. When this task was complete the pollutant data could be sorted into, or allocated, to the appropriate input-output sector on the basis of the identifying SIC codes.

(ii) Selective Merging with Fuel Combustion Data

When the pollutant data from the emissions inventory tapes had been bridged into the input-output sectors of the statewide model the results were inspected and any sectors which remained at zero were noted. The

pollutants for those sectors were then established on the basis of the fuel combustion emissions data derived as described in 5(iv) above. These entries were selectively merged with the emissions inventory data to form a basic set of pollutant data for each sector of the statewide model. This merging was undertaken for the agricultural sectors and for several of the trade and service sectors. Sector 135 "Owner Occupied Real Estate" remains null in terms of pollutants. This is due to the fact that no fuel use was allocated to this sector in the processing matrix. Fuel purchases for household use were treated as a final demand.

(iii) Air Basin Summary Emissions Data

The Air Basin Summary Emissions Data as prepared by the California Air Resources Board are designed to provide an overall control estimate for the pollutants of each of the major sectors of the air basins.

(iv) Adjusting the Data Sets

The Air Basin Summary Emissions data were keypunched for each of the fourteen air basins and summed to yield a statewide emissions control total for the relevant sectors of the input-output model. The 22 major categories of the Air Basin Summary Data were bridged to the 152 productive input-output sectors as shown in Table 9.

The Air Basin Summary Data were then used as controls to proportionally adjust the merged emissions inventory data and fuel combustion data by sectors thus bringing the two data sets into overall agreement. The follow-

Table 9

Relation of Economic Categories to I/O Table Sectors

ECONOMIC CATEGORY = 1 PETROLEUM PRODUCTION										
I/O TABLE SECTORS =	41	42								
ECONOMIC CATEGORY = 2 PETROLEUM REFINING										
I/O TABLE SECTORS =	78									
ECONOMIC CATEGORY = 3 PETROLEUM MARKETING										
I/O TABLE SECTORS =	131	132								
ECONOMIC CATEGORY = 4 ORGANIC SOLVENT USE - SURFACE COATING										
I/O TABLE SECTORS =	138	142								
ECONOMIC CATEGORY = 5 ORGANIC SOLVENT USE- DRY CLEANING										
I/O TABLE SECTORS =	138									
ECONOMIC CATEGORY = 6 ORGANIC SOLVENT USE -DEGREASING										
I/O TABLE SECTORS =	124	125	115	142						
ECONOMIC CATEGORY = 7 CHEMICAL PRODUCTION										
I/O TABLE SECTORS =	73	74	75	76	77	71	79	80		
ECONOMIC CATEGORY = 8 METALLURGICAL PROCESSES										
I/O TABLE SECTORS =	86	87	88	89	90	91	92	93	94	95
	96	97	98	99	100	101	102	51		
ECONOMIC CATEGORY = 9 MINERALS PRODUCTION										
I/O TABLE SECTORS =	81	82	83	84	85	39	40	43	44	
ECONOMIC CATEGORY = 10 FOOD AND AGRICULTURE PROCESSING										
I/O TABLE SECTORS =	52	53	54	55	56	57	58	59	60	61
	62									
ECONOMIC CATEGORY = 11 PESTICIDES PRODUCTION										
I/O TABLE SECTORS =	72									
ECONOMIC CATEGORY = 12 WOOD PROCESSSING										
I/O TABLE SECTORS =	63	64	65	66	67	68	69	70		
ECONOMIC CATEGORY = 13 COMBUSTION OF FUELS IN ORCHARD HEATERS										
I/O TABLE SECTORS =	20	21	22	23	24					
ECONOMIC CATEGORY = 14 FARMING OPERATIONS										
I/O TABLE SECTORS =	1	2	3	4	5	6	7	8	9	10
	11	12	13	14	15	16	17	18	19	20
	21	22	23	24	25	26	27	28	29	30
	31	32	33	34	35	36	37	38		
ECONOMIC CATEGORY = 15 CONSTRUCTION AND DEMOLITION										
I/O TABLE SECTORS =	45	46	47	48	49	50				
ECONOMIC CATEGORY = 16 OTHER ORGANIC SOLVENT USE										
I/O TABLE SECTORS =	74	75	76	77						
ECONOMIC CATEGORY = 17 COMBUSTION OF FUELS IN MISC. INDUSTRIES										
I/O TABLE SECTORS =	103	104	105	106	107	108	109	110	111	112
	113	114	116	117	118	133	134	135	136	137
	139	140	141	143	144	145	146	147	148	149
	150	151	152	126	127	129	130			
ECONOMIC CATEGORY = 18 COMBUSTION OF FUELS IN POWER PLANTS										
I/O TABLE SECTORS =	128									
ECONOMIC CATEGORY = 19 TRANSPORTATION FUEL USE IN TRUCKS AND BUSES										
I/O TABLE SECTORS =	120	121								
ECONOMIC CATEGORY = 20 AIRCRAFT										
I/O TABLE SECTORS =	123									
ECONOMIC CATEGORY = 21 RAILROADS										
I/O TABLE SECTORS =	119									
ECONOMIC CATEGORY = 22 SHIPS										
I/O TABLE SECTORS =	122									

ing exception is noted.

In certain cases the Air Basin Summary Data showed zero entries where the emissions inventory data had entries present. In these cases the zero control of the summary data was ignored and the emissions inventory data were entered. The overall emissions totals were then adjusted proportionally to bring the totals for the input-output sectors and the air basin summary totals into agreement. In all cases the grand totals of the air basin summary emissions sheets were taken as limiting.

(v) Forming the Statewide Emission Coefficients for Input-Output Sectors

When the input-output sector emission data were adjusted to agree with the overall totals provided by the sums of the air basin summary data for the fourteen air basins, the total levels of each of the five pollutants in tons were divided by the gross output or production level in millions of dollars for each sector.

The coefficients were thus calculated in tons of pollutant for each of the 5 critical pollutants per million dollars of product output for each of the 152 productive sectors of the model. These statewide pollutant coefficients are shown in Table 10.

Table 10

POLLUTION COEFFICIENTS IN TONS PER MILLION DOLLARS OF PRODUCTION

CALIFORNIA I/O TABLE SECTORS	PART.	SOX	NOX	HC	CO
1 DAIRIES	8.620625	2.229085	5.016844	.004679	5.925510
2 BROILERS, CHICKENS AND EGGS	1.720504	1.575402	1.190188	.001727	4.691657
3 TURKEYS AND OTHER POULTRY	.359425	.623003	.247604	.071885	.662939
4 CATTLE AND CALVES	4.322647	1.169855	2.506463	.003878	6.982937
5 HOGS	1.595238	.333333	.833333	.214286	2.357143
6 SHEEP, LAMBS, AND WOOL	2.757009	1.121495	1.464174	1.012461	15.716511
7 MISC. LIVESTOCK	15.465116	4.069767	8.720930	2.558140	28.372093
8 APIARY PRODUCTS	1.139896	0.	.414508	.984456	16.632124
9 COTTON	12.590698	2.304032	7.197573	.009516	14.026407
10 WHEAT	10.622896	1.868687	6.043771	.004209	11.022727
11 RICE	19.865772	3.557047	11.250763	.006101	7.565589
12 BARLEY	15.401003	2.731830	8.796992	.006266	16.033835
13 CORN	40.206704	6.854749	22.905028	.033520	53.089385
14 HAY AND PASTURE	6.679502	1.386215	3.865999	.006418	12.854576
15 OATS	20.571429	3.642857	11.857143	2.357143	21.785714
16 SORGHUM GRAIN	24.908257	4.266055	14.197248	.022936	41.399083
17 GRASS SEED	4.796748	1.002710	2.899729	.867209	10.243902
18 FOOD, FEED GRAINS, NEC	55.000000	10.000000	32.500000	7.500000	70.000000
19 TOBACCO	0.	0.	0.	0.	0.
20 WALNUTS	12.126277	2.070566	6.898793	.009285	25.849582
21 ALMONDS	8.076285	1.647319	4.643449	.016584	25.494748
22 NONCITRUS FRUITS	4.648765	.832282	2.667458	.005934	10.914621
23 CITRUS FRUITS	2.529700	.489168	1.465176	.002329	9.415327
24 FRUIT AND TREE NUTS, NEC	20.000000	1.818182	6.363636	2.727273	24.545455
25 VEGETABLES	6.792695	1.132829	3.896419	.007847	16.518048
26 DRIED BEANS	1.284672	.233577	.759124	.919708	15.459854
27 DRIED PEAS	0.	0.	0.	0.	0.
28 MELONS	4.328231	.688776	2.491497	.008503	16.836735
29 SUGAR BEETS	13.687269	2.419440	7.797147	.015848	15.404120
30 HOPS	0.	0.	0.	0.	1.333333
31 POTATOES	7.623656	1.387097	4.290323	.860215	7.623656
32 SWEET POTATOES	2.513966	.335196	1.061453	.223464	1.787709
33 VEGETABLES + SUGAR, NEC	0.	0.	0.	0.	0.
34 SAFFLOWER	4.682540	.820106	2.539683	.476190	3.862434
35 OIL CROPS, NEC	0.	0.	0.	0.	0.
36 GREENHOUSE AND NURSERY PRODUCTS	3.143477	8.677572	3.772172	.001971	1.052424
37 FORESTRY AND FISHERY PRODUCTS	44.855430	7.145236	25.825518	.066596	143.093401
38 AGRIC., FORESTRY, FISHERY SERV	25.441049	0.	.063144	.002310	.006160
39 METALS MINING	9.537755	3.403514	3.387684	.007915	.427418
40 COAL MINING	0.	0.	0.	0.	0.
41 CRUDE PETROLEUM	3.830655	.550780	.339778	56.863851	.064898
42 NATURAL GAS + N.G. LIQUIDS	.041920	0.	.041920	20.603647	.014971
43 STONE + CLAY MIN + QUARRY	89.770462	.233429	.658951	.002432	.145893
44 CHEM + FERT MINERAL MIN	86.480509	0.	2.833840	.027647	.131324
45 NEW CONSTRUCT, RESIDENT	1.136928	.331430	1.209714	.631714	9.251941
46 NEW CONSTRUCT, NONRESIDENT	.006342	0.	.004628	.003085	0.
47 NEW CONSTRUCT, PUBLIC UTILITY	6.530745	2.083531	6.799518	1.143368	8.297005
48 NEW CONSTRUCT, HIGHWAYS	.084180	0.	0.	.050972	0.
49 NEW CONSTRUCT, ALL OTHER	.461673	0.	.001958	.328508	0.
50 MAIN. AND REPAIR CONSTRUCTION	.047818	0.	.001316	.032244	.000219
51 ORDNANCE + GUIDED MISSILES	.016373	.151175	.070130	.006276	.002456
52 MEAT PRODUCTS	.097482	.005416	0.	.010470	0.
53 DAIRY PRODUCTS	.121206	.003687	.000461	.002765	.006913
54 CANNED AND FROZEN FOODS	.157641	.064692	.001434	.027971	.042889
55 GRAIN MILL PRODUCTS	12.519020	.023464	.001422	.027730	.027730

Table 10 - Cont.

		PART.	SOX	NOX	HC	CO
56	BAKERY PRODUCTS	.186317	.020994	0.	.000875	.000875
57	SUGAR	3.904869	1.309122	.014998	.989876	.162837
58	CONFECTIONARY PRODUCTS	6.611655	.349243	.003424	2.639869	.037663
59	BEVERAGES AND FLAVORINGS	.040622	.016587	.000339	.003385	.001354
60	MISC FOOD PRODUCTS	.672645	.051782	.009368	.247981	.397342
61	TOBACCO MANUFACTURERS	0.	0.	0.	0.	0.
62	TEXTILE PRODUCTS	.100230	.024998	.000238	.216172	.007618
63	LOGGING CAMPS + SAWMILLS	5.546309	.518553	.059648	.266973	2.737558
64	MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	1.332463	1.148887	.011718	.084813	.117176
65	WOODEN CONTAINERS	.048239	0.	0.	.067535	0.
66	HOUSEHOLD FURNITURE	.159309	0.	0.	.247175	0.
67	OFFICE FURNITURE AND FIXTURES	.180765	.014122	0.	.207598	.001412
68	PAPER + PAPERBOARD PRODUCTS	.661900	.793718	.016873	.089987	.456265
69	NEWSPAPERS	.003819	.016233	.001910	.002865	.001910
70	OTHER PRINTING AND PUBLISHING	.015117	.017805	.000672	.110523	.001344
71	INDUSTRIAL CHEMICALS	3.668761	10.677433	2.571117	.126566	.563192
72	AGRICULTURAL CHEMICALS	.524896	3.872941	2.388558	36.571132	.143359
73	GUM AND WOOD CHEMICALS	17.838478	25.765452	.921190	19.460665	323.757229
74	PLASTICS MATERIALS AND SYNTHETIC FIBERS	1.443013	.008002	1.242965	64.498146	.034675
75	DRUGS	.409858	.035468	.580632	69.632442	.049919
76	CLEANING AND TOILET PREPARATIONS	1.054182	.002845	.157203	.950328	.009959
77	PAINTS AND ALLIED PRODUCTS	.115358	0.	.010815	1.274949	0.
78	PETROLEUM REFINING AND RELATED PRODUCTS	.264044	3.061326	1.314723	4.849889	3.444942
79	RUBBER AND PLASTICS PRODUCTS	1.322067	.449286	.176457	2.972955	.015949
80	LEATHER TANNING AND PRODUCTS	.097677	0.	.048838	.160469	.003488
81	GLASS	9.388302	.797980	2.192166	.149703	.643070
82	CEMENT AND CONCRETE PRODUCTS	50.836070	9.358253	15.592317	.144042	3.372013
83	STRUCTURAL CLAY PRODUCTS	21.318664	.645779	7.884876	.127561	2.375827
84	POTTERY AND RELATED PRODUCTS	1.086133	.042098	.143134	.117875.	0.
85	MISC STONE AND CLAY PRODUCTS	13.741236	.633981	1.814927	.034807	16.754512
86	BLAST FURNACES AND BASIC STEEL PRODUCTS	2.764276	11.399613	2.286267	.227444	41.396387
87	IRON AND STEEL FOUNDRIES AND FORGINGS	3.621395	.387132	.269522	.044104	13.922035
88	PRIMARY NONFERROUS METAL PRODUCTS	.259919	.537914	.160502	.011531	.026802
89	METAL CONTAINERS	.289863	.017211	.190223	.240949	.066125
90	HEATING APPARATUS AND PLUMBING FIXTURES	.103313	0.	.007125	.053438	.007125
91	FABRICATED STRUCTURAL STEEL	.103380	.002461	.006400	.030522	0.
92	SCREW MACHINE PRODUCTS	0.	0.	0.	.013064	0.
93	METAL STAMPINGS	.518069	0.	1.295172	.033972	.464988
94	CUTLERY, HAND TOOLS AND GENERAL HARDWARE	.073601	.007830	.037583	.059507	.305365
95	OTHER FABRICATED METAL PRODUCTS	.125829	.023165	.046857	.057913	.055281
96	ENGINES, TURBINES AND GENERATORS	.050077	0.	.004552	.015934	.117227
97	FARM MACHINERY	.024602	0.	0.	.013668	0.
98	CONSTRUCTION + MATERIAL HANDLING EQUIP	.138381	0.	.025535	.023063	.070838
99	METAL WORKING MACHINERY	.019358	.038716	.005807	.007743	.002904
100	SPECIAL INDUSTRIAL MACHINERY	.071065	.068735	.026795	.026795	0.
101	GENERAL INDUSTRIAL MACHINERY	.011279	0.	.003471	.011279	0.
102	MACHINE SHOP PRODUCTS	.011864	0.	0.	.003650	0.
103	COMPUTERS AND OFFICE EQUIPMENT	1.971799	0.	.000356	.001778	0.
104	SERVICE INDUSTRY MACHINES	.078296	.140933	.630285	.183996	.003915
105	ELECTRIC TRANSMISSION EQUIPMENT	.011944	0.	0.	.014115	0.
106	ELECTRICAL INDUSTRIAL APPARATUS	.047616	.001642	.029555	.045974	0.
107	HOUSEHOLD APPLIANCES	.087734	0.	.070753	.650931	0.
108	ELECTRIC LIGHTING AND WIRING	.060533	0.	0.	.198893	0.
109	RADIO AND TV RECEIVING SETS	.016878	0.	.004603	.070579	0.
110	COMMUNICATION EQUIPMENT	.005376	.013116	.035263	.015051	0.
111	ELECTRONIC COMPONENTS	.039692	.007145	.047366	.192903	0.
112	MISC ELECTRICAL PRODUCTS	.316811	.006741	.002247	.040444	0.
113	MOTOR VEHICLES	.081471	.002839	.037131	1.805895	.000655
114	AIRCRAFT	.017994	.012508	.053652	.152728	.000658
115	SHIP AND BOAT BUILDING AND REPAIRING	.086110	.006624	.043528	28.679302	0.
116	OTHER TRANSPORTATION EQUIPMENT	.057832	0.	.008897	.147917	0.
117	CLOCKS AND SCIENTIFIC EQUIPMENT	.017836	.011772	.023187	.362073	0.

Table 10 - Cont.

		PART.	SOX	NOX	HC	CO
118	JEWELRY, SPORTING GOODS, ETC.	1.029252	.125731	.446745	.223373	.001338
119	RAILROADS	2.202032	3.684284	23.551268	9.680669	10.596570
120	LOCAL TRANSIT AND INTERCITY BUSES	5.821285	5.113224	49.580775	82.692942	1186.447811
121	TRUCK TRANSPORTATION	8.295922	7.382476	70.286246	70.327131	269.630507
122	WATER TRANSPORTATION	1.164477	12.025803	6.692737	1.204586	2.429894
123	AIR TRANSPORTATION	2.846873	.639332	4.486792	12.093364	42.777499
124	PIPELINE TRANSPORTATION	.014098	.028197	.155082	224.319752	.056394
125	TRANSPORTATION SERVICES	.002259	.128773	.056479	.103922	.015814
126	COMMUNICATION EXCEPT RADIO AND TV	.046638	.225644	.566167	.126710	.702651
127	RADIO AND TELEVISION BROADCASTING	.017831	.518301	.353063	.011888	.035663
128	ELECTRIC COMPANIES AND SYSTEMS	5.661698	21.430376	19.529639	1.019663	2.581649
129	GAS COMPANIES AND SYSTEMS	0.	.000575	.013598	.010150	0.
130	WATER AND SANITARY SERVICES	5.235291	12.681979	9.566179	.517267	.925549
131	WHOLESALE TRADE	.103337	.003030	.275866	11.326046	.004258
132	RETAIL TRADE	.002474	0.	.004124	.478644	.000165
133	BANKING AND FINANCIAL INTERMEDIARIES	.065653	.648870	.875878	.108911	.568287
134	INSURANCE	0.	0.	.000158	.000158	0.
135	OWNER OCCUPIED REAL ESTATE	0.	0.	0.	0.	0.
136	REAL ESTATE	.143790	.262626	1.612788	.420086	2.356400
137	HOTELS AND LODGING PLACES	.003057	0.	.113122	.000764	0.
138	PERSONAL AND REPAIR SERVICES	.009028	.016972	.011917	9.646399	.001806
139	MISCELLANEOUS BUSINESS SERVICES	.010520	.000277	.004429	.003599	.000185
140	ADVERTISING	.000860	0.	0.	.003441	0.
141	MISC PROFESSIONAL SERVICES	.009651	.014223	.065697	.002201	0.
142	AUTOMOBILE REPAIR	.032994	.000303	.000605	7.161819	.005751
143	MOTION PICTURES	.001328	.005312	.009961	.008411	0.
144	AMUSEMENT AND RECREATION SERVICES	.004368	0.	.031013	.002621	0.
145	DOCTORS AND DENTISTS	.058746	.043370	.640690	.180182	1.015246
146	HOSPITALS	.074719	.290766	.420050	.004424	.000983
147	OTHER MEDICAL SERVICES	.132162	2.324424	2.060529	.102125	.414080
148	EDUCATIONAL SERVICES	.177143	.463869	1.483637	.025002	.001596
149	NONPROFIT ORGANIZATIONS	.015790	.029258	.091954	.005109	.000464
150	POST OFFICE	.078853	.210565	.909847	.220963	1.233926
151	OTHER FEDERAL GOVT ENTERPRISES	.655583	.403839	1.444905	.870614	.039335
152	STATE AND LOCAL GOVT ENTERPRISES	2.977226	34.128567	40.657391	3.700092	18.307857
153	NONCOMPETITIVE IMPORTS	0.	0.	0.	0.	0.
154	DUMMY INDUSTRIES	0.	0.	0.	0.	0.
155	GOVERNMENT INDUSTRY	0.	0.	0.	0.	0.
156	SPECIAL INDUSTRIES	0.	0.	0.	0.	0.
157	TOTAL INTERMEDIATE INPUTS	0.	0.	0.	0.	0.
158	EMPLOYEE COMPENSATION	0.	0.	0.	0.	0.
159	PROFIT TYPE INCOME	0.	0.	0.	0.	0.
160	NET INTEREST	0.	0.	0.	0.	0.
161	INDIRECT BUSINESS TAXES	0.	0.	0.	0.	0.
162	CAPITAL CONSUMPTION ALLOWANCES	0.	0.	0.	0.	0.
163	TOTAL VALUE ADDED	0.	0.	0.	0.	0.
164	GROSS INPUT = GROSS OUTPUT	0.	0.	0.	0.	0.

11. Developing the Emission Coefficients for Air Basins

(i) The Emissions Inventory Data

For the statewide model the emissions inventory data were relatively complete in terms of SIC code coverage. For those sectors where no basic emissions data were available, recourse could be made to the fuel combustion data derived for input-output sectors.

At the air basin level the basic emissions inventory data became rather sparse and the fuel combustion data by sector were not available. In view of this a procedure for estimating pollutant levels by detailed sector based on statewide averages had to be devised.

A computer program was written to sort the emissions inventory data into input-output sectors by air basin. As an example, the emissions inventory array for the five pollutants for the San Diego air basin is shown as Table 11. The columns of the array are totaled for each of the five pollutants, permitting a comparison with the totals of the air basin summary data.

(ii) The Air Basin Summary Emissions Data

The summary emissions data for each of the 22 economic categories of the air basins were converted to tons per year. These data are shown in Table 12 along with the basin totals for each pollutant. When the totals of the summary data of Table 12 are compared with the totals of Table 11 it is seen that only 1% of the CO emission is covered by the emissions inventory data along with some 15% of the particulates. Similarly only 27% of the NOx emissions are covered. Approximately 67% of the SOx emissions are covered by the inventory data.

Table 11

EMISSIONS INVENTORY DATA IN TONS/YEAR SAN DIEGO AIR BASIN

	PART.	SOX	NOX	HC	CO
1 DAIRIES	0	0	0	0	0
2 BROILERS, CHICKENS AND EGGS	0	0	0	0	0
3 TURKEYS AND OTHER POULTRY	0	0	0	0	0
4 CATTLE AND CALVES	0	0	0	0	0
5 HOGS	0	0	0	0	0
6 SHEEP, LAMBS, AND WOOL	0	0	0	0	0
7 MISC. LIVESTOCK	0	0	0	0	0
8 APIARY PRODUCTS	0	0	0	0	0
9 COTTON	0	0	0	0	0
10 WHEAT	0	0	0	0	0
11 RICE	0	0	0	0	0
12 BARLEY	0	0	0	0	0
13 CORN	0	0	0	0	0
14 HAY AND PASTURE	0	0	0	0	0
15 OATS	0	0	0	0	0
16 SORGHUM GRAIN	0	0	0	0	0
17 GRASS SEED	0	0	0	0	0
18 FOOD, FEED GRAINS, NEC	0	0	0	0	0
19 TOBACCO	0	0	0	0	0
20 WALNUTS	0	0	0	0	0
21 ALMONDS	0	0	0	0	0
22 NONCITRUS FRUITS	0	0	0	0	0
23 CITRUS FRUITS	0	0	0	0	0
24 FRUIT AND TREE NUTS, NEC	0	0	0	0	0
25 VEGETABLES	0	0	0	0	0
26 DRIED BEANS	0	0	0	0	0
27 DRIED PEAS	0	0	0	0	0
28 MELONS	0	0	0	0	0
29 SUGAR BEETS	0	0	0	0	0
30 HOPS	0	0	0	0	0
31 POTATOES	0	0	0	0	0
32 SWEET POTATOES	0	0	0	0	0
33 VEGETABLES + SUGAR, NEC	0	0	0	0	0
34 SAFFLOWER	0	0	0	0	0
35 OIL CROPS, NEC	0	0	0	0	0
36 GREENHOUSE AND NURSERY PRODUCTS	0	0	0	0	0
37 FORESTRY AND FISHERY PRODUCTS	0	0	0	0	0
38 AGRIC., FORESTRY, FISHERY SERV	0	0	0	0	0
39 METALS MINING	0	0	0	0	0
40 COAL MINING	0	0	0	0	0
41 CRUDE PETROLEUM	0	0	0	0	0
42 NATURAL GAS + N.G. LIQUIDS	0	0	0	0	0
43 STONE + CLAY MIN + QUARRY	4036	0	13	0	0
44 CHEM + FERT MINERAL MIN	0	0	0	0	0
45 NEW CONSTRUCT, RESIDENT	0	0	0	0	0
46 NEW CONSTRUCT, NONRESIDENT	0	0	0	0	0
47 NEW CONSTRUCT, PUBLIC UTILITY	0	0	0	0	0
48 NEW CONSTRUCT, HIGHWAYS	0	0	0	0	0
49 NEW CONSTRUCT, ALL OTHER	0	0	0	4	0
50 MAIN. AND REPAIR CONSTRUCTION	0	0	0	1	0
51 ORDNANCE + GUIDED MISSILES	0	0	19	136	0
52 MEAT PRODUCTS	0	0	0	0	0
53 DAIRY PRODUCTS	0	0	0	0	0
54 CANNED AND FROZEN FOODS	0	0	0	0	0
55 GRAIN MILL PRODUCTS	32	0	0	0	0
56 BAKERY PRODUCTS	0	0	0	0	0
57 SUGAR	0	0	0	0	0
58 CONFECTIONARY PRODUCTS	0	0	0	0	0
59 BEVERAGES AND FLAVORINGS	0	0	0	0	0
60 MISC FOOD PRODUCTS	0	0	0	0	0

Table 11 - Cont.

	PART.	SOX	NOX	HC	CO
61 TOBACCO MANUFACTURERS	0	0	0	0	0
62 TEXTILE PRODUCTS	0	0	0	12	0
63 LOGGING CAMPS + SAWMILLS	0	0	0	0	0
64 MILLWORK, PLYWOOD + OTHER WOOD PRODUCTS	0	0	0	0	0
65 WOODEN CONTAINERS	0	0	0	0	0
66 HOUSEHOLD FURNITURE	0	0	0	399	0
67 OFFICE FURNITURE AND FIXTURES	0	0	0	9	0
68 PAPER + PAPERBOARD PRODUCTS	0	0	0	0	0
69 NEWSPAPERS	0	0	0	0	0
70 OTHER PRINTING AND PUBLISHING	0	0	0	0	0
71 INDUSTRIAL CHEMICALS	31	0	0	0	0
72 AGRICULTURAL CHEMICALS	0	0	0	0	0
73 GUM AND WOOD CHEMICALS	0	0	0	3	0
74 PLASTICS MATERIALS AND SYNTHETIC FIBERS	0	0	0	0	0
75 DRUGS	46	211	267	4122	10
76 CLEANING AND TOILET PREPARATIONS	0	0	0	0	0
77 PAINTS AND ALLIED PRODUCTS	0	0	0	0	0
78 PETROLEUM REFINING AND RELATED PRODUCTS	9	0	0	0	0
79 RUBBER AND PLASTICS PRODUCTS	0	0	0	0	0
80 LEATHER TANNING AND PRODUCTS	0	0	0	0	0
81 GLASS	0	0	0	20	0
82 CEMENT AND CONCRETE PRODUCTS	65	0	3	0	0
83 STRUCTURAL CLAY PRODUCTS	19	0	0	0	0
84 POTTERY AND RELATED PRODUCTS	0	0	0	0	0
85 MISC STONE AND CLAY PRODUCTS	4	0	0	0	0
86 BLAST FURNACES AND BASIC STEEL PRODUCTS	0	0	0	0	0
87 IRON AND STEEL FOUNDRIES AND FORGINGS	0	0	0	0	0
88 PRIMARY NONFERROUS METAL PRODUCTS	0	0	0	86	0
89 METAL CONTAINERS	0	0	0	54	0
90 HEATING APPARATUS AND PLUMBING FIXTURES	0	0	0	0	0
91 FABRICATED STRUCTURAL STEEL	0	0	0	0	0
92 SCREW MACHINE PRODUCTS	0	0	0	0	0
93 METAL STAMPINGS	0	0	0	10	0
94 CUTLERY, HAND TOOLS AND GENERAL HARDWARE	0	0	0	0	0
95 OTHER FABRICATED METAL PRODUCTS	0	0	0	120	0
96 ENGINES, TURBINES AND GENERATORS	0	0	5	309	67
97 FARM MACHINERY	0	0	0	0	0
98 CONSTRUCTION + MATERIAL HANDLING EQUIP	0	0	0	20	0
99 METAL WORKING MACHINERY	0	0	0	0	0
100 SPECIAL INDUSTRIAL MACHINERY	0	0	0	0	0
101 GENERAL INDUSTRIAL MACHINERY	0	0	0	0	0
102 MACHINE SHOP PRODUCTS	9	0	0	53	0
103 COMPUTERS AND OFFICE EQUIPMENT	0	0	0	11	0
104 SERVICE INDUSTRY MACHINES	0	0	0	7	0
105 ELECTRIC TRANSMISSION EQUIPMENT	0	0	0	0	0
106 ELECTRICAL INDUSTRIAL APPARATUS	0	0	0	0	0
107 HOUSEHOLD APPLIANCES	0	0	0	0	0
108 ELECTRIC LIGHTING AND WIRING	0	0	0	0	0
109 RADIO AND TV RECEIVING SETS	0	0	0	0	0
110 COMMUNICATION EQUIPMENT	0	0	0	0	0
111 ELECTRONIC COMPONENTS	0	0	0	515	0
112 MISC ELECTRICAL PRODUCTS	0	0	0	0	0
113 MOTOR VEHICLES	0	0	0	0	0
114 AIRCRAFT	3	14	110	1170	103
115 SHIP AND BOAT BUILDING AND REPAIRING	7	0	2	825	0
116 OTHER TRANSPORTATION EQUIPMENT	0	0	0	0	0
117 CLOCKS AND SCIENTIFIC EQUIPMENT	0	0	1	122	0
118 JEWELRY, SPORTING GOODS, ETC.	0	0	0	147	0
119 RAILROADS	0	0	0	0	0
120 LOCAL TRANSIT AND INTERCITY BUSES	0	0	0	0	0
121 TRUCK TRANSPORTATION	0	0	0	3	0
122 WATER TRANSPORATATION	0	0	0	0	0

Table 11 - Cont.

	PART.	SOX	NOX	HC	CO
123 AIR TRANSPORTATION	0	0	0	46	0
124 PIPELINE TRANSPORTATION	0	0	0	0	0
125 TRANSPORTATION SERVICES	0	0	0	0	0
126 COMMUNICATION EXCEPT RADIO AND TV	0	0	0	0	0
127 RADIO AND TELEVISION BROADCASTING	0	0	0	0	0
128 ELECTRIC COMPANIES AND SYSTEMS	1826	11735	9335	258	1316
129 GAS COMPANIES AND SYSTEMS	0	0	0	0	0
130 WATER AND SANITARY SERVICES	143	475	390	15	33
131 WHOLESALE TRADE	41	0	1	627	14
132 RETAIL TRADE	0	0	0	207	0
133 BANKING AND FINANCIAL INTERMEDIARIES	0	0	0	0	0
134 INSURANCE	0	0	0	0	0
135 OWNER OCCUPIED REAL ESTATE	0	0	0	0	0
136 REAL ESTATE	0	0	0	0	0
137 HOTELS AND LODGING PLACES	0	0	0	0	0
138 PERSONAL AND REPAIR SERVICES	8	5	6	480	3
139 MISCELLANEOUS BUSINESS SERVICES	0	0	0	0	0
140 ADVERTISING	0	0	0	0	0
141 MISC PROFESSIONAL SERVICES	0	0	0	0	0
142 AUTOMOBILE REPAIR	0	0	0	0	0
143 MOTION PICTURES	0	0	0	0	0
144 AMUSEMENT AND RECREATION SERVICES	0	0	0	0	0
145 DOCTORS AND DENTISTS	0	0	0	0	0
146 HOSPITALS	0	0	0	0	0
147 OTHER MEDICAL SERVICES	0	0	0	0	0
148 EDUCATIONAL SERVICES	0	1	31	0	0
149 NONPROFIT ORGANIZATIONS	0	0	0	0	0
150 POST OFFICE	0	0	0	0	0
151 OTHER FEDERAL GOVT ENTERPRISES	0	0	0	24	0
152 STATE AND LOCAL GOVT ENTERPRISES	0	0	0	0	0
153 NONCOMPETITIVE IMPORTS	0	0	0	0	0
154 DUMMY INDUSTRIES	0	0	0	0	0
155 GOVERNMENT INDUSTRY	0	0	0	0	0
156 SPECIAL INDUSTRIES	0	0	0	0	0
157 TOTAL INTERMEDIATE INPUTS	0	0	0	0	0
TOTAL, 157 I/O SECTORS	6279	12441	10183	9815	1546

Table 12

SUMMARY EMISSIONS DATA IN TONS/YEAR - SAN DIEGO AIR BASIN

	PART.	SOX	NOX	HC	CO
1 PETROLEUM PRODUCTION	0.	0.	0.	0.	0.
2 PETROLEUM REFINING	0.	0.	0.	0.	0.
3 PETROLEUM MARKETING	0.	0.	0.	7409.500000	0.
4 ORGANIC SOLVENT USE - SURFACE COATING	0.	0.	0.	17775.500000	0.
5 ORGANIC SOLVENT USE- DRY CLEANING	0.	0.	0.	1898.000000	0.
6 ORGANIC SOLVENT USE -DEGREASING	0.	0.	0.	9891.500000	0.
7 CHEMICAL PRODUCTION	0.	0.	0.	0.	0.
8 METALLURGICAL PROCESSES	73.000000	0.	0.	0.	0.
9 MINERALS PRODUCTION	7081.000000	0.	36.500000	0.	0.
10 FOOD AND AGRICULTURE PROCESSING	584.000000	0.	0.	0.	0.
11 PESTICIDES PRODUCTION	0.	0.	0.	693.500000	0.
12 WOOD PROCESSSING	0.	0.	0.	0.	0.
13 COMBUSTION OF FUELS IN ORCHARD HEATER	0.	0.	0.	109.500000	0.
14 FARMING OPERATIONS	1496.500000	0.	0.	0.	0.
15 CONSTRUCTION AND DEMOLITION	24747.000000	0.	0.	0.	0.
16 OTHER ORGANIC SOLVENT USE	0.	0.	0.	5329.000000	0.
17 COMBUSTION OF FUELS IN MISC. INDUSTRI	219.000000	693.500000	1204.500000	109.500000	146.000000
18 COMBUSTION OF FUELS IN POWER PLANTS	3102.500000	12665.500000	10220.000000	219.000000	1131.500000
19 TRANSPORTATION FUEL USE IN TRUCKS AND	2080.500000	1314.000000	21389.000000	17191.500000	122092.500000
20 AIRCRAFT	1606.000000	0.	2737.500000	3248.500000	7300.000000
21 RAILROADS	36.500000	109.500000	766.500000	182.500000	255.500000
22 SHIPS	328.500000	3650.000000	1423.500000	109.500000	328.500000
TOTALS	41354.500000	18432.500000	37777.500000	64167.000000	131254.000000

(iii) Merging and Adjusting the Data

To overcome the disparities between the basic emissions inventory data and the summary data which the comparisons reveal, the statewide coefficients were applied to each input-output sector of the air basin where the emissions inventory showed zero pollutants. The statewide coefficients were first multiplied by the production level for each sector in the air basin to obtain estimates of pollution levels in absolute terms. Where the basic emissions data were non-zero these were used directly and entered into an "unadjusted" data array by input-output sectors.

This procedure attempts to use as much of the primary emissions data available for detailed sectors at the air basin level as possible. Where no such data exist but production units are obviously present resort is made to applying the statewide average emission coefficients to the estimated levels of production for the relevant sectors of the air basin economy. The resulting array, composed of some primary data and some statewide average data is subsequently adjusted to agree with the summary emissions data given for the 22 economic categories of the individual air basins.

As in the statewide case described above, the input-output sector pollutant data were subsequently adjusted to agree with the basin summary data first by each of the 22 categories and then in a final adjustment to bring the totals of the 152 sectors into agreement with the totals of the basin summary data. Following the pattern for the statewide case, if the basin summary data showed zero for a given category but the estimating technique used for the input-output sector indicated that pollutants were present, the zero of the basin summary data was ignored and the input-output sector estimate was used.

(iv) The Air Basin Coefficients

The total pollutant levels derived as described above were divided by the production levels for the basin industries and the coefficients formed in tons of pollutants per million dollars of production.

The procedure is the best that could be devised without resorting to an extensive analysis of the primary data along with the abatement practices prevailing in each air basin and then establishing the coefficients for detailed sectors on an ad hoc basis. The procedure has merit, in that it attempts to capture the differences in emission levels among the various air basins. Because of the highly aggregated nature (22 categories) of the summary emission data certain disparities in the primary data cannot be overcome by the overall adjustment processes that have been applied. A comparative analysis of the statewide and air basin coefficients per unit of product delivered revealed certain anomalies in the rankings of various industries among basins. A specific example of the primary data problem can be given.

As might be expected Truck Transportation and Local Transit and Intercity buses rank among the top five sectors statewide in terms of carbon monoxide emission levels. This is also true in each of the air basins except the San Francisco Air Basin. An analysis of the San Francisco Air Basin data reveals that a very small amount of CO is reported in the primary emissions data for the truck transportation sector. The procedure for estimating the emission coefficients for the basins, as outlined above, requires that statewide averages be applied unless primary data are available. In this instance primary data on CO emissions are available for the truck transportation sector, but as given are several orders of magnitude below the statewide averages. Nonetheless one might expect that the final "adjustment" process to which the

primary data are subjected to bring them into agreement with the summary emissions totals for the basin would correct such a deficiency. This would be true if there were a one-to-one correspondence between the input-output sectors and the categories of the air basin summary data. Since this is not so, a proportional adjusting of the primary data will leave those original data entries which diverged substantially (order of magnitude) from the statewide averages in a relatively unchanged position in terms of ranking. Undoubtedly, complex procedures could have been devised for flagging those entries outside of certain tolerance limits and adjusting them statistically to conform more closely to the statewide averages. As noted above, however, this would have required an in-depth comparative analysis of the emission coefficients for all air basins. Certain anomalies due to the primary data deficiencies remain in the analyses presented below. These do not detract from the general usefulness of the method and should only serve to highlight the need to improve the data gathering and verification processes.

12. Direct plus Indirect plus Induced Emissions per Unit of Product Delivered

(i) Method

In Section 2 details of the typical input-output multiplier and impact analysis were given. An analysis of this type was accomplished routinely for the statewide model and for each air basin in several steps.

1. The Leontief Inverse $(I-A)^{-1}$ was formed for each input-output model.

2. The pollution coefficients which were derived as described in preceding sections were set up as a diagonal matrix and multiplied into the Leontief inverse.

3. The columns of the resulting matrix were summed to give the "direct plus indirect" emissions per million dollars of demand.

4. The $(I-A)^{-1}$ inverse matrix was augmented with the household column and household row and reinverted.

5. The augmented matrix was again pre-multiplied by the diagonal matrix of pollution coefficients.

6. The columns elements of the augmented inverse were again summed to give the "direct plus indirect plus induced" emissions per million dollars of demand.

7. This procedure was repeated for each of the five air pollutants P, NOx, SOx, HC, CO.

8. The results were ranked so that each of the industries of the various models could be viewed in terms of its pollutant output per one million dollars of product delivered.

(ii) Results

The results indicate that there is a substantial difference in most instances in the direct, or "on site" emissions for a given industry and the "total" pollutants load from all industries to deliver its product to

final consumers. Virtually all industries are interrelated in the modern economy, so that a study of the "on site" emissions of a particular industry while critical, should also be related to the broader aspects of how that industry is interrelated with the other industries in the economy.

The results of the interindustry analysis and the rankings for all industries are shown in the Appendices. The top ranking industries for each pollutant and each air basin are shown on succeeding pages.

(a) Particulates

For the State of California and for each of the four air basins the ten principal sectors ranked according to the total emission coefficients for particulates are shown in Table 13. The sectors which appear most frequently among the principal sectors across the five economies are the Forestry and Fishery Products sectors and the Corn sector. Each of these two sectors appears as one of the prime sources of total particulate emissions per unit of final demand in the State model and in the South Coast, San Joaquin and San Francisco basins. (In the San Diego basin the Forestry & Fishery Products sector is ranked 19th and there is no Corn sector.)

Although Metals Mining and Confectionary Products do not rank among the principal sectors statewide, each appears among the prime sectors in three of the four basins. The ratio of total (direct plus indirect plus induced) emissions varies for the Metals Mining sector from a low of 1.05 in the San Francisco basin to 1.23 in the South Coast Basin. For Confectionary Products the ratio varies from 1.05 in the San Diego to 1.31 in the San Joaquin.

Table 13

Particulate Emissions Coefficients Ranking - 1976

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/$10^6)	Total Emission Coeff. (Tons/$10^6)	Rank
Calif.	43	Stone & Clay Mining	89.8	103.2	1
	44	Chem. & Fert. Mineral Mining	86.5	99.0	2
	18	Food, Feed Grains, nec.	55.0	78.6	3
	82	Cement & Concrete Products	50.8	78.2	4
	37	Forestry & Fishery Products	44.9	55.9	5
	13	Corn	40.2	51.3	6
	7	Misc. Livestock	15.5	40.0	7
	38	Agric., Forest, Fish. Serv.	25.5	38.9	8
	55	Grain Mill Products	12.5	35.2	9
	83	Structural Clay Products	21.3	35.0	10
San Diego	18	Stone & Clay Mining	212.9	221.5	1
	21	New Constr. Public Utility	95.5	97.7	2
	55	Structural Clay Products	56.2	70.1	3
	31	Confectionary Products	21.8	22.9	4
	54	Cement & Concrete Products	1.7	21.6	5
	91	Truck Transportation	19.1	20.8	6
	53	Glass	15.9	19.4	7
	45	Gum & Wood Chemicals	17.6	19.3	8
	19	New Construct, Residential	16.6	18.4	9
	57	Misc. Stone & Clay Products	2.3	17.7	10

Table 13 (Cont.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
South Coast	108	Local Transit & Intercity Bus.	51.5	52.4	1
	33	Chem. & Fert. Mineral Mining	29.3	30.9	2
	116	Electric Companies & Systems	9.7	10.1	3
	27	Forestry & Fishery Products	9.1	9.9	4
	12	Corn	8.2	8.8	5
	14	Oats	4.2	4.8	6
	29	Metals Mining	3.2	4.0	7
	7	Misc. Livestock	3.2	3.9	8
	11	Barley	3.1	3.9	9
	74	Blast Furnaces & Basic Steel	2.8	3.8	10
San Joaquin	66	Gum & Wood Chemicals	155.5	163.5	1
	76	Structural Clay Products	149.4	155.1	2
	34	Metals Mining	115.7	122.5	3
	18	Food, Feed Grains, nec.	80.0	86.7	4
	110	Jewelry, Sporting Goods, etc.	77.8	84.2	5
	32	Forestry & Fishery Products	65.2	70.0	6
	13	Corn	58.4	64.4	7
	52	Confectionary Products	34.8	45.5	8
	72	Rubber & Plastics Products	37.7	43.5	9
	16	Sorghum Grain	36.2	42.0	10

Table 13 (Cont.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
San Franc.	26	Metals Mining	91.7	96.1	1
	65	Glass	22.4	24.5	2
	24	Forestry & Fishery Products	15.2	16.2	3
	57	Gum & Wood Chemicals	14.7	16.0	4
	11	Corn	13.6	14.4	5
	68	Pottery & Related Products	10.4	11.2	6
	43	Confectionary Products	9.5	11.1	7
	14	Sorghum Grain	8.5	9.3	8
	25	Agric. Forestry, Fishery Serv.	8.6	9.1	9
	47	Logging Camps & Sawmills	7.5	8.7	10

The ratio for each sector varies across the basins because of differing economic linkages and differing coefficients between the economies.

The sector with the highest total particulate emissions coefficient is the Stone & Clay Mining sector in the San Diego basin. Its coefficient of 221.5 tons of particulate matter per million dollars of production for final demand is substantially higher than the 163.5 figure of the next most significant sector, Gum and Wood Products of the San Joaquin basin. It is also significantly higher than the 103.2 value for the Stone & Clay Mining sector in the California state-wide economy.

While the single most significant emitter of particulates on a per unit production basis is located in the San Diego basin, the most significant emissions overall are to be found in the San Joaquin basin. Each of the principal sectors ranked two through ten in this basin have higher emission coefficients than their correspondingly ranked sectors in the other three basins and the statewide economy.

The fifty principal sectors, ranked by total particulate emission coefficients in each of the five economies are shown as follows:

California..... Table 14
San Diego..... Table 15
South Coast.... Table 16
San Joaquin.... Table 17
San Francisco.. Table 18

Table 14

1976 CALIFORNIA EMISSION COEFFICIENTS

TSP EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
43	STONE + CLAY MIN + QUARRY	89.7705	99.0049	103.2438	1
44	CHEM + FERT MINERAL MIN	86.4805	94.7495	98.9772	2
18	FOOD, FEED GRAINS, NEC	55.0000	74.9900	78.6081	3
82	CEMENT AND CONCRETE PRODUCTS	50.8361	73.6447	78.1755	4
37	FORESTRY AND FISHERY PRODUCTS	44.8554	51.3262	55.9311	5
13	CORN	40.2067	47.7658	51.2822	6
7	MISC. LIVESTOCK	15.4651	35.9729	39.9917	7
38	AGRIC., FORESTRY, FISHERY SERV	25.4411	34.6863	38.9068	8
55	GRAIN MILL PRODUCTS	12.5190	31.3032	35.1553	9
83	STRUCTURAL CLAY PRODUCTS	21.3187	30.4127	35.0038	10
16	SORGHUM GRAIN	24.9083	31.3099	34.8347	11
2	BROILERS, CHICKENS AND EGGS	1.7205	28.4619	32.1902	12
15	OATS	20.5714	28.4977	32.0503	13
85	MISC STONE AND CLAY PRODUCTS	13.7412	26.1410	30.7461	14
11	RICE	19.8658	26.7739	30.5984	15
4	CATTLE AND CALVES	4.3227	26.5230	30.0171	16
3	TURKEYS AND OTHER POULTRY	.3594	25.9558	29.6475	17
6	SHEEP, LAMBS, AND WOOL	2.7570	25.9495	29.4886	18
63	LOGGING CAMPS + SAWMILLS	5.5463	24.6773	29.3870	19
24	FRUIT AND TREE NUTS, NEC	20.0000	24.7276	28.5063	20
73	GUM AND WOOD CHEMICALS	17.8385	23.7863	28.0297	21
8	APIARY PRODUCTS	1.1399	23.5284	27.4976	22
1	DAIRIES	8.6206	22.6144	26.5293	23
12	BARLEY	15.4010	22.2763	25.8230	24
9	COTTON	12.5907	21.7690	25.1260	25
52	MEAT PRODUCTS	.0975	18.3455	22.0973	26
29	SUGAR BEETS	13.6873	17.6112	21.5577	27
10	WHEAT	10.6229	17.6222	21.4540	28
20	WALNUTS	12.1263	16.8396	20.6040	29
5	HOGS	1.5952	16.8958	20.2766	30
31	POTATOES	7.6237	15.4612	19.9316	31
53	DAIRY PRODUCTS	.1212	14.2761	18.3820	32
81	GLASS	9.3883	13.3808	18.0108	33
25	VEGETABLES	6.7927	13.4313	17.9318	34
47	NEW CONSTRUCT, PUBLIC UTILITY	6.5308	12.9403	17.7498	35
39	METALS MINING	9.5378	13.4887	17.4582	36
48	NEW CONSTRUCT, HIGHWAYS	.0842	12.2229	16.9896	37
72	AGRICULTURAL CHEMICALS	.5249	12.5631	16.8762	38
21	ALMONDS	8.0763	12.6448	16.4041	39
22	NONCITRUS FRUITS	4.6488	12.1540	16.3474	40
14	HAY AND PASTURE	6.6795	12.7317	16.2496	41
64	MILLWORK, PLYWOOD + OTHER WOOD PROD	1.3325	11.1905	15.8947	42
58	CONFECTIONARY PRODUCTS	6.6117	11.9708	15.7285	43
28	MELONS	4.3282	11.0808	15.5826	44
65	WOODEN CONTAINERS	.0482	10.0821	14.8022	45
121	TRUCK TRANSPORTATION	8.2959	10.1432	14.5575	46
23	CITRUS FRUITS	2.[illegible]297	10.1841	14.3720	47
57	SUGAR	3.9049	10.8300	14.3369	48
71	INDUSTRIAL CHEMICALS	3.6688	9.6870	13.8583	49
45	NEW CONSTRUCT, RESIDENT	1.1369	8.7275	13.5768	50

Table 15

1976 SAN DIEGO EMISSION COEFFICIENTS

TSP EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
18	STONE + CLAY MIN + QUARRY	212.9127	221.0154	221.5412	1
21	NEW CONSTRUCT, PUBLIC UTILITY	95.5393	97.2510	97.7091	2
55	STRUCTURAL CLAY PRODUCTS	56.2188	69.4936	70.0764	3
31	CONFECTIONARY PRODUCTS	21.8163	22.5436	22.8583	4
54	CEMENT AND CONCRETE PRODUCTS	1.7290	21.0427	21.5694	5
91	TRUCK TRANSPORTATION	19.1078	20.2659	20.8478	6
53	GLASS	15.9173	18.8095	19.3614	7
45	GUM AND WOOD CHEMICALS	17.6273	18.9553	19.3194	8
19	NEW CONSTRUCT, RESIDENT	16.6323	17.8695	18.3697	9
57	MISC STONE AND CLAY PRODUCTS	2.2546	17.2331	17.7255	10
47	DRUGS	14.8888	15.4822	15.9887	11
90	LOCAL TRANSIT AND INTERCITY BUSES	13.4080	14.0351	14.6659	12
97	ELECTRIC COMPANIES AND SYSTEMS	13.2509	13.5775	13.8626	13
29	GRAIN MILL PRODUCTS	10.7822	11.6983	11.8948	14
22	NEW CONSTRUCT, HIGHWAYS	1.2315	11.0661	11.6213	15
93	AIR TRANSPORTATION	9.6310	10.4272	10.9270	16
92	WATER TRANSPORATATION	8.6584	9.8711	10.2794	17
23	NEW CONSTRUCT, ALL OTHER	6.7539	9.3503	9.9223	18
16	FORESTRY AND FISHERY PRODUCTS	7.4339	8.1971	8.7535	19
35	LOGGING CAMPS + SAWMILLS	5.4807	7.7259	8.1805	20
56	POTTERY AND RELATED PRODUCTS	1.8415	5.8001	6.4069	21
8	BARLEY	2.5524	4.8811	5.2441	22
17	AGRIC., FORESTRY, FISHERY SERV	4.2164	4.5655	5.0335	23
59	IRON AND STEEL FOUNDRIES AND FORGIN	1.9972	3.7628	4.1950	24
9	HAY AND PASTURE	1.1070	3.8135	4.1799	25
122	DUMMY INDUSTRIES	0.	3.5662	3.9317	26
7	WHEAT	1.7605	3.4002	3.8054	27
24	MAIN. AND REPAIR CONSTRUCTION	.6995	3.0417	3.6670	28
44	AGRICULTURAL CHEMICALS	.5187	3.2038	3.6095	29
14	POTATOES	1.2635	2.8178	3.3357	30
33	MISC FOOD PRODUCTS	2.2195	3.0989	3.3313	31
12	VEGETABLES	1.1258	2.6158	3.2095	32
58	BLAST FURNACES AND BASIC STEEL PROD	1.5245	2.8100	3.2018	33
99	WATER AND SANITARY SERVICES	.8499	2.4545	3.0873	34
10	NONCITRUS FRUITS	.7704	2.4503	2.9816	35
46	PLASTICS MATERIALS AND SYNTHETIC FI	1.4259	2.5255	2.8893	36
49	PAINTS AND ALLIED PRODUCTS	.1140	2.4103	2.7626	37
11	CITRUS FRUITS	.4193	2.2147	2.7428	38
43	INDUSTRIAL CHEMICALS	.7684	2.1244	2.4990	39
121	STATE AND LOCAL GOVT ENTERPRISES	.5622	1.7599	2.4837	40
13	DRIED BEANS	.2129	1.9005	2.4736	41
51	RUBBER AND PLASTICS PRODUCTS	1.3064	2.0449	2.4556	42
28	CANNED AND FROZEN FOODS	.5202	2.0618	2.4505	43
1	DAIRIES	1.4287	2.0367	2.3541	44
36	MILLWORK, PLYWOOD + OTHER WOOD PROD	1.3167	1.9945	2.3471	45
48	CLEANING AND TOILET PREPARATIONS	1.0417	1.9093	2.2726	46
40	PAPER + PAPERBOARD PRODUCTS	.6541	1.8683	2.2529	47
89	RAILROADS	.8497	1.6626	2.2364	48
20	NEW CONSTRUCT, NONRESIDENT	.0928	1.5818	2.0722	49
15	GREENHOUSE AND NURSERY PRODUCTS	.5210	1.3590	1.9886	50

Table 16

1976 SOUTH COAST EMISSION COEFFICIENTS

TSP EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
108	LOCAL TRANSIT AND INTERCITY BUSES	51.5026	52.0178	52.4328	1
33	CHEM + FERT MINERAL MIN	29.2537	30.5796	30.9425	2
116	ELECTRIC COMPANIES AND SYSTEMS	9.6732	9.9000	10.1378	3
27	FORESTRY AND FISHERY PRODUCTS	9.1456	9.5649	9.9455	4
12	CORN	8.1977	8.5861	8.8410	5
14	OATS	4.1943	4.5968	4.8429	6
29	METALS MINING	3.2263	3.6665	3.9673	7
7	MISC. LIVESTOCK	3.1532	3.6665	3.8658	8
11	BARLEY	3.1401	3.6083	3.8638	9
74	BLAST FURNACES AND BASIC STEEL PROD	2.8014	3.4795	3.7770	10
23	SUGAR BEETS	2.7907	3.1683	3.5148	11
9	COTTON	2.5671	3.2055	3.4585	12
141	DUMMY INDUSTRIES	0.	3.0482	3.3493	13
16	WALNUTS	2.4724	2.8321	3.1605	14
111	AIR TRANSPORTATION	2.2467	2.5554	2.9017	15
10	WHEAT	2.1659	2.4827	2.7605	16
118	WATER AND SANITARY SERVICES	1.2033	2.2406	2.6444	17
107	RAILROADS	1.6829	2.2047	2.5842	18
75	IRON AND STEEL FOUNDRIES AND FORGIN	1.3326	2.0534	2.3921	19
13	HAY AND PASTURE	1.3619	2.1260	2.3879	20
17	ALMONDS	1.6467	1.9744	2.3043	21
24	POTATOES	1.5544	1.9384	2.2835	22
110	WATER TRANSPORATATION	1.5166	1.9528	2.2782	23
1	DAIRIES	1.7577	2.0468	2.2764	24
36	NEW CONSTRUCT, PUBLIC UTILITY	1.4827	1.8149	2.2005	25
20	VEGETABLES	1.3850	1.6532	2.0517	26
15	GRASS SEED	.9780	1.5162	1.7949	27
140	STATE AND LOCAL GOVT ENTERPRISES	.9883	1.3119	1.7850	28
51	LOGGING CAMPS + SAWMILLS	.2586	1.5148	1.7796	29
60	AGRICULTURAL CHEMICALS	.1692	1.5134	1.7739	30
18	NONCITRUS FRUITS	.9478	1.3006	1.6640	31
77	METAL CONTAINERS	.4521	1.2742	1.5877	32
22	MELONS	.8825	1.1322	1.5307	33
59	INDUSTRIAL CHEMICALS	.3004	1.1449	1.4307	34
91	COMPUTERS AND OFFICE EQUIPMENT	.6546	1.0165	1.4200	35
71	STRUCTURAL CLAY PRODUCTS	.6143	.9737	1.3610	36
62	PLASTICS MATERIALS AND SYNTHETIC FI	.6127	1.0875	1.3473	37
47	CONFECTIONARY PRODUCTS	.7943	1.0603	1.3182	38
19	CITRUS FRUITS	.5158	.9266	1.2880	39
70	CEMENT AND CONCRETE PRODUCTS	.5637	.9328	1.2868	40
26	GREEHOUSE AND NURSERY PRODUCTS	.6409	.8236	1.2362	41
4	CATTLE AND CALVES	.8813	1.0899	1.1931	42
79	FABRICATED STRUCTURAL STEEL	.0917	.7700	1.1068	43
43	CANNED AND FROZEN FOODS	.0509	.7960	1.0987	44
73	MISC STONE AND CLAY PRODUCTS	.2768	.7322	1.0945	45
46	SUGAR	.7191	.9251	1.0873	46
32	STONE + CLAY MIN + QUARRY	.2593	.7326	1.0868	47
25	SWEET POTATOES	.5126	.6851	1.0834	48
21	DRIED BEANS	.2619	.6760	1.0562	49
81	METAL STAMPINGS	.0690	.7027	1.0442	50

Table 17

1976 SAN JOAQUIN EMISSION COEFFICIENTS

TSP EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
66	GUM AND WOOD CHEMICALS	155.5499	161.9566	163.4706	1
76	STRUCTURAL CLAY PRODUCTS	149.4310	152.9293	155.1194	2
34	METALS MINING	115.7083	120.7495	122.4506	3
18	FOOD, FEED GRAINS, NEC	79.9595	85.4926	86.7115	4
110	JEWELRY, SPORTING GOODS, ETC.	77.8086	82.3803	84.2236	5
32	FORESTRY AND FISHERY PRODUCTS	65.2112	67.8590	69.9706	6
13	CORN	58.4529	62.8937	64.3883	7
52	CONFECTIONARY PRODUCTS	34.7754	43.8171	45.5066	8
72	RUBBER AND PLASTICS PRODUCTS	37.7012	41.8613	43.4943	9
16	SORGHUM GRAIN	36.2119	40.4708	41.9972	10
75	CEMENT AND CONCRETE PRODUCTS	29.5159	38.9041	41.0964	11
7	MISC. LIVESTOCK	22.4833	35.9682	37.5419	12
49	GRAIN MILL PRODUCTS	20.3782	35.4319	36.9159	13
11	RICE	28.8811	33.2925	35.0191	14
15	OATS	29.9069	33.5105	34.9196	15
23	FRUIT AND TREE NUTS, NEC	29.0762	30.7702	32.6185	16
12	BARLEY	22.3901	27.3985	28.9325	17
78	MISC STONE AND CLAY PRODUCTS	19.6344	25.5149	27.4900	18
115	AIR TRANSPORTATION	22.1778	23.8306	25.6637	19
37	STONE + CLAY MIN + QUARRY	17.6244	22.7581	24.7648	20
1	DAIRIES	12.5328	22.6362	24.3962	21
27	SUGAR BEETS	19.8987	21.7816	23.7680	22
2	BROILERS, CHICKENS AND EGGS	2.5013	21.9503	23.2096	23
9	COTTON	18.3045	21.4566	22.7087	24
4	CATTLE AND CALVES	6.2843	21.4015	22.6917	25
10	WHEAT	15.4437	20.4697	22.2307	26
122	WATER AND SANITARY SERVICES	9.7440	18.9539	21.2444	27
19	WALNUTS	17.6293	19.2772	21.1224	28
64	INDUSTRIAL CHEMICALS	14.4069	19.0594	20.7424	29
6	SHEEP, LAMBS, AND WOOL	4.0082	18.7753	20.0100	30
3	TURKEYS AND OTHER POULTRY	.5225	18.6150	19.9027	31
74	GLASS	14.0615	17.4200	19.6994	32
8	APIARY PRODUCTS	1.6572	17.9391	19.4942	33
113	TRUCK TRANSPORTATION	12.5710	14.8623	17.2145	34
28	POTATOES	11.0833	14.5943	16.7651	35
47	DAIRY PRODUCTS	.4821	14.6574	16.5394	36
144	STATE AND LOCAL GOVT ENTERPRISES	12.1946	13.5209	16.2256	37
51	SUGAR	5.5959	14.3078	16.0606	38
20	ALMONDS	11.7414	13.3303	15.1880	39
112	LOCAL TRANSIT AND INTERCITY BUSES	8.8212	12.6695	15.0623	40
14	HAY AND PASTURE	9.7107	13.3805	14.8958	41
46	MEAT PRODUCTS	.4922	13.0843	14.3388	42
24	VEGETABLES	9.8753	11.7327	13.9323	43
87	CUTLERY, HAND TOOLS AND GENERAL HAR	8.9332	11.0869	13.0654	44
5	HOGS	2.3192	11.3711	12.7472	45
41	NEW CONSTRUCT, PUBLIC UTILITY	6.9666	10.3791	12.2884	46
50	BAKERY PRODUCTS	.0788	9.7531	11.7548	47
30	SAFFLOWER	6.8075	9.9369	11.7178	48
96	COMPUTERS AND OFFICE EQUIPMENT	8.0764	9.4383	11.1992	49
17	GRASS SEED	6.9736	9.4623	11.0527	50

Table 18

1976 SAN FRANCISCO EMISSION COEFFICIENTS

TSP EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
26	METALS MINING	91.6541	95.7355	96.0608	1
65	GLASS	22.4288	24.0546	24.4530	2
24	FORESTRY AND FISHERY PRODUCTS	15.2277	15.8014	16.1832	3
57	GUM AND WOOD CHEMICALS	14.6751	15.7400	16.0486	4
11	CORN	13.6496	14.1370	14.4092	5
68	POTTERY AND RELATED PRODUCTS	10.4373	10.8020	11.2232	6
43	CONFECTIONARY PRODUCTS	9.4684	10.7918	11.0888	7
14	SORGHUM GRAIN	8.4560	8.9795	9.2594	8
25	AGRIC., FORESTRY, FISHERY SERV	8.6369	8.8060	9.1127	9
47	LOGGING CAMPS + SAWMILLS	7.4762	8.4479	8.6906	10
13	OATS	6.9837	7.4779	7.7419	11
60	CLEANING AND TOILET PREPARATIONS	5.1573	6.6020	6.9239	12
32	NEW CONSTRUCT, PUBLIC UTILITY	5.4216	6.0850	6.4731	13
10	BARLEY	5.2284	5.7513	6.0255	14
7	MISC. LIVESTOCK	5.2502	5.5736	5.7646	15
71	IRON AND STEEL FOUNDRIES AND FORGIN	4.5536	5.2872	5.6375	16
20	SUGAR BEETS	4.6466	5.1994	5.5678	17
15	WALNUTS	4.1167	5.0409	5.3883	18
105	TRUCK TRANSPORTATION	3.9573	4.5969	5.0255	19
63	RUBBER AND PLASTICS PRODUCTS	3.9576	4.6209	4.9289	20
9	WHEAT	3.6063	4.1274	4.4232	21
21	POTATOES	2.5881	3.8021	4.1626	22
18	VEGETABLES	2.3060	3.6772	4.0965	23
16	ALMONDS	2.7418	3.6369	3.9860	24
27	CRUDE PETROLEUM	3.1801	3.3759	3.7301	25
104	LOCAL TRANSIT AND INTERCITY BUSES	2.7769	3.2321	3.6495	26
17	NONCITRUS FRUITS	1.5782	3.1633	3.5479	27
1	DAIRIES	2.9266	3.2441	3.4710	28
59	DRUGS	1.8043	2.8141	3.1991	29
12	HAY AND PASTURE	2.2676	2.8575	3.1392	30
72	PRIMARY NONFERROUS METAL PRODUCTS	.0087	2.7020	2.9650	31
70	BLAST FURNACES AND BASIC STEEL PROD	.0433	2.5497	2.8684	32
66	CEMENT AND CONCRETE PRODUCTS	1.5269	2.3805	2.7639	33
67	STRUCTURAL CLAY PRODUCTS	1.6712	2.3702	2.7528	34
112	ELECTRIC COMPANIES AND SYSTEMS	2.1356	2.4096	2.6306	35
51	OFFICE FURNITURE AND FIXTURES	1.2454	2.1452	2.5112	36
22	SAFFLOWER	1.5897	2.1575	2.4798	37
49	WOODEN CONTAINERS	1.1610	2.1499	2.4324	38
77	METAL STAMPINGS	1.1920	1.9680	2.3208	39
50	HOUSEHOLD FURNITURE	1.0975	1.9342	2.2766	40
29	STONE + CLAY MIN + QUARRY	1.0868	1.8620	2.2347	41
19	DRIED BEANS	.4361	1.7620	2.1608	42
44	BEVERAGES AND FLAVORINGS	.0582	1.5781	1.9542	43
107	AIR TRANSPORTATION	1.3061	1.5872	1.9393	44
30	NEW CONSTRUCT, RESIDENT	.9438	1.5182	1.9070	45
58	PLASTICS MATERIALS AND SYNTHETIC FI	.6354	1.5421	1.8533	46
23	GREEHOUSE AND NURSERY PRODUCTS	1.0672	1.4156	1.8395	47
48	MILLWORK, PLYWOOD + OTHER WOOD PROD	.4116	1.5473	1.8280	48
4	CATTLE AND CALVES	1.4675	1.7055	1.8060	49
87	COMPUTERS AND OFFICE EQUIPMENT	.7860	1.3628	1.7951	50

(b) Sulfur Oxides

For the State of California and for each of the four air basins the ten principal sectors ranked according to total emissions coefficients of sulfur oxides are shown in Table 19. The most significant emissions of this pollutant resulting from production for final demands are associated with the following sectors: Water Transportation, Gum & Wood Chemicals, Electric Companies & Systems, and Industrial Chemicals. Water Transportation, which ranks first in the San Diego basin, appears among the top ten sectors in all five economies. Each of the remaining sectors ranks in the top ten statewide and also in three of the four basins. On the other hand, Drugs, Metals Mining, and Plastics Materials & Synthetics rank second in the San Diego, South Coast and San Francisco basins, respectively, but are not found in the top ten sectors statewide.

The sector with the highest total emissions coefficient in each of the five cases is different from its counterparts in the other four: Water & Sanitary Services (statewide); Water Transportation (San Diego); Electric Companies & Systems (South Coast); State & Local Government Enterprises (San Joaquin) and Industrial Chemicals (San Francisco).

The sector with the largest coefficient overall is State and Local Government Enterprises, which includes municipal public utilities, in the San Joaquin basin. The SOx emission rate of 233.4 tons resulting in the basin from a million dollars of production by this sector for final demands significantly exceeds the rates associated with all other sectors. Overall, the San Joanquin sectors display the highest SOx emissions rates.

It is of interest to note that in Table 19 there are several sectors which show substantial differences between the emissions that are <u>directly</u> attributable to the sector and the <u>total</u> emissions which result from the sector's linkages to the rest of the economy. For example, the ratio of the total emissions coefficient to the direct coefficient for the Water &

Table 19

Sulfur Oxide Emission Coefficients Ranking - 1976

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
Calif.	130	Water & Sanitary Services	12.7	42.4	1
	152	State & Local Gov. Enterprises	34.1	40.9	2
	73	Gum & Wood Chemicals	25.8	36.7	3
	128	Electric Companies & Systems	21.4	27.1	4
	88	Blast Furnaces & Basic Steel	11.4	21.5	5
	71	Industrial Chemicals	10.7	21.0	6
	122	Water Transportation	12.0	20.7	7
	18	Food, Feed Grains, nec.	10.0	19.8	8
	120	Local Transit & Intercity Bus.	5.1	18.3	9
	82	Cement & Concrete Products	9.4	18.3	10
San Diego	92	Water Transportation	78.1	85.9	1
	47	Drugs	55.4	57.5	2
	97	Electric Cos. & Systems	43.9	44.9	3
	45	Gum & Wood Chemicals	20.7	23.7	4
	43	Industrial Chemicals	8.6	12.2	5
	58	Truck Transportation	9.8	11.6	6
	54	Blast Furnaces & Basic Steel	9.1	11.6	7
	91	Cement & Concrete Products	7.5	10.8	8
	15	Local Transit & Intercity Bus.	6.8	9.3	9
	90	Greenhouse & Nursery Products	7.0	8.9	10

Table 19 (Cont.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
South Coast	116	Electric Companies & Systems	38.5	40.5	1
	29	Metals Mining	31.2	33.4	2
	110	Water Transportation	12.1	15.5	3
	74	Blast Furnaces & Basic Steel	7.5	10.2	4
	73	Misc. Stone & Clay Products	7.4	10.1	5
	26	Greenhouse & Nursery Products	8.0	9.9	6
	27	Forestry & Fishery Products	6.6	8.7	7
	12	Corn	6.3	8.3	8
	70	Cement & Concrete Products	4.9	7.9	9
	109	Truck Transportation	5.8	7.9	10
San Joaquin	144	State & Local Gov. Enterprises	227.4	233.4	1
	122	Water & Sanitary Services	2.1	157.4	2
	66	Gum & Wood Chemicals	66.5	72.7	3
	112	Local Transit & Intercity Bus.	4.3	59.7	4
	35	Crude Petroleum	34.4	38.1	5
	115	Air Transportation	14.8	24.5	6
	114	Water Transportation	4.6	20.8	7
	139	Other Medical Services	15.5	20.2	8
	71	Petroleum Refining	2.3	18.1	9
	64	Industrial Chemicals	7.9	15.7	10

Table 19 (Cont.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
San Franc.	55	Industrial Chemicals	39.2	49.5	1
	58	Plastics Materials & Synths.	0.0	17.8	2
	56	Agricultural Chemicals	0.0	17.6	3
	112	Electric Companies & Systems	9.5	12.6	4
	57	Gum & Wood Chemicals	0.2	11.8	5
	61	Paints & Allied Products	0.0	11.4	6
	11	Corn	6.4	11.0	7
	23	Greenhouse & Nursery Products	8.0	10.4	8
	136	State & Local Gov. Enterprises	6.7	9.3	9
	106	Water Transportation	5.6	9.2	10

Sanitary Services sector in the San Joaquin basin is 157.4/2.1 = 75.0. This high ratio is attributable largely to the primary linkage between the Water & Sanitary Services sector and the State and Local Government Enterprises sector. The relatively non-polluting Water sector purchases approximately 86% of its intermediate local inputs from public utilities in the State and Local sector which has the highest emissions rate in the basin.

The Plastics & Synthetics and the Agricultural Chemicals sectors in the San Francisco basin offer other examples of high total to direct emission rates, examples which are closely analagous to the hypothetical Service sector discussed in the Introduction to this report. As was the case with the theoretical Service sector, the San Francisco Plastics & Synthetics and Agricultural Chemicals sectors have direct emissions coefficients of zero. In spite of their direct coefficients, however, the sectors rank second and third in the basin on the basis of total emission coefficients. This phenomenon arises primarily due to the fact that each of the two sectors purchases over half of its total supporting local production from the Industrial Chemicals sector which has the basin's highest total emissions coefficient.

The fifty principal sectors, ranked by total SOx emission coefficients, in each of the five economies are shown as follows:

California..... Table 20
San Diego..... Table 21
South Coast..... Table 22
San Joaquin..... Table 23
San Francisco... Table 24

1976 CALIFORNIA EMISSION COEFFICIENTS

SOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
130	WATER AND SANITARY SERVICES	12.6820	38.3775	42.3763	1
152	STATE AND LOCAL GOVT ENTERPRISES	34.1286	36.3442	40.8549	2
73	GUM AND WOOD CHEMICALS	25.7655	32.9615	36.6697	3
128	ELECTRIC COMPANIES AND SYSTEMS	21.4304	24.2745	27.0594	4
86	BLAST FURNACES AND BASIC STEEL PROD	11.3996	17.7087	21.5344	5
71	INDUSTRIAL CHEMICALS	10.6774	17.3563	21.0014	6
122	WATER TRANSPORATATION	12.0258	17.2788	20.6960	7
18	FOOD, FEED GRAINS, NEC	10.0000	16.5942	19.7560	8
120	LOCAL TRANSIT AND INTERCITY BUSES	5.1132	14.3993	18.3332	9
82	CEMENT AND CONCRETE PRODUCTS	9.3583	14.3224	18.2818	10
72	AGRICULTURAL CHEMICALS	3.8729	12.7588	16.5279	11
36	GREEHOUSE AND NURSERY PRODUCTS	8.6776	10.6660	14.6346	12
13	CORN	6.8548	11.3205	14.3934	13
37	FORESTRY AND FISHERY PRODUCTS	7.1452	10.0729	14.0971	14
7	MISC. LIVESTOCK	4.0698	10.3598	13.8717	15
121	TRUCK TRANSPORTATION	7.3825	9.4313	13.2888	16
74	PLASTICS MATERIALS AND SYNTHETIC FI	.0080	9.1298	12.8881	17
89	METAL CONTAINERS	.0172	7.9855	12.0848	18
16	SORGHUM GRAIN	4.2661	8.7650	11.8453	19
15	OATS	3.6429	8.2944	11.3990	20
6	SHEEP, LAMBS, AND WOOL	1.1215	7.8594	10.9521	21
11	RICE	3.5571	7.5825	10.9246	22
4	CATTLE AND CALVES	1.1699	7.7318	10.7852	23
77	PAINTS AND ALLIED PRODUCTS	0.	7.0441	10.6897	24
93	METAL STAMPINGS	0.	6.4648	10.6457	25
2	BROILERS, CHICKENS AND EGGS	1.5754	7.2900	10.5481	26
39	METALS MINING	3.4035	7.0659	10.5348	27
91	FABRICATED STRUCTURAL STEEL	.0025	6.3939	10.5236	28
12	BARLEY	2.7318	7.3152	10.4146	29
1	DAIRIES	2.2291	6.8208	10.2419	30
9	COTTON	2.3040	7.1474	10.0811	31
87	IRON AND STEEL FOUNDRIES AND FORGIN	.3871	5.9112	9.8636	32
95	OTHER FABRICATED METAL PRODUCTS	.0232	5.6176	9.7737	33
47	NEW CONSTRUCT, PUBLIC UTILITY	2.0835	5.5097	9.7126	34
14	HAY AND PASTURE	1.3862	6.6124	9.6866	35
119	RAILROADS	3.6843	5.7165	9.5031	36
8	APIARY PRODUCTS	0.	5.9555	9.4241	37
78	PETROLEUM REFINING AND RELATED PROD	3.0613	6.3249	9.3228	38
63	LOGGING CAMPS + SAWMILLS	.5186	5.1830	9.2986	39
76	CLEANING AND TOILET PREPARATIONS	.0029	5.4329	9.2875	40
92	SCREW MACHINE PRODUCTS	0.	4.9591	9.1932	41
3	TURKEYS AND OTHER POULTRY	.6230	5.9307	9.1568	42
52	MEAT PRODUCTS	.0054	5.8669	9.1455	43
10	WHEAT	1.8687	5.6869	9.0354	44
29	SUGAR BEETS	2.4194	5.4516	8.9004	45
64	MILLWORK, PLYWOOD + OTHER WOOD PROD	1.1489	4.7794	8.8903	46
79	RUBBER AND PLASTICS PRODUCTS	.4493	4.8546	8.7785	47
68	PAPER + PAPERBOARD PRODUCTS	.7937	4.6974	8.7638	48
31	POTATOES	1.3871	4.8464	8.7530	49
55	GRAIN MILL PRODUCTS	.0235	5.2432	8.6093	50

Table 21

1976 SAN DIEGO EMISSION COEFFICIENTS

SOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
92	WATER TRANSPORATATION	78.0556	85.1600	85.8694	1
47	DRUGS	55.4107	56.6340	57.5142	2
97	ELECTRIC COMPANIES AND SYSTEMS	43.8899	44.3930	44.8884	3
45	GUM AND WOOD CHEMICALS	20.6574	23.1048	23.7375	4
43	INDUSTRIAL CHEMICALS	8.5606	11.5813	12.2323	5
91	TRUCK TRANSPORTATION	9.8189	10.5824	11.5936	6
58	BLAST FURNACES AND BASIC STEEL PROD	9.1396	10.8857	11.5666	7
54	CEMENT AND CONCRETE PRODUCTS	7.5030	9.9077	10.8228	8
90	LOCAL TRANSIT AND INTERCITY BUSES	6.8007	8.2428	9.3390	9
15	GREENHOUSE AND NURSERY PRODUCTS	6.9572	7.8358	8.9299	10
16	FORESTRY AND FISHERY PRODUCTS	5.7287	6.6668	7.6337	11
44	AGRICULTURAL CHEMICALS	3.1051	6.2302	6.7962	12
99	WATER AND SANITARY SERVICES	1.4393	5.4588	6.5585	13
121	STATE AND LOCAL GOVT ENTERPRISES	3.2856	4.6731	5.9310	14
9	HAY AND PASTURE	1.1114	4.6398	5.2766	15
8	BARLEY	2.1902	4.0768	4.7078	16
50	PETROLEUM REFINING AND RELATED PROD	2.4544	4.3870	4.7003	17
46	PLASTICS MATERIALS AND SYNTHETIC FI	.0064	3.7335	4.3657	18
89	RAILROADS	2.0682	3.1649	4.1619	19
14	POTATOES	1.1121	2.6694	3.5695	20
18	STONE + CLAY MIN + QUARRY	.1872	2.6292	3.5429	21
7	WHEAT	1.4982	2.7406	3.4448	22
35	LOGGING CAMPS + SAWMILLS	.4158	2.4790	3.2690	23
115	HOSPITALS	.0280	2.0273	3.2575	24
57	MISC STONE AND CLAY PRODUCTS	.5083	2.2536	3.1092	25
118	NONPROFIT ORGANIZATIONS	.0028	1.6588	3.0827	26
1	DAIRIES	1.7872	2.4621	3.0137	27
21	NEW CONSTRUCT, PUBLIC UTILITY	1.6705	2.1948	2.9908	28
53	GLASS	.6398	1.9369	2.8961	29
13	DRIED BEANS	.1873	1.8961	2.8920	30
116	OTHER MEDICAL SERVICES	.2238	1.5992	2.8614	31
106	HOTELS AND LODGING PLACES	0.	1.9551	2.8565	32
12	VEGETABLES	.9082	1.7799	2.8117	33
11	CITRUS FRUITS	.3922	1.8823	2.8000	34
49	PAINTS AND ALLIED PRODUCTS	0.	2.1604	2.7727	35
10	NONCITRUS FRUITS	.6673	1.8381	2.7612	36
59	IRON AND STEEL FOUNDRIES AND FORGIN	.3104	1.9741	2.7251	37
117	EDUCATIONAL SERVICES	.0012	1.3525	2.6923	38
102	BANKING AND FINANCIAL INTERMEDIARIE	.0625	1.0151	2.6413	39
55	STRUCTURAL CLAY PRODUCTS	.5178	1.6282	2.6410	40
40	PAPER + PAPERBOARD PRODUCTS	.6364	1.6818	2.3501	41
51	RUBBER AND PLASTICS PRODUCTS	.3602	1.5643	2.2780	42
36	MILLWORK, PLYWOOD + OTHER WOOD PROD	.9211	1.6160	2.2287	43
48	CLEANING AND TOILET PREPARATIONS	.0023	1.5964	2.2278	44
96	RADIO AND TELEVISION BROADCASTING	.0499	1.0932	2.1841	45
2	BROILERS, CHICKENS AND EGGS	1.2631	1.8654	2.1429	46
56	POTTERY AND RELATED PRODUCTS	.0338	1.0315	2.0860	47
95	COMMUNICATION EXCEPT RADIO AND TV	.0217	1.0193	1.9671	48
22	NEW CONSTRUCT, HIGHWAYS	0.	.9998	1.9646	49
28	CANNED AND FROZEN FOODS	.0519	1.2848	1.9603	50

Table 22

1976 SOUTH COAST EMISSION COEFFICIENTS

SOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
116	ELECTRIC COMPANIES AND SYSTEMS	38.4815	39.9595	40.5238	1
29	METALS MINING	31.1662	32.7242	33.4378	2
110	WATER TRANSPORATATION	12.0530	14.6782	15.4501	3
74	BLAST FURNACES AND BASIC STEEL PROD	7.4975	9.5051	10.2110	4
73	MISC STONE AND CLAY PRODUCTS	7.3895	9.2344	10.0937	5
26	GREENHOUSE AND NURSERY PRODUCTS	7.9759	8.9296	9.9085	6
27	FORESTRY AND FISHERY PRODUCTS	6.5675	7.7687	8.6714	7
12	CORN	6.3005	7.7346	8.3392	8
70	CEMENT AND CONCRETE PRODUCTS	4.9179	7.1036	7.9435	9
109	TRUCK TRANSPORTATION	5.7627	6.9262	7.9018	10
118	WATER AND SANITARY SERVICES	3.0765	6.3475	7.3052	11
108	LOCAL TRANSIT AND INTERCITY BUSES	3.9913	5.3699	6.3544	12
32	STONE + CLAY MIN + QUARRY	3.0907	5.0123	5.8526	13
7	MISC. LIVESTOCK	3.7407	5.1790	5.6518	14
60	AGRICULTURAL CHEMICALS	3.5598	4.9605	5.5784	15
69	GLASS	3.3008	4.6326	5.5756	16
14	OATS	3.3483	4.7449	5.3285	17
107	RAILROADS	3.2829	4.3854	5.2857	18
140	STATE AND LOCAL GOVT ENTERPRISES	2.8432	4.0065	5.1290	19
9	COTTON	2.1177	4.4071	5.0072	20
13	HAY AND PASTURE	1.2741	4.1419	4.7633	21
11	BARLEY	2.5109	4.1393	4.7454	22
23	SUGAR BEETS	2.2238	3.5723	4.3942	23
66	PETROLEUM REFINING AND RELATED PROD	2.4229	3.7073	4.1341	24
16	WALNUTS	1.9031	3.3084	4.0874	25
36	NEW CONSTRUCT, PUBLIC UTILITY	1.9151	3.0452	3.9598	26
71	STRUCTURAL CLAY PRODUCTS	1.6816	2.8676	3.7864	27
15	GRASS SEED	.9216	2.9955	3.6565	28
17	ALMONDS	1.5141	2.7854	3.5680	29
24	POTATOES	1.2749	2.7420	3.5606	30
10	WHEAT	1.7176	2.8255	3.4845	31
112	PIPELINE TRANSPORTATION	.0259	2.6809	3.4546	32
1	DAIRIES	2.0488	2.8367	3.3812	33
59	INDUSTRIAL CHEMICALS	.2422	2.3809	3.0586	34
20	VEGETABLES	1.0412	2.0720	3.0172	35
75	IRON AND STEEL FOUNDRIES AND FORGIN	.1062	2.1337	2.9373	36
18	NONCITRUS FRUITS	.7650	2.0726	2.9346	37
30	CRUDE PETROLEUM	1.5237	2.1365	2.9270	38
77	METAL CONTAINERS	.0065	2.1607	2.9044	39
19	CITRUS FRUITS	.4496	1.9866	2.8439	40
134	HOSPITALS	.0486	1.6064	2.7177	41
21	DRIED BEANS	.2147	1.8107	2.7126	42
81	METAL STAMPINGS	0.	1.8358	2.6458	43
79	FABRICATED STRUCTURAL STEEL	.0013	1.8250	2.6240	44
2	BROILERS, CHICKENS AND EGGS	1.4480	2.1341	2.5370	45
47	CONFECTIONARY PRODUCTS	1.1180	1.9190	2.5307	46
22	MELONS	.6331	1.5818	2.5271	47
51	LOGGING CAMPS + SAWMILLS	.4766	1.8910	2.5193	48
137	NONPROFIT ORGANIZATIONS	.0050	1.2840	2.5027	49
125	HOTELS AND LODGING PLACES	0.	1.6427	2.4779	50

Table 23

1976 SAN JOAQUIN EMISSION COEFFICIENTS

SOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
144	STATE AND LOCAL GOVT ENTERPRISES	227.4393	230.0093	233.3719	1
122	WATER AND SANITARY SERVICES	2.1332	154.5342	157.3817	2
66	GUM AND WOOD CHEMICALS	66.5313	70.8618	72.7440	3
112	LOCAL TRANSIT AND INTERCITY BUSES	4.3214	56.7285	59.7033	4
35	CRUDE PETROLEUM	34.4472	35.8263	38.1220	5
115	AIR TRANSPORTATION	14.7540	22.1993	24.4783	6
114	WATER TRANSPORATATION	4.6203	18.6980	20.7632	7
139	OTHER MEDICAL SERVICES	15.4904	16.8584	20.1807	8
71	PETROLEUM REFINING AND RELATED PROD	2.3443	16.4101	18.0576	9
64	INDUSTRIAL CHEMICALS	7.8894	13.6150	15.7073	10
121	GAS COMPANIES AND SYSTEMS	.0038	11.3133	12.9449	11
113	TRUCK TRANSPORTATION	6.2392	9.5962	12.5205	12
65	AGRICULTURAL CHEMICALS	5.6674	10.4560	12.4438	13
34	METALS MINING	8.0161	9.7821	11.8970	14
36	NATURAL GAS + N.G. LIQUIDS	0.	9.6796	11.7127	15
76	STRUCTURAL CLAY PRODUCTS	6.6295	8.3682	11.0911	16
18	FOOD, FEED GRAINS, NEC	4.7527	9.4093	10.9247	17
125	BANKING AND FINANCIAL INTERMEDIARIE	4.3242	6.2136	10.2118	18
79	BLAST FURNACES AND BASIC STEEL PROD	5.4179	7.4152	9.3849	19
13	CLAN	3.2579	7.3818	9.2399	20
120	ELECTRIC COMPANIES AND SYSTEMS	.0167	6.8001	8.6472	21
31	GREENHOUSE AND NURSERY PRODUCTS	4.1242	5.4583	8.3440	22
32	FORESTRY AND FISHERY PRODUCTS	3.3959	5.4300	8.0552	23
16	SORGHUM GRAIN	2.0275	6.0727	7.9703	24
11	RICE	1.6906	5.1869	7.3335	25
119	RADIO AND TELEVISION BROADCASTING	3.4541	4.6092	7.2204	26
12	BARLEY	1.2984	5.3111	7.2181	27
15	OATS	1.7314	5.4576	7.2094	28
128	REAL ESTATE	1.7502	5.5922	6.9910	29
27	SUGAR BEETS	1.1499	4.4644	6.9340	30
143	OTHER FEDERAL GOVT ENTERPRISES	2.6913	3.5388	6.8963	31
9	COTTON	1.0950	5.1602	6.7168	32
111	RAILROADS	1.6473	3.9290	6.7166	33
28	POTATOES	.6593	3.9999	6.6987	34
67	PLASTICS MATERIALS AND SYNTHETIC FI	.0038	4.7323	6.6188	35
10	WHEAT	.8881	4.4150	6.6043	36
7	MISC. LIVESTOCK	1.9343	4.6383	6.5947	37
138	HOSPITALS	.0329	3.2544	6.5512	38
24	VEGETABLES	.5384	3.7510	6.4856	39
134	AUTOMOBILE REPAIR	.0001	4.1547	6.4325	40
140	EDUCATIONAL SERVICES	.0808	2.8711	6.4165	41
26	MELONS	.3274	3.5875	6.3135	42
14	HAY AND PASTURE	.6588	4.4279	6.3118	43
142	POST OFFICE	1.4033	2.1780	6.1654	44
25	DRIED BEANS	.1110	3.2647	5.9753	45
19	WALNUTS	.9841	3.6733	5.9673	46
137	DOCTORS AND DENTISTS	.2890	2.1688	5.9224	47
23	FRUIT AND TREE NUTS, NEC	.8641	3.5582	5.8561	48
141	NONPROFIT ORGANIZATIONS	.1950	2.0342	5.7894	49
29	SWEET POTATOES	.1593	2.8226	5.7587	50

Table 24

1976 SAN FRANCISCO EMISSION COEFFICIENTS

SOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
55	INDUSTRIAL CHEMICALS	39.2262	48.8309	49.4538	1
58	PLASTICS MATERIALS AND SYNTHETIC FI	.0074	17.1483	17.7896	2
56	AGRICULTURAL CHEMICALS	.0101	16.9544	17.5906	3
112	ELECTRIC COMPANIES AND SYSTEMS	9.5376	12.1013	12.5566	4
57	GUM AND WOOD CHEMICALS	.2032	11.1972	11.8331	5
61	PAINTS AND ALLIED PRODUCTS	0.	10.7121	11.3520	6
11	CORN	6.3536	10.3971	10.9580	7
23	GREENHOUSE AND NURSERY PRODUCTS	8.0432	9.5745	10.4481	8
136	STATE AND LOCAL GOVT ENTERPRISES	6.6965	8.2813	9.3040	9
106	WATER TRANSPORATATION	5.6488	8.4805	9.1541	10
24	FORESTRY AND FISHERY PRODUCTS	6.6229	8.0254	8.8122	11
14	SORGHUM GRAIN	3.9542	8.1886	8.7654	12
114	WATER AND SANITARY SERVICES	2.4884	7.6394	8.4106	13
13	OATS	3.3765	7.4178	7.9617	14
60	CLEANING AND TOILET PREPARATIONS	.0026	7.1357	7.7990	15
10	BARLEY	2.5321	6.7423	7.3073	16
66	CEMENT AND CONCRETE PRODUCTS	4.2053	6.4054	7.1953	17
62	PETROLEUM REFINING AND RELATED PROD	4.2185	6.7726	7.0702	18
12	HAY AND PASTURE	1.2849	5.7664	6.3467	19
105	TRUCK TRANSPORTATION	4.0335	5.1811	6.0643	20
20	SUGAR BEETS	2.2426	5.1528	5.9118	21
104	LOCAL TRANSIT AND INTERCITY BUSES	2.7937	4.9224	5.7825	22
9	WHEAT	1.7321	4.6276	5.2372	23
63	RUBBER AND PLASTICS PRODUCTS	1.6506	4.4960	5.1308	24
26	METALS MINING	2.6494	4.4087	5.0791	25
15	WALNUTS	1.9192	4.2224	4.9381	26
7	MISC. LIVESTOCK	3.7722	4.5174	4.9108	27
59	DRUGS	.0329	3.7780	4.5715	28
16	ALMONDS	1.5269	3.7242	4.4436	29
65	GLASS	1.7750	3.5769	4.3979	30
18	VEGETABLES	1.0500	3.2880	4.1520	31
21	POTATOES	1.2857	3.3968	4.1396	32
17	NONCITRUS FRUITS	.7714	3.3226	4.1152	33
32	NEW CONSTRUCT, PUBLIC UTILITY	1.9312	2.8240	3.6237	34
68	POTTERY AND RELATED PRODUCTS	.0328	2.5900	3.4581	35
103	RAILROADS	1.4921	2.5241	3.3482	36
19	DRIED BEANS	.2165	2.4767	3.2985	37
22	SAFFLOWER	.7602	2.4147	3.0790	38
52	PAPER + PAPERBOARD PRODUCTS	.3504	2.3525	3.0436	39
1	DAIRIES	2.0661	2.5627	3.0303	40
69	MISC STONE AND CLAY PRODUCTS	.4935	2.2316	2.9686	41
36	ORDNANCE + GUIDED MISSILES	.1401	2.0735	2.8735	42
29	STONE + CLAY MIN + QUARRY	.1817	1.9439	2.7119	43
48	MILLWORK, PLYWOOD + OTHER WOOD PROD	1.0649	2.1266	2.7051	44
96	MISC ELECTRICAL PRODUCTS	.0013	1.7667	2.5533	45
101	CLOCKS AND SCIENTIFIC EQUIPMENT	.0023	1.6743	2.5393	46
67	STRUCTURAL CLAY PRODUCTS	.5027	1.7294	2.5177	47
33	NEW CONSTRUCT, HIGHWAYS	0.	1.5675	2.4358	48
70	BLAST FURNACES AND BASIC STEEL PROD	.0564	1.7013	2.3581	49
27	CRUDE PETROLEUM	.5105	1.6011	2.3310	50

(c) Nitrogen Oxides

The principal sectors ranked according to total emission coefficients of nitrogen oxides are shown in Table 25. As can be seen from the Table the transportation sectors are prominent. The Truck Transportation and Local Transit & Intercity Buses sectors place in the top ten sectors statewide and in each of the four basins with the notable exception of the Truck Transportation sector in the San Francisco basin. Railroads also place in the ten principal sectors in four of the five cases, ranking eleventh in the San Joaquin basin. Air Transportation ranks first in the San Joaquin basin and eighth in the San Diego basin.

Several non-transportation sectors are also prominent among the principal sectors. Forestry and Fishery Products appears in the top ten in each of the five cases. The State & Local Government Enterprises and the Water & Sanitary Services sectors appear among the principal sectors in each listing, save for that of San Diego where they rank twelfth and fourteenth respectively. The Corn sector, ranked seventh statewide, places sixth in the South Coast and San Francisco basins and tenth in the San Joaquin.

The Air Transportation sector in the San Joaquin basin has the highest NOx emission rate of all sectors. Its coefficient of 281.9 tons per million dollars of production for final demand significantly exceeds the second ranked coefficient of 225.0 associated with the Local Transit & Intercity Buses sector in the San Francisco basin. Overall, the sectors of the San Joaquin basin again display the highest coefficients.

The fifty principal sectors, ranked by total NOx emission coefficients, in each of the five economies are shown as follows:

California ..... Table 26
San Diego ..... Table 27
South Coast ..... Table 28
San Joaquin ..... Table 29
San Francisco ... Table 30

Table 25

Nitrogen Oxide Emission Coefficients Ranking - 1976

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
Calif.	121	Truck Transportation	70.3	87.6	1
	120	Local Transit & Intercity Bus.	49.6	68.0	2
	18	Food, Feed Grains, nec.	32.5	51.8	3
	152	State & Local Gov. Enterprises	40.7	51.4	4
	130	Water & Sanitary Services	9.6	47.3	5
	37	Forestry & Fishery Products	25.8	37.4	6
	13	Corn	22.9	34.4	7
	119	Railroads	23.6	34.3	8
	82	Cement & Concrete Products	15.6	33.6	9
	7	Misc. Livestock	8.7	28.0	10
San Diego	91	Truck Transportation	169.2	180.7	1
	90	Local Transit & Intercity Bus.	119.4	124.2	2
	47	Drugs	74.5	77.9	3
	97	Electric Companies & Systems	37.6	39.6	4
	92	Water Transportation	32.4	39.0	5
	16	Forestry & Fishery Products	22.0	25.8	6
	89	Railroads	15.4	19.9	7
	93	Air Transportation	14.2	17.9	8
	55	Structural Clay Products	9.2	13.4	9
	122	Dummy Industries	0.0	11.5	10

Table 25 (Contd.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
South Coast	109	Truck Transportation	55.5	65.3	1
	108	Local Transit & Intercity Bus.	39.1	46.0	2
	116	Electric Companies & Systems	28.7	31.7	3
	27	Forestry & Fishery Products	24.5	28.0	4
	107	Railroads	21.9	25.8	5
	12	Corn	21.7	24.8	6
	118	Water & Sanitary Services	7.0	21.2	7
	140	State & Local Gov. Enterprises	15.9	20.0	8
	110	Water Transportation	11.0	17.0	9
	70	Cement & Concrete Products	8.7	16.2	10
San Joaquin	115	Air Transportation	272.7	281.9	1
	144	State & Local Gov. Enterprises	139.9	146.6	2
	76	Structural Clay Products	122.7	129.4	3
	34	Metals Mining	105.3	112.1	4
	122	Water & Sanitary Services	2.8	101.0	5
	113	Truck Transportation	78.6	92.5	6
	112	Local Transit & Intercity Bus.	55.4	92.2	7
	18	Food, Feed, Grains, nec.	19.8	26.7	8
	32	Forestry & Fishery Products	15.7	21.1	9
	13	Corn	13.9	20.4	10

Table 25 (contd.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
San Franc.	104	Local Transit & Intercity Bus.	213.6	225.0	1
	136	State & Local Gov. Enterprises	41.5	45.2	2
	114	Water & Sanitary Services	0.1	26.5	3
	24	Forestry & Fishery Products	23.2	25.9	4
	112	Electric Companies & Systems	22.7	24.5	5
	11	Corn	20.5	23.2	6
	137	Dummy Industries	0.0	18.6	7
	14	Sorgum Grain	12.7	15.7	8
	103	Railroads	10.9	15.7	9
	13	Oats	10.6	13.3	10

Table 26

1976 CALIFORNIA EMISSION COEFFICIENTS

NOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
121	TRUCK TRANSPORTATION	70.2863	80.9568	87.5596	1
120	LOCAL TRANSIT AND INTERCITY BUSES	49.5808	61.2995	68.0330	2
18	FEED, FEED GRAINS, NEC	32.5000	46.3681	51.7800	3
152	STATE AND LOCAL GOVT ENTERPRISES	40.6574	43.7109	51.4317	4
130	WATER AND SANITARY SERVICES	9.5662	40.4266	47.2712	5
37	FORESTRY AND FISHERY PRODUCTS	25.8255	30.5188	37.4068	6
13	CORN	22.9050	29.1628	34.4225	7
119	RAILROADS	23.5513	27.8144	34.2958	8
82	CEMENT AND CONCRETE PRODUCTS	15.5923	26.8109	33.5880	9
7	MISC. LIVESTOCK	8.7209	22.0384	28.0496	10
128	ELECTRIC COMPANIES AND SYSTEMS	19.5296	22.8649	27.6316	11
16	SORGHUM GRAIN	14.1973	19.9903	25.2627	12
15	OATS	11.8571	18.4288	23.7429	13
11	RICE	11.2508	17.1769	22.8974	14
4	CATTLE AND CALVES	2.5065	17.4566	22.6830	15
6	SHEEP, LAMBS, AND WOOL	1.4642	17.0554	22.3492	16
1	DAIRIES	5.0168	15.4642	21.3200	17
2	BROILERS, CHICKENS AND EGGS	1.1902	15.2185	20.7952	18
12	BARLEY	8.7970	14.8635	20.1686	19
8	APIARY PRODUCTS	.4145	14.1950	20.1321	20
52	MEAT PRODUCTS	0.	14.1803	19.7922	21
122	WATER TRANSPORATATION	6.6927	13.4233	19.2724	22
3	TURKEYS AND OTHER POULTRY	.2476	13.6265	19.1484	23
47	NEW CONSTRUCT, PUBLIC UTILITY	6.7995	11.7744	18.9684	24
55	GRAIN MILL PRODUCTS	.0014	12.9758	18.7376	25
83	STRUCTURAL CLAY PRODUCTS	7.8849	11.7498	18.6171	26
63	LOGGING CAMPS + SAWMILLS	.0597	11.1159	18.1605	27
9	COTTON	7.1976	12.9188	17.9402	28
10	WHEAT	6.0438	11.8662	17.5976	29
25	SUGAR BEETS	7.7972	11.2864	17.1895	30
154	DUMMY INDUSTRIES	0.	10.6769	16.9952	31
53	DAIRY PRODUCTS	.0005	10.3667	16.5082	32
5	EGGS	.8333	11.1932	16.2501	33
20	WALNUTS	6.8988	10.3422	15.9730	34
72	AGRICULTURAL CHEMICALS	2.3886	9.4720	15.9234	35
31	POTATOES	4.2903	9.0337	15.7204	36
54	CANNED AND FROZEN FOODS	.0014	9.0846	15.5290	37
14	HAY AND PASTURE	3.8660	10.1587	15.4207	38
86	BLAST FURNACES AND BASIC STEEL PROD	2.2863	8.8000	15.3484	39
24	FRUIT AND TREE NUTS, NEC	6.3636	9.6645	15.3166	40
48	NEW CONSTRUCT, HIGHWAYS	0.	7.1778	14.3078	41
25	VEGETABLES	3.8964	7.5588	14.2905	42
71	INDUSTRIAL CHEMICALS	2.5711	7.9176	14.1568	43
123	AIR TRANSPORTATION	4.4868	8.0925	13.9112	44
85	MISC STONE AND CLAY PRODUCTS	1.8149	6.8608	13.7491	45
74	PLASTICS MATERIALS AND SYNTHETIC FI	1.2430	7.1805	13.6133	46
93	METAL STAMPINGS	1.2952	6.4322	13.5884	47
21	ALMONDS	4.6435	7.9214	13.5446	48
36	GREENHOUSE AND NURSERY PRODUCTS	3.7722	6.6762	13.4691	49
89	METAL CONTAINERS	.1902	6.3886	13.4053	50

Table 27

1976 SAN DIEGO EMISSION COEFFICIENTS

NOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
91	TRUCK TRANSPORTATION	169.2341	178.7503	180.6798	1
90	LOCAL TRANSIT AND INTERCITY BUSES	119.3798	122.1215	124.2131	2
47	DRUGS	74.5355	76.2449	77.9243	3
97	ELECTRIC COMPANIES AND SYSTEMS	37.6473	38.6454	39.5906	4
92	WATER TRANSPORATATION	32.3600	37.6488	39.0024	5
16	FORESTRY AND FISHERY PRODUCTS	22.0104	23.9082	25.7532	6
85	RAILROADS	15.3895	17.9532	19.8557	7
93	AIR TRANSPORTATION	14.1589	16.2012	17.8585	8
55	STRUCTURAL CLAY PRODUCTS	9.2157	11.4970	13.4294	9
122	DUMMY INDUSTRIES	0.	10.2846	11.4965	10
8	BARLEY	7.4974	10.1560	11.3598	11
121	STATE AND LOCAL GOVT ENTERPRISES	4.8729	6.9979	9.3980	12
99	WATER AND SANITARY SERVICES	1.4712	7.1263	9.2245	13
21	NEW CONSTRUCT, PUBLIC UTILITY	5.7950	7.3082	8.8271	14
7	WHEAT	5.1509	7.0802	8.4239	15
9	HAY AND PASTURE	3.2949	7.1686	8.3835	16
35	LOGGING CAMPS + SAWMILLS	.0508	6.1699	7.6773	17
1	DAIRIES	4.2757	6.5303	7.5828	18
54	CEMENT AND CONCRETE PRODUCTS	.0550	5.6827	7.4288	19
14	POTATOES	3.6565	5.6231	7.3405	20
15	GREENHOUSE AND NURSERY PRODUCTS	3.2149	4.7793	6.8668	21
28	CANNED AND FROZEN FOODS	.0012	5.4420	6.7308	22
12	VEGETABLES	3.3208	4.7391	6.7077	23
53	GLASS	2.5622	4.6267	6.4569	24
58	BLAST FURNACES AND BASIC STEEL PROD	1.9485	5.0234	6.3226	25
57	MISC STONE AND CLAY PRODUCTS	2.1212	4.6543	6.2870	26
44	AGRICULTURAL CHEMICALS	2.0357	5.1061	6.1860	27
43	INDUSTRIAL CHEMICALS	2.1913	4.8720	6.1141	28
119	POST OFFICE	.1091	3.1718	6.0186	29
10	AGNCITRUS FRUITS	2.2734	3.9552	5.7166	30
22	NEW CONSTRUCT, HIGHWAYS	0.	3.5622	5.4031	31
46	PLASTICS MATERIALS AND SYNTHETIC FI	1.0594	3.8300	5.0363	32
115	HOSPITALS	.0503	2.6448	4.9920	33
11	CITRUS FRUITS	1.2487	3.2171	4.9681	34
118	NONPROFIT ORGANIZATIONS	.0110	1.9878	4.7047	35
13	DRIED BEANS	.6470	2.8044	4.7046	36
102	BANKING AND FINANCIAL INTERMEDIARIE	.1050	1.5298	4.6326	37
18	STONE + CLAY MIN + QUARRY	.4728	2.8298	4.5731	38
45	GUM AND WOOD CHEMICALS	.7851	3.3446	4.5517	39
116	OTHER MEDICAL SERVICES	.2470	2.0261	4.4344	40
117	EDUCATIONAL SERVICES	.0463	1.8402	4.3967	41
106	HOTELS AND LODGING PLACES	.0136	2.5730	4.2928	42
59	IRON AND STEEL FOUNDRIES AND FORGIN	.2297	2.6182	4.2511	43
63	METAL STAMPINGS	1.1038	2.7232	4.1260	44
19	NEW CONSTRUCT, RESIDENT	1.0310	2.3550	4.0135	45
4	CATTLE AND CALVES	2.1362	3.5019	3.9599	46
56	POTTERY AND RELATED PRODUCTS	.1673	1.8593	3.8713	47
50	PETROLEUM REFINING AND RELATED PROD	1.1205	3.2518	3.8495	48
49	PAINTS AND ALLIED PRODUCTS	.0092	2.5678	3.7359	49
96	RADIO AND TELEVISION BROADCASTING	.0423	1.6366	3.7181	50

Table 28

1976 SOUTH COAST EMISSION COEFFICIENTS

NOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
109	TRUCK TRANSPORTATION	55.4617	63.3918	65.2785	1
108	LOCAL TRANSIT AND INTERCITY BUSES	39.1234	44.1261	46.0298	2
116	ELECTRIC COMPANIES AND SYSTEMS	28.6667	30.6022	31.6934	3
27	FORESTRY AND FISHERY PRODUCTS	24.4637	26.2541	27.9997	4
107	RAILROADS	21.9293	24.0271	25.7681	5
12	CORN	21.6972	23.6501	24.8191	6
118	WATER AND SANITARY SERVICES	6.9760	19.3692	21.2213	7
140	STATE AND LOCAL GOVT ENTERPRISES	15.9307	17.7822	19.9529	8
110	WATER TRANSPORATATION	10.9538	15.5264	17.0191	9
70	CEMENT AND CONCRETE PRODUCTS	8.7002	14.5446	16.1688	10
14	OATS	11.2319	13.1921	14.3207	11
11	BARLEY	8.3331	10.5025	11.6746	12
7	MISC. LIVESTOCK	8.2611	10.4212	11.3355	13
23	SUGAR BEETS	7.3860	9.0729	10.6623	14
36	NEW CONSTRUCT, PUBLIC UTILITY	6.4410	8.7625	10.5313	15
9	COTTON	6.8180	9.3092	10.4697	16
16	WALNUTS	6.5350	8.2642	9.7707	17
29	METALS MINING	6.3112	7.8861	9.2662	18
69	GLASS	5.1223	7.3418	9.1653	19
74	BLAST FURNACES AND BASIC STEEL PROD	4.3087	7.4066	8.7717	20
10	WHEAT	5.7251	7.4725	8.7467	21
33	CHEM + FERT MINERAL MIN	5.2794	6.7795	8.4445	22
1	DAIRIES	4.7523	6.9875	8.0405	23
13	HAY AND PASTURE	3.6621	6.7263	7.9280	24
17	ALMONDS	4.3986	6.0094	7.5228	25
71	STRUCTURAL CLAY PRODUCTS	3.6302	5.7253	7.5022	26
24	POTATOES	4.0641	5.8441	7.4271	27
73	MISC STONE AND CLAY PRODUCTS	2.9644	5.6057	7.2675	28
20	VEGETABLES	3.6910	5.2153	7.0431	29
26	GREENHOUSE AND NURSERY PRODUCTS	3.5733	5.0047	6.8976	30
15	GRASS SEED	2.7468	5.3879	6.6660	31
141	DUMMY INDUSTRIES	0.	4.8842	6.2654	32
43	CANNED AND FROZEN FOODS	.0009	4.6736	6.0622	33
111	AIR TRANSPORTATION	2.4571	4.3587	5.9475	34
18	NONCITRUS FRUITS	2.5268	4.1587	5.8257	35
37	NEW CONSTRUCT, HIGHWAYS	0.	3.9475	5.7968	36
22	MELONS	2.3601	3.8414	5.6694	37
51	LOGGING CAMPS + SAWMILLS	.1478	3.9780	5.1929	38
62	PLASTICS MATERIALS AND SYNTHETIC FI	1.6566	3.7371	4.9289	39
138	POST OFFICE	.3565	2.4428	4.9097	40
19	CITRUS FRUITS	1.3879	3.2010	4.8589	41
77	METAL CONTAINERS	.4992	3.3919	4.8303	42
34	NEW CONSTRUCT, RESIDENT	1.1459	3.0259	4.7911	43
32	STONE + CLAY MIN + QUARRY	.6501	3.0337	4.6587	44
31	NATURAL GAS + N.G. LIQUIDS	2.3443	3.4588	4.6224	45
136	EDUCATIONAL SERVICES	.7791	2.2122	4.4464	46
112	PIPELINE TRANSPORTATION	.1469	2.9278	4.4241	47
134	HOSPITALS	.2207	2.2669	4.4160	48
21	DRIED BEANS	.7191	2.6540	4.3981	49
135	OTHER MEDICAL SERVICES	.8074	2.1457	4.3044	50

Table 29

1976 SAN JOAQUIN EMISSION COEFFICIENTS

NOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
115	AIR TRANSPORTATION	272.6840	279.2609	281.9075	1
144	STATE AND LOCAL GOVT ENTERPRISES	139.9289	142.7276	146.6327	2
76	STRUCTURAL CLAY PRODUCTS	122.6998	126.2433	129.4054	3
34	METALS MINING	105.2676	109.6552	112.1113	4
122	WATER AND SANITARY SERVICES	2.8293	97.6873	100.9942	5
113	TRUCK TRANSPORTATION	78.6018	89.0813	92.4774	6
112	LOCAL TRANSIT AND INTERCITY BUSES	55.4467	88.7581	92.2128	7
10	FLLD, FEED GRAINS, NEC	19.7640	24.9194	26.6792	8
32	FORESTRY AND FISHERY PRODUCTS	15.7051	18.0286	21.0773	9
13	CORN	13.9291	18.2164	20.3742	10
111	RAILROADS	13.5765	17.0186	20.2559	11
35	CRUDE PETROLEUM	15.4412	16.8744	19.5404	12
51	SUGAR	4.5797	14.6348	17.1654	13
114	WATER TRANSPORATATION	2.3647	13.3281	15.7265	14
16	SORGHUM GRAIN	8.6337	12.9067	15.1105	15
75	CEMENT AND CONCRETE PRODUCTS	4.4517	11.5303	14.6956	16
71	PETROLEUM REFINING AND RELATED PROD	4.1352	12.2939	14.2071	17
120	ELECTRIC COMPANIES AND SYSTEMS	5.8075	11.4920	13.6372	18
11	RICE	6.8418	10.8475	13.3404	19
15	OATS	7.2106	11.0732	13.1075	20
139	OTHER MEDICAL SERVICES	7.0916	8.8314	12.6897	21
7	MISC. LIVESTOCK	5.3034	10.3674	12.6394	22
12	BARLEY	5.3497	9.7673	11.9819	23
142	POST OFFICE	3.1314	6.5436	11.1742	24
1	DAIRIES	3.0509	8.1882	10.7292	25
27	SUGAR BEETS	4.7416	7.7363	10.6042	26
145	DUMMY INDUSTRIES	0.	8.8658	10.3824	27
10	WHEAT	3.6754	7.8312	10.3737	28
128	REAL ESTATE	5.5507	8.6226	10.2470	29
9	COTTON	4.3770	8.3329	10.1407	30
65	AGRICULTURAL CHEMICALS	3.2387	7.5478	9.8563	31
140	EDUCATIONAL SERVICES	2.9223	5.5479	9.6652	32
41	NEW CONSTRUCT, PUBLIC UTILITY	4.1349	6.8895	9.6461	33
125	BANKING AND FINANCIAL INTERMEDIARIE	3.0145	4.9448	9.5879	34
19	WALNUTS	4.1953	6.8713	9.5354	35
4	CATTLE AND CALVES	1.5242	7.4552	9.3180	36
28	POTATOES	2.6090	6.0899	9.2241	37
121	GAS COMPANIES AND SYSTEMS	.0468	7.2886	9.1834	38
23	FRUIT AND TREE NUTS, NEC	3.8699	6.4832	9.1518	39
47	DAIRY PRODUCTS	.2302	6.1204	8.8375	40
49	GRAIN MILL PRODUCTS	.3989	6.6839	8.8265	41
64	INDUSTRIAL CHEMICALS	1.6694	6.2889	8.7187	42
14	HAY AND PASTURE	2.3510	6.4941	8.6819	43
6	SHEEP, LAMBS, AND WOOL	.8904	6.8871	8.6697	44
79	BLAST FURNACES AND BASIC STEEL PROD	1.3903	6.2905	8.5778	45
24	VEGETABLES	2.3695	5.3558	8.5316	46
36	NATURAL GAS + N.G. LIQUIDS	.4468	6.1216	8.4827	47
42	NEW CONSTRUCT, HIGHWAYS	0.	5.1925	8.4731	48
48	CANNED AND FROZEN FOODS	.7557	5.9080	8.2826	49
46	MEAT PRODUCTS	.0017	6.3744	8.1856	50

Table 30

1976 SAN FRANCISCO EMISSION COEFFICIENTS

NOX EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
104	LOCAL TRANSIT AND INTERCITY BUSES	213.5780	222.8917	224.9815	1
136	STATE AND LOCAL GOVT ENTERPRISES	41.4944	42.7174	45.2026	2
114	WATER AND SANITARY SERVICES	.0559	24.6267	26.5006	3
24	FORESTRY AND FISHERY PRODUCTS	23.1538	23.9625	25.8743	4
112	ELECTRIC COMPANIES AND SYSTEMS	22.6790	23.4127	24.5190	5
11	CORN	20.5354	21.8446	23.2073	6
137	DUMMY INDUSTRIES	0.	16.9846	18.5944	7
14	SORGHUM GRAIN	12.7285	14.2864	15.6879	8
103	RAILROADS	10.9271	13.6791	15.6815	9
13	OATS	10.6305	11.9674	13.2889	10
10	BARLEY	7.8869	9.3958	10.7685	11
20	SUGAR BEETS	6.9905	8.2280	10.0722	12
7	MISC. LIVESTOCK	7.8187	8.8164	9.7725	13
77	METAL STAMPINGS	6.4556	7.4352	9.2019	14
15	WALNUTS	6.1851	7.4033	9.1425	15
32	NEW CONSTRUCT, PUBLIC UTILITY	6.0961	6.8513	8.7945	16
9	WHEAT	5.4185	6.5852	8.0666	17
12	HAY AND PASTURE	3.4661	5.7942	7.2043	18
16	ALMONDS	4.1631	5.2899	7.0378	19
21	POTATOES	3.8465	5.1034	6.9083	20
18	VEGETABLES	3.4933	4.5249	6.6243	21
23	GREENHOUSE AND NURSERY PRODUCTS	3.3819	4.0676	6.1903	22
1	DAIRIES	4.4978	5.0267	6.1631	23
131	OTHER MEDICAL SERVICES	2.1030	3.4659	5.9318	24
106	WATER TRANSPORATATION	1.4570	4.0020	5.6386	25
107	AIR TRANSPORTATION	2.1158	3.7091	5.4721	26
17	NONCITRUS FRUITS	2.3915	3.5304	5.4563	27
117	BANKING AND FINANCIAL INTERMEDIARIE	.8939	2.3788	5.4411	28
57	GUM AND WOOD CHEMICALS	2.3807	3.6009	5.1461	29
22	SAFFLOWER	2.2770	3.3105	4.9246	30
130	HOSPITALS	.4287	2.3063	4.7449	31
135	OTHER FEDERAL GOVT ENTERPRISES	1.4747	2.0582	4.5258	32
66	CEMENT AND CONCRETE PRODUCTS	1.2977	2.5787	4.4980	33
71	IRON AND STEEL FOUNDRIES AND FORGIN	.8907	2.7247	4.4784	34
133	NONPROFIT ORGANIZATIONS	.0939	1.6532	4.3777	35
134	POST OFFICE	.9286	1.4431	4.2819	36
132	EDUCATIONAL SERVICES	.1596	1.6745	4.2547	37
56	AGRICULTURAL CHEMICALS	1.2776	2.6466	4.1924	38
121	HOTELS AND LODGING PLACES	.1155	2.3383	4.1592	39
111	RADIO AND TELEVISION BROADCASTING	.3603	1.9684	4.1360	40
129	DOCTORS AND DENTISTS	.6539	1.3875	4.1109	41
70	BLAST FURNACES AND BASIC STEEL PROD	.9657	2.5046	4.1005	42
19	DRIED BEANS	.6806	2.0938	4.0907	43
118	INSURANCE	.0002	1.6660	4.0585	44
108	PIPELINE TRANSPORTATION	.1390	2.0934	3.7929	45
120	REAL ESTATE	1.6460	2.6552	3.7549	46
30	NEW CONSTRUCT, RESIDENT	1.0846	1.7035	3.6500	47
59	DRUGS	.5206	1.6983	3.6262	48
127	MOTION PICTURES	.0102	1.7902	3.6253	49
65	GLASS	.5924	1.6178	3.6127	50

(d) Hydrocarbons

The hydrocarbon emission coefficients for the statewide economy and for the economies of the four air basins are shown in Table 31. Although the transportation sectors are not as prominent as they are in the case of nitrogen oxide emissions, they are nevertheless important among the sectors with the highest emission rates of hydrocarbons. Local Transit & Intercity Buses appear in the lists of all five economies, placing first in the San Diego and South Coast basins. Pipeline Transportation and Truck Transportation also appear among the principal sectors statewide and in the San Joaquin and San Francisco basins. Air Transportation, which ranks first in the San Joaquin basin, is also one of the principal sectors in the San Diego basin.

Prominent non-transportation sectors include Plastics Materials & Synthetics, Drugs, Crude Petroleum, and Agricultural Chemicals. Each of these sectors ranks among the top ten sectors statewide and among the ten principal sectors in three of the four basins. The Ship and Boat Building and Repair sector is another conspicuous sector. It is among the principal ten sectors statewide and in the South Coast and San Francisco basins and places eleventh and ninteenth, respectively, in the San Diego and San Joaquin basins.

The Local Transit and Intercity Buses sector in the San Diego basin is the sector with the highest emissions coefficient. The rate of 688.7 tons of hydrocarbons per million dollars of production for final demand exceeds slightly the next highest coefficient of 657.6 tons associated with the Air Transportation sector in the San Joaquin basin. With the exception of the top ranked sector, the sectors of the San Joaquin basin have higher coefficients than correspondingly ranked sectors in the other three basins.

Table 31

Hydrocarbon Emission Coefficients Ranking - 1976

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
Calif.	124	Pipeline Transportation	224.3	239.5	1
	120	Local Transit & Intercity Bus.	82.7	100.1	2
	121	Truck Transportation	70.3	95.1	3
	74	Plastics Materials & Synthetics	64.5	91.1	4
	75	Drugs	69.6	91.0	5
	41	Crude Petroleum	56.9	72.3	6
	72	Agricultural Chemicals	36.6	62.6	7
	42	Nat. Gas & N.G. Liquids	20.6	51.6	8
	78	Petroleum Refining	4.8	47.5	9
	115	Ship & Boat Building & Repair	28.7	46.7	10
San Diego	90	Local Transit & Intercity Bus.	681.9	688.7	1
	47	Drugs	120.2	125.2	2
	53	Glass	106.3	110.6	3
	46	Plastics Materials & Synth.	101.3	105.7	4
	111	Auto Repair	42.6	47.1	5
	44	Agricultural Chemicals	38.9	42.4	6
	122	Dummy Industries	0.0	34.3	7
	93	Air Transportation	25.9	31.3	8
	100	Wholesale Trade	15.7	21.2	9
	107	Personal & Repair Services	15.1	21.0	10

Table 31 (contd.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
South Coast	108	Local Transit & Intercity Bus.	553.3	558.9	1
	31	Natural Gas & N.G. Liquids	196.3	200.6	2
	62	Plastic Materials & Synth.	66.0	70.8	3
	141	Dummy Industries	0.0	28.4	4
	103	Ship & Boat Building & Repair	17.6	22.1	5
	107	Railroads	9.7	16.1	6
	60	Agricultural Chemicals	11.5	16.1	7
	126	Personal & Repair Services	9.4	14.0	8
	30	Crude Petroleum	9.6	13.2	9
	119	Wholesale Trade	7.6	11.7	10
San Joaquin	115	Air Transportation	646.6	657.6	1
	68	Drugs	361.5	368.9	2
	66	Gum & Wood Chemicals	184.3	195.2	3
	116	Pipeline Transportation	149.9	156.4	4
	112	Local Transit & Intercity Bus.	118.2	129.1	5
	113	Truck Transportation	100.5	118.6	6
	67	Plastics Materials & Synth.	90.8	100.5	7
	35	Crude Petroleum	48.3	53.7	8
	65	Agricultural Chemicals	22.3	33.5	9
	71	Petroleum Refining	8.6	33.1	10

Table 31 (contd.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
San Franc.	59	Drugs	243.4	257.0	1
	99	Ship & Boat Building & Repair	80.8	87.8	2
	27	Crude Petroleum	73.6	77.3	3
	104	Local Transit & Intercity Bus.	44.5	49.6	4
	105	Truck Transportation	37.9	47.5	5
	28	Natural Gas & N.G. Liquids	26.7	29.6	6
	70	Blast Furnaces & Basic Steel	13.4	19.8	7
	108	Pipeline Transportation	14.9	19.0	8
	115	Wholesale Trade	11.1	15.8	9
	122	Personal & Repair Services	10.3	15.2	10

The fifty principal sectors, ranked by the total emission coefficients, in each of the five economies are shown as follows:

California .... Table 32
San Diego .... Table 33
South Coast .... Table 34
San Joaquin .... Table 35
San Francisco... Table 36

Table 32

1976 CALIFORNIA EMISSION COEFFICIENTS

HC EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
124	PIPELINE TRANSPORTATION	224.3198	230.1191	239.5493	1
120	LOCAL TRANSIT AND INTERCITY BUSES	82.6929	88.6732	100.0860	2
121	TRUCK TRANSPORTATION	70.3271	83.9483	95.1394	3
74	PLASTICS MATERIALS AND SYNTHETIC FI	64.4982	80.2409	91.1440	4
75	DRUGS	69.6324	79.7324	91.0352	5
41	CRUDE PETROLEUM	56.8639	62.3835	72.2813	6
72	AGRICULTURAL CHEMICALS	36.5711	51.6778	62.6123	7
42	NATURAL GAS + N.G. LIQUIDS	20.6037	42.0988	51.6461	8
78	PETROLEUM REFINING AND RELATED PROD	4.8499	38.8438	47.5410	9
115	SHIP AND BOAT BUILDING AND REPAIRIN	28.6793	34.4289	46.6705	10
73	GUM AND WOOD CHEMICALS	19.4607	34.0609	44.8190	11
79	RUBBER AND PLASTICS PRODUCTS	2.9730	25.7996	37.1834	12
18	FOOD, FEED GRAINS, NEC	7.5000	20.9656	30.1383	13
123	AIR TRANSPORTATION	12.0934	19.9413	29.8035	14
77	PAINTS AND ALLIED PRODUCTS	1.2750	18.3206	28.8968	15
119	RAILROADS	9.6807	15.9400	26.9253	16
154	DUMMY INDUSTRIES	0.	16.1981	26.9069	17
62	TEXTILE PRODUCTS	.2162	14.4025	26.6691	18
71	INDUSTRIAL CHEMICALS	.1266	15.6210	26.1960	19
138	PERSONAL AND REPAIR SERVICES	9.6464	13.7122	25.8414	20
131	WHOLESALE TRADE	11.3261	14.5633	25.5672	21
122	WATER TRANSPORATATION	1.2046	15.5344	25.4480	22
128	ELECTRIC COMPANIES AND SYSTEMS	1.0197	17.1026	25.1817	23
76	CLEANING AND TOILET PREPARATIONS	.9503	13.2385	24.4212	24
129	GAS COMPANIES AND SYSTEMS	.0102	14.5856	22.8811	25
142	AUTOMOBILE REPAIR	7.1618	12.1567	22.6652	26
7	MISC. LIVESTOCK	2.5581	11.6582	21.8467	27
15	OATS	2.3571	12.8139	21.8207	28
113	MOTOR VEHICLES	1.8059	9.6472	21.3709	29
152	STATE AND LOCAL GOVT ENTERPRISES	3.7001	8.2484	21.3345	30
48	NEW CONSTRUCT, HIGHWAYS	.0510	9.0839	21.1686	31
60	LEATHER TANNING AND PRODUCTS	.1605	8.6704	20.9450	32
82	CEMENT AND CONCRETE PRODUCTS	.1440	9.2179	20.7045	33
118	JEWELRY, SPORTING GOODS, ETC.	.2234	8.7906	20.6195	34
30	HOPS	0.	9.6363	20.5668	35
9	COTTON	.0095	11.8553	20.3662	36
8	APIARY PRODUCTS	.9845	10.0342	20.0970	37
68	PAPER + PAPERBOARD PRODUCTS	.0900	8.2599	20.0571	38
85	MISC STONE AND CLAY PRODUCTS	.0348	8.2942	19.9692	39
58	CONFECTIONARY PRODUCTS	2.6399	10.4151	19.9417	40
54	CANNED AND FROZEN FOODS	.0280	8.8707	19.7933	41
107	HOUSEHOLD APPLIANCES	.6509	7.6464	19.7154	42
66	HOUSEHOLD FURNITURE	.2472	7.1316	19.6099	43
6	SHEEP, LAMBS, AND WOOL	1.0125	10.6123	19.5848	44
55	GRAIN MILL PRODUCTS	.0277	9.7981	19.5638	45
13	CORN	.0335	10.5295	19.4443	46
52	MEAT PRODUCTS	.0105	9.8813	19.3928	47
88	PRIMARY NONFERROUS METAL PRODUCTS	.0115	8.0778	19.3408	48
116	OTHER TRANSPORTATION EQUIPMENT	.1479	7.2636	19.2248	49
16	SORGHUM GRAIN	.0229	10.2050	19.1412	50

Table 33

1976 SAN DIEGO EMISSION COEFFICIENTS

HC EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
90	LOCAL TRANSIT AND INTERCITY BUSES	681.9061	684.8419	688.6586	1
47	DRUGS	120.1897	122.0960	125.1605	2
53	GLASS	106.2622	107.2686	110.6085	3
46	PLASTICS MATERIALS AND SYNTHETIC FI	101.2840	103.5091	105.7103	4
111	AUTOMOBILE REPAIR	42.5809	44.2156	47.0767	5
44	AGRICULTURAL CHEMICALS	38.9339	40.4234	42.3939	6
122	DUMMY INDUSTRIES	0.	32.0914	34.3029	7
93	AIR TRANSPORTATION	25.8718	28.2564	31.2806	8
100	WHLESALE TRADE	15.7154	17.3999	21.2065	9
107	PERSONAL AND REPAIR SERVICES	15.0636	17.0974	21.0017	10
85	SHIP AND BOAT BUILDING AND REPAIRIN	16.0062	17.7647	20.7193	11
38	HOUSEHOLD FURNITURE	12.1046	13.8941	16.5907	12
89	RAILROADS	5.6421	9.2456	12.7172	13
60	PRIMARY NONFERROUS METAL PRODUCTS	8.6371	11.0484	12.5986	14
51	RUBBER AND PLASTICS PRODUCTS	3.9015	8.3056	10.7905	15
65	OTHER FABRICATED METAL PRODUCTS	6.0340	7.1925	9.6911	16
92	WATER TRANSPORATATION	3.8330	5.8268	8.2969	17
50	PETROLEUM REFINING AND RELATED PROD	6.3647	7.0744	8.1652	18
49	PAINTS AND ALLIED PRODUCTS	2.0021	5.4389	7.5707	19
102	BANKING AND FINANCIAL INTERMEDIARIE	.0050	1.5116	7.1735	20
119	POST OFFICE	.0101	1.8284	7.0233	21
110	MISC PROFESSIONAL SERVICES	.0001	2.0175	6.6158	22
72	MACHINE SHOP PRODUCTS	1.8805	3.2883	6.5985	23
118	NONPROFIT ORGANIZATIONS	.0002	1.5297	6.4874	24
31	CONFECTIONARY PRODUCTS	3.4644	4.5609	6.4645	25
114	DOCTORS AND DENTISTS	.0083	1.1763	6.1068	26
116	OTHER MEDICAL SERVICES	.0047	1.6864	6.0812	27
106	HOTELS AND LODGING PLACES	.0000	2.8936	6.0320	28
91	TRUCK TRANSPORTATION	.2931	2.5089	6.0298	29
101	RETAIL TRADE	1.4209	2.0082	6.0237	30
103	INSURANCE	.0000	2.1812	6.0163	31
117	EDUCATIONAL SERVICES	.0012	1.3221	5.9871	32
115	HOSPITALS	.0002	1.6883	5.9716	33
108	MISCELLANEOUS BUSINESS SERVICES	.0002	1.8501	5.9032	34
73	COMPUTERS AND OFFICE EQUIPMENT	.0037	2.2409	5.7910	35
39	OFFICE FURNITURE AND FIXTURES	1.6890	3.0067	5.7429	36
13	DRIED BEANS	1.2070	2.2750	5.7425	37
96	RADIO AND TELEVISION BROADCASTING	.0006	1.8404	5.6388	38
121	STATE AND LOCAL GOVT ENTERPRISES	.1695	1.1944	5.5741	39
84	AIRCRAFT	.1207	2.0744	5.5540	40
79	RADIO AND TV RECEIVING SETS	.0032	2.0330	5.5013	41
94	TRANSPORTATION SERVICES	.6179	1.4633	5.4702	42
80	COMMUNICATION EQUIPMENT	.0007	1.2807	5.3761	43
21	NEW CONSTRUCT, PUBLIC UTILITY	1.5005	2.5990	5.3707	44
48	CLEANING AND TOILET PREPARATIONS	1.4923	3.1492	5.3474	45
25	ORDNANCE + GUIDED MISSILES	.3700	1.8941	5.2700	46
81	ELECTRONIC COMPONENTS	.1170	1.6487	5.2583	47
66	ENGINES, TURBINES AND GENERATORS	.6940	2.5103	5.1898	48
14	POTATOES	1.1289	2.0433	5.1772	49
99	WATER AND SANITARY SERVICES	.0216	1.3474	5.1763	50

Table 34

1976 SOUTH COAST EMISSION COEFFICIENTS

HC EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
108	LOCAL TRANSIT AND INTERCITY BUSES	553.3239	555.8807	558.9408	1
31	NATURAL GAS + N.G. LIQUIDS	196.3430	198.6844	200.5549	2
62	PLASTICS MATERIALS AND SYNTHETIC FI	65.9638	68.8561	70.7718	3
141	DUMMY INDUSTRIES	0.	26.1431	28.3634	4
103	SHIP AND BOAT BUILDING AND REPAIRIN	17.5822	19.3029	22.0784	5
107	RAILROADS	9.6583	13.3459	16.1443	6
60	AGRICULTURAL CHEMICALS	11.5101	14.1923	16.1132	7
126	PERSONAL AND REPAIR SERVICES	9.4155	10.8034	14.0255	8
30	CRUDE PETROLEUM	9.5525	10.7144	13.1719	9
119	WHOLESALE TRADE	7.6403	8.6986	11.7002	10
111	AIR TRANSPORTATION	5.6939	7.5937	10.1477	11
112	PIPELINE TRANSPORTATION	6.2055	7.3150	9.7202	12
130	AUTOMOBILE REPAIR	4.9661	6.4916	9.0999	13
67	RUBBER AND PLASTICS PRODUCTS	.5353	6.2318	8.5765	14
14	OATS	4.4279	6.5486	8.3629	15
66	PETROLEUM REFINING AND RELATED PROD	4.1418	6.9589	8.2857	16
65	PAINTS AND ALLIED PRODUCTS	1.9954	5.9552	7.9467	17
63	DRUGS	2.9115	4.7249	7.4600	18
110	WATER TRANSPORATATION	1.6537	4.9344	7.3338	19
7	MISC. LIVESTOCK	4.8055	5.5608	7.0305	20
21	DRIED BEANS	1.7277	3.2065	6.0101	21
64	CLEANING AND TOILET PREPARATIONS	1.3027	3.6052	5.9595	22
36	NEW CONSTRUCT, PUBLIC UTILITY	1.6696	2.9671	5.8104	23
50	TEXTILE PRODUCTS	.0226	3.1529	5.7892	24
109	TRUCK TRANSPORTATION	1.2046	2.6925	5.7254	25
116	ELECTRIC COMPANIES AND SYSTEMS	.8971	3.8478	5.6019	26
24	POTATOES	1.6159	2.9664	5.5110	27
61	GUM AND WOOD CHEMICALS	.6564	3.3214	5.3511	28
121	BANKING AND FINANCIAL INTERMEDIARIE	.0171	1.0464	5.3242	29
15	GRASS SEED	1.6291	3.0878	5.1424	30
140	STATE AND LOCAL GOVT ENTERPRISES	.5814	1.6529	5.1423	31
106	JEWELRY, SPORTING GOODS, ETC.	.1618	2.3806	5.1291	32
38	NEW CONSTRUCT, ALL OTHER	.8742	2.0320	5.0888	33
59	INDUSTRIAL CHEMICALS	.0558	2.9034	5.0104	34
95	HOUSEHOLD APPLIANCES	.4405	2.2041	4.9546	35
34	NEW CONSTRUCT, RESIDENT	.9224	2.0774	4.9149	36
122	INSURANCE	.0002	1.5973	4.8939	37
105	CLOCKS AND SCIENTIFIC EQUIPMENT	.1471	1.7970	4.8351	38
134	HOSPITALS	.0051	1.3577	4.8124	39
91	COMPUTERS AND OFFICE EQUIPMENT	.0009	1.8311	4.8063	40
9	COTTON	.0179	2.9185	4.7839	41
102	AIRCRAFT	.0887	1.6973	4.7557	42
137	NONPROFIT ORGANIZATIONS	.0066	.9656	4.7540	43
135	OTHER MEDICAL SERVICES	.0161	1.2824	4.7523	44
138	POST OFFICE	.0347	.7763	4.7419	45
99	ELECTRONIC COMPONENTS	.2389	1.7086	4.7128	46
118	WATER AND SANITARY SERVICES	.2470	1.7187	4.6959	47
129	MISC PROFESSIONAL SERVICES	.0025	1.1877	4.6766	48
125	HOTELS AND LODGING PLACES	.0009	2.0780	4.6745	49
120	RETAIL TRADE	1.1770	1.6001	4.6611	50

Table 35

1976 SAN JOAQUIN EMISSION COEFFICIENTS

HC EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
115	AIR TRANSPORTATION	646.6084	654.1911	657.5797	1
68	DRUGS	361.5176	365.4243	368.8650	2
66	GUM AND WOOD CHEMICALS	184.2897	192.4050	195.2036	3
116	PIPELINE TRANSPORTATION	149.8522	153.0438	156.4325	4
112	LOCAL TRANSIT AND INTERCITY BUSES	118.1963	124.6649	129.0881	5
113	TRUCK TRANSPORTATION	100.5214	114.2153	118.5634	6
67	PLASTICS MATERIALS AND SYNTHETIC FI	90.8199	97.7255	100.5304	7
35	CRUDE PETROLEUM	48.3242	50.2478	53.6613	8
65	AGRICULTURAL CHEMICALS	22.3019	30.5707	33.5264	9
71	PETROLEUM REFINING AND RELATED PROD	8.5674	30.6582	33.1078	10
76	STRUCTURAL CLAY PRODUCTS	22.3083	25.6904	29.7389	11
36	NATURAL GAS + N.G. LIQUIDS	9.7468	24.1245	27.1474	12
107	SHIP AND BOAT BUILDING AND REPAIRIN	19.1586	21.6518	25.0060	13
122	WATER AND SANITARY SERVICES	5.5557	16.6745	20.9085	14
144	STATE AND LOCAL GOVT ENTERPRISES	12.7857	15.7525	20.7523	15
145	DUMMY INDUSTRIES	0.	16.3695	18.3113	16
114	WATER TRANSPORATATION	4.1655	15.0374	18.1082	17
18	FLCD, FEED GRAINS, NEC	8.0341	14.9461	17.1992	18
123	WHOLESALE TRADE	9.6797	12.2547	16.5584	19
111	RAILROADS	6.9889	11.5193	15.6640	20
130	PERSONAL AND REPAIR SERVICES	8.7395	11.0065	15.3631	21
120	ELECTRIC COMPANIES AND SYSTEMS	.1735	12.1961	14.9426	22
69	CLEANING AND TOILET PREPARATIONS	4.9339	10.7891	13.3356	23
64	INDUSTRIAL CHEMICALS	.1000	9.1000	12.2109	24
75	CEMENT AND CONCRETE PRODUCTS	.0719	7.8444	11.8970	25
70	PAINTS AND ALLIED PRODUCTS	1.1722	9.1949	11.8375	26
42	NEW CONSTRUCT, HIGHWAYS	.0546	7.5955	11.7957	27
72	RUBBER AND PLASTICS PRODUCTS	1.8829	8.7051	11.7238	28
142	POST OFFICE	.7635	5.7397	11.6685	29
105	MOTOR VEHICLES	6.2403	9.3672	11.6448	30
134	AUTOMOBILE REPAIR	4.7843	7.8162	11.2031	31
15	OATS	2.5250	8.4686	11.0733	32
23	FRUIT AND TREE NUTS, NEC	2.9215	6.9101	10.3268	33
7	MISC. LIVESTOCK	2.7403	7.3463	10.2552	34
51	SUGAR	.0052	6.9752	10.2152	35
52	CONFECTIONARY PRODUCTS	1.3088	6.8279	9.9511	36
74	GLASS	2.3518	5.6041	9.8176	37
13	CORN	.0359	6.6308	9.3936	38
9	COTTON	.0102	7.0701	9.3847	39
61	PAPER + PAPERBOARD PRODUCTS	.3268	5.9235	9.3639	40
48	CANNED AND FROZEN FOODS	.0014	6.3021	9.3423	41
87	CUTLERY, HAND TOOLS AND GENERAL HAR	3.2072	5.6518	9.3092	42
16	SORGHUM GRAIN	.0246	6.4373	9.2589	43
12	BARLEY	.0067	6.2496	9.0850	44
28	POTATOES	.9215	5.0652	9.0781	45
78	MISC STONE AND CLAY PRODUCTS	.0373	5.3247	8.9758	46
25	DRIED BEANS	.9852	4.9128	8.9431	47
30	SAFFLOWER	.5101	5.5316	8.8237	48
37	STONE + CLAY MIN + QUARRY	.0275	5.0475	8.7570	49
14	HAY AND PASTURE	.0069	5.9524	8.7535	50

Table 36

1976 SAN FRANCISCO EMISSION COEFFICIENTS

HC EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
59	DRUGS	243.4499	253.9283	257.0028	1
99	SHIP AND BOAT BUILDING AND REPAIRIN	80.8240	84.6148	87.8196	2
27	CRUDE PETROLEUM	73.6231	74.4574	77.2859	3
104	LOCAL TRANSIT AND INTERCITY BUSES	44.5436	46.2189	49.5516	4
105	TRUCK TRANSPORTATION	37.8826	44.0361	47.4583	5
28	NATURAL GAS + N.G. LIQUIDS	26.6761	27.7176	29.6017	6
70	BLAST FURNACES AND BASIC STEEL PROD	13.4298	17.3032	19.8482	7
108	PIPELINE TRANSPORTATION	14.8849	16.2698	18.9801	8
115	WHOLESALE TRADE	11.1225	12.3624	15.7796	9
122	PERSONAL AND REPAIR SERVICES	10.2869	11.6077	15.1727	10
73	METAL CONTAINERS	5.0940	9.8904	12.5662	11
60	CLEANING AND TOILET PREPARATIONS	3.3226	9.9307	12.5010	12
42	SUGAR	3.4811	9.4786	11.6384	13
62	PETROLEUM REFINING AND RELATED PROD	7.5727	9.5012	10.6543	14
106	WATER TRANSPORATATION	.6137	7.9113	10.5214	15
130	HOSPITALS	.0004	6.4404	10.3294	16
103	RAILROADS	5.0615	6.9992	10.1925	17
107	AIR TRANSPORTATION	4.4362	6.7446	9.5562	18
71	IRON AND STEEL FOUNDRIES AND FORGIN	3.3356	6.7098	9.5066	19
129	DOCTORS AND DENTISTS	.0173	5.0505	9.3937	20
137	DUMMY INDUSTRIES	0.	6.6490	9.2161	21
43	CONFECTIONARY PRODUCTS	3.3228	6.7686	9.1403	22
77	METAL STAMPINGS	1.7733	5.5825	8.3999	23
81	FARM MACHINERY	2.2227	5.2088	8.1599	24
131	OTHER MEDICAL SERVICES	.0098	4.1168	8.0493	25
75	FABRICATED STRUCTURAL STEEL	.4529	4.8352	7.5537	26
97	MOTOR VEHICLES	1.6964	4.5221	7.0001	27
32	NEW CONSTRUCT, PUBLIC UTILITY	1.4804	3.8534	6.9523	28
13	OATS	3.0519	4.8089	6.9163	29
33	NEW CONSTRUCT, HIGHWAYS	.0660	3.4997	6.8645	30
58	PLASTICS MATERIALS AND SYNTHETIC FI	1.7662	4.2076	6.6927	31
66	CEMENT AND CONCRETE PRODUCTS	.0082	3.5003	6.5611	32
7	MISC. LIVESTOCK	3.3121	4.9033	6.4280	33
39	CANNED AND FROZEN FOODS	.0013	3.9156	6.2439	34
100	OTHER TRANSPORTATION EQUIPMENT	.0142	3.7794	6.2354	35
101	CLOCKS AND SCIENTIFIC EQUIPMENT	.3777	2.8244	6.1761	36
134	POST OFFICE	.0212	1.6083	6.1354	37
78	CUTLERY, HAND TOOLS AND GENERAL HAR	.7788	2.9686	6.1019	38
57	GUM AND WOOD CHEMICALS	.0201	3.6118	6.0761	39
34	NEW CONSTRUCT, ALL OTHER	.4253	2.6423	6.0742	40
76	SCREW MACHINE PRODUCTS	.0169	2.9788	6.0692	41
79	OTHER FABRICATED METAL PRODUCTS	.0750	3.2288	6.0457	42
55	INDUSTRIAL CHEMICALS	.0008	3.6021	6.0161	43
56	AGRICULTURAL CHEMICALS	.0188	3.5405	6.0057	44
24	FORESTRY AND FISHERY PRODUCTS	.0862	2.9241	5.9730	45
82	CONSTRUCTION + MATERIAL HANDLING EQ	.0067	2.8708	5.9162	46
112	ELECTRIC COMPANIES AND SYSTEMS	.2523	4.0800	5.8444	47
80	ENGINES, TURBINES AND GENERATORS	.0206	2.8722	5.7946	48
136	STATE AND LOCAL GOVT ENTERPRISES	.3550	1.7429	5.7062	49
61	PAINTS AND ALLIED PRODUCTS	.0539	3.2261	5.7057	50

(e) Carbon Monoxide

The carbon monoxide emission coefficients for the principal sectors in the California statewide economy and for each of the four air basins are shown in Table 37. As would be expected the Truck Transportation and the Local Transit & Intercity Buses sectors are found among the first five principal sectors in the statewide economy and in the economies of each of the four basins (with, again, the notable exception of the Truck Transportation sector in San Francisco Basin). The Forestry & Fishery Products sector is also among the first five sectors in each case.

The Corn sector is among the principal emitters of CO statewide and for each basin where corn is produced. (Corn production is absent in the San Diego Basin.) Gum & Wood Chemicals, which ranks first as an emitter of CO statewide, ranks among the top ten sectors in the San Diego, San Joaquin and San Francisco basins. The Blast Furnaces & Basic Steel sector, sixth statewide, is found among the principal sectors in both the San Diego and South Coast basins.

The most significant sector in the rankings is the Local Transit & Intercity Buses sector in the South Coast basin. Its total CO emission coefficient of 962.6 is almost four and a half times the statewide average of 215.7. The coefficient for this sector is slightly higher than that of the next largest figure, 928.0, of the San Joaquin Gum & Wood Chemicals sector. For each of the principal sectors #2-10, the San Joaquin sectors exhibit higher direct and total emission coefficients than the correspondingly ranked sectors statewide and in the other air basins.

The fifty principal sectors, ranked by total CO emission coefficients, in each of the five economies are shown as follows:

California ..... Table 38
San Diego ..... Table 39
South Coast..... Table 40
San Joaquin..... Table 41
San Francisco... Table 42

Table 37

Carbon Monoxide Emission Coefficients Ranking - 1976

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
Calif.	71	Gum & Wood Chemicals	323.8	367.3	1
	121	Truck Transportation	269.6	326.1	2
	120	Local Transit & Intercity Bus.	186.4	215.7	3
	37	Forestry & Fishery Products	143.1	178.3	4
	18	Food, Feed Grains, nec.	70.0	116.5	5
	86	Blast Furnaces & Basic Steel	41.4	86.4	6
	13	Corn	53.1	81.7	7
	63	Logging Camps & Sawmills	2.7	79.6	8
	7	Misc. Livestock	28.4	76.6	9
	6	Sheep, Lambs & Wool	15.7	69.5	10
San Diego	90	Local Transit & Intercity Bus.	822.6	831.6	1
	91	Truck Transportation	414.2	441.7	2
	45	Gum & Wood Chemicals	252.4	263.4	3
	16	Forestry & Fishery Products	111.6	122.6	4
	122	Dummy Industries	0.0	46.5	5
	93	Air Transportation	34.5	42.9	6
	58	Blast Furnaces & Basic Steel	32.3	42.2	7
	35	Logging Camps & Sawmills	2.1	34.1	8
	57	Misc. Stone & Clay Products	13.1	23.1	9
	28	Canned & Frozen Foods	0.0	20.8	10

Table 37 (Contd.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
South Coast	108	Local Transit & Intercity Bus.	950.1	962.6	1
	109	Truck Transportation	215.9	252.2	2
	27	Forestry & Fishery Products	130.6	143.3	3
	74	Blast Furnaces & Basic Steel	69.7	90.3	4
	141	Dummy Industries	0.0	60.1	5
	12	Corn	48.4	56.8	6
	73	Misc. Stone & Clay Products	29.9	43.9	7
	111	Air Transportation	27.5	38.6	8
	7	Misc. Livestock	25.9	33.7	9
	16	Walnuts	23.6	32.3	10
San Joaquin	66	Gum and Wood Chemicals	895.6	928.0	1
	113	Truck Transportation	555.2	628.5	2
	112	Local Transit & Intercity Bus.	443.2	465.5	3
	32	Forestry & Fishery Products	121.5	140.0	4
	87	Cutlery, Hand Tools	111.7	124.1	5
	115	Air Transportation	98.3	118.2	6
	18	Food, Feed Grains, nec.	59.4	81.2	7
	13	Corn	45.1	65.0	8
	76	Structural Clay Products	41.4	62.5	9
	71	Petroleum Refining	38.6	57.8	10

Table 37 (contd.)

Region	I-O No.	Sector Name	Direct Emission Coeff. (Tons/10^6)	Total Emission Coeff. (Tons/10^6)	Rank
San Franc.	104	Local Transit & Intercity Bus.	200.9	204.3	1
	24	Forestry & Fishery Products	131.1	133.2	2
	47	Logging Camps & Sawmills	54.0	60.8	3
	11	Corn	48.6	50.2	4
	14	Sorghum Grain	37.9	39.5	5
	57	Gum & Wood Chemicals	31.1	34.4	6
	71	Iron & Steel Foundries	27.8	30.5	7
	7	Misc. Livestock	26.0	27.1	8
	15	Walnuts	23.7	25.4	9
	16	Almonds	23.4	25.1	10

Table 38

1976 CALIFORNIA EMISSION COEFFICIENTS

CO EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
73	GUM AND WOOD CHEMICALS	323.7572	350.0598	367.3021	1
121	TRUCK TRANSPORTATION	269.6305	308.1162	326.0526	2
120	LOCAL TRANSIT AND INTERCITY BUSES	186.4478	197.4432	215.7348	3
37	FORESTRY AND FISHERY PRODUCTS	143.0934	159.6015	178.3125	4
18	FOOD, FEED GRAINS, NEC	70.0000	101.7723	116.4737	5
86	BLAST FURNACES AND BASIC STEEL PROD	41.3964	68.6441	86.4328	6
13	CORN	53.0894	67.3991	81.6872	7
61	LOGGING CAMPS + SAWMILLS	2.7376	60.4239	79.5604	8
7	MISC. LIVESTOCK	28.3721	60.2415	76.5708	9
6	SHEEP, LAMBS, AND WOOL	15.7165	55.0973	69.4777	10
16	SORGHUM GRAIN	41.3991	54.2619	68.5843	11
123	AIR TRANSPORTATION	42.7775	52.5224	68.3289	12
8	APIARY PRODUCTS	16.6321	52.1846	68.3126	13
154	DUMMY INDUSTRIES	0.	42.4371	59.6004	14
4	CATTLE AND CALVES	6.9829	43.8649	58.0623	15
87	IRON AND STEEL FOUNDRIES AND FORGIN	13.9220	38.6001	56.9777	16
85	MISC STONE AND CLAY PRODUCTS	16.7545	37.3014	56.0132	17
89	METAL CONTAINERS	.0661	35.6993	54.7599	18
52	MEAT PRODUCTS	0.	39.1150	54.3595	19
2	BROILERS, CHICKENS AND EGGS	4.6917	39.0410	54.1899	20
54	CANNED AND FROZEN FOODS	.0429	35.5787	53.0847	21
15	OATS	21.7857	36.2144	50.6499	22
64	MILLWORK, PLYWOOD + OTHER WOOD PROD	.1172	31.4033	50.5176	23
1	DAIRIES	5.9255	32.8632	48.7702	24
20	WALNUTS	25.8496	33.4231	48.7190	25
3	TURKEYS AND OTHER POULTRY	.6629	33.7071	48.7073	26
93	METAL STAMPINGS	.4650	29.0866	48.5262	27
65	WOODEN CONTAINERS	0.	29.2032	48.3823	28
55	GRAIN MILL PRODUCTS	.0277	32.4709	48.1227	29
21	ALMONDS	25.4948	32.8155	48.0908	30
24	FRUIT AND TREE NUTS, NEC	24.5455	32.4785	47.8323	31
82	CEMENT AND CONCRETE PRODUCTS	3.3720	29.3730	47.7828	32
91	FABRICATED STRUCTURAL STEEL	0.	28.3842	47.5864	33
152	STATE AND LOCAL GOVT ENTERPRISES	18.3079	25.7534	46.7269	34
47	NEW CONSTRUCT, PUBLIC UTILITY	8.2970	25.6827	45.2249	35
95	OTHER FABRICATED METAL PRODUCTS	.0553	25.7759	45.1003	36
45	NEW CONSTRUCT, RESIDENT	9.2519	24.9793	44.6832	37
68	PAPER + PAPERBOARD PRODUCTS	.4563	25.2454	44.1530	38
28	MELONS	16.8367	25.5082	43.8001	39
12	BARLEY	16.0338	29.1912	43.6023	40
25	VEGETABLES	16.5181	24.9060	43.1927	41
116	OTHER TRANSPORTATION EQUIPMENT	0.	23.9895	43.1601	42
26	DRIED BEANS	15.4599	24.3904	42.5743	43
5	HOGS	2.3571	27.7733	41.5103	44
92	SCREW MACHINE PRODUCTS	0.	21.2214	40.9087	45
53	DAIRY PRODUCTS	.0069	23.6864	40.3696	46
77	PAINTS AND ALLIED PRODUCTS	0.	23.3091	40.2598	47
48	NEW CONSTRUCT, HIGHWAYS	0.	20.6642	40.0327	48
76	CLEANING AND TOILET PREPARATIONS	.0100	22.0449	39.9677	49
10	WHEAT	11.0227	24.1450	39.7142	50

Table 39

1976 SAN DIEGO EMISSION COEFFICIENTS

CO EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
90	LOCAL TRANSIT AND INTERCITY BUSES	822.5793	826.8321	831.6056	1
91	TRUCK TRANSPORTATION	414.1969	437.2667	441.6702	2
45	GUM AND WOOD CHEMICALS	252.4292	260.6295	263.3845	3
16	FORESTRY AND FISHERY PRODUCTS	111.5680	118.3635	122.5742	4
122	DUMMY INDUSTRIES	0.	43.7219	46.4878	5
93	AIR TRANSPORTATION	34.5415	39.1398	42.9222	6
58	BLAST FURNACES AND BASIC STEEL PROD	32.2762	39.2649	42.2299	7
35	LOGGING CAMPS + SAWMILLS	2.1344	30.6396	34.0797	8
57	MISC STONE AND CLAY PRODUCTS	13.0633	19.3336	23.0597	9
28	CANNED AND FROZEN FOODS	.0334	17.8100	20.7515	10
59	IRON AND STEEL FOUNDRIES AND FORGIN	10.8548	17.0811	20.3513	11
12	VEGETABLES	12.8789	15.2358	19.7287	12
13	DRIED BEANS	12.0538	14.5464	18.8832	13
8	BARLEY	12.5014	16.0318	18.7794	14
54	CEMENT AND CONCRETE PRODUCTS	2.6291	14.7438	18.7289	15
6	APIARY PRODUCTS	12.9678	16.5600	18.2562	16
92	WATER TRANSPORATATION	6.8317	12.9935	16.0828	17
9	HAY AND PASTURE	10.0225	13.2380	16.0107	18
89	RAILROADS	4.6929	10.6633	15.0051	19
10	NONCITRUS FRUITS	8.5100	10.8896	14.9096	20
7	WHEAT	8.5943	11.4815	14.5482	21
19	NEW CONSTRUCT, RESIDENT	7.2136	10.4700	14.2552	22
11	CITRUS FRUITS	7.3410	9.8036	13.7999	23
21	NEW CONSTRUCT, PUBLIC UTILITY	6.4691	10.3134	13.7799	24
119	POST OFFICE	.0245	6.7925	13.2896	25
22	NEW CONSTRUCT, HIGHWAYS	0.	8.7489	12.9505	26
14	POTATOES	5.9441	8.1726	12.0921	27
1	DAIRIES	4.6200	9.2635	11.6657	28
47	DRUGS	2.5538	6.9833	10.8161	29
55	STRUCTURAL CLAY PRODUCTS	1.8524	6.3357	10.7461	30
49	PAINTS AND ALLIED PRODUCTS	0.	7.5656	10.2317	31
102	BANKING AND FINANCIAL INTERMEDIARIE	.0113	2.3143	9.3955	32
4	CATTLE AND CALVES	5.4445	8.1275	9.1729	33
40	PAPER + PAPERBOARD PRODUCTS	.3557	6.1139	9.0238	34
121	STATE AND LOCAL GOVT ENTERPRISES	.3632	3.5281	9.0056	35
18	STONE + CLAY MIN + QUARRY	.1138	4.9545	8.9331	36
48	CLEANING AND TOILET PREPARATIONS	.0078	6.0931	8.8424	37
23	NEW CONSTRUCT, ALL OTHER	0.	4.4658	8.7939	38
100	WHOLESALE TRADE	.0235	3.8233	8.5842	39
108	MISCELLANEOUS BUSINESS SERVICES	0.	3.5018	8.5709	40
15	GREENHOUSE AND NURSERY PRODUCTS	.8206	3.7748	8.5389	41
42	OTHER PRINTING AND PUBLISHING	.0011	4.0164	8.5205	42
44	AGRICULTURAL CHEMICALS	.1118	6.0193	8.4838	43
118	NONPROFIT ORGANIZATIONS	.0000	2.1700	8.3705	44
115	HOSPITALS	.0000	2.9378	8.2948	45
33	MISC FOOD PRODUCTS	.3098	6.4752	8.2341	46
63	METAL STAMPINGS	.3626	5.0321	8.2336	47
110	MISC PROFESSIONAL SERVICES	0.	2.3902	8.1411	48
117	EDUCATIONAL SERVICES	.0000	2.2110	8.0455	49
53	GLASS	.5014	3.8368	8.0138	50

Table 40

1976 SOUTH COAST EMISSION COEFFICIENTS

CO EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
108	LOCAL TRANSIT AND INTERCITY BUSES	950.0700	955.9467	962.6039	1
109	TRUCK TRANSPORTATION	215.9116	245.5880	252.1859	2
27	FORESTRY AND FISHERY PRODUCTS	130.5782	137.1840	143.2885	3
74	BLAST FURNACES AND BASIC STEEL PROD	69.6563	85.5461	90.3196	4
141	DUMMY INDUSTRIES	0.	55.3060	60.1361	5
12	CORN	48.4461	52.6673	56.7553	6
73	MISC STONE AND CLAY PRODUCTS	29.8547	38.0590	43.8699	7
111	AIR TRANSPORTATION	27.5226	32.9974	38.5534	8
7	MISC. LIVESTOCK	25.8906	30.4865	33.6837	9
16	WALNUTS	23.5887	27.0705	32.3385	10
17	ALMONDS	23.2649	26.6396	31.9319	11
14	OATS	19.8803	24.1998	28.1467	12
77	METAL CONTAINERS	.1586	21.1002	26.1300	13
22	MELONS	15.3642	18.9436	25.3363	14
70	CEMENT AND CONCRETE PRODUCTS	3.4112	19.5513	25.2310	15
20	VEGETABLES	15.0734	18.5873	24.9792	16
43	CANNED AND FROZEN FOODS	.0745	18.9243	23.7802	17
21	DRIED BEANS	14.1077	17.5637	23.6627	18
11	BARLEY	14.6315	19.0889	23.1874	19
36	NEW CONSTRUCT, PUBLIC UTILITY	7.5713	16.8772	23.0627	20
8	APIARY PRODUCTS	15.1775	20.0255	22.8409	21
23	SUGAR BEETS	14.0569	17.2367	22.7950	22
51	LOGGING CAMPS + SAWMILLS	.0158	18.2317	22.4800	23
79	FABRICATED STRUCTURAL STEEL	0.	16.5823	21.9858	24
81	METAL STAMPINGS	.7799	16.3837	21.8613	25
107	RAILROADS	7.2430	15.4985	21.5864	26
9	COTTON	12.7996	17.1726	21.2307	27
6	SHEEP, LAMBS, AND WOOL	14.3419	19.3280	21.1325	28
34	NEW CONSTRUCT, RESIDENT	8.4428	14.4951	20.6679	29
13	HAY AND PASTURE	11.7303	16.2147	20.4171	30
75	IRON AND STEEL FOUNDRIES AND FORGIN	.2945	14.1276	19.5622	31
18	NONCITRUS FRUITS	9.9600	13.5978	19.4272	32
37	NEW CONSTRUCT, HIGHWAYS	0.	12.7606	19.2278	33
110	WATER TRANSPORATATION	4.7866	13.8383	19.0579	34
10	WHEAT	10.0587	13.9937	18.4497	35
80	SCREW MACHINE PRODUCTS	0.	12.3747	18.4224	36
15	GRASS SEED	9.3480	13.7824	18.2518	37
19	CITRUS FRUITS	8.5919	12.2991	18.0967	38
83	OTHER FABRICATED METAL PRODUCTS	.0810	12.3711	17.9656	39
138	POST OFFICE	.0288	7.8462	16.4731	40
104	OTHER TRANSPORTATION EQUIPMENT	0.	11.0625	16.2456	41
1	DAIRIES	5.4073	12.3567	16.0388	42
78	HEATING APPARATUS AND PLUMBING FIXT	.0087	9.9349	15.7932	43
85	FARM MACHINERY	0.	10.2020	15.7645	44
82	CUTLERY, HAND TOOLS AND GENERAL HAR	.5122	9.3459	15.7042	45
24	POTATOES	6.9569	10.1303	15.6660	46
86	CONSTRUCTION + MATERIAL HANDLING EQ	.1083	9.6406	15.5950	47
89	GENERAL INDUSTRIAL MACHINERY	0.	9.0994	15.2402	48
35	NEW CONSTRUCT, NONRESIDENT	0.	8.4710	14.9752	49
88	SPECIAL INDUSTRIAL MACHINERY	0.	8.6425	14.7843	50

Table 41

1976 SAN JOAQUIN EMISSION COEFFICIENTS

CO EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
66	GUM AND WOOD CHEMICALS	895.5801	921.7555	927.9873	1
113	TRUCK TRANSPORTATION	555.2316	618.8298	628.5121	2
112	LOCAL TRANSIT AND INTERCITY BUSES	443.1707	455.6441	465.4936	3
32	FORESTRY AND FISHERY PRODUCTS	121.4863	131.3153	140.0073	4
87	CUTLERY, HAND TOOLS AND GENERAL HAR	111.7127	119.9798	128.1242	5
115	AIR TRANSPORTATION	98.2652	110.6912	118.2368	6
18	FEED, FEED GRAINS, NEC	59.4300	76.1752	81.1925	7
13	CORN	45.0729	58.8892	65.0412	8
76	STRUCTURAL CLAY PRODUCTS	41.3658	53.4427	62.4579	9
71	PETROLEUM REFINING AND RELATED PROD	38.5872	52.3472	57.8018	10
16	SORGHUM GRAIN	35.1478	48.6514	54.9344	11
7	MISC. LIVESTOCK	24.0879	43.5663	50.0438	12
75	CEMENT AND CONCRETE PRODUCTS	.0063	35.0597	44.0839	13
8	APIARY PRODUCTS	14.1207	37.3571	43.7583	14
6	SHEEP, LAMBS, AND WOOL	13.3433	38.1877	43.2700	15
78	MISC STONE AND CLAY PRODUCTS	14.2246	33.8213	41.9516	16
56	LOGGING CAMPS + SAWMILLS	21.9390	34.1644	40.4398	17
51	SUGAR	.2470	32.2352	39.4501	18
122	WATER AND SANITARY SERVICES	12.3782	28.6557	38.0837	19
19	WALNUTS	21.9463	29.9014	37.4967	20
42	NEW CONSTRUCT, HIGHWAYS	0.	27.8284	37.1813	21
20	ALMONDS	21.6451	29.2055	36.8523	22
23	FRUIT AND TREE NUTS, NEC	20.8391	29.1219	36.7301	23
46	MEAT PRODUCTS	0.	31.3031	36.4668	24
15	OATS	18.4961	30.5746	36.3747	25
1	DAIRIES	5.0308	27.8415	35.0860	26
4	CATTLE AND CALVES	5.9285	29.5701	34.8810	27
114	WATER TRANSPORATATION	2.0630	27.1386	33.9766	28
144	STATE AND LOCAL GOVT ENTERPRISES	13.6564	22.3402	33.4737	29
12	BARLEY	13.6127	27.0647	33.3787	30
48	CANNED AND FROZEN FOODS	.0747	25.8727	32.6426	31
49	GRAIN MILL PRODUCTS	.0579	25.5905	31.6992	32
26	MELONS	14.2944	22.3433	31.3690	33
24	VEGETABLES	14.0238	21.8707	30.9248	34
34	METALS MINING	13.5659	23.4304	30.4327	35
25	DRIED BEANS	13.1254	21.2995	30.2740	36
2	BROILERS, CHICKENS AND EGGS	3.9832	24.9072	30.0911	37
14	HAY AND PASTURE	10.9135	23.2145	29.4520	38
120	ELECTRIC COMPANIES AND SYSTEMS	.7863	23.2812	29.3971	39
10	WHEAT	9.3583	22.0999	29.3488	40
52	CONFECTIONARY PRODUCTS	.1188	22.2982	29.2529	41
27	SUGAR BEETS	13.0781	20.9715	29.1481	42
61	PAPER + PAPERBOARD PRODUCTS	.0734	21.1257	28.7867	43
39	NEW CONSTRUCT, RESIDENT	7.8549	19.6743	28.4946	44
145	DUMMY INDUSTRIES	0.	23.9839	28.3078	45
70	PAINTS AND ALLIED PRODUCTS	0.	22.1893	28.0738	46
47	DAIRY PRODUCTS	.0369	20.2997	28.0465	47
142	POST OFFICE	.9204	14.6576	27.8597	48
65	AGRICULTURAL CHEMICALS	.2595	21.1280	27.7096	49
9	COTTON	11.9084	22.5527	27.7068	50

Table 42

1976 SAN FRANCISCO EMISSION COEFFICIENTS

CO EMISSIONS IN TONS PER MILLION DOLLARS OF DEMAND

RANKING IN ORDER OF DIRECT + INDIRECT + INDUCED EFFECTS

	SECTOR	DIRECT	+INDIRECT	+INDUCED	RANK
104	LOCAL TRANSIT AND INTERCITY BUSES	200.9167	202.8629	204.2750	1
24	FORESTRY AND FISHERY PRODUCTS	131.0967	131.9070	133.1989	2
47	LOGGING CAMPS + SAWMILLS	53.9860	59.9998	60.8210	3
11	CORN	48.6385	49.2525	50.1733	4
14	SORGHUM GRAIN	37.9283	38.5778	39.5248	5
57	GUM AND WOOD CHEMICALS	31.1074	33.3107	34.3548	6
71	IRON AND STEEL FOUNDRIES AND FORGIN	27.7604	29.3316	30.5166	7
7	MISC. LIVESTOCK	25.9934	26.4697	27.1157	8
15	WALNUTS	23.6824	24.2736	25.4488	9
16	ALMONDS	23.3573	23.9233	25.1044	10
13	OATS	19.9592	20.5899	21.4828	11
137	DUMMY INDUSTRIES	0.	17.0560	18.1437	12
18	VEGETABLES	15.1332	15.6469	17.0654	13
10	BARLEY	14.6896	15.3543	16.2818	14
8	APIARY PRODUCTS	15.2377	15.7134	16.2706	15
19	DRIED BEANS	14.1637	14.7201	16.0694	16
20	SUGAR BEETS	14.1127	14.5710	15.8172	17
6	SHEEP, LAMBS, AND WOOL	14.3989	15.4035	15.7673	18
12	HAY AND PASTURE	11.7769	12.5163	13.4691	19
17	NONCITRUS FRUITS	9.9996	10.5728	11.8741	20
9	WHEAT	10.0986	10.6297	11.6306	21
30	NEW CONSTRUCT, RESIDENT	8.4763	9.9463	11.2615	22
107	AIR TRANSPORTATION	8.6966	9.7148	10.9061	23
32	NEW CONSTRUCT, PUBLIC UTILITY	7.6014	8.5762	9.8893	24
21	POTATOES	6.9845	7.4788	8.6984	25
103	RAILROADS	4.0030	6.2141	7.5671	26
48	MILLWORK, PLYWOOD + OTHER WOOD PROD	1.0460	6.4431	7.3930	27
4	CATTLE AND CALVES	6.3975	6.9232	7.2631	28
1	DAIRIES	5.4287	5.8634	6.6313	29
49	WOODEN CONTAINERS	0.	5.6633	6.6190	30
136	STATE AND LOCAL GOVT ENTERPRISES	4.3300	4.9085	6.5878	31
22	SAFFLOWER	3.5386	4.2219	5.3125	32
2	BROILERS, CHICKENS AND EGGS	4.2983	4.6813	5.1979	33
52	PAPER + PAPERBOARD PRODUCTS	.8146	3.6038	4.7385	34
114	WATER AND SANITARY SERVICES	.0013	2.9748	4.2410	35
112	ELECTRIC COMPANIES AND SYSTEMS	2.8924	3.4454	4.1930	36
50	HOUSEHOLD FURNITURE	0.	2.4321	3.5904	37
65	GLASS	1.3421	2.1612	3.5092	38
80	ENGINES, TURBINES AND GENERATORS	.1074	2.1385	3.3767	39
77	METAL STAMPINGS	1.3102	2.1001	3.2939	40
82	CONSTRUCTION + MATERIAL HANDLING EQ	.0095	1.9245	3.2149	41
55	INDUSTRIAL CHEMICALS	.8771	2.1324	3.1553	42
81	FARM MACHINERY	0.	1.8598	3.1102	43
5	HOGS	2.1595	2.4785	3.0626	44
100	OTHER TRANSPORTATION EQUIPMENT	0.	1.9648	3.0054	45
61	PAINTS AND ALLIED PRODUCTS	0.	1.9350	2.9857	46
117	BANKING AND FINANCIAL INTERMEDIARIE	.1344	.9148	2.9841	47
84	SPECIAL INDUSTRIAL MACHINERY	0.	1.6153	2.9271	48
85	GENERAL INDUSTRIAL MACHINERY	0.	1.5696	2.8835	49
54	OTHER PRINTING AND PUBLISHING	.0251	1.3575	2.8785	50

13. Synopsis

Non-survey techniques and secondary source economic data were used to construct input-output models and emissions for the four major air basins of the State of California.

California Air Resources Board emissions inventory data were supplemented with estimates of fuel combustion emissions to derive air pollution coefficients for five critical pollutants for each detailed sector of a statewide input-output model. The estimates were adjusted to agree with broader emission totals for major economic categories provided by the Air Resources Board for all California air basins.

The statewide coefficients for detailed industries were used to supplement the basic emissions inventory data available for each air basin. The totals thus derived were adjusted to the summary estimates of emissions for each individual basin.

The adjusted emission coefficients derived for detailed sectors were multiplied into the Leontief inverses of each air basin input-output model and the direct plus indirect plus induced emissions were calculated and ranked for each of the five pollutants. The rankings indicate in tons per million dollars of deliveries the total pollutant load generated in the air basin economy for each industry.

The values of the emission coefficients derived for the various industries seem to be reasonable in terms of orders of magnitude. The rankings indicate rather clearly those industries with higher pollutant levels per million dollar of product deliveries. With all industries on a comparable basis the disparities in emission levels in many instances

are pronounced.

From the empirical results some observations may be made. First, for each pollutant the sectors with the highest associated total emission rates will vary between basins. Second, in each basin (and in the statewide economy as well) the ranking of the economic sectors by total emissions differs from the ranking by direct emissions. Third, the ratio of total to direct emissions for a particular sector will vary across basins due to variations in direct emission rates and to differences in industrial structure.

Although it has not been done in the study, the emission coefficients could be related to employment and income levels for each basin and additional coefficients derived which ranked each industry in terms of employment or income generated per ton of pollutant emitted. In this manner those industries which generate the lowest income and employment levels per ton of pollutant emitted could be analyzed in greater detail as part of a broader policy analysis concerned with the potential growth pattern of the respective air basins.

14. Glossary of Economic Terms*

Final Demand. Products and services that are purchased for ultimate use, or consumption, and not for further resale or processing. Final demand is contrasted with interindustry demand wherein products and services are purchased as part of the production process.

Value Added. Value added is usually defined as the difference between the final value, or sale price, of a product and the cost of the materials and supplies used to produce the product. More specifically, value added consists of payments to wages, salaries, profits, interest, rent, taxes and depreciation.

Multiplier. The concept relates to the secondary and tertiary (indirect) increases or decreases of some measure of economic activity such as employment or income resulting from an initial change in demand for, or output of, some good or service.

Output Multiplier. The column sums of the Leontief Inverse of an input-output model. These sums show in dollar terms the degree of "interrelatedness" of the sectors of the economy under study.

Technical Coefficient. (Technological Coefficient). The term used in interindustry, or input-output, analysis to define the ratio of the units of input to the units of output. Technical coefficients are derived by normalizing (dividing) each of the column elements of the transactions table by the respective column sum.

Leontief Inverse. The term used to describe the table which shows the direct and indirect (total) requirements of each industry from all other industries to deliver a unit of product to final demand. The table is named after Professor Wassily Leontief who pioneered in the field of input-output analysis.

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* The interested reader may consult Douglas Greenwald et al., The McGraw-Hill Dictionary of Modern Economics, McGraw-Hill, New York, New York, 1973.

15. Footnotes

[1]Actually the computer algorithm does not follow the iterative procedure outlined here. As can be seen from Appendix 1 the input-output model is a set of simultaneous linear equations. Thus matrix inversion is employed to generate the table of total requirements.

[2]It is to be noted that this figure is understated because the induced impact (the impact generated by increased consumer expenditures) has been ignored in our simple illustration. However, for all air pollutant emissions pertaining to the California air basins analyzed in the body of this report, the induced impact is included with the direct and indirect impacts. The induced impact is determined by "closing" the I-O model with respect to households, i.e., by shifting households from an exogenous to an endogeous variable in the model.

[3]Non-stationary transportation sources of emissions considered in this report include those transportation sectors explicitly set forth in the Statewide I-O model (e.g. Truck Transport, Local Transit and Inter-city Buses) and those transportation activities which are implicitly included in non-transportation sectors (e.g. auto travel by the in-surance industry, auto and truck travel by the communications companies and other utilities).

[4]The official 1972 U.S. Input-Output Table was released by BEA in June of 1979.

[5]For a complete description of the California input-output model for 1976 prepared by the Department of Water Resources including specific sector definitions, data, and procedures used see: State of California, The Resources Agency, Department of Water Resources, Division of Planning, Techniques for Statewide and Regional Resource - Constrained Industrial Outlooks, Draft Technical Report, Sacramento, California, November 1978.

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