SYNTHETIC ORGANIC CHEMICALS

nited States Production
nd Sales, 1977

ITC PUBLICATION 920

ted States International Trade Commission / Washington, D.C. 20436

RECENT REPORTS OF THE UNITED STATES INTERNATIONAL TRADE COMMISSION ON SYNTHETIC ORGANIC CHEMICALS

Synthetic Organic Chemicals, United States Production and Sales, 1972 (TC Publication 681, 1974), $2.70

*Synthetic Organic Chemicals, United States Production and Sales, 1973 (ITC Publication 728, 1975), $3.25

Synthetic Organic Chemicals, United States Production and Sales, 1974 (USITC Publication 776, 1976), $3.20

Synthetic Organic Chemicals, United States Production and Sales, 1975 (USITC Publication 804, 1977), $3.10

Synthetic Organic Chemicals, United States Production and Sales, 1976 (USITC Publication 833, 1977), $5.25

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UNITED STATES INTERNATIONAL TRADE COMMISSION

SYNTHETIC ORGANIC CHEMICALS

United States Production and Sales, 1977

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1978

USITC PUBLICATION 920

$6.25 S/N 049-000-00048-1

UNITED STATES INTERNATIONAL TRADE COMMISSION

COMMISSIONERS

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INTRODUCTION

This is the 61st annual report of the U.S. International Trade Commission on Domestic production and sales of synthetic organic chemicals and the raw materials from which they are made. The report consists of 15 sections, each covering a specified group (based principally on use) of organic chemicals as follows: Tar and tar crudes; crude products from petroleum and natural gas for chemical conversion; cyclic intermediates; dyes; organic pigments; medicinal chemicals; flavor and perfume materials; plastics and resin materials; rubber-processing chemicals; elastomers; plasticizers; surface-active agents; pesticides and related products; miscellaneous end-use chemicals and chemical products; and miscellaneous cyclic and acyclic chemicals. Data have been supplied by approximately 800 producers.

Each of the 15 statistical sections is headed by a short paper on recent developments in part or all of the given end-use group. This is followed by a summary of the statistical data. The first table in each section gives statistics on products and groups of products in as great detail as is possible without revealing the operations of individual producers. Statistics for an individual chemical or group of chemicals are given only when there are three or more producers, no one or two of which may be predominant. Moreover, even when there are three or more producers, statistics are not given if there is any possibility that their publication would violate the statutory provisions relating to unlawful disclosure of information accepted in confidence by the Commission.[1]

Data are reported by producers for only those items where the volume of production or sales or value of sales exceeds certain minimums. Those minimums for all sections are 5,000 pounds of production or sales or $5,000 of value of sales with the following exceptions: Plastics and resin materials--50,000 pounds or $50,000; pigments, medicinal chemicals, flavor and perfume materials, rubber-processing chemicals, and elastomers--1,000 pounds or $1,000. They are usually given in terms of undiluted materials; however, products of 95 percent or more purity are considered to be 100 percent pure. Commercial concentrations are applied to dyes, certain plastics and resins, and a few solvents; such concentrations are specifically noted.

The statistics given in this report include data from all known domestic producers of the item covered and include the total output of each company's plants, i.e., the quantities produced for consumption within the producing plant, as well as the quantities produced for domestic and foreign sale. The quantities reported as produced, therefore, generally exceed the quantities reported as sold. Some of these differences, however, are attributable to changes in inventory.

The second table in each section lists all items for which data on production or sales have been reported, by primary manufacturers, identified by manufacturers' codes. Each code consists of not more than three capital letters which is assigned on a permanent basis.

The third table in each section is a directory, alphabetized by the codes of the manufacturers reporting in that section.

Table 1 of the Appendix is a directory, alphabetized by the names of the manufacturers reporting in all sections and includes their office addresses.

Table 2 of the Appendix summarizes and gives the competitive status of U.S. general imports in 1976 of benzenoid intermediates and finished benzenoid products, entered under schedule 4, parts 1B and 1C, of the Tariff Schedules of the United States.

Table 3 of the Appendix lists synonymous names for cyclic intermediates. Information on all synonymous names of the organic chemicals included in this report may be found in the *SOCMA Handbook: Commercial Organic Chemical Names*, published by the Chemical Abstracts Service of the American Chemical Society, or the *Colour Index* (Revised Third Edition), published jointly by the Society of Dyes and Colourists and the American Association of Textile Chemists and Colourists.

As specified in the reporting instructions sent to manufacturers, production and sales (unless otherwise specified) are defined as follows:

> *<u>PRODUCTION</u> is the total quantity of a commodity made available by <u>ORIGINAL MANUFACTURERS ONLY</u> within the customs territory of the United States (includes the 50 states, the District of Columbia, and Puerto Rico). It covers synthetic organic chemicals, specified crudes from petroleum and coal tar, and certain chemically described natural products, such as, alkaloids, enzymes, and perfume isolates. It is the sum--expressed in terms of 100% active ingredient unless otherwise specified in the reporting instructions--of the quantities:*
>
> > *Produced, separated, and consumed in the same plant or establishment. A commodity is considered separated either when it is isolated from the reaction system or when it is not isolated, but weighed, analyzed, or otherwise measured. This includes byproducts and co-products that are not classifiable as waste materials;*

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[1] Title 18, U.S.C. 1905 and Title 44, U.S.C. 3508.

Produced and not isolated, but directly converted to a finished or semifinished item not included in this report (e.g., polyester film, polyurethane tires, nylon fiber, bar soap, etc.). (See specific instructions in individual sections);
Produced and transferred to other plants or establishments of the same firm or 100%-owned subsidiaries or affiliates;
Produced and sold to, or bartered with, other firms (including less than 100% owned subsidiaries);
Produced for others under toll agreements (see general instructions);
Produced and held in stock.

PRODUCTION EXCLUDES:
Purification of a commodity, which is purchased by, or transferred from within, your company, unless inclusion of such processing is specifically requested in the reporting instructions for individual sections;
Intermediate products which are formed in the manufacturing process, but are not isolated from the reaction system--that is, not weighed, analyzed, or otherwise measured; except such products as described above as being produced and not isolated, but directly converted to a finished or semifinished item.
Materials that are used in the process but which are recovered for re-use or sale;
Waste products having no economic significance.

SALES are actual quantities of commodities sold by ORIGINAL MANUFACTURERS ONLY. Sales include the quantity and value of:
Shipments of a commodity for domestic use or for export, or segregation in a warehouse when title has passed to the purchaser in a bona fide sale;
Shipments of a commodity produced for you by others under toll agreements;
Shipments to subsidiary or affiliated companies, provided the ownership is less than 100%.

SALES EXCLUDES:
All intra-company transfers within a corporate entity;
All shipments to 100% owned subsidiary or affiliated companies;
All resales of imported or purchased material, including materials obtained by barter;
All shipments of a commodity produced for others under toll agreements.

VALUE OF SALES is the net selling price f.o.b. plant or warehouse, or delivered price. F.o.b. prices are preferred, but if they are not readily available from your records, delivered prices are acceptable.

SUMMARY

Combined production of all synthetic organic chemicals, tar, tar crudes, and primary products from petroleum and natural gas in 1977 was 306,566 million pounds--an increase of 7.4 percent over the output in 1976 (see table 1). Sales of these materials in 1977, which totaled 161,106 million pounds, valued at $33,961 million, were 6.1 percent larger than in 1976 in terms of quantity and 0.6 percent larger in terms of value. These figures include data on production and sales of chemicals measured at several successive steps in the manufacturing process, and therefore, they necessarily reflect some duplication.

In 1977, production of all synthetic organic chemicals, including cyclic intermediates and finished products, totaled 174,502 million pounds, or 9.8 percent more than the output in 1976. Each section showed an increase in production in 1977 over 1976. Flavor and perfume materials (150 million pounds) led the increase with a gain of 16.7 percent; miscellaneous end-use chemicals and chemical products (19,348 million pounds) increased 16.0 percent; plastics and resin materials (34,623 million pounds) were 15.4 percent greater than in 1976; plasticizers (1,792 million pounds) increased 12.9 percent; elastomers (synthetic rubber) (5,813 million pounds) increased 7.5 percent; miscellaneous cyclic and acyclic chemicals (86,968 million pounds) increased 7.5 percent; cyclic intermediates (18,726 million pounds) increased 5.8 percent; rubber-processing chemicals (402 million pounds) increased 4.6 percent; dyes (264 million pounds increased 3.2 percent; surface-active agents (4,718 million pounds) increased 3.0 percent; medicinal chemicals (241 million pounds) increased 2.1 percent; pesticides and related products (1,388 million pounds) increased 1.7 percent; and organic pigments (69 million pounds) increased 1.4 percent.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS AND THEIR RAW MATERIALS U.S. PRODUCTION AND SALES, 1976 AND 1977

	PRODUCTION			SALES					
				QUANTITY			VALUE		
	1976	1977	Increase, or decrease (-), 1977 over 1976[1]	1976	1977	Increase, or decrease (-), 1977 over 1976[1]	1976	1977	Increase, or decrease (-), 1977 over 1976[1]
	Million pounds	*Million pounds*	*Percent*	*Million pounds*	*Million pounds*	*Percent*	*Million dollars*	*Million dollars*	*Percent*
Grand Total[2]	[5]285,678	306,566	7.3	[5]152,112	161,768	6.4	[5]33,924	38,254	12.8
Tar	6,364	5,929	-6.8	2,905	2,924	0.7	96	...	...
Tar crudes[3]	7,182	(4)	(4)	4,519	(4)	(4)	285	(4)	(4)
Primary Crude products from Petroleum and Natural Gas	112,873	126,133	11.8	59,083	61,008	3.3	5,490	5,820	6.0
Synthetic organic chemicals total[2]	[5]159,259	174,502	9.6	[5]85,605	97,836	14.3	[5]28,053	32,434	15.6
Cyclic intermediates	[5]17,700	18,726	5.8	7,664	7,986	4.2	2,387	2,596	8.8
Dyes	256	264	3.2	250	255	1.8	620	690	11.2
Organic pigments	68	69	1.4	54	57	6.0	261	268	2.6
Medicinal chemicals	236	241	2.1	161	162	1.0	742	794	7.1
Flavor and perfume materials	129	150	16.7	111	108	3.1	195	207	6.0
Plastics and resin materials	[5]29,989	34,623	15.4	[5]25,050	29,799	19.0	[5]8,785	10,882	23.9
Rubber-processing chemicals	384	402	4.6	224	238	6.2	247	278	12.5
Elastomers (synthetic rubber)	5,386	5,813	7.9	3,710	4,177	12.6	1,529	1,940	26.9
Plasticizers	1,587	1,792	12.9	1,466	1,668	13.8	566	632	11.7
Surface-active agents	4,582	4,718	3.0	2,512	2,515	0.1	821	875	6.6
Pesticides and related products	1,364	1,388	1.7	1,193	1,263	5.9	2,410	2,808	16.5
Miscellaneous end-use chemicals and chemical products	[5]16,684	19,348	16.0	[5]10,101	10,855	7.5	[5]2,402	2,547	6.1
Miscellaneous cyclic and acyclic chemicals	[5]80,892	86,968	7.5	[5]33,110	38,753	17.0	[5]7,088	7,919	11.7

[1] Percentages calculated from figures rounded to thousands.
[2] Because of rounding, figures may not add to the totals shown.
[3] Estimated in part to avoid disclosing individual company operations.
[4] Not available.
[5] Revised.

SYNTHETIC ORGANIC CHEMICALS, 1977

GENERAL

In this report synthetic organic chemicals are classified on the basis of their principal use as follows: cyclic intermediates, dyes, organic pigments, medicinal chemicals, flavor and perfume materials, plastics and resin materials, rubber-processing materials, elastomers, plasticizers, surface-active agents, pesticides and related products, miscellaneous end-use chemicals and chemical products, and miscellaneous cyclic and acyclic chemicals. Most of these groups are further subdivided either by use or by chemical composition. As intermediate chemicals are used in the manufacture of finished products, aggregate figures that cover both intermediates and finished products necessarily include considerable duplication.

Total production of synthetic organic chemicals (intermediates and finished products combined) in 1977 was 174,502 million pounds or 9.6 percent more than the output of 159,259 million pounds reported for 1976 and 66.6 percent more than the output of 104,711 million pounds reported for 1967 (see table 2). Sales of synthetic organic chemicals in 1977 amounted to 97,834 million pounds, valued at $32,434 million, compared with 85,392 million pounds, valued at $27,888 million in 1976 and 55,177 million pounds, valued at $10,438 million in 1967. Production of all cyclic products (intermediates and finished products combined) in 1977 totaled 41,942 million pounds or 5.2 percent more than the 39,870 million pounds reported for 1976 and 25.3 percent more than the 33,479 million pounds reported for 1967, however, the transfer of several items, in 1976, from the cyclic intermediates section to the section on primary production from petroleum and natural gas has caused the output of cyclic products to appear much lower in relation to 1967 and 1976 than would otherwise have resulted. Production of all acyclic products in 1977 totaled 132,560 million pounds, or 10.8 percent more than the 119,692 million pounds reported for 1976 and 86.1 percent more than the 71,232 million pounds reported for 1967.

TABLE 2.--SYNTHETIC ORGANIC CHEMICALS: SUMMARY OF U.S. PRODUCTION AND SALES OF INTERMEDIATES AND FINISHED PRODUCTS, 1967, 1976, AND 1977

[Production and sales in thousands of pounds; sales value in thousands of dollars]

CHEMICAL	1967[1]	1976[2]	1977	Increase, or decrease (-): 1977 over 1967	Increase, or decrease (-): 1977 over 1976
				Percent	*Percent*
Organic chemicals, cyclic and acyclic, Grand total:					
Production	104,711,357	159,259,344	174,501,873	66.7	9.6
Sales	55,176,823	85,605,088	97,835,979	77.3	14.3
Sales value	10,438,453	28,053,140	32,434,301	210.7	15.6
Cyclic, total:					
Production	33,479,469	39,869,736	41,941,778	25.3	5.2
Sales	19,328,628	24,253,265	26,041,307	34.7	7.4
Sales value	4,610,293	12,433,093	14,170,157	207.4	14.0
Acyclic, total:					
Production	71,231,888	119,692,607	132,560,095	86.1	10.8
Sales	35,848,195	61,351,823	71,794,672	98.4	17.0
Sales value	5,828,160	15,620,047	18,264,144	208.4	16.9
1. *Cyclic Intermediates*					
Production	20,793,132	17,700,000	18,725,626	-9.9	5.8
Sales	9,461,180	7,663,691	7,985,790	-15.6	4.2
Sales value	1,000,359	2,386,993	2,596,627	159.6	8.8
2. *Dyes*					
Production	206,240	256,250	264,369	28.2	3.2
Sales	198,592	249,887	254,516	28.1	1.8
Sales value	332,049	620,294	689,992	107.8	11.2
3. *Organic Pigments*					
Production	53,322	67,727	68,707	28.8	1.4
Sales	42,867	54,211	57,434	34.0	6.0
Sales value	108,354	261,089	267,747	147.1	2.6
4. *Medicinal Chemicals*					
Cyclic:					
Production	110,129	136,374	153,922	39.8	12.9
Sales	70,120	79,581	83,586	19.2	5.0
Sales value	348,873	642,829	718,392	105.9	11.8
Acyclic:					
Production	69,941	99,431	86,811	24.1	-12.7
Sales	56,804	81,253	78,798	38.7	-3.0
Sales value	36,402	98,692	75,626	107.8	-23.4

See footnotes at end of table.

TABLE 2.--SYNTHETIC ORGANIC CHEMICALS: SUMMARY OF U.S. PRODUCTION AND SALES OF INTERMEDIATES AND FINISHED PRODUCTS, 1967, 1976, AND 1977--CONTINUED

[Production and sales in thousands of pounds; sales value in thousands of dollars]

CHEMICAL	1967[1]	1976[2]	1977	Increase, or decrease (-) 1977 over 1967	1977 over 1976
5. Flavor and Perfume Materials				*Percent*	*Percent*
Cyclic:					
Production	57,978	55,090	58,452	0.8	6.1
Sales	47,285	48,503	46,809	-1.0	-3.5
Sales value	52,866	125,479	134,628	154.7	7.3
Acyclic:					
Production	53,558	73,756	91,964	71.7	24.7
Sales	49,311	62,445	60,756	23.2	-2.7
Sales value	40,495	69,843	72,473	79.0	3.7
6. Plastics and Resin Materials					
Cyclic:					
Production	5,033,497	9,252,262	10,802,389	114.6	16.8
Sales	4,224,121	7,898,224	9,444,644	123.6	19.6
Sales value	1,036,940	3,278,777	4,275,111	312.3	30.4
Acyclic:					
Production	8,759,452	20,737,169	23,820,652	171.9	14.8
Sales	7,753,242	17,151,982	20,354,360	162.5	18.7
Sales value	1,635,690	5,505,923	6,606,712	303.9	20.0
7. Rubber-Processing Chemicals					
Cyclic:					
Production	220,139	334,735	335,549	61.5	6.2
Sales	169,970	186,393	202,251	19.0	8.5
Sales value	116,318	218,263	243,756	113.9	14.0
Acyclic:					
Production	43,994	49,688	46,464	5.6	-6.5
Sales	30,878	37,879	35,833	16.0	-5.4
Sales value	15,477	28,594	29,009	87.4	1.4
8. Elastomers (Synthetic Rubber)					
Cyclic:					
Production	2,297,637	3,146,083	3,449,123	50.1	9.6
Sales	1,940,099	1,970,636	2,157,680	11.2	9.5
Sales value	439,530	560,386	760,128	72.9	35.6
Acyclic:					
Production	1,524,908	2,239,717	2,364,113	55.0	5.6
Sales	1,321,945	1,739,501	2,019,749	52.8	16.1
Sales value	434,657	968,676	1,180,132	171.5	21.8
9. Plasticizers					
Cyclic:					
Production	929,871	1,185,909	1,407,084	51.3	18.6
Sales	865,084	1,110,869	1,390,319	60.7	25.2
Sales value	167,827	360,453	474,781	182.9	31.2
Acyclic:					
Production	332,908	401,525	384,956	15.6	-4.1
Sales	296,767	354,842	277,308	-6.6	-21.8
Sales value	93,142	205,812	157,549	69.1	-23.4
10. Surface-Active Agents					
Cyclic:[3]					
Production	1,418,444	2,312,728	989,564	-30.2	-57.2
Sales	852,238	1,393,489	469,432	-44.9	-66.3
Sales value	95,810	319,422	200,244	109.0	-37.3
Acyclic:					
Production	2,060,851	2,269,670	3,728,608	80.9	64.3
Sales	897,786	1,118,596	2,045,151	127.8	82.3
Sales value	220,877	501,818	674,778	205.5	34.5

See footnotes at end of table.

TABLE 2.--SYNTHETIC ORGANIC CHEMICALS: SUMMARY OF U.S. PRODUCTION AND SALES OF INTERMEDIATES AND FINISHED PRODUCTS, 1967, 1976, AND 1977--CONTINUED

[Production and sales in thousands of pounds; sales value in thousands of dollars]

CHEMICAL	1967[1]	1976[2]	1977	Increase, or decrease (-) 1977 over 1967	1977 over 1976
11. Pesticides and Related Products				*Percent*	*Percent*
Cyclic:					
Production	823,158	940,263	829,537	0.8	-11.8
Sales	681,532	838,814	691,136	1.4	-17.6
Sales value	627,742	1,843,896	1,664,008	161.9	-9.8
Acyclic:					
Production	226,505	424,128	557,982	146.3	31.6
Sales	215,831	353,790	571,821	164.9	61.6
Sales value	159,301	566,238	1,144,265	618.3	102.1
12. Miscellaneous End-Use Chemicals and Chemical Products[4]					
Cyclic:					
Production	(1,535,922)	2,265,262	2,761,320	...	21.9
Sales	(775,540)	1,739,863	2,213,649	...	27.2
Sales value	(283,575)	1,180,206	1,479,800	...	25.4
Acyclic:					
Production	(58,159,771)	14,419,646	16,586,612	...	15.0
Sales	(25,225,631)	8,360,847	8,641,594	...	3.4
Sales value	(3,192,119)	1,221,726	1,067,681	...	-12.6
13. Miscellaneous Cyclic and Acyclic Chemicals[4]					
Cyclic:					
Production	...	2,214,054	2,076,136	...	-6.2
Sales	...	1,019,104	1,044,011	...	2.4
Sales value	...	635,006	659,943	...	3.9
Acyclic:					
Production	...	78,677,877	84,891,933	...	7.9
Sales	...	32,090,688	37,709,300	...	17.5
Sales value	...	6,452,725	7,255,919	...	12.4

1 Standard reference base period for Federal Government general-purpose index numbers.
2 Data revised for plastics and resin materials, intermediates (production only), and for the miscellaneous sections.
3 Includes ligninsulfonates.
4 Items in these two sections were previously included in the section named miscellaneous chemicals.

The following tabulation shows, by chemical groups, the number of companies that reported production in 1976 of one or more of the chemicals included in the groups listed in table 2:

Chemical group	*Number of companies*
Cyclic intermediates	172
Dyes	42
Organic pigments	36
Medicinal chemicals	95
Flavor and perfume materials	44
Plastics and resin materials	251
Rubber-processing chemicals	28
Elastomers (synthetic rubber)	35
Plasticizers	55
Surface-active agents	169
Pesticides and related products	86
Miscellaneous end-use chemicals and chemical products	133
Miscellaneous cyclic and acyclic chemicals	252

Synthetic Organic Chemicals From Coal

John J. Gersic

The bulk of synthetic organic chemicals is currently made from petroleum or natural gas. In the past, however, the synthetic organic chemical industry was actually based on coal and remained so until after World War II when petroleum became relatively abundant and economical due, principally, to the discovery of the large oil fields in the Middle East. Now, coal derivatives are being increasingly studied as feedstocks for synthetic organic chemicals because shortages in petroleum and natural gas feedstocks are possible in the future.

This new interest in coal is resulting in old processes being restudied as well as new methods being developed. Some of the new methods are related to the renewed activity in processes to convert coal into other fuels such as synthetic crude oil and synthetic natural gas. In addition to use as fuels, these materials may also be used as synthetic organic chemical feedstocks. Further, methanol, made from coal for use as a fuel, can also be used as a feedstock to make other synthetic organic chemicals such as plastics.

This paper discusses the manufacturing processes for chemicals from coal and then some of the recent developments in this area. The paper will also address European and U.S. interests and support for coal-chemicals research, and the economics of coal versus natural gas and petroleum for chemical sources.

Chemicals from coal

It has been estimated that about one-quarter of a million chemical compounds can be obtained from coal or derived from its distillates. 1/ In the traditional coke-oven process, the principal sources of chemicals are coke-oven gas and coal tar (while the main product, coke, goes into the production of iron and steel). The main components of these two coke-oven byproducts are ammonia, pyridine bases, light oils, medium oils, and heavy oils.

The coke-oven byproducts have been the sources of many chemicals. The pyridine bases may be refined to obtain pyridine, picolines, and lutidines. The light oils, obtained from both the coke-oven gas and the coal tar, are the primary source of the major aromatics, such as benzene, toluene and xylenes. The middle oils, obtained from the coal tar, can be refined into phenol, cresols, and naphthalene. Obtainable from the heavy oils from coal are anthracene, acenaphthene, phenanthrene, pyrene, and chrysene.

1/ *Chemtech*, October 1975, p. 260.

Although these chemicals are typical products of the usual coke-oven process (requiring a temperature of at least 900° C), others are possible depending upon the temperature of the coking operation. At temperatures below about 700° C, for example, the liquid products are mainly paraffinic rather than cyclic in structure.

Additional variables in the production of chemicals from coal include the type of coal used, oven design, timing of the coking cycle, and the severity of the distillation of the resulting coal tar. Thus, there can be much variation in the quantity, quality, and type of chemicals obtained as coking byproducts. Of particular concern are high manufacturing costs, sulfur content problems, and the increasing tendency of producers of light oils to sell these oils to petroleum refineries, which process them along with their petroleum fractions. However, this does not mean that the traditional coke-oven processes will be entirely replaced.

Most coke-ovens are built today to provide metallurgical coke, much of which is used in blast furnaces for iron and steel production. And, although the consumption of coke per ton of metal produced is decreasing because of the use of supplemental fuels which displace coal in blast furnaces, and other advancements in technology, steel production is expected to continue to increase. It can, therefore, be concluded that the byproduct chemicals from coke-oven operations may be prevalent for some time to come. The challenge is to improve the traditional processes and develop new ones so that improved quantity and quality of chemicals result without sacrifices to the coke characteristics.

Review of recent developments in chemicals from coal research and development

Many of the proposed and demonstrated new processes to obtain chemicals from coal are closely tied to the research to change coal into another fuel. In the ordinary burning of coal for fuel, it pollutes the atmosphere and leaves an ash which is dirty and difficult to dispose of. Therefore, chemicals from coal research may receive indirect help from the research expenditures on processes to convert coal into other fuels such as synthetic natural gas, methanol, and synthetic crude.

Coal can be converted into synthesis gas, which is a mixture of carbon monoxide and hydrogen. This synthesis gas is almost completely convertible into chemical products, particularly methanol or ammonia, without the production of any fuel byproducts. Although the production processes to make these two chemicals from synthesis gas are well established, it is possible that olefins (now the major-tonnage chemicals from petroleum), can also be produced from synthesis gas in future years. For, example, possible methods would include:

- steam cracking of hydrocarbons obtained from a Fischer-Tropsch reaction using synthesis gas; 1/

- the dehydration of alcohols from methanol homologation to ethanol and propanol and the dehydration of ethanol to ethylene and propanol to propylene; 2/

- the dehydration of linear primary alchohols from a Fischer-Tropsch reaction; 3/

- the cracking of methyl ether made from methanol which was in turn made from synthesis gas. 4/

The most promising routes to the olefins from coal appear to be those involving methanol as an intermediate. 5/

Another possibility for the manufacture of chemicals from coal is through the liquefaction of coal. Those processes under development include COED (Char Oil Energy Development Process), Garret Flash Pyrolysis Process, Toscoal (Toscoal Low Temperature Pyrolysis Process), Lurgi/Ruhr Gas Flash Carbonization Process, and the Lurgi Pressure-gasification Process. 6/ Indeed, the currently-practiced coke-oven operations are examples of coal liquefaction by pyrolysis.

Coal liquefaction can also be accomplished by hydrogenation. In this process, coal is treated with hydrogen while in liquid suspension, whereas in pyrolysis the coal is destructively distilled. The hydrogenation processes in general are versatile and can produce natural gas, paraffins of low-molecular weight, synthetic crude oil, and heavy fuel oils. Process variations have been developed by Hydrocarbon Research, Inc., U.S. Department of Energy, Gulf Oil Co., Consolidated Coal Co., and Exxon Co.

In summary, coal can be gasified into synthesis gas or liquefied or pyrolyzed into liquids. The synthesis gas can be used to produce olefins and chemicals now made from natural gas. Coal liquids, on the other hand, are a rich source of cyclic organic chemicals. It does not appear to be economically feasible to make cyclic chemicals from synthesis gas or olefins from coal liquids. 7/

1/ Chem Systems Inc., Chemicals From Coal and Shale: An R&D Analysis for National Science Foundation, June 1975, p. 178.
2/ Ibid., p. 193.
3/ Ibid., p. 202.
4/ Ibid., p. 212.
5/ Ibid., p. 218.
6/ Ibid., p. 229.
7/ Ibid., p. 136.

European developments in coal processing

Because of relatively abundant supplies of domestic coal, Europe has kept abreast of the world's latest coal technology developments. During World War II coal provided the base for significant quantities not only of chemicals but of fuels as well, and historically, coal has played an important role in the European dye industry. The large scale development of acetylene chemistry in Europe is but another indication of that area's reliance on coal.

The United Kingdom is a leading coal producing nation. Much research on chemicals from coal has been carried out by organizations such as the British Steel Corp., the National Coal Board (NCB), and Coalite and Chemicals Ltd.

West Germany is also a leading coal producing nation and is noted worldwide for its coal research. The Bituminous Coal Mining Association in Essen, with a staff of 1,000 employees, remains the single largest coal research laboratory in the free world. 1/

A large part of the current European capacity for chemicals from coal is based on the usual coke-oven technology. However, as the production of synthetic natural gas from coal increases, the availability of coal liquids should increase dramatically. It is possible that this could cause the reintroduction of technology used during World War II to produce various products from these liquids. 2/ Also on the drawing board is a large coal complex in which the NCB has an interest that will use a combination of old and new technologies.

NCB is currently involved in the study of the extraction of chemicals from coal using solvents in their supercritical gaseous state. 3/ The chemicals recovered are mainly cyclic organic chemicals; the yield is reportedly as high as 35 to 40 percent of the coal feed. 3/ The recovered chemicals could be used as a feedstock or a substitute oil refinery fraction. NCB personnel are discussing the process with Royal Dutch/Shell scientists. Such discussion fits in with NCB's belief that the optimum site for a supercritical gas extraction plant would be next to both a coal mine and an oil refinery.

The breadth and depth of coal research in the United Kingdom is indicative of a country where the coal industry has been nationalized and is important to the country. Similar programs, though smaller, exist in France which also has a nationalized coal sector. However, even in those countries such as the United States and West Germany where the coal industry is still in private hands, much of the coal research and development is or soon will be funded by the respective governments. 1/ This interest of the governments should insure the long term availability of coal R.& D. funds.

1/ Organization for Economic Co-operation and Development, Energy R&D, 1975, p. 139.
2/ Oil and Gas Journal, Dec. 8, 1975, p. 84.
3/ Chemical and Engineering News, June 19, 1978, p. 10.

Coal versus petroleum and natural gas

As indicated previously, petroleum and natural gas are now the primary feedstocks for synthetic organic chemicals production. This situation prevails because petroleum and natural gas (especially in the United States) are readily available and low priced; in addition, both can be easily transported and stored. The result of this dependence is a worldwide network of facilities specifically designed to use petroleum and natural gas feedstocks. In some cases these facilities are so sensitive that even a change in sources of petroleum feedstocks can cause an increase in operating cost. Obviously then, essentially entirely new facilities would be needed to process entirely new feedstocks. The new investment that would be required is one of the drawbacks to a synthetic organic chemicals industry based on coal.

A recent study quantifies the increased investment cost. 1/ It indicates that a 100 million cubic feet per day hydrogen plant based on natural gas would require an investment of $145 million, whereas the same plant based on coal would be $298 million. 2/ In the case of an ammonia plant the same trend is observed. It would cost $307 million based on natural gas, $435 million based on residual oil and $482 million based on coal. 2/ The investments needed for methanol and synthesis gas plants follow the same pattern.

Obviously, chemical plants based on coal as a feedstock are not now competitive with those based on natural gas or petroleum. Estimates vary as to how high prices of the current petroleum feedstocks would have to rise before coal based plants would be competitive. A wellhead price of about $3.00 per million Btu's for natural gas (equivalent to about $18 per barrel of crude petroleum) appears reasonable, however. 3/ Based on current indications, such a natural gas price may be reached by the mid-1980's based on the proposed oil pricing scheme outlined in The National Energy Plan. 4/

Spokesmen for the chemical industry argue that the economy would benefit the greatest from the use of coal as fuel rather than a synthetic organic chemical feedstock. 5/ This argument does not mean that byproduct chemicals from processes using coal as a fuel would be ignored. It does mean that petroleum and natural gas would continue to be the preferred synthetic organic chemicals feedstocks; therefore on-purpose coal-to-chemicals plants should not be built at this time. 5/

1/ Chemical Week, May 10, 1978, p. 62.
2/ Ibid., p. 64.
3/ Hydrocarbon Processing, Mar. 11, 1977, p. 15.
4/ Executive Office of the President, Energy and Policy Planning, The National Energy Plan, Apr. 29, 1977.
5/ Chemical Week, May 10, 1978, p. 64.

Tar

Janet L. Dietzman

Coal tar is produced chiefly by the steel industry as a byproduct of the manufacture of coke; water-gas tar and oil-gas tar are produced by the fuel-gas industry. Production of coal tar, therefore, depends on the demand for steel; production of water-gas tar and oil-gas tar reflects the consumption of manufactured gas for industrial and household use. Water-gas and oil-gas tars have properties intermediate between those of petroleum asphalts and coal tar. Petroleum asphalts are not usually considered to be raw materials for chemicals.

The quantity of coal tar produced in the United States in 1977 amounted to 593 million gallons (see table 1). Production in 1977 was 6.8 percent less than the 636 million gallons of coal tar produced in 1976. Sales of coal tar in 1977 amounted to 292 million gallons compared with 291 million gallons in 1976. U.S. production of water-gas and oil-gas tars was not reported to the Commission for 1976 or 1977; production of these tars in 1968 amounted to 21 million gallons, according to trade publications.

Tar Crudes

Tar crudes are obtained from coke-oven gas and by distilling coal tar, water-gas tar, and oil-gas tar. The most important tar crudes are benzene, toluene, xylene, creosote oil, and pitch of tar. Some of these products are identical with those obtained from petroleum. Data for materials obtained from petroleum are included, for the most part, with the statistics for like materials obtained from coke-oven gas and tars, and are shown in tables 1 and 1B.

Domestic production of industrial and specification grades of benzene reported by coke-oven operators and petroleum refinery operators in 1977 amounted to 1,435 million gallons--0.7 percent more than the 1,425 million gallons reported for 1976. These statistics include data for benzene produced from light oil and petroleum. Sales of benzene by coke-oven operators and petroleum refiners in 1977 amounted to 659 million gallons compared with 637 million gallons in 1976. In 1977 the output of toluene (including material produced for use in blending in aviation fuel) amounted to 1,018 million gallons--1.9 percent more than the 999 million gallons reported for 1976. Sales of toluene (Nitration grade, 1°) in 1977 were 396 million gallons compared with 534 million gallons in 1976. The output of xylene in 1977 (including that produced for blending in motor fuels) was 811 million gallons, compared with 722 million gallons in 1976. Over 99 percent of the 811 million gallons of xylene produced in 1977 was obtained from petroleum sources.

Production and sales figures on crude naphthalene from coal-tar oils in 1977 could not be published without disclosing the operations of individual companies. Production of petroleum-derived naphthalene in 1977 amounted to 151 million pounds, compared with 260 million pounds[1] in 1976. Production figures on road tar for 1977 cannot be published; in 1972 production amounted to 30 million gallons.

Some of the products obtained from tar and included in the statistics in table 1 are obtained from other products for which data are also included in the table. The statistics, therefore, involve considerable duplication, and for this reason no group totals or grand totals are given.

Data for 1977 tar crudes were supplied by 11 companies and company divisions.

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[1] Revised figure for 1976.

TABLE 1.--TAR AND TAR CRUDES: U.S. PRODUCTION AND SALES, 1977

[Listed below are all tar crudes for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists separately all products for which data on production and/or sales were reported and identifies the manufacturers of each]

TAR AND TAR CRUDES	UNIT OF QUANTITY	PRODUCTION	SALES: QUANTITY	SALES: VALUE	SALES: UNIT VALUE[1]
				1,000 dollars	
Coal tar:[2] Coke-oven operators	1,000 gal	592,935	292,393	...	...
Crude light oil:[3] Coke-oven operators	1,000 gal	178,420	94,226	...	...
Light-oil distillates:					
Benzene, all grades, total[4]	1,000 gal	1,435,747	658,535	504,272	$0.77
Coke-oven operators	1,000 gal	64,571	64,851	[5]53,081	.82
Petroleum refiners[6]	1,000 gal	1,371,176	593,684	451,191	.76
Toluene, all grades, total[4]	1,000 gal	1,017,546	456,841	253,260	.55
Coke-oven operators	1,000 gal	9,618	9,483	[5]6,023	.64
Petroleum refiners	1,000 gal	1,007,928	[7]447,358	[7]247,237	.55
Xylene, all grades, total[4]	1,000 gal	811,055	426,273	219,128	.51
Coke-oven operators	1,000 gal	1,706	1,872	[5]1,180	.63
Petroleum refiners	1,000 gal	809,349	424,401	217,948	.51
Solvent naphtha:[3]					
Coke-oven operators	1,000 gal	1,628	1,539	...	...
Crude tar-acid oils:[3]					
Coke-oven operators	1,000 gal	3,366	3,355	...	...
Creosote oil (Dead oil) (tar distillers)[8] (100% creosote basis), total	1,000 gal	83,052	60,654	...	...
Distillate as such (100% creosote basis)	1,000 gal	47,033	35,418	20,685	.58
Creosote content of coal tar solution (100% creosote basis)	1,000 gal	36,019	25,236	([9])	([9])
Tar, refined, for uses other than road tar	1,000 gal	21,251	15,178	9,277	.61
Pitch of tar (tar distillers)[8], total	1,000 tons	815	743	97,663	131.44
Hard (water softening point above 160° F)	1,000 tons	622	557	73,008	131.07
Other[10]	1,000 tons	193	186	24,655	132.55

[1] Unit value per gallon or ton as specified.

[2] Includes only data for coal tar reported to the Office of Energy Data and Interpretation, Energy Information Administration, Department of Energy (Energy Data Reports, Coke & Coal Chemicals, March 22, 1978). At date of publication, sales value for coal tar was not available. Data on U.S. production of water-gas tar and oil-gas tar are not collected by the U.S. International Trade Commission, but according to trade publications, production of these tars amounted to 21 million gallons in 1968.

[3] Data reported by tar distillers are not included because publication would disclose the operations of individual companies. At date of publication, sales value for coke-oven operators was not available.

[4] Includes data for material produced for use in blending motor fuels. The annual production statistics for petroleum refiners on benzene, toluene, and xylene are not comparable with the combined monthly production figures because of fiscal year revisions.

[5] Sales value figures are estimated from Energy Data Reports, Coke & Coal Chemicals, monthly, December 1, 1977 thru March 22, 1978, and Mineral Industries Surveys, Coke and Coal Chemicals, monthly, March 25, 1977 thru September 15, 1977.

[6] Benzene, specification grades (1°, 2°) only.

[7] Toluene, specification grades (1°, 2°) only.

[8] Data from coke-oven operators was unavailable at time of publication.

[9] In 1977, production of coal-tar solution containing creosote (100% solution basis) amounted to 49,514 thousand gallons; sales were 32,845 thousand gallons, valued at 17,941 thousand dollars, with a unit value of $0.55 per gallon.

Footnotes--Continued

[10] Includes pitch emulsion, medium and soft pitch.

Note 1.--Statistics for materials produced in coke and gas-retort ovens are compiled by the Office of Energy Data and Interpretation, Energy Information Administration, Department of Energy. Statistics for materials produced in tar and petroleum refineries are compiled by the U.S. International Trade Commission.

Note 2.--Data for all other tars and tar crudes are not included in 1977 report because publication would disclose the operation of individual companies. Preliminary coke-oven operators data was obtained from cumulative totals reported in Energy Data Reports, Coke and Coal Chemicals, March 22, 1978, as the annual publication data was not available to include in this report.

TABLE 1A.--TAR: U.S. PRODUCTION AND CONSUMPTION, 1976 AND 1977

(In thousands of gallons)

TAR	1976	1977
PRODUCTION		
Coal tar from coke-oven byproduct plants, total[1]	636,382	592,935
CONSUMPTION		
Total	604,376	(2)
Tar consumed by distillation, total	433,747	(2)
Coal tar distilled or topped by coke-oven operators[1]	163,051	(2)
Coal tar and oil-gas tar distilled by tar distillers[3]	270,696	275,287
Tar consumed by the producers chiefly as fuel[1]	165,169	(2)
Coal tar consumed at coke-oven plants in miscellaneous uses[1]	5,460	(2)

[1] Reported to the Office of Energy Data Interpretation, Energy Information Administration, Department of Energy.
[2] Department of Energy data were not available at time of publication.
[3] Reported to the U.S. International Trade Commission. Represents tar purchased from companies operating include tar consumed other than by distillation by tar distillers.

TABLE 1B.--TAR AND TAR CRUDES: SUMMARY OF U.S. PRODUCTION OF SPECIFIED PRODUCTS, 1967, 1976, AND 1977

TAR AND TAR CRUDES	UNIT OF QUANTITY	1967[1]	1976	1977	INCREASED, OR DECREASED (-) 1977 OVER 1967	1977 OVER 1976
					Percent	*Percent*
Coal tar[2]	1,000 gal	780,334	636,382	592,935	-24.0	-6.8
Benzene:[3]						
Coke-oven operators	1,000 gal	90,642	60,411	64,571	-28.8	6.9
Petroleum refiners	1,000 gal	878,704	1,364,811	1,371,176	56.1	0.5
Total	1,000 gal	969,346	1,425,222	1,435,747	48.1	0.7
Toluene:[3]						
Coke-oven operators	1,000 gal	19,357	8,824	9,618	-50.3	9.0
Petroleum refiners	1,000 gal	[4]624,454	990,152	1,007,928	61.4	1.8
Total	1,000 gal	643,811	998,976	1,017,546	58.1	1.9
Xylene:[3]						
Coke-oven operators	1,000 gal	5,488	1,496	1,706	-68.9	14.0
Petroleum refiners	1,000 gal	[4]449,349	720,518	809,349	80.1	12.3
Total	1,000 gal	454,837	722,014	811,055	78.3	12.3
Naphthalene:						
Crude[5]	1,000 lb	520,991	([6])	([6])	([6])	([6])
Petroleum naphthalene, all grades	1,000 lb	376,679	107,191	150,737	-60.0	40.6
Total	1,000 lb	897,670	([6])	([6])	([6])	([6])
Creosote oil (Dead oil):[7]						
Distillate as such (100% creosote basis)	1,000 gal	108,832	77,126	[8]47,033	([9])	([9])
Creosote content of coal tar solution (100% creosote basis)	1,000 gal	17,402	36,841	[8]36,019	([9])	([9])
Total	1,000 gal	126,234	113,967	[8]83,052	([9])	([9])

[1] Standard reference base period for Federal Government general-purpose index numbers.
[2] Includes only data for coal tar reported to the office of Energy Data and Interpretation, Energy Information Administration, Department of Energy.
[3] Data reported by tar distillers are not included because publication would disclose the operations of individual companies.
[4] Includes data for material produced for use in blending motor fuels. Statistics are not comparable with monthly figures which include some o-xylene.
[5] Naphthalene solidifying at less than 79°C. Figures include production by tar distillers and coke-oven operators and represent combined data for the commercial grades of naphthalene. Because of conversion between grades, the figures may include some duplication. Statistics on naphthalene refined from domestic crudes are reported in the section on "cyclic intermediates."
[6] Statistics for 1976 and 1977 cannot be published; to do so would disclose the operations of individual companies.
[7] Includes data for creosote oil produced by tar distillers and coke-oven operators and used only in wood preserving.
[8] Includes data for creosote oil produced by tar distillers only in wood preserving.
[9] Comparison not possible because 1977 data from the Department of Energy was not available at time of publication for inclusion in report.

TABLE 2.--TAR CRUDES FOR WHICH U.S. PRODUCTION OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURERS, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3]

TAR CRUDES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Light-oil distillates:	
Ethylbenzene	KPT.
*Solvent naphtha[1]	NEV.
Pyridine, crude bases	KPT.
Naphthalene, crude, solidifying at:	
Less than 74° C	COP.
74° C. to less than 79° C.:	
74° C. to less than 76° C	ASC, KPT.
76° C. to less than 79° C	ASC, KPT.
Methylnaphthalene	KPT.
*Crude tar-acid oils:[1]	
Tar-acid content 5% to less than 24%	KPT.
Tar-acid content 24% to 50%	ASC.
Cresylic acid, crude	KPT, PRD.
*Creosote oil (Dead oil):	
*Distillate as such	ASC, CBT, COP, HUS, KPT, RIL, WTC.
*Creosote in coal tar solution	ASC, KPT, RIL, WTC.
All other distillate products:	
Carbon black oil	KPT.
Creosote tar acid oil	KPT.
Crude coal tar solvent	KPT.
Crude tetralin	KPT.
Priming and refractory oil	KPT.
50° to 60° residue oil	WTC.
All other	ASC, KPT.
Tar, road	KPT, RIL.
Tar for other uses:	
Crude	RIL.
*Refined	ASC, KPT, RIL.
*Pitch of tar:	
Soft (water softening point less than 110° F.)	ASC, KPT.
Medium (water softening point 110° F. to 160° F.)	ASC, COP, KPT, RIL.
*Hard (water softening point above 160° F.)	ASC, KPT, RIL, WTC.
Pitch emulsion	JEN.
Refined anthracene	ASC.

[1] Does not include manufacturers' identification codes for producers who report to the Office of Energy Data and Interpretation, Energy Information Administration, Department of Energy. Those producers are listed in the U.S. Bureau of Mines Mineral Industry Survey, Nov. 6, 1976, entitled "Coke Producers in the U.S. in 1976."

TABLE 3.--TAR AND TAR CRUDES: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of tar and tar crudes to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ASC	Allied Chemical Corp., Semet-Solvay Div.	KPT	Koppers Co., Inc. & Roads Materials Div.
CBT	Samuel Cabot, Inc.	NEV	Neville Chemical Co.
COP	Coopers Creek Chemical Corp.	PRD	Ferro Corp., Productol Chemical Div.
HUS	Husky Industries, Inc.	RIL	Reilly Tar & Chemical Corp.
JEN	Jennison-Wright Corp.	WTC	Witco Chemical Corp.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

SECTION II -- PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION

Free World Prospects for Olefins and Aromatics

Louis DeToro

Overview

Ethylene and propylene (olefins) and benzene, toluene, and xylene (aromatics) are petrochemicals of exceeding commercial importance. The olefins and aromatics are the "building blocks" for most of the synthetic organic chemicals covered in the Commission's report. These petrochemicals are the source of chemical intermediates, plastics, synthetic fibers, pesticides, detergents, and other products. In the 1976 edition of Synthetic Organic Chemicals, United States Production and Sales, the production total for these five commodities amounted to approximately 50 percent (by weight) of the primary products from petroleum and natural gas.

Because of lower feedstock costs and other factors, the United States has maintained a competitive edge in exports of petrochemicals in recent years. The President's National Energy Plan (NEP), should it meet the approval of the Congress, will increase the domestic cost of petroleum and natural gas, and probably erase at least some of the United States' competitive edge. 1/ The NEP cost effect is one of several factors which may affect the future price of U.S. petrochemicals and thus the volume of domestic exports.

Major petrochemical buildups are occurring throughout the free world and in Communist-dominated areas. These buildups may serve to dampen U.S. export prospects. Data on the potential for trade, and on existing capacity and production, is relatively scarce for the Communist bloc countries. Because of the scarcity of data on petrochemical markets in these nations, data in this paper are restricted to the free world. It is reported, however, that some Communist countries (notably the U.S.S.R., Communist China, Rumania, and Yugoslavia) are spending foreign exchange in efforts to increase petrochemical capacities. The U.S.S.R., for one, has definite plans to increase its aromatics trade in world markets. 2/ However, the most noteworthy buildups which could affect U.S. export markets are in Mexico, Canada, the Middle East, and Africa.

1/ An example of the prospective effect of the NEP on "building block" prices is given in "Energy Program to Hurt Petrochemical Market," C&EN, May 23, 1977. The price of benzene from all sources could rise from 85 cents/gallon to $1.40/gallon with the enactment of the National Energy Plan price policy for feedstocks, according to a consultant specializing in forecasts for petrochemicals.

2/ Technip, of France, will market Russian aromatics. See Oil and Gas Journal, Oct. 10, 1977, pp. 86 and 91.

The Canadians are planning ethylene and aromatics projects in the Provinces of Ontario and Alberta. 1/ Because of the close proximity to the United States, the output from these plants is expected to impact U.S. markets. Plans for olefins and aromatics projects in OPEC countries (Saudi Arabia in particular) and by Mexico's state-controlled petroleum company (Pemex) also threaten to exacerbate the decline in the United States's competitive edge. 2/

As of 1977, most of the free world's existing capacity in olefins and aromatics was concentrated in North America and Western Europe (table A). Free world construction plans show large olefins and aromatic buildups all over the world (table B). The figures shown in table A represents relative magnitudes of existing capacities in the free world and table B represents likely or planned projects through 1985. 3/ Because of the uncertainties involved in compiling such statistics, these figures can not be exact; but they are nonetheless representative of free world capacities and construction in coming years for the olefins and aromatics.

The U.S. International Trade Commission estimates of planned construction based on published data were made with a relatively optimistic view towards a stable and healthy world economy and growing petrochemicals demand in the free world. Toluene and mixed xylenes were excluded and replaced by ortho and para-xylene isomer figures because of the difficulty in isolating capacities or construction data for these primary aromatics, both of which are coproducts in refinery streams.

In line with burgeoning petrochemical buildups overseas, and rising U.S. feed stock costs (as discussed above), and with increased purchasing power in developing lands, world trade patterns should begin to shift slightly. Although most consumption should still occur in developed areas, trade among developing areas in the Middle East, Africa, and the Far East will begin. A weaker dollar could moderate the loss in U.S. exports of derivative petrochemicals; however, an ironic balancing effect could occur should the enactment of the NEP bolster the dollar, and thereby further weaken U.S. export competitiveness in petrochemicals.

1/ "Slower Demand Growth Seen for Olefins," the Oil and Gas Journal, May 16, 1977, p. 50.

2/ Argentina, Brazil, Canada, India, Kuwait, Qatar, Rumania, South Korea, Spain, Yugoslavia, and the European Community (EEC) are a few other areas where petrochemical projects are blossoming.

3/ These data are estimates based upon several published sources. In general, the published numbers herein are compromises of divergent data with a bias toward the higher of the published figures.

Olefins and aromatics prices to 1985 are expected to resemble the pattern which occurred prior to 1973. 1/ In those years, a moderate decline in prices was the rule. The reason for this return to an old pattern is that a free world oversupply of the basic petrochemical building blocks is likely to exist. New capacities coming on line indicate rising supplies, while demand growth is seen as moderating to a certain extent. Although prices rose dramatically after 1973, following a long period of decline, the situation regarding supply and demand balance has already shifted in major producing-consuming areas.

U.S. prospects

U.S. ethylene forecasters as late as 1974 were concerned over a supply shortfall for the remainder of the 1970's. 2/ When the world economy went into a recession in 1974 and 1975, chemical economic forecasters made a sharp adjustment. Forecasts of demand growth were scaled down until they began to fall short of existing U.S. capacities. Forecasters now see a prospective oversupply into the next decade.

Ethylene supply in the United States is currently rising at about 7 percent per year, while demand is slowing down in line with a decreased growth rate in the U.S. gross national product. The expected oversupply situation is due to several factors; among these factors are maturing domestic derivatives markets, new developments in ethylene production technology, and declining derivatives export markets. 3/

U.S. propylene prospects call for higher demand growth rates than those for ethylene. Gulf Oil Chemicals has forecasted growth rates as high as 11 percent per year for 1976-80 and over 8 percent from 1980 to 1985, with domestic production and consumption in balance. 4/ More recent forecasts call for less rapid growth, although still at higher levels than projected for ethylene demand. Likely new target rates for demand growth are near 9 percent per year through 1980 and between 6 and 8 percent per year from 1980 to 1985. Supply projections indicate a balance between production and consumption throughout the period. 5/

1/ "Petrochemical Panel Forecasts Soft Prices and Surplus Supply in Basic Olefins and Aromatics," CMR, Nov. 14, 1977.
2/ "Ethylene Oversupply Could Last Until 1980," C&EN, Apr. 14, 1977.
3/ "Ethylene Growth Slips," CMR, Feb. 6, 1978.
4/ "Propylene Supply Tightens, Prices Rise," C&EN, Sept. 13, 1976.
5/ Various sources; see for example "Slower Demand Growth Seen for Olefins," Oil and Gas Journal, May 16, 1977, p. 50.

For aromatics in the United States, the outlook is one of abundant supply. 1/ A principal consideration in aromatics markets is the use of these products as replacements for lead to raise octane values of gasoline to acceptable levels. 1/

In the U.S. benzene market, demand is expected to grow at 6 plus percent per year through 1985. 2/ This represent a considerable reduction from previous estimates of consumption growth rates. According to one petrochemical company official, there is a need for only 100 million gallons of annual new effective capacity to cover demand into the early 1980's. 1/

U.S. toluene usage for chemcials is likely to increase, but only at a rate of 4.5 percent per year. 1/ The ratio between the value of toluene for chemicals and its value for gasoline could rise to 1.75 from the rule-of-thumb figure of 1.5 which has characterized the past. The demand growth for xylenes in the U.S. has stabilized since the middle 70's. Forecasts for 1978 consumption center on 1,150 million gallons. Sales growth has moderated in recent years.

Market prospects for major free world producers

In Western Europe, the future has been called "dim" for olefins and aromatics markets, especially in the EEC. 3/ Forecasted growth rates for petrochemical feedstocks, once much higher, have recently been scaled down by a considerable measure. Overcapacity and maturing markets are principal reasons for a demand/supply imbalance. The forecast average annual demand growth rate for ethylene through 1981 currently stands at 4.6 percent; for propylene, 5.6 percent. Average annual growth rates for the aromatics are projected at 4.0 percent for benzene; 4.7 percent for toluene; and 5 percent for ortho and para-xylene isomers. 4/

Specifically in the olefins market, European ethylene capacity will be larger than previously expected, and the overcapacity will last at least until 1981. The supply for propylene, another olefin, will be somewhat tighter. 5/ Because of petrochemical oversupplies, it is reported that the traditional EEC benzene import market could dry up. At least one expert expects benzene to flow westward across the Atlantic during the 1978-81 period. 6/

1/ "Aromatic Outlook: Abundant Supply," C&EN, Apr. 4, 1977.
2/ Various sources; see for example "Slower Demand Growth Seen for Olefins," Oil and Gas Journal, May 16, 1977, p. 50.
3/ "Outlook Dims for European Olefins, Aromatics," C&EN, Mar. 13, 1978.
4/ These more "pessimistic" forecasts are the outcome of a recent meeting of the Conseil Europeen des Federations de l' Industrie Chimique (Cefic). The Economist has quoted ethylene demand growth at slightly under 4.0 percent through the early 1980's. "Europe's Chemical Moans," The Economist, June 3, 1978, p. 88.
5/ "Europe Carries Big Ethylene Load," Chemical Week, Mar. 8, 1978.
6/ Oil and Gas Journal, Mar. 28, 1977, p. 31.

In Japan, the olefins markets are causing some concern, according to trade journal articles. Overcapacity is plaguing the ethylene market just as in Europe. 1/ Burdened with excess capacity, Japan is likely to spend the next few years getting the supply/demand picture back into balance. Ethylene demand, without exports, is expected to increase from 6 to 7 percent a year through 1980, and it may take at least that long for demand to catch up with capacity already installed. In addition, new competition from the United States and from Southeast Asia is expected to shape Japanese strategy in world markets well into the 1980's.

While ethylene is in oversupply, the Japanese propylene market appears to have taken an opposite turn. Latest projections show that Japan may well have a deficit of the petrochemical in coming years. 2/

Capacity buildups outside traditional areas

Outside traditional producing areas, major petrochemical buildups planned for Mexico and the Middle East represent the most prominent changes. In the Middle East, 9 ethylene plants are being planned or are under construction. 3/ Even by conservative estimates, projects now under study for the Middle East and Africa could add 3 million metric tons a year of ethylene capacity in 1983 or soon after. 4/ In Saudi Arabia alone, plans have been detailed for three worldscale ethylene facilities to be built by joint-venture affiliates of Shell Oil (656,000 metric tons a year), of Mobil Oil (450,000 metric tons a year), and of Dow Chemical (400,000 metric tons a year). 5/

In Mexico, Petroleos Mexicanos (Pemex) has begun a vast construction program which will make Mexico a large-scale petrochemical producer. Since the domestic market is not large by world standards, Mexico may become an increasingly important petrochemical exporter. Sixty-six chemical plants are due to be constructed. An outline of the olefins and aromatics plants scheduled for completion through 1982 is shown in the tabulation below: 6/

1/ "Overcapacity Plagues Japanese Ethylene," C&EN, Apr. 4, 1978.
2/ "Propylene: Crystal Ball Gazing," Chemical Engineering, May 23, 1977, p. 99.
3/ Oil and Gas Journal, Oct. 17, 1977, p. 54.
4/ "U.S. Leads Olefins Investment, East Bloc Dominates Ammonia," European Chemical News, Feb. 24, 1978.
5/ "Saudi Arabia Details Plans for Chemicals," C&EN, Mar. 6, 1978.
6/ As of 1977.

Product	Location	Capacity tons/year	Completion date
Ethylene	Allende, Ver.	500,000	1981
	La Cangrejera, Ver.	500,000	1979
	Poza Rica, Ver.	182,000	1978
	Undecided	500,000	--
Propylene	Poza Rica, Ver.	300,000	1980
Benzene	La Cangrejera, Ver.	168,000	1979
	La Cangrejera, Ver.	49,000	1979
	La Cangrejera, Ver.	82,000	1979
	Undecided	75,000	1982
Orthoxylene	La Cangrejera, Ver.	55,000	1979
Isomer	Undecided	25,000	1982
Paraxylene	La Cangrejera, Ver.	240,000	1979
Isomer	Undecided	100,000	1982

Source: "Mexico Shoots for Big Petroleum Role," Oil and Gas Journal, Feb. 7, 1977.

Table A.--Free world existing (design) capacities in olefins and aromatics, 1977

(In millions of metric tons per year)

	Ethylene	Propylene	Benzene	p-Xylene	o-Xylene
Africa	0.2	0.1	1/	2/	2/
South America	1.0	.4	0.6	0.2	0.1
Far East	6.0	3.5	2.8	.8	.3
Western Europe	14.1	7.8	5.9	1.2	.9
Middle East	.1	1/	2/	2/	2/
North America	15.0	7.7	7.9	1.9	.7
Total	36.4	19.5	17.2	4.1	2.0

1/ Negligible.
2/ Not available.

Source: Compiled from estimates of the U.S. International Trade Commission.

Table B.--Free world construction projects: Olefins and aromatic plants planned for completion in 1978 to 1985 1/

(In millions of metric tons per year)

	Ethylene	Propylene	Benzene	p-Xylene	o-Xylene
Africa	1.3	0.2	2/	2/	2/
South America	3.1	.8	3/ 0.9	0.4	0.1
Far East	3.4	1.4	1.4	.6	.1
Western Europe	5.5	3.0	2.2	.3	.1
Middle East	1.4	2/	.9	.4	.2
North America	5.5	3.0	4/ .8	.3	.1
Total	20.2	8.4	6.2	2.0	0.6

1/ As of 1977.
2/ Not available.
3/ Bolivia has a $640 million BTX unit planned.
4/ Canada has a $225 million benzene plant in the offering.

Source: Compiled from estimates of the U.S. International Trade Commission.

Primary Products From Petroleum And Natural Gas

Louis N. DeToro and J. Ross Lewis, Jr.

Primary products that are derived from petroleum and natural gas[1] are related to the intermediates and finished products made from such primary materials in much the same way that crude products derived from the distillation of coal tar are related to their intermediates and finished products. Many of the primary products derived from petroleum are identical with those derived from coal tar (e.g., benzene, toluene, and xylene). Considerable duplication exists in the statistics on the production and sales of primary petroleum products because some of these primary chemicals are converted to other primary products derived from petroleum and because data on some production and sales are reported at successive stages in the conversion process. The statistics are sufficiently accurate, however, to indicate trends in the industry. Many of the primary products for which data are included in the statistics may be used either as fuel or as basic materials from which to derive other chemicals. In this report every effort has been made to exclude data on materials that are used as fuel; however, data are included on toluene and xylene which are used in blending aviation and motor fuel.

The output of primary products derived from petroleum and natural gas as a group amounted to 125,911 million pounds in 1977. Production in 1976 was 112,873 million pounds. The output of aromatic and naphthenic products from petroleum amounted to 52,263 million pounds in 1977, compared with 48,167 million pounds in 1976. Sales amounted to $2,469 million in 1977 and $2,757 million in 1976. Production of benzene, toluene, and xylene from petroleum increased marginally in 1977, while the unit values of these products remained nearly the same (table 1).

Production of all aliphatic hydrocarbons and derivatives from petroleum and natural gas was 67,902 million pounds in 1977, compared with 64,706 million pounds in 1976. Sales of these products were valued at $2,994 million in 1977 compared with $2,732 million in 1976. Production of ethylene was 25,426 million pounds in 1977--13.1 percent more than the 22,475 million pounds produced in 1976. The output of 1,3-butadiene in 1977 (3,259 million pounds) decreased from the production in 1976 (3,507 million pounds).

Data for 1977 crude products from petroleum and natural gas for chemical conversion were supplied by 76 companies and company divisions.

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[1] Statistics on aromatic chemicals from coal tar are given in the report on "Tar and Tar Crudes."

TABLE 1.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION: U.S. PRODUCTION AND SALES, 1977

[Listed below are the primary products from petroleum and natural gas for chemical conversion for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists separately all primary products from petroleum and natural gas for chemical conversion for which data on production and/or sales were reported and identifies the manufacturers of each]

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	126,133,316	61,008,376	5,820,390	$0.095
AROMATICS AND NAPHTHENES[2]				
Total	52,262,978	24,120,593	2,469,213	.102
Alkyl aromatics[3]	394,160	345,269	33,992	.098
Benzene (1° and 2°)	10,037,010	4,345,770	451,191	.104
Cumene	2,644,259	1,294,122	160,081	.124
Cyclohexane	3,019,895	2,197,591	261,405	.119
Dicyclopentadiene (including cyclopentadiene)	56,374	55,202	4,547	.082
Ethylbenzene	8,311,535	211,483	27,875	.132
Naphthalene, all grades	150,737	92,671	12,869	.139
Naphthenic acid	20,673	14,627	1,985	.136
Styrene	6,867,418	2,798,973	520,498	.186
Toluene, all grades, total	7,297,395	3,387,165	247,237	.073
Nitration grade, 1°	4,189,864	2,856,841	210,696	.074
Pure commercial grade, 2°	2,131,507	530,324	36,541	.069
All other[4,5]	976,024	...	...	...
Xylenes, mixed, total	6,151,055	3,225,450	217,948	.068
3° grade	1,649,777	1,256,311	84,565	.067
5° grade	1,933,702	1,357,912	90,762	.067
All other[5]	2,567,576	611,227	42,621	.070
o-Xylene	984,605	810,051	88,402	.109
p-Xylene	3,172,247	1,840,549	270,995	.147
All other aromatics and naphthenes[6]	3,155,615	3,501,670	170,188	.049
ALIPHATIC HYDROCARBONS				
Total	78,870,338	36,887,783	3,351,177	.091
C_2 Hydrocarbons, total	32,710,208	13,907,446	1,260,483	.091
Acetylene[7]	270,459	48,256	7,999	.166
Ethane	7,013,644	5,676,436	268,007	.047
Ethylene	25,426,105	8,182,754	984,477	.120
C_3 Hydrocarbons, total	21,529,401	13,880,735	997,365	.072
Propane	8,200,936	8,574,314	494,761	.058
Propylene[8]	13,328,465	5,306,421	502,604	.095
C_4 Hydrocarbons, total	12,652,328	5,377,040	683,200	.127
Butadiene and butylene fractions	754,495	346,054	56,643	.188
1,3-Butadiene, grade for rubber (elastomers)	3,258,972	2,471,399	440,997	.178
n-Butane	3,347,892	866,138	45,843	.053
1-Butene	75,549	62,741	11,936	.190
1-Butene and 2-butene, mixed[9]	2,105,572	376,717	29,733	.079
Isobutane	1,554,071	204,010	13,091	.064
Isobutylene, 2-butene and mixed butylenes	948,810	694,969	62,721	.090
All other[10]	606,968	355,012	22,236	.063

See footnotes at end of table.

TABLE 1.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION: U.S. PRODUCTION AND SALES, 1977--CONTINUED

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
ALIPHATIC HYDROCARBONS--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
C_5 Hydrocarbons, total	1,233,769	604,235	52,642	$0.087
Amylenes and pentenes	179,404	71,045	12,298	.173
Isoprene (2-Methyl-1,3-butadiene)	166,275	96,531	13,193	.137
All other[11]	888,090	436,659	27,151	.062
All other aliphatic hydrocarbons, derivatives, and mixtures, total	5,744,631	3,118,327	357,487	.115
Alpha olefins[12]	389,887	353,722	70,899	.200
Dodecene (Tetrapropylene)	293,929	...	...	...
Heptenes, mixed	115,052	55,718	5,473	.098
Hexane	674,142	327,412	24,757	.076
Hydrocarbon derivatives[13]	141,047	83,194	20,735	.249
Nonene (Tripropylene)	346,198	168,202	15,956	.095
n-Paraffins, total[14]	1,641,518	1,162,937	79,676	.069
Polybutene	...	206,001	30,636	.149
All other[15]	2,142,858	761,141	109,355	.144

[1] Calculated from rounded figures.
[2] The chemical raw materials designated as aromatics are in some cases identical with those obtained from the distillation of coal tar; however, the statistics given in the table above relate only to such materials as are derived from petroleum and natural gas. Statistics on production or sales of benzene, toluene, and xylene from all sources are given in tables 1 and 1B of the report on "Tar and Tar Crudes."
[3] Includes cyclosols, decylbenzene, and other alkyl aromatics.
[4] Includes toluene, solvent grade, 90 percent.
[5] Includes toluene and xylene used as solvents, as well as that which is blended in aviation and motor gasolines.
[6] Includes data for crude cresylic acid, cyclohexene, phenols, polyethylbenzene, distillates, solvents, and miscellaneous cyclic hydrocarbons.
[7] Production figures for acetylene from calcium carbide for chemical synthesis are collected by the U.S. Bureau of the Census.
[8] Includes data for refinery propylene.
[9] The statistics represent principally the butene content of crude refinery gases from which butadiene is manufactured.
[10] Includes data for butanes, mixed C_4 streams.
[11] Includes data for C_5 hydrocarbon mixtures, pentanes, and piperylenes.
[12] Includes data for the following molecular weight ranges: C_6-C_7; C_8-C_{10}; C_{11}-C_{15}; C_{15}-C_{20}; C_{16}-C_{18}; and C_{16}-C_{30}.
[13] Includes data for methyl, ethyl, propyl, butyl, octyl, nonyl, decyl, hexadecyl, and miscellaneous mercaptans, and other hydrocarbons derivatives.
[14] Includes data for the following chain lengths: C_6-C_9; C_9-C_{15}; C_{10}-C_{14}; C_{10}-C_{16}; C_{15}-C_{17}; and others.
[15] Includes production and/or sales data for cyclooctadiene, di-isobutylene, di-isopropyl, dodecene, eicosane, methane, methyl acetylene propadiene, mixtures of C_2 and C_3, C_6 and C_7, and C_5 and C_9 hydrocarbons, neohexane, n-heptane, n-octane, polybutene, propylene tetramer, propylene trimer, triisobutylene, and other hydrocarbons.

TABLE 2.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*) CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
AROMATICS AND NAPHTHENES	
*ALKYL AROMATICS:	
Cyclosols	SHC.
Decylbenzene	QH, UCC.
Alkyl aromatics: all other	ACC.
*BENZENE:	
*Benzene 1° (99-100 %)	AMO, APR, ASH, ATR, CCP, CPI, CSD, CSO, CSP, EKX, ENJ, GOC, GRS, HES, MOC, MON, PLC, PPR, QH, SHC, SKO, SM, SOG, SUN, TOC, TX, UCC, UOC.
*Benzene 2° (98-98.9%)	DOW, SOC.
Cresylic acid (Less than 75 percent distilling over 215° C)	PRD.
Cresylic acid, refined	ATR, ENJ.
*Cumene (Isopropyl benzene)	ACC, ASH, CLK, CSP, DOW, GOC, MOC, MON, SHC, SKO, SOC, SUN, TX, UCC.
*Cyclohexane	CSD, ENJ, GOC, GRS, PLC, PPR, SHO, SUN, SWC, TX, UOC.
Cyclohexene (Tetrahydrobenzene)	MON, PLC, TBO, USR.
Cyclopentane	PLC.
*Dicyclopentadiene (Including cyclopentadiene)	DOW, ENJ, GOC, MON.
*Ethylbenzene	ACC, ATR, CSD, DOW, ELP, FG, GOC, KPP, MCB, MON, OXI, SOG, STY, SUN, TOC, UCC.
Methylcyclopentane	PLC.
*Naphthalene	ASH, COL, MON, TID.
*NAPHTHENIC ACID:	
Naphthenic acid, acid number 150-199	GOC, PRD, SOC, SUN.
Naphthenic acid, acid number 200-224	ATR, PRD.
Naphthenic acid, acid number less than 150	ATR, SUN, TX.

TABLE 2.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
AROMATICS AND NAPHTHENES--Continued	
Petroleum phenols	SKO.
Sodium carbolate and phenate, crude	ATR.
*Styrene (Vinylbenzene)	ACC, CSD, DOW, ELP, FG, GOC, KPP, MCB, MON, OXI, SHC, SUN, TBO, TX, UCC.
*TOLUENE ALL GRADES, TOTAL:	
*Toluene, 1° (99.5-100%)	ASH, ATR, CCP, CPI, CSD, ENJ, GOC, GRS, KPP, MOC, MON, PLC, PPR, QH, SHC, SKO, SOG, SUN, TCC, TOC, TX, UCC, UOC.
*Toluene, 2° (98.5-99.4%)	ACC, AMO, ATR, DOW, ELP, HES, PPB, SUN.
*Toluene, 90-98.4% (Non-fuel)	CSP, FG, MON, SKO, SM.
*XYLENES, MIXED, TOTAL:	
*Xylene, 3° (99-100%)	CCP, CPI, CSD, CSO, PPR, QH, SHC, UCC.
*Xylene, 5° (98-98.9 %)	ATR, ENJ, GOC, GRS, HCF, HES, MOC, SOC, SOG, UOC.
*Xylene, 90-97.9% (Non-fuel)	AMO, ASH, CSP, MON, SUN, TOC.
*o-Xylene (90-100% of o-xylene isomer)	ATR, CPI, CSD, ENJ, MON, PPB, SHC, SOC, SUN, TOC.
*p-Xylene (90-100% of p-xylene isomer)	ACC, ATR, ENJ, HCR, PLC, PPR, SHC, SOC, SOG, STX, SUN, TOC.
*ALL OTHER AROMATICS AND NAPHTHENES:	
Aromatics, C9	MOC.
Carbon black feedstock	ENJ.
Hydrocarbon polymer	JCC.
Polyethylbenzene	FG.
All other products from petroleum and natural gas, cyclic	ACU, CPI, DOW, EKX, ENJ, NWP, SOG, SUN, TNA, TX.
ALIPHATIC HYDROCARBONS	
C/1 HYDROCARBONS:	
Methane	MOC, MON, SHO.
*C/2 HYDROCARBONS:	
*Acetylene (For chemical use only)	DOW, MNO, RH, UCC, USR.
*Ethane	ACU, ATR, ENJ, MOC, MON, OMC, PAN, PLC, PUE, SHO, SM, TX, USI.
*Ethylene	ACC, ACU, AMO, ATR, BAS, BFG, CBN, CO, CPX, DOW, DUP, EKX, ELP, ENJ, GOC, JCC, KPP, MOC, MON, NWP, OMC, PLC, PUE, SHC, SHO, SM, SNO, SUN, TX, UCC, USI.

TABLE 2.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ALIPHATIC HYDROCARBONS--Continued	
*C/3 HYDROCARBONS:	
*Propane (Commercial and hd-5)	AMO, APR, ASH, ATR, CCP, COR, CPI, CSD, CSO, CSP, ENJ, GRS, MOC, OMC, PAN, PLC, PUE, SHO, SM, SOG, SUN, TX, UCC, UOC, USI.
*Propylene	ACC, ACU, AMO, ASH, ATR, BFG, CBN, CLK, CO, CPX, CSD, CSO, DOW, DUP, EKX, ELP, ENJ, GOC, JCC, KPP, MOC, MON, NWP, OMC, PLC, PUE, SHC, SHO, SIO, SKO, SM, SOC, SOG, SUN, TX, UCC.
Propylene tetramer	ATR, SUN.
Propylene trimer	ATR.
Hydrocarbons,C2-C3,mixtures	CSO.
Methyl acetylene propadiene	MON.
*C/4 HYDROCARBONS:	
*Butadiene and butylene fractions	ACU, ATR, CO, CPX, CSD, DOW, EKX, GOC, UCC.
*1,3-Butadiene, grade for rubber (Elastomers)	ACC, ATR, BFG, CPY, DOW, ELP, ENJ, FRS, MON, NWP, PLC, PTT, PUE, SHC, SM, TUS, UCC.
*n-Butane	AMO, APR, ATR, COR, CSD, CSO, CSP, ELP, MOC, OMC, PLC, SHO, SM, SUN, UCC, USI.
Butanes,mixed	ENJ.
*1-Butene	GOC, PLC, PTT, SHO, TNA.
*2-Butene	MON, PLC, SHO.
*1-Butene and 2-butene, mixed	AMO, ATR, CSO, DOW, ENJ, GOC, MOC, SHC, SHO.
Butylenes,mixed	MON, SM.
Chemical butane	SM.
Hydrocarbons, C4, fraction	JCC.
Hydrocarbons,C4,mixtures	GOC.
*Isobutane (2-Methylpropane)	AMO, ATR, CSD, CSO, CSP, ELP, ENJ, MOC, OMC, PLC, SHO, SM, SUN, TBO, TX, USI.
*Isobutylene (2-Methylpropene)	ENJ, OCC, PTT, SHC.
Hydrocarbons, C4, all other	BFG, CBN, TNA.
*C/5 HYDROCARBONS:	
*Amylenes	SHC, SHO.
Dibutanized aromatic concentrate	CO, CPX, DUP, JCC, OMC.
Isoamylene	CBN.
Isopentane (2-Methylbutane)	PLC, SHO.
*Isoprene (2-Methyl-1,3-butadiene)	BFG, DOW, ENJ, MON.
n-Pentane	APR, ATR, MOC, PLC.
*Pentenes, mixed	CSO, DOW, ENJ, TX, UCC.

TABLE 2.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ALIPHATIC HYDROCARBONS--Continued	
*C/5 HYDROCARBONS--Continued	
Piperylene (1,3-Pentadiene)	MON.
Hydrocarbons, C5, all other	BPG, CSO, DOW, PLC, PUE, SHC, UCC.
*ALL OTHER ALIPHATIC HYDROCARBONS, DERIVATIVES, AND MIXTURES:	
C/6 HYDROCARBONS:	
Di-isopropyl (2,3-Dimethylbutane)	PLC.
*Hexane	APR, ENJ, HMY, PLC, SHO, SOG, UOC.
Hydrocarbons, C5-C6, mixtures	COR.
Methylcyclopentadiene	ENJ.
Neohexane (2,2-Dimethylbutane)	PLC.
Hydrocarbons, C6, all other	PLC, SWC.
C/7 HYDROCARBONS:	
n-Heptane	EKX, SOG, UOC.
*Heptenes, mixed	ACC, AIP, ENJ, TID.
Hydrocarbons, C6-C7, mixtures	CPI.
Hydrocarbons, C7, all other	ENJ.
C/8 HYDROCARBONS:	
Cyclooctadiene	CBN.
Di-isobutylene (Di-isobutene)	BFG, PTT, TX.
n-Octane	SOG.
Hydrocarbons, CB, all other	ENJ.
C/9 AND ABOVE HYDROCARBONS (EXCEPT ALPHA OLEFINS):	
*Dodecene (Tetrapropylene)	ATR, CO, ENJ, SOC, SUN, TX.
Eicosane	HMY.
*Nonene (Tripropylene)	AIP, ATR, ENJ, TID, UOC.
*ALPHA OLEFINS:	
Alpha olefins,C6-C7	GOC, SHC, SOC, TNA.
Alpha olefins,CB-C10	GOC, SOC, TNA.
Alpha olefins,C11-C15	GOC, SOC, TNA.
Alpha olefins: all other	GOC, SOC, TNA.
*N-PARAFFINS - CARBON CHAIN LENGTH:	
n-Paraffins,C6-C9	SOG, UCC.
n-Paraffins,C9-C15	BPG, SHO, SOG.
n-Paraffins,C10-C14	ENJ, SHO, SOG, DOC.
n-Paraffins,C10-C16	CO.
n-Paraffins	ENJ, GOC.

TABLE 2.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ALIPHATIC HYDROCARBONS--Continued	
ALL OTHER ALIPHATIC HYDROCARBONS, DERIVATIVES, AND MIXTURES--Continued	
Hydrocarbons, C5-C9, mixtures	PPR.
* Polybutene	ACC, CSD, SOC.
Tri-isobutylene	TX.
* HYDROCARBON DERIVATIVES:	
n-Butyl mercaptan (1-Butanethiol)	PLC.
tert-Butyl mercaptan (2-Methyl-2-propanethiol)	PAS, PLC.
Di-tert-butyl disulfide	PLC.
Ethyl mercaptan (Ethanolthiol)	PAS, PLC.
Hexadecyl mercaptans	PAS.
Isopropyl mercaptan (2-Propanethiol)	PAS.
Methyl mercaptan (Methanethiol)	DOW, PAS.
t-Nonyl mercaptan	PAS.
tert-Octyl mercaptan (2,4,4-Trimethyl-2-pentanethiol)	PAS.
n-Propyl mercaptan (1-Propanethiol)	PAS, PLC.
n-Tetradecyl mercaptan	PAS.
Hydrocarbon derivatives: all other hydrocarbon derivatives	ACC, PAS, PLC, TX.
Hydrocarbons, C9 and above, all other, including mixtures	CO, ENJ, SOC.

TABLE 3.--PRIMARY PRODUCTS FROM PETROLEUM AND NATURAL GAS FOR CHEMICAL CONVERSION: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of primary products from petroleum and natural gas for chemical conversion to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ACC	Amoco Chemicals Corp.	KPP	Arco/Polymers, Inc.
ACU	Allied Chemical Corp., Union Texas Petroleum Div.		
AIP	Air Products & Chemicals, Inc.	MCB	Borg-Warner Corp., Borg-Warner Chemicals
AMO	Amoco Oil Co.	MNO	Monochem, Inc.
AMO	Amoco Texas Refining Co.	MOC	Marathon Oil Co., Texas Refining Div.
APR	Atlas Processing Co.	MON	Monsanto Co.
ASH	Ashland Oil, Inc.		
ATR	Atlantic Richfield Co.	NWP	Northern Petrochemical Co.
BAS	BASF Wyandotte Corp.	OCC	Oxirane Chemical Co.
BFG	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.	OMC	Olin Corp.
		OXI	Oxirane Chemical Co. (Channelview)
CBN	Cities Service Co., Petrochemical Div.	PAN	Amoco Production Co.
CCP	Crown Central Petroleum Corp.	PAS	Pennwalt Corp.
CLK	Clark Oil & Refining Corp.	PLC	Phillips Petroleum Co.
CO	Continental Oil Co.	PPR	Phillips Puerto Rico Core, Inc.
COL	Collier Carbon & Chemical Corp.	PRD	Ferro Corp., Productol Chemical Div.
COR	Commonwealth Oil & Refining Co., Inc.	PTT	Petro-Tex Chemical Corp.
CPI	Commonwealth Petrochemicals, Inc.	PUE	Puerto Rico Olefins Co.
CPX	Chemplex Co.		
CPY	Copolymer Rubber & Chemical Corp.	QH	Quintana-Howell Joint Venture
CSD	Cosden Oil & Chemical Corp.		
CSO	Cities Service Co.	RH	Rohm & Haas Co.
CSP	Coastal States Petrochemical Co.		
		SHC	Shell Oil Co., Shell Chemical Co. Div.
DOW	Dow Chemical Co.	SHO	Shell Oil Co.
DUP	E. I. duPont de Nemours & Co., Inc.	SIO	Standard Oil Co.
		SKO	Getty Refining & Marketing Co.
EKX	Eastman Kodak Co., Texas Eastman Co. Div.	SM	Mobil Oil Corp. & Mobil Chemical Co.
ELP	El Paso Products Co.	SNO	SunOlin Chemical Co.
ENJ	Exxon Chemical Co. U.S.A.	SOC	Standard Oil Co. of California, Chevron Chemical Co.
		SOG	Charter International Oil Co.
FG	Foster Grant Co., Inc.	STY	Styrochem Corp.
FRS	Firestone Tire & Rubber Co., Firestone Synthetic Rubber & Latex Co. Div.	SUN	Sun Company, Inc.
		SWC	Corco Cyclohexane, Inc.
GOC	Gulf Oil Corp., Gulf Oil Chemicals Co.-U.S.	TBO	Tauber Oil Co.
		TID	Getty Refining & Marketing Co.
GRS	Champlin Petroleum Co.	TNA	Ethyl Corp.
		TOC	Tenneco Oil Co.
HCF	Hercofina	TUS	Texas-U.S. Chemical Co.
HCR	Hercor Chemical Corp.	TX	Texaco, Inc.
HES	Amerada Hess Corp. (Hess Oil Virgin Islands Corp.)		
		UCC	Union Carbide Corp.
HMY	Humphrey Chemical Co.	UOC	Union Oil Co. of California
		USI	National Distillers & Chemicals Corp., U.S. Industrial Chemicals Co.
JCC	Jefferson Chemical Co., Inc.		
		USR	Uniroyal, Inc., Uniroyal Chemical Div.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Import Penetration of U.S. Markets for Cyclic Intermediates

Daniel F. McCarthy

Summary of current status of imports

Imports of cyclic (benzenoid) intermediates in 1977 amounted to 307 million pounds valued at $325.9 million. Imports of cyclic intermediates are covered in part 1 B, Schedule 4 of the TSUS. In the import statistics, they are referred to as benzenoid chemicals and include a certain amount of noncyclic chemicals which were manufactured from cyclic raw materials. Imports more than doubled in 1972-77 ($150 million in 1972: $326 million in 1977; table A). However, because of inflation in the United States and the different inflation rates in exporting countries, these value figures may not reflect the true impact of imports on the U.S. market for cyclic intermediates. On the basis of quantity, imports of organic cyclic intermediates amounted to 221 million pounds in 1972 and have increased irregularly through 1977 to 307 million pounds, which represents an average growth rate of 6.8 percent per year.

The ratio of the value of imports of cyclic intermediates to that of domestic sales ranged from 6.5 percent to 9.8 percent in 1972-77. Measured, however, on the basis of volume the ratio of imports to sales did not exceed 2.8 percent in the last 5 years. In 1974 when imports of cyclic intermediates peaked at 2.8 percent of U.S. sales, they amounted to 401 million pounds, valued at $259 million. Sales of such products in 1974 by domestic producers amounted to 14.2 billion pounds, valued at $3.4 billion.

The principal cyclic intermediate imports (along with those benzenoid noncyclic chemicals referred to in the first paragraph) in 1977 were phthalic anhydride, (53 million pounds), cyclohexane (22 million pounds), and acetone (18 million pounds). Increased U.S. consumption of phthalate plasticizers, especially those used to increase flexibility of polyvinyl chloride (PVC) plastics materials, and increased use of polyester resins provided an increase in the market for imports of phthalic anhydride over that of 1976 when such imports amounted to 31.5 million pounds.

Increased domestic consumption of nylon 6 and nylon 66 resulted in the increased demand for cyclohexane as a precursor material for these products. Increased consumption of acetone for such uses as the manufacture of methyl methacrylate and for bisphenol A were contributing factors to the large volume of acetone imports in 1977. Bisphenol A is used in the manufacture of epoxy resins and polycarbonate resins, which are expected to grow from 7 to 10 percent a year according to industry estimates. Methyl methacrylate is likewise used as a raw material for plastics and resins.

Derivation and uses of principal cyclic intermediates

The cyclic intermediates included here are derived principally from the basic petrochemical raw materials: benzene, toluene, xylene and naphthalene. The principal intermediates derived from benzene include cyclohexane, phenol, styrene, detergent alkylates, maleic anhydride, and aniline. Cyclohexane is used mostly in the production of the nylons. Stryrene is polymerized to polystyrene and used in plastics products. Styrene is also used in synthetic rubber, polyester resins and alkyd protective coatings. Phenol is used in the manufacutre of phenolic resins and of bisphenol A. Other products obtained from phenol include caprolactam used to produce nylon 6, alkylated phenols, and chlorinated phenol to make the herbicide 2, 4-D. A byproduct in the production of phenol from cumene, alpha-methylstyrene, is used as an additive in resin formulations to increase their high-temperature performance. The alkylbenzenes are used mostly to make synthetic detergents. Maleic anhydride is used to make alkyd resins, some agricultural chemicals, and styrene-maleic anhydride resins. Aniline is used to produce isocyanates which, in turn, are used to make polyurethanes for insulation, cushioning, and other applications of foamed plastics. Aniline is also used in the production of dyes, drugs, and photographic chemicals such as hydroquinone. Monochlorobenzene has been used in the manufacture of the pesticide DDT, drugs, perfumes, and in solvents. Ortho-dichlorobenzene is used mostly as a solvent for metal degreasing. Para-dichlorobenzene, on the other hand, is used as a moth repellant for wool. Resorcinol (meta-dihydroxybenzene) is used by the tire industry in a resorcinol-formaldehyde resin to bond the tire cord to the rubber. Resorcinol-formaldehyde resins are also used as wood adhesives.

Intermediates derived from toluene include toluene diisocyanate (TDI), benzoic acid and phenol. Toluene diisocyanates, when reacted with polyols or polyesters, make polyurethanes. The flexible polyurethane foams are used for cushioning and padding in automobiles and furniture. The semi-rigid urethane foams are used for crash pads in automobiles, whereas the rigid urethane foams are used in plastic panels for home construction and insulation.

The principal intermediates produced from xylene include phthalic anhydride from ortho-xylene, isophthalic acid made from meta-xylene, and terephthalic acid from para-xylene. The major uses of phthalic anhydride include plasticizers, alkyd resins and unsaturated polyester resins. Isophthalic acid is also used to make unsaturated polyester and alkyd resins. Terephthalic acid (TPA) and its dimethyl ester (DMT) are primarily (90 percent) used to make polyester fibers and the remaining 10 percent is used to make polyester plastic film.

Intermediates derived from naphthalene include phthalic anhydride, insecticide intermediates and beta-naphthol which is used in the manufacture of dyes, rubber, perfume, and pharmaceuticals.

U.S. production and sales

In 1977, the volume of U.S. production of all industrial organic chemicals (principally cyclic intermediates) amounted to 43 billion pounds, representing an increase of 27.4 percent over the 34 billion pounds produced in 1976. Of that 1977 volume, the output of cyclic intermediates was about 16 percent more than in 1976; sales, however, were only 1.6 percent larger than in 1976. Production of cyclic intermediates amounted to 36.9 billion pounds in 1977 and sales amounted to 13.2 billion pounds, valued at $3.4 billion (the difference between the two sets of numbers being captive consumption). In addition to the cyclic intermediates, there is an estimated production in 1977 of miscellaneous industrial organic chemicals amounting to approximately 6.5 billion pounds; sales amounted to 2.3 billion pounds, valued at $1.3 billion.

Comparision of the output of some of the principal cyclic intermediates in 1977 with that in 1976 shows an increase in 1977 of 44.1 percent for ethylbenzene, 38.1 percent for cyclohexane, 9.0 percent for styrene monomer, 7.4 percent for aniline, 7.1 percent for dimethyl terephthalate, 3.5 percent for toluene diisocyanate (80/20 mixture), and 1.4 percent for bisphenol A. The output of synthetic phenol in 1977 increased 10.7 percent over 1976, whereas, the output of monochlorobenzene decreased 1 percent. Production of cresols and cresylic acid, however, decreased 11.5 percent; production of straight-chain dodecylbenzene decreased only slightly. For this group of selected intermediates, which account for 67.7 perent of the 1977 output of all industrial organic chemicals, there was an increase of 17.5 percent in output in 1977 over the 1976 output.

Sales of intermediates in 1977 were influenced by several factors including changes in consumer demand for the end products of the chemical industry. The severe weather conditions in the eastern United States in the first quarter of 1977 hampered transportation and thereby reduced sales of chemicals. There was a slight increase in the demand for housing which resulted in an increased demand for plastics and in turn a demand for plasticizers made from phthalic anhydride. Increased sales of automobiles had a favorable effect on the sales of alpha-methylstyrene-based plastics. Along with increased sales of intermediates in 1977, raw materials had increased 6.5 percent; one producer announced that his intermediates prices will be increased by 5.0 percent. 1/

Industry changes

In 1977, there were 172 producers of cyclic intermediates, compared with 175 producers in 1976. There were approximately 1400 cyclic intermediates produced by these manufacturers, many items produced by only one manufacturer. In 1977, one large producer of many of these cyclic intermediates was reported to be negotiating with a foreign producer for the purpose of selling the company. The sale will probably be consumated in 1978.

1/ Chemical Marketing Reporter, Mar. 13, 1978 p. 55.

Concentration in the industry

In 1977, 5 of the 172 companies accounted for 37 percent of the sales value and 10 companies accounted for 56 percent. These ratios are significantly higher than those in 1973 when 5 companies accounted for 25 percent and 10 companies 36.5 percent. The trend in overall concentration seems to be increasing in favor of the larger companies. However, there is a large number of producers of the large-volume cyclic intermediates. For example, there are 10 producers of phthalic anhydride, 17 producers of phenol, and 15 producers of styrene monomer.

Regulations

There are many Government regulations which affect the production and sales of chemicals in the United States. However, of particular interest is the Toxic Substances Control Act, which was passed in late 1976, with the Environmental Protection Agency (EPA) being responsible for establishing standards for the use of toxic chemicals. In 1977 para-phenylenediamine (PPD) and 2,4-diaminoanisole (2,4-D) were found in tests conducted by the National Cancer Institute to have a positive link to cancer in animals. 1/ In December, 1977 the Environmental Protection Agency (EPA) published a notice on inventory reporting regulations. 2/ These regulations required that, effective January 1, 1978, persons who manufacture or import chemical substances: (1) report the identity of each; (2) estimate the amount manufactured; and (3) indicate whether each chemical substance is manufactured and used only within one site.

Although precise data are not available for the cyclic intermediates industry, expenditures for pollution control by the entire chemical industry in 1977 amounted to 11 percent of total capital expenditures. The chemical industry spent $301 million for water pollution control, $470 million for air purification, and $96 million for solid waste control; a total of $867 million. 3/

International trade

In 1973-77, the value of U.S. exports of industrial (benzenoid) organic chemicals exceeded imports in this group by an average ratio of 3.3 to 1. Analysis of the 1977 U.S. foreign trade statistics for this group of chemicals showed a lower unit value for exports (28 cents per pound) than for imports ($1.06 per pound).

Imports of industrial (benzenoid) organic chemicals in 1977 amounted to $326 million compared with $294 million in 1976. Since 1972, imports have

1/ Chemical Week, Jan. 25, 1978, p. 13.
2/ Federal Register, Dec. 23, 1977, p. 64572.
3/ McGraw-Hill Publications, annual Survey of Pollution Control Expenditures.

grown from $150 million to $326 million in 1977 or by an average growth rate of 16.8 percent per year (table A). On the basis of quantity, however, the average annual growth rate in 1972-77 for imports of industrial organic chemicals was 6.8 percent per year compared with 6.6 percent for exports and 6.9 percent for domestic production. The principal sources of imports of cyclic intermediates in 1972-77 were West Germany and Japan and, in 1975-77, Italy, the United Kingdom, and Switzerland were also important sources. In 1977 these five countries accounted for nearly 80 percent of the total imports for consumption of cyclic intermediates (benzenoid chemicals) (table B). Analysis of benzenoid intermediates imports in 1974 through 27 customs districts showed that imports through the port of New York accounted for 64 percent of the total, followed by Houston, Tex. (8 percent); Norfolk, Va. (4.5 percent); Philadelphia, Pa. (3.4 percent) and Wilmington, N.C. (3.3 percent).

The principal products imported, which vary from year to year, reflect the demand for such products in the United States. Analysis of benzenoid cyclic intermediate imports in 1976 showed that 77 percent of the total quantity was accounted for by the following functional-group products: phenols and phenol alcohols (17.9 percent); polycarboxylic acids (17.3 percent); hydrocarbons (15.9 percent); amine-function compounds (8.7 percent); oxygen-function amines (6.0 percent); ketones (4.1 percent); hydrocarbon derivatives, (3.9 percent); and halogenated hydrocarbons (3.4 percent). In 1977, on the basis of an analysis of imports of benzenoid chemicals and products by the U.S. International Trade Commission, phthalic anhydride (53 million pounds) was the principal product imported. The principal sources of phthalic anhydride were Italy, Canada, Venezuela, Mexico, and Argentina. Cyclohexane (22 million pounds) was the second most important cyclic intermediate imported in 1977. Cyclohexane was imported from Argentina and West Germany. Acetone (18 million pounds) came from Italy, Brazil, West Germany, and the Netherlands. (Imports of nonbenzenoid acetone, made from isopropyl alcohol, were insignificant in 1977). Other imports of lesser volume in 1977 included maleic anhydride, para-cresol, caprolactam, styrene monomer, m,p-cresol, copper phthalocyanine crude, phenol, fumaric acid, 1-chloro-2-nitrobenzene, H acid, p-nitroaniline, and beta-napthol. Imports of these 15 intermediates accounted for approximately 63 percent of the total quantity of intermediates imported in 1977.

There were 819 benzenoid intermediates imported in 1977: 67 more than the 752 imported in 1976. During 1977, imports from member countries of the Organization for Economic Cooperation and Development (OECD) accounted for 89 percent of the total value of imports of cyclic intermediates; with 11 percent coming from less developed countries. The nine European Economic Community (EEC) countries accounted for 54 percent of the total and Japan for 20 percent.

Prices of imported benzenoid cyclic intermediates are usually lower than those of the competitive domestic products. However, the values of competitive imports are appraised by the U.S. Customs Service for duty purposes based on the American selling price (ASP) of the domestic products. Since the oil embargo of 1974, some prices of benzenoid chemicals imported from Europe have been higher than like or similar domestic products. In addition, prices of some imports of cyclic intermediates, especially from Europe, by U.S. subsidiaries of foreign manufacturers may not reflect the true market value of these products. These related-party transactions amounted to 32 percent of the total value of imports of cyclic intermediates in 1976, the latest year for which statistics are available.

Exports of cyclic intermediates

The United States maintains a positive balance of trade in cyclic intermediates. In 1973-77, the value of exports ranged from 3 to 3.8 times the value of imports. Exports went principally to the Netherlands, Canada, Brazil, Mexico, and Belgium in 1976 and 1977. These countries accounted for approximately 45 percent by value of the total exports of cyclic intermediates in 1977. The principal industrial organic chemical products exported in 1977 were styrene monomer, lubricating oil additives, toluene diisocyanates (TDIs), detergent alkylates, rubber-processing chemicals, and cyclohexane. These products accounted for 48 percent of the total value of exports of cyclic intermediates in 1977.

Balance of trade

In each year since 1966, exports of cyclic intermediates have been much larger than imports (tables A and B). In 1976 and 1977, the United States has had a negative balance of trade with West Germany, Japan, Italy, the United Kingdom, Switzerland, and France. Imports from West Germany in 1977 exceeded exports to that country by $100 million; imports from Japan exceeded exports to Japan by $35 million 1/; imports from Italy exceeded exports by $33 million. Our negative balance of trade with the United Kingdom, Switzerland, and France was considerably smaller. On the other hand, our trade balance with Belgium, Canada, the Netherlands, Mexico, and Brazil has been positive (table C). In 1977, our exports to the Netherlands exceeded imports by $152 million, exports to Canada were $75 million larger than imports; exports to Mexico were $58 million larger than imports; and exports to Brazil were $78 million larger. Brazil has become a sizeable export market for industrial organic chemicals in the past 2 or 3 years.

1/ However, the U.S. surplus was $512 million for all chemicals traded with Japan in 1977.

Outlook

Although data were not available for the cyclic intermediates industry,the sales by majority-owned foreign affiliates of U.S. chemical companies in 1976 amounted to $43.1 billion, a 15 percent increase over the $37.6 billion reported for 1975. 1/ This trend may have continued into 1977.

According to the U.S. Department of Commerce, the value of shipments for the Industrial Organic Chemicals Industry (SIC code 2869) is expected to increase by 10 percent in 1978 over 1977. 2/ However, "three important unknowns are clouding the year ahead in the industry." 3/ The unknowns referred to are: (1) dependence on petroleum feedstocks, including natural gas; (2) the Toxic Substances Control Act; and (3) the scheduled trade negotiations (General Agreements on Tariffs and Trade) regarding tariff reductions and trade restrictions. "Until a clearer picture emerges, a wait and see attitude seems to have developed, affecting decisions on new plant investments in 1977 and perhaps into 1978." 3/

1/ Survey of Current Business, Mar. 1978, p. 34.
2/ U.S. Industrial Outlook, 1978, p. 93.
3/ Ibid., p. 85.

Table A.--Industrial organic chemicals: 1/ U.S. production, imports, exports, and apparent consumption, 1966-77

Year	Production 2/	Imports 3/	Exports 4/	Apparent consumption	Ratio of imports to consumption
	Million dollars	Million dollars	Million dollars	Million dollars	Percent
1966	2,391	48	211	2,228	2.1
1967	2,503	48	231	2,320	2.1
1968	2,915	67	292	2,690	2.5
1969	3,325	84	290	3,119	2.7
1970	3,229	91	336	2,984	3.0
1971	3,467	129	304	3,292	3.9
1972	3,730	150	320	3,560	4.2
1973	4,110	169	484	3,795	4.5
1974	8,037	259	930	7,366	3.5
1975	7,569	205	779	6,995	2.9
1976	8,882	294	1,008	8,168	3.6
1977	12,217	326	995	11,548	2.8

1/ Principally cyclic benzenoid intermediates. Some acyclic organic chemical compounds derived from benzenoid chemicals are also included.

2/ Partly estimated. Statistics include duplication since some of the chemicals represent successive steps in production. Value of production calculated using the average unit values of sales of all products.

3/ For the most part, imports have been "competitive" with domestic production and have been valued for duty purposes at the "American selling price." Data represents customs import value--the value appraised by the U.S. Customs Service in accordance with the legal requirements of sec. 402 and 402a of the Tariff Act of 1930, as amended.

4/ Includes exports of some finished products. Figures include estimates and are not strictly comparable with imports or production.

Source: Production, U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales; imports compiled from official statistics of the U.S. Department of Commerce. Exports are partly estimated, compiled from official statistics of the U.S. Department of Commerce.

Table B.--Industrial organic chemicals: 1/ U.S. imports for consumption, by principal sources, 1972-77

(In thousands of dollars 2/)

Source	1972	1973	1974	1975	1976	1977
West Germany	66,085	72,715	84,059	62,145	94,768	105,172
Japan	36,181	29,793	65,027	49,243	61,228	65,770
Italy	11,305	10,705	17,323	19,073	30,678	32,711
United Kingdom	7,605	10,433	21,119	18,820	24,709	31,132
Switzerland	11,593	16,063	15,846	14,773	17,280	21,956
France	1,611	4,233	8,585	9,797	12,371	15,763
Belgium	1,220	7,919	10,494	1,871	2,154	9,839
Canada	4,301	5,515	4,826	4,352	8,081	7,270
Netherlands	5,067	4,724	10,291	6,738	8,987	4,858
Mexico	35	486	1,812	388	3,452	4,673
Argentina	3	-	-	657	1,927	3,353
All other	5,031	6,892	19,190	17,625	28,201	23,403
Total	150,037	169,478	258,572	205,482	293,836	325,900

1/ Principally cyclic benzenoid intermediates. Some acyclic organic chemical compounds derived from benzenoid chemicals are also included.

2/ Customs import value, the value appraised by the U.S. Customs Service in accordance with the legal requirements of sec. 402 and 402a of the Tariff Act of 1934, as amended.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table C.--Industrial organic chemicals: U.S. trade, by principal trading partners, 1976 and 1977.

(In thousands of dollars)

Source	Imports 1/	Exports 2/	Trade Balance
1976:			
West Germany	94,768	10,487	-84,281
Japan	61,228	27,380	-33,848
Italy	30,678	3/	-30,000
United Kingdom	24,709	15,497	-9,212
Switzerland	17,280	2,681	-14,599
France	12,371	11,401	-970
Belgium	2,154	46,779	44,625
Canada	8,081	93,471	85,390
Netherlands	8,987	178,111	169,124
Mexico	3,452	63,964	60,512
Argentina	1,927	3/	-1,500
Brazil	98	59,444	59,346
All other	28,103	498,985	470,882
Total	293,836	1,008,200	714,364
1977:			
West Germany	105,172	5,038	-100,134
Japan	65,770	30,736	-35,034
Italy	32,711	3/	-32,500
United Kingdom	31,132	27,458	-3,674
Switzerland	21,956	6,541	-15,415
France	15,763	3/	-15,500
Belgium	9,839	61,126	51,287
Canada	7,270	82,676	75,406
Netherlands	4,858	156,581	151,723
Mexico	4,673	62,965	58,292
Argentina	3,353	6,283	2,930
Brazil	538	78,512	77,974
All other	22,865	477,469	454,604
Total	325,900	995,385	669,485

1/ Data represent customs import value--the value appraised by the U.S. Customs Service in accordance with the legal requirements of sec. 402 and 402a of the Tariff Act of 1930, as amended.

2/ Incudes exports of some finished products. Figures include estimates and are not strictly comparable with imports.

3/ Not available.

Source: Imports compiled from official statistics of the U.S. Department of Commerce. Exports are partly estimated, compiled from official statistics of the U.S. Department of Commerce.

Note.--Because of rounding, figures may not add to the totals shown.

Cyclic Intermediates

Daniel F. McCarthy and Bonnie Noreen

Cyclic intermediates are synthetic organic chemicals derived principally from petroleum and natural gas and from coal-tar crudes produced by destructive distillation (pyrolysis) of coal. Most cyclic intermediates are used in the manufacture of more advanced synthetic organic chemicals and finished products, such as dyes, medicinal chemicals, elastomers (synthetic rubber), pesticides, and plastics and resin materials. Some intermediates, however, are sold as end products without further processing. For example, refined naphthalene may be used as a raw material in the manufacture of 2-naphthol or of other more advanced intermediates, or may be packaged and sold as a moth repellant or as a deodorant. In 1977 about 43 percent of the total output of cyclic intermediates was sold; the rest was consumed chiefly by the producing plants in the manufacture of more advanced intermediates and finished products.

Total production of cyclic intermediates in 1977 amounted to 18,726 million pounds, a 6 percent increase from the 17,700 (revised) million pounds produced in 1976. Sales of cyclic intermediates in 1977 were 7,986 million pounds, valued at $2,597 million, compared with 7,664 million pounds, valued at $2,387 million in 1976. These totals for 1976 and 1977 cannot be compared with 1975 figures because several items were transferred to the primary products from petroleum and natural gas section.[1]

Intermediates which were produced in excess of 2 billion pounds in 1977 were dimethyl terephthalate (5,410 million pounds), and phenol (2,338 million pounds). Other large-volume intermediates produced in 1977 were isocyanates (1,057 million pounds), phthalic anhydride (926 million pounds), cyclohexanone (745 million pounds), aniline (584 million pounds), nitrobenzene (552 million pounds), alkylbenzenes (526 million pounds), bisphenol A (455 million pounds), monochlorobenzene (326 million pounds), toluene-2,4-diamine (222 million pounds), and 2,4-dinitrotoluene (209 million pounds). The 12 chemicals noted above accounted for 71 percent of the total output of intermediates in 1977.

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[1] Items transferred from cyclic intermediates to primary products from petroleum and natural gas are ethylbenzene, cyclohexane, cyclohexene, styrene, m-xylene, o-xylene, p-xylene, and cumene.

TABLE 1.--CYCLIC INTERMEDIATES: U.S. PRODUCTION AND SALES, 1977

[Listed below are all cyclic intermediates for which any reported data on production and sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists alphabetically all cyclic intermediates on which data on production and/or sales were reported and identifies the manufacturers of each]

CYCLIC INTERMEDIATES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	18,725,626	7,985,790	2,596,627	$0.33
o-Acetoacetanisidide	...	1,276	1,879	1.47
o-Acetoacetotoluidide	...	1,268	946	.75
Acetophenone, tech.	4,299	...	...	...
Alkylbenzenes[2]	526,121	456,491	116,969	.26
3'-Amino-p-acetanisidide	739	...	...	...
1-Amino-2-bromo-4-hydroxyanthraquinone	800	...	...	...
p-[(p-Aminophenyl)azo]benzenesulfonic acid	277	...	...	...
Aniline (Aniline oil)	584,078	175,892	42,081	.24
2-Anilinoethanol	130	20	24	1.24
Anilinomethanesulfonic acid and salt	350	...	...	...
Benzoic acid, tech	79,637	30,854	7,489	.24
2-Benzothiazolethiol, sodium salt	...	4,106	2,636	.64
Biphenyl	68,274	26,826	7,364	.27
p-tert-Butylphenol	22,531	19,402	7,358	.38
Butylphenols, mixed	1,389	574	198	.34
6-tert-Butyl-2,4-xylenol	285	...	...	...
Chlorobenzene, mono-	325,518	174,840	35,049	.20
4-Chlorophthalic acid	619	...	...	...
Cresols, total[3]	92,842	82,106	41,075	.50
o-Cresol	21,060	15,710	6,636	.42
All other[4]	71,782	66,396	34,439	.52
Cresylic acid, refined[3]	46,449	41,801	13,868	.33
p-[(2-Cyanoethyl)methylamino]benzaldehyde	100	...	...	...
Cyclohexanone	744,949	32,618	11,743	.36
Cyclohexylamine	6,868	6,490	4,799	.74
1,4-Diaminoanthraquinone	47	...	...	...
o-Dichlorobenzene	47,371	55,741	15,250	.27
p-Dichlorobenzene	65,094	62,039	14,235	.23
2,4-Dichlorophenol	...	8,889	5,387	.61
N,N-Diethylaniline	2,118	1,833	1,740	.95
1,4-Dihydroxyanthraquinone (Quinizarin)	1,690	...	...	...
N,N-Dimethylaniline	13,060	8,672	4,810	.55
N,N-Dimethylbenzylamine	66	...	...	...
2,4-Dinitrotoluene	209,091	...	...	...
Dinonylphenol	1,717	1,819	577	.32
p-Dodecylphenol	32,307	...	...	...
N-Ethylaniline, refined	992	1,115	960	.86
2-(N-Ethylanilino)ethanol	292	...	...	...
N-Ethyl-N-phenylbenzylamine	1,263	...	...	...
3-(N-Ethyl-m-toluidino)propionitrile	154	103	221	2.14
Hydroquinone, tech.	...	11,892	16,559	1.39
p-Hydroxybenzenesulfonic acid	...	10,089	3,380	.33
Isocyanic acid derivatives, total	1,057,315	951,346	462,806	.49
Polymethylene polyphenylisocyanate	352,250	316,491	146,477	.46
Toluene-2,4- and 2,6-diisocyanate (80/20 mixture)	583,610	532,498	240,571	.45
Other isocyanic acid derivatives	121,455	102,357	75,758	.74
4,4'-Isopropylidenediphenol (Bisphenol A)	454,942	121,438	45,597	.38
3,4-Lutidine	...	145	231	1.60
Melamine	125,918	76,091	26,710	.35
dl-p-Mentha-1,8-diene (Limonene)	8,755	6,994	725	.10
Metanilic acid (m-Aminobenzenesulfonic acid)	1,338	...	...	...
3-(N-Methylanilino)propionitrile	64	...	...	...

See footnotes at end of table.

TABLE 1.--CYCLIC INTERMEDIATES: U.S. PRODUCTION AND SALES, 1977--CONTINUED

CYCLIC INTERMEDIATES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
4,4'-Methylenebis[N,N-dimethylaniline) (Methane base)	998	...	...	...
α-Methylstyrene	60,245	54,725	9,507	$0.17
Nitrobenzene	552,329	19,193	4,182	.22
5-Nitro-o-toluenesulfonic acid [$SO_3H=1$]	5,890	...	...	....
Nonylphenol	102,852	39,486	9,961	.25
1-[(7-Oxo-7H-benz[de]anthracene-3-yl)amino]anthraquinone	155	...	...	...
Phenol, total[3]	2,337,836	1,205,733	231,692	.19
From cumene	2,131,661	1,116,733	212,328	.19
Other	206,175	89,000	19,364	.22
2,2'-[(Phenyl)imino]diethanol (N-Phenyldiethanolamine)	501	264	189	.71
Phthalic anhydride	925,952	566,794	128,492	.23
Salicylic acid, tech.	45,291	5,812	4,857	.84
Terephthalic acid, dimethyl ester[5]	5,409,672	...	...	...
Toluene-2,4-diamine (4-m-Tolylenediamine)	222,400	...	...	...
1,3,3-Trimethyl-$\Delta^{2,\alpha}$-indolineacetaldehyde	373	...	...	...
1,3,3-Trimethyl-2-methyleneindoline	910	...	...	...
7,7'-Ureylenebis[4-hydroxy-2-naphthalenesulfonic acid]	260	...	...	...
Violanthrone (Dibenzanthrone)	236	...	...	...
All other cyclic intermediates	4,529,877	3,721,013	1,315,081	.35

[1] Calculated from unrounded figures.
[2] Includes straight-chain dodecylbenzene, tridecylbenzene, and other straight-chain alkylbenzenes. Branched-chain alkylbenzenes are included in "All other cyclic intermediates."
[3] Does not include data for coke ovens and gas-retort ovens, reported to the Office of Energy Data and Interpretation, Energy Information Administration, Department of Energy.
[4] Figures include (o,m,p)-cresol from coal tar and some m-cresol and p-cresol.
[5] The figures for terephthalic acid, dimethyl ester (DMT) include both the acid itself and the dimethyl ester without double counting. The acid production figure was multiplied by the factor 1.16 to convert it to equivalent DMT.

Note.--The data for production (in thousands of pounds) for cyclic intermediates for 1976 have been revised as shown below:

Grand total	17,700,000
Terephthalic acid, dimethyl ester	5,051,049

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT. COMPANY IDENTIFICATION CODES WHICH ARE FOLLOWED BY AN "(E)" ARE SO LABELED BECAUSE THE COMPANY FAILED TO SUPPLY THE U.S. INTERNATIONAL TRADE COMMISSION WITH THEIR DATA IN SUFFICIENT TIME FOR ITS INCLUSION IN THIS REPORT. THE COMPANY IS PRESUMED TO HAVE CONTINUED PRODUCTION OF THE COMPOUND IN QUESTION IN 1977 AND THE VOLUME OF PRODUCTION AND SALES HAS BEEN ESTIMATED BY THE USITC STAFF MEMBERS]

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
8-Acetamido-1-(4-acetamido-2-hydroxy-5-nitrophenylazo)-2-naphthol	TRC.
3-[(2-Acetamido-4-aminophenyl)azo]-1,5-naphthalenedisulfonicacid	TRC.
5-Acetamido-2-ethoxy-N-(2-cyanoethyl)aniline	HST.
5-Acetamido-2-ethoxy-N-(2-cyanoethyl)ethylaniline	HST.
5-Acetamido-2-ethoxyethyl-N-(2-cyanoethyl-N-hydroxyethyl)aniline	HST.
2,2'-[(3-Acetamido-6-ethoxyphenyl)imino]diethanol	HST.
2,2'-[(5-Acetamido-2-ethoxyphenyl)imino]diethanol	TCH.
2,2'-[(3-Acetamido-6-methoxyphenyl)imino]diethanol	HST.
2,2'-[(3-Acetamidophenyl)imino]diethanol	TCH.
3-Acetamido-N-(2-succinimidoethyl)-N-ethylaniline	EKT.
4-Acetaminophenacyltrimethylammonium chloride	DUP.
Acetanilide N.F.	SAL.
Acetanilide, tech.	ARA, SAL.
p-Acetanisidide	EKT, SDC.
Acetoacetanilide	EKT, FMP, HST.
*o-Acetoacetanisidide	EKT, FMP, HST, SDH.
*o-Acetoacetotoluidide	EKT, FMP, HST.
2',4'-Acetoacetoxylidide	EKT, HST.
1'-Acetonaphthone	GIV.
Acetone phenylhydrazone	DUP.
Acetophenone, crude	ACS.
*Acetophenone, tech.	MON, SKO, UCC.
p-Acetotoluidide	EK.
N-(2-Acetoxyethyl)-N-(2-cyanoethyl)aniline	EKT.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OB SALES WERE EITHEB REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
α-Acetylamino-p-toluenesulfonamine	SDW.
N-Acetylanthranilic acid	SW.
p-Acetylbenzenesulfonamide	LIL.
p-Acetylbenzenesulfonic acid, sodium salt	LIL.
p-Acetylbenzenesulfonylurethane	LIL.
N-Acetylsulfanilyl chloride	ACY, ARA.
*ALKYLBENZENES:	
Alkylbenzene straight-chain (Except dodecyl and tridecyl)	MON(E), WTC.
DODECYLBENZENE (INCLDDING TRIDECYLBENZENE):	
Dodecylbenzene, straight-chain	CO, MON(E), UCC, WTC.
Dodecylbenzene, other	CO, SOC, WTC.
Alkylbenzene all other (Except dodecyl, tridecyl and stright-chain)	WTC.
Alkylphenols, mixed	PRD.
3'-Aminoacetanilide	AC.
4'-Aminoacetanilide (Acetyl-p-phenylenediamine)	GAF, SAL, TBC.
*3'-Amino-p-acetanisidide	EKT, HST, SDC.
3'-Aminoacetophenone	ARA.
3'-Amino-p-acetphenetidine	HST.
5-Amino-2-(p-aminoanilino)benzenesulfonic acid	TRC.
4-Amino-3-[(4-aminophenyl)azo]-5-hydroxy-6-phenylazo-2,7-naphthalenedisulfonic acid	DUP.
2-(p-Aminoanilino)-5-nitrobenzenesulfonic acid	TRC.
3-Amino-p-anisanilide	PCW.
1-Aminoanthraquinone and salt	ACY, TRC.
6-Amino-3,4'-azodibenzenesulfonic acid (C.I. Acid Yellow 9)	TRC.
p-Aminobenzamide	SAL, SDH.
1-Amino-4-benzamidoanthraquinone	ACY, TRC.
7-(p-Aminobenzamido)-4-hydroxy-2-naphthalenesulfonic acid	TRC.
o-Aminobenzenethiol	FMT.
p-Aminobenzoic acid, tech.	PD, SAL.
2-Amino-6-benzothiazolecarboxylic acid	DUP.
2-Amino-6-benzothiazolesulfonic acid	DUP.
1-Amino-4-bromo-9,10-dihydro-9,10-dioxo-2-anthracenesulfonic acid and sodium salt	AC, TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*1-Amino-2-bromo-4-hydroxyanthraquinone	AC, DUP, GAF, VPC.
1-Amino-5-chloroanthraquinone	TRC.
4-Amino-6-chloro-m-benzenedisulfonamide	ABB.
4-Amino-6-chloro-m-benzenedisulfonamide chloride	ABB.
2-Amino-5-chlorobenzophenone	GNW.
1-Amino-2-chloro-4-hydroxyanthraquinone	TRC.
3-Amino-5-chloro-2-hydroxybenzenesulfonic acid	TRC.
3-Amino-6-chloropyridazine	ACY.
2-Aminc-5-chloro-p-toluenesulfonic acid [SO_3H=1]	ACY, HSC.
6-Amino-4-chloro-m-toluenesulfonic acid [SO_3H=1]	ACY, DUP.
2-Amino-p-cresol	SW.
1-Amino-2,4-dibromoanthraquinone	DUP, GAF, VPC.
1-Amino-2,4-dichloroanthraquinone	TRC.
2-Amino-5,6-dichlorobenzothiazole	SAL.
5-Amino-4,5'-dihydroxy-3,4'-[(2-methoxy-5-methyl-p-phenylene)bis(azo)]-di-2,7-naphthalenedisulfonic acid, 5'-benzenesulfonate	TRC.
5-Amino-2,4-dimethylacetanilide	PD.
3-Amino-9-ethylcarbazole	AC, SDC.
3-Amino-α-ethylhydrocinnamic acid	SDW.
4-Amino-N-ethyl-N-(β-methylsulfonamidoethyl)-m-toluidine-phosphate	WAY.
4-Amino-5-hydroxy-2,7-naphthalenedisulfonic acid, benzenesulfonate	TRC.
4-Amino-3-hydroxy-1-naphthalenesulfonic acid	ACY, TRC.
6-Amino-4-hydroxy-2-naphthalenesulfonic acid, sodium salt	TRC.
7-Amino-4-hydroxy-2-naphthalenesulfonic acid, sodium salt	AC, TRC.
3-Amino-2-hydroxy-5-nitroacetanilide	TRC.
2-(2-Amino-5-hydroxy-7-sulfo-1-naphthylazo)-5-nitrobenzoic acid	TRC.
2-(6-Amino-3-imino-3H-xanthen-9-yl)-benzoic acid, hydrochloride	EK.
3-Amino-2-mercaptobenzoic acid	X.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
5-Amino-6-methoxy-2-naphthalenesulfonic acid	TRC.
m-[(4-Amino-3-methoxyphenyl)azo]benzenesulfonic acid	AC, TRC.
2-Amino-4-methoxytoluene	HST.
4-Amino-5-methoxy-o-toluenesulfonic acid	ATL.
4-[(4-Amino-5-methoxy-o-tolyl)azo]-4-hydroxy-2,7-naphthalenedisulfonic acid, benzenesulfonate	TRC.
3-[(4-Amino-5-methoxy-o-tolyl)azo]-1,5-naphthalenedisulfonic acid	TRC.
7-[(4-Amino-5-methoxy-o-tolyl)azo]-1,3-naphthalenedisulfonic acid	TRC.
3-Amino-4-methylbenzamide	SAL.
5-Amino-3-methyl-1-(4-chlorophenyl)pyrazole	DUP.
4-Amino-4'-(3-methyl-5-oxo-2-pyrazolin-1-yl)-2,2'-stilbenedisulfonic acid	TRC.
2-Amino-6-methylpyridine	RIL.
2-Amino-4-methylpyrimidine (2-Amino-4-methyl-1,3-diazine)	ACY.
2-Amino-4-(methylsulfonyl)phenol	TRC.
2-Amino-5-methyl-1,3,4-thiadiazole	ACY.
2-Amino-1,5-naphthalenedisulfonic acid	ACY, SDH.
3-Amino-1,5-naphthalenedisulfonic acid (C Acid)	TRC.
6-Amino-1,3-naphthalenedisulfonic acid (Amino I acid)	AC, TRC.
7-Amino-1,3-naphthalenedisulfonic acid (Amino G acid)	AC, TRC.
2-Amino-1-naphthalenesulfonic acid (Tobias acid)	ACY, SW.
6-Amino-2-naphthalenesulfonic acid (Broenner's acid)	TRC.
7-Amino-1,3,5-naphthalenetrisulfonic acid	TRC.
7-Amino-1,3,6-naphthalenetrisulfonic acid	AC.
8-Amino-2-naphthol	BUC, TRC.
2-Amino-4-nitroacetanilide	SDC.
2-Amino-5-nitrobenzenesulfonic acid [SO_3H=1]	TRC.
2-Amino-6-nitrobenzothiazole	HST, SAL.
4-Amino-4'-nitro-2,2'-stilbenedisulfonic acid	AC, GAF, TRC.
2-Amino-5-nitrothiazole	PCW.
3'-Aminooxanilic acid	ATL, TRC.
4'-Aminooxanilic acid	ATL.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
6-Aminopenicillanic acid	WYT.
p-Aminophenethyl alcohol	EKT.
o-Aminophenol	TRC.
p-Aminophenol	MAL, SDC.
m-[(p-Aminophenyl)azo]benzenesulfonic acid	TRC.
*p-[(p-Aminophenyl)azo]benzenesulfonic acid	ACY, DUP, TRC.
7-[(4-Aminophenyl)azo]-1,3-naphthalenedisulfonic acid	TRC.
5-Amino-8-(phenylazo)-2-naphthol	ALL.
5-[(p-Aminophenyl)azo]salicylic acid	ATL, TRC.
2,2'-(m-Aminophenylimino)diethanol, diacetate ester	DUP.
2-(p-Aminophenyl)-6-methylbenzothiazole	DUP.
2-(p-Aminophenyl)-6-methylbenzothiazolesulfonic acid	DUP.
2-(p-Aminophenyl)-6-methyl-7-benzothiazolesulfonic acid and salt	DUP, TRC.
1-(m-Aminophenyl)-5-oxo-2-pyrazoline-3-carboxylic acid	TRC.
m-Aminophenylphosphonic acid	ICI.
2-Aminopyridine	NEP, RIL.
3-Aminopyridine	RIL.
4-Aminopyridine	RIL.
3-Amino-p-toluamide	SDH.
α-Amino-p-toluenesulfonamide	SDW.
4-Amino-m-toluenesulfonic acid [$SO_3H=1$]	ACY, DUP.
5-Amino-o-toluenesulfonic acid [$SO_3H=1$]	DUP, MON.
6-Amino-m-toluenesulfonic acid [$SO_3H=1$]	DUP.
m-[(4-Amino-3-tolyl)azo]benzenesulfonic acid	TRC.
3-[(4-Amino-o-tolyl)azo]-1,5-naphthalenedisulfonic acid	TRC.
7-[(4-Amino-o-tolyl)azo]-1,3-naphthalenedisulfonic acid	TRC.
*Aniline (Aniline oil)	ACY, DUP, FST, MAL, MOB, RUC, USR.
Aniline hydrochloride	ACY.
2'-Anilino-6-diethylamino-3-methylfluoran	X.
*2-Anilinoethanol	EKT, MIL, TCH.
7-Anilino-4-hydroxy-2-naphthalenesulfonic acid	TRC.
*Anilinomethanesulfonic acid and salt	AC, ACY, ATL, DUP, TRC.
8-Anilino-1-naphthalenesulfonic acid (Phenyl peri acid)	EK, SDC.
3-Anilinopropionitrile	DUP.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
o-Anisaldehyde	ASL.
o-Anisidine	DUP.
p-Anisidine	DUP.
o-Anisidinomethanesulfonic acid	ATL, GAF, TRC.
Anisole, tech.	DUP.
9,10-Anthracenedicarboxaldehyde	EK.
Anthranilic acid (o-Aminobenzoic acid)	SW.
Anthranilic acid, methyl ester	SW.
Anthraquinone, 100%	TRC.
N,N'-(1,5-Anthraquinonylene)dianthranilic acid	TRC.
4-Azidobenzaldehyde	EK.
1-(p-Azo-azobenzene)-2-hydroxy-3,6-disulfonaphthalene, disodium salt	BCC.
Benzaldehyde, tech.	HN, KLM, MNR(E), UOP.
1-Benzamido-5-chloroanthraquinone	TRC.
7-Benzamido-4-hydroxy-2-naphthalenesulfonic acid	ATL, TRC.
Benzanilide	DUP.
7H-Benz[de]anthracen-7-one (Benzanthrone)	ACY, DUP, TRC.
Benzenesulfonic acid	EK, UPF.
Benzenesulfonic acid, propyl ester	CWN.
Benzenesulfonyl chloride	UPF, USR.
1,2,4,5-Benzenetetracarboxylic-1,2:4,5-dianhydride	DUP.
1,2,4-Benzenetricarboxlic acid, 1,2-anhydride (Trimellitic anhydride)	ACC.
Benzensulfonic-4-chloro-3-[4,5-dihydro-3-methyl-5-oxo-4-(phenylazo)-1H-pyrazol-1-yl]-monosodium salt	BCC.
Benzhydrol (Diphenylmethanol)	UOP.
Benzidine hydrochloride and sulfate	GAF.
Benzil	LEM.
Benzilic acid	LEM.
Benzoic acid, methyl ester	HPC.
*Benzoic acid, tech.	HN, KLM, PFZ, VEL.
Benzoin	SFS.
Benzoin isobutyl ether	SFS.
Benzoin isopropyl ether	LEM, SFS.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Benzoinoxime	RSA.
Benzonitrile	VEL.
p-Benzoquinone, dioxime	SDC.
2-Benzothiazolethiol	USR.
*2-Benzothiazolethiol, sodium salt	ACY, GYR, USR.
1H-Benzotriazole	SW.
Benzoylacetic acid, ethyl ester	EKT.
o-Benzoylbenzoic acid	ACY, GAF.
Benzoyl chloride	HK, VEL.
N-Benzylacetamide	SDW.
Benzylamine	ARS, MLS.
4-Benzyl-6-chloro-3-keto-2-methyl-7-sulfamyl-1,2,4-benzylthiadiazine-1,1-dioxide	ABB.
4-Benzyl-6-chloro-3-keto-7-sulfamyl-1,2,4-benzylthiadiazine-1,1-dioxide	ABB.
Benzyl ether (Dibenzyl ether)	UOP.
3-(Benzylethylamino)acetanilide	EKT.
4,4'-Benzylidenedi-o-toluidine	ACY.
Benzylidene phthalide	LIL.
6-Benzylidineaminopenicillanic acid, tertiary octylamine salt	TRD.
N-Benzyloxycarbonyloxy-5-norbornene-2,3-dicarboximide	X.
6'-N-Benzyloxycarbonyl-tri-N-salicylydene kanamycin A	X.
1-Benzyl-4-phenylisonipecotic acid	SDW.
1-Benzyl-4-phenylisonipecotonitrile	SDW.
Benzyltrimethylammonium chloride	MLS.
Benzyltrimethylammonium hydroxide	MLS.
[3,3'-Bianthra[1,9-cd]pyrazole]-6,6'(2H,2'H)-dione (Pyrazoleanthrone Yellow)	TRC.
[4,4'-Bi-7H-benz[de]anthracene]-7,7'-dione	ACY, DUP.
*Biphenyl	CHL, DOW, GOC, MON, SUN, TCC.
3'-[Bis(2-acetoxyethyl)amino]-p-acetonisidide	TCH.
Bis(p-aminocyclohexyl)methane	DUP.
1,2-Bis(2-aminophenylthio)ethane	X.
1,4-Bis[1-anthraquinonylamino]anthraquinone	TRC.
1,4-Bis[1-anthraquinonylamino]anthraquinone and 1,4-bis[5-chloro-1-anthraquinonylamino]anthraquinone (mixed)	TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
2,6-Bis(p-azidobenzylidene)-4-methylcyclohexanone	X.
N-N-Bis [cyanoethyl]aniline	DUP.
4,4'-Bis[diethylamino]benzhydrol, 2,6-naphthalenedisulfonate	X.
4,4'-Bis[diethylamino]benzhydrol salt, 2,7-naphthalene-disulfonic acid mixture	TRC.
4,4'-Bis[diethylamino]benzophenone (Ethyl ketone base)	X.
4-Bis[(p-diethylaminophenyl)methyl]-2,7-naphthalenedisulfonic acid, leuco form	TRC.
1,4-Bis-(2,6-diethylphenyl)-9,10-anthracenedione	EK.
4,4'-Bis[dimethylamino]benzhydrol (Michler's hydrol)	X.
4,4'-Bis[dimethylamino]benzophenone (Michler's ketone)	X.
Bis(β-dimethylaminoethyl)phenylacetonitrile	WYT.
1,5-Bis[2,4-dinitrophenoxy]-4,8-dinitroanthraquinone	VPC.
3,3'-Bis[3',3'-(1'-ethyl-2'-methyl)indolyl]phthalide	X.
3'-[Bis(2-hydroxyethyl)amino]acetanilide	GAF.
3'-[Bis(2-hydroxyethyl)amino]benzanilide	DUP.
3'-[Bis(2-hydroxyethyl)amino]benzanilide, diacetate ester	TCH.
3'-[Bis(2-hydroxyethyl)amino]-4'-methoxyacetanilide	EKT.
4,4'-Bis[(p-hydroxyphenyl)azo]-2,2'-stilbenedisulfonic acid (C.I. Direct Yellow 4)	ATL, TRC.
Bis-(p-nitrophenyl)ether	DUP.
1,2-Bis(tribromophenoxy)ethane	VEL.
p-Bromcaniline	EK.
p-Bromcanisole	OPC.
3-Bromo-7H-benz[de]anthracen-7-one (3-Bromobenzanthrone)	ACY.
Bromobenzene,mono-	GTL, WCC.
2-Bromo-6-chloro-4-nitroaniline	AC, HST.
9-Bromo-4-chlorophthalocyanine, copper salt	BCC.
2-Bromc-4,6-dinitroaniline	AC, HST, SDC.
2-(2-Bromo-4,6-dinitrophenylazo)-5-diethylaminoacetanilide	TRC.
Bromoethylbenzene	RSA.
2-Bromo-4'-nitroacetophenone	GAF, RSA.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N-(4-Bromopentyl)-phthalimide	SDW.
(p-Bromophenyl)acetonitrile	SFS.
4-Bromoresorcylic acid	PCW.
4-Bromoresorcylic acid, ethanolamide	PCW.
8-Bromotheophyline	CHT.
p-Bromotoluene	EK, SFS.
α-Bromotoluene	WCC.
2-Bromo-1,3,5-triethylbenzene	DUP.
p-Butylaniline	HDW.
3-(N-Butylanilino)propionitrile	MIL.
2-tert-Butylanthraquinone	DUP.
p-tert-Butylbenzaldehyde	GIV.
tert-Butylbenzene	UOP.
p-tert-Butylbenzoic acid	SHC.
o-(p-tert-Butylbenzoyl)benzoic acid	DUP.
2-tert-Butyl-p-cresol	ACY.
6-tert-Butyl-m-cresol	KPT.
2'-tert-Butyl-4',6'-dimethylacetophenone	GIV.
2-tert-Butyl-4-ethylphenol	ACY.
tert-Butylhydroquinone	X.
2-tert-Butyl-5-methylanisole	GIV.
o-sec-Butylphenol	TNA.
o-tert-Butylphenol	TNA.
*p-tert-Butylphenol	DCW, PRD, SCN.
*Butylphenols, mixed	DOW, PRD, SCN.
p-tert-Butyltoluene	GIV, SHC.
5-tert-Butyl-1,2,3-trimethylbenzene	GIV.
5-tert-Butyl-m-xylene	GIV.
*6-tert-Butyl-2,4-xylenol	PIT, PRD, RH.
d-10-Camphorsulfonic acid	KP.
Carbamic acid, 2[N-(2-cyano)ethyl phenylamino]ethyl ester	GAF.
(3-Carbamoyl-3,3-diphenylpropyl)diisopropylmethylammonium iodide	SK.
Carboethoxyimidazole	ARA.
N-[(3-Carboxy-4-chlorophenyl)-sulfonyl]anthranilic acid	TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
2-Carboxydiphenyl sulfide	PD.
2-(p-Carboxyphenoxy)-2-pivaloyl-2,(4)-dichloroacetanilide	EK.
Cedrene	GIV.
o-Chloranil	UPJ.
2-Chloroacetamido-5-chlorobenzophenone	WYT.
2'-Chloroacetoacetanilide	EKT, HST.
4'-Chloroacetophenone	LIL.
3'-Chloro-p-acetotoluidide	EK.
4'-(Chloroacetyl)acetanilide	DUP.
9-Chloroacridine	EK.
o-Chloroaniline	DUP.
m-Chloroaniline	DUP.
p-Chloroaniline	DUP, MON.
2-(o-Chloroanilino)ethanol	EKT, TCH.
3-(o-Chloroanilino)propionitrile	DUP, TCH.
1-Chloroanthraquinone	ACY, TRC.
2-Chloroanthraquinone	ACY.
o-Chlorobenzaldehyde	HN.
p-Chlorobenzaldehyde	HN.
Chloro-7H-benz[de]anthracen-7-one (Chlorobenzanthrone)	TRC.
*Chlorobenzene, mono-	ACS, DOW, MON, MTO, PPG, SCC.
p-Chlorobenzenesulfinic acid	TRC.
p-Chlorobenzenesulfonamide	NES.
p-Chlorobenzenesulfonic acid	IMC, UPF.
p-Chlorobenzenethiol	SFA.
o-Chlorobenzoic acid	HN.
m-Chlorobenzoic acid, methyl ester	VEL.
p-Chlorobenzophenone	OPC.
p-Chlorobenzoyl chloride	HN.
N-(o-Chlorobenzyl)-N-ethyl-m-toluidine	DUP.
4,4'-(o-Chlorobenzylidene)di-2,5-xylidine	GAF.
p-Chlorobenzylsulfonamide	PFZ.
Chloro(p-chlorophenyl)phenylmethane	OPC, UOP.
7-Chloro-1,3-dihydro-3-hydroxy-5-phenyl-2H-1,4-benzodiazepin-2-one, acetate ester	WYT.
7-Chloro-1,3-dihydro-5-phenyl-2H-1,4-benzodiazepin-2-one-4-oxide	WYT.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
4'-Chloro-2',5'-dimethoxyacetoacetanilide	PCW.
4-Chloro-2,5-dimethoxyaniline	PCW.
Chlorodimethoxybenzene	PCW.
2-Chloro-10-[3-(dimethylamino)propyl]phenothiazine	SK.
1-Chloro-2,4-dinitrobenzene (Dinitrochlorobenzene)	SDC.
3-Chloro-4,6-dinitrobenzenesulfonic acid	TRC.
3-Chlorodiphenylamine	SK.
Chlorodiphenylmethane	OPC.
N-(2-Chloroethyl)-N-ethylaniline	GAF.
p-[(2-Chloroethyl)methylamino]benzaldehyde	DUP.
2-Chloro-4-hydroxybenzoic acid	EK.
7-Chloro-4-hydroxyquinidine hydrochloride	PD.
4-Chlorometanilic acid	BCC.
1-Chloro-2-methylanthraquinone	ACY, TRC.
α-Chloromethylnaphthalene, crude	SFS.
4-Chloro-N-methyl-3-nitrobenzenesulfonamide	TRC.
5-Chloro-2-(N-methyl)sulfamyl-4-sulfamyl-N-benzylaniline	ABB.
ar-Chloro-methylstyrene	DOW.
Chloronaphthalenes	KPT.
2-Chloro-4-nitroaniline (o-Chloro-p-nitroaniline)	DUP.
4-Chloro-2-nitroaniline (p-Chloro-o-nitroaniline)	DUP.
1-Chloro-5-nitroanthraquinone	TRC.
1-Chloro-2-nitrobenzene (Chloro-o-nitrobenzene)	DUP, MON.
1-Chloro-4-nitrobenzene (Chloro-p-nitrobenzene)	DUP, MON.
2-Chloro-5-nitrobenzenesulfinic acid	TRC.
4-Chloro-3-nitrobenzenesulfonamide	AC, DUP, EKT, TRC.
2-Chloro-5-nitrobenzenesulfonic acid	TRC.
4-Chloro-3-nitrobenzenesulfonic acid	TRC.
4-Chloro-3-nitrobenzenesulfonyl chloride	EKT, VPC.
2-Chloro-4-nitrobenzoic acid	SAL.
2-Chloro-5-nitrobenzoic acid	TRC.
2-Chloro-4-nitrobenzoic acid, potassium salt	SAL.
5-Chloro-2-nitro-diethoxybenzene	HST.
4-Chloro-3-nitro-N,N-dimethylbenzenesulfonamide	EKT.
2-Chloro-5-nitrophenyl methyl sulfone	TRC.
4-Chloro-3-nitrophenyl methyl sulfone	TRC.
2-Chloro-4-nitrotoluene	DUP.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
o-Chlorophenol	DOW, MON.
p-Chlorophenol	DOW, MON, RDA.
p-Chlorophenol, hydrazine sulfate	HST.
(p-Chlorophenyl)acetonitrile	OPC, SK, UOP.
4-Chloro-α-phenyl-o-cresol	MON.
(m-Chlorophenyl)diethanolamine	HST.
o-Chlorophenyl-1-hydroxycyclopentyl-N-methylkitimine	PD.
2,2'-[(m-Chlorophenyl)imino]diethanol	TCH.
2,2'-[(m-Chlorophenyl)imino]diethanol, diacetate ester	SDC.
3-(o-Chlorophenyl)-5-methyl-4-isoxazole carboxylic acid chloride	ARS.
1-(o-Chlorophenyl)-3-methyl-2-pyrazolin-5-one	HST.
1-(m-Chlorophenyl)-3-methyl-2-pyrazolin-5-one	TRC.
1-(p-Chlorophenyl)-3-methyl-2-pyrazolin-5-one	VPC.
p-Chlorophenyl methyl sulfone	TRC.
*4-Chlorophthalic acid	DUP, HSC, SW.
(3-Chloropropenyl)benzene	SDW.
1-(3-Chloropropyl)-4-methylpiperazine	SK.
4-Chlororesorcinol	PCW.
5-Chlorosalicylic acid	PCW.
o-Chlorotoluene	HK, HN.
m-Chlorotoluene	HN.
p-Chlorotoluene	HN.
α-Chlorotoluene (Benzyl chloride)	MON, SFS.
3-Chloro-p-toluidine [NH_2=1]	DUP.
4-Chloro-o-toluidine [NH_2=1] and hydrochloride	PCW.
N-[(5-Chloro-o-tolyl)azo]sarcosine	AIL, ATL.
1-(6-Chloro-o-tolyl)-3-methyl-2-pyrazolin-5-one	TRC.
p-Chloro-α,α,α-trifluorotoluene	HK.
4-Chloro-3,5-xylenol	FER.
Cholic acid	WIL.
o-Chlorophenylcyclopentyl ketone	ARA.
Cinnamic acid	SFS.
Cinnamoyl chloride	EK.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*CRESOLS:	
m-Cresol	KPT.
*O-CRESOL:	
o-Cresol, from coal tar	KPT, PRD.
o-Cresol, from petroleum	MER, NPC(E), PRD, SW.
p-Cresol	SW.
CRESOLS, MIXED:	
(M,P)-CRESOL:	
(m,p)-Cresol, from coal tar	KPT, PRD.
(m,p)-Cresol, from petroleum	MER, NPC(E), PRD.
(O,M,P)-CRESOL:	
(o,m,p)-Cresol, from coal tar	KPT.
Cresols, mixed	PIT.
*CRESYLIC ACID, REFINED	
Cresylic acid, refined from coal tar	KPT, PRD.
Cresylic acid, refined from petroleum	MER, NPC(E), PRD.
p-Cumylphenol	X.
2-[p-(Cyanoacetamido)phenyl]-6-methyl-7-benzothiazole-sulfonic acid	DUP.
4-(Cyanoacetyl)morpholine	PCW.
4-[(2-Cyanoethyl)ethylamino]-o-tolualdehyde	DUP, GAF.
N-(2-Cyanoethyl)-N-ethyl-m-toluidine	EKT.
*p-[(2-Cyanoethyl)methylamino]benzaldehyde	ATL, DUP, GAF.
N-[2-(N-[2-Cyanoethyl]m-toluidino)ethyl]succinimide	EKT.
Cyclododecatriene (CDDT)	DUP.
1,2-Cyclohexanedicarboxylic anhydride	ACS.
1,3-Cyclohexanedione	PD.
Cyclohexanol	ALF, DUP, MON.
*Cyclohexanone	ALF, CEL, CNP, DBC, DUP, MON, UCC.
Cyclohexanone oxime	CNP.
3-Cyclohexene-1-carboxaldehyde	UCC.
4-Cyclohexene-1,2-dicarboximide	SPC.
4-Cyclohexene-1,2-dicarboxylic acid	PTT.
4-Cyclohexene-1,2-dicarboxylic anhydride	DKA.
Cyclohexene oxide	USR.
β-(1-Cyclohexenyl)ethylamine	MLS.
*Cyclohexylamine	ABB, RBC, VGC.
2-Cyclopentanone-β-(2,5-dihydroxybenzene) ethyl ketone	X.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Cyclopentyl magnesium bromide	ARA.
2-(N-Cyclopropylmethyl-N-phthalimidoacetyl)-amino-5-chlorobenzophenone	PD.
p-Cymene	HPC.
Deoxycholic acid	WIL.
Diacenaphtho[1,2-j:1',2'-l]fluoranthene (Decacyclene)	SDC.
3,5-Diacetamido-2,4,6-triiodobenzoic acid	SDW.
Dialkylbenzene	SOC.
*1,4-Diaminoanthraquinone	DUP, SDC, TRC.
3,3'-Diaminobenzanilide	TRC.
2,4-Diaminobenzenesulfonic acid [SO_3H=1]	DUP, TRC.
2,5-Diaminobenzenesulfonic acid [SO_3H=1]	TRC.
3,5-Diaminobenzoic acid	SAL.
4,4'-Diamino-2,2'-biphenyldisulfonic acid	ACY.
1,3 Diaminocyclohexane	DUP.
1,4-Diamino-2,3-dichloroanthraquinone	DUP.
1,4-Diamino-2,3-dicyanoanthraquinone	DUP.
1,4-Diamino-2,3-dihydroanthraquinone	ACY, DUP, HSH, TRC.
4,8-Diamino-9,10-dihydro-1,5-dihydroxy-9,10-dioxo-2,6-anthracenedisulfonic acid	TRC.
4,8(and 4,5)-Diamino-9,10-dihydro-1,5(and 1,8)-dihydroxy-9,10-dioxo-2,6(and 2,7)-anthracenedisulfonic acid	TRC.
1,4-Diamino-9,10-dihydro-9,10-dioxo-2,3-anthracenedicarboximide	DUP.
1,5-Diamino-4,8-dihydroxyanthraquinone	VPC.
2,4-Diamino-phenol-dihydrochloride	EK.
2,4-Diamino-6-phenyl-s-triazine	VEL.
2,6-Diaminopyridine	RIL.
4,4'-Diamino-2,2'-stilbenedisulfonic acid	CGY(E), GAF, TRC, X.
3,5-Diamino-2,4,6-triiodobenzoic acid	SDW.
2-Diazo-1-naphthol-5-sulfonic acid, sodium salt	HST.
6,11-Dibenzamido-16H-dinaphthol[2,3-α,2',3'-i]carbazole-5,10,15,17-tetrone	ACY.
4,5'-Dibenzamido-1,1'-iminodianthraquinone	TRC.
Dibenzo(b,def)chrysene-7,14-dione	TRC.
1,5-Dibenzoylnaphthalene	GAF, TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
2'-Dibenzylamino-6'-diethyl(aminofluoran)-	X.
2-(Dibenzylamino)ethanol	DUP.
N,N'-Dibenzylethylenediamine	WYT.
N,N'-Dibenzylethylenediamine diacetate	WYT.
N',N'-Dibenzylidenetoluene-α,α-diamine	SDH.
3,9-Dibromo-7H-benz[de]anthracen-7-one	DUP, TRC.
2,6-Dibromo-4-nitroaniline	SDC.
3,5-Dibromo-3'-trifluoromethylsalicylanilide (Fluorophene)	PCW.
p-Dibutoxybenzene (DBB)-	ALL.
2,5-Dibutoxy-4-morpholinobenzenediazonium sulfate salt (DBB Sulfate)-	ALL.
2,6-Di-tert-butyl-4-nonylphenol-	GAF.
2,4-Di-tert-butylphenol-	PIT, PRD.
2,6-Di-sec-butylphenol	TNA.
2,6-Di-tert-butylphenol-	TNA.
3,4-Dichloroaniline-	DUP, MON.
2,3-Dichloroanisole-	HST.
1,5-Dichloroanthraquinone-	TRC.
2,6-Dichlorobenzaldehyde	DUP.
Dichlorobenzanthrone	ACY.
o(and p)-Dichlorobenzene	MTO.
*o-Dichlorobenzene-	ACS, DOW, MON, PPG, SCC(E).
*p-Dichlorobenzene-	ACS, DOW, DVC, PPG, SCC(E).
4,6-Dichloro-m-benzenedisulfonamide-	ABB.
4,6-Dichloro-m-benzenedisulfonyl chloride-	ABB.
3,3'-Dichlorobenzidine base and salts-	CWN, LAK.
2,2'-Dichlorobenzil-	MTO.
2,4-Dichlorobenzoic acid	HN.
2,4-Dichlorobenzoyl chloride	HN.
Dichlorobenzyl chloride-	SFS.
2,4-Dichloro-3,5-dinitro-α,α,α-trifluorotoluene-	GAF.
Dichlorodiphenylsilane	DCC.
2,4-Dichloro-6-isopropylamino-s-triazine	VTC.
2,5-Dichloro-4-(3-methyl-5-oxo-2-pyrazolin-1-yl)benzenesulfonic acid-	HST, TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Dichloromethylphenylsilane	CWN, DCC.
1,2-Dichloro-4-nitrobenzene	DUP, MON.
1,4-Dichloro-2-nitrobenzene (Nitro-p-dichlorobenzene)	ALL.
*2,4-Dichlorophenol	DOW, MON, RDA.
2,6-Dichlorophenol (2,6-DCP)	RDA.
2,4-Dichlorophenoxyacetic acid, dimethylamine salt	PD.
2,6-Dichloropyrazine	ACY.
3,6-Dichloropyridazine	ACY.
4,7-Dichloroquinoline	PD.
2,5-Dichlorosulfanilic acid [$SO_3H=1$]	DUP, VPC.
2,5-Dichloro-4-sulfobenzenediazonium sulfate	TRC.
p,α-Dichlorotoluene	HN.
α,α-Dichlorotoluene (Benzal chloride)	SFS.
2,6-Dichlorotoluene	DUP.
Dicyclohexylamine	ABB, VGC.
Dicyclopentadiene (includes Cyclopentadiene)	VEL.
Dicyclopentadiene diepoxide	VIK.
Dicyclopentadiene dioxide	VEL.
Didodecylbenzene	CC.
p-Diethoxybenzene	ALL.
3-Diethylaminoacetanilide	DUP.
p-(Diethylamino)benzaldehyde	ATL, DUP.
3'-[2-(Diethylamino)ethyl]-4'-hydroxyacetanilide	PD.
α-[(2-Diethylamino)ethyl]-α-phenylcyclohexanemethanol, hydrochloride	ACY.
7-Diethylamino-4-methylcoumarin, crude	X.
7-Diethylamino-3-methyl-1-phenyl-spiro[1]benzopyrano[2,3-C]pyrazole-4[1H],1'[3'H]isobenzofuren-3'-one	X.
m-(Diethylamino)phenol (N,N-Diethyl-3-aminophenol)	ACY.
3-[(4'-N,N-Diethylamino)phenylazo]-1H-1,2,4-triazole	TRC.
3-(Diethylamino)propiophenone	ACY.
4-(Diethylamino)-o-tolualdehyde	DUP.
*N,N-Diethylaniline	ACS, ACY, BCC, DUP.
2,6-Diethylaniline	TNA.
N,N-Diethyl-m-anisidine	DUP.
Diethylbenzene	DOW.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N,N-Diethylcyclohexylamine	DUP.
N[1],N[1]-Diethyl-4-methoxymetanilamide	PCW.
N,N-Diethyl-4-nitroso-m-phenetidine	GAF.
N,N-Diethyl-m-phenetidine	GAF.
N,N-Diethyl-p-phenylenediamine oxalate	EK.
N,N-Diethyl-m-toluidine	DUP.
N,N-Diethyl-p-toluidine	RSA.
6,11-Dihydrodibenz(b,e)oxepin-11-one	PFZ.
9,10-Dihydro-9,10-dioxo-1,5-anthracenedisulfonic acid	TRC.
9,10-Dihydro-9,10-dioxo-1,5-anthracenedisulfonic acid, disodium salt	TRC.
9,10-Dihydro-9,10-dioxo-1,8-anthracenedisulfonic acid, potassium salt	TRC.
9,10-Dihydro-9,10-dioxo-1,5(and 1,8)-anthracenedisulfonic acid and salt	TRC.
9,10-Dihydro-9,10-dioxo-2,6-anthracenedisulfonic acid and salt	TRC.
9,10-Dihydro-9,10-dioxo-2,7-anthracenedisulfonic acid and salt	TRC.
9,10-Dihydro-9,10-dioxo-1-anthracenesulfonic acid and salt	ACY, TRC.
[Dihydrogen 3,3''-phthalocyaninedisulfonato(2-)]copper	ATL.
9,10-Dihydro-5-nitro-9,10-dioxo-1-anthracenesulfonic acid	TRC.
1,2-Dihydro-2,2,4,7-tetramethylquinoline	EKT.
1,2-Dihydrotriamcinolone	UPJ.
1,2-Dihydro-2,2,4-trimethylquinoline	EKT.
*1,4-Dihydroxyanthraquinone (Quinizarin)	ACY, DUP, EKT, HSH, TRC.
1,5-Dihydroxyanthraquinone	TRC.
1,5(and 1,8)-Dihydroxyanthraquinone	TRC.
1,8-Dihydroxyanthraquinone	TRC.
2,5-Dihydroxy-p-benzenedisulfonic acid, dipotassium salt	EK.
2,5-Dihydroxybenzenesulfonic acid, potassium salt	EK.
2,4-Dihydroxybenzophenone	ACY, DUP, EKT.
1,5-Dihydroxy-4,8-dinitroanthraquinone	TRC, VPC.
1,8-Dihydroxy-4,5-dinitroanthraquinone	EKT, VPC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N,N-Di(β-hydroxyethyl)-m-chloroaniline	MIL.
17α,21-Dihydroxy-16α-methylpregna-1,4,9(11)-triene-3,20-dione	X.
17α,21-Dihydroxy-16β-methylpregna-1,4,9(11)-triene-3,20-dione,21 benzoate	X.
6,7-Dihydroxy-2-naphthalenesulfonic acid	WAY.
3,3'-Dihydroxy-2-naphthanilide	SDC, WAY.
11β,21-Dihydroxypregna-4,16-diene-3,20-dione,21-acetate	X.
11β,21-Dihydroxypregna-1,4,16-triene-3,20-dione,21-acetate	X.
4,6-Dihydroxypyrimidine	KF.
16,17-Dihydroxyviolanthrone (Dihydroxydibenzanthrone)	ACY, DUP.
Diisopropylbenzene	DOW.
N,N'-Diisopropyl-p-phenylenediamine	DUP.
2,5-Dimethoxyaniline	EKT, PCW.
1,5(and 1,8)-Dimethoxyanthraquinone	TRC.
2,5-Dimethoxybenzaldehyde	CWN, UPJ.
m-Dimethoxybenzene	ACY, ARS, GAF.
p-Dimethoxybenzene	ARS(E).
3,3'-Dimethoxybenzidine hydrochloride	CWN.
2,6-Dimethoxybenzoic acid	ARS(E).
2,6-Dimethoxybenzyl chloride	X.
N,N'-[(3,3'-Dimethoxy-4,4'-biphenylylene)bis(azo)]bis[N-methyltaurine]	ATL, GAF.
2,5-Dimethoxy-α-methylphenethylamine	X.
1,4-Dimethoxy-2-nitrobenzene	EKT.
2,5-Dimethoxytetrahydrofuran	HEX.
p-(Dimethylamino)benzaldehyde	DUP, EK, GAF.
m-(Dimethylamino)benzoic acid	X.
6-Dimethylamino-2-[2-(2,5-dimethyl-1-phenyl-3-pyrryl)-vinyl]-1-methyl-1-quinolinium methyl sulfate	EK.
2-[[2-(Dimethylamino)ethyl]-(p-methoxybenzyl)amino] pyridine	HEX.
2-[[2-(Dimethylamino)ethyl]-2-thenylamino]-pyridine	ABB.
2-Dimethylaminomethyl-4-nitro-6-ethoxyphenol	ARA.
6-Dimethylamino-1-methylquinaldinium methyl sulfate	EK.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
m-(Dimethylamino)phenol	ACY.
11-[3-(Dimethylamino)propyl]-11-hydroxy-dibenz(b,e) oxepin	PFZ, SK.
6-(Dimethylamino)quinaldine	EK.
*N,N-Dimethylaniline	ACS, ACY, BCC, DUP, TNA.
7,12-Dimethylbenz[a]anthracene	EK.
3,3'-Dimethylbenzidine hydrochloride	EK.
*N,N-Dimethylbenzylamine	ARS, MLS, RH.
α,α-Dimethylbenzyl hydroperoxide	USS.
2,2'-Dimethyl-1,1'-bianthraquinone	ACY, TRC.
5,5-Dimethyl-1,3-cyclohexanedione	EKT.
N,N-Dimethylcyclohexylamine	ABB, DUP.
5,5-Dimethylhydantoin	GLY.
2,6-Dimethylhydroquinone	ARA.
2,3-Dimethylindole	DDP.
2,5-Dimethyl-4(2)-morpholinylmethylphenol, hydrochloride	WAY.
2,3-Dimethyl-5-nitrobenzenesulfethanolamide	TRC.
N,N-Dimethyl-p-nitrosoaniline	ACY.
2,6-Dimethylol-p-cresol	SW.
N,N-Dimethyl-p-phenylenediamine monohydrochloride	EK.
1,4-Dimethylpiperazine	JCC.
3,5-Dimethylpyrazole	X.
N,N-Dimethyl-o-toluidine	RSA.
N,N-Dimethyl-p-toluidine	EK, RSA.
1,1-Dimethyl-3-(3-trifluoromethylphenyl)urea	HST.
2,4-Dinitroaniline	HST, SDC.
1,5(and 1,8)-Dinitroanthraquinone	SDC, TRC.
3,3'-Dinitrobenzanilide	TRC.
m-Dinitrobenzene	DUP.
2,4-Dinitrobenzenesulfonic acid	TRC.
3,5-Dinitrobenzoic acid	SAL.
3,5-Dinitrobenzoyl chloride	EK.
Dinitrocaprylphenol	RH.
2,4-Dinitrocumene	DUP.
3',5'-Dinitro-2'-hydroxyacetanilide	TRC.
2,6-Dintro-4-isopropylphenol	SDC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
2,4-Dinitrophenol, tech.	SDC, VPC.
3,5-Dinitrosalicylic acid	SAL.
3,5-Dinitrosalicylic acid, 5-nitrofurylidene hydrazine	LEM.
4,4'-Dinitrostilbene-2,2'-disulfonic acid	AC, CGY(E), GAF, X.
*2,4-Dinitrotoluene	ACS, DUP, RUC.
2,4(and 2,6)-Dinitrotoluene	AIP, DUP, MOB, UCC.
*Dinonylphenol	GAF, JCC, MON.
2,4-Di-tert-pentylphenol	PAS.
Di-tert-pentylphenoxyacetyl chloride	EK.
1,5-Diphenoxyanthraquinone	VPC.
Diphenylamine	ACY, DUP, ORO, RUC, USR.
2,5-Diphenyl-p-benzoquinone	EK.
N,N'-Diphenylethylenediamine	RPC.
Diphenylmethane	PD.
2,5-Diphenyloxazole	EK.
4,4'-Dithiodianiline	ACY.
1,4-Di-p-toluidinoanthraquinone	HSH.
p-Ditolylmercapto-2,5-diethoxybenzenediazonium chloride, zinc chloride salt	HST.
Divinylbenzene	DOW, FG.
Dodecylaniline	X.
Dodecylbenzene (See Alkylbenzenes)	
Dodecylbenzyl chloride	SFS.
Dodecylmethylbenzyl chloride	RH.
*p-Dodecylphenol	GAF, MCB, MON, TX.
Ethoxylated and propoxylated-m-toluidine	TCH.
6-(2-Ethoxy-1-naphthamido)penicillanic acid	WYT.
2-Ethoxy-1-naphthoic acid	WYT.
2-Ethoxy-1-naphthoyl chloride	OPC, WYT.
4[(p-Ethoxyphenyl)azo]-m-phenylenediamine monohydrochloride	EK.
N1-(6-Ethoxy-3-pyridazinyl)sulfanilamide	ACY.
3'-(Ethylamino)acetanilide	EKT.
N-Ethyl-N-(β-aminoethyl)-m-toluidine	X.
3-(Ethylamino)-p-toluenesulfonic acid [$SO_3H=1$]	SW.
o-Ethylaniline	TNA.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*N-Ethylaniline, refined	ACS, ACY, BCC, DUP.
*2-(N-Ethylanilino)ethanol	DUP, MIL, TCH.
1-[2-(Ethylanilino)ethylene]pyridinium chloride	GAF.
[2-(N-Ethylanilino)ethyl]trimethylammonium chloride	DUP.
3-(N-Ethylanilino)propionitrile	MIL, TCH.
α-(N-Ethylanilino)-m-toluenesulfonic acid	GAF, X.
α-(N-Ethylanilino)-p-toluenesulfonic acid	SW, TRC.
Ethylbenzyl chloride	SFS.
d(-)Ethyl-3-(α-carboxybenzyl)aminc crotonate, potassium salt	KF.
2-(N-Ethyl-N,β-cyanoethyl)-4-acetaminoanisole	SDC, TCH, VPC.
N-Ethylcyclohexylamine (Herbicide intermediate)	ABB.
N-Ethyl-N-(2,3-dihydroxypropyl)-m-toluidine	EKT.
Ethylene-bis-tetrabromophthalimide	LEM.
3,3'-Ethylenedioxydiphenol	WAY.
N-Ethylmaleimide	EK.
2-[N-Ethyl-p-[(6-methoxy-2-benzonthiazoyl)azo]anilino] ethanol	TRC.
dl-13B-Ethyl-3-methoxy-B,14-secogona-1,3,5(10),9(11)-tetraene-14,17-dione	WYT.
6-Ethyl-2-methylaniline	TNA.
N-Ethyl-N-(2-methylsulfonamidoethyl)-m-toluidine	X.
9-Ethyl-3-nitrocarbazole	SDC.
α-Ethyl-3-nitrocinnamic acid	SDW.
p-Ethylphenol	ACY, SW.
*N-Ethyl-N-phenylbenzylamine	DUP, GAF, X.
2-Ethylpyridine	RIL.
6-Ethyl-1,2,3,4-tetrahydro-1,1,4,4-tetramethyl-naphthalene	GIV.
N-Ethyl-p-toluenesulfonamide	NES.
N-Ethyl-o-toluidine	DUP.
N-Ethyl-m-toluidine	DUP.
2-(N-Ethyl-m-toluidino)ethanol	TCH.
*3-(N-Ethyl-m-toluidino)propionitrile	DUP, MIL, TCH.
α-(N-Ethyl-m-toluidino)-m-toluenesulfonic acid	ATL, GAF.
o-Formylbenzenesulfonic acid (o-Sulfobenzaldehyde)	X.
Fuchsin acid	EK.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Furan	PLC, QKO.
Furfuryl acetate	EK.
Furfuryl alcohol	QKO.
Glycidonitrile	PD.
p-Glycolylarsanilic acid, sodium salt	SDW.
p-Heptylbenzoyl chloride	EK.
Hexachlorobenzene	DVC.
Hexachlorocyclopentadiene	VEL, X.
1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dicarboxylic acid	X.
1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dicarboxylic anhydride (Chlorendic anhydride)	VEL.
Hexahydro-1-methyl-4-phenyl-1H-azepine-4-carbonitrile	WYT.
Hexahydro-1-methyl-4-phenyl-1H-azepine-4-carboxylic acid	WYT.
Hexamethylenimine	CEL, DUP.
Hippuric acid	SFS.
p-Hydrazinobenzenesulfonic acid	GAF, STG.
Hydrazobenzene	LAK.
Hydroquinonesulfonic acid, potassium salt	NES.
*Hydroquinone, tech.	CRS, EKT, GYR.
4'-Hydroxyacetanilide	TRC.
3'-Hydroxyacetophenone	ARA, X.
p-Hydroxybenzaldehyde	DOW.
*p-Hydroxybenzenesulfonic acid	PRD, UPF, USS.
p-Hydroxybenzoic acid	HN.
3'-Hydroxy-2-(N-benzyl-N-methylamino)acetophenone hydrochloride	SDW.
α-Hydroxy-α-α-bis(p-hydroxyphenyl)-o-toluenesulfonic acid, γ-sultone	EK.
N-Hydroxy-5-endo-cis-norbornene-2,3-dicarboximide	X.
4'-(2-Hydroxyethoxy)acetanilide	TRC.
m-(β-Hydroxyethoxy)phenol	BJL.
3-[N-(2-Hydroxyethyl)anilino]propionitrile	DUP, MIL, TCH.
3-[N-(2-Hydroxyethyl)anilino]propionitrile, acetate	MIL, TCH.
N-(β-Hydroxyethyl)-3,5-dihydroxybenzamide	WAY.
N-(β-Hydroxyethyl)-N-ethyl-m-toluidine	MIL.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
1-(2-Hydroxyethyl)-1,2,3,4-tetrahydro-2,2,4,7-tetramethylquinoline	EKT.
1-(2-Hydroxyethyl)-1,2,3,4-tetrahydro-2,2,4-trimethylquinoline	EKT.
N-[7-Hydroxy-8-(2-hydroxy-5-methylsulfamayl)phenylazo]-1-naphthyl acetamide	TRC.
7-Hydroxy-8-[[4'-[(p-hydroxyphenyl)azo]-3.3'-dimethyl-4-biphenylyl]azo]-1.3-naphthalenedisulfonic acid	ATL, TRC.
4-Hydroxymetanilamide	DUP, TRC.
4-Hydroxymetanilic acid	TRC.
3-Hydroxy-2-methylcinchoninic acid	DUP, GAF.
4-Hydroxy-N'-methylmetanilamide	TRC.
4(5)-Hydroxymethyl-5(4)-methylimidazole hydrochloride	PD, TNA.
1-(Hydroxymethyl)-2-pyrrolidone	GAF.
3-Hydroxy-N-(3-N-morpholino-γ-propyl)-2-naphthamide	WAY.
7-Hydroxy-1,3-naphthalenedisulfonic acid	TRC.
3-Hydroxy-2,7-naphthalenedisulfonic acid, disodium salt	ACY, TRC.
7-Hydroxy-1,3-naphthalenedisulfonic acid, disodium salt	ACY.
6-Hydroxy-2-naphthalenesulfonic acid, sodium salt	ACY, TRC.
8-Hydroxy-1-naphthalenesulfonic acid, γ-sultone	TRC.
3-Hydroxy-2-naphthoic acid (B.C.N.)	ACY, PCW.
3-Hydroxy-2-naphthoic acid, (Diethylenetriamine)amide	PCW.
3-Hydroxy-2-naphthoic acid, morpholinopropylamide	PCW.
3-Hydroxy-2-naphthoic acid, ethanolamide	PCW.
3-Hydroxy-2-naphthoic acid, methyl ester	PCW.
3-Hydroxy-2-naphthoic acid, sodium salt	PCW.
1-(2-Hydroxy-1-naphthyazo)-6-nitro-2-naphthol-4-sulfonic acid	ATL.
N-(7-Hydroxy-1-naphthyl)acetamide	TRC.
1-(2-Hydroxy-1-naphthylazo)-6-nitro-2-hydroxynaphthalene-4-sulfonic acid	TRC.
2-Hydroxy-5-nitrometanilic acid	TRC.
1-Hydroxy-6-octadecyloxy-2-naphthoic acid	ARA.
2-Hydroxy-4-n-octoxybenzophenone	ACY, CCW.
11 α-Hydroxyprogesterone	UPJ.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
2-Hydroxy-4-sulfo-1-naphthalenediazonium hydroxide, inner salt	ACY.
1-Hydroxy-4-p-toluidinoanthraquinone	HSH.
1,1'-Iminobis[4-aminoanthraquinone]-	ACY.
1,1'-Iminobis[4-benzamidoanthraquinone]-	ACY.
1,1'-Iminobis[5-benzamidoanthraquinone]-	TRC.
1,1'-Iminobis[4-nitroanthraquinone]-	ACY, TBC.
1,1'-Iminodianthraquinone (1,1'-Dianthrimide)-	ACY.
2-Indolecarboxylic acid-	ARA.
Indole-2,3-dione	DUP.
1-(H)-Indole-5-sulfonic acid,2(1,3-dihydro-3-oxo-5-sulfo-2H-indol-2-ylidine)-2,3-dihydro-3-oxo, disodium salt	BCC.
2-Iodacetamido-5-chlorobenzophenone-	WYT.
10-(p-Iodophenyl)undecanoic acid, ethyl ester-	EK.
Isatoic anhydride-	SW.
Isobutylbenzene-	PLC, TNA.
*ISOCYANIC ACID DERIVATIVES:	
Bitolylene diisocyanate (TODI)	CWN, UPJ.
p-Chlorophenyl isocyanate-	MCB.
Diphenylmethane-4,4'-diisocyanate (MDI)-	MOB, UPJ.
Phenylisocyanate	MOB, UPJ.
*Polymethylene polyphenylisocyanate	JCC, MOB, RUC, UPJ.
Toluene 2,4-diisocyanate	DUP, MOB.
*Toluene 2,4-and 2,6-diisocyanate (80/20 Mixture)	ACS, BAS, DOW, DUP, MOB, OMC, RUC, UCC.
Toluene 2,4-and 2,6-diisocyanate (65/35 Mixture)	DUP, MOB.
Toluene 2,4-and 2,6-diisocyanate (65/35 Mixture) and (80/20 Mixture)-	DUP.
p-Toluenesulfonyl isocyanate	CWN.
Trimers of toluene 2,4 and 2,6 diisocyanate-	DUP.
Tris(2-isocyanate-p-tolyl isocyanate)-	DUP.
Isocyanic acid derivatives, all other-	MCB, UCC.
2-Isonitrosoacetanilide-	DUP.
Isooctylphenol	PRD(E).
Isophthalic acid (Benzene-1,3-dicarboxylic acid)	ACC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Isophthalic acid, diphenyl ester	BJL.
Isophthalonitrile	SW.
Isophthaloyl chloride	DUP.
N-Isopropylaniline	USR.
5,5'-Isopropylidenebis(2-hydroxy-m-xylene-α,α'-diol)	ARK.
*4,4'-Isopropylidenediphenol (Bisphenol A)	DOW, GE, SHC, UCC.
4,4'-Isopropylidenediphenol, ethoxylated	ICI.
4,4'-Isopropylidenediphenol, propoxylated	ICI.
o-Isopropylphenol	PRD.
Isopropylphenol, mixed	FMP, SCN, TNA.
4-Isopropyl-m-phenylenediame	DUP.
Isothiocyanic acid, phenyl ester	EK.
Leuco quinizarin (1,4,9,10-Anthratetrol)	HSH, TRC.
2,4-Lutidine	KPT, RIL.
2,6-Lutidine	RIL.
*3,4-Lutidine	KPT, RIL, UCC.
Mandelonitrile	KF.
*Melamine	ACS, ACY, MLC.
p-Mentha-1,4(8)-diene	GIV.
*dl-p-Mentha-1,8-diene (Limonene)	ARZ, HPC, NCI.
p-Menth-1-ene (Carvomenthene)	GIV.
o-Mercaptobenzoic acid	AMB.
*Metanilic acid (m-Aminobenzenesulfonic acid)	DUP, TRC, USM.
2-Methoxy-5-acetamino-N,N-bis(acetoxyethyl)aniline	HST.
1-Methoxyanthraquinone	DUP.
4-Methoxymetanilic acid	AC.
4'-Methoxy-2-(p-methoxyphenyl)acetophenone	ARA.
Methoxymethyldiphenyl oxide	SFS.
N-(2-Methoxy-1-naphthyl)acetamide	TRC.
6-Methoxy-8-nitroquinoline	SDW.
(p-Methoxyphenyl)acetic acid	UOP.
6-Methoxyquinoline	DUP.
Methylacetoacetic ester enamine of D-2-amino-2-(1,4-cyclohexadienyl)acetic acid, sodium salt	TRD.
1-(Methylamino)anthraquinone	ACY.
1-(Methylamino)-4-p-toluidinoanthraquinone	VPC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
2-(N-Methylanilino)ethanol	TCH.
*3-(N-Methylanilino)propionitrile	DUP, MIL, TCH.
5-Methyl-o-anisidine [NH_2=1]	SW.
5-Methyl-o-anisidinesulfonic acid	ACS, BCC.
m-Methylanisole	GIV.
2-Methylanthraquinone	ACY.
3-Methylbenzo[f]quinoline	ACY.
2-Methylbenzothiazole	PMT.
N-Methylbenzylamine	SDW.
Methyl biphenyl	DOW.
N-Methyl-N-carboxyanthranilic anhydride	SW.
1-Methyl-4-(3-chloropropyl)piperazine hydrochloride	SK.
3-Methylcholanthrene	EK.
Methylcyclohexane	PLC.
N-Methylcyclohexylamine	ABB.
N-Methyldicyclohexylamine	ABB.
N-Methyleneaniline	PCW.
4,4'-Methylenebis[2-chloroaniline]	ADC, DUP.
4,4'-Methylenebis[2-chloroaniline] and 4,4'-methylenebis[aniline], mixed	DUP.
4,4'-Methylenebis[N,N-diethylaniline]	ACY.
*4,4'-Methylenebis[N,N-dimethylaniline] (Methane base)	ACY, DUP, X.
Methylenediamine	MOB.
4,4'-Methylenedianiline	ACS, DOW, DUP, RUC.
5,5'-Methylenedisalicylic acid	HN.
2-Methyl-6-ethylaniline	TNA.
Methylhydroquinone	EKT.
N-Methyl-p-nitroaniline	ACY, EK.
4-Methyl-2-nitroanisole	SW.
2-Methyl-5-nitroimidazole	RDA.
2-Methyl-5-norbornene-2,3-dicarboxylic anhydride	BCC, VEL.
5-Methyl-5-norbornene-2,3-dicarboxylic anhydride	ACS.
m-(3-Methyl-5-oxo-2-pyrazolin-1-yl)benzenesulfonamide	VPC.
m-(3-Methyl-5-oxo-2-pyrazolin-1-yl)benzenesulfonic acid	TRC.
p-(3-Methyl-5-oxo-2-pyrazolin-1-yl)benzenesulfonic acid	GAF, TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
3-(3-Methyl-5-oxo-2-pyrazolin-1-yl)-1,5-naphthalenedisulfonic acid	TRC.
2-Methyl-5-phenylbenzoxazole	EK.
1-Methyl-4-phenylisonipecotic acid	SDW, WYT.
1-Methyl-4-phenyl-4-piperidine carbonitrile	WYT.
3-Methyl-1-phenyl-2-pyrazolin-5-one (Developer Z)	ACY, SDH.
4-Methylphthalic acid	EK.
N-Methylpyrazine	UCC.
3-Methyl-2-pyrazolin-5-one	DUP.
3-Methyl-5-pyrazolone-1-(4'-sulfophenyl)-5-pyrazolone-3, 3-dicarboxylic acid	HST.
4'-[(4-Methyl-2-pyrimidinyl)sulfamoyl]acetanilide	DUP.
1-Methylpyrrole	PCW
N-Methylpyrrole-2-acetonitrile	TNA.
*α-Methylstyrene	ACS, CLK, DOW, GP, SKO, UCC, USS.
ar-Methylstyrene (Vinyltoluene)	DOW.
2-(Methylsulfonyl)-4-nitroaniline	TRC.
3-Methyl-1-p-tolyl-2-pyrazolin-5-one	HST.
Naphthacene	EK.
1-Naphthalenesulfonic acid	TRC.
2-Naphthalenesulfonic acid	ACY.
1-Naphthalenesulfonic acid, sodium salt	TBC.
2-Naphthalenesulfonic acid, sodium salt	ACY.
1,4,5,8-Naphthalenetetracarboxylic acid	TRC.
Naphthalimide	ACS, BCC, UCC.
2-Naphthol, tech. (β-Naphthol)	ACY.
Naphth[1,2-d][1,2,3]oxadiazole-5-sulfonic acid	TRC.
1-Naphthylamine (α-Naphthylamine)	DUP.
p-(2-Naphthylamino)phenol (N-(p-Hydroxyphenyl)-2-naphthylamine)	SDC.
1-Naphthylchloroformate	UCC.
Nicotinonitrile (3-Cyanopyridine)	NEP.
3'-Nitroacetanilide	EKT.
4'-Nitroacetanilide	GAF, TBC.
2'-Nitro-p-acetanisidide	DUP.
3'-Nitro-p-acetanisidide	EKT, HST.
4'-Nitro-o-acetanisidide	DUP.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
3'-Nitroacetophenone	X.
o-Nitroaniline	MON, X.
m-Nitroaniline	X.
p-Nitroaniline	DUP, MON.
2-Nitro-p-anisidine [NH_2=1]	DUP.
4-Nitro-o-anisidine [NH_2=1]	DUP.
o-Nitroanisole	DUP.
5-Nitroanthranilic acid	SW, TRC.
1-Nitroanthraquinone	ACY, TRC.
m-Nitrobenzaldehyde	X.
*Nitrobenzene	ACY, DUP, FST, MOB, RUC.
m-Nitrobenzenesulfonic acid, sodium salt	DUP, USM.
m-Nitrobenzoic acid	SAL.
p-Nitrobenzoic acid	DUP.
m-Nitrobenzoic acid, sodium salt	SAL.
2-(4'-Nitrobenzoylamino)-6-naphthol-8-sulfonic acid	TRC.
m-Nitrobenzoyl chloride	ARS.
p-Nitro-α-bromotoluene	DUP.
Nitrochlorodimethoxybenzene	PCW.
2-Nitro-p-cresol	SW.
p-Nitro-N-(2-diethylamine)ethylbenzamide	PD.
Nitrodiphenylamine	ACY, MON.
5-Nitro-2-furanmethanediol, diacetate	X.
5-Nitroisatoic anhydride	SW.
5-Nitroisophthalic acid	SAL.
1-Nitronaphthalene	DUP.
3-Nitro-1,5-naphthalenedisulfonic acid	TRC.
7(and 8)-Nitronaphth[1,2-d][1,2,3]oxadiazole-5-sulfonic acid	GAF, TRC.
4'-Nitrooxanilic acid	ATL.
o-Nitrophenol	DUP, MON.
p-Nitrophenol	DUP.
p-Nitrophenoxyethanol	TCH.
4'-(p-Nitrophenyl)acetophenone	ASH.
2-(o-Nitrophenylazo)-4,6-di-tert-pentylphenol (OH=1)	TRC.
4-Nitro-o-phenylenediamine	ASH, FMT.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
(p-Nitrophenyl)hydrazine	EK.
2,2'-[(m-Nitrophenyl)imino]diethanol, diacetate ester	DUP.
2-(p-Nitrophenyl)-2H-naphtho[1,2-d]triazole-6,8-disulfonic acid	TRC.
m-Nitrophenylphosphonic acid	ICI.
4-Nitrosodiphenylamine	USR.
4-Nitroso-N-ethyl-N-(β-methylsulfonamidoethyl)-m-toluidine	X.
p-Nitrosophenol	ATL, SDC.
β-Nitrostyrene	CWN.
4-Nitro-4'-(5-sulfo-2H-naphtho[1,2-d]triazol-2-yl)-2,2'-stilbenedisulfonic acid	ATL, TRC.
3-Nitro-p-toluamide	X.
o-Nitrotoluene	DUP, FST.
m-Nitrotoluene	DUP, FST.
p-Nitrotoluene	DUP, FST.
Nitrotoluene mixtures	DUP, FST.
p-Nitrotoluene-o-sulfonic acid	CGY(E).
3-Nitro-p-toluenesulfonic acid [SO_3H=1]	TRC.
*5-Nitro-o-toluenesulfonic acid [SO_3H=1]	DUP, GAF, X.
3-Nitro-p-toluic acid, methyl ester	X.
2-Nitro-p-toluidine [NH_2=1]	SW.
5-Nitro-o-toluidine [NH_2=1]	PCW.
5-Nitro-o-toluidine hydrochloride	PCW.
4-Nitro-m-xylene	DUP.
Nonyl-dinonylphenol, mixture	USR.
Nonyl mercaptans	ACY.
*Nonylphenol	GAF, JCC, KLM, MCB, MON, PRD, RH, SCN, UCC.
Norborene-2,3-dicarboxylic acid, monomethyl ester	BJL.
Octylphenol	RH, SCN.
Octylphenoxydiethoxy chloride	RH.
Oxanilide	EK.
*1-[(7-Oxo-7H-benz[de]anthracene-3-yl)amino]-anthraquinone	ACY, DUP, TRC.
1,1'-[(7-Oxo-7H-benz[de]anthracen-3,9-ylene)-diimino]dianthraquinone	DUP, TRC.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
5-Oxo-1-phenyl-2-pyrazoline-3-carboxylic acid, ethyl ester	STG.
5-Oxo-1-(p-sulfophenyl)-2-pyrazoline-3-carboxylic acid (Pyrazolone T)	ACY, STG.
4,4'-Oxydianiline	DUP.
Pentabromochlorocyclohexane	DOW.
Pentabromoethylbenzene	GTL.
2,3,4,5,6-Pentabromotoluene	WCC.
Pentachloropyridine	DOW.
2-Pentylanthraquinone	DUP.
o-(p-tert-Pentylbenzoyl)benzoic acid	DUP.
p-Pentylbenzoyl chloride	EK.
o-Pentylphenol (o-Amylphenol)	PAS.
p-tert-Pentylphenol	PAS.
3,4,9,10-Perylenetetracarboxylic acid	BCC, MON.
3,4,9,10-Perylenetetracarboxylic-3,4:9,10-diimide	ACS, BCC.
2-Phenethylamine	MLS.
o-Phenethylbenzoic acid	LIL.
p-Phenetidine	MON.
*PHENOL:	
NATURAL:	
FROM COAL TAR:	
Natural phenol from coal tar, 39° C., M.P.	PRD.
Natural phenol from coal tar, all other	KPT.
FROM PETROLEUM:	
Natural phenol from petroleum, all other	MER, NPC(E), PRD.
SYNTHETIC:	
BY CAUSTIC FUSION:	
Synthetic phenol by caustic fusion, U.S.P.	RCI, TOC.
Synthetic phenol by caustic fusion, all other	SW.
*Synthetic phenol from cumene by oxidation, U.S.P.	ACS, CLK, DOW, GP, MON, SHC, SOC, UCC, USS.
Synthetic phenol from toluene by oxidation, U.S.P.	KLM.
Phenolsulfonaphthalein, sodium salt	EK.
Phenolsulfonic acid, sodium salt	SAL.
Phenoxyacetic acid, sodium salt	SFS.
2-(Phenoxymethyl)benzoic acid	PFZ.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Phenylacetic acid, ethyl ester, tech.	OPC, SFS.
Phenylacetic acid, methyl ester	OPC.
Phenylacetic acid, potassium salt	OPC, SFS.
Phenylacetic acid, sodium salt	OPC.
Phenylacetonitrile (α-Tolunitrile)	OPC, SFS, UOP.
Phenylacetyl chloride	OPC.
2,2'-[(Phenyl)amino]diethanol, diacetic ester	SDC, TRC.
p-Phenylazoaniline (C.I. Solvent Yellow 1) and hydrochloride	ACY, ATL.
4-(Phenylazo)diphenylamine	EK.
Phenyl-1,2,3-butanetrione-2-oxime	EK.
α-Phenyl-o-cresol	RBC.
1-Phenyl-4,4-dimethyl-3-pyrazolidinone	EK.
o-Phenylenediamine	DUP, SW, TRC.
m-Phenylenediamine	DUP.
p-Phenylenediamine	DUP, SDC.
d-Phenylephrine	SDW.
dl-Phenylephrine	SDW.
Phenyl ether (Diphenyl oxide)	DOW, MON.
dl-2-Phenylglycine (racemic)	KF.
d(-)-2-Phenylglycine	DUP, KF, UPJ.
N-Phenylglycine-o-carboxylic acid, sodium salt	X.
d(-)-2-Phenylglycyl chloride hydrochloride	KF, UPJ.
Phenylglycine, potassium salt	BCC.
N-Phenylglycine, sodium and potassium salts	ACS.
Phenylglycine, sodium salt	BCC, LIL.
5-Phenylhydantoin	ABE.
*2,2'-[(Phenyl)imino]diethanol (N-Phenyldiethanolamine)	EKT, MIL, TCH.
Phenylmalonic acid	X.
Phenylmalonic acid, diethyl ester	SFS.
3-Phenyl-5-methylisoxazole-4-carbonyl chloride	ARS.
o-Phenylphenol	DOW, RCI.
p-Phenylphenol	DOW.
o-Phenylphenol, sodium salt	DOW.
N-Phenyl-p-phenylenediamine	USR.
Phenylphosphinic acid	SFS.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Phenylphosphonothioic dichloride	SFA.
Phenylphosphorous dichloride	SFA.
1-Phenyl-1,2-propanedione, 2-oxime	ORT, PD.
Phenyl-2-propanone	ORT.
1-Phenyl-3-pyrazolidinone	EK.
dl-Phenylsuccinic acid	PD.
4-Phenylsulfinyl-1,2-phenylenediamine	ARA.
4-Phenylthiomorpholine-1,1-dioxide	EKT.
Phenylundecanoic acid	EK.
1(2H)-Phthalazinone	X.
Phthalic acid	EK.
*Phthalic anhydride	ACS, BAS, ENJ, HK, KPT, MON, PTO, SOC, STP, USS.
Phthalide	FMT.
Phthalimide	SW.
Phthalimidoacetic acid	PD.
Phthalimidoacetyl chloride	PD.
'[Phthalocyaninato(2-)]copper	DUP.
PICOLINES:	
Picoline (3,4-mixture)	KPT.
2-Picoline (α-Picoline)	KPT, RIL.
3-Picoline (β-Picoline)	NEP, RIL.
4-Picoline (γ-Picoline)	NEP, RIL.
Picolinic acid	RSA.
Picolinonitrile (2-Cyanopyridine)	NEP.
3-Picolylamine	RIL.
Picric acid (Trinitrophenol)	SDC.
2-Pipecoline	LIL.
Piperidine	ABB, RIL.
3-Piperidinopropiophenone hydrochloride	ACY.
Polychlorobenzene	DCW.
Polychlorobiphenyl	MON.
Polydichlorodiphenylsulfone	UCC.
Polyethylbenzene (80 percent diethylbenzene)	ELP, UCC.
Potassium phthalimide	PD.
Propiophenone	ORT, UOP.
Propyl Red	EK.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
B,16-Pyranthrenedione	TRC.
PYRIDINE, REFINED:	
2° Pyridine, refined	KPT, NEP.
Pyridine hydrochloride	EK.
2-Pyrimidinol	CGY(E).
2-Pyrrolidinone	GAF.
Quinaldine	ACY.
QUINOLINE:	
Quinoline, 1° and 2°	KPT.
Quinoline, other grades	KPT.
2,4-Quinolinediol	PCW.
Resorcinol, tech.	KPT.
β-Resorcylic acid	HST, KPT.
Salicylaldehyde	DOW, RDA.
Salicylaldehyde oxime	EK.
Salicylanilide	PCW.
Salicylic acid, ammonium chromium complex	TRC.
Salicylic acid, phenyl ester	DOW.
*Salicylic acid, tech.	DOW, HN, MON, SDH.
Salicylideneaminoquanidine oleate	DUP.
Stigmasterol	UPJ.
Sulfanilamide, tech.	SAL.
Sulfanilic acid (p-Aminobenzenesulfonic acid) and salt	ACY.
4-Sulfo-o-sec-butylphenol	VTC.
4,6-m-Sulfo-o-sec-butylphenol	VTC.
5-Sulfoisophthalic acid, 1,3-dimethyl ester	PCW, X.
5-Sulfoisophthalic acid, lithium salt	PCW.
5-Sulfoisophthalic acid, sodium salt	PCW.
N,5'-Sulfonyldianthranilic acid	TRC.
4,4'-Sulfonyldiphenol (4,4'-Dihydroxydiphenyl sulfone)	UFF.
4-Sulfophthalic acid	CWN.
Sulfur trioxide pyridine complex	UPJ.
Terephthalic acid	ACC, DUP, HCF.
*Terephthalic acid, dimethyl ester	ACC, DUP, EKT, HCF, HST.
Terephthaloyl chloride	DUP.
Terephthaloyldiacetic acid, diethyl ester	PCW.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Terphenyl (Phenylbiphenyl) (m-,o-,and p-isomers)	MON.
3,3',4,4'-Tetraaminobenzophenone	BJL.
3',3'',5',5''-Tetrabromo-m-cresol-sulfonphthalein-	EK.
Tetrabromophthalic anhydride	VEL.
1,4,5,8-Tetrachloroanthraquinone	DUP.
1,2,4,5-Tetrachlorobenzene	DOW.
1,2,4,5-Tetrachloro-3-nitrobenzene	SDH.
2,3,5,6-Tetrachloropyridine-	DOW.
α,α,2,6-Tetrachlorotoluene	DUP.
Tetrahydrobenzyl alcohol	UCC.
Tetrahydrofuran-	DUP, GAF, QKO.
Tetrahydrofurfuryl dimethacrylate-	SAR.
1,2,3,4-Tetrahydro-6-methoxyquinoline-	DUP.
Tetrahydronaphthalene-	UCC.
Tetrahydronaphthol-1, tetrahydronaphthone-1-	UCC.
1,2,3,4-Tetrahydro-2,2,4,7-tetramethylquinoline-	EKT.
1,4,5,8-Tetrahydroxyanthraquinone, leuco derivative-	TRC.
p-(1,1,3,3-Tetramethylbutyl)phenol	GAF.
N,N,N',N'-Tetramethyl-p-phenylenediamine, dihydrochloride-	EK.
2-Thiophenecarboxaldehyde-	ABB.
Thiophenol	SPA.
s-Thymol	GIV, KPT.
*Toluene-2,4-diamine (4-m-Tolylenediamine)	ACS, OMC, RUC, UCC.
Toluene-2,4-(and 2,6)-diamine-	AIP.
Toluene-3,4-diamine-	EK.
p-Toluenesulfinic acid, sodium salt-	NES.
o(and p)-Toluenesulfonic acid-	TEN.
p-Toluenesulfonic acid	NES, UPF.
p-Toluenesulfonic acid monohydrate	UPF.
p-Toluenesulfonyl chloride	MON.
p-Toluic acid-	SFS.
p-Toluic acid, methyl ester-	DUP.
o-Toluidine-	DUP, FST.
m-Toluidine-	DUP.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
p-Toluidine	DUP.
p-Toluidine hydrochloride	EK.
Toluidines, mixed	DUP.
2-o-Toluidinoethanol	TCH.
o-Toluidinomethanesulfonic acid	TRC.
m-Toluidinomethanesulfonic acid	ATL.
o-(p-Toluoyl)benzoic acid	GAF.
p-Toluoyl chloride	TNA.
4-(o-Tolylazo)-o-toluidine (C.I. Solvent Yellow 3)	SDH.
4-(o-Tolylazo)-o-toluidine hydrochloride	ATL.
1-p-Tolyldodecane	X.
p-Tolylhydroquinone	UPJ.
2,2'-(o-Tolylimino)diethanol	TCH.
2,2'-(m-Tolylimino)diethanol	MIL, TCH.
2,2'-(m-Tolylimino)diethanol, diacetate ester	SDC.
Tolyltriazole	SW.
2,4,6-Triamino-5-nitrosopyrimidine	SK.
1,2,4-Triazolidine-3,5-dione	EK.
N,N,N-Tribenzylamine	MLS.
2,4,6-Tribromophenol	VEL.
3,4',5-Tribromosalicylanilide	PCW.
1,2,3(and 1,2,4)-Trichlorobenzene	PPG, SCC(E).
1,2,4-Trichlorobenzene	DOW, SCC, X.
1,1,1-Trichloro-2,2-diphenylethane	CWN.
1,2,4-Trichloro-5-nitrobenzene	ALL.
Trichlorophenylsilane	DCC.
α,α,α-Trichlorotoluene (Benzotrichloride)	HK, VEL.
α,2,4-Trichlorotoluene	HN.
α,3,4-Trichlorotoluene	NIL.
2,4,6-Trichloro-s-triazine	CGY(E).
Tri(dimethylaminomethyl)phenol	MLS.
2-(Trifluoromethyl)phenothiazine	SK.
α,α,α-Trifluoro-N-phenyl-m-toluidine (3-(Trifluoromethyl)diphenylamine)	SK.
α,α,α-Trifluorotoluene	HK.
2,4,3'-Trihydroxydiphenyl	PCW, PIT.

TABLE 2.--CYCLIC INTERMEDIATES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

CYCLIC INTERMEDIATES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Trimellitic anhydride, acid chloride	ARS.
Trimesic acid	AMB.
1,2,3-Trimethylbenzene (Hemimellitine)	SUN.
1,2,4-Trimethylbenzene (Pseudocumene)	SUN.
3,3,5-Trimethylcyclohexanol (m-Homomenthol)	ARS.
2,3,3-Trimethyl-3H-indole	GAF, VPC.
*1,3,3-Trimethyl-Δ^{2}, α-indolineacetaldehyde	ATL, DUP, GAF, TRC, VPC.
*1,3,3-Trimethyl-2-methyleneindoline	DUP, GAF, VPC.
Trimethylphenylammonium chloride	X.
Trimethylphenylammonium iodide	TRC.
2,4,6-Trimethylpyridine	KPT, PFN.
2,4,7-Trinitrofluoren-9-one	WAY.
Triphenylmethane	EK.
Tri-n-propoxybenzaldehyde	CWN.
2,4,6-Tripropoxybenzaldehyde	X.
2,4,6-Tri-n-propoxybenzaldehyde	CWN.
α,α',α''-Tris(dimethylamino)mesitol	RH.
Tris(2-methyl-1-aziridinyl)phosphine oxide	ARS.
*7,7'-Ureylenebis[4-hydroxy-2-naphthalenesulfonic acid]	DUP, GAF, TRC.
5-Vinyl-2-picoline (MVP)	PLC.
2-Vinylpyridine	RIL.
4-Vinylpyridine	RIL.
*Violanthrone (Dibenzanthrone)	ACS, BCC, DUP, TRC.
Xanthene-9-carboxylic acid	MAL.
Xylenesulfonic acid, mixed isomers	NES.
2,6-Xylenol	GE, KPT.
Xylenol crystals	PRD.
XYLIDINES:	
2,4-Xylidine (m-4-Xylidine)	DUP.
2,6-Xylidine	DUP.
Xylidine, original mixture	DUP.
Cyclic intermediates, all other	ABB, ACS, ALL, ARA, ARS, BJL, CWN, DUP, EGR, EK, GAF, HK, HST, ICI, KF, LIL, MIL, MOB, MRK, PD, PFZ, PLC, PRD, RSA, SAL, SDC, SDW, SK, SRL, STC, SW, TCH, TRC, UCC, UPJ, VPC, WAY, WCC, X, X, X, X, X.

TABLE 3.--Cyclic intermediates: Directory of manufacturers, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of cyclic intermediates to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company
ABB	Abbott Laboratories
AC	American Color & Chemical Corp.
ACC	Amoco Chemicals Corp.
ACS	Allied Chemical Corp., Specialty Chemicals Div.
ACY	American Cyanamid Co.
ADC	Anderson Development Co.
AIP	Air Products & Chemicals, Inc.
ALD	Aldrich Chemical Co., Inc.
ALF	Allied Chemical Corp., Fibers Div.
ALL	Alliance Chemical Corp.
AMB	American Bio-Synthetics Corp.
ARA	Araphahoe Chemicals, Inc. Sub/Syntex U.S.A., Inc.
ARK	Armstrong Cork Co.
ARS	Arsynco, Inc.
ARZ	Arizona Chemical Co.
ASH	Ashland Oil, Inc., Ashland Chemical Co.
ASL	Ansul Chemical Co.
ATL	Atlantic Chemical Corp.
BAS	BASF Wyandotte Corp.
BCC	Buffalo Color Corp.
BJL	Burdick & Jackson Laboratories, Inc.
BUC	Synalloy Corp., Blackman-Uhler Chemical Div.
CCW	Cincinnati Milacron Chemicals, Inc.
CEL	Celanese Corp., Celanese Chemical Co.
CGY	Ciba-Geigy Corp.
CHL	Chemol, Inc.
CHT	Chattem Drug & Chemical Co.
CLK	Clark Oil & Refining Corp.
CNP	Nipro, Inc.
CO	Continental Oil Co.
CRS	Carus Chemical Co.
CWN	Upjohn Co., Fine Chemical Div.
DBC	Dow Badische Co.
DCC	Dow Corning Corp.
DKA	Denka Chemical Corp.
DOW	Dow Chemical Co.
DUP	E.I. duPont de Nemours & Co., Inc.
DVC	Dover Chemical Corp., Sub of ICC Industries, Inc.
EGR	Eagle River Chemical Corp.
EK	Eastman Kodak Co.:
EKT	Tennessee Eastman Co. Div.
ELP	El Paso Products Co.
ENJ	Exxon Chemical Co. U.S.A.
FER	Ferro Corp., Ottawa Chemical Div.
FG	Foster Grant Co., Inc.
FMP	FMC Corp., Industrial Chemical Div.
FMT	Fairmount Chemical Co., Inc.
FST	First Chemical Corp.
GAF	GAF Corp.
GE	General Electric Co.
GIV	Givaudan Corp.
GLY	Glyco Chemicals, Inc.
GNW	Greenwood Chemical Co.
GOC	Gulf Oil Corp., Gulf Oil Chemicals Co.-U.S.
GP	Georgia-Pacific Corp., Plaquemine Div.
GTL	Great Lakes Chemical Corp.
GYR	Goodyear Tire & Rubber Co.
HCF	Hercofina
HDW	Hardwicke Chemical Co.
HEX	Hexagon Laboratories, Inc.
HK	Hooker Chemicals & Plastics Corp.
HN	Tenneco Chemicals, Inc.
HPC	Hercules, Inc.
HSC	Chemetron Corp., Pigments Div., Sub. of Allegheny Ludlum Industries, Inc.
HSH	Harshaw Chemical Co.
HST	American Hoechst Corp.: Hoechst Fibers Industries Div. Industrial Chemicals Div.
ICI	ICI United States, Inc., Chemical Specialties Co.
IMC	IMC Chemical Group, Inc.
JCC	Jefferson Chemical Co., Inc.
KF	Kay-Fries Chemicals, Inc.
KLM	Kalama Chemical, Inc.
KPT	Koppers Co., Inc.
LAK	Bofors Lakeway, Inc.
LEM	Napp Chemicals, Inc.
LIL	Eli Lilly & Co.
MAL	Mallinckrodt, Inc.
MCB	Borg-Warner Corp., Borg-Warner Chemicals
MER	Merichem Co.
MIL	Milliken & Co., Milliken Chemical Div.
MLC	Melamine Chemicals, Inc.
MLS	Miles Laboratories, Inc., Sumner Div.
MNR	Monroe Chemical Co.
MOB	Mobay Chemical Co.
MON	Monsanto Co.
MRK	Merck & Co., Inc.
MTO	Montrose Chemical Corp. of California
NCI	Union Camp Corp.
NEP	Nepera Chemical Co., Inc.
NES	Nease Chemical Co., Inc.
NIL	Nilok Chemicals, Inc.
NOR	Morton-Norwich Products, Inc., Norwich Eaton Pharmaceutical Div.
NPC	Northwest Petrochemical Corp.

TABLE 3.--CYCLIC INTERMEDIATES: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
OMC	Olin Corp.	SKO	Getty Refining & Marketing Co.
OPC	Orbis Products Corp.	SOC	Standard Oil Co. of California, Chevron Chemical Co.
ORO	Chevron Chemical Co.	SRL	G. D. Searle & Co.
ORT	Roehr Chemicals	STC	American Hoechst Corp., Sou-Tex Works
PAS	Pennwalt Corp.	STG	Stange Co.
PCW	Pfister Chemical, Inc.	STP	Stepan Chemical Co.
PD	Parke, Davis & Co. Sub. of Warner-Lambert Co.	SUN	Sun Company, Inc.
PFN	Pfanstiehl Laboratories, Inc.	SW	Sherwin-Williams Co.
PFZ	Pfizer, Inc. & Pfizer Pharmaceuticals, Inc.	TCC	Tanatex Chemical Corp.
PIT	Pitt-Consol Chemical Co.	TCH	Emery Industries, Inc., Trylon Div.
PLC	Phillips Petroleum Co.	TEN	Cities Service Co., Copperhill Operations
PPG	PPG Industries, Inc.	TNA	Ethyl Corp.
PRD	Ferro Corp., Productol Chemical Div.	TOC	Tenneco Oil Co.
PTO	P. R. Chemical Co., Inc.	TRC	Toms River Chemical Corp.
PTT	Petro-Tex Chemical Corp.	TRD	Manufacturing Enterprises, Inc., Squibb Manufacturing, Inc., Trade Enterprise, Inc., Ersana, Inc.
QKO	Quaker Oats Co.	TX	Texaco, Inc.
RBC	Fike Chemicals, Inc.	UCC	Union Carbide Corp.
RCI	Reichhold Chemicals, Inc.	UOP	UOP, Inc., Chemical Div.
RDA	Rhodia, Inc.	UPF	Jim Walter Resources, Inc.
RH	Rohm & Haas Co.	UPJ	Upjohn Co.
RIL	Reilly Tar & Chemical Corp.	USM	USM Corp., Bostik Div.
RPC	A. Kewanee Industry, Millmaster Chemical Group, Refined-Onyx Co. Div.	USR	Uniroyal, Inc., Uniroyal Chemical Div.
RSA	R.S.A. Corp.	USS	USS Chemicals Div. of U.S. Steel Corp.
RUC	Rubicon Chemicals, Inc.	VEL	Velsicol Chemical Corp.
SAL	Salsbury Laboratories	VGC	Virginia Chemicals, Inc.
SAR	Sartomer Industries, Inc.	VIK	Viking Chemical Co.
SCC	Standard Chlorine of Delaware, Inc.	VPC	Mobay Chemical Corp., Verona Div.
SCN	Schenectady Chemicals, Inc.	VTC	Vicksburg Chemical Co. Sub. of Vertac Consolidated
SDC	Martin-Marietta Corp., Sodyeco Div.		
	Sterling Drug, Inc.:		
SDH	Hilton-Davis Chemical Co. Div.	WAY	Philip A. Hunt Chemical Corp., Organic Chemical Div.
SDW	Winthrop Laboratories Div.		
	Stauffer Chemical Co.:	WCC	White Chemical Corp.
SFA	Agricultural Div.	WIL	Inolex Corp., Inolex Pharmaceutical Div.
SFC	Calhio Chemicals, Inc.	WTC	Witco Chemical Corp.
SFS	Specialty Div.	WYT	Wyeth Laboratories, Inc., Wyeth Laboratories Div. of American Home Products Corp.
SHC	Shell Oil Co., Shell Chemical Co. Div.		
SK	SmithKline Laboratories		

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix. The above codes identify those of the 172 reporting companies and company divisions for which permission to publish was not restricted.

Dyes

Edmund Cappuccilli

Synthetic benzenoid dyes are compounds or mixtures which usually possess a color and can be used to impart that color to various items such as cloth, rugs, paper, plastic, or leather, with or without the use of a bonding substance. In the United States, the textile industry is the principal consumer of dyes. At the present time, there are several hundred dyes produced in the United States to meet the demands of the domestic and foreign consumers. Dyes are classified by the chemical composition (e.g., azoic, anthraquinone, and so forth) and also by the type of reaction occurring in the application process. Some of the more common application classes are acid, basic, direct, disperse, solvent, and vat dyes.

The synthetic benzenoid dye industry in 1977 continued to recover from the low production registered in 1975. One of the primary reasons for the increased production is the upturn in the U.S. economy after 1976. This economic recovery by the industry helped to offset the increased pressures from imports and Federal regulations.

Production and sales

In 1977, the production of synthetic dyes in the United States increased by 3 percent to 264 million pounds. Although this increase was not nearly so large as the 24-percent increase of the previous year, it does represent a sign of continued economic improvement in the dye industry. The quantity of sales of domestically produced dyes increased by 2 percent (to 255 million pounds) with a 11-percent increase in the value of sales (to $690 million). A 10-percent increase in the average unit value of sales from $2.48 in 1976 to $2.72 was also registered in 1977. The somewhat slower rise in prices in 1977 (from the 30-percent increase in 1976) is due principally to the easing of the overall inflation rate coupled with increasing imports. This increase in imports, especially lower priced competitive imports, contributed to the smaller rise in dye prices since the domestic dye producers had to insure that their products remained competitive in the domestic market.

Some industry sources anticipate that production of dyes in 1978 will continue to increase but not to the extent recorded in 1977. An increase of 1 or 2 percent is expected even though increasing Government regulations, including pollution controls, and imports will continue to affect the dye industry. These adverse factors, however, should be offset by increased production in the dye-consuming industries (e.g., textiles and paper products).

Over the past several years, the major classes of dyes (e.g., acid; basic; direct; disperse; food, drug and cosmetic (FD&C); fluorescent brightening agents; solvent; and vat) have shown changes in production for a variety of reasons. For example, the classes of dyes which have a variety of uses or are closely associated with a stable market have had the most constant output over the past several years. Conversely, those dye classes which depend mainly on the volatile textile markets have experienced large fluctuations during the same period. The following examples illustrate recent trends in the dye industry.

Because of their specialized applications, the output of certain classes of dyes for the past several years has varied greatly compared to the overall dye industry. For example, fluorescent brightening agents have shown the smallest change of all the major dye classes. They are used primarily in household detergent formulations to produce a brightening effect on clothes. The synthetic detergent industry, which manufactures these formulations, has been quite stable for the past several years. Because of this stability, the demand for fluorescent brightening agents has remained relatively constant when compared to other classes of dyes.

Basic dyes, on the other hand, are used in the textile industry mainly on acrylic and modacrylic fibers. The decrease in the production of textiles made from these fibers during the recession of 1975 greatly affected the production of basic dyes. In 1975, the production of basic dyes decreased by 41 percent while the overall production of dyes declined only 25 percent.

Changes in the dye industry

During 1970-77, the number of dye plants in the United States declined as several companies closed their plants or sold them to foreign companies. In most cases, the plants were owned by U.S. companies. As a result, the U.S. dye industry is slowly being dominated by subsidiaries of foreign firms. In 1970, there were approximately 45 dye producers in the United States. By 1977, the number of companies reporting production or sales of dyes to the U.S. International Trade Commission had declined to 41.

Several companies allege that increasing production costs and foreign imports are the main reasons they have sold part or all of their dyestuff plants in the past few years. Most sales of dyestuff plants in the past few years were to foreign firms. For example, one large U.S. chemical company recently sold its dyestuff business to a West German firm because of declining profits.[1] The foreign producers can usually supply their subsidiaries with lower cost intermediates or semifinished dyes with a lowering of production costs. It is the belief of the dye industry that there will continue to be sales and mergers of dye plants as the cost of production continues to rise and competition from imports continues to increase.

Some dye producers have stopped producing certain classes of dyes for a variety of reasons. For example, in late 1977, DuPont discontinued the production of vat dyes because of the increased costs of dye intermediates and of required pollution controls.[2] The estimated increase in the selling price of the finished product would eliminate any competitive edge over the imported vat dyes.

Government regulations and controls, which are considered by many people to be a major factor in the decline of domestically owned dye plants in the United States are also affecting the competitiveness between certain classes of domestic dyes and similar imported products.

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[1] American Dyestuff Reporter, September 1977, pp. 17-18.
[2] Ibid., October 1977, p. 68.

Increasing pollution controls have affected the vat dyes to a greater extent than other classes because of the need to control the effluents from the vat dye production process. Vat dyes had consistently been one of the lowest priced classes of dyes produced in the United States and one of the more competitive compared with similar imports. The increased cost of vat dyes owing to pollution control costs is expected to decrease the competitiveness of these products in future years.

Another example of the effect of Government regulations on the dye industry is the withdrawal by the Food and Drug Administration (FDA) of certain dyes which have proven potentially harmful to man. At the present time the two classes most affected by these regulations are the FD&C dyes and the direct dyes based on benzidine. A short time ago, Red Dye 40, a food coloring dye, was withdrawn by the FDA from the domestic market because it was a suspected carcinogen. In 1978, however, it was shown in laboratory tests that Red Dye 40 did not cause cancer in mice as had previously been suspected. Its fate is now being decided by the FDA. Other dyes are still undergoing tests. Three benzidine-based direct dyes, C.I. Direct Blue 6, C.I. Direct Black 38, and C.I. Direct Brown 95, have all been reported to cause cancer in rats and may be withdrawn from the domestic market in the near future.[1]

In addition, the output of other dyes in coming years will probably be affected either by restrictions or by withdrawals from production as a result of increased testing for carcinogens. At the present time, direct dyes, especially those based on benzidene, are the main subject of investigations by the FDA and National Institute for Occupational Safety and Health; they will probably experience a decline in production in the near future as alternative dyes are found to replace them.

Foreign trade

Imports of synthetic benzenoid dyes in 1977 (TSUS 406.50) amounted to 21.3 million pounds valued at $101.7 million (table A), an increase of 13.9 percent in quantity and 15.7 percent in value over the 1976 level.

West Germany and Switzerland continued to supply the bulk of the dye imports to the United States in 1977 despite increased imports from several other countries (e.g., Japan and the United Kingdom). Total imports from West Germany and Switzerland were 14.4 million pounds in 1977. Although this quantity amounted to 67 percent of the total dyes imported in 1977, it was 2.7 percent less than the combined total reported in 1976.

Large volumes of dyes are shipped by producers in West Germany and Switzerland to their U.S. subsidiaries; such shipments in 1977 are estimated to have comprised 85 percent (about 12 million pounds) of total imports from these countries.[2]

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[1] *Chemical Week*, May 1978, p. 57.
[2] Estimated from items examined by the Commission for TSUS 406.50.

Future sources of imported dyes, especially the noncompetitive products, are not expected to vary greatly from the present ones because of the secure position of major chemical companies in West Germany and Switzerland in the dyestuff field. Minor shifts in the importing patterns may occur in the coming years, however, because some European and Japanese companies are constructing dye plants in several developing countries where low labor rates and minimal pollution controls now exist. Also, the possibility of a duty exemption for dyes imported under TSUS item 406.50 applicable to eligible countries under the Generalized System of Preferences provision of the 1974 Trade Act may have been a factor in the decision to construct dye plants in these countries.

During the past few years, the major imported dye by far has been Vat Blue 1, 20%, which is used for dyeing cotton fiber items (i.e., denim) and for printing. In 1977, 4.1 million pounds of Vat Blue 1, 20%, was imported into the United States. This quantity was an increase of 20.6 percent from the 3.4 million pounds imported in 1976. Imports of Vat Blue 1, 20%, and several other major imported dyes in 1975-77 by quantity are shown in table B. Future imports of Vat Blue 1, 20%, will depend upon the use of this product in textiles, and on the ability of the U.S. producer to market a competitive product despite costs of pollution controls. At the present time, it appears that U.S. imports of Vat Blue 1, 20% will increase for several years, depending on consumer demand.

The future of dye imports, in general, may depend upon the outcome of the current trade negotiations in Geneva, Switzerland. Topics for discussion in the Geneva trade negotiations include: (1) the elimination of the American selling price (ASP) method of valuation of imports for duty purposes; (2) the substitution of the ASP method by one of assessing import duties based on transaction values; and (3) the possible reduction of duty rates by 60 percent. Industry sources have indicated that the adoption of any one or all of the above proposals may have a significant effect on the domestic dye industry in the future. Irrespective of the outcome to these proposals, imports of dyes are expected to continue to increase by 5 to 10 percent per year over the next few years, because of the predicted growth of consumer products (e.g., clothing, rugs, and paper products) which utilize dye products in their production. This rate of increase, however, could accelerate if new trade developments, such as adoption of any of the above trade-agreement proposals, should occur.

Table A.--Synthetic dyes: 1/ U.S. imports, by principal sources, 1975-77

Source	1975	1976	1977
	Quantity (1,000 pounds)		
West Germany	5,652	8,407	8,889
Switzerland	2,585	4,742	5,507
United Kingdom	1,497	1,901	2,130
Japan	704	1,153	1,639
France	820	831	933
All other	650	1,704	2,248
Total	11,908	18,738	21,346
	Value (1,000 dollars)		
West Germany	23,001	39,906	41,765
Switzerland	12,108	25,248	30,620
United Kingdom	6,348	9,075	11,266
Japan	3,432	4,849	6,069
France	3,049	3,622	4,372
All other	2,493	5,221	7,615
Total	50,431	87,921	101,707
	Unit value (per pound)		
West Germany	$4.07	$4.75	$4.70
Switzerland	4.68	5.32	5.56
United Kingdom	4.24	4.77	5.29
Japan	4.88	4.21	3.70
France	3.72	4.36	4.69
All other	3.84	3.06	3.39
Total	4.24	4.69	4.77

1/ TSUS item 405.60.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table B.--Synthetic dyes: U.S. imports by principal products, 1/ 1975-77 2/

(In thousands of pounds)

Item	1975	1976	1977
Vat Blue 1, 20%	5,995	3,409	4,111
Solvent Black 5	692	263	3/
Phorwite CL 4/	675	3/	3/
Phorwite RKH 4/	359	3/	3/
Disperse Blue 73	331	901	3/
Food, Drug, and Cosmetic Yellow 5	281	3/	3/
Fluorescent Brightening Agent 351	209	644	480
Disperse Blue 79	3/	734	388
Fluorescent Brightening Agent 119	3/	248	3/
Basic Yellow 2	3/	117	280
Solvent Black 7	3/	3/	499
Direct Black ANBN	3/	3/	322
Acid Blue 277	3/	3/	247

1/ Selected on the basis of items examined by the Commission for TSUS item 406.50.
2/ The 7 dyes imported in the largest quantities are shown for each year.
3/ Not applicable.
4/ A fluorescent brightening agent.

Source: Compiled from official statistics of the International Trade Commission, July 1978.

Dyes

Edmund Cappuccilli

Synthetic dyes are derived in whole or in part from cyclic intermediates. Approximately two-thirds of the dyes consumed in the United States are used by the textile industry to dye natural and synthetic fibers or fabrics; about one-sixth is used for coloring paper; and the rest is used chiefly in the production of organic pigments and in the dyeing of leather and plastics. Of the several thousand different synthetic dyes that are known, more than one thousand are manufactured by one or more domestic producers. The large number of dyes results from the many different types of materials to which dyes are applied, the different conditions of service for which dyes are required, and the costs that a particular use can bear. Dyes are sold as pastes, powders, lumps, and solutions; concentrations vary from 6 percent to 100 percent. The concentration, form, and purity of a dye are determined largely by the use for which it is intended.

Total domestic production of dyes in 1977 amounted to 264 million pounds, or 3.2 percent greater than the 256 million pounds produced in 1976 (table 1). Sales of dyes in 1977 amounted to 255 million pounds, valued at $690 million, compared with 250 million pounds, valued at $620 million, in 1976. In terms of quantity, sales of dyes in 1977 were 1.9 percent greater than in 1976 and in terms of value, 11.3 percent greater. The average unit value of sales of all dyes in 1977 was $2.71 per pound compared with $2.48 per pound in 1976.

The production of six classes of dyes continued to increase in 1977, while the remaining three major classes registered slight to moderate declines in their production. Acid dyes increased by 8.7 percent from 28.2 million pounds in 1976 to 30.7 million in 1977. The other five classes of dyes increased by the following percentages: basic dyes (17.2), disperse dyes (10.6), fiber-reactive dyes (47.0), solvent dyes (8.9), and vat dyes (13.6).

TABLE 1.--DYES: U.S. PRODUCTION AND SALES, 1977

[Listed below are all dyes for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists all dyes for which data on production and/or sales were reported and identifies the manufacturers of each]

DYES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	264,369	254,516	689,992	$2.71
ACID DYES				
Total	30,705	29,003	98,188	3.42
Acid yellow dyes, total	11,323	10,821	30,646	2.83
Acid Yellow 17	201	208	667	3.21
Acid Yellow 19	563	545	1,225	2.25
Acid Yellow 23	430	458	1,884	4.12
Acid Yellow 40	58	...	...	...
Acid Yellow 151	2,284	2,061	3,417	1.66
All other	7,787	7,549	23,453	3.11
Acid orange dyes, total	4,079	3,627	11,443	3.16
Acid Orange 7	380	353	808	2.29
Acid Orange 8	218	241	567	2.35
Acid Orange 10	210	166	395	2.39
Acid Orange 24	547	536	1,342	2.50
Acid Orange 60	521	497	1,618	3.25
All other	2,203	1,834	6,713	3.66
Acid red dyes, total	4,925	4,694	19,525	4.16
Acid Red 1	438	445	1,070	2.41
Acid Red 4	53	56	209	3.76
Acid Red 14	77	77	293	3.82
Acid Red 73	129	124	584	4.73
Acid Red 88	48	...	...	...
Acid Red 114	240	163	736	4.51
Acid Red 137	129	118	591	5.00
Acid Red 151	503	524	1,413	2.70
Acid Red 182	96	78	348	4.45
Acid Red 266	259	299	1,119	3.74
Acid Red 337	1,429	1,268	5,209	4.11
All other	1,524	1,542	7,953	5.16
Acid violet dyes, total	194	165	804	4.86
Acid Violet 3	58	56	245	4.36
All other	136	109	559	5.13
Acid blue dyes, total	5,311	5,347	20,282	3.79
Acid Blue 25	238	541	3,379	6.25
Acid Blue 27	77	95	383	4.05
Acid Blue 40	600	531	2,449	4.61
Acid Blue 113	409	353	1,279	3.63
All other	3,987	3,827	12,792	3.34
Acid green and brown dyes, total	1,907	1,741	7,070	4.06
Acid Brown 14	419	427	1,409	3.30
All other	1,488	1,314	5,661	4.31
Acid black dyes, total	2,966	2,608	8,418	3.23
Acid Black 1	425	354	1,128	3.19
Acid Black 52	617	459	1,357	2.96
Acid Black 107	178	231	978	4.24
All other	1,746	1,564	4,955	3.17

See footnotes at end of table.

TABLE 1.--DYES: U.S. PRODUCTION AND SALES, 1977--CONTINUED

DYES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
AZOIC DYES AND COMPONENTS				
Azoic Diazo Components, Bases (Fast Color Bases)	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Azoic Diazo Components, Bases (Fast Color Bases) Total	581	533	1,229	$2.31
Azoic Diazo Components, Salts (Fast Color Salts)				
Total	1,271	1,235	1,602	1.30
Azoic Diazo Component 6, salt	78	81	115	1.42
All other azoic diazo components, salts	1,193	1,154	1,487	1.29
BASIC DYES				
Total	17,103	16,249	57,353	3.53
Basic yellow dyes, total	5,772	5,135	16,694	3.25
Basic Yellow 11	753	...	...	...
Basic Yellow 13	275	208	516	2.48
All other	4,744	4,927	16,178	3.28
Basic orange dyes, total	1,638	1,712	4,751	2.77
Basic Orange 2	486	603	1,430	2.37
Basic Orange 21	559	580	1,637	2.82
All other	593	529	1,684	3.18
Basic red dyes, total	3,070	2,846	10,262	3.61
Basic Red 14	876	718	1,505	2.09
Basic Red 18	591	600	1,395	2.33
Basic Red 49	104	103	377	3.66
All other	1,499	1,425	6,985	4.90
Basic violet dyes, total	3,129	3,187	11,699	3.67
Basic Violet 1	1,039	1,112	3,661	3.29
All other	2,090	2,075	8,038	3.87
Basic blue dyes, total	2,956	2,750	11,690	4.25
Basic Blue 3	909	692	2,156	3.11
All other	2,047	2,058	9,534	4.63
All other basic dyes	538	619	2,257	3.65
DIRECT DYES				
Total	30,735	33,120	88,467	2.67
Direct yellow dyes, total	11,896	12,128	32,841	2.71
Direct Yellow 4	707	1,023	1,976	1.93
Direct Yellow 6	246	264	1,030	3.90
Direct Yellow 11	2,838	2,908	5,477	1.88
Direct Yellow 28	84	74	421	5.70
Direct Yellow 34	127	111	392	3.51
Direct Yellow 44	467	419	1,302	3.11
Direct Yellow 50	196	206	740	3.60
Direct Yellow 84	239	340	624	1.84
Direct Yellow 105	258	223	694	3.11
Direct Yellow 106	1,170	1,497	3,344	2.23
All other	5,564	5,063	16,841	3.33
Direct orange dyes, total	1,857	1,622	4,826	2.98
Direct Orange 15	636	523	872	1.67
Direct Orange 39	158	134	365	2.72
Direct Orange 72	236	227	688	3.03
Direct Orange 102	323	307	1,146	3.73
All other	504	431	1,755	4.07

See footnotes at end of table.

TABLE 1.--DYES: U.S. PRODUCTION AND SALES, 1977--CONTINUED

DYES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
DIRECT DYES--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Direct red dyes, total	5,515	5,050	15,324	$3.03
Direct Red 2	81	64	275	4.31
Direct Red 23	192	186	813	4.38
Direct Red 24	213	214	838	3.93
Direct Red 72	371	324	1,121	3.46
Direct Red 80	465	481	1,671	3.47
Direct Red 81	1,806	737	2,804	3.80
All other	2,387	3,044	7,802	2.56
Direct violet dyes	145	143	567	3.97
Direct blue dyes, total	6,380	6,147	19,501	3.17
Direct Blue 1	186	145	627	4.32
Direct Blue 15	530	514	1,502	2.92
Direct Blue 80	472	441	1,956	4.44
Direct Blue 86	911	739	2,502	3.38
Direct Blue 98	278	203	559	2.75
Direct Blue 218	...	888	3,126	3.52
All other	4,003	3,217	9,229	2.87
Direct green dyes	399	393	1,721	4.38
Direct brown dyes	639	795	2,328	2.93
Direct black dyes, total	3,904	6,842	11,359	1.66
Direct Black 22	856	1,110	1,517	1.37
All other	3,048	5,732	9,842	1.72
DISPERSE DYES				
Total	43,262	40,811	158,140	3.87
Disperse yellow dyes, total	8,160	8,005	21,098	2.64
Disperse Yellow 23	814	829	1,997	2.41
Disperse Yellow 42	663	655	1,414	2.16
Disperse Yellow 54	1,058	1,065	3,278	3.08
All other	5,625	5,456	14,409	2.64
Disperse orange dyes, total	6,551	5,727	16,249	2.84
Disperse Orange 3	134	113	304	2.70
Disperse Orange 25	451	530	1,409	2.66
All other	5,966	5,084	14,536	2.86
Disperse red dyes, total	9,827	8,761	41,132	4.69
Disperse Red 1	345	323	864	2.68
Disperse Red 5	67	79	205	2.60
Disperse Red 17	202	191	516	2.70
Disperse Red 50	427	255	1,163	4.56
Disperse Red 60	2,388	1,980	7,510	3.79
Disperse Red 65	253	187	639	3.42
Disperse Red 177	320	...	...	...
All other	5,825	5,746	30,235	5.26
Disperse violet dyes, total	584	520	2,310	4.44
Disperse Violet 1	62	35	185	5.32
Disperse Violet 27	45	68	186	2.71
All other	477	417	1,939	4.65
Disperse blue dyes, total	15,664	15,424	70,846	4.59
Disperse Blue 3	1,106	1,091	3,488	3.20
Disperse Blue 64	363	499	1,192	2.39
Disperse Blue 79	2,636	2,946	8,016	2.72
All other	11,559	10,888	58,150	5.34
Disperse green and brown dyes	1,317	1,159	3,769	3.25
Disperse black dyes	1,159	1,215	2,736	2.25

See footnotes at end of table.

TABLE 1.--DYES: U.S. PRODUCTION AND SALES, 1977--CONTINUED

DYES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
FIBER-REACTIVE DYES	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Fiber-reactive dyes, total	5,153	4,742	25,758	$5.43
Reactive yellow dyes	1,019	965	5,486	5.68
All other reactive dyes	4,134	3,777	20,272	5.37
FLUORESCENT BRIGHTENING AGENTS				
Fluorescent brightening agents, total	33,254	31,003	50,899	1.64
Fluorescent Brightening Agent 28	1,042	1,003	1,494	1.49
Fluorescent Brightening Agent 61	115	...	...	...
All other fluorescent brightening agents	32,097	30,000	49,405	1.65
FOOD, DRUG, AND COSMETIC COLORS				
Total	5,744	5,381	37,278	6.93
Food, Drug, and Cosmetic Dyes				
Total	5,366	5,030	33,412	6.64
FD&C Blue No. 1	259	316	1,969	6.24
FD&C Red No. 3	461	479	5,097	10.63
FD&C Red No. 40	1,712	1,486	11,990	8.07
FD&C Yellow No. 5	1,658	1,528	7,944	5.20
FD&C Yellow No. 6	1,142	1,059	4,866	4.59
All other food, drug, and cosmetic dyes	134	162	1,546	9.54
Drug and Cosmetic and External Drug and Cosmetic Dyes				
Total	378	351	3,866	11.00
D&C Red No. 7	66	58	401	6.90
D&C Red No. 9	114	71	345	4.83
D&C Red No. 19	15	...	...	...
All other drug and cosmetic and external drug and cosmetic dyes	183	222	3,120	14.05
MORDANT DYES				
Total	695	594	2,173	3.66
Mordant orange dyes	78	72	214	2.99
All other mordant dyes	617	522	1,959	3.75
SOLVENT DYES				
Total	12,999	9,955	32,251	3.24
Solvent yellow dyes	1,400	1,350	5,324	3.94
Solvent orange dyes	821	690	2,616	3.79
Solvent red dyes, total	2,774	2,795	8,164	2.92
Solvent Red 24	73	58	255	4.37
All other	2,701	2,737	7,909	2.89
Solvent blue dyes	3,959	1,308	9,079	6.94
All other solvent dyes	4,045	3,812	7,068	1.85
VAT DYES				
Total	60,478	59,815	101,887	1.70
Vat yellow dyes	1,609	1,485	4,300	2.90

See footnotes at end of table.

TABLE 1.--DYES: U.S. PRODUCTION AND SALES, 1977--CONTINUED

DYES	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
VAT DYES--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Vat orange dyes, total	2,392	2,233	11,253	$5.04
Vat Orange 15, 10%	207	...	...	...
All other	2,185	2,233	11,253	5.04
Vat red dyes	429	378	2,651	7.02
Vat violet dyes	704	432	1,724	3.99
Vat green dyes, total	4,263	4,542	7,223	1.59
Vat Green 3, 10%	1,318	1,129	2,462	2.18
All other	2,945	3,413	4,761	1.39
Vat black dyes, total	3,887	3,865	8,957	2.32
Vat Black 25, 12-1/2%	2,241	2,368	4,773	2.02
All other	1,646	1,497	4,184	2.79
All other vat dyes	47,194	46,880	65,779	1.40
All other dyes[3]	22,389	22,075	34,767	1.57

[1] Calculated from unrounded figures.
[2] The data include dyes which are similar to, but not chemically identical with, the indicated *Colour Index* name.
[3] The data include azoic compositions, azoic coupling components, sulfur dyes, and miscellaneous dyes. Statistics for those groups of dyes may not be published separately because publication would disclose information received in confidence.

TABLE 1A.--DYES: U.S. PRODUCTION AND SALES, BY CLASS OF APPLICATION, 1977

CLASS OF APPLICATION	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Total	264,369	254,516	689,992	$2.71
Acid	30,705	29,003	98,188	3.39
Azoic dyes and components:				
Azoic diazo components, bases (Fast color bases)	581	533	1,229	2.31
Azoic diazo components, salts (Fast color salts)	1,271	1,235	1,602	1.30
Basic	17,103	16,249	57,353	3.53
Direct	30,735	33,120	88,467	2.67
Disperse	43,262	40,811	158,140	3.87
Fiber-reactive	5,153	4,742	25,758	5.43
Fluorescent brightening agents	33,254	31,003	50,899	1.64
Food, drug, and cosmetic colors	5,744	5,381	37,278	6.93
Mordant	695	594	2,173	3.66
Solvent	12,999	9,955	32,251	3.24
Vat	60,478	59,815	101,887	1.70
All other[2]	22,389	22,075	34,767	1.57

[1] Calculated from unrounded figures.
[2] The data include azoic compositions, azoic coupling components, sulfur dyes, and miscellaneous dyes. Statistics for those groups of dyes may not be published separately because publication would disclose information received in confidence.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ACID DYES	
*ACID YELLOW DYES:	
Acid Yellow 1	ACY.
Acid Yellow 3	ACS, ACY, BCC.
Acid Yellow 11	BDO, CMG.
Acid Yellow 14	TBC.
*Acid Yellow 17	AC, ATL, CMG, SDH, TBC.
*Acid Yellow 19	AC, ALT, ATL, BAS, ICI.
*Acid Yellow 23	AC, ACY, ALT, GAF, MRX, SDH, TBC, VPC, WJ.
Acid Yellow 29	TRC.
Acid Yellow 34	ATL.
Acid Yellow 36	DUP, GAF, TBC.
Acid Yellow 38	GAF.
*Acid Yellow 40	ALT, ATL, TRC.
Acid Yellow 42	AC, ACY, GAF.
Acid Yellow 49	DUP, VPC.
Acid Yellow 54	AC, TRC.
Acid Yellow 63	AC.
Acid Yellow 65	ATL, TRC.
Acid Yellow 73	BCC, SDH.
Acid Yellow 76	TBC.
Acid Yellow 99	GAF, TRC.
Acid Yellow 114	TBC.
Acid Yellow 121	GAF.
Acid Yellow 127	TRC.
Acid Yellow 128	TRC.
Acid Yellow 129	AC, TRC.

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TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C I D D Y E S--Continued	
*ACID YELLOW DYES--Continued:	
Acid Yellow 135	ICI.
*Acid Yellow 151	AC, ALT, ATL, DUP, TRC, VPC.
Acid Yellow 159	ALT, TRC, VPC.
Acid Yellow 169	TRC.
Acid Yellow 174	AC, DUP, VPC.
Acid Yellow 198	DUP.
Acid Yellow 199	ICI.
Acid Yellow 200	DUP.
Acid Yellow 216	VPC.
Acid Yellow 219	TRC.
Acid Yellow 221	BAS.
Acid Yellow dyes, all other	ACY, ALT, VPC.
*ACID ORANGE DYES:	
Acid Orange 1	AC, GAF.
Acid Orange 5	ACY.
*Acid Orange 7	AC, ACY, ATL, BDO, GAF, PDC, TRC, VPC.
*Acid Orange 8	AC, ACY, ATL, GAF, TRC, VPC.
*Acid Orange 10	AC, ACY, ATL, GAF, PDC, TRC.
Acid Orange 12	PSC.
*Acid Orange 24	ACY, ALT, ATL, FAB, GAF, TRC.
Acid Orange 47	TRC.
Acid Orange 50	AC.
Acid Orange 51	TRC.
Acid Orange 52	ATL.
*Acid Orange 60	AC, ALT, ATL, DUP, GAF, TRC, VPC.
Acid Orange 62	TRC.
Acid Orange 63	TRC.
Acid Orange 64	DUP.
Acid Orange 72	ACY.
Acid Orange 74	GAF, TRC.
Acid Orange 86	TRC.
Acid Orange 116	AC, ALT, GAF.
Acid Orange 119	TRC.
Acid Orange 128	DUP, PDC.
Acid Orange 132	DUP.
Acid Orange 152	DUP.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ACID DYES--Continued	
*ACID ORANGE DYES--Continued:	
Acid Orange 156	TRC.
Acid Orange dyes, all other	ALT, ATL, DUP, TRC.
*ACID RED DYES:	
*Acid Red 1	AC, ACY, ATL, BDO, DUP, GAF, TRC, VPC.
*Acid Red 4	AC, ATL, BDO, GAF, PDC, TRC.
*Acid Red 14	ATL, BDO, GAF, PDC.
Acid Red 18	TRC.
Acid Red 26	ACY.
Acid Red 27	ATL.
Acid Red 33	BDO.
Acid Red 37	AC, ATL, TRC.
Acid Red 51	BDC.
Acid Red 57	ICI, TRC.
Acid Red 59	VPC.
Acid Red 66	AC, ATL.
*Acid Red 73	ACY, ATL, GAF, HSH, PSC, TRC.
Acid Red 85	FAB, GAF.
Acid Red 87	SDH.
*Acid Red 88	ATL, GAF, PDC, TRC.
Acid Red 89	BDO.
Acid Red 97	GAF.
Acid Red 99	AC, FAB.
Acid Red 111	VPC.
*Acid Red 114	ALT, ATL, DUP, TRC.
Acid Red 115	ATL.
Acid Red 119	ALT.
Acid Red 133	GAF.
Acid Red 134	TRC.
*Acid Red 137	ATL, DUP, GAF, TRC, VPC.
Acid Red 138	ALT.
*Acid Red 151	AC, ACY, ATL, DUP, HSH, ICI, TRC, VPC.
Acid Red 167	ATL, TRC.
Acid Red 179	TRC.
*Acid Red 182	AC, ALT, ATL, DUP, VPC.
Acid Red 183	CMG.
Acid Red 186	AC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977-Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C I D D Y E S--Continued	
*ACID RED DYES--Continued:	
Acid Red 194	TRC.
Acid Red 211	TRC.
Acid Red 213	TRC.
Acid Red 225	VPC.
Acid Red 257	TRC.
*Acid Red 266	ALT, ATL, DUP, GAF, ICI, TRC.
Acid Red 277	VPC.
Acid Red 278	VPC.
Acid Red 299	ALT.
Acid Red 309	TRC.
*Acid Red 337	ALT, ATL, DUP, TRC, VPC.
Acid Red 364	DUP.
Acid Red 384	DUP.
Acid Red 388	DUP.
Acid Red dyes, all other	AC, ACY, ALT, ATL, BCC, DUP, TRC, VPC.
*ACID VIOLET DYES:	
Acid Violet 1	BDO.
*Acid Violet 3	ACY, ATL, TRC.
Acid Violet 4	SDH.
Acid Violet 7	ATL, BDO, GAF.
Acid Violet 12	BDC.
Acid Violet 17	GAF, SDH.
Acid Violet 43	HSH.
Acid Violet 49	SDH, TRC.
*ACID BLUE DYES:	
Acid Blue 7	SDH.
Acid Blue 9	GAF, X.
Acid Blue 15	GAF.
Acid Blue 23	TRC.
*Acid Blue 25	ATL, DUP, HSH, ICI, TRC, VPC.
*Acid Blue 27	ATL, BDO, GAF, VPC.
Acid Blue 29	PDC.
*Acid Blue 40	ATL, BDO, DUP, GAF, ICI, TRC, VPC.
Acid Blue 41	ATL, BDO, GAF.
Acid Blue 43	ATL, TRC.
Acid Blue 45	TRC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ACID DYES--Continued	
*ACID BLUE DYES--Continued:	
Acid Blue 62	BDO, CMG.
Acid Blue 74	DUP.
Acid Blue 78	TRC.
Acid Blue 80	TRC.
Acid Blue 83	VPC.
Acid Blue 92	ATL, FAB.
Acid Blue 93	HSC.
Acid Blue 104	ATL, GAF.
*Acid Blue 113	AC, ALT, GAF, HSH, VPC.
Acid Blue 118	AC.
Acid Blue 122	DUP.
Acid Blue 145	ACS, BCC, HSH.
Acid Blue 158, 158:1, and 158:2	AC, TRC.
Acid Blue 203	VPC.
Acid Blue 205	VPC.
Acid Blue 230	DUP.
Acid Blue 231	GAF, TRC.
Acid Blue 277	TRC.
Acid Blue 298	DUP.
Acid Blue dyes, all other	AC, ACY, ALT, ATL, TRC, VPC.
ACID GREEN DYES:	
Acid Green 1	ACY.
Acid Green 3	TRC.
Acid Green 5	WJ.
Acid Green 16	TRC.
Acid Green 20	GAF, TRC.
Acid Green 25	BDO, HSH, TRC.
Acid Green 35	TRC.
Acid Green 70	TRC.
Acid Green dyes, all other	ALT.
ACID BROWN DYES:	
*Acid Brown 14	AC, ACY, ALT, ATL, FAB, GAF, TRC.
Acid Brown 19	TRC.
Acid Brown 31	GAF.
Acid Brown 45	TRC.
Acid Brown 83	VPC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C I D D Y E S--Continued	
ACID BROWN DYES--Continued:	
Acid Brown 90	ACY.
Acid Brown 97	ACY.
Acid Brown 98	ACY, PDC, TBC.
Acid Brown 147	TBC.
Acid Brown 152	GAF.
Acid Brown 158	GAF.
Acid Brown 160	BAS.
Acid Brown 161	BAS.
Acid Brown 163	BAS.
Acid Brown 165	BAS.
Acid Brown 223	VPC.
Acid Brown 239	TRC.
Acid Brown 243	GAF.
Acid Brown 354	ACY.
Acid Brown dyes, all other	ALT, ATL, VPC.
*ACID BLACK DYES:	
*Acid Black 1	AC, ACY, ATL, BDO, GAF, HSH, PDC, TRC, VPC.
Acid Black 2	ACY.
Acid Black 24	AC.
Acid Black 29	GAF.
Acid Black 41	PDC.
*Acid Black 52	AC, ALT, ATL, FAB, GAF, TRC.
Acid Black 58	TRC.
Acid Black 60	TRC.
Acid Black 92	ACY.
*Acid Black 107	ALT, GAF, TRC, VPC.
Acid Black 172	VPC.
Acid Black 194	BAS.
Acid Black dyes, all other	AC, ALT, ATL, TBC, VPC.
A Z O I C D Y E S A N D C O M P O N E N T S	
AZOIC COMPOSITIONS:	
AZOIC YELLOW COMPOSITIONS:	
Azoic Yellow 1	ALL, BUC.
Azoic Yellow 2	ALL.
Azoic Yellow compositions, all other	ALL.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A Z O I C D Y E S A N D C O M P O N E N T S--Continued	
AZOIC COMPOSITIONS--Continued	
AZOIC ORANGE COMPOSITIONS:	
Azoic Orange 3	ALL, BUC.
AZOIC RED COMPOSITIONS:	
Azoic Red 1	ALL, BUC, X.
Azoic Red 2	ALL, BUC.
Azoic Red 6	ALL, BUC.
Azoic Red compositions, all other	ALL, ATL.
AZOIC VIOLET COMPOSITIONS:	
Azoic Violet 1	BUC.
Azoic Violet compositions, all other	ALL.
AZOIC BLUE COMPOSITIONS:	
Azoic Blue 3	ALL, BUC, GAF, SDH.
Azoic Blue compositions, all other	ATL.
AZOIC BROWN COMPOSITIONS:	
Azoic Brown 9	ALL, BUC, GAF.
Azoic Brown 10	BUC.
Azoic Brown compositions, all other	ALL.
AZOIC BLACK COMPOSITIONS:	
Azoic Black 4	BUC.
Azoic Black compositions, all other	ATL.
*AZOIC DIAZO COMPONENTS, BASES:	
Azoic diazo component 2, base	BUC.
Azoic diazo component 4, base	ALL, BUC, SDH.
Azoic diazo component 5, base	GAF.
Azoic diazo component 12, base	BUC, PCW, SDH.
Azoic diazo component 13, base	BUC.
Azoic diazo component 14, base	ALL.
Azoic diazo component 32, base	ALL.
Azoic diazo component 34, base	ALL.
Azoic diazo components, base, all other	ALL.
*AZOIC DIAZO COMPONENTS, SALTS:	
Azoic diazo component 1, salt	ALL, BUC.
Azoic diazo component 2, salt	BUC.
Azoic diazo component 3, salt	ALL, BUC.
Azoic diazo component 5, salt	ALL, BUC.
*Azoic diazo component 6, salt	ALL, BUC, GAF.
Azoic diazo component 8, salt	ALL, BUC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
AZOIC DYES AND COMPONENTS--Continued	
*AZOIC DIAZO COMPONENTS, SALTS--Continued:	
Azoic diazo component 9, salt	ALL, BUC.
Azoic diazo component 10, salt	ALL, BUC.
Azoic diazo component 11, salt	ALL.
Azoic diazo component 12, salt	ALL, BUC.
Azoic diazo component 13, salt	ALL, BUC.
Azoic diazo component 14, salt	ALL, BUC.
Azoic diazo component 32, salt	ALL.
Azoic diazo component 34, salt	ALL.
Azoic diazo component 41, salt	ALL.
Azoic diazo component 42, salt	ALL.
Azoic diazo component 44, salt	ALL, BUC.
Azoic diazo component 49, salt	ALL, BUC.
Azoic diazo components, salt, all other	ALL.
AZOIC COUPLING COMPONENTS:	
Azoic coupling component 2	BUC, PCW, SDH.
Azoic coupling component 3	BUC, PCW.
Azoic coupling component 7	BUC, PCW, X.
Azoic coupling component 8	BUC, PCW.
Azoic coupling component 10	PCW.
Azoic coupling component 11	BUC, PCW.
Azoic coupling component 12	PCW.
Azoic coupling component 13	HST.
Azoic coupling component 14	BUC, PCW.
Azoic coupling component 15	BUC, GAF.
Azoic coupling component 17	BUC, PCW.
Azoic coupling component 18	BUC, PCW.
Azoic coupling component 19	PCW.
Azoic coupling component 20	BUC, PCW.
Azoic coupling component 21	BUC, PCW.
Azoic coupling component 29	BUC, PCW.
Azoic coupling component 34	BUC, PCW.
Azoic coupling component 35	PCW.
Azoic coupling component 43	ALL, ATL, BUC, GAF.
Azoic coupling components, all other	ATL.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
BASIC DYES	
*BASIC YELLOW DYES:	
Basic Yellow 1	DUP.
Basic Yellow 2	ACY.
*Basic Yellow 11	ATL, DUP, GAF, TRC, VPC.
*Basic Yellow 13	ATL, DUP, GAF, VPC.
Basic Yellow 15	DUP.
Basic Yellow 21	VPC.
Basic Yellow 23	BAS.
Basic Yellow 25	BAS.
Basic Yellow 26	GAF.
Basic Yellow 28	ATL, GAF, VPC.
Basic Yellow 29	ATL, DUP, VPC.
Basic Yellow 31	DUP.
Basic Yellow 37	ACY, GAF.
Basic Yellow 41	ACY.
Basic Yellow 49	BAS.
Basic Yellow 52	DUP.
Basic Yellow 53	DUP.
Basic Yellow 58	DUP.
Basic Yellow 78	ACY.
Basic Yellow 79	DUP.
Basic Yellow 83	DUP.
Basic Yellow dyes, all other,	ACY, DUP, VPC, X.
*BASIC ORANGE DYES:	
Basic Orange 1	PSC, TRC.
*Basic Orange 2	ACY, ATL, DUP, GAF, PSC, TRC.
Basic Orange 14	GAF.
*Basic Orange 21	ATL, DUP, GAF, TRC, VPC.
Basic Orange 24	DUP.
Basic Orange 25	DUP.
Basic Orange 26	DUP.
Basic Orange 28	VPC.
Basic Orange 31	ACY.
Basic Orange 39	DUP.
Basic Orange 40	BAS.
Basic Orange dyes, all other,	ALT, DUP, VPC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
B A S I C D Y E S--Continued	
*BASIC RED DYES:	
Basic Red 1	BAS, DUF, GAF.
Basic Red 2	DUP.
Basic Red 12	ACY, DUP, VPC.
Basic Red 13	ATL.
Basic Red 14	ACY, ATL, DUP, GAF, VPC.
Basic Red 15	ATL, DUP, GAF.
Basic Red 17	DUP.
* Basic Red 18	ATL, DUP, GAF, VPC.
Basic Red 22	TRC.
Basic Red 23	VPC.
Basic Red 29	BAS.
Basic Red 30	ACY.
* Basic Red 49	DUP, GAF, TRC, VPC.
Basic Red 51	BAS.
Basic Red 73	DUP.
Basic Red dyes, all other	DUP, VPC, X.
*BASIC VIOLET DYES:	
* Basic Violet 1	ACS, ACY, BAS, BCC, DSC.
Basic Violet 3	DSC, DUP, SDH.
Basic Violet 4	DSC, DUP.
Basic Violet 7	ATL.
Basic Violet 10	ACY, DUP.
Basic Violet 14	VPC.
Basic Violet 15	DUP.
Basic Violet 16	ATL, DUP, GAF, TRC.
Basic Violet 35	BAS.
Basic Violet dyes, all other	ACY, BCC, DUP, VPC.
* BASIC BLUE DYES:	
Basic Blue 1	DSC, GAF, SDH, VPC.
Basic Blue 2	DSC.
* Basic Blue 3	DUP, GAF, HST, TRC.
Basic Blue 5	DSC.
Basic Blue 6	ACY.
Basic Blue 7	DSC, DUP, SDH.
Basic Blue 9	ACY, SDH.
Basic Blue 11	SDH.
Basic Blue 21	DUP.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANFUACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
B A S I C D Y E S--Continued	
*BASIC BLUE DYES-- Continued	
Basic Blue 22	DUP, VPC.
Basic Blue 26	DSC, SDH.
Basic Blue 35	DUP.
Basic Blue 41	ATL, BAS, GAF, TRC.
Basic Blue 45	VPC.
Basic Blue 47	VPC.
Basic Blue 54	ACY, ATL, BAS.
Basic Blue 69	VPC.
Basic Blue 75	EKT.
Basic Blue 76	ACY.
Basic Blue 77	DUP.
Basic Blue 78	BAS.
Basic Blue 87	DUP.
Basic Blue 94	DUP.
Basic Blue dyes, all other	ACS, DUP, EKT, VPC, X.
BASIC GREEN DYES:	
Basic Green 1	DSC.
Basic Green 4	ACY, DSC.
BASIC BROWN DYES:	
Basic Brown 1	ACY, DUP, PSC, TRC.
Basic Brown 2	GAF.
Basic Brown 4	GAF, PSC, TRC.
Basic Brown dyes, all other	DUP.
BASIC BLACK DYES:	
Basic Black dyes, all other	ALT, VPC.
D I R E C T D Y E S	
*DIRECT YELLOW DYES:	
*Direct Yellow 4	AC, ACY, ATL, DUP, GAF, TRC, VPC.
Direct Yellow 5	ACY, GAF.
*Direct Yellow 6	AC, ACY, DUP, GAF, TRC.
Direct Yellow 8	ATL.
*Direct Yellow 11	AC, ACY, DUP, GAF, SDH, TRC.
Direct Yellow 12	ACY, ATL, TRC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
DIRECT DYES--Continued	
*DIRECT YELLOW DYES--Continued:	
Direct Yellow 26	ATL.
Direct Yellow 27	ATI.
*Direct Yellow 28	ATL, DUP, GAF, PDC, TRC.
Direct Yellow 29	GAF.
*Direct Yellow 34	AC, ALT, ATL, TBC.
Direct Yellow 39	TBC.
*Direct Yellow 44	AC, ATL, DUP, GAF, HSH, TRC.
*Direct Yellow 50	AC, ATL, DUP, FAB, GAF, HSH, TRC.
Direct Yellow 51	FAB.
Direct Yellow 59	ATL.
Direct Yellow 81	ATL.
*Direct Yellow 84	AC, ATL, GAF, TBC.
*Direct Yellow 105	AC, ALT, TRC.
*Direct Yellow 106	AC, ALT, GAF, TRC.
Direct Yellow 107	ATL, GAF, TBC.
Direct Yellow 114	ACY.
Direct Yellow 118	TBC.
Direct Yellow 119	DUP.
Direct Yellow 120	AC.
Direct Yellow 127	DUP, TBC.
Direct Yellow 131	DUP.
Direct Yellow 132	TRC.
Direct Yellow 137	DUP.
Direct Yellow 139	DUP.
Direct Yellow 147	ACY, DUP.
Direct Yellow 314	AC.
Direct Yellow dyes, all other	ALT, ATL, TRC.
*DIRECT ORANGE DYES:	
Direct Orange 6	ATL.
Direct Orange 8	FAB.
*Direct Orange 15	AC, ACY, DUP, GAF, TRC.
Direct Orange 26	ATL, TBC.
Direct Orange 29	TRC.
Direct Orange 34	ATL, DUP, GAF.
Direct Orange 37	ATL, GAF.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
DIRECT DYES--Continued	
*DIRECT ORANGE DYES --Continued	
*Direct Orange 39	AC, ACY, ALT, FAB, GAF.
Direct Orange 59	DUP, GAF.
Direct Orange 61	TRC.
*Direct Orange 72	AC, ATL, FAB, HSH, TRC.
Direct Orange 73	TRC.
Direct Orange 74	DUP.
Direct Orange 78	VPC.
Direct Orange 80	ATL.
Direct Orange 83	GAF.
Direct Orange 88	DUP.
*Direct Orange 102	AC, ACY, ATL, DUP, GAF.
Direct Orange 118	TRC.
Direct Orange dyes, all other	AC, ALT.
*DIRECT RED DYES:	
Direct Red 1	FAB, GAF.
*Direct Red 2	AC, ATL, TRC.
Direct Red 4	ATL, TRC.
Direct Red 16	ATL, TRC.
*Direct Red 23	AC, ACY, ATL, DUP, GAF, HSH, TRC, VPC.
*Direct Red 24	AC, ATL, HSH, TRC, VPC.
Direct Red 26	AC, ATL, GAF.
Direct Red 28	FAB.
Direct Red 31	ATL, GAF.
Direct Red 37	GAF.
Direct Red 39	ATL, GAF, TRC.
Direct Red 62	ATL, TRC.
*Direct Red 72	ATL, DUP, GAF, TRC.
Direct Red 73	AC, ATL.
Direct Red 75	ATL.
Direct Red 76	GAF.
Direct Red 79	TRC.
*Direct Red 80	AC, ALT, ATL, HSH, SDH, TRC, VPC.
*Direct Red 81	AC, ATL, CMG, DUP, GAF, HSH, SDH, TRC, VPC.
Direct Red 83	AC, ALT, ATL, FAB.
Direct Red 95	GAF.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
D I R E C T D Y E S--Continued	
*DIRECT RED DYES--Continued	
Direct Red 117	DUP.
Direct Red 122	TRC.
Direct Red 149	ATL, CMG.
Direct Red 152	CMG.
Direct Red 153	ATL.
Direct Red 209	TRC.
Direct Red 212	VPC.
Direct Red 236	DUP.
Direct Red 238	DUP.
Direct Red 239	TRC.
Direct Red dyes, all other	AC, ACY, ALT, ATL, VPC.
*DIRECT VIOLET DYES:	
Direct Violet 7	ATL.
Direct Violet 9	ATL, GAF, TRC.
Direct Violet 66	ATL, DUP, TRC.
*DIRECT BLUE DYES:	
*Direct Blue 1	AC, ACY, ATL, GAF, TRC.
Direct Blue 2	FAB, GAF.
Direct Blue 6	FAB, GAF.
Direct Blue 8	ATL.
Direct Blue 14	ATL, TRC.
*Direct Blue 15	AC, ATL, DUP, GAF, VPC.
Direct Blue 25	ATL, TRC.
Direct Blue 67	ATL.
Direct Blue 71	ALT.
Direct Blue 75	TRC.
Direct Blue 76	AC, ALT, ATL, GAF.
Direct Blue 78	AC, CMG.
*Direct Blue 80	AC, ALT, ATL, FAB, GAF, TRC.
*Direct Blue 86	AC, ALT, ATL, DUP, FAB, TRC, VPC.
Direct Blue 91	TRC.
*Direct Blue 98	ALT, ATL, FAB, GAF, TRC.
Direct Blue 100	ALT.
Direct Blue 120, 120:1, 120:2, and 120:3	AC, ATL, TRC.
Direct Blue 126	ALT, HSH.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
D I R E C T D Y E S--Continued	
*DIRECT BLUE DYES--Continued	
Direct Blue 143	DUP.
Direct Blue 151	ATL, TRC.
Direct Blue 160	ALT, TRC, VPC.
Direct Blue 189	TRC.
Direct Blue 191	ALT, GAF.
Direct Blue 199	DUP.
*Direct Blue 218	AC, ATL, DUP, GAF, TRC.
Direct Blue 260	DUP.
Direct Blue 263	DUP.
Direct Blue dyes, all other	AC, ALT, ATL, HSH, TRC.
*DIRECT GREEN DYES:	
Direct Green 1	FAB, GAF.
Direct Green 6	FAB, GAF.
Direct Green 26	TRC.
Direct Green 27	TRC.
Direct Green 28	TRC.
Direct Green 47	DUP.
Direct Green 51	TRC.
Direct Green 69	TRC.
Direct Green dyes, all other	ACY, DUP, TRC.
*DIRECT BROWN DYES:	
Direct Brown 2	FAB, GAF.
Direct Brown 6	FAB.
Direct Brown 31	FAB, GAF.
Direct Brown 44	FAB.
Direct Brown 74	FAB.
Direct Brown 95	BCC, FAB, GAF.
Direct Brown 154	FAB.
Direct Brown dyes, all other	AC, ALT, ATL, VPC.
*DIRECT BLACK DYES:	
Direct Black 4	FAB, GAF.
Direct Black 19	ATL, TRC.
*Direct Black 22	AC, ALT, ATL, TRC, VPC.
Direct Black 38	FAB, GAF.
Direct Black 78	AC.
Direct Black 80	AC, ATL, FAB.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
D I R E C T D Y E S--Continued	
*DIRECT BLACK DYES--Continued	
Direct Black 190	AC, ATL, FAB.
Direct Black dyes, all other	AC, ACS, ALT, ATL, FAB, TRC.
D I S P E R S E D Y E S	
*DISPERSE YELLOW DYES	
Disperse Yellow 1	GAF.
Disperse Yellow 3	AC, GAF, HSH, TRC, VPC.
Disperse Yellow 5	ATL, GAF.
*Disperse Yellow 23	AC, ALT, ATL, DUP, EKT, HSH, TRC.
Disperse Yellow 31	GAF.
Disperse Yellow 33	AC, EKT, TRC.
Disperse Yellow 34	AC, EKT.
*Disperse Yellow 42	AC, ALT, DUP, EKT, SDC, TRC.
*Disperse Yellow 54	AC, BAS, DUP, GAF, SDC, TRC, VPC.
Disperse Yellow 56	BAS.
Disperse Yellow 58	HST.
Disperse Yellow 64	BAS, DUP.
Disperse Yellow 67	DUP, GAF, VPC.
Disperse Yellow 68	HST.
Disperse Yellow 74	VPC.
Disperse Yellow 77	VPC.
Disperse Yellow 85	EKT.
Disperse Yellow 86	AC, EKT.
Disperse Yellow 88	ALT, EKT.
Disperse Yellow 93	VPC.
Disperse Yellow 96	VPC.
Disperse Yellow 108	EKT.
Disperse Yellow 118	AC.
Disperse Yellow 125	SDC.
Disperse Yellow 126	ICI.
Disperse Yellow 131	DUP.
Disperse Yellow 136	DUP.
Disperse Yellow 137	DUP.
Disperse Yellow 138	DUP.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
D I S P E R S E D Y E S--Continued	
*DISPERSE YELLOW DYES--Continued	
Disperse Yellow 198	BAS.
Disperse Yellow dyes, all other	EKT, HST, MAY, SDC, VPC.
*DISPERSE ORANGE DYES:	
*Disperse Orange 3	AC, ATL, GAF, HSH, TRC.
Disperse Orange 5	ATL, BUC, EKT, SDC.
Disperse Orange 17	AC, EKT, GAF, HSH.
Disperse Orange 21	TRC.
*Disperse Orange 25	ALT, ATL, DUP, EKT, TRC, VPC.
Disperse Orange 29	AC, ATL, GAF, HSH, VPC.
Disperse Orange 30	TRC.
Disperse Orange 31	BAS.
Disperse Orange 33	BAS.
Disperse Orange 37	AC, ATL, EKT.
Disperse Orange 38	TRC.
Disperse Orange 41	AC, DUP.
Disperse Orange 44	DUP, TRC.
Disperse Orange 53	TRC.
Disperse Orange 55	RSH.
Disperse Orange 56	TRC.
Disperse Orange 57	EKT.
Disperse Orange 58	EKT.
Disperse Orange 59	HSH.
Disperse Orange 62	BUC, DUP.
Disperse Orange 66	VPC.
Disperse Orange 75	DUP.
Disperse Orange 77	MAY.
Disperse Orange 78	MAY.
Disperse Orange 79	MAY.
Disperse Orange 89	AC.
Disperse Orange 90	AC.
Disperse Orange 94	SDC.
Disperse Orange 95	DUP.
Disperse Orange 98	DUP.
Disperse Orange 125	DUP.
Disperse Orange dyes, all other	AC, ALT, BUC, DUP, EKT, HSH, SDC, VPC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
DISPERSE DYES--Continued	
*DISPERSE RED DYES:	
*Disperse Red 1	AC, ATL, DUP, EKT, GAF, HSH, TRC.
Disperse Red 4	GAF, TRC.
*Disperse Red 5	AC, EKT, HSH.
Disperse Red 7	AC.
Disperse Red 11	AC, DUP.
Disperse Red 13	ATL, GAF.
Disperse Red 15	GAF, HSH, TRC.
*Disperse Red 17	AC, ATL, EKT, GAF, HSH, TRC.
Disperse Red 21	EKT.
Disperse Red 30	EKT.
Disperse Red 35	EKT.
*Disperse Red 50	ALT, GAF, TRC.
Disperse Red 54	BAS.
Disperse Red 55	DUP, TRC, VPC.
Disperse Red 59	DUP, GAF.
*Disperse Red 60	AC, DUP, GAF, TRC, VPC.
*Disperse Red 65	AC, ALT, DUP, EKT, TBC.
Disperse Red 73	TRC.
Disperse Red 76	BAS.
Disperse Red 82	VPC.
Disperse Red 86	EKT, HSH, TBC.
Disperse Red 88	EKT.
Disperse Red 90	VPC.
Disperse Red 91	BAS.
Disperse Red 96	ACY.
Disperse Red 105	VPC.
Disperse Red 106	VPC.
Disperse Red 108	VPC.
Disperse Red 109	VPC.
Disperse Red 115	MAY.
Disperse Red 117	EKT.
Disperse Red 118	BAS.
Disperse Red 128	DUP.
Disperse Red 133	VPC.
Disperse Red 135	ALT, DUP.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
D I S P E R S E D Y E S--Continued	
*DISPERSE RED DYES--Continued	
Disperse Red 136	EKT.
Disperse Red 137	EKT.
Disperse Red 138	EKT.
Disperse Red 140	DUP.
Disperse Red 159	VPC.
Disperse Red 161	DUP.
Disperse Red 162	DUP.
Disperse Red 163	EKT.
*Disperse Red 177	ALT, SDC, TRC, VPC.
Disperse Red 178	TRC.
Disperse Red 179	GAF.
Disperse Red 211	TRC.
Disperse Red 217	DUP.
Disperse Red 219	DUP.
Disperse Red 220	DUP.
Disperse Red 271	DUP.
Disperse Red 313	SDC.
Disperse Red 319	ALT.
Disperse Red dyes, all other	AC, BUC, EKT, HSH, HST, MAY, SDC, TRC, VPC.
*DISPERSE VIOLET DYES:	
*Disperse Violet 1	AC, HSH, TRC.
Disperse Violet 17	DUP, VPC.
Disperse Violet 26	DUP.
*Disperse Violet 27	AC, ACY, DUP, EKT, TRC.
Disperse Violet 28	DUP, TRC.
Disperse Violet 33	ICI.
Disperse Violet 40	VPC.
Disperse Violet 41	EKT.
Disperse Violet 43	EKT.
Disperse Violet 64	DUP.
Disperse Violet dyes, all other	EKT, MAY, SDC.
*DISPERSE BLUE DYES:	
*Disperse Blue 3	AC, EKT, HSH, TRC.
Disperse Blue 7	AC, TRC.
Disperse Blue 9	BAS.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
DISPERSE DYES--Continued	
*DISPERSE BLUE DYES--Continued	
Disperse Blue 27	EKT.
Disperse Blue 35	ICI.
Disperse Blue 55	TRC.
Disperse Blue 56	VPC.
Disperse Blue 60	DUP.
Disperse Blue 61	VPC.
Disperse Blue 62	DUP, EKT.
*Disperse Blue 64	AC, DUP, EKT, TRC.
Disperse Blue 73	ACY, TRC.
Disperse Blue 77	EKT, GAF, HST.
*Disperse Blue 79	ALT, ATL, EKT, HSH, MAY, TRC.
Disperse Blue 81	HST, VPC.
Disperse Blue 87	BAS.
Disperse Blue 94	BAS, HST.
Disperse Blue 95	HST.
Disperse Blue 102	EKT.
Disperse Blue 109	DUP.
Disperse Blue 112	EKT.
Disperse Blue 118	EKT.
Disperse Blue 122	ICI.
Disperse Blue 123	EKT.
Disperse Blue 125	TRC.
Disperse Blue 138	VPC.
Disperse Blue 139	VPC.
Disperse Blue 148	BAS.
Disperse Blue 152	HST.
Disperse Blue 165	DUP, HST, VPC.
Disperse Blue 174	AC.
Disperse Blue 192	DUP.
Disperse Blue 194	DUP.
Disperse Blue 283	DUP.
Disperse Blue dyes, all other	AC, ATL, BUC, DUP, EKT, HSH, HST, MAY, SDC, TRC, VPC.
DISPERSE GREEN DYES:	
Disperse Green 7	DUP.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
DISPERSE DYES--Continued	
DISPERSE BROWN DYES:	
Disperse Brown 1	AC, ALT, ATL, GAF, HST, ICI, SDC, TRC.
Disperse Brown 2	EKT.
Disperse Brown 14	DUP.
Disperse Brown dyes, all other	SDC, TRC.
*DISPERSE BLACK DYES:	
Disperse Black 1	GAF.
Disperse Black 9	AC, EKT.
Disperse Black 33	AC, EKT.
Disperse Black dyes, all other	AC, ALT, DUP, EKT, SDC, VPC.
FIBER-REACTIVE DYES	
*REACTIVE YELLOW DYES:	
Reactive Yellow 1	ICI.
Reactive Yellow 2	TRC.
Reactive Yellow 3	TRC.
Reactive Yellow 4	ICI.
Reactive Yellow 6	TRC.
Reactive Yellow 7	ICI.
Reactive Yellow 13	HST.
Reactive Yellow 15	HST.
Reactive Yellow 17	HST.
Reactive Yellow 18	ICI.
Reactive Yellow 22	ICI.
Reactive Yellow 24	HST.
Reactive Yellow 25	VPC.
Reactive Yellow 27	VPC.
Reactive Yellow 37	HST.
Reactive Yellow 42	HST.
Reactive Yellow 86	ICI.
Reactive Yellow dyes, all other	HST, ICI.
REACTIVE ORANGE DYES:	
Reactive Orange 1	FAB, ICI.
Reactive Orange 4	ICI.
Reactive Orange 11	TRC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
FIBER-REACTIVE DYES--Continued	
REACTIVE ORANGE DYES--Continued:	
Reactive Orange 12	ICI.
Reactive Orange 13	ICI.
Reactive Orange 14	ICI.
Reactive Orange 16	HST.
Reactive Orange 78	HST.
Reactive Orange 84	ICI.
Reactive Orange dyes, all other	ICI.
REACTIVE RED DYES:	
Reactive Red 1	ICI.
Reactive Red 2	FAB, ICI.
Reactive Red 4	TRC.
Reactive Red 5	ICI.
Reactive Red 8	ICI.
Reactive Red 11	ICI.
Reactive Red 21	HST.
Reactive Red 29	ICI.
Reactive Red 31	ICI.
Reactive Red 33	ICI.
Reactive Red 40	VPC.
Reactive Red 41	VPC.
Reactive Red 43	ICI, TRC.
Reactive Red 55	TRC.
Reactive Red 58	ICI.
Reactive Red 86	TRC.
Reactive Red 94	HST.
Reactive Red 120	ICI, TRC.
Reactive Red dyes, all other	HST, VPC.
REACTIVE VIOLET DYES:	
Reactive Violet 1	ICI.
Reactive Violet 4	HST.
Reactive Violet 5	HST.
Reactive Violet dyes, all other	HST.
REACTIVE BLUE DYES:	
Reactive Blue 3	ICI.
Reactive Blue 4	ICI.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
FIBER-REACTIVE DYES--Continued	
REACTIVE BLUE DYES--Continued:	
Reactive Blue 5	ICI.
Reactive Blue 7	TRC.
Reactive Blue 19	HST.
Reactive Blue 21	HST.
Reactive Blue 25	ICI.
Reactive Blue 29	VPC.
Reactive Blue 38	HST.
Reactive Blue 71	ICI.
Reactive Blue 89	HST.
Reactive Blue 109	ICI.
Reactive Blue dyes, all other	HST, ICI.
REACTIVE GREEN DYES:	
Reactive Green 19	ICI.
REACTIVE BROWN DYES:	
Reactive Brown 9	ICI.
Reactive Brown 10	ICI.
Reactive Brown 17	ICI.
Reactive Brown 18	HST.
REACTIVE BLACK DYES:	
Reactive Black 5	HST.
Reactive Black 9	ICI.
Reactive Black dyes, all other	HST.
FLUORESCENT BRIGHTENERS	
Fluorescent brightener 9	X.
Fluorescent brightener 22	CGY.
Fluorescent brightener 24	CGY.
Fluorescent brightener 25	GAF.
*Fluorescent brightener 28	CCW, CGY, VPC, X.
Fluorescent brightener 46	CGY.
Fluorescent brightener 49	S.
Fluorescent brightener 52	S.
Fluorescent brightener 59	CGY.
*Fluorescent brightener 61	ACY, CCW, DGO, GAF.
Fluorescent brightener 68	PCW.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTUER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
F L U O R E S C E N T B R I G H T E N E R S--Continued	
Fluorescent brightener 71	ACY, CGY.
Fluorescent brightener 75	GAF.
Fluorescent brightener 126	X.
Fluorescent brightener 128	X.
Fluorescent brightener 134	CGY.
Fluorescent brightener 135	CGY.
Fluorescent brightener 148	VPC.
Fluorescent brightener 159	ACY.
Fluorescent brightener 191	VPC.
Fluorescent brightener 200	VPC.
Fluorescent brighteners, all other	ACY, CCW, DGO, S, VPC.
F O O D, D R U G, A N D C O S M E T I C C O L O R S	
FOOD, DRUG, AND COSMETIC DYES:	
*Food, drug, and cosmetic Blue 1	ACS, ALT, BCC, KON, SDH, WJ.
Food, drug, and cosmetic Blue 2	ACS, ALT, BCC, KON, SDH, WJ.
Food, drug, and cosmetic Green 3	WJ.
Food, drug, and cosmetic Red 2	BCC, KON, SDH.
*Food, drug, and cosmetic Red 3	ALT, BDO, KON, STG, WJ, X.
Food, drug, and cosmetic Red 4	ALT, KON.
*Food, drug, and cosmetic Red 40	ACS, ALT, BCC, KON, SDH, WJ.
*Food, drug, and cosmetic Yellow 5	ACS, ALT, BCC, KON, SDH, STG, WJ.
*Food, drug, and cosmetic Yellow 6	ACS, ALT, BCC, KON, SDH, STG, WJ.
Food, drug, and cosmetic dyes, all other	STG.
DRUG AND COSMETIC DYES:	
Drug and cosmetic Blue 6	ACS, BCC.
Drug and cosmetic Green 5	BCC, KON.
Drug and cosmetic Green 6	KON.
Drug and cosmetic Green 8	KON, X.
Drug and cosmetic Orange 4	ACS, KON.
Drug and cosmetic Orange 5	SDH, SNA, TMS.
Drug and cosmetic Orange 17	SNA.
Drug and cosmetic Red 6	KON, SDH, SNA, TMS.
*Drug and cosmetic Red 7	KON, SDH, SNA, TMS.
Drug and cosmetic Red 8	SNA.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
FOOD, DRUG, AND COSMETIC COLORS--Continued	
DRUG AND COSMETIC DYES--Continued	
*Drug and cosmetic Red 9	KON, MRX, SDH, SNA, TMS.
Drug and cosmetic Red 10	KON, SNA.
Drug and cosmetic Red 11	SNA.
Drug and cosmetic Red 12	SNA.
Drug and cosmetic Red 13	SNA.
Drug and cosmetic Red 17	KON.
*Drug and cosmetic Red 19	KON, SNA, TMS.
Drug and cosmetic Red 21	SDH, SNA.
Drug and cosmetic Red 22	SDH.
Drug and cosmetic Red 27	SDH, TMS.
Drug and cosmetic Red 30	KON, SNA.
Drug and cosmetic Red 33	BCC, KON.
Drug and cosmetic Red 36	ALT, KON, SDH, SNA, TMS.
Drug and cosmetic Red 37	ACS, BCC.
Drug and cosmetic Violet 2	BCC.
Drug and cosmetic Yellow 5	KON.
Drug and cosmetic Yellow 6	KON.
Drug and cosmetic Yellow 10	KON.
Drug and cosmetic Yellow 11	ACS, BCC, KON.
DRUG AND COSMETIC DYES, EXTERNAL:	
External drug and cosmetic Violet 2	KON.
External drug and cosmetic Yellow 1	ACS, BCC, CMG, KON.
External drug and cosmetic Yellow 7	KON.
MORDANT DYES	
MORDANT YELLOW DYES:	
Mordant Yellow 1	PDC.
Mordant Yellow 8	PDC.
Mordant Yellow 20	PDC.
Mordant Yellow 26	PDC.
Mordant Yellow 30	TRC.
Mordant Yellow dyes, all other	ATL.
*MORDANT ORANGE DYES	
Mordant Orange 1	ACY, PDC, TRC.
Mordant Orange 6	ATL, GAF, PDC, TRC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
M O R D A N T D Y E S--Continued	
*MORDANT ORANGE DYES--Continued:	
Mordant Orange 8	TRC.
MORDANT RED DYES	
Mordant Red 7	ACY, ATL, BDO, PDC.
Mordant Red 9	MRX.
Mordant Red 11	ACY.
Mordant Red 60	SDH.
MORDANT BROWN DYES:	
Mordant Brown 1	PDC, TRC.
Mordant Brown 18	PDC.
Mordant Brown 19	GAF.
Mordant Brown 33	GAF, PDC, TRC.
Mordant Brown 40	PDC.
Mordant Brown 70	PDC.
MORDANT BLACK DYES:	
Mordant Black 9	VPC.
Mordant Black 11	GAF, TRC.
Mordant Black 13	HSH.
Mordant Black 17	GAF, TRC.
S O L V E N T D Y E S	
*SOLVENT YELLOW DYES:	
Solvent Yellow 1	HSH.
Solvent Yellow 3	PSC.
Solvent Yellow 13	ACY, GAF.
Solvent Yellow 14	ACY, ATL, DUP, GAF, MRT, PSC, VPC.
Solvent Yellow 19	GAF.
Solvent Yellow 29	GAF.
Solvent Yellow 30	PSC.
Solvent Yellow 31	MRT.
Solvent Yellow 33	AC, ACS, ACY, BCC.
Solvent Yellow 40	ACS, BCC.
Solvent Yellow 42	ACS, ATL, BCC.
Solvent Yellow 43	DGC, MRT.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
SOLVENT DYES--Continued	
*SOLVENT YELLOW DYES--Continued:	
Solvent Yellow 44	DGO.
Solvent Yellow 47	ACY, DUP.
Solvent Yellow 56	ACY, PSC.
Solvent Yellow 71	ACY.
Solvent Yellow 72	AC, ACY.
Solvent Yellow 77	MRT.
Solvent Yellow 87	ACY.
Solvent Yellow 107	MRT.
Solvent Yellow 109	MRT.
Solvent Yellow 131	DGO.
Solvent Yellow dyes, all other	AC.
*SOLVENT ORANGE DYES:	
Solvent Orange 3	ACY, PSC.
Solvent Orange 7	ACY, ATL, GAF, PSC.
Solvent Orange 20	ACY, GAF.
Solvent Orange 23	ACS, ATL, BCC.
Solvent Orange 25	ACY, DUP.
Solvent Orange 31	PSC.
Solvent Orange 51	ACY.
Solvent Orange 74	MRT.
Solvent Orange dyes, all other	AC, BCC, DUP.
*SOLVENT RED DYES:	
Solvent Red 1	PSC.
Solvent Red 8	GAF.
Solvent Red 11	VPC.
Solvent Red 19	MRT.
Solvent Red 22	GAF.
*Solvent Red 24	AC, ACY, ATL, MRT, PSC.
Solvent Red 26	AC, ACY, MRT, PSC.
Solvent Red 27	PSC.
Solvent Red 33	DUP, GAF.
Solvent Red 49	ACY, DUP, GAF.
Solvent Red 68	ACS, BCC.
Solvent Red 74	BCC.
Solvent Red 105	ACY.
Solvent Red 108	ACY.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
S O L V E N T D Y E S--Continued	
*SOLVENT RED DYES--Continued	
Solvent Red 111	AC, ACY.
Solvent Red 115	ACY.
Solvent Red 126	ACY.
Solvent Red 164	MRT.
Solvent Red 165	MRT.
Solvent Red 168	MRT.
Solvent Red 169	MRT.
Solvent Red 171	MRT.
Solvent Red dyes, all other	AC, ACY, VPC.
SOLVENT VIOLET DYES:	
Solvent Violet 8	ACY, DSC.
Solvent Violet 9	DSC.
Solvent Violet 13	AC, HSH.
Solvent Violet 26	AC.
*SOLVENT BLUE DYES:	
Solvent Blue 3	ACY, SW.
Solvent Blue 4	DSC, DUP, SDH.
Solvent Blue 5	DSC.
Solvent Blue 7	ACY.
Solvent Blue 14	ACY.
Solvent Blue 16	AC.
Solvent Blue 23	HSC.
Solvent Blue 35	MRT.
Solvent Blue 36	AC, DDP, MRT.
Solvent Blue 37	DUP.
Solvent Blue 38	ACY, DUP.
Solvent Blue 58	ACY, GAF.
Solvent Blue 59	AC, ACY.
Solvent Blue 98	MRT.
Solvent Blue 99	MRT.
Solvent Blue 100	MRT.
Solvent Blue 101	MRT.
Solvent Blue dyes, all other	ACY, DUP, X.
SOLVENT GREEN DYES:	
Solvent Green 1	AC, ACY, DSC.
Solvent Green 3	AC, HSH.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
S O L V E N T D Y E S -- C O N T I N U E D	
SOLVENT BROWN DYES:	
Solvent Brown 11	GAF.
Solvent Brown 12	PSC.
Solvent Brown 19	DUP.
Solvent Brown 20	ACY, DUP.
Solvent Brown 22	PSC.
Solvent Brown 38	ACY.
SOLVENT BLACK DYES:	
Solvent Black 5	ACY.
Solvent Black 7	ACY, PSC.
Solvent Black 13	ACS, BCC.
Solvent Black 26	ACY.
Solvent Black dyes, all other	ATL, PSC.
S U L F U R D Y E S	
SULFUR YELLOW DYES:	
Leuco sulfur Yellow 1	SDC.
Leuco sulfur Yellow 2	ACY, SDC.
Leuco sulfur Yellow 4	SDC.
Sulfur Yellow dyes, all other	SDC.
SULFUR RED DYES:	
Sulfur Red dyes, all other	SDC.
SULFUR BLUE DYES:	
Leuco sulfur Blue 7	SDC.
Leuco sulfur Blue B	SDC.
Leuco sulfur Blue 13	ACY.
Sulfur Blue 7	ACY.
SULFUR GREEN DYES:	
Leuco sulfur Green 2	SDC.
Leuco sulfur Green 3	SDC.
Leuco sulfur Green 14	SDC.
Leuco sulfur Green 16	SDC.
Sulfur Green dyes, all other	SDC.
SULFUR BROWN DYES:	
Leuco sulfur Brown 3	SDC, SDH.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTUER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
S U L F U R D Y E S--Continued	
SULFUR BROWN DYES--Continued:	
Leuco sulfur Brown 10	SDC.
Leuco sulfur Brown 14	SDC.
Sulfur Brown dyes, all other	ACY, SDC.
SULFUR BLACK DYES:	
Leuco sulfur Black 1	SDC.
Leuco sulfur Black 2	SDC.
Leuco sulfur Black 10	ACY.
Leuco sulfur Black 11	SDC.
Solubilized sulfur Black 2	SDC.
Sulfur Black 1	ACY, SDC.
Sulfur Black 2	SDC.
Sulfur Black 11	SDC.
Sulfur Black dyes, all other	SDC.
V A T D Y E S	
*VAT YELLOW DYES:	
Vat Yellow 2, B-1/2%	AC, TRC, VPC.
Vat Yellow 3, 12-1/2%	HST.
Vat Yellow 14 12-1/2%	TRC.
Vat Yellow 15, 11-1/2%	ACY.
Vat Yellow 22, 10%	DUP.
Vat Yellow 33, 15%	TRC.
Vat Yellow dyes, all other	VPC.
*VAT ORANGE DYES:	
Vat Orange 1, 20%	HST, TRC, VPC.
Vat Orange 2, 12%	ACY, DUP, TBC.
Vat Orange 3, 13-1/2%	HST.
Vat Orange 4, 6%	DUP.
Vat Orange 5, 10%	HST.
Vat Orange 7, 11%	HST, TRC.
Vat Orange 9, 12%	ACY, TRC.
*Vat Orange 15, 10%	ACY, TRC, VPC.
Vat Orange dyes, all other	SDC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
V A T D Y E S--Continued	
*VAT RED DYES:	
Vat Red 1, 13%	ACY.
Vat Red 10, 18%	DUP.
Vat Red 13, 11%	DUP, TRC.
Vat Red 14, 10%	HST.
Vat Red 15, 10%	HST, TRC.
Vat Red 32, 20%	DUP.
Vat Red 41, 20%	HST.
Vat Red 52, 10%	DUP.
*VAT VIOLET DYES:	
Vat Violet 1, 11%	DUP, TRC.
Vat Violet 2, 20%	ACY, HST.
Vat Violet 3, 15%	HST.
Vat Violet 9, 12%	TRC.
Vat Violet 13, 6-1/4%	BAS, TRC.
Vat Violet 21	DUP, VPC.
VAT BLUE DYES:	
Vat Blue 1, 20%	ACS, BCC.
Vat Blue 5, 16%	ATL, HST.
Vat Blue 6, 8-1/3%	ACY, BAS, TRC.
Vat Blue 16, 16%	BAS.
Vat Blue 18, 13%	AC, ACY, TRC.
Vat Blue 20, 14%	ACY, TRC.
Vat Blue 43	SDC.
Vat Blue 67	HST.
Vat Blue dyes, all other	BAS, BCC.
*VAT GREEN DYES:	
Vat Green 1, 6%	ACY, DUP.
*Vat Green 3, 10%	AC, ACY, BAS, DUP, TRC.
Vat Green 8, 8-1/2%	DUP.
Vat Green 9, 12-1/2%	ACY, BAS, TRC.
Vat Green 32	VPC.
Vat Green dyes, all other	ACY, SDC.
VAT BROWN DYES:	
Vat Brown 1, 11%	ACY, DUP, TRC.
Vat Brown 3, 11%	AC, ACY, TRC, VPC.

TABLE 2.--DYES FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

DYES	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
V A T D Y E S--Continued	
VAT BROWN DYES--Continued:	
Vat Brown 5, 13%	ACY.
Vat Brown 6	AC.
Vat Brown 11, 12%	TRC.
Vat Brown 13, 17%	TRC.
Vat Brown 14, 12%	AC.
Vat Brown 57, 12.8%	HST, TRC.
Vat Brown dyes, all other	AC, ACY, SDC, VPC.
*VAT BLACK DYES:	
Vat Black 16	ACS, BCC.
Vat Black 21, 18-1/2%	ACY.
Vat Black 22, 19%	ACY, TRC.
*Vat Black 25, 12-1/2%	AC, ACY, DUP, TRC.
Vat Black 27, 12-1/2%	ACY, BDO, DUP, TRC.
Vat Black dyes, all other	AC, ACY, SDC.
MISCELLANEOUS DYES, ALL OTHER	DUP, SDC, WAY.

TABLE 3.--DYES: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of dyes to the U.S. International Trade Commission for 1977 are listed below in order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
AC	American Color & Chemical Corp.	ICI	ICI United States, Inc., Chemical Specialties Co.
ACS	Allied Chemical Corp., Specialty Chemical Div.		
ACY	American Cyanamid Co.		
ALL	Alliance Chemical Corp.	KON	H. Kohnstamm & Co., Inc.
ALT	Crompton & Knowles Corp., Dyes & Chemical Div.		
ATL	Atlantic Chemical Corp.	MAY	Otto B. May Co. Div. of Cone Mills Corp.
		MRT	Morton Norwich Products, Morton Chemical Co. Div.
BAS	BASF Wyandotte Corp.		
BCC	Buffalo Color Corp.	MRX	Max Marx Color & Chemical Co.
BDO	Benzenoid Organics, Inc.		
BUC	Synalloy Corp., Blackman-Uhler Chemical Div.		
		PCW	Pfister Chemical Works
		PDC	Berncolors-Poughkeepsie, Inc.
CCW	Cincinnati Milacron Chemicals, Inc.	PSC	Passaic Color & Chemical Co.
CGY	Ciba-Geigy Corp.		
CMG	Nyanza, Inc.		
		S	Sandoz, Inc.
		SDC	Martin-Marietta Corp., Sodyeco Div.
DGO	Day-Glo Color Corp.	SDH	Sterling Drug, Inc., Hilton-Davis Chemical Co. Div.
DSC	Dye Specialties, Inc.		
DUP	E. I. duPont de Nemours & Co., Inc.	SNA	Sun Chemical Corp., Pigments Div.
		STG	Stange Co.
		SW	Sherwin-Williams Co.
EKT	Eastman Kodak Co., Tennessee Eastman Co. Div.		
		TMS	Sterling Drug, Inc., Thomasset Colors Div.
FAB	Fabricolor Manufacturing Corp.	TRC	Toms River Chemical Corp.
GAF	GAF Corp.	VPC	Mobay Chemical Corp, Verona Div.
HSC	Chemetron Corp., Pigments Div. Sub. of Allegheny Ludlum Industries, Inc.	WAY	Philip A. Hunt Chemical Corp., Organic Chemical Div.
HSH	Harshaw Chemical Co.	WJ	Warner-Jenkinson Manufacturing Co.
HST	American Hoechst Corp. Industrial Chemicals Div.		

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

SECTION V -- ORGANIC PIGMENTS

Organic Pigments
(Color Lakes & Toners)

Bonnie Noreen

Description and uses

An organic pigment is a concentrated form of minute particles of coloring matter which is substantially insoluble in the medium in which it is dispersed. The organic pigment differs from a dye in that a dye is generally soluble in the transport medium or in the final product. Pigments are used rather than dyes when the color required must be insoluble, or substantially so, in its vehicle. An example of this is in the area of printing inks where distinction of colors is required and dyes would "bleed," or spread into surrounding areas. Usually pigments, having more opacity than dyes, are less expensive to use in certain applications since more of the dye is required to achieve the same degree of coloration. For example, opacity, plus a greater resistance to heat, makes pigments more desirable as coloring agents in many plastics and industrial paints.

There are both organic and inorganic pigments. Organic pigments, in general, are more expensive and are available in brighter and more varied colors. They are usually transparent and are affected by organic solvents while inorganic pigments are usually opaque and insoluble in organic solvents. Although both pigment types have functional as well as decorative properties and can contribute to the durability and visibility of the end product, the inorganic pigments are more functional in that some add reinforcement and rust inhibition and generally are more heat resistant than organic pigments. Organic pigments comprise approximately 10 percent of the total volume and 30 percent of the total value of all pigments.[1] The volume of organic pigments as a percent of the total output is not expected to change drastically but their percent of the value is expected to increase in the next several years partly because of the increased costs of the petrochemical raw materials.

The largest use of organic pigments is in printing inks. The second largest use is in paints and other coatings. Lesser amounts are employed to color plastics, textiles, and many other products. When employed in inks and paints, pigments must be readily dispersible in such mediums as oils, organic solvents, varnishes, and resins.

Organic pigments can be derived from synthetic or natural dyestuffs. For economic reasons, the natural products have been almost completely replaced by synthetics. These pigments are generally prepared in one of two ways from dyes or pigment intermediates closely related to dyes. Color lakes are prepared by the precipitation of a water-soluble dye on an insoluble inorganic compound or substrate. In contrast, toners, or full strength colors, do not require a substrate or base. Toners are by far the more commercially important of the two pigments and are marketed either full strength or extended, i.e., diluted by

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[1] Kirk-Othmer, Encyclopedia of Chemical Technology, Vol. 15, pp. 557-569; and Kline Guide to the Chemical Industry, 3rd Edition p. 151.

the addition of a solid diluent.[1] Over the past 10 years production of lakes has decreased by 59 percent while production of toners increased by 34 percent. The sales unit values of both have increased, toners by 71 percent in 10 years and lakes by 192 percent (table A).

Production and sales

In 1977, the pigment industry continued to recover from the economic setback of 1975. The production of organic pigments in 1977 was 68.7 million pounds or 980,000 pounds more than in 1976, which represents an increase of 1.4 percent. The sales quantity increased by 3.2 million pounds (6 percent) in 1977 to a total of 57.4 million pounds, but the sales unit value decreased by 15¢ to $4.66 per pound (table A). The decrease in unit value could possibly be attributed to increased import competition.

Foreign trade

In 1977, U.S. exports of organic pigments registered a high in both quantity and value. The total quantity of exports, 14.7 million pounds, was 30,000 pounds greater than in 1974, the next highest year, and 242,000 pounds (1.7 percent) greater than in 1976. The total value of exports in 1977 was $3.8 million more than the $36.5 million recorded in 1976. This is an increase of 10 percent. Canada, Japan, the Netherlands, the United Kingdom, Belgium, West Germany, Italy, and Austrialia make up 57 percent of the quantity and 60 percent of the value of these exports (table B).

Imports of 7.6 million pounds in 1977 were less than the all-time high reached in 1974, but were 11 percent higher than the 6.9 million pounds in 1976 (table C). Imports of organic pigments to the United States come mostly from West Germany and Switzerland. These two countries accounted for 64 percent of the quantity and 76 percent of the value in 1977. Imports of Pigments Blue 15, Red 1[illegible], Yellow 92, Green 7, and Green 36 accounted for 56 percent of the total U.S. organic pigments imports in 1977.[2] Imports in 1977 accounted for 11.4 percent of the apparent U.S. consumption on a quantity basis, and 11.5 percent on a value basis (table D).

The domestic industry

Concentration in the pigments industry in 1977 was about the same as in 1976. In 1977, 5 of the 36 companies accounted for 59 percent of the sales and 10 companies accounted for 83 percent. In 1976, 5 companies accounted for 61 percent of total sales, and 10 companies 87 percent.

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[1] Although extended toners are provided for under TSUS item 406.70, analysis of import data indicates that imports have also been entered under TSUS item 409.00 as mixtures.

[2] Imports of Benzenoid Chemicals and Products, 1977; USITC Publication #900, p. 73.

The number of domestic companies reporting production of organic pigments has not varied much in the past 10 years, but the number of companies partially or completely owned by foreign investors is increasing. In early 1977, Harmon Colors Corp., a subsidiary of Bayer A.G., acquired the organic pigment business of Allied Chemical Corp. In mid-1977, GAF offered for sale its dye and pigments business.[1] The purchase, by BASF Wyandotte, was concluded in early 1978. Recently there have been negotiations on the sale of yet another large producer to a Germany based company. The amount of foreign interest in the pigment industry is expected to continue to increase in the immediate future. Many U.S. producers have indicated that rising domestic costs are making it more difficult to compete with lower priced foreign pigments. Industry attributes the rising domestic costs to various U.S. pollution controls and safety regulations, increasing labor and overhead costs, and increasing costs of the pigment intermediates and dyestuffs. Foreign companies with U.S. subsidiaries can bypass many of these expenses by manufacturing semifinished dyestuffs abroad and providing them to the U.S. subsidiaries at prices below U.S. market prices.

The U.S. pigment industry is highly dependent upon imported pigment intermediates. According to some industry sources, this dependency has increased in the past several years to the point that approximately one-third of the domestic output of pigments is now based on imported pigment intermediates. These sources point out that many foreign intermediate suppliers are also producers of organic pigments. By increasing the prices of the intermediates to dependent U.S. producers, they could make their own pigments more competitive in the U.S. market. Further import penetration into the pigment intermediate market could, they believe, pose a threat to the domestic pigments industry. They argue that the current trade negotiations may have an adverse effect on the domestic industry in that import duties may be reduced beyond the point where the domestic manufacturers can compete on a price basis with imports.

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1 American Dyestuff Reporter, September 1977, pp. 17 and 18.

TABLE A.--Organic pigments (toners and lakes): U.S. production and sales, 1968-77

Year	Production	Sales		
		Quantity	Value	Unit Value[1]
	1,000 pounds	1,000 pounds	1,000 dollars	Per pound
Toners:				
1968	49,919	42,202	116,337	$2.76
1969	57,310	47,375	129,310	2.73
1970	52,547	43,754	119,353	2.73
1971	55,086	44,247	126,564	2.86
1972	62,878	50,506	145,941	2.89
1973	66,949	58,991	178,583	3.03
1974	67,464	56,318	222,805	3.96
1975	47,723	40,779	182,067	4.46
1976	66,020	52,818	256,707	4.86
1977	67,134	56,037	263,671	4.71
Lakes:				
1968	3,830	3,608	3,597	1.00
1969	3,701	3,419	3,839	1.12
1970	3,977	3,412	3,612	1.06
1971	3,240	2,805	3,449	1.23
1972	3,019	2,709	3,402	1.26
1973	2,446	2,473	3,583	1.45
1974	2,334	2,163	5,007	2.31
1975	1,930	1,593	3,923	2.46
1976	1,707	1,393	4,382	3.15
1977	1,573	1,397	4,076	2.92
Total:				
1968	53,749	45,810	119,934	2.62
1969	61,011	50,794	133,149	2.62
1970	56,524	47,166	122,965	2.61
1971	58,326	47,052	130,013	2.76
1972	65,897	53,215	149,343	2.81
1973	69,395	61,464	182,166	2.96
1974	69,798	58,481	227,812	3.90
1975	49,653	42,372	185,990	4.39
1976	67,727	54,211	261,089	4.81
1977	68,707	57,434	267,747	4.66

[1] Calculated from rounded figures.

Source: U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales.

TABLE B.--Organic pigments: U.S. exports, 1973-77

Market	1973	1974	1975	1976	1977
	Quantity (1,000 pounds)				
Canada	1,894	2,736	2,624	2,696	1,873
Japan	860	719	655	1,391	1,058
Netherlands	875	969	1,063	1,309	1,474
United Kingdom	962	1,132	756	720	1,157
Belgium	329	398	250	595	807
West Germany	383	492	508	366	827
Italy	1,019	1,089	577	1,200	829
Australia	337	675	580	708	413
All other	4,083	6,586	5,107	5,519	6,308
Total	10,743	14,716	12,120	14,504	14,746
	Value (1,000 dollars)				
Canada	3,434	6,037	5,007	6,839	5,199
Japan	3,187	4,215	2,637	4,952	4,015
Netherlands	1,107	1,643	1,738	3,218	3,817
United Kingdom	1,612	3,253	1,878	2,071	3,284
Belgium	791	1,236	933	1,904	2,570
West Germany	952	1,190	889	1,208	2,251
Italy	1,663	2,431	1,430	2,877	1,840
Australia	780	1,400	985	1,341	1,293
All other	5,997	8,642	9,565	12,087	15,986
Total	19,515	33,147	25,062	36,497	40,255

Source: Compiled from official statistics of the U.S. Department of Commerce.

TABLE C.--Organic pigments: U.S. imports, 1973-77

Source	1973	1974	1975	1976	1977
	Quantity (1,000 pounds)				
West Germany	2,105	3,225	2,009	2,407	2,722
Switzerland	2,226	2,891	1,243	2,326	2,135
Japan	177	437	527	819	738
Canada	862	395	796	527	709
Italy	51	224	126	300	524
United Kingdom	360	269	299	204	205
All other	273	701	319	305	612
Total	6,054	8,142	5,319	6,888	7,645
	Value (1,000 dollars)				
West Germany	7,206	12,553	8,281	13,488	16,246
Switzerland	6,003	9,179	6,303	12,618	11,409
Japan	448	1,500	1,422	2,330	2,604
Canada	1,147	835	981	1,343	1,621
Italy	192	741	404	800	1,452
United Kingdom	1,166	1,056	1,789	700	1,041
All other	485	1,441	1,098	1,067	2,064
Total	16,647	27,305	20,278	32,346	36,437

Source: Compiled from official statistics of the U.S. Department of Commerce.

TABLE D.--Organic pigments: U.S. production, imports, exports, and apparent consumption, 1968-77

Year	Production 1/	Imports	Exports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity (1,000 pounds)				
1968-------	53,749	1,653	4,921	50,481	3.3
1969-------	61,011	3,447	4,408	60,050	5.7
1970-------	56,524	3,617	5,632	54,509	6.6
1971-------	58,326	5,764	6,222	57,868	10.0
1972-------	65,897	4,612	7,094	63,415	7.3
1973-------	69,395	6,054	10,743	64,706	9.4
1974-------	69,798	8,142	14,716	63,224	12.9
1975-------	49,653	5,319	12,120	42,852	12.4
1976-------	67,727	6,888	14,504	60,111	11.5
1977-------	68,707	7,645	14,746	61,606	12.4
	Value (1,000 dollars)				
1968-------	140,985	4,940	8,366	137,559	3.6
1969-------	159,868	8,783	7,846	160,805	5.5
1970-------	146,806	10,622	9,575	147,853	7.2
1971-------	160,921	12,966	10,870	163,017	8.0
1972-------	183,826	12,017	12,867	182,976	6.6
1973-------	205,882	16,647	19,515	203,014	8.2
1974-------	272,212	27,305	33,147	266,370	10.3
1975-------	217,977	20,278	25,062	213,193	9.5
1976-------	325,767	32,346	36,497	321,616	10.1
1977-------	320,175	36,437	40,255	316,357	11.5

1/ Value of production estimated, based on unit value of sales.

Source: Production, U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales; imports and exports compiled from official statistics of the U.S. Department of Commerce.

ORGANIC PIGMENTS

Bonnie J. Noreen and Edmund Cappuccilli

Organic pigments are toners and lakes derived in whole or in part from benzenoid chemicals and colors.

Statistics on production and sales of all organic pigments in 1977 are given in table 1.[1] For a few important pigments already reported in table 1, supplemental data on sales by commercial forms are reported in table 1A. Individual toners and lakes are identified in this report by the names used in the third edition of the Colour Index.

Total production of organic pigments in 1977 was 68.7 million pounds--1.5 percent more than the 67.7 million pounds produced in 1976. Total sales of organic pigments in 1977 amounted to 57.4 million pounds, valued at $267.7 million, compared with 54.2 million pounds, valued at $261.1 million, in 1976. In terms of quantity, sales of organic pigments in 1977 were 5.9 percent greater than in 1976 in terms of value, sales in 1977 were 2.6 percent greater than in 1976.

Production of toners in 1977 amounted to 67.1 million pounds--1.7 percent more than the 66.0 million pounds reported in 1976. Sales in 1977 were 56.0 million pounds, valued at $263.7 million, compared with 52.8 million pounds, valued at $256.7 million, in 1976. Sales in 1977 were 6.1 percent greater than those of 1976 in terms of quantity, and 2.7 percent greater in terms of value. The individual toners listed in the report which were produced in the largest quantities in 1977 were Pigment Yellow 12, 8.7 million pounds; Pigment Blue 15:3, beta form, 6.7 million pounds; Pigment Red 49, barium toner, 5.1 million pounds; Pigment Blue 15, alpha form, 3.7 million pounds; and Pigment Red 53, barium toner, 3.7 million pounds.

Production of lakes totaled 1.6 million pounds in 1977--7.8 percent less than the 1.7 million pounds reported for 1976. Sales of lakes in 1977 amounted to 1.4 million pounds, valued at $4.1 million, almost identical to the sales reported in 1976 of 1.4 million pounds, valued at $4.4 million.

For each of 6 selected pigments, or groups of pigments, table 1A gives data on sales by commercial forms. Pigment Green 7, Pigment Red 3, and Pigment Blue 15, alpha form, were sold principally in the dry full-strength form. The remaining 2 pigments and group of pigments for which statistics are published were sold principally in the flushed form.

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[1] See also table 2 which lists these products and identifies the manufacturers by codes. These codes are listed in table 3.

TABLE 1.--ORGANIC PIGMENTS: U.S. PRODUCTION AND SALES, 1977

[Listed below are all organic pigments for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published.) Table 2 lists separately all organic pigments for which data on production or sales were reported and identifies the manufacturers of each]

ORGANIC PIGMENTS	PRODUCTION	SALES		
		QUANTITY	VALUE[1]	UNIT VALUE[2]
	1,000 pounds dry basis[3]	*1,000 pounds dry basis*[3]	*1,000 dollars*	*Per pound*
Grand total	68,707	57,434	267,747	$4.66
TONERS				
Total	67,134	56,037	263,671	4.71
Yellow toners, total	18,495	12,837	52,903	4.12
Acetoacetarylide yellows:				
Pigment Yellow 1, C.I. 11 680	422	362	1,505	4.16
Pigment Yellow 3, C.I. 11 710	156	150	634	4.23
Pigment Yellow 73, C.I. 11 738	455	448	1,785	3.99
Pigment Yellow 74, C.I. 11 741	1,463	1,249	7,508	6.01
Diarylide yellows:				
Pigment Yellow 12, C.I. 21 090	8,670	5,768	19,072	3.31
Pigment Yellow 13, C.I. 21 100	367	300	1,191	3.97
Pigment Yellow 14, C.I. 21 095	3,248	2,323	7,616	3.28
Pigment Yellow 17, C.I. 21 105	1,002	612	2,536	4.14
All other	2,712	1,625	11,056	6.80
Orange toners, total	1,923	1,549	8,289	5.35
Pigment Orange 5, C.I. 12 075	663	520	1,880	3.62
Pigment Orange 13, C.I. 21 110	230	186	981	5.28
Pigment Orange 16, C.I. 21 160	439	441	1,996	4.52
Pigment Orange 34, C.I. 21 115	75	75	380	5.06
All other	516	327	3,052	9.33
Red toners, total	25,267	21,847	98,069	4.49
Naphthol reds, total	970	798	5,654	7.09
Pigment Red 2, C.I. 12 310	36	38	230	6.03
Pigment Red 5, C.I. 12 490	41	43	329	7.58
Pigment Red 9, C.I. 12 460	7	...	...	...
Pigment Red 17, C.I. 12 390	84	39	267	6.84
Pigment Red 22, C.I. 12 315	94	82	582	7.11
Pigment Red 23, C.I. 12 355	255	242	1,780	7.36
All other naphthol reds	453	354	2,466	6.97
Pigment Red 3, C.I. 12 120	1,583	1,313	5,045	3.84
Pigment Red 4, C.I. 12 085	172	150	506	3.37
Pigment Red 38, C.I. 21 120	205	161	1,328	8.25
Pigment Red 48, C.I. 15 865, barium toner	517	485	2,202	4.54
Pigment Red 48, C.I. 15 865, calcium toner	1,525	1,529	6,908	4.52
Pigment Red 48, C.I. 15 865, manganese toner	271	168	786	4.67
Pigment Red 49, C.I. 15 630, barium toner	5,077	4,602	11,670	2.54
Pigment Red 49, C.I. 15 630, calcium toner	1,450	1,312	3,932	3.00
Pigment Red 52, C.I. 15 860, calcium toner	1,439	1,256	5,653	4.50
Pigment Red 52, C.I. 15 860, manganese toner	496	479	1,621	3.39
Pigment Red 53, C.I. 15 585, barium toner	3,651	2,736	8,572	3.13
Pigment Red 57, C.I. 15 850, calcium toner	2,984	2,278	10,433	4.58
Pigment Red 63, C.I. 15 880	39	35	164	4.63
Pigment Red 81, C.I. 45 160, PMA	489	462	4,324	9.35
Pigment Red 81, C.I. 45 160, PTA	47	44	533	12.14
All other	4,352	4,039	28,738	7.12
Violet toners, total	1,693	2,159	17,850	8.27
Pigment Violet 1, C.I. 45 170, PMA	65	58	563	9.62
Pigment Violet 1, C.I. 45 170, PTA	154	83	952	11.52
Pigment Violet 3, C.I. 42 535, fugitive	269	272	1,126	4.14
Pigment Violet 3, C.I. 42 535, PMA	447	380	2,157	5.67

See footnotes at end of table.

TABLE 1.--ORGANIC PIGMENTS: U.S. PRODUCTION AND SALES, 1977--CONTINUED

ORGANIC PIGMENTS	PRODUCTION	SALES		
		QUANTITY	VALUE[1]	UNIT VALUE[2]
TONERS--Continued	*1,000 pounds dry basis*[3]	*1,000 pounds dry basis*[3]	*1,000 dollars*	*Per pound*
Violet toners--Continued				
Pigment Violet 3, C.I. 42 535, PTA	24	29	275	$9.58
Pigment Violet 23, C.I. 51 319	266	198	4,335	21.86
All other	468	1,139	8,442	7.41
Blue toners, total	15,855	14,056	64,014	4.55
Pigment Blue 1, C.I. 42 595, PMA	92	114	1,133	9.90
Pigment Blue 15, C.I. 74 160, alpha form	3,674	2,855	16,541	5.79
Pigment Blue 15:1, C.I. 74 160, alpha form	331	266	1,865	7.01
Pigment Blue 15:3, C.I. 74 160, beta form	6,670	6,025	28,639	4.75
All other	5,088	4,796	15,836	3.30
Green toners, total	3,535	3,237	21,448	6.63
Pigment Green 2, C.I. 42 040 and 49 005, PMA	24	23	236	10.34
Pigment Green 2, C.I. 42 040 and 49 005, PTA	36	36	456	12.54
Pigment Green 7, C.I. 74 260	2,974	2,745	17,638	6.43
Pigment Green 36, C.I. 74 265	211	179	1,405	7.85
All other	290	254	1,713	6.74
Brown and black toners, total	366	352	1,098	3.12
Pigment Brown 5, C.I. 15 800	86	52	229	4.42
All other	280	300	869	2.90
LAKES				
Total	1,573	1,397	4,076	2.92
Red lakes:				
Pigment Red 60:1, C.I. 16 105	295	302	1,191	3.95
Pigment Red 83, C.I. 58 000	59	52	323	6.23
Violet lake: Pigment Violet 5:1, C.I. 58 055	80	85	424	4.98
Blue lakes	602	737	1,710	2.32
All other lakes	537	221	428	1.94

[1] The value of sales from toners are reported on a dry full-strength basis and the value of sales for lakes are reported on a dry form basis. All sales value data exclude the additional costs of processing or packaging in commercial forms other than the dry full-strength or dry form.
[2] "All other" unit values calculated from rounded figures.
[3] Quantities for toners are reported as dry-full strength toner content, excluding the weight of any dispersing agent, vehicle, or extender. Quantities for lakes are reported as dry lake content, excluding the weight of any dispersing agent or vehicle.

Note.--The C.I. *(Colour Index)* numbers shown in this report are the identifying numbers given in the third edition of the *Colour Index*.
The abbreviations PMA and PTA stand for phosphomolybdic and phosphotungstic (including phosphotungstomolybdic) acids, respectively.

TABLE 1A.--U.S. SALES OF SELECTED DRY FULL-STRENGTH COLORS, DRY EXTENDED COLORS, DRY DISPERSIONS, AQUEOUS DISPERSIONS, AND FLUSHED COLORS, 1977

[Listed below are supplemental sales data, by commercial forms, of selected pigments that have been reported in table 1]

SELECTED PIGMENTS BY COMMERCIAL FORMS	SALES[1]		
	QUANTITY	VALUE	UNIT VALUE[2]
	1,000 pounds dry basis[3]	*1,000 dollars*	*Per pound*
Pigment Yellow 12, C.I. 21 090 and Pigment Yellow 14, C.I. 21 095, total	8,091	28,026	$3.46
Dry full-strength toner	2,961	9,833	3.32
Flushed color	3,976	14,278	3.59
Aqueous dispersion,[4] dry dispersions, and dry extened toner[5]	1,154	3,915	3.39
Pigment Red 3, C.I. 12 120, total	1,313	5,291	4.00
Dry full-strength toner	832	3,149	3.78
Dry extended toner, aqueous dispersions,[4] and flushed color[5]	481	2,142	4.45
Pigment Red 53:1, C.I. 15 585, barium toner, total	2,736	8,706	3.18
Flushed color	1,822	5,895	3.24
Dry dispersions, dry full-strength toner, and aqueous dispersions[4,5]	914	2,811	3.08
Pigment Red 57:1, calcium toner, C.I. 15 850, total	2,278	10,547	4.63
Flushed color	1,895	8,808	4.65
Dry full-strength toner and aqueous dispersions[4,5]	383	1,739	4.54
Pigment Blue 15, C.I. 74 160, alpha form, total	2,855	16,816	5.89
Dry full-strength toner	1,338	7,847	5.87
Aqueous dispersions[4]	512	2,633	5.14
Dry extended toner and flushed color[5]	1,005	6,336	6.30
Pigment Green 7, C.I. 74 260, total	2,745	17,947	6.55
Dry full-strength toner	1,456	9,528	6.57
Flushed color	438	3,139	7.16
Aqueous dispersions[4]	585	3,473	5.94
Dry extended toner and dry dispersions[5]	266	1,807	6.79

[1] Sales quantities are identical in table 1 and 1A; the sales value data in table 1A generally exceed the value in table 1 because table 1A includes the additional processing and packaging costs of the various commercial forms

[2] Calculated from unrounded figures.

[3] Quantity of the various commercial forms is given in terms of dry full-strength toner content.

[4] Includes presscake.

[5] Separate data on these commercial forms may not be published without revealing the operation of individual companies.

Note.--The C.I. *(Colour Index)* numbers shown in this report are the identifying numbers given in the third edition of the *Colour Index*.

The abbreviations PMA and PTA stand for phosphomolybdic and phosphotungstic (including phosphotungstomolybdic) acids respectively.

TABLE 2.--ORGANIC PIGMENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

ORGANIC PIGMENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
TONERS	
*YELLOW TONERS:	
ACETOACETARYLIDE YELLOWS:	
*Pigment Yellow 1	ACY, AMS, DUP, GLX, HPC, HRC, HSC, HSH, HST, KCW, KON, S, SDH, SNA.
Pigment Yellow 2	KCW.
*Pigment Yellow 3	BNS, HPC, HRC, HSC, HSH, HST, KCW, KON.
Pigment Yellow 4	HRC.
Pigment Yellow 5	HPC.
Pigment Yellow 6	HPC.
Pigment Yellow 49	S.
Pigment Yellow 60	HSH.
Pigment Yellow 65	HRC, HSH.
*Pigment Yellow 73	HPC, HRC, HSH, HST, SNA.
*Pigment Yellow 74	DUP, GLX, HPC, HRC, HSC, HSH, HST, ICC, SDH, SNA, VPC.
Pigment Yellow 75	HPC.
Pigment Yellow 98	HST.
Acetoacetarylide yellows, all others	HPC, KCW, SNA.
DIARYLIDE YELLOWS:	
*Pigment Yellow 12	AMS, APO, BOR, GLX, HPC, HRC, HSC, HSH, HST, ICC, IND, ROM, SDH, SNA.
*Pigment Yellow 13	APO, BUC, GLX, HPC, HSC, HST, IND, ROM, SDH, SNA, USM.
*Pigment Yellow 14	AMS, APO, BNS, BOR, BUC, GAF, GLX, HPC, HRC, HSC, HSH, HST, ICC, IND, ROM, S, SDH, SNA, USM.
*Pigment Yellow 17	AMS, APO, BOR, BUC, GLX, HPC, HSC, HSH, HST, ICC, IND, ROM, SDH, SNA.
Pigment Yellow 55	HPC, ICC.

TABLE 2.--ORGANIC PIGMENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

ORGANIC PIGMENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
TONERS--Continued	
*YELLOW TONERS--Continued	
DIARYLIDE YELLOWS--Continued	
Pigment Yellow 83	AMS, GLX, HSC, HST, ICC, IND, S.
Diarylide yellows, other	IND, ROM, S.
YELLOW PIGMENTS, OTHER:	
(Basic Yellow 2), fugitive	MRX.
Pigment Yellow 16	HST, ICC.
Pigment Yellow 20	ICC.
Pigment Yellow 97	HST.
Pigment Yellow 124	ICC.
Pigment Yellow toners, all other	HRC, HST, LVR.
*ORANGE TONERS:	
Pigment Orange 1	HRC, KCW.
Pigment Orange 2	HFC, UHL.
*Pigment Orange 5	ACY, HPC, HSC, HSH, HST, SDH, SNA.
*Pigment Orange 13	AMS, HPC, HRC, HSC, HSH, ICC, KON, SNA.
Pigment Orange 15	HRC.
*Pigment Orange 16	BNS, GLX, HPC, HRC, HSH, HST, ICC, IND, ROM, SDH.
*Pigment Orange 34	BUC, GLX, ICC, IND, ROM, SDH.
Pigment Orange 43	HRC, HST.
Pigment Orange 45	HSC.
Pigment Orange 47	DUP.
Pigment Orange 48	DUP.
Pigment Orange 49	DUP.
Pigment Orange toners, all other	KON, LVR, ROM.
*RED TONERS:	
*NAPHTHOL REDS:	
*Pigment Red 2	HPC, HRC, HSH, KCW, KON, S.
*Pigment Red 5	GAF, GLX, HPC, HSH, ROM, S.
Pigment Red 7	HST, S.
*Pigment Red 9	HFC, HST, MRX.
Pigment Red 13	HPC, KCW.
Pigment Red 15	HST.
*Pigment Red 17	ACY, BNS, HPC, ICC, ROM, SNA, UHL.
Pigment Red 21	BNS.
*Pigment Red 22	ACY, DUP, GLX, HPC, KCW, MRX, ROM, SNA.
*Pigment Red 23	ACY, BUC, DUP, GLX, HPC, HSH, IND, KCW, ROM, S, SDH, UHL.

TABLE 2.--ORGANIC PIGMENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

ORGANIC PIGMENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
TONERS--Continued	
*RED TONERS--Continued	
*NAPHTHOL REDS--Continued	
Pigment Red 31	ROM.
Pigment Red 112	HPC, HST.
Naphthol reds, all other	ICC, IND, KCW, ROM, S, SDH, SNA, USM.
RED PIGMENTS, OTHER:	
*Pigment Red 3	ACY, CIK, DUP, HPC, HSC, HSH, KCW, KON, SDH, SNA, UHL.
*Pigment Red 4	ACY, AMS, HPC, HSC, KON, MRX, SDH, UHL.
Pigment Red 6	DUP, HSH, KCW, KON.
*Pigment Red 38	HRC, HSH, SNA.
Pigment Red 41	HRC.
Pigment Red 48	HPC, ICC, SDH.
Pigment Red 58	DUP, HPC.
*Pigment Red 63	HSC, HSH, KON, SNA.
Pigment Red 88	HRC, ICC.
Pigment Red 90	AMS, BOR, ICC, SDH.
Pigment Red 122	HRC, HST, SNA.
Pigment Red 123	HRC, HSC.
Pigment Red 146	HST.
Pigment Red 149	HST.
Pigment Red 168	HRC, HST.
Pigment Red 170	HST.
Pigment Red 179	HRC.
Pigment Red 181	HST.
Pigment Red 190	HRC, HSC.
Pigment Red 202	HRC.
Pigment Red 206	DUP.
Pigment Red 207	DUP.
Pigment Red 224	HRC.
*Pigment Red 48:1, barium	ACY, AMS, BOR, DUP, HPC, HSC, HSH, S, SNA.
*Pigment Red 49:1, barium	ACY, AMS, BNS, BOR, CIK, HSC, ICC, KON, MRX, SDH, SNA, UHL.
*Pigment Red 53:1, barium	ACY, AMS, BOR, CIK, HSC, HSH, ICC, KON, MGR, MRX, SDH, SNA.
*Pigment Red 48:2, calcium	ACY, AMS, BOR, DUP, HPC, HSC, HSH, MGR, MRX, SNA.
*Pigment Red 49:2, calcium	ACY, AMS, BNS, BOR, CIK, HSC, SDH.
*Pigment Red 52:1, calcium	ACY, AMS, HPC, HSC, MGR, SNA, UHL.
Pigment Red 53:2, calcium	APO.

TABLE 2.--ORGANIC PIGMENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

ORGANIC PIGMENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
TONERS--Continued	
*RED TONERS-Continued	
RED PIGMENTS, OTHER--Continued	
Pigment Red 54, calcium	HSH, SDH.
*Pigment Red 57:1, calcium	ACY, AMS, APO, BNS, BOR, CIK, DUP, HPC, HSC, HSH, ICC, KON, MGR, SDH, SNA, UHL.
Pigment Red 1, dark	HPC, HSH.
Pigment Red 1, light	HPC, HSH, SDH.
*Pigment Red 48:4, manganese	ACY, DUP, HPC, HRC, HSH.
*Pigment Red 52:2, manganese	ACY, HPC, HSC, HSH.
*Pigment Red 81, PMA	DUP, HPC, KON, MGR, MRX, SNA, UHL.
*Pigment Red 81, PTA	DUP, HPC, HSC, KON, MGR, MRX, UHL.
Pigment Red 49, sodium	BNS, KON, SDH.
Pigment Red 48:3, strontium	HSH, S.
Pigment Red toners, all other	DUP, HRC, HSC, HST, IND, X.
*VIOLET TONERS:	
Pigment Violet 19	DUP, HRC, SNA.
*Pigment Violet 23	BUC, HRC, HSC, HST, SDC, SNA.
Pigment Violet 31	DUP.
Pigment Violet 36	HST.
Pigment Violet 42	DUP.
Pigment Violet 1, fugitive	KCW, UHL.
*Pigment Violet 3, fugitive	ACY, HSC, KON, MGR, UHL.
Pigment Violet 4, fugitive	KCW.
*Pigment Violet 1, PMA	HPC, MGR, MRX, SNA, UHL.
*Pigment Violet 3, PMA	AMS, DUP, HPC, HSC, KON, LVB, MGR, MRX, SDH, UHL.
*Pigment Violet 1, PTA	DUP, HPC, HSC, MGR, MRX, SNA.
*Pigment Violet 3, PTA	ACY, HPC, HSC, KON, MRX.
Pigment Violet toners, all other	ACY, BUC, HPC, ROM.
*BLUE TONERS:	
Pigment Blue 19	SW.
Pigment Blue 22	DUP.
Pigment Blue 25	GLX, ICC, IND.
Pigment Blue 27	BOR.
Pigment Blue 61	BSC.
*Pigment Blue 15, alpha form	ACY, DUP, HPC, HSC, HSH, HST, ICC, SDH, TMS, USM.
*Pigment Blue 15:1, alpha form	HRC, HSC, HST, SNA.
Pigment Blue 15:2, alpha form	HRC, HSC, SNA.
*Pigment Blue 15:3, beta form	ACY, AMS, APO, BAS, BUC, DUP, HPC, HSC, ICC, POP, ROM, SNA.

TABLE 2.--ORGANIC PIGMENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

ORGANIC PIGMENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
TONERS--Continued	
*BLUE TONERS--Continued	
Pigment Blue 15:4, beta form	HSC, SNA.
*Pigment Blue 1, PMA	BNS, DUP, HPC, KON, MGR, MRX, UHL.
Pigment Blue 9, PMA	UHL.
Pigment Blue 10, PMA	SDH.
Pigment Blue 14, PMA	DUP, GAF.
Pigment Blue 1, PTA	MRX.
Pigment Blue 2, PTA	KON.
Pigment Blue toners, all other	IND, LVB, SDH, TNI, UHL, VPC.
*GREEN TONERS:	
*Pigment Green 7	ACY, BAS, CIK, DUP, HPC, HBC, HSC, HST, POP, SDH, SNA, TMS.
Pigment Green 8	HPC, KCW.
Pigment Green 10	DUP, HPC.
*Pigment Green 36	ACY, DUP, HRC, HST, SNA.
Pigment Green 1, PMA	MRX, UHL.
*Pigment Green 2, PMA	MGR, MRX, S, UHL.
Pigment Green 4, PMA	MGR.
*Pigment Green 2, PTA	ACY, HPC, KON, MRX, S, UHL.
Pigment Green 4, PTA	ACY.
Pigment Green toners, all other	HST, UHL, VPC.
BROWN TONERS:	
Pigment Brown 1	S.
*Pigment Brown 5	BUC, BRC, ICC, ROM.
Pigment Brown 3, PMA	KON.
Pigment Brown toners, all other	HRC, LVR, SDH.
BLACK TONERS:	
Pigment Black 7	HST.
Pigment Black toners, all other	DUP, HST, LVB, UHL.
LAKES	
YELLOW LAKES:	
(Acid Yellow 11)	KCW.
(Acid Yellow 23)	KON, MRX.
(Basic Yellow 37)	BNS.
(Direct Yellow 29)	KCW.
ORANGE LAKES:	
Pigment Orange 17	KCW, KON.

TABLE 2.--ORGANIC PIGMENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

ORGANIC PIGMENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
LAKES--Continued	
RED LAKES:	
(Acid Red 17)	KCW.
(Acid Red 26)	HPC, KCW.
(Basic Red 1)	BNS.
*Pigment Red 60:1	HSH, KON, MRX, SDH, SNA.
*Pigment Red 83	HPC, HSH, KON, MRX, UHL.
Pigment Red lakes, all other	LVR.
VIOLET LAKES.	
*Pigment Violet 5:1	DUP, HPC, HRC, HSH, KON, MRX, S, UHL.
(Basic Violet 1)	BNS.
(Basic Violet 4)	BNS.
(Basic Violet 10)	BNS.
*BLUE LAKES:	
(Basic Blue 7)	BNS.
Pigment Blue 17:1	GAF, SDH.
Pigment Blue 24	BOR, KON.
Pigment Blue lakes, all other	LVR.
GREEN LAKES:	
Pigment Green lakes, all other	LVR.
BROWN LAKES:	
Pigment Brown lakes, all other	KON.
BLACK LAKES:	
(Acid Black 2)	KCW.
Pigment Black lakes, all other	KON.

TABLE 3.--ORGANIC PIGMENTS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of organic pigments to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ACY	American Cyanamid Co.	KCW	Keystone Color Works, Inc.
AMS	Ridgway Color & Chemicals	KON	H. Kohnstamm & Co., Inc.
APO	Apollo Colors, Inc.		
		LVR	C. Lever Co., Inc.
BAS	BASF Wyandotte Corp.		
BNS	Binney and Smith, Inc.		
BOR	Borden, Inc., Printing Ink Div.	MGR	Magruder Color Co., Inc.
BUC	Synalloy Corp., Blackman-Uhler Chemical Div.	MRX	Max Marx Color & Chemical Co.
		POP	Pope Chemical Corp.
CIK	Flint Ink Corp., Cal/Ink Div.		
		ROM	United Merchants & Manufacturers, Inc., Roma Chemical Div.
DUP	E. I. duPont de Nemours & Co., Inc.		
GAF	GAF Corp.	S	Sandoz, Inc., Colors & Chemicals Div.
GLX	Galaxie Chemical Corp.	SDC	Martin-Marietta Corp., Sodyeco Div.
		SDH	Sterling Drug, Inc., Hilton-Davis Chemical Co. Div.
HPC	Hercules, Inc.	SNA	Sun Chemical Corp., Pigments Div.
HRC	Harmon Colors Corp.	SW	Sherwin-Williams Co.
HSC	Chemetron Corp., Pigments Div. Sub. of Allegheny Ludlum Industries, Inc.	TMS	Sterling Drug, Inc., Thomasset Colors Div.
HSH	Harshaw Chemical Co.		
HST	American Hoechst Corp., Industrial Chemicals Div.	TNI	Gillette Co., Chemical Div.
		UHL	Paul Uhlich & Co., Inc.
		USM	USM Corp., Bostik Div.
ICC	Inmont Corp.		
IND	Indol Chemical Co., Inc.	VPC	Mobay Chemical Corp., Verona Div.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Medicinal Chemicals

Tedford C. Briggs

The most important new developments during 1977 were significant Government actions affecting consumers and producers of medicinal chemicals. The Department of Health, Education, and Welfare (HEW) ordered a drug removed from the market, proposed restrictions on antibiotics and some other anti-infective agents used as growth promoters in animal feeds, and drafted legislation that may change drug approval and regulatory procedures.

Also, several significant new drugs were marketed in 1977. An indepth analysis of the anti-infective sulfonamides is provided below, as a case study, pointing out trends in that important group of medicinal chemicals. The market for sulfonamides may be affected by HEW restrictions on the use of medicinals in animal feeds.

Government Actions

In an unprecedented move, HEW banned sales of the antidiabetic drug phenformin on the basis that it presented an imminent hazard to the public. An estimated 385,000 patients were using the drug to control some type of diabetes. The Secretary of HEW acted to remove phenformin because of evidence that the drug had an incidence rate of fatalities associated with its general use that was far higher than has been regarded as acceptable for any other drug approved for use in the United States for a broad patient population. HEW estimated that the risk of death from phenformin use ranged from 5 to 80 times greater than for other drugs known to produce life-threatening side effects.

In another Government action, with likely significant economic effects, the Food and Drug Administration (FDA) decided to restrict the use of antibiotics as growth promoters routinely added to cattle and poultry feeds. The FDA proposal would virtually eliminate the use of the penicillins, oxytetracycline, and chlortetracycline in animal feeds. The sales value of antibiotics consumed in animal feeds has been estimated at $170 million.

Farm groups have opposed the proposed restrictions on antibiotic feed additives, and they have estimated that implementation of the proposal could cost from $2 billion to $5 billion annually in increased feed costs, lower feed efficiency, and higher animal mortality rates.

According to the FDA, the use of subtherapeutic doses of antibiotics in animal feeds promotes the growth of antibiotic-resistant bacteria in the animals' intestines. These bacteria contain plasmids (small lengths of genetic material), which can be transferred among various types of bacteria. A single plasmid can confer bacterial resistance against several antibiotics. Also, the plasmids can supposedly be transferred from nonpathogenic bacteria to pathogenic bacteria, thus creating a new group of drug-resistant harmful bacteria that could infect both animals and humans.

There is little agreement with the FDA assessment from the antibiotic producers or the cattle and poultry producers. These groups argue that the FDA reasoning is speculative and that there is little or no actual evidence supporting the FDA position. Thus, before the FDA plan to restrict the use of antibiotics in feeds can be implemented, the agency must go through a process of hearings to receive public comment.

During 1977, pressure mounted for major changes in the law regulating the testing, approval, and marketing of medicinal chemicals in the United States. The basic legislation which now controls these procedures is set forth in the 1906 Pure Food and Drug Act, as amended. Major changes in the 1906 Act have occurred only twice, in 1938 and 1962. In those instances the amendments were direct congressional responses to specific drug-related disasters. In 1938, the Congress passed drug safety rules in the wake of more than 100 deaths caused by a preparation of sulfanilamide. In 1962, drug efficacy rules were enacted into law after congressional hearings on the thalidomide disaster in Germany which left a number of deformed infants whose mothers took the drug while pregnant.

As the result of both consumer and industry dissatisfaction with the current law, a number of bills were drafted in 1977 which, if enacted, would significantly alter the regulation and marketing of drugs in the United States. According to the Secretary of HEW, the present law highlights irrelevant historical distinctions and perpetuates time-consuming repetitive processes that are closed to effective public review. Under the present system, an application for approval of a new drug averages 34 volumes of paperwork, takes years to process, and costs millions of dollars.

Among the features included in some of the proposed legislation are provisions to speed up the approval process for new drugs and to make it easier to remove a drug from the market if it has an unusually high incidence of harmful side effects. Other proposals would require that drug packets include messages to patients spelling out the proper use and adverse effects of a drug and, thus, make industry information on drug safety easily available to the public for the first time. Another provision would specify that patent protection for a drug would begin on the day of FDA approval. Drug patents now take effect when a drug is first submitted to the FDA for approval, a process that can take years. FDA reportedly is seeking legislation that would articulate more precisely the responsibilities of the agency, thus easing the differences of opinion about its role in regulating drugs.

New drugs

Several new drugs were introduced into the prescription market in 1977, and others entered clinical trials which are steps in the testing procedures required for FDA approval for marketing.

The drugs mentioned below do not constitute an exhaustive list of new products and the information is based upon recent reports in various trade journals.

Cimetidine.--This new drug for treating duodenal ulcers received FDA approval for marketing. Cimetidine has been available for use in the United Kingdom for about a year, and it is now being marketed worldwide. The drug was developed in the United Kingdom and belongs to a new class of compounds that reduce or block excess acid secretions in the gastrointestinal tract, thus promoting the healing of duodenal ulcers.

Disopyramide phosphate.--This new drug for treating ventricular arrhythmias is now being marketed in the United States. The drug has been available for some time in several European countries and reportedly has fewer side effects than some of the other antiarrhythmic agents.

Sodium valporate.--This drug for treating epilepsy received FDA approval for marketing in early 1978. Sodium valporate was developed in France and has been in use there since 1967.

Probucol.--This drug for lowering blood cholesterol levels was approved by the FDA in early 1977. The domestic market for cholesterol reducing agents has been estimated at $35 million.

Adenine arabinoside.--This antiviral drug demonstrated clinical effectiveness against a virulent form of encephalitis caused by a herpes virus. Presently the drug is approved for treatment of eye infections caused by herpes simplex virus.

The Anti-Infective Sulfonamides

The anti-infective sulfonamides are an important group of drugs to examine for market factors affecting domestic production because these drugs are, for the most part, mature products that have passed through the stages of discovery, development, extensive use, the development of competing products, expiration of many basic patents, reductions of tariffs on imported sulfonamides, and yet they continue to be an important group of domestically produced medicinal chemicals.

Development of sulfonamides as medicinal chemicals

The anti-infective sulfonamides, or sulfa drugs, are derivatives of sulfanilamide which was first synthesized in 1908 by Gelmo as a step in obtaining a better synthetic red dye. In 1935 Gerhard Domagk reported that a red dye called Prontosil protected mice against lethal doses of infective streptococci.

Studies by workers in the Pasteur Institute in France led to the important discovery in late 1935 by Trefouel, Trefouel, Nitti, and Bovet, that the dye Prontosil was altered by the metabolism of the host to give sulfanilamide as the bacteriostatic agent. These discoveries stimulated research throughout the world on the therapeutic properties of derivatives of sulfanilamide, and it was soon discovered that nitrogen-containing heterocyclic-substituted sulfanilamides were more effective anti-infective agents than the parent compound.

The discovery and development of the anti-infective sulfonamides were major milestones in the development of synthetic medicinal chemicals, and the effectiveness of these compounds was demonstrated soon after the discovery of their bacteriostatic properties. Sulfanilamide and its derivatives were the "miracle" drugs of World War II, and in 1942 the War Department announced that every U.S. soldier going into a combat zone would be equipped with a container of sulfa drugs. The results were dramatic in controlling infections resulting from wounds and in curing and preventing infectious diseases.

By 1945, about 5,500 sulfonamides had been described in the literature, and because of the intensive research in this area many of the compounds were developed independently leading to many patent interferences.

In recent years the importance of sulfonamides has diminished in the treatment of infectious diseases of man, as bacterial resistance to the sulfonamides has increased, and as the frequently more effective and less toxic antibiotics have been developed. Nevertheless, the anti-infective sulfonamides continue to be the drugs of choice in the treatment of certain urinary tract and systemic infections in humans and, because of their relatively low cost and demonstrated effectiveness, are frequently-used anti-infective agents in veterinary medicine. About 25 different anti-infective sulfonamides were produced in the United States in 1977.

Methods of production

Acetanilide is the basic chemical used to produce most anti-infective sulfonamides. Acetanilide is treated with chlorosulfonic acid to obtain n-acetylsulfanilyl chloride which can be reacted with ammonia and then an alkali to obtain sulfanilamide, or n-acetylsulfanilyl chloride can be used to produce a multitude of other sulfonamides.

Production

Production data for sulfanilamide drugs were first published in United States International Trade Commission statistics in 1937 and are summarized in the table on the following page.

Sulfanilamide and related anti-infective sulfonamides:
U.S. Production, 1937-77

(In thousands of pounds)

Year	Production	Year	Production	Year	Production
1937	355	1951	6,411	1965	4,728
1938	339	1952	5,786	1966	5,450
1939	709	1953	4,672	1967	5,046
1940	646	1954	4,157	1968	4,794
1941	2,091	1955	2,767	1969	4,916
1942	5,436	1956	3,817	1970	5,943
1943	10,006	1957	3,843	1971	6,063
1944	4,514	1958	3,725	1972	6,078
1945	5,912	1959	5,835	1973	6,781
1946	5,104	1960	5,080	1974	7,104
1947	6,142	1961	4,181	1975	4,677
1948	2,660	1962	4,257	1976	4,015
1949	4,895	1963	4,639	1977	4,435
1950	4,967	1964	4,964		

Source: U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales, 1937-77.

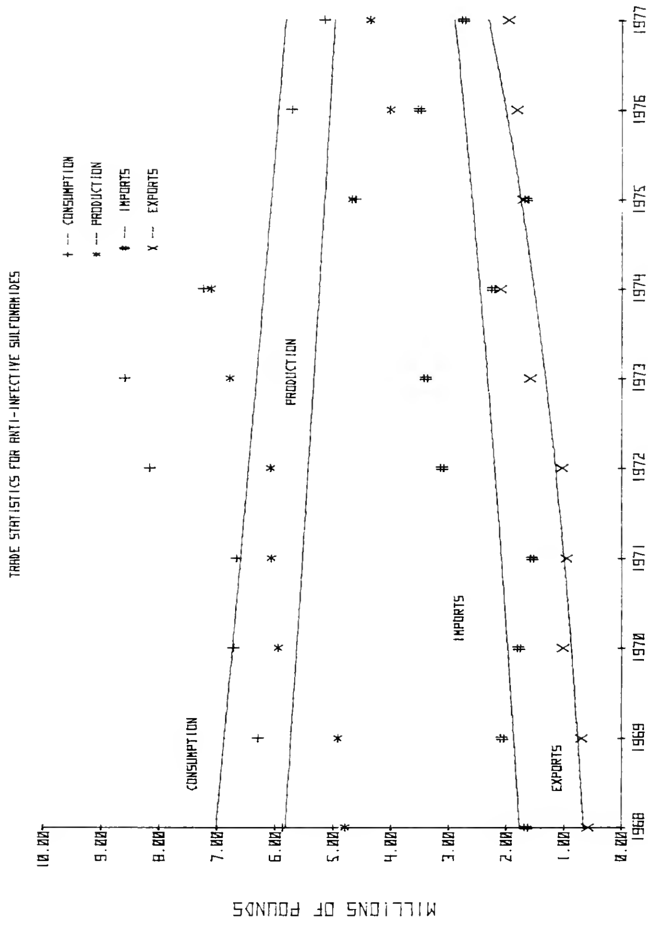
Production of the anti-infective sulfonamides peaked in 1943 at 10 million pounds at the height of World War II. At that time, the sulfonamides were the only widely effective anti-infective drugs, and the United States was supplying these drugs for most of the Allied Forces. Some market analysts predicted that the anti-infective sulfonamides would largely be replaced by the antibiotics, but a glance at the production statistics reveals that this has not been the case. Production has varied widely from a post-World War II low of 2.7 million pounds in 1948 to a high of 7.1 million pounds in 1974.

Trade Statistics:

Statistics for production, imports, exports, and consumption of anti-infective sulfonamides for a 10-year period, 1968-77, are shown graphically in the following illustration. A non-linear regression analysis was used to establish trend lines for the data.

The chart shows a gradual decline in the trend for both production and consumption. The declines are probably due to loss of markets to competing anti-infective agents such as the antibiotics. Consumption and production could drop sharply, as would imports, if the FDA places strong restrictions on the use of anti-infective sulfonamides in animal feeds.

Both exports and imports showed increasing trends during 1968-77, with exports increasing somewhat more rapidly than imports. Imports of some individual anti-infective sulfonamides, such as sulfamethazine, have shown large increases. There may be some correlation between imports of sulfamethazine, as shown in the following table, and its U.S. patent protection which expired about 1963.


TRADE STATISTICS FOR ANTI-INFECTIVE SULFONAMIDES
+ -- CONSUMPTION
* -- PRODUCTION
# -- IMPORTS
X -- EXPORTS
CONSUMPTION
PRODUCTION
IMPORTS
EXPORTS
MILLIONS OF POUNDS
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977

Sulfamethazine and its sodium salt: U.S. imports, 1958-77

(In thousands of pounds)

Year	Imports	Year	Imports	Year	Imports
1958	3	1965	121	1972	679
1959	9	1966	225	1973	861
1960	7	1967	343	1974	1,010
1961	5	1968	479	1975	683
1962	63	1969	783	1976	1,434
1963	107	1970	773	1977	1,064
1964	175	1971	482		

Source: U.S. International Trade Commission, Imports of Benzenoid Chemicals and Products, 1958-77.

Medicinal Chemicals

Tedford C. Briggs

Medicinal chemicals include the medicinal and feed grades of all organic chemicals having therapeutic value, whether obtained by chemical synthesis, by fermentation, by extraction from naturally occurring plant or animal substances, or by refining a technical grade product. They include antibiotics and other anti-infective agents, antihistamines, autonomic drugs, cardiovascular agents, central nervous system depressants and stimulants, hormones and synthetic substitutes, vitamins, and other therapeutic agents for human or veterinary use and for animal feed supplements.

The table shows statistics for production and sales of medicinal chemicals grouped by pharmacological class. The statistics shown are for bulk chemicals only. Finished pharmaceutical preparations and products put up in pills, capsules, tablets, or other measured doses are excluded.[1] The difference between production and sales reflects inventory changes, processing losses, and captive consumption of medicinal chemicals processed into ethical and proprietary pharmaceutical products by the primary manufacturer. In some instances, the difference may also include quantities of medicinal grade products used as intermediates, for example, penicillin G salts used as intermediates in the manufacture of semi-synthetic penicillins. All quantities are given in terms of 100-percent content of the pure bulk drug.

Total U.S. production of bulk medicinal chemicals in 1977 amounted to 240.7 million pounds, or 2.1 percent more than the 235.8 million pounds produced in 1976 and 15.5 percent more than the 208.4 million pounds produced in 1975. Total sales of bulk medicinal chemicals in 1977 amounted to 162.4 million pounds, valued at $794.0 million, compared with sales in 1976 of 160.8 million pounds, valued at $741.5 million, and sales in 1975 of 148.8 million pounds, valued at $772.1 million. In terms of quantity, sales in 1977 were 1.0 percent more than in 1976 and 9.1 percent more than in 1975. In terms of value, sales in 1977 were 7.1 percent more than in 1976 and 2.8 percent more than in 1975.

Production of the more important groups of medicinal chemicals in 1977 was as follows: Antibiotics, 23.1 million pounds (12.9 percent more than in 1976), of which 14.0 million pounds was for medicinal use and 9.1 million pounds was

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[1] Complementary statistics on the dollar value of manufacturers' shipments of finished pharmaceutical preparations, except biologicals, are published annually by the U.S. Department of Commerce, Bureau of the Census, in Current Industrial Reports, Series MA-28G. Many pharmaceutical manufacturers who report to the Bureau of the Census are excluded from the U.S. International Trade Commission report because they are not primary producers of medicinal chemicals, that is, they do not themselves produce the bulk drugs which go into their pharmaceutical products but purchase their drug requirements from domestic or foreign producers.

for other uses; anti-infective agents other than antibiotics, 28.0 million pounds (1.2 percent more than in 1976); central nervous system depressants and stimulants, 52.5 million pounds (0.4 percent less); and vitamins, 37.1 million pounds (11.4 percent more).

Production of some of the more important individual products listed in the table was as follows: Choline chloride, 48.2 million pounds (2.5 percent larger than in 1976); aspirin, 31.4 million pounds (11.1 percent more); penicillins (except semi-synthetic), 7.5 million pounds (4.6 percent more); tetracyclines, 5.6 million pounds (1.3 percent less); and vitamin E, 5.3 million pounds (15.1 percent more).

TABLE 1.--MEDICINAL CHEMICALS: U.S. PRODUCTION AND SALES, 1977

[Listed below are all synthetic organic medicinal chemicals for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists all medicinal chemicals for which data on production and/or sales were reported and identifies the manufacturers of each]

MEDICINAL CHEMICALS	PRODUCTION[1]	SALES[1] QUANTITY	SALES[1] VALUE	SALES[1] UNIT VALUE[2]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	240,733	162,384	794,018	$4.89
Acyclic	86,811	78,798	75,626	.96
Benzenoid[3]	109,143	57,943	380,521	6.57
Cyclic nonbenzenoid[4]	44,779	25,643	337,871	13.18
Antibiotics, total[5]	23,120	7,407	255,867	34.54
Cephalosporins	806	...	...	...
Penicillins, semisynthetic, total	2,034	443	38,380	86.64
Amoxicillin	305	...	...	...
Ampicillin	1,167	...	...	...
All other (semisynthetic)[6]	562	443	38,380	86.64
Penicillins (except semisynthetic), total	7,460	2,915	35,862	12.30
Penicillin G, potassium, for medicinal use	2,712	...	...	...
All other, for all uses	4,748	2,915	35,862	12.30
Tetracyclines, for all uses	5,615	...	...	...
Other antibiotics, total	7,205	4,049	181,625	44.86
For medicinal use[7]	3,474	1,096	136,183	124.25
For nonmedicinal uses[8]	3,731	2,953	45,442	15.39
Antihistamines, total	454	249	6,914	27.77
Chlorpheniramine maleate	37	...	...	...
All other	417	249	6,914	27.77
Anti-infective agents (except antibiotics), total	27,977	11,140	42,166	3.79
Anthelmintics, total	10,932	4,856	15,964	3.29
Piperazine dihydrochloride	1,464	1,279	1,777	1.39
All other	9,468	3,577	14,187	3.97
Antifungal agents	776	735	1,189	1.62
Antiprotozoan agents	8,233	...	...	...
Sulfonamides	4,435	731	4,680	6.40
Urinary antiseptics	327	392	1,180	3.01
Other anti-infective agents[9]	3,274	4,426	19,153	4.33
Autonomic drugs, total	1,194	834	15,885	19.05
Sympathomimetic (adrenergic) agents, total	1,085	771	12,255	15.89
Phenylpropanolamine hydrochloride	433	359	2,952	8.22
All other	652	412	9,303	22.58
Other autonomic drugs	109	63	3,630	57.62
Central depressants and stimulants, total	52,479	38,340	134,275	3.50
Analgesics, antipyretics, and nonhormonal anti-inflammatory agents, total	45,857	33,520	63,293	1.90
Aspirin	31,415	...	...	...
All other[10]	14,442	33,520	63,293	1.90
Anticonvulsants, hypnotics, and sedatives	1,426	505	3,996	7.91
Antidepressants	162	...	...	...
Antitussives	200	151	39,263	260.02
Skeletal muscle relaxants	417	422	3,817	9.05
Tranquilizers	556	...	...	...
Other central depressants and stimulants[11]	3,861	3,742	23,906	6.39
Dermatological agents and local anesthetics, total	2,139	1,975	3,032	1.54
Lidocaine	46	20	258	12.90
All other	2,093	1,955	2,774	1.42

See footnotes at end of table.

TABLE 1.--MEDICINAL CHEMICALS: U.S. PRODUCTION AND SALES, 1977--CONTINUED

MEDICINAL CHEMICALS	PRODUCTION[1]	SALES[1] QUANTITY	SALES[1] VALUE	SALES[1] UNIT VALUE[2]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Expectorants and mucolytic agents, total	2,302	1,862	7,258	$3.90
Ethylenediamine dihydriodide	1,300	1,180	4,050	3.43
All other	1,002	682	3,208	4.70
Hematological agents, total	28	23	2,862	124.43
Sodium heparin	5	2	1,843	921,50
All other	23	21	1,019	48.52
Hormones and synthetic substitutes, total	1,103	160	81,503	509.39
Synthetic hypoglycemic agents	942	...	...	...
All other[12]	161	160	81,503	509.39
Renal-acting and edema-reducing agents, total	1,754	275	6,400	23.27
Theophylline derivatives	113	...	...	...
All other[13]	1,641	275	6,400	23.27
Vitamins, total	37,128	22,726	164,430	7.24
Vitamin D	12	9	3,226	358.44
Vitamin E	5,289	3,466	51,059	14.73
All other vitamins[14]	31,827	19,251	110,145	5.72
Miscellaneous medicinal chemicals, total	91,055	77,393	73,426	.95
Choline chloride (all grades)	48,167	42,556	16,970	.40
All other[15]	42,888	34,837	56,456	1.62

[1] The data on production and sales are for bulk medicinal chemicals only.
[2] Calculated from rounded figures.
[3] Benzenoid, as used in this report, describes any cyclic medicinal chemical whose molecule contains either a six-membered carbocyclic ring with conjugated double bonds or a six-membered heterocyclic ring with 1 or 2 hetero atoms and conjugated double bonds, except the pyrimidine ring.
[4] Includes antibiotics of unknown structure.
[5] Production of all antibiotics for medicinal use amounted to 13,992,000 pounds, and sales amounted to 3,198,000 pounds, valued at $205,523,000. Production of all antibiotics for animal feed and other nonmedicinal uses amounted to 9,128,000 pounds, and sales amounted to 4,209,000 pounds, valued at $50,344,000.
[6] Includes sales quantity and value of amoxicillin and ampicillin.
[7] Includes production and sales of antifungal and antituberculer antibiotics and sales of cephalosporins.
[8] Includes sales quantity and value of tetracyclines.
[9] Includes sales quantity and value of antiprotozoan agents.
[10] Includes sales quantity and value of aspirin.
[11] Includes sales quantity and value of antidepressants and tranquilizers. Also includes production and sales of amphetamines, general anesthetics, and respiratory and cerebral stimulants.
[12] Includes sales quantity and value of synthetic hypoglycemic agents.
[13] Includes sales quantity and value of theophylline derivatives.
[14] Includes production and sales of vitamin A, vitamin B, vitamin C, and vitamin K.
[15] Includes production and sales of antineoplastic agents, cardiovascular agents, diagnostic agents, gastisintestinal agents (except choline chloride), therapeutic nutrients, smooth muscle relaxants, and unclassified medicinal chemicals.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS, OR GROUPS OF CHEMICALS, FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); OTHER CHEMICALS DO NOT APPEAR, IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTIBIOTICS:	
*PENICILLINS, SEMI-SYNTHETIC:	
*Amoxicillin	BEE, BOC, BRS.
*Ampicillin	BEE, BOC, BRS, TRD, WYT.
Ampicillin, sodium	BEE, BRS, WYT.
Carbenicillin, disodium	BEE, PFZ.
Carbenicillin indanyl, sodium	PFZ.
Cloxacillin, sodium	BEE, BRS.
Dicloxacillin, sodium	BEE, BRS, W[illegible].
Hetacillin	BRS.
Hetacillin, potassium	BRS.
Methicillin, sodium	BEE, BRS.
Nafcillin, sodium	BRS, WYT.
Oxacillin, sodium	BEE, BRS.
Ticarcillin, disodium	BEE.
*PENICILLINS (EXCEPT SEMI-SYNTHETIC):	
FOR MEDICINAL USE:	
Penicillin V (Phenoxymethylpenicillin)	BRS, LIL, PFZ.
Penicillin G, benzathine	WYT.
*Penicillin G, potassium	BRS, LIL, OMS, PFZ, WYT.
Penicillin V, potassium	BRS, LIL.
Penicillin G, procaine (Medicinal grade)	LIL, PFZ, WYT.
Penicillin G, sodium	PFZ.
FOR NONMEDICINAL USES:	
Penicillin G, procaine (Animal feed grade)	MRK, OMS, PFZ.
*TETRACYCLINES:	
FOR MEDICINAL USE:	

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTIBIOTICS--Continued	
*TETRACYCLINES--Continued	
FOR MEDICINAL USE--Continued	
Chlortetracycline (Medicinal grade)	ACY.
Demeclocycline	ACY.
Doxycycline	PFZ.
Methacycline	PFZ.
Minocycline	ACY.
Oxytetracycline (Medicinal grade)	PFZ.
Tetracycline	ACY, BRS, PFZ, UPJ.
FOR NONMEDICINAL USES:	
Chlortetracycline (Animal feed grade)	ACY, RLS.
Oxytetracycline (Animal feed grade)	PFZ.
*OTHER ANTIBIOTICS:	
*FOR MEDICINAL USE:	
ANTIFUNGAL ANTIBIOTICS:	
Amphotericin B	OMS, TRD.
Candicidin	PEN.
Nystatin (Medicinal grade)	ACY, OMS, TRD.
ANTITUBERCULAR ANTIBIOTICS:	
Dihydrostreptomycin	MRK, PFZ.
Streptomycin (Medicinal grade)	LIL, MRK, PFZ.
*CEPHALOSPORINS:	
Cefazolin	LIL, SK.
Cefoxitin	MRK.
Cephalexin	LIL.
Cephaloridine	LIL.
Cephalothin	LIL.
Cephapirin	BRS.
Cephapirin, sodium	BRS.
Cephradine	SK, TRD.
OTHER ANTIBIOTICS FOR MEDICINAL USE:	
Amikacin sulfate	BRS.
Bacitracin (Medicinal grade)	IMC.
Chloramphenicol	PD, RLS.
Clindamycin	UPJ.
Erythromycin	ABB, LIL, UPJ.
Erythromycin estolate	LIL.
Erythromycin stearate	UPJ.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTIBIOTICS--Continued	
*OTHER ANTIBIOTICS--Continued	
*FOR MEDICINAL USE--Continued	
OTHER ANTIBIOTICS FOR MEDICINAL USE--Continued	
Gentamycin	SCH.
Kanamycin	BRS.
Lincomycin	UPJ.
Neomycin (Medicinal grade)	OMS, PEN, PFZ, UPJ.
Novobiocin (Medicinal grade)	UPJ.
Polymyxin B	PFZ.
Spectinomycin (Medicinal grade)	ABB, UPJ.
Thiostrepton	OMS.
Tyrothricin	PEN.
Vancomycin	LIL.
*FOR NONMEDICINAL USES:	
Bacitracin (Animal feed grade)	IMC, PEN.
Cycloheximide	UPJ.
Hygromycin B	LIL.
Lasalocid	HOF.
Lincomycin (Animal feed grade)	UPJ.
Monensin, sodium	LIL.
Neomycin (Animal feed grade)	PFZ, UPJ.
Novobiocin (Animal feed grade)	UPJ.
Nystatin (Animal feed grade)	OMS.
Spectinomycin (Animal feed grade)	UPJ.
Streptomycin	MRK, PFZ.
Tylosin	LIL.
*ANTIHISTAMINES:	
ANTINAUSEANTS:	
Cyclizine hydrochloride	BUR.
Dimenhydrinate	GAN, SRL.
Meclizine hydrochloride	PFZ.
Trimethobenzamide hydrochloride	HOF.
OTHER ANTIHISTAMINES:	
Bromodiphenhydramine hydrochloride	PD.
Brompheniramine maleate	HEX, SCH.
Chlorcyclizine hydrochloride	BUR.
*Chlorpheniramine maleate	HEX, SCH, SK.
Chlorpheniramine tannate	MAL.
Cyproheptadine hydrochloride	MRK.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTIHISTAMINES--Continued	
OTHER ANTIHISTAMINES--Continued	
Dexbrompheniramine maleate	SCH.
Dexchlorpheniramine maleate	SCH.
Dimethindene maleate	CGY.
Diphenhydramine hydrochloride	BJL, GAN, PD.
Doxylamine succinate	BJL, BKC.
Methapyrilene fumarate	ABB.
Methapyrilene hydrochloride	ABB, MON.
Methdilazine hydrochloride	BJL.
Phenindamine tartrate	HOF.
Pheniramine maleate	HEX.
Phenyltoloxamine citrate	BRS, GAN, X.
Pyrilamine maleate	HEX.
Pyrilamine resin adsorbate	MRK.
Pyrilamine tannate	MAL.
Pyrrobutamine phosphate	LIL.
Tripelennamine	CGY.
Tripelennamine citrate	CGY.
Tripelennamine hydrochloride	CGY.
Triprolidine hydrochloride	BUR.
*ANTI-INFECTIVE AGENTS (EXCEPT ANTIBIOTICS):	
*ANTHELMINTICS:	
Dichlorvos	SHC.
Diethylcarbamazine citrate	ACY.
Gentian Violet	SDH.
Hexylresorcinol	MRK.
Phenothiazine (Medicinal grade)	WAG.
Piperazine	DOW, JCC.
Piperazine citrate	BUR, JCC.
*Piperazine dihydrochloride	DOW, FLM, JCC, WHL.
Piperazine hexahydrate	JCC.
Piperazine hydrochloride	DOW, FLM, JCC, LEM.
Piperazine phosphate	JCC.
Pyrantel pamoate	PFZ.
Pyrantel tartrate	PFZ.
Pyrvinium pamoate	PD.
Rafoxanide	MRK.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTI-INFECTIVE AGENTS (EXCEPT ANTIBIOTICS)--Continued	
*ANTHELMINTICS--Continued	
Thiabendazole	MRK.
Dredofos	TNA.
*ANTIPROTOZOAN AGENTS:	
ARSENIC AND BISMUTH COMPOUNDS:	
Arsanilic acid	ABB, FLN, WHL.
Bismuth subsalicylate	MAL, NOB, PEN.
Carbarsone	LIL, WHL.
Glycobiarsol	SDW, X.
Nitarsone	SAL.
Roxarsone	SAL.
OTHER ANTIPROTOZOAN AGENTS:	
Aklomide	SAL.
Amodiaquin hydrochloride	PD.
Amprolium	MRK.
Chloroquine phosphate	SDW.
Clopidol	DOW.
Diiodohydroxyquin	RSA.
Dimetridazole	RDA.
Ethopabate	MRK.
Furazolidone	NOR.
Hydroxychloroquine sulfate	SDW.
Iodochlorhydroxyquin	CGY.
Metronidazole	RDA.
Nifuroxime	NOB.
Nitromide	SAL.
Nitrophenide	ACY.
Primaquine phosphate	SDW.
Pyrimethamine	BUR.
Ronidazole	MRK.
*SULFONAMIDES:	
Acetyl sulfisoxazole	HOF.
Dinsed	SAL.
Mafenide acetate	SDW.
Mafenide hydrochloride	SDW.
Phthalylsulfacetamide	LEM.
Sulfabenzamide	ACY.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTI-INFECTIVE AGENTS (EXCEPT ANTIBIOTICS)--Continued	
*SULFONAMIDES--Continued	
Sulfabenzamide, sodium	ACY.
Sulfacetamide	LEM.
Sulfacetamide, sodium	LEM.
Sulfachloropyrazine, sodium	ACY.
Sulfachloropyridazine, sodium	ACY.
Sulfacytine	PD.
Sulfadiazine	ACY.
Sulfadimethoxine	HOF.
Sulfadizine, sodium	MRK.
Sulfaquanidine	ACY.
Sulfamerazine	ACY.
Sulfamerazine, sodium	ACY.
Sulfamethazine	ACY, LEM, RLS.
Sulfamethazine, sodium	LEM, SAL.
Sulfamethizole	ACY.
Sulfamethoxazole	HOF.
Sulfanilamide	SAL.
Sulfanitran	SAL.
Sulfapyridine	ACY, LEM.
Sulfaquinoxaline	MRK.
Sulfasalazine (Salicylazosulfapyridine)	SAL.
Sulfathiazole	MRK.
Sulfathiazole, sodium	MRK, SAL.
Sulfisoxazole	HOF.
Sulfisoxazole, sodium	HOF.
OTHER ANTI-INFECTIVE AGENTS:	
*ANTIFUNGAL AGENTS:	
Benzoic acid	MON.
Calcium undecylenate	WTL.
Sodium caprylate	LEM.
Zinc undecylenate	NTL, WTL.
ANTILEPROTIC AND ANTITUBERCULAR AGENTS:	
Aminosalicylic acid	MLS.
Sodium aminosalicylate	MLS.
Sodium sulfoxone	ABB.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*ANTI-INFECTIVE AGENTS (EXCEPT ANTIBIOTICS)--Continued	
*OTHER ANTI-INFECTIVE AGENTS--Continued	
MERCURY COMPOUNDS:	
Merbromin	HYN.
Thimerosal	LIL.
*URINARY ANTISEPTICS:	
Methenamine hippurate	RIK.
Methenamine mandelate	ARN, NEP, PD.
Nitrofurantoin	NOR.
Phenazopyridine hydrochloride	NEP.
GENERAL ANTISEPTICS AND ANTIBACTERIAL AGENTS:	
Aminacrine	SDW.
Aminacrine hydrochloride	SDW.
Benzalkonium chloride	SDW.
Betanapthol	ACY.
Bromoform	DOW.
Camphor, monobromated	PEN.
Carbadox	PFZ.
Cetalkonium chloride	FIN, SDW.
Cetylpyridinium chloride	FIN, HEX.
Chlorobutanol	SFS.
Chlorothymol	OPC.
M-Cresyl acetate	ADC.
Iodoform	MAL, PEN.
Nalidixic acid	SDH.
Nitrofurathiazide	SCH.
Nitrofurazone	NOR.
Oxolinic acid	NEP.
Oxyquinoline	ASH, MRK.
Oxyquinoline benzoate	ASH, LEM.
Oxyquinoline citrate	ASH, MRK.
Oxyquinoline sulfate	ASH, LEM.
Oxyquinoline zinc	MRK.
Povidone - iodine complex	GAP.
Resorcinol	KPT.
Thymol	GIV.
Thymol iodide	MAL.
Trimethoprim	BUR.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*AUTONOMIC DRUGS:	
*SYMPATHOMIMETIC AGENTS:	
Cinnamedrine hydrochloride	SDW.
Cyclopentamine hydrochloride	LIL.
Ephedrine	UPJ.
Isoetharine hydrochloride	SDW.
Isoproterenol hydrochloride	SDW.
Levarterenol bitartrate	SDW.
Mephentermine	ARA.
Mephentermine sulfate	ARA.
Methoxyphenamine hydrochloride	MLS.
Naphazoline hydrochloride	CGY.
Nordefrin hydrochloride	SDW.
Phenylephrine	SDW.
Phenylephrine bitartrate	GAN.
Phenylephrine hydrochloride	GAN, HEX, SDW.
*Phenylpropanolamine hydrochloride	ARS, GAN, NEP, ORT, X.
Propylhexedrine	SK.
Pseudoephedrine hydrochloride	BUR, GAN, UPJ.
Pseudoephedrine sulfate	GAN.
Tetrahydrozoline hydrochloride	PFZ.
Sympathomimetic (Adrenergic) agents, all other	CGY.
*OTHER AUTONOMIC DRUGS:	
GANGLIONIC BLOCKING AGENTS:	
Tetraethylammonium chloride	RSA.
PARASYMPATHOLYTIC QUATERNARY AMMONIUM COMPOUNDS (EXCEPT TROPANE DERIVATIVES):	
Diphemanil methylsulfate	SCH.
Isopropamide iodide	SK.
Mepenzolate bromide	LKL.
Methantheline bromide	SRL.
Pipenzolate bromide	LKL.
Propantheline bromide	SBL.
Tridihexethyl iodide	ACY.
PARASYMPATHOLYTIC TERTIARY AMINES (EXCEPT TROPANE DERIVATIVES):	

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFCATURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*AUTONOMIC DRUGS--Continued	
*OTHER AUTONOMIC DRUGS--Continued	
PARASYMPATHOLYTIC TERTIARY AMINES (EXCEPT TROPANE DERIVATIVES)--Continued	
Adiphenine hydrochloride	CGY.
Cycrimine hydrochloride	LIL.
Dicyclomine hydrochloride	BKC.
Orphenadrine citrate	RIK.
Oxybutynin chloride	X.
Oxyphencyclimine hydrochloride	PFZ.
Piperidolate hydrochloride	LKL.
Thiphenamil hydrochloride	BJL.
Trihexyphenidyl hydrochloride	ACY, SDW.
PARASYMPATHOLYTIC TROPANE DERIVATIVES:	
Anisotropine methylbromide	ARA.
Benztropine mesylate	ARA.
Homatropine hydrobromide	ARA.
Homatropine methylbromide	ARA.
PARASYMPATHOMIMETIC AGENTS:	
Bethanechol chloride	MRK.
Carbachol	MRK.
Neostigmine bromide	HEX, HOF.
Neostigmine methylsulfate	HCF.
Pyridostigmine bromide	HOF.
SYMPATHOLYTIC AGENTS:	
Ergonovine maleate	LIL.
Timolol maleate	MRK.
*CENTRAL DEPRESSANTS AND STIMULANTS:	
*ANALGESICS, ANTIPYRETICS, AND NONHORMONAL ANTI-INFLAMMATORY AGENTS:	
SALICYLIC ACID DERIVATIVES:	
*Aspirin (Acetylsalicylic acid)	DOW, MON, NOR, SDG.
Diflunisal	MRK.
Phenyl salicylate (Salol)	DOW.
Potassium salicylate	HN.
Salicylamide	PEN.
Salicylsalicylic acid	PD.
Sodium salicylate	HN.
OTHER ANALGESICS AND ANTIPYRETICS:	
Acetaminophen	ARA, MAL, MON, NEP, NOR, PEN.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*CENTRAL DEPRESSANTS AND STIMULANTS--Continued	
*ANALGESICS, ANTIPYRETICS, AND NONHORMONAL ANTI-INFLAMMATORY AGENTS--Continued	
*OTHER ANALGESICS AND ANTIPYRETICS--Continued	
Aminobenzoic acid	GAN.
Anileridine hydrochloride	MRK.
Aurothioglucose	SCH.
Ethoheptazine citrate	WYT.
Ibuprofen	X.
Indomethacin	MRK.
Meclofenamic acid, sodium salt	PD.
Mefenamic acid	PD.
Meperidine hydrochloride	PEN, SDW, WYT.
Methadone hydrochloride	LIL, MAL, PEN.
Morphine sulfate	MBK.
Naproxen	ARA.
Oxycodone hydrochloride	EN.
Oxyphenbutazone	CGY.
Phenacetin	MCN.
Phenylbutazone	CGY.
Potassium aminobenzoate	GAN.
Propoxyphene hydrochloride	GAN, RLS.
Sodium aminobenzoate	GAN.
Sulindac	MRK.
*ANTICONVULSANTS, HYPNOTICS, AND SEDATIVES:	
ANTICONVULSANTS (EXCEPT BARBITURATES):	
Ethosuximide	PD.
Ethotoin	ABB.
Methsuximide	PD.
Phensuximide	PD.
Phenytoin, sodium	PD.
Anticonvulsants (Except barbiturates), all other	CGY.
BARBITURATES:	
Amobarbital	GAN, LIL.
Amobarbital, sodium	GAN.
Barbital	GAN.
Barbital, sodium	GAN.
Butabarbital	ABB, GAN.
Butabarbital, sodium	ABB, GAN.
Butalbital	GAN.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*CENTRAL DEPRESSANTS AND STIMULANTS--Continued	
*ANTICONVULSANTS, HYPNOTICS, AND SEDATIVES--Continued	
BARBITURATES--Continued	
Butalbital, sodium	GAN.
Hexobarbital	GAN.
Mephobarbital	SDW.
Methohexital, sodium	LIL.
Pentobarbital	ABB, GAN.
Pentobarbital, sodium	ABB, GAN.
Phenobarbital	GAN.
Phenobarbital, sodium	GAN.
Secobarbital	GAN.
Secobarbital, sodium	GAN.
Talbutal	SDW.
Thiamylal, sodium	PD.
Thiopental, sodium	ABB.
HYPNOTICS AND SEDATIVES (EXCEPT BARBITURATES):	
Carbromal	PD.
Ethchlorvynol	ABB.
Ethinamate	LIL.
Flurazepam hydrochloride	HCF.
Glutethimide	BKL, CGY, GAN.
Methaqualone	X.
Methaqualone hydrochloride	X.
Methyprylon	HOF.
Triclofos, sodium	LKL.
PSYCHOTROPIC AGENTS:	
*ANTIDEPRESSANTS:	
Amitriptyline hydrochloride	MRK, PD.
Desipramine hydrochloride	LKL.
Doxepin hydrochloride	PFZ, SK.
Imipramine hydrochloride	CGY.
Nortriptyline	LIL.
*TRANQUILIZERS:	
PHENOTHIAZINE DERIVATIVES:	
Acetophenazine maleate	SCB.
Chlorpromazine hydrochloride	SK.
Fluphenazine hydrochloride	OMS, SCH.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*CENTRAL DEPRESSANTS AND STIMULANTS--Continued	
PSYCHOTROPIC AGENTS--Continued	
*TRANQUILIZERS--Continued	
PHENOTHIAZINE DERIVATIVES--Continued	
Perphenazine	SCH.
Prochlorperazine edisylate	SK.
Prochlorperazine maleate	SK.
Promazine hydrochloride	WYT.
Promethazine hydrochloride	WYT.
Trifluoperazine hydrochloride	SK.
OTHER TRANQUILIZERS:	
Buclizine hydrochloride	PFZ.
Chlordiazepoxide hydrochlcride	HCF, PD.
Chlormezanone	SDW.
Clorazepate dipotassium	ABB.
Diazepam	HOF.
Ethoxybutamoxane	LIL.
Hydroxyzine hydrochloride	PFZ.
Hydroxyzine pamoate	PFZ.
Meprobamate	BKL.
Molindone hydrochloride	X.
Oxazepam	WYT.
Thiothixene hydrochloride	PFZ.
*OTHEB CENTRAL DEPRESSANTS AND STIMULANTS:	
AMPHETAMINES:	
Amphetamine (Racemic)	ARN, SK.
Amphetamine sulfate (Racemic)	ARN, SK.
Dextroamphetamine	ARN, SK.
Dextroamphetamine sulfate	ARN, SK.
Methamphetamine (Levo)	ARN.
Methamphetamine hydrochloride (Dextro)	ARN.
Amphetamines, all other	ARN.
*ANTITUSSIVES:	
Benzonatate	CGY.
Caramiphen edisylate	SK.
Carbetapentane citrate	PFZ.
Codeine	MRK, PEN.
Dextromethorphan hydrobromide	HOF.
Ethylmorphine hydrochloride	MRK.
Hydrocodone bitartrate	MAL, MRK, PEN.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*CENTRAL DEPRESSANTS AND STIMULANTS--Continued	
*OTHER CENTRAL DEPRESSANTS AND STIMULANTS--Continued	
*ANTITUSSIVES--Continued	
Noscapine	MRK.
Thebaine	MRK, PEN.
GENERAL ANESTHETICS:	
Ketamine hydrochloride	PD.
RESPIRATORY AND CEREBRAL STIMULANTS:	
Benzphetamine hydrochloride	UPJ.
Caffeine, citrated	MAL.
Caffeine, natural	CPR, GNF.
Caffeine, synthetic	PFZ.
Deanol acetamidobenzoate	RIK.
Diethylpropion hydrochloride	BKC, GAN.
Methylphenidate hydrochloride	CGY.
Nikethamide	CGY.
Phendimetrazine tartrate	GAN.
Phentermine	HEX.
*SKELETAL MUSCLE RELAXANTS:	
Carisoprodol	BKL.
Chlorphenesin carbamate	UPJ.
Cyclobenzaprine hydrochloride	MRK.
Methocarbamol	HEX, PEN.
Succinylcholine chloride	ABB, BUR.
Tubocurarine	ABB.
*DERMATOLOGICAL AGENTS AND LOCAL ANESTHETICS:	
DERMATOLOGICAL AGENTS:	
Allantoin	HFT.
Aluminum phenolsulfonate	SAL.
Ammonium phenolsulfonate	SAL.
Bismuth subgallate	MAL, PEN.
Glycol salicylate	RDA.
Podophyllum resin	PEN.
Salicylic acid	DOW.
Sodium phenolsulfonate	SAL.
Zinc phenolsulfonate	MAL, SAL.
LOCAL ANESTHETICS:	
Cocaine	MRK.
Dibucaine	CGY.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*DERMATOLOGICAL AGENTS AND LOCAL ANESTHETICS--Continued	
LOCAL ANESTHETICS--Continued	
Dibucaine hydrochloride	CGY.
Dyclonine hydrochloride	BJL.
Ethyl aminobenzoate (Benzocaine)	PD.
Isobutyl aminobenzoate	RSA.
*Lidocaine (Diethylaminoacetoxylidide)	AST, LEM, RLS, SDW.
Lidocaine hydrochloride	SDW.
Oxethazaine	ARA, WYT.
Phenacaine hydrochloride	SDW.
Pramoxine hydrochloride	ABB.
Procaine hydrochloride	ARA, PFZ.
Proparacaine hydrochloride	OMS.
Tetracaine	SDW.
Tetracaine hydrochloride	SDW.
*EXPECTORANTS AND MUCOLYTIC AGENTS:	
*Ethylenediamine dihydriodide	HFT, MAL, WAG, WHL.
Guaiacol	PEN.
Guaifenesin (Glyceryl guaiacolate)	GAN, HEX, PEN.
Iodinated glycerol	X.
Potassium guaiacolsulfonate	HN.
*HEMATOLOGICAL AGENTS:	
Ammonium heparin	RIK, WIL.
Anisindione	SCH.
Cellulose, oxidized	EKT.
Dextran (Plasma expander)	PHR.
Diphenadione	UPJ.
Lithium heparin	ABB, RIK, WIL.
Potassium warfarin	RSA.
*Sodium heparin	ABB, RIK, SPR, WIL.
Sodium warfarin	PEN.
Warfarin	SDW.
*HORMONES AND SYNTHETIC SUBSTITUTES:	
ANABOLIC AGENTS AND ANDROGENS:	
Fluoxymesterone	UPJ.
Testosterone cypionate	UPJ.
Zeranol	IMC.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*HORMONES AND SYNTHETIC SUBSTITUTES--Continued	
CORTICOSTEROIDS:	
Betamethasone	SCH.
Betamethasone dipropionate	SCH.
Betamethasone sodium phosphate	SCH.
Betamethasone valerate	SCH.
Cortisone	SCH.
Cortisone acetate	UPJ.
Dexamethasone	MRK, SCH.
Dexamethasone sodium phosphate	MRK.
Fludrocortisone acetate	UPJ.
Fluorometholone	UPJ.
9-α-Fluoroprednisolone acetate	UPJ.
Fluprednisolone	UPJ.
Halcinonide	TRD.
Hydrocortisone	UPJ.
Hydrocortisone acetate	UPJ.
Medrysone	UPJ.
Methylprednisolone	UPJ.
Prednisolone	UPJ.
Prednisolone acetate	UPJ.
Prednisone	UPJ.
Triamcinolone	TRD, X.
Triamcinolone acetonide	OMS, TRD.
Triamcinolone diacetate	TRD.
ESTROGENS AND PROGESTOGENS:	
ESTROGENS:	
Chlorotrianisene	BKC.
Diethylstilbestrol	DLI.
Diethylstilbestrol diphosphate	ARA.
Estradiol cypionate	UPJ.
Estrogenic substances, conjugated	ORG.
Natural estrogenic substance	ORG.
PROGESTOGENS:	
Dinoprostone	X.
Hydroxyprogesterone caproate	UPJ.
Medroxyprogesterone acetate	UPJ.
Megestrol acetate	UPJ.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*HORMONES AND SYNTHETIC SUBSTITUTES--Continued	
ESTROGENS AND PROGESTOGENS--Continued	
PROGESTOGENS--Continued	
Melengestrol acetate	UPJ.
Norethindrone acetate	PD.
Norgestrel	WYT.
Progesterone	UPJ.
*SYNTHETIC HYPOGLYCEMIC AGENTS:	
Acetohexamide	LIL.
Chlorpropamide	PFZ.
Phenformin hydrochloride	CGY.
Tolazamide	UPJ.
Tolbutamide	UPJ.
THYROID HORMONE AND ANTITHYROID AGENTS:	
Methimazole	LIL.
Propylthiouracil	ARA.
2-Thiouracil	ACY.
Thyroglobulin	NEP.
Thyroid	LIL.
OTHER HORMONES AND SYNTHETIC SUBSTITUTES:	
Corticotropin	ARP, ORG.
Danazol (Pituitary)	SDW.
Epinephrine bitartrate	SDW.
Glucagon	LIL.
Insulin	ARP, LIL.
Thyroxine (Levo), sodium (Thyroid hormone)	BAX.
*RENAL-ACTING AND EDEMA-REDUCING AGENTS:	
BENZOTHIADIAZINE DERIVATIVES:	
Benzthiazide	PFZ.
Chlorothiazide	MRK.
Hydrochlorothiazide	ABB, CGY, MRK.
Hydroflumethiazide	X.
Methyclothiazide	ABB.
Polythiazide	PFZ.
Trichlormethiazide	SCH.
*THEOBROMINE AND THEOPHYLLINE DERIVATIVES:	
Aminophylline	GAN.
Oxtriphylline	NEP.
Theophylline sodium glycinate	CHT.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*RENAL-ACTING AND EDEMA-REDUCING AGENTS--Continued	
OTHER RENAL-ACTING AND EDEMA-REDUCING AGENTS:	
Acetazolamide	ACY.
Amiloride	MRK.
Dichlorphenamide	MRK.
Ethacrynic acid	MRK.
Probenecid	MRK.
Spironolactone	SRL.
Triamterene	ACY, SK.
*VITAMINS:	
VITAMIN A:	
β-Carotene (Provitamin A)	HOF.
Tretinoin (Vitamin A acid)	EK, HOF.
Vitamin A acetate (Animal feed grade)	HOF.
Vitamin A acetate (Medicinal grade)	HOF.
Vitamin A alcohol	EK, HOF.
Vitamin A palmitate (Animal feed grade)	HOF.
Vitamin A palmitate (Medicinal grade)	HOF.
Vitamin A propionate (Animal feed grade)	HOF.
VITAMIN B-COMPLEX:	
NICOTINIC ACID AND DERIVATIVES:	
Niacin (Nicotinic acid) (Animal feed grade)	MRK, NEP, RIL.
Niacin (Nicotinic acid) (Medicinal grade)	MRK, RIL.
Niacinamide (Nicotinamide)	MRK, NEP, RIL.
PANTOTHENIC ACID AND DERIVATIVES:	
Calcium pantothenate (Racemic) (Animal feed grade)	HFT.
Calcium pantothenate (Racemic) (Medicinal grade)	HFT.
Calcium pantothenate (Racemic) - calcium chloride complex (Animal feed grade)	HFT.
Dexpanthenol	HOF.
Panthenol (Racemic)	HOF, PD.
Sodium pantothenate	PD.
OTHER B-COMPLEX VITAMINS:	
Biotin	HOF.
Cyanocobalamin (Animal feed grade)	MRK.
Cyanocobalamin (Medicinal grade)	MRK.
Cyanocobalamin (U.S.P. Crystalline)	MRK.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*VITAMINS--Continued	
VITAMIN B-COMPLEX--Continued	
OTHER B-COMPLEX VITAMINS--Continued	
Inositol	STA.
Pyridoxine	HOF.
Riboflavin (Medicinal grade)	HOF, MRK.
Riboflavin (Feed grade)	HOF, MRK.
Riboflavin-5-phosphate, sodium	HCF.
Thiamine hydrochloride	HOF.
Thiamine mononitrate	HOF.
VITAMIN C:	
Ascorbic acid	HOF, PFZ.
Calcium ascorbate	PFZ.
Sodium ascorbate	HOF, PFZ.
*VITAMIN D:	
Cholecalciferol (Vitamin D_3)	DA, TMH, VTM.
*VITAMIN E:	
d-α Tocopherol	EKT, GNM.
dl-α Tocopherol	HOF.
d-α Tocopheryl acetate	EKT, GNM.
dl-α Tocopheryl acetate (Feed grade)	DA, GNM, HCF.
dl-α Tocopheryl acetate (Medicinal grade)	GNM, HOF.
d-α Tocopheryl acid succinate	EKT, GNM.
VITAMIN K:	
Menadione sodium bisulfite	ABB, HET, HFT.
Phytonadione	MRK.
OTHER MEDICINAL CHEMICALS:	
ANTINEOPLASTIC AGENTS:	
Azathioprine	BUR.
6-Azauridine	PD.
Calusterone	UPJ.
Cytarabine	UPJ.
Mercaptopurine	BUR.
Methotrexate	PFN.
Streptozocin	PFN, UPJ.
Vinblastine sulfate	LIL.
Vincristine sulfate	LIL.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
OTHER MEDICINAL CHEMICALS--Continued	
CARDIOVASCULAR AGENTS:	
ANTIHYPERTENSIVE AGENTS:	
Diazoxide	SCH.
Guanethidine sulfate	CGY.
Hydralazine hydrochloride	CGY.
Methyldopa	MRK.
Prazosin hydrochloride	PFZ.
Rauwolfia serpentina	PEN.
Reserpine	PEN.
BIOFLAVONOIDS:	
Hesperidin	SKG.
Lemon bioflavonoid complex	SKG.
Naringin	SKG.
VASODILATORS:	
Amyl nitrite	MAL.
Dioxyline phosphate	LIL.
Nicotinyl alcohol tartrate	HOF.
OTHER CARDIOVASCULAR AGENTS:	
Disopyramide	SRL.
Procainamide hydrochloride	OMS, PD.
DIAGNOSTIC AGENTS:	
ROENTGENOGRAPHIC CONTRAST MEDIA:	
Diatrizoate, meglumine	SDW.
Diatrizoate, sodium	SDW.
Iodipamide, meglumine	OMS.
Iodipamide, sodium	OMS.
Iodohippurate, sodium	OMS.
Iopanoic acid	SDW.
Iothalamate, meglumine	MAL.
Iothalamate, sodium	MAL.
Iothalamic acid	MAL.
Methiodal, sodium	SDW.
Tyropanoate, sodium	SDW.
Roentgenographic contrast media, all other	OMS.
OTHER DIAGNOSTIC AGENTS:	
Betazole hydrochloride (Gastric secretion indicator)	LIL.
Indocyanine Green (Cardiac cutput test)	EK.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTUER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*OTHER MEDICINAL CHEMICALS--Continued	
DIAGNOSTIC AGENTS--Continued	
OTHER DIAGNOSTIC AGENTS--Continued	
Inulin (Kidney function test)	PFN.
Metyrapone (Pituitary function test)	CGY.
Phenolsulfonphthalein (Kidney function test)	HYN.
Xylose (Intestinal malabsorption test)	PFN.
GASTROINTESTINAL AGENTS AND THERAPEUTIC NUTRIENTS:	
GASTROINTESTINAL AGENTS:	
*CHOLINE CHLORIDE (ALL GRADES):	
Choline chloride (Animal feed grade)	DA, DOW, HFT, IMC, TMH.
Choline chloride (Medicinal grade)	HFT.
OTHER GASTROINTESTINAL AGENTS:	
Apomorphine hydrochloride	MRK.
Betaine base	HFT.
Betaine hydrochloride	HFT.
Bile acids, oxidized	SRL, WIL.
Bisacodyl	PD.
Choline bicarbonate	IMC.
Choline bitartrate	HFT.
Choline citrate (Tricholine citrate)	HFT.
Choline dihydrogen citrate	HFT.
Colestipol hydrochloride	X.
Dehydrocholic acid	WIL.
Dextrothyroxine, sodium	BAX.
Florantyrone	SRL.
Iron bile salts	LIL, WIL.
Magnesium citrate	MAL.
Methionine, hydroxy analogue, calcium salt	DUP, MON.
Ox bile extract	ABB, WIL.
Pectin	SKG.
Phenolphthalein	SCH.
Sitosterols	UPJ.
Sodium dehydrocholate	WIL.
Sodium tartrate	MAL.
THERAPEUTIC NUTRIENTS:	
AMINO ACIDS AND SALTS:	
Amino acid mixtures	BRS, CHT, MDJ.
Glutamic acid	LEM.

TABLE 2.--MEDICINAL CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

MEDICINAL CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*OTHER MEDICINAL CHEMICALS--Continued	
GASTROINTESTINAL AGENTS AND THERAPEUTIC NUTRIENTS--Con.	
THERAPEUTIC NUTRIENTS--Continued	
AMINO ACIDS AND SALTS--Continued	
Glutamic acid hydrochloride	LEM.
Potassium glutamate	LEM.
Tyrosine	BRS, MDJ.
OTHER THERAPEUTIC NUTRIENTS:	
Calcium gluceptate	PFN.
Calcium glucoheptonate	PFN.
Copper gluconate	PFZ.
Ferrous gluconate	PFZ, SDW.
Magnesium gluconate	PFZ.
Manganese gluconate	PFZ.
Potassium gluconate	PFZ.
Toldimfos, sodium	RSA.
Zinc glucoheptonate	PFN.
Zinc gluconate	PFZ.
SMOOTH MUSCLE RELAXANTS:	
Alverine citrate	ARA.
Alverine hydrochloride	ARA.
Flavoxate hydrochloride	SK.
Papaverine hydrochloride	LIL.
UNCLASSIFIED MEDICINAL CHEMICALS:	
Allopurinol	BUR.
Carbidopa	MRK.
Dopamine hydrochloride	SDW.
Ethoxzolamide (Carbonic anhydrase inhibitor)	ARA.

TABLE 3.--MEDICINAL CHEMICALS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of medicinal chemicals to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ABB	Abbott Laboratories	MAL	Mallinckrodt Chemical Works
ACY	American Cyanamid Co.	MDJ	Mead Johnson & Co.
ADC	Anderson Development Co.	MLS	Miles Laboratories, Inc. Sumner Div.
ARA	Arapahoe Chemicals, Inc. Sub/Syntex Corp., (U.S.A.)	MON	Monsanto Co.
ARN	Arenol Chemical Corp.	MRK	Merck & Co., Inc.
ARP	Armour Pharmaceutical Co.	NEP	Nepera Chemical Co., Inc.
ARS	Arsynco, Inc.	NOR	Morton-Norwich Products, Inc., Norwich Eaton Pharmaceutical Div.
ASH	Ashland Oil, Inc., Ashland Chemical Co.	NTL	NL Industries, Inc.
AST	Astra Pharmaceutical Products, Inc.	OMS	E.R. Squibb & Sons, Inc.
BAX	Baxter/Travenol Laboratories, Inc.	OPC	Orbis Products Corp.
BEE	Beecham, Inc.	ORG	Organics, Inc.
BJL	Burdick & Jackson Laboratories, Inc.	ORT	Roehr Chemicals, Inc.
BKC	J.T. Baker Chemical Co.	PD	Parke, Davis & Co. Sub of Warner-Lambert Co.
BKL	Kewanee Industries, Inc., Millmaster Chemical Co. Div.	PEN	CPC International, Inc., Penick Corp.
BOC	Biocraft Laboratories, Inc.	PFN	Pfanstiehl Laboratories, Inc.
BRS	Bristol-Myers Co.	PFZ	Pfizer, Inc. and Pfizer Pharmaceuticals, Inc.
BUR	Burroughs-Wellcome Co.	PHR	Pharmachem Corp.
CGY	Ciba-Geigy Corp. and Ciba Pharmaceutical Co.	RDA	Rhodia, Inc.
CHT	Chattem Drug & Chemical Co.	RIK	Riker Laboratories, Inc. Sub. of 3M Co.
CPR	Certified Processing Corp.	RIL	Reilly Tar & Chemical Corp.
DA	Diamond Shamrock Corp.	RLS	Rachelle Laboratories, Inc.
DLI	Dawe's Laboratories, Inc.	RSA	R.S.A. Corp.
DOW	Dow Chemical Co.	SAL	Salsbury Laboratories
DUP	E.I. duPont de Nemours & Co., Inc.	SCH	Schering Corp.
EK	Eastman Kodak Co.:		Sterling Drug Corp.:
EKT	Tennessee Eastman Co. Div.	SDG	Glenbrook Laboratories Div.
EN	Endo Laboratories, Inc.	SDW	Winthrop Laboratories Div.
FIN	Hexcel Corp., Hexcel Specialty Chemicals	SFS	Stauffer Chemical Co., Specialty Div.
FLM	Fleming Laboratories, Inc.	SHC	Shell Oil Co., Shell Chemical Co. Div.
GAF	GAF Corp.	SK	SmithKline Chemicals
GAN	Gane's Chemical Inc.	SKG	Sunkist Growers, Inc.
GIV	Givaudan Corp.	SPR	Scientific Protein Laboratories, Inc.
GNF	General Foods Corp., Maxwell House Div.	SRL	G.D. Searle & Co.
GNM	General Mills Chemicals, Inc.	STA	A.E. Staley Manufacturing Co.
HET	Heterochemical Corp.	TMH	Thompson-Hayward Chemical Co.
HEX	Hexagon Laboratories, Inc.	TNA	Ethyl Corp.
HFT	Syntex Agribusiness, Inc.	TRD	Manufacturing Enterprises, Inc., Squibb Manufacturing Inc., Trade Enterprises, Inc., Ersana, Inc.
HN	Tenneco Chemicals, Inc.	UPJ	Upjohn Co.
HOF	Hoffmann-LaRoche, Inc.	VTM	Vitamins, Inc.
HYN	Hynson, Westcott & Dunning, Inc.	WAG	West Agro-Chemicals, Inc.
IMC	IMC Chemical Group, Inc.	WHL	Whitmoyer Laboratories, Inc.
JCC	Jefferson Chemical Co., Inc.	WIL	Inolex Corp., Inolex Pharmaceutical Div.
KPT	Koppers Co., Inc.	WTL	Pennwalt Corp., Lucidol Div.
LEM	Napp Chemicals, Inc.	WYT	Wyeth Laboratories, Inc., Wyeth Laboratories Div. of American Home Products Corp.
LIL	Eli Lilly & Co.		
LKL	Richardson-Merrell, Inc., Merrell-National Laboratories Div.		

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

The Flavor and Perfume Chemical Industry - an Overview

Anne Klein

The flavor and perfume[1] chemicals considered here are important as raw materials in the production of food flavors, perfumery, cosmetics, and toiletries. Important flavor and perfume products not included here are flavor and perfume oil blends, and "synthetic essential oils" which are artificial mixtures.

U.S. production, sales, and consumption

Production of flavor and perfume chemicals in the United States in 1977 continued its significant annual rate of growth begun the previous year as it recovered from the depressed level of 1975. Production by domestic firms increased to 150.4 million pounds, valued at an estimated $290.3 million,[2] an increase over 1976 of 16.8 percent and 28.1 percent, respectively.

In 1977, acyclic compounds constituted 61.2 percent of total output of flavor and perfume chemicals, benzenoid cyclic, 30.9 percent, and other cyclic, 7.9 percent.[3] Based on value of sales the top ranking single chemical in 1977, as in 1976 and 1975, was monosodium glutamate (MSG). Following MSG in value of sales were vanillin, saccharin, anethole, methyl salicylate, and coumarin. The aggregate value of shipments of these chemicals amounted to $84.3 million or 40.7 percent of the total.

MSG is the leading flavor enhancer. Vanillin is one of the most widely used chemicals, both in perfume formulations and in flavors. Saccharin remains the only artificial sweetener whose use is permitted in the United States. P-propenylanisole (anethole) is extensively used in low-cost fragrances, particularly in soap and household products, and in flavor compositions for chewing gums and anisette-type alcoholic beverages. Methyl salicylate has long had diverse large volume uses varying from an industrial masking odor to a popular chemical flavoring agent for candy and soft drinks. Coumarin has long been extensively used in perfumery and as a masking agent.

U.S. apparent consumption[4] of flavor and aroma chemicals in 1977 increased by 22.9 percent over the level in 1976 to about 159 million pounds. MSG consumption, which rose, slightly, accounted again in 1977, as in 1976, for a significant share of the total consumption of all flavor and perfume chemicals. The following factors suggest that the rise in demand for flavor and aroma chemicals will continue, although slower than the rise from 1976 to 1977.

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[1] Also known as aroma chemicals; the terms "perfume," "fragrance," and "aroma" are used interchangeably here.

[2] The value of production is estimated by applying the unit value of sales to quantity of production.

[3] The benzenoid, other cyclic, and acyclic breakdowns of the flavor and aroma chemicals tables accommodate tariff classification requirements rather than industry practices.

[4] Apparent consumption is estimated here by adding U.S. imports to and subtracting U.S. exports from U.S. production.

°Observable changing tastes among both men and women purchasers of toiletries, according to an industry periodical,[1] may have important and differing implications for sales of toiletries in the next several years. These changing tastes may have secondary implications for aroma chemicals as raw materials for these products. There is an expected growth of demand, the industry believes, in the so-called "treatment cosmetics," for women, or products that cleanse and moisturize the skin. On the other hand, significant growth of demand is not expected for fragrances for women, which are believed to have reached a plateau. The industry believes, however, that the demand for men's toiletries, particularly fragrances, is rapidly rising. According to an industry educational group,[2] retail sales of men's fragrances in 1976 amounted to $650 million and in 1977 exceeded $800 million. The group believes that the accelerated growth of demand for men's fragrances which began in 1976, will reach 10 to 12 percent annually through 1983.

°There continues to be, particularly in perfume bases, a public acceptance of the substitution of aroma chemicals for natural oils which are subject to high prices and/or supply problems. This acceptance would tend to enhance consumption of synthetic aroma chemicals considered here.

°U.S. disposable personal incomes in terms of constant 1972 dollars increased by about 25 percent during the 1970-77 period.[3] This pattern will probably continue through the 1978-83 period. Increased disposable income for individuals and families tends to increase their consumption of prepared food, cosmetics, and toilet preparations--products in which flavor and aroma chemicals are raw materials.

International trade

Because of the traditionally international orientation of the flavor and aroma chemical industry and the relatively low freight costs for the products, foreign trade is relatively important for flavor and fragrance chemicals. In 1977, imports, for example, represented about 25.8 percent of U.S. apparent consumption while exports amounted to 20.5 percent of U.S. production.

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[1] Chemical Marketing Reporter, June 26, 1978.
[2] The Fragrance Foundation of New York, NY.
[3] Based on official statistics of the Bureau of Economic Analysis, U.S. Department of Commerce.

Imports.--Imports of all natural and synthetic flavor and aroma chemicals in 1977 amounted to 34.6 million pounds, valued at $81.6 million--32 percent in terms of quantity and 24 percent in terms of value over the 1976 level. Imports of monosodium glutamate, principally from Korea, Japan, and Taiwan, alone amounted to 18 million pounds, valued at $9.6 million.

Other flavor and aroma chemicals imported during 1977 in significant quantities were vanillin, saccharin, and menthol. These items came principally from Canada, Japan, and Brazil.

In 1977, the sole domestic producer of saccharin filed a complaint that imports of saccharin from Japan and the Republic of Korea were allegedly being dumped in the United States and causing injury to the U.S. saccharin industry. In December 1977, the U.S. International Trade Commission reported its negative findings in this case to the Secretary of the Treasury in connection with Investigation Nos. AA-1921-174 and 175.

Exports.--Exports amounted to 26 million pounds valued at $52 million, a slight increase over 1976 both in terms of quantity and value. The negative trade balance observed for most years during 1970-76 was again observed in 1977. The ratio of exports to imports was 74.2 percent in 1977, showing a further steep decline of this ratio when compared with the 1976 level of 96.7 percent. There has been no evidence that the multinational orientation of the principal firms of this industry will change in the next several years. These firms typically tend to import aroma chemicals from their foreign affiliates rather than initiate production in the United States when it is mere cost-efficient to do so. One can thus anticipate a continuation of this negative balance of trade into the early 1980's for the flavor and aroma chemical industry.

The industry

The traditionally international orientation of the flavor and aroma chemical industry will probably continue. Of all companies reporting sales of aroma chemicals to the Commission in 1977, those companies having affiliates in one to four foreign countries accounted for about 42 percent of the total sales value of these products and were represented among the top members of the flavor and aroma chemical industry when ranked by sales values. During early 1978, Haarman and Reimer of West Germany, which maintains operations in 13 countries, and whose total sales annually exceed $130 million, has opened a new production facility in Bushy Park, S.C., for the manufacture of synthetic menthol.

The concentration profile of producers of flavor and perfume chemicals changed to a small extent in 1977 from that observed in 1976. In 1977, the four largest companies in terms of value of sales together accounted for 43 percent of total sales value compared with 49 percent in 1976. In 1977, 14 companies accounted for almost 75 percent of total sales value; in 1976, that share was accounted for by 9 companies.

Regulation--an update

The flavor and perfume chemicals included here are widely used in food products or in cosmetics and toiletries. The regulation of these chemicals continues to be more important when an ingredient is used in foods than in cosmetics. Labeling requirements by the FDA, begun in 1976, have been in place since the beginning of 1977. These Federal regulations require that cosmetic containers must include on their labels, in addition to the name and address of the manufacturer, packer, or distributor, and net quantity of contents, a list of ingredients in descending order of predominance. Fragrance and flavor ingredients may be listed as such.

The flavor enhancer monosodium glutamate, which early in the decade (1970) had been removed by the Food and Drug Administration (FDA) from baby foods but not from its Generally Regarded as Safe (GRAS) list, has been produced and consumed during the decade in increasing quantities. Consumption of MSG in the United States, is estimated to have reached 56 million pounds in 1977. The industry estimates that demand for MSG in 1978 amounted to nearly 60 million pounds.[1]

During 1978 it became mandatory for stores selling products containing saccharin to display a poster warning of health hazards inherent in using saccharin-containing products, as required by the FDA.

The Cosmetic, Toiletry, and Fragrance Association, a trade association comprised of more than 90 members, has expanded work in 1977 on its intra-industry Cosmetic Ingredient Review which would review the safety of some 2700 ingredients in products which are applied to the eyes or to the skin. The industry believes that initiatives on its part will probably tend to retard any government regulation initiatives in this area during the next few years.

Regulation has traditionally been minimal in the home markets of our principal trading partners. Actions by governments increasing regulation have been rare. In Canada, cosmetic containers are subject to labeling requirements of the Consumers' Packaging and Labelling Act and Regulations. This probably has negligible affect on U.S. trade with Canada which produces 96 percent of all cosmetic products consumed by Canadians. In Japan, cosmetics, along with drugs, "quasidrugs" and medical devices are controlled with respect to sale, labeling, and advertisement by the Pharmaceutical Affairs Law of Japan. In West Germany as in other countries of the European Community a Cosmetic Directive is in effect which contains a list of "generally prohibited substances" and a list of substances allowed but to a restricted extent. These 35 or 40 agents are generally regarded, in most countries including the United States, as poisonous or damaging to health.

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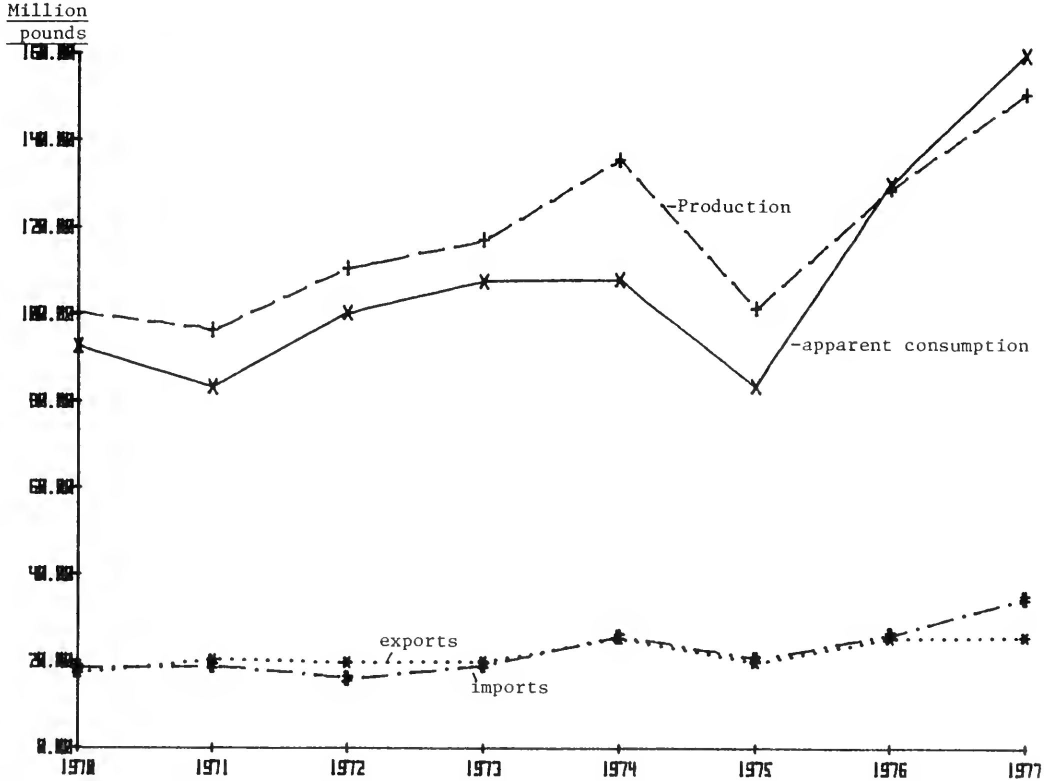
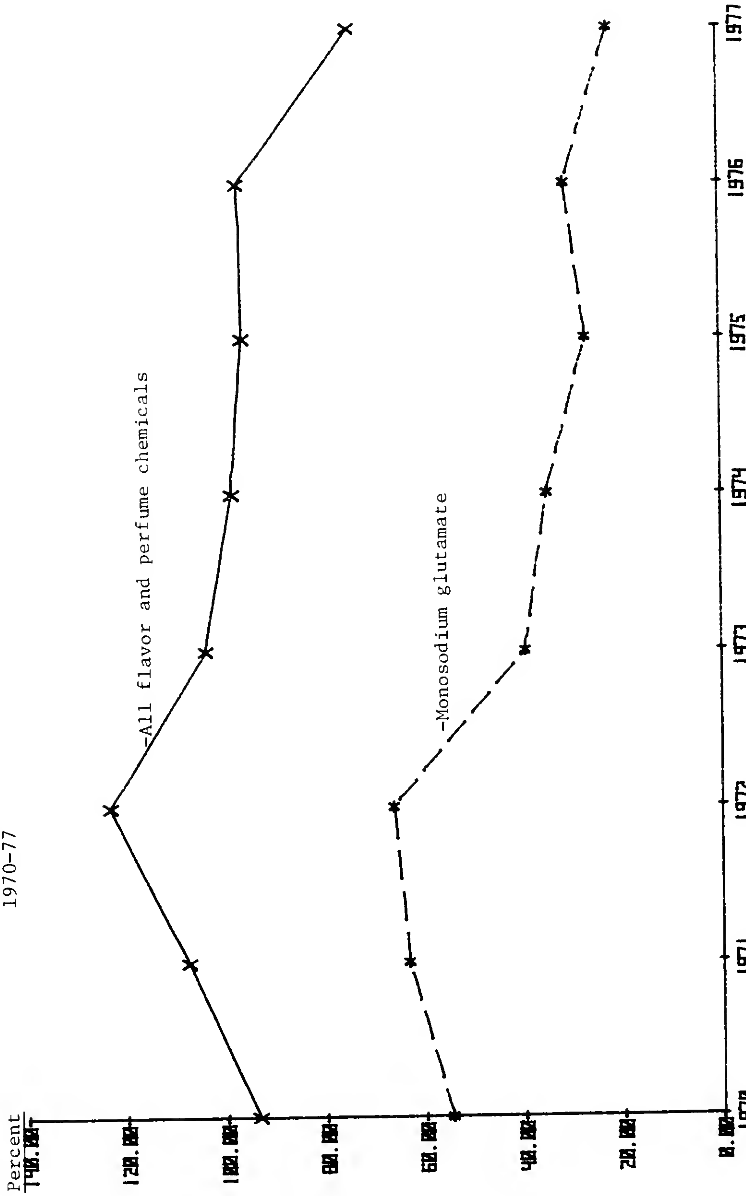
[1] Chemical Marketing Reporter, July 31, 1978.

Flavor and perfume chemicals: U.S. production, imports, exports, and apparent consumption, 1970-77



Source: Production, compiled from official statistics of the U.S. International Trade Commission; imports and exports, compiled from official statistics of the U.S. Department of Commerce.

Flavor and perfume chemicals and monosodium
glutamate: U.S. balance of trade as a ratio
of quantity of exports to quantity of imports,
1970-77



Source: Compiled from official statistics of the U.S. Department of Commerce.

FLAVOR AND PERFUME MATERIALS

Anne Klein

Flavor and perfume materials are organic chemicals used to impart flavors and aromas to foods, beverages, cosmetics, and soaps. These aroma chemicals are also utilized to neutralize or mask unpleasant odors in industrial processes and products as well as in consumer products.

Total domestic production of flavor and perfume materials in 1977 amounted to 150.4 million pounds (table 1). Sales of these materials in 1977 amounted to 107.6 million pounds, valued at $207.1 million, compared with 110.9 million pounds, valued at $195.3 million, in 1976. These totals do not include benzyl alcohol, which, before 1973, was included in flavor and perfume materials but is now shown in the miscellaneous cyclic section of this series. U.S. production of flavor and perfume materials in 1977 increased 16.8 percent from the level in 1976 but the quantity of sales decreased slightly, by 3 percent.

Production of cyclic flavor and perfume materials in 1977 amounted to 58.5 million pounds; sales amounted to 46.8 million pounds, valued at $134.6 million. Individual publishable chemicals in the cyclic group produced in the greatest volume in 1977 were α-terpineol, anethole, cinnamaldehyde, benzyl acetate, and isopentyl salicylate.

U.S. output of acylic flavor and perfume materials in 1977 amounted to 92.0 million pounds; sales of these materials amounted to 60.8 million pounds, valued at $72.5 million. Monosodium glutamate was by far the most important of the acyclic chemicals in 1976, although the data are not publishable. Other important acyclic compounds included linalyl alcohol, citronellol, and hydroxycitronellal.

TABLE 1.--FLAVOR AND PERFUME MATERIALS: U.S. PRODUCTION AND SALES, 1977

[Listed below are all synthetic organic flavor and perfume materials for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists separately all flavor and perfume materials for which data on production and/or sales were reported and identifies the manufacturers of each]

FLAVOR AND PERFUME MATERIALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	150,416	107,565	207,101	$1.93
CYCLIC				
Total	58,452	46,809	134,628	2.88
Benzenoid and Naphthalenoid				
Total	46,491	37,970	106,617	2.81
4-Allyl-2-methoxyphenol (Eugenol)	299	277	1,188	4.30
4-Allyl-2-methoxyphenol acetate	4	7	34	5.02
Anisyl acetate	...	4	27	6.31
Benzophenone[2]	973	569	1,112	1.95
Benzyl acetate	1,542	1,396	1,370	.98
Benzyl benzoate	...	725	643	.89
Benzyl propionate	28	26	45	1.71
Cinnamaldehyde	2,010	1,219	1,634	1.34
Cinnamyl acetate	32	14	70	4.92
Cinnamyl anthranilate	...	1	20	18.85
Cinnamyl propionate	...	3	16	6.17
2-Ethylhexyl salicylate	...	69	130	1.87
Isobutyl phenylacetate	...	23	55	2.39
Isobutyl salicylate	...	10	19	1.83
Isopentyl salicylate	1,052	796	958	1.20
4'-Methoxyacetophenone	22	...	...	...
2-Methoxy-4-propenylphenol (Isoeugenol)	127	130	896	6.89
p-Methylanisole	23	25	50	2.01
Methyl anthranilate	...	223	401	1.80
α-Methylcinnamaldehyde	...	7	16	2.33
Methyl phenylacetate	28	...	...	...
2-Phenethyl phenylacetate	30	15	70	4.73
Phenethyl propionate	22	...	...	...
3-Phenyl-1-propanol (Hydrocinnamic alcohol)	52	...	...	...
3-Phenylpropyl acetate	7	...	...	...
p-Propenylanisole (Anethole)	2,423	2,310	8,603	3.72
p-Tolyaldehyde	28	...	...	...
All other benzenoid and naphthalenoid materials	37,789	30,121	89,260	2.96
Terpenoid, heterocyclic, and Alicyclic				
Total	11,961	8,839	28,011	3.17
Cedrol	35	30	196	6.46
Cedryl acetate	320	172	728	4.24
Dihyrdonordicylcopentadienyl acetate	87	53	72	1.36
Dihyrdonordicyclopentadienyl propionate (Cyclaprop)	...	89	130	1.46
Dihydroterpinyl acetate	136	78	144	1.83
Guaiacwood acetate	...	45	199	4.47
α-Ionone	72	59	494	8.41
Ionone (α- and β-)	27	22	131	6.05
Isobornyl propionate	...	3	8	2.56
α-Methylionone	22	...	...	...
Methylionone (α- and β-)	628	444	2,482	5.59
α-Terpineol	2,570	2,393	1,161	.49
α-Terpinyl acetate	1,004	899	903	1.00
Vetivenyl acetate	37	...	...	...
All other terpenoid, heterocyclic, and alicyclic materials	7,023	4,552	21,363	4.69

See footnotes at end of table.

TABLE 1.--FLAVOR AND PERFUME MATERIALS: U.S. PRODUCTION AND SALES, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
ACYCLIC	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Total	91,964	60,756	72,473	$1.19
Allyl heptanoate	2	2	10	4.37
Butyl butyryl lactate	45	44	192	4.33
Butyl undecylenate	23	...	...	...
Citral dimethyl acetal	39	...	...	...
Citronellyl acetate	53	28	103	3.64
Citronellyl formate	21	18	89	5.05
Citronellyl isobutyrate	7	...	...	...
Citronellyl propionate	5	2	12	4.89
3,7-Dimethyl-cis-2,6-octadien-1-ol (Nerol)	...	320	293	.92
3,7-Dimethyl-trans-2,6-octadiene-1-ol (Geraniol)	...	1,783	4,553	2.55
3,7-Dimethyl-cis-2,6-octadien-1-ol acetate (Neryl acetate)	10	...	...	...
3,7-Dimethyl-1,6-octadien-3-ol (Linalool; Linalyl alcohol)	3,273	2,703	5,139	1.90
3,7-Dimethyl-1,6-octadien-3-ol acetate (Linalyl acetate)	910	942	2,546	2.70
3,7-Dimethyl-6-octen-1-al (Citronellal)	1,013	...	...	...
3,7-Dimethyl-6-octen-1-ol (Citronellol)	2,508	1,337	3,690	2.76
Ethyl heptanoate	5	6	17	2.90
Ethyl hexanoate (Ethyl caproate)	14	8	23	2.86
Ethyl isovalerate	12	...	...	...
Ethyl myristate	20	...	...	...
Ethyl propionate	...	124	155	1.26
Geranyl acetate	...	95	331	3.47
Geranyl butyrate	5	...	...	...
Geranyl formate	18	18	88	4.93
Geranyl propionate	...	1	7	7.35
2-Hexanal	3	1	21	20.45
7-Hydroxy-3,7-dimethyl-1-octanal (Hydroxycitronellal)	1,690	623	3,889	6.24
Isopentyl butyrate	129	106	152	1.43
Isopentyl formate	7	7	17	2.45
Isopentyl isovalerate	25	...	...	...
Rhodinol	13	...	...	...
All other acyclic materials	82,114	52,588	51,146	.97

[1] Calculated from the unrounded figures.
[2] Includes significant quantities having other end uses.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURES' INDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS INDENTIFICATION WITH THE DESIGNATED PRODUCT]

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CYCLIC	
BENZENOID AND NAPHTHALENOID:	
Acetaldehyde, diphenethyl acetal (Phenylethyl acetal)	GIV.
2'-Acetonaphthone (β-Methyl naphthyl ketone)	GIV.
1-Acetoxy-2-sec-butyl-1-ethenylcyclohexane	GIV.
p-Allylanisole	GIV, SCM, X.
Allyl anthranilate	RT.
4-Allyl-1,2-dimethoxybenzene (4-Allylveratrole)	CI, FB, GIV, UOP.
*4-Allyl-2-methoxyphenol (Eugenol)	CI, FB, GIV, IFF, NEO, PEN, UNG.
*4-Allyl-2-methoxyphenol acetate (Eugenol acetate)	CI, ELN, GIV, UNG.
4-Allyl-1,2-(methylenedioxy)-benzene (Safrole)	FB, GIV.
Allyl phenoxyacetate	GIV.
α-Amyl cinnamic aldehyde	IFF.
tert-Amyl cymene	PFW.
p-Anisaldehyde	OPC, SW, UOP.
Anisole (Methoxybenzene) (Methyl phenyl ether)	OPC.
*Anisyl acetate	ELN, GIV, OPC, UOP.
Anisyl butyrate	RT.
Anisyl caproate	RT.
Aurangeol (Hydroxycitronellidene methyl anthranilate	FB.
Benzaldehyde glyceryl acetal	GIV.
*Benzophenone	CWN, GAF, NEO, PD, UOP.
*Benzyl acetate	FB, GIV, MCN, OPC, UOP.
*Benzyl benzoate	MON, PFZ, UOP, VEL.
Benzyl butyrate	ELN, FB, GIV.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
BENZENOID AND NAPHTHALENOID--Continued	
Benzyl cinnamate	FB.
Benzyl ether	FB, UOP, VEL.
Benzyl formate	GIV.
Benzyl glyceryl acetal	CI.
Benzyl isobutyrate	ELN, GIV.
Benzyl isopentyl ether	GIV.
Benzyl isovalerate	ELN.
Benzyl laurate	GIV.
1-(Benzyloxy)-2-methoxy-4-propenylbenzene (Benzyl isoeugenyl ether)	ELN, GIV.
Benzyl phenylacetate	ELN, GIV.
* Benzyl propionate	ELN, FB, GIV, OPC.
Benzyl salicylate	FB, GIV, MON, UOP.
4-tert-Butyl-2',6'-dimethyl-3',5'-dinitroacetophenone (Musk ketone)	GIV.
6-tert-Butyl-3-methyl-2,4-dinitroanisole (Musk ambrette)	GIV.
p-tert-Butyl-α-methylhydrocinnamalehyde	GIV, UOP.
Butyl phenyl acetate	GIV.
1-tert-Butyl-3,4,5-trimethyl-2,6-dinitrobenzene (Musk tibetene)	GIV, UOP.
5-tert-Butyl-2,4,6-trinitro-m-xylene (Musk xylol)	GIV.
Carvacrol	GIV.
*Cinnamaldehyde	CI, FB, UOP.
Cinnamic aldehyde dimethyl acetal	IFF.
*Cinnamyl acetate	ELN, FB, GIV.
Cinnamyl alcohol	FB, UOP.
*Cinnamyl anthranilate	FEL, GIV, RT.
Cinnamyl butyrate	FB.
Cinnamyl cinnamate	FB.
*Cinnamyl propionate	ELN, FB, GIV.
Cinnamyl tiglate	FB.
Coumarin	RDA.
Cuminyl acetate	IFF.
Cuminyl alcohol	GIV, IFF.
Cuminyl formate	IFF.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
BENZENOID AND NAPHTHALENOID--Continued	
trans-Decahydro-β-naphthol	IFF.
2-4-Dibromo-6-nitro-m-cresyl methyl ether	GIV.
3,4-Dimethoxybenzaldehyde (Veratraldehyde)	GIV, SDH, SLV.
1,2-Dimethoxy-4-propenylbenzene (4-Propenylveratrole)	FB, GIV.
3,7-Dimethyl-2,6-octadienyl phenylacetate (Geranyl phenylacetate)	GIV.
α,α-Dimethylphenethyl acetate	IFF.
α,α-Dimethylphenethyl alcohol	IFF.
α-α-Dimethylphenethyl butyrate	IFF.
Dimethyl phenylethyl carbinol	IFF.
Dimethyl phenylethyl carbinyl acetate	IFF.
Diphenylmethane (Benzylbenzene)	UOP.
1,3-Diphenyl-2-propanone (Dibenzylketone)	GIV.
p-Ethoxybenzaldehyde	GIV.
2-Ethoxynaphthalene	GIV.
Ethyl anthranilate	FB, SW.
Ethyl benzoate	ELN.
Ethyl cinnamate	ELN, GIV.
Ethyl-α,β-epoxy-β-methylhyrocinnamate	ELN.
*2-Ethyl hexyl salicylate	FEL, MON, NEO.
Ethyl phenylacetate	GIV, OPC.
Ethyl phenylglycidate	ELN, GIV.
Ethyl salicylate	FB.
3'-Ethyl-5',6',7',8'-tetrahydro-5',5',8',8',-tetramethyl-2'-acetonaphthone	GIV, UOP.
Geranyl benzoate	GIV.
Hexyl benzoate	PFW.
α-Hexylcinnamaldehyde	CI, IFF.
Homomenthyl salicylate	NEC.
Hydratropaldehyde	GIV, IFF.
Hydratropaldehyde,dimethyl acetal	GIV, IFF.
Hydrocinnamic acid	ARS.
Hydrocoumarin	ARS, GIV, UOP.
Hydroxycitronellal methyl anthranilate	GIV.
4-Hydroxy-3-ethoxybenzaldehyde (Ethylvanillin)	MON, SDH, SLV.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
BENZENOID AND NAPHTHALENOID--Continued	
3-Hydroxy-4-methoxybenzaldehyde (Iso-vanillin)	SDH, SLV.
4-Hydroxy-3-methoxybenzaldehyde (Vanillin)	MON, SLV.
4(4-Hydroxy-3-methoxyphenyl)-2-butanone (Vanillylacetone)	GIV.
Indole	GIV.
Isoamyl phenylacetate	ELN, FB.
Isobutyl benzoate	ELN, FB.
*Isobutyl phenylacetate	ELN, FB, GIV, OPC.
Isobutylquinoline	IFF.
*Isobutyl salicylate	FB, GIV, UOP.
Isohexenyl tetrahydrobenzaldehyde (Myrac aldehyde)	IFF.
Isopentyl benzoate	GIV.
*Isopentyl salicylate	FB, GIV, MON, UOP.
Isopropylbenzaldehyde (Cumaldehyde)	GIV.
p-Isopropyl-α-methylhydrocinnamaldehyde (Cyclamen-aldehyde)	GIV, RDA.
p-Isopropyl-α-methylhydrocinnamyl alcohol	GIV.
Linalyl anthranilate	FMT.
Linalyl benzoate	GIV, HOF.
p-Mentha-1,8-diene (Limonene)	RT, SKG.
Menthyl anthranilate	PFW.
*4'-Methoxyacetophenone	GIV, OPC, UOP.
o-Methoxy benzaldehyde	OPC.
p-Methoxybenzyl alcohol (Anisyl alcohol)	ELN, GIV, OPC, UOP.
o-Methoxy cinnamic aldehyde	CI, FB, OPC.
o-Methoxy cinnamic aldehyde crystals	CI.
2-Methoxynaphthalene	GIV.
p-Methoxyphenyl methylglycidate	OPC.
1-p-Methoxyphenyl penten-1-one-3 (α-Methyl-anisal-acetone)	GIV.
*2-Methoxy-4-propenylphenol (Isoeugenol)	CI, FB, GIV, IFF, NEO, UOP.
2-Methoxy-4-propenylphenol,acetate	CI.
4'-Methylacetophenone	OPC, UOP.
*p-Methylanisole	GIV, OPC, SW, UOP.
*Methyl anthranilate	FB, SW, UNG.
Methyl benzoate	HN.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CYCLIC--Continued	
BENZENOID AND NAPHTHALENOID--Continued	
α-Methylbenzyl acetate (Styralyl acetate)	CI, FB, GIV.
*α-Methylcinnamaldehyde	CI, FB, GIV.
Methyl cinnamate	FB.
6-Methylcoumarin	GIV.
3,4-Methylenedioxyphenyl-2-butanone	PFW.
1,2-(Methylenedioxy)-4-propenylbenzene (Isosaferol)	GIV.
4-Methyl-7-ethoxycoumarin	GIV.
p-Methyl ethyl phenyl glycidate	PFW.
p-Methylhydratropaldehyde	GIV.
1-Methyl-isohexyl-hexahydro benzaldehyde	GIV.
Methyl N-methylanthranilate	GIV, OPC, SW.
*Methyl phenylacetate	ELN, GIV, OPC.
Methyl salicylate	HN, MON.
Musk 89	IFF.
1,1,3,3,5-Pentamethyl-4,6-dinitroindan (Moskene)	GIV.
α-Pentylcinnamaldehyde	CI, FB, UOP.
Phenethyl acetate	GIV, IFF, OPC.
Phenethyl alcohol	IFF, OPC.
Phenethyl formate	ELN, IFF.
Phenethyl isobutyrate	ELN, GIV, IFF.
Phenethyl isovalerate	ELN, FB, RT.
Phenethyl methacrylate	NEO.
*2-Phenethyl phenylacetate	CI, ELN, GIV, IFF, NEO.
*Phenethyl propionate	ELN, GIV, IFF, OPC, PFW.
Phenethyl salicylate	GIV, NEO.
2-Phenoxyethyl isobutyrate	ELN, GIV, OPC.
Phenoxyethyl propionate	IFF.
Phenylacetaldehyde	GIV.
Phenylacetaldehyde,dimethyl acetal	ELN, GIV.
Phenylacetic acid	GIV.
Phenylacetic acid isopentyl ester	GIV.
α-Phenylanisole	GIV.
4-Phenyl-3-buten-2-one	FB, NEO.
Phenylethyl antranilate	OPC, RT.
Phenylethyl tiglate	FB.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
BENZENOID AND NAPHTHALENOID--Continued	
*3-Phenyl-1-propanol (Hydrocinnamic alcohol)	ELN, FB, GIV.
*3-Phenylpropyl acetate	ELN, FB, GIV.
3-Phenylpropyl aldehyde	CI.
3-Phenylpropyl cinnamate	FB, RT.
Piperonal (Heliotropin)	AMB, GIV.
*p-Propenylanisole (Anethole)	ARZ, FB, HPC, NCI, SCM.
4-Prophenyl-1,2-dimehoxybenzene (Methyl isoeugenol)	CI.
p-Propylanisol (Dihydroanethole)	FB, GIV.
N-Propyl phenyl ethyl alcohol	GIV.
SWEETNERS, SYNTHETIC:	
Cyclohexanesulfamic acid	ABB.
Cyclohexanesulfamic acid,calcium salt	ABB.
Cyclohexanesulfamic acid,sodium salt	ABB.
Saccharin (1,2-Benzisothiazolin-3-one,-1,1-dioxide)	SW.
Saccharin,sodium salt	SW.
Saccharin solution	SW.
*p-Tolualdehyde	FB, GIV, TCC.
p-Tolylacetaldehyde	GIV.
p-Tolyl acetate	ELN, GIV.
p-Tolylphenylacetate	GIV.
α-(Trichloromethyl)benzyl acetate (Rosetone)	NEO.
Triethanolamine salicylate	NEO.
Trimethylcyclohexyl salicylate	ARS.
all other Benzenoid or naphthalenoid chemicals	SCM.
TERPENOID, HETEROCYCLIC, AND ALICYCLIC:	
Acetyl-n-butyryl (2,3-Hexanedione)	FB.
Acetyl cedrene (Vertoflex)	OPC.
Acetyl isovaleryl (5-Methyl-2,3-hexanedione)	FB.
Acetyl propionyl (2,3-Pentanedione)	FB.
Alloocimene	GIV, IFF, X.
Allyl cyclohexyl Propionate	GIV.
Amyris acetate	GIV.
Bornyl isovalerate	FB, RT.
p-tert-Butylclohexyl acetate (Verbeniax)	CI, IFF.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
TERPENOID, HETEROCYCLIC, AND ALICYCLIC--Continued	
p-tert-Butylcyclohexanone	IFF.
2-sec-Butylcyclohexanone	GIV.
o-tert-Butylcyclohexyl acetate	IFF.
Cadinene	FB.
Carvone oxide	NEO.
β-Caryophyllene	CI, FB, GIV.
Caryophyllene acetate	CI.
Caryophyllene oxide	GIV.
Cedrene	NEO.
α-Cedrene epoxide (Andrane)	IFF.
Cedrenol	GIV, IFF, NEO.
*Cedrol	ELN, GIV, IFF, NEO.
*Cedryl acetate	ELN, GIV, IFF, NEO, UNG.
Cedryl formate	IFF, OPC.
Cyclohexyl acetate	RT.
Cyclohexyl butyrate	RT.
Cyclohexyl cyclohexanol	CI.
2-Cyclohexylcyclohexanone	GIV.
Cyclohexyl isovalerate	RT.
Dihydro-iso-jasmone	FB.
*Dihydronordicyclopentadienyl acetate (Cyclacet)	CI, GIV, IFF, OPC.
Dihydronordicyclopentadienyl isobutyrate	IFF, OPC.
Dihydronordicyclopentadienyl methyl ether	OPC.
*Dihydronordicyclopentadienyl propionate (Cyclaprop) (Verdyl propionate extra)	CI, GIV, IFF, OPC.
Dihydro terpineol	NCI.
*Dihydroterpinyl acetate	GIV, NCI, OPC.
3,5-Dimethyl-3-cyclohexen-1-carboxaldehyde	IFF.
3-5 Dimethyl cyclopentadione	PFW.
2,5-Dimethyl-4-hydroxy-3-(2H)-furanone	PFW.
Ethylene brassylate	NEO.
Ethyl furoate	RT.
Furfural acetone	RT.
Furfural acrolein	RT.
Galaxolide (1,3,4,6,7,8-Hexahydro-4,6,6,7,8,8-hexamethyl-cyclopenta-γ-2-benzopyran)	IFF.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
TERPENOID, HETEROCYCLIC, AND ALICYCLIC--Continued	
*Guaiacwood acetate	ELN, FB, GIV, NEO, UNG.
Guaiene	FB.
3-Hydroxy-2-ethyl-4-pyrone (Ethylmatol)	PFZ.
4-(4-Hydroxy-4-methyl pentyl)-3-cyclohexene-10-carboxaldehyde (Lyral)	IFF.
3-Hydroxy-2-methyl-4-pyrone (Maltol)	PFZ.
4-Hydroxynonanic acid, γ-lactone (γ-Nonalactone)	CI, GIV.
4-Hydroxyoctanoic acid, γ-lactone (γ-Octalactone)	GIV.
4-Hydroxyundecanoic acid, γ-lactone (γ-Undecalactone)	FB.
4-Hydroxyvaleric acid, γ-lactone (γ-Valerolactone)	GIV.
*Ionone (α- and β-)	GIV, HOF, NEO, STP.
*α-Ionone	GIV, IFF, STP.
β-Ionone	HCF, STP.
Isoamyl furoate	RT.
Isobornyl acetate	NCI, RDA.
*Isobornyl propionate	ELN, GIV, OPC.
Isocamphyl cyclohexanols	GIV.
Isohexenyl cyclohexenyl carboxaldehyde	OPC.
Iscjasmone	FB.
Isomenthone	GIV.
2-Isopropylcyclohexanol	CI, GIV.
Isopulegyl acetate	GIV.
Jasmal	IFF.
Lavandin, acetylated	GIV, UNG.
p-Mentha-1,3-diene (α-Terpinene)	SCM.
p-Mentha-1,4-diene (γ-Terpinene)	SCM.
p-Mentha-6,8-dien-2-ol (Laevo carveol)	FB, NEO, PFW.
p-Mentha-6,8-dien-2-one (Dextro-carvone) (Carvol)	FB, NEO.
1-p-Mentha-6,8-dien-2-yl acetate (Laevo-carvyl acetate)	FB.
p-Menthan-3-one (Menthone)	GIV, SCM.
p-Menth-8-en-3-ol (Isopulegol)	GIV.
p-Menth-1-en-3-one (Piperitone)	GIV.
p-Menth-4-(8)-en-3-one (Pulegone)	GIV.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOB AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
TERPENOID, HETEROCYCLIC, AND ALICYCLIC--Continued	
1-1-p-Menthen-6-yl-1-propanone	GIV.
Menthol, snthetic, U.S.P.	SCM.
Menthol,synthetic,tech.	GIV, NCI.
Menthyl acetate	FB, GIV, SCM.
3-Methyl cyclohexendione-1,2	PFW.
Methyl furoate	RT.
α-Methyl-β-furyl acrolein	RT.
*Methylionone(α- and β-)	GIV, IFF, NEO, BDA, STP.
*γ-Methylionone	GIV, NEO, UNG.
6-Methyl-α-ionone	GIV.
Nopol	NCI.
Nopyl acetate	FEL, NCI, OPC, BT.
3-Pentyl tetrahydro-4-pyridine	IFF.
Rose oxide	FB.
α-Santalol	GIV.
α-Santalyl acetate	GIV.
Sassafrass oil,hydrogenated	GIV.
Terpineol(α- and β-)	GIV.
*α-Terpineol	HPC, NCI, SCM.
*α-Terpinyl acetate	GIV, NCI, NEO, PFW, RDA, SCM, UNG.
α-Terpinyl propionate	ELN, GIV.
[4,4',4'',4'''-Tetraaminophthalocyaninato(2-)]-copper	HPC.
Tetrahydrofurfuryl-n-butyrate	BT.
Tetrahydrofurfuryl propionate	BT.
3,3,5-Trimethyl cyclohexanol (m-Homomenthol)	ABS, NEO.
1-(2,6,6-Trimethyl-2-cyclohexen-1-yl)-1,6-heptadien-3-one (Allyl-α-ionone)	IFF.
2,6,10-Trimethyl-9-undecen-1-al	GIV.
Vetivenol	GIV.
*Vetivenyl acetate	FB, GIV, IFF, NEO, PFW, UNG.
All other terpenoid,heterocyclic,or alicyclic flavor and perfume chemicals	SCM, VIK.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C	
Allyl disulfide	RT.
*Allyl heptanoate	ELN, FB, RT.
Allyl hexanoate	ELN, FB, GIV, PFW.
Allyl isothiocyanate (Synthetic mustard oil)	OPC.
Allyl isovalerate	RT.
Allyl mercaptan	RT.
Allyl octanoate (Allyl caprylate)	RT.
Allyl sulfide	RT.
Ammonium isovalerate	RSA.
Amyl propionate	GIV.
Butter acids	RT.
Butter esters	RT.
Butyl butyrate	FB.
*Butyl butyryl lactate	BJL, ELN, RT.
*Butyl undecylenate	CI, FB, GIV, IFF.
*Citral dimethyl acetal	CI, GIV, IFF, RDA.
Citronellic acid	PFW.
*Citronellyl acetate	ELN, GIV, IFF, NCI, SCM.
Citronellyl butyrate	ELN, GIV.
*Citronellyl formate	ELN, GIV, IFF, NEO.
*Citronellyl isobutyrate	ELN, GIV, IFF.
Citronellyl oxyacetaldehyde	IFF, OPC.
*Citronellyl propionate	ELN, GIV, IFF.
Crude acetate mixture (Linalyl, neryl, geranyy acetates, main components)	X.
2,4-Decadienal	PFW.
Decanal (Capraldehyde)	CI, GIV.
Decyl acetate	GIV.
Diethyl acetal	FB.
Diethyl glutarate	PFW.
Diethyl sebacate	ELN, UOP.
Diethyl succinate	ELN.
Dihydro myrcenol	IFF.
2,6-Dimethyl-5-hepten-1-al	GIV.
Dimethyl hexanediol	X.
Dimethyl hexynediol	RDA, X.
3,7-Dimethyl-2,3,6-nonadienenitrile	GIV.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
3,7-Dimethyl-trans-2,6-octadienal (Citral A geranial)	FB, FEL, GIV, SCM.
*3,7-Dimethyl-cis-2,6-octadien-1-ol (Nerol)	ELN, FB, GIV, IFF, NCI, SCM.
*3,7-Dimethyl-trans-2,6-octadien-1-ol (Geraniol)	CI, ELN, FB, FEL, GIV, IFF, NCI, SCM, UOP.
*3,7-Dimethyl-1,6-octadien-3-ol (Linalool) (Linalyl alcohol)	ELN, FB, FEL, GIV, HOF, NCI, RDA, SCM.
*3,7-Dimethyl-cis-2,6-octadienol, acetate (Neryl acetate)	CI, ELN, FB, GIV, IFF.
*3,7-Dimethyl-1,6-octadien-3-ol,acetate (Linalyl acetate)	ELN, FB, GIV, HOF, NCI, RDA, SCM, UNG.
3,7-Dimethyl-1,6-octadien-3-yl isobutyrate (Linalyl isobutyrate)	ELN, HOF.
3,7-Dimethyl-1,6-octadien-3-yl propionate (Linalyl propionate)	ELN, GIV, HOF.
3,7-Dimethyloctanol-1 [Tetrahydogeraniol]	GIV, NCI.
3,7-Dimethyl-3-octanol	IFF, SCM.
Dimethyloctanyl acetate	IFF.
*3,7-Dimethyl-6-octen-1-al (Citronellal)	CI, FB, GIV, RDA, SCM, UOP.
2,6-Dimethyl,2-octene-7-yne-6-ol	RDA, X.
*3,7-Dimethyl-6-octen-1-ol (Citronellol)	CI, ELN, FB, GIV, IFF, NCI, SCM.
3,7-Dimethyl-7-octenol 70pct,6-octenol isomer 30pct	GIV.
Dimyrcetol	IFF.
Ethyl butyrate	FB, NW.
Ethyl caprate	ELN, FB.
Ethyl crotonate	RT.
Ethylene glycol acetal of heptaldehyde	OPC.
Ethyl formate	FB.
*Ethyl heptanoate	ELN, FB, FEL, RT.
Ethyl heptenone	HOF.
*Ethyl hexanoate	ELN, FB, NW, PFW, RT.
Ethyl isobutyrate	FB.
*Ethyl isovalerate	ELN, FB, PFW.
Ethyl laurate	ELN, FB.
Ethyl levulinate	PFW.
Ethyl linalool (3,7-Dimethyl-1,6-nonadien-3-ol)	HCF.
Ethyl linalyl acetate (3,7-Dimethyl-1,6-nonadien-3-ol, acetate	HOF.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C-- Continued	
Ethyl-2-methyl butyrate	PFW, SCM.
Ethyl-2-methyl-2-pentenoate	PFW.
*Ethyl myristate	ELN, PFW, RT.
Ethyl nonanoate	ELN, FB.
Ethyl octanoate	ELN, FB.
Ethyl oxyhydrate	FLO, RT.
*Ethyl propionate	FB, NW, UOP.
Ethyl valerate	ELN.
Geranic acid	FB.
*Geranyl acetate	CI, ELN, FB, FEL, GIV, IFF, NCI, PFW, SCM.
*Geranyl butyrate	ELN, FB, GIV.
Geranyl crotonate	FB.
*Geranyl formate	CI, ELN, GIV.
Geranyl isobutyrate	IFF.
Geranyl isovalerate	FB.
Geranyl nitrile (Gerano nitrile) (Citralva)	CI, IFF.
*Geranyl propionate	ELN, FB, IFF.
Geranyl tiglate	FB.
Glutamic acid, monosodium salt (Monosodium glutamate)	GTL, SFF.
Heptanolide	FB.
2,4-Hexadieneal	PFW.
Hexadieneol	PFW.
*2-Hexanal	FB, GIV, SCM.
cis-3-Hexen-1-ol	GIV, SW.
2-Hexenol	FB.
cis-3-Hexen-1-yl acetate	GIV.
cis-3-Hexenyl butyrate	OPC.
cis-3-Hexenyl tiglate	OPC.
Hexyl caproate	FB.
3-Hexynol	HOP, SW.
3-Hydroxy-2-butanone (Acetoin)	PMT.
*7-Hydroxy-3,7-dimethyl-1-octanal (Hydroxycitronellal)	CI, GIV, IFF, BDA, SCM, UOP.
7-Hydroxy-3,7-dimethyl octanal, dimethyl acetal (Hydroxycitronellal, dimethyl acetal)	GIV.
Hydroxy-2-propanone (Acetol)	FB.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
Isoamyl caproate	FB.
Isoamyl caprylate	FB.
Isoamyl geranate	FB.
Isoamyl propionate	FB.
Isobutyl acetate	FB.
Isobutyl butyrate	FB.
Isodihydro lavandulol	FB.
Isodihydro lavandulylacetate	FB.
Isodihydro lavandulylaldehyde	FB.
Isononyl acetate	CI, OPC.
Isopentyl acetate (Isoamyl acetate)	FB, NW, PFW.
*Isopentyl butyrate	FB, GIV, NW, PFW, UOP.
*Isopentyl formate	ELN, FB, GIV, RT.
*Isopentyl isovalerate	ELN, FB, PFW.
Lauraldehyde	GIV.
Linalalool oxide	HOF.
Linalyl formate	HOF.
Methoxy citronellal	SCM.
Methyl butenol	X.
α-Methyl butric acid	PFW.
Methyl butynol	X.
3-Methyl butyraldehyde	FB.
Methyl crotonate	RT.
Methyl heptadienone	HCP.
3-Methyl-5-heptanone oxime	GIV.
Methyl heptenone	HCF, RDA.
Methyl isobutyrate	PFW.
Methyl isovalerate	FB.
Methyl mercaptopropylamine	PFW.
3-Methyl-2-[and3]nonene nitrile	GIV.
Methyl-2-nonenoate	GIV, PFW.
Methylol methyl hexyl ketone	GIV.
4-Methyl pentanoic acid	PFW.
Methyl pentylnol	X.
Methyl propionate	FB.
β-Methyl thiopropionaldehyde	RT.

TABLE 2.--FLAVOR AND PERFUME MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

FLAVOR AND PERFUME MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
2-Methylundecanal	GIV.
Myrcenyl acetate	IFF.
Myristaldehyde	GIV.
Nerolidol (3,7,11-Trimethyl-1,6,10-dodecatrien-3-ol)	HOF.
Nonanal	GIV.
Nonane diacetate	CI.
1,3-Nonanediol acetate	CI, GIV.
Nonanol	GIV.
β-Nonanone	HOF.
Nonyl acetate	ELN, GIV.
Ocimenyl acetate	IFF.
2-trans-6-cis-Octadienal	PFW.
Octanal	CI, GIV.
3-Octanol	GIV, SCM.
3-Octanone (Ethyl amyl ketone)	GIV.
N-Octyl acetate	ELN.
N-Octyl alcohol	GIV.
Pentyl acetate	UOP.
n-Propyl n-butyrete	PFW.
Pseudo linalyl acetate (Neobergamate)	IFF.
*Rhodinol	FB, FEL, GIV, IFF.
Rhodinyl acetate	GIV, IFF.
Tepyl acetate	ELN, UOP.
Tetrahydro allo-ocimene	IFF.
Tetrahydro pseudoionone	CI.
Undecanal	GIV.
9-Undecenal	GIV.
All other acyclic flavor and perfume materials	SCM, X, X.

TABLE 3.--FLAVOR AND PERFUME MATERIALS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of flavor and perfume materials to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of Company	Code	Name of Company
ABB	Abbott Laboratories	OPC	Orbis Products Corp.
AIP	Air Products & Chemicals, Inc.		
AMB	American Bio-Synthetics Corp.	PD	Parke, Davis & Co. Sub. of Warner-Lambert Co.
ARS	Arsynco, Inc.		
ARZ	Arizona Chemical Co.	PEN	CPC International, Inc., Penick Div.
		PFW	Polak's Frutal Works, Inc.
BJL	Burdick & Jackson Labs., Inc.	PFZ	Pfizer, Inc.
CI	Chem-Fleur, Inc.	RDA	Rhodia, Inc.
CWN	Upjohn Co., Fine Chemical Div.	RSA	R.S.A. Corp.
		RT	Ritter International
ELN	Elan Chemical Co.		
		SCM	SCM Corp.
FB	Fritzsche, Dodge & Olcott, Inc.	SDH	Sterling Drug, Inc., Hilton-Davis Chemical Co. Div.
FEL	Felton International, Inc.		
FLO	Florasynth, Inc.	SFF	Stauffer Chemical Co., Food Ingredients Div.
FMT	Fairmount Chemical Co., Inc.		
		SKG	Sunkist Growers, Inc.
GAF	GAF Corp.	SLV	Sterwin Chemicals, Inc.
GIV	Givaudan Corp.	STP	Stepan Chemical Co.
GRW	Great Western Sugar Co.	SW	Sherwin-Williams Co.
HN	Tenneco Chemicals, Inc.	TCC	Tanatex Chemical Corp.
HOF	Hoffman-LaRoche, Inc.		
HPC	Hercules, Inc.	UNG	Ungerer & Co.
		UOP	UOP, Inc., Chemical Div.
IFF	International Flavors & Fragrances, Inc.		
		VEL	Velsicol Chemical Corp.
MON	Monsanto Co.	VIK	Viking Chemical Co.
NCI	Union Camp Corp.		
NEO	Norda Inc.		
NW	Northwestern Chemical Co.		

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Synthetic Resins and Plastics Materials

Edward J. Taylor

The synthetic resins and plastics materials 1/ industry is a major user of many of the synthetic organic chemicals covered in this report. These plastic materials are in turn sold in the fabrication of consumer products such as automobile instrument panels and soft drink bottles. This paper discusses the industry in general, certain end-use markets, foreign trade, new product areas and the impact of government regulations on the industry.

Production, sales, and major markets

The U.S. production, consumption, and sales of synthetic resins and plastics materials reached an all-time high in 1977; production amounted to 35 billion pounds, consumption reached 32 billion pounds, and sales, 30 billion pounds. These quantities represent gains of 15 percent, 18 percent, and 19 percent, respectively, above what it was in 1976. The average unit value of sales for all plastics materials in 1977 was double the level of the early 1970's (i.e., 37 cents per pound in 1977 compared to about 19 cents per pound during 1970-72).

The principal markets for plastics materials include building/construction, packaging, and automotive applications. These three markets have accounted for over half the annual consumption of all plastics materials in recent years. Industry sources 2/ estimate that building/construction applications represented 27 percent of domestic synthetic resins consumption in 1976; packaging represented 25 percent; and the automotive industry represented about 6 percent of synthetic resins demand during the same year.

Building/construction.--Major synthetic plastics products used in the building and construction trade include pipe, siding, and insulation. The chief plastics beneficiary of the rise in building starts are the thermosetting resins, 3/ of which about 40 percent are consumed in this market.

Insulation applications have made important strides as a result of the energy crisis. Polyurethane foam and polystyrene foam are two of the principal materials used in insulation. Other important plastics applications in the building/construction sector are glazing, panels, ducts, and tanks.

1/ Unless otherwise stated, the term "plastics materials" as used in this paper is synonymous with "synthetic resins and plastics materials."

2/ Charles Genest (Arthur D. Little) "Plastics Industry to Grow at Triple the Rate of GNP through 1981,": a paper presented at the Third Annual Conference on Contingency Planning, New York, fall 1977.

3/ A plastic material that cures by heat, catalyst, or other chemical means, and, when cured, cannot be resoftened by heating.

Plastics products now account for only about 5 percent of all the materials used in building and construction. Thus the building and construction industry offers great market potential for plastics. A surge in this market usually has a multiplier effect on other important markets for plastics such as appliances, furniture, and housewares. These increase although interior applications usually lag behind the building boom.

Packaging.--A highly diversified market, packaging constitutes the single most important use for thermoplastic resins. 1/ At the present time, packaging uses comprise about 30 percent of all the thermoplastic resins consumed. Packaging materials includes both rigid and flexible plastics items such as shrink wrap, blister containers, bottles, disposable cups, boxes, and trays, all of which are familiar consumer items. The value of U.S. shipments for the total packaging industry was $38 billion in 1977, 9 percent above the 1976 level of $35 billion. 2/ The quantity of plastics materials used by the packaging industry increased to 7.1 billion pounds in 1977, up 11 percent from 6.4 billion pounds in 1976. 3/

Plastics materials currently constitute about 10 percent of all material used in packaging. The growth of plastics in packaging has been at the expense of both traditional materials (glass, paper products, and nonferrous metals) and older plastics (e.g., cellulosic plastics).

The preference for newer plastics materials over other materials is due primarily to cost/performance factors. For example, plastics materials, when compared with glass or metal, may be formed into a great variety of shapes, with lower temperatures and energy requirements. Also, plastics products (cups, bottles, and so forth) are typically lighter in weight per given volume than those of glass or metal which results in lower shipping costs.

Automotive industry.--Although plastics materials are used in all forms of transportation, the automobile represents the most important end use for plastics in the transportation industry. The increase in consumption of plastics in the automotive industry is the result of an absolute gain in the number of new car sales as well as Federal regulations governing fuel consumption (i.e., the Energy Policy and Conservation Act of 1975). The act specifies that all 1985 model autos must meet a standard of 27.5 miles per gallon (mpg) on a production-weighted average basis, which is an increase of 53 percent over the federally mandated standard of 18 mpg that must be met by the 1978 model autos. In order to attain this increased fuel efficiency, it will be necessary to reduce the weight and size of automobiles. The substitution of plastics and other lighter weight materials must take place.

1/ A plastic material that will repeatedly soften when heated, and harden when cooled.

2/ U.S. Department of Commerce, U.S. Industrial Outlook 1978.

3/ Modern Plastics, Jan. 1978, p. 43.

Industry sources 1/ report that the average 1977 auto contained 166 pounds of plastics as compared with 20 pounds in the typical 1960 automobile. It has been forecast 2/ that the typical 1985 auto will contain 350 to 500 pounds of plastics. This means that as a share of total vehicle weight, plastics will increase from 5 percent in 1977 to about 20 percent in 1985, with a reduction in the the overall weight of the automobile.

Foreign trade

The plastic materials industry is export-competitive and should maintain a positive trade balance in the coming years. It may, however, be unfavorably impacted by the export plants being built in the oil-rich countries.

Exports.--In 1977, exports accounted for about 8 percent of U.S. production of plastics materials, a level consistent with that of recent years. The quantity of exports of plastics materials amounted to 2,770 million pounds in 1977, a 5 percent decline from the 2,913 million pounds estimated for 1976. However, the value of exports increased in 1977 to $1,197 million, a 3.7 percent gain above what it was in 1976; this increase in value was due mostly to inflationary reasons rather than any shift in product lines. Thermoplastic commodity resins 3/ accounted for about two-thirds of the total volume and 45 percent of the value in both 1976 and 1977. Large U.S. exports of plastics, particularly the commodity resins, are indicative of the inability of the plastics materials industries of developing countries to keep pace with the growth of the local plastics materials fabrication and processing industries. One reason given for the decline in the quantity of U.S. plastics materials exports in 1977 was the excess production capacity for these materials in Europe and Japan. 4/

Canada was the leading market for U.S. exports of plastics materials in 1977, as it has been for at least the last decade. Other important U.S. markets in the Western Hemisphere during 1977 include Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela--nations whose fabrication industries have outpaced their local plastics production capabilities. The major Asian markets in 1977 included Hong Kong, Japan, Korea, New Zealand, the Philippines, Singapore, and Taiwan. The leading markets in Europe, on the other hand, were all developed nations--Belgium, the Netherlands, France, and West Germany. A significant share of these exports are believed to represent shipments by U.S. producers to their European subsidiaries.

1/ The Society of the Plastics Industry, Inc., 1977 Facts and Figures of the Plastics Industry.

2/ Du Pont's Annual Report 1977, p. 19. Several independent marketing research firms have made similar forecasts. Included among these are: Predicasts, Inc. (Cleveland, Ohio), and Springborn Laboratory (Enfield, Conn.).

3/ Low-density polyethylene, high-density polyethylene, polypropylene, polystyrene and its copolymers and terpolymers, and polyvinyl chloride and its copolymers.

4/ Chemical Week, Dec. 7, 1977, pp. 57, 58 and 63.

Imports.--Except for 1974, imports have not exceeded 1 percent of consumption in any year during the period 1950-77; in 1977 the ratios of imports to consumption were 0.7 percent (quantity) and 0.9 percent (value). Imports of plastics materials in 1977 amounted to 207 million pounds valued at $112 million, an increase of 8.4 percent and 8.7 percent, respectively, over 1976.

Traditionally, the capital-intensive, technology-oriented manufacture of plastics materials has given the United States a competitive edge over its foreign competition, but that advantage appears to be diminishing. In addition, the U.S. plastic manufacturers have recently had a cost advantage in both raw materials and energy over Western Europe and Japan. Should the proposed National Energy Plan 1/ become enacted, the energy cost advantage may also disappear.

The leading sources of imports of plastics materials in 1977 included Canada, France, Japan, the United Kingdom, and West Germany; together they accounted for three-fourths of the volume of plastics imports that year, up from two-thirds of the total in 1976. West Germany was the major source in 1977, a position that Japan held in earlier years. Since most foreign plastics materials do not compete with domestic plastics in the U.S. market, imports are usually sought for one of three reasons: (1) A shortage of a particular resin exists in the United States; (2) the imported plastic is a new product not yet made domestically; or (3) foreign firms are supplying their U.S. affiliates or subsidiaries to make up a short-fall for a given resin or resins.

The pattern of U.S. imports of plastics materials is not expected to change significantly until at least the mid-1980's. At that time, the oil-rich nations of the Middle East are expected to attain a capacity for plastics materials which will allow substantial export. 2/

New areas of growth

The plastics materials industry continues to be a leader in the development of technology and of applications for its products. This leadership has resulted in continued new areas of growth which have contributed greatly to the health of the industry.

1/ Executive Office of the President, Energy and Policy Planning, The National Energy Plan, Apr. 29, 1977.

2/ Chemical Week, Mar. 23, 1977, pp. 29-40.

Polyethylene terephthalate.--The thermoplastic polyester resin, polyethylene terephthalate (PET), is making rapid inroads into the disposable (one-way) soft drink bottle field as a replacement for glass. This market grew from zero consumption of PET in 1976 to 51 million pounds in 1977, and is forecast to reach 176 million pounds in 1978 and to climb to 309 million pounds by 1980. 1/ This penetration has been most pronounced in the "family size" bottles (32 ounce and 64 ounce), where PET now accounts for an estimated 25 percent of the Coca Cola and Pepsi Cola family-size containers.

PET bottles offer certain advantages over glass containers (lighter weight, safety), as discussed earlier. Future markets for PET bottles include containers for such diverse products as cooking oils, salad dressing, fruit juice, and shampoos.

Engineering thermoplastics.--The engineering thermoplastic resins comprise a family of high-performance resins which have mechanical, chemical, and thermal properties suitable for use in construction, transportation equipment, machine components, and chemical processing equipment. 2/ Industry sources forecast that by the mid-1980's the domestic demand for engineering resins will have reached 2 billion pounds, about 3 1/2 times the reported 1976 level of 600 million pounds. 3/ These materials enjoy a cost-benefit advantage over die-cast metals. They also have considerably lower production energy requirements than the metals they compete with and offer improved fuel economy in automobiles through reduced weight.

The engineering resins are closely tied to the durable goods economy. For example, automotive applications (e.g., distributor caps), together with electrical/electronics uses (e.g., coil bobbins) and home appliance applications (e.g., dishwasher pump parts) are the three leading markets for these engineering resins, and together account for about three-fourths of the domestic consumption.

Government regulations

A high degree of concern has been expressed in many segments of the U.S. Government about how specific chemicals might adversely affect the health of individuals who come into contact with them. This concern has resulted in various laws and regulations designed to control industry actions.

1/ Modern Plastics, April 1978, pp. 48 and 49.
2/ Whittington's Dictionary of Plastics, First edition. These engineering resins include polyacetal resins, polycarbonate resins, polyimide and amide-imide polymers, polyphenylene oxide, polyphenylene sulfide, and polysulfone. Whittington's also lists ABS resins and nylon resins in this category.
3/ Chemical Marketing Reporter, Sept. 19, 1977, p. 38.

Occupational Safety and Health Administration (OSHA).--Since 1974, polyvinyl chloride (PVC) resins have been subjected to closer government scrutiny (for safety) than any of the other plastics materials; so far the PVC resin industry has not only survived but output has increased under these conditions (4,744 million pounds in 1974 versus 5,153 million pounds in 1977). Because of a worker health problem, OSHA in October 1974 imposed strict rules governing the level of vinyl chloride monomer (VCM, the raw material for PVC) to which workers may be exposed. These rules specify a maximum exposure of 1 part per million (ppm) during an 8-hour period, and 5 ppm for any 15-minute period. Prior to the OSHA ruling the exposure level to VCM was 500 ppm for an 8-hour period.

An independent marketing research firm estimated that the OSHA regulations lowering worker exposure levels to VCM have added 0.3 cent to 1 cent per pound to the manufacturing cost of VCM and from 1 cent to 3 cents per pound to costs for PVC resins. 1/ Since 1974, five producers of PVC resins have left the market while four new producers have entered this field.

Environmental Protection Agency (EPA).--It has been estimated that to meet proposed standards under the Clean Air Act (limiting the emission level of VCM in the atmosphere to 10 ppm) the initial industry outlay will be $183 million with an annual upkeep expenditure of $70 million. 2/ In addition, EPA's new water effluent guideline will become effective in 1983. The total capital cost for existing plants to meet these guidelines has been estimated by EPA at an aggregate of $83 million, with an annual maintenance of $17 million for all existing plants. Thus, in order for industry to maintain precontrol profits and also to recover the annual control costs for meeting both the air and water standards, EPA estimates that it will be necessary to increase the price of PVC resins by at least 7 percent. 3/

The Toxic Substances Control Act (TSCA).--This law, which became effective on January 1, 1977, may be the most significant legislation ever to impact the plastics materials industry. 4/ It empowers the EPA to ban or restrict the use of chemicals to protect public health. EPA's new regulatory powers are being directed not only toward the production side of business through pollution standards, and so forth, but also on the marketing side through prescreening and testing for safety of new and existing products. TSCA could affect plastics materials either directly, or indirectly by impacting the ingredients of plastics materials (e.g., acrylonitrile, benzene). Many studies have already been made and are now being done to assess the probable economic effects that strict enforcement of the act could have on the plastics materials industry. The cost to industry of compliance with TSCA has been estimated by EPA at $80 million to $140 million, and by a business-consulting firm at $360 million to $1.3 billion. 5/

1/ Chemical and Engineering News, Nov. 10, 1975, pp. 13 and 14.

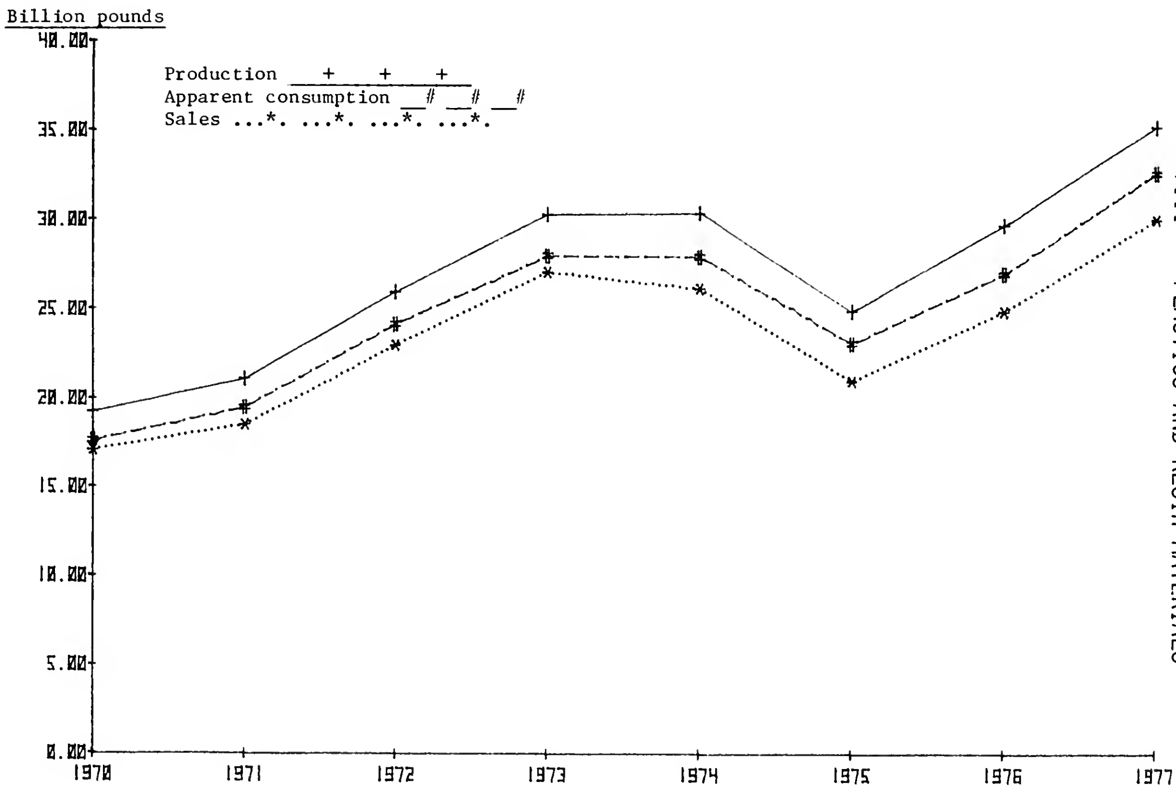
2/ Modern Plastics, February 1976, p. 16, also 41 F.R. 46561 and 42 F.R. 28154.

3/ Ibid.

4/ Salomon Brothers, an international investment banking house, "Government Regulations of Marketing will Lower Chemical Earnings Growth," July 6, 1977.

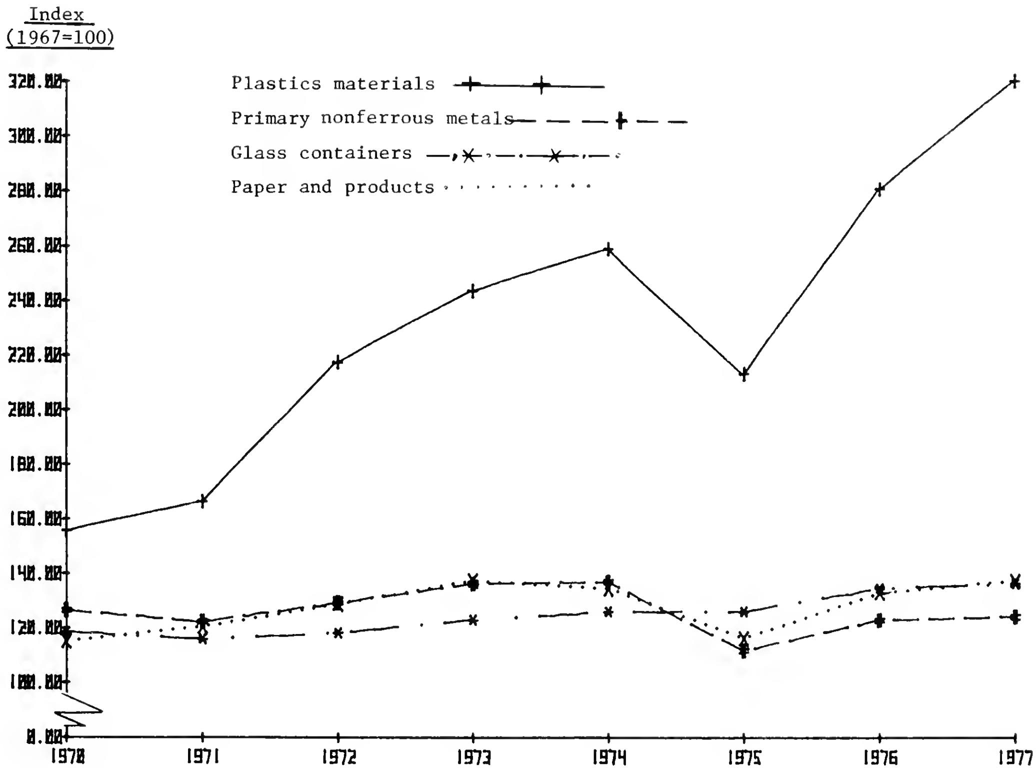
5/ U.S. Department of Commerce, U.S. Industrial Outlook 1978, p. 91.

Plastics and resin materials: U.S. production, apparent consumption, and sales, 1970-77.



Source: Production and sales, U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales.

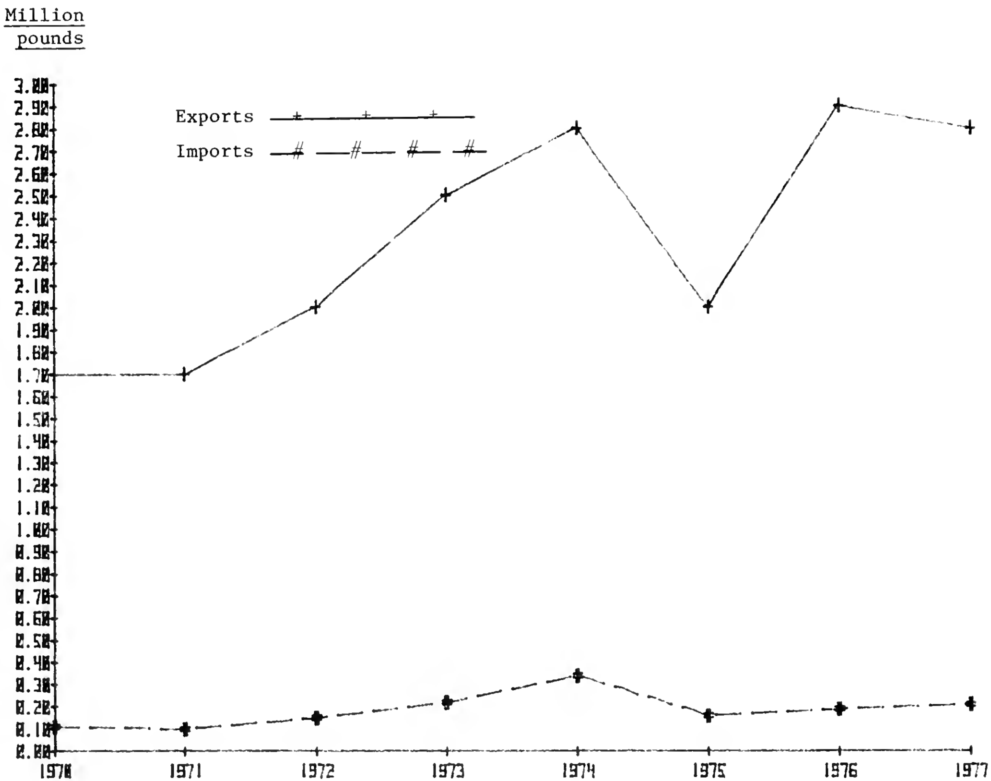
Indexes of industrial production 1/ of plastics and resins and selected competitive materials, 1970-77.



1/ Seasonally adjusted.

Source: Federal Reserve System

Plastics and resin materials: U.S. exports and imports, 1970-77.



Source: Compiled from official statistics of the U.S. Department of Commerce.

PLASTICS AND RESIN MATERIALS

Edward Taylor

Plastics and resin materials are high molecular weight polymers which, at some stage in their manufacture, exist in such physical condition that they can be shaped or otherwise processed by the application of heat and pressure. The terms "plastics," "resin," and "polymers," can be (and often are) used interchangeably by the trade. Depending on the chemical composition, manufacturing process or intended use, the commercial products may contain plasticizers, fillers, extenders, stabilizers, coloring agents, or other additives. There are about 40 to 50 basic plastics and resins which are available commercially. These basic materials are available in literally thousands of individual compounds each with its distinct properties depending on the molecular weight of the resin and the types and amounts of the additives present. Plastics materials may be molded, cast, or extruded into semi-finished or finished solid forms. Resin materials may be in the form of solutions, pastes, or emulsions for applications such as protective coatings, adhesives, or paper and textile treatment.

Statistics on U.S. production and sales of synthetic plastics and resin materials for 1977 are given in table 1. U.S. production of plastics and resin materials in 1977 totaled 34,623 million pounds, or 15.5 percent more than the 29,989 million pounds[1] produced in 1976. Sales in 1977 totaled 29,799 million pounds, valued at $10,882 million compared with 25,050 million pounds,[1] valued at $8,785 million[1] in 1976.

Thermosetting materials are those which harden with a change in composition in the final treatment so that in their final state as finished articles they are substantially infusible and insoluble, that is, they cannot again be softened by heat or solvents. U.S. production of thermosetting materials totaled 7,129 million pounds in 1977 compared with 5,970 million pounds in 1976. Production of the most important products in 1977 included phenolic resins (1,797 million pounds), amino (or urea and melamine) resins (1,361 million pounds), polyester resins, (unsaturated) (1,018 million pounds) and alkyd resins (753 million pounds).

Thermoplastic materials are those which in their final states as finished articles can be repeatedly softened by heat and hardened by a decrease in temperature. U.S. production of thermoplastic materials totaled 27,494 million pounds in 1977 compared with 24,020 million pounds[1] in 1976. Production of the most important products in 1977 included polyethylene (10,100 million pounds), vinyl resins (6,438 million pounds), and styrene type materials (5,203 million pounds).

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[1] Certain of the 1976 data have been revised. See footnote 1, table 1 for details.

TABLE 1.--PLASTICS AND RESIN MATERIALS: U.S. PRODUCTION AND SALES, 1977[1]

[Quantities and values are given in terms of the total weight of the materials (dry basis). Listed below are all plastics and resin materials, urethane type elastomers, and certain precursors for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists all products for which data on production and/or sales were reported and identifies the manufacturers of each]

PLASTICS AND RESIN MATERIALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
	1,000 pounds dry basis[3]	*1,000 pounds dry basis*[3]	*1,000 dollars*	*Per pound*
Grand total	34,623,041	29,799,004	10,881,823	$0.37
Plastics and resin materials, benzenoid[4]	10,802,389	9,444,644	4,275,111	.45
Plastics and resin materials, nonbenzenoid	23,820,652	20,354,360	6,606,712	.32
THERMOSETTING RESINS				
Total	7,129,280	5,593,603	2,287,028	.41
Alkyd resins, total	753,363	434,347	189,499	.44
Phthalic anhydride type	637,222	374,974	163,023	.43
Polybasic acid type	54,820	33,163	14,940	.45
Styrenated-alkyds or copolymer alkyds	38,227	21,901	9,143	.42
Other copolymer alkyds	23,094	4,309	2,393	.56
Dicyandiamide resins	1,973	1,840	1,796	.98
Epoxy resins:[5,6]				
Unmodified	261,283	273,580	233,571	.85
Advanced	(79,311)	(52,286)	(54,621)	1.04
Melamine-formaldehyde resins (an amino resin)	198,119	162,938	93,968	.58
Phenolic and other tar acid resins	1,797,128	1,390,702	546,973	.39
Polyester resins, unsaturated[7]	1,017,970	866,434	351,476	.41
Polyether and polyester polyols for urethanes[8]	1,572,357	1,154,269	432,663	.37
Polyurethane elastomer and plastic products, total	255,006	188,116	187,837	1.00
Elastomers[9]	92,244	79,009	105,665	1.34
Plastics	162,762	109,107	82,172	.75
Silicone resins	18,348	11,348	31,403	2.77
Urea-formaldehyde resins (an amino resin)	1,162,853	1,045,287	169,994	.16
Other thermosetting resins[10]	90,880	69,742	47,848	.69
THERMOPLASTIC RESINS				
Total	27,493,761	24,200,401	8,594,795	.36
Acrylic resins, total[11]	967,155	...	...	...
Polymethyl methacrylate	355,137	...	...	...
Thermosetting acrylics	30,770	5,172	3,678	.71
Other acrylics	581,248	...	...	...
Cellulose plastics[11]	356,367	228,329	190,996	.84
Engineering plastics[12]	524,995	415,802	428,107	1.03
Petroleum hydrocarbon resins	333,540	332,257	78,477	.24
Polyamide resins, total	284,950	257,948	300,199	1.16
Nylon type[11,13]	244,365	218,285	246,905	1.13
Non-nylon type	40,585	39,663	53,294	1.34
Polyester resins, saturated[11,14]	384,054	216,010	272,246	1.26
Polyethylene resins, total	10,100,116	9,199,437	2,610,435	.28
Density 0.940 and below	6,494,273	5,804,039	1,660,254	.29
Density over 0.940	3,605,843	3,395,398	950,181	.28
Polypropylene resins	2,705,831	2,212,005	629,522	.28
Polyterpene resins	14,485	14,117	6,561	.46
Polytetrafluorethylene (PTFE)	18,459	14,242	54,735	3.84

See footnotes at end of table.

TABLE 1.--PLASTICS AND RESIN MATERIALS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

PLASTICS AND RESIN MATERIALS	PRODUCTION	SALES		
		QUANTITY	VALUE	PER VALUE[2]
THERMOPLASTIC RESINS--Continued	*1,000 pounds dry basis*[3]	*1,000 pounds dry basis*[3]	*1,000 dollars*	*Per pound*
Rosin modifications, total	46,925	47,081	19,833	$0.42
Rosin esters, unmodified (ester gums)	20,829	21,485	8,222	.38
Rosin esters, modified	26,096	25,596	11,611	.45
Styrene plastics materials, total	5,203,024	5,031,021	1,752,096	.35
Acrylonitrile-butadiene-styrene terpolymer (ABS) resins	1,108,130	1,091,198	519,197	.48
Styrene-acrylonitrile copolymer (SAN) resins	141,424	...	...	...
Straight polystyrene	2,196,169	2,064,231	577,985	.28
Rubber modified polystyrene	1,013,776	1,007,776	270,098	.27
Styrene-butadiene latexes	481,603	473,215	169,646	.36
All other styrene latexes	46,990	46,102	14,530	.32
All other styrene plastics materials[15]	214,932	348,499	200,640	.58
Vinyl resins, total[16]	6,438,458	5,364,642	1,638,431	.31
Polyvinyl acetate[17]	768,563	686,196	254,555	.37
Polyvinyl alcohol[18]	138,717	116,933	78,117	.67
Polyvinyl chloride and copolymers	5,267,291	4,363,441	1,155,251	.26
Polyvinylidene chloride latex resins	20,686	...	...	...
Other vinyl and vinylidene resins	243,201	198,072	150,508	.76
All other thermoplastic resins[19]	115,402	862,338	609,479	.71

[1] Certain data have been revised for 1976. These revisions are summarized below:

PLASTICS AND RESIN MATERIALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE
	1,000 pounds dry basis	*1,000 pounds dry basis*	*1,000 dollars*	*Per pound*
Grand total	29,989,431	25,050,206	8,784,700	$0.35
Thermoplastic resins, total	24,019,587	20,369,586	6,906,238	.34
Engineering resins	378,226	290,716	239,471	.82
Polyester resins, saturated	131,585	84,185	90,697	1.08

[2] Calculated from rounded figures.

[3] Dry weight basis unless otherwise specified. Dry weight basis is the total weight of the materials including resin and coloring agents, extenders, fillers, plasticizers, and other additives, but excluding water and other liquid diluents unless they are an integral part of the materials.

[4] Includes benzenoid plastics and resin materials as defined in part 1 of schedule 4 of the Tariff Schedules of the United States; also includes urethane type elastomers which are not defined in part 1 of schedule 4 of the TSUS.

[5] Includes reactive diluents which are an integral part of the resin. Excludes the weight hardeners sold in association with the resin as part of a two-component system.

[6] Data shown for advanced epoxy resins are that part of the unmodified epoxy resins which is further processed; therefore, the totals in parentheses are not included in the grand total.

[7] Polyester resins are unsaturated alkyd resins, later to be copolymerized with a monomer (such as styrene or methyl methacrylate), and polyallyl resins (such as diallyl phthalate and diglycol carbonate). Data are on an "as sold" basis, including monomer if part of the resin system.

[8] In addition to the polyols, the other principal starting materials used in the production of urethane products are the isocyanic acid derivatives, mainly the 80/20 mixture of toluene-2,4- and 2,6-diisocyanate. Statistics for the isocyanic acid derivatives are reported in the "Cyclic Intermediates" section of the Synthetic Organic Chemicals report.

[9] The data on urethane elastomers are believed to be not fully representative of the total urethane market in view of the very large number of urethane elastomer producers.

[10] Includes acetone-formaldehyde resins, furfuryl type resins, polybutadiene resins and certain other thermosetting resins.

[11] Does not include production or sales for fiber use.

[12] Engineering plastics: Includes acetal, polycarbonate, polyimide and amide-imide polymers, polysulfone, and polyphenylene oxide, and polyphenylene sulfide. Engineering plastics are defined in Whittington's Dictionary of Plastics, as "Those [plastics] which have mechanical, chemical and thermal properties suitable for use in construction, machine components and chemical processing equipment." The above list of plastics (all of which are thermoplastic) was selected from a larger group in this source. The other plastics named in Whittington's Dictionary as engineering plastics, ABS resins and nylon resins, are not included in the above list as they are published separately.

Footnotes--Continued

[13] Statistics for nylon 6 and nylon 6/6 which are used in plastic applications (e.g., molding, etc.) are included here.
[14] Statistics are included here for polyethylene terephthalate used in plastics applications (e.g., molding, etc.).
[15] Includes data for styrene-acrylonitrile copolymer (SAN) resins (sales only), α-methyl styrene polymers, and all other styrene copolymers.
[16] Data are on the basis of dry resin content, excluding the weight of plasticizers, extenders, fillers, coloring agents, stabilizers, or impact modifiers, unless otherwise noted.
[17] Data for polyvinyl acetate produced and sold in latex form includes the weight of any protective colloids which are used as emulsion stabilizers and form an integral part of the resin system. Production and sales do not include polyvinyl acetate used as a reactive intermediate for polyvinyl alcohol or other vinyl resins.
[18] Production and sales do not include polyvinyl alcohol used as a reactive intermediate for polyvinyl butyral or other vinyl resins.
[19] Includes acrylic resins (sales only), coumarone-indene resins, fluorocarbon resins except PTFE, polybutylene type resins, polyphenyl aromatic ester resins, and other thermoplastics materials.

Note.--Data reported to the U.S. International Trade Commission do not necessarily coincide with that reported to the Society of the Plastics Industry (SPI) because of differences in both the reporting instructions and in the coverage of certain resins.

TABLE 2.--PLASTICS AND RESIN MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT. COMPANY IDENTIFICATION CODES WHICH ARE FOLLOWED BY AN "(E)" ARE SO LABELED BECAUSE THE COMPANY FAILED TO SUPPLY THE U.S. INTERNATIONAL TRADE COMMISSION WITH THEIR DATA IN SUFFICIENT TIME FOR ITS INCLUSION IN THIS REPORT. THE COMPANY IS PRESUMED TO HAVE CONTINUED PRODUCTION OF THE COMPOUND IN QUESTION IN 1977 AND THE VOLUME OF PRODUCTION AND SALES HAS BEEN ESTIMATED BY THE USITC STAFF MEMBERS]

PLASTICS AND RESIN MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
THERMOSETTING RESINS	
Acetone-formaldehyde resins	ACY, AMP, PPG.
*ALKYD RESINS:	
*Alkyd copolymers, all other	DSO, FLW, GEI, MCC, PPG, REL, SCM, STT, SW.
*Phthalic anhydride type alkyd resins	ACY, APT, ASH, AZS, BAL, BEN, BRU, CEL, CGL, CNE, CPV, DEG, DSO, DUP, EW, FAR, FLW, FOC, FRE, GEI, GIL, GRV, HAN, ICF, IMC, JOB, JSC(E), KMC, KMP, KPT, MCC, MID, MNP, NPV, OBC, PER, PFP, PPG, PRT, RCI, RED, REL, RH, RSY, SCM, SCN, SED, SKT, SM, STT, SW, X.
*Polybasic acid type alkyd resins	ACY, ASH, AZS, BEN, CEL, CGL, DEG, EW, FAR, FOC, GEI, GRV, HAN, ICF, IMC, MCC, MID, PLS, PPG, RCI, RED, REL, RH, SCM, SCN, SED, SKT, SM, STT, SW.
*Styrenated-alkyds, or copolymer alkyds	APT, ASH, CGL, CNE, CPV, DSO, EW, FLW, FRE, GEI, GRV, HAN, ICF, JOB, KPT, MCC, REL, SCM, SM, STT, SW.
AMINO RESINS:	
*Melamine-formaldehyde resins	ACS, ACY, AMP, BOR, CBD, CEL, CGL, CNE, CPV, DAN, DGO, DSO, DUP, ENJ, GE, GRV, HAN, JSC(E), KPT, MID, MON, OCF, PMC, PPG, PPL, QCP, RCI, REL, RH, SCM, SED, SM, SNW, STC, USM, VAL, WBD.
* Urea-formaldehyde resins	ACS, ACY, AMP, APX, BOR, CBD, CBM, CEL, CGL, CMP, CNE, CPV, DAN, DSO, DUP, GAF, GOC, GP, GRV, HNC, HRT, IBI, JSC(E), KPT, MMM, MON, NTC, PC, PMC, PPG, PPL, RCI, REL, RH, RPC, SAC, SCM, SNW, SW, UNO, USM, USO, VAL, VPC, X, X.
* Dicyandiamide resins	APX, ECC, JSC(E), RPC, S, SNW, STC, DSM, VAL, VPC.

TABLE 2.--PLASTICS AND RESIN MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PLASTICS AND RESIN MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
THERMOSETTING RESINS--Continued	
EPOXY RESINS:	
*Epoxy resins, advanced	ACS, ASH, AZS, BEN, CEL, CGY, CNI, DSO, EW, GE, GRV, HYC, ICF, MCC, MID, MMM, MRT, NPV, OCF, PCL, PPG, RCI, SCM, SCN, SM, STT, WLN(E).
*Epoxy resins unmodified	CEL, CGY, DA, DOW, ICF, JOB, RCI, SHC, SM, UCC.
Furfuryl type resins	ACB, HVG, STC, UNO, WBD.
*Phenolic and other tar acid resins	ABS, ACR, ACS, AMP, ASH, BME, BOR, CBD, CBM, CGL, CLK, DA, DSO, ENJ, EW, FAR, FOM, GE, GEI, GIL, GOC, GP, GRG, HER, HKD, HPC, HVG, ICF, INL, IRI, KPT, MCA, MID, MMM, MON, MRB, NCI, OCF, PLS, PPG, PPL, PYZ, RAB, RCI, RGC, RH, RPC, SCN, SIM, SKT, SM, SPL, STC, UCC, UNO, USR, VPC, VSV, WCA, WRD.
Polybutadiene resins	ATR, CGL, CNI.
POLYESTER RESINS, UNSATURATED, AND ALLYL RESINS:	
Allyl resins	ACS, FMP(E), PPG.
*Polyester resins, unsaturated	ACS, ACY, APH, APT, ASH, AZS, CEL, CNE, CPV, DA, DOW, DSO, EW, FMP, FRE, GEI, GRG, ICF, ICI, IPC, KMC, KPT, MCC, MFG, MRB, MRO, OCF, POL, PPG, PPL, RCI, RH, RSC, SCM, SCN, SHC, SIL, SLC, SM, SW.
*Polyether and polyester polyols for urethanes	APT, ARK, BAS, CHC, CPV, DOW, DSO, FRE, GPM, HPC, ICF, ICI, JCC, MMM, MOB, NTL, OCF, OMC, PPG, RCI, SKT, UCC, UNO, UPJ, WTC.
*POLYURETHANE ELASTOMER AND PLASTIC PRODUCTS:	
*Polyurethane elastomers	ACY, BAS, BFG, CNI, CWN, DNS, DUP, EPI, INP, MMM, MOB, MRT, PFP, PLN, PPG, PRC, PBT, REZ, RUB, TKL, UPJ, USR, WTC.
*Polyurethane resins	APT, ASH, BAS, CGL, CPV, DSO, DUP, EW, FAR, ICF, ICI, JOB, KMC, MCC, MID, MNP, NTL, OMC, PFP, PCL, PPG, PVI, QUN, RCI, SCM, SCN, SLC, SW, TNO, UPJ, USM, USR, WLN(E), WTC.
*Silicone resins	ASH, CGL, DCC, JOB, MID, RCI, SCM, SM, SPD, SWS.
Thermosetting resins, nonbenzenoid, all other	APX, SW, USO.
Thermosetting resins, benzenoid, all other	GEI, MOB, MON, PP3, S, SCM, SED, SM, VAL.

TABLE 2.--PLASTICS AND RESIN MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PLASTICS AND RESIN MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
THERMOPLASTIC RESINS	
*ACRYLIC RESINS:	
*Acrylic resins, all other	ACY, AZS, CHP, CYR, DSO, DUP, EFH, GLC, GNM, GRD, ICF, JNS, JSC(E), MID, OBC, PPG, PRT, PVI, PYC, RH, SAR, SCM, SM, SW, TX, UBS, VPC.
Ethyl acrylate butyl acrylate copolymer	QUN, VAL.
*Polymethyl methacrylate	ASH, CNE, DSO, DUP, ICF, IOC, JOB, MRT, PPG, PVI, PYC, RH, SAR, SNW, SOR, SWE, TKL.
*Thermosetting acrylics	CPV, DSO, GRV, ICF, MID, PPG, SCM, USM.
*CELLULOSE PLASTICS AND RESINS:	
Cellulose nitrate	DUP, HPC.
Cellulose plastics, all other	DCW, DUP, EKT, HPC, ICF, PPG.
Chlorinated polyolefins, thermoplastic	EKX.
Coumarone-indene resins	DUP, HPC, NEV, VEL.
*ENGINEERING PLASTICS:	
Acetal resins	CEL, DUP, FLH.
Polycarbonate resins	GE, MCB.
Polyimides and amide-imide polymers	ACC, DUP, EW, MON, PDI.
Polyphenylene oxide type resins	GE.
Polyphenylene sulfide resins	PLC.
Polysulfone resins	UCC.
FLUOROCARBON RESINS:	
Chlorotrifluoroethylene resins	ACS.
*Polytetrafluoroethylene (PTFE)	ACS, DUP, ICI.
Fluorocarbon resins, all other	DUP, PAS.
*Petroleum hydrocarbon resins	EKX, ENJ, GRV, GYR, HPC, ICF, NEV, NPV, RCI, SCM, SM, VEL, ZGL.
*POLYAMIDE RESINS:	
*Non-nylon type, polyamide resins	AMP, AZS, CBY, COO, DEG, EMR, GNM, HAL, RSN, SM, SNW, USM.
*Nylon type, polyamide resins	ALF, BCM, CEL, CTR, DGO, DUP, FG, FR , GNM, MON, POL, USM.
Polybutylene type resins	ENJ, WTC.
*Polyester resins, saturated	CEL, COO, DEG, DGO, DSO, DUP, EKT, GAF, GE, GRV, GYR, ICF, ICI, MCC, MID, MMM, MRT, RUB, SCM, SED, STT, SW, USM.
*POLYETHYLENE AND COPOLYMERS RESINS:	
*Polyethylene resins, high density (density over 0.940)	ACC, ACS, CPX, DOW, DUP, GOC, HPC, KPP, MON, PLC, SLT, UCC, USI.
*Polyethylene resins, low density (density of 0.940 and below)	ACS, CBN, CPX, DOW, DUP, EKX, ENJ, GOC, KPP, NWP, PLC, RCC, RH, UCC, USI.

TABLE 2.--PLASTICS AND RESIN MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PLASTICS AND RESIN MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
THERMOPLASTIC RESINS--Continued	
Polyphenyl aromatic ester resins	HPC.
*Polypropylene polymer and copolymer resins	ACC, EKX, ENJ, HPC, KPP, NVT, PLC, RCC, SHC.
*Polyterpene resins	CBY, HPC, SCN.
*ROSIN MODIFICATIONS:	
Modified rosin (unesterified)	DPP.
*Modified rosin esters	ASH, CBY, DPP, EW, FCD, FRP, GRV, ICF, MCC, RCI, SCM, SM, STC, SW, [illegible].
*Rosin esters, unmodified (ester gums)	ASH, CBY, DPP, FAR, FRP, RCI.
*STYRENE TYPE PLASTICS MATERIALS:	
*Acrylonitrile-butadiene-styrene (ABS) Terpolymer resins	BFG, CSD, DOW, FRS, GRD, GYR, MCB, MON, RCC, USR.
α-Methyl styrene polymers	ACC, DOW.
*Styrene-acrylonitrile copolymer resins (SAN)	BFG, CSD, DOW, MON, SKT, UCC.
POLYSTYRENE:	
*Rubber modified polystyrene	DOW, GOR, KPP, MON, SHC, SOL, USS.
*Straight polystyrene	ACC, AEP, ASY, BAS, CSD, DOW, FG, GAF, GOR, JSC(E), KPP, MON, RCC, RCD, SHC, SOL, UCC, USS.
Styrene copolymers, all other	ATR, BFG, DA, DOW, DSO, DUP, GRD, GYR, HPC, IOC, JNS, MMM, MON, MRT, OBC, PLC, PVI, RCC, RCD, RH, SED, SKT, SW, TKL, UBS.
STYRENE LATEXES:	
*Styrene-butadiene latexes	BOR, CEL, DOW, DSO, GAF, GNT, GRD, GYR, KPP, UOC, USR.
*all other Styrene latexes	BFG, DOW, FIR, GNT, GRD, MON, UOC.
*VINYL RESINS:	
*Polyvinyl acetate resins	AIP, AZS, BAL, BEN, BLS, BOR, CEL, CNE, DAN, FAR, FLH, FLN, GLC, GRD, JOE, JSC(E), KMC, KMP, KNP, MCC, MON, NSC, OBC, QCP, RCI, RPC, SCM, SCO, SED, SW, UBS, UCC, X.
*Polyvinyl alcohol resins	AIP, DUP, MON.
Polyvinyl butyral resins	DUP, MON, UBS, UCC.
*Polyvinyl chloride and copolymer resins	AIP, BFG, BOR, CO, CPR, DA, FIR, GNT, GP, GRA, GYR, HN, KYS, NSC, PNT, RBT, RCO, RUB, SFP, SHT, TNA, UCC.
Polyvinyl formal resin	MON.

TABLE 2.--PLASTICS AND RESIN MATERIALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PLASTICS AND RESIN MATERIALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
THERMOPLASTIC RESINS--Continued	
*VINYL RESINS--Continued	
Vinyl acetate-acrylate copolymers	DSO, FLW, NPV.
*Polyvinylidene chloride latex type resins	BFG, DOW, GRD, MRT.
Vinyl and vinylidene resins, all other	DOW, DUP, EW, RH, UCC.
Thermoplastic resins, nonbenzenoid, all other	DSO, SW.
Thermoplastic resins, benzenoid, all other	DGO, RPC.

TABLE 3.--PLASTICS AND RESIN MATERIALS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of plastics and resin materials to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company
ABS	Abex Corp., Friction Products Group
ACC	Amoco Chemicals Corp.
ACR	CPC International, Inc., Acme Resin Corp.
ACS	Allied Chemical Corp., Specialty Chemical Div.
ACY	American Cyanamid Co.
AEP	A & E Plastics Pak Co., Inc.
AIP	Air Products & Chemicals, Inc.
ALF	Allied Chemical Corp., Fibers Div.
AMR	Pacific Resins & Chemical Co.
APT	Whittaker Corp., Whittaker Coatings & Chemical, Mol Rez Resins
APX	Apex Chemical Co., Inc.
ARK	Armstrong Cork Co.
ASH	Ashland Oil, Inc., Ashland Chemical Co. Div.
ASY	American Synthetic Rubber Corp.
ATR	Atlantic Richfield Co.
AZS	AZS Corp.:
	AZ Products Co. Div.
	AZS Chemical Co.
BAL	Baltimore Paint & Chemical Corp.
BAS	BASF Wyandotte Corp.
BCM	Belding Chemical Industries
BEN	Bennett's
BFG	B.F. Goodrich Co., B.F. Goodrich Chemical Co. Div.
BLS	Life Savers, Inc.
BME	Bendix Corp., FMD Div.
BOR	Borden Co., Borden Chemical Co. Div.
BRU	M.A. Bruder & Sons, Inc.
CBD	Chembond Corp.
CBM	Carborundum Co.
CBN	Cities Service Co., Petrochemicals Div.
CBY	Crosby Chemicals, Inc.
CEL	Celanese Corp.:
	Celanese Plastics Co.
	Celanese Polymer Specialties Co.
CGL	Cargill, Inc.
CGY	Ciba-Geigy Corp., Resins Dept.
CHC	Carpenter Chemical Co.
CHP	C.H. Patrick & Co., Inc.
CLK	Clark Chemical Corp.
CMP	Commercial Products Co., Inc.
CNE	Conchemco, Inc.
CNI	Conap, Inc.
CNT	Certainteed Corp.
CO	Continental Oil Co.
COO	The Terrell Corp.
CPV	Cook Paint & Varnish Co.
CPX	Chemplex Co.
CSD	Cosden Oil & Chemical Co.
CTR	Customs Resins, Inc.
CWN	Upjohn Co., Fine Chemical Div.
CYR	CY/RO Industries, Inc.
DA	Diamond Shamrock Corp.
DAN	Dan River, Inc., Chemical Products Dept.
DCC	Dow Corning Corp.
DEG	Degan Oil & Chemical Co.
DGO	Day-Glo Color Corp.
DNS	Dennis Chemical Co.
DOW	Dow Chemical Co.
DPP	Dixie Pine Chemicals, Inc.
DSO	DeSoto, Inc.
DUP	E.I. duPont de Nemours & Co., Inc.
ECC	Eastern Color & Chemical Co.
EFH	E.F. Houghton & Co.
	Eastman Kodak Co.:
EKT	Tennessee Eastman Co. Div.
EKX	Texas Eastman Co. Div.
EMR	Emery Industries, Inc.
ENJ	Exxon Chemical Co. U.S.A.
EPI	Eagel Pitcher Industries, Inc., Ohio Rubber Co.
EW	Westinghouse Electric Corp., Industrial Materials Div.
FAR	Syncon, Inc.
FCD	Synres Chemical Corp.
FG	Foster Grant Co., Inc.
FIR	Firestone Tire & Rubber Co., Firestone Plastics Co. Div.
FLH	H.B. Fuller Co.
FLN	Franklin Chemical Corp.
FLW	O'Brien Corp., Fuller-O'Brien Div.
FMP	FMC Corp., Industrial Chemical Div.
FOC	Handschy Chemical Co., Farac Oil & Chemical Co. Div.
FOM	Formica Corp.
FRE	Freeman Chemical Corp.
FRF	Firestone Tire & Rubber Co., Firestone Synthetic Fibers Co.
FRP	FRP Company
FRS	Firestone Tire & Rubber Co., Firestone Synthetic Rubber & Latex Co. Div.
GAF	GAF Corp..
GE	General Electric Co.:
GEI	Insulating Materials Products Sec.
GIL	Gilman Paint & Varnish Co.
GLC	General Latex & Chemical Corp.
GNM	General Mills Chemicals, Inc.
GNT	General Tire & Rubber Co., Chemical Plastics Div.
GOC	Gulf Oil Corp., Gulf Oil Chemicals Co.-U.S.
GOR	Carl Gordon Industries, Inc.
GP	Georgia-Pacific Corp.:
	Plaquemine Div.
	Resins Operations
GPM	General Plastics Manufacturing Co.
GRA	Great American Chemical Corp.
GRD	W.R. Grace & Co., Polymers Chemicals Div.
GRG	P.D. George Co.
GRV	Guardsman Chemicals, Inc.
GYR	Goodyear Tire & Rubber Co.
HAL	C.P. Hall Co.
HAN	Hanna Chemical Coating Corp.
HER	Heresite & Chemical Co.
HKD	Hooker Chemicals & Plastics Corp, Durez Div.

TABLE 3.--PLASTICS AND RESIN MATERIALS: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
HN	Tenneco Chemicals, Inc.	PER	Perry & Derrick Co.
HNC	H & N Chemical Co.	PFP	Midwest Manufacturing Corp.
HPC	Hercules, Inc.	PLC	Phillips Petroleum Co.
HRT	Hart Products Corp.	PLN	Disogrin Industries Corp.
HVG	Haveg Industries, Inc. Sub of Hercules, Inc.	PLR	Polysar Resins, Inc.
HYC	Dexter Corp., Hysol Co. Div.	PLS	Plastics Engineering Co.
		PMC	Plastics Manufacturing Co.
ICF	Inmont Corp.	PNT	Pantasote Co.
ICI	ICI United States, Inc.:	POL	Polymer Corp.
	Plastics Div.	PPG	PPG Industries, Inc.
	Chemical Specialties Co.	PPL	Pioneer Plastics Div. of LOF Plastics, Inc.
IMC	IMC Chemical Group, Inc., McWorter Resins	PRC	Products Research & Chemical Corp.
INL	Inland Steel Co., Inland Steel Container	PRT	Pratt & Lambert, Inc.
	Co. Div.	PVI	Polyvinyl Chemical Ind.
INP	Indopol, Inc.	PYC	Polycast Technology Corp.
IOC	Ionac Chemical Co. Div. of Sybron Corp.	PYZ	Polyrez Co., Inc.
IPC	Interplastic Corp.		
IRI	Ironsides Resins, Inc.	QCP	Quaker Chemical Corp.
		QUN	K.J. Quinn & Co., Inc.
JCC	Jefferson Chemical Co.		
JNS	S.C. Johnson & Sons, Inc.	RAB	Raybestos-Manhattan, Inc., RM Friction
JOB	Jones-Blair Paint Co.		Materials Co. Div.
JSC	Jersey State Chemical Co.	RBT	Robintech, Inc.
JWC	J.W. Carroll & Sons Div. of U.S. Industries,	RCC	Rexene Polyolefins Co.
	Inc.	RCC	Rexene Styrenics Co.
		RCD	Richardson Co., Polymeric Systems Div.
KMC	Kohler-McLister Paint Co.	RCI	Reichhold Chemicals Inc. and Reichhold
KMP	Kelly-Moore Paint Co.		Polymers Inc.
KPP	Arco/Polymers, Inc.	RCO	Rico Chemical Corp.
KPT	Koppers Co.	RED	Red Spot Paint and Varnish Co., Inc.
KYS	Keysor Corp.	REL	Reliance Universal, Inc., Louisville Resins
			Operations
MCA	Masonite Corp., Alpine Div.	REZ	Hexcel Corp.
MCB	Borg-Warner Corp., Borg-Warner Chemicals	RGC	Rogers Corp.
MCC	McCloskey Varnish Co.	RH	Rohm & Haas Co.
MCC	McCloskey Varnish Co. of the Northwest	RPC	A. Kewanee Industry, Millmaster Onyx
MCC	McCloskey Varnish Co. of the West		Group, Refined-Onyx Co. Div.
MFG	Rockwell International Corp.	RSC	Resinous Chemicals Corp.
MID	Dexter Corp., Midland Div.	RSN	Rilsan Corp.
MMM	Minnesota Mining & Manufacturing Co.	RSY	Resyn Corp.
MNP	The Valspar Corp.	RUB	Hooker Chemical Corp., Ruco Div.
MOB	Mobay Chemical Co.		
MON	Monsanto Corp.	S	Sandoz, Inc.
MRB	Marblette Co.	SAC	Southeastern Adhesives Co., Inc.
MRO	W.R. Grace & Co., Hatco Polyester Div.	SAR	Sartomer Industries, Inc.
MRT	Morton Chemical Co. Div. of Morton Norwich	SCM	SCM Corp.
	Products, Inc.	SCN	Schenectady Chemicals, Inc.
		SCO	Scholler Bros., Inc.
NCI	Union Camp Corp.	SED	Conchemco, Inc.
NEV	Neville Chemical Co.	SFP	Stauffer Chemical Co., Plastics Div.
NPV	Norris Paint & Varnish Co., Inc.	SHC	Shell Oil Co., Shell Chemical Co. Div.
NSC	National Starch & Chemical Corp.	SHT	Shintech, Inc.
NTC	National Casein Co.	SIC	Vistron Corp., Silmar Div.
NTL	NL Industries, Inc.	SIM	Simpson Timber Co., Chemicals Div.
NVT	Novamont Corp.	SKT	Textron Inc., Spencer Kellogg Div.
NWP	Northern Petrochemical Co.	SLC	Soluol Chemical Co., Inc.
		SLT	Soltex Polymer Corp.
OBC	O'Brien Corp.	SM	Mobil Oil Corp., Mobil Chemical Co.,
OCF	Owens-Corning Fiberglas Corp.		Chemical Coatings Div.
OMC	Olin Corp.	SNW	Sun Chemical Corp., Chemicals Div.
		SOR	MW Manufacturers, Southern Resin Div.
PAS	Pennwalt Corp.	SPC	Insilco Corp., Sinclair Paint Co. Div.
PC	Proctor Chemical Co., Inc.	SPD	General Electric Co., Silicone Products
PDI	Phelps Dodge Industries, Inc., Phelps Dodge		Dept.
	Magnet Wire Co. Div.	SPL	Spaulding Fibre Co., Inc.

TABLE 3.--PLASTICS AND RESIN MATERIALS: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
STC	American Hoechst Corp., Sou-Tex Works	USM	USM Corp., Bostik Div.
STT	Standard T Chemical Co.	USO	U.S. Oil Co.
SW	Sherwin-Williams Co.	USR	Uniroyal, Inc., Uniroyal Chemical Div.
SWE	Swedcast Corp.	USS	USS Chemicals Div. of U.S. Steel Corp.
SWS	Stauffer Chemical Co., SWS Silicones Div.	VAL	Valchem Div. of United Merchants & Manufacturers, Inc.
TKL	Thiokol Corp.	VEL	Veliscol Chemical Corp.
TNA	Ethyl Corp.	VPC	Mobay Chemical Corp., Verona Div.
TNO	Trancoa Chemical Corp.	VSV	Valentine Sugars, Inc., Valite Div.
TX	Texaco, Inc.		
UBS	A.E. Staley Manufacturing Co., Chemicals Specialties Div.	WCA	West Coast Adhesives Co., Inc.
UCC	Union Carbide Corp.	WLN	Wilmington Chemical Corp.
UNO	United-Erie, Inc.	WRD	Weyerhaeuser Co.
UOC	Union Oil Co. of California	WTC	Witco Chemical Corp.
UPJ	Upjohn Co.		
USI	U.S. Industrial Chemicals Co.: National Distillers & Chemical Corp. National Petro Chemical Corp.	ZGL	Carolina Processing Corp.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

RUBBER-PROCESSING CHEMICALS

David B. Beck

Rubber-processing chemicals are organic compounds that are added to natural and synthetic rubber to give them qualities necessary for their conversion into finished rubber goods. In this report, statistics are given for cyclic and acyclic compounds by use--such as accelerators, antioxidants, blowing agents, and peptizers. Data on production and sales of rubber-processing chemicals in 1977 are given in table 1.[1]

Production of rubber-processing chemicals as a group in 1977 amounted to 402 million pounds, or 4.7 percent more than the 384 million pounds in 1976. Sales of rubber-processing chemicals in 1977 amounted to 238 million pounds, valued at $278 million, compared with 224 million pounds, valued at $247 million, in 1976.

The production of cyclic rubber-processing chemicals in 1977 amounted to 356 million pounds, or 6.3 percent more than the 335 million pounds in 1976. Sales in 1977 were 202 million pounds, valued at $249 million, compared with 186 million pounds, valued at $218 million, in 1976. Of the total production of cyclic rubber-processing chemicals in 1977, accelerators, activators, and vulcanizing agents accounted for 39.8 percent and antioxidants, antiozonants, and stabilizers for 55.9 percent. Production of antioxidants, antiozonants, and stabilizers, which amounted to 198.7 million pounds in 1977, included 132.0 million pounds of amino compounds and 66.7 million pounds of phenolic and phosphite compounds. Sales of amino antioxidants, antiozonants, and stabilizers in 1977 amounted to 79.1 million pounds, valued at $99.1 million; sales of phenolic and phosphite antioxidant, antiozonants, and stabilizers, were 38.2 million pounds, valued at $43.6 million.

Production of acyclic rubber-processing chemicals in 1977 amounted to 46.5 million pounds, or 6.4 percent less than the 49.7 million pounds reported for 1976. Sales in 1977 totaled 35.8 million pounds, valued at $29.0 million, compared with 37.9 million pounds, valued at $28.6 million, in 1976. Dithiocarbamic acid derivatives accounted for 15.9 percent of sales (based on quantity) of acyclic rubber-processing chemicals in 1977 and bis-(dimethylthiocarbamoyl) disulfide accounted for 10.4 percent.

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[1] See also table 2 which lists these producers and identifies the manufacturers by codes. These codes are given in table 3.

TABLE 1.--RUBBER-PROCESSING CHEMICALS: U.S. PRODUCTION AND SALES, 1977

[Listed below are all rubber-processing chemicals for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists separately all rubber-processing chemicals for which data on production and/or sales were reported and identifies the manufacturers of each]

RUBBER-PROCESSING CHEMICALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	402,013	238,084	277,765	$1.17
CYCLIC				
Total	355,549	202,251	248,756	1.23
Accelerators, activators, and vulcanizing agents, total	141,354	71,794	82,465	1.15
Aldehyde-amine reaction products	732	620	1,041	1.68
Dithiocarbamic acid derivatives	243	162	547	3.37
Thiazole derivatives, total	132,107	62,307	64,937	1.04
N-Cyclohexyl-2-benzothiazolesulfenamide	...	2,315	3,041	1.31
2,2'-Dithiobis(benzothiazole)	19,530	7,353	6,847	.93
2-Mercaptobenzothiazole	...	5,994	3,828	.64
All other thiazole derivatives	109,035	46,645	51,221	1.10
All other accelerators, activators, and vulcanizing agents[2]	8,272	8,705	15,940	1.83
Antioxidants, antiozonants, and stabilizers, total	198,664	117,292	142,673	1.22
Amino compounds, total	131,957	79,054	99,065	1.25
Aldehyde- and acetone-amine reaction products	...	5,518	5,713	1.04
Substituted p-phenylenediamines	77,002	42,154	62,328	1.48
All other amino compounds[3]	54,955	31,382	31,024	.99
Phenolic and phosphite compounds, total	66,707	38,238	43,608	1.15
Phenolic compounds, total	20,482	15,985	28,749	1.80
Polyphenolics (including bisphenols)	13,080	12,455	24,449	1.96
Phenol, alkylated	3,778	1,416	1,147	.81
Phenol, styrenated	...	855	502	.59
Other	3,624	1,259	2,651	2.11
Phosphite compounds	46,224	22,253	14,859	.67
Peptizers	2,222	...	...	...
Retarder: N-Nitrosodiphenylamine	1,469	679	722	1.06
All other cyclic rubber-processing chemicals[4]	11,840	12,486	22,896	1.83
ACYCLIC				
Total	46,464	35,833	29,009	.81
Dithiocarbamic acid derivatives, total[5]	8,302	5,687	8,559	1.50
Diethyldithiocarbamic acid, zinc salt	502	440	356	.81
Dimethyldithiocarbamic acid, zinc salt	1,710	1,570	1,466	.93
All other dithiocarbamic acid derivatives	6,090	3,677	6,737	1.83
Bis(diethylcarbamoyl)disulfide	2,373	1,998	1,890	.95
Bis(dimethylthiocarbamoyl)disulfide	...	3,716	2,816	.76
Shortstops: Dimethyldithiocarbamic acid, sodium salt	3,455	1,420	596	.42
All other acyclic rubber-processing chemicals[6]	32,334	23,012	15,148	.66

[1] Calculated from rounded figures.
[2] Includes guanidines and other uses not separately shown.
[3] Includes aldehyde- and acetone-amine reactions products (production only).
[4] Includes blowing agents and other uses not separately shown.
[5] Data on dithiocarbamates included in this table are for materials used chiefly in the processing of natural and synthetic rubber. Data on dithiocarbamates which are used chiefly as fungicides are included in the report on "Pesticides and Related Products".
[6] Includes "other" thiurams, xanthates, sulfides, conditioning and lubricating agents, polymerization regulators, shortstops, and other uses not separately shown.

TABLE 2.--RUBBER-PROCESSING CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT.]

RUBBER-PROCESSING CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C	
*ACCELERATORS, ACTIVATORS AND VULCANIZING AGENTS:	
*ALDEHYDE-AMINE REACTION PRODUCTS:	
Bis(cinnamylidene)hexamethylenediamine	DUP.
n-Butyraldehyde-aniline condensate	DUP, RCD.
Heptaldehyde-aniline condensate	USR.
Triethyltrimethylenetriamine	USR.
*DITHIOCARBAMIC ACID DERIVATIVES:	
Dibenzyldithiocarbamic acid, sodium salt	USR.
Dibenzyldithiocarbamic acid, zinc salt	USR.
Dibutyldithiocarbamic acid, N,N-dimethylcyclohexyl amine salt	RBC.
Piperidinecarbodithioic acid, piperidinium potassium salts, mixed	DUP.
GUANIDINES:	
Dicatechol borate, di-o-tolylguanidine salt	DUP.
1,3,-Diphenylguanidine	ACY.
1,3-Di-o-tolylguanidine	ACY.
*THIAZOLE DERIVATIVES:	
2-Benzothiazyl N,N-diethylthiocarbamoyl sulfide	PAS.
1,3-Bis(2-benzothiazolylmercaptomethyl) urea	LAK.
N-tert-Butyl-2-benzothiazolesulfonamide	ACY, BFG, USR, X.
*N-Cyclohexyl-2-benzothiazolesulfenamide	ACY, BFG, MON, USR.
N,N-Diisopropyl-2-benzothiazolesulfenamide	ACY.
2,5-Dimercapto-1,3,4-thiodiazole	VNC.
N-(2,6-Dimethylmorpholino)-2-benzothiazolesulfenamide	MON.

TABLE 2.--RUBBER-PROCESSING CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

RUBBER-PROCESSING CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*ACCELERATORS, ACTIVATORS AND VULCANIZING AGENTS--Continued	
*THIAZOLE DERIVATIVES--Continued	
*2,2'-Dithiobis (Benzothiazole)	ACY, BFG, GYR, MON, USR.
*2-Mercaptobenzothiazole	ACY, BFG, GYR, MON, USR.
2-Mercaptobenzothiazole, copper salt	ACY.
2-Mercaptobenzothiazole, zinc chloride	DUP.
2-Mercaptobenzothiazole, zinc salt	ACY, GYR, USR.
4-Morpholinyl 2-benzothiazyl disulfide	GYR.
N-Oxydiethylene-2-benzothiazolesulfenamide	ACY, BFG.
ALL OTHER CYCLIC ACCELERATORS, ACTIVATORS AND VULCANIZING AGENTS:	
Bis(morpholinothiocarbamoyl) disulfide	ACY.
Dibenzylamine	USR.
Dimethylethanolamine, toluene-2,4-diisocyanate adduct	DUP.
Di-N,N'-pentamethylenethiuram tetrasulfide	DUP, VNC.
4,4'-Dithiodimorpholine	MON.
2-Imidazolidenethione (1,3-Ethylene-2-thiourea)	DUP, RBC.
m-Phenylenebismaleimide	DUP.
Poly-p-dinitrosobenzene	DUP.
Tetramethylthiuram disulfide	DUP.
Tetramethylthiuram tetrasulfide	GYR.
p-Toluenesulfonic acid, zinc salt	USR.
Accelerators, activators, and vulcanizing agents, cyclic, other	PAS.
*ANTIOXIDANTS, ANTIOZONANTS AND STABILIZERS:	
*AMINO COMPOUNDS:	
*ALDEHYDE AND ACETONE-AMINE REACTION PRODUCTS:	
Butyraldehyde-aniline condensate	DUP.
Diphenylamine-acetone condensate	ACY, BFG, USR.
Phenyl-2-naphthylamine-acetone condensate	USR.
*SUBSTITUTED P-PHENYLENEDIAMINES:	
Alkylaryl-p-phenylamine-diamines	MON.
N,N'-Bis(1,4-dimethylpentyl)-p-phenylenediamine	MON, UPM, USR.
N,N'-Bis(1-ethyl-3-methylpentyl)-p-phenylenediamine	UPM.
N,N'-Bis(1-methylheptyl)-p-phenylenediamine	BFG, UPM.
N-Cyclohexyl-N'-phenyl-p-phenylenediamine	UPM, USR.

TABLE 2.--RUBBER-PROCESSING CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

RUBBER-PROCESSING CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*ANTIOXIDANTS, ANTIOZONANTS, AND STABILIZERS--Continued	
*AMINO COMPOUNDS--Continued	
*SUBSTITUTED P-PHENYLENEDIAMINES--Continued	
Diarylenediamines, mixed	GYR.
N,N-Dicyclohexyl-p-phenylenediamine	UPM.
N-(1,3-Dimethylbutyl)-N-phenyl-p-phenylenediamine	GYR, UPM, USR.
N,N'-Di-2-naphthyl-p-phenylenediamine	BFG.
N,N'-Diphenyl-p-phenylenediamine	BFG, DUP, USR.
N-Isopropyl-N'-phenyl-p-phenylenediamine	USR.
N-(1-Methylheptyl)-N'-phenyl-p-phenylenediamine	UPM.
N-(1-Methylpentyl)-N'-phenyl-p-phenylenediamine	USR.
OTHER AMINES:	
p-Anilinophenol	BFG.
1,2-Dihydro-6-dodecyl-2,2,4-trimethylquinoline	X.
1,2-Dihydro-6-ethoxy-2,2,4-trimethylquinoline	X.
1,2-Dihydro-2,2,4-trimethylquinoline	BFG, X.
Diphenylamine,styrenated	GYR.
Diphenylamine, substituted	USR.
4-Isopropoxydiphenylamine	BFG.
4,4'-Methylenedianiline	USR.
Nonyldiphenylamine mixture (Mono-, di-, and tri-)	USR.
Octyldiphenylamine	ACY, USR.
Octyldiphenylamine, alkylated	BFG.
Octyldiphenylamine mixtures (Mono-, nonyl-, and di-)	DUP.
N-Phenyl-1-naphthylamine	DUP, USR.
N-Phenyl-2-naphthylamine	BFG, DUP.
Toluenediamine (Mixed isomers)	DUP.
p-(p-Toluenesulfonamido)diphenylamine	USR.
*PHENOLIC AND PHOSPHITE COMPOUNDS:	
*PHENOLIC COMPOUNDS:	
*POLYPHENOLICS (INCLUDING BISPHENOLS):	
Bisphenol, hindered	GYR, USR.
4,4'-Butylidenebis(6-tert-butyl-m-cresol)	MON.
2,5-Di-sec-butyldecylhydroquinone	USR.
2,5-Di-(1,1-dimethylpropyl)hydroquinone	X.
2,2'-Methylenebis(6-tert-butyl-p-cresol)	ACY.
2,2'-Methylenebis(6-tert-butyl-4-ethylphenol)	ACY.
2,2'-Methylenebis[6-(1-methylcyclohexyl)-p-cresol]	ACY, ICI.

TABLE 2.--RUBBER-PROCESSING CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED IDENTIFIED BY MANUFACTURER, 1977--Continued

RUBBER-PROCESSING CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*ANTIOXIDANTS, ANTIOZONANTS, AND STABILIZERS--Continued	
*PHENOLIC AND PHOSPHITE COMPOUNDS--Continued	
*PHENOLIC COMPOUNDS--Continued	
*POLYPHENOLICS (INCLUDING BISPHENOLS)--Continued	
4,4'-Thiobis(6-tert-butyl-m-cresol)	X.
Thiobisphenol, alkylated	USR, X.
1,1,3-Tri(2-methyl-4-hydroxy-5-tert-butylphenyl)butane	ICI.
ALL OTHER PHENOLIC	
o-Cresol, alkylated	PIT.
*Phenol, alkylated	ACY, BFG, GYR, NEV, RCI.
Phenol, hindered	DUP, USR.
*Phenol, styrenated, mixtures	GYR, NEV, USR.
N-Stearoyl-p-aminophenol	MLS.
Tris-(3,5-di-tert-butyl-4-hydroxybenzyl)isocyanurate	X.
PHOSPHITE COMPOUNDS:	
Alkylaryl phosphites mixed	MCB, X.
Nonylphenyl phosphites, mixed	MCB, NPI, USR, X.
Polymeric phosphites	MCB, NPI.
Polyphenolic phosphite, polyalkylated	BFG, MCB.
Triaryl phosphites	MCB.
ALL OTHER ANTIOXIDANTS, ANTIOZONANTS, AND STABILIZERS:	
2-Mercaptobenzimidazole	USR.
2-Mercaptobenzimidazole, zinc salt	USR.
BLOWING AGENTS:	
Dinitrosopentamethylenetetramine	NPI.
p,p'-Oxybis(benzenesulfonhydrazide)	USR.
p-Toluenesulfonylsemicarbazide	USR.
*PEPTIZERS:	
2',2'''-Dithiobis(benzanilide)	ACY.
Dixylyl disulfides, mixed	PIT.
Xylenethiol	DUP.
ALL OTHER CYCLIC RUBBER-PROCESSING CHEMICALS:	
p-tert-Amylphenol sulfide (Tackifier)	PAS.
4-Chloro-2,6-bis(2,4-dihydroxybenzyl)phenol	ICI.
N-(Cyclohexylthio)phthalimide	X.
Diphenyl-4,4'-diphenylmethylenedicarbamate	USR.

TABLE 2.--RUBBER-PROCESSING CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED IDENTIFIED BY MANUFACTURER, 1977--Continued

RUBBER-PROCESSING CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
ALL OTHER CYCLIC RUBBER-PROCESSING CHEMICALS--Continued	
N-(2-Methyl-2-nitropropyl)-4-nitrosoaniline	MON.
*Nitrosodiphenylamine (Retarder)	ACY, BFG, GYR, USR.
A C Y C L I C	
ACCELERATORS, ACTIVATORS AND VULCANIZING AGENTS:	
*DITHIOCARBAMIC ACID DERIVATIVES:	
Dibutyldithiocarbamic acid, nickel salt	DUP, USR.
Dibutyldithiocarbamic acid, sodium salt	ALC, DUP, USR, VNC.
Dibutyldithiocarbamic acid, zinc salt	ALC, PAS, VNC.
Diethyldithiocarbamic acid, cadmium salt and bis-(diethylthiocarbamoyl) disulfide, mixture	VNC.
Diethyldithiocarbamic acid, selenium salt	VNC.
Diethyldithiocarbamic acid, sodium salt	PAS.
Diethyldithiocarbamic acid, tellurium salt	VNC.
*Diethyldithiocarbamic acid, zinc salt	ALC, GYR, VNC.
Dimethylammonium-dimethyldithiocarbamate	USR.
Dimethyldithiocarbamic acid, bismuth salt	VNC.
Dimethyldithiocarbamic acid, copper salt	VNC.
Dimethyldithiocarbamic acid, lead salt	VNC.
Dimethyldithiocarbamic acid, selenium salt	VNC.
Dimethyldithiocarbamic acid, sodium salt and sodium polysulfide	BFG.
*Dimethyldithiocarbamic acid, zinc salt	ALC, FMN, GYR, PAS, USB, VNC.
THIURAMS:	
*Bis(diethylthiocarbamoyl)disulfide	DUP, GYR, PAS.
*Bis(dimethylthiocarbamoyl) disulfide	DUP, GYR, PAS, VNC.
Bis(dimethylthiocarbamoyl) sulfide	DUP, GYR, USR.
N,N'-Dioctadecyl-N,N'-diisopropyl thiuram disulfide	USR.
Methyl-ethyl thiurams, mixed	PAS.
XANTHATES AND SULFIDES:	
Di-n-butylxantho disulfide	USR.
Diisopropylxantho disulfide	BFG, RBC.
Zinc diisopropyl xanthate	VNC.

TABLE 2.--RUBBER-PROCESSING CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED IDENTIFIED BY MANUFACTURER, 1977-Continued

RUBBER-PROCESSING CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ALL OTHER ACYCLIC ACCELERATORS, ACTIVATORS AND VULCANIZING AGENTS:	
p-Aminocyclohexylmethane carbonate	DUP.
n-Butyraldehyde-butylamine condensate	DUP.
Di-n-butylammonium oleate	DUP.
3-Ethyl-1,1-dimethyl-2-thiourea	VNC.
Ethylenediamine carbamate	DUP.
Methacrylic acid, zinc salt	USR.
Tetramethylthiourea	RBC.
1,1,3-Trimethyl-2-thiourea	RBC.
CONDITIONING AND LUBRICATING AGENTS:	
Alkyl alcohols, mixed	DUP.
Mono- and dialkyl phosphate ammonium salts, mixed	DUP.
Sodium alkyl sulfates	DUP.
POLYMERIZATION REGULATORS:	
Alkyl mercaptans, mixed	PLC.
n Dodecyl mercaptans	PAS, PLC.
tert-Hexadecyl mercaptan	PLC.
n-Hexyl mercaptan	PLC.
n-Octyl mercaptan	PAS, PLC.
tert-Octyl mercaptan	PAS, PLC.
Tetradecyl mercaptan	PLC.
Tridecyl mercaptan	PAS.
SHORTSTOPS:	
Dimethyldithiocarbamic acid, potassium salt	USR.
*Dimethyldithiocarbamic acid, sodium salt	ALC, DUP, GYR, PAS, USR.
ALL OTHER ACYCLIC RUBBER-PROCESSING CHEMICALS:	
3,7-Dioctylphenothiazine	USR.
Waxes and paraffinic products	DUP, BCI.
Zinc laurate (Activator, physical property improver and processing auxiliary)	USR.

TABLE 3.--RUBBER-PROCESSING CHEMICALS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of rubber-processing chemicals to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ACY	American Cyanamid Co.	MCB	Borg-Warner Corp., Borg-Warner Chemicals Div.
ALC	Alco Chemical Corp.	MLS	Miles Laboratories, Inc., Sumner Div.
ASH	Ashland Oil, Inc., Ashland Chemical Co.	MON	Monsanto Co.
BFC	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.	NEV	Neville Chemical Co.
		NPI	Stepan Chemical Co., Polychem Dept.
DUP	E. I. duPont de Nemours & Co., Inc.	PAS	Pennwalt Chemicals Corp.
		PIT	Pitt-Consol Chemical Co.
		PLC	Phillips Petroleum Co.
FMN	FMC Corp., Agricultural Chemical Div.	RBC	Fike Chemicals, Inc.
GYR	Goodyear Tire & Rubber Co.	RCD	Richardson Co.
		RCI	Reichhold Chemicals, Inc.
ICI	ICI United States, Inc., Chemical Specialties Co.	UPM	UOP, Inc.
		USR	Uniroyal, Inc., Uniroyal Chemical Div.
LAK	Bofors Lakeway, Inc.	VNC	Vanderbilt Chemical Corp.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Synthetic Elastomers: Role of U.S. Imports

David B. Beck

Synthetic elastomers (also referred to as synthetic rubber) comprise part of a large group of materials called polymers (which encompasses all plastics as well as elastomers). An elastomer is any polymer material that is capable of recovering quickly and forcibly from large deformations such as stretching, bending, or twisting. Generally, a cured elastomer (1) can be stretched to at least three times its original length at room temperature and (2) after being held at twice its original length for 1 minute, will return to 1.5 times its original length within 5 minutes.

U.S. consumption of synthetic elastomers was estimated at 5.6 billion pounds in 1977. More than half of the synthetic elastomers consumed in the United States are used in the manufacture of tires and tire products. The remainder are consumed in a wide variety of industrial end uses, chiefly nontire automotive components; latex applications (carpet and drape backing, dipped goods, adhesives, molded products); impact modifiers for plastics; hoses and belting; footwear; gaskets and seals; and wire and cable insulation. U.S. production in 1977 amounted to more than 5.7 billion pounds, an increase of 7.5 percent over 1976. U.S. exports accounted for 9.7 percent of 1977 production, and were 1.5 times as large as U.S. imports that year.

U.S. consumption

Total annual U.S. consumption of synthetic elastomers for the 6-year period from 1972 to 1977, along with domestic production, imports, and exports, is shown in the table below.

Synthetic elastomers: U.S. production, imports, exports, and consumption, 1972-77

(In millions of pounds)

Year	Production	Imports	Exports	Consumption	Ratio (percent) of imports to consumption
1972	5,154.4	249.8	602.8	5,133.0	4.9
1973	6,185.9	304.0	657.2	5,379.8	5.7
1974	5,823.5	249.5	631.2	4,872.5	5.1
1975	4,631.7	203.9	510.2	4,329.3	4.7
1976	5,441.1	273.5	623.3	4,687.3	5.8
1977	5,749.9	367.0	559.1	1/ 5,600.0	6.5

1/ Compiled from estimates of the U.S. International Trade Commission.

Source: Production data compiled from U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales; import, export, and consumption data compiled from official statistics of the U.S. Department of Commerce.

Consumption in 1977 reached an estimated all-time high of 5.6 billion pounds; the previous record was 5.38 billion pounds in 1973. Styrene-butadiene rubber (SBR) accounted for about 55 percent of the total in 1977; polybutadiene accounted for about 15 percent; butyl, polychloroprene (neoprene), ethylene-propylene, nitrile, and isoprene elastomers, less than 6 percent each. As with many commodities, consumption of synthetic elastomers dropped in 1974 as a result of the Arab oil embargo. The continuing recession in 1975 kept consumption down. Although the national economy began to recover in 1976, the United Rubber Workers' Union went on strike against the major tire producers, effecting a slackening of demand for elastomers during the summer of that year. Later in 1976 and through most of 1977, U.S. tire producers stepped up tire production for two reasons: (1) to replenish inventories that had dropped to near-critical levels during the 1976 strike; and (2) to meet increasing demand brought about by the improving economy; hence, the large jump in synthetic elastomers consumption in 1977.

Consumption (quantity basis) of the larger volume synthetic elastomers, except polychloroprene (neoprene), increased in 1977 over 1976, as shown below:

Elastomer type	Change in U.S. consumption from 1976 to 1977 (Percent)
Styrene-butadiene	+14
Butyl	+23
Nitrile	+12
Polybutadiene	+22
Polyisoprene	+16
Polychloroprene	-4
Ethylene-propylene	+25

The larger increases in consumption of butyl and polybutadiene elastomers were accounted for at least in part by a 31-percent increase in demand for truck and bus tires: butyl, because it has superior air retention for inner tubes, which are still commonly used in truck and bus tires; and polybutadiene, because an average of 7 pounds of it are used in the production of every truck and bus tire.

The 25-percent increase in ethylene-propylene elastomer consumption in 1977 over 1976 was a continuation of rising growth equaling an average compounded rate of 15 percent per year since 1972. While declines in consumption of other types of elastomers ranged from 7.5 percent to 27 percent in 1975 (overall synthetic decline was 11 percent), ethylene-propylene elastomer consumption declined only 7.5 percent in 1975 but rebounded quickly in 1976. Although consumption of ethylene-propylene elastomers in tires never burgeoned to producers' intitial great expectations, that group of elastomers has been found to be suitable for a growing number of nontire applications.

Similarly, the decline in polychloroprene consumption in 1977 was a continuation of a downward trend. Polychloroprene will continue to be best suited for industrial applications where good weathering and water resistance (e.g., in bridge mounts) are important; in less demanding end uses, polychloroprene has yielded to less expensive substitutes (i.e., other elastomers and plastics materials).

U.S. imports

Imports of synthetic elastomers during 1972-77 fluctuated in the same pattern as U.S. consumption, accounting, on the average, for 5.4 percent of total consumption. The chief sources each year during 1972-77 were Canada and Japan. On the average, Canada accounted for 54 percent of the total (52 percent in 1977); Japan, for 25 percent (23 percent in 1977). The bulk of the remainder came from West European countries.

Effective August 3, 1975,[1] imports of synthetic elastomers from Romania became eligible for duty-free treatment under the Generalized System of Preferences provided for in title V of the Trade Act of 1974 (Public Law 93-618). The share of U.S. imports originating in Romania rose from virtually nil before 1975 to 2.2 percent in 1976 and 1.2 percent in 1977.

Total U.S. imports of synthetic elastomers increased irregularly from 249 million pounds in 1972 to 367 million pounds in 1977. For the 6-year period, styrene-butadiene rubber accounted for about one-third of the total; polybutadiene accounted for about one-fourth; and butyl rubber, about 15 percent. For the first time, the level of polybutadiene imports, accounting for 34 percent of the U.S. synthetic elastomers import total in 1977, jumped above the import level of the perennial leader styrene-butadiene rubber, which accounted for 24 percent of the total in 1977. The figure on the following page is a graphic illustration of U.S. imports of the three large-volume elastomers (with respect to imports), which together accounted for 74 percent of total U.S. imports of synthetic elastomers in 1977.

The ratio of total synthetic elastomer imports to consumption reached a record 6.4 percent in 1977. The following tabulation indicates by types of elastomers the changes which occurred in the import/consumption ratios from 1976 to 1977:

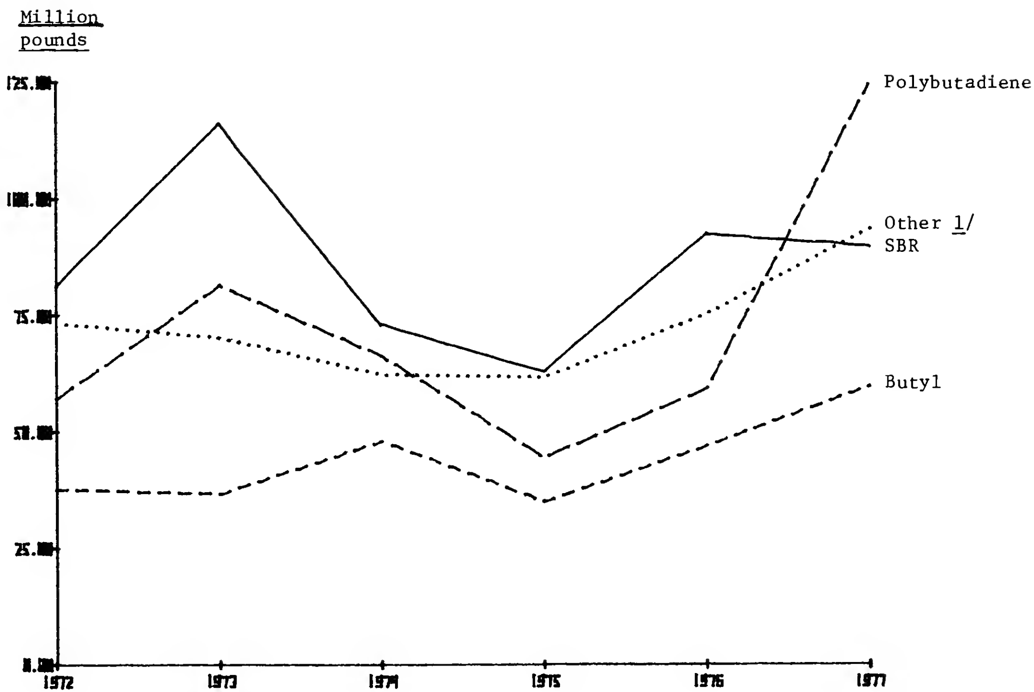
Type of elastomer	1976	1977
Styrene-butadiene----------	3.3	2.8
Butyl----------------------	18.4	19.1
Nitrile--------------------	11.5	10.9
Polybutadiene--------------	7.8	13.5
Polyisoprene---------------	.8	4.8
Polychloroprene------------	2.6	2.7
Ethylene-propylene---------	1/	1.0

1/ Less than 0.05.

The most significant change in import/consumption ratios from 1976 to 1977 was for polybutadiene. Production of polybutadiene in 1977 is estimated to have increased only about 5 percent over 1976, while demand strengthened with the increase in truck and bus tire production. Since the domestic polybutadiene industry as a

[1] Presidential Proclamation 4369, dated Apr. 24, 1975.

Synthetic elastomers: U.S. imports, by types, 1972-77



1/ Includes nitrile rubber (5 percent of 1977 total), polyisoprene (2 percent), polychloroprene (2 percent), ethylene-propylene elastomers (1 percent), and other specialty elastomers (16 percent).

Source: Compiled from official statistics of the U.S. Department of Commerce.

whole operated at or near capacity in 1977, imports served to meet the temporarily increased demand; however, import statistics for the first four months of 1978 indicate that by yearend, the polybutadiene import level will be 18 percent below the 1977 level.

Competitiveness of imports in U.S. market

Imported synthetic elastomers are generally comparable in quality to U.S. products. The average unit value of imports (including insurance and shipping costs) was 1 to 4 cents lower than the average unit value of U.S. sales during 1972-77. However, there are three factors which offset the effect of unit value differences between domestic product and imported material. First, the overall U.S. product mix is different from that of imports. Many imported specialty elastomers are not produced in volume in the United States. Furthermore, the proportion of each type of elastomer comprising imports may differ from that for U.S. production. Secondly, the proximity of U.S. producers to industrial consumers, rapid response to those consumers' needs, and steady availability of supply all contributed to the competitive edge held by domestic producers despite price differences. Finally, many imports from Western Europe and elsewhere, are intracompany transfers, some of which are valued below the domestic market price.

Those importers which did account for a significant part of the U.S. market during 1972-77 included Polysar, Inc. and the larger Japanese trading companies. Polysar, Inc., a wholly owned subsidiary of Polysar, Ltd. (the largest producer of synthetic elastomers in Canada), was the major importer of synthetic elastomers into the United States during 1972-77. The larger Japanese importing firms are wholly owned subsidiaries of large Japanese chemical companies and include, among others, JSR America, Inc.; Mitsubishi International Corp.; Mitsui & Co., U.S.A.; Nichimen Company, Inc.: and Marubeni America Corp. Significant as imports were during 1972-1977, exports continued to outpace imports during the period.

The United States was a net exporter of most types of synthetic elastomers throughout 1972-77. On the average, U.S. export quantity each year was 2.2 times that for imports.

Trade outlook for 1978

Based upon preliminary import data for 1978, the quantity of U.S. imports of synthetic elastomers is projected to return to about the 1976 level. The push by U.S. tiremakers to replenish depleted inventories is beyond the crisis stage, and near-term demand growth is not expected to top 3 or 4 percent for the year. The domestic industry is expected to operate at or near practical production capacity, with no impending strike threats or the like.

Exports, on the other hand, are expected to approach the 600 million pound level in 1978. As a result, the export/import ratio will climb from 1.5 (in 1977) to about 2.0 (compared with the 1972-77 average of 2.2).

ELASTOMERS

David B. Beck

Elastomers (synthetic rubber) are high polymeric materials with properties similar to those of natural rubber. The term "elastomers" as used in this report, means a substance, whether in bale, crumb, powder, latex, and other crude form, which can be vulcanized or similarly processed into a material that can be stretched to at least twice its original length and, after having been so stretched and the stress removed, will return with force to approximately its original length. U.S. production and sales of elastomers in 1977 are shown in table 1.[1]

Total U.S. production[2] of synthetic rubber in 1977 amounted to 5,813 million pounds, an increase of 7.9 percent from that produced in 1976. Total sales[2] of elastomers in 1977 amounted to 4,177 million pounds, an increase of 12.6 percent from that sold in 1976.

Styrene-butadiene rubber (SBR, or S-type rubber) in 1977 continued to be elastomer produced in the greatest quantity as it has been for more than a quarter of a century. U.S. production of S-type rubber, including 34 million pounds of its vinylpyridine sub-type, amounted to 3,288 million pounds in 1977, an increase of 9 percent from that reported for 1976. Solution polymerized butadiene rubber, a stereo type elastomer, was produced domestically in 1977 in the next largest amount--758 million pounds; production of isoprene the other major stereoelastomer, amounted to 137 million pounds.[3] Total U.S. production of these stereo type elastomers amounted to 896 million pounds in 1977--a decrease of 2 percent from 1976.[4] Other principal types of synthetic elastomers for which U.S. production data are reported separately are ethylene-propylene rubber, production of which was 348 million pounds in 1977, isobutylene-isoprene (butyl) rubber, production of which was 329 million pounds,[3] acrylonitrile butadiene (N-type) rubber, production of which was 161 million pounds, and polychloroprene (Neoprene) rubber, production of which was 365 million pounds.[3]

Sales of S-type rubber by U.S. producers in 1977 (including its vinylpyridine sub-type) amounted to 1,946 million pounds, an increase of 9 percent over sales reported for 1976. Sales of solution polymerized butadiene rubber amounted to 544 million pounds, and those of ethylene-propylene rubber to 298 million pounds. Sales of N-type rubber in 1977 amounted to 135 million pounds. Sales of solution polymerized butadiene rubber in 1977 increased from sales in 1976 by 32 percent, and sales of ethylene-propylene rubber increased 22 percent. Sales of N-type rubber in 1977 were 4 percent above those in 1976.

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[1] See also Table 2 which lists these products and indicates the manufacturers of each by code. The codes are identified by company name in table 3.

[2] Does not include urethane type elastomers.

[3] Reported by the Rubber Manufacturers' Association.

[4] The 1976 totals for stereorubber erroneously included production and sales of ethylene-propylene rubber; the revised production total for stereorubber in 1976 is 915.6 million pounds.

TABLE 1.--ELASTOMERS (SYNTHETIC RUBBER):[1] U.S. PRODUCTION AND SALES, 1977

[Listed below ate all elastomers (synthetic rubber) for which reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists all elastomers for which data on production and/or sales were reported and identifies the manufacturers of each]

ELASTOMERS	PRODUCTION[2]	SALES		
		QUANTITY[2]	VALUE	UNIT VALUE[3]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	5,813,236	4,177,429	1,940,260	$0.46
Cyclic	3,449,123	2,157,680	760,128	.35
Acyclic	2,364,113	2,019,749	1,180,132	.58
Acrylonitrile-butadiene type (N-type)	161,280	134,563	87,813	.65
Butadiene (emulsion polymerized) type	37,397	27,848	8,290	.30
Chloroprene type (Neoprene)	([4])	...	...	...
Ethylene-propylene type	348,534	298,391	147,804	.50
Isobutylene-isoprene type (Butyl)	([5])	...	...	...
Silicone type	52,563	43,340	127,020	2.93
Stereo elastomers:				
Butadiene (solution polymerized) type	758,429	544,117	182,669	.34
Isoprene type	([6])	...	...	...
Styrene-butadiene type (S-type)	3,254,079	1,924,576	643,680	.33
Styrene-butadiene-vinylpyridine type	33,967	21,536	15,898	.74
Urethane type	([7])	...	...	...
All other elastomers[8]	1,166,987	1,183,058	727,086	.61

[1] The term "elastomers" is defined as substances in bale, crumb, powder, latex, and other crude forms which can be vulcanized or similarly processed into materials that can be stretched at 68° F. to at least twice their original length and, after having been stretched and the stress removed, will return with force to approximately their original length.

[2] Includes oil content of oil-extended elastomers.

[3] Calculated from rounded figures.

[4] Included in "All other elastomers". The production of polychloroprene rubber in 1977 was reported by the Rubber Manufacturers' Association to be 165,388 metric tons (364,614,400 pounds).

[5] Included in "All other elastomers". The production of butyl rubber in 1977 was reported by the Rubber Manufacturers' Association to be 149,455 metric tons (329,488,500 pounds).

[6] Included in "All other elastomers". The production of polyisoprene rubber in 1977 was reported by the Rubber Manufacturers' Association to be 62,260 metric tons (137,258,400 pounds).

[7] The data on production and sales of urethane elastomers are reported in the section "Plastics and Resin Materials" with urethane plastics and polyols.

[8] Includes production and sales data for acrylic ester, butyl, chloroprene, epichlorohydrin, fluorinated, isobutylene, isoprenes, and polysulfide elastomers, certain solution elastomers, chlorinated rubber, chlorosulfonated polyethylene, thermoplastic rubber, miscellaneous elastomers.

TABLE 2.--ELASTOMERS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

ELASTOMERS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CYCLIC	
Butadiene-styrene type:	
*Butadiene-styrene (S-Type)	ASH, ASY, BFG, BOR, CPY, FIR, FRS, GNT, GRD, GYR, PLC, PLR, RCI, SWL, TUS, USR.
Butadiene-styrene-itaconic acid	ASY.
*Butadiene-styrene-vinylpyridine	BFG, FIR, FRS, GNT, GYR, MIL, USR.
Polyester elastomer	DUP.
Thermoplastic elastomers, cyclic	PLC, SHC, USR.
ACYCLIC	
Butadiene-acrylic acid-acrylonitrile	ASY.
*Butadiene-acrylonitrile type (N-Type)	BFG, CPY, FRS, GYR, RCI, USR.
Depolymerized butyl rubber	HDM.
Epichlorohydrin rubber	BFG.
*Ethylene-propylene rubber	BFG, CPY, DUP, ENJ, ORO, USR.
Fluoroelastomers	DUP, MMM.
Isobutylene-isoprene type (Butyl)	CBN, ENJ.
Polyacrylate ester, type elastomers	ACY, BFG, DUP.
Polyalkalene oxide	PRC.
Polyalkalene sulfide, type elastomers	TKL.
*Polybutadiene type (Emulsion)	BFG, FRS, GYR, TKL, TUS.
Polychloroprene type (Neoprene)	DKA, DUP, PTT.
Polyethylene, chlorosulfonated	DUP.
Polyisobutylene, type elastomers	ENJ.
Products of natural rubber:	
Depolymerized natural rubber	HDM.
Polymerized chlorinated rubber	ICI, X.
*Silicone type elastomers	DCC, SPD, SWS.
Stereoisomer type:	
Depolymerized isoprene	HDM.
*Polybutadiene (Solution polymerized)	ASY, BFG, FRS, GNT, GYR, PLC.
Polyisoprene (Solution polymerized)	BFG, GYR.
Stereoisomer type, all other	WAY.

TABLE 3.--ELASTOMERS (SYNTHETIC RUBBER): DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of elastomers to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ACY	American Cyanamid Co.	ICI	ICI United States, Inc., Chemical Specialties Co.
ASH	Ashland Oil, Inc.		
ASY	American Synthetic Rubber Corp.		
		MIL	Milliken & Co., Milliken Chemical Div.
BFG	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.	MMM	Minnesota Mining and Manufacturing Co.
BOR	Borden, Inc., Borden Chemical Div.		
		ORO	Chevron Chemical Co.
CBN	Cities Service Co., Columbian Group		
CHP	C. H. Patrick & Co. Inc.	PLC	Phillips Petroleum Co.
CPY	Copolymer Rubber & Chemical Corp.	PLR	Polysar Resins, Inc., Polysar Latex Div.
		PRC	Products Research & Chemical Corp.
DCC	Dow Corning Corp.	PTT	Petro-Tex Chemical Corp.
DKA	Denka Chemical Corp.		
DUP	E. I. duPont de Nemours & Co., Inc.		
		RCI	Reichhold Chemicals, Inc., Reichhold Polymers, Inc.
ENJ	Exxon Chemical Co., U.S.A.		
		SHC	Shell Oil Co., Shell Chemical Co. Div.
	Firestone Tire & Rubber Co.:	SPD	General Electric Co., Silicone Products Dept.
FIR	Firestone Plastics Co. Div.		
FRS	Firestone Synthetic Rubber & Latex Co. Div.	SWL	Southwest Latex Corp.
		SWS	Stauffer Chemical Co., SWS Silicones Div.
GNT	General Tire & Rubber Co., Chemical/Plastics Div.	TKL	Thiokol Chemical Corp.
		TUS	Texas-U.S. Chemical Co.
GRD	W. R. Grace & Co., Polymers & Chemicals Div.		
GYR	Goodyear Tire & Rubber Co.	USR	Uniroyal, Inc., Chemical Div.
HDM	Hardman, Inc.	WAY	Philip A. Hunt Chemical Corp., Organic Chemical Div.
HPC	Hercules, Inc.		

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Plasticizers

J. Lawrence Johnson

Plasticizers are organic chemical substances that are added to synthetic plastics and resin materials to (1) improve workability during fabrication, (2) extend or modify the natural properties of these materials, or (3) develop new, improved properties not present in the original material. Plasticizers are not final products of themselves but rather components of other materials which, in turn, are formed into final products.

Roughly 85 percent of total annual plasticizer shipments are consumed in the manufacture of plastics materials, with elastomer production accounting for the remainder. Polyvinyl chloride (PVC) resins used in flexible applications (e.g., shower curtains, wall coverings, tablecloths, and window shades) now account for about two-thirds of all plasticizers consumed in the United States. Plasticizers convert this brittle PVC material, which decomposes when heated, into a flexible workable polymer.

U.S. Production and sales

In 1977, plasticizer production reached 1.8 billion pounds; consumption was 1.5 billion pounds and sales 1.7 billion pounds. These increases over 1976 of 5.5 percent, 12.2 percent, and 13.8 percent respectively, reflect the continuing recovery of the flexible PVC resin markets from the 1974 and 1975 recession.

Industry sources 1/ forecast demand growth for plasticizers at an average rate of 6.3 percent per year from 1976 to 1981. This is in line with a projected average annual growth rate for flexible PVC applications of 6.4 percent per year during this period.

The phthalic anhydride esters (i.e., phthalates) were again the leading plasticizers in 1977, accounting for about 67 percent of the total production quantity. The phthalic anhydride esters have dominated the plasticizer market for over 25 years mainly because these materials are unequaled on a cost/performance basis for general-purpose plasticizer applications.

The most important phthalate plasticizer is di(2-ethylhexyl) phthalate, accounting for an estimated 22 percent of all plasticizer sales. It is the standard PVC plasticizer and properties of other plasticizers are usually reported relative to it. Di(2-ethylhexyl) phthalate has good compatibility properties with PVC resins and is available at a price (31 cents per pound in mid-1978) generally below that of the other common phthalates.

1/ Chemical and Engineering News, Nov. 27, 1976, p. 12.

Consumption of the trimellitates (esters of trimellitic anhydride) is forecast to grow at a faster rate (10.7 percent) between 1976 and 1981 than any other class of plasticizers 1/. These trimellitates have relatively low volatility at higher temperatures which makes them choice plasticizers for PVC used to coat wire and cable for electrical applications.

Major PVC markets

The chief uses for plasticizers in PVC applications are, in descending order of importance: flooring, wire and cable insulation, meat and produce films, and furniture upholstery. Together, they account for about 50 percent of the total plasticizers consumed annually in flexible PVC applications; flooring alone represents about 18 percent of the total.

Flooring.--In flooring, the trend away from vinyl asbestos tile to the more highly plasticized coated types of resilient vinyl flooring is expected to continue. This should lead to increased uses of plasticizers in the flooring market, which has already captured a primary share of consumption.

Wire and cable insulation.--Most plasticizers used in extruded, flexible PVC applications in this field are in the low voltage range (500 volts and below) where building wire accounts for the greatest share. These are wires suitable for appliances and communications (90° C-rated wire) as well as for use on equipment and machinery (105° C-rated wire). Thus the insulation market for plasticizers as might be expected, is closely tied to the growth of the construction industry. Over the past 2 years the construction industry has been particularly healthy, and plasticizer growth in wire and cable insulation grew about 7 percent more in 1977 than in 1976. Plasticizer growth in this market is forecast at about 8 percent per year during 1976-81 2/.

Furniture coverings.--The market for plasticizers used in furniture coverings is cyclical and generally follows the pattern of new home construction. Since furniture sales are closely related to the level of disposable personal income, changes in the business cycle are a good indication of market performance. When the level of disposable personal income is high, furniture sales tend to climb at a faster rate than construction in general, thereby accelerating plasticizer usage in this market.

Foreign trade

The United States is the world's leading producer of plasticizers and is highly export competitive. The pattern of U.S. foreign trade in plasticizers has remained relatively unchanged during the 1970's in terms of export markets, import sources, and relative levels of trade.

1/ Chemical and Engineering News, Nov. 27, 1976, p. 12.
2/ Hydrocarbon Processing, January 1978, p. 155 and 156.

U.S. exports.--Exports of plasticizers in 1977 amounted to 152.5 million pounds, representing a 36 percent increase over the amount in 1976. This gain is indicative of the continuing recovery being made in the foreign plastics markets from the worldwide recession of 1974 and 1975. Exports in 1977 accounted for 9 percent of production, an annual level typical of the level during 1970-76.

Canada has been the single most important export market for plasticizer materials during the past decade, and in 1977 accounted for 18 percent of the quantity exported. Other major export markets for plasticizers in 1977 included Belgium, France, Italy, and the Netherlands in Europe, and Hong Kong, Japan, and Singapore in the Far East. These seven markets, together with Canada, accounted for 80 percent of the quantity of U.S. plasticizer exports in 1977.

Most of the exports of large-volume, low-priced phthalic anhydride ester plasticizers have gone to the developing nations in recent years. These developing areas tend to manufacture flexible PVC products (shower curtains, tablecloths) for which low price takes precedence over quality. Exports of the higher priced, specialty type plasticizers usually go to the more advanced economies which tend to produce higher quality PVC products that require a good deal of sophisticated technology.

U.S. imports.--Imports of plasticizers continue to be negligible and amounted to only 6.2 million pounds in 1977, or about 0.4 percent of domestic consumption. Since 1970, annual imports of plasticizers have not exceeded 11.6 million pounds. Most imports represent specialty items or shipments from a foreign manufacturer to its U.S. subsidiary.

Canada, Japan, and the United Kingdom accounted for more than 70 percent of the U.S. imports of plasticizers by quantity in 1977; these countries have been among the leading suppliers since the mid-1960's.

The Generalized System of Preferences (GSP).--The GSP has had a negligible impact on the source of plasticizers imports since its implementation in January 1976. Imports of plasticizers from GSP sources in 1977 amounted to 1.2 million pounds, or about 19 percent of total imports. This compares to 1.9 million pounds, or about 16 percent in 1974. The Republic of Korea was the leading source of GSP plasticizer imports in 1977, supplying 886,000 pounds.

Recent developments

Certain changes have occurred recently which have altered the makeup of the plasticizer industry. Most important of these is the trend towards plasticizers based on linear alcohols. Also of importance is the increased use of trimellitates as plasticizers. The most recent development of note is the use of materials (e.g., ethylene vinyl acetate) which impart flexibility into PVC resins, but are not the typical ester type plasticizers.

Linear alcohols.--Industry sources 1/ claim that production of phthalic anhydride esters derived from linear (straight-chain) alcohols have increased from less than 8 percent of all phthalate esters plasticizers in 1966 to 25 percent or more a decade later. A major reason for this rapid growth is that linear type plasticizers offer improved low-temperature flexibility over phthalate plasticizers made from branched-chain alcohols. Also, the linear derived products are less volatile than those made from branched-chain alcohols. Both of these are important qualities in the prevention of fogging 2/ in automobiles, which is caused in part by volatile plasticizers incorporated in the vinyl products (e.g., upholstery, ceiling, and side panels) used in automobiles. Presently, linear phthalates are the major plasticizers used by automotive vinyl makers 3/ to reduce this condition.

Trimellitates.--Plasticizers derived from trimellitic anhydride have antifogging properties which are superior to all other plasticizers. However, price is a prohibiting factor. Trimellitic anhydride is a relatively expensive starting material (49 cents per pound) when compared with phthalic anhydride (26 cents per pound in mid-1978). Therefore, trimellitate plasticizers are used primarily in those applications where quality is paramount (e.g., wire and cable coatings).

Plasticizer substitutes.--High molecular weight materials such as polymers of ethylene vinyl acetate (EVA) are being employed as plasticizer substitutes. 4/ These materials add about 20 percent to the cost of the vinyl product over the standard phthalate type plasticizers. However they enhance the product's effective life as well as improve its resistance to heat, wear, and chemical attack. These new permanent plasticizers have nearly zero extraction, volatility, migration and exudation properties. 5/ These qualities are essential in applications such as vinyl roofing on automobiles and vinyl wrap for wharf piling where materials are subject to extreme climatic changes.

1/ Plastics World, July 19, 1976, pp. 54 and 55.
2/ "Fog" is the film formed on auto windshields when car interiors are shut in hot weather.
3/ Plastics Technology, May 1978, pp. 65-70.
4/ Modern Plastics, June 1978, pp. 42 and 43.
5/ Plastics World, July 19, 1976, pp. 54 and 55.

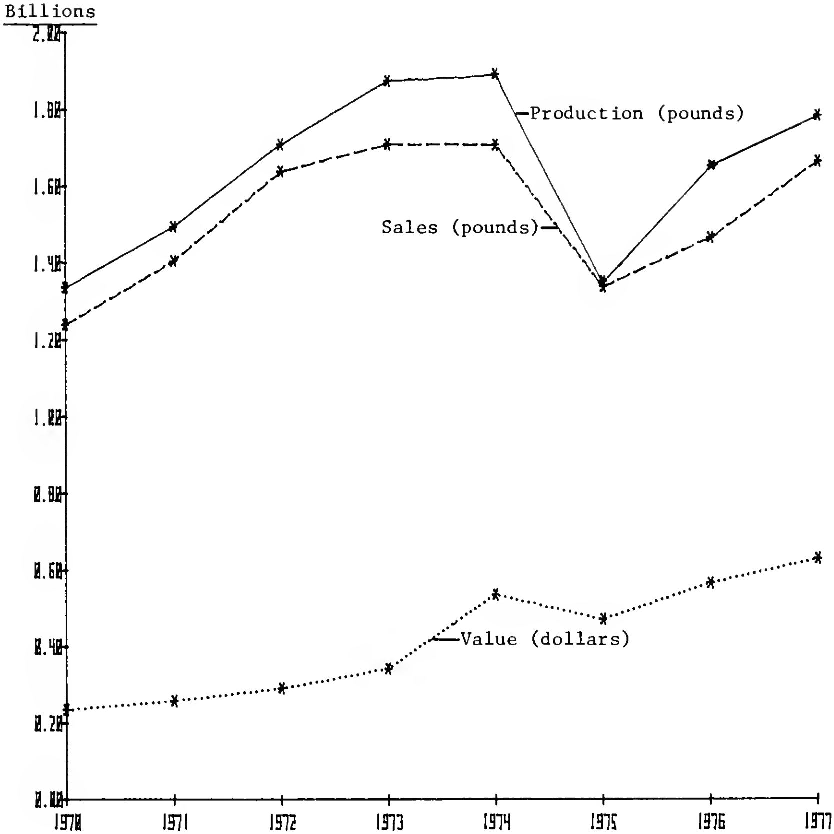
TABLE A.--Plasticizers: U.S. production, imports, exports, and sales, 1970-77

Year	Production	Sales			Exports			Imports		
		Quantity	Value	Unit value 1/	Quantity	Value	Unit value 1/	Quantity	Value	Unit value 1/
	1,000 pounds	1,000 pounds	1,000 dollars	Per pound	1,000 pounds	1,000 dollars	Per pound	1,000 pounds	1,000 dollars	Per pound
1970-------	1,336,072	1,239,116	234,836	$0.19	104,909	20,788	$0.20	1,427	638	$0.45
1971-------	1,494,038	1,404,096	257,765	.18	105,321	18,893	.18	1,543	698	.45
1972-------	1,708,313	1,637,497	290,564	.18	169,274	24,274	.14	939	432	.46
1973-------	1,873,383	1,708,413	341,385	.20	161,944	32,672	.20	4,729	1,407	.30
1974-------	1,891,685	1,707,125	535,247	.31	196,338	57,758	.29	11,620	4,524	.39
1975-------	1,351,702	1,338,317	470,390	.35	163,486	34,749	.21	2,267	1,113	.49
1976-------	1,698,587	1,465,623	566,114	.39	111,681	50,452	.45	2,504	1,407	.56
1977-------	1,792,040	1,667,627	632,330	.38	152,504	50,830	.33	6,166	3,798	.66

1/ Calculated from rounded figures.

Source: Production, U.S. International Trade Commission, Synthetic Organic Chemicals, United States Production and Sales; imports and exports compiled from official statistics of the U.S. Department of Commerce.

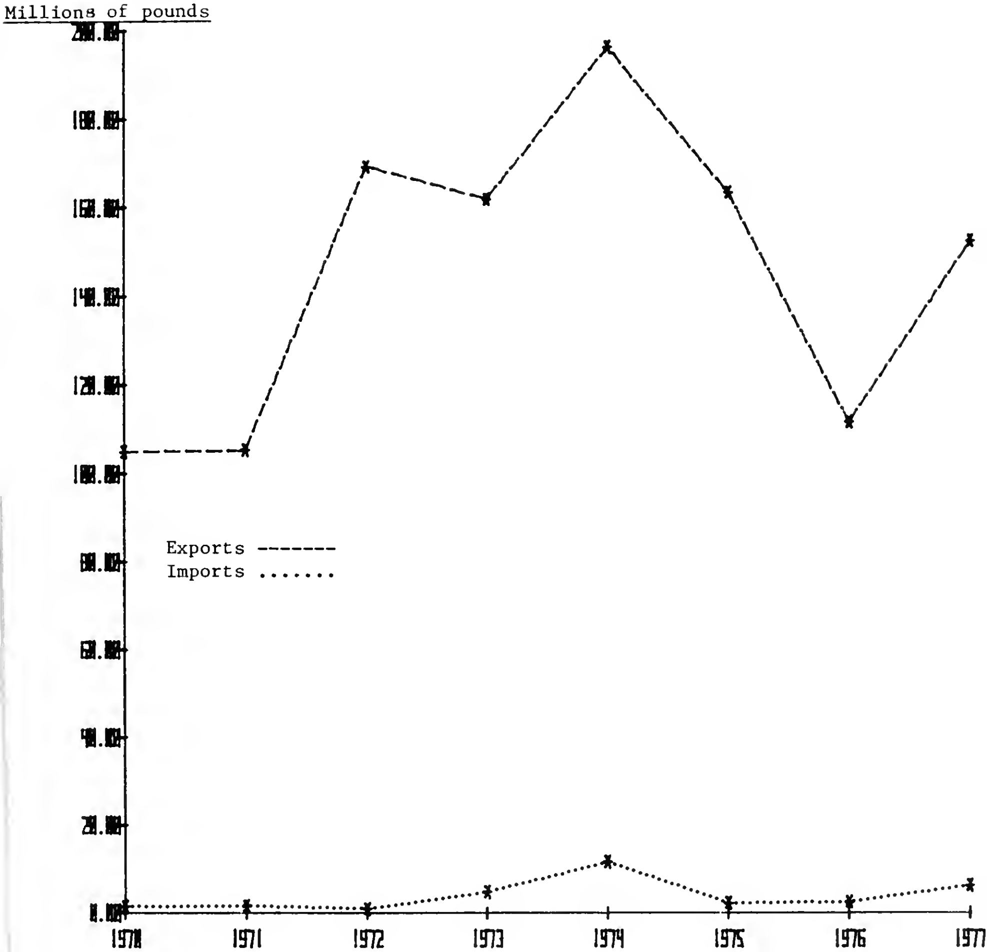
Plasticizers: U.S. production and sales, 1970-77. 1/



1/ 1977 figures are estimates.

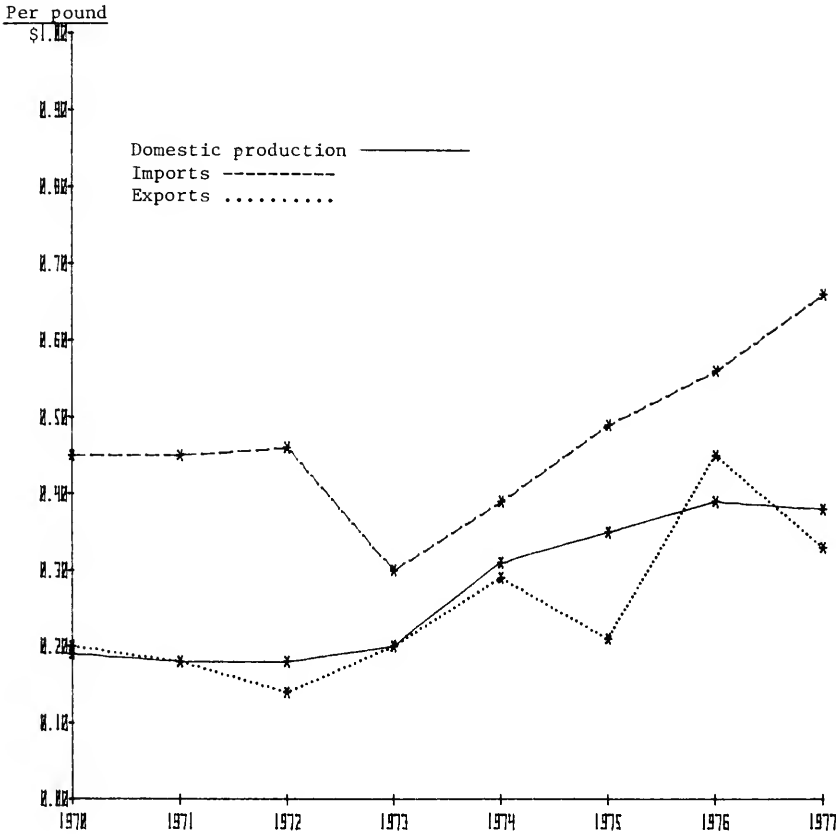
Source: Compiled from official statistics of the U.S. International Trade Commission.

Plasticizers: U.S. imports and exports, 1970-77.



Source: Compiled from official statistics of the U.S. Department of Commerce.

Plasticizers: U.S. imports, exports, and domestic production, 1970-77.



Sources: Compiled from official statistics of the U.S. International Trade Commission and the U.S. Department of Commerce.

PLASTICIZERS

J. Lawrence Johnson

Plasticizers are organic chemicals that are added to synthetic plastics and resin materials to (1) improve workability during fabrication, (2) extend or modify the natural properties of these materials, or (3) develop new improved properties not present in the original material. Table 1 presents statistics on U.S. production and sales of plasticizers in as great a detail as is possible without revealing the operations of individual producers.

U.S. production of plasticizers totaled 1,792 million pounds in 1977, an increase of 5.5 percent from the 1,699 million pounds[1] reported for 1976. Sales of plasticizers totaled 1,668 million pounds, valued at $632 million, in 1977 compared with 1,466 million pounds,[1] valued at $566 million,[1] in 1976.

Production of cyclic plasticizers in 1977, which consisted chiefly of the esters of phthalic anhydride, phosphoric acid, and trimellitic acid, amounted to 1,375 million pounds, an increase of 14.9 percent from the 1,197 million pounds[1] reported for 1976. Sales of cyclic plasticizers in 1977 totaled 1,302 million pounds, valued at $425 million, compared with 1,111 million pounds,[1] valued at $360 million,[1] in 1976. The most important cyclic plasticizer was di(2-ethylhexyl) phthalate, with production of 389 million pounds, in 1977.

Production of acyclic plasticizers in 1977 totaled 417 million pounds, an increase of 3.7 percent from the 402 million pounds reported for 1976. Sales of acyclic plasticizers totaled 366 million pounds, valued at $208 million, in 1977, compared with 355 million pounds, valued at $206 million, in 1976. Epoxidized soya oils were the most important acyclic plasticizer in 1977 with production of 93 million pounds.

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[1] Some data for 1976 has been revised as shown in footnote 2 on Table 1.

TABLE 1.--PLASTICIZERS:[1] U.S. PRODUCTION AND SALES, 1977[2]

[Listed below are plasticizers for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists separately all plasticizer chemicals for which data on production and/or sales were reported and identifies the manufacturers of each]

PLASTICIZERS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[3]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	1,792,040	1,667,627	632,330	$0.38
Benzenoid[4]	1,407,084	1,390,319	474,781	.34
Nonbenzenoid	384,956	277,308	157,549	.57
CYCLIC				
Total	1,374,908	1,301,912	424,651	.33
Phosphoric acid esters[5]	92,013	74,769	51,344	.69
Phthalic anhydride esters, total	1,202,413	1,156,159	341,110	.30
Dibutyl phthalate	16,592	19,348	7,215	.37
Diethyl phthalate	17,471	13,496	5,796	.43
Diisodecyl phthalate	160,567	149,408	43,941	.29
Dimethyl phthalate	9,887	8,309	3,272	.39
Dioctyl phthalates, total	400,207	391,782	109,097	.28
Di(2-ethylhexyl) phthalate	388,543	381,982	105,839	.28
Other dioctyl phthalates	11,664	9,800	3,258	.33
Di-tridecyl phthalate	23,278	16,267	5,952	.37
n-Hexyl n-decyl phthalate	15,182	...	...	...
All other phthalic anhydride esters	559,229	557,549	165,837	.30
Trimellitic acid esters, total	27,278	25,729	12,418	.48
Tri-n-octyl n-decyl trimellitate	1,213	1,037	610	.59
Trioctyl trimellitate	12,510	10,637	5,052	.48
All other trimellitic acid esters	13,555	14,055	6,756	.48
All other cyclic plasticizers[6]	53,204	45,255	19,779	.44
ACYCLIC				
Total	417,132	365,715	207,679	.57
Adipic acid esters, total	68,910	65,404	31,846	.49
Di(2-ethylhexyl) adipate	42,561	40,607	17,854	.44
Diisodecyl adipate	2,527	2,228	1,138	.51
All other adipic acid esters	23,822	22,569	12,854	.57
Complex linear polyesters and polymeric plasticizers, total	47,995	37,455	35,928	.96
Adipic acid type	10,482	...	...	...
All other	37,513	37,455	35,928	.96
Epoxidized esters, total	120,482	114,892	53,917	.47
Epoxidized linseed oils	5,207	5,139	3,538	.69
Epoxidized soya oils	92,503	89,343	40,343	.45
All other epoxidized esters	22,772	20,410	10,036	.49
Isopropyl myristate	3,139	3,245	2,307	.71
Oleic acid esters, total	11,785	9,950	4,525	.45
Butyl oleate	2,575	1,435	725	.51
Methyl oleate	4,333	4,208	1,642	.39

See footnotes at end of table.

TABLE 1.--PLASTICIZERS:[1] U.S. PRODUCTION AND SALES, 1977[2]--CONTINUED

PLASTICIZERS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[3]
ACYCLIC--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Oleic acid esters--Continued				
n-Propyl oleate	326	202	93	$0.46
All other oleic acid esters	4,551	4,105	2,065	.50
Palmatic acid esters	4,987	3,649	2,001	.55
Phosphoric acid esters	17,313	13,035	10,008	.77
Ricinoleic and acetylricinoleic acid esters	...	875	695	.79
Sebacic acid esters	4,482	3,594	4,011	1.12
Stearic acid esters, total	14,186	13,411	7,211	.54
n-Butyl stearate	8,059	7,460	2,989	.40
All other stearic acid esters	6,127	5,951	4,222	.71
All other acyclic plasticizers[7]	123,853	100,205	55,230	.55

[1] Includes data for compounds used principally (but not exclusively) as primary plasticizers. Does not include clearly defined extenders of secondary plasticizers.
[2] Certain 1976 data are revised as shown below:

PLASTICIZERS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	1,698,587	1,465,623	566,114	$0.39
Benzenoid	1,414,925	1,207,137	416,232	.34
Plasticizers, cyclic, total	1,197,062	1,110,781	360,302	.32
Phthalic anhydride esters, total	1,154,086	986,472	292,867	.30
Dioctyl phthalates, total	413,952	393,454	102,989	.26
Di(2-ethylhexyl) phthalate	396,739	380,293	99,266	.26
Ditridecyl phthalate	21,625	14,224	4,924	.35

[3] Calculated from unrounded figures.
[4] Includes benzenoid products as defined in part 1 of schedule 4 of the Tariff Schedules of the United States Annotated.
[5] Includes data for cresyl diphenyl phosphate, dibutyl phenyl phosphate, diphenyl octyl phosphate, tricresyl phosphate, triphenyl phosphate, and other cyclic phosphoric acid esters.
[6] Includes data for glycol dibenzoates, toluenesulfonamides, tetrahydrofurfuryl oleate, and other cyclic plasticizers.
[7] Includes data for azelaic, citric and acetylcitric, myristic, pelargonic, ricinoleic (production only), acetylricinoleic (production only), glyceryl, and glycol esters, and other acyclic plasticizers.

TABLE 2.--PLASTICIZERS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

PLASTICIZERS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CYCLIC	
Diethylene glycol dibenzoate	VEL.
Dipropanediol dibenzoate (Dipropylene glycol dibenzoate)	VEL.
N-Ethyl-p-toluenesulfonamide	MON.
Isopropylidenediphencxypropanol	DOW.
*PHOSPHORIC ACID ESTERS:	
Cresyl diphenyl phosphate	FMP, IMC, MON, SFS.
Dibutyl phenyl phosphate	FMP, MON.
Diphenyl octyl phosphate	MON.
Tricresyl phosphate	FMP, IMC, SFS.
Triphenyl phosphate	EK, MON.
Phosphoric acid esters, all cther	SFS.
*PHTHALIC ANHYDRIDE ESTERS:	
Alkyl benzyl phthalates	MON.
Bis (2-Ethylhexyl)Terephthalate	EKT.
Butyl benzyl phthalate	MON.
Butyl cyclohexyl phthalate	CPS.
Butyl octyl phthalates	RCI, USS.
Di(2-butoxyethyl) phthalate	HAL.
*Dibutyl phthalate (Including diisobutyl phthalate)	BAS, EKT, GRH, RCI, SW, UCC, USS, WTH.
Dicyclohexyl 2-ethylhexyl phthalate	GRH.
Dicyclohexyl phthalate	MON, PFZ.
Diethyl isophthalate	PFZ.
*Diethyl phthalate	EKT, KF, MON, PFZ.
Di-n-hexyl phthalate	USS.
*Diisodecyl phthalate	BAS, CO, ENJ, GRH, HN, RCI, TEK, USS.
Diisononyl phthalate	ENJ.

TABLE 2.--PLASTICIZERS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PLASTICIZERS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*PHTHALIC ANHYDRIDE ESTERS--Continued	
Di(2-methoxyethyl) phthalate	EKT.
*Dimethyl phthalate	EKT, KF, MON, PFZ, TCC.
*DIOCTYL PHTHALATES:	
*Di(2-ethylhexyl) phthalate	BAS, BFG, CO, EKT, GRH, HN, MON, RCI, TEK, USS.
Diiso-octyl phthalate	RCI, USS.
Dioctyl phthalates, all other	PFZ, USS, WTH.
Dinonyl phthalate	ENJ.
Diphenyl phthalate	MON.
*Di-tridecyl phthalate	ENJ, GRH, HN, RCI, RUB, SM, TEK, USS.
Diundecyl phthalate	MON.
GLYCOL PHTHALATE ESTERS:	
Butyl phthalyl butyl glycolate	MON.
Glycol phthalate esters, all others	SCP.
*Hexyl n-decyl phthalate	CC, HN, TEK.
Hexyl iso-octyl phthalate	PFZ.
n-Octyl n-decyl phthalate	RCI, TEK, USS.
Phthalic anhydride esters, all other	BAS, GRH, HN, MON.
Tetrahydrofurfuryl oleate	EMR.
Toluenesulfonamide o-, p-mixtures	MCN.
*TRIMELLITIC ACID ESTERS:	
Tri(2-ethylhexyl) trimellitate	GRH, PFZ, PPL.
Tri-n-hexyl n-decyl trimellitate	GRH.
Triisooctyl trimellitate	PFZ, RCI, RUB, USS.
*Tri-n-octyl n-decyl trimellitate	PFZ, RCI, RUB.
*Trioctyl trimellitate	EKT, HN, RCI, RUB, USS, WTH.
all other Trimellitic acid esters	ENJ, MON, PFZ, TEK, WTH, X.
*Cyclic plasticizers, all other	HAL, HN, NEV.
A C Y C L I C	
*ADIPIC ACID ESTERS:	
Di(2-(2-butoxyethoxy)ethyl) adipate	RCI, TKL.
*Di(2-ethylhexyl) adipate	BAS, GRH, HN, MON, PFZ, PPL, RCI, RH, RUB, USS, WM, WTH.
Diisobutyl adipate	GRH, HAL.
Diisodecyl adipate	GRH, HN, PFZ, RCI, RH, SM, USS.
*Diiso-octyl adipate	HN, RCI, RH.
Diisopropyl adipate	WTH.

TABLE 2.--PLASTICIZERS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PLASTICIZERS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
*Adipic acid esters--Continued	
Dinonyl adipate	WTH.
Di-n-octyl adipate	TEK.
Di-tridecyl adipate	EMR, GRH, RUB.
n-Hexyl n-decyl adipate	DA, USS.
Iso-octyl isodecyl adipate	GRH.
n-Octyl n-decyl adipate	MON, RCI, RH, USS.
Adipic acid esters, all others	MON, SM.
AZELAIC ACID ESTERS:	
Di(2-ethylhexyl) azelate	EMR, PFZ, RCI, WM.
Diiso-octyl azelate	EMR.
Azelaic acid esters, all others	EMR, PFZ.
CITRIC AND ACETYLCITRIC ACID ESTERS:	
Tributyl acetylcitrate	PFZ.
Tributyl citrate	PFZ.
Triethyl citrate	PFZ.
Tristearyl citrate	ICI.
Citric and acetylcitric acid esters, all other	PFZ.
*COMPLEX LINEAR POLYESTERS AND POLYMERIC PLASTICIZERS:	
*Adipic acid type complex linear polyesters and polymeric plasticizers	ASH, DUP, GRH, HAL, TEK, WTH.
Complex linear polyesters and polymeric plasticizers, all other	EKT, EKX, EMB, HAL, HN, HPC, MON, RCI, RH.
Di(2-(2-butoxyethoxy)ethyl) methane	TKL.
Dibutyl tartrate	ARC.
Diiso-octyl diglycolate	CCA.
*EPOXIDIZED ESTERS:	
Butyl epoxystearates	UCC, WTC.
*Epoxidized linseed oils	ASH, SWT, VIK, WTC.
*Epoxidized soya oils	ASH, FMP, RH, UCC, VIK, WTC.
Epoxy oleates, mixed	RH.
2-Ethylhexyl epoxytallates	UCC.
Octyl epoxystearates	WTC.
Octyl epoxytallates	RH, WTC.
Epoxidized esters, all other	UCC.
Glyceryl tripropionate	EKT.

TABLE 2.--PLASTICIZERS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PLASTICIZERS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
MYRISTIC ACID ESTERS:	
*Isopropyl myristate	ARC, TCH, WM, WTH.
Isopropyl palmitate-isopropyl myristate mixture	WTH.
Myristyl ethoxy myristate	SCP.
*OLEIC ACID ESTERS:	
*Butyl oleate	ARC, ELC, EMR, GRO, HAL, WM, WTH.
Decyl oleate	SCP, VND.
Glyceryl trioleate (Triolein)	EMR, GLY, GRO, TCH.
Isobutyl oleate	DA.
*Methyl oleate	EMR, GRO, HUM, TCH.
PROPYL OLEATES:	
Isopropyl oleate	SCP, WM.
*n-Propyl oleate	CHL, EMR, GRO, TCH, WM.
Oleic acid esters, all other	EMR, HAL.
*PALMITIC ACID ESTERS:	
2-Ethylhexyl palmitate	WTH.
Isobutyl palmitate	ARC.
Isopropyl palmitate	ARC, TCH, WM, WTH.
Palmitic acid esters, all other	SCP.
PELARGONIC ACID ESTERS:	
Diethylene glycol dipelargonate (Diethylene glycol dinonanoate)	EMR.
Glycol pelargonate	EMR.
Isodecyl pelargonate	EMR.
*PHOSPHORIC ACID ESTERS:	
Tri(2-butoxyethyl) phosphate	FMP.
Tributyl phosphate	MON.
Triethyl phosphate	EKT.
Trioctyl phosphate	HN, UCC.
*RICINOLEIC AND ACETYLRICINOLEIC ACID ESTERS:	
n-Butyl acetylricinoleate	NTL.
Butyl ricinoleate	NTL.
Glyceryl monoricinoleate	NTL.
Glyceryl tri(acetylricinoleate)	NTL.
Methyl acetylricinoleate	RH.
Methyl ricinoleate	NTL, TCH.

TABLE 2.--PLASTICIZERS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--Continued

PLASTICIZERS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*RICINOLEIC AND ACETYLRICINOLEIC ACID ESTERS--Continued	
Ricinoleic and acetylricinoleic acid esters, all other	NTL.
*SEBACIC ACID ESTERS:	
Dibutoxyethyl sebacate	HAL.
Dibutyl sebacate	EKT, HAL.
Di(2-ethylhexyl) sebacate	RH.
Diiso-octyl sebacate	GRH.
Sebacic acid esters, all other	X, X.
*STEARIC ACID ESTERS:	
*n-Butyl stearate	ARC, ASH, CHL, EMR, GRO, TCH, WM, WTH.
Dimethylammonium stearate	RH.
2-Ethylhexyl stearate	SCP.
Glyceryl triacetyl stearate	NTL.
Hexadecyl stearate	WM.
Isobutyl stearate	DA, WM, WTH.
Isopropyl stearate	WTH.
Methyl stearate	HUM.
Polyglycol stearates	WTH.
Stearic acid esters, all other	ARC, HPC, SCP, TCH, VND, WM, WTH.
Sucrose acetate isobutyrate	ARC, EKT.
Triethylene glycol di(caprylate-caprate)	HAL, PVO, WM.
Triethylene glycol di(2-ethylbutyrate)	UCC.
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	EKX.
Acyclic plasticizers, all other	EMR, HPC, PFZ, PVO, SM, TCH, USS, WM, WTH.

TABLE 3.--PLASTICIZERS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of plasticizers to the U.S. International Trade Commission of 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of Company
ARC	Armak Co.	NEV	Neville Chemical Co.
ASH	Ashland Oil, Inc., Ashland Chemical Co.	NTL	NL Industries, Inc.
BAS	BASF Wyandotte Corp.		
BFG	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.	PFZ	Pfizer, Inc.
		PPL	Pioneer Plastics Div. of LOF Plastics, Inc.
CCA	Interstab Chemical, Inc.	PVO	PVO International, Inc.
CHL	Chemol, Inc.		
CO	Continental Oil Co.		
CPS	CPS Chemical Co.	RCI	Reichhold Chemicals, Inc.
		RH	Rohm & Haas Co.
DA	Diamond Shamrock Corp.	RUB	Hooker Chemical Corp., Ruco Div.
DOW	Dow Chemical Co.		
DUP	E. I. duPont de Nemours & Co., Inc.	SCP	Henkel, Inc.
		SFS	Stauffer Chemical Co., Specialty Chemical Div.
EK	Eastman Kodak Co.:		
EKT	Tennessee Eastman Co. Div.	SM	Mobil Oil Corp., Mobil Chemical Co. Div., Chemical Coatings Div.
EKX	Texas Eastman Co. Div.		
ELC	Elco Corp. Sub of Detrex Chemical Industries, Inc.	SW	Sherwin-Williams Co.
		SWT	Unitech Chemical, Inc.
EMR	Emery Industries, Inc.		
ENJ	Exxon Chemical Co. U.S.A.		
		TCC	Tanatex Chemical Corp.
FMP	FMC Corp., Industrial Chemical Group	TCH	Emory Industries, Inc., Trylon Div.
GLY	Glyco Chemicals, Inc.	TEK	Teknor Apex Co.
GRH	W. R. Grace & Co., Hatco Chemical Div.	TKL	Thiokol Chemical Corp.
GRO	A. Gross & Co., Millmaster Onyx Group, Kewanee Industries, Inc.		
		UCC	Union Carbide Corp.
		USS	USS Chemicals Div. of U.S. Steel Corp.
HAL	C. P. Hall Co.		
HN	Tenneco Chemicals, Inc.		
HPC	Hercules, Inc.	VEL	Velsicol Chemical Corp
HUM	Kraft Inc., Humko Plastics Div.	VIK	Viking Chemical Co.
		VND	Van Dyk & Co., Inc.
ICI	ICI United States, Inc., Chemical Specialties Co.		
IMC	IMC Chemical Group, Inc.	WM	Inolex Corp.
		WTC	Witco Chemical Corp.
KF	Kay-Fries Chemicals, Inc.	WTH	Union Camp Corp., Chemical Div.,
MON	Monsanto Co.		

Note.--Complete names and addresses of the above reporting companies are listed in table I of the appendix.

Surface-Active Agents

Anne Klein

This paper covers surface-active agents or surfactants which are organic chemicals that reduce the surface tension of water or other solvents. They are used in packaged soaps and detergents for household and industrial use, in the processing of textiles and leather, by the mining industry in ore flotation fluids, and in petroleum production. Additional applications are in the manufacture of sprays, cosmetics, elastomers, food, lubricants, paints, and pharmaceuticals.

U.S. production and demand

U.S. production of surface-active agents amounted to 4.7 billion pounds in 1977 and was valued at $1.7 billion. It had declined slightly, by 1.6 percent in terms of quantity, from the level in 1976, as shown in the following tabulation:

Year	Annual change in production quantity (Percent)
1971	(-1.5)
1972	5.5
1973	8.3
1974	7.4
1975	(-7.4)
1976	9.9
1977	(-1.6)

The slight decline in the level of production in 1977 may be attributed to a slackening in demand for household detergents, the principal market for surface-active agents. The synthetic detergent industry believes that the rate of growth of household detergents may continue to be lower than in the past. They expect a probable slowing of population growth rates in the 1975-85 decade compared to the previous decade (caused by smaller membered households). Women, at present, spend more time in activities outside the home, including jobs. This reduces the amount of familv laundering and other household cleaning chores.

Whether the slowing of demand for household detergents will continue to affect the overall market for surface-active chemicals will depend on the growth of industrial uses of the latter. It is possible that the increased use of surface-active chemicals in secondary and tertiary oil recovery operations in the United States will compensate for any reduced demand by household detergent manufacturers.

Surfactants, including ligninsulfonates, are used increasingly in petroleum enhanced recovery procedures termed "microemulsions" or "micellar dispersions" which use surfactant solutions of various concentrations in the flooding of old wells in secondary or tertiary oil recovery. The Energy Research and Development Administration (ERDA) presently contributes to a significant part of the cost of industry research in a number of enhanced oil and gas recovery projects. Also, the petroleum industry conducts over 150 other enhanced oil recovery projects in the United States and, in 10 to 15 percent of the projects, surfactants are used for chemical flooding. Continued development and eventual commercialization of chemical flooding methods are probable. This could result in an accelerated demand in the early 1980's for sulfonated surface-active agents.

There was a significant increase in production of ligninsulfonates during 1970-77 from 491 million pounds to 1,160 million pounds, a more rapid change than that shown for any other group of surfactants. In addition to the continued use of ferrochrome ligninsulfonates in the secondary and tertiary oil recovery research mentioned above, additional expanding demand for ligninsulfonates has stemmed for such diverse uses as: an extender in the manufacture of phenolic resins; in air pollution control programs in which ligninsulfonates act as a binder for the recovery of polluting materials (such as dust caused by wind-erosion or fly-ash from industrial plants); and in certain other uses, including dispersants in water treatment formulations and in the increasing production of gypsum board used in housing. In addition, ligninsulfonates are used as a binder for such items as charcoal briquets and carbon black.

U.S. exports and foreign markets

During 1970-77, annual U.S. exports[1] of surfactants increased from 134 million pounds, valued at $41 million to 157 million pounds, valued at $83 million. Exports ranged from 3.3 to 4.2 percent by quantity of U.S. production as shown in the following tabulation:

Year	Previous Year (Percent)	Rate of exports to production[1] (Percent)
1970	-	3.4
1971	6.0	3.7
1972	6.3	3.7
1973	15.2	4.0
1974	13.8	4.2
1975	(-23.7)	3.5
1976	7.9	3.4
1977	(-3.7)	3.3

[1] U.S. exports are partly estimated.

Principal export markets are in Canada, Japan, the Netherlands, Belgium, the United Kingdom, France, and other European countries. In terms of value the largest group of exports specified in 1977 were nonionic surface-active agents ($21 million), which reflects the ascendency of the linear alcohols, alkoxylated, as the choice for the surfactant constituent in household detergent products in European markets as well as in U.S. markets.

The volume of U.S. exports is not expected to exceed 173 million pounds in 1982, and will probably continue the erratic pattern of growth of the previous decade. High shipping costs, relative to the low unit prices of surfactants, may tend to render exports of these items to overseas markets less profitable. In addition, according to industry data, significant overseas production of surfactants takes place in Germany, France, Italy, and the United Kingdom, all of which are large markets for actual or potential U.S. exports.

U.S. imports

U.S. imports[1] of surface-active agents totaled 98 million pounds in 1977, an increase over 1976 of 11 percent. Imports represented only 2.1 percent of U.S. consumption in 1977, as shown in the following tabulation.

Year	Change from previous year (Percent)	Ratio of imports to consumption (Percent)
1970---------------	-	1.7
1971---------------	(-24.3)	1.5
1972---------------	(-25.0)	1.1
1973---------------	47.6	1.5
1974---------------	17.7	1.6
1975---------------	2.7	1.8
1976---------------	17.3	1.9
1977---------------	11.4	2.1

In 1977, imports consisted principally of non-benzenoid surface-active agents which included 28.5 million pounds of ligninsulfonates and 29 million pounds of other surface-active agents, the predominant part of which consisted of linear alcohols, alkoxylated.

It is anticipated that by 1982 total imports will exceed 150 million pounds and will consist of a relatively unchanged product mix. The U.S. industry will probably continue to supply nearly all of the domestic market demand of synthetic detergents at strongly competitive prices and supply the bulk of the U.S. demand in other surface-active agents. It is believed that substantially increased U.S. productive capacity for ligninsulfonate surfactants, which came on stream in Illinois in 1977, will supply a considerable part of the expected increased U.S. demand for these surfactants.

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[1] U.S. imports are partly estimated.

Synthetic detergent constituents - problems and regulations

Whole synthetic detergent formulated products are not included in the analysis in this paper, but only their surface-active components. Nevertheless, the problems and regulations surrounding synthetic detergent formulations as a whole are discussed inthe following sections since the formulated products manufacturers are important users of surface-active agents.

Marketable synthetic detergents used for laundering are formulations containing surface-active agents as essential ingredients along with subsidiary constituents such as builders, boosters, anti-soil-redepositing agents, optical brighteners, perfume, and other auxiliary constituents. The function of the "builder" is as a sequestering agent, which binds up the calcium and magnesium ions of "hard" water which would otherwise cause a troublesome precipitate. The use of two groups of synthetic detergent constituents, the surface-active agents and the builders, has historically spawned problems for the environment which has stimulated both legislation and industry research for substitute chemicals and reformulation.

Surface-active agents

Prior to 1965, a serious foaming problem in rivers and sewage treatment plants was caused by the preeminent use of the surfactant component alkylbenzenesulfonate (ABS). This ingredient exhibits delayed biodegradeability because of the branched chain structure of its molecules. In 1965, detergent manufacturers substituted linear alkylbenzenesulfonate (LAS) for ABS in their formulations, and thus helped alleviate the foaming sewage problem. Today LAS remain an important surfactant, although production has declined from 715 million pounds in 1970 to 633 million pounds in 1977.

Meanwhile, the use in synthetic detergent formulations of linear alcohol ethoxylates (LAE) of molecular length of C_{10} or higher chains (e.g., dodecyl) has increased. The increased use of synthetic polyester blends in clothes fabrics, which are characterized by a tendency to retain oily soil deposits, has spurred the increased use in laundry detergent formulations of linear alcohol ethoxylates, which are superior in removing oily deposits. In addition, the laundry detergent manufacturers increased their consumption of linear alcohol ethoxylates as synthetic detergent surfactants in order to compensate for the lower levels of phosphate builders now allowed in laundry detergent formulations. The lower phosphate levels, they belived, lowered the overall cleaning performance of their products, and thus more surfactant was needed. Production of linear alcohol ethoxylates rose from 328 million pounds in 1970 to about 577 million pounds in 1977, thus rivaling the prominence that LAS had formerly held.

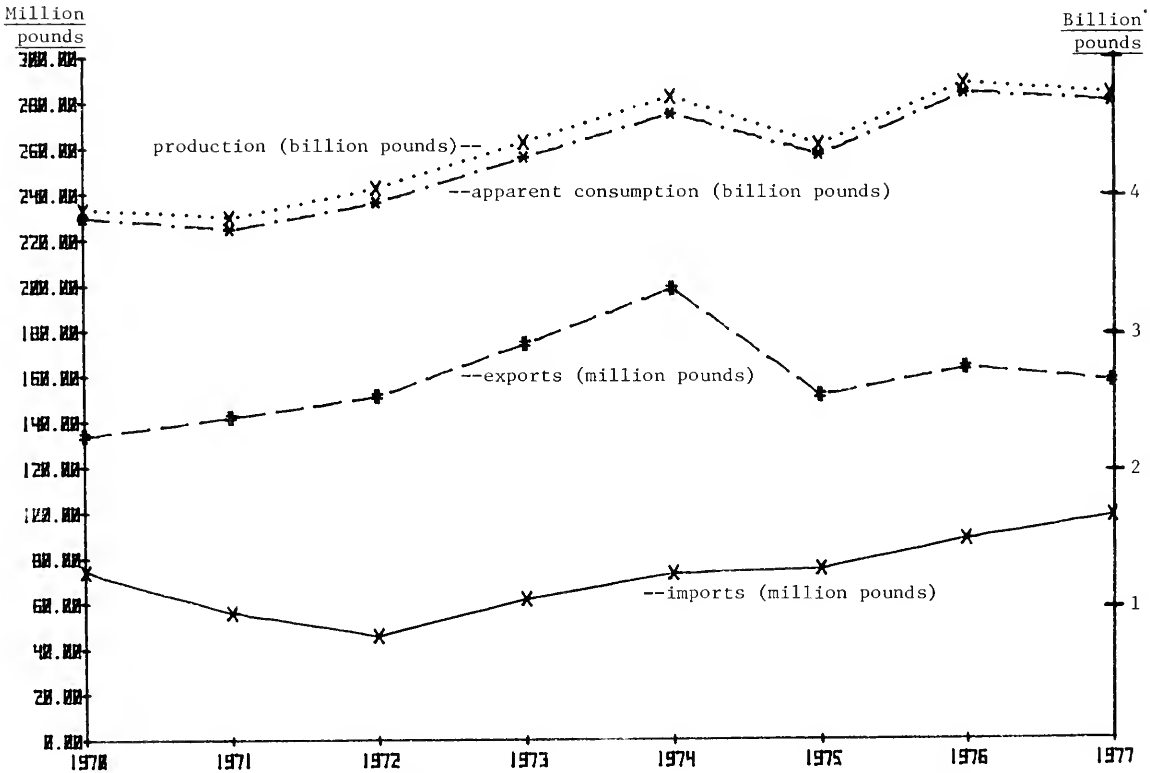
Builders

Coping with water hardness, the builders role was a more complex problem than reducing foaming. Sodium tripolyphosphate (STPP), the most effective builder, is still the principal builder used in synthetic detergent formulations, although the percent of phosphorus content has been reduced since 1970, even in areas of the United States where they are not banned. During the 1970's, complete bans or limitations on the phosphate content of home laundry detergents in the United States followed general consumer concern for the environment. Of particular concern was the accelerated rates at which bodies of fresh water such as the Great Lakes were undergoing eutrophication, a condition in which algae reproduce too rapidly in the presence of the nutrient phosphates. The resulting corrective legal and regulatory action has been channelled through State and local jurisdictional units. Those areas in which the phosphate laundry detergent builders are banned include the States of Indiana, Michigan, New York, and Vermont; Dale County in Florida; the cities of Chicago and certain Chicago suburbs; the city of Akron, Ohio; and several other communities in the United States.

The enactment of most legislation affecting phosphate content occurred between October 1970 and June 1971. However, Michigan, New York, and Vermont passed such laws as recently as the fall of 1977 and early 1978. These laws and regulations probably necessitated certain revisions of product formulations and of distribution patterns of detergent manufacturers. However, according to the industry, even in nonban areas the phosphate content of laundry detergents was reduced from the level existing in 1970 (9 to 12 percent phosphorus), to an average level of 6 percent at present. As a result the industry reports that overall U.S. consumption of sodium tripolyphosphate declined from 573,000 short tons (P_2O_5 content) in 1969 to 246,000 short tons (P_2O_5 content) in 1976. Consumption of STPP has declined at the rate of 12.9 percent per year since 1970 and is expected to decline further until 1982, at an average rate of 4.5 to 6.0 percent per year.

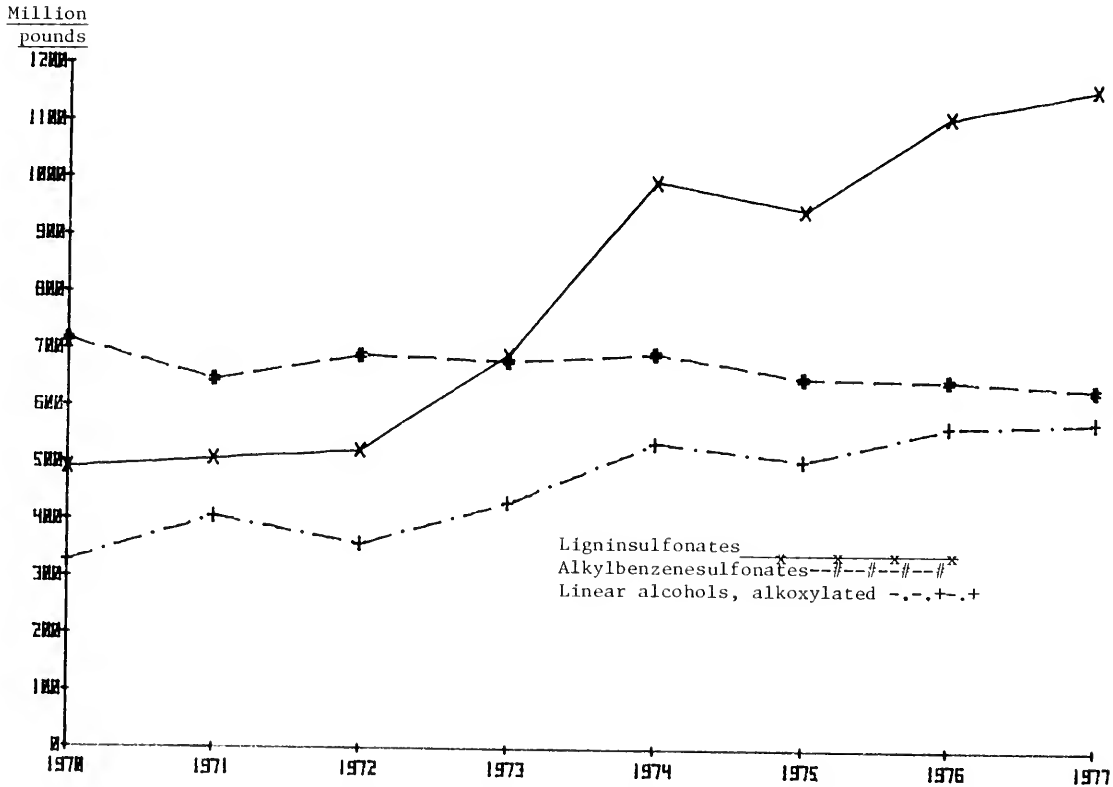
According to the industry, since the reduction in the use of phosphates, some synthetic detergent manufacturers have substituted sodium carbonate and sodium silicate as builders. These compounds were used as builders before phosphate grew in popularity following World War II. Development is currently proceeding on the possible use of sodium aluminosilicate (including zeolites) and sodium silicate, which control water hardness by ion exchange.

Surface-active agents: U.S. production, imports, exports, and apparent consumption, 1970-77.



Source: Production, compiled from official statistics of the U.S. International Trade Commission: Imports and Exports, compiled from official statistics of the U.S. Department of Commerce and partly estimated.

Selected surface-active agents: U.S. production, 1970-77



Source: Production, compiled from official statistics of the U.S. International Trade Commission.

SURFACE-ACTIVE AGENTS

Anne Klein

The surface-active agents included in this report are organic chemicals that reduce the surface tension of water or other solvents and are used chiefly as detergents, dispersing agents, emulsifiers, foaming agents, or wetting agents in either aqueous or nonaqueous systems. Waxes and products used chiefly as plasticizers are excluded. Surface-active agents are produced from natural fats and oils, from silvichemicals such as lignin, rosin, and tall oil, and from chemical intermediates derived from coal tar and petroleum. A major part of the output of the bulk chemicals shown in this report is consumed in the form of packaged soaps and detergents for household and industrial use. The remainder is used in the processing of textiles and leather, in ore flotation and oil-drilling operations, and in the manufacture of agricultural sprays, cosmetics, elastomers, foods, lubricants, paint, pharmaceuticals, and many other products.

The statistics for production and sales of surface-active agents are grouped by ionic class and by chemical class and subclass. All quantities are reported in terms of 100-percent organic surface-active ingredient and thus exclude all inorganic salts, water, and other diluents. Sales statistics reflect sales of bulk surface-active agents only; sales of formulated products are excluded.

Total U.S. production of surface-active agents in 1977 amounted to 4,718 million pounds, or 1.6 percent less than the 4,796 million pounds reported for 1976. Sales of bulk surface-active agents in 1977 amounted to 2,515 million pounds, valued at $875 million, compared with sales in 1976 of 2,512 million pounds, valued at $821 million. In terms of quantity, sales in 1977 were approximately the same as reported in 1976; in terms of value, however, sales in 1977 were 6.5 percent greater than in 1976.

Production of anionic surface-active agents in 1977 amounted to 3,207 million pounds, or 68 percent of the total output reported for 1977. Sales of anionics in 1977 amounted to 1,425 million pounds valued at $335 million.

Production of cationic surface-active agents in 1977 amounted to 297 million pounds, 17.9 percent greater than the 252 million pounds reported in 1976. Production of nonionic surface-active agents amounted to 1,195 million pounds in 1977, 21.4 percent greater than the 1,170 million pounds reported in 1976. Sales of cationic surface-active agents in 1977 increased by 14.8 percent in terms of quantity and 14.5 percent in terms of value over 1976. Sales of nonionics in 1977, however, declined slightly from 1976, by 1.0 percent, in terms of quantity but increased by 5.1 percent in terms of value over 1976.

The difference between production and sales reflects inventory changes and captive consumption of soaps and surface-active agents by synthetic rubber producers, and by manufacturers of cosmetics, packaged detergents, bar soaps, and other formulated consumer products. In some instances the difference may also reflect quantities of surface-active agents used as chemical intermediates, e.g., nonionic alcohol and alkylphenol ethoxylates which may be converted to anionic surface-active agents by phosphation or sulfation.

TABLE 1.--SURFACE-ACTIVE AGENTS: U.S. PRODUCTION AND SALES, 1977[1]

[Listed below are all surface-active agents for which reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in cinfidence and may not be published or where no data were reported.) Table 2 lists all surface-active agents for which data on production and/or sales were reported and identifies the manufacturers of each]

SURFACE-ACTIVE AGENTS	PRODUCTION[2]	SALES[3]		
		QUANTITY[2]	VALUE	UNIT VALUE[4]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	4,718,174	2,514,583	875,023	$0.35
Benzenoid[5]	989,564	469,432	200,244	.43
Nonbenzenoid[6]	3,728,608	2,045,151	674,778	.25
AMPHOTERIC				
Total	18,294	17,498	18,880	1.08
ANIONIC				
Total	3,207,064	1,425,199	334,771	.23
Carboxylic acids (and salts thereof), total	637,808	134,340	51,461	.38
Carboxylic acids having amide, ester, or ether linkages	5,290	4,478	4,494	1.00
Coconut oil acids, potassium salt	9,016	1,757	1,176	.67
Coconut oil acids, sodium salt	129,966	1,726	607	.35
Corn oil acids, potassium salt	189	209	146	.70
Mixed vegetable oil acids, potassium salt	3,722	3,508	4,893	1.39
Oleic acid, potassium salt	451	196	101	.51
Oleic acid, sodium salt	301	232	205	.88
Soybean oil acid, potassium salt	904	359	160	.44
Tall oil acids, potassium salt	6,995	4,247	2,342	.55
Tall oil acids, sodium salt	796	522	178	.34
Tallow acids, sodium salt	353,862	21,322	5,562	.26
All other carboxylic acids	126,316	95,784	31,597	.33
Phosphoric and polyphosphoric acid esters (and salts thereof), total	38,622	21,899	15,622	.71
Alcohols and phenols, alkoxylated and phosphated, total	25,358	15,405	10,625	.69
Dinonylphenol, ethoxylated and phosphated	574	508	373	.73
Mixed linear alcohols, ethoxylated and phosphated	3,280	2,993	2,328	.78
Nonylphenol, ethoxylated and phosphated	10,392	5,574	3,560	.64
Polyhydric alcohol, ethoxylated and phosphated	255	249	152	.61
Tridecyl alcohol, ethoxylated and phosphated	673	404	327	.81
All other	10,184	5,677	3,885	.69
Alcohols, phosphated or polyphosphated	13,264	6,494	4,997	.77
Sulfonic acids (and salts thereof), total	1,961,387	1,038,055	164,455	.16
Alkylbenzenesulfonates, total	632,605	176,733	62,868	.36
Dodecylbenzenesulfonic acid	179,260	88,294	26,415	.30
Dodecylbenzenesulfonic acid, calcium salt	6,123	7,868	5,820	.74
Dodecylbenzenesulfonic acid, isopropylamine salt	4,954	4,676	2,743	.59
Dodecylbenzenesulfonic acid, potassium salt	185	184	97	.53
Dodecylbenzenesulfonic acid, sodium salt	318,785	51,815	15,842	.31
Dodecylbenzenesulfonic acid, triethanolamine salt	6,823	7,390	2,961	.40
Tridecylbenzenesulfonic acid, sodium salt	99,414	...	...	...
All other	17,061	16,506		.53
Toluenesulfonic acid, potassium and sodium salts	19,756	...	...	...

See footnotes at end of table.

TABLE 1.--SURFACE-ACTIVE AGENTS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

SURFACE-ACTIVE AGENTS	PRODUCTION[2]	SALES[3] QUANTITY[2]	VALUE	UNIT VALUE[4]
ANIONIC--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Sulfonic acids (and salts thereof)--Continued				
Xylenesulfonic acid, ammonium salt	3,194	3,257	888	$0.27
Xylenesulfonic acid, sodium salt	29,055	20,460	5,558	.27
Ligninsulfonates, total	1,160,244	762,186	43,197	.06
Ligninsulfonic acid, calcium salt	534,609	490,405	15,962	.03
Ligninsulfonic acid, sodium salt	109,384	92,062	9,504	.10
All other	516,251	179,719	17,731	.10
Naphthalenesulfonates, total	11,217	5,741	3,679	.64
Diisopropylnaphthalenesulfonic acid, sodium salt	1,776	1,587	1,451	.91
All other	9,441	4,154	2,228	.54
Sulfonic acids having amide linkages, total	4,603	3,103	3,253	1.05
N-Methyl-N-(tall oil acyl)taurine, sodium salt	364	357	367	1.03
All other	4,239	2,746	2,886	1.05
Sulfonic acids having ester or ether linkages, total	77,032	28,430	33,913	1.19
Sulfosuccinic acid esters, total	16,512	13,954	12,949	.93
Sulfosuccinic acid, bis(2-ethylhexyl)ester, sodium salt	13,394	11,327	11,209	.99
All other	3,118	2,627	1,740	.66
Other sulfonic acids having ester or ether linkages	60,520	14,476	20,964	1.45
All other sulfonic acids	23,681	38,145	11,099	.29
Sulfuric acid esters (and salts thereof), total	533,224	214,437	96,784	.45
Acids, amides, and esters, sulfated, total	16,153	12,187	5,452	.45
Butyl oleate, sulfated, sodium salt	1,084	1,080	440	.41
Isopropyl oleate, sulfated, sodium salt	81	81	51	.63
Propyl oleate, sulfated, sodium salt	545	389	174	.45
Oleic acid, sulfated disodium salt	5,569	...	...	...
Tall oil sulfated, sodium salt	2,107	1,155	320	.28
Other acids, amides, and esters, sulfated	6,767	9,482	4,467	.47
Alcohols, sulfated, total	222,980	57,875	34,232	.59
Dodecyl sulfate, ammonium salt	10,722	...	...	...
Dodecyl sulfate, magnesium salt	236	226	251	1.11
Dodecyl sulfate, sodium salt	56,375	27,966	15,157	.54
Mixed linear alcohols, sulfated, ammonium salt	18,496	1,306	723	.55
Mixed linear alcohols, sulfated, sodium salt	...	2,385	1,611	.68
Other alcohols, sulfated	137,151	25,992	16,490	.63
Ethers, sulfated, total	272,621	124,282	50,541	.41
Dodecyl alcohol, ethoxylated and sulfated, sodium salt	11,308	11,129	8,528	.77
Mixed linear alcohols, ethoxylated and sulfated, ammonium salt	123,153	...	...	...
Mixed linear alcohols, ethoxylated and sulfated, sodium salt	122,059	30,562	11,613	.38
All other	16,101	82,591	30,400	.37
Castor oil, sulfated, sodium salt	4,235	3,935	2,102	.53
Cod oil, sulfated, sodium salt	1,862	1,837	433	.24
Neat's-foot oil, sulfated, sodium salt	1,149	763	263	.34
Soybean oil, sulfated, sodium salt	697	643	222	.35
Tallow, sulfated, sodium salt	4,981	4,761	1,011	.21
Other anionic surface-active agents[7]	44,568	24,623	8,977	.36

See footnotes at end of table.

TABLE 1.--SURFACE-ACTIVE AGENTS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

SURFACE-ACTIVE AGENTS	PRODUCTION[2]	SALES[3] QUANTITY[2]	SALES[3] VALUE	SALES[3] UNIT VALUE[4]
CATIONIC	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Total	297,353	204,301	140,791	$0.69
Amine oxides and oxygen-containing amines (except those having amide linkages), total	78,332	21,695	15,521	.72
Acyclic, total	72,630	18,435	13,407	.73
(Tallow alkyl)amine, ethoxylated	3,913	3,509	2,251	.73
All other	68,717	14,926	11,156	.74
Cyclic (including imidazoline and oxazoline derivatives), total	5,702	3,260	2,114	.65
1-(2-Hydroxyethyl)-2-nor(coconut oil alkyl)-2-imidazoline	139	...	...	...
1-(2-Hydroxyethyl)-2-nor(tall oil alkyl)-2-imidazoline	932	217	146	.67
All other	4,631	3,043	1,968	.64
Amines and amine oxides having amide linkages, total	28,437	22,718	16,958	.75
Stearic acid - ethylenediamine condensate, monoethoxylated	2,903	2,772	2,317	.84
Tall oil acids - diethylenetriamine and polyalkylenepolyamine condensates	14,098	13,390	7,562	.56
All other	11,436	6,556	7,079	1.08
Amines, not containing oxygen (and salts thereof), total	78,854	59,712	42,234	.71
Diamines, polyamines, and amine salts, total	18,578	16,011	10,176	.64
N-(9-Octadecenyl)trimethylenediamine	2,963	1,918	1,339	.70
N-(Tallow alkyl)trimethylenediamine	5,535	4,789	2,901	.61
All other	10,080	9,304	5,936	.64
Primary, secondary, and tertiary monoamines, total	60,276	43.701	32,058	.73
(Hydrogenated tallow alkyl)amine	3,416	2,784	1,791	.64
9-Octadecenylamine	6,619	4,260	2,640	.62
(Tallow alkyl)amine	9,786	6,752	5,564	.82
N,N-Dimethyl(mixed alkyl)amine	6,115	4,454	3,471	.78
N,N-Dimethyloctadecylamine	754	725	639	.88
N-Methyl bis(hydrogenated tallow alkyl)amine	3,254	...	...	...
All other	30,332	24,726	17,953	.73
Quaternary ammonium salts, not containing oxygen, total	88,889	80,270	52,476	.65
Acyclic, total	72,990	66,362	35,354	.53
Bis(coconut oil alkyl)dimethylammonium chloride	2,934	2,305	1,951	.85
Bis(hydrogenated tallow alkyl)dimethylammonium chloride	60,348	55,477	22,794	.41
Trimethyl(tallow alkyl)ammonium chloride	1,308	1,498	1,107	.74
All other	8,400	7,082	9,502	1.34
Benzenoid, total	15,899	13,908	17,122	1.23
Benzyl(coconut oil alkyl)dimethylammonium chloride	218	...	...	...
Benzyldimethyl(mixed alkyl)ammonium chloride	8,241	7,684	10,999	1.43
Benzyltrimethylammonium chloride	...	1,024	462	.45
All other	7,440	5,200	5,661	1.08
Other cationic surface-active agents	22,841	19,906	13,602	.68
NONIONIC				
Total	1,195,463	867,585	380,581	.44
Carboxylic acid amides, total	80,918	55,522	31,374	.57
Diethanolamine condensates (amine/acid ratio=2/1), total	20,327	14,987	9,033	.60

See footnotes at end of table.

TABLE 1.--SURFACE-ACTIVE AGENTS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

SURFACE-ACTIVE AGENTS	PRODUCTION[2]	SALES[3] QUANTITY[2]	SALES[3] VALUE	SALES[3] UNIT VALUE[4]
NONIONIC--Continued				
Carboxylic acid amides--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Diethanolamine condensates (amine/acid ratio= 2/1)--Continued				
Capric acid	187	...	...	...
Castor oil acids	1,777	992	625	$0.63
Coconut oil acids	10,180	7,880	4,713	.60
Coconut oil and tallow acids	1,801	1,694	833	.49
Lauric acid	226	198	140	.70
Lauric and myristic acids	3,295	1,889	1,240	.66
Oleic acid	960	...	...	...
Stearic acid	591	366	231	.63
All other	1,310	1,968	1,251	.64
Diethanolamine condensate (other amine/acid ratios), total	37,475	32,281	17,627	.55
Coconut oil acids (amine/acid ratio=1/1)	22,692	22,043	11,669	.53
Lauric acid (amine/acid ratio=1/1)	6,569	3,975	2,092	.53
Lauric and myristic acid (amine/acid ratio=1/1)	3,156	2,487	1,617	.65
Linoleic acid (amine/acid ratio=1/1)	300	300	285	.95
Oleic acid (amine/acid ratio=1/1)	641	...	...	...
Stearic acid (amine/acid ratio=1/1)	625	631	429	.68
All other	3,492	2,845	1,535	.54
All other carboxylic acid amides, total	23,116	8,254	4,714	.57
Coconut oil acids (ratio 1/1), ethanolamine condensate	...	742	407	.56
All other	23,116	7,512	4,307	.57
Carboxylic acid esters, total	225,922	190,700	114,656	.60
Anhydrosorbitol monolaurate	4,356	2,789	2,221	.80
Anhydrosorbitol mono-oleate	4,011	3,680	2,887	.78
Anhydrosorbitol monostearate	...	4,657	3,241	.70
Diethylene glycol esters, total	1,125	1,098	694	.63
Diethylene glycol distearate	383	417	258	.62
Diethylene glycol monolaurate	267	275	168	.61
Diethylene glycol monostearate	225	156	94	.60
All other	250	250	174	.70
Ethoxylated anhydrosorbitol esters, total	26,135	26,939	16,875	.63
Ethoxylated anhydrosorbitol monolaurate	7,685	...	...	...
Ethoxylated anhydrosorbitol mono-oleate	8,034	7,912	5,243	.66
Ethoxylated anhydrosorbitol monostearate	6,650	7,996	4,214	.53
All other	3,766	11,031	7,418	.67
Ethylene glycol esters, total	3,025	3,242	1,682	.52
Ethylene glycol distearate	1,448	1,686	644	.38
Ethylene glycol monostearate	1,577	1,556	1,038	.67
Glycerol esters, total	93,208	79,394	44,521	.56
Glycerol dioleate	73	...	...	...
Glycerol mono-oleate	3,875	3,273	2,187	.67
Glycerol monostearate	21,287	18,581	9,226	.50
Glycerol monoester of hydrogenated cotton-seed oil acids	2,763	...	...	...
Glycerol monoester of hydrogenated soybeu oil acids	8,985	9,225	5,926	.64
Glycerol monoester of lard acids	...	1,737	971	.56
All other	56,225	46,578	26,211	.52
Natural fats and oils, alkoxylated, total	15,091	13,907	5,804	.42
Castor oil, ethoxylated	8,236	7,487	2,936	.39
Hydrogenated castor oil, ethoxylated	...	1,963	1,105	.56

See footnotes at end of table.

TABLE 1.--SURFACE-ACTIVE AGENTS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

SURFACE-ACTIVE AGENTS	PRODUCTION[2]	SALES[3] QUANTITY[2]	SALES[3] VALUE	SALES[3] UNIT VALUE[4]
NONIONIC--Continued				
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Carboxylic acid esters--Continued				
Natural fats and oils, alkoxylated--Continued				
Lanolin, ethoxylated	1,005	826	642	$0.78
All other	5,850	3,631	1,121	.31
Polyethylene glycol esters, total	39,367	31,544	16,425	.52
Polyethylene glycol esters of chemically defined acids, total	20,673	16,357	11,474	.70
Polyethylene glycol dilaurate	1,256	1,203	873	.73
Polyethylene glycol dioleate	3,390	929	586	.63
Polyethylene glycol distearate	2,965	2,888	1,916	.66
Polyethylene glycol monolaurate	3,459	3,662	2,872	.78
Polyethylene glycol mono-oleate	2,707	2,245	1,382	.62
Polyethylene glycol monostearate	6,743	5,268	3,696	.70
All other	153	162	149	.92
Polyethylene glycol esters of mixed acids, total	18,694	15,187	4,952	.33
Polyethyleoe glycol diester of tall oil acids-	3,060	...	...	...
All other	15,634	15,187	4,952	.33
Polyglycerol esters	1,378	1,282	1,555	1.21
1,2-Propanediol monolaurate	49	37	49	1.32
1,2-Propanediol monostearate	2,307	2,216	1,481	.67
All other carboxylic acid esters	35,870	19,915	17,221	.86
Ethers, total	882,905	617,191	229,474	.37
Benzenoid ethers, total	225,660	195,004	76,118	.39
Dinonylphenol, ethoxylated	...	1,852	1,109	.60
Dodecylphenol, ethoxylated	14,785	...	...	...
Nonylphenol, ethoxylated	130,384	123,043	41,373	.34
Phenol, ethoxylated	2,796	2,222	1,112	.50
All other	77,695	67,887	32,524	.48
Nonbenzenoid ethers, total	657,246	422,186	153,356	.36
Linear alcohols, alkoylated, total	576,703	361,377	122,113	.34
Decyl alcohol, ethoxylated	2,641	...	...	...
Mixed linear alcohols, ethoxylated	466,347	336,605	109,400	.33
9-Octadecenyl alcohol, ethoxylated	1,075	817	833	.77
Oleyl alcohol, ethoxylated	284	254	333	1.31
All other	106,356	23,701	11,547	.49
Other ethers and thioethers, total	80,543	60,809	31,243	.51
Tridecyl alcohol, ethoxylated	7,305	7,273	3,789	.52
All other	73,238	53,536	27,454	.51
Other nonionic surface-active agents	5,718	4,172	5,077	1.22

[1] The data for production (in thousands of pounds) for 1976 has been revised as shown below:

Grand total	4,795,775
Nonionic surface-active agents, total	1,170,144
Ethers, total	866,210
Nonbenzenoid ethers, total	633,414
Linear alcohols, alkoxylated, total	567,423
Mixed linear alcohols, ethoxylated	441,659

[2] All quantities are given in terms of 100 percent organic surface-active ingredient.
[3] Sales include products sold as bulk surface-active agents only.
[4] Calculated from rounded figures.
[5] The term "benzenoid" used in this report, describes any surface-active agents, except lignin derivatives, whose molecular structure includes 1 or more 6-membered carbocyclic or heterocyclic rings with conjugated double bonds (e.g., the benzene ring or the pyridine ring).
[6] Includes ligninsulfonates.
[7] Includes all other natural fats and oils, sulfated.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT. COMPANY IDENTIFICATION CODES WHICH ARE FOLLOWED BY AN "(E)" ARE SO LABELED BECAUSE THE COMPANY FAILED TO SUPPLY THE U.S. INTERNATIONAL TRADE COMMISSION WITH THEIR DATA IN SUFFICIENT TIME FOR ITS INCLUSION IN THIS REPORT. THE COMPANY IS PRESUMED TO HAVE CONTINUED PRODUCTION OF THE COMPOUND IN QUESTION IN 1977 AND THE VOLUME OF PRODUCTION AND SALES HAS BEEN ESTIMATED BY THE USITC STAFF MEMBERS]

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A M P H O T E R I C	
Acyclic amphoteric surface-active agents, all other	DUP, SCP.
1,1-Bis(carboxyethyl)-2-undecyl-imidazoline, sodium salt	MOA.
1,1-Bis(carboxymethyl)-2-undecyl-2-imidazolinium chloride, disodium salt	SCP.
1,1-Bis(carboxymethyl)-2-undecyl-2-imidazolinium hydroxide, disodium salt	BRD, MIR.
(1-Carboxyheptadecyl)trimethylammonium hydroxide, inner salt	DUP.
(Carboxymethyl)[3-(coconut oil amido)propyl]dimethyl ammonium chloride, sodium salt	X.
(Carboxymethyl)[3-(coconut oil amido)propyl]dimethyl ammonium hydroxide, inner salt	TCH, WM.
1-Carboxymethyl-2-heptadecyl-1-(2-hydroxyethyl)-2-imidazolinium hydroxide, sodium derivative, sodium salt	MIR.
1-Carboxymethyl-1-(2-hydroxyethyl)-2-nonyl-2-imidazolinium hydroxide, sodium derivative, sodium salt	MIR.
1-Carboxymethyl-1-(2-hydroxyethyl)-2-undecyl-2-imidazolinium hydroxide, sodium derivative, sodium salt	GAF, MIR, TCH.
N-(Coconut oil alkyl)-β-alanine, partial sodium salt	GNM.
N-(Coconut oil alkyl)-β-alanine, sodium salt	GNM.
N-Dodecyl-β-alanine, partial sodium salt	GNM.
N-Dodecyl-3-iminodipropionic acid	GNM.
N-Dodecyl-3-iminodipropionic acid, disodium salt	GNM.
N-(Dodecyl and tetradecyl)-β-alanine	GNM.
N-(Dodecyl and tetradecyl)-β alanine triethanolamine	

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A M P H O T E R I C--Continued	
salt	GNM.
Heptadecylmethylbenzimidazolinesulfonic acid, sodium salt	CGY(E).
1-(2-Hydroxyethyl)-2-heptyl-3-carboxyethyl-imidazoline, sodium salt	MOA.
1-(2-Hydroxyethyl)-2-undecyl-3-carboxyethylimidazoline, sodium salt	MOA.
Mixed acyclic primary amines, ethoxylated and sulfated, sodium salt	DUP, RH.
Oleic acid-ethylenediamine condensate, propoxylated and sulfated, sodium salt	S.
Polypeptide ammonium salt	X.
Polypeptide ethyl ester	X.
Polypeptide, sodium salt	X.
N-(Tallow alkyl)-3-iminodipropionic acid, disodium salt	GNM.
Cyclic amphoteric surface-active agents, all other	SBC, SCP.
A N I O N I C	
CARBOXYLIC ACIDS (AND SALTS THEREOF):	
AMINE SALTS OF FATTY, ROSIN, AND TALL OIL ACIDS:	
Coconut oil acids, diethanolamine salt	SOP.
Coconut oil acids, ethanolamine salt	SBP.
Mixed fatty acids, ethanolamine salt	SBP.
Oleic acid, butylamine salt	DYS.
Oleic acid, diethylamine salt	ASH, WTC.
Oleic acid, triethanolamine salt	SNW.
Rosin acids, triethanolamine salt	AES.
Stearic acid,N,N,N',N'-tetrakis(2-hydroxyethyl)-ethylenediamine salt	ICI.
Stearic acid, triethanolamine salt	GLY.
Tallow acids, ethanolamine salt	SBP.
Tallow acids, triethanolamine salt	SBP.
Amine salts of fatty, rosin,and tall oil acids, all other	VAL, WM, X.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
CARBOXYLIC ACIDS HAVING AMIDE, ESTER, OR ETHER LINKAGES:	
N-(Coconut oil acyl)polypeptide, potassium salt	X.
N-(Coconut oil acyl)polypeptide, sodium salt	X.
N-(Coconut oil acyl)polypeptide, triethanolamine salt	X.
N-(Coconut oil acyl)sarcosine	HMP.
N-(Coconut oil acyl)sarcosine, sodium salt	HMP.
N-Lauroylsarcosine	HMP.
N-Lauroylsarcosine, sodium salt	CP, HMP, ONX.
N-(Mixed alkylsulfonyl)glycine, sodium salt	GAF.
N-Oleoylpolypeptide, sodium salt	LMI.
N-Oleoylsarcosine	HMP.
N-Oleoylsarcosine, sodium salt	GAF.
Carboxylic acids with amide, ester or ether linkage, other	AZS, BRD, CHP, HMP, X.
POTASSIUM AND SODIUM SALTS OF FATTY, ROSIN, AND TALL OIL ACIDS:	
Animal grease, sodium salt	NMC.
Castor oil acids, potassium salt	NTL, SEA.
Castor oil acids, sodium salt	HEW.
*Coconut oil acids, potassium salt	AES, CON, DA, DYS, ESS, GBC, HEW, HNT, MCP, NMC, PCH, PEK, PG, PNX, SNW, SOP.
Coconut oil acids, sodium salt	AGP, BSW, CON, CP, GRC, HEW, JRG, LEV, NMC, NPR, PG.
Corn oil acids, potassium salt	GBC, HNT, NMC.
Corn oil acids, sodium salt	GRC, NMC.
Fish oil acids, sodium salt	DA, PG.
Lauric acid, potassium salt	GAF.
Mixed vegetable fatty acids, potassium salt	AES, DYS, GRC, GRL, LUB, PCH, QCP, SLC.
Oleic acid, potassium salt	AES, DA, HNT, SNW, USR, WBG, X.
Oleic acid, sodium salt	BSW, LUB, NMC, USR, WEG, WTC.
Olive oil acids, sodium salt	HNT.
Palmitic and stearic acids, potassium salt	HEW.
Palmitic and stearic acids, sodium salt	HEW.
Palm oil acids, sodium salt	HEW.
Rosin acids, potassium salt	PEK, X.
Rosin acids, sodium salt	HBT, SLM, X.
*Soybean oil acids, potassium salt	NMC, PEK, PNX.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
CARBOXYLIC ACIDS (AND SALTS THEREOF)--Continued	
POTASSIUM AND SODIUM SALTS OF FATTY, ROSIN, AND TALL OIL ACIDS--Continued	
Stearic acid, potassium salt	CON, DA, WTC.
Stearic acid, sodium salt	DA, JRG, WTC.
*Tall oil acids, potassium salt	AES, ASY, CON, DYS, ESS, GRC, HNT, PEK, PNX, SOP, USR, X.
*Tall oil acids, sodium salt	AES, ASY, CON, DAN, GRC, NMC, SOP, UNP, X.
Tall oil acids and stearic acid, potassium salt	DYS.
Tallow acids, potassium salt	AES, AGP, ASY, DYS, PG, USR.
*Tallow acids, sodium salt	ASY, BSW, CON, CP, GRC, HEW, JRG, LEV, LUB, NMC, NPR, PG, PRX.
Potassium and sodium salts of fatty, rosin, and tall oil acids, all other	HEW, NMC, VAL.
OTHER CARBOXYLIC ACIDS:	
Carboxylic acids, all other	SCP, USR.
PHOSPHORIC AND POLYPHOSPHORIC ACID ESTERS (AND SALTS THEREOF):	
ALCOHOLS AND PHENOLS, ALKOXYLATED AND PHOSPHATED:	
Butyl alcohol, ethoxylated and phosphated	GAF.
*Dinonylphenol, ethoxylated and phosphated	GAF, MOA, TCH, WAY, WTC.
Dodecyl alcohol, ethoxylated and phosphated	GAF.
Dodecylphenol, ethoxylated and phosphated	ARL, GAF.
Hexylphenol, ethoxylated and phosphated	CRT, WAY.
Isopentyl alcohol, ethoxylated and phosphated	GAF.
*Mixed linear alcohols, ethoxylated and phosphated	AZS, BAS, CHP, CRT, CST, CTL, GAF, MOA, SCP, TCC, TCH, WTC.
*Nonylphenol, ethoxylated and phosphated	ARL, AZS, CTL, DEX, GAF, MOA, SCP, SOP, TCC, WAY, WTC, X.
Nonylphenol, ethoxylated and phosphated, barium	HRT.
9-Octadecenyl alcohol, ethoxylated and phosphated	GAF.
Octylphenol, ethoxylated and phosphated	RH.
Phenol, ethoxylated and phosphated	GAF, RH, WTC, X.
*Polyhydric alcohol, ethoxylated and phosphated	DEX, MOA, SCP, TCH, X.
*Tridecyl alcohol, ethoxylated and phosphated	DAN, GAF, MIL, SNW, WTC, X.
Alcohols and phenols, alkoxylated and phosphated or polyphosphated, all other	BAS, CHP, GAF, WAY, WTC, X.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
PHOSPHORIC AND POLYPHOSPHORIC ACID ESTERS (AND SALTS THEREOF)--Continued	
ALCOHOLS, PHOSPHATED OR POLYPHOSPHATED:	
Butyl phosphate, potassium salt	DUP.
Decyl polyphosphate, sodium salt	USM.
2-Ethylhexyl phosphate	GAF, TCC.
2-Ethylhexyl phosphate, sodium salt	CHP, WTC.
2-Ethylhexyl polyphosphate	X.
2-Ethylhexyl polyphosphate, sodium salt	X.
Hexyl phosphate	ICI, SFS.
Hexyl phosphate, potassium salt	ICI.
Hexyl polyphosphate, potassium salt	DEX.
Mixed alkyl phosphate	CTL, DUP, SFS, X.
Mixed alkyl phosphate, diethanolamine salt	DUP.
Octyl decyl phosphate	X.
Octyl phosphate	SCP, TCH, WTC, X.
Octyl phosphate, alkylamine salt	DUP, SCP.
Octyl phosphate, potassium salt	DEX.
Octyl polyphosphate	DEX.
Octyl polyphosphate, potassium salt	DEX, SNW.
Phosphated and polyphosphated alcohols, all other	BRD, MIL, VAL, X.
OTHER PHOSPHORIC AND POLYPHOSPHORIC ACID ESTERS:	
Glycerol monoester of mixed fatty acids, phosphated	QCP, WTC.
Phosphoric and polyphosphoric acid esters, all other	X.
SULFONIC ACIDS (AND SALTS THEREOF):	
ALKYLBENZENESULFONATES:	
DODECYLBENZENESULFONATES:	
*Dodecylbenzenesulfonic acid	ARC, ATR, CO, CRT, CTL, EMK, HLI(E), LAK, LEV, MON, ONX, PIL, PLX, PRX, RCD, STP, TCI, TEN, WTC.
Dodecylbenzenesulfonic acid, (Mixed alkyl)amine salt	ECC, X.
Dodecylbenzenesulfonic acid, ammonium salt	AES, HLI(E).
Dodecylbenzenesulfonic acid, branched chain	WTC.
Dodecylbenzenesulfonic acid, butylamine salt	WTC.
*Dodecylbenzenesulfonic acid, calcium salt	ICI, RCD, RH, STP, TMH, WTC, X.
Dodecylbenzenesulfonic acid, dimethylamine salt	PIL.
Dodecylbenzenesulfonic acid, ethylenediamine	

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
SULFONIC ACIDS (AND SALTS THEREOF)--Continued	
ALKYLBENZENESULFONATES--Continued	
DODECYLBENZENESULFONATES--Continued	
salt	ICI.
Dodecylbenzenesulfonic acid, isopropanolamine salt	PIL.
*Dodecylbenzenesulfonic acid, isopropylamine salt	CIN, CTL, ICI, MRV, RCD, STP, TCH, WTC.
*Dodecylbenzenesulfonic acid, potassium salt	AES, RCD, STP.
*Dodecylbenzenesulfonic acid, sodium salt	AAC, AES, APX, ARD, ATR, AZS, BLA, CO, CP, CRI, CTL, DUP, ECC, HLI(E), LEV, NMC, ONX, PEK, PG, PIL, PRX, RCD, STP, TEN.
Dodecylbenzenesulfonic acid, sodium salt, branched chain	WTC.
Dodecylbenzenesulfonic acid, strontium salt	HLI(E).
*Dodecylbenzenesulfonic acid, triethanolamine salt	AAC, ARD, ARL, ATR, CIN, CTL, ESS, PIL, RCD, SOP, STP, WTC.
Dodecylbenzene sulfonates, all other	WTC.
OTHER ALKYLBENZENESULFONATES:	
Decylbenzenesulfonic acid, sodium salt	ATR, PLX.
Pentadecylbenzenesulfonic acid, potassium salt	STP.
Tridecylbenzenesulfonic acid	PLX, RCD, WTC.
*Tridecylbenzenesulfonic acid, sodium salt	BLA, CP, NPR, PG, RCD, WTC.
Undecylbenzene sulfonic acid	SCP.
Undecylbenzene sulfonic acid, sodium salt	WTC.
Undecylbenzene sulfonic acid, triethanolamine salt	SCP, WTC.
Alkylbenzene sulfonates, all other	USR.
BENZENE-, CUMENE-, TOLUENE-, AND XYLENESULFONATES:	
Cumenesulfonic acid, ammonium salt	NES, STP, WTC.
Cumenesulfonic acid, sodium salt	NES, WTC.
Toluenesulfonic acid, potassium and sodium salts	CO, NES, PPG, WTC.
*Xylenesulfonic acid, ammonium salt	CO, NES, STP, WTC.
*Xylenesulfonic acid, sodium salt	ATR, CO, NES, PIL, SDC, STP, WTC.
Benzene-, cumene-, toluene-, and xylenesulfonates, all other	WTC.
LIGNINSULFONATES:	
Ligninsulfonic acid, ammonium salt	CRZ, SPA.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
SULFONIC ACIDS (AND SALTS THEREOF)--Continued	
LIGNINSULFONATES--Continued	
*Ligninsulfonic acid, calcium salt	CRZ, CWP, LKY, MAR, PSP.
Ligninsulfonic acid, chromium salt	MAR, PSP, RAY.
Ligninsulfonic acid, iron salt	CRZ, PSP.
Ligninsulfonic acid, magnesium salt	CWP.
*Ligninsulfonic acid, sodium salt	CRZ, MAR, PSP, RAY, SPA.
Ligninsulfonic acid, zinc salt	PSP, WVA.
NAPHTHALENESULFONATES:	
Butylnaphthalenesulfonic acid, sodium salt	DA, ECC.
Dibutylnaphthalenesulfonic acid	GAF.
*Diisopropylnaphthalenesulfonic acid, sodium salt	DA, DUP, UDI.
Dipentylnaphthalenesulfonic acid	X.
Dipentylnaphthalenesulfonic acid, (Mixed alkyl) amine salt	X.
Dipentylnaphthalenesulfonic acid, ammonium salt	X.
Methylenebis(2-naphthalenesulfonic acid)	VPC.
Methylenebis(2-naphthalenesulfonic acid), sodium salt	DUP.
Methylnaphthalenesulfonic acid, sodium salt	DA, UDI.
Methylnonylnaphthalenesulfonic acid, sodium salt	UDI.
Tetrahydronaphthalenesulfonic acid, sodium salt	DUP.
Naphthalenesulfonates, all other	CGY(E), DUP, PFZ, RH.
SULFONIC ACIDS HAVING AMIDE LINKAGES:	
SULFOSUCCINAMIC ACID DERIVATIVES:	
N-(1,2-Dicarboxyethyl)-N-octadecylsulfosuccinamic acid, tetrasodium salt	ACY, MOA.
N-Octadecylsulfosuccinamic acid, disodium salt	ACY.
N-(Oleoyloxyisopropyl)sulfosuccinamic acid	WTC.
Sulfosuccinamic acid derivatives, all other	ARD, SBC.
TAURINE DERIVATIVES:	
N-(Coconut oil acyl)-N-methyltaurine, sodium salt	GAF, TNI.
N-Cyclohexyl-N-palmitoyltaurine, sodium salt	GAF.
N-Methyl-N-oleoyltaurine, sodium salt	GAF, HRT.
N-Methyl-N-palmitoyltaurine, sodium salt	GAF.
N-Methyl-N-(tall oil acyl)taurine, sodium salt	CRT, GAF, DSM, X.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
SULFONIC ACIDS (AND SALTS THEREOF)--Continued	
sulfonic acids having ester or ether linkages:	
SULFOSUCCINIC ACID ESTERS:	
Sulfosuccinic acid-bis(diisobutyl)ester, sodium salt	MOA.
Sulfosuccinic acid, bis(2,6-dimethyl-4-heptyl) ester, sodium salt	DAN, GAF, MOA.
*Sulfosuccinic acid, bis(2-ethylhexyl)ester, sodium salt	ACY, CGY(E), CHP, DA, DAN, ECC, EMK, HDG, HRT, MCP, MOA, PC, RH, SCO, SOS, USM, WTC.
Sulfosuccinic acid, dihexyl ester, sodium salt	ACY, MOA.
Sulfosuccinic acid, diisodecyl ester, sodium salt	ACY.
Sulfosuccinic acid, diisocctyl ester, sodium salt	X.
Sulfosuccinic acid, dipentyl ester, sodium salt	ACY.
Sulfosuccinic acid, ditridecyl ester, sodium salt	ACY, MOA.
Sulfosuccinic acid esters, all other	ARD, HDG, LAK, RH, SCP.
ALL OTHER SULFONIC ACIDS HAVING ESTER OR ETHER LINKAGES:	
Coconut oil acids, 2-sulfoethyl ester, sodium salt	GAF, LEV, X.
Dodecyldiphenyloxidedisulfonic acid, disodium salt	DOW.
Dodecyl sulfoacetate, sodium salt	STP.
Glycerol monostearate sulfoacetate, sodium salt	WTC.
Iso-octyphenol, ethoxylated and sulfonated, sodium salt	RH.
n-Octylphenol, ethoxylated and sulfonated, sodium salt	CRT.
Sulfonic acids with ether linkages, all other	PG, WTC, X.
OTHER SULFONIC ACIDS:	
Butylhydroxybiphenylsulfonic acid (Rwa-50)	RBC.
Mixed alkane sulfonic acid, sodium salt	CCL, DUP, QCP, X.
Petroleumsulfonic acid, water soluble (Acid layer), sodium salt	WTC.
Sulfosuccinic acid-half ester (Coconut monoisoprop	

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
SULFONIC ACIDS (AND SALTS THEREOF)--Continued	
OTHER SULFONIC ACIDS--Continued	
anol)amide, disodium salt	MOA.
Sulfonic acids, all other	ARD, LAK, SLM, STP, WTC.
SULFURIC ACID ESTERS (AND SALTS THEREOF):	
ACIDS, AMIDES, AND ESTERS, SULFATED:	
Coconut oil acids-ethanolamine salt, sulfated, potassium salt	EMK.
CARBOXYLIC ACID ESTERS (EXCEPT NATURAL FATS AND OILS), SULFATED:	
ESTERS OF SULFATED OLEIC ACID:	
2-Butoxyethyl oleate, sulfated, sodium salt	S.
*Butyl oleate, sulfated, sodium salt	AKS, CIN, CRT, ICI, MRV, PC.
Butyl and propyl oleate, sulfated, sodium salt	MCP.
Glycerol trioleate, sulfated, sodium salt	MRV.
*Isobutyl oleate, sulfated, sodium salt	DA.
Isopropyl oleate, sulfated, sodium salt	CRT, DEX, HRT.
Methyl oleate, sulfated, sodium salt	DUP, ICI.
*Propyl oleate, sulfated, sodium salt	ACY, AKS, CHP, GAF, MRV.
Esters of sulfated oleic acid, all other	CHP.
OTHER SULFATED ESTERS:	
Glycerol monoester of coconut oil acids, sulfated, sodium salt	CP.
9-Octadecenyl acetate, sulfated, sodium salt	DA, DUP.
OTHER SULFURIC ACID ESTERS:	
*Mixed fatty acids, sulfated, potassium salt	SCC.
*Oleic acid, sulfated, disodium salt	ACT, ACY, DA, GAF, TEN.
Sulfuric acid esters, all other	SLM.
*Tall oil, sulfated, sodium salt	ACT, APX, BAO, CHP, CRT, ICI, KAL(E), SEA, WHI, WHW.
ALCOHOLS, SULFATED:	
Decyl and octyl sulfate, sodium salt	TCH.
Decyl sulfate, sodium salt	HLI(E), ONX, SCP.
DODECYLSULFATE SALTS:	
*Dodecyl sulfate, ammonium salt	AAC, CTL, HLI(E), JRG, ONX, STP, TCH, TNI.
*Dodecyl sulfate, diethanolamine salt	DUP, JRG, ONX, SCP, STP, TCH.
Dodecyl sulfate, N,N-diethylcyclohexylamine salt	DUP.
*Dodecyl sulfate, isopropanolamine salt	JRG, ONX, TCH.
*Dodecyl sulfate, magnesium salt	AAC, HLI(E), STP.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N O N I C--Continued	
SULFURIC ACID ESTERS (AND SALTS THEREOF)--Continued	
ALCOHOLS, SULFATED--Continued	
DODECYLSULFATE SALTS--Continued	
Dodecyl sulfate, potassium salt	PG.
*Dodecyl sulfate, sodium salt	AAC, CTL, DUP, HLI(E), ONX, SCP, STP, TCH.
*Dodecyl sulfate, triethanolamine salt	AAC, CTL, ONX, SCP, STP, TCH.
2-Ethylhexyl sulfate, sodium salt	AAC, SCP, TCH.
Hexadecyl sulfate, sodium salt	AAC.
Hexyl sulfate, potassium salt	DEX.
Linear alcohols, sulfated, all other	AAC, AZS, DUP, PG, X.
*Mixed linear alcohols, sulfated, ammonium salt	CP, LAK, NTL, PG, RCD, S, SCP, X.
*Mixed linear alcohols, sulfated, sodium salt	DUP, LAK, PG, RCD, SCP, WTC.
Mixed linear alcohols, sulfated, triethanolamine salt	LAK, PG, RCD, SCP.
Nonyl sulfate, sodium salt	TEN.
Octadecyl sulfate, ammonium salt	EMK.
Octyl sulfate, sodium salt	AAC, APX, DUP.
Tridecyl sulfate, sodium salt	AAC, DA, SCP.
ETHERS, SULFATED:	
ALKYLPHENOLS, ETHOXYLATED AND SULFATED:	
Nonylphenol, ethoxylated and sulfated, ammonium salt	GAF, HLI(E), MOA, STP, WTC.
Nonylphenol, ethoxylated and sulfated, sodium salt	CRT, GAF.
Octylphenol, ethoxylated and sulfated, sodium salt	RH.
Sulfated cyclic ethers, all other	TCH.
Decyl alcohol, propoxylated and sulfated, sodium salt	APX.
Dodecyl alcohol, ethoxylated and sulfated, ammonium salt	AAC, AKS, CTL, HLI(E), STP.
*Dodecyl alcohol, ethoxylated and sulfated, sodium salt	AAC, CTL, HLI(E), ONX, SCP, STP, TCH.
Dodecyl and tetradecyl alcohols, ethoxylated and sulfated, ammonium salt	LEV.
Hexyl alcohol, propoxylated and sulfated, sodium salt	APX.
Mixed linear alcohols, ethoxylated and sulfated, ammonium salt	CO, LAK, MOA, ONX, PG, PIL, RCD, SCP, SHC, STP, WTC,

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A N I O N I C--Continued	
SULFURIC ACID ESTERS (AND SLATS THEREOF)--Continued	
ETHERS, SULFATED--Continued	X.
*Mixed linear alcohols, ethcxylated and sulfated, sodium salt	CO, DA, DUP, GAF, HLI(E), LAK, LEV, ONX, PG, PIL, RCD, SCP, SHC, STP, TCI, WTC.
Tridecyl alcohol, ethoxylated and sulfated, sodium salt	AAC.
Sulfated ethers, all other	PG, WTC.
NATURAL FATS AND OILS, SULFATED:	
*Castor oil, sulfated, sodium salt	ACT, ACY, AKS, APX, ARL, BAO, CRT, DA, DEX, GAF, HRT, ICI, KAL(E), LEA, LUB, MRV, S, SCO, SCP, SEA, SLM, WHW.
Coconut oil, sulfated, sodium salt	ACY, BAO, DA.
*Cod oil, sulfated, sodium salt	BAO, SEA, WHI, WHW.
Grease, other than wool, sulfated, sodium salt	WHI.
Herring oil, sulfated, sodium salt	SEA, SLM, WHW.
Lard, sulfated, sodium salt	CRT, WAW, WHW.
Mixed fish oils, sulfated, sodium salt	ACT, MRD, SLM.
Mixed vegetable oils, sulfated, sodium salt	LUB.
Mustard seed oil, sulfated, sodium salt	DA.
*Neat'S foot oil, sulfated, sodium salt	ACT, ARC, BAO, DA, MRD, PC, SLM.
Peanut oil, sulfated, sodium salt	ACY, CHP.
Pecan oil, sulfated, sodium salt	CRT.
Ricebean oil, sulfated, sodium salt	SEA.
*Soybean oil, sulfated, sodium salt	ACT, ONX, SEA, WHW.
Sperm oil, sulfated, sodium salt	ACT, ONX.
*Tallow, sulfated, sodium salt	ACT, ACY, AZS, DA, ECC, LUB, MRD, PC, SID, SLM, SOS, WHI.
OTHER ANIONIC SURFACE-ACTIVE AGENTS:	
Fatty acid lactolates, mixed salts	BFP.
Mixed linear olefin sulfonate	X.
Polyethylene-vinyl alcohol copolymer, potassium salt	X.
Tridecyl alcohol, ethoxylated and carbonated, sodium salt	S.
Anionic surface-active agents, all other	S, SLM, VAL, WVA.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C A T I O N I C	
AMINE OXIDES AND OXYGEN-CONTAINING AMINES (EXCEPT THOSE HAVING AMIDE LINKAGES):	
ACYCLIC:	
N,N-Bis(2-hydroxyethyl)(coconut oil alkyl)amine	ABC.
N,N-Bis(2-hydroxyethyl)octadecylamine	ARC, FIN.
N,N-Bis(2-hydroxyethyl)(tallow alkyl)amine	ARC.
(Coconut oil alkyl)amine, ethoxylated	ARC, DA, TCH, X.
(Coconut oil alkyl)amine, ethoxylated, acetate	PG.
(Coconut oil alkyl)amine, ethoxylated, oleate	DUP.
N,N-Dimethylhexadecylamine oxide	ABC, ONX.
Ethylenediamine, propoxylated	DUP.
(Hydrogenated tallow alkyl)amine, ethoxylated	TCH.
N-(2-Hydroxyethyl)-N,N',N'-tris(2-hydroxypropyl)-ethylenediamine	X.
(Mixed alkyl)amine, ethoxylated	GAF, ICI, RH.
(9-Octadecenyl)amine, ethoxylated	ARC, TCH.
Octadecylamine, ethoxylated	ARC, TCH.
(Soybean oil alkyl)amine, ethoxylated	ABC.
*(Tallow alkyl)amine, ethoxylated	ARC, DUP, GAF, TCH.
N-(Tallow alkyl)trimethylenediamine, ethoxylated	ARC, TCH.
N,N,N',N'-Tetrakis(2-hydroxyethyl)ethylenediamine	X.
N,N,N',N'-Tetrakis(2-hydroxypropyl)ethylenediamine, propoxylated and ethyoxylated	ARC.
Triethanolamine, ethoxylated	MIL.
Amine oxides and oxygen-containing amines (Except those with amide linkages), acyclic, all other	AZS, BRD, CHP, GAF, ONX, PG, SBC, SDH, TCH, X.
CYCLIC:	
2-(8-Heptadecenyl)-4-hydroxymethyl-4-methyl-2-oxazoline	BRD.
1-(2-Hydroxyethyl)-2-heptadecyl-3-carboxyethylimidazoline	MOA.
1-(2-Hydroxyethyl)-2-nonyl-2-imidazoline	BRD, MOA, SBC, SCP.
*1-(2-Hydroxyethyl)-2-nor(coconut oil alkyl)-2-imidazoline	BRD, GAF, MOA, SCP, TCH.
*1-(2-Hydroxyethyl)-2-nor(tall oil alkyl)-2-imidazoline	BRD, HDG, MOA, TCH, X.
1-(2-Hydroxyethyl)-2-undecyl-3-carboxyethylimidazo	

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C A T I O N I C--Continued	
AMINE OXIDES AND OXYGEN-CONTAINING AMINES (EXCEPT THOSE HAVING AMIDE LINKAGES)--Continued	
CYCLIC--Continued	
line	MOA.
Lignin amines	WVA.
Rosin amine, ethoxylated	HPC, X.
Amine oxides and oxygen-containing amines (Except those having amine linkages), cyclic, all other	CGY(E), TCH, X.
AMINES AND AMINE OXIDES HAVING AMIDE LINKAGES:	
CARBOXYLIC ACID - DIAMINE AND POLYAMINE CONDENSATES:	
Carboxylic acid-diamine and polyamine condensates, all other	ICI, STC, VND, X.
Coconut oil acids-N,N-dimethyltrimethylenediamine condensate	SCP.
Mixed fatty acids-polyalkylenepolyamine condensate	QCP, TCH, X.
Oleic acid-diethylenetriamine condensate	ICI, TCH.
Oleic acid-N,N-dimethyltrimethylenediamine condensate	CCW.
Oleic acid-ethylenediamine condensate, monoethoxylated	CLD, DEX, SOC.
Pelargonic acid-tetraethylenepentamine condensate	ICI.
Stearic acid-diethylenetriamine condensate	S, STC.
Stearic acid-diethylenetriamine condensate, polyethoxylated	APX.
Stearic acid-N,N-diethylethylenediamine condensate	S.
*Stearic acid-ethylenediamine condensate, monoethoxylated	CLD, CST, DA, DEX, ICI, MBV, S, SLC.
Stearic acid-ethylenediamine condensate, polyethoxylated	ICI.
Stearic acid-tetraethylenepentamine condensate	ONX.
*Tall oil acids-diethylenetriamine condensate and polyalkylenepolyamine condensate	AZS, NCW, QCP, SCP, X.
OTHER AMINES AND AMINE OXIDES HAVING AMIDE LINKAGES:	
3-Lauramido-N,N-dimethylpropylamine oxide	SNW.
Stearic acid,diethanolamine condensate, methyl sulfate	DUP.
Amines and amine oxides having amide linkages, all other	HLI(E), SCP.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C A T I O N I C--Continued	
AMINES, NOT CONTAINING OXYGEN (AND SALTS THEREOF):	
AMINE SALTS:	
(Coconut oil alkyl)amine acetate	ARC.
(Hydrogenated tallow alkyl)amine acetate	ARC.
(9-Octadecenyl)amine acetate	GNM.
Octadecylamine acetate	ARC.
(Tallow alkyl)amine acetate	ARC.
N-(Tallow alkyl)trimethylenediamine oleate	ARC, ASH.
Amine salts (Not containing oxygen), all other	SM.
DIAMINES AND POLYAMINES:	
IMIDAZOLINE DERIVATIVES:	
1-(2-Aminoethyl)-2-nor(tall oil alkyl)-2-imidazoline	SCP.
N-(Docosyl and eicosyl)trimethylenediamine	ENO.
2-Heptadecyl-2-imidazoline	SCC.
N-(Coconut oil alkyl)trimethylenediamine	ARC, GNM.
N-Dodecyldiethylenetriamine	ARC.
N-(Mixed alkyl)polyethylenepolyamine	ARC, CCW, SNW.
*N-(9-Octadecenyl)trimethylenediamine	ARC, ASH, ENO, GNM.
N-(Soybean oil alkyl)trimethylenediamine	ENO.
N-(Tallow - alkyl)dipropylenetriamine	GNM, NCW.
*N-(Tallow alkyl)trimethylenediamine	ARC, ASH, ENO, GNM, NCW.
Diamines and polyamines, all other	ICI, SFC, X.
PRIMARY MONOAMINES:	
(Coconut oil alkyl)amine	ARC, ASH, ENO.
(Docosyl and eicosyl)amine	ENO.
Dodecylamine	ARC, ASH, GNM.
Hexadecylamine	ENO.
*(Hydrogenated tallow alkyl)amine	ARC, ASH, ENO, GNM.
(Mixed alkyl)amine	ARC.
*9-Octadecenylamine	ARC, ASH, ENO, GNM.
Octadecylamine	ARC, ASH, ENO, GNM.
Octylamine	ARC.
(Soybean oil alkyl)amine	ARC, ENO.
(Tall oil alkyl)amine	GNM.
*(Tallow alkyl)amine	ARC, ASH, ENO, GNM, NCW.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C A T I O N I C--Continued	
AMINES, NOT CONTAINING OXYGEN (AND SALTS THEREOF)--Con.	
SECONDARY AND TERTIARY MONOAMINES:	
Bis(coconut oil alkyl)amine	ARC.
Bis(hydrogenated tallow alkyl)amine	ARC, ASH.
N,N-Dimethyl(coconut oil alkyl)amine	ARC, BRD.
N,N-Dimethyldecylamine	BRD.
N,N-Dimethyldodecylamine	ARC, BRD.
N,N-Dimethylhexadecylamine	ARC, BRD.
N,N-Dimethyl(hydrogenated tallow alkyl)amine	ARC, ASH, ENO.
*N,N-Dimethyl(mixed alkyl)amine	ARC, BRD, ENO, ONX, TNA.
N,N-Dimethyl-1-9-octadecenylamine	ENO.
N,N-Dimethyloctadecylamine	ARC, BRD, ENO, ONX.
N,N-Dimethyloctylamine	BRD.
N,N-Dimethyl(soybean oil alkyl)amine	ARC, ENO.
N,N-Dimethyltetradecylamine	ARC, BRD.
*N-Methylbis(hydrogenated tallow alkyl)amine	ARC, ASH, ENO, GNM.
Triisodecylamine	GNM.
Trilaurylamine	GNM.
Trioctylamine	GNM.
Secondary and tertiary monoamines, all other	ARC.
OXYGEN-CONTAINING QUATERNARY AMMONIUM SALTS:	
Benzyl(coconut oil alkyl)bis(2-hydroxyethyl)ammonium chloride	SCP, X.
Benzyl(coconut oil alkyl,ethoxylated)dimethyl ammonium chloride	ARC, DUP, GAF, SCP.
1-Benzyl-1-(2-hydroxyethyl)-2-nor(tall oil alkyl)-2-imidazoline	MOA, X.
Benzyl(tallow alkyl)bis(2-hydroxyethyl)ammonium chloride	DUP.
Bis(2-hydroxyethyl, ethoxylated)methyl(9-octadecenyl)-ammonium chloride	ARC.
Bis(2-hydroxyethyl, ethoxylated)methyloctadecyl ammonium chloride	ARC.
(Coconut oil alkyl)bis(2-hydroxyethyl, ethoxylated)-methylammonium chloride	ARC.
(Ethoxybenzyl)dimethyl(octylphenoxy)ammonium chloride	ARC, RH.
(Ethoxybenzyl)dimethyl(octyltolyloxy)ammonium	

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
AMINES, NOT CONTAINING OXYGEN (AND SALTS THEREOF)--Con.	
OXYGEN-CONTAINING QUATERNARY AMMONIUM SALTS:	
chloride	RH.
1-Ethyl-2-(8-heptadecenyl)-1-(2-hydroxyethyl)-2-imidazolinium ethyl sulfate	ICI.
N-Ethyl-N-hexadecylmorpholinium ethyl sulfate	BRD, ICI.
N-Ethyl-N-(soybean oil alkyl)morpholinium ethyl sulfate	ICI.
(2-Hydroxyethyl)dimethyl(3-stearamidopropyl)ammonium dihydrogen phosphate	ACY.
(2-Hydroxyethyl)dimethyl(3-stearamidopropyl)ammonium nitrate	ACY.
(3-Lauramidopropyl)trimethylammonium methyl sulfate	ACY.
2-(2-Lauroyloxyethyl)carbamoyl-1-methylpyridinium chloride	WTC.
1-Methyl-2-(2-stearoyloxyethyl)carbamoylpyridinium chloride	WTC.
Oxygen-containing quaternary ammonium salts (Except those having amide linkages), all other	AAC, ARC, HLI(E), ICI, TCH.
Quaternary ammonium salts having amide linkages, all other	ASH, MRV, TCH, VND.
QUATERNARY AMMONIUM SALTS, NOT CONTAINING OXYGEN:	
ACYCLIC:	
*Bis(coconut oil alkyl)dimethylammonium chloride	ARC, ASH, ENO, GNM.
*Bis(hydrogenated tallow alkyl)dimethylammonium chloride	ARC, ASH, ENO, GNM.
(Coconut oil alkyl)trimethylammonium chloride	ARC.
Dimethylbis(soybean oil alkyl)ammonium chloride	ARC.
Dimethyldioctadecylammonium choride	ASH.
Dodecyltrimethylammonium chloride	ARC, GNM.
Ethyldimethyl(mixed alkyl)ammonium ethyl sulfate	DEX, JOR, TCC.
Ethyldimethyl(9-octadecenyl)ammonium bromide	ONX.
Ethylhexadecyldimethylammonium bromide	FIN.
Hexadecyltrimethylammonium bromide	FIN.
Hexadecyltrimethylammonium chloride	ARC, BRD.
Hexadecyltrimethylammonium p-toluenesulfonate	FIN.
Methyltrioctylammonium chloride	GNM.
(Mixed linear alkyl)trimethyl ammonium bromide	DUP.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C A T I O N I C--Continued	
QUATERNARY AMMONIUM SALTS, NOT CONTAINING OXYGEN--Con.	
ACYCLIC--Continued	
N,N,N',N',N'-Pentamethyl-N-(tallow alkyl)trimethylene-bis[ammonium chloride]	ARC.
Trimethyl(mixed alkyl)ammonium chloride	X.
Trimethyloctadecylammonium chloride	ARC.
Trimethyl(soybean oil alkyl)ammonium chloride	ARC.
Trimethyl(tallow alkyl)ammonium chloride	ARC, ASH, GNM.
Trimethyltetradecylammonium bromide	FIN.
BENZENOID:	
*Benzyl(coconut oil alkyl)dimethylammonium chloride	ARC, CIN, CRT, LUB, TCC.
*Benzyldimethyl(mixed alkyl)ammonium chloride	BRD, FIN, ONX, RH, SDH.
Benzyldimethyloctadecylammonium chloride	AAC, FIN, HLI(E), ONX, RH, SCP, SNW, TNI.
Benzyldimethyl(tallow alkyl)ammonium chloride	ENO.
Benzyldimethyltetradecylammonium chloride	FIN, X.
Benzyldodecyldimethylammonium chloride	FIN, ONX.
Benzylhexadecyldimethylammonium chloride	ONX.
1-Benzyl-2-picolinium bromide	FIN.
*Benzyltrimethylammonium chloride	CHP, CIN, CRT, SNW, TCC.
(3,4-Dichlorobenzyl)dodecyldimethylammonium chloride	ONX.
(Dodecylbenzyl)triethylammonium chloride	PC.
2-Dodecylisoquinolinium bromide	CNX.
(Dodecylmethylbenzyl)trimethylammonium chloride	RH.
1-Dodecylpyridinium chloride	CCL, DAN.
1-Phenethyl-2-picolinium bromide	FIN.
Quaternary ammonium salts not containing oxygen, cyclic, all other	CCL, DEX, ICI, TCC.
OTHER CATIONIC SURFACE-ACTIVE AGENTS:	
Mixed substituted oximes	GNM.
Tallow amine, ethoxylated and propoxylated, methyl sulfate	DUP.
Tallow amine, ethoxylated, quarternary ammonium salt	DUP.
Cationic surface-active agents, all other	APX, FIN, WTC.
N O N I O N I C	
CARBOXYLIC ACID AMIDES:	
(AMINE/ACID RATIO = 2/1):	
*Capric acid (Ratio =2/1)	CGY(E), SCP, TCH.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
NONIONIC	
CARBOXYLIC ACID AMIDES--Continued	
(AMINE/ACID RATIO = 2/1)--Continued	
*Castor oil acids (Ratio = 2/1)	CLI, MOA, NTL, PC.
*Coconut oil acids (Ratio = 2/1)	AKS, ARD, ABL, AZS, BRD, BSW, CCL, CIN, CLI, CTL, DA, ECC, HRT, LUB, MCP, MOA, MRV, PEK, PG, PNX, PVO, RCD, SBC, SCP, STP, TCH, VAL, WTC, X.
*Coconut oil and tallow acids (Ratio = 2/1)	CLI, CRT, CTL, ESS, MOA, PG, SCP, UNN.
*Lauric acid (Ratio = 2/1)	CLI, CTL, HRT, MOA, TCH.
*Lauric and myristic acids (Ratio = 2/1)	BRD, HRT, MOA, PG, RCD, SBC, STP.
*Linoleic acid (Ratio = 2/1)	HRT, KNP, VND.
*Oleic acid (Ratio = 2/1)	CCW, CLI, EMR, SCP, STP.
Pelargonic acid (Ratio = 2/1)	TCH.
Soybean oil acids (Ratio=2/1)	MOA.
*Stearic acid (Ratio = 2/1)	CLI, CTL, ONX, SCO, SOS, VAL.
Tall oil acids (Ratio = 2/1)	MOA, WTC.
Tallow acids (Ratio = 2/1)	SBC.
Diethanolamine condensates (Amine/acid = 2/1), all other	SOS.
OTHER AMINE/ACID RATIOS:	
Capric acid (Ratio"1/1)	MOA.
*Coconut oil acids (Ratio = 1/1)	ARD, AZS, CLI, CON, CTL, DA, GAF, HLI(E), JRG, MOA, MRV, ONX, PIL, SBC, SCP, STP, TCC, WTC.
Isostearic acid (Ratio=1/1)	MOA.
*Lauric acid (Ratio = 1/1)	CLI, DA, EFH, HLI(E), LEV, MOA, ONX, SBC, SCP.
*Lauric and myristic acid (Ratio = 1/1)	ARD, CLI, SBC, SCP, TCH.
Linoleic acid (Ratio = 1/1)	MOA, SBC, VND.
Myristic acid (Ratio=1/1)	MOA.
*Oleic acid (Ratio = 1/1)	EFH, EMK, HLI(E), SBC.
Soybean oil acids (Ratio=1/1)	MOA.
*Stearic acid (Ratio = 1/1)	CGY(E), CHP, ECC, MRV, VND, VPC.
Tall oil acids	EFH.
Tallow acids	MCA, RPC, TCH.
Diethanolamine condensates, amine/acid ratio=1/1, all other	HLI(E), SBC.
ALL OTHER CARBOXYLIC ACID AMIDES:	
Alkanolamine condensates, all other	EFH, SBC, TCH.
Carboxylic acid-alkanocamine condensate, alkoxylated, all other	PG.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N O N I O N I C--Continued	
CARBOXYLIC ACID AMIDES--Continued	
ALL OTHER CARBOXYLIC ACID AMIDES--Continued	
Carboxylic acid-diamine and polyamine condensate, all other	HUM.
*Coconut oil acids (Specify amine/acid ratio)	STP.
Coconut oil acids (Ratio = 1/1)	HLI(E), HUM, MOA, SCP, STP, VND, WTC.
Coconut oil acids (Ratio = 2/1)	STP, TCH.
Coconut oil acids, other code	SCP.
Coconut oil acids-N,N-dimethyltrimethylene-diamine (amine/acid ratio=1/2	JRG.
Coconut oil acids-ethanolamine condensate, ethoxylated	DA, STP.
Diethanolamine condensate, all other	EFH, ORO.
Isopropanolamine condensates, all other	EFH, SBC, WTC, X.
Lauric acid (Ratio = 2/1)	TNI.
Lauric acid (Specify amine/acid ratio)	CLI, MOA.
Lauric acid (Ratio = 1/1)	MCA.
Lauric and myristic acids (Specify amine/acid ratio)	LEV.
Lauric and myristic acids (Ratio = 1/1)	ARD, MOA, PG, SCP.
Oleic acid-ethanolamine condensate, ethoxylated	GAF.
Palmitic acid-diethanolamine condensate, alkoxylated	ROB.
Stearic acid (Ratio = 1/1)	MOA, SBC, VND, WTC.
Stearic acid (Ratio = 1/2)	HAL, WTC.
Stearic acid (Ratio = 2/1)	CLI, ECC.
Stearic acid-ethylenediamine condensate amine/acid ratio=1/2	ARC, DA.
Carboxylic acid amides, all other	VPC.
CARBOXYLIC ACID ESTERS:	
ANHYDROSORBITOL ESTERS:	
Anhydrosorbitol dioleate	ICI.
Anhydrosorbitol monoester of tall oil acids	HDG, ICI.
*Anhydrosorbitol monolaurate	GLY, HDG, ICI, TCH.
*Anhydrosorbitol mono-oleate	GLY, HDG, ICI, TCH.
Anhydrosorbitol monopalmitate	GLY, HDG, ICI, TCH.
*Anhydrosorbitol monostearate	GLY, HDG, ICI, PVO, TCH.
Anhydrosorbitol sesquioleate	GLY, HDG, TCH.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N O N I O N I C--Continued	
CARBOXYLIC ACID ESTERS--Continued	
ANHYDROSOBITOL ESTERS--Continued	
Anhydrosorbitol triester of tall oil acids	GLY.
Anhydrosorbitol trioleate	GLY, ICI, TCH.
Anhydrosorbitol tristearate	GLY, ICI, TCH.
Anhydrosorbitol esters, all other	CHP, ICI, TCH.
DIETHYLENE GLYCOL ESTERS:	
*Diethylene glycol distearate	ARC, GLY, VAL.
Diethylene glycol monoester of coconut oil acids	DA.
*Diethylene glycol monolaurate	ECC, GLY, HAL, HDG, WM.
Diethylene glycol mono-oleate	ARC, HAL.
Diethylene glycol monoricinoleate	DA.
*Diethylene glycol monostearate	ARC, CHP, CLI, HAL, HDG.
Diethylene glycol sesquiester of tall oil acids	ECC.
Diethylene glycol sesquilaurate	ARC, GLY.
Diethylene glycol sesquistearate	WTC.
ETHOXYLATED ANHYDROSORBITOL ESTERS:	
*Ethoxylated anhydrosorbitol monolaurate	AAC, GLY, HDG, ICI, PVO, TCH.
*Ethoxylated anhydrosorbitol mono-oleate	AAC, EMR, GLY, HDG, ICI, PVO, TCH.
Ethoxylated anhydrosorbitol monopalmitate	ICI, TCH.
*Ethoxylated anhydrosorbitol monostearate	AAC, GLY, HDG, ICI, PVO, TCH.
Ethoxylated anhydrosorbitol monotallate	TCH.
Ethoxylated anhydrosorbitol triester of tall oil acids	ICI, TCH.
Ethoxylated anhydrosorbitol trioleate	GLY, ICI, TCH.
Ethoxylated anhydrosorbitol tristearate	GLY, HDG, ICI, PVO, TCH.
ETHOXYLATED SORBITOL ESTERS:	
Ethoxylated sorbitol beeswax ester	ICI.
Ethoxylated sorbitol esters, all other	ICI.
Ethoxylated sorbitol hexaester of tall oil acids	TCH.
Ethoxylated sorbitol hexaoleate	ICI, TCH.
Ethoxylated sorbitol lanolin ester	ICI.
Ethoxylated sorbitol mono-oleate	ICI.
Ethoxylated sorbitol pentalaurate	ICI.
Ethoxylated sorbitol tetraester of lauric and oleic acid	ICI.
Ethoxylated sorbitol tetraoleate	ICI.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CARBOXYLIC ACID ESTERS--Continued	
ETHYLENE GLYCOL ESTERS:	
*Ethylene glycol distearate	ARC, EMR, HAL, HUM, TCH, WM.
*Ethylene glycol monostearate	ARC, CLI, GLY, HAL, HDG, KNP, TCH, VND, WM.
GLYCEROL ESTERS:	
COMPLEX GLYCEROL ESTERS:	
Glycerol monoester of mixed fatty acids, acetylated	EKT.
Glycerol monoester of mixed fatty acids, succinylated	EKT.
Glycerol mono-oleate, acetylated	TCH.
Complex glycerol esters, all other	GLY, SCP.
GLYCEROL ESTERS OF CHEMICALLY DEFINED ACIDS:	
Glycerol dilaurate	VND.
*Glycerol dioleate	ARC, HAL, X.
Glycerol distearate	ARC.
Glycerol monocaprylate	ARC, PVO.
Glycerol monolaurate	GLY, HAL.
*Glycerol mono-oleate	ARC, CCW, EMR, GLY, GRO, HAL, HDG, PVO, TCH, WM, WTC.
Glycerol monoricinoleate	GLY, HDG.
*Glycerol monostearate	ARC, BLS, CHL, CIN, DA, EMR, GLY, GRO, HAL, HDG, PVO, SOS, TCH, VND, WM, WTC.
Glycerol esters of chemically defined acids, all other	ARC.
GLYCEROL ESTERS OF MIXED ACIDS:	
Glycerol monoester of coconut oil acids	GLY, PVO, WTC.
Glycerol monoester of cottonseed oil acids	EKT.
*Glycerol monoester of hydrogenated cottonseed oil acids	EKT, LEV, WM.
*Glycerol monoester of hydrogenated soybean oil acids	ASH, BFP, EKT, PVO, TCH, WTC.
*Glycerol monoester of lard acids	EKT, GLY, PVO.
Glycerol monoester of mixed vegetable oil acid	LEV.
Glycerol monoester of palm oil acids	EKT.
Glycerol monoester of safflower oil acids	EKT.
Glycerol monoester of tall oil acids	EKT, FER, WTC.
Glycerol monoesters of mixed animal and vegetable oil acids	BFP.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N O N I O N I C--Continued	
GLYCEROL ESTERS--Continued	
GLYCEROL ESTERS OF MIXED ACIDS--Continued	
Glycerol sesquiester of hydrogenated tallow acids	JRG.
Glycerol esters of mixed acids, all other	ICI, PG, SLM, TCH, WTC.
NATURAL FATS AND OILS, ETHOXYLATED:	
*Castor oil, ethoxylated	DA, GAF, ICI, MIL, NTL, PVO, TCH, TMH, X.
Corn oil, ethoxylated	TCH.
*Hydrogenated castor oil, ethoxylated	DA, ICI, TCH.
*Lanolin, ethoxylated	AAC, CRD, CRN, ICI, MIL, TCH.
Tall oil acids, ethoxylated	TCH.
Natural fats and oils, ethoxylated, all other	DA, JCC, MIL, TCH.
POLYETHYLENE GLYCOL ESTERS:	
POLYETHYLENE GLYCOL ESTERS OF CHEMICALLY DEFINED ACIDS:	
Polyethylene glycol dilaurate	ARC, DA, GLY, HAL, HDG, TCH, WM.
*Polyethylene glycol dioleate	ARC, BRD, CGY(E), CLD, EFH, GLY, HAL, HDG, SLC, TCH, WM.
*Polyethylene glycol distearate	ARC, CHP, GLY, HAL, HDG, TCH.
*Polyethylene glycol monolaurate	ARC, BRD, CCA, DA, ECC, GLY, HAL, HDG, ICI. STC, TCH, VND, WM.
*Polyethylene glycol mono-oleate	ARC, BRD, CCA, CIN, CLD, CRT, DA, DEX, EFH, GAF, GLY, HAL, HDG, MRT, MRV, ONX, SCP, TCH, WM.
Polyethylene glycol monopalmitate	ICI, KNP.
Polyethylene glycol monoricinoleate	HAL, WTC.
*Polyethylene glycol monostearate	AKS, ARC, ARL, CGY(E), CHP, CIN, CRT, DA, EFH, EMR, GAF, GLY, HAL, HDG, HRT, ICI, PVO, SLC, SOS, TCH, VND.
Polyethylene glycol esters of chemically defined acids, all other	ICI, SBC.
POLYETHYLENE GLYCOL ESTERS OF MIXED ACIDS:	
Polyethylene glycol diester of tall oil acids	ARC, EFH, MIL, X.
Polyethylene glycol monoester of capric and caprylic acids	ECC.
Polyethylene glycol monoester of soybean oil acids	GLY.
Polyethylene glycol monoester of tall oil acids	TCH.
Polyethylene glycol monoester of tall oil acids,	

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N O N I O N I C--Continued	
GLYCEROL ESTERS OF MIXED ACIDS--Continued	
POLYETHYLENE GLYCOL ESTERS--Continued	
POLYETHYLENE GLYCOL ESTERS OF MIXED ACIDS--Continued	
ethoxylated	X.
Polyethylene glycol sesquiester of coconut oil acids	ARC, MRT.
Polyethylene glycol sesquiester of tall oil acids	ICI, SLM, X.
Polyethylene glycol sesquiester of tallow acids	ARC.
Polyethylene glycol esters of mixed acids, all other	ARC, EFH, ICI, SOS, TCH.
POLYGLYCEROL ESTERS:	
Polyglycerol distearate	GLY, PVO.
Polyglycerol monoester of tall oil acids	FER, HDG.
Polyglycerol mono-oleate	PVO, WTC.
Polyglycerol monostearate	PVO, TCH, VND.
Polyglycerol esters, all other	PVO, TCH.
PROPANEDIOL ESTERS:	
1,2-Propanediol dioleate	X.
*1,2-Propanediol monolaurate	ARC, PVO, SBC.
1,2-Propanediol mono-oleate	EFH.
*1,2-Propanediol monostearate	ARC, EKT, GLY, HAL, TCH, WM.
1,2-Propanediol sesquiester of hydrogenated tallow acids	JRG.
Propanediol esters, all other	PVO, TCH.
OTHER CARBOXYLIC ACID ESTERS:	
Cetyl palmitate	ROB.
Di-isobutylene maleate	RH.
Ethoxylated 1,2-propanediol monostearate	ICI.
Methylglucoside laurate	HDG.
Pentaerythritol stearate	VAL.
Polyalkylene glycol adipate	X.
Carboxylic acid esters, all other	AAC, CCW, CRN, DUP, EMR, HDG, PVO, STC, TCH, VND, WTC, X.
ETHERS:	
BENZENOID ETHERS:	
Diisobutylphenol, ethoxylated	GAF.
*Dinonylphenol, ethoxylated	GAF, JCC, RH, TCH.
*Dodecylphenol, ethoxylated	DA, GAF, MON, TCH, TMH.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
N O N I O N I C--Continued	
ETHERS--Continued	
BENZENOID ETHERS--Continued	
Iso-octylphenol, ethoxylated	AAC, DA, RH.
(Mixed alkyl)phenol, ethoxylated	MIL, NTL, X.
(Mixed alkyl)phenol, ethoxylated, butyl ether	RH.
(Mixed alkyl)phenol-formaldehyde	ARC, NTL, X.
(Mixed alkyl)phenoxypoly(ethyleneoxy)ethyl chloride	GAF.
*Nonylphenol, ethoxylated	DA, GAF, HDG, ICI, JCC, MIL, MCN, OMC, RH, STP, TCH, TMH, UCC, WTC, X.
Nonylphenol, ethoxylated and propoxylated	RH.
Nonylphenol-formaldehyde, alkoxylated	X.
n-Octylphenol, ethoxylated	TCH, TMH, X.
tert-Octylphenol-formaldehyde, ethoxylated	ARC, DA, SDW.
*Phenol, ethoxylated	DA, GAF, ICI, TCH.
Phenols, ethoxylated, all other	DA, EFH, RH, X.
NONBENZENOID ETHERS:	
LINEAR ALCOHOLS, ALKOXYLATED:	
*Decyl alcohol,ethoxylated	GAF, ICI, TCH, WTC.
Decyloxypoly(ethyleneoxy)ethyl chloride	GAF.
Dodecyl alcohol, ethoxylated	AAC, GAF, HDG, ICI, MIL.
Hexadecyl alcohol, ethoxylated	ICI, TCH.
*9-Octadecenyl alcohol, ethoxylated	AAC, GAF, ICI, TCH.
Octadecyl alcohol, ethoxylated	DA, DUP, ICI.
*Oleyl alcohol, ethoxylated	CRD, CRN, GAF, HDG.
Wool wax alcohols, ethoxylated	CRD.
Chemically defined linear alcohol, alkoxylated, all other	GAF, ICI, X.
Coconut oil alcohol, ethoxylated	GLY, JCC, TCH.
Decyl and octyl alcohols, ethoxylated	GAF.
*Mixed linear alcohols, ethoxylated	BAS, CO, DA, DUP, GAF, HDG, JCC, RH, SHC, STP, TCH, UCC, WTC.
Mixed linear alcohols, ethoxylated and propoxylated	ATR, BAS, DUP, JCC, STP, TCH, UCC, WTC.
Tallow alcohol, ethoxylated	AAC, ATR, JCC.
Mixed linear alcohols, alkoxylated, all other	GAF, GLY, TCH.
OTHER ETHERS AND THIOETHERS:	
Corn starch, propoxylated	VAL.

TABLE 2.--SURFACE-ACTIVE AGENTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

SURFACE-ACTIVE AGENTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ETHERS--Continued	
OTHER ETHERS AND THIOETHERS--Continued	
tert-Dodecyl mercaptan, ethoxylated	AAC.
Glucose, ethoxylated	TCH.
Glycerine, alkoxylated	X.
Mixed alcohols, ethoxylated	CRN, PVO, RH, X, X.
Poly(mixed ethylene, propylene)glycol	BAS, UCC, X.
Polyoxyalkylene glycols, alkoxylated	X.
Polypropylene glycol, ethoxylated	BAS, WTC.
*Tridecyl alcohol, ethoxylated	AAC, DA, DUP, GAF, ICI, JCC, MIL, MON, OMC, PVO, TCH, TMH, X.
Tridecyl alcohol, propoxylated and ethoxylated	JCC, MIL, TCH.
Trimethylheptanol, ethoxylated	TCH.
Trimethylnonyl alcohol, ethoxylated	HDG, UCC.
Trimethylolpropane, alkoxylated	BAS, HDG.
Ethers and thioethers, all other	AAC, ICI, TCH, TNA.
OTHER NONIONIC SURFACE-ACTIVE AGENTS:	
Octyl phosphate, ethoxylated	DUP.
Tri(castor oil alkyl)phosphate	GLY.
Trimethylalpropane, ethoxylated	DUP.
Nonionic surface-active agents, all other	MIL, MON, RH, X, X.

TABLE 3.--SURFACE-ACTIVE AGENTS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of surface-active agents to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
AAC	Alcolac Chemical Corp.	ECC	Eastern Color & Chemical Co.
ACT	Arthur C. Trask Co.	EFH	E.F. Houghton & Co.
ACY	American Cyanamid Co.	EKT	Eastman Kodak Co., Tennessee Eastman Co. Div.
AES	Penetone Corp.	EMK	Emkay Chemical Co.
AGP	Armour-Dial, Inc.	EMR	Emery Industries, Inc.
AIP	Air Products & Chemicals, Inc.	ENO	Enenco, Inc.
AKS	Arkansas Co., Inc.	ESS	Essential Chemicals Corp.
APX	Apex Chemical Co., Inc.		
ARC	Armak Co.	FER	Ferro Corp., Keil Chemical Div.
ARD	Ardmore Chemical Co.	FIN	Hexcel Corp., Hexcel Specialties Chemicals
ARL	Arol Chemical Products Co.		
ASH	Ashland Oil, Inc., Ashland Chemical Co.	GAF	GAF Corp.
ASY	American Synthetic Rubber Corp.	GLY	Glyco Chemicals, Inc.
ATR	Atlantic Richfield Co., ARCO Chemical Co.	GNM	General Mills Chemicals, Inc.
		GRC	Chemed Corp., Dubois Chemicals Div.
AZS	AZS Corp.:	GRL	Chemed Corp., Vestal Laboratories, Inc.
	AZ Products Co. Div.	GRO	A.H. Gross & Co., Millmaster Onyx Group, Kewanee Industries, Inc.
	AZS Chemical Co.		
BAO	Bayoil Co., Inc.	HAL	C.P. Hall Co.
BAS	BASF Wyandotte Corp.	HDG	Hodag Chemical Corp.
BFP	Breddo Food Products Co., Inc.	HEW	Hewitt Soap Co., Inc.
BLA	Astor Products, Inc., Blue Arrow Div.	HLI	Haag Laboratories, Inc.
BLS	Life Savers, Inc.	HMP	W.R. Grace & Co., Organic Chemicals Div.
BRD	Lonza, Inc.		
BSW	Original Bradford Soap Works, Inc.	HNT	Huntington Laboratories, Inc.
		HPC	Hercules, Inc.
CCA	Interstab Chemical, Inc.	HRT	Hart Products Corp.
CCL	Catawba-Charlab, Inc.	HUM	Kraft, Inc., Humko Products Div.
CCW	Cincinnati Milacron Chemicals, Inc.		
CGY	Ciba-Geigy Corp.	ICI	ICI United States, Inc., Chemical Specialties Co.
CHL	Chemol, Inc.		
CHP	C.H. Patrick & Co., Inc.		
CIN	Cindet Chemicals, Inc.	JCC	Jefferson Chemical Co., Inc.
CLD	Colloids, Inc.	JOR	Jordan Chemical Co.
CLI	Clintwood Chemical Co.	JRG	Andrew Jergens Co.
CO	Continental Oil Co.		
CON	Concord Chemical Co., Inc.	KAL	Pathan Chemical Co.
CP	Colgate-Palmolive Co.	KNP	Knapp Products, Inc.
CRD	Croda, Inc.		
CRN	CPC International, Inc., Amerchol	LAK	Bofors Lakeway, Inc.
CRT	Crest Chemical Corp.	LEA	Leatex Chemical Co.
CRZ	Crown Zellerbach Corp., Chemical Products Div.	LEV	Lever Brothers Co.
CST	Charles S. Tanner Co.	LKY	Lake States Div. of St. Regis Paper Co.
CTL	Continental Chemical Co.	LMI	North American Chemical Co.
CWP	Consolidated Papers, Inc.	LUR	Laurel Products Corp.
DA	Diamond Shamrock Corp.	MAR	American Can Co.
DAN	Dan River, Inc., Chemical Products Dept.	MCP	Moretex Chemical Products, Inc.
DEX	Dexter Chemical Corp.	MIL	Milliken & Co., Milliken Chemical Div.
DOW	Dow Chemical Co.	MIR	Miranol Chemical Co., Inc.
DUP	E.I. duPont de Nemours & Co., Inc.	MOA	Mona Industries, Inc.
DYS	Davies-Young Co.	MON	Monsanto Co.

TABLE 3.--SURFACE-ACTIVE AGENTS: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
MRD	Marden-Wild Corp.	SEA	Seaboard Chemicals, Inc.
MRT	Morton Chemical Co. Div. of Morton Norwich Products, Inc.	SFS	Stauffer Chemical Co., Specialty Div.
		SHC	Shell Oil Co., Shell Chemical Co. Div.
MRV	Marlowe-Van Loan Corp.	SID	George F. Siddall Co., Inc.
		SLC	Soluol Chemical Co., Inc.
NCW	Nostrip Chemical Works, Inc.	SLM	Salem Oil & Grease Co.
NES	Nease Chemical Co., Inc.	SM	Mobil Oil Corp., Mobil Chemical Co., Chemical Coatings Div.
NMC	National Milling & Chemical Co., Inc.		
NPR	Safeway Stores, Inc.	SNW	Sun Chemical Corp., Chemicals Div.
NTL	NL Industries, Inc.	SOC	Standard Oil Co. of California, Chevron Chemical Co.
OMC	Olin Corp.	SOP	Southern Chemical Products Co., Inc.
ONX	Kewanee Industry, Millmaster Onyx Group, Onyx Chemical Co. Div.	SOS	SSC Industries, Inc.
		SPA	Scott Paper Co.
ORO	Chevron Chemical Co.	STC	American Hoechst Corp., Sou-Tex Works
		STP	Stepan Chemical Co.
PC	Proctor Chemical Co., Inc.		
PCH	Peerless Chemical Co.	TCC	Tanatex Chemical Corp.
PEK	Peck's Products Co.	TCH	Emery Industries, Inc., Trylon Div.
PFZ	Pfizer, Inc.		
PG	Procter & Gamble Co., Procter & Gamble Mfg. Co.	TCI	Texize Chemical Co.
		TEN	Cities Service Co., Copperhill Operations
PIL	Pilot Chemical Co.	TMH	Thompson-Hayward Chemical Co.
PLX	Plex Chemical Corp.	TNA	Ethyl Corp.
PNX	Murphy-Phoenix Co.	TNI	The Gillette Co., Chemical Div.
PRX	Purex Corp.		
PSP	Georgia-Pacific Corp.	UCC	Union Carbide Corp.
PVO	PVO International, Inc.	UDI	Petrochemicals Co., Inc.
		UNN	United Chemical Corp. of Norwood
QCP	Quaker Chemical Corp.	UNP	United Chemical Products Corp.
		USM	USM Corp., Bostik Div.
RAY	ITT Rayonier, Inc.	USR	Uniroyal, Inc., Uniroyal Chemical Div.
RBC	Fike Chemicals, Inc.		
RCD	Richardson Co.	VAL	Valchem Div. of United Merchants & Manufacturers, Inc.
RH	Rohm & Haas Co.		
ROB	Robeco Chemicals, Inc.	VND	Van Dyk & Co., Inc.
RPC	Kewanee Industry, Millmaster Onyx Group, Refined-Onyx Co. Div.	VPC	Mobay Chemical Corp., Verona Div.
		WAW	W.A. Wood Co.
S	Sandoz, Inc., Sandoz Colors & Chemical Div.	WAY	Philip A. Hunt Chemical Corp., Organic Chemical Div.
SBC	Scher Bros. Inc.		
SBP	Sugar Beet Products Co.	WBG	White & Bagley Co.
SCO	Scholler Bros., Inc.	WHI	White & Hodges, Inc.
SCP	Henkel, Inc.	WHW	Whittemore-Wright Co., Inc.
SDC	Martin-Marietta Corp., Sodyeco Div.	WM	Inolex Corp.
	Sterling Drug, Inc.:	WTC	Witco Chemical Corp.
SDH	Hilton-Davis Chemical. Div.	WVA	Westvaco Corp., Chemicals Div., Poly-chemicals Dept.
SDW	Winthrop Laboratories Div.		

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Pesticides - Developments in 1977

Edmund Cappuccilli

Unfavorable weather conditions in several sections of the country and changes in the markets for agricultural products in 1977 resulted in a decrease in the use of certain organic pesticides, such as acyclic fungicides and herbicides. Continued high level of imports and the increased number of pesticides undergoing reregistration by the Environmental Protection Agency (EPA) also affected the use of some pesticides. Other factors in the domestic market for pesticides in 1977 included the continued use of plant growth regulators for specific crops, and the increased use of synthetic pyrethroids as insecticides on cotton crops.

The production of synthetic organic pesticides in 1977 recovered somewhat from the low output in 1976 but did not reach the high level attained in 1975. While total organic pesticide production increased by approximately 2 percent to 1.39 billion pounds over 1976, fungicides continued to remain at the 1976 level of 142 million pounds. The total value of sales of pesticides increased by 16 percent over the 1976 level to $2.8 billion and the average unit value of sales increased appromixately 10 percent to $2.22 per pound.

In addition to the unfavorable conditions mentioned above, the output of pesticides in 1977 was affected by the softening of prices for certain farm products. Some of these factors, along with the reported increase in inventories, are also expected to affect the production of pesticides in 1978. It is, therefore, anticipated that pesticide production in 1978 will remain at the 1977 level or increase slightly, from 1 to 5 percent. The value of sales for pesticides in 1978 is also expected to remain close to the 1977 level. However, some downward pressure on prices due to increased inventories at the end of 1977 may depress the value from 1 to 3 percent.

Plant growth regulators

For the past several years, major pesticide producers in the United States have been conducting more research on plant growth regulators. They believe that plant growth regulators are the probable answer to the need for increased food production in the future.

Plant growth regulators--chemicals which increase or modify plant growth--have been used in agriculture for almost 4 decades. The total production of all plant growth regulators in 1976 was estimated to be 7 million pounds. Maleic hydrazide, produced in the largest volume and one of the better known plant growth regulators, is used primarily to increase the yield of tobacco. In 1976, 3.8 million pounds of maleic hydrazide was produced in the United States.

Pesticide producers are continuing to develop plant growth regulators for a wide variety of purposes, such as the loosening of ripened fruits for faster harvesting, controlling the size of fruits, and so forth, despite the increasing costs of development and the uncertainty of commercial utilization. Recently, research on plant growth regulators for sugar cane has increased. Several major pesticide producers have products either in commercial use or under experimental use permits issued by the EPA. The immediate future of this type of growth regulator does not appear to be optimistic, however, owing to the steep decline of sugar prices from their high in late 1974. Future development of these higher priced plant growth regulators will probably be directed toward certain crops which should financially benefit the farmers by the application of these specialty products.

Synthetic pyrethroids

Synthetic pyrethroids are a class of pesticides whose properties have made them quite attractive for commercial use in this era of environmental concern. Two of the qualities which make synthetic pyrethroids especially desirable are their high toxicity to insects combined with low toxicity to mammals. These compounds were also found to remain highly effective for longer periods of time than organophosphate insecticides used in similar situations. Interest in these compounds increased in 1977 when the EPA issued an emergency exemption use permit for three synthetic pyrethroids to be used on cotton because of the withdrawal of certain organophosphate insecticides used primarily for bollworm control.

Production of synthetic pyrethroids has been increasing steadily over the past few years and should increase substantially in the near future as new products and uses are introduced despite the higher costs. The favorable environmental qualities of synthetic pyrethroids will probably be the determining factor in future use, as Government controls on other insecticides continue to increase.

Government regulatory actions continue to increase

The EPA continued to be the dominant Government agency affecting the pesticide industry in 1977. Under the Federal Environmental Pesticides Control Act, the EPA continued its registration/reregistration of all pesticide products. Because of the uncertainty and delays encountered in this reregistration process, the sale of certain pesticide products in 1977 was erratic.

The procedure employed by the EPA to identify pesticides which may be hazardous to man and to the environment is called "Rebuttable Presumption Against Reregistration (RPAR)." Pesticides placed on the RPAR list are reviewed to decide whether they can be reregistered. While these products are awaiting review on the RPAR list, producers usually have shown a tendency to limit production of these products until disposition is determined (the production of several pesticides placed on the RPAR list decreased in 1977).

The notice by EPA to cancel the registration of some widely used pesticides such as chlordane, DBCP and heptachlor, combined with the voluntary withdrawals of several pesticides from the reregistration process, is probably a main reason for the slowdown in the overall rate of production from the previous years. This trend, however, should eventually be offset by increased production of alternative pesticides.

The EPA's involvement with the pesticide industry is not expected to diminish in the near future. The pesticide producers must be willing to reassess their future plans to conform with reasonable Government regulations if they are to remain competitive in the domestic market.

Foreign trade

In 1977, imports of benzenoid pesticides (TSUS 405.15) totaled 47.7 million pounds valued at $101.3 million. This represented a decrease of 19.9 percent in quantity and a decrease of 21.4 percent in value from the 62.1 million pounds, valued at $128.8 million imported in 1976. Sales from domestic inventory existing throughout most of 1977 and a decrease in consumer demand were two factors primarily responsible for the decrease in imports of pesticides in 1977. Imports of pesticides in the future are expected to continue their general upward trend despite the decrease experienced in 1977. The annual increments, however, are not expected to be as large as in previous years.

An analysis of a large sample of benzenoid pesticide imports in 1975-77, which shows the major pesticides in the "competitive" and "noncompetitive" classes, 1/ is given in table A. Over the past 2 years, the pesticide imported in the greatest quantity has been bentazon, a "noncompetitive" herbicide produced in West Germany. Imports of bentazon in 1977 increased by 97.0 percent over the 1976 level to 19.9 million pounds. Increases of this magnitude are not expected to continue in the future because of increased competition from domestic products with properties similar to this imported postemergence herbicide and the variability of future crop plantings.

Over the past 3 years, one of the largest volume "competitive" pesticides imported into the United States has been 2,4-dichlorophenoxyacetic acid (2,4-D). Imports of 2,4-D decreased by 58 percent in 1977 from a high of 6.0 million pounds reported in 1976. However, the 2.5 million pounds of 2,4-D imported in 1977 is still far above the 80,000 pound per year average imported during the 4 years prior to the 1974 Trade Act. The Trade Act of 1974 has enabled several countries to ship 2,4-D to the United States under the Generalized System of Preferences (GSP) which grants duty-free treatment to

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1/ "Competitive" benzenoid imports are those products which are similar to domestic products because they accomplish results substantially equal to those accomplished by the domestic products, when used in substantially the same manner.

"Competitive" imports are subject to a special basis of valuation for customs purposes known as the "American selling price." If the benzenoid imports are "noncompetitive," the products are valued for customs purposes on the basis of the "United States value." The essential difference between these two values is that "American selling price" is based on the wholesale price in the United States of the "competitive" domestic product, whereas "United States value" is based on the wholesale price in the United States of the imported product less most of the expenses incurred in bringing the product to the United States and selling it.

certain imported products from designated beneficiary countries. Imports of "competitive" pesticides from GSP beneficiary countries are expected to increase in the future primarily because of the 15 to 20 percent competitive edge realized by duty-free entry.

Although there were large imports from certain GSP countries, total imports of pesticides in 1977 continued to be dominated by the United Kingdom and West Germany, as shown in table B. Combined imports (principally "noncompetitive" pesticides) from the United Kingdom and West Germany in 1977 amounted to 28.9 million pounds, or 58.0 percent of the total pesticide imports. This was an increase of 12.0 percent over the combined total of the two countries in 1976. Because of their strong positions in the marketing and research areas of the pesticide industry, the United Kingdom and West Germany are expected to remain as the principal foreign sources of pesticides for the next several years. Government regulations and greater competitiveness by U.S. producers should keep imports from increasing more than 10.0 percent per year for the next few years. Imports of certain pesticides, however, may exceed the predicted yearly increase because of consumer preference or because of a favorable cost advantage. There are indications that the beneficiary countries of GSP will be producing more of the "competitive" pesticides in the future to meet the anticipated demand from the U.S. market. In addition, several European countries and Japan are working to develop and to test new environmentally safe pesticides for future distribution, especially in the United States. All these developments indicate a modest rate of increase of pesticides imports for the next several years.

TABLE A.--U. S. imports of major pesticides, 1/ 1975-77

(million pounds)

Status	1975	1976	1977
Competitive:			
2,4-D	3.0	6.0	2.5
2,4-DB	...	...	0.9
Chlordimeform	...	0.7	...
Dichloroprop	1.3	...	...
Diuron	1.4	...	...
MCPA	...	2.1	1.0
Noncompetitive:			
Bentazon	1.7	10.1	19.9
Chlorothalonil	3.8	3.9	3.6
Paraquat dichloride	9.5	4.2	5.0

[1] Based on the items examined by the Commission for TSUS item 405.15.

Source: Imports of Benzenoid Chemicals and Products, 1975, 1976, and 1977.

Note.--All of the compounds in the above table are herbicides, except chlorothalonil (a fungicide) and chlordimeform (an secticide).

Table B.--Pesticides 1/: U.S. imports by principal source, 1975-77

Source	1975	1976	1977
	Quantity (1,000 pounds)		
West Germany	7,362	15,732	14,941
United Kingdom	17,587	12,988	14,025
Japan	3,922	5,613	4,870
Switzerland	6,388	10,885	3,761
Canada	4,842	2,289	4,609
All other	10,315	14,607	7,528
Total	50,416	62,114	49,734
	Value (1,000 dollars)		
West Germany	20,035	48,643	41,033
United Kingdom	29,493	19,904	20,136
Japan	6,323	10,599	13,067
Switzerland	14,618	26,060	7,251
Canada	5,043	3,383	5,810
All other	21,615	20,244	14,000
Total	97,127	128,833	101,297
	Unit value (per pound)		
West Germany	$2.72	$3.09	$2.75
United Kingdom	1.68	1.53	1.44
Japan	1.61	1.89	2.68
Switzerland	2.29	2.39	1.93
Canada	1.04	1.48	1.26
All other	2.10	1.39	1.86
Average	1.93	2.07	2.06

1/ TSUS item 405.15.

Source: Compiled from official statistics of the U.S. Department of Commerce.

PESTICIDES AND RELATED PRODUCTS

Edmund Cappuccilli

Pesticides and related products include fungicides, herbicides, insecticides, rodenticides, and related products such as plant growth regulators, seed disinfectants, soil conditioners, soil fumigants, and synergists. The data are given in terms of 100 percent active materials; they thus exclude such materials as diluents, emulsifiers, and wetting agents.

U.S. production of pesticides and related products in 1977 amounted to 1,388 million pounds--1.7 percent greater than the 1,364 million pounds reported for 1976 (table 1).[1] Sales in 1977 were 1,263 million pounds, an increase of 5.9 percent, as compared with 1,193 million pounds reported in 1976; the value of sales was $2,808 million in 1977, compared with $2,410 million in 1976--an increase of 16.5 percent.

The output of cyclic pesticides and related products amounted to 994 million pounds in 1977--5.7 percent greater than the 940 million pounds produced in 1976. Sales in 1977 were 904 million pounds, valued at $2,066 million, compared with 839 million pounds, valued at $1,844 million in 1976. Production of acyclic pesticides and related products in 1977 amounted to 394 million pounds, compared with 424 million pounds reported for 1976, a decrease of 7.2 percent. Sales in 1977 were 359 million pounds, an increase of about 1.4 percent, as compared with 354 million pounds reported in 1976; the value of sales was $742 million in 1977, compared with $566 million in 1976--an increase of 31.0 percent.

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[1] See also table 2 which lists these products and identifies the manufacturers by codes. These codes are given in table 3.

XIII -- PESTICIDES AND RELATED PRODUCTS

TABLE 1.--Pesticides and related products: U.S. production and sales, 1977

[Listed below are all pesticides and related products for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists all pesticides and related products for which data on production and/or sales were reported and identifies the manufacturers of each]

PESTICIDES AND RELATED PRODUCTS	PRODUCTION	SALES		
		QUNATITY	VALUE	UNIT VALUE[1]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	1,387,519	1,263,007	2,808,273	$2.22
Benzenoid	829,537	691,186	1,664,008	2.41
Nonbenzenoid	557,982	571,821	1,144,265	2.00
CYCLIC				
Total	993,896	903,794	2,066,441	2.29
Fungicides, total	110,624	101,284	150,688	1.49
Naphthenic acid, copper salt	1,276	1,148	954	.83
Pentachlorophenol (PCP)	44,862	43,349	16,276	.38
Phenylmercuric acetate (PMA)	178	164	1,261	7.70
All other cyclic fungicides[2]	64,308	56,623	132,197	2.33
Herbicides and plant growth regulators, total	550,145	476,477	1,331,425	2.79
2,4-Dichlorophenoxyacetic acid, dimethylamine salt	21,281	16,349	17,380	1.06
2,4-Dichlorophenoxyacetic acid, iso-octyl ester	6,392	6,129	6,244	1.02
Plant growth regulators[3]	5,438	4,528	17,433	3.85
All other cyclic herbicides[4]	517,034	449,471	1,290,368	2.87
Insecticides and rodenticides, total	333,127	326,033	584,328	1.79
Organophosphorus insecticides, total	113,498	116,815	269,602	2.31
Methyl parathion	39,695	49,257	49,992	1.01
All other organophosphorus insecticides[5]	73,803	67,558	219,610	3.25
Toxaphene(chlorinated camphene)	39,780	...	...	...
All other cyclic insecticides and rodenticides[6]	179,849	209,218	314,726	1.50
ACYCLIC				
Total	393,623	359,213	741,832	2.07
Fungicides, total	32,653	32,249	38,097	1.18
Dithiocarbamic acid salts[7]	29,650	30,169	31,832	1.06
All other acyclic fungicides[8]	3,003	2,080	6,265	3.01
Herbicides and plant growth regulators[9]	124,063	107,863	287,773	2.67
Insecticides, rodenticides, soil conditioners and fumiganta, total	236,907	219,101	415,962	1.90
Methyl bromide (Bromomethane)	34,684	35,280	17,753	.50
Organophosphorus insecticides[10]	90,547	71,210	221,674	3.11
Trichloronitromethane (Chloropicrin)	5,803	6,266	3,784	.60
All other acyclic insecticides, rodenticides, soil conditioners and fumigants[11]	105,873	106,345	172,751	1.62

[1] Calculated from rounded figures.
[2] Includes benomyl, captafol, captan, chlorothalonil, dinocap, DMTT, folpet, pentachloronitrobenzene, sodium pentachlorophenate, 2,4,5-trichlorophenol salts, all other phenylmercury compounds, and others.
[3] Includes maleic hydrazide.
[4] Includes alachlor, atrazine, barban, benefin, bensulide, 2,4-D acid (esters and salts), 2,4-DB, dicamba, dinitrophenol compounds, diuron, isopropyl phenylcarbamates (IPC and CIPC), MCPA, molinate, NPA, picloram, propanil, silvex and its esters, 2,4,5-T acid (esters and salts), triazines, trifluralin, uracils, and others.
[5] Includes carbophenothion, diazinon, dioxathion, fensulfothion, papathion, ronnel, and other phosphorothioates and phosphorodithioates.
[6] Includes carbaryl, carbofuran, chlorinated insecticides (BHC + lindane, chlordan, chlorobenzilate, DDT, dicofol, endosulfan, endrin, heptachlor, methoxychlor, and others), insect attractants, DEET and other insect repellents, small amounts of rodenticides, piperonyl butoxide and other synergists, and others.

Footnotes--Continued

[7] Includes ferbam, maneb, nabam, PETD, and zineb, plus the remaining dithiocarbamates which are used chiefly as fungicides.

[8] Includes dodine, and others.

[9] Includes CDAA, dalapon, methanearsonic acid salts, sodium TCA, thiocarbamates, and organophosphorus herbicides, and others.

[10] Includes acephate, DDVP, disulfoton, ethion, malathion, monocrotophos, naled, phorate, and other organophosphorus insecticides.

[11] Includes DBCP, soil conditioners and fumigants, aldicarb, small quantities of rodenticides, and others.

Note.--Does not include data for the insect fumigant, p-dichlorobenzene nor the fungicide, o-phenylphenol. These data are included in the section on "Cyclic Intermediates." It also does not include data for the fungicides, dimethyldithiocarbamic acid, sodium salt and dimethyldithiocarbamic acid, zinc salt (i.e., ziram). These data are included in the section on "Rubber-Processing Chemicals." The data for ethylene dibromide, a fumigant, are included in the "Miscellaneous End-Use Chemicals and Chemical Products" section.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTRISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT]

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CYCLIC	
*FUNGICIDES:	
2,6-Bis(dimethylaminomethyl)cyclohexanone	MRK.
2-Bromo-4'-hydroxyacetophenone	BKM.
2,4-Dichloro-6-(o-chloroanilino)-s-triazine	CHG.
1,4-Dichloro-2,5-dimethoxybenzene (Chloroneb)	DUP.
1,2-Dihydro-6-ethoxy-2,2,4-trimethylquinoline (Ethoxyquin)	MON.
5-Ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole	OMC, VNC.
Hexahydro-1,3,5-triethyl-s-triazine	CHG.
Mercaptobenzothiazole, zinc salt	VNC.
Methyl-1-(butylcarbamoyl)-2-benzimidazolecarbamate (Benomyl)	DUP.
2-(1-Methyl-n-heptyl)-4,6-dinitrophenyl crotonate (Dinocap)	RH.
3-(2-Methylpiperidino)propyl 3,4-dichlorobenzoate (Piperalin)	LIL.
*Naphthenic acid,copper salt	CCA, MCI, TRO, WTC, X.
Pentachloronitrobenzene (PCNB)	OMC.
*Pentachlorophenol (PCP)	DOW, FRO, MON, RCI.
Pentachlorophenol, potassium salt	X.
Pentachlorophenol,sodium salt	DOW.
*Phenylmercuric acetate (PMA)	CLY, MRK, TRO.
Phenylmercuric ammonium acetate	TRO.
Phenylmercuric oleate	TRC.
Phenylmercuric propionate	MRK.
8-Quinolinol(8-hydroxyquinoline),copper salt	ASH, X.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*FUNGICIDES--Continued	
cis-N-[(1,1,2,2-Tetrachloroethyl)thio]-1-cyclohexene-1,2-dicarboximide (Captafol)	ORO.
2,4,5,6-Tetrachloroisophthalonitrile	DA.
Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (DMTT)	MRK, VCC.
2-(Thiocyanomethylthio)benzothiazole	BKM.
N-Trichloromethylthio-4-cyclohexene-1,2-dicarboximide (Captan)	SFA, SPC, X.
N-Trichloromethylthiophthalamide (Folpet)	SFA, SPC.
2,4,5-Trichlorophenol	DOW.
2,4,5-Trichlorophenol, potassium salt	X.
2,4,5-Trichlorophenol, sodium salt	DOW, GAF.
1,3,5-Tri(2-isopropanol)-s-triazine	EFH.
Cyclic fungicides, all other	LIL, X.
*HERBICIDES AND PLANT GROWTH REGULATORS:	
3-Amino-2,5-dichlorobenzoic acid, ammonium salt (2,5-Dichloro-3-aminobenzoic acid, ammonium salt)	AMC, GAF.
4-Amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5-(4H)-one	CHG, RH.
4-Amino-3,5,6-trichloropicolinic acid (Picloram)	DOW.
4,6-Bis(isopropylamino)-2-methoxy-s-triazine (Prometon)	CGY.
2,4-Bis(isopropylamino)-6-(methylthio)-s-triazine (Prometryn)	CGY.
5-Bromo-3-sec-butyl-6-methyluracil (Bromacil)	DUP.
2-(tert-Butylamino)-4-chloro-6-(ethylamino)-s-triazine	CGY.
2-(sec-Butylamino)-4-ethylaminc-6-methoxy-s-triazine	CGY, RH.
2-(tert-Butylamino)-4-ethylamino-6-methoxy-s-triazine	CGY.
2-(tert-Butylamino)-4-ethylamino-6-(methylthio)-s-triazine	CGY.
N-sec-Butyl-4-tert-butyl-2,6-dinitroaniline	AMC, X.
3-tert-Butyl-5-chloro-6-methyluracil	DUP.
N-Butyl-N-ethyl-α,α,α-triflucro-2,6-dinitro-p-toluidine (Benefin)	LIL.
2-Butynyl-4-chloro-m-chlorocarbanilate (Barban)	GOC.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*HERBICIDES AND PLANT GROWTH REGULATORS--Continued	
2-Chloro-4,6-bis(ethylamino)-s-triazine (Simazine)	CGY.
2-Chloro-4,6-bis(isopropylamino)-s-triazine (Propazine)	CGY.
2-Chloro-2',6'-diethyl-N-(n-butoxymethyl)acetanilide (Butachlor)	MON.
2-Chloro-2',6'-diethyl-N-(methoxymethyl)acetanilide (Alachlor)	MON.
2-Chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine (Atrazine)	CGY, FRI, SHC, VTC.
2-[4-Chloro-6-(ethylamino)-s-triazin-2-ylamino]-2-methylpropionitrile (Cyanazine)	CGY.
N-(2-Chloroethyl)-α,α,α-trifluoro-2,6-dinitro-N-propyl-p-toluidine (Fluchloralin)	BAS.
2-Chloro-N-isopropylacetanilide (Propachlor)	DOW, MON.
4-Chloro-5-(methylamino)-2-(α, α, α-trifluoro-m-tolyl)-3-(2H)-pyridazinone (Norflurazon)	S.
3-Cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4-(1H,3H)-dione	DUP.
N-(Cyclopropylmethyl)-α, α, α-trifluoro-2,6-dinitro-N-propyl-p-toluidine (Profluralin)	CGY.
3,5-Dibromo-4-hydroxybenzonitrile, octanoic acid esters (Bromoxynil octanoate)	CLY, DOW, RDA.
3,6-Dichloro-2-anisic acid (Dicamba)	VEL.
4-(2,4-Dichlorophenoxy)butyric acid (2,4-DB Acid)	RDA.
4-(2,4-Dichlorophenoxy)butyric acid, isobutyl ester	RDA.
4-(2,4-Dichlorophenoxy)butyric acid, iso-octyl ester	RDA.
3-(3,4-Dichlorophenyl)-1,1-dimethylurea (Diuron)	DUP.
3-(3,4-Dichlorophenyl)-1-methoxy-1-methylurea (Linuron)	DUP.
2-(3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione (Methazole)	VEL, X.
2,4-Dichlorophenyl p-nitrophenyl ether	RH.
3',4'-Dichloropropionanilide (Propanil)	EGR, RH.
S-(O,O-Diisopropyl phosphorodithioate) ester of N-(α-mercaptoethyl)benzenesulfonamide (Bensulide)	SFA.
N,N-Dimethyl-2,2-diphenylacetamide (Diphenamid)	CWN.
1,2-Dimethyl-3,5-diphenyl-1H-pyrazolium methyl sulfate	ACY, LAK.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*HERBICIDES AND PLANT GROWTH REGULATORS--Continued	
N-(1,1-Dimethyl-2-propynyl)-3,5-dichlorobenzamide (Pronamide)	RH.
Dimethyl-2,3,5,6-tetrachloroterephthalate (DCPA)	DA.
1,1-Dimethyl-3-(α,α,α-trifluoro-m-tolyl)urea (Fluometuron)	CGY.
Dinitrobutylphenol (DNBP)	DOW, VTC.
Dinitrobutylphenol, ammonium salt	DOW.
Dinitrobutylphenol, triethanolamine salt	DOW, VTC.
2,6-Dinitro-N,N-dipropyl cumidine	LIL.
3,5-Dinitro-N4,N4-dipropylsulfanilamide	SDC.
2-(Ethylamino)-4-(isopropylamino)-6-(methylthio)-s-triazine (Ametryne)	CGY.
5-Ethyl cyclohexylethylthiocarbamate	SFA.
S-Ethyl-hexahydro-1H-azepine-1-carbothioate (Molinate)	SFA.
N-(1-Ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	ACY, X.
2-(Ethylthio)-4,6-bis(isopropylamino)-s-triazine	CGY.
3-Isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide	BAS.
Isopropyl N-(3-chlorophenyl)carbamate (CIPC)	PPG.
Isopropyl N-phenylcarbamate (IPC)	PPG.
1-(2-Methylcyclohexyl)-3-phenylurea (Siduron)	DUP.
Methyl 5-(2',4'-dichlorophenoxy)-2-nitrobenzoate	SM.
1-Naphthylphthalamic acid (NPA)	USR.
7-Oxabicyclo-[2.2.1]-heptane-2,3-dicarboxylic acid, disodium salt (Endothall)	PAS.
PHENOXYACETIC ACID DERIVATIVES:	
4-Chloro-2-methylphenoxyacetic acid (MCPA)	RDA, TMH.
4-Chloro-2-methylphenoxyacetic acid, dimethylamine salt	RDA.
4-Chloro-2-methylphenoxyacetic acid, iso-octyl ester	RDA.
2,4-DICHLOROPHENOXYACETIC ACID, ESTERS AND SALTS:	
2,4-Dichlorophenoxyacetic acid (2,4-D)	DOW, RDA.
2,4-Dichlorophenoxyacetic acid, butoxyethanol ester	DOW.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*HERBICIDES AND PLANT GROWTH REGULATORS--Continued	
PHENOXYACETIC ACID DERIVATIVES--Continued	
2,4-DICYLOROPHENOXYACETIC ACID, ESTERS AND SALTS--Continued	
2,4-Dichlorophenoxyacetic acid,2-butoxyethyl ester	RIV.
2,4-Dichlorophenoxyacetic acid,butcxypolypropylenegl ycol ester	DOW.
2,4-Dichlorophenoxyacetic acid,n-butyl ester	PBI, RIV.
2,4-Dichlorophenoxyacetic acid,sec-butyl ester	DOW.
*2,4-Dichlorophenoxyacetic acid,dimethylamine salt	DOW, PBI, RDA, RIV, TMH.
2,4-Dichlorophenoxyacetic acid,ethanolamine and isopropanolamine salts	DOW.
2,4-Dichlorophenoxyacetic acid, isobutyl ester	RDA.
*2,4-Dichlorophenoxyacetic acid,iso-octyl ester	DOW, PBI, RDA, RIV, TMH.
2,4-Dichlorophenoxyacetic acid,lithium salt	GTH.
2,4-Dichlorophenoxyacetic acid,sodium salt	RIV.
2,4,5-TRICHLOROPHENOXYACETIC ACID, ESTERS AND SALTS	
2,4,5-Trichlorophenoxyacetic acid, butoxyethanol ester	DOW.
2,4,5-Trichlorophenoxyacetic acid,butcxypolypropyleneglycol ester	DOW.
2,4,5-Trichlorophenoxyacetic acid,iso-octyl ester	RIV, TMH.
2,4,5-Trichlorophenoxyacetic acid,triethylamine salt	DOW.
*PLANT GROWTH REGULATORS:	
2-Chloro-6-(trichloromethyl)pyridine	DOW
2,4-Dichlorcbenzyltributylphosphonium chloride	SM.
1,2-Dihydro-3,6-pyridazinedione (Maleic hydrazide) (MH)	ACY, CHP, FMT, USR.
Gibberellic acid	ABB, MRK.
3-Indolebutyric acid	ABA, MRK.
1-Naphthaleneacetamide	AMC.
1-Naphthaleneacetic acid (NAA)	GNW.
1-Naphthaleneacetic acid,ethyl ester	AMC.
1-Naphthaleneacetic acid,sodium salt	GNW.
Plant growth regulators, cyclic, all other	ABB, MMM.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
*HERBICIDES AND PLANT GROWTH REGULATORS--Continued	
Sodium 5-[2-chloro-4-(trifluoromethyl)-phenoxy]-2-nitrobenzoate	RH.
2-(2,4,5-Trichlorophenoxy)propionic acid (Silvex)	TMH.
2-(2,4,5-Trichlorophenoxy)propionic acid, 2-butoxypolypropylene ester	DOW.
2-(2,4,5-Trichlorophenoxy)propionic acid, dimethylame salt	RIV.
2-(2,4,5-Trichlorophenoxy)propionic acid, iso-octyl ester	RIV.
α, α, α-Trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine (Trifluralin)	LIL.
1,1,1-Trifluoro-N-(2-methyl-4-(phenylsulfonyl)-phenyl)methanesulfonamide	CGY.
Cyclic herbicides, all other	MMM, RH.
INSECT ATTRACTANTS AND REPELLENTS:	
tert-Butyl 4(or 5)-chloro-2-methylcyclohexanecarboxylate (Trimedlure)	UOP.
N,N-Diethyltoluamide (DEET)	PFZ.
Di-n-propylisocinchomeronate	MGK.
INSECTICIDES:	
Bacillus thuringiensis	ABB, S.
(5-Benzyl-3-furyl)methyl-2,2-dimethyl-3-(2-methylpropenyl)cyclopropane carboxylate (Resmethrin)	PEN.
2,3,4,5-δ²-Butenylene-tetrahydrofurfural	PLC.
2-(p-tert-Butylphenoxy)cyclohexyl-2-propynyl sulfite	USR.
CHLORINATED INSECTICIDES:	
4,4'-Dichloro-α-trichloromethylbenzhydrol (Dicofol)	RH.
Ethyl 4,4'-dichlorobenzilate (Chlorobenzilate)	CGY.
Heptachloro-tetrahydro-endo-methanoindene (Heptachlor)	VEL.
1,2,3,4,5,6-Hexachlorocyclohexane (Benzene hexachloride) (BHC)	X.
Hexachloroepoxyoctahydro-endo,endo-dimethanophthalene (Endrin)	VEL.
Hexachloro-hexahydro-methano-benzodioxathiepin 3-oxide (Endosulfan)	X.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
INSECTICIDES--Continued	
CHLORINATED INSECTICIDES--Continued	
Octachlorohexahydro-4,7-methanoindene (Chlordan)	VEL.
*Toxaphene (Chlorinated camphene)	HN, HPC, VTC.
1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane (DDT)	MTO.
1,1,1-Trichloro-2,2-bis(p-methoxyphenyl)ethane (Methoxychlor)	CHF, DUP, EGR.
2,3-Dihydro-2,2-dimethyl-7-benzofuramyl methylcarbamate	FMN.
Distinnaxane, hexakis(2-methyl-2-phenylpropyl)	SHC.
m-(1-Ethylpropyl)phenyl methylcarbamate	ORO
m-(Methylbutyl)phenyl methylcarbamate	ORO.
1-Naphthyl N-methylcarbamate (Carbaryl)	UCC.
*ORGANOPHOSPHORUS INSECTICIDES:	
O-(4-Bromo-2,5-dichlorophenyl) O-methylphenyl (phosphonothioate (Leptophos)	VEL.
4-tert-Butyl-2-chlorophenyl methyl methylphosphoramidate (Crufomate)	DOW.
S-[[(p-Chlorophenyl)thio]methyl] O,O-diethyl phosphorodithioate (Carbophenothion)	SFA.
2-Chloro-1-(2,4,5-trichlorophenyl)vinyl dimethyl phosphate (Tetrachlorvinphos)	SHC.
O-(2,4-Dichlorophenyl) O-ethyl S-propyl phosphorodithioate	CHG.
2-(Diethoxyphosphinylimino)-4-methyl-1,3-dithiolane	ACY.
O,O-Diethyl S-(2-chloro-1-phthalimidoethyl) phosphorodithioate	HPC.
O,O-Diethyl O-(2-isopropyl-4-methyl-6-pyrimidinyl) phosphorothioate (Diazinon)	CGY.
O,O-Diethyl O-[4-(methylsulfinyl)phenyl]phosphorothioate	CHG.
O,O-Diethyl O-(p-nitrophenyl)phosphorothioate (Parathion)	MON.
O, O'-Diethyl-O'-pyrazinyl phosphorodithidate	ACY.
O,O-Diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate	DOW.
O,O-Dimethyl O-[4-(methylthio)-m-tolyl]phosphorothioate (Fenthion)	CHG.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
INSECTICIDES--Continued	
*ORGANOPHOSPHORUS INSECTICIDES--Continued	
*0,0-Dimethyl 0-(p-nitrophenyl)phosphorothioate (Methyl parathion)	AMP, MON, VTC.
0,0-Dimethyl S-[(4-oxo-1,2,3-benzotriazin-3(4h)-yl)methyl]phosphorodithioate (Azinphos-methyl)	CHG.
0,0-Dimethyl S-(phthalimidomethyl)phosphorodithioate	SPA.
0,0-Dimethyl 0-(2,4,5-trichlorophenyl)phosphorothioate (Ronnel)	DOW.
2,3-p-Dioxanedithiol S,S-bis-(0,0-diethyl phosphorodithioate (Dioxathion)	HPC.
0-Ethyl 0-[4-(methylthio)phenyl] S-propyl phosphorodithioate	CHG.
0-Ethyl 0-(p-nitrophenyl)phenylphosphonothioate (EPN)	SPA, VEL.
0-Ethyl-S-phenylethylphosphonodithioate	SPA.
0-Ethyl 0-(2,4,5-trichlorophenyl)ethyl phosphonothioate	CHG.
0,0,0',0'-Tetramethyl-0,0'-thiodi-p-phenylene phioate	ACY.
Cyclic insecticides,all other	EGR, S, X.
NEMATOCIDES:	
0,0-Diethyl 0-(2,4-dichlorophenyl)phosphorothioate (Dichlofenthion)	SM.
RODENTICIDES:	
3-(α-Acetonylbenzyl)-4-hydroxycoumarin (Warfarin)	MOT.
2-Diphenylacetyl-1,3-indandione and sodium salt	NES.
2-Pivaloyl-1,3-indandione (Pindone)	MOT, PIC.
N-(3-Pyridylmethyl)-N'-(p-nitrophenyl)urea	CWN.
Rodenticides, cyclic,all other	MOT.
CYCLIC PESTICIDES, ALL OTHER:	
Benzyl bromoacetate	MRK.
4-Bromoacetoxymethyl-N-dioxoline	EFH.
α-[2-(2-n-Butoxyethoxy)-ethoxy]-4,5-methylenedioxy-2-propyltoluene (Piperonyl butoxide)	ALP, FMN.
N-(2-Ethylhexyl)bicyclo(2.2.1)-5-heptene-2,3-dicarboximide	MGK.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
ACYCLIC	
*FUNGICIDES:	
Bis-1,4-bromoacetoxy-2-butene	VIN.
Chloromethoxypropylmercuric acetate	TRO.
Disodium cyanodithioimidocarbcnate	BKM.
*DITHIOCARBAMIC ACID FUNGICIDES:	
Dimethyldithiocarbamic acid,ferric salt (Perbam)	FMN
Dimethyldithiocarbamic acid,potassium salt	BKM.
Dimethyldithiocarbamic acid,sodium salt	VCC.
Ethylene bis(dithiocarbamic acid),diammonium salt	RBC.
Ethylene bis(dithiocarbamic acid),disodium salt (Rabam)	ALC, USR, VCC.
Ethylene bis(dithiocarbamic acid),manganese salt (Maneb)	DUP, RH.
Ethylene bis(dithiocarbamic acid), manganese salt with zinc ions	RH.
Ethylene bis(dithiocarbamic acid),zinc salt (Zineb)	FMN, RH.
Dithiocarbamic acid fungicides,acyclic, all other	BKM, VNC, X.
n-Dodecylguanidine acetate (Dodine)	ACY, MRK.
Methylene bis(thiocyanate)	MBK, YCC.
Acyclic fungicides, all other	BKM.
*HERBICIDES AND PLANT GROWTH REGULATORS:	
N,N-Bis(phosphonomethyl)glycine	MON.
2-Chloroallyl diethyldithiocarbamate (CDEC)	MON.
2-Chloro-N,N-diallylacetamide (CDAA)	MON.
2,2-Dichloropropionic acid,sodium salt (Dalapon)	DOW.
N-[5-(1,1-Dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea (Tebuthiuron)	LIL.
Ethyl carbamoylphosphonate, ammonium salt	DUP.
S-Ethyldiisobutylthiocarbamate (Butylate)	SFA.
S-Ethyl dipropylthiocarbamate (EPTC)	SFA.
Ethyl xanthogen disulfide	RBC.
Methanearsonic acid,disodium salt (DSMA)	CLY, DA, VIN.
Methanearsonic acid,dodecyl- and octyl- ammonium salt	CLY.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
*HERBICIDES AND PLANT GROWTH REGULATORS--Continued	
N-(Phosphonomethyl)glycine, isopropylamine salt	MON.
PLANT GROWTH REGULATORS:	
2-(Chloroethyl)phosphonic acid	GAF.
Succinic acid, 2,2-dimethylhydrazide	USR.
S-Propyl butylethylthiocarbamate (Pebulate)	SFA.
S-Propyl dipropylthiocarbamate (Vernolate)	SFA.
S,S,S-Tributyl phosphorotrithioate	PLC.
Tributyl phosphorotrithioite (Merphos)	SM.
Trichloroacetic acid, sodium salt (TCA)	DOW.
S-(1,2,3-Trichloroallyl) diisopropylthiocarbamate (Triallate)	MON.
Acyclic herbicides, all other	BKM, S, X.
INSECTICIDES:	
2-(2-Butoxyethoxy)ethyl thiocyanate	RH.
Butyl 3,4-dihydro-2,2-dimethyl-4-oxo-2H-pyran-6-carboxylate	KF.
3,3-Dimethyl-1-(methylthio)-2-butanone O-(methylamino)carbomyl oxime	EGR.
Methyl N',N'-dimethyl-N-[(methylcarbamoyl)oxy]-1-thiooxamidate	DUP.
S-Methyl-N-[(methylcarbamoyl)oxy]thioacetimidate (Methomyl)	DUP, EGR, SHC.
2-Methyl-2-(methylthio)propionaldehyde O-(methylcarbamoyl)oxime (Aldicarb)	SHC, UCC.
*ORGANOPHOSPHORUS INSECTICIDES:	
S-[1,2-Bis(ethoxycarbonyl)ethyl]O,O-dimethyl phosphorodithioate (Malathion)	ACY.
2-Carbomethoxy-1-propen-2yl dimethyl phosphate	SHC.
1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate (Naled)	SHC.
O,O-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate (Disulfoton)	CHG.
O,O-Diethyl O-[2-(ethylthio)ethyl] phosphorothioate (Demeton O)	CHG.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
INSECTICIDES--Continued	
*ORGANOPHOSPHORUS INSECTICIDES--Continued	
O,O-Diethyl S-[(ethylthio)methyl] phosphorodithioate (Phorate)	ACY, CHG, X.
3-(Dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide	SHC.
O,S-Dimethylacetylphosphoramidothioate (Acephate)	ORO.
O,O-Dimethyl-O-2,2-dichlorovinyl phosphate (DDVP)	SHC.
Dimethyl phosphate of 3-hydroxy-N-methyl-cis-crotonamide	SHC.
O,S-Dimethyl phosphoramidothioate	CHG.
O,O-Dimethyl phosphorochloridothioate	CHG.
S-[2-(Ethylsulfinyl)ethyl]O,O-dimethyl phosphorothioate (Oxydemetonmethyl)	CHG.
O,O,O',O'-Tetraethyl S,S'-methylene bisphosphorodithioate (Ethion)	FMN.
Tetraethyl pyrophosphate (TEPP)	X.
O,O,O,O-Tetra-n-propyldithiopyrophosphate	SFA.
Organophosphorus insecticides, acyclic, all other	X, X.
Acyclic insecticides, all other	X.
RODENTICIDES:	
2-Hydroxyethyl n-octyl sulfide	PLC.
Sodium fluoroacetate	RBC.
Rodenticides, acyclic, all other	PLC, RBC.
SOIL CONDITIONERS:	
Polyacrylonitrile,hydrolyzed,sodium salt	ACY.
SOIL FUMIGANTS:	
1,2-Dibromo-3-chloropropane (DBCP)	DOW, SHC.
1,3-Dichloropropene	DOW.
1,3-Dichloropropene,1,2-dichloropropane	SHC.
O-Ethyl S,S-dipropyl phosphorodithioate	SM.
*Methyl bromide (Bromomethane)	DOW, GTL, VEL.
Methyl isothiocyanate	MRT.
*Trichloronitromethane (Chloropicrin)	DOW, IMC, NLO.

TABLE 2.--PESTICIDES AND RELATED PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE REPORTED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

PESTICIDES AND RELATED PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ACYCLIC PESTICIDES, ALL OTHER:	
2-[(Hydroxymethyl)amino]-2-methylpropanol	TRO.
2-[(Hydroxymethyl)]ethanol	TBC.
3-Iodo-2-propynyl butylcarbamate	TRO.
Acyclic pesticides and related products,all other	MRK, PCW, X.

TABLE 3.--PESTICIDES AND RELATED PRODUCTS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of pesticides and related products to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company	Code	Name of company
ABB	Abbott Laboratories	MMM	Minnesota Mining & Manufacturing Co.
ACY	American Cyanamid Co.	MON	Monsanto Co.
ALC	Alco Chemical Corp.	MOT	Motomoco, Inc.
ALP	Alpha Laboratories, Inc.	MRK	Merck & Co., Inc.
AMC	Amchem Products, Inc. Sub. of Union Carbide Corp.	MRT	Morton Chemical Co. Div. of Morton Norwich Products, Inc.
AMP	Kerr-McGee Chemical Corp.	MTO	Montrose Chemical Corp. of California
ARA	Arapahoe Chemical, Inc. Sub/Syntex U.S.A., Inc.	NES	Nease Chemical Co., Inc.
ASH	Ashland Oil, Inc., Ashland Chemical Co.	NLO	Niklor Chemical Co.
		OMC	Olin Corp., Agricultural Products Dept.
		ORO	Chevron Chemical Co.
BAS	BASF Wyandotte Corp.		
BKM	Buckman Labs., Inc.	PAS	Pennwalt Corp.
		PCW	Pfister Chemical, Inc.
CCA	Interstab Chemical, Inc.	PD	Parke, Davis & Co. Sub of Warner-Lambert Co.
CGY	Ciba-Geigy Corp., Agricultural Div.		
CHF	Chemical Formulators, Inc.	PEN	CPC International, Inc., Penick Div.
CHG	Mobay Chemical Corp., Chemagro Agricultural Div.	PFZ	Pfizer, Inc.
		PIC	Pierce Organics, Inc.
CLY	W. A. Cleary Corp.	PLC	Phillips Petroleum Co.
CWN	Upjohn Co., Fine Chemical Div.	PPG	PPG Industries, Inc.
DA	Diamond Shamrock Corp.	RBC	Fike Chemicals, Inc.
DOW	Dow Chemical Co.	RCI	Reichhold Chemicals, Inc.
DUP	E. I. duPont de Nemours & Co., Inc.	RDA	Rhodia, Inc.
		RH	Rohm & Haas Co.
EFH	E. F. Houghton & Co.	RIV	Riverdale Chemical Co.
EGR	Eagle River Chemical Corp.		
		S	Sandoz Inc., Crop Protection Dept.
FMN	FMC Corp., Agricultural Chemical Div.	SDC	Martin-Marietta Corp., Sodyeco Div.
FMT	Fairmount Chemical Co.		Stauffer Chemical Co.:
FRI	Farmland Industries, Inc.	SFA	Agricultural Div.
FRO	Vulcan Materials Co., Chemical Div.	SFC	Calhio Chemicals, Inc. Div.
		SHC	Shell Oil Co., Shell Chemical Co. Div.
GAF	GAF Corp.	SM	Mobil Oil Corp., Mobil Chemical Co., Phosphorus Div.
GNW	Greenwood Chemical Co.		
GOC	Gulf Oil Corp., Gulf Oil Chemical Co. - U.S.	TMH	Thompson-Hayward Chemical Co.
GTH	Guth Chemical Co.	TRO	Troy Chemical Corp.
GTL	Great Lakes Chemical Corp.		
		UCC	Union Carbide Corp.
HK	Hooker Chemicals & Plastics Corp.	UOP	UOP, Inc., Chemical Div.
HN	Tenneco Chemicals, Inc.	USM	USM Corp., Bostik Div.
HPC	Hercules, Inc.	USR	Uniroyal, Inc., Uniroyal Chemical Div.
IMC	IMC Chemical Group, Inc.	VCC	Vinings Chemical Co.
		VEL	Velsicol Chemical Corp.
KF	Kay-Fries Chemicals, Inc.	VIN	Vineland Chemical Co., Inc.
		VNC	Vanderbilt Chemical Corp.
LAK	Bofors Lakeway, Inc.	VTC	Vicksburg Chemical Co. Sub. of Vertac Consolidated
LIL	Eli Lilly & Co.		
MCF	Miller Chemical & Fertilizer Corp.	WTC	Witco Chemical Corp.
MCI	Mooney Chemical Corp.		
MGK	McLaughlin, Gormley & King Co.	ZOC	Zoecon Corp.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the appendix.

Organic Floccuants

K. James O'Connor, Jr.

In recent years, the public has become increasingly concerned over the state of the environment, including, among other factors, the quality of water. Not only in response to these concerns, but also as a result of increased Government regulation in this area, the U.S. chemical industry has found it necessary to institute new measures to more thoroughly cleanse the effluent of its manufacturing plants. One facet of this cleansing is the removal of suspended or colloidal particles from wastewater. This is accomplished by a process known as coagulation or flocculation.

This paper will examine the mechanism by which flocculation of colloidal particles occurs. It will also examine the developing market for polyacrylamide, polyamines, and polyepichlorohydrins, all of which are commonly referred to as organic flocculants.

Organic versus inorganic flocculants

In general, the vast majority of particles suspended in wastewater are too small to be seen with the unaided eye. Flocculation causes these smaller particles to coagulate into larger ones called flocs, which can not only be seen, but which will also settle out, or float, depending on their nature, and which can subsequently be rapidly filtered out of the water.

The process of flocculation for the removal of suspended particles from water is not new. In the past, the coagulant aids of choice have generally been inorganic compounds, most often alum or various ferric (iron) salts. While these compounds are effective as flocculants, large quantities are required in relation to the suspended matter. This has never been a significant drawback with regard to cost, as the materials are relatively inexpensive. (In 1977, a typical price for alum was 6.5 cents per pound.) However, the large amount of coagulants used produced a correspondingly large amount of sludge. Consequently, the total cost of using inorganic flocculants, although initially inexpensive, is becoming increasingly costly because of the problem of sludge disposal. Ocean dumping of sludge, once common, is generally prohibited by environmental regulations. Similar regulations have greatly increased the cost of sludge disposal in landfills, as precautions must be taken to avoid any seepage of material into groundwater supplies.

Organic flocculants, on the other hand, produce far less sludge because the mechanism by which they operate reduces the amount of colloidal particles more efficiently than inorganic flocculants. (This mechanism is described below.) Thus the cost of using organic flocculants is greatly reduced because significantly smaller amounts are required (from 1/3 to 1/25 as much as inorganic flocculants, depending on the constituents of the wastewater) and much less sludge is generated.

Flocculation mechanism

Colloidal particles suspended in water generally carry a small electrical charge which causes the particles to mutually repel one another. For effective flocculation to occur, this charge must be neutralized. Whether the suspended particles are anionic (possessing a negative charge) or cationic (positively charged) depends on the particular contaminant. In general, naturally occuring colloidal particles, such as those found in municipal waste, possess a net negative charge and must be treated with a cationic flocculant. Industrial wastes tend to contain positively charged matter and must be treated with an anionic flocculant. Wastewater which contains a variety of suspended solids is generally most effectively treated with a nonionic polymer which possesses a mixture of charges.

Polyacrylamide comprises the largest segment of the organic flocculant industry. Depending on the degree of hydrolyzation of the amide ($-CONH_2$) group to carboxyl (-COOH) groups during polymerization, polyacrylamide may be made cationic, nonionic, or anionic. Polyamines and polyepichlorohydrins are generally cationic.

Once the appropriate organic flocculant is in solution, the suspended particles migrate to the polymer molecules which are then adsorbed onto the surfaces of the suspended particle. This process, called bridging, results in a large three-dimensional network which can be rapidly filtered from the solution.

Market growth and outlook

The following table summarizes production and sales for the last 3 years of polyacrylamide and other polymers used as organic flocculants. While not all polyacrylamide is used for the production of flocculants, this is its major use. As shown in the table, both production and sales declined moderately in the 1975 recession, followed by a strong rebound in 1976, and continued growth in 1977. Production of polymers used as flocculants increased from 49.0 million pounds in 1975, to 71.4 million pounds in 1977, while the value of sales increased from $39.7 million to $59.3 million in the same period. The corresponding figures for acyclic organic chemicals[1] are included in the table for comparison. It can be seen that the rate of decline for acyclic chemicals was much more pronounced than that for organic flocculants in 1974-75 and that acyclic chemicals' recovery rate was less pronounced in 1975-77.

As Government regulations governing wastewater become more stringent in the near future, the organic flocculant industry can expect continued steady growth for the following reasons. First, the problem of sludge disposal will become more acute, which will favor the organic flocculants because they decrease the amount of sludge created in effluent cleanup. Second, as new plants are built, their sludge-handling equipment will be designed to process sludge

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[1] Miscellaneous cyclic and acyclic chemicals, sec. XV, p.

created when organic polymers are used for flocculation instead of inorganic compounds. (Older plants already have sludge-handling equipment which will process flocculant products of inorganic compounds, and conversion of the equipment would not be cost-effective.) Lastly, the organic flocculants have been shown to be pharmacologically inert and therefore virtually devoid of toxicity. The majority of the compounds used for flocculation have received either EPA or FDA approval for their respective uses.

U.S. production and sales of organic flocculants and all acyclic organic chemicals, by types, 1974-77

(Quantities in thousands of pounds; value in thousands of dollars)

Item	1974	1975	Percentage change, 1975 from 1974	1976	Percentage change, 1976 from 1975	1977	Percentage change, 1977 from 1976
	Production quantity						
Organic flocculants:							
Polyacrylamide	29,217	26,276	-10.0	41,507	58.0	45,319	9.2
Other	(1)	22,764	-	27,242	19.7	26,069	-4.3
Total	(1)	49,040	-	68,749	40.2	71,388	3.8
All acyclic organic chemicals	97,037,182	83,083,936	-14.4	93,251,568	12.2	104,242,933	11.8
	Sales quantity						
Organic flocculants:							
Polyacrylamide	30,844	25,581	-17.1	36,829	44.0	37,244	1.1
Other	(1)	15,777	-	21,620	37.0	23,241	7.5
Total	(1)	41,358	-	58,449	41.3	60,485	3.5
All acyclic organic chemicals	46,072,171	37,620,969	-18.3	39,685,672	5.2	45,702,563	15.2
	Sales value						
Organic flocculants:							
Polyacrylamide	25,849	25,665	-0.7	41,479	38.1	40,916	1.4
Other	(1)	13,994	-	14,697	4.8	18,368	20.0
Total	(1)	39,659	-	56,176	29.4	59,284	5.2
All acyclic organic chemicals	7,141,574	7,256,145	1.6	7,629,105	4.9	8,168,496	7.1

1 Not available.

Source: U.S. International Trade Commission.

XIV -- MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS

Miscellaneous End-Use Chemicals and Chemical Products

K. James O'Connor, Jr. and Janet Dietzman

This section incorporates those end-use groups which are not readily classifiable within the prior sections of this report. Both cyclic and acyclic chemicals fall within this section. With the exception of gasoline additives, both production and sales of all end-use groups contained within this section increased over 1976 levels.

In 1977 the production of miscellaneous end-use chemicals exceeded 19.3 billion pounds, an increase of 16.5 percent over the more than 16.6 billion pounds of production reported for 1976 (see revisions to 1976 data at end of table 1). Sales in 1977 exceeded 10.8 billion pounds, valued at $2.5 billion. The sales quantity represents an increase of 7.5 percent over that of 1976 with the value of sales increasing by 6.1 percent. As in 1976, polymers for fibers and urea again collectively accounted for 84 percent of the 1977 production of these miscellaneous end-use chemicals. Urea accounted for 73 percent of the 1977 sales quantity of these chemicals.

Production of gasoline additives for 1977 totaled 1.15 billion pounds, a decrease of 10 percent from the previous year. The decline in sales was even more pronounced. Total sales quantity for 1977 was 862 million pounds, down 26.2 percent from the 1976 sales quantity of 1.09 billion pounds. This market is expected to continue its decline as a result of environmental legislation which restricts the use of lead alkyls in gasoline.

TABLE 1.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS: U.S. PRODUCTION AND SALES, 1977[1]

[Listed below are all miscellaneous end-use chemicals and chemical products for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists alphabetically all miscelleneous end-use chemicals and chemical products on which data on production and/or sales were reported and identifies the manufacturers of each]

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
	1,000 pound	*1,000 pound*	*1,000 dollars*	*Per pound*
Grand total	19,347,932	10,855,243	2,547,481	$0.23
Chelating agents, nitriloacids and salts, total	168,317	140,009	70,128	.50
(Diethylenetrinitrilo)pentaacetic acid, pentasodium salt	6,174	4,014	2,582	.64
(Ethylenedinitrilo)tetraacetic acid, calcium disodium salt	295	...	...	...
(Ethylenedinitrilo)tetraacetic acid, tetrasodium salt	54,464	36,404	23,555	.65
(N-Hydroxyethylethylenedinitrilo)triacetic acid, trisodium salt	2,488	3,235	3,022	.93
All other	106,897	96,356	40,969	.43
Chemical indicators	8	6	472	74.33
Chemical reagents	83	72	1,996	35.03
Enzymes, total	(3)	(3)	52,181	...
Hydrolytic enzymes, total	(3)	(3)	32,170	...
Amylases	(3)	(3)	5,853	...
Proteases, total	(3)	(3)	19,041	...
Papain	(3)	(3)	2,772	...
Rennin	(3)	(3)	6,167	...
All other proteases	(3)	(3)	10,102	...
All other hydrolytic enzymes	(3)	(3)	7,276	...
Non-hydrolytic enzymes	(3)	(3)	20,011	...
Gasoline additives, total[4]	1,152,253	861,745	785,709	.92
N,N'-Disalicylidene-1,2-propanediamine	480	...	...	...
Ethylenedibromide	244,238	...	...	...
Tetraethyl lead	326,935	294,383	287,407	.98
Tetra(methyl-ethyl) lead, (TEL-TML, reacted)	432,819	392,625	391,015	1.02
Tetramethyl lead	119,642	...	...	...
All other gasoline additives	28,619	188,062	116,616	.95
Lubricating oil and grease additives, total	1,477,597	1,253,329	491,932	.39
Oil soluble petroleum sulfonate, calcium salt	287,495	273,850	90,098	.33
Oil soluble petroleum sulfonate, sodium salt	117,808	104,916	27,540	.26
Phenol salts, total	126,013	121,059	49,734	.41
Nonylphenol, barium salt	8,363	7,739	5,635	.73
All other	117,650	113,320	44,099	.37
Sulfur compounds	163,044	158,522	64,396	.41
Zinc dialkyldithiophosphate	32,587	18,828	10,599	.56
All other lubricating oil and grease additives	750,650	576,154	249,565	.43
Paint driers, naphthenic acid salts, total[5,6]	15,434	10,781	10,654	.99
Calcium naphthenate	1,119	944	644	.68
Cobalt naphthenate	3,735	3,372	5,258	1.56
Lead naphthenate	4,901	3,379	2,262	.67
Manganese naphthenate	1,539	1,015	665	.65
Zinc naphthenate	1,300	1,169	802	.69
All other	2,837	902	1,023	1.13
Photographic chemicals	16,152	3,114	11,039	3.54

See footnotes at end of table.

TABLE 1.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
	1,000 pound	*1,000 pound*	*1,000 dollars*	*Per pound*
Polymers for fibers, total	6,022,251	355,232	171,215	$0.48
Nylon 6 and 6/6	1,873,993	...	...	...
Polyacrylonitrile and acrylonitrile copolymers	795,028	...	...	...
Polyethylene terephthalate	2,332,020	176,194	57,334	.33
All other polymers for fibers	1,021,210	179,037	113,882	.64
Polymers, water soluble, total	252,349	226,531	257,602	1.13
Cellulose ethers and esters	149,127	146,187	175,373	1.20
Polymers used as flocculants, total	72,181	61,278	60,156	.98
Polyacrylamide	46,112	38,037	41,788	1.10
All other	26,069	23,241	18,368	.79
Sodium polyacrylate	7,911	7,520	5,622	.75
All other water soluble polymers	14,419	11,546	16,451	1.42
Tanning materials, synthetic, total	61,589	56,206	25,521	.45
2-Naphthalenesulfonic acid, formaldehyde condensate and salt	35,510	34,269	14,732	.43
All other	26,079	21,937	10,789	.49
Textile chemicals, other than surface-active agents	6,999	3,345	3,286	.98
Urea, total	10,143,695	7,919,822	568,736	.07
In feed compounds	475,228	397,657	25,534	.06
In liquid fertilizer	2,946,998	2,557,540	185,659	.07
In solid fertilizer	5,368,190	4,397,246	274,446	.06
In plastics	1,195,791	416,808	25,213	.06
All other	157,488	150,571	57,884	.38
All other miscellaneous end-use chemicals and chemical products[7]	31,205	25,051	97,010	3.87

[1] Certain data have been revised for 1976. These revisions are shown below:

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	16,684,908	10,100,710	2,401,932	.25
Gasoline additives, total	1,271,143	1,088,445	446.250	.69
All other gasoline additives	702,395	526,962	423,866	.81
Urea, total	8,995,288	7,307,906	423,567	.06
Urea, in liquid fertilizer	2,412,138	2,310,931	108,112	.05
Urea, in solid fertilizer	4,866,132	4,149,055	256,593	.06

[2] Calculated from rounded figures.
[3] Not available.
[4] Statistics exclude production and sales of tricresyl phosphate. Statistics on tricresyl phosphate are given with the section on "Plasticizers."
[5] Quantities are given on the basis of solid naphthenate.
[6] Statistics exclude production and sales of copper naphthenate. Statistics for copper naphthenate are given in the section on "Pesticides and Related Products."
[7] Includes all other items listed in table 2 which are not individually publishable or publishable as groups.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT. COMPANY IDENTIFICATION CODES WHICH ARE FOLLOWED BY AN "(E)" ARE SO LABELED BECAUSE THE COMPANY FAILED TO SUPPLY THE U.S. INTERNATIONAL TRADE COMMISSION WITH THEIR DATA IN SUFFICIENT TIME FOR ITS INCLUSION IN THIS REPORT. THE COMPANY IS PRESUMED TO HAVE CONTINUED PRODUCTION OF THE COMPOUND IN QUESTION IN 1977 AND THE VOLUME OF PRODUCTION AND SALES HAS BEEN ESTIMATED BY THE USITC STAFF MEMBERS]

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
Biological stains	MMC.
*CHELATING AGENTS, NITRILOACIDS AND SALTS:	
(Diethylenetrinitrilo)pentaacetic acid	HMP.
(Diethylenetrinitrilo)pentaacetic acid, monosodium hydrogen ferric salt	CGY.
*(Diethylenetrinitrilo)pentaacetic acid, pentasodium salt	CGY, DAN, DOW, HMP, RFC.
(Diethylenetrinitrilo)pentaacetic acid, sodium salt	CGY.
N,N-Dihydroxyethylglycine, sodium salt	DAN, HMP.
Ethanoldiglycine, disodium salt	HMP.
(Ethylenedinitrilo)tetraacetic acid (Ethylenediamine tetraacetic acid) (EDTA)	CGY, DOW, HMP.
*(Ethylenedinitrilo)tetraacetic acid, calcium disodium salt	CGY, DOW, HMP.
(Ethylenedinitrilo)tetraacetic acid, diammonium salt	DOW, HMP.
(Ethylenedinitrilo)tetraacetic acid, disodium copper salt, dihydrate	HMP.
(Ethylenedinitrilo)tetraacetic acid, disodium magnesium salt	HMP.
(Ethylenedinitrilo)tetraacetic acid, disodium salt	CGY, DOW, HMP.
(Ethylenedinitrilo)tetraacetic acid, disodium zinc salt, dihydrate	HMP.
(Ethylenedinitrilo)tetraacetic acid, manganese salt	DOW, HMP.
(Ethylenedinitrilo)tetraacetic acid, monoammonium ferric salt	HMP.
(Ethylenedinitrilo)tetraacetic acid, monosodium iron salt	HMP.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*CHELATING AGENTS, NITRILOACIDS AND SALTS--Continued	
(Ethylenedinitrilo)tetraacetic acid, tetraammonium salt	DOW, HMP.
(Ethylenedinitrilo)tetraacetic acid, tetrapotassium salt	CGY, HMP.
*(Ethylenedinitrilo)tetraacetic acid, tetrasodium salt	CGY, CRT, DAN, DOW, HMP, JOR, RPC.
(Ethylenedinitrilo)tetraacetic acid, trisodium salt	CGY, HMP.
(N-Hydroxyethylethylenedinitrilc) triacetic acid	HMP.
(N-Hydroxyethylethylenedinitrilo)triacetic acid, copper salt	HMP.
(N-Hydroxyethylethylenedinitrilo)triacetic acid, iron salt	HMP.
(N-Hydroxyethylethylenedinitrilo)triacetic acid, magnesium salt	HMP.
*(N-Hydroxyethylethylenedinitrilo)triacetic acid, trisodium salt	CRT, DAN, DOW, HMP, RPC.
Nitrilotriacetic acid	HMP, MON.
Nitrilotriacetic acid, trisodium salt	HMP.
Chelating agents, nitriloacids and salts, all other	CGY(E), DOW, EK, HMP.
*Chemical indicators	BCC, EK, FIN, GFS, MMC.
*Chemical reagents	EK, GFS, MMC, RSA, X.
*ENZYMES:	
*HYDROLYTIC ENZYMES:	
*AMYLASES:	
Amylases, all other	BAX, MLS, PFZ, RH, X.
*PROTEASES:	
Bromelain	DOL.
Ficin	PFZ.
*Papain	BAX, MLS, PEN, PFZ.
Pepsin	CHH, SPR.
*Rennin	CHH, MLS, PFZ.
*Proteases, all other	BAX, MLS, PIC, PMP, SPR.
Hydrolytic enzymes including pectic enzymes and lipase, all other	BAX, JFR, MLS, PMP, RH, SPR, WBC.
*NON-HYDROLYTIC ENZYMES:	
Glucose oxidase	DLI.
Nonhydrolytic enzymes	ASH, CGY, DLI, ICI, MLS, OMS, PLB.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
FLOTATION REAGENTS:	
PHOSPHORODITHIOATES (DITHIOPHOSPHATES):	
Dicresylphosphorodithioic acid	ACY.
Dicresylphosphorodithioic acid, ammonium salt	ACY.
Dicresylphosphorodithioic acid, sodium salt	KCU.
OTHER FLOTATION REAGENTS:	
2,2'-Dimethylthiocarbanilide (Di-o-tolylthiourea)	BBC.
Rosin amines	HPC.
Thiocarbanilide (Diphenylthiourea)	ACY, RBC.
Floatation reagents, all other	KCU.
*GASOLINE ADDITIVES:	
Butylphenols, mixed	TNA.
N-sec-Butyl-N-phenylphenylenediamine	X.
4,4'-Di-sec-butylaminodiphenylmethane	X.
2,6-Di-tert-butylphenol	TNA.
N,N'-Di-sec-butyl-p-phenylenediamine	DUP, USR, X.
N,N'-Diisopropyl-p-phenylenediamine	DUP, USR.
*N,N'-Disalicylidene-1,2-propanediamine	DUP, FEB, TX, X.
Ethoxylated hydantoin glycol dicocoate	GLY.
*Ethylene dibromide	DOW, PPG, TNA.
Methylcyclopentadienylmanganese tricarbonyl	TNA.
4,4'-Methylene bis(2,6-di-tert-butyl phenol)	TNA.
*Tetraethyl lead	DUP, PPG, TNA.
*Tetra(methyl-ethyl)lead, (Tel-tml,reacted)	DUP, PPG, TNA, X.
*Tetramethyl lead	DUP, TNA, X.
1,3,5-Tris(3,5-di-tert-butyl-4-hydroxybenzyl) mesitylene	TNA.
Gasoline additives, all other	ASH, DUP, TNA, X.
*LUBRICATING OIL AND GREASE ADDITIVES:	
CHLOROSULFURIZED AND SULFURIZED COMPOUNDS:	
Methylene-bridged polyalkl phenols	TNA.
4,4'-Thiobis(6-tert-butyl-o-cresol)	TNA.
Chlorosulfurized and sulfurized compounds: used as lubricating oil and grease additives, all other	GLY.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*LUBRICATING OIL AND GREASE ADDITIVES--Continued	
OIL-SOLUBLE PETROLEUM SULFONATES:	
Oil-soluble petroleum sulfonate, ammonium salt	NTL.
Oil-soluble petroleum sulfonate, barium salt	PAR, WTC, X(E).
*Oil-soluble petroleum sulfonate, calcium salt	ORO, PAR, PLC, TNA, TX, WTC, X(E).
Oil-soluble petroleum sulfonate, magnesium salt	WTC.
*Oil-soluble petroleum sulfonate, sodium salt	ENJ, MOR, PAR, SHC, WTC, X(E).
Oil-soluble petroleum sulfonate, all other	SHC.
*PHENOL SALTS:	
Alkylphenol, calcium salt	ORO.
*Nonylphenol, barium salt	CCA, ENJ, X.
Phenol salts, all other	TNA, TX, WTC, X(E).
PHOSPHORODITHIOATES (DITHIOPHOSPHATES):	
Di-2-ethylhexylphosphorodithicic acid	ELC, SFA.
Di-N-propylphosphorodithioic acid	ELC, SFA.
*Zinc dialkyldithiophosphate	ELC, ORO, TNA, TX.
Zinc hydrocarbon dithiophosphate	X(E).
Zinc isopropyl hexyl phosphorodithioate	ELC.
Phosphorodithioates used as lubricating oil and grease additives, all other	ELC, ORO, TX.
*SULFUR COMPOUNDS:	
Aliphatic hydrocarbon sulfides	ELC, X(E).
Aliphatic imides, sulfur compcunds	ORO.
Chlorosulfurized sperm oil	CCW.
Diisobutylene polysulfide	ELC, TX.
Di-tertiary nonylpolysulfide	PAS.
Sulfurized lard oil	CCW, FER, QCP, WBG.
Sulfurized sperm oil	ELC.
Sulfurized sperm oil substitutes	CCW, FER.
Triisobutylene polysulfide	TX.
Sulfur compounds, all other	CCW, ELC, ORO.
Lubricating oils and grease additives, all other	ALX, ELC, ENJ, GBH, MIL, ORO, PLC, SHC, SM, TNA, TX, X(E).
*PAINT DRIERS, NAPHTHENIC ACID SALTS:	
Aluminum naphthenate	SHP.
Barium naphthenate	CCA.
Cadmium naphthenate	CCA.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*PAINT DRIERS, NAPHTHENIC ACID SALTS--Continued	
*Calcium naphthenate	CCA, HN, MCI, SHP, TRO, WTC, X.
Chromium naphthenate	MCI, WTC.
*Cobalt naphthenate	CCA, HN, MCI, SHP, TRO, WTC, X.
Iron naphthenate	CCA, HN, WTC.
*Lead naphthenate	CCA, MCI, SHP, SW, TRO, TX, WTC, X.
Lithium naphthenate	CCA, MCI.
*Manganese naphthenate	CCA, HN, MCI, SHP, SW, TRO, WTC, X.
Rare earths naphthenate	CCA.
Strontium naphthenate	CCA.
*Zinc naphthenate	CCA, HN MCI, SW, TRO, WTC, X.
Paint dryers, naphthenic acid salts, all other	EK, MCI, SM, SW.
*PHOTOGRAPHIC CHEMICALS:	
N-2-(4-Amino-N-ethyl-m-toluidino)ethyl methane-sulfonamide	X.
3-Amino-1,2,4-triazole (5-Amino-1,3,4-triazole)	FMT.
Benzotriazole	FMT, SW.
p-Benzylaminophenol hydrochloride	EK.
3-Chloro-4-diethylaminobenzenediazonium chloride (p-Diazo-2-chloro-N,N-diethylaniline)-zinc chloride	ESA.
Chlorohydroquinone	EK.
4-Diazo-3,5-diethoxythiocresol salts	FMT.
2,5-Diethoxy-4-morpholinobenzenediazonium chloride	ALL, ESA.
p-Diethylaminobenzenediazonium chloride (p-Diazo-N,N-diethylaniline)-zinc chloride	ESA, FMT.
N,N-Diethyltoluene-2,5-diamine, monohydrochloride	EKT.
p-Dimethylaminobenzenediazonium chloride (p-Diazo-N,N-dimethylaniline)-zinc chloride	ESA, FMT.
p-Diphenylaminediazonium sulfate	FMT.
p-(N-Ethylbenzimido)benzenediazonium chloride (p-Diazo-N-benzyl-N-ethylaniline)-zinc chloride	FMT.
p-[Ethyl(2-hydroxyethyl)amino]benzenedizonium chloride (p-Diazo-N-ethyl-N-hydroxyethylaniline)-zinc chloride	ESA, FMT.
N-Ethyl-N-hydroxyethyl-p-phenylenediamine sulfate	WAY.
Hydroquinone (Hydroquinol)	EKT.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*PHOTOGRAPHIC CHEMICALS--Continued	
p-[(2-Hydroxyethyl)methylamino]benzenediazonium	
de (p-Diazo-N-hydroxyethyl-N-methylaniline)-zinc	
chloride	ESA, FMT.
4-Methoxy-1-naphthol	X.
p-Methylaminophenol sulfate (Metol)	EK.
5-Methylbenzotriazole	EK.
6-Nitrobenzimidazole	EK, FMT.
Phenyl-5-mercaptotetrazole	FMT.
1-Phenyl-3-pyrazolidine	CGY.
Photographic chemicals, all other	DUP, EK, ESA, FMT, HST, MIL, WAY, X.
*POLYMERS FOR FIBERS:	
Cellulose acetate	CEL, DUP, EKT.
*Nylon 6 and 6/6	ALF, CEL, DUP, FRF, MON.
*Polyacrylonitrile and acrylonitrile copolymers	ACY, DUP, MON.
*Polyethylene terephthalate	CEL, DUP, EK, EKT, GYR.
Polymers for fibers, all other	BKL, DUP, EKT, FRF, MON, SKP.
*POLYMERS, WATER SOLUBLE:	
*CELLULOSE ETHERS AND ESTERS:	
Hydroxyethylcellulose	HPC, UCC.
Methylcellulose	DOW.
Sodium carboxymethylcellulose (100%)	BAS, BUK, HPC, KON.
Cellulose ethers and esters, all other	DOW HPC.
Dextran	PHR.
*POLYMERS USED AS FLOCCULANTS:	
*Polyacrylamide	ACY, CEL, DOW, HPC, MRK, X.
*All other polymers used as flocculants	ACY, DOW, X, X.
POLYACRYLIC ACID SALTS:	
Ammonium polyacrylate	BFG.
*Sodium polyacrylate	ALC, BFG, CEL, DA, RH, X.
Polyacrylic acid salts, all other	BFG, X.
Polyethyleneimine	DOW.
Polymethacrylic acid, sodium salt	GRD, X.
1-Vinyl-2-pyrrolidinone, polymers	DAN, GAF.
RARE SUGARS:	
Rare sugars	PFN.
Silicone greases	DCC, SPD, SWS.

TABLE 2.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*TANNING MATERIALS, SYNTHETIC:	
Hydroxytoluenesulfonic acid, formaldehyde condensate (Cresol-formaldehyde sulfonate), sodium salt	DA.
1-Naphthalenesulfonic acid, formaldehyde condensate and salt	DA.
*2-Naphthalenesulfonic acid, formaldehyde condensate and salt	AKS, DA, GRD, RH.
1-Phenol-2-sulfonic acid, formaldehyde condensate (Phenol-formaldehyde, sulfonated)	RH.
Tanning materials, synthetic, all other	CGY(E), DA, MIL, UCC.
*TEXTILE CHEMICALS, OTHER THAN SURFACE-ACTIVE AGENTS:	
Dimethyloldihydroxyethyene urea	CHP, DAN.
2,2',4,4'-Tetrahydroxybenzophenone	GAF.
Tri(behenoyloxymethyl)trimethoxymethylmelamine	DUP.
Textile chemicals, other than surface active agents, all other	DAN, DUP, GAF, HDG.
UREA, BY END-USE MARKETS:	
Urea, primary solution (Report on 100% urea-content basis)	ACN, ACS, ACY(E), AGY, AIP, APD, ARM, BIC, BOR, CFA, CPI, CHN, CNC, COL, FMS, FRI, GCC, GPI, HKY, HPC, JDC, MSC, OMC, PLC, SAG, SMP, SNI, SOH, TER, TRI, TVA, VLN, WLC, WYC.
UREA IN COMPOUNDS OR MIXTURES (100% BASIS):	
*Urea in feed compounds (100% Basis)	ACN, AGY, APD, BIC, FMS, JDC, MSC, SNI, SOH, TER, TRI, VLN, WYC.
*Urea in liquid fertilizer (100% Basis)	ACN, AGY, AIP, APD, ARM, BIC, CFA, CFI, CHN, CNC, FRI, GPI, HKY, HPC, JDC, MSC, PLC, SAG, SMP, SNI, SOH, TER, TRI, TVA, VLN, WLC, WYC.
*Urea in plastics (100% Basis)	ACS, ACY(E), BOR, FMS, OMC, SOH, TRI.
*Urea in solid fertilizer (100% Basis)	ACN, ACS, AGY, APD, BIC, CFA, CPI, COL, FMS, GCC, HPC, JDC, MSC, OMC, SOH, TER, TRI, TVA, VLN, WLC, WYC.
Urea liquor	TER.
Urea in compounds and mixtures (100% Basis), all other	ACS, SOH, WYC.

TABLE 3.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of miscellaneous end-use chemicals and chemical products to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company
	Allied Chemical Corp.:
ACN	Agricultural Div.
ACS	Specialty Chemicals Div.
ACY	American Cyanamid Co.
AGY	Agway, Inc., Olean Nitrogen Complex
AIP	Air Products & Chemicals, Inc.
AKS	Arkansas Co., Inc.
ALC	Alco Chemical Corp.
ALF	Allied Chemical Corp., Fibers Div.
ALL	Alliance Chemical, Inc.
ALX	Alox Corp.
APD	Atlas Powder Co. Sub. of Tyler Corp.
ARM	USS Agri-Chemicals Div. of U.S. Steel Corp.
ASH	Ashland Oil, Inc., Ashland Chemical Co. Div.
BAX	Baxter/Travenol Laoratories, Inc.
BCC	Buffalo Color Corp.
BFG	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.
BIC	Beker Industries, Inc.
BOR	Borden Co., Borden Chemical Div.
BUK	Buckeye Cellulose Corp.
CCA	Interstab Chemical, Inc.
CCW	Cincinnati Milacron Chemicals, Inc.
CEL	Celanese Corp.:
	Celanese Fibers Co.
	Celanese Polymers Specialties Co.
CFA	Cooperative Farm Chemicals Association
CFI	CF Industries, Inc.
CGY	Ciba-Geigy Corp.
CHH	CHR. Hansen's Laboratory, Inc.
CHN	N-Ren Corp., Cherokee Nitrogen Div.
CHP	C.H. Patrick & Co., Inc.
CNC	Columbia Nitrogen Corp.
COL	Collier Carbon & Chemicals Corp.
CRN	CPC International, Inc., Amerchol
CRT	Crest Chemical Corp.
DA	Diamond Shamrock Corp.
DAN	Dan River, Inc., Chemical Products Dept.
DCC	Dow Corning Corp.
DLI	Dawe's Laboratories, Inc.
DOL	Castle & Cooke, Inc., Castle & Cooke Foods, Hawaii Region
DOW	Dow Chemical Co.
DUP	E. I. duPont de Nemours & Co., Inc.
EK	Eastman Kodak Co.:
EKT	Tennessee Eastman Co. Div.
ELC	Elco Corp. Sub. of Detrex Chemical Industries, Inc.
ENJ	Exxon Chemical Co. U.S.A.
ESA	East Shore Chemical Co., Inc.
FER	Ferro Corp., Keil Chemical Div.
FIN	Hexcel Corp., Hexcel Specialty Chemicals
FMP	FMC Corp., Industrial Chemical Group
FMS	First Mississippi Corp.
FMT	Fairmount Chemical Co., Inc.
FND	Fiber Industries, Inc.
FRF	Firestone Tire & Rubber Co., Firestone Synthetic Fibers Co.
FRI	Farmland Industries, Inc.
GAF	GAF Corp.
GCC	W. R. Grace & Co.
GFS	G. Frederick Smith Chemical Co.
GLY	Glyco Chemicals, Inc.
GPI	Goodpasture, Inc.
	W.R. Grace & Co.:
GRD	Polymers & Chemicals Div.
GRH	Hatco Chemical Div.
GYR	Goodyear Tire & Rubber Co.
HDG.	Hodag Chemical Corp.
HKY	Hawkeye Chemical Co.
HMP	W. R. Grace & Co., Organic Chemicals Div.
HN	Tenneco Chemicals, Inc.
HPC	Hercules, Inc.
HST	American Hoechst Corp., Industrial Chemicals Div.
ICI	ICI United States, Inc.
JDC	Nipak, Inc.
JFR	George A. Jeffrey's & Co., Inc.
JOR	Jordan Chemical Co.
KCU	Kennecott Copper Corp., Utah Copper Div.
MCI	Mooney Chemicals, Inc.
MIL	Milliken & Co., Milliken Chemical Div.
MLS	Miles Laboratories, Inc., Marschall Div.
MMC	MC&B Manufacturing Chemists, Inc.
MON	Monsanto Co.
MOR	Marathon Morco, Co.
MRK	Merck & Co., Inc.
MSC	Mississippi Chemical Corp.
NTL	NL Industries, Inc.
OMC	Olin Corp.
OMS	E. R. Squibb & Sons, Inc.
ORO	Chevron Chemical Co.
PAR	Pennzoil Co., Penneco Div.
PAS	Pennwalt Corp.
PCW	Pfister Chemical Inc.
PEN	CPC International, Inc., Penick Corp.
PFN	Pfanstiehl Laboratories, Inc.
PFZ	Pfizer, Inc.
PHR	Pharmachem Corp.
PIC	Pierce Chemical, Inc.
PLB	P-L Biochemicals, Inc.
PLC	Phillips Petroleum Co.
PMP	Premier Malt Products, Inc.
PPG	PPG Industries, Inc.
QCP	Quaker Chemical Corp.
RBC	Fike Chemicals, Inc.
RH	Rohm & Haas Co.
RPC	A Kewanee Industry, Millmaster Onyx Group, Refined-Onyx Co. Div.

TABLE 3.--MISCELLANEOUS END-USE CHEMICALS AND CHEMICAL PRODUCTS: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
RSA	R.S.A. Corp.	TER	Terra Chemicals International, Inc.
		TNA	Ethyl Corp.
SAG	Swift Agricultural Chemicals	TRI	Triad Chemicals
SFA	Stauffer Chemical Co., Agricultural Div.	TRO	Troy Chemical Corp.
SHC	Shell Oil Co., Shell Chemical Co. Div.	TVA	Tennessee Valley Authority
SHP	Shepherd Chemical Co.	TX	Texaco, Inc.
SKP	Shakespeare Co., Monofilament Div.		
SM	Mobil Oil Corp., Chemical Co., Chemical Coatings Div.	UCC	Union Carbide Corp.
		USR	Uniroyal, Inc., Uniroyal Chemical Div.
SMP	J.R. Simplot Co., Minerals & Chemical Div.	VLN	Valley Nitrogen Producers, Inc.
SNI	Kaiser Aluminum & Chemical Corp., Kaiser Agricultural Chemicals Div.	WAY	Phillip A. Hunt Chemical Corp., Organic Chemical Div.
SOH	Vistron Corp.		
SPD	General Electric Co., Silicone Products Dept.	WBC	Worthington Biochemical Corp.
		WBG	White & Bagley Co.
SPR	Scientific Protein Laboratories, Inc.	WLC	Agrico Chemical Co.
SW	Sherwin-Williams Co.	WTC	Witco Chemical Corp.
SWS	Stauffer Chemical Co., SWS Silicones Div.	WYC	Wycon Chemical Co.

Note.--Complete names and addresses of the above reporting companies are listed in Table 1 of the Appendix.

Miscellaneous Cyclic and Acyclic Chemicals

K. James O'Connor, Jr. and Janet Dietzman

The term miscellaneous chemicals as it is used here comprises those synthetic organic products that are not included in the use groups covered by the other sections of this report. They include products that are employed in a great variety of uses. The number of chemicals used extensively for only one purpose is not large. Among the products covered are those used for refrigerants, aerosols, solvents, and a wide range of chemical intermediates.

U.S. production of miscellaneous cyclic and acyclic chemicals in 1977 amounted to 87 billion pounds, an increase of 7.5 percent over 1976. U.S. sales for 1977 totaled 39 billion pounds valued at $7.9 billion. Compared with 1976, sales quantity increased by 17 percent and sales value increased by 11.7 percent. Production of miscellaneous cyclic chemicals comprised only 2.4 percent of this section's total production.

The group among miscellaneous acyclic chemicals with the greatest volume of production and sales is the halogenated hydrocarbons. U.S. production for this group in 1977 was 23.9 billion pounds, an increase of 15 percent over the previous year. Production increased in all segments of this group except fluoronated hydrocarbons. The production of fluoronated hydrocarbons decreased from 1 million pounds in 1976 to 921,000 pounds in 1977. This segment of the industry is expected to continue its decline because of Federal regulations limiting the use of certain fluoronated hydrocarbons.

TABLE 1.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: U.S. PRODUCTION AND SALES, 1977[1]

[Listed below are all miscellaneous cyclic and acyclic chemicals for which any reported data on production or sales may be published. (Leaders (...) are used where the reported data are accepted in confidence and may not be published or where no data were reported.) Table 2 lists all miscellaneous cyclic and acyclic chemicals for which data on production and/or sales were reported and identifies the manufacturers of each]

MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand total	86,968,069	38,753,311	7,919,082	$0.20
CYCLIC				
Total	2,076,136	1,044,011	663,163	.63
Benzoic acid, sodium salt	13,600	12,348	6,632	.54
Benzoyl peroxide	7,048	7,101	16,410	2.31
Benzyl alcohol	8,096	5,526	3,982	.72
tert-Butyl peroxybenzoate	3,329	3,417	6,303	1.84
Caprolactam	867,339	...	...	...
2,6-Di-tert-butyl-p-cresol (BHT):				
Food grade	10,777	9,543	8,079	.85
Tech. grade	11,942	11,706	9,802	.84
Dioxane (1,4-Diethylene oxide)	12,251	5,671	3,902	.69
Hexamethylenetetramine, tech. grade	88,171	41,926	12,850	.31
p-Hydroxybenzoic acid, propyl ester	230	...	...	...
2-Hydroxy-4-methoxybenzophenone	793	704	1,681	2.39
Maleic anhydride	293,965	224,116	69,000	.31
α-Pinene	93,018	7,376	745	.10
β-Pinene	38,658	6,773	1,910	.28
Tall oil salts	2,887	2,725	1,810	.66
All other miscellaneous cyclic chemicals	624,032	705,079	520,057	.73
ACYCLIC				
Total	84,891,933	37,709,300	7,255,919	.19
Nitrogenous Compounds				
Total[3]	7,236,831	2,050,792	764,851	.37
Amides	297,050	125,605	69,857	.56
Amines, total	1,410,088	416,757	225,756	.55
Butylamines, total	...	38,963	20,334	.52
n-Butylamine, mono-	3,977	...	...	...
Di-n-butylamine	4,424	3,636	2,169	.60
All other butylamines	...	35,327	18,165	.51
Ethylamines:				
Diethylamine	14,179	6,964	3,943	.57
Triethylamine	13,700	10,983	8,016	.73
Isopropylamine, mono-	42,632	39,561	14,016	.35
Methylamines:				
Dimethylamine	71,815	62,094	19,807	.32
Methylamine, mono-	53,227	31,353	9,958	.32
Trimethylamine	31,705	27,613	8,316	.30
All other	1,174,429	199,226	141,366	.75
2-Dimethylaminoethanol (N,N-Dimethylethanolamine)	7,008	5,411	4,120	.76
Ethanolamines, total	308,409	268,910	93,954	.35
2-Aminoethanol (Monoethanolamine)	102,732	89,356	30,037	.34
2,2'-Aminodiethanol (Diethanolamine)	100,932	83,773	29,451	.35
2,2',2''-Nitrilotriethanol (Triethanolamine)	104,745	95,781	34,466	.36

See footnotes at end of table.

TABLE 1.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE [2]
ACYCLIC--Continued				
Nitrogenous Compounds--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Hexamethylene diamine adipate (Nylon salt)	876,500	...	...	...
Nitriles, total	...	717,325	156,347	.22
Acetonitrile	57,840	...	...	...
Acrylonitrile	1,646,021	526,389	127,869	.24
2-Methyllactonitrile (Acetone cyanohydrin)	843,692	...	...	...
Nitriles, all other	...	190,936	28,478	.15
All other nitrogenous compounds	1,790,223	516,784	214,817	.42
Acids, Acyl Halides, and Anhydrides				
Total	6,590,128	1,480,422	438,051	.30
Acetic acid, 100%	2,570,238	599,990	79,729	.14
Acetic anhydride, 100%	...	138,563	30,618	.22
Acrylic acid	283,358	40,137	12,894	.32
Adipic acid	1,535,500	181,097	61,554	.34
Dodecenylsuccinic anhydride	1,342	1,264	868	.69
Fumaric acid	33,971	28,567	11,689	.41
Lauroyl chloride	2,045	...	...	...
Oxalic acid	12,285	12,278	4,899	.40
Polyacrylic acid	1,948	1,821	1,671	.92
Propionic acid	84,020	48,619	8,518	.18
All other acids, acyl halides, and anhydrides	2,065,421	428,086	225,611	.53
Salts of Organic Acids				
Total	401,897	322,087	166,266	.52
Acetic acid salts, total	23,054	20,082	11,258	.56
Barium acetate	99	58	103	1.77
Sodium acetate	18,496	...	...	...
Zinc acetate	415	417	521	1.25
All other	4,044	19,607	10,634	.54
2-Ethylhexanoic acid (α-Ethylcaproic acid) salts, total	16,281	15,683	19,470	1.24
Calcium 2-ethylhexanoate	1,991	2,003	1,377	.69
Cobalt 2-ethylhexanoate	4,409	3,975	6,582	1.66
Lead 2-ethylhexanoate	1,896	1,899	1,126	.59
Manganese 2-ethylhexanoate	1,401	1,442	1,056	.73
Zinc 2-ethylhexanoate	1,565	1,545	1,285	.83
Zirconium 2-ethylhexanoate	2,660	2,619	3,650	1.39
All other	2,359	2,200	4,394	2.00
Maleic acid salts	1,327	534	1,719	3.22
Stearic acid salts, total[4]	91,579	90,722	57,130	.61
Aluminum distearate	3,005	2,967	2,242	.76
Aluminum tristearate	297	298	229	.77
Barium stearate	795	797	578	.73
Cadmium stearate	48	48	98	2.04
Calcium stearate	50,535	50,980	28,297	.56
Lead stearate	1,446	1,211	904	.75
Magnesium stearate	4,991	4,583	3,141	.56
Zinc stearate	26,680	25,865	18,313	.71
All other	3,782	3,973	3,328	.84
All other salts of organic acids	269,656	195,066	76,689	.39

See footnotes at end of table.

TABLE 1.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
ACYCLIC--Continued				
Aldehydes	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Total	8,904,565	3,147,460	204,397	.06
Butyraldehyde	791,942	42,948	7,821	.18
Formaldehyde (37% by weight)	6,046,497	2,789,782	127,517	.05
Isobutyraldehyde	382,853	4,953	670	.14
All other	1,683,273	309,777	68,389	.22
Ketones				
Total	3,335,042	2,450,700	403,060	.16
Acetone, total	2,218,619	1,556,443	211,240	.14
From cumene	1,323,751	1,117,867	147,837	.13
From isopropyl alcohol	894,868	438,576	63,403	.14
2-Butanone (Methyl ethyl ketone)	511,581	509,463	95,293	.19
4-Hydroxy-4-methyl-2-pentanone (Diacetone alcohol)	...	46,750	12,688	.27
4-Methyl-2-pentanone (Methyl isobutyl ketone)	241,455	165,043	41,882	.25
4-Methyl-3-penten-2-one (Mesityl oxide)	37,639	22,372	5,851	.26
All other	325,748	150,629	36,106	.24
Alcohols, Monohydric, Unsubstituted				
Total	14,374,044	8,639,319	1,030,250	.12
Alcohols, C_{11} or lower, unmixed, total	13,371,423	...	...	...
Butyl alcohols:				
n-Butyl alcohol (n-Propylcarbinol)	840,488	420,425	72,940	.17
Isobutyl alcohol (Isopropylcarbinol)	173,319	130,014	17,250	.13
Ethyl alcohol, synthetic[5]	1,338,635	942,972	170,860	.18
2-Ethyl-1-hexanol	492,589	339,429	70,468	.21
n-Hexyl alcohol	41,431	24,719	5,743	.23
Isopropyl alcohol	1,888,413	1,281,993	162,165	.13
Methanol, synthetic	6,452,741	3,630,385	210,111	.06
Propyl alcohol (Propanol)	111,067	86,929	20,643	.24
All other	2,032,740	...	...	...
Alcohols, C_{12} and higher, unmixed	380,661	...	...	...
All other unmixed monohydric alcohols	...	1,364,300	167,823	.12
Mixtures of alcohols	580,529	418,153	132,247	.32
Esters of Monohydric Alcohls				
Total	3,916,779	2,108,331	588,550	.28
n-Butyl acetate, unmixed	114,291	109,797	27,090	.25
Butyl acrylate	260,067	125,852	44,078	.35
Dibutyl maleate	4,826	5,273	1,978	.38
Di(2-ethyl-1-hexyl) maleate	779	...	...	...
Dilauryl-3,3'-thiodipropionate	2,100	2,093	2,548	1.22
Ethyl acetate (85%)	217,846	220,225	38,302	.17
Ethyl acrylate	260,187	128,118	36,318	.28
2-Ethyl-1-hexyl acrylate	47,430	48,337	19,102	.40
Fatty Acid Esters, not included with plasticizers or surface-active agents	25,570	25,890	13,487	.52
Isobutyl acetate	...	42,734	10,262	.24
Methyl acetate	4,466	...	...	...
Methyl methacrylate	744,950	194,969	72,055	.37
Phosphorus acid esters, not elsewhere specified	54,830	45,087	36,030	.80
Propyl acetate	49,411	44,654	11,376	.25
Vinyl acetate	1,585,745	789,442	140,333	.18
All other	544,281	325,860	135,591	.42

See footnotes at end of table.

TABLE 1.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS	Production	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
ACYCLIC--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Polyhydric Alcohols[6]				
Total	4,993,181	4,016,911	918,946	.23
Ethylene glycol	3,675,461	2,958,366	556,557	.19
Glycerol, synthetic only	140,631	131,768	62,726	.48
Pentaerythritol	114,114	107,341	47,036	.44
Propylene glycol	489,064	487,152	121,146	.25
Sorbitol (70% by weight)	196,036	163,507	54,343	.33
All other	377,875	168,777	77,138	.46
Polyhydric Alcohol Esters				
Total	345,531	120,902	58,536	.48
Trimethylolpropane triacrylate	1,067	...	...	...
All other	344,464	120,902	58,536	.48
Polyhydric Alcohol Ethers				
Total	1,764,468	1,304,165	385,770	.30
2-Butoxyethanol	170,165	148,805	44,017	.30
2-(2-Butoxyethoxy)ethanol (Diethylene glycol monobutyl ether)	34,485	25,413	7,965	.31
2-[2-(2-Butoxyethoxy)ethoxy]ethanol (Triethylene glycol, monobutyl ether	7,457	...	...	...
Diethylene glycol	327,158	244,867	41,198	.17
Dipropylene glycol	54,266	50,602	12,090	.24
2-Ethoxyethanol	232,928	116,725	29,815	.26
2-(2-Ethoxyethoxy)ethanol (Diethylene glycol monoethyl ether)	36,352	32,143	8,493	.26
2-[2-(2-Ethoxyethoxy)ethoxy]ethanol (Triethylene glycol monoethyl ether)	19,383	...	...	...
2-Methoxyethanol (Ethylene glycol monomethyl ether)	113,024	96,579	25,755	.27
2-(2-Methoxyethoxy)ethanol (Diethylene glycol monomethyl ether)	17,335	12,648	3,636	.29
2-[2-(2-Methoxyethoxy)ethoxy]ethanol (Triethylene glycol monomethyl ether)	24,613	9,208	3,269	.35
Polyethylene glycol	109,728	81,041	30,517	.38
Polypropylene glycol	30,394	24,388	9,060	.37
Propylene glycol, mixed ethers	27,674	...	...	...
Tetraethylene glycol	...	16,583	6,096	.37
Triethylene glycol	129,622	101,237	29,521	.29
All other	429,884	343,926	134,338	.39
Halogenated Hydrocarbons				
Total	23,901,524	9,743,606	1,579,750	.16
Brominated hydrocarbons	83,453	...	...	...
Chlorinated hydrocarbons, total	22,897,188	8,879,757	1,165,373	.13
Carbon tetrachloride	809,063	385,491	49,078	.13
Chlorinated paraffins, total	...	81,502	23,127	.28
35%-64% chloride	71,777	70,926	18,755	.26
Other	...	10,576	4,372	.41
Chloroethane (Ethyl chloride)	612,481	295,717	40,807	.14
Chloroform	301,526	285,114	49,387	.17
Chloromethane (Methyl chloride)	475,975	195,933	26,868	.14
1,2-Dichloroethane (Ethylene dichloride)	10,996,772	1,525,984	123,107	.08
Dichloromethane (Methylene chloride)	477,856	475,118	87,494	.18
1,2-Dichloropropane (Propylene dichloride)	58,529	...	...	...
Tetrachloroethylene (Perchloroethylene)	614,126	526,993	62,994	.12

See footnote at end of table.

TABLE 1.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: U.S. PRODUCTION AND SALES, 1977[1]--CONTINUED

MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE[2]
ACYCLIC--Continued				
Halogenated Hydrocarbons--Continued	*1,000 pounds*	*1,000 pounds*	*1,000 dollars*	*Per pound*
Chlorinated hydrocarbons, total--Continued:				
1,1,1-Trichloroethane (Methyl chloroform)	634,844	560,070	114,428	.20
Trichloroethylene	297,503	295,386	47,094	.16
Vinyl chloride, monomer (Chloroethylene)	5,985,912	4,127,058	507,545	.12
All other chlorinated hydrocarbons	1,560,824	125,391	33,444	.27
Fluorinated hydrocarbons, total	920,825	...	...	...
Chlorodifluoromethane (F-22)	179,368	128,676	88,123	.68
Dichlorodifluoromethane (F-12)	358,281	339,559	135,923	.40
Tetrafluoroethylene, monomer	24,990	...	...	...
Trichlorofluoromethane (F-11)	212,556	197,211	66,907	.34
All other fluorinated hydrocarbons	145,630	...	...	...
Iodinated hydrocarbons	58	...	...	...
All other halogenated hydrocarbons	...	198,403	123,424	.62
All Other Miscellaneous Acyclic Chemicals				
Total	9,127,943	2,324,605	717,492	.31
2-Butanone peroxide	8,236	8,386	9,911	1.18
ert-Butyl peroxide (Di-tert-butyl peroxide)	2,830	2,728	2,669	.98
Carbon disulfide	504,528	389,963	31,164	.08
Epoxides, ethers, and acetals, total	6,664,811	1,611,567	369,352	.23
Ethylene oxide	4,364,070	548,640	129,049	.24
Ethyl ether, absolute	8,141	...	...	...
Propylene oxide	1,865,838	...	...	...
All other epoxides, ethers, and acetals	426,762	1,062,927	240,303	.23
Hydrocarbons	...	4,693	2,720	.58
Phosgene (Carbonyl chloride)	665,993	...	...	...
Silicone fluids	142,408	68,797	114,687	1.67
Sodium methoxide (Sodium methylate)	9,982	15,323	4,775	.31
All other	1,129,155	223,148	182,214	.81

[1] Certain data have been revised for 1976. These revisions are summarized below:

MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS	PRODUCTION	SALES		
		QUANTITY	VALUE	UNIT VALUE
	1,000 pounds	*1,000 pounds*	*1,000 dollars*	*Per pound*
Grand Total	80,891,931	33,109,792	7,087,731	.21
Miscellaneous chemicals, cyclic, total	2,214,054	1,019,104	635,006	.62
All other miscellaneous chemicals, cyclic	1,026,402	751,087	514,005	.68
Miscellaneous chemicals, acyclic, total	78,677,877	32,090,688	6,452,725	.20
Nitrogenous compounds, total	6,561,675	1,904,620	742,255	.39
Amines, total	1,317,039	415,658	227,511	.55
Amines, all other	327,433	283,490	174,833	.62
Nitrogenous compounds, all other	760,188	424,383	190,114	.45

[2] Calculated from rounded figures.

[3] Statistics exclude production and sales of fatty amines. Statistics on fatty amines are given with "Surface-Active Agents."

[4] Statistics exclude production and sales of potassium and sodium stearates. Statistics on these stearates are included with "Surface-Active Agents."

[5] Statistics on production of ethyl alcohol from natural sources by fermentation are issued by the Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms.

[6] Some polyols which are used as intermediates for urethanes have been included with "Plastics and Resin Materials."

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977

[CHEMICALS FOR WHICH SEPARATE STATISTICS ARE GIVEN IN TABLE 1 ARE MARKED BELOW WITH AN ASTERISK (*); CHEMICALS NOT SO MARKED DO NOT APPEAR IN TABLE 1 BECAUSE THE REPORTED DATA ARE ACCEPTED IN CONFIDENCE AND MAY NOT BE PUBLISHED. MANUFACTURERS' IDENTIFICATION CODES SHOWN BELOW ARE TAKEN FROM TABLE 3. AN "X" SIGNIFIES THAT THE MANUFACTURER DID NOT CONSENT TO HIS IDENTIFICATION WITH THE DESIGNATED PRODUCT. COMPANY IDENTIFICATION CODES WHICH ARE FOLLOWED BY AN "(E)" ARE SO LABELED BECAUSE THE COMPANY FAILED TO SUPPLY THE U.S. INTERNATIONAL TRADE COMMISSION WITH THEIR DATA IN SUFFICIENT TIME FOR ITS INCLUSION IN THIS REPORT. THE COMPANY IS PRESUMED TO HAVE CONTINUED PRODUCTION OF THE COMPOUND IN QUESTION IN 1977 AND THE VOLUME OF PRODUCTION AND SALES HAS BEEN ESTIMATED BY THE USITC STAFF MEMBERS]

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
CYCLIC	
6-Acetoxy-2,4-dimethyl-1,3-dioxane	GIV.
Acetylcyclohexane sulfonyl peroxide	WTL.
1-(3-Aminopropyl)morpholine	JCC.
BENZOIC ACID SALTS:	
*Sodium benzoate	HN, MON, PFZ.
Benoic acid salts, all other	SYP(E).
p-Benzoquinone (p-Quinone)	EKT.
Benzothiazole	ACY, RCI.
Benzotriazole, substituted	CGY.
*Benzoyl peroxide	AZT, CAD, NOC, WTC, WIL.
*Benzyl alcohol	MNR, SFS, UOP, VEL.
Bis(2,4-dichlorobenzoyl) peroxide	CAD, WTL.
Bis(α,α-dimethylbenzyl)peroxide	ARC, WTL.
2,4-Bis(4-hydroxy-3,5-di-tert-butylphenoxy)-6-(n-octylthio)-1,3,5-triazine	CGY(E).
2,4-Bis(n-octylthio-6-(4'-hydroxy-3',5'-di-tert-butylanlino)-1,35-triazine	CGY(E).
Boron fluoride - phenol complex	ACS.
N-Bromosuccinimide (Succinibromimide)	ARA.
Butyl benzoate	PFZ, TCC, VEL.
2(and 3)-tert-Butyl-4-methoxyphenol (BHA)	EKT, X.
*tert-Butyl peroxybenzoate	AZT, CAD, NOC, WTC, WTL.
4-tert-Butylpyrocatechol	BKL, DOW.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
Camphene	HPC, NCI, SCM.
*Caprolactam (2-Oxohexamethylenimine)	ALF, CNP, DBC.
Cellulose acetate phthalate	EK, UCC.
1-(3-Chloroally)-3,5,7-triaza-1-azoniaadamantane chloride	DOW.
Cumene hydroperoxide	ACS, CLK, RCI.
Cyanuric acid	FMB.
Cyclohexanone peroxide	NCC.
1,4-Cyclohexylenedimethanol	EKT.
Cyclopropane	OH.
Decabromobiphenyl or ether	DOW, FIN, WCC.
Decahydronaphthalene (Decalin)	DUP.
Dehydroacetic acid or sodium salt	EKT, GAN.
Diazodinitrophenol	HPC.
2,5-Di(benzoyl peroxy)-2,5-dimethylhexane	WTC, WTL.
*2,6-Di-tert-butyl-p-cresol, (BHT), Food grade	ASH, KPT, SHC, USR.
*2,6-Di-tert-butyl-p-cresol, (BHT), Technical grade	ASH, KPT, SHC, USR.
2,5-Di-tert-butylhydroquinone	EKT.
1,3-Dichloro-5,5-dimethylhydantoin	GLY.
Dichloro-s-triazine-2,4,6(1H,3H,5H)trione (Dichloro isocyanuric acids and salts)	FMB.
4,4'-Dichloro-3-(trifluoromethyl)carbanilide	CGY.
Dicyclohexylammonium nitrite	OMC.
2,5-Dihydrothiophene-1,1-dioxide (Sulfolene)	GAF, PLC, WTC.
2,2'-Dihydroxy-4,4'-dimethoxybenzophenone	GAF.
3,5-Dihydroxy-3,5,dimethyl-1,2-peroxycyclopentane	WTL.
2,2'-Dihydroxy-4-methoxybenzophenone	ACY
Diiodomethyl-p-tolylsulphone	ABB.
Diisopropylbenzene hydroperoxide	HPC.
Diketene	EKT.
p-Dimethoxybenzene (Dimethyl ether of hydroquinone)	ASL, EKT.
4,4-Dinitrocarbanilide-4,6-dimethyl-2-pyrimidinol	MRK.
Di-n-octadecyl-3,5-di-tert-butyl-4-hydroxyphenyl phosphonate	CGY(E).
* Dioxane (1,4-Diethylene oxide)	CWN, DOW, FER, UCC.
1,3-Dioxolane	FER.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
4-(Dodecyloxy)-2-hydroxybenzophenone	DUP, EKT.
1,2-Epoxy-3-phenoxypropane (Glycidyl phenyl ether)	X.
Ethyl cellulose phthalate	EK.
Ethyleneimine, monomer	DOW.
2-Ethylhexyl benzoate	TCC.
Ethylidine norbornene	UCC, X.
FURAN DERIVATIVES:	
2-Furaldehyde (Furfural)	QKO.
Tetrahydrofurfuryl alcohol	QKO.
Gallic acid, tech.	MAL.
Glyceryl p-aminobenzoate	VND.
*Hexamethylenetetramine, tech.	BOR, HKD, HMP, HN, PLS, WCL.
Hydrindantin	HEX, PIC.
p-Hydroxybenzoic acid, butyl ester	HN.
p-Hydroxybenzoic acid, ethyl ester	HN.
p-Hydroxybenzoic acid, methyl ester	ARS, HN, LEM.
*p-Hydroxybenzoic acid, propyl ester	ARS, HN, LEM.
*2-Hydroxy-4-methoxybenzophenone	ACY, GAF, GLY.
2-Hydroxy-4-methoxy-5-sulfobenzophenone trihydrate	ACY.
2-(2-Hydroxy-5-tert-octylphenyl)benzotriazole	ACY.
Isopropyl-o-cresols	UCC.
LACTONES:	
Butyrolactone	GAF.
Glucono-6-lactone	PFZ.
*Maleic anhydride	ACC, ASH, DKA, HN, KPT, MON, PTT, RCI, USS.
p-Menthane	HPC.
8-p-Menthyl hydroperoxide	HPC.
p-Methoxybenzylidenemalonic acid, diethyl and dimethyl esters	ACY.
p-Methoxybenzylidenemalonic acid, dimethyl ester	ACY.
4-Methoxyphenol	ASL, EKT.
2,2'-Methylenebis[4-chlorophenol] (Dichlorophene)	GIV.
2,2'-Methylenebis[3,4,6-trichlorophenol] (Hexachlorophene)	GIV.
4-Methylmorpholine	JCC, UCC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
C Y C L I C--Continued	
1-Methyl-2-pyrolidone,monomer	GAF.
Morpholine	DOW, JCC.
Morpholine salt of p-toluene sulfonic acid	AMB, ASH.
Octadecyl-3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate	CGY(E).
Phenothiazine	WAG.
2-Phenoxyethanol (Ethylene glycol monophenyl ether)	DOW, TCH.
2-(2-Phenoxyethoxy)ethanol (Diethylene glycol phenyl ether)	DOW.
Phthalic acid, lead salt, (Dibasic)	NTL.
Picramic acid, sodium salt	SDC.
*α-Pinene	ARZ, CBY, NCI, SCM.
*β-Pinene	ARZ, CBY, HPC, NCI, SCM.
Pinene, sulfate	HPC.
Pinene, wood	HPC.
Piperazine, ethoxylated	GAF.
Poly-4-(2-acryloxyethoxy)-2-hydroxybenzophenone	ACY.
Propyl gallate	EKT.
Resorcinol monobenzoate	EKT.
ROSIN ACID SALTS:	
Calcium resinate	CBY.
Calcium zinc resinate	CBY.
Salicylic acid, lead salt	NTL.
Styrene oxide	UCC.
Succinic anhydride	ACS, ORO.
Tall oil, chemically modified	FOC, X.
*TALL OIL SALTS (LINOLEIC-ROSIN ACID SALTS):	
Calcium maganese tallate	MCI.
Calcium tallate	CCA, HN, MCI, X.
Cobalt tallate	CCA, HN, MCI, SHP.
Lead manganese tallate	MCI.
Lead tallate	HN, MCI.
Manganese tallate	HN, MCI, SHP.
Tri(oxyaluminum tallate)	KCH.
Zinc tallate	MCI.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
*TALL OIL SALTS (LINOLEIC-ROSIN ACID SALTS)--Continued	
Tall oil salts, all other (Linoleic-rosin acid salts)	MCI, ZGL.
Terpine hydrocarbons, monocyclic (Solvenol)	NCI,
Tetrabromobisphenol A	GTL.
2,3,5,6-Tetrachloro-4-(methylsulfonyl) pyridine	DOW.
1,2,3,4-Tetrahydronaphthalene (Tetralin)	DUF.
Tetrahydrothiophene	PAS.
Tetrahydrothiophene-1,1-dioxide (Sulfolane)	PLC.
[2,2'-Thiobis(4-octylphenolate)]-n-butylamine nickel salt	ACY.
Thiophene	PAS.
Triallyl cyanurate	ACY.
3,4,4'-Trichlorocarbanilide	MON.
1,3,5-Trichloro-s-triazine-2,4,6-(1H,3H,5H)trione (Trichloroisocyanuric acid)	MON.
1,2,3-Triketohydrindene hydrate	PIC.
3,5,5-Trimethyl-2-cyclohexene-1-one (Isophorone)	ENJ.
2,4,6-Trinitroresorcinol and lead derivative	REM.
Triphenyl phosphite	MON.
1-Vinyl-2-pyrrolidinone--other copolymers	GAF.
1-Vinyl-2-pyrrolidinone ethylacrylate, copolymer	GAF.
1-Vinyl-2-pyrrolidinone-methylacrylic acid, dimethyl amine ethyl ester, copolymer	GAF.
1-Vinyl-2-pyrrolidinone, monomer	GAF, TKL.
1-Vinyl-2-pyrrolidinone--vinyl acetate copolymer	GAF, UCC.
Cyclic chemicals, all other	AAC, AIP, ALB, AMB, ARA, ARS, AZT, CAD, CGY(E), CHT, CTN, DOW, EK, EKT, EVN, FIN, GAF, GIV, GLY, GOC, HMY, HPC, JCC, KCU, MON, PAS, PD, PFN, PIC, SCM, SAL, SM, STC, SW, SYP(E), TNA, TNI, UCC, UPJ, VEL, VIK, VTC, WAY, WCC, WTC, WTL, X, X.
A C Y C L I C	
*NITROGENOUS COMPOUNDS:	
Acetamidoethanol (N-Acetyl-ethanolamine)	SBC.
β-Alanine	HFT.
Dl-Allyl-3-(2-hydroxyethyl)-2-thiourea	FMT.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
NITROGENOUS COMPOUNDS--Continued	
*AMIDES:	
Acetamide	ACS.
Acrylamide monomer	ACY, X.
1,1'-Azobisformamide	FMT, NPI, USR.
N-Bromoacetamide	ABA.
Chloro-N-(2-hydroxyethyl)acetamide	KF.
Coconut oil amide	ARC, HUM.
N,N-Diethyldodecanamide	EK, X.
N,N-Dimethylacetamide	DUP.
3-Dimethylformamide	AIP, DUP.
Erucamide	FIN, HUM.
Erucamide - lauramide	FIN.
N,N'-Ethylenebis-oleamide (Cleic acid-ethylenediamine condensate (Amine/acid ratio = 1/2)	ARC.
N,N'-Ethylenebis(stearamide)	CCW.
Fish oil fatty acid amide	HUM.
Formamide	DUP.
12-Hydroxystearamide	CCW.
Methacrylamide	DUP.
N-Methylacetamide	ARS.
N,N'-Methylenebis(acrylamide)	ACY.
Oleamide (Octadecene amide)	ARC, FIN, GLY, HUM.
Oleoylpalmitamide	FIN.
Stearamide (Octadecane amide)	ARC, FIN, GLY, HUM.
Stearylerucamide	FIN.
Tallow amide, hydrogenated	ARC.
Amides, all other	ARS, EKT, FIN, HAL, KF, TKL, VGC.
*AMINES:	
Allylamines	SHC.
Bis-hexamethylenetriamine amine	DUP.
*BUTYLAMINES:	
*n-Butylamine, mono	AIP, PAS, VGC.
sec-Butylamine, mono	PAS, VGC.
tert-Butylamine, mono	MCN.
*Di-n-butylamine	AIP, PAS, VGC.
Diisobutylamine	AIP, VGC.
Tri-n-butylamine	PAS, VGC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
NITROGENOUS COMPOUNDS--Continued	
AMINES--Continued	
BUTYLAMINES--Continued	
n-Butylethylamine	PAS.
Diethylenetriamine	DOW, UCC.
N¹,N¹-Diethyl-1,4-pentanediamine (Novoldiamine)	MOB.
Diisopropylamine	PAS, UCC.
Dimethylaminopropylamine	JCC.
1,3-Dimethylbutylamine	VGC.
ETHYLAMINES:	
*Diethylamine	AIP, PAS, UCC, VGC.
Ethylamine, mono	AIP, PAS, UCC, VGC.
*Triethylamine	AIP, PAS, UCC, VGC.
Ethylenediamine	DOW, JCC, UCC.
(2-Ethylhexyl)amine, mono-	VGC.
1,6-Hexanediamine (Hexamethylenediamine)	CEL, DUP, ELP, MON.
n-Hexylamine	PAS.
3,3'-Iminobispropylamine	JCC.
*Isopropylamine, mono	AIP, PAS, UCC, VGC.
METHYLAMINES:	
*Dimethylamine	AIP, DUP, GAF, IMC.
Dimethylamine sulfate	GLY, RH.
*Methylamine, mono	AIP, DUP, GAF, IMC.
*Trimethyl amine	AIP, DUP, GAF, IMC.
n-Octylamine, mono	VGC.
Pentaethylenehexamine	UCC.
PENTYLAMINES (AMYLAMINES):	
Dipentylamine	PAS.
Pentylamine, mono	PAS.
1,2-Propanediamine (Propylenediamine)	VGC.
1,3-Propanediamine (1,3-Diaminopropane)	JCC.
Tripentylamine	PAS.
PROPYLAMINES:	
Dipropylamine	AIP, VGC.
Propylamine, mono	PAS, VGC.
Tripropylamine	PAS, VGC.
Tetraethylenepentamine	DOW, UCC.
N,N,N',N'-Tetramethyl-1,3-butanediamine	UCC.
Tetramethylethylenediamine	RH.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
NITROGENOUS COMPOUNDS--Continued	
AMINES--Continued	
Triethylenetetramine	DOW, UCC.
Amines, all other	AAC, ABB, BAS, EK, JCC, ONX, PAS, RH, UCC, USR, VGC, VGC, WAY, X.
2-Amino-1-butanol	IMC.
2-Aminoethanol (Monoethanol amine) sulfite	EVN.
Aminoethoxyethanol	JCC.
2-(2-Aminoethylamino)ethanol (Aminoethylethanol amine)	DOW, HDG, UCC.
2-Aminoethyl mercaptoacetate (Monoethanolamine thio glycolate)	EVN.
2-Amino-2-ethyl-1,3-propanediol	IMC.
2-Amino-2-(hydroxymethyl)-1,3-propanediol [Tris (hydroxymethyl)aminomethane]	IMC.
2-Amino-2-methyl-1,3-propanediol	IMC.
2-Amino-2-methyl-1,3-propanediol condensate	IMC.
2-Amino-2-methyl-1-propanol	IMC.
2-Amino-2-methyl-1-propanol hydrochloride	VAL.
1,3-Bis(hydroxymethyl)urea (Dimethylolurea)	GLY.
Biuret (Carbamyl urea)	DOW.
1-Butyl-3-ethyl-2-thiourea	PAS.
Butyl isocyanate	UPJ, X.
Chlorocholine chloride	ACY.
2-Chloro-N,N-diethylethylamine hydrochloride	HEX, VEL.
2-Chloro-N,N-dimethylethylamine (Dimethylamino ethyl chloride) hydrochloride	HEX, VEL.
2-Chloro-N,N-dimethylpropylamine hydrochloride	VEL.
3-Chloro-N,N-dimethylpropylamine hydrochloride	VEL.
Choline base	RH.
Cyanoacetic acid	KF.
2-Dibutylaminoethanol	PAS.
1,3-Dibutyl-3-thiourea	PAS, RBC.
1,4-Dicyanobutene	DUP.
2-Diethylaminoethanol (N,N-Diethylethanolamine)	PAS, UCC.
2-Diethylaminoethyl acrylate	CPS.
2-Diethylaminoethyl methacrylate	CPS, DUP, UCC.
Diethylhydroxylamine	PAS.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
NITROGENOUS--Continued	
1,3-Diethyl-2-thiourea	PAS, RBC.
2-Diisopropylaminoethanol (N,N-Diisopropylethanol amine)	PAS, UCC.
2-Diisopropylaminoethyl methacrylate	X.
Di-(methoxyethyl)hydroxylamine	X.
2-Dimethylaminoethanethiol hydrochloride	EVN.
*2-Dimethylaminoethanol (N,N-Dimethylethanolamine)	JCC, PAS, UCC.
Dimethylaminoethyl methacrylate	AAC, CPS.
Dimethylaminoethylmethacrylate, methyl chloride, quaternary salt	AAC.
Dimethylamino-2-propanol	PAS.
1,1-Dimethylhydrazine	USR.
Dimethyl isocyanate	GNM.
2,5-Dithiobiurea	FMT.
Dithiooxamide	RBC.
*ETHANOLAMINES:	
*2,2'-Aminodiethanol (Diethanolamine)	DOW, JCC, OMC, UCC.
*2-Aminoethanol (Monoethanolamine)	DOW, GLY, JCC, OMC, UCC.
*2,2',2''-Nitrilotriethanol (Triethanolamine)	DOW, JCC, OMC, UCC.
2-Ethylaminoethanol (Ethylmonoethanolamine)	PAS, UCC.
Ethyl cyanoacetate	KF.
Ethyl formylglycine	ARC.
5-(N-Ethyl-N-hydroxyethylamino)-2-pentanone	SDW, UCC.
Formamidinedisulfide dihydrochloride	WAY.
Glycine ethyl ester hydrochloride	SFS.
Glycine (Aminoacetic acid), non-medical	CHT.
*Hexamethylenediamine adipate (Nylon salt)	CEL, DUP, MON.
2-(Hydroxymethyl)-2-nitro-1,3-propanediol (Tris-(hydroxymethyl)nitromethane)	IMC.
ISOPROPANOLAMINES:	
1-Amino-2-propanol (Monoisopropanolamine)	DOW.
1,1'-Iminodi-2-propanol (Diisopropanolamine)	DOW.
1,1',1''-Nitrilotri-2-propanol (Triisopropanol amine)	DOW.
2-Isopropylaminoethanol	PAS.
Isopropyl ethylthionocarbamate	DOW.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
NITROGENOUS COMPOUNDS--Continued	
Ketimine, tetrafunctional	GNM, MIL.
3-Methoxypropylamine	JCC.
2-Methylaminoethanol (N-Methylethanolamine)	PAS, UCC.
Methyl carbamate	BKL.
Methyl cyanoacetate	KF.
Methyl α-cyanoacrylate	EKT.
2,2'-(Methylimino)diethanol (Methyldiethanolamine)	PAS, UCC.
Methyl isocyanate	UCC.
2-Methyl-2-nitro-1-propanol	IMC.
N-Methyltaurine	GAF.
Nitrated lard oil	SM.
*NITRILES:	
*Acetonitrile	DUP, EKX, MON, SOH.
*Acrylonitrile, monomer	ACY, DUP, MON, SOH.
Adiponitrile	DUP, ELP, MON.
n-Butyronitrile	EKX, WYT.
Coconitrile	ASH.
Crotononitrile	RBC.
3-Dimethylaminopropionitrile	ACY.
3-Ethoxypropionitrile	DIX.
Glycolonitrile	KF.
Hydracrylonitrile (Ethylene cyanohydrin)	TKL.
Isobutyronitrile	AIP, EKX.
Lactonitrile	MON.
Malononitrile	ASH.
Methacrylonitrile	DOW.
*2-Methyllactonitrile (Acetone cyanohydrin)	DUP, MON, RH.
Oleonitrile (Octodecene nitrile)	ARC.
Stearonitrile (Octadecane nitrile)	ASH.
Tall oil nitrile	ASH.
Tallow nitrile	ASH.
Tallow nitrile, hydrogenated	ASH.
3,3'-Thiodipropionitrile	EVN.
Vinylacetonitrile	RBC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
NITROGENOUS COMPOUNDS--Continued	
NITRILES--Continued	
Nitriles, all other	ARA, ASH, HMP, KF.
Nitroethane	IMC.
Nitromethane	IMC.
1-Nitropropane	IMC.
2-Nitropropane	IMC.
Octadecyl isocyanate	UPJ.
Pentaerythritol tetranitrate	DUP, HPC.
n-Propyl carbamate	BKL.
Propylisocyanate	HPC.
Sarcosine (N-Methylaminoacetic acid)	CGY, HMP.
Semicarbazide hydrochloride	FMT.
N,N,N',N'-Tetrakis(2-hydroxypropyl)ethylenediamine	BAS.
Tetramethylammonium bromide	RSA.
Tetramethylammonium chloride	RSA.
Tetramethylguanidine	ACY.
Thiosemicarbazide	ACY, FMT.
Nitrogenous compounds, acyclic, all other	AAC, ACS, ARA, BME(E), CHP, CPS, DAN, DOW, DUP, EK, EKT, EVN, GOC, HCP, HMP, IMC, JCC, MON, PAS, PCW, PD, PFZ, PIC, RBC, REM, RH, RSA, S, SBC, SCP, SK, STC, TKL, TNA, USR, VAL, VEL, WAY, WYC, X, X, X.
*ACIDS, ACID ANHYDRIDES, AND ACYL HALIDES:	
*ACETIC ACID, 100%:	
Acetic acid, synthetic (100%)	BOR, CEL, EKT, FMP, MON, UCC.
*ACETIC ANHYDRIDE, 100%:	
Acetic anhydride from acetaldehyde (100%)	EKT.
Acetic anhydride from acetic acid, other than recovered, by the vapor-phase process (100%)	CEL, UCC.
*Acrylic acid	CEL, DBC, UCC.
*Adipic acid	ALF, CEL, DUP, ELP, X.
Azelaic acid	EMR.
Bromobutyric acid	GTL.
α-Bromolauric and stearic acids	DUP.
tert-Butylperoxy maleic acid	WTC, WTL.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ACIDS, ACID ANHYDRIDES, AND ACYL HALIDES--Continued	
Butyric acid	CEL, EKT.
Butyric anhydride	EKT.
Butyryl chloride	WCC.
Castor oil fatty acids, dehydrated	NTL.
Chloroacetic acid, mono-	BUK, DOW, PFZ.
Chloroacetyl chloride	DOW.
Citric acid	MLS, PFZ.
Crotonic acid (2-Butenoic acid)	EKT.
Decanoyl chloride	WTL.
2,2-Dichloropropionic acid	DOW.
Dimer acid (C-36 Aliphatic dibasic acid)	EMR.
Di-n-propylacetic acid	ARA.
Di-n-propylacetyl chloride	ARA.
Dithiodipropionic acid	EVN.
Dodecanedioic acid	DUP.
*Dodecenylsuccinic anhydride	ACS, BCC, DIX, HMY.
Dodecylsuccinic anhydride	HN.
2-Ethylbutyric acid (Diethylacetic acid)	UCC.
2-Ethylhexanoic acid (α-Ethylcaproic acid)	EKT, UCC.
2-Ethylhexanoyl chloride	AZT, CAD, WTL.
Formic acid, 90%	CEL, UCC.
*Fumaric acid	HN, MON, PFZ, USS.
Gluconic acid, technical	PFZ.
Glutaric anhydride	UCC.
Glycolic acid (Hydroxyacetic acid)	DUP.
n-Hexadecenylsuccinic anhydride	HMY.
Isethionic acid (2-Hydroxyethanesulfonic acid)	GAF, WTC.
Isoascorbic acid (Erythorbic acid)	PFZ.
Isobutyric acid	EKX.
Isobutyric anhydride	EKT.
Iso-octadecenylsuccinic anhydride	HMY.
Itaconic acid (Methylenesuccinic acid)	PFZ.
LACTIC ACID:	
Lactic acid, edible, 100%	CLN, MON.
Lactic acid, technical, 100%	MON.
*Lauroyl chloride	GAF, ONX, UOP, WCC, WTL.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ACIDS, ACID ANHYDRIDES, AND ACYL HALIDES--Continued	
Maleic acid	ACS, PFN, PFZ.
Malic acid	ACS.
Mercaptoacetic acid (Thioglycolic acid)	EVN.
3-Mercaptopropionic acid	EVN.
Mercaptosuccinic acid (Thiomalic acid)	EVN.
Methacrylic acid	DUP, RH.
Methanesulfonic acid	PAS.
Methanesulfonyl chloride	PAS.
Neodecanoic acid	ENJ.
Neopentanoic acid	ENJ.
Nonanoic acid (Pelargonic acid)	EMR, GIV.
Nonenylsuccinic anhydride	HMY.
Octenylsuccinic anhydride	HMY.
Oleic acid	ASH.
Oleoyl chloride	GAF, HRT.
*Oxalic acid	ACS, HK, PFZ.
Palmitoyl chloride	GAF, PD.
Peroxyacetic acid	FME, UCC.
Pivaloyl chloride	AZT, WCC.
*Polyacrylic acid	BFG, DA, RH, SNW, TKL, X.
*Propionic acid	CEL, EKT, IMC, UCC.
Propionic anhydride	EKT.
Sebacic acid	BAS, WTH.
Sebacoyl chloride	WTL.
Sorbic acid	MON.
Stearoyl chloride	UOP.
Succinic acid	ACS.
Thioacetic acid	EVN, BSA.
3,3'-Thiodipropionic acid	EVN.
Thiolactic acid	EVN.
Trichloroacetic acid	DOW.
Valeric acid	UCC.
Acids, acid anhydrides, and acyl halides, all other	ABB, ARA, BCC, BFG, CHG, DOW, EK, ENJ, EVN, HMP, HMY, MON, PIC, SK, TX, WAY, WCC, WTL.
*SALTS OF ORGANIC ACIDS:	
*ACETIC ACID SALTS:	
Aluminum acetate	ACY, UCC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
SALTS OF ORGANIC ACIDS--Continued	
ACETIC ACID SALTS--Continued	
Ammonium acetate	ACS, BKC, MAL.
*Barium acetate	ACS, BKC, CBN, MAL.
Butyltin acetate (Dibutyltin diacetate)	MET.
Calcium acetate	ACS, MAL.
Cobalt acetate	HSH, SHP, UCC.
Copper acetate	ACS, BKC.
Lead acetate	ACS, BKC, MAL.
Lead subacetate	BKC.
Lead tetraacetate	ARA.
Magnesium acetate	BKC, SHP.
Manganese acetate	HSH, SHP.
Mercuric acetate	MAL.
Nickel acetate	BKC, HSH, SHP.
Potassium acetate	ACS, BKC, MAL, UCC.
*Sodium acetate	ACS, BKC, CHP, DAN, EKT, HCP, HSH, MAL, UCC.
Sodium diacetate	UCC.
Strontium acetate	MAL.
*Zinc acetate	ACS, BKC, SHP, UCC.
Zirconium acetate	HSH, TZC.
Acetic acid salts, all other	RBC, X.
Adipic acid, ammonium salt	ELP.
Allylsulfonic acid, sodium salt	IOC, UOP.
Chloroacetic acid, sodium salt	DOW.
CITRIC ACID SALTS:	
Ammonium citrate	MAL, PFZ.
Calcium citrate	PFZ.
Ferric ammonium citrate	PFZ.
Potassium citrate	PFZ.
Sodium citrate	PFZ.
*2-ETHYLHEXANOIC ACID (ALPHA-ETHYLCAPROIC ACID) SALTS	
Aluminum 2-ethylhexanoate	NOC, WTC.
Barium 2-ethylhexanoate	CCA.
Cadmium 2-ethylhexanoate	CCA.
*Calcium 2-ethylhexanoate	CCA, HN, MCI, TRO, WTC, X.
*Cobalt 2-ethylhexanoate	CCA, HN, MCI, TRO, WTC, X.
Copper 2-ethylhexanoate	CCA.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
SALTS OF ORGANIC ACIDS--Continued	
2-ETHYLHEXANOIC ACID(α-ETHYLCAPROIC ACID) SALTS--Con.	
Iron 2-ethylhexanoate	CCA, HN.
*Lead 2-ethylhexanoate	CCA, HN, NTL, TRO, WTC, X.
Lithium 2-ethylhexanoate	WTC.
*Manganese 2-ethylhexanoate	CCA, HN, MCI, TRO, X.
Nickel 2-ethylhexanoate	MCI, WTC.
Potassium 2-ethylhexanoate	CCA, MCI.
Rare earths 2-ethylhexanoate	CCA, MCI.
Stannous 2-ethylhexanoate	WTC, X.
*Zinc 2-ethylhexanoate	CCA, HN, MCI, SYP(E), WTC, X.
*Zirconium 2-ethylhexanoate	CCA, HN, MCI, TRO, WTC, X.
2-Ethylhexanoic acid salts, all other	MCI.
FORMIC ACID SALTS:	
Chromic formate	GAF.
Lead formate	NTL.
Nickel formate	SHP.
Potassium formate	HCP.
Sodium formate, refined	BKC.
Sodium formate, technical	CEL.
Formic acid salts, all other	SHP.
Fumaric acid, lead salt	NTL.
GLUCOHEPTANOIC ACID SALTS:	
Calcium glucoheptanoate	PFN.
Sodium glucoheptanoate	HMP, PFN.
GLUCONIC ACID SALTS:	
Ammonium gluconate	PFZ.
Humic acids, sodium salts	X.
Isoascorbic acid, sodium salt (Sodium erythorbate)	PFZ.
LACTIC ACID SALTS:	
Calcium lactate	HUM.
Sodium lactate (Nalac)	MAL, PFN.
Lactic acid salts, all other	MRK, PFN, TCC.
LAURIC ACID SALTS:	
Lauric acid, barium-cadmium salt	X.
Lauric acid salts, all other	UCC, X.
Laurolauric acid, dibutyltin salt	CCA.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
SALTS OF ORGANIC ACIDS--Continued	
LINOLEIC ACID--Continued	
Calcium linoleate	CCA, SHP.
Manganese linoleate	SHP.
*MALEIC ACID SALTS:	
Maleic acid, dibutyltin salt	CCA, X, X.
Maleic acid, tribasic lead salt	NTL.
Maleic acid salts, all other	CCA, X.
MERCADTOACETIC ACID (THIOGLYCOLIC ACID) SALTS:	
Ammonium mercaptoacetate	EVN.
Calcium mercaptoacetate	EVN.
Potassium mercaptoacetate	EVN.
Sodium mercaptoacetate	EVN.
Mercaptoacetic acid (Thioglycolic acid) salts, all other	CCA.
Mercaptopropionic acid, dibutyltin salt	CCA.
NEODECANOIC ACID SALTS:	
Cadmium neodecanoate	CCA.
Calcium neodecanoate	CCA, MCI.
Cobalt manganese neodecanoate	HPC.
Cobalt neodecanoate	MCI, SHP.
Lead-cobalt neodecanoate	MCI.
Lead neodecanoate	MCI.
Lithium neodecanoate	MCI.
Manganese neodecanoate	MCI, SHP.
Zinc neodecanoate	CCA.
Zirconium neodecanoate	MCI.
Neodecanoic acid salts, all other	CCA, MCI, SHP.
OCTANOIC-ACID (CAPRYLIC ACID) SALTS:	
Aluminum octanoate	DA.
Stannous octanoate	CCW, X.
Octanoic acid (Caprylic acid) salts, all other	X.
OLEIC ACID SALTS:	
Lead oleate	NCC.
Stannous oleate	X.
Oleic acid salts, all other	HAL, SHP.
OXALIC ACID SALTS:	
Ammonium oxalate	ACS.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
SALTS OF ORGANIC ACID--Continued	
OXALIC ACID SALTS--Continued	
Potassium oxalate	BKC.
Sodium oxalate	BKC.
PALMITIC ACID SALTS:	
Aluminum palmitate	DA.
PHOSPHORODITHIOIC ACID SALTS (DITHIOPHOSPHATES):	
Sodium di-sec-butyl/diethyl phosphorodithioate	ACY.
Sodium di-sec-butyl phosphorodithioate	ACY.
Sodium diethyl phosphorodithioate	ACY.
Sodium dihexyl phosphorodithioate	ACY.
Sodium diisopropyl phosphorodithioate	ACY.
Phosphorodithioc acid salts (Dithiophosphates), All other	ACY.
PROPIONIC ACID SALTS:	
Calcium propionate	HFT, PFZ.
Sodium propionate	HFT, PFZ.
Propionic acid salts, all other	UCC.
RICINOLEIC ACID SALTS:	
Calcium ricinoleate	NTL.
Sodium ethyl oxalacetate	PMP(E).
Sodium glycolate	HCP, SAL.
Sodium sorbitol borate	ICI.
SORBIC ACID SALTS: Potassium sorbate	MON.
*STEARIC ACID SALTS:	
ALUMINUM STEARATES:	
*Aluminum distearate	DA, NOC, PEN, SYP, WTC.
Aluminum monostearate	DA, NOC, SYP, WTC.
*Aluminum tristearate	DA, NOC, SYP, WTC.
Ammonium stearate	DA.
*Barium stearate	DA, NOC, PEN, SYP, WTC.
*Cadmium stearate	NOC, SYP, WTC.
*Calcium stearate	DA, FER, HN, MAL, NOC, PEN, SYP, WTC, X.
Cobalt stearate	SHP, WTC, X.
Ferric stearate	SHP, WTC.
*Lead stearate	NTL, WTC, X.
Lithium stearate	DA, NOC, PEN, WTC.
*Magnesium stearate	DA, NOC, PEN, SYP, WTC.
Manganese stearate	MAL.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
SALTS OF ORGANIC ACIDS--Continued	
STEARIC ACID SALTS--Continued	
Nickel stearate	WTC.
Silver stearate	PEN.
*Zinc stearate	DA, HN, MAL, NOC, PEN, PLS, SYP, WTC, X.
Stearic acid salts, all other	WTC.
Succinic acid, sodium salt	MAL.
TARTARIC ACID SALTS:	
Antimony potassium tartrate	PFZ.
Potassium sodium tartrate	PFZ.
XANTHIC ACID SALTS:	
Potassium amylxanthate	DOW.
Potassium ethylxanthate	DCW.
Potassium pentylxanthate	ACY.
Sodium n-butylxanthate	KCC, USR.
Sodium sec-butylxanthate	DOW.
Sodium ethylxanthate	DOW.
Sodium isobutylxanthate	DOW.
Sodium isopropylxanthate	DOW.
Salts of organic acids, all other	CCA, EK, HCP, HSH, MCI, MON, STP, TCH, UCC, WTC.
*ALDEHYDES:	
Acetaldehyde	CEL, EKX, PUB, SHC, UCC.
Acrolein (Acrylaldehyde)	SHC, UCC.
*Butyraldehyde	CEL, EKX, UCC.
Chloral (Trichloroacetaldehyde)	MTO.
Crotonaldehyde	EKT.
2-Ethylbutyraldehyde	UCC.
2-Ethylhexanal (α-Ethylcaproaldehyde)	EKX.
*Formaldehyde (37% HCHO by weight)	ACS, AMP, BOR, CBD, CEL, DUP, GAF, GOC, GP, HKD, HN, HPC, IMC, MON, RCI, WCL.
Glutaraldehyde	UCC.
Glyoxal	ACY, UCC.
*Isobutyraldehyde	CEL, DBC, EKX, UCC.
Isopentaldehyde, mixed isomers	UCC.
2-Methylvaleraldehyde (2-Methylpentaldehyde)	UCC.
Propionaldehyde	EKX, UCC.
Valeraldehyde (Pentanal)	UCC.
Aldehydes, acyclic, all other	EK, RDA, UCC, X.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
*KETONES:	
*ACETONE:	
*Acetone from cumene	ACS, CLK, DOW, GP, GYR, MON, SHC, SOC, UCC, USS.
*Acetone from isopropyl alcohol	EKT, ENJ, SHC, UCC.
Acetone, all other	OCC.
Acetone, crude	SKO.
*2-Butanone (Methyl ethyl ketone)	ATR, CEL, ENJ, SHC, UCC.
1-Chloro-1-penten-3-one (β-Chlorovinyl ethyl ketone)	ABB.
Chloro-2-propanone (Chloroacetone)	EK.
1,3-Dihydroxy-2-propanone (Dihydroxyacetone)	BAX, PFZ.
Diisopropyl ketone (2,4-Dimethyl-3-pentanone)	EKX.
2-Heptanone (Methyl amyl ketone)	EKT.
3-Heptanone (Ethyl butyl ketone)	UCC.
2,5-Hexanedione (Acetonylacetone)	ARS.
*4-Hydroxy-4-methyl-2-pentanone (Diacetone alcohol)	CEL, SHC, UCC.
Isovalerone (Diisobutyl ketone)	EKT, UCC.
Lactide (3,6-Dimethyl-2,5-p-dioxanedione)	CLN.
4-Methoxy-4-methyl-2-pentanone	SHC.
5-Methyl-2-hexanone (Methyl isoamyl ketone)	EKT.
*4-Methyl-2-pentanone (Methyl isobutyl ketone)	EKT, ENJ, SHC, UCC.
*4-Methyl-3-penten-2-one (Mesityl oxide)	ENJ, SHC, UCC.
Methylpseudoionone	RDA.
3-Octanone (Ethyl amyl ketone)	WTH.
2,4-Pentanedione (Acetylacetone)	UCC.
2-Pentanone	EKT.
3-Pentanone (Diethyl ketone)	HEX, ORT, UCC.
Pseudoionone	SCM.
2,6,8-Trimethyl-4-nonanone (Isobutyl heptyl ketone)	UCC.
Ketones, all other	ARC, CHG, DUP, EK, EKI, MRK, ORT, PFZ, SHC, UCC.
*ALCOHOLS, MONOHYDRIC, UNSUBSTITUTED:	
*ALCOHOLS, C11 OR LOWER, UNMIXED (95% OR MORE PURE):	
Allyl alcohol	FMP, SHC.
AMYL ALCOHOLS:	
2-Methyl-1-butanol	UCC.
2-Pentanol	UCC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ALCOHOLS, MONOHYDRIC UNSUBSTITUTED--Continued	
ALCOHOLS, C-11 OR LOWER, UNMIXED (95% OR MORE PURE)--Continued	
BUTYL ALCOHOLS:	
*n-Butyl alcohol (n-Propylcarbinol)	CEL, CO, DBC, EKX, GAF(E), OXO, SHC, TNA, UCC.
sec-Butyl alcohol (Methylethylcarbinol)	ENJ, SHC.
tert-Butyl alcohol (Trimethylcarbinol)	OCC, SHC.
*Isobutyl alcohol (Isopropylcarbinol)	CEL, DBC, EKX, OXO, SHC, UCC.
*Ethyl alcohol, synthetic only	EKX, PUB, SHC, UCC, USI.
*2-Ethyl-1-hexanol	DBC, EKX, OXO, SHC, UCC.
2-Ethyl-4-methyl-1-pentanol	EKX.
n-Heptyl alcohol	EKX.
*n-Hexyl alcohol	CO, ENJ, TNA, UCC.
Iso-octyl alcohol	ENJ, USS.
*Isopropyl alcohol	ATR, ENJ, SHC, UCC.
*Methanol, synthetic only	AIP, BOR, CEL, DUP, GP, HCF, HN, MON, RH, UCC.
2-Methyl-1-pentanol	UCC.
1-Octanol	CC.
2-Octanol (sec-Capryl alcohol)	WTH.
*Propyl alcohol (Propanol)	CEL, EKX, UCC.
2-Propyn-1-ol (Propargyl alcohol)	GAF.
Alcohols, unmixed C11 or lower, all other	ENJ, PUB, SHC, UCC, VEL.
*ALCOHOLS C12 OR HIGHER, UNMIXED (95% OR MORE PURE):	
1-Decanol	CO, TNA.
Dodecyl alcohol (Lauryl alcohol)	CO, TNA.
1-Hexadecanol (Cetyl alcohol)	CO, PG.
Isodecyl alcohol	ENJ, USS.
1-Octadecanol (Stearyl alcohol)	CO, PG.
cis-9-Octadecen-1-ol (Oleyl alcohol)	ASH.
1-Tetradecanol (Myristyl alcohol)	CO, UCC.
1-Tridecanol	ENJ.
2,6,8-Trimethyl-4-nonanol	UCC.
Alcohols, unmixed C12 or higher, all other	SCP.
*MIXTURES OF ALCOHOLS:	
Alcohol mixtures, all other	CO, CPS, EKX, ENJ, NCI, PG, SHC, TNA, UCC, WTH.
*ESTERS OF MONOHYDRIC ALCOHOLS:	
Acrylic monomers, mixed	RH.
Allyl methacrylate	GLY, JCC, SAR.
AMYL ACETATES:	
Amyl acetate (n-Pentyl acetate)	UCC.
Amyl acetates, all other	PUB.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ESTERS OF MONOHYDRIC ALCOHOLS--Continued	
BUTYL ACETATES:	
*n-Butyl acetate	CEL, EKT, UCC.
*Isobutyl acetate	CEL, EKT, EKX, DCC.
* Butyl acrylate	CEL, DBC, RH, SM, UCC.
N-Butyl chloroformate	CTN.
sec-Butyl chloroformate	CTN.
Butyl lactate	IMC.
Butyl maleate	TCH.
Butyl mercaptopropionate	EVN.
Butyl methacrylate	RH, TX.
tert-Butyl peroxyacetate	AZT, WTL.
tert-Butyl peroxy-2-ethylhexanoate	AZT, WTC.
tert-Butyl peroxyisobutyrate	AZT, WTL.
tert-Butyl peroxyisopropylcarbonate	WTL.
tert-Butyl peroxyneodecanoate	WTC, WTL.
tert-Butyl peroxypivalate	AZT, WTC.
Cetyl lactate	SBC, VND.
Diallyl maleate	FMP(E).
Dibutyl fumarate	RCI.
*Dibutyl maleate	HN, RCI, USS.
Diethyl carbonate (Ethyl carbonate)	CTN.
Diethyl(ethoxymethylene)malonate	KF.
*Di(2-ethyl-1-hexyl) maleate	CHP, DAN, HBT, RUB.
Diethyl maleate	ACY.
Diethyl malonate (Malonic ester)	ABB, KF.
Diethyl methylmalonate	SFS.
Diethyl oxalate (Ethyl oxalate)	FMP, PFZ.
Diisobutyl maleate	RUB.
Diiso-nonyl maleate	RUB.
Diisopropyl peroxydicarbonate (Isopropyl percarbonate)	PPG.
*Dilauryl-3,3'-thiodipropionate	ACY, CCW, EVN.
Dimethyl carbonate	CTN.
Dimethyl maleate	AAC.
Dimethyl malonate	KF.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ESTERS OF MONOHYDRIC ALCOHOLS--Continued	
Dioctyl maleate	RCI, USS.
Di-n-propyl peroxydicarbonate	WTL.
Distearyl-3,3'-thiodipropionate	ACY, EVN.
Dithiobis(stearyl propionate)	EVN.
Ditridecyl maleate	EPH.
Di(tridecyl)-3,3'-thiodipropionate	ACY, EVN.
2-Ethoxyethyl acetate	EKX.
*Ethyl acetate (85%)	CEL, EKT, EKX, MON, PUB, UCC.
Ethyl acetoacetate	EKT.
*Ethyl acrylate	CEL, DBC, RH, UCC.
Ethyl chloroacetate	DOW.
Ethyl chloroformate	CTN.
Ethylene carbonate	JCC.
2-Ethyl-1-hexyl acetate	EKT.
*2-Ethyl-1-hexyl acrylate	CEL, DBC, UCC.
2-Ethyl-1-hexyl methacrylate	DUP.
Ethyl silicate	SPS.
*FATTY ACID ESTERS, NOT INCLUDED WITH PLASTICIZERS OR SURFACE ACTIVE AGENTS:	
Butyl palmitate	TKL.
Dimethyl brassylate	EMR.
Isopropyl linoleate	VND.
Methyl esters of coconut oil	HUM, PG.
Methyl esters of tallow	CHL, FER, HUM, PG.
Methyl 12-hydroxystearate	NTL, WTH.
Methyl stearate	CHL.
Myristyl myristate	VND.
Fatty acid esters, not included with plasticizers surface-active agents, all other	ARC, CCW, CHP, CRN, FER, UCC, WTC.
Isobutyl acrylate	UCC.
Isobutyl chloroformate	CTN.
Isobutyl isobutyrate	EKX.
Isodecyl thioglycolate	EVN.
Iso-octyl mercaptoacetate	CCW, EVN.
Iso-octyl-3-mercaptopropionate	EVN.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ESTERS OF MONOHYDRIC ALCOHOLS--Continued	
Isopropyl acetate	EKT, UCC.
Isopropyl chloroformate	CTN, PPG, WTL.
Isostearyl neopentanoate	VND.
Lauryl lactate	VND.
Lauryl methacrylate	RH, TX.
Menthallylidene diacetate	RDA.
2-Methoxyethyl acrylate	AAC.
*Methyl acetate	GRD, MON, UCC.
Methyl acetoacetate	EKT.
Methyl acrylate, monomer	CEL, RH.
Methyl borate	SFS.
Methyl chloroacetate	DOW.
Methyl chloroformate	CTN.
Methyl formate	CEL, DUP.
*Methyl methacrylate, monomer	CYR, DUP, RH.
Methyl sulfate (Dimethyl sulfate)	DUP.
Myristyl lactate	VND.
Octadecyl-3-mercaptopropionate	EVN.
*PHOSPHORUS ACID ESTERS:	
Bis(2-ethylhexyl) hydrogen phosphate	UCC.
Bis(2-ethylhexyl)hydrogen phosphite	SM.
Butyl acid phosphate	HK, SM.
Dibutyl hydrogen phosphite	SM.
Didodecyl hydrogen phosphate	DUP.
Diethyl phosphorochloridothionate	SFA.
Dimethyl methylphosphonate	SM.
Dimethyl phosphoridothionate	SFA.
2-Ethylhexyl hydrogen phosphate	SM.
Iso-octyl hydrogen phosphate	SM.
Methyl dihydrogen phosphate	HK.
Trialkyl phosphite	MCB.
Tributyl phosphate	FMP, SFS.
Triethyl phosphite	SFA, SFS, SM.
Triiso-octyl phosphite	MCB, SM.
Triisopropyl phosphite	SM.
Trimethyl phosphite	SFA, SFS, SM.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ESTERS OF MONOHYDRIC ALCOHOLS--Continued	
PHOSPHORUS ACID ESTERS--Continued	
Tris(2,3-dibromopropyl)phosphate	VEL.
Tris(2-ethylhexyl)phosphite	SM.
Phosphorus acid esters, all other	DUP, HK, HN, MIL, SFA, SM, USO.
*Propyl acetate	CEL, EKT, UCC.
Propylene carbonate	JCC.
Stearyl methacrylate	RH, TX.
Tetraethyl orthosilicate (Tetraethyl silicate)	UCC.
Tetraethyl silicate, condensed	UCC.
TITANIC ACID ESTERS:	
Tetraoctyl orthosilicate	MON.
Tetrabutyl titanate	DUP.
Tetraisopropyl titanate	DUP.
Tetrakis(2-ethylhexyl)titanate	DUP.
Titanic acid esters, all other	DUP.
Triethyl orthoacetate	KF.
Triethyl orthoformate	KF.
Triethyl orthopropionate	KF.
Triisodecyl orthoformate	KF.
Trimethyl orthoformate	KF.
*Vinyl acetate, monomer	BOR, CEL, DUP, NSC, UCC, USI.
Monohydric alcohol esters, all other	AAC, CTN, DAN, DUP, EK, EKT, EMR, EVN, FER, SFA, TKL, UCC, VND, WTL.
*POLYHYDRIC ALCOHOLS:	
2,2-Bis(bromomethyl)-1,3-propanediol	DOW.
1,2(and 1,3)-Butanediol	CEL, DUP.
1,4-Butanediol	BAS, GAF.
2-Butene-1,4-diol	GAF.
2-Butyne-1,4-diol	GAF.
3-Chloro-1,2-propanediol (Glycerol α-chlorohydrin)	EKT, EVN.
2,2-Dimethyl-1,3-propanediol (Neopentyl glycol)	EKX.
*Ethylene glycol	BAS, CAU, CEL, DIX, DOW, EKX, JCC, NWP, OMC, PPG, SHC, UCC.
2-Ethyl-1,3-hexanediol	UCC.
2-Ethyl-2-(hydroxymethyl)-1,3-propanediol (Trimethylolpropane)	CEL.
*Glycerol, synthetic only	DOW, FMP, SHC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
POLYHYDRIC ALCOHOLS--Continued	
1,6-Hexanediol	CEL.
Mannitol	ICI.
3-Mercapto-1,2-propanediol (Thioglycerol)	EVN.
2-Methyl-2,4-pentanediol (Hexylene glycol)	SHC.
*Pentaerythritol	CEL, HPC, IMC, PST.
1,5-Pentanediol	UCC.
*Propylene glycol (1,2-Propanediol)	DOW, JCC, OCC, OMC, UCC.
*Sorbitol (70% by Weight)	BRD, ICI, MRK, PFZ.
2,2,4-Trimethyl-1,3-pentanediol	EKX.
Polyhydric alcohols, all other	ARA, GAF, GLY, JCC, UCC.
ESTERS AND ETHERS OF POLYHYDRIC ALCOHOLS:	
*POLYHYDRIC ALCOHCL ESTERS:	
1,3-Butanediol dimethacrylate	SAR.
2-Butoxyethyl acetate	EKT.
Diethylene glycol chloroformate	PPG.
2-(2-Ethoxyethoxy)ethyl acetate	EKT.
Ethylene glycol diacetate	EKT, UCC.
Ethylene glycol dimercaptoacetate	EVN.
Ethylene glycol dimethacrylate	SAR.
Ethylene glycol hydroxyacetate	CCA.
Glyceryl diacetate (Diacetin)	ARC, HAL.
Glyceryl monoacetate (Monoacetin)	EVN, HAL.
Glyceryl triacetate (Triacetin)	ARC, EKT, UCC.
Glyceryl trioleate	PVO.
Glycol adipate	WM.
1,6-Hexanediol diacrylate	CEL, SAR.
Hexylene glycol diacetate	UCC.
Hydroxyethyl acrylate	DCW.
Hydroxypropyl acrylate	DOW.
Hydroxypropyl methacrylate	CPV, RH.
Lanolin acetate	CRN.
Lanolin alcohol acetate	CRN.
Pentaerythritol caprylate	MOB.
Pentaerythritol tetraacrylate	CEL, SAR, UCC.
Pentaerythritol tetrakis (3-Mercaptopropionate)	EVN.
Polyethylene glycol dimethacrylate	SAR.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ESTERS AND ETHERS OF POLYHYDRIC ACLOHOLS--Continued	
POLYHYDRIC ALCOHOL ESTERS--Continued	
Sucrose octa-acetate	HFT, PD.
2-Sulfoethyl methacrylate	DOW.
Tetraethylene glycol diacrylate	CEL, TKL.
Tetraethylene glycol dimethacrylate	AAC, CEL, SAR.
Triethylene glycol diacrylate	CEL, SAR, TKL.
Triethylene glycol dimethacrylate	SAR.
*Trimethylolpropane triacrylate	CEL, SAR, TKL.
Trimethylolpropane tri(3-mercaptopropionate)	EVN.
2,2,3-Trimethyl-1,3-pentanediol monoisobutyrate	EKX.
Polyhydric alcohol esters, all other	ARC, CCW, CEL, CTN, EKT, EVN, GOC, RH, SAR, SM, TKL, UCC, USB, WCC, WM.
*POLYHYDRIC ALCOHOL ETHERS:	
Bis(2-butoxyethyl)ether (Diethylene glycol di-n-butyl ether)	ASL.
Bis(2-ethoxyethyl)ether (Diethylene glycol diethyl ether)	UCC.
Bis(hydroxyethyl)ether butynediol	GAF, MOB.
Bis[2-(2-methoxyethoxy)ethyl] ether (Tetraethylene glycol dimethyl ether)	ASL.
Bis(2-methoxyethyl)ether (Diethylene glycol dimethyl ether)	ASL.
*2-Butoxyethanol	DOW, EKX, JCC, OMC, SHC, UCC.
*2-(2-Butoxyethoxy)ethanol (Diethylene glycol monobutyl ether)	DOW, EKX, JCC, OMC, SHC, UCC.
*2-[2-(2-Butoxyethoxy)ethoxy]ethanol (Triethylene glycol monobutyl ether)	DOW, OMC, UCC.
1-Butoxyethoxy-2-propanol	UCC.
*Diethylene glycol	DAS, CEL, DIX, DOW, EKX, JCC, NWP, OMC(E), PPG, SHC, UCC.
Dimethoxyethane (Ethylene glycol dimethyl ether)	ASL.
*Dipropylene glycol	DOW, JCC, CCC, OMC, UCC.
*2-Ethoxyethanol	DOW, EKX, JCC, OMC, SHC, UCC.
*2-(2-Ethoxyethoxy)ethanol (Diethylene glycol monoethyl ether)	DOW, EKX, JCC, OMC, SHC, UCC.
*2-[2-(2-Ethoxyethoxy)ethoxy]ethanol (Triethylene glycol monoethyl ether)	DOW, OMC, UCC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
ESTERS AND ETHERS OF POLYHYDRIC ALCOHOLS--Continued	
POLYHYDRIC ALCOHOL ETHERS--Continued	
2-[2-(Hexyloxy)ethoxy]ethanol	UCC.
Isobutoxyethanol	UCC.
2-(2-Isobutoxyethoxy)ethanol (Diethyene glycol monoisobutyl ether)	UCC.
1-Isobutoxy-2-propanol (Propylene glycol isobutyl ether)	DOW.
*2-Methoxyethanol (Ethylene glycol monomethyl ether)	DOW, JCC, OMC, PPG, SHC, UCC.
*2-(2-Methoxyethoxy)ethanol (Diethylene glycol mono methyl ether)	DOW, JCC, OMC, PPG, SHC, UCC.
*2-[2-(2-Methoxyethoxy)ethoxy]ethanol (Triethylene glycol monomethyl ether)	DOW, OMC, UCC.
2-(2-Methoxyethoxy)ethyl-2-methoxyethyl ether (Triethylene glycol dimethyl ether)	ASL.
Methoxypolyethylene glycol	DUP, UCC.
1-Methoxy-2-propanol	DOW.
3-(3-Methoxypropoxy)propanol	DOW.
3-[3-(3-Methoxypropoxy)propoxy]propanol	DOW.
Paraformaldehyde	CEL, HN.
Polyethoxylated-1,4-butanediol	HDG.
*Polyethylene glycol	BAS, CAU, DA, DOW, DUP, JCC, OMC, UCC, X.
POLYPROPOXY ETHERS:	
Polypropoxybutyl ether	BAS, DA.
Polypropoxy ethers, all other	TNI, UCC.
Polyglycols, ethylene glycol and glycol ether, mixed	DOW.
Polyoxypropylene polyoxyethyene glycol, mixed	UCC.
*Polypropylene glycol	BAS, DOW, HDG, JCC, OMC, UCC.
Polytetramethylene glycol ether	DUP, QKO.
*Propylene glycol, mixed ethers	BAS, DOW, JCC, UCC.
Sorbitol, ethoxylated	GLY, ICI, TCH.
Sorbitol, propoxylated	ICI.
*Tetraethylene glycol	DOW, EKX, OMC, UCC.
1,1,3,3-Tetramethoxypropane	KP.
*Triethylene glycol	CEL, DOW, EKX, JCC, OMC, PPG, SHC, UCC.
Tripropylene glycol	DOW, HDG, UCC.
Polyhydric alcohol ethers, all other	CRN, EKX, JCC, TCH, TX, UCC, X.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
*HALOGENATED HYDROCARBONS:	
*BROMINATED (INCLUDING BROMOCHLORINATED) HYDROCARBONS	
1-Bromobutane (n-Butyl bromide)	ABB.
2-Bromobutane (sec-Butyl bromide)	WCC.
Bromochloromethane	DOW.
1-Bromo-3-chloropropane (Trimethylenechlorobromide)	VEL.
1-Bromododecane	WCC.
Bromoethane (Ethyl bromide)	DCW, GTL.
1-Bromohexane (n-Hexyl bromide)	WCC.
1-Bromo-octadecane	HMY.
1-Bromopentane (n-Amyl bromide)	HMY.
1-Bromopropane (n-Propyl bromide)	WCC.
Bromotrichloromethane	VEL.
Dibromoethane (Methylene bromide)	DOW.
1,1,2,2-Tetrabromoethane (Acetylene tetrabromide)	DOW.
Vinyl bromide (Bromoethylene)	TNA.
Brominated (Including bromochlorinated) hydrocarbons, all other	EK, GTL, HMY, PD, VEL, WCC.
*CHLORINATED (NOT OTHERWISE HALOGENATED) HYDROCARBONS	
*Carbon tetrachloride	ACS, DA, DOW, DUP, FMB, FBO, SPI, TNA.
*CHLORINATED PARAFFINS (C10-C30):	
*Chlorinated paraffins, 35-64% chlorine	CCH, DA, DVC, FER, HPC, ICI, NEV, PLX.
Chlorinated paraffins, less than 35% chlorine	HK.
Chlorinated paraffins, 65% or more chlorine	DA, DVC, NEV.
1-Chlorobutane (n-Butyl chloride)	PUB, UCC.
*Chloroethane (Ethyl chloride)	DOW, DUP, HPC, PPG, SFP, SHC, TNA.
*Chloroform	ACS, DA, DOW, FRO, SPI.
*Chloromethane (Methyl chloride)	ACS, CO, DCC, DOW, DUP, FRO, SPI, TNA, UCC.
2-Chloro-2-methylpropane (tert-Butyl chloride)	EK.
3-Chloro-2-methyl-1-propene (Methallyl chloride)	FMP.
3-Chloropropene (Allyl chloride)	DOW, SHC.
Dichlorobutadiene	DUP.
1,4-Dichlorobutene	DUP, PTT.
*1,2-Dichloroethane (Ethylene dichloride)	ACS, BAS, BFG, CO, DA, DOW, FRO, PPG, SFP, SHC, TNA, UCC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
HALOGENATED HYDROCARBONS--Continued	
CHLORINATED (NOT OTHERWISE HALOGENATED HYDROCARBONS--Continued	
*Dichloromethane (Methylene chloride)	ACS, DA, DOW, DUP, FRO, SPI.
*1,2-Dichloropropane (Propylene dichloride)	BAS, DOW, JCC.
2,3-Dichloropropene	DCW.
Octyl chloride	HDW.
1,1,2,2-Tetrachloroethane (Acetylene tetrachloride)	HK.
*Tetrachloroethylene (Perchlcroethylene)	DA, DOW, DUP, FRO, HK, PPG, SPI, TNA.
*1,1,1-Trichloroethane (Methyl chloroform)	DOW, FRO, PPG.
1,1,2-Trichloroethane (Vinyl trichloride)	DCW.
*Trichloroethylene	DA, DOW, HK, PPG, TNA.
1,2,3-Trichloropropane	DOW, SHC.
1,2,3-Trichloropropene	DOW.
*Vinyl chloride, monomer (Chloroethylene)	ACS, BFG, BOR(E), CO, DOW, FRO, MNO, PPG, SFP, SHC, TNA, USR.
Vinylidene chloride, monomer (1,1-Dichloroethylene)	DOW, PPG.
Chlorinated (Not otherwise halogenated) hydrocarbons, all other	DUP, RDA, RH.
*FLUORINATED (INCLUDING OTHER HALOGENATED) HYDROCARBONS:	
2-Bromo-2-chloro-1,1,1-trifluoroethane	ICI.
Bromotrifluoromethane	DUP.
1-Chloro-1,1-difluoroethane	PAS.
*Chlorodifluoromethane (F-22)	ACS, DUP, KAI, PAS, RCN, UCC.
Chloropentafluoroethane	DUP.
Chlorotrifluoroethylene (Trifluorovinyl chloride)	ACS, MMM.
Chlorotrifluoromethane	X.
Dibromodifluoromethane	DUP.
1,2-Dibromo-1,1,2,2-tetrafluoroethane	DUP.
*Dichlorodifluoromethane (F-12)	ACS, DUP, KAI, PAS, RCN, UCC.
Dichlorotetrafluoroethane	ACS, DUP, PAS.
1,1-Difluoroethane	ACS, DUP.
Difluorotetrachloroethane	X.
Hexafluoropropylene, monomer	DUP.
1-Iodoperfluorohexane	DUP.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
HALOGENATED HYDROCARBONS--Continued	
FLUORINATED (INCLUDING OTHER HALOGENATED) HYDROCARBONS--Continued	
*Tetrafluoroethylene, monomer	ACS, DUP, ICI.
Tetrafluoromethane	DUP.
Trichlorofluoromethane (F-11)	ACS, DUP, KAI, PAS, RCN, UCC.
*Trichlorotrifluoroethane	ACS, DUP.
Vinyl fluoride, monomer	X.
Vinylidene fluoride, monomer	PAS, X.
Fluorinated (Including other fluorohalogenated) hydrocarbons, all other	DUP, ICI.
*IODINATED (NOT OTHERWISE HALOGENATED) HYDROCARBONS:	
Diiodomethane (Methylene iodide)	NIB.
Iodoethane (Ethyl iodide), non-medical	FMT, BSA.
Iodoform (Triiodomethane)	NTB.
Iodomethane (Methyl iodide)	FMT, RSA.
OTHER MISCELLANEOUS ACYCLIC CHEMICALS:	
Acetyl peroxide	WTL.
Aluminum isopropoxide (Aluminum isopropylate)	CHT, KCH.
*2-Butanone peroxide	CAD, NOC, RCI, WTC, WTL.
tert-Butyl hydroperoxide	CAD, OCC, WTC, WTL.
*tert-Butyl peroxide (Di-tert-butyl peroxide)	CAD, NOC, SHC, WTC, WTL.
*Carbon disulfide	ACS, FMB, PAS, PPG, SFI.
2-Chloroethanol (Ethylene chlorohydrin)	UCC.
Decanoyl peroxide	WTC, WTL.
2,3-Dibromopropanol	GTL.
2,5-Dimethyl-2,5-bis(2-ethyl-1-hexanoyl peroxy) hexane	WTC, WTL.
2,5-Dimethyl-2,5-di(tert-butylperoxy)hexane	WTL.
2,5-Dimethyl-2,5-di(tert-butylperoxy)hexyne-3	WTL.
*EPOXIDES, ETHERS, AND ACETALS:	
1-(Allyloxy)-2,3-epoxypropane (Allyl glycidyl ether)	AAC.
Bis(2-chloroethoxy)methane (Dichloroethylformal)	TKL.
Bis(2-chloroethyl)ether (Dichlorodiethyl ether)	DOW.
Bis(2-chloro-1-methylethyl)ether (Dichloroisopropyl ether)	DOW.
Butylene oxide	DOW.
Butyl vinyl ether	GAF, PUB.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
OTHER MISCELLANEOUS ACYCLIC CHEMICALS--Continued	
EPOXIDES, ETHERS, AND ACETALS--Continued	
2-Chloroethyl vinyl ether	AAC.
Chloromethyl methyl ether	RHX.
2,2-Dichloro-1,1-difluoroethyl methyl ether	DOW.
Dimercaptodiethyl ether	EVN.
Epichlorohydrin	DOW, SHC.
*Ethylene oxide	BAS, CAU, CEL, DOW, EKX, JCC, NWP, OMC, PPG, SHC, SNO, UCC.
Ethyl ether, U.S.P.	MAL, USI.
*Ethyl ether, absolute	EKX, MAL, USI.
Ethyl ether, tech.	ENJ, PUB, UCC, USI.
Ethyl vinyl ether	GAF.
Glycidol (2,3-Epoxy-1-propanol)	DIX.
Isobutyl vinyl ether	GAF.
Isopropyl ether	ENJ, SHC.
Methylal (Dimethoxymethane)	CEL.
Methyl vinyl ether	GAF, UCC.
*Propylene oxide	BAS, DOW, JCC, OCC, OMC, OXI.
Epoxides, ethers, acetals, all other	DA, FIN, PG, UCC, VIK.
FATS AND OILS, CHEMICALLY MODIFIED:	
Hydrogenated tallow glyceraldehydes	CHL.
Stearic acid glycerides and cxidized stearic acid glycerides	SDW.
Fats and oils, chemically modified, all other	DOM.
Glutaraldehyde bis(sodium bisulfite)	EK, FMT.
n-Hexadecyl disulfide	PAS.
*HYDROCARBONS:	
n-Decane	HMY, PLC.
n-Dodecane	HMY.
Hexadecane	HMY.
Myrcene	SCM. X.
n-Octadecane	HMY.
n-Octane	HMY.
Hydrocarbons, all other	CBY, HMY, SFS, UCC.
Lauroyl peroxide	WTC, WTL.
2-Mercaptoethanol	PLC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
OTHER MISCELLANEOUS ACYCLIC CHEMICALS--Continued	
Methyl sulfide (Dimethyl sulfide)	CRZ, PAS.
Methyl sulfoxide (Dimethyl sulfoxide)	CRZ.
ORGANO-ALUMINUM COMPOUNDS:	
Diethylaluminum chloride	TNA, TSA.
Diethylaluminum iodide	TNA, TSA.
Diisobutylaluminum chloride	TNA, TSA.
Diisobutylaluminum hydride	TNA, TSA.
Ethylaluminum dichloride	TNA, TSA.
Ethylaluminum sesquichloride	TNA, TSA.
Isopropenylaluminum	TSA.
Methylaluminum sesquichloride	TNA.
Sodium aluminum chlorohydroxylactate	REH.
Sodium aluminum hydroxylactate	REH.
Triethylaluminum	TNA, TSA.
Triisobutylaluminum	TNA, TSA.
Organo-aluminum compounds, all other	TNA, TSA.
ORGANO-BORON COMPOUNDS:	
Boron fluoride - ethyl ether complex	ACS.
Trimethyl borate	MHI.
Organo-boron compounds, all other	ACS, ADC, TSA.
ORGANO-LITHIUM COMPOUNDS:	
n-Butyllithium	FTE.
sec-Butyllithium	FTE.
Organo-lithium compounds, all other	UCC.
ORGANO-MAGNESIUM COMPOUNDS:	
Methylmagnesium bromide	ARA.
Methylmagnesium chloride	ARA, X.
Organo-magnesium compounds, all other	TNA, TSA.
ORGANO-SILICON COMPOUNDS:	
α-Chloropropyltrichlorosilane	DCC.
Chloropropyltrimethoxysilane	DCC.
Chlorotrimethylsilane	DCC.
Dichlorodimethylsilane	DCC.
Dichloromethylsilane	DCC.
Dichloromethylvinylsilane	DCC, UCC.
Diethoxyphosphorylethyltriethoxysilane	UCC.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
OTHER MISCELLANEOUS ACYCLIC CHEMICALS--Continued	
ORGANO-SILICON COMPOUNDS--Continued	
α-Glycidoxypropyltrimethoxysilane	UCC.
Mercaptopropyltrimethoxysilane	UCC.
α-Methacryloxypropyltrimethoxysilane	UCC.
Methyltrimethoxysilane and polymethyltrisiloxane	DCC, UCC.
Polyoxyalkene silicones	UCC.
*Silicone fluids	DCC, SPD, SWS, UCC.
Trichloromethylsilane	DCC.
Trichloropropylsilane	DCC.
Trichlorovinylsilane	UCC.
Vinyltriethoxysilane	UCC.
Organo-silicone compounds, all other	ARA, DCC, RSA, UCC.
ORGANO-TIN COMPOUNDS:	
Bis(tributyltin)oxide	X.
Dibutyltin bis(isooctylmercaptoacetate)	CCW, X, X.
Dibutyltin bis(mercaptolaurate)	X.
Dibutyltin dichloride	CCW, X.
Dibutyltin methoxide (Dibutylmethoxytin)	CCA.
Dibutyltin oxide	X.
Tributyltin chloride	X.
Tributyltin fluoride	X.
Organo-tin compounds, all other	CCA, CCW, X.
ORGANO-ZINC COMPOUNDS:	
Diethylzinc	TSA.
Perchloromethanethiol (Perchloromethyl mercaptan)	SFA, SFC.
*Phosgene (Carbonyl chloride)	ACS, CTN, DUP, OMC, PPG(E), RUC, UCC, UPJ.
Pine oil, synthetic	CBY, NCI, SCM.
Sodium ethoxide	FMP.
Sodium formaldehyde bisulfite	EK, WAY.
Sodium formaldehyde sulfoxylate	DA.
*Sodium methoxide (Sodium methylate)	DA, HSH, RBC.
Succinyl peroxide	WTL.
Zinc formaldehyde sulfoxylate	USO.
Miscellaneous acylic chemicals, all other	AAC, ABB, ARA, CAD, CCL, DA, DAN, EK, GAF, GLY, GNM, HK, HMY, KCH, PIC, PVO, RBC, SAR, SFS, SHC, SM, TNA, UCC, USR, VTC, WAY, WTL, X, X, X.

TABLE 2.--MISCELLANEOUS CHEMICALS FOR WHICH U.S. PRODUCTION AND/OR SALES WERE EITHER REPORTED OR ESTIMATED, IDENTIFIED BY MANUFACTURER, 1977--CONTINUED

MISCELLANEOUS CHEMICALS	MANUFACTURERS' IDENTIFICATION CODES (ACCORDING TO LIST IN TABLE 3)
A C Y C L I C--Continued	
MIXTURERS NOT SPECIFICALLY ITEMIZED:	
Mixtures of miscellaneous acyclic chemicals not specifically itemized	ALX, ARA, CEL, DUP, EKX, HPC, ICI, MON, MRK, MRT, NCI, PAS, PG, PLC, PMP, PVO, RH, S, SCP, SM, TNA, VEL, WLN.

TABLE 3.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: DIRECTORY OF MANUFACTURERS, 1977

ALPHABETICAL DIRECTORY BY CODE

[Names of manufacturers that reported production or sales of miscellaneous cyclic and acyclic chemicals to the U.S. International Trade Commission for 1977 are listed below in the order of their identification codes as used in table 2]

Code	Name of company
AAC	Alcolac Chemical Corp.
ABB	Abbott Laboratories
ACS	Allied Chemical Corp., Specialty Chemicals Div.
ACY	American Cyanamid Co.
ADC	Anderson Development Co.
AIP	Air Products & Chemicals, Inc.
ALB	Ames Laboratories, Inc.
ALD	Aldrich Chemical Co., Inc.
ALF	Allied Chemical Corp., Fibers Div.
ALX	Alox Corp.
AMB	American Bio-Synthetics Corp.
ARA	Arapahoe Chemicals, Inc. Sub/Syntex Corp. (U.S.A)
ARC	Armak Co.
ARS	Arsynco, Inc.
ARZ	Arizona Chemical Co.
ASH	Ashland Oil, Inc., Ashland Chemical Co.
ASL	Ansul Chemical Co.
AZT	Dart Industries, Inc., Aztec Chemicals Div.
BAS	BASF Wyandotte Corp.
BAX	Baxter/Travenol Laboratories, Inc.
BCC	Buffalo Color Corp.
BFG	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.
BKC	J. T. Baker Chemical Co.
BKL	Kewanee Industries, Inc., Millmaster Chemical Co. Div.
BME	Bendix Corp., FMD Div.
BOR	Borden Co., Borden Chemical Div.
BRD	Lonza, Inc.
BUK	Buckeye Cellulose Corp.
CAD	Noury Chemical Corp.
CAU	Calcasieu Chemical Corp.
CBD	Chembond Corp.
CBY	Crosby Chemicals, Inc.
CCA	Interstab Chemical, Inc.
CCH	Pearsall Chemical Corp.
CCL	Catawba-Charlab, Inc.
CCW	Cincinnati Milacron Chemicals, Inc.
CEL	Celanese Corp.:
	Celanese Chemical Co.
	Celanese Fibers Co.
CGY	Ciba-Geigy Corp.
CHG	Mobay Chemical Corp., Chemagro Agricultural Div.
CHL	Chemol, Inc.
CHP	C. H. Patrick & Co., Inc.
CHT	Chattem Drug & Chemical Co., Chattem Chemicals Div.
CLK	Clark Chemical Corp.
CLN	Standard Brands, Inc., Clinton Corn Processing Co. Div.
CNP	Nipro Inc.
CO	Continental Oil Co.
CPS	CPS Chemical Co.
CPV	Cook Paint & Varnish Co., Inc.
CRN	CPC International, Inc., Amerchol
CRZ	Crown Zellerbach Corp., Chemical Products Div.
CTN	Chemetron Corp., Chemical Products Div.
CWN	Upjohn Co., Fine Chemical Div.
DA	Diamond Shamrock Corp.
DAN	Dan River, Inc., Chemical Products Dept.
DBC	Dow Badische Co.
DCC	Dow Corning Corp.
DIX	Dixie Chemical Co.
DKA	Denka Chemical Corp.
DOM	Dominion Products, Inc.
DOW	Dow Chemical Co.
DUP	E. I. duPont de Nemours & Co., Inc.
DVC	Dover Chemical Corp. Sub. of ICC Industries, Inc.
EFH	E. F. Houghton & Co.
EK	Eastman Kodak Co.:
EKT	Tennessee Eastman Co. Div.
EKX	Texas Eastman Co. Div.
ELP	El Paso Products Co.
EMR	Emery Industries, Inc.
ENJ	Exxon Chemical Co. U.S.A.
EVN	Evans Chemetics, Inc.
FER	Ferro Corp.:
	Grant Chemical Div.
	Keil Chemical Div.
FIN	Hexcel Corp., Hexcel Specialty Chemicals
	FMC Corp.:
FMB	Industrial Chemical Group
FMB	Specialty Chemicals Group
FMP	Industrial Chemical Group
FMT	Fairmount Chemical Co., Inc.
FOC	Handschy Chemical Co., Farac Oil & Chemical Div.
FRO	Vulcan Materials Co., Chemicals Div.
FTE	Foote Mineral Co.
GAF	GAF Corp.
GAN	Gane's Chemical Works, Inc.
GIV	Givaudan Corp.
GLY	Glyco Chemicals, Inc.
GNM	General Mills Chemicals, Inc.
GOC	Gulf Oil Corp., Gulf Oil Chemicals Co.-U.S.
GP	Georgia-Pacific Corp.:
	Plaquemine Div.
	Resins Operations

TABLE 3.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
GRD	W. R. Grace & Co., Polymers & Chemicals Div.	OCC	Oxirane Chemical Co.
GTL	Great Lakes Chemical Corp.	OH	Airco, Inc., Ohio Medical Products Div.
GYR	Goodyear Tire & Rubber Co.	OMC	Olin Corp.
		ONX	A Kewanee Industry, Millmaster Onyx Group, Onyx Chemical Co.
HAL	C.P. Hall Co.		
HCF	Hercofina	ORO	Chevron Chemical Co.
HCP	Honig Chemical & Processing Corp.	ORT	Roehr Chemicals, Inc.
HDG	Hodag Chemical Corp.	OXC	Oxochem Enterprise
HDW	Hardwicke Chemical Co.	OXI	Oxirane Chemical Co. (Channelview)
HEX	Hexagon Laboratories, Inc.		
HFT	Syntex Agribusiness, Inc.	PAS	Pennwalt Corp.
HK	Hooker Chemicals & Plastic Corp.:	PD	Parke, Davis & Co. Sub of Warner-Lambert Co.
HKD	Durez Div.		
HMP	W. R. Grace & Co., Organic Chemicals Div.	PEN	CPC International, Inc., Penick Corp.
HMY	Humphrey Chemical Co.	PFN	Pfanstiehl Laboratories, Inc.
HN	Tenneco Chemicals, Inc.	PFX	Plastifax, Inc.
HPC	Hercules, Inc.	PFZ	Pfizer, Inc. & Pfizer Pharmaceuticals, Inc.
HRT	Hart Products Corp.	PG	Procter & Gamble Co.
HSH	Harshaw Chemical Co.	PIC	Pierce Chemical, Inc.
HUM	Kraft, Inc., Humko Products Chemical Div.	PLC	Phillips Petroleum Co.
		PLS	Plastics Engineering Co.
ICI	ICI United States, Inc.:	PMP	Premier Malt Products, Inc.
	Chemical Specialties Group	PPG	PPG Industries, Inc.
	Plastics Div.	PST	Perstorp, Inc., Toledo Div.
IMC	IMC Chemical Group, Inc., Nitroparaffin Div.	PTT	Petro-Tex Chemical
IOC	Ionac Chemical Co. Div. of Sybron Corp.	PUB	Publicker Industries, Inc.
		PVO	PVO International, Inc.
JCC	Jefferson Chemical Co., Inc.		
		QKO	Quaker Oats Co.
KAI	Kaiser Aluminum & Chemical Corp.		
KCC	Kennecott Copper Corp., Chino Mines Div.	RBC	Fike Chemicals, Inc.
KCH	Joseph Ayers, Inc.	RCI	Reichhold Chemicals, Inc.
KF	Kay-Fries Chemicals, Inc.	RCN	Racon, Inc.
KPT	Koppers Co., Inc.	RDA	Rhodia, Inc.
		REH	Reheis Chemical Co. Div. of Armour Pharmaceutical Co.
LEM	Napp Chemicals, Inc.		
		REM	Remington Arms Co., Inc.
MAL	Mallinckrodt Chemical Works	RH	Rohm & Haas Co.
MCB	Borg-Warner Corp., Borg-Warner Chemicals	RSA	R.S.A. Corp.
MCI	Mooney Chemicals, Inc.	RUB	Hooker Chemical Corp., Ruco Div.
MHI	Ventron Corp.	RUC	Rubicon Chemicals, Inc.
MIL	Milliken & Co., Milliken Chemical Div.		
MLS	Miles Laboratories, Inc., Marschall Div.	S	Sandoz, Inc.
MMM	Minnesota Mining & Manufacturing Co.	SAL	Salsbury Laboratories
MNO	Monochem, Inc.	SAR	Sartomer Industries, Inc.
MNR	Monroe Chemical	SBC	Scher Bros.
MOB	Mobay Chemical Co.	SCM	SCM Corp.
MON	Monsanto Co.	SCP	Henkel, Inc.
MRK	Merck & Co., Inc.	SDC	Martin-Marietta Corp., Sodeyco Div.
MRT	Morton Chemical Co. Div. of Morton Norwich Products, Inc.	SDW	Sterling Drug, Inc., Winthrop Laboratories Div.
MTO	Montrose Chemical Corp. of California		Stauffer Chemical Co.:
		SFA	Agricultural Div.
NCI	Union Camp Corp.	SFC	Calhio Chemicals, Inc. Div.
NEV	Neville Chemical Co.	SFI	Industrial Div.
NOC	Norac Co., Inc. and Mathe Div.	SFP	Plastics Div.
NPI	Stephan Chemical Co., Polychem Dept.	SFS	Specialty Chemical Div.
NSC	National Starch & Chemical Corp.	SHC	Shell Oil Co., Shell Chemical Co. Div.
NTB	National Biochemical Co.	SHP	Shepherd Chemical Co.
NTL	NL Industries, Inc.	SK	SmithKline Chemicals
NWP	Northern Petrochemicals Co.	SKO	Getty Refining & Marketing Co.

TABLE 3.--MISCELLANEOUS CYCLIC AND ACYCLIC CHEMICALS: DIRECTORY OF MANUFACTURERS, 1977--CONTINUED

Code	Name of company	Code	Name of company
SM	Mobil Oil Corp., Chemical Co.:	USB	U.S. Borax Research Corp.
	Chemical Coatings Div.	USI	U.S. Industrial Chemicals Co., National Distillers & Chemicals Corp.
	Phosphorus Div.		
SNO	SunOlin Chemical Co.	USO	U.S. Oil Company
SNW	Sun Chemical Corp., Chemical Div.	USR	Uniroyal, Inc., Uniroyal Chemical Div.
SOC	Standard Oil Co. of California, Chevron Chemical Co.	USS	USS Chemicals Div. of U.S. Steel Corp.
SOH	Vistron Corp.	VAL	Valchem Div. of United Merchants & Manufacturing, Inc.
SPD	General Electric Co., Silicone Products Dept.	VEL	Velsicol Chemical Corp.
STC	American Hoechst Corp., Sou-Tex Works	VGC	Virginia Chemicals, Inc.
STP	Stepan Chemical Co.	VIK	Viking Chemical Co.
SW	Sherwin-Williams Co.	VND	Van Dyk & Co., Inc.
SWS	Stauffer Chemical Co., SWS Silicones Div.	VTC	Vicksburg Chemical Co. Sub. of Vertac Consolidated
SYP	Dart Industries, Inc., Synthetic Products Co. Div.	WAG	West Agro Chemical, Inc.
		WAY	Phillip A. Hunt Chemical Corp., Organic Chemical Div.
TCC	Tanatex Chemical Co.		
TCH	Emery Industries Inc., Trylon Div.	WCC	White Chemical Corp.
TKL	Thiokol Chemical Corp.	WCL	Wright Chemical Corp.
TNA	Ethyl Corp.	WLN	Wilmington Chemical Corp.
TNI	The Gillette Co., Chemical Div.	WM	Inolex Corp.
TRO	Troy Chemical Corp.	WTC	Witco Chemical Corp.
TSA	Texas Alkyls, Inc.	WTH	Union Camp Corp., Chemical Div.
TX	Texaco, Inc.	WTL	Pennwalt Corp., Lucidol Div.
TZC	Magnesium Elektron, Inc.	WYC	Wycon Chemical Co.
		WYT	Wyeth Laboratories, Inc., Wyeth Laboratories Div. of American Home Products Corp.
UCC	Union Carbide Corp.		
UOP	UOP, Inc., Chemical Div.		
UPJ	Upjohn Co.		
UPM	UOP, Inc.	ZGL	Carolina Processing Corp.

Note.--Complete names and addresses of the above reporting companies are listed in table 1 of the Appendix.

APPENDIX

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977

[Names of synthetic organic chemical manufacturers that reported production and/or sales to the U.S. International Trade Commission for 1977 are listed below alphabetically, together with their identification codes as used in table 2 of the 15 individual sections of this report]

Identi-fication code	Name of company	Office address
AEP	A & E Plastik Pak Co., Inc	14505 Proctor Ave., Industry, CA 91749.
AZS	AZS Corp.:	
	AZ Products Co. Div	2525 So. Combee Rd., Eaton Park, FL 33840.
	AZS Chemical Co.	762 Marietta Blvd., N.W., Atlanta, GA 30313.
ABB	Abbott Laboratories	14th St. and Sheridan Rd., N. Chicago, IL 60064.
ABS	Abex Corp., Friction Products Group	P. O. Box 3207, Winchester, VA 22601.
WLC	Agrico Chemical Co	P. O. Box 3166, Tulsa, OK 74101.
AGY	Agway, Inc., Olean Nitrogen Div	1446 Buffalo St., Olean, NY 14760.
OH	Airco, Inc., Ohio Medical Products Div	3030 Airco Dr., Madison, WI 53701.
AIP	Air Products & Chemicals, Inc.	P. O. Box 538, Allentown, PA 18105.
ALC	Alco Chemical Corp	Trenton Ave. and William St., Philadelphia, PA 19134.
AAC	Alcolac, Inc	3440 Fairfield Rd., Baltimore, MD 21212.
ALD	Aldrich Chemical Co., Inc	940 W. St. Paul Ave., Milwaukee, WI 53233.
ALL	Alliance Chemical Corp	33 Avenue P, Newark, NJ 07105.
	Allied Chemical Corp.:	
ACN	Agricultural Div	P. O. Box 2120, Houston, TX 77001.
ALF	Fibers Div	1411 Broadway - 38th Fl., New York, NY 10018.
ASC	Semet-Solvay Div	Columbia Rd., Morristown, NJ 07960.
ACS	Specialty Chemicals Div	P. O. Box 1219 R, Morristown, NJ 07960.
ACU	Union Texas Petroleum Div	P. O. Box 2120, Houston, TX 77001.
ALX	Alox Corp	3943 Buffalo Ave., Niagara Falls, NY 14303.
APH	Alpha Chemical Corp	P. O. Drawer A, Collierville, TN 38017.
ALP	Alpha Laboratories, Inc	1685 S. Fairfax St., Denver, CO 80222.
AMC	Amchem Products, Inc. Sub. of Union Carbide Corp.	Brookside Ave. and Spring Garden St., Ambler, PA 19002.
HES	Amerada Hess Corp. (Hess Oil Virgin Islands Corp.)	1 Hess Plaza, Woodridge, NJ 07095.
AMB	American Bio-Synthetics Corp	710 W. National Ave., Milwaukee, WI 53204.
MAR	American Can Co.	American Lane, Greenwich, CT 06830.
AC	American Color & Chemical Corp	P. O. Box 51, Reading, PA 19603.
ACY	American Cyanamid Co	Wayne, NJ 07470.
	American Hoechst Corp.:	
HST	Hoechst Fibers Industries Div	Route 202-206 North, Somerville, NJ 08876.
HST	Industrial Chemicals Div	129 Quidnick St., Coventry, RI 02816.
STC	Sou-Tex Works	P. O. Box 866, Mount Holly, NC 28120.
ASY	American Synthetic Rubber Corp	4500 Camp Ground Rd., Louisville, KY 40216.
ALB	Ames Laboratories, Inc	200 Rock Lane, Milford, CT 06460.
ACC	Amoco Chemicals Corp	200 E. Randolph Dr., Chicago, IL 60680.
AMO	Amoco Oil Company	200 E. Randolph Dr., Chicago, IL 60680
PAN	Amoco Production Co	P. O. Box 591, Tulsa, OK 74102.
AMO	Amoco Texas Refining Co	200 E. Randolph Dr., Chicago, IL 60680.
ADC	Anderson Development Co	1415 E. Michigan St., Adrian, MI 49221.
ASL	Ansul Chemical Co	1 Stanton St., Marinette, WI 54143.
APX	Apex Chemical Co., Inc	200 S. 1st St., Elizabethport, NJ 07206.
APO	Apollo Colors, Inc	899 Skokie Blvd., Northbrook, IL 60062.
ARA	Arapahoe Chemicals, Inc. Sub/Syntex U.S.A., Inc.	2075 N. 55th St., Boulder, CO 80302
KPP	ARCO/Polymers, Inc	1500 Market St., Philadelphia, PA 19101.
ARD	Ardmore Chemical Co., Inc	840 Valleybrook Ave., Lyndhurst, NJ 07071.
ARN	Arenol Chemical Corp	40-33 23d St., Long Island City, NY 11101.
ARZ	Arizona Chemical Co	Berdan Ave., Wayne, NJ 07470.
AKS	Arkansas Co., Inc	185 Foundry St., Newark, NJ 07105.
ARC	Armak Co	300 S. Wacker Dr., Chicago, IL 60606.
AGP	Armour-Dial, Inc	2000 Aucutt Rd., Montgomery, IL 60538.
ARP	Armour Pharmaceutical Co	P. O. Box 511, Kankakee, IL 60901.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
ARK	Armstrong Cork Co	Charlotte & Liberty Sts., Lancaster, PA 17604.
ARL	Arol Chemical Products Co	649 Ferry St., Newark, NJ 07105.
ARS	Arsynco, Inc	P. O. Box 8, Carlstadt, NJ 07072.
ASH	Ashland Oil, Inc	1401 Winchester Ave., Ashland, KY 41101 and P. O. Box 2458, Columbus, OH 43216.
	Ashland Chemical Co	P. O. Box 2219, Dublin, OH 43216.
BLA	Astor Products, Inc., Blue Arrow Div	5244 Edgewood Ct., Jacksonville, FL 32205.
AST	Astra Pharmaceutical Products, Inc	7 Neponset St., Worcester, MA 01606.
ATL	Atlantic Chemical Corp	10 Kingsland Rd., Nutley, NJ 07110.
ATR	Atlantic Richfield Co	515 S. Flower St., Los Angeles, CA 90064.
APD	Atlas Powder Co. Sub. of Tyler Corp	P. O. Box 87, Joplin, MO 64801.
APR	Atlas Processing Co	P. O. Box 3099, 3333 Midway St., Shreveport, LA 71103.
KCH	Joseph Ayers, Inc	Route #2, Bethlehem, PA 18017.
BAS	BASF Wyandotte Corp	100 Cherry Hill Rd., Parsippany, NJ 07054.
BRP	BP Oil, Inc	397 Midland Bldg., Cleveland, OH 44115.
BKC	J. T. Baker Chemical Co	222 Red School Lane, Phillipsburg, NJ 08865.
BAL	Baltimore Paint & Chemical Co	2325 Hollins Ferry Rd., Baltimore, MD 21230.
BAX	Baxter/Travenol Laboratories, Inc	6301 N. Lincoln Ave., Morton Grove, IL 60053.
BAO	Bayoil Co., Inc	2 Union St., Peabody, MA 01960.
BEE	Beecham, Inc	65 Industrial S., Clifton, NJ 07012.
BIC	Beker Industries Corp	120 W. Putnam Ave., Greenwich, CT 06830.
BCM	Belding Chemical Industries	1430 Broadway, New York, NY 10018.
BME	Bendix Corp., FMD Div	P. O. Box 238, Troy, NY 12180.
BEN	Bennett's	2131 S. 300 West, Salt Lake City, UT 84115.
BDO	Benzenoid Organics, Inc	P. O. Box 157, Route 140, Bellingham, MA 02019.
PDC	Berncolors-Poughkeepsie, Inc	75 N. Water St., Poughkeepsie, NY 12602.
BNS	Binney and Smith, Inc	P. O. Box 431, 1100 Church Lane, Easton, PA 18042.
BOC	Biocraft Laboratories, Inc	12 Industrial Way, Waldwick, NJ 07463.
LAK	Bofors Lakeway, Inc	5025 Evanston Ave., Muskegon, MI 49443.
BOR	Borden, Inc.:	
	Borden Chemical Div	180 E. Broad St., Columbus, OH 43215.
	Printing Ink Div., Pigments Div	630 Glendale-Milford Rd., Cincinnati, OH 45215.
MCB	Borg-Warner Corp., Borg-Warner Chemicals	International Center, Parkersburg, WV 26101.
BFP	Breddo Food Products Corp., Inc	18th and Kansas Avenue, Kansas City, KS 66105.
BRS	Bristol-Meyers Co	345 Park Ave., New York, NY 10022.
BRU	M. A. Bruder & Sons, Inc	52d St. and Grays Ave., Philadelphia, PA 19143.
BUK	Buckeye Cellulose Corp	2899 Jackson Ave., P.O. Box 8407, Memphis, TN 38108.
BKM	Buckman Laboratories, Inc	1256 N. McLean Blvd., Memphis, TN 38108.
BCC	Buffalo Color Corp	340 Elk St., Buffalo, NY 14210.
BJL	Burdick & Jackson Laboratories, Inc	1953 S. Harvey St., Muskegon, MI 49442.
BUR	Burroughs Wellcome Co	3030 Cornwallis Rd., Research Triangle Park, NC 27709.
CFI	CF Industries, Inc	Salem Lake Dr., Long Grove, IL 60047
	CPC International, Inc.:	
ACR	Acme Resin Corp	1401 S. Circle Avenue, Forest Park, IL 60130.
CRN	Amerchol	Talmadge Rd., Edison, NJ 08817.
PEN	Penick Corp	1050 Wall St. W., Lyndhurst, NJ 07071.
CPS	CPS Chemical Co	P. O. Box 162, Old Bridge, NJ 08857.
CBT	Samuel Cabot, Inc	One Union St., Boston, MA 02108.
CAU	Calcasieu Chemical Corp	P. O. Box 1522, Lake Charles, LA 70602.
CBM	Carborundum Co	P. O. Box 477, Niagara Falls, NY 14302.
CGL	Cargill, Inc	P. O. Box 9300, Minneapolis, MN 55402.
COR	Carl Gordon Industries, Inc	1001 Southbridge St., Worcester, MA 01610.
ZGL	Carolina Processing Corp	P.O. Box 161, Severn, NC 27877.
CHC	Carpenter Chemical Co	P. O. Box 27205, Richmond, VA 23261.
JWC	J.W. Carroll & Sons Div. of U.S. Industries, Inc.	P. O. Box 4908, Carson, CA 90745.
CRS	Carus Chemical Co	1500 8th St., LaSalle, IL 61301.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
DOL	Castle & Cooke, Inc., Castle & Cooke Foods, Hawaii Pineapple Div.	650 Iwilei Rd., P. O. Box 3380, Honolulu, HI 96801.
CCL	Catawba-Charlab, Inc	5046 Old Pineville Rd., Charlotte, NC 28231.
CEL	Celanese Corp.:	
	Celanese Chemical Co	1211 Avenue of the Americas, New York, NY 10036.
	Celanese Fibers Co	P. O. Box 1414, Charlotte, NC 28201.
	Celanese Plastics Co	26 Main St., Chatham, NJ 07928.
	Celanese Polymer Specialties Co	One Riverfront Plaza, Louisville, KY 40202.
CNT	Certainteed Corp	P. O. Box 860, Valley Forge, PA 19482.
CPR	Certified Processing Corp	U.S. Highway 22, Hillside, NJ 07205.
GRS	Champlin Petroleum Co	P. O. Box 9176, Corpus Christi, TX 78408.
SOG	Charter International Oil Co	P. O. Box 5008, Houston, TX 77012.
CHT	Chattem Drug & Chemical Co	1715 W. 38th St., Chattanooga, TN 37409.
CBD	Chembond Corp	P. O. Box 270, Springfield, OR 97477.
	Chemed Corp.:	
GRC	Dubois Chemicals Div	Dubois Tower, Cincinnati, OH 45202.
GRL	Vestal Laboratories Div	4963 Manchester Ave., St. Louis, MO 63110.
	Chemetron Corp.:	
CTN	Chemical Products Div	P. O. 66251-AMF O'Hare, Chicago, IL 60666.
HSC	Pigments Div., Sub. of Allegheny Ludlum Industries, Inc.	491 Columbia Ave., Holland, MI 49423.
CI	Chem-Fleur, Inc	200 Pulaski St., Newark, NJ 07105.
CHF	Chemical Formulators, Inc	P. O. Box 26, Nitro, WV 25143.
CHL	Chemol, Inc	P. O. Box 20687, Greensboro, NC 27420.
CPX	Chemplex Co	3100 Golf Rd., Rolling Meadows, IL 60008.
ORO	Chevron Chemical Co	575 Market St., Rm. 3280, San Francisco, CA 94105.
CHH	CHR. Hansen's Laboratory, Inc	9015 W. Maple St., West Allis, WI 53214.
CGY	Ciba-Geigy Corp	444 Saw Mill River Rd., Ardsley, NY 19502.
	Agricultural Div	P. O. Box 11422, Greensboro, NC 27409.
	Pharmaceutical Div	556 Morris Ave., Summit, NJ 07901.
	Resins Dept	444 Saw Mill River Rd., Ardsley, NY 10502.
CCW	Cincinnati Milacron Chemicals, Inc	West St., Reading, OH 45215.
CIN	Cindet Chemicals, Inc	2408 Doyle St., P. O. Box 20926, Greensboro, NC 27406.
	Cities Service Co.:	
CBN	Columbian Div	P. O. Box 300, Tulsa, OK 74102.
TEN	Copperhill Operations	Copperhill, TN 37317.
CBN	Petrochemicals Div	P. O. Box 1522, Lake Charles, LA 70602, and 6th & Boston Sts., Tulsa, OK 74102.
CSO	Petroleum Products Group	P. O. Box 1562, Lake Charles, LA 70602.
CLK	Clark Oil & Refining Corp	131st St. & Kedzie Ave., Blue Island, IL 60406.
CLY	W. A. Cleary Corp	P. O. Box 10, Somerset, NJ 08873.
CLI	Clintwood Chemical Co	4342 S. Wolcott Ave., Chicago, IL 60609.
CSP	Coastal States Petrochemical Co	P. O. Drawer 521, Corpus Christi, TX 78403.
CP	Colgate-Palmolive Co	300 Park Ave., New York, NY 10022.
COL	Collier Carbon & Chemical Corp	P. O. Box 60455, Los Angeles, CA 90060.
CLD	Colloids, Inc	394 Frelinghuysen Ave., Newark, NJ 07114.
CNC	Columbia Nitrogen Corp	P. O. Box 1483, Augusta, GA 30903.
CMP	Commercial Products Co., Inc	117 Ethel Ave., Hawthorne, NJ 07506.
COR	Commonwealth Oil Refining Co., Inc	Petrochemical Complex, Ponce, PR 00731.
CPI	Commonwealth Petrochemicals, Inc	Petrochemical Complex, Ponce, PR 00731.
CNI	Conap, Inc	1405 Buffalo St., Olean, NY 14760.
CNE & SED	Conchemco, Inc	1000 Marshall Dr., Lenexa, KS 66215, and 18th & Garfield Sts., Kansas City, MO 64127.
CON	Concord Chemical Co., Inc	17th & Federal Sts., Camden, NJ 08105.
CWP	Consolidated Papers, Inc	231 1st Ave N., Wisconsin Rapids, WI 54494.
CTL	Continental Chemical Co	270 Clifton Blvd., Clifton, NJ 07015.
CO	Continental Oil Co	P. O. Box 1267, 1000 South Pine, Ponce City, OK 74601.
CPV	Cook Paint & Varnish Co	P. O. Box 389, Kansas City, MO 64141.
CFA	Cooperative Farm Chemicals Association	P. O. Box 308, Lawrence, KS 66044.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identification code	Name of company	Office address
COP	Coopers Creek Chemical Corp	River Rd., W. Conshohocken, PA 19428.
CPY	Copolymer Rubber & Chemical Corp	P. O. Box 2591, Baton Rouge, LA 70821.
SWC	Corco Cyclohexane, Inc	Petrochemical Complex, Ponce, PR 00731.
CSD	Cosden Oil & Chemical Co	P. O. Box 1311, Big Spring, TX 79720.
CRT	Crest Chemical Corp	225 Emmett St., Newark, NJ 07114.
CRD	Croda, Inc	51 Madison Ave., Suite 2518, New York, NY 10010.
ALT	Crompton & Knowles Corp., Dyes & Chemicals Div.	500 Pear St., Reading, PA 19603.
CBY	Crosby Chemicals, Inc	P. O. Box 460, Picayune, MS 39466.
CCP	Crown Central Petroleum Corp	1 N. Charles St., Baltimore, MD 21203.
CRZ	Crown Zellerbach Corp., Chemical Products Div.	Camas, WA 98607.
CTR	Customs Resins Div. of Bemis Co., Inc	P. O. Box 933, Henderson, KY 42420.
DAN	Dan River, Inc., Chemical Products Dept	P. O. Box 261, Danville, VA 24541.
	Dart Industries, Inc.:	
AZT	Aztec Chemicals Div	555 Garden St., Elyria, OH 44035.
SYP	Synthetic Products Co. Div	1636 Wayside Rd., Cleveland, OH 44112.
DYS	Davies-Young Co	2700 Wagner Place, Maryland Heights, MO 63043.
DLI	Dawe's Laboratories, Inc	450 State St., Chicago Heights, IL 60411.
DGO	Day-Glo Color Corp	4732 St. Clair Ave., Cleveland, OH 44103.
DEC	Degen Oil & Chemical Co	200 Kellogg St., Jersey City, NJ 07305.
DKA	Denka Chemical Corp	8701 Park Place Blvd., Houston, TX 77017.
DNS	Dennis Chemical Co	2701 Papin St., St. Louis, MO 63103.
DSO	DeSoto, Inc	1700 S. Mt. Prospect Ave., Des Plaines, IL 60018.
DEX	Dexter Chemical Corp	845 Edgewater Rd., Bronx, NY 10474.
HYC	Hysol Div	211 Franklin St., Olean, NY 14760.
MID	Midland Div	1-7 E. Water St., Waukegan, IL 60085.
DA	Diamond Shamrock Corp	1100 Superior Ave., Cleveland, OH 44114.
PLN	Disogrin Industries Corp	Grenier Field, Manchester, NH 03130.
DIX	Dixie Chemical Co	3635 W. Dallas Ave., P. O. Box 13410, Houston, TX 77019.
DPP	Dixie Pine Chemicals, Inc	P. O. Box 470, Hattiesburg, MS 39401.
DOM	Dominion Products, Inc	882 3d Ave., Brooklyn, NY 11232.
DVC	Dover Chemical Corp. Sub. of ICC Industries, Inc.	15th & Davis Sts., Dover, OH 44622.
DBC	Dow Badische Chemical Co	602 Copper Rd., Freeport, TX 77541.
DOW	Dow Chemical Co	2020 Dow Center, Midland, MI 48640.
DCC	Dow Corning Corp	P. O. Box 1767, Midland, MI 48640.
DUP	E. I. duPont de Nemours & Co., Inc	DuPont Bldg., Wilmington, DE 19898.
DSC	Dye Specialties, Inc	26 Journal Sq., Jersey City, NJ 07306.
EPI	Eagle Pitcher Industries, Ohio Rubber Co. Div.	P. O. 1398, Denton, TX 76201.
EGR	Eagle River Chemical Corp	P. O. Box 2648, W. Helena, AR 72390.
ECC	Eastern Color & Chemical Co	35 Livingston St., Providence, RI 02904.
EK	Eastman Kodak Co	343 State St., Rochester, NY 14650.
EKT	Tennessee Eastman Co. Div	P. O. Box 511, Kingsport, TN 37662.
EKX	Texas Eastman Co. Div	P. O. Box 511, Kingsport, TN 37662.
ESA	East Shore Chemical Co., Inc	1221 E. Barney Ave., Muskegon, MI 49443.
ELN	Elan Chemical Co	268 Doremus Ave., Newark, NJ 07105.
ELC	Elco Corp. Sub. of Detrex Industries, Inc.	P. O. Box 09168, Cleveland, OH 44109.
ELP	El Paso Products Co	P. O. Box 3986, Odessa, TX 79760.
EMR	Emery Industries, Inc	1300 Carew Tower, Cincinnati, OH 45202.
TCH	Trylon Div	P. O. Box 628, Mauldin, SC 29662.
EMK	Emkay Chemical Co	319 2d St., Elizabeth, NJ 07206.
EN	Endo Laboratories, Inc	1000 Stewart Ave., Garden City, NY 11530.
ENO	Enenco, Inc	P. O. Box 398, Memphis, TN 38101.
ESS	Essential Chemicals Group	28391 Essential Rd., Merton, WI 53056.
TNA	Ethyl Corp	330 S. 4th St., Richmond, VA 23231.
EVN	Evans Chemetics, Inc	90 Tokeneke Rd., Darien, CT 06820.
ENJ	Exxon Chemical Co. U.S.A	P. O. Box 3272, Houston, TX 77001.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
	FMC Corp.:	
FMN	Agricultural Chemical Div	100 Niagara St., Middleport, NY 14105.
FMB	Industrial Chemical Group	2000 Market St., Philadelphia, PA 19103.
FMP	Industrial Chemical Group	2000 Market St., Philadelphia, PA 19103.
FMB	Specialty Chemicals Div	Sawyer Ave. & River Rd., Town of Tonawanda, NY 14150.
FRP	FRP Co	P. O. Box 349, Baxley, GA 31513.
FAB	Fabricolor Manufacturing Corp	24-1/2 Van Houten St., Paterson, NJ 07509.
FMT	Fairmount Chemical Co., Inc	117 Blanchard St., Newark, NJ 07105.
FRI	Farmland Industries, Inc	P. O. Box 7305, Kansas City, MO 64116.
FEL	Felton International, Inc	599 Johnson Ave., Brooklyn, NY 11235.
FER	Ferro Corp.:	
	Grant Chemical Div	P. O. Box 263, Baton Rouge, LA 70821.
	Keil Chemical Div	3000 Sheffield Ave., Hammond, IN 46320.
	Ottawa Chemical Div	700 N. Wheeling St., Toledo, OH 43605.
PRD	Productol Chemical Div	13215 E. Penn St., Whittier, CA 90602.
FND	Fiber Industries, Inc	P. O. Box 10038, Charlotte, NC 28201.
RBC	Fike Chemicals, Inc	P. O. Box 546, Nitro, WV 25143.
	Firestone Tire & Rubber Co.:	
FIR	Firestone Plastics Co. Div	P. O. Box 699, Pottstown, PA 19464.
FRF	Firestone Synthetic Fibers Co	P. O. Box 450, Hopewell, VA 23869.
FRS	Firestone Synthetic Rubber & Latex Co. Div.	381 W. Wilbeth Rd., Akron, OH 44301.
FST	First Chemical Corp	P. O. Box 1427, Pascagoula, MS 39567.
FMS	First Mississippi Corp	P. O. Box 1249, Jackson, MS 39205.
FLM	Fleming Laboratories, Inc	P. O. Box 10372, Charlotte, NC 28237.
CIK	Flint Ink Corp., Cal/Ink Div	1404 4th St., Berkeley, CA 94710.
FLO	Florasynth, Inc	410 E. 62nd St., New York, NY 10021.
FTE	Foote Mineral Co	Route 100, Exton, PA 19341.
FOM	Formica Corp	120 E. 4th St., Cincinnati, OH 45202.
FG	Foster Grant Co., Inc	289 N. Main St., Leominster, MA 01453.
FLN	Franklin Chemical Corp	2020 Bruck St., Columbus, OH 43207.
FRE	Freeman Chemical Corp	222 E. Main St., Port Washington, WI 53074.
FB	Fritzsche Dodge & Olcott, Inc	76 9th Ave., New York, NY 10011.
FLH	H. B. Fuller Co., Polymer Div	4450 Malsbary Rd., Blue Ash, OH 45242.
GAF	GAF Corp	P. O. Box 6037, Chattanooga, TN 37401 and 33 Riverside Ave., Rensselaer, NY 12144.
GLX	Galaxie Chemical Corp	26 Piercy St., Paterson, NJ 07524.
GAN	Gane's Chemicals, Inc	1144 Avenue of the Americas, New York, NY 10036.
GE	General Electric Co	1 Plastics Ave., Pittsfield, MA 01201 and 1350 S. Second St., Coshocton, OH 43812.
GEI	Insulating Materials Products Section	1 Campbell Rd., Schenectady, NY 12306.
SPD	Silicone Products Dept	Bldg. 11-24, Waterford, NY 12188.
GNF	General Foods Corp., Maxwell House Div	1125 Hudson St., Hoboken, NJ 07030.
GLC	General Latex & Chemical Corp	666 Main St., Cambridge, MA 02139.
GNM	General Mills Chemicals, Inc	4620 W. 77th St., Minneapolis, MN 55435.
GPM	General Plastics Manufacturing Co	3481 S. 35th St., Tacoma, WA 98409.
GNT	General Tire & Rubber Co., Chemical/ Plastics Div	1 General St., Akron, OH 44329.
GRG	P. D. George Co	5200 N. 2d St., St. Louis, MO 63147.
PSP	Georgia-Pacific Corp	P. O. Box 1235, Bellingham, WA 98225.
GP	Plaquemine Div	P. O. Box 629, Plaquemine, LA 70764.
GP	Resins Operations	900 S.W. 5th Ave., Portland, OR 97240.
SKO	Getty Refining & Marketing Co	P. O. Box 1650, Tulsa, OK 74102.
TID	Delaware Refinery	Delaware City, DE 19706.
TNI	The Gillette Co., Chemical Div	3500 W. 16th St., N. Chicago, IL 60064.
GIL	Gilman Paint & Varnish Co	216 W. 8th St., Chattanooga, TN 37401.
GIV	Givaudan Corp	100 Delawanna Ave., Clifton, NJ 07014.
GLY	Glyco Chemicals, Inc	51 Weaver St., Greenwich, CT 06830.
GPI	Goodpasture, Inc	P. O. Drawer 921, Brownfield, TX 79316.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identification code	Name of company	Office address
BFG	B. F. Goodrich Co., B. F. Goodrich Chemical Co. Div.	6100 Oak Tree Blvd., Cleveland, OH 44131.
GYR	Goodyear Tire & Rubber Co	1144 E. Market St., Akron, OH 44316.
GCC	W. R. Grace & Co	P. O. Box 277, Memphis, TN 38101.
GRH	Hatco Chemical Div	King George Post Rd., Fords, NJ 08863.
MRO	Hatco Polyester Div	1711 Elizabeth Ave. West, Linden, NJ 07036.
HMP	Organic Chemicals Div	Poisson Ave., Nashua, NH 03060.
GRD	Polymers & Chemicals Div	55 Hayden Ave., Lexington, MA 02173.
GRA	Great American Chemical Corp	650 Water St., Fitchburg, MA 01420.
GTL	Great Lakes Chemical Corp	P. O. Box 2200, West Lafayette, IN 47906.
GRW	Great Western Sugar Co	P. O. Box 5308, Terminal Annex, Denver, CO 80217.
GNM	Greenwood Chemical Co	P. O. Box 26 - State Highway #690, Greenwood, VA. 22943.
GRO	A. Gross & Co., Millmaster Onyx Group, Kewanee Industries, Inc.	625 Doremus Ave., Newark, NJ 07105.
GRV	Guardsman Chemical, Inc	1350 S. 15th St., Louisville, KY 40210.
GOC	Gulf Oil Corp., Gulf Oil Chemicals Co. - U.S.	P. O. Box 3766, Houston, TX 77001.
GTH	Guth Corp	322 S. Center St., Hillside, IL 60162.
HNC	H & N Chemicals Co	90 Maltese Dr., Totowa, NJ 07512.
HLI	Haag Laboratories, Inc	14010 S. Seeley Ave., Blue Island, IL 60406.
HAL	C. P. Hall Co	7300 S. Central Ave., Chicago, IL 60638.
FOC	Handschy Chemical Co., Farac Oil and Chemical Div.	13601 S. Ashland Ave., Riverdale, IL 60627.
HAN	Hanna Chemical Coatings Corp	P. O. Box 147, Columbus, OH 43216.
HDM	Hardman, Inc	600 Cortlandt St., Belleville, NJ 07109.
HDW	Hardwicke Chemical Co	Route 2, Box 50A, Elgin, SC 29045.
HRC	Harmon Colors Corp	550 Belmont Ave., Haledon, NJ 07507.
HSH	Harshaw Chemical Co	1945 E. 97th St., Cleveland, OH 44106.
HRT	Hart Products Corp	173 Sussex St., Jersey City, NJ 07302.
HVG	Haveg Industries, Inc. Sub. of Hercules, Inc.	900 Greenback Rd., Wilmington, DE 19808.
HKY	Hawkeye Chemical Co	P. O. Box 899, Clinton, IA 52733.
SCP	Henkel, Inc	400 Alfred Ave., Teaneck, NJ 07666.
HCF	Hercofina	310 N. Front St., Wilmington, NC 28402.
HCR	Hercor Chemical Corp	Petrochemical Complex, Ponce, PR 00731.
HPC	Hercules, Inc	910 Hercules Tower, Wilmington, DE 19899.
HER	Heresite & Chemical Co	822 S. 14th St., Manitowoc, WI 54220.
HET	Heterochemical Corp	111 E. Hawthorne Ave., Valley Stream, NY 11580.
HEW	Hewitt Soap Co., Inc	333 Linden Ave., Dayton, OH 45403.
HEX	Hexagon Laboratories, Inc	4166 Boston Rd., Bronx, NY 10475.
REZ	Hexcel Corp	20701 Nordhoff St., Chatsworth, CA 91311.
FIN	Hexcel Specialty Chemicals	205 Main St., Lodi, NJ 07644.
HDG	Hodag Chemical Corp	7247 N. Central Park Ave., Skokie, IL 60076.
HOF	Hoffmann-LaRoche, Inc	324-424 Kingsland St., Nutley, NJ 07110.
HCP	Honig Chemical & Processing Corp	414 Wilson Ave., Newark, NJ 07105.
HK	Hooker Chemicals & Plastics Corp	MPO Box 8, Niagara Falls, NY 14302.
HKD	Durez Div	Walck Rd., N. Tonawanda, NY 14121.
RUB	Ruco Div	P. O. Box 456, Revin Rd., Burlington, NJ 08016.
EFH	E. F. Houghton & Co	303 W. Lehigh Ave., Philadelphia, PA 19133.
HMY	Humphrey Chemical Co	Devine St., North Haven, CT 06473.
WAY	Philip A. Hunt Chemical Corp., Organic Chemical Div.	P. O. Box 4249, E. Providence, RI 02914.
HNT	Huntington Laboratories, Inc	970 E. Tipton St., Huntington, IN 46750.
HUS	Husky Industries, Inc	62 Perimeter Center E., Atlanta, GA 30346.
HYN	Hynson, Westcott & Dunning, Inc	Charles and Chase Sts., Baltimore, MD 21201.
ICI	ICI United States, Inc.:	
	Chemical Specialties Co	Wilmington, DE 19897.
	Plastics Div	Wilmington, DE 19897.
	Specialty Chemicals Group	Wilmington, DE 19897.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identification code	Name of company	Office address
IMC	IMC Chemical Group, Inc	P. O. Box 207, Terre Haute, IN 47808; P. O. Box 149, Orrington, ME 04474 and 100 Lister Ave., Newark, NJ 07105.
	McWorter Resins	P. O. Box 308, Cottage Pl., Carpentersville, IL 60110
	Nitroparaffin Div	666 Garland Pl., Des Plaines, IL 60016.
RAY	ITT Rayonier, Inc	605 3d Ave., New York, NY 10016.
IND	Indol Chemical Co., Inc	FT. of Leffert St., Carterit, NJ 07008.
INP	Indpol, Inc	P. O. Box 1213, Tustin, CA 92680.
INL	Inland Steel Co., Inland Steel Container Co.	4300 W. 130th St., Chicago, IL 60658.
ICC & ICF	Inmont Corp	1255 Broad St., Clifton, NJ 07015, and 150 Wagaraw Rd., Hawthorne, NJ 07506.
WM	Inolex Corp	Jackson & Swanson Sts., Philadelphia, PA 19148.
WIL	Inolex Pharmaceutical Div	2600 Bond St., Park Forest South, IL 60466.
SPC	Insilco Corp., Sinclair Paint Co. Div	3960 E. Washington Blvd., Los Angeles, CA 90023.
IFF	International Flavor and Fragrances, Inc	521 W. 57th St., New York, NY 10019.
IPC	Interplastic Corp	2015 NE. Broadway St., Minneapolis, MN 55413.
CCA	Interstab Chemical, Inc	500 Jersey Ave., New Brunswick, NJ 08903.
IOC	Ionac Chemical Co. Div. of Sybron Corp	Birmingham Rd., Birmingham, NJ 08011.
IRI	Ironsides Co	270 W. Mound St., Columbus, OH 43216.
JCC	Jefferson Chemical Co., Inc	P. O. Box 52332, Houston, TX 77052.
JFR	George A. Jeffreys & Co., Inc	P. O. Box 709, Salem, VA 24153.
JEN	Jennison-Wright Corp	P. O. Box 691, Toledo, OH 43694.
JRG	Andrew Jergens Co	2535 Spring Grove Ave., Cincinnati, OH 45214.
UPF	Jim Walter Resources, Inc	3300 1st Ave. N., Birmingham, AL 35202.
JNS	S. C. Johnson & Son, Inc	1525 Howe St., Racine, WI 53403.
JOB	Jones-Blair Co	2728 Empire Central, Dallas, TX 75235.
JOR	Jordan Chemical Co	1830 Columbia Ave., Folcraft, PA 19032.
KAI	Kaiser Aluminum & Chemical Corp	P. O. Box 337, Gramercy, LA 70052.
SNI	Kaiser Agricultural Chemicals Div	P. O. Box 246, Savannah, GA 31402.
KLM	Kalama Chemical, Inc	1110 The Bank of California Center, Seattle, WA 98164
KF	Kay-Fries Chemicals, Inc., Member Dynamit Nobel Group.	200 Summit Ave., Montvale, NJ 07645.
KMP	Kelly-Moore Paint Co	987 Commercial St., San Carlos, CA 94070.
	Kennecott Copper Corp.:	
KCC	Chino Mines Div	Hurley, MN 88043.
KCU	Utah Copper Div	P. O. Box 11299, Salt Lake City, UT 84147.
AMP	Kerr-McGee Chemical Corp	1101 McGee Tower, Oklahoma City, OK 73102.
	A Kewanee Industry:	
BKL	Millmaster Chemical Co. Div	99 Park Ave., New York, NY 10016.
	Millmaster Onyx Group:	
ONX	Onyx Chemical Co. Div	190 Warren St., Jersey City, NJ 07302.
RPC	Refined-Onyx Co. Div	624 Schuyler Ave., Lyndhurst, NJ 07071.
KYS	Keysor Corp	P. O. Box 308, Saugus, CA 91350.
KCW	Keystone Color Works, Inc	151 W. Gay Ave., York, PA 17403.
KNP	Knapp Products, Inc	187 Garibaldi Ave., P. O. Box 405, Lodi, NJ 07644.
KMC	Kohler-McLister Paint Co	P. O. Box 546, Denver, CO 80201.
KON	H. Kohnstamm & Co., Inc	161 Avenue of the Americas, New York, NY 10013.
KPT	Koppers Co., Inc	Koppers Bldg., Pittsburgh, PA 15219.
	Roads Materials Div	Koppers Bldg., Pittsburgh, PA 15219.
HUM	Kraft, Inc., Humko Sheffield Chemical Operation.	P. O. Box 398, Memphis, TN 38101.
LKY	Lake States Div. of St. Regis Paper Co	515 W. Davenport St., Rhinelander, WI 54501.
LUR	Laurel Products Corp	2600 E. Tioga St., Philadelphia, PA 19134.
LEA	Leatex Chemical Co	2722 N. Hancock St., Philadelphia, PA 19133.
LEV	Lever Brothers Co	390 Park Ave., New York, NY 10022.
LVR	C. Lever Co., Inc	736 Dunks Ferry Rd., Cornwells Hgts. PA 19020.
BLS	Life Savers, Inc	Church St., Canajoharie, NY 13317.
LIL	Eli Lilly & Co	P. O. Box 618, Indianapolis, IN 46206 and G.P.O. Box 4388, San Juan, PR 00936.
BRD	Lonza, Inc	22-10 Route 208, Fair Lawn, NJ 07410.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
MMC	MC&B Manufacturing Chemists, Inc	2909 Highland Ave., Norwood, OH 45212.
SOR	MW Manufacturers, Southern Resin Div	P. O. Box 68, Thomasville, NC 27360.
TZC	Magnesium Elektron, Inc	Star Route A, Box 202-1, Flemington, NJ 08822.
MGR	Magruder Color Co., Inc	1029 Newark Ave., Elizabeth, NJ 07201.
MAL	Mallinckrodt, Inc	675 Brown Rd., St. Louis, MO 63134.
TRD	Manufacturing Enterprises, Inc., Squibb Manufacturing, Inc., Trade Enterprises, Inc., Ersana, Inc.	P. O. Box 609, Humacao, PR 00661.
MOR	Marathon Morco Co	P. O. Drawer C, 4401 Park Ave., Dickinson, TX 77539.
MOC	Marathon Oil Co., Texas Refining Div	P. O. Box 1191, Texas City, TX 77590.
MRB	Marblette Co	37-31 30th St., Long Island City, NY 11101.
MRD	Marden-Wild Corp	500 Columbia St., Somerville, MA 02143.
MRV	Marlowe-Van Loan Corp	P. O. Box 1851, High Point, NC 27260.
SDC	Martin-Marietta Corp., Sodyeco Div	P. O. Box 10098, Charlotte, NC 28237.
MRX	Max Marx Color & Chemical Co	192 Coit St., Irvington, NJ 07111.
MCA	Masonite Corp., Alpine Chemical Div	P. O. Box 2392, Gulfport, MS 39503.
MAY	Otto B. May Co. Div. of Cone Mills Corp	52 Amsterdam St., Newark, NJ 07105.
MCC	McCloskey Varnish Co	7600 State Rd., Philadelphia, PA 19136.
MCC	McCloskey Varnish Co. of the Northwest	4155 N.W. Yeon Ave., Portland, OR 97210.
MCC	McCloskey Varnish Co. of the West	5501 E. Slauson, Los Angeles, CA 90040.
MGK	McLaughlin Gormley King Co	8810 10th Ave., N., Minneapolis, MN 55427.
MDJ	Mead Johnson & Co	2404 Penna. St., Evansville, IN 47721.
MLC	Melamine Chemicals, Inc	P. O. Box 748, Donaldsonville, LA 70346.
MRK	Merck & Co., Inc	126 E. Lincoln Ave., P. O. Box 2000, Rahway, NJ 07065.
MER	Merichem Co	1914 Haden Rd., Houston, TX 77015.
PFP	Midwest Manufacturing Corp	Oak St. at Bluff Rd., Burlington, IA 52601.
MLS	Miles Laboratories, Inc.:	
	Marschall Div	1127 Myrtle St., Elkhart, IN 46514.
	Sumner Div	1127 Myrtle St., Elkhart, IN 46514.
MIL	Milliken & Co., Milliken Chemical Div	P. O. Box 817, Inman, SC 29349.
MMM	Minnesota Mining & Manufacturing Co	3M Center, St. Paul, MN 55101.
MIR	Miranol Chemical Co., Inc	277 Cuit St., Irvington, NJ 07111.
MSC	Mississippi Chemical Corp	P. O. Box 388, Yazoo City, MS 39194.
MOB	Mobay Chemical Corp	Penn Lincoln Parkway, W. Pittsburgh, PA 15205.
CHG	Chemagro Agricultural Div	P. O. Box 4913, Hawthorne Rd., Kansas City, MO 64120.
VPC	Verona Div	Iorio Ct., Union, NJ 07083.
SM	Mobil Oil Corp	P. O. Box 900, Dallas, TX 75221.
	Mobil Chemical Co	P. O. Box 3868, Beaumont, TX 77704.
	Chemical Coatings Div	1024 South Ave., Plainfield, NJ 07062.
	Phosphorus Div	P. O. Box 26683, Richmond, VA 23261.
MOA	Mona Industries, Inc	65 E. 23d St., Paterson, NJ 07524.
MNO	Monochem, Inc	P. O. Box 488, Geismar, LA 70734.
MNR	Monroe Chemical Co	1296 N.W. 3rd, Kalama, WA 98625.
MON	Monsanto Co	800 N. Lindbergh Blvd., St. Louis, MO 63166.
MTO	Montrose Chemical Corp. of California	3250 Wilshire Blvd. Suite 1800, Los Angeles, CA 90010.
MCI	Mooney Chemicals, Inc	2301 Scranton Rd., Cleveland, OH 44113.
MCP	Moretex Chemical Products, Inc	P. O. 1799, Spartanbury, SC 29304.
	Morton Norwich Products, Inc.:	
MRT	Morton Chemical Co. Div	110 N. Wacker Dr., Chicago, IL 60606.
NOR	Norwich Eaton Pharmaceutical Div	17 Eaton Ave., Norwich, NY 13815.
MOT	Motomco, Inc	267 Vreeland Ave., P. O. Box 300, Paterson, NJ 07513.
PNX	Murphy-Phoenix Co	9505 Cassius Ave., Cleveland, OH 44105.
NTL	NL Industries, Inc	1230 Avenue of the Americas, New York, NY 10020.
CHN	N-Ren Corp., Cherokee Nitrogen Div	P. O. Box 429, Pryor, OK 74361.
LEM	Napp Chemicals, Inc	199 Main St., Lodi, NJ 07644.
NTB	National Biochemical Co	3127 W. Lake St., Chicago, IL 60612.
NTC	National Casein Co	601 W. 80th St., Chicago, IL 60620.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi- fication code	Name of company	Office address
NMC	National Milling & Chemical Co	4601 Flat Rock Rd., Philadelphia, PA 19127.
NSC	National Starch & Chemical Corp	10 Finderne Ave., Bridgewater, NJ 08876.
NES	Nease Chemical Co., Inc	P. O. Box 221, Route 26N, State College, PA 16801.
NEP	Nepera Chemical Co., Inc	Route 17, Harriman, NY 10926.
NEV	Neville Chemical Co	Neville Island P. O., Pittsburgh, PA 15225.
NLO	Niklor Chemical Co	2060 E. 220th St., Long Beach, CA 90810.
NIL	Nilok Chemicals, Inc	2235 Langdon Farm Rd., Cincinnati, OH 45230.
JDC	Nipak, Inc	P. O. Box 2820, Dallas, TX 75221.
CNP	Nipro, Inc	P. O. Box 1483, Augusta, GA 30903.
NOC	Norac Co., Inc	405 S. Motor Ave., Azusa, CA 91703.
	Mathe Div	169 Kennedy Dr., Lodi, NJ 07644.
NEO	Norda, Inc	140 Route 10, E. Hanover, NJ 07936.
NPV	Norris Paint & Varnish Co., Inc	P. O. Box 2023, Salem, OR 97308.
LMI	North American Chemical Co	19 S. Canal St., Lawrence, MA 01843.
NWP	Northern Petrochemical Co	2350 E. Devon Ave., Des Plaines, IL 60018.
NW	Northwestern Chemical Co	120 N. Aurora St., W. Chicago, IL 60185.
NPC	Northwest Petrochemical Corp	P. O. Box 99, Anacortes, WA 98221.
NCW	Nostrip Chemical Works, Inc	P. O. Box 160, Pedricktown, NJ 08067.
CAD	Noury Chemical Corp	2153 Lockport-Olcott Rd., Burt, NY 14028.
NVT	Novamont Corp	P. O. Box 189, Kenova, WV 25530.
CMC	Nyanza, Inc	Megunco Rd., Ashland, MA 01721.
OBC	O'Brien Corp	2001 W. Washington Ave., South Bend, IN 46634.
FLW	Fuller-O'Brien Div	450 E. Grand Ave., S. San Francisco, CA 94080.
OMC	Olin Corp	120 Long Ridge Rd., Stamford, CT 06904.
	Agricultural Products Dept	P. O. Box 991, Little Rock, AR 72203.
OPC	Orbis Products Corp	140 Route 10, E. Hanover, NJ 07936.
ORG	Organics, Inc	7125 N. Clark St., Chicago, IL 60628.
BSW	Original Bradford Soap Works, Inc	200 Providence St., W. Warwick, RI 02893.
OCF	Owens-Corning Fiberglas Corp	Fiberglas Tower, Toledo, OH 43659.
OCC	Oxirane Chemical Co	10801 Choate Rd., Pasadena, TX 77507.
OXI	Oxirane Chemical Co. (Channelview)	P. O. Box 580, Channelview, TX 77530.
OXC	Oxochem Enterprise	King George Post Rd., Fords, NJ 08863.
PLB	P-L Biochemical, Inc	1037 W. McKinley Ave., Milwaukee, WI 53201.
PPG	PPG Industries, Inc	1 Gateway Center, Pittsburgh, PA 15222.
PTO	P. R. Chemical Co., Inc	P. O. Box 496, Arecibo, PR 00612.
PVO	PVO International, Inc., Chemical Specialties Div.	416 Division St., Boonton, NJ 07005.
AMR	Pacific Resins & Chemicals, Inc	1754 Thorne Rd., Tacoma, WA 93421.
PNT	Pantasote Co. of New York, Inc	26 Jefferson St., Passaic, NJ 07056.
PD	Parke, Davis & Co. Sub.of Warner-Lambert Co.	P. O. Box 118, Detroit, MI 48232.
PSC	Passaic Color & Chemical Co	28-36 Paterson St., Paterson, NJ 07501.
KAL	Pathan Chemical Co	427 Moyer St., Philadelphia, PA 19125.
CHP	C. H. Patrick & Co., Inc	P. O. Box 2526, Greensville, SC 29602.
CCH	Pearsall Chemical Corp	P. O. Box 437, Houston, TX 77001.
PEK	Peck's Products Co	610 E. Clarence,St. Louis, MO 63147.
PCH	Peerless Chemical Co	12416 Cloverdale St., Detroit, MI 48204.
AES	Penetone Corp	74 Hudson Ave., Tenafly, NJ 07670.
PAS	Pennwalt Corp	3 Parkway, Philadelphia, PA 19102.
WTL	Lucidol Div	1740 Military Rd., Buffalo, NY 14240.
PAR	Pennzoil Co., Penreco Div	Union Bank Bldg., Butler, PA 16001.
PER	Perry & Derrick Co., Inc	2510 Highland Ave., Norwood, OH 45212.
PST	Perstop, Inc., Toledo Div	600 Matzinger Rd., Toledo, OH 43612.
UDI	Petrochemicals Co., Inc	P. O. Box 2199, Fort Worth, TX 76101.
PTT	Petro-Tex Chemical Corp	8600 Park Place Blvd., Houston, TX 77017.
PFN	Pfanstiehl Laboratories, Inc	1219 Glen Rock Ave., Waukegan, IL 60085.
PCW	Pfister Chemical, Inc	Route 46 & Linden Ave., Ridgefield, NJ 07657.
PFZ	Pfizer, Inc	235 E. 42d St., New York, NY 10017.
	Pfizer Pharmaceuticals, Inc	P. O. Box 628, Barceloneta, PR 00617.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
PHR	Pharmachem Corp----------------------------	P. O. Box 1035, Bethlehem, PA 18018.
PDI	Phelps Dodge Industries, Inc., Phelps Dodge Magnet Wire Co. Div.	132 E. Creighton Ave., Fort Wayne, IN 46863.
PLC	Phillips Petroleum Co----------------------	15C1 Phillips Bldg., Bartlesville, OK 74003.
PPR	Phillips Puerto Rico Core, Inc-------------	GPO Box 4129, San Juan, PR 00936.
PIC	Pierce Chemical Co-------------------------	3747 N. Meridian Rd., Rockford, IL 61103.
PIL	Pilot Chemical Co--------------------------	11756 Burke St., Santa Fe Springs, CA 90670.
PPL	Pioneer Plastics Div. of LOF Plastics, Inc.	Pionite Rd., Auburn, ME 04210.
PIT	Pitt-Consol Chemical Co--------------------	P. O. Box 1267, 1000 S. Pine, Ponca City, OK 74601.
PLS	Plastics Engineering Co--------------------	3518 Lakeshore Rd., Sheboygan, WI 53081.
PMC	Plastics Manufacturing Co------------------	2700 S. Westmoreland, Dallas, TX 75224.
PFX	Plastifax, Inc-----------------------------	P. O. Box 2216, Gulfport, MS 39503.
PLX	Plex Chemical Corp-------------------------	1205 Atlantic St., Union City, CA 94487.
PFW	Polak's Frutal Works, Inc------------------	33 Sprague Ave., Middletown, NY 10990.
PYC	Polycast Technology Corp-------------------	69 Southfield Ave., Stamford, CT 06902.
POL	Polymer Corp-------------------------------	2120 Fairmont Ave., Reading, PA 19603.
PYZ	Polyrez Co., Inc---------------------------	P. O. Box 320, Woodbury, NJ 08096.
PLR	Polysar Resins, Inc------------------------	29 Fuller St., Leominster, MA 01453.
	Polysar Latex Div------------------------	3305 Amnicola Hwy., Chattanooga, TN 37406.
PVI	Polyvinyl Chemical Industries--------------	730 Main St., Wilmington, MA 01887.
POP	Pope Chemical Corp-------------------------	33 6th Ave., Paterson, NJ 07524.
PRT	Pratt & Lambert, Inc-----------------------	P. O. Box 22, Buffalo, NY 14240.
PMP	Premier Malt Products, Inc-----------------	917 W. Juneau Ave., Milwaukee, WI 53201.
PG	Procter & Gamble Co., Procter & Gamble Mfg. Co.	P. O. Box 599, Cincinnati, OH 45201.
PC	Proctor Chemical Co., Inc------------------	P. O. Box 399, Salisbury, NC 28144.
PRC	Products Research & Chemical Corp----------	2820 Empire Ave., Burbank, CA 91505.
PUB	Publicker Industries, Inc------------------	1429 Walnut St., Philadelphia, PA 19102.
PUE	Puerto Rico Olefins Co---------------------	Firm Delivery, Ponce, PR 00731.
PRX	Purex Corp---------------------------------	5101 Clark Ave., Lakewood, CA 90712.
QCP	Quaker Chemical Corp-----------------------	Lime & Elm Sts., Conshohocken, PA 19428.
QKO	Quaker Oats Co-----------------------------	Merchandise Mart Plaza, Chicago, IL 60654.
QUN	K. J. Quinn & Co., Inc---------------------	195 Canal St., Malden, MA 02148.
QH	Quintana-Howell Joint Venture--------------	P. O. Box 4656, Corpus Christi, TX 79408.
RSA	R.S.A. Corp--------------------------------	690 Sawmill River Rd., Ardsley, NY 10502.
RLS	Rachelle Laboratories, Inc-----------------	700 Henry Ford Ave., Long Beach, CA 90801.
RCN	Racon, Inc---------------------------------	P. O. Box 198, Witchita, KS 67201.
RAB	Raybestos-Manhattan, Inc., RM Friction Materials Co. Div.	75 E. Main St., Stratford, CT 06497.
RED	Red Spot Paint & Varnish Co., Inc----------	110 Main St., Evansville, IN 47703.
REH	Reheis Chemical Co. Div. of Armour Pharmaceutical Co.	236 Snyder Ave., Berkely Hgts., NJ 07922.
RCI	Reichhold Chemicals, Inc-------------------	525 N. Broadway, White Plains, NY 10603.
	Reichhold Polymers, Inc------------------	525 N. Broadway, White Plains, NY 10603.
RIL	Reilly Tar & Chemical Corp-----------------	1615 Merchants Bank, Indianapolis, IN 46204.
REL	Reliance Universal, Inc., Louisville Resins Operation	P. O. Box 21-423, Louisville, KY 40221.
REM	Remington Arms Co., Inc--------------------	939 Barnum Ave., Bridgeport, CT 06602.
RSC	Resinous Chemicals Corp--------------------	1399 W. Blancke St., Linden, NJ 07036.
RSY	Resyn Corp---------------------------------	1401 W. Blancke St., Linden, NJ 07036.
RCC	Rexene Polyolefins Co----------------------	W. 115 Century Rd., Paramus, NJ 07652.
RCC	Rexene Styrenics Co------------------------	W. 115 Century Rd., Paramus, NJ 07652.
RDA	Rhodia, Inc--------------------------------	120 Jersey Ave., New Brunswick, NJ 08903.
RCD	Richardson Co------------------------------	2400 E. Devon Ave., Des Plaines, IL 60018.
	Polymeric Systems Div--------------------	15 Meigs Ave., Madison, CT 06443.
LKL	Richardson-Merrell, Inc., Merrell-National Laboratories Div.	110 E. Amity Rd., Cincinnati, OH 45215.
RCO	Rico Chemical Corp-------------------------	P. O. Box 387, Guayanilla, PR 00656.
AMS	Ridgway Color & Chemical-------------------	75 Front St., Ridgway, PA 15853.
RIK	Riker Laboratories, Inc. Sub. of 3M Co------	19901 Nordhoff St., Northridge, CA 91324.
RSN	Rilsan Corp--------------------------------	139 Harristown Rd., Glen Roc, NJ 07452.
RT	Ritter International-----------------------	4001 Goodwin Ave., Los Angeles, CA 90039.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identification code	Name of company	Office address
RIV	Riverdale Chemical Co	220 E. 17th St., Chicago Heights, IL 60411.
ROB	Robeco Chemicals, Inc	99 Park Ave., New York, NY 10016.
RBT	Robintech, Inc	1407 Texas St., Fort Worth, TX 76102.
MFG	Rockwell International Corp	4501 Benefit Ave., Ashtabula, OH 44004.
ORT	Roehr Chemicals Div. of Aceto Industrial Chemical Corp.	52-20 37th St., Long Island City, NY 11101.
RGC	Rogers Corp	Rogers, CT 06263.
RH	Rohm & Haas Co	Independence Mall West, Philadelphia, PA 19105.
RUC	Rubicon Chemicals, Inc	P. O. Box 517, Geismar, LA 70734.
SCM	SCM Corp	299 Park Ave., New York, NY 10017.
SOS	SSC Industries, Inc	P. O. Box 90987, East Point, GA 30344.
NPR	Safeway Stores, Inc	2800 Ygnacio Valley Rd., Walnut, CA 94604.
SLM	Salem Oil & Grease Co	60 Grove St., Salem, MA 01970.
SAL	Salsbury Laboratories	2000 Rockford Rd., Charles City, IA 50616.
S	Sandoz, Inc	P. O. Box 357, Fair Lawn, NJ 07410.
	Colors & Chemicals Div	Route #10, E. Hanover, NJ 07936.
	Crop Protection	P. O. Box 207, Wasco, CA 93280.
SAR	Sartomer Industries, Inc	Gov. Printz Blvd. & Wanamaker Ave., Essington, PA 19029.
SCN	Schenectady Chemicals, Inc	P. O. Box 1046, Schenectady, NY 12301.
SBC	Scher Bros., Inc	P. O. Box 1236, Allwood Station, Clifton, NJ 07012.
SCH	Schering Corp	1011 Morris Ave., Union, NJ 07083.
SCO	Scholler Bros., Inc	Collins and Westmoreland Sts., Philadelphia, PA 19134.
SPA	Scott Paper Co	Scott Plaza, Philadelphia, PA 19113.
SEA	Seaboard Chemicals, Inc	30 Foster St., Salem, MA 01970.
SRL	G. D. Searle & Co	P. O. Box 5110, Chicago, IL 60680.
SKP	Shakespeare Co., Monofilament Div	P. O. Box 246, Columbia, SC 29202.
SHO	Shell Oil Co	P. O. Box 2463, Houston, TX 77001.
SHC	Shell Chemical Co. Div	P. O. Box 2463, Houston, TX 77001.
SHP	Shepherd Chemical Co	4900 Beech St., Norwood, OH 45212.
SW	Sherwin-Williams Co	1370 Ontario St. NW., Cleveland, OH 44101.
SHT	Shintech, Inc	3800 Buffalo Speedway-Suite 210, Houston, TX 77098.
SID	George F. Siddall Co., Inc	P. O. Box 925, Spartanburg, SC 29304.
SMP	J. R. Simplot Co., Minerals Chemical Div	P. O. Box 912, Pocatello, ID 83210.
SIM	Simpson Timber Co., Chemicals Div	2301 N. Columbia Blvd., Portland, OR 97217.
GFS	G. Frederick Smith Chemical Co	867 McKinley Ave., P. O. Box 23214, Columbus, OH 43223.
SK	SmithKline Chemicals	1500 Spring Garden St., Philadelphia, PA 19101.
SLT	Soltex Polymer Corp	P. O. Box 1000, Deer Park, TX 77536.
SLC	Soluol Chemical Co., Inc	Green Hill and Market Sts., W. Warwick, RI 02893.
SAC	Southeastern Adhesives Co., Inc	P. O. Box 791, Lenoir, NC 28645.
SOP	Southern Chemical Products Co., Inc	430 Lower Boundary St., Macon, GA 31202.
SWL	Southwest Latex Corp	1001 Chemical Rd., Pasadena, TX 77507.
SPL	Spaulding Fibre Co., Inc	310 Wheeler St., Tonawanda, NY 14150.
OMS	E. R. Squibb & Sons, Inc	40 W. 57th St., New York, NY 10019.
STA	A. E. Staley Mfg. Co	2200 E. Eldorado St., Decatur, IL 62525.
UBS	Chemical Specialties Div	2200 E. Eldorado St., Decatur, IL 62525.
CLN	Standard Brands, Inc., Clinton Corn Processing Co. Div.	1251 Beaver Channel Parkway, Clinton, IA 52733.
SCC	Standard Chlorine of Delaware, Inc., Sub. of Standard Chlorine Chemical Co., Inc.	1035 Belleville Turnpike, Kearny, NJ 07032.
SIO	Standard Oil Co.	270 Midland Bldg., Cleveland, OH 44130.
SOC	Standard Oil Co. of California, Chevron Chemical Co.	575 Market St., Rm. 3280, San Francisco, CA 94105.
STT	Standard T Chemical, Inc	P. O. Box A-3351, Chicago, IL 60690.
STG	Stange Co	342 N. Western Ave., Chicago, IL 60612.
	Stauffer Chemical Co.:	
SFA	Agricultural Div	636 California St., San Francisco, CA 94119.
SFC	Calhio Chemicals, Inc	636 California St., San Francisco, CA 94119.
SFF	Food Ingredients Div	636 California St., San Francisco, CA 94119.
SFI	Industrial Div	636 California St., San Francisco, CA 94119.
SFP	Plastics Div	636 California St., San Francisco, CA 94119.
SFS	Specialty Div	636 California St., San Francisoc, CA 94119.
SWS	SWS Silicones Div	636 California St., San Francisco, CA 94119.
STP	Stepan Chemical Co	RR #1, Elwood, IL 60421 and 100 West Hunter Ave., Maywood, NJ 07607.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
	Sterling Drug, Inc.:	
SDG	Glenbrook Laboratories Div	90 Park Ave., New York, NY 10016.
SDH	Hilton-Davis Chemical Co. Div	2235 Langdon Farm Rd., Cincinnati, OH 45237.
TMS	Thomasset Colors Div	120 Lister Ave., Newark, NJ 07105.
SDW	Winthrop Laboratories Div	90 Park Ave., New York, NY 10016.
SLV	Sterwin Chemicals, Inc	Military Rd., Rothschild, WI 54474.
STY	Styrochem Corp	Petrochemical Complex, Ponce, PR 00731.
SBP	Sugar Beet Products Co	P. O. Box 1387, Saginaw, MI 48605.
	Sun Chemical Corp.:	
SNW	Chemical Div	P. O. Box 70, Chester, SC 29706.
SNA	Pigments Div	441 Tompkins Ave., Staten Island, NY 10305.
SUN	Sun Company, Inc	100 Matsonford Rd., Radnor, PA 19087.
SKG	Sunkist Growers, Inc	P. O. Box 7888, Van Nuys, CA 91409.
SNO	SunOlin Chemical Co	P. O. Box F, Claymont, DE 19703.
SWE	Swedcast Corp	7350 Empire Dr., Florence, KY 41042.
SAG	Swift Agricultural Chemicals	P. O. Box 2175, Beaumont, TX 77704.
BUC	Synalloy Corp., Blackman-Uhler Chemical Div.	P. O. Box 5627, Spartanburg, SC 29301.
FAR	Syncon Resins, Inc	77 Jacobus Ave., S. Kearny, NJ 07032.
FCD	Synres Chemical Corp	1036 Commerce Ave., Union, NJ 07083.
HFT	Syntex Agribusiness, Inc	P. O. Box 1246 S.S.S., Springfield, MO 65805.
TCC	Tanatex Chemical Corp	P. O. Box 388, Lyndhurst, NJ 07071.
CST	Charles S. Tanner Co	1310 Barcelona Dr., Greensville, SC 29605.
TBO	Tauber Oil Co	1610 Melrose Blvd., Houston, TX 77052.
TEK	Teknor Apex Co	505 Central Ave., Pawtucket, RI 02662.
HN	Tenneco Chemicals, Inc	Park Eighty Plaza West-One, Saddle Brook, NJ 07662.
TOC	Tenneco Oil Co	P. O. Box 2511, Houston, TX 77001.
TVA	Tennessee Valley Authority	Muscle Shoals, AL 35660.
TER	Terra Chemicals International, Inc	P. O. Box 1828, Sioux City, IA 51121.
COO	Terrell Corp	820 Woburn St., Wilmington, MA 01887.
TX	Texaco, Inc	P. O. Box 430, 4800 Fournace Pl., Bellaire, TX 77401.
TSA	Texas Alkyls, Inc	P. O. Box 600, Deer Park, TX 77536.
TUS	Texas-U.S. Chemical Co	P. O. Box 667, Port Neches, TX 77651.
TCI	Texize Chemicals Co	P. O. Box 368, Greenville, SC 29602.
SKT	Textron, Inc., Spencer Kellogg Div	120 Delaware Ave., Buffalo, NY 14240.
TKL	Thiokol Corp	P. O. Box 1000, Newtown, PA 18940.
TMH	Thompson-Hayward Chemical Co	2 E. Madison St., Waukegan, IL 60085, and 5200 Speaker Rd., Kansas City, MO 66110.
TRC	Toms River Chemical Corp	P. O. Box 71, Toms River, NJ 08753.
TNO	Trancoa Chemical Corp	312 Ash St., Reading, MA 01867.
ACT	Arthur C. Trask Co	7666 W. 63d St., Summit, IL 60501.
TRI	Triad Chemical	P. O. Box 310, Donaldsonville, LA 70346.
TRO	Troy Chemical Co	One Avenue L, Newark, NJ 07105.
UPM	UOP, Inc	10 UOP Plaza, Des Plaines, IL 60016.
UOP	Chemical Div	State Highway 17, E. Rutherway, NJ 07073.
USM	USM Corp., Bostik, Inc	Boston St., Middleton, MA 01949, and P. O. Box 5695, Greenville, SC 29606.
ARM	USS Agri-Chemicals Div. of U.S. Steel Corp	P. O. Box 1685, Atlanta, GA 30301.
USS	USS Chemicals Div. of U.S. Steel Corp	600 Grant St., Rm. 2880, Pittsburgh, PA 15230.
UHL	Paul Uhlich & Co., Inc	1 Railroad Ave., Hastings on the Hudson, NY 10706.
UNG	Ungerer & Co	161 Avenue of the Americas, New York, NY 10013.
NCI	Union Camp Corp	P. O. Box 6170, Jacksonville, FL 32205.
WTH	Chemical Div	P. O. Box 220, Dover, OH 44622.
UCC	Union Carbide Corp	270 Park Ave., New York, NY 10017.
UOC	Union Oil Co. of California	1650 E. Golf Rd., Schaumburg, IL 60196.
USR	Uniroyal, Inc., Uniroyal Chemical Div	Emic Bldg., Spencer St., Naugatuck, CT 06770.
SWT	Unitech Chemical, Inc	115 W. Jackson Blvd., Chicago, IL 60604.
UNN	United Chemical Corp. of Norwood	Endicott St., Norwood, MA 02062.

TABLE 1.--SYNTHETIC ORGANIC CHEMICALS: ALPHABETICAL DIRECTORY OF MANUFACTURERS, BY COMPANY, 1977--CONTINUED

Identi-fication code	Name of company	Office address
UNP	United Chemical Products Corp	472 York St., Jersey City, NJ 07302.
UNO	United-Erie, Inc	438 Huron St., Erie, PA 16512.
ROM	United Merchants & Manufacturers, Inc., Roma Chemical Div.	749 Quequechan St., Fall River, MA 02721.
USB	U.S. Borax Research Corp	3075 Wilshire Blvd., Los Angeles, CA 90005.
USI	U.S. Industrial Chemicals Co.:	
	National Distillers & Chemicals Corp	99 Park Ave., New York, NY 10016.
	National Petro Chemical Corp	99 Park Ave., New York, NY 10016.
USO	U.S. Oil Co	P. O. Box 4228, E. Providence, RI 02914.
UPJ	Upjohn Co	7000 Portage Rd., Kalamazoo, MI 49002.
CWN	Fine Chemical Div	410 Sackett Point Rd., North Haven, CT 06473.
VAL	Valchem Div. of United Merchants & Manufacturers, Inc.	1407 Broadway, New York, NY 10018.
VSV	Valentine Sugars, Inc., Valite Div	726 Whitney Bldg., New Orleans, LA 70130.
VLN	Valley Nitrogen Producers, Inc	1111 Van Ness Ave., Fresno, CA 93717.
MNP	The Valspar Corp	1101 S. 3d St., Minneapolis, MN 55415.
VNC	Vanderbilt Chemical Corp	31 Taylor Ave., Bethel, CT 06801, and Rt. 5 - Box 54, Murray, KY 42071.
VND	Van Dyk & Co., Inc	Main & Williams Sts., Belleville, NJ 07109.
VEL	Velsicol Chemical Corp	341 E. Ohio St., Chicago, IL 60611.
MHI	Ventron Corp	152 Andover St., Danvers, MA 01923.
VTC	Vicksburg Chemical Co. Sub. of Vertac Consolidated.	P. O. Box 3, Vicksburg, MS 39180.
VIK	Viking Chemical Co	838 Baker Bldg., Minneapolis, MN 55402.
VIN	Vineland Chemical Co., Inc	W. Wheat Rd., Vineland, NJ 08360.
VCC	Vinings Chemical Co	2555 Cumberland Pkwy., Suite 200, Atlanta, GA 30339.
VGC	Virginia Chemicals, Inc	3340 W. Norfolk Rd., Portsmouth, VA 23703.
SOH	Vistron Corp	393 Midland Bldg., Cleveland, OH 44115.
SIC	Silmar Div	12333 S. Van Ness Ave., Hawthorne, CA 90250.
VTM	Vitamins, Inc	200 E. Randolph Dr., Chicago, IL 60601.
FRO	Vulcan Materials Co., Chemicals Div	P. O. Box 7689, Birmingham, AL 35223.
WJ	Warner-Jenkinson Manufacturing Co	2526 Baldwin St., St. Louis, MO 63106.
WAG	West Agro-Chemical, Inc	501 Santa Fe, Kansas City, MO 64105.
WCA	West Coast Adhesives Co., Inc	11104 NW. Front Ave., Portland, OR 97231.
EW	Westinghouse Electric Corp., Industrial Materials Div.	Manor, PA 15665.
WVA	Westvaco Corp., Polychemicals Dept	P. O. Box 5207, N. Charleston, SC 29406.
WRD	Weyerhaeuser Co	118 S. Palmetto Ave., Marshfield, WI 54449.
WBG	White & Bagley Co	P. O. Box 706, Worcester, MA 01613.
WHI	White & Hodges, Inc	576 Lawrence St., Lowell, MA 01853.
WCC	White Chemical Corp	P. O. Box 278, Bayonne, NJ 07002.
WHL	Whitmoyer Laboratories, Inc	19 N. Railroad St., Myerstown, PA 17067.
APT	Whittaker Corp., Whittaker Coatings & Chemicals, Mol Rez Resins.	3134 California St., NE., Minneapolis, MN 55418.
WHW	Whittemore-Wright Co., Inc	62 Alford St., Boston, MA 02129.
WLN	Wilmington Chemical Corp	P. O. Box 66, Wilmington, DE 19899.
WTC	Witco Chemical Corp	P. O. Box 305, Paramus, NJ 07652.
WAW	W. A. Wood Co	108 Spring St., Everett, MA 02149.
WBC	Worthington Biochemical Corp	Halls Mill Rd., Freehold, NJ 07728.
WCL	Wright Chemical Corp	Acme Station, Riegelwood, NC 28456.
WYC	Wycon Chemical Co	5 Greenway Plaza East, Houston, TX 77046.
WYT	Wyeth Laboratories, Inc., Wyeth Laboratories Div. of American Home Products Corp.	P. O. Box 831, Paoli, PA 19301.
ZOC	Zoecon Corp	975 California Ave., Palo Alto, CA 94304.

U.S. IMPORTS OF BENZENOID CHEMICALS AND PRODUCTS

U.S. general imports of benzenoid chemicals and products entered under the Tariff Schedules of the United States (TSUS), schedule 4, part 1, subparts B and C are analyzed by the U.S. International Trade Commission annually and published in detail in a separate report.[1] General imports of benzenoid items entered in parts 1B and 1C totaled 412.5 million pounds with a foreign invoice value of $570.5 million in 1977 compared with 362.4 million pounds with a foreign invoice value of $493.8 million in 1976.

Benzenoid products that are "competitive" with similar domestic products, because they accomplish results substantially equal to those accomplished by the similar domestic product when used in substantially the same manner, are subject to a special basis of valuation for customs purposes known as the "American selling price." If "noncompetitive," the benzenoid products are valued for customs purposes on the basis of the "United States value." The essential difference between these two values is that "American selling price" is based on the wholesale price in the United States of the "competitive" domestic product, whereas "United States value" is based on the wholesale price in the United States of the imported product less most of the expenses incurred in bringing the product to the United States and selling it. When neither of these two valuation bases applies, then the "export value," "foreign value," or "constructed value" is used as the valuation basis under section 402 and 402a Tariff Act of 1930, as amended. The competitive status of benzenoid imports in 1977 is shown in table 2.

Industrial organic chemicals that are entered under part 1B consist chiefly of benzenoid intermediates and small quantities of acyclic compounds which are derived in whole or in part from benzenoid compounds. Also included are mixtures and small quantities of finished products not specially provided for in part 1C (e.g., rubber-processing chemicals). In terms of value, 34.6 percent of all the benzenoid imports under part 1B in 1977 came from West Germany; 21.2 percent, from Japan; 9.8 percent, from Italy; and 9.0 percent, from the United Kingdom.

Finished organic chemical products entered under part 1C include dyes, pigments, medicinals, flavor and perfume materials, pesticides, plastics materials, and certain other specified products. In terms of value 34.4 percent of all finished benzenoid imports under part 1C in 1977 came from West Germany; 16.4 percent, from the United Kingdom; and 12.0 percent, from Japan.

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[1] *Imports of Benzenoid Chemicals and Products, 1977*, TC Publication 900, 1978.

TABLE 2.--BENZENOID CHEMICALS AND PRODUCTS: SUMMARY OF U.S. GENERAL IMPORTS ENTERED UNDER SCHEDULE 4, PARTS 1B AND 1C OF THE TSUS, AND ANALYSIS BY COMPETITIVE STATUS, 1977

Part and competitive status	Number of items	Quantity	Percent of total quantity	Foreign invoice value	Percent of foreign value	Unit foreign value
		1,000 pounds		*1,000 dollars*		*Per pound*
Schedule 4, Part 1B						
Total[1]	819	247,775	100.0	196,215	100.0	$0.79
Competitive:						
Duty based on ASP[2]	368	208,232	84.0	123,832	63.1	.59
Noncompetitive:						
Duty based on U.S. value	284	22,772	9.2	35,125	17.9	1.54
Duty based on export value	157	14,087	5.7	34,257	17.5	2.43
Competitive status not available	10	2,685	1.1	3,001	1.5	1.12
Schedule 4, Part 1C						
Total[1]	1,851	164,736	100.0	374,293	100.0	2.27
Competitive:						
Duty based on ASP[2]	671	72,297	43.9	148,132	39.6	2.05
Noncompetitive:						
Duty based on U.S. value	970	28,686	17.4	80,281	21.4	2.80
Duty based on export value	197	60,356	36.7	133,286	35.6	2.21
Competitive status not available	13	3,397	2.1	12,593	3.4	3.71
Summary (Schedule 4, Parts 1B and 1C)						
Total[1]	2,670	412,511	100.0	570,508	100.0	1.38
Competitive:						
Duty based on ASP[2]	1,039	280,529	68.0	271,964	47.7	.97
Noncompetitive:						
Duty based on U.S. value	1,254	51,458	12.5	115,406	20.2	2.24
Duty based on export value	354	74,443	18.0	167,543	29.4	2.25
Competitive status not available	23	6,082	1.5	15,594	2.7	2.56

1 Detail may not add to total due to rounding.
2 American selling price.

Source: Compiled by the U.S. International Trade Commission from records of the U.S. Bureau of Customs.

Note.--The totals shown in this table differ from those given in the official statistics of the U.S. Department of Commerce chiefly because of differences in coverage and in the methods used in compiling the data. In general, the statistics coverage in 1977 varies from a low of 63 percent for pigments, to about 86 percent coverage of 86 percent flavor and perfumes materials, 85 percent dyes, 81 percent intermediates, and 73 percent medicinals and pharmaceuticals.

TABLE 3.--CYCLIC INTERMEDIATES: GLOSSARY OF SYNONYMOUS NAMES

Common name	Standard (Chemical Abstracts) name
A Acid	3,5-Dihydroxy-2,7-naphthalenedisulfonic acid.
1,2,4-Acid	4-Amino-3-hydroxy-1-naphthalensulfonic acid (1-Amino-2-naphthol-4-sulfonic acid).
Acid yellow 9	6-Amino-3,4'-azodibenzenesulfonic acid.
p-Aminobenzenesulfonic acid	Sulfanilic acid and salt.
m-Aminobenzoyl J acid	4-Hydroxy-7-(m-aminobenzamido)-2-naphthalenesulfonic acid.
Aminoepislon acid	8-Amino-1,6-naphthalenedisulfonic acid.
Amino G acid	7-Amino-1,3-naphthalenedisulfonic acid.
Amino J acid	6-Amino-1,3-naphthalenedisulfonic acid.
Amino R salt	3-Amino-2,7-naphthalenedisulfonic acid.
Aniline oil	Aniline.
Anthraflavic acid	2,6-Dihydroxyanthraquinone.
Anthrarufin	1,5-Dihydroxyanthraquinone.
Armstrong & Wynne's acid	4-Hydroxy-2-naphthalenesulfonic acid.
B Acid	5-Amino-4-hydroxy-1,7-naphthalenedisulfonic acid.
2B Acid	6-Amino-4-chloro-m-toluenesulfonic acid.
4B Acid	6-Amino-m-toluenesulfonic acid.
Benzal chloride	α,α-Dichlorotoluene.
Benzanthrone	7H-Benz[de]anthracen-7-one.
Benzotrichloride	α,α,α,-Trichlorotoluene.
Bisphenol A	4,4'-Isopropylidenediphenol.
B.O.N	3-Hydroxy-2-naphthoic acid.
Broenner's acid	6-Amino-2-naphthalenesulfonic acid.
Bromamine acid	1-Amino-4-bromo-2-anthraquinonesulfonic acid.
Bromobenzanthrone	3-Bromo-7H-benz[de]anthracene-7-one.
C Acid (Cassella acid)	3-Amino-1,5-naphthalenedisulfonic acid.
C.A. Acid	3-Amino-6-chloro-4-sulfobenzoic acid.
C-Amine (Lake Red C acid)	2-Amino-5-chloro-p-toluenesulfonic acid.
Chicago Acid (SS acid)	4-Amino-5-hydroxy-1,3-naphthalenedisulfonic acid.
Chlorobenzanthrone	Chloro-7H-benz[de]anthracen-7-one.
Chromotropic acid	4,5-Dihydroxy-2,7-naphthalenedisulfonic acid.
Chrysazin	1,8-Dihydroxyanthraquinone.
1,6-Cleve's acid	5-Amino-2-naphthalenesulfonic acid.
1,7-Cleve's acid	8-Amino-2-naphthalenesulfonic acid.
Crocein acid	7-Hydroxy-1-naphthalenesulfonic acid.
2-Cyanopyridine	Picolinonitrile.
3-Cyanopyridine	Nicotinonitrile.
Cyanuric chloride	2,4,6-Trichloro-s-triazine.
D Acid	6-Amino-1-naphthalenesulfonic acid.
DADI	Dianisidine diisocyanate.
DBB	p-Dibutoxybenzene.
Decacyclene	Diacenaphtho[1,2-j:1',2'-ℓ]fluoranthene.
Dehydrothio-p-toluidine	2-(p-Aminophenyl)-6-methylbenzothiazole.
Developer Z	3-Methyl-1-phenyl-2-pyrazolin-5-one.
o-Dianisidine	3,3'-Dimethoxybenzidine.
1,1'-Dianthrimide	1,1'-Iminodianthraquinone.
Dibenzanthrone	Violanthrone.
4,4'-Dihydroxydiphenylsulfone	4,4'-Sulfonyldiphenol.
Dimethyl POPOP	1,4-Bis[2-(4-methyl-5-phenyloxazolyl)]benzene.
4,5-Dinitrochrysazin	1,8-Dihydroxy-4,5-dinitroanthraquinone.
Dioxy S acid	4,5-Dihydroxy-1-napththalenesulfonic acid.
Diphenyl Epsilon Acid	6,8-Dianilino-1-naphthalenesulfonic acid.
Durene	1,2,4,5-Tetramethylbenzene.
Epsilon Acid (Andresen's acid)	8-Hydroxy-1,6-naphthalenedisulfonic acid.
F Acid	7-Hydroxy-2-naphthalenesulfonic acid.
Fast Red G base	2-Nitro-p-toluidine [NH_2=1].
Fast Scarlet R base	5-Nitro-o-anisidine [NH_2=1].
Fischer's aldehyde	1,3,3-Trimethyl-$\Delta^{2,\alpha}$-indolineacetaldehyde.
Fischer's base	1,3,3-Trimethyl-2-methyleneindoline.
Freund's acid	4-Amino-2,7-naphthalenedisulfonic acid.

TABLE 3.--CYCLIC INTERMEDIATES: GLOSSARY OF SYNONYMOUS NAMES--CONTINUED

Common name	Standard (Chemical Abstracts) name
G salt	7-Hydroxy-1,3-naphthalenedisulfonic acid.
Gamma acid	6-Amino-4-hydroxy-2-naphthalenesulfonic acid, sodium salt.
Gold salt	9,10-Dihydro-9,10-dioxo-1-anthracenesulfonic acid and salt.
H Acid	4-Amino-5-hydroxy-2,7-naphthalenedisulfonic acid. (8-Amino-1-naphthol-3,6-disulfonic acid).
Hellimellitene	1,2,3-Trimethylbenzene.
Indoxyl	3(2H)-Indolone.
J Acid	7-Amino-4-hydroxy-2-naphthalenesulfonic acid, sodium salt.
J Acid Urea	7,7'-Ureylenebis[4-hydroxy-2-naphthalenesulfonic acid].
K Acid	4-Amino-5-hydroxy-1,7-naphthalenedisulfonic acid.
Koch's Acid	8-Amino-1,3,6-napthalenetrisulfonic acid.
L Acid	5-Hydroxy-1-naphthalenesulfonic acid.
Lake Red C amine	2-Amino-5-chloro-p-toluenesulfonic acid.
Laurent's acid	5-Amino-1-naphthalenesulfonic acid.
M Acid	8-Amino-4-hydroxy-2-naphthalenesulfonic acid.
MEP	5-Ethyl-2-picoline (2-Methyl-5-ethylpyridine).
Mesitylene	1,3,5-Trimethylbenzene.
Methane base	4,4'-Methylenebis[N,N-dimethylaniline].
Michler's hydrol	4,4'-Bis[dimethylamino]benzhydrol.
Michler's ketone	4,4'-Bis[dimethylamino]benzophenone.
Naphthionic acid	4-Amino-1-naphthalenesulfonic acid.
o-Naphthionic acid	1-Amino-2-naphthalenesulfonic acid.
β-Naphthol	2-Naphthol, tech.
Naphthol AS	3-Hydroxy-2-naphthanilide.
α-Naphthylamine	1-Naphthylamine.
Neville & Winther's acid	4-Hydroxy-1-naphthalenesulfonic acid.
m-Nitrobenzoyl J acid	4-Hydroxy-7-(m-nitrobenzamido)-2-naphthalenesulfonic acid.
Oxy Koch's acid	1-Naphthol-3,6,8-trisulfonic acid.
Pentaanthrimide	1,4,5,8-Tetrakis(1-anthraquinonylamino)anthraquinone.
Peri Acid	8-Amino-1-naphthalenesulfonic acid.
Phenylbiphenyl	Terphenyl.
N-Phenyldiethanolamine	2,2'-[(Phenyl)imino]diethanol.
Phenyl Gamma acid	6-Anilino-4-hydroxy-2-naphthalenesulfonic acid.
Phenyl J acid	7-Anilino-4-hydroxy-2-naphthalenesulfonic acid.
Phenyl peri acid	8-Anilino-1-naphthalenesulfonic acid.
POPOP	1,4-Bis[2-(5-phenyloxazolyl)]benzene.
Pseudocumene	1,2,4-Trimethylbenzene.
Pyrazoleanthrone	Anthra[1,9-cd]pyrazol-6(2H)-one.
Pyrazoleanthrone yellow	[3,3'-Bianthra[1,9-cd]pyrazole]-6,6'-(2H,2'H)dione.
Pyrazolone T	5-Oxo-1-(p-sulfophenyl)-2-pyrazoline-3-carboxylic acid.
Quinizarin	1,4-Dihydroxyanthraquinone.
2-Quinizarinsulfonic acid	9,10-Dihydro-1,4-dihydroxy-9,10-dioxo-2-anthracenesulfonic acid.
Quinoline yellow base	Quinophthalone.
R salt	3-Hydroxy-2,7-naphthalenedisulfonic acid, disodium salt.
RG Acid (Violet acid)	4-Hydroxy-2,7-naphthalenedisulfonic acid.
Rhoduline acid (J Acid Imide)	7,7'-Iminobis[4-hydroxy-2-napthalenesulfonic acid].
RR acid	3-Amino-5-hydroxy-2,7-naphthalenedisulfonic acid.
S Acid	4-Amino-5-hydroxy-1-naphthalenesulfonic acid.
Schaffer's acid	6-Hydroxy-2-naphthalenesulfonic acid.
Silver salt	9,10-Dihydro-9,10-dioxo-2-anthracenesulfonic acid and salt.

TABLE 3.--Cyclic intermediates: Glossary of synonymous names--Continued

Common name	Standard (Chemical Abstracts) name
Solvent Yellow 1	p-Phenylazoaniline and hydrochloride.
Solvent Yellow 3	4-(o-Tolylazo)-o-toluidine.
SS Acid (Chicago acid)	4-Amino-5-hydroxy-1,3-naphthalenedisulfonic acid.
o-Sulfobenzaldehyde	o-Formylbenzenesulfonic acid.
Thioindoxyl	3(2H)-Thianaphthenone.
Thiosalicylic acid	o-Mercaptobenzoic acid.
Tobias Acid	2-Amino-1-naphthalenesulfonic acid.
TODI	Bitolylene diisocyanate.
o-Tolidine	3,3'-Dimethylbenzidine.
α-Toluic acid	Phenylacetic acid.
α-Tolunitrile	Phenylacetonitrile.
4-m-Tolylenediamine	Toluene-2,4-diamine.
Trimellitic anhydride	1,2,4-Benzenetricarboxylic acid, 1,2-anhydride.
Trimethyl base	1,3,3-Trimethyl-2-methyleneindoline.
Trinitrophenol	Picric acid.
Urea J Acid (J Acid Urea)	7,7'-Ureylenebis[4-hydroxy-2-naphthalenesulfonic acid .
Vinyltoluene	ar-Methylstyrene.
Violet acid (RG Acid)	4-Hydroxy-2,7-naphthalenedisulfonic acid.

☆ U S GOVERNMENT PRINTING OFFICE 1978 273 367 641

Library Cataloging Data

U.S. International Trade Commission.
Synthetic organic chemicals, United States production and sales, 1977. Washington [U.S. Govt. Print. Off. 1978]

355, A 417 p. illus. 27 cm. (USITC Publication 920)

Appendix includes: Directory of manufacturers, p. 400-412; U.S. imports of benzenoid chemicals and products, p. 413-414; Cyclic intermediates: glossary of synonymous names, p. 415-417.

1. Coal-tar products. 2. Petroleum industry and trade--U.S. 3. Intermediates. 4. Dyes and dyeing. 5. Drugs. 6. Flavoring essences. 7. Plastics industry and trade--U.S. 8. Rubber industry and trade. 9. Elastomers. 10. Cleaning compounds. 11. Pesticides. 12. Chemicals--Manufacture and industry--U.S.--Directories. I. Title.

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