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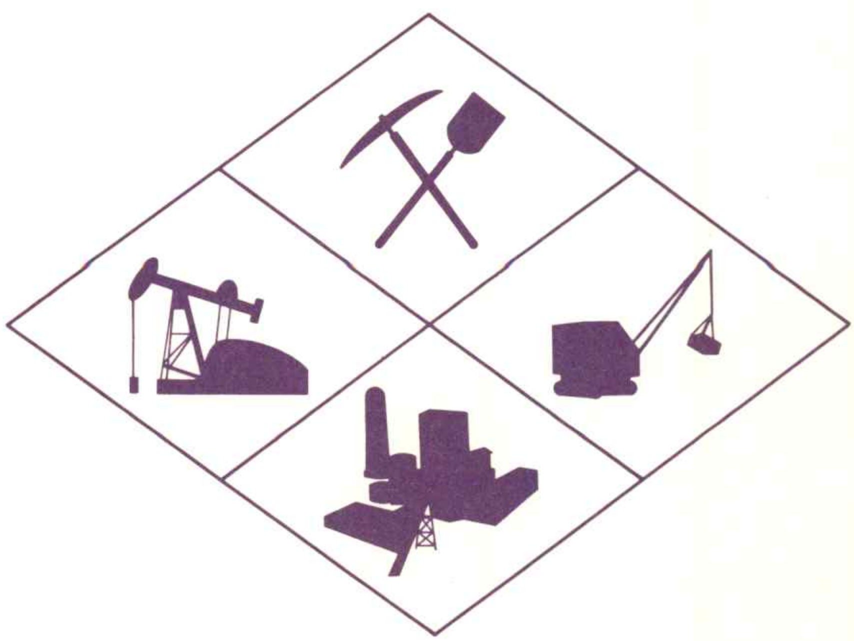
Kansas Mineral Industry Report, 1975 – 1977

By Carol Zarley and David Collins

Mineral Resources Series 6



Kansas Geological Survey
The University of Kansas
Lawrence, Kansas
1978

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EXECUTIVE SUMMARY

Through agriculture and mineral wealth Kansas maintains a large contribution to the primary resource productivity of the national economy. In 1977 alone, the value of minerals produced in the State amounted to more than 1½ billion dollars. Even allowing for inflation, the dollar value of mineral production has increased over 20% since 1975.

Much of that increase came in minerals used for fuel. Although oil production hit a 40 year low in 1977--and natural gas production dropped 5% from 1976 to 1977--the market value of both those commodities increased significantly. Despite a slight drop in the unit value of coal, coal production increased more than 40% during the past year.

For non-fuel minerals the picture was mixed, largely due to demand fluctuations in the construction industry. The value of clay and shale products rose sharply, due to increased production and higher prices. Brick production, for instance, increased by 5%. Salt production in Kansas continued to grow and demand remained strong. Cement production held about steady; the market for crushed stone improved slightly; and sand and gravel production was down almost 5%, mostly because of a decrease in road construction and repair.

Overall, the mineral production of Kansas has a promising future. Production declines in the fuels are leveling off and higher prices are increasing their value to the State economy. Large reserves of most of the other commodities bode well for the continued health of the mineral industries, though demand is tied to the health of the economy in general.

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Kansas Mineral Industries Report
1975-1977

INTRODUCTION

The 1975-1977 Mineral Industry Report provides a summary of the production and shipment of mineral commodities in Kansas during the past three years, together with discussion of events related to the performance of the mineral industries. The report is basically presented in two parts. The first part deals with the fuel minerals produced in Kansas; crude oil, natural gas, natural gas liquids, and coal, together with helium which occurs as an economically extractable constituent of natural gas. The second part of the report deals with the non-fuel minerals produced in Kansas; cement, clay and shale products, sand and gravel, crushed stone, salt, and a category of miscellaneous minerals reported together to avoid disclosure of individual company data. Each part of the report begins with a summary of the entire group of minerals followed by more detailed discussion of the individual commodity industries.

In order to provide greater meaning to recent trends in Kansas' mineral industries, the statistical summaries for individual commodities report data for the past ten years. Changes in government policy, the economy, or the internal structure of the mineral industries prior to 1975 that were relevant to recent industry developments are mentioned in the text of the report. To make clear the effect of recent high rates of inflation on the purchasing power of the dollar, the value of shipments of individual commodities or commodity groups is reported in the dollar value of each particular year and in a deflated real value which indicates the amount of dollars in 1972 which would have had an equal purchasing power.

Readers who have questions regarding data presented in this report, or seeking further information regarding the performance of the mineral industries in the Kansas economy are advised to contact the Mineral Economics Section of the Kansas Geological Survey. Questions concerned particularly with fuel minerals or helium may be directed to Carol Zarley. Questions concerned particularly with non-fuel minerals may be directed to David Collins. A summary of data sources used in developing the tables in the report is provided in an appendix.

The Kansas Mineral Industry Summary, 1975-1977, which follows this introduction, provides a tabulation of the quantity and value of shipments of mineral resources produced in Kansas for each of the past three years. As indicated in this table and subsequent tables in the report, data for 1977 should generally be considered preliminary and subject to revision. Errors in the 1977 data may exist because individual companies may not have had final production figures at the time data for this report were collected and were therefore providing their own estimates. In addition, data for each year contain some estimations for companies that did not submit reports.

Kansas Mineral Industry Summary, 1975-1977

Mineral Production and Value in Kansas, 1975, 1976, and (Preliminary) 1977*

	Quantity Units	1975 Quantity	1975 Value ($1000)	1976 Quantity	1976 Value ($1000)	1977 Quantity	1977 Value ($1000)
Cement: Portland	1,000 short tons	1,832	55,033	2,005	66,478	2,025	71,200
Masonry	1,000 short tons	57	2,311	72	3,281	80	3,820
Clay, Shale and Products			13,887		15,589		20,289
Coal	1,000 short tons	517	10,022	576	11,520	1,043	19,388
Helium, Refined	million cubic feet 14.73 psia - 70°F	497	11,928	503	11,066	565	12,712
Natural Gas	million cubic feet 14.65 psia - 60°F	850,786	184,621	836,206	332,810	787,917	382,928
Natural Gas Liquids	1,000 bbls.	29,858	96,694	30,201	114,439	30,200	171,439
Crude Oil	1,000 bbls.	59,106	647,212	58,714	610,628	57,496	715,825
Salt	1,000 short tons	1,446	31,214	1,310	35,291	1,489	41,927
Sand and Gravel[1]	1,000 short tons	10,866	13,467	12,291	14,940	12,100	16,580
Stone, Crushed[2]	1,000 short tons	12,681	29,159	13,031	31,935	13,020	36,220
Miscellaneous: Gypsum (crude and calcined), salt brine, dimension stone, crude helium, carbon black, sulfur, lime, pumicite and volcanic ash, diatomaceous marl, and industrial sand and gravel (1976-1977)			18,128		22,041		22,068
TOTAL			1,113,676		1,270,018		1,514,396

1/ excludes industrial sand and gravel in 1976 and 1977
2/ excludes crushed stone used in cement manufacturing
* Information sources include U.S. Department of Commerce, U.S. Bureau of Mines, Kansas Corporation Commission, Kansas Department of Human Resources, and the Kansas Geological Survey

MINERAL FUEL COMMODITIES

Production trends for the mineral fuels were mixed over the three year period, 1975-1977. Crude oil and natural gas production declined 2.7% and 7.4%, respectively, from 1975 levels. The volume of natural gas liquids extracted each year from 1975-1977 was below production recorded for 1974, with an overall decline of nearly 2.8%. In a noticeable upward trend, coal production recovered from a recent low in 1975, as the addition of several new coal mining operations caused tonnages to exceed the one million ton mark for the first time since 1973.

Several significant price increases for the mineral fuel commodities were evident during 1975-1977. Average wellhead natural gas prices more than doubled. Average unit prices for crude oil oscillated, dipping temporarily in 1976 and then increasing by slightly more than $2 per barrel in 1977. Composite wholesale prices for natural gas liquids, as reported by the U.S. Bureau of Mines, actually declined in 1975, showed a moderate increase in 1976, and then rose nearly 50% during 1977. Average tonnage prices of coal tripled during 1975 compared to 1974 unit prices, increased further in 1976, and then declined in 1977 due to the inclusion of a greater percentage of lower value unwashed coal. Average current dollar unit values for 1977 are estimated at $12.45 per barrel for crude oil, 48.6¢ per thousand cubic feet for natural gas, $5.68 per barrel for natural gas liquids, and $18.59 per ton for coal.

The statistics for annual total value of each mineral fuel commodity are given in Table A for the period 1968-1977, both in current dollar value and in constant 1972 dollars. Over the entire ten year period, combined mineral fuel value increased 190% in current dollars and 70% in constant dollar value. From 1968-1971, a slight upward trend is noted in current dollars. However, prices were not rising as fast as the generalized inflationary rate, so that real values were steadily falling during these years. After a one-year decline in 1972, the series for combined value began to break sharply, rising to $499,881,000 in 1973 and then to $838,132,000 in 1974. The changes in constant dollar values were less in absolute amount, but showed the same substantial rates of increase.

The years 1975 through 1977 were each marked by increases in the total value of mineral fuel production. The gain in current dollar value was 37.4%, increasing from $938,549,000 in 1975 up to $1,289,580,000 in 1977. Discounting for inflation, the gain in constant 1972 dollars was still a substantial 23.7%. The combined effects of the production and price changes were

Table A: Value of Mineral Fuel Commodities

Current Dollar Value of Production
($1,000s)

Year	Crude Oil	Natural Gas	Natural Gas Liquids	Coal	Total
1968	285,405	115,307	36,804	6,526	444,042
1969	283,891	122,759	38,077	7,108	451,824
1970	277,469	125,994	45,214	9,102	457,774
1971	276,433	127,267	51,254	6,579	461,533
1972	259,578	127,859	56,340	7,840	451,617
1973	281,466	138,521	71,504	8,390	499,881
1974	582,996	147,206	103,628	4,302	838,132
1975	647,212	184,621	96,694	10,022	938,549
1976	610,628	332,810	114,439	11,520	1,069,389
1977p	715,825	382,928	171,439	19,388	1,289,580

Constant Dollar Value of Production
(1,000s 1972 Dollars)

Year	Crude Oil	Natural Gas	Natural Gas Liquids	Coal	Total
1968	345,652	139,648	44,573	7,904	537,777
1969	327,365	141,558	43,908	8,196	521,027
1970	303,710	137,909	49,490	9,963	501,072
1971	287,891	132,542	53,378	6,852	480,663
1972	259,578	127,859	56,340	7,840	451,617
1973	266,036	130,927	67,584	7,930	472,477
1974	500,813	126,455	89,020	3,696	719,984
1975	508,615	145,085	75,987	7,876	737,563
1976	456,408	248,756	85,536	8,611	799,311
1977p	506,528	270,965	121,313	13,719	912,525

p: preliminary data

such that, except for crude oil, the value of each year's output by mineral fuel commodity increased in both current and constant dollar terms. The drop in 1976 crude oil prices caused a 5.7% and 10.3% decline during 1976 in current and constant value, respectively. While the value of crude oil production increased in 1977 to a record $715,825,000 in current dollars, the constant dollar value fell below that for 1975.

More detailed discussions of economic and production events related to the mineral fuel commodities during 1975-1977 are given below in separate sections for crude oil, natural gas and derivative natural gas liquids, and coal. The concluding section discusses developments related to helium, which although not a fuel itself, is closely associated with the production of natural gas.

Crude Oil

Economic Trends

Kansas crude oil prices in recent years have been influenced by a complex system of price controls and price related legislation, and by the upward pressure on market price from the international actions of the Organization of Petroleum Exporting Countries (OPEC). By way of background, the U.S. Cost of Living Council imposed price ceilings on domestic crude oil during 1971 as part of the general wage-price freeze under Phase I of the Economic Stabilization Act of 1970. This system evolved into a two-tiered pricing scheme which was inherited and continued by the Federal Energy Administration during 1974 and 1975. A category called old oil (that produced from established wells and in excess of 10 barrels per day in a specified base period) was regulated at an average $5.25 per barrel. New oil, stripper oil (from wells producing 10 barrels or less per day), and an incentive category of released oil, were all allowed to sell at uncontrolled prices. Because of the substantial price increases by the OPEC nations, the price of domestic uncontrolled oil rose considerably, with lagged adjustments to world prices and transportation costs. By late 1974 the price of uncontrolled oil averaged about $10.65 per barrel, and climbed to $12.70 per barrel at year end 1975.

The Energy Policy and Conservation Act (EPCA), signed in late December 1975, stipulated a rollback in the average price of domestic crude oil to $7.66 per barrel (effective February 1976), with provisions for a possible annual inflation-incentive increase of 10% until scheduled decontrol in early 1979. The legislated rollback had the effect of regulating that oil previously uncontrolled at an initial average price of $11.28 per barrel, while leaving the $5.25 lower tier price intact. In mid-August 1976 the Energy Conservation and Production Act removed price controls from stripper production, effective September 1, 1976. Since then stripper oil prices in Kansas have increased from an average $14 per barrel by the end of 1976, up to $15 by year end 1977.

The deregulation of stripper oil has been especially important to Kansas. Nationally, stripper wells comprise 73% of the total number of domestic oil wells, but account for only 14% of domestic production. In Kansas, the percentage of stripper wells is much higher, about 95%, and the contribution to total production substantially greater at nearly 76% of production.

Kansas ranks third among the states in number of stripper wells and fourth in stripper production. Of the five leading stripper states (the others are Texas, Oklahoma, Illinois, and New Mexico), Kansas is the only one whose average daily stripper production per well is below the 2.93 barrel U.S. stripper average.

Higher crude oil prices in Kansas have served to soften the annual declines in production and proved reserves. State oil production declined 0.7% in 1976 and 2.0% in 1977, compared to the 4.4% - 10.2% declines recorded during 1968-1974. The reserve figures given in Table B show a similar reduction in the rate of decline.

Estimates for average crude prices in Kansas and the total value of state oil production are given in Table B for the period 1968-1977. The composite average barrel prices have been calculated on the basis of weighted estimates for controlled and uncontrolled oil. Since prices generally have been rising faster than production has been falling, the total value of crude oil output has increased substantially in the last ten years. The largest annual jump in value occurred in 1974, reflecting the economic response to fuel shortages during the winter of 1973-74 resulting from the OPEC oil embargo. The decline in unit price and total value during 1976 is a result of the legislated rollback of crude oil prices in the EPCA.

A general price deflator has been applied to each annual estimate of total value of crude oil production in order to reflect the effect inflation has had on the purchasing power of income derived from oil production. The statistics in column (6) of Table B are given in 1972 dollars for all years. Even with this discount, unit prices have increased 141% since 1968 and the real value of the 57.5 million barrels produced in 1977 is $160,876,000 greater than that of the 94.5 million barrels produced during 1968.

Against a background of rising oil prices, the Tax Reduction Act of 1975 eliminated the ability of certain producers to claim the percentage depletion allowance which had been granted since 1927. Generally, only those independents having daily production less than 2,000 barrels (from all producing leases) could take the 22% depletion in 1975; the volume qualification being reduced to 1,800 barrels in 1976, 1,600 barrels in 1977, and the following scheduled reductions thereafter:

Year	Average Daily Production	Percentage Depletion
1978	1,400	22
1979	1,200	22
1980	1,000	22
1981	1,000	20
1982	1,000	18
1983	1,000	16
1984 and thereafter	1,000	15

Table B: Crude Oil Statistical Summary

Year	(1) Production (1,000s bbls)	(2) Stripper (1,000s bbls)	(3) Enhanced Oil Recovery (1,000 bbls)	(4) Value ($1,000s)	(5) Average Value	(6) Real Value ($1,000s)	(7) Crude Runs to Stills (1,000s bbls)	(8) Net Imports (1,000s bbls)	(9) End Year Reserves (1,000s bbls)
1968	94,505	63,149	32,424	$285,405	$3.02	$345,652	135,792	41,287	600,842
1969	88,716	59,441	31,921	283,891	3.20	327,365	136,283	47,567	566,013
1970	84,853	55,835	29,187	277,469	3.27	303,710	131,392	46,539	539,305
1971	78,532	51,857	26,756	276,433	3.52	287,891	132,855	54,323	501,552
1972	73,744	50,448	26,755	259,578	3.52	259,578	133,329	59,585	453,394
1973	66,227	45,949	21,361	281,466	4.25	266,036	136,242	70,015	401,089
1974	61,691	44,615	21,317	582,996	9.45	500,813	133,851	72,160	395,107
1975	59,106	43,707	18,701	647,212	10.95	508,615	141,119	82,013	364,394
1976	58,714	44,433	19,016	610,628	10.40	456,408	145,604	86,890	361,570
1977 p	57,496	44,272	N/A	715,825	12.45	506,528	147,679	90,183	359,500

p: preliminary data

Kansas Oil Refineries

Name	City, County	Daily Crude Capacity
Total Petroleum, Inc.	Arkansas City, Cowley	46,230
CRA Inc.	Coffeyville, Montgomery	48,338
CRA Inc.	Phillipsburg, Phillips	26,400
Derby Refining Co.	Wichita, Sedgwick	25,000
E-Z Serve	Shallow Water, Scott	9,500
Getty Oil Co.	El Dorado, Butler	78,700
Mid America Refining Co.	Chanute, Neosho	3,100
Mobil Oil Corp.	Augusta, Butler	50,000
National Cooperative Refinery Assoc.	McPherson, McPherson	54,150
Pester Refining Co.	El Dorado, Butler	22,500
Phillips Petroleum Co.	Kansas City, Wyandotte	90,000

Source: International Petroleum Encyclopedia, 1977, Tulsa, Okla., The Petroleum Publishing Co.

Production and Reserves

Crude oil is currently produced in 87 of the 105 counties in Kansas. Production began in Gray County during 1976, and in Wallace County during 1977. The leading ten oil producing counties are Ellis, Russell, Barton, Ness, Rooks, Butler, Graham, Stafford, Rice, and Cowley. During 1976, their combined production accounted for about one-half of the Kansas total.

About 32% of Kansas oil production is from projects using enhanced recovery methods. The term "enhanced recovery" includes all production techniques used after primary recovery (ordinary pumping and flowing) have depleted a well. The most common methods used in Kansas are pressure maintenance by water injection, water flooding, and water dumpflooding. A reported average of 17 barrels of water is currently used to produce 1 barrel of oil.

The statistics given in column (3) of Table B are taken from a questionnaire canvass of enhanced oil recovery operations in Kansas, performed annually by staff of the Kansas Geological Survey. To this extent, the accuracy of the statistics are directly dependent on the completeness of response to the questionnaire survey. The 32.4 million barrels given for 1968 is an apparent peak in enhanced production, occurring twelve years after total state production peaked at 124.7 million barrels in 1956.

About 95% of all oil producing wells in Kansas can be classified as stripper wells. The volume of production from these wells is given in column (2) of Table B. The 44,433,000 barrels reported for 1976 is the first production decline reversal since 1964. Reported abandonments during 1976 were the lowest since 1965. The removal of price controls during 1976 and the expectation of higher prices served to cause some operators to delay plugging and abandonments of marginal wells.

For readers who are interested in a more detailed listing of oil production data in Kansas, the Kansas Geological Survey annually publishes _Oil and Gas Production in Kansas_ and _Enhanced Oil-Recovery Operations in Kansas_. The _Oil and Gas Production_ report is arranged by county and identifies each field as to name, discovery date, location of discovery well, current and cumulative production, number of producing and abandoned wells during the year, average gravity of the oil, and the name, depth and thickness of each producing zone in the field. The _Enhanced Oil-Recovery Operations_ report is a compilation of questionnaire data submitted by operators of enhanced recovery projects. Each project is identified as to name, type, location, field, pay zones and their depths and sources of water. Injection patterns are indicated, along with other information such as data on water injection, and annual and cumulative oil production.

* * *

Estimates of proved recoverable reserves in Kansas were 359.5 million barrels as of December 31, 1977. Gross additions and revisions during 1977 totaled 55.4 million barrels, including an estimated 6.8 million barrels from fields discovered during 1977. Subtracting out 1977 production of 57.5 million barrels yields a net decline in reserves of 2.1 million barrels from the 361.6 million barrels at year end 1976. This is the smallest decrease in the last 20 years. Reserve statistics are frequently revised in response to better information provided by additional drilling, production and performance, the successful use of improved recovery techniques, as well as changing economic conditions which affect ultimate recovery.

Refining

The eleven refineries in Kansas, listed in Table B, have a combined reported daily capacity of 453,918 barrels. With declining state production, increasing volumes of imported crude oil have been used for processing by Kansas refineries. Especially interesting has been the increase in the proportion of foreign oil used due to a recent pipeline connection to the Gulf Coast. The specific trade balance for crude oil during 1976 was as follows:

Imports from (in 1,000s barrels)		
Domestic -		74,133
Texas -	28,898	
Oklahoma -	21,321	
Wyoming -	17,945	
Colorado -	3,515	
Montana -	935	
Nebraska -	794	
N & S Dakota		
Louisiana -	672	
Utah -	63	
Foreign -		16,974
Libya -	10,297	
Nigeria -	2,299	
Algeria -	976	
Saudi Arabia -	915	
Others -	2,487	

Exports to (in 1,000s barrels)		
Domestic -		8,447
Indiana -	3,987	
Ohio -	1,736	
Texas -	1,230	
Penn. -	775	
Illinois -	719	

Crude runs to refinery stills during 1976 totaled 145.6 million barrels. The major petroleum products produced were motor gasoline (91.4 million barrels), distillate fuel oil (40.1 million barrels), and residual fuel oil (5.8 million barrels). Various other products such as aviation gasoline, liquified petroleum gases, jet fuels, kerosine, asphalt, lubricating oils, solvents, road oils, wax, and petrochemical feed stocks accounted for 27.3 million barrels.

Natural Gas and Derivative Liquids

Economic Trends

Similar to crude oil, natural gas prices have undergone considerable change in the past few years. To a large extent, Kansas natural gas is dedicated to interstate commerce and therefore wellhead prices of this gas are made the jurisdiction of the Federal Energy Regulatory Commission (formerly Federal Power Commission). Since 1974 several opinions were issued that raised natural gas prices in response to the growing scarcity of natural gas and recognition of higher replacement costs of natural gas. On December 4, 1974, the Commission issued Opinion 699-H which established a national rate for new natural gas of 50¢ per Mcf (thousand cubic feet), with a 1¢ annual escalator. (Prices had previously been determined on an area rate basis.) New gas was defined as new dedications to interstate commerce on sales from wells commenced after January 1, 1973. In addition, sales of natural gas "rolled over" from the renegotiation of expiring contracts after January 1, 1973 were also permitted the 50¢ rate. In a separate decision (Opinion 749), a national base rate for old gas - interstate gas flowing prior to 1973 - was set at 23 1/2¢, and subsequently raised to 29 1/2¢ per Mcf, effective July 1, 1976. This 6¢ increase was in recognition of the increased tax liability resulting from the Tax Reduction Act mentioned in the crude oil section. The 22% depletion allowance was abolished for 1975 and subsequent years except for those natural gas producers (1) having daily production not exceeding 6 MMcf (million cubic feet), (2) selling natural gas under fixed contract, or (3) selling regulated, interstate gas. For those producers in category (3) but not (1) or (2), the depletion exemption ended July 1, 1976; for those small producers in category (1), a scheduled phase out was stipulated identical to that given on page 7 for oil producers, with 1 barrel of oil equivalent to 6 Mcf of gas. In Opinion 770-A, issued November 5, 1976, the Commission established a three-tier system for pricing new natural gas. The rate for gas first flowing into interstate commerce during 1975-1976 was set at $1.42/Mcf, with a 1¢ quarterly escalator starting October 1, 1976. The base rate for new gas of a 1973/74 vintage was 93¢/Mcf with an annual 1¢ escalator effective January 1, 1977. The rate for pre-1973 gas remained in accord with Opinions 699-H and 749; however, sales of rolled over gas were not permitted the $1.42 or 93¢ rates. Qualifying small producers were allowed to charge 35¢ for old flowing gas, and 130% of the 52¢ and 93¢ rates, but were given no differential for the gas in the $1.42 category.

The composite effects of these regulated price increases, along with the upward pressure on intrastate natural gas sales in Kansas, has resulted in more than a twofold increase in the value of Kansas natural gas production from 1975 to 1977, in spite of a production decline of 62.9 billion cubic feet. Columns (3) and (4) in Table C-1 give the estimated total value and average wellhead price of Kansas natural gas since 1968. Unit prices are calculated averages, based on the estimates for both interstate and intrastate gas. Total values have been adjusted for inflation, and reported in 1972 dollars in column (5).

Table C-1: Natural Gas Statistical Summary

Year	(1) Production (million cu. feet)	(2) Hugoton (million cu. feet)	(3) Panoma (million cu. feet)	(4) Value ($1,000s)
1968	848,381	595,454	5,843	$115,307
1969	888,039	641,660	6,361	122,759
1970	909,413	652,062	14,473	125,994
1971	894,451	650,027	26,834	127,267
1972	898,618	652,744	37,283	127,859
1973	902,190	639,087	57,068	138,521
1974	894,308	640,673	64,535	147,206
1975	850,786	594,356	79,194	184,621
1976	836,206	565,999	98,920	332,810
1977[p]	787,917	515,516	103,092	382,928

Year	(5) Avg. Value (¢/MCF)	(6) Real Value (1972 dollars)	(7) Net Exports (million cu. feet)	(8) End-Year Reserves
1968	13.6¢	$139,648	290,324	14,590,415
1969	13.8	141,558	295,890	14,202,259
1970	13.9	137,909	270,556	13,397,856
1971	14.2	132,542	223,055	12,603,650
1972	14.2	127,859	218,004	12,003,910
1973	15.4	130,927	235,881	11,786,408
1974	16.5	126,455	245,884	11,768,648
1975	21.7	145,085	286,509	12,730,321
1976	39.8	248,756	275,228	12,015,823
1977[p]	48.6	270,965	225,000	11,978,800

p: preliminary data

Production and Reserves

Natural gas production in Kansas during 1975-1977 fell at annual rates of 4.9%, 1.7% and 5.8% respectively. As the statistics in Table C-1 show, these declines are essentially composites of those from the State's largest field, Hugoton, and the rates of increasing production from the second largest field, Panoma.

The Hugoton Gas Area is located in the southwestern counties of Grant, Finney, Hamilton, Haskell, Kearny, Morton, Seward, Stanton, and Stevens. With 43% of the total producing gas wells in Kansas, this large, mature field consistently accounts for the majority of State production. The rates of decline for Hugoton - 7.2% in 1975, 4.8% in 1976, and 8.9% in 1977 - have exceeded the State average decline rates. Annual production from Hugoton has dropped 136.6 bcf since 1970, the peak year of both Hugoton and Kansas gas production.

The Panoma Gas Area underlies Hugoton in Grant, Hamilton, Kearny, Morton, Stanton, and Stevens counties. Although known for many years, Panoma has recently been the center of strong development activity. In 1965, Panoma produced 3.7 billion cubic feet or less than 0.5% of the Kansas total. By 1977, production had increased to an estimated 103.1 billion cubic feet, accounting for 13.1% of State production.

The remaining natural gas production in Kansas comes from many smaller fields. In addition to the nine Hugoton and Panoma counties, production is currently reported in 49 other counties across the State. Natural gas volumes extracted from these fields account for about 21% of total state production. A detailed listing of this production data can be found in the Kansas Geological Survey's Oil and Gas Production Report Series. Arranged in a county format, each field is identified as to name, year of discovery, location of discovery well, annual and cumulative production, number of wells, and the names and depth of the producing zone.

* * *

Estimated proved reserves of natural gas in Kansas were 11,978.8 billion cubic feet as of December 31, 1977. Gross additions and revisions during 1977 totaled 742.9 billion cubic feet, including 24.6 billion in new discoveries. Underground storage balances increased 8.0 billion cubic feet. Subtracting out 1977 production of 787.9 billion cubic feet, yields a net decline in gas reserves of 37.0 billion cubic feet from year end 1976. About 98% of these reserves are classified as non-associated, with the remaining 2% as associated-dissolved. This is contrasted to the current percentages of production of about 87% non-associated and 13% extracted in combination with oil.

Natural Gas Liquids

Most of Kansas natural gas is processed before it is sent through transmission lines to consumer markets, in order to extract various liquid fuels. Processing typically involves an overall 3% reduction in the volume of gas for end-use distribution. The locations and capacities of the 29 gas processing plants in Kansas are listed in Table C-2. Annual production volumes, total values, and reserves are also given in Table C-2.

During 1976, 1,389,850 million cubic feet of natural gas was processed for the extraction of 30,201,000 barrels of natural gas liquids. The volume reduction was 40,975 million cubic feet. Combined liquified petroleum gases, primarily propane, accounted for 20,085,000 barrels; ethane 3,682,000 barrels; plant condensate 4,000 barrels; and natural gasoline and cycle products 6,430,000 barrels. This latter product is primarily used by refineries as an input, along with crude oil, in the manufacture of petroleum products. Estimated 1977 volumes are quite similar to those given for 1976.

Although production has remained relatively stable, value and prices of natural gas liquids have been consistent with the general trend of rising energy prices. Table C-2 lists the average barrel price and total value of natural gas liquids since 1968, as reported by the U.S. Bureau of Mines. Total production values have also been adjusted by a general price deflator to constant 1972 dollar values in column (5).

* * *

Estimated proved reserves of natural gas liquids in Kansas were 422.4 million barrels as of December 31, 1977. Gross additions and revisions during 1977 totaled 64.5 million barrels, including 0.9 million in new discoveries. Subtracting out 1977 estimated production of 30.2 million barrels yields a net increase of 34.3 million barrels from year end 1976.

Table C-2: Natural Gas Liquids Statistical Summary

Year	(1) Natural Gas Processed (million cu. feet)	(2) Natural Gas Liquids Production (1,000s bbls)	(3) Value ($1,000s)	(4) Average Value	(5) Real Value (1972 dollars)	(6) Reserves (1,000s bbls)
1968	1,239,723	20,572	$ 36,804	$1.79	$ 44,573	270,556
1969	1,493,907	24,429	38,077	1.56	43,908	269,261
1970	1,445,817	27,363	45,214	1.65	49,490	294,073
1971	1,451,438	28,602	51,254	1.79	53,378	276,593
1972	1,497,319	30,604	56,340	1.84	56,340	393,082
1973	1,503,660	30,456	71,504	2.35	67,584	387,298
1974	1,407,239	31,032	103,628	3.34	89,020	394,419
1975	1,367,949	29,858	96,694	3.24	75,987	417,029
1976	1,389,850	30,201	114,439	3.79	85,536	388,078
1977p	1,380,000	30,200	171,439	5.68	121,313	422,400

p: preliminary data

Natural Gas Processing Plants

Company/Plant	County	Gas Capacity	Company/Plant	County	Gas Capacity
Alamo Chemical Co.			Cities Service Co.		
Greenwood Plant	Morton	84.0	Wilburton Plant	Morton	5.0
Amoco Production Co.			Colorado Interstate Gas		
Kinsler Plant	Grant	20.0	Lakin Plant	Kearney	215.0
Ulysses Plant	Grant	400.0	Morton Plant	Morton	112.0
Anadarko Production Co.			Kansas Refined Helium Co.		
Cimarron River Plant	Seward	15.0	Otis Plant	Rush	24.0
Interstate Plant	Morton	16.0	Mesa Petroleum Co.		
Woods Plant	Seward	10.0	Ulysses Plant	Grant	242.0
Central States Gas Co.			Mobil Oil Corp.		
Rattle Snake Creek Plant	Stafford	12.0	Hickok Plant	Grant	210.0
			National Helium Corp.		
Cities Service Co.			National Helium Plant	Seward	1,000.0
Cheney Plant	Kingman	100.0	Northern Gas Products		
Hutchinson Fractionation Plant	Reno	--	Northern Gas Plant	Ellsworth	950.0
			Northern Helex Co.		
Jayhawk Plant	Grant	520.0	Northern Helex Plant	Ellsworth	520.0
Midway Plant	Kingman	25.0	Northern Natural Gas Co.		
Spivey Plant	Harper	70.0	Holcomb Plant	Finney	200.0
Sunflower Plant	Scott	250.0			
Wichita Plant	Sedgwick	130.0			

Source: International Petroleum Encyclopedia, 1977, Tulsa, Okla., The Petroleum Publishing Co.

Coal

Relative to its size, the coal industry in Kansas has undergone considerable change in the past few years. Since 1975, production has more than doubled. Production in 1978 should exceed that for 1977 with the addition of several new mines being planned. This trend shows a strong reversal in coal production that started with a sharp decline in 1974 (see Table D).

At the start of 1975, Kansas had three active mines - Clemen's Mine #22 and #25 in Crawford County, and Wilkinson's mine in Cherokee County. During 1974, the Pittsburg and Midway Coal Mining Co. (P&M) discontinued mining operations in Kansas from P&M's Mine #19 in Cherokee County and from the Kansas portion of P&M's Midway Mine in Linn County, Kansas and Bates County, Missouri. During 1975-1977, nine new mining operations have opened. Of these, two shut down during this period, and seven remain in operation. Most of the new mines are relatively small, and a direction for the Kansas coal industry is being defined as one with more, smaller mines serving primarily local markets. Consumption of coal in Kansas, primarily in electric power generation, has increased substantially in recent years in face of natural gas curtailments and higher fuel oil prices.

The name, operator and locations of active mines in Kansas during 1975 through 1977 are listed on the next page.

Table D: Coal Statistical Summary

Year	(1) Production (1,000s tons)	(2) Value ($1,000s)	(3) Average Value	(4) Real Value ($1,000s)	(5) Net Exports (+) Imports (-)
1968	1,268	6,526	5.15	7,904	NA
1969	1,313	7,108	5.41	8,196	NA
1970	1,627	9,102	5.59	9,963	NA
1971	1,151	6,579	5.72	6,852	NA
1972	1,227	7,840	6.39	7,840	NA
1973	1,305	8,390	6.43	7,930	+185
1974	680	4,302	6.33	3,696	-1,200
1975	517	10,022	19.38	7,876	-2,600
1976	576	11,520	20.00	8,611	-3,100
1977	1,043	19,388	18.59	13,719	-3,000

p: preliminary data

Coal Mines Operating in Kansas, 1975-1977*

Mine Name/ Operator	Location	Status
Fort Scott Mine Bill's Coal Co.	Bourbon Co., Vernon Co., Mo. Ft. Scott, Ks. S25-26-25E SE26-26-25E NE35-26-25E N36-26-25E	Started Kansas operation March 1976; continuous since then
Fulton Mine Bill's Coal Co.	Bourbon Co. Ft. Scott, Ks. 35-23-25E 02-24-25E	Started operations in March 1977; continuous since then
Mine #1 Bradbury Bros.	Bourbon Co. Ft. Scott, Ks. SW28-26-25E	Started operations in Sept. 1976; continuous since then
Mine #2 Bradbury Bros.	Bourbon Co. Ft. Scott, Ks. SE20-27-25E	Started coal mining in late fall 1977
Mine #22 Clemens Coal Co.	Crawford Co. Pittsburg, Ks. 15-28-25E	Continuous except for UMW strike in Dec. 1977
Mine #25 Clemens Coal Co.	Crawford Co. Pittsburg, Ks. 10-31-25E	Shut down several months in 1977 and 1976; shut down for the UMW strike in Dec. 1977
Dell Lamb Mine Lamb Coal Co. Houston, Texas	Wilson Co.	Lamb Coal Co. started March 1975; closed summer 1975 - Beechner took over Jan. 1976
Thayer Mine Beechner Const. Co.	Wilson Co. Thayer, Ks. SW21-29-17E NW28-29-17E	Mined during summer 1976; sold some coal in 1977; closed
Golden Eagle Mine Fuel Dynamics, Inc.	Crawford Co. Oswego, Ks. 02-31-22E 11-31-25E	Started mining June 1977
Pat's Coal Co.	Bourbon Co. Ft. Scott, Ks. E 1/2 20-26-25E	Started mining Sept. 1977; continuous since then
Wilkinson's, Inc.	Cherokee Co. Weir, Ks. 20-32-25E	Mined coal during fall & winter 1974-75, 1975-76; continuous during fall 1976 through 1977; shut down during UMW strike
Alternate Fuels	Crawford Co. Pittsburg, Ks. NE SE 34-28-25E	Started mining coal in summer 1977

*Prepared by Lawrence Brady, Kansas Geological Survey

Average prices for Kansas coal have been rather stable since 1975 at an estimated $19.38/ ton in 1975, $20.00/ton in 1976, and $18.59/ton in 1977. The drop in average price from 1976 to 1977 resulted from the fact that 1976 figures were based on sales of nearly all washed coal, while all new production added during 1977 was unwashed coal. The most noticeable increase in price occurred during 1974-1975 when average prices increased from about $6.40/ton to $19.38/ ton in 1975, resulting from strengthened demand for coal and the decrease in the amount of Kansas coal tied to low-value long-term contracts.

* * *

In December 1976, the Kansas Geological Survey published a report on strippable coal reserves in Kansas (L.L. Brady and others, An Evaluation of the Strippable Coal Reserves in Kansas, Mineral Resources Series 5). A reserve base for measured and indicated reserves of coal having a stripping ratio of 30:1 or less was estimated to be 526 million tons. (This figure refers to a reserve base of economically recoverable coal that is present in the ground and has not been adjusted for tonnages that would be considered lost in an actual mining operation.) The economic coal beds are all in the eastern third of Kansas, with the following reserve estimates by county.

County	Millions of tons	County	Millions of tons
Anderson	4	Jackson	1
Atchison	6	Jefferson	3
Bourbon	27	Labette	9
Brown	8	Leavenworth	12
Chautauqua	3	Linn	98
Cherokee	151	Lyon	1
Coffey	4	Montgomery	5
Cowley	2	Neosho	1
Crawford	98	Osage	49
Doniphan	1	Shawnee	17
Douglas	3	Wilson	2
Franklin	21		

Helium

Helium is found as a naturally occurring constituent of natural gas in amounts ranging from less than a trace up to 8% by volume. It is currently considered economically feasible to extract helium from natural gas containing 0.3% or more helium.

In the last 15 years, a small but important helium industry has developed in Kansas, with extraction from the rich (0.3% - 0.5%) gases of the Hugoton field. Four plants in Ellsworth, Grant, Seward, and Scott counties produce a crude variety of almost 70-80% helium with the remainder being mostly nitrogen and some traces of other impurities. Three plants in Grant, Morton, and Rush counties produce a refined grade (99.995%) pure) that is the final marketable form of helium. These plants are listed in Table E. High purity helium is used in leak detection, as a lifting gas, in providing controlled atmospheres, as a pressurizing and purifying agent in space craft and rockets, in shielded arc welding, as a cooling agent, and importantly in the growing field of cryogenics.

Sales of refined helium have been recovering in recent years due to strengthened domestic and export demand, after the de-emphasis of the U.S. space program caused a temporary dip in the early 1970s. Since 1975, refined helium production in Kansas has increased 13.7%. In 1976, Kansas accounted for about two-thirds of total refined helium extracted in the U.S., and almost 88% of private sector helium production.

The unit price of refined helium in Kansas during 1977 has been estimated at $22.50/Mcf by the U.S. Bureau of Mines. This is down from the $24/Mcf 1975 average price, but a slight increase from the $22/Mcf 1976 value. The Bureau of Mines' plant price for refined helium has been $35/Mcf since 1961.

The production of crude helium has been in limbo during recent years. This part of the industry developed in response to the Federal helium conservation program authorized by the Helium Amendments Act of 1960. Until then, the U.S. Bureau of Mines was essentially the sole producer of helium. Escalating demand caused concern that additional capacity was needed and that the substantial quantity of helium that was contained in natural gases going to fuel markets ought to be saved for future use while it could be inexpensively obtained rather than lost at the burner tip as an inert constituent of natural gas. As a result of the Helium Act, contracts were drawn up between four private companies to operate five crude extraction plants, three in Kansas

Table E: Helium Statistical Summary

Year	(1) Refined Helium Production-KS (million cu. ft.)	(2) Value ($1,000s)	(3) Average Value per Mcf	(4) Real Value ($1,000s)	(5) U.S. Production Refined Helium: Private Plants	(5) U.S. Production Refined Helium: Bureau of Mines Plants	(6) KS as a % of Private Sector Production
1968	292	$ 7,300	$25.00	$8,841	389	478	75.1%
1969	330	7,590	23.00	8,752	399	361	82.7
1970	354	8,142	23.00	8,912	417	231	84.9
1971	342	7,182	21.00	7,480	403	174	84.9
1972	384	8,064	21.00	8,064	454	174	84.6
1973	416	8,736	21.00	8,257	467	180	89.1
1974	499	11,477	23.00	9,859	530	169	94.2
1975	497	11,928	24.00	9,374	561	185	88.6
1976	503	11,066	22.00	8,271	574	180	87.6
1977[p]	565	12,712	22.50	8,995	N/A	N/A	N/A

p: preliminary data

Ownership and Location of Helium Extraction Plants in the U.S., 1977

Category and Owner or Operator	Location	Product Purity
Government Owned:		
Bureau of Mines	Exell, Texas	Crude helium
Bureau of Mines	Keyes, Oklahoma	Crude and high purity helium
Private Industry:		
Alamo Chemical-Gardner Cryogenics	Elkhart, Kansas	High purity helium
Cities Service Cryogenics, Inc.	Scott City, Kansas	Crude helium
Cities Services Helex, Inc.	Ulysses, Kansas	Crude and high purity helium
Kansas Refined Helium Co.	Otis, Kansas	High purity helium
National Helium Corp.	Liberal, Kansas	Crude helium
Northern Helex Co.	Bushton, Kansas	Crude helium
Phillips Petroleum Co.	Dumas, Texas	Crude helium
Phillips Petroleum Co.	Hansford County, Texas	Crude helium
Western Helium Co.	Redrock, New Mexico	High purity helium

Source: Mineral Yearbook, 1976, U.S. Bureau of Mines, Department of Interior and two in Texas. A pipeline system was constructed connecting these plants to the Government's undergound storage facility in the Cliffside field near Amarillo, Texas. The program ran smoothly for a few years with a sizeable quantity of helium extracted, purchased by the Bureau of Mines, and stored in its crude state to be refined by the Bureau when needed. However, apparent economic difficulties developed, caused by heavy front-end costs, a slacker general demand than anticipated, and the unexpected competition from the private purification plants whose unit price did not include a component for defraying conservation costs. In late 1973, the Bureau stopped accepting crude helium for conservation. This, in effect, left most of the extraction capacity in Kansas unused. Although a few short-term contracts were made with the Government by the affected companies and some crude was (and still is) sold to purification plants for subsequent refining, the majority was vented directly or indirectly into the atmosphere.

In light of recent concern for efficient use and conservation of scarce resources, the termination of the helium program was unfortunate and considered unwise by many concerned parties. Insofar as the U.S. is not likely to face a helium shortage for a number of years (39 billion cubic feet is held in the Cliffside storage field compared to current annual sales of under 1 billion cubic feet) it was considered essential that long-term storage arrangements could be made -- a format that avoided the pitfalls of the original program yet was economically attractive to private producers. In the last quarter of 1975, the Bureau of Mines announced that contracts could now be made by helium producers, distributors, and users with the Government for long-term storage of helium (to the owner's account) in the Cliffside facility. An initial charge is levied upon entry, with all cumulative fees incurred during storage payable upon re-delivery. At year end 1977, the Bureau had entered into ten contracts with private companies for storage and redelivery of helium.

The value of crude helium produced in Kansas which was not subsequently refined in Kansas is reported in the category of miscellaneous mineral commodities which covers industries having less than three active producers.

NON - FUEL MINERALS

The years 1975 through 1977 were marked by increases in the total value of shipments of nonfuel minerals by Kansas producers. The gain in real value in 1975 was less than 1%, with noticeable differences in the performance of individual commodities. Evaporated and rock salt, the combined miscellaneous commodities, and portland cement were the only individual commodities to show increases in real value in 1975, while all of the construction related mineral commodities other than portland cement decreased. Inflation from 1974 to 1975 caused the current dollar values of shipments to increase for every nonfuel mineral commodity except clay and shale products, with a combined increase in current value of all nonfuel minerals of 10.1%. Gains from 1975 to 1976 were the greatest of the three years, with the real value of shipments increasing by 10.5% and the current value (including inflation) up by 16.2%. Rock salt was the only commodity to decline in value due to a sharp drop in the quantity of shipments. From 1976 to 1977 shipments of every nonfuel mineral commodity increased in both current and real dollar value, with overall changes of 5.9% in real value and 11.9% in current value. For the last three years the value of nonfuel minerals has remained between 14 and 15% of the total value of all mineral shipments by Kansas producers.

The total value of shipments of nonfuel mineral commodities by Kansas producers from 1968 to 1977 is reported in Table F. The quantity and value of shipments of individual commodities are reported in subsequent tables.

Table F: Value of Shipments of Non-Fuel Minerals by Kansas Producers

Year	Current dollar value[1]	Constant (1972) dollar value[1]
1968	100,077	121,203
1969	98,104	113,127
1970	98,535	107,854
1971	101,478	105,684
1972	116,262	116,262
1973	135,198	127,786
1974	148,208	127,316
1975	163,199	128,251
1976	189,555	141,681
1977[p]	212,104	150,088

[1] thousand dollars

[p] preliminary

On December 12, 1977, President Carter established a cabinet-level interagency committee to study U.S. nonfuel minerals problems. The establishing memorandum stated that "...the committee will address problems of domestic and international supply and demand among nonfuel minerals, examine Federal actions affecting the health of the U.S. mining industry, and submit policy options and recommendations to the President..." It thus marks a commitment by the Administration to develop a national minerals policy.

Specific questions which may be addressed by the committee include:

1. How is U.S. vulnerability to foreign supply curtailments and price manipulations affected by trends toward international politization of certain minerals markets?
2. What is the capacity of the U.S. to deal with the economic and social consequences of possible supply/price disruptions?
3. Are land use decisions based on adequate minerals information and analysis?
4. How do current tax laws affect the use of raw materials relative to the use of recycled minerals?
5. Do government regulations adequately address environment, health, and safety conditions without unduly affecting the supply and price of minerals?
6. Do existing functions of policy analysis, data collection, and data analysis adequately support Federal decision-makers?

These questions and many others need attention at the state and local levels as well as the Federal. The Kansas Geological Survey, in 1977, initiated efforts to expand its consideration of many of these questions in relation to its traditional involvement in the development of data concerning mineral industries in Kansas. A mineral economics section has been established within the Survey to give special attention to the role of mineral resources in the Kansas economy. While continuing to give attention to the major problems related to water and mineral fuel resources in the Kansas economy, increased attention will be directed toward the non-fuel resources because of the increasing conflicts resulting from alternative land use demands, quality variations of deposits, and uncertainty related to tax and regulatory policies at all levels of government.

A major initial aspect of the Survey's expanded concern with nonfuel mineral resources deals with the questions of adequacy and appropriateness of existing information flows and retrieval systems. A common complaint from the mining industry is directed at the proliferation of city, county, state, and Federal forms, requiring thousands of hours of industry employees' time in what is generally considered unproductive work. Attention should be given to potential advantages and disadvantages which would result from a coordination of data collecting efforts by all levels of government. If such coordination would reduce the time requirements placed on industry, it might also encourage better compliance with requests for information, with an improved understanding of the nature and problems of the non-fuel mineral industries by the various governments and by the industries themselves. At the same time, any information system must protect confidentiality of company data which might affect competitive positions.

Construction Related Mineral Commodities

Over the past 10 years, construction related mineral commodities have annually contributed 10-16% of the total value of production in the Kansas mineral industries, with the highest percentage occurring in 1973. Table G reports the value of shipments of these commodities by Kansas producers during this period. Values are shown in current dollar costs and constant (1972) dollars. To avoid double counting in the total value, the value of crushed stone used in cement manufacturing is not included in the total value of crushed and broken stone shipments, recognizing that its value contributes to the value of cement shipments. For reasons of data consistency and confidentiality the value of dimension stone, crushed stone exported from Kansas for cement production, and industrial sand and gravel (1976 and 1977) are not included in the total values.

The total current dollar value of construction related mineral commodities shipped by Kansas producers increased in every year from 1968 to 1977. Only in 1970 was the increase less than 1%. This upward trend of current dollar values is, however, an illusory gain. While the current dollar value of shipments increased by 116.% from 1968 to 1977, the real value of shipments increased by only 26.6% over the same period. Changes in real value of shipments depend upon a change in the physical quantity of shipments and/or a change in the unit value of the shipped commodity relative to the general price level in the economy, thus eliminating the false appearance of increased value due to general inflation. Instead of showing a continual increase from 1968 to 1977, the real value of shipments decreased 9.2% from 1968 to 1971; increased by 23.4% of the 1968 level from 1971 to 1973; decreased by 4.9% of the 1968 level from 1973 to 1975; and finally increased 17.3% of the 1968 level from 1975 to 1977. The data for individual commodities in Table A shows that the real value of shipments declined from 1973 to 1975 for all construction related mineral commodities except portland cement, which has continued to increase since 1970. The unique performance of portland cement, discussed in more detail in the following review of the cement industry, was due to the combined effects of a smaller than average decline in the physical quantity of shipments and a greater than average rate of increase in the unit value of portland cement.

Sales of construction related mineral commodities are closely tied to the level of construction contracts negotiated. A lag generally exists (as much as 6 quarters on large projects)

Table G: Value of Shipments by Kansas Producers in Construction Related Mineral Industries

Part 1: Value in current dollars (thousands):

Year	Portland cement	Masonry cement	Clay & Shale Products	Sand & Gravel	Crushed Stone[1]	Total
1968	29898	1177	9724	10559	16392	67750
1969	29365	1023	10317	10061	18405	69129
1970	28177	1029	9200	12351	18553	69310
1971	29961	1232	10069	11351	18804	71417
1972	35432	1452	13456	10920	20457	81717
1973	42172	2068	13454	12663	28584	98941
1974	46940	2203	14775	13388	28543	105849
1975	55033	2311	13887	13467	29159	113857
1976	66478	3281	15589	14940	31935	132223
1977[p]	71200	3820	20289	16580	36220	148109

Part 2: Value in constant (1972) dollars (thousands)

Year	Portland cement	Masonry cement	Clay & Shale Products	Sand & Gravel	Crushed Stone[1]	Total
1968	36209	1425	11777	12788	19852	81873
1969	33861	1180	11896	11602	21223	79715
1970	30842	1126	10070	13519	20308	75865
1971	31203	1283	10486	11821	19583	74377
1972	35432	1452	13456	10920	20457	81717
1973	39860	1955	12716	11969	27017	93517
1974	40326	1892	12692	11501	24519	90928
1975	43248	1816	10913	10583	22915	89475
1976	49688	2452	11652	11167	23869	98829
1977[p]	50332	2703	14357	11730	25630	104803

[1]excludes crushed stone used in cement manufacturing

[p]preliminary

between the negotiation of construction contracts and the actual use of materials. The real value of new construction contracts in Kansas should, therefore, serve well as a leading indicator of the real value of shipments of construction related mineral commodities in the State; that is, changes in the real value of new construction contracts one year should have a fairly well-defined relationship to changes in shipments of related mineral commodities the following year. The level of new construction contracts depends upon the availability of low interest investment and mortgage funds. These interest rates thus provide a second leading indicator of activity in the construction related mineral commodities. Interest rates were generally at high points in 1970 and 1974, the same years in which the real value of new construction contracts fell to low points. In each case they were one year ahead of low points in the real value of shipments. In 1972 interest rates were at low points while the real value of new construction contracts reached a high point. One year later the real value of shipments reached a high.

On the basis of new construction contracts as a leading indicator, the growth in real value of shipments of construction related mineral commodities which has occurred since 1975 can be expected to continue through 1978 (the real value of new construction contracts in Kansas during 1977 was over 90% higher than in 1976). The high interest rates of 1974 were the result of tight monetary policies of the federal government aimed at the problem of general inflation. The outlook for new construction contracts in 1978 may depend strongly on how the federal government deals with the developing national problems of inflation at home and deterioration of the dollar in foreign currency markets. If the responsibility for dealing with these problems falls mainly to the Federal Reserve, interest rates can be expected to increase sharply with a matching decline in new construction contracts. This could result in a decline in shipments of construction related mineral commodities in 1979. These relationships highlight the impact of national economic problems on activity in Kansas.

Cement

Table H provides a statistical summary of Kansas cement production from 1968 to 1977. As indicated by the figures on origin and destination of shipments, Kansas has been a net exporter of cement with net exports amounting to 35-45% of portland cement shipments and 55-75% of masonry cement shipments.

Since 1971 there have been 5 cement plants operating in Kansas. In addition, one cement plant in Nebraska owned by Ideal Basic Industries, Inc., exports limestone from Jewell County, Kansas, for its production process. Capacity utilization has been high during the 1970s, with Kansas producers consistently placed in the top three districts reported by the Bureau of Mines.

When the Bureau of Mines reported in December of 1975 that portland cement shipments in the United States had declined for the second consecutive year, it marked the first time in the past 30 years and only the fourth time since 1880 that portland cement shipments declined for two or more consecutive years. Kansas producers followed the national trend, although the two year decline of 21% for the nation was over twice the magnitude of decline in Kansas where it was held under 10%. Masonry cement shipments in Kansas also experienced their second consecutive annual decline in 1975, following the national trend more closely than portland cement shipments. These differences may be partially explained by the fact that much of the Kansas portland cement shipments at the time were tied to large-scale long-term construction projects. Contrary to the trend, production of masonry cement in Kansas actually increased in 1975 as producers made significant increases in stocks at the mills. Since 1975, there have been increases in quantity and real value of shipments of both portland and masonry cement. Despite maintenance problems at some plants which led to preliminary projection of decreased portland cement production in 1977 (The Journal, Kansas Geological Survey, January, 1978), there was actually a minor increase in shipments of about 1%, almost equaling the record level of shipments in 1973. Masonry cement shipments set a new record in 1977, almost 10% above the previous high in 1975.

As mentioned previously, the general downturn in the construction related mineral industries during the 1973-1975 period was primarily the result of national economic policies aimed at the problem of general inflation. While this downturn caused the real value of shipments of all other construction related minerals to decline, the real value of portland cement shipments continued to increase. To accomplish this, the average mill value of portland cement had to

Table H: Kansas Cement Industry

Portland Cement

Year	Production[1]	Shipments[1]	Value[1]	Average value[3]	Constant (1972) dollar value of shipments[2]	Shipments with Kansas destination[1]	Net export[1]	% Capacity utilized
1968	1859	1820	29898	16.43	36209	1077	743	76.9
1969	1831	1836	29365	16.00	33861	1063	773	74.3
1970	1687	1729	28177	16.29	30842	964	765	N/A
1971	1799	1732	29961	17.31	31203	983	749	N/A
1972	1986	1889	35432	18.76	35432	1048	841	N/A
1973	2036	2026	42172	20.82	39860	1126	900	95.1
1974	1996	1940	46940	24.20	40326	1146	794	92.0
1975	1835	1832	55033	30.04	43248	1122	710	78.3
1976	1950	2005	66478	33.16	49688	1229	776	83.8
1977[p]	N/A	2025	71200	35.16	50382	1230	795	N/A

Masonry Cement

Year	Production[1]	Shipments[1]	Value[1]	Average value[3]	Constant (1972) dollar value of shipments[2]	Shipments with Kansas destination[1]	Net export[1]
1968	50	54	1177	21.95	1425	26	28
1969	61	49	1023	21.00	1180	24	25
1970	40	46	1029	22.43	1126	22	24
1971	43	50	1232	24.64	1283	20	30
1972	54	59	1452	24.61	1452	24	35
1973	70	73	2068	28.33	1955	27	46
1974	58	64	2203	34.42	1892	29	35
1975	66	57	2311	40.54	1816	26	31
1976	70	72	3281	45.57	2452	34	54
1977[p]	N/A	80	3820	48.04	2703	33	47

[1] thousand short tons
[2] thousand dollars
[3] dollars per ton
[p] preliminary

increase rapidly enough to offset the effects of both declining volume of shipments and a drop in the real value of the dollar due to general inflation. The magnitude of price changes that did occur with portland cement are suggested by the fact that from 1947 it took 25 years for the average mill value to double, but from 1972 it took only five years to double again. Due to this rapid increase in mill value, the current dollar value of portland cement shipments by Kansas producers increased 30% from 1973 to 1975, despite the loss in volume of almost 10%. Even when these values are adjusted to eliminate effects of general inflation, there remains an 8.5% increase in real value.

The mill value of masonry cement increased in much the same manner as that of portland cement. This did cause an increase in the current dollar value of masonry cement shipments by Kansas producers, but the decline in the volume of shipments was sufficient to cause a drop in their real value.

Several factors related to production costs have contributed to the rapid increase in cement prices during the 1970s. These include energy, labor, and pollution control costs. Cement manufacturing is one of the most energy intensive industries in the United States. As a result, the cost of producing cement has been influenced more by the increased energy costs of the 1970s than have costs in other industries. These cost increases then create higher than average increases in product price. This was a necessary condition for portland cement shipments to increase in real value in the absence of increased volume. Production costs in Kansas were also affected by the cement industry's first national three-year agreement signed with the United Cement, Lime, and Gypsum Workers International Union covering the period from May 1, 1975 through April 30, 1978. Air quality standards and other pollution control regulations established in recent years are particularly significant for the cement industry because low value to weight ratios for cement have generally led to location of cement plants as close as possible to major markets. This avoided excessive transportation costs, but has led to greater pressures for pollution control.

The critical role of energy supplies in the cement industry influenced capital investment activities of Kansas producers during the period of 1975 to 1977. Since 1974 all of the producers have developed a capacity to use coal as an alternative fuel during periods of natural gas curtailment. This had become a problem for all five operating cement plants in Kansas, as they are all served by one interstate transmission line for natural gas and have all been given the next to the lowest ranking (just above power plants) in terms of priority of service. In 1977 gas for burning was available for about 7 months. All of the coal used by the plants comes from the Kansas-Missouri-Oklahoma region. Increasing fuel costs have also encouraged employment or development of technologies which make more efficient use of energy. Other capital investments have been made in pollution control programs to meet air quality standards. In 1975 Monarch Cement in Humboldt, Kansas, announced completion of a $13 million expansion including pollution control equipment and conversion to a new clinker production technology with suspension preheating systems which would cut fuel consumption up to 40% (Pit and Quarry, April 1975). In 1977 Lone Star Industries, Inc. completed remodeling of their grinding facilities and installation of the final phase of pollution control equipment at their Bonner Springs plant.

Nationally, the problem of increasing energy costs has encouraged research on development of new blends of material inputs which form clinker with lower energy requirements while maintaining or improving characteristics of the resulting cement. In March 1978, the Department of Energy announced successful preliminary tests of an electric generating system harnessing waste heat to operate steam and freon powered turbines which drive the generator. Although initially designed for use in connection with diesel power plants, the report indicated that energy intensive operations such as cement plants expel waste heat hot enough for potential application of the system (DOE Information: Weekly announcements, Vol. 2, No. 11, week ending 3-17-78).

Clay and Shale Products

Table I provides a statistical summary of activity in the brick industry and other clay and shale products in Kansas over the past 10 years. Six plants are currently producing brick in Kansas - Cloud Ceramics (Concordia), Excelsior Brick Corporation (Fredonia - Excelsior Clay Products, Inc., prior to May 1977), Kansas Brick and Tile (Hoisington), Humbolt Brick and Tile (Humbolt), and Acme Brick and Tile (Weir and Kanopolis). The remainder of the ceramic industry produced lightweight aggregate of expanded shale (Buildex, Inc., at Ottawa and Marquette), pottery (Pittsburg Pottery, Pittsburg), and structural clay products (W.S. Dickey Clay Manufacturing Co., Pittsburg).

As seen in Table G, Part 2, the real value of shipments by the clay and shale products industry closely followed the trends in other construction related mineral industries, with the most recent low point in 1975. In addition to the general economic effects on the construction industry, the clay and shale products industry was affected by a strike of the W.S. Dickey Clay Manufacturing Company in Pittsburg lasting from July 1975 to September 1976. Although the strike caused a shutdown of production, its effect on shipments was largely mitigated through sales from inventories. A significant increase in demand for structural clay products from the plant occurred during 1977 as a result of the 1976 closing of another W.S. Dickey plant in St. Louis.

While the price of cement, discussed previously, responded quickly and strongly to increased energy costs in 1973, the prices of clay and shale products did not show major increases until 1977. This is illustrated by the brick prices, shown in Table I, where increases remained below 5% per year from 1969 to 1973, jumped to around 10% per year from 1973 to 1976 (about half the rate of increase in cement prices), and finally increased by 22% in 1977. The difference between changes in cement prices and those of ceramic products is indicative of weak demand for ceramic products from 1973 to 1975 combined with less energy intensive production processes.

Table I: Clay and Shale Products Industries in Kansas

Year	Brick Production[1]	Brick Shipments[1]	Average value of brick shipped[2]	Value of brick shipped[3]	Value of other product shipments[3]	Total current dollar value[3]	Total constant dollar (1972) value[3]
1968	94049	102088	45.99	4695	5029	9724	11777
1969	99587	94316	50.50	4763	5553	10316	11896
1970	92096	79709	51.83	4131	5069	9200	10070
1971	84356	92802	53.35	4951	5118	10069	10486
1972	91712	103639	55.07	5707	7749	13456	13456
1973	97173	97196	57.91	5629	7825	13454	12716
1974	96228	88197	62.96	5553	9222	14775	12692
1975	88760	84542	69.76	5898	7989	13887	10913
1976	89487	96397	75.85	7312	8277	15589	11652
1977	97361	99366	92.48	9189	11100	20289	14357

[1] thousands of bricks

[2] dollars per thousand bricks

[3] thousands of dollars

Sand and Gravel

Sand and gravel shipments by Kansas producers are reported in Table J. The greatest quantity of shipments occurred in 1973; however, weak market prices caused the real value in 1973 to fall over $1.5 million below the record level of $13.5 million in 1970. In 1975 shipments by Kansas producers fell to their lowest level since 1960. It was a 15 year low in both quantity and real value. Nevertheless, due to the effects of inflation, the current dollar value reached its highest level to that date. Shipments recovered in 1976, increasing by 13%, but a slight drop in average unit price held the gain in real value to only 5.5%. Preliminary data indicates that the quantity of shipments in 1977 was about 1% below 1976, due to a significant decline in road construction and repairs which offset increases in building activity. Price increases for sand and gravel in 1977 resulted in a continued increase in real value despite the decline in quantity.

Table J: Shipments of Sand and Gravel by Kansas Producers

Year	Quantity Shipped[1]	Current dollar value[2]	Constant (1972) dollar value[2]
1968	12427	10559	12788
1969	12029	10061	11602
1970	12968	12351	13519
1971	11862	11351	11821
1972	11591	10920	10920
1973	13261	12663	11969
1974	11687	13388	11501
1975	10866	13467	10583
1976[3]	12291	14940	11167
1977[p]	12100	16580	11730

[1]thousand short tons

[2]thousand dollars

[3]1976 and 1977 data exclude industrial sand

[p]preliminary

The price increase in 1977 probably reflects, in part, the impact on production costs of compliance with more stringent antipollution and land rehabilitation regulations. Producers have historically located close to their markets because transportation costs usually constitute a major portion of the delivered cost of sand and gravel. In metropolitan areas this has increasingly subjected producers to adverse zoning decisions and stringent regulations against noise, air, water, and landscape pollutions. To avoid causing financial disaster for the producer, operators must have some guarantee that they will be able to work a property for its useful life, while at the same time operating under clearly defined local standards of pollution control and post-extraction land rehabilitation requirements.

Sand and gravel deposits occur throughout the state, the result of natural disintegration of a variety of rocks. Most of the material currently being produced is dredged from floodplain and riverbed deposits, primarily in the Kansas and Arkansas river valleys. Although total domestic resources of sand and gravel are essentially inexhaustible, there are real or potential shortages in many localized areas. Individual deposits vary significantly in quality, causing marked differences in processing requirements and, therefore, in production costs. Each deposit is basically a non-renewable resource which may be permanently removed from the resource base by competing land uses. As a result, it is important in land use planning to weigh the advantages of allowing extraction of sand and gravel before such deposits are covered by buildings or put to other uses which would prohibit extraction. This is particularly important in the case of high grade industrial sand deposits. While they contributed less than 2% to the quantity of sand and gravel shipments in a recent year, they accounted for almost 7% of the total value. This also suggests the importance of resource surveys to identify locations of currently undeveloped but potentially economical deposits.

Sand and gravel producers vary considerably in corporate size with the top 5% in order of size accounting for 33% of the total quantity of shipments. Because of this great variation in size of operations, government policies related to the sand and gravel industry should be formulated with an understanding of potentially different impacts which the policies may have on producers of different size.

Stone

The quantity and value of stone shipments by Kansas producers are reported in Table K. Total figures for crushed and broken stone in Table K do not include stone shipments for use in cement manufacturing. These figures are reported separately in Table K. The quantity and value of dimension stone shipments are also reported separately in Table K, except where reporting could result in disclosure of individual company data. The value of dimension stone shipments is included in each year's value of miscellaneous mineral commodities, reported in Table M.

The greatest quantity and real value of crushed and broken stone shipments to date occurred in 1973. Since 1973 variations in stone shipments have followed basically the same pattern as sand and gravel. After declining to a low in 1975, stone shipments increased mildly in 1976 followed by a slight but insignificant decline in 1977. As with sand and gravel, the 1976 expansion did not continue into 1977 due to the decline in road construction and repair. The price of crushed stone increased more rapidly than the general inflation rate in 1977, creating a 13.5% increase in current value and a 7% increase in real value. This price increase reflects the same basic impact of antipollution and land rehabilitation requirements on production costs that were discussed in connection with sand and gravel. Due to the high degree of similarity between conditions affecting stone production and those affecting sand and gravel, the comments related to regulation and land use planning policies will not be repeated here. As in sand and gravel production, the corporate size of stone producers is highly variable with 6% of the firms accounting for 33% of the shipments.

Table K: Stone Shipments of Kansas Producers by Use and Type

Year	Concrete aggregate and roadstone Quantity[1]	Value[2]	Riprap and other crushed stone[3] Quantity[1]	Value[2]	Agricultural Quantity[1]	Value[2]	Total crushed stone excluding use in cement Quantity[1]	Value[2]	Constant 1972 dollar value[2]
1968	8843	12741	1577	1372	778	1279	11200	16392	19852
1969	10242	15125	1605	2040	755	1241	12600	18405	21223
1970	10329	15965	1103	1314	861	1274	12295	18553	20308
1971	10254	16781	551	1076	629	947	11437	18804	19583
1972	9882	17643	1246	1764	621	1051	11748	20457	20457
1973	13369	26211	1074	1567	540	805	14985	28584	27017
1974	12510	25735	1401	1763	562	1046	14474	28543	24519
1975	11248	26466	739	1401	694	1292	12681	29159	22915
1976	11561	28652	606	1610	864	1673	13031	31935	23869
1977[p]	N/A	N/A	N/A	N/A	N/A	N/A	13020	36220	25630

Year	Crushed stone used in cement manufacturing Quantity[1]	Value[2]
1968	3162	3726
1969	3209	3849
1970	2845	3408
1971	3471	4386
1972	2799	3392
1973	3349	5017
1974	3395	5814
1975	3209	6015
1976	3317	6293
1977[p]	3480	6680

Year	Dimension stone Quantity[1]	Value[2]
1968	10	536
1969	19	395
1970	21	445
1971	w	507
1972	w	w
1973	w	w
1974	w	513
1975	17	676
1976	w	w
1977[p]	w	w

[1] thousand short tons
[2] thousand dollars
N/A not available

[3] includes crushed sandstone, quartzite and other stone
[p] preliminary
w withheld

Salt

Salt is the primary non-fuel, non-construction related mineral produced in Kansas, with rock and evaporated salt providing 3% of the total value of all mineral shipments and 20% of the value of non-fuel mineral shipments in the state. Since 1972 five companies, operating in Ellsworth, Reno, and Rice counties, have been producing rock and evaporated salt from the Wellington Formation (lower Permian). The producing salt vein is estimated by the Bureau of Mines to have enough rock salt to supply the Nation for the next 250,000 years. Two of the Kansas firms mine salt through solution techniques producing evaporated salt, one firm mines rock salt underground, and the other two firms use both techniques. A sixth firm produces salt brine from the Wellington Formation in Sedgwick County for use in the chemical industry.

Table L reports data on shipments of rock and evaporated salt. The value of salt brine shipments is included with miscellaneous mineral commodities in Table M to avoid disclosure of company data. The only decline in shipments of evaporated salt since 1968 occurred from 1973 to 1975, amounting to less than 1% per year. 1971 is the only year since 1968 in which the real value of evaporated salt shipments declined. There was a minor increase in shipments, but the average value of evaporated salt increased less rapidly than general inflation, causing the decline in real value. Since 1973 the real value of evaporated salt shipments has steadily increased despite the 1973 to 1975 decline in quantity shipped. As with portland cement, the increases in real value of shipments during those years reflected the energy intensive nature of evaporated salt production and the resulting effect of energy cost increases on total production costs. Data collected in 1974 by the Bureau of Mines indicated the following energy requirements per ton of product:

Rock Salt	0.1 million BTU/ton
Evaporated Salt	4.2 million BTU/ton
Portland Cement	6.0 million BTU/ton

With a much less energy intensive technology required for rock salt production, real value of rock salt shipments has been less strongly influenced by increased energy costs and has been more dependent on changes in the quantity of shipments. There have been strong fluctuations in the quantity of shipments of rock salt in recent years, with the greatest volume of shipments since 1968 (675,000 short tons) occurring in 1975 and the lowest volume since 1968 (525,000 short tons)

Table L: Salt Shipments by Kansas Producers

	Evaporated Salt				Rock Salt			
Year	Shipments[1]	Average value[2]	Current Value[3]	Constant 1972 dollar value[3]	Shipments[1]	Average value[2]	Current value[3]	Constant 1972 dollar value[3]
1968	556	23.16	12875	15571	572	4.62	2645	3203
1969	623	22.17	13810	15924	647	5.07	3280	3782
1970	670	22.65	15178	16613	560	5.41	3023	3314
1971	676	23.44	15847	16503	564	5.08	2865	2983
1972	723	23.80	17207	17207	646	5.19	3355	3355
1973	782	25.47	19914	18822	615	5.77	3546	3352
1974	778	29.73	23127	19866	589	6.58	3880	3333
1975	771	34.07	26274	20627	675	7.32	4940	3882
1976	785	39.22	30795	23017	525	8.56	4496	3360
1977[p]	864	44.75	36672	27410	625	8.41	5255	3719

	Total exaporated and rock salt		
Year	Shipments[1]	Current value[3]	Constant 1972 dollar value[3]
1968	1128	15520	18774
1969	1270	17090	19706
1970	1230	18206	19927
1971	1240	18712	19486
1972	1369	20562	20562
1973	1397	23460	22174
1974	1367	27007	23199
1975	1446	31214	24529
1976	1310	35291	26377
1977[p]	1489	41927	29668

[1]thousand short tons

[2]dollars per ton

[3]thousand dollars

[p]preliminary

occurring in 1976. The variations in quantity of rock salt shipments are due in part to the dependence of one of its primary uses (de-icing agent) on weather conditions.

The pattern of salt production by type in Kansas is the reverse of the national pattern. Evaporated salt production has exceeded rock salt production in Kansas each year since 1970, with salt brine third. Nationally, salt brine constitutes well over 50% of all salt production with rock salt constituting over two-thirds of the remaining salt production. In the past three years, some capacity in evaporated salt production has been added by several producers, but no major expansions have been announced.

Miscellaneous

Minerals in the miscellaneous category included gypsum (crude and calcined), salt brine, dimension stone, crude helium (1975-1977), carbon black, sulfur, lime, pumicite and volcanic ash, diatomaceous marl, coal (1968-1969), lead and zinc (1968-1971), and industrial sand and gravel (1976-1977). These mineral commodities are reported as a group because either their individual values are very low or they are produced by a limited number of firms and must be grouped to maintain confidentiality of corporate data. The current and real dollar values of shipments of these commodities are reported in Table M. Variations in value occurring from year to year in this table are of no particular significance due to frequent changes in the commodities included in the miscellaneous category.

Crude gypsum is mined by National Gypsum Co. in Barber County and by the Bestwall Division, Georgia-Pacific Corp., in Marshall County. The primary use for crude gypsum was in cement manufacturing; and for calcined gypsum was in wallboard construction. Vulcan Materials, Inc., in Sedgwick County was the sole producer of salt brine with output used in the chemical industry. Great Western Sugar Company in Sherman County was the State's only producer of lime, with the entire output used in sugar refining at the company's Goodland plant. Sulfur was recovered as a by-product of crude petroleum refined by Skelly Oil Company, Butler County; CRA, Inc., Montgomery County; and Phillips Petroleum Company, Wyandotte County. Carbon black was produced by Columbian Carbon Company, a subsidiary of Cities Service Oil Company, in Grant County. The principal uses of carbon black are in rubber compounding, inks, and paint. Crude helium production occurred in Grant and Rice counties.

Table M: Shipments of Miscellaneous Mineral Commodities by Kansas Producers

Year	Current dollar value[1]	Constant (1972) dollar value[1]
1968	16807	20355
1969	11887	13707
1970	11019	12061
1971	11349	11819
1972	13983	13983
1973	12797	12095
1974	15352	13188
1975	18128	14246
1976	22041	16474
1977[p]	22068	15616

[1]thousand dollars

[p]preliminary

APPENDIX

Table	Data Sources
A	See Tables B - E
B	Column 1, Kansas Corporation Commission Column 2, Interstate Oil Compact Commission and the National Stripper Well Association, National Stripper Well Survey Column 3, Kansas Geological Survey Column 4, Kansas Geological Survey and U.S. Bureau of Mines Column 7, U.S. Bureau of Mines Column 9, American Petroleum Institute
C-1	Columns 1-3, Kansas Corporation Commission Column 4, Kansas Geological Survey Column 7, U.S. Bureau of Mines Column 8, American Gas Association
C-2	Columns 1-3, U.S. Bureau of Mines Column 6, American Gas Association
D	U.S. Bureau of Mines (1968-1970) and Kansas Geological Survey (1971-1977)
E	U.S. Bureau of Mines
F	See Tables H-M
G	See Tables H-K
H	U.S. Bureau of Mines, Mineral Yearbook and Mineral Industry Surveys, Cement
I	U.S. Department of Commerce, Current Industrial Reports, Clay Construction Products, and Kansas Geological Survey
J	U.S. Bureau of Mines, Mineral Yearbook and Kansas Geological Survey
K	U.S. Bureau of Mines, Mineral Yearbook and Kansas Geological Survey
L	U.S. Bureau of Mines, Mineral Yearbook and Kansas Geological Survey, Mine Operator's Annual Report
M	U.S. Bureau of Mines and Kansas Geological Survey

Additional Notes:

1. The real or constant dollar values reported in the commodity tables were obtained by using the implicit price deflators for gross national product reported in The Annual Report of the Council of Economic Advisors, United States Government, Washington, 1977 and 1978. The base year for these deflators is 1972.

2. Information for the list of "Coal Mines Operating in Kansas, 1975-1977," page 18, was provided by Larry Brady, Mineral Resources Section, Kansas Geological Survey.

3. Information on the energy requirements of salt and cement production, page 39, was obtained from U.S. Bureau of Mines, Mineral Facts and Problems, 1975 Edition, Washington, 1976.