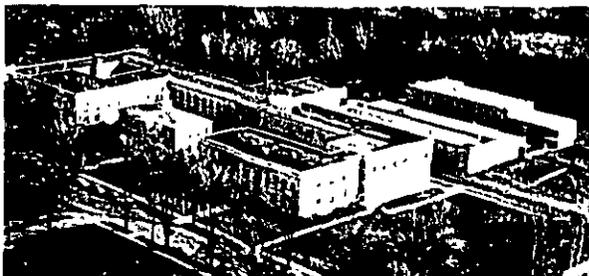


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**THE INSTITUTE OF PAPER CHEMISTRY, APPLETON, WISCONSIN**

CONSUMPTION OF SALT CAKE IN 1963 AND 1964 BY PULP MILLS  
IN THE NORTH CENTRAL AND SOUTH CENTRAL STATES

Project 2533

Report Two

December, 1967

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONSUMPTION OF SALT CAKE IN 1963 AND 1964 BY PULP MILLS  
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December, 1967

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONSUMPTION OF SALT CAKE IN 1963 AND 1964 BY PULP MILLS  
IN THE NORTH CENTRAL AND SOUTH CENTRAL STATES

In 1965, The Institute of Paper Chemistry conducted its first major survey of the consumption of certain papermaking chemicals. Most of the information obtained has been reported previously (see Project 2533 initial report: Paper Industry Consumption of Starches, Pigment Binders, and Latexes in 1963 and 1964). In this survey we also obtained data on the use of salt cake in the North Central and South Central regions of the United States. However, these findings were not included in the first report, mainly because data had not been received from several pulp mills in these regions.

Since the report was issued and up to the present time, a number of inquiries on salt cake usage have been received from pulp manufacturers. Because of this continuing interest, we recently obtained as much of the missing data as possible, and now wish to summarize the findings. This report covers only the two regions actually surveyed: the North Central and South Central States. Table I lists the states involved and the regional totals for salt cake consumption, which now represent all pulp mills operating in these two areas in 1963 and 1964. In nearly every instance the respondents reported natural and by-product varieties separately.

The North Central data for both 1963 and 1964 are substantially free from estimates made by the Institute's Chemical Resources Group; this is also true for 1964 South Central totals. However, a substantial portion of the 1963 South Central total has been estimated, since a number of mills provided exact data for 1964 and 1965, but none for 1963.

TABLE I

CONSUMPTION OF SALT CAKE BY ALL PULP MILLS IN  
THE NORTH CENTRAL<sup>a</sup> AND SOUTH CENTRAL<sup>b</sup> STATES IN 1963 AND 1964

	Tons		Change
	1963	1964	
North Central Region			
Natural salt cake	27,050	26,780	- 270
By-product salt cake	16,450	14,830	-1,620
Total North Central	43,500	41,610	-1,890
South Central Region			
Natural salt cake	I	160,940	-
By-product salt cake	I	150,390	-
	(300,000) <sup>c</sup>	311,330	(+11,330) <sup>c</sup>

<sup>a</sup>North Central Region: Minnesota, Iowa, Missouri, Wisconsin, Michigan, Illinois, Indiana, Ohio.

<sup>b</sup>South Central Region: Alabama, Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, Texas.

<sup>c</sup>Estimated. A number of mills provided exact data for 1964 and 1965, but none for 1963.

I = Data incomplete.

Additional amounts of purchased chemicals were reported as being equivalent to make-up salt cake. Since the questionnaire did not specifically request this information, the total usage of such chemicals is not known. The reported portion would increase South Central totals for 1963 by less than 0.5%, and for 1964 by about 1%.

The survey also asked for a statement of the number of pounds of purchased salt cake consumed per ton of pulp. Not all companies provided these figures, but a generalized summary of the information is presented in Table II.

TABLE II

CONSUMPTION OF PURCHASED SALT CAKE PER TON OF PULP, NORTH  
CENTRAL AND SOUTH CENTRAL STATES, 1963 AND 1964

Salt Cake Consumption, pounds per ton of pulp	Number of Companies Reporting			
	North Central States		South Central States	
	1963	1964	1963	1964
Less than 100	0	0	5	6
100-149	1	1	4	4
150-199	1	2	3	2
200 and over	3	2	0	0

This table lists four ranges of salt cake consumption, in pounds per ton of pulp, and gives the number of companies that reported usage within each of these ranges. The generally lower consumption rates in the South Central states are evident. Examination of individual reports frequently showed a downward trend in use rate between 1963 and 1964, in both regions.

It may be of interest to describe some calculations in which the salt cake consumption data reported to the Institute were combined with Bureau of Census statistics to obtain apparent average use rate figures for the two regions.

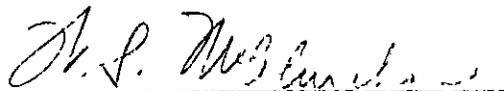
The Bureau of the Census presented regional data in 1963 and 1964 on the consumption of sulfate pulp [Current Industrial Reports, Series M26A (63)-12 and M26A(64)-13]. In the South Central region, total production of bleached, semibleached, and unbleached sulfate pulp amounted to 4,781,884 tons in 1963, and 5,699,503 tons in 1964. If these Census totals for sulfate pulp are divided into the Institute's findings for salt cake consumption (Table I), the quotients are 125 pounds per ton in 1963 and 109 pounds per ton in 1964 for the South Central States.

The Census reports withheld data on North Central production of unbleached sulfate pulp in 1964, and on both unbleached and semibleached pulp

in 1963. However, combinations of data given in several Census tables permitted rough estimates to be made of 1963 North Central sulfate pulp production; dividing these estimates into reported salt cake consumption data led to North Central apparent use rates of 179 pounds per ton in 1963 and 162 pounds per ton in 1964.

Although these use rate calculations appear to be in accord with the 17 actual reports made to the Institute, they should be regarded only as approximations, mainly because they were derived from two noncoordinated sets of statistical data. If accurate regional averages should be desired, a unified and more carefully defined survey would be required. However, no further study of this aspect of salt cake usage is anticipated unless further interest is expressed by member companies

THE INSTITUTE OF PAPER CHEMISTRY

  
\_\_\_\_\_  
William S. McClenahan  
Chemical Resources Group

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONSUMPTION OF CERTAIN PAPERMAKING CHEMICALS

A Confidential Status Report

Project 2533

May 18, 1966

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THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

CONSUMPTION OF CERTAIN PAPERMAKING CHEMICALS

SUMMARY

A status report as of May, 1966 has been prepared, which describes the Chemical Resources Group's survey of the 1963 and 1964 consumption of certain papermaking chemicals. The data reported represent replies from over 130 companies out of a total of 175 to which questionnaires were distributed.

Summations of U.S. consumption data and growth rates are presented for natural and modified starches used in primary paper and board manufacture, including both on- and off-machine pigment coating; for starch used in converting operations, and at the wet end, size press or calender stack; and for pigment binders other than starch: casein, soy protein, latexes (styrene/butadiene, acrylic, polyvinyl acetate), polyvinyl alcohol and miscellaneous binders.

For nonpigment-binder applications of latex, summations, as available, are included for styrene/butadiene, styrene/butadiene rubber, nitrile, neoprene, natural rubber, acrylic, polyvinyl acetate, polyvinylidene chloride and "others." A table is also presented which summarizes the total consumption reported to date of synthetic materials discussed in previous sections of the report.

#### INTRODUCTION

In May, 1965, the Chemical Resources Group at The Institute of Paper Chemistry began a survey of the consumption of a number of chemicals by paper and paperboard manufacturers and converters. The subjects were starches, pigment binders, and latexes. Questionnaires were delivered personally to about 120 pulp, paper, and paperboard manufacturers and/or converters. Most of these companies were members of the Institute. Subsequently, a distribution by mail raised the total sample size to 175 companies. As of May, 1966, replies had been received from over 130, and additional participation is expected. A copy of a recent form of the questionnaire is attached to this report.

Following the elimination of certain procedural problems, this first chemicals survey is expected to be completed by the fall of 1966. At the request of several suppliers of chemicals, a report of the present status of the survey has been prepared; this report is also being made available to other companies that are interested in reviewing the preliminary, incomplete totals. The final report will contain projections to include all manufacturers of paper and paperboard.

This is a report of the status of the Chemical Resources Group survey as of May, 1966. Although an analysis of the paper industry is being made, it is not yet possible to state precisely what proportion of the total production of paper and paperboard is represented by the reports received.

Questionnaires were distributed to 175 companies: about 120 personally, the remainder by mail. These companies represented over 500 paper and board mills, and nearly 300 pulp mills listed in the 1964 Edition of "Lockwood's Directory of the Paper and Allied Trades." Several large converters were also included. Replies were received from over 130 companies representing about 340 paper and board mills, about 200 pulp mills, and four converters that do no basic papermaking. Based on Lockwood's "Statistical Table," page 139 of the 1964 Edition, the companies contacted represented over 60% of United States paper mills and over 75% of U.S. pulp mills. Similarly, the replies represented a total of over 78,000 tons of daily capacity of paper and paperboard (about 26 million tons of annual capacity). This includes an estimated 5000 tons per day of building paper and board or related products; the remainder is estimated to be about equally divided between paper and paperboard. Reports are still expected from companies representing over 20,000 tons of daily capacity. Capacity information on companies that have not reported is still being developed.

However, the present survey totals may represent a higher proportion of chemical consumption by the paper industry than is indicated by the capacity information given above. The reason is that the questionnaires were sent to essentially all of the known major consumers of starches and pigment binders

among the basic paper and paperboard manufacturers. The recently published 1963 Census of Manufactures (MC63(2)-26A) may offer a more realistic basis for comparison. For the first time, this Census includes starch consumption by mills that represent the production of pulp, paper, paperboard, and building paper and paperboard. This total for 1963 was 921,363,000 pounds, and it is said to include starch used in primary paper and board manufacture, including on-machine pigment coating, plus a portion of off-machine coating that could not be segregated; however, essentially no starch used in other converting operations is included. Reports from the Chemical Resources Group (CRG) survey thus far for 1963 represent 810,374,000 pounds, or 88% of Census' findings. However, the CRG survey differs from Census in that it has definitely included off-machine coating, so the percentage with respect to Census is actually somewhat less than 88% to date.

The CRG survey covered all sizes of papermakers and all papermaking regions of the United States. A high percentage of returns was not expected from companies that engage only in converting operations, and questionnaires were submitted only to a few major ones. Relatively fewer replies were also received from those smaller papermakers whose major products are saturated or coated with nonpigmented materials, such as latexes.

Only an approximation is given in the present status report of the number of companies that reported usage of the various chemicals. This has been done in order to avoid the possibility of inferences or disclosures in the event that any subsequent reports should represent only one or two additional companies for some categories.

STARCH CONSUMPTION

TABLE I

MAY, 1966 STATUS OF SURVEY OF STARCH CONSUMPTION IN PRIMARY PAPER AND PAPERBOARD MANUFACTURE IN THE UNITED STATES, INCLUDING PIGMENT COATING

Type of Starch	Number of Companies Reporting Usage	Consumption, million pounds		
		1963	1964	Change
Corn	> 65	399.464	444.388	44.924(+11%)
Milo	> 5	15.276	17.662	2.386(+16%)
Potato	> 25	84.636	35.482	-49.154(-58%)
Tapioca	> 25	58.236	95.326	37.090(+64%)
Wheat	> 5	8.954	8.292	- 0.662(-7%)
Other dry milled	> 7	5.902	4.946	- 0.956(-16%)
Oxidized	> 50	118.184	131.194	13.010(+11%)
Acid hydrolyzed	> 10	5.544	8.710	3.166(+56%)
Hydroxyethylated	> 50	69.224	73.990	4.766(+7%)
Cationic	> 40	12.552	17.460	4.908(+39%)
Dextrinized	> 6	9.232	8.208	- 1.024(-11%)
Other modified <sup>a</sup>	> 20	23.170	13.730 <sup>a</sup>	- 9.438(-41%)
Total natural	> 80	572.468	606.096	33.628(+6%)
Total modified	> 90	237.906	253.292	15.386(+6%)
Grand total	>110	810.374	859.388	49.014(+6%)

<sup>a</sup>Decreasing order reported in 1964: unknown (4,192,000 lb.), acetylated, oxidized base, modified wheat, modified potato, dialdehyde, pregelatinized, resin treated, cold water swelling. This order may not be typical of the industry as a whole.

Table I presents the May, 1966 totals reported for the consumption of starches in primary paper and paperboard manufacture, including both on- and off-machine pigment coating, size press and calender stack applications, but excluding other converting operations.

Because copies of questionnaires distributed at the beginning of the survey did not specifically ask for milo starch to be reported separately, the total may be low.

Seven companies including both large and small ones, were unable to provide data or estimates for 1963. In the absence of any other guides, the 1963 data for these concerns were assumed to be the same as those reported for 1964. The total amount of starch, natural and modified, estimated in this manner in Table I amounted to 113 million pounds, or 14% of the total. This would probably have the effect of making the 1963 total somewhat high, and the apparent growth rate between 1963 and 1964 somewhat low.

TABLE II

MAY, 1966 STATUS OF SURVEY OF STARCH CONSUMPTION  
IN PIGMENT COATING OPERATIONS IN THE UNITED STATES

Type of Starch	Number of Companies Reporting Usage	Consumption, million pounds		
		1963	1964	Change
Purchased unmodified	> 15	145.090	149.566	4.476(+3%)
Purchased modified	> 20	50.238	61.706	11.468(+23%)
Total	> 25	195.328	211.272	15.944

It was suggested that respondents follow their accepted mill or company practice in allocating starch to the pigment binder category. A rough

guide was proposed as follows: if a formulation contained more than about 25 pounds of starch per 100 pounds of pigment, it could be considered as a "pigmented size" rather than a "coating," and could be omitted from the pigment binder total. However, it appears that some mills may consider formulations having much higher starch levels to be "coatings."

The totals reported in Table II are also included in the Table I totals for these starches.

Although information was not requested on the kind of modified starch used for pigment coating, the reports indicate that the major types were oxidized and hydroxyethylated in both 1963 and 1964.

About 13% of the unmodified and 12% of the modified starch binder included in the above totals for 1963 were estimated to be the same as for 1964, since the actual data were not available from the respondents.

TABLE III

APPARENT AVERAGE STARCH CONTENT OF PRIMARY PAPER AND PAPERBOARD  
PRODUCTS, INCLUDING PIGMENT COATED: BY NUMBER  
OF COMPANIES AT VARIOUS USAGE LEVELS

Percentage of Starch	Number of Companies	
	1963	1964
< 1	19	18
1-2	7	9
2-3	5	3
3-4	10	9
4-5	6	7
5-6	6	5
6-7	5	7
7-8	2	2
> 8	3	3

A total of 63 companies included in their reports the tonnage produced of grades of paper and paperboard that contained starch. They had been requested to include the tonnage of starch-containing basic paper and paperboard products, including pigment coated types, but omitting other converted products. From the data supplied, ratios were calculated which indicated average starch contents of these products. Because of the diversity of products represented, the table of percentage ranges is merely a rough indication of the average level of starch consumption by the reporting companies. Of the 63 companies, 36 reported an increase in the proportion of starch used in 1964 as compared with 1963, 23 reported a decrease, and 4 indicated no change.

This inquiry about the amount of production that contained starch was made only in the questionnaires that were distributed in person.

TABLE IV

MAY, 1966 STATUS OF SURVEY OF STARCH CONSUMPTION  
BY METHOD OF APPLICATION

Method of Application	Number of Companies Reporting Usage	Consumption, million pounds		
		1963	1964	Total
Wet end	> 45	74.092	78.290	4.198(+6%)
Size press	> 40	266.386	289.866	23.480(+9%)
Calender stack	> 25	31.694	33.950	2.256(+7%)
Total		372.172	402.106	29.934(+8%)

A number of companies, particularly the larger ones, were unable to provide a breakdown of starch consumption by method of application. This

inquiry was confined to the questionnaires distributed in person. Hence the breakdown above should be regarded as an indication of trends in industry practice, but not an attempt at a complete appraisal.

TABLE V

MAY, 1966 STATUS OF SURVEY OF STARCH CONSUMPTION  
IN CONVERTING OPERATIONS IN THE UNITED STATES

Type of Starch	Number of Companies Reporting Usage	Consumption, million pounds		
		1963	1964	Change
Unmodified	> 25	167.884	183.450	15.566(+9%)
Modified	> 40	37.986	41.242	3.256(+9%)
Total	> 45	205.870	224.692	18.822(+9%)

Because converting operations are diversified in character and are often performed at a number of locations, these totals probably contain a higher percentage of estimates by responding companies than does Table I.

As examples of "converting," the questionnaires mentioned laminating, corrugating, and box manufacture. Pigment coating is excluded from Table V.

Few direct indications were obtained on the nature of the modified starches used in converting.

About 14% of the natural and 9% of the modified starch included in the 1963 totals for converting have been assumed to be the same as that reported for 1964, since actual data were not available.

#### PIGMENT BINDER CONSUMPTION

The importance of pigment binders may be judged from estimates (Paper Industry, January, 1966) that machine capacities of coated grades of printing paper will be as follows:

Year	Capacity, tons
1964	2,827,000
1965	3,175,000
1966	3,441,000
1967	3,547,000

This represents an average annual growth rate of about 8% between 1964 and 1967. Coated paperboard capacities are not included in the above, and statistics for coated board seem to be less reliable; however, growth is generally stated to be at least 10% per year.

It is believed that consumption data reported in Table VI for several pigment binders will increase considerably when an additional group of expected reports has been received. This increase is particularly likely for polyvinyl acetate, but probably it will also occur for starch, soy protein, and S/B latex. Respondents to date have already been asked to check their data reported on polyvinyl acetate usage, but the changes received have been relatively minor. It is possible that literature estimates for PVAc use as a pigment binder include some formulated products actually used for other purposes. In the present survey, companies were asked to limit reports to polyvinyl acetate purchased in noncompounded form.

It is of interest that the current totals for soy protein usage in 1963 and 1964 already exceed the estimate for 1965 consumption given in the January 10, 1966 issue of Oil, Paint and Drug Reporter. However, the current survey reports on casein used as a pigment binder are well below literature estimates, and it seems unlikely that the gap will be closed completely as additional replies are received.

TABLE VI

MAY, 1966 STATUS OF SURVEY OF PIGMENT BINDER CONSUMPTION  
FOR ON-MACHINE AND OFF-MACHINE COATING OF PAPER AND  
PAPERBOARD IN THE UNITED STATES (EXCLUDING PIGMENTED SIZING)

Pigment Binders	Number of Companies Reporting Usage	Consumption, million pounds, dry basis		
		1963	1964	Change
Starch				
Purchased unmodified	> 15	145.090 <sup>a</sup>	149.566	4.476(+3%)
Purchased modified	> 20	50.238 <sup>a</sup>	61.706	11.468(+23%)
Casein	> 25	24.622	26.554	1.932(+8%)
Soy protein	> 35	21.784	23.582	1.798(+8%)
Latexes				
Styrene/butadiene, SB (50% or more styrene)	> 40	35.018 <sup>a</sup>	39.336	4.318(+12%)
Polyvinyl acetate	> 15	6.032 <sup>a</sup>	7.502	1.470(+24%)
Acrylic	> 15	6.182 <sup>a</sup>	6.232	0.050(+1%)
Polyvinyl alcohol	> 10	0.642	0.788	0.146(+23%)
Other binders <sup>b</sup>	> 9	1.156	1.276	0.120(+10%)

<sup>a</sup>1963 consumption was estimated to be equal to 1964 as a percentage of the 1963 total: starch, 25%; S/B, 19%; acrylic, 35%; polyvinyl acetate, 20%.

<sup>b</sup>In decreasing order: carboxymethyl cellulose, gelatin, methyl cellulose, polyvinyl chloride copolymer, nitrocellulose, Kelgin, hydroxyethyl cellulose, nitrile latex, polyamide.

Recently, respondents were asked to check their casein reports, and to submit information on casein used for purposes other than pigment binding; the total amounts reported for the latter have so far amounted to 482,000 pounds in 1963 and 484,000 pounds in 1964. Again it is possible that some compounded

casein adhesives have in the past been reported as pigment binders. It should be mentioned that casein purchases in 1965 were undoubtedly much lower than in 1964, due to its great increase in price. Although casein has characteristics that are difficult to duplicate in some coated products, it is doubtful that the 1964 level of usage will be regained for some time, even though prices have moderated.

Acrylic latex as a pigment binder has shown relatively little evidence of growth in the 1963-1964 period, based on reports received to date.

Polyvinyl alcohol is a very effective adhesive, and it can be used in much smaller quantities than other binders. The price decrease of 1965 has probably accelerated its use.

#### LATEX CONSUMPTION, EXCLUDING PIGMENT BINDING

The current status of reports on consumption of latex for purposes other than pigment binding is given in Table VII. The number of companies reporting uses of this nature is much smaller than in the case of pigment binding. Many companies that produce latex-impregnated products have not yet responded, and it has been possible to include in this survey only a small fraction of the existing converters. Hence, the value of the present data resides mainly in the growth rates that are indicated.

Polyvinyl acetate has shown rapid growth in these nonpigmented applications, as it did in pigment coatings. Acrylic latexes have shown their best potential in nonpigmented products.

TABLE VII

MAY, 1966 STATUS OF SURVEY OF LATEX CONSUMPTION BY THE PAPER  
INDUSTRY, EXCLUDING PIGMENT BINDING APPLICATIONS

Latex	Number of Companies Reporting Usage	Consumption, million pounds, dry basis		
		1963	1964	Change
Nitrile	> 10	6.858	7.160	0.302(+4%)
Styrene/butadiene, SB (50% or more styrene)	> 5	5.510 <sup>a</sup>	6.712	0.202(+3%)
Styrene/butadiene, SBR (less than 50% styrene)	> 10	5.904	6.178	0.274(+5%)
Neoprene	> 7	2.966	3.144	0.178(+6%)
Acrylic	> 10	2.148 <sup>a</sup>	2.664	0.516(+24%)
Polyvinyl acetate	> 20	1.828 <sup>a</sup>	2.408	0.580(+32%)
Polyvinylidene chloride	> 10	0.512 <sup>b</sup>	1.394	b
Natural rubber	> 5	0.322	0.370	0.038(+10%)
Other latexes	> 5	4.660 <sup>c</sup>	4.938 <sup>c</sup>	0.278(+6%)

<sup>a</sup>1963 consumption was estimated to be equal to 1964 as follows, as a percentage of the 1963 total: S/B, 71%; acrylic, 4%; polyvinyl acetate, 5%.

<sup>b</sup>See text.

<sup>c</sup>Breakdown not available.

The polyvinylidene chloride data require some comment. It is probable that our survey has not reached a number of users. Growth appears to have been rapid since 1963, but rates cannot be determined very accurately from the data presented, since some estimates are included to make up the totals. The PVDC totals are also affected strongly by a major increase in consumption reported by one company. It is probable that the "other latex" category includes some

polyvinylidene chloride. The properties of PVDC coatings lead to the opinion that sales of this latex will continue to grow as users become accustomed to the idea of multiple coating techniques, and as they install the necessary production equipment.

COMBINED STATUS REPORT ON LATEXES AND SYNTHETIC BINDERS

Table VIII combines the paper industry consumption data for synthetic materials presented in previous sections. Overall growth rates have been calculated. The table requires no comment beyond that previously given.

TABLE VIII

MAY, 1966 STATUS OF SURVEY OF CONSUMPTION OF SYNTHETIC PIGMENT BINDERS AND LATEXES BY THE PAPER INDUSTRY (COMBINED APPLICATIONS)

	Consumption, million pounds, dry basis		
	1963	1964	Change
Modified starches for pigment binding	50.238	61.706	11.468(+23%)
Latexes			
Styrene/butadiene, SB (50% or more styrene)	41.528	46.048	4.520(+11%)
Polyvinyl acetate	7.860	9.910	2.050(+26%)
Acrylic	8.330	8.896	0.566(+7%)
Nitrile	6.858	7.160	0.302(+4%)
Styrene/butadiene, SBR (less than 50% styrene)	6.510	6.712	0.202(+3%)
Neoprene	2.966	3.144	0.178(+6%)
Polyvinylidene chloride	0.512 <sup>a</sup>	1.394 <sup>a</sup>	a
Other latexes	4.660	4.938	0.278(+6%)
Polyvinyl alcohol	0.642 <sup>b</sup>	0.788 <sup>b</sup>	0.146(+23%)

<sup>a</sup>See text.

<sup>b</sup>Pigment binder usage only. About eight respondents volunteered information on other applications of polyvinyl alcohol, representing 0.638 million pounds in 1963 and 0.706 million pounds in 1964 (+11%).

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A handwritten signature in cursive script, reading "W.S. McClenahan". The signature is written in dark ink and is positioned above a horizontal line.

---

William S. McClenahan  
Research Associate  
Chief, Chemical Resources Group

CONFIDENTIAL CHEMICAL RESOURCES SURVEYChemical Consumption in the Pulp and Paper Industry of the United States

Please indicate the consumption in your company or mill of each chemical listed on this questionnaire. Designate whether pounds or tons is represented. Only consumption in U. S. mills should be included.

	<u>Consumption</u>		
	<u>1963</u>	<u>1964</u>	
<b>I. <u>Starch and dextrin, total use in primary paper and board manufacture, including both on-and off-machine pigment coating, size press and calender stack applications. (EXCLUDE other converting operations, e.g., laminating, corrugating, box-manufacture, etc.)*</u></b>			
(1) Cornstarch, unmodified	_____	_____	(1)
(2) Potato starch, unmodified	_____	_____	(2)
(3) Tapioca starch, unmodified	_____	_____	(3)
(4) Wheat starch, unmodified	_____	_____	(4)
(5) Milo starch, unmodified	_____	_____	(5)
(6) Dry milled starch (specify) _____	_____	_____	(6)
(7) Oxidized (hypochlorite)	_____	_____	(7)
(8) Dialdehyde (periodate)	_____	_____	(8)
(9) Acid hydrolyzed	_____	_____	(9)
(10) Hydroxyethylated	_____	_____	(10)
(11) Cationic	_____	_____	(11)
(12) Dextrinized	_____	_____	(12)
(13) Other (specify) _____	_____	_____	(13)
(14) " " _____	_____	_____	(14)
<b>II. <u>Starch and dextrin consumption in converting operations (laminating, corrugating, box-manufacture, etc.)**</u></b>			
(1) Total unmodified starch (specify) _____	_____	_____	(1)
(2) Total modified starch, including dextrin	_____	_____	(2)

## NOTES

\*Section I includes starch and dextrin added at the wet end, size press, calender stack, or at on- or off-machine coating stations. Hence, quantities reported in Section III-(3) should also be included in Section I.

\*\*Section II: estimates are acceptable if data are not readily available. Please designate estimates by adding "est."

The sum of the starch and dextrin consumption in Sections I and II should represent the total for your company's operations in the United States; if only certain mills are represented, the ones included or excluded should be designated on a separate attachment.

Information reported to the Chemical Resources Group will not be disclosed in any manner which will directly or indirectly reveal consumption practices of individual companies, unless written approval is granted by the respondent.

Code \_\_\_\_\_

Revision C

Page 2

CONFIDENTIAL CHEMICAL RESOURCES SURVEYChemical Consumption in the Pulp and Paper Industry of the United States

Please indicate the consumption in your company or mill of each chemical listed on this questionnaire. Designate whether pounds or tons is represented. Only consumption in U. S. mills should be included.

Consumption

	<u>1963</u>	<u>1964</u>
III. <u>Pigment binders for paper and paperboard including both on-and off-machine coating, but excluding pigmented sizing*</u>		
(1) Casein	_____	_____ (1)
(2) Soy protein	_____	_____ (2)
(3) Starch for pigment binding only, total	_____	_____ (3)
a. Purchased unmodified	_____	_____ (3a)
b. Purchased modified	_____	_____ (3b)
(4) Latex		
a. Styrene/butadiene (SB)		
(50% or more styrene) (dry solids basis)	_____	_____ (4a)
b. Acrylic	_____	_____ (4b)
c. Polyvinyl acetate	_____	_____ (4c)
d. Other latex (specify) _____	_____	_____ (4d)
e. " " _____	_____	_____ (4e)
(5) Polyvinyl alcohol	_____	_____ (5)
(6) Other binders (specify) a. _____	_____	_____ (6a)
(e.g., CMC, etc.) b. _____	_____	_____ (6b)
IV. <u>Additional latex usage (other than pigment binder)</u>		
(1) SBR (less than 50% styrene) (dry solids basis)	_____	_____ (1)
(2) SB (50% or more styrene) "	_____	_____ (2)
(3) Nitrile "	_____	_____ (3)
(4) Neoprene "	_____	_____ (4)
(5) Natural rubber "	_____	_____ (5)
(6) Acrylic "	_____	_____ (6)
(7) Polyvinyl acetate "	_____	_____ (7)
(8) Polyvinylidene chloride "	_____	_____ (8)
(9) Other latexes (specify) _____	_____	_____ (9)
(10) " " _____	_____	_____ (10)

## NOTES

\*Section III: Interpretations should follow accepted mill or company practice. (A general rough guide: if a formulation contains more than about 25 pounds of starch per 100 pounds of pigment, it could be considered as a "pigmented size" rather than a "coating", and could be omitted from Section III).

Information reported to the Chemical Resources Group will not be disclosed in any manner which will directly or indirectly reveal consumption practices of individual companies, unless written approval is granted by the respondent.