The Institute of Paper Chemistry
Appleton, Wisconsin

Applications of Various Chemical Additives in the Pulp and Paper Industry: a Qualitative Survey

Project 2533

A *Confidential Report* to the Staff of
The Institute of Paper Chemistry

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Summary

Personal contacts were made during 1965 with approximately 135 companies and organizations associated with the paper industry, most of them being manufacturers of pulp and paper. The primary purpose was to acquaint the industry with the newly-formed Chemical Resources Group, and to distribute a questionnaire which seeks data on 1963 and 1964 purchases of starches, pigment binders, latexes and salt cake.

Where circumstances were favorable, qualitative statements were also invited on applications of a variety of chemical additives. The responses obtained from 90 different sources are presented in this report in abbreviated form, and arranged under 22 subject headings. The findings will be valuable in planning future Chemical Resources Group surveys. It is hoped that they will also be useful to IPC staff members whose research and interests pertain to the subject matter of the survey.

Introduction

The Chemical Resources Group was established at The Institute of Paper Chemistry in January, 1965. During the period from May to November, personal contacts were made with essentially all the member companies of the Institute, and with more than 30 non-member paper companies, trade organizations and suppliers. The purpose in making these contacts was threefold:

1. To establish a long-range working relationship with as many Institute member companies as possible, which would enable the group to obtain accurate data on the consumption of chemicals by these companies. The need for a project of this nature was described by John G. Strange in a letter to the member companies dated April 28, 1965.

2. To distribute a questionnaire seeking data on 1963 and 1964 paper industry consumption of starches, pigment binders, latexes and salt cake.

3. To obtain qualitative information on paper industry applications for a number of chemical additives. This information was desired by several staff members of the Institute, especially by the Physical Chemistry Section. It was also needed to guide future activities of the Chemical Resources Group.

The present report deals only with the third of these objectives, and summarizes under 22 subject headings the comments obtained from 90 different sources.

Discussion

The Chemical Resources Group plans to build up a fund of information on the consumption of chemicals by the paper industry. The response of Institute member company executives to the announcement of this objective was highly favorable. However, preliminary contacts indicated that a personal discussion with the liaison man in each member company would probably be very beneficial in establishing sound working relationships for the future. It was also learned that a number of companies, particularly among the larger ones, did not have centrallized data available on their purchases of chemicals, and that they might have to put forth considerable effort to provide the information required. Hence it seemed prudent to limit the request for quantitative data to a relatively small group of chemicals: starches, pigment binders, latexes and salt cake. The findings from this quantitative survey will be the subject of future reports.

However, it was often possible to obtain considerable qualitative information on applications of chemicals, particularly when the liaison man had a technical background. The subjects discussed were generally limited to areas in which the heads of several Institute research sections had expressed interest. Comments obtained were occasionally detailed, but more frequently were very general and somewhat fragmentary in nature; time limitations, and the degree of familiarity with the area on the part of both interviewer and respondent, often governed the depth of response. In many instances the contact was reluctant to discuss matters in detail which he believed to be of a more or less proprietary nature, even though assurance was given that his replies would be circulated only to a limited extent, and only within the Institute.

Although memoranda were written on each of these interviews, their diversity was such that it has been difficult to extract the concensus of the respondents on any given subject. Hence it seemed advisable to organize the replies under a number of topical headings, with subdivisions wherever feasible. The compilations are presented in this report.

In general, the names of individuals who offered the comments are not identified in the report, although they are given in the memoranda. In the interest of economy of space, the companies they represent are designated by a five letter descriptive code which preceeds each comment; the key to these simple code designations will be found in Appendix II. If only the code letters are recorded under a given subject heading in the report, it should be inferred that the item is pertinent to the company's operations (e.g., the chemical is in use), but that no other comment was obtained. In most instances no entry whatever has been made when the company reported that it did not make use of the product under discussion; in addition to space-saving considerations, it was felt that negative reports would often no longer be valid within a short time. An effort has been made to minimize duplication of comments, but some repetition was inevitable due to the overlapping of subject matter.

The respondents often had suggestions to offer pertaining to subjects for research, industry needs, services desired, etc. These comments have been summarized in Appendix II, and in the section on New Chemicals Reports.

Conclusions

The report gives a general picture of the usage of chemical additives by a substantial portion of the paper industry.*

It is evident that disagreement occasionally exists as to the practical value of a given class of additive. In some instances the Institute might render a service by pointing out ways in which application methods could be improved.

The comments obtained should offer some guidance to areas in which research might be emphasized; they will be a very useful guide in planning future surveys by the Chemical Resources Group

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* However, it should be noted that little, if any, qualitative information was obtained from several of the largest paper manufacturers, since too much time was required in working out procedural details, and the liaison man was occasionally not too knowledgeable in the areas of interest.

William S. McClenahan

Comments of Respondents

It should be emphasized that the comments reported in the following sections are solely for the guidance of the staff of The Institute of Paper Chemistry. They should be regarded as CONFIDENTIAL, and should not be quoted to any individual who is not a staff member.

ALUM

The question put to the respondents was, "Would greater knowledge of the chemistry of alum benefit the mills?" Continental Can Company was greatly interested in this subject, but most others interviewed showed only moderate interest, particularly in pH control, reactions with rosin, or reactions which were thought to cause formation of deposits. Operating personnel usually had no opinions on the matter, in contrast to technical personnel. Negative comments are not recorded. A study which gave considerable emphasis to the reaction with rosin might draw greater evidence of interest.

A. Comments on the chemistry of alum

1. CONCC - Study over whole pH range of great interest.

2. CONSP - Might be interested in a research program. Have worked with J. Swanson already.

3. FIBRP - Alum formed filamentous slime, and Champion could not solve the problem after 1-1/2 years' effort.

4. FOXRV - More knowledge would be helpful.

5. GULFS - Contact at Demopolis thinks information could be improved.

6. MICAR - Receive alum shipments frequently and storage creates no problem. But is alum the best pH controller, or would H_2SO_4 be better, for example?

7. MMMCO - Study of interest if it can be translated into practice.

8. NICPA - Small use, but more knowledge needed.

9. NWPCO - Don't know enough about alum, but not sure of interest in project.

10. OILGC - Excess aluminum ion hurts sizing. Study might help them to understand and control separate alum functions of pH regulation and sizing.

11. PKGCA - Alum plus silicones seems to form scale which plugs wires, felts. Silica is high in Filer City water. More should be known about alum: is it responsible for the deposits? How to inhibit?

12. STREG - Technical staff would probably like more knowledge.

13. THILM - Knowledge is inadequate.

14. WALDF - Need more fundamental information. Alum forms coatings on wires.

15. WARDP - Study might help get more balanced system.

16. MOHWK - Interested in effect of aging on sheets neutralized to pH 7 with soda ash or sodium aluminate. Why does Tappi cold extract give pH 7.0, but hot extract pH 5.5? Does this indicate a breakdown of an alum salt, and will aging produce a similar effect?

17. MANNG - Deflocculants for rope pulp are active at neutral, alkaline, or slightly acid pH. How much alum can be added to rosin size before a return to neutral or alkaline conditions will not improve formation, and how does the retained alum affect sheet properties? Too much alum not only gives poor formation in sandpaper backing, but also impairs aging properties of resins used to bind the abrasive.

18. WARNC - Study might benefit, but alum use is decreasing. No difficulties observed, possibly because of high-quality water supply with few competing ions.

19. LIRAP - Excessive use of alum causes trouble. Ordinarily there is uncertainty whether alum or rosin is at fault.

20. HERCL - Much is still to be learned about the reaction of rosin and alum.

21. WSTKC - A study would be beneficial if it could lead to improvements in rosin/alum combination.

B. Existing literature on alum chemistry

Several respondents (e.g., BRGST, FOXRV and WESTN) referred to recent literature on alum published by American Cyanamid Company. Unfortunately, none of them could recall the exact title. BRGST said chemical structures are given at various pH levels.

BUBBLE COATING

Inquiries were made concerning new developments in the coating field. Without exception the replies pertained to bubble coating. Although several companies reported that others were using the process commercially, this does not presently appear to be correct, and more development and economic appraisal work is underway. The process is being considered for use in making publication grade paper as well as board, and its adoption could have a strong effect on the pricing and profit picture.

A. Notes on bubble coating

1. ALBEM - A.D. Little says that although 80% of the bubbles are destroyed in calendering, the sheet is still opaque.

2. BLAND - Packaging Corporation of America at Rittman, Ohio is said to be using bubble coating consistently on board. Fibreboard Paper Products Corporation, Antioch, California is also understood to be using it to some extent. Bubble coating works in the publication field, but Blandin is not using it at the moment. Their base stock is not smooth enough, but otherwise the properties of the coating are very good. He does not think that it would be economical to use on publication grade over 35 pounds, and it should be 30 pounds or lower, since the coating costs 12-16 cents per pound, dry basis, as compared with conventional coatings at less than 4 cents. It may be economical for use on board. He also made a few coments on the patent situation.

3. BBRDA - The Boxboard Research and Development Association is working with starch in a development which might serve as a large outlet (bubble coating?). Soy protein has been found experimentally to be equivalent to casein, but it reduces the brightness one point, and the savings realized are balanced by the increased requirement of titanium dioxide. The capital involved in bubble coating is not as large as might be expected. The solvent requirement is relatively small, and it is not recovered. The process may be used on publication grade paper to provide lighter weight, but serious pricing problems may result. Samples of boxboard were displayed which had brightness values of over 90, made with 2.5 pounds per thousand square feet of coating, with a materials cost of 75 cents: Water resistance and printability were said to be good.

4. CONPG - BRDA members are said not to be overly enthusiastic. New binders are being sought. Several new gloss coats are coming out.

5. CONSP - Little work is being done at the present time with bubble coating.

6. DINAT - Diamond's board production is 50-60% coated. After considerable work with bubble coating they are not convinced that it is

economical, and quality problems exist. They made the BRDA samples described above. They have been able to duplicate A.D. Little's coatings weights, but cannot verify their economics. Board of 92 brightness can be produced with lightweight mineral coatings.

7. FIBPP - They make about 0.5 million tons of board per year, 10% coated. They are not yet in the commercial stage in bubble coating, but are not completely discouraged and will continue work.

8. FITCH - They are interested in bubble coating, but so far the process is not being made available to manufacturers of paper. (Presumably it would be available to papermaker members of the Boxboard Research and Development Association.)

9. MICAR - Diamond National is said to be leading in bubble coating.

10. PKGCP - The process was used commercially for a time at their Rittman, Ohio mill, but it is now shelved while A.D. Little is developing means for obtaining more uniform bubble size. The process has a lot of promise. It is too expensive for use at Filer City, where the brightness presently achieved is 82-83. Regular fume hoods can be used, but air pollution may be a problem.

11. POTLF - The mill in Rittman, Ohio is using the process on cylinder board made from waste paper.

12. WALDF - Bubble coating is being used at Rittman, Ohio, and perhaps by Michigan Carton Company at Battle Creek. Waldorf is still investigating the process, but is uncertain as to the savings possible.

FOAM CONTROL
(see also Pitch and Deposit Control)

Most respondents said that foam control chemicals were used. None appeared to be consistently superior. These chemicals often represent a substantial raw material cost, and prevention of foam formation is preferable where capital costs involved are not excessive. A number of instances were cited where foam control chemicals were suspected of leading to pitch or deposit formation; in several cases this appeared to be due to excessive applications of defoamer, followed by a reaction with rosin or dissolved salts, although several unnamed chemicals have had to be withdrawn from the market.

Some companies are represented in more than one of the following categories.

A. Companies that mentioned difficulties with defoamers

1. BOWAT - Use up to 1/4 pound per ton. Under some suspicion as forming pitch.

2. CHESP - On one occasion thought that a foam killer caused pitch.

3. CONSP - Certain defoamers, perhaps sulfonated tallows, react with alum in the fan pump to produce precipitates. The effect can be demonstrated in the laboratory.

4. DIERK - The use of Nopco 160-N, possibly in excess, seemed to produce very severe pitch. They are not absolutely sure the compound was responsible, but are unwilling to try it again.

5. DINAT - On one occasion it was thought that a gummy deposit on the press rolls was due to the use of excess defoamer.

6. EASTX - Ionic defoamers, which may have been metal stearates, used in the screen room caused trouble when the hardness of the water reached certain levels. Riegel Paper Corporation in North Carolina was particularly bothered by this behavior, and had to switch to non-ionic types.

7. FIBPP - They had one bad experience with a foam control agent which spoiled considerable quantities of Fourdrinier bleached kraft board, with which a precipitate was formed, resulting in considerable down time. He thought it was a Houghton additive, but did not know the type. This additive caused trouble on two machines.

8. FITCH - Various defoamers are used. Excesses will cause pitch trouble, but the respondent had no correlation with type.

9. GLATF - Kerosene used as a defoamer in the pulpmill once caused serious pitch trouble.

10. KCSTR - This company has considered the possibility of pitch formation from defoamers but has not studied the matter.

11. MMMCO - Too much antifoam agent will produce pitch unless the right amount of dispersant is used. The trouble appears in the form of wire plugging or press roll sticking.

12. MOHWK - Excessive defoamer can combine with sizing or small amounts of pitch to produce press roll deposits; this is definitely a misusage, and is easily corrected.

13. NWPCO - Too much defoamer softens pitch and produces gummy agglomerates.

14. OILGC - It is possible that defoamers can produce deposits.

15. POTLF - Silicones are dangerous in coatings because of the possibility of introducing spots.

16. PUBPC - Pitch has been produced from foam control chemical usage in a meat wrap. Apparently an excessive amount of rosin size was used which produced foam, and then additional defoamer was added that produced deposits. Subsequently they reduced the rosin and changed from Nalco to Houghton defoamer.

17. WARNC - Pitch has been produced from defoamers made by a major supplier. The product has been withdrawn from the market, but no identification would be given other than that the troublesome types may have been soaps, perhaps sulfonates. The product was understood to have worked satisfactorily with southern hardwoods, but not with northern species.

B. Companies that mentioned large consumption of defoamers.

1. BOWAT - Various kinds are used, up to 1/4 pound per ton.

2. FIBPP - Foam control chemicals made by various producers are used in all their mills. Much of this material is used in kraft pulp manufacture, but some coatings. Suppliers are continually approaching them with cheaper and better materials.

3. GLATF - The defoamer suppliers have done a good job of providing effective materials, and Glatfelter uses large quantities of them, especially because of inadequate design of their brown stock washers in the pulpmill. They do not use defoamers on the machine.

4. HAMRM - Many kinds of defoamers are used, but none of them exhibits outstanding behavior. There have been no reports of pitch generation.

5. WEYER - Many foam killer suppliers call on the mills, and foam control is a large cost item.

C. Companies that mentioned small consumption of defoamers.

1. BADGR - This sulfite pulp manufacturer considers their cost of defoamer per ton of paper to be very low compared to the industry average.

2. CRANE - This company is a large consumer of rag pulp and their foam problem is not serious; however defoamers are used with some grades, and no pitch formation has been noted.

3. FOXRV - Little defoamer is used, but they are kept on hand and Fox River has a Hall defoamer. The company uses large quantities of rag pulp. Defoamers are normally used in surface sizing applications. On one occasion they thought their use led to pitch trouble, but switching types did not eliminate the difficulty. Kerosene is used with one grade routinely, said to be a calender stock.

4. LIRAP - Foam control is not a serious problem since they have improved their operating conditions. Sized grades use Pioneer Paste TD63X3. Unsized (absorbent) grades use Hodag WR145 (liquid).

5. NWPCO - Foam control chemicals have been used in both mills, but not in large volume.

6. WSTKC - Little foam control agent is used since Douglas fir is good in this respect.

D. Additional comments on foam-control chemicals.

1. BLAND - Blandin conducts a continuous pitch-prevention program. They add polyphosphates, Nalco 818 to the groundwood white water, to screen stock, and in the chemi-mechanical pulp mill; this mill uses poplar. Unless such treatment is regularly employed the couch rolls get gummy. They figure the cost per ton at about 10-15 cents.

2. BRGST - Use Nopco LDC for the most part: 2765 pounds per month recently (approximately 17 tons per year).

3. CONCC - Some of their mills use foam control agents, one of them finding small amounts of kerosene to be very satisfactory.

4. CONPG - Their South Side Mill now uses Nalco 71C, which is doing the job economically.

5. DINAT - Chemicals are used in coatings and at the wet end. In coatings, which have a life of about five hours, they use tributyl phosphate; this is a poor practice because the chemical is expensive and the effect lasts only about one hour. The nature of the wet end

additive was not known. At one time a gummy deposit on bronze press rolls was cured by decreasing the amount of defoamer. A sort of vicious circle is involved: too much size causes excessive foam, and an increase in defoamer may cause an interaction which yields pitchy material.

6. GULFS - Kerosene is very effective in bag grades, on-machine. Silicones are used in the pulpmill screw presses and vacuum washers. Salesmen try to scare off the use of silicones on-machine; however the contact did not believe that silicones actually form pitch.

7. HOLVO - A Nopco product is used, perhaps DF.

8. KCSTR - Nopco types are used in the sulfite mill; Houghton DRX510 on-machine. They are eliminating sources of air introduction, and are using deaerators, which have reduced the need for foam killers.

9. KNOWL - For certain grades of paper a variety of defoamers is used, and 3-4 are kept on hand so that they can switch until one is found that will correct problem.

10. MMMCO - Nalco 212 gives pretty good control, although it does not eliminate foam.

11. MOHWK - They no longer have trouble with foam; Deculators remove 90% of the air and the remaining foam is controlled by various additives.

12. MOSNE - Defoamers are used periodically in white water, and regularly in black liquor.

13. OILGC - A variety of foam killers is used, and they are always looking for better ones.

14. PKGCA - At Filer City proprietary defoamers of uncertain composition are used, following manufacturers' recommendations. They differ for pulpmill, paper machine, and size press, and may include stearates, castor oil derivatives, and silicones. Pitch problems are not severe enough for them to notice any relationship to defoamers.

15. POTLF - Some foam control agents are used in black liquor washings. In coatings they have used Polyglycol B1200. Hercules' 340F is very effective for black liquor washings. They use no foam controls on the wet end of the machine.

16. SIMTM - Although they use a Deculator system, some grades need foam control chemicals; they use a local product, a fish oil derivative called Lebcol, which seems to be specific for their type of pulp. However he thought that if it were used in paper it might result in fish eyes.

17. SONCO - There are too many foam killers now. Satisfactory ones are paraffin oil, and sulfonated fatty acids.

18. STRNG - Foam in coatings and at the calender stack produces some problems and they are trying additives. Foam killers are used on the Fourdrinier machine, and some are very poor, others are good; Hercules' number 4 and number 5 are more or less standard materials and are good; number 5 is the food grade.

19. THILM - Foam control agents are used, many of which are good, but they are always interested in greater overall economy.

20. WALDF - Hercules' number 5 and number 831 are used. Number 5 is introduced by means of an automatic emulsifying machine, and application is to the paper machine itself.

21. WARDP - Hercules' model S-3 applicator and a number 5 brick are used for washing of pulp and on-machine.

22. WESTN - Fuel oil is used to control foam, and they have not observed intensification of pitch.

23. RIEGC - Defoamers were too expensive, so RIEGC made their own. Subsequently they induced Nopco and Nalco to make them at the right price.

GUMS

The question put to the respondents was, "If you use vegetable gums, is the purpose to provide strength improvement, machine speed-up (improved drainage), better tensile/tear balance, filler retention, or improved formation?"

A number of companies are represented in more than one of the above categories.

A. Strength improvement

1. ALBEM - Lycoid 251 is used at the Hollywood mill. The original intent was to control linting, since many of their papers have high bulk. Slightly increased tensile strength results.

2. BADGR - Gums are added at the fan pump. Lycoid (guar) gives better fiber bonding, which results in better surface laydown, and the elimination of picking and linting.

3. CHESP - Locust and guar gums are used to achieve strength and speed. They are superior to cationic starch with heavy board.

4. CONCC -

5. CONPG - Guar gum is used at the wet end in the North Side Mill, where there are two cylinder machines making corrugated liner and two Fourdrinier machines making bogus medium. The gum improves mullen of the liner as well as drainage and flat crush for medium. This mill also uses some cool-water-swelling grade to improve mullen in automotive and liner grades and sometimes to improve ply bonding in boxboard grades.

6. DIERK - Locust bean and guar gums are being evaluated in an effort to improve tensile strength and give increase in speed. Their paper machine operates at about 700 feet per minute on paperboard, and 1000-1400 on paper. Sometimes the bag plant needs a rough sheet, in which case they do no calendering, and as a result do not get the highest possible strength. Nothing is added to the paper to improve crush resistance of corrugated board, but if a customer should ask for improvement, they would probably add starches or gums at the wet end.

7. HAMRM - Guar and locust gums are used for strength improvement through internal bonding.

8. LNGVF - Gums are used for strength improvement, which probably results in part from the improved formation.

9. MANDO - Gums are used for bond strength (pick resistance). (See also B. Formation improvement)

10. MANNG -

11. MICAR - Small amounts of gums are used for ply bonding. Not much can be done with gums on cylinder machines; strong fiber must be used. Some cationic starch is used along with or in place of gums. Acrawax and Separan are also employed (Acrawax described in directories as a synthetic wax).

12. OILGC - Wet end use of gums is substantial, mainly with starch in the head box to give internal bond strength by means other than refining. They are not used at all times to avoid giving a crutch to machine operators.

13. PKGCA - Gums are under consideration. Locust was once tried for internal bonding.

14. STREG - Their interest in gums is to improve strength, but this results from better formation. There is a trend away from guar gum to starch plus retention aids such as Kymene 557 and Nopco types. If they can get pearl starch at 5 cents per pound, they are ahead using retention aids. Tapioca starch is available on the East Coast at 4 cents. Apparently their West Coast mills, and not all their Eastern mills, are using tapioca. Cationic starches have performed well, but pearl starch plus retention aids is cheaper at the same levels of strength.

15. WALDF - Guar gum is used for strength improvement. They formerly used carboxymethyl cellulose on jute liner in order to improve strength.

16. WESTN - Some gums are used at the St. Mary's Mill, probably for mullen improvement in liner board. Tests have been made at the Terre Haute Mill, but although gums had some merit, they were not economical with the system.

17. WSTKC - Gums are used for mullen improvement with Douglas-fir, at the wet end; relatively little is used and they hope to eliminate gums entirely. Usage and non-usage of gums appears to follow a rather cyclical pattern.

18. WVAPP - Gum usage has been an in-out-proposition. At present they are being used, probably for mullen improvement.

B. Formation improvement

1. ALBEM - Lycoid 251, used at the Hollywood Mill provides slightly increased tensile strength, and they expect to get improved formation, but it is difficult to say with certainty.

2. BRGST - Locust bean gum will be investigated for formation improvement.

3. CONCC -

4. DINAT - Lycoid (OMP ?) is used to improve formation.

5. HOLVO - Karaya is used.

6. LNGVF - Gums are used for strength improvement, which probably results in part from improved formation.

7. MANDO - Gums are preferred to cationic starch for obtaining closer formation and higher strength. In 1964 they consumed 164,000 pounds of Adcol (ADM) and 16,000 pounds of Guartec (General Mills). Stein, Hall Lycoid has also been used in previous years.

8. MANNG -

9. MMMCO - Gums are used in limited amounts for formation improvement and occasionally to obtain better drainage.

10. MOSNE - Karaya gum is used in one product because the customer wants it, probably for formation improvement.

11. RIEGJ - Gums are used to improve formation and the results are excellent with cylinder sheets, but not very good with Fourdrinier.

12. STREG - Gums are used to improve strength, which results from better formation.

C. Machine speed-up (improved drainage)

1. CONCC -

2. CONPG - Guar gum is used at the wet end of two Fourdrinier machines making bogus medium at the North Side Mill, to improve drainage and flat crush.

3. CHESP - Locust and guar gums are used to achieve speed and strength.

4. DIERK - At present they are testing the effect of locust bean and guar gums in order to improve tensile strength and increase speed. The paper machine operates at about 700 feet per minute on paperboard and 1,000-14,000 on paper.

5. MANNG -

6. MMMCO - Limited amounts of gums are used occasionally to obtain better drainage.

D. Improve retention

1. CONCC -

2. KCSTR - Locust bean (or Lycoid, which seemed to be thought of as a synonym) is used for better retention of titanium dioxide, only.

3. KNOWL - Karaya gum is deacetylated and used for the dispersion and retention of pigments, especially titanium dioxide. They mix the pigment and gum together.

4. NWPCO - Gums are not used at the present time and probably will not be in the future. Some years ago they used gums in a number of products but found that they decreased retention of titanium dioxide and their use was discontinued. One specific use mentioned was the use of guar and/or locust gum to replace pearl starch for use in kraft envelope stock; the starch was employed at a level of 3-5%.

E. Better tensile/tear balance

1. CONCC -

F. Miscellaneous comments

1. FIBPP - Gums, particularly guar, have been used in the past, but results have not been too satisfactory and at the moment they are not being employed.

2. FOXRV - No gums are being used now but some Karaya may enter into one grade in the future. They have experimented in a limited way with others, but the results did not justify commercial use.

3. GULFS - Gums are not used at Tuscaloosa since their Corn Products jet cooker will not operate properly with them. They also were said not to have worked well at Demopolis.

4. MICAR - Small amounts of gums are used for ply bonding. Not much can be done with gums on cylinder machines; strong fiber must be used. Some cationic starch is used along with or in place of gums. Acrawax and Separan are also employed.

5. MOHWK - Gums are used for a highly special reason, and since only one other mill makes the product they could not discuss it further.

6. NEKED - Gums have been tried on several occasions but have never produced the beneficial results obtained by other companies.

7. NICPC - Guar and Lycoid gums are used as beater additives. No starch is used in the wet end, only in the size press, and Kelgin is used alternatively or in combination with starch. This starch is the pearl corn variety, none of it oxidized or acid- or enzyme- converted.

8. SIMTM - No natural gums are employed, but synthetic cellulose esters, carboxymethyl cellulose and hydroxyethyl cellulose are included in coatings as thickening agents.

9. TENNR - Mannogal and Dycol were observed in the plant, apparently for use in the beaters.

10. WOODC - Gums serve as thickening agents.

LATEX

Comments are included on latex applications as binders, coatings and saturants.

1. ALBEM - Urea/formaldehyde resin is used at pH 5 to "set" a nitrile latex.

2. BRGST - Only styrene/butadiene (SB) is used. Polyvinyl acetate causes troubles in the deinking plant. Polyvinyl acetate has not been impressive in trial runs.

3. CNTNR - Still uses acrylic binders, but believes consumption generally is declining due to high cost, plus some unfavorable experiences with odor. Their latex purchases are entirely from Dow.

4. CONSP - Polyvinylidene chloride now costs $0.41/pound on a delivered solids basis. About six companies are now selling it, or are about to do so, including Dewey and Almy, Morton, and National Starch; Staley is ready.

5. DOWCC - Contacts would not comment on the size of the latex market for paper, except that the Chem. Eng. News estimate of 96 million pounds was probably too high, and a 30-million pound estimate would be too low. (Another source quoted a Dow representative as estimating their share of the latex market to be 80%).

6. GRACE - Kimberly-Clark is the largest saturator. All makers of paper-based pressure sensitive tape now engage in saturating to meet at least part of their requirements for the paper base. Second to K-C is MMMCO, and in third place is Johnson and Johnson's Permacel Division. Others are Sherford Mills at Hickory, N.C.; Technical Tape Corporation; Fibre Leather Co. at Fall River, Mass; Weblon; Premoid; and Armstrong Cork Company. The contact said that we would get no information from Armstrong.

7. GRBAY - Their Diversified Products department made semiproduction runs in 1964 using styrene/butadiene (SB) and polyvinylidene chloride latexes, about 5000 pounds of each. Custom coating will be done in 1965, which might raise latex consumption four-fold. Apparently SB latex is applied as a base coat, with a finish coat of PVDC.

8. LAFIB - A good average latex application rate would be 0.3 pound of solids per pound of saturated paper product. Their mill is rated at 15 tons/day in Lockwood's Directory. They consider a week to be six days, and have averaged about five days per week in production; this is probably typical among saturators.

9. MANNG - Acrylic latex usage may grow considerably within five years. Rohm and Hass Company has developed excellent copolymers. One, probably P-339, is excellent for use with asbestos. Another, P-205, increases edge tear strength four-fold, at a 25% level. The latexes can be blended to obtain intermediate properties.

10. MOSNE - For saturating papers, each user (MMMCO and others) requires different properties. Brown Company makes creped paper for saturating, but is not believed to impregnate it.

11. NICPC - No latexes are used on-machine, but off-machine coating uses polyvinylidene chloride, a small amount of styrene/butadiene and some polyvinyl acetate. Multiple coats are required with PVDC, the priming apparently being done with other latexes. Their PVDC-coated papers are used for packaging which has short shelf life (e.g., potato chips), so color changes are not troublesome.

12. NVFCO - Acrylics and polyvinyl chloride are used in their laminates, but not in the manufacture of paper.

13. OMCCO - Estimates of 2 million pound per year consumption for polyvinylidene chloride (PVDC) latex are probably low. Besides barrier coating, the only other use for PVDC is in flameproofing, an application being fostered by National Starch Company.

14. PMOID - For estimating latex consumed in saturated products, multiply production data by 0.3 to obtain the quantity of dry latex solids. Some products contain as little as 10% latex, others as much as 50%. Styrene/butadiene rubber (SBR) latex is believed to be consumed in largest amount for all uses except automotive, followed by nitrile, neoprene and acrylic in that order. Acrylics are relatively new.

15. RIEGC - Use Dow 636 and Rhoplex B-15.

NEW CHEMICALS REPORTS

The Research Bulletin of The Institute of Paper Chemistry frequently includes mention of whatever new chemicals may have been brought to the attention of the Editorial Department as being of potential value to Institute member companies. Although this is not confidential information it has been disseminated in a Confidential bulletin as a matter of convenience, and because there did not appear to be enough material available to justify a separate publication. Because of the confidential aspect, very few suppliers of chemicals are aware of this service to members. A few have heard of it, and have expressed interest in having their own new products included among these notes, and also in knowing whether some sort of subscription service might be feasible.

During about 20 interviews, inquiries were made concerning these New Materials Notes. (In most interviews it did not seem to be advisable to extend the time to include this subject.) The comments of 16 interviewees are contained in the following sections. Of these, 8 expressed definite interest in the present service, 8 suggested improvements, and only one had little or no interest in new materials. Three respondents made strong pleas for the Institute to offer critical opinions of the new items, and even to provide results of IPC laboratory evaluations; however, three questioned whether such programs would be successful.

A. New Materials Notes are useful

1. BOWAT - Dr. Joseph N. Swartz, Technical Director, always reads the New Materials section of the Research Bulletin, and to him it is one of the most interesting parts.

2. CROWN - Dr. J. S. Barton, Director of Research, reads the New Materials Notes regularly.

3. DIERK - The Notes are helpful.

4. KVPSP - Mr. G. G. Rumberger reads this section of the Research Bulletin, but the notes have limited value for him because the chemicals have generally been known to him for a long time before they appear in the bulletin.

5. MOSNE - Mr. H. C. Crandall, Vice President, Research says that his group makes use of the new products information.

6. SIMLE - Dr. Claus Globig, Manager of the Central Research and Development Laboratory says the notes on new materials are very helpful to him.

7. WALDF - Mr. W. O. Kroeschell, Technical Director thinks that the new chemicals section of the Research Bulletin is of considerable value.

8. WARDP - Mr. Ralph C. Kingel, Technical Director says that his men make use of the new products information.

B. Suggested changes

1. CNTNR - More details are desirable, including some indication when the Institute might be aware of the fact that the so-called new product was essentially equivalent to an old one, or merely a minor modification such as in solids content, etc. They said that their research department would not be interested in examining a product whose major claim was that it was equivalent to another but 2 cents cheaper per pound; on the other hand the mills would definitely be interested in a 2 cent differential.

2. DIERK - It would be helpful if the bulletin could include somewhat more information on individual chemicals than is now routinely supplied.

3. HERCL - In disseminating information about chemicals it is very important to include anything that the company may have available on the status of Food and Drug Administration approval.

4. KCLRK - Dr. Jack E. Jayne does not make very much use of the New Materials Notes. He thought that this could be a useful service if a serious effort were made to obtain information very promptly from the chemical suppliers, and if it could be reported perhaps monthly. This is one of his responsibilities within his own company.

5. KCSTR - Mr. Walter Sherman, Mill Manager, says that they have not been paying much attention to the New Materials Notes, but would if the information were more novel. It would be better to issue the information as a news letter, since the reading of reports is often deferred unless the subject is of direct and immediate concern.

6. KVPSP - The reporting to the membership of new developments in papermaking chemicals would be a valuable contribution if the information could be made available at an early stage in the supplier's development program.

7. STREG - Mr. John Cramsie of the Technical Services Department, who is involved with raw materials evaluation, described his own information program. He issues a news letter periodically to all divisions of St. Regis. His items are very brief, and he tries very hard to keep the letter to one page, but occasionally he attaches supplementary documents where they may be important to the recipients (e.g. announcements from the Federal Register dealing with Food and Drug Administration matters). The letter is mailed at intervals of two days to one to two months, depending on the rate at which material accumulates. He not only reports information received from suppliers, but also summarizes the results of tests made in St. Regis plants and laboratories. The latter

feature is probably one of the most valuable aspects of the letter, and the whole program has excellent acceptance. The letters end with the reminder: "When materials fail to perform, it points up product limitations that many suppliers try to conceal, and these are exactly what other mills need to know."

8. WALDF - The New Materials Notes occasionally includes information on chemical intermediates, and he thought that these were of questionable value to papermakers.

C. Comments on evaluations by IPC or others

1. BOWAT - They would very much like to have new materials evaluated by the Institute, to tell the members whether they are really worth laboratory or mill trials or not. Information as to whether these products are truly new would be of great value. Since the Institute features reports on the relative toxicity of slimicides, they thought it might be possible to do a similar screening program on other chemicals. Need for information of this kind was mentioned several times during the interview.

2. CONCC - The research and development would be very much interested in having IPC evaluate new chemical products. They do not find mill tests to be the entire answer, since the runs cannot be controlled adequately. If mill operations are thoroughly understood by laboratory personnel, test data can be correlated with the mill. The writer pointed out the problem of evaluating new products adequately, considering the many different applications that will be made of a given product. The respondents still felt that it would be extremely helpful to them for IPC to follow suppliers' directions exactly in checking out their claims, which apparently are often not born out.

3. STREG - Mr. Cramsie circulates within the company the findings of various St. Regis mills that have made trials with new chemical products. He thinks that some mechanism is badly needed for such feed back of information within the entire industry, but doubts that the mills would be willing to co-operate in providing the needed information even to the Institute.

4. WALDF - The Boxboard Research and Development Association at one time considered the screening of chemicals to eliminate multi-company testing of the same chemicals. They even approached Western Michigan University to see what might be done. However they could not decide what criteria should be evaluated, since different companies had different interests; The Institute of Paper Chemistry would probably encounter the same sort of difficulty.

5. WVAPP - Dr. W. C. Walker felt that the screening of new chemicals might lead to difficulties. The National Printing Ink Research Institute attempted a program of this kind and was said to have created as many problems as they solved by testing components in ink formulations. The main difficulty may have been the selection of meaningful test conditions.

6. APLTN - The IPC might do more evaluating work.

D. New Materials Notes are of little value

1. CRANE - In general Mr. L. B. Tucker, Technical Director, feels that the Institute obtains information too early in the development stage to be of much interest to his company, which prefers not to spend time on new products until they have been proved out by other mills.

PIGMENTS: CLAY

Despite its widespread usage, few contacts had any comments to make about clay; these statements are reproduced below.

1. ALBEM - Some clay is used in their small (about 25 ton/day) Hollywood Mill at Richmond, Va. Only about half of it is retained, but the city has not yet complained.

2. BADGR - Use about 0.5 million pounds/month, about 80% of it filler grade.

3. BRGST - In 1964, about 213 tons of coating grade was purchased from Minerals and Chemicals Philipp Corp., and 330 tons of hydrofined coating clay from J. M. Huber Corp. More than 7500 tons of filler grade was also consumed.

4. CONPG - Small amounts of filler clay are used. Optical brightener suppliers claim them to be more effective with clay than with titanium dioxide. Some clay goes into adhesives formulated in mills from starch, polyvinyl alcohol and large proportions of clay; although coating grades are preferred because of their viscosity behavior, filler grades are being evaluated in these adhesives.

5. EASTX - Clay is used extensively.

6. FIBPP - Modest amounts of clay are used.

7. GULFS - Used in opacified drugstore wrap.

8. HOLVO - Pigments are mainly clay, fuller's earth, and red oxide for wallet grades.

9. KCSTR - Clay consumption is not at as high a rate as in some mills.

10. MOHWK - Much clay and TiO_2 are used, also HiSil calcium silicate.

11. MOSNE - Some clay and TiO_2 are used.

12. PKGCA - Clay is used only in coatings.

13. WALDF - About one-third of Waldorf's cylinder boxboard is coated, probably with about 100 pounds of clay per ton or 3 pounds per thousand square feet. About one-eighth of fourdrinier board is coated, with about 3.5 pounds of clay per thousand square feet, or perhaps 150 pounds per ton, since fourdrinier grades are lighter in weight and also use size press applications. Solid bleached kraft uses a size press plus two coats, making a total of 6-7 pounds per thousand or about 200 lbs./ton.

14. WARDP - Clay is the only pigment used, and retention aids are thought to be economical.

15. WARNC - Because of their long experience with the use of clay, they have few retention problems, as compared with the TiO_2 and $CaCO_3$ situation.

PIGMENTS: CALCIUM CARBONATE

Although pigments were discussed with a high percentage of contacts, few made any comments about calcium carbonate usage.

1. BRGST - Consumption in coatings was about 40 tons in 1964.

2. CONSP - Very large amounts go into coatings, none as filler. Little titanium dioxide is used as filler. There is a trend toward reduction in consumption of calcium carbonate, and toward its replacement with high brightness clays or perhaps aluminum pigments.

3. FOXRV - Usage is at the rate of 10-15 lbs./ton. Water-washed grades are now replacing precipitated; hence retention aids would not be economical.

4. HAMRM - Although they reported definite interest in non-acid sizing for higher quality bonds and permanent book grades, very little calcium carbonate was said to be used.

5. STREG - Usage is small, since few alkaline process applications exist.

6. WARNC - Have trouble retaining clay and $CaCO_3$.

PIGMENTS: TITANIUM DIOXIDE

Most comments on pigments dealt with titanium dioxide, particularly with respect to retention. Eight companies indicated that relatively little difficulty was encountered; six reported trouble in varying degrees. Very few companies have observed changes in efficiency of TiO_2 due to contact with starch. Those that had made this observation ascribed the trouble to dirt adsorption, inadequate dispersion of pigment, or pigment losses due to over-dispersion of fines and pigments; the role of chlorinated starches in the latter instance was cited by many respondents.

A. Companies with little retention problem.

1. BRGST - Consumption in 1964 was over 750 tons, and a large amount of study goes into the effect of machine variables and retention aids. The rate of loss is low, and saveall filtrates are a sensitive test point.

2. CONSP - Little TiO_2 is used as filler except at the Stevens Point Mill, and retention aids are probably not used.

3. FIBPP - TiO_2 is used rather rarely as a pigment, and apparently for filling rather than coating.

4. HOLVO - The TiO_2 level and total consumption is not high enough to warrant retention aids.

5. MOSNE - Some TiO_2 filler is used.

6. PKGCA - TiO_2 is employed as a wash coat at the size press.

7. POTLF - TiO_2 is applied only to the surface and retention problems are not serious now. They may become important in five years, since construction of a dam will decrease water availability.

8. WALDF - Carloads of TiO_2 are used as a filler in board, serving as a brightener and opacifier, perhaps mainly to cover dark filler stock (this terminology was said to be unusual). Losses are not serious with board; if they were, more TiO_2 would be used, not retention aids.

B. Comments on retention problems

1. BLAND - The retention problem is so serious that they have little interest in TiO_2. Occasional usage of rutile is made in coatings, only, especially in 32-pound grades, perhaps in 35- or 40-pound also. A major objection is the color of mill effluents.

2. CRANE - Crane uses TiO_2; Byron Weston, TiO_2 and clay. Retention is a problem, mainly because of the appearance of the river.

3. DINAT - Wet end retention is poor and much more TiO_2 goes into coating than filling.

4. EASTX - TiO_2 and clay are used extensively, but no $CaCO_3$. Retention of TiO_2 is a serious cost problem. Three air-knife and one trailing blade coaters are used on-machine; one off-machine coater is in use.

5. FOXRV - Retention is fair. Predispersion of TiO_2 helps greatly with rosin/alum sizing, but reagglomeration occurs with Cato/Aquapel.

6. MMMCO - TiO_2 retention is a problem; and although it is difficult to judge the degree of seriousness, improved retention is desired.

C. Optical efficiency and broke recovery.

1. CRANE - Starches may produce over-flocculation of TiO_2, resulting in decrease of opacity.

2. FITCH - Chlorinated starch definitely decreases pigment retention, but no effect has been noted of starch on optical efficiency.

3. FOXRV - Broke recirculation definitely reduces opacity and additional TiO_2 is added routinely to compensate for this effect. The cause is not known, but it is not the accumulation of dirt.

4. KCSTR - With TiO_2, they try not to get oxidized starch into the white water, and do not bleach broke. However, optical efficiency changes have not been noted.

5. MOHWK - In 1963, TiO_2 efficiency of use was poor. They are now doing much better, but would not elaborate, although elimination of dirt may have been hinted at.

6. PKGCA - No retention problems exist due to broke recovery, but chlorinated starch definitely causes loss of fines and pigments.

7. STREG - TiO_2 is not as effective when recirculated, but the respondent believed this was due to inadequate dispersion. A Rohm and Haas brochure on a recent retention aid documents dispersion effects, and could pertain to broke. The calculations in the brochure appear to be in error, but the technique used is good.

8. THILM - Starches act as dispersants, leading to poorer retention of TiO_2.

9. WARNC - Recirculation of broke containing TiO_2 results in a decrease in opacity, which is probably due to adsorption and absorption of dirt from various sources. During the fall they observe a decrease in brightness in materials that are filtered out of effluent streams. This drop is believed to be due to coloring matter extracted by the water from fallen leaves. Calcining restores both opacity and brightness.

PIGMENTS: MISCELLANEOUS

1. BLAND - A trial run on Carbide's High-Purity Asbestos from California showed phenomenal retention. By nature or processing, this product is electropositive. It was used to the extent of 2.5% of the furnish, and on a sheet containing 13% ash, tray water solids were down by one-third. The present price of $125/ton is expected to drop to $100, delivered to the Midwest.

2. BOWAT - Desire to improve opacity, so coating and sheet weights can be lowered. One approach being tried is modification of pigment crystal structure to give increased bulk, which generally improves opacity. They have tested synthetic fillers, asbestos, clay, zeolites, etc., to improve strike-through in newsprint, a problem with the larger, more transparent fibers of Southern trees; also high speed operation is essential, and retention is poor. Huber's Zeolex at a 3% level made considerable improvement. The pigment must be low in cost.

3. CRANE - DuPont's PKT (Pigmentary Potassium Titanate) has been tested, but an opinion of it had not yet been formulated. This material is more expensive than TiO_2, but it definitely has a somewhat longer ("fibrous") microscopic crystalline form, and better retentive properties are claimed for it. The PKT is supposed to resist over-flocculation by retention aids.

4. FITCH - No converting is done except off-machine coating with baryta. The binder is not starch, and its nature was not disclosed. Only two other companies use baryta for coatings: Eastman Kodak and Lee-Schoeller.

PITCH AND DEPOSIT CONTROL

(see also Foam Control)

"Pitch" problems are widespread and frequently appear to result from specific equipment and/or operating conditions. Many additives are employed, and although a few types were mentioned specifically by several respondents, no one of them was reported to be outstanding in its behavior. Because of the diversity of the comments, no attempt has been made to classify them.

1. BADGR - Pitch is not a severe problem and some polyphosphates and talc are used. Costs per ton of paper are very low compared to the industry average.

2. BLAND - They conduct a continuous pitch prevention program. Polyphosphates, Nalco 818 are added to the groundwood white water, to screen stock, and in the chemi-mechanical pulpmill; this mill uses poplar. Unless such treatment is regularly employed the couch rolls get gummy. They figure the cost per ton at about 10 to 15 cents.

3. BOWAT - Some pitch problems occur, which are handled mainly with alum and alkali; talc is used in the case of some specialties. It is suspected that foam control chemicals sometimes do cause pitch troubles, but it is not a certainty.

4. CONCC - They have no pitch problems at the present time.

5. CONSP - Coconut derivatives, Hodag RA-2, SD-4 and kerosene are used to control the problem at the presses. Almost everything has been tried, and little advantage has been noted among the products. The Wisconsin River Division uses some alum and Mistron Vapor.

6. DIERK - Pitch troubles have been terrific at times. The general superintendent thinks that the filtrate from the washers churns around in the tanks and picks up soap which is then pumped onto the pulp in the washing plant, and when it reaches the machine, alum precipitates a material which sticks on the wire. Others believe that the use of outer chips from trees is responsible since they contain more pitchy substance. Defoaming agents used in the washroom and after the screens may have a tendency to form a pitchy soap. Pitch tests may show a level of 5 pounds per ton one day with no evidence of pitch trouble; the next day difficulty may occur when tests indicate only 3 pounds of pitch per ton. Therefore the difference in behavior must be due to differences in the nature of the pitch itself, or in some operating variable such as the amount of alum. No chemicals are used to control pitch and the best solution is to keep it out of the system. When trouble occurs they clean the wires with xylene.

7. EASTX - They have no pitch problems at present, but some were encountered previously with hardwood pulps, which they cured by the use of dispersants, Vanderbilt Vanzah.

8. FIBPP - Use of pitch control chemicals has been small, mainly talc, and application was primarily in a sulfite mill in Washington, which produced 50 tons per day.

9. FOXRV - Virtually no pitch problems. In one case a northeastern softwood pulp caused difficulty, whereas the same tree from the northwest was satisfactory. The name of the species was not available, and they are uncertain whether the tree or the pulping was at fault.

10. GLATF - They have very little trouble with pitch, and say that kraft pulp is less of a problem than sulfite. However the salesmen are trying to get them to think that they have pitch trouble. At one time the use of kerosene as a defoamer in the pulpmill provoked a good deal of pitch formation.

11. GULFS - The respondent at Tuscaloosa has never seen "pitch" problems in the alkaline pulping industry. Although wires fill up with an alum-based material, it is deposited uniformly, not in "blobs". The Demopolis respondent said that no pitch additives were employed at that mill either.

12. HAMRM - Dispersants, phosphates, and perhaps sulfonates are used. Talc and clay have not been too satisfactory.

13. KCSTR - Their peroxide-bleached pulp storage system seems to lead to self-sizing and pitch problems; Mistron and diatomaceous earth are used, but no cure is consistently effective.

14. LIRAP - Polyphosphates are now used instead of diatomaceous earth.

15. MMMCO - Pitch problems are pretty severe in their carbonless carbon paper, and the use of nickel rather than aluminum salts in sizing may be responsible for some aggravated conditions. Dispersants are employed to combat the trouble.

16. NICPC - Bentonite is used only for pitch control. Although they buy all their pulp, they have some troubles, both seasonal and on specific orders which require a specially severe beating. The "pitch season" begins when the ice goes out of the river and runs into June. Other additives are Gycotan and Keratene, and many more have been evaluated.

17. NWPCO - Pitch problems are encountered occasionally and treatments are applied routinely. All available materials have been tested. A product of U.S. Movidyn (Chicago) has been used with good results for two years; The designation is BF-7, which may be colloidal alumina like Baymal.

18. OILGC - There is not much pitch trouble with neutral sulfite or kraft pulp.

19. POTLF - No pitch problems occur when their pulp is made into paper in Lewiston, but some customers have had trouble with the same pulps. Therefore Potlatch has added small amounts of talc, perhaps 5 pounds per ton, to pulp sold to these customers.

20. PUBPC - Pitch troubles do not occur with their newsprint, but they use anhydrous magnesium silicate (Mistron Vapor) on one machine which produces light weight sheets. Formerly they had a good deal of down-time to remove black tacky deposits from the wire with xylene. They have now cut the down-time to 1/10 of the former level at a cost of 80 cents per ton.

21. SONCO - Dispersants are needed for pitch control, and also for asphalt and other materials encountered in waste paper and laminates. The "IPC Cold Process" was said to be too costly.

22. STREG - The respondent believes that "pitch" is a misnomer with kraft pulps and for deposits formed on paper machines. Unbleached kraft contains fatty acids, whose sodium salts foam, and corrective silicones lead to silicate deposits. Hard water precipitates calcium salts of these acids, and additives often aggravate the problem and usually divert attention from the proper course, which is prevention. The use of chelating agents and higher temperatures in the wash water would do a lot of good. However sulfite mills actually have a problem, and some chemicals are quite good. Among those mentioned were talc, DuPont's Baymal, and products of U.S. Movidyn. Around paper machines, "pitch" is mainly caused by poor sizing techniques, or the use of too much defoamer. There are no company-wide answers for foam, each system being different. Mechanical improvements would often help, but the expense may be difficult to justify.

23. THILM - Pitch control additives are satisfactory to a degree, but are not perfect. Pitch is often an internal problem and it is better to correct the difficulty at the source.

24. WALDF - Pitch problems come and go. At present they are trying the addition of detergents to the semi-chemical digesters at a rate of 2 pounds per ton. The Missoula Mill is also evaluating detergents, whereas previously Nalco 918 or 818 or dispersants had been employed; talc did not work at Missoula.

25. WSTKC - "Pitch balls" are used for pitch control at the rate of about 8 per hour, but the respondent did not know the nature of this additive. They believe that a small additional cost for routine pitch control is economically justified. No information was

available on the production of pitch from the use of foam control chemicals. However it is thought that the carry-over of calcium carbonate from the cooking liquors acts as a nucleus for the accumulation of pitch; this appears to be a somewhat seasonal occurrence.

26. WESTN - Pitch problems have occurred at times, but not at present. They use fuel oil to control foam and have not observed intensification of pitch. Perhaps because of higher digester temperatures, their pulp contains some sodium oxalate, which exchanges with calcium ions to form a troublesome scale. They have tried to precipitate calcium oxalate ahead of the trouble spots (the washers) but more problems arose than were cured. Chelating agents will not prevent the precipitation of calcium oxalate. Ammonia might dissolve it, but the fumes are difficult to deal with in the mill. So far they have had to learn how to live with the problem.

27. WEYER - Mistron is used to disperse pitch, but temperature changes can redeposit the material. These inhibitors may work satisfactorily in one mill but not in others.

POLYACRYLAMIDES

A relatively large proportion of mills have at least evaluated polyacrylamides. Their primary use is to improve retention and strength properties, though formation and drainage improvement were also mentioned.

A. Comments on retention improvement.

1. CRANE - Separan and other retention aids have been tried repeatedly, but the effects are erratic.

2. HAMRM - Separan is an effective retention aid and is easier to handle than cationic starch.

3. HOLVO - Trials only have been made to improve retention.

4. MANDO - In 1964, 24,000 pounds of Separan was used as a retention aid, and in the savealls.

5. MMMCO - Polyacrylamides have been tried as retention aids, but none are used commercially.

6. MOSNE - Separan and other retention aids are consumed.

7. NWPCO - Nalco 633 and Separan are used as retention aids at Brainerd.

8. STREG - The primary application is to improve retention.

9. WARDP - Polyacrylamides are being tested as retention aids. They are the only type that are effective with oxidized starch in the system. Starch-glue-borax is used also as a wet end additive and gives some cost savings with polyacrylamides.

10. WOODC - Separan was said to be a successful retention aid.

B. Strength improvement

1. CONCC - Polyacrylamides have been used to improve strength.

2. FIBPP - Accostrength is used to improve mullen and ply bonding in multi-cylinder machine operations.

3. GULFS - Polyacrylamides have been tried for strength improvement but are not in steady use. They depress tear strength although salesmen say otherwise. At Demopolis they are not used on the machine, but are used in the water treatment plant for coagulating.

4. KNOWL - Small amounts of Accostrength are used to improve strength and stiffness.

5. MICAR - Separan is employed for ply bonding. Gums, cationic starch, and Acrawax are also used.

6. PKGCA - Filer City is replacing cationic starch with polyacrylamides, which are far better for strength improvement.

7. STREG - Some polyacrylamide resin is used to improve strength in food board.

8. WALDF - Polyacrylamides are used occasionally, mainly for ply bonding and speed up, for their higher test grades of boxboard. The main product of this nature would be kraft filled cylinder sheets for can banding stock for beer cartons.

C. Drainage improvement

1. CONCC - Polyacrylamides have been used to improve drainage.

2. WALDF - Polyacrylamides are used occasionally for machine speed up (see also Strength Improvement).

D. Formation improvement

1. ALBEM - Polyacrylamides have been tested as formation aids, but the cost is high. They vary as flocculating and deflocculating agents depending upon the concentration.

2. MMMCO - Polyacrylamides have been tried as formation aids, but none are used commercially.

E. Miscellaneous comments

1. GULFS - At Demopolis, polyacrylamides are used in the water treatment plant for coagulating.

2. KNOWL - Small amounts of Accostrength are used to improve strength and stiffness.

3. MOSNE - Accostrength is used, not for its customary purpose, but as a chemical component in the treatment of paper to upgrade thermal properties.

4. POTLF - Accostrength resins have been used in the past, but not now.

PROTEINACEOUS MATERIALS

(see also Retention Aids)

1. BRGST - Consumption of delta protein has ranged from 10,000 pounds in 1963 to 70,000 in 1964 and an estimated 80,000 in 1965. They were able to operate on a 1.5 year guaranteed supply contract during the shortage induced by the high price of casein. For a time, delivery required three weeks, but an increase in protein production has reduced this time to two days. Penick and Ford introduced Pensets to compete with casein, but they apparently have not been as successful as anticipated.

2. CHAMP - Their consumption of casein has never been disclosed, since it is large enough to influence the market price. Borden is the other major casein purchaser, and resales to the paper industry are heavy. S. D. Warren is another major consumer. Casein is seldom bought on long term contracts. The scarcity is likely to continue, due to greater consumption of milk in food products as the standard of living rises in producing countries; also Japan has begun to import substantial quantities during the past few years, thereby increasing consumption. Finding a casein substitute is a major problem: soy protein is successful in some products, polyvinyl alcohol in others, but neither is a universal substitute. Soy protein production is not likely to be greatly increased, because producers fear future competition from synthetics, and large present consumers like Champion have been unwilling to underwrite the expansion. The IPC survey on casein and protein is a timely one.

3. GRBAY - About 100 tons per year of animal glue solids is used in coating and converting (tube and can body manufacture).

4. HAMRM - The consumption of casein did not diminish appreciably until 1965, when long-term contracts began to expire.

5. WALDF - Two years ago the ratio of synthetic to natural pigment binder was about 33:67, but today it is more like 90:10. Only two companies manufacture soy protein, and paper coaters who definitely require casein in their formulations are in difficulty because of its high price. Waldorf cannot distinguish between casein and protein in their applications. The Boxboard Research and Development Association strongly considered a technical project to determine how the substitution could be made, but it was dropped for lack of interest. Natural binders will find it increasingly difficult to compete against synthetic latexes, now priced, per dry pound, at 32 cents for acrylics, 31 cents for polyvinyl acetate, and 26 cents for styrene/butadiene.

6. RIEGC - Ralston Purina is increasing plant capacity.

PULPING

1. BLAND - Consumes about 1750 pounds per day of sodium sulfite, together with sodium hydroxide at pH 11, in chemi-mechanical pulping.

2. BOWAT - Ozark-Mahoning offers natural salt cake in greatly improved quality, guaranteed minimum Na_2SO_4 being 99% instead of the 97-98% formerly available. It is free flowing, and capable of being air-blown (the Mannheim type was particularly difficult to handle.) There is probably no synthetic (as contrasted to by-product) salt cake made today. Some natural salt cake from Saskatchewan is sold in Georgia, so it will probably be able to compete in North Central States. Several comments on freight rates were also given. New pulp mills may operate at a consumption level of 80-90 pounds of salt cake per ton of pulp, but as they begin to operate above capacity, losses increase. The average rate at the Calhoun mill is 171 pounds/ton, but at Catawba about 90. Cross-recovery systems complicate the picture.

3. CONCC - Average salt cake figures within a company may disguise considerable differences among mills. One of their semi-chemical linerboard mills with cross-recovery consumes 60 pounds per ton of bone-dry pulp (56 pounds per ton of air-dry); another mill consumes 90 pounds per ton of board as made (x 0.96 = about 87 pounds on an air-dry basis); the Hodge, Louisiana mill with cross-recovery consumes 100 pounds per ton of purchased cake; and a bleached pulp mill, 110 pounds, air-dry.

4. PUBPC - Production of groundwood and sulfite pulp was 180 tons per day in 1946 and is now 550. They are converting their process from a calcium to a magnesium base, which will solve a $750-per-day barging cost from May to October. They were the first company to use Bauer chip refiners for groundwood. Tear values of 64 are obtained with sawdust or shavings. Sawdust costs them $12 per ton, and groundwood pulp can be produced for about $28 per ton, which is the price of logs. Spaulding Pulp and Paper Company was purchased in April; it will convert to the Magnefite process using full recovery.

5. SCOTT - Some of the nitrogen in spent cooking liquor (ammonia-base?) has been found to be available to plants as a nutrient. However recovery is expensive because of the large proportion of water. Much more study is needed on the utilization of waste heat for drying; Weyerhaeuser and Crown Zellerbach are working on the problem. The memo contains a number of comments on the relative economics of making or purchasing various chemical raw materials, including bleach.

6. SONCO - They formerly made sodium sulfite, but now use by-product material from nearby urea/formaldehyde manufacturing, especially from Reichhold in Alabama. Mead is interested in the use of neutral ammonium sulfite, and Sonoco is considering ammonia or mixed base pulping, but will burn the liquors, since recovery of chemicals costs $2-3 per ton, which is not economical.

RETENTION AIDS

Considerable evaluation work is underway with retention aids. Although considerable difference of opinion as to their worth prevails, an appreciable number of mills are using them commercially. Retention of titanium dioxide pigment is the most common goal, but some mills use aids also for clay retention. Because of the diversity of opinion and applications, the comments are presented in seven categories.

A. Used for clay retention

1. CHAMP - They are used with clay, but not regularly.

2. HAMRM - Titanium dioxide losses are costly and retention aids are employed, also for clay alone and for clay-TiO_2. Very little calcium carbonate is used.

3. HERCL - It would not be economical to use retention aids for clay and $CaCO_3$ retention if the only interest were the value of the pigment retained. The economic analysis must include the value of maintaining a clean system and of reducing the load on the savealls. They believe it is usually impossible to work well without aids. They may also reduce two-sidedness.

4. STREG - Sveen glue and sometimes polyacrylamides are used as retention aids with clay, for example in making uncoated printing papers containing 18% ash. Calcium carbonate usage is small.

5. WARDP - Retention aids are thought to be economical with clay, the only pigment used.

6. WOODC - Retention aids are desirable for clay.

B. Not used for clay retention

1. BOWAT - The Catawba Mill does clay coating, and clay gets into the white water through broke recovery, but retention aids cannot be justified economically for clay.

2. FITCH -

3. GULFS - Retention aids have never been found to be worthwhile with clay.

4. MICAR - Retention aids are not economical for clay.

5. THILM - No calcium carbonate is employed and they could not justify the use of retention aids with clay.

6. WARNC - They have had long experience with the use of clay and little retention problem exists; however problems exist with TiO_2 and $CaCO_3$.

C. Cationic starch

1. BLAND - Cationics are inadequate retention aids.

2. CONSP - Cationic starch is used for internal bond strength improvement and to control press stickiness; its retentive properties in the savealls is secondary.

3. CRANE - Retention is a problem, mainly because of the appearance of the river. Retention aids, including Separan, have been tried repeatedly, but the effects are erratic. They are now using Vanderbilt's VanzakRA, but its effectiveness is still in doubt.

4. FOXRV - Cationic starch is used to aid in retaining Aquapel, and it also helps with TiO_2. Predispersion of TiO_2 helps greatly with rosin/alum sizing, but re-agglomeration occurs with cationic starch/Aquapel.

5. GLATF - Cationic starch is used for both its bonding and retentive attributes. It is an effective additive, and about the only one that is satisfactory for use with flotation type savealls. However, it is too expensive, and National Starch is attempting to produce a cheaper form. Kymene 557 is being evaluated in the savealls.

6. HAMRM - Their experience with cationic starch has not been very good from an economic standpoint as compared with Separan or Reten, which are easier to disperse.

7. KCSTR - Little cationic starch is used. It does retain pigment better, but seems not to be uniform in behavior, and all the starch that is needed can be applied at the size press.

8. MOHWK - Their primary interest in cationic starch is its pigment retention properties and the fact that the starch itself is better retained. No Separan is used. Retens are used in flotation savealls.

9. NWPCO - Cationic is better than ordinary starch for retention. They used Epic N (Dutch cationic and ethylated potato) for 1.5 years; it had no effect on strength of a printing paper.

10. POTLF - Cationic starch is used to obtain improved bond strength and some improvement in stiffness. A lot of work is being done in the industry on a combination of regular unmodified starch with polyamide wet strength and retention-aid resins, such as Kymene 557 and a Nalco product. These combinations are effective at low cost.

11. STREG - Cationic starches have performed well, but pearl starch plus retention aids is cheaper at the same levels of strength.

12. THILM - Cationic starch is efficient, but they can use ordinary starch to good effect under the right conditions.

13. WARNC - Cationic starch has been used to improve retention, but it may aid formation also.

14. WOODC - Not successful retention aids.

D. Polyacrylamides

1. BADGR - Polyacrylamides are used as retention aids for titanium dioxide in fine papers.

2. CRANE - Separan and others have given erratic results.

3. HAMRM - Separan is effective. It is easier to disperse and more economical than cationic starch.

4. MANDO - Separan was used to the extent of 24,000 pounds as a retention aid, including the savealls.

5. MOSNE - Some Separan and other retention aids are consumed.

6. NWPCO - Nalco 633 and Separan are used as retention aids at Brainerd. Enzyme-converted potato starch on recycle spoiled retention when Separan was used. The respondent thought that this effect was fairly well proved. Sveen glue used at Cloquet had not behaved in this manner.

7. POTLF - Accostrength resins have been used, but not now.

8. STREG - Polyacrylamides are used to some extent, mainly for retention, but some to improve strength in food board.

9. WOODC - Tests on Separan were successful but details were not available.

E. Glue

1. BLAND - On one machine they use Sveen glue as a retention aid for clay; the product is 32- to 35-pound paper manufactured at high speed. The ash content ratio between the paper and the stuff box is 40% without retention aids, but 60-65% when they are used. Animal glue, either bone or hide, is superior to cationic starch.

2. GLATF - Sveen glue has been used as an additive in the savealls. However it is difficult to control, and is introducing some biological problems.

3. MANDO - Sveen glue has been used as a retention aid but consumption figures were not available.

4. STREG - Sveen glue is used as a retention aid with clay, for example in making uncoated printing papers containing 18% ash.

F. Starch

1. POTLF - A lot of work is being done in the industry on a combination of regular unmodified starch with retention aid resins such as Kymene 557. The object is to improve bond strength and stiffness. These combinations are effective at low cost.

2. SIMTM - Retention aids have been tried with ground asphalts. About half the time starch is satisfactory and improves flocculation and drainage. However Nalco derivatives are better than starch.

3. STREG - There is a trend away from guar gum to starch plus retention aids such as Kymene 557 and Nopco types. Pearl starch at 5 cents per pound plus retention aids is cheaper than cationic starches at the same levels of strength.

4. THILM - Ordinary starch can be used to good effect under the right conditions.

G. Miscellaneous

1. BRGST - About 20 retention aids have been investigated in the past two years, with cost reduction as a major goal. Retention aids are employed with all products except those which require an ash level below 5%.

2. CHESP - Retention aids for fines have been tried without too much success.

3. EASTX - Research on the use of retention aids for titanium dioxide is underway but they do not yet know whether success will be achieved.

4. FIBPP - Retention aids for TiO_2 and clay have been evaluated. Retention is not a real problem with heavier weight products such as board. They have also tested retention aids for drainage improvement. The results of all this work were rather negative.

5. KCSTR - Locust bean gum (Lycoid) is used for better retention of titanium dioxide only.

6. POTLF - Kymene 557 is used as a retention aid together with Aquapel in milk cartons.

7. RIEGJ - Retention aids increase two-sidedness in colored papers by causing coagulation on one side without preventing the washing away of pigment on the other. This may be very difficult to cure with chemicals.

8. STRNG - The retention of colored pigments in the wet end is a problem sometimes but retention aids are not yet being used, a little rosin/alum is quite effective.

9. HERCL - Retention aids were claimed to reduce two-sidedness. The comment was subsequently qualified to indicate that a balance may exist, since the agents can cause fibers to floc and open the sheet, but as the retention of fines and pigments increases the sheet becomes more closed.

SIZING: ALKALINE AND NEUTRAL

There is growing interest in alkaline and neutral sizing. Comments have been categorized by end use where this information was made available. Although the major product in use is Aquapel (Hercules), some evaluation work with Cyanosize (American Cyanamid) appears to be under way.

A. General comments.

1. BADGR - A very small amount of alkaline size is used on machine-glazed Yankee papers, where the high heat employed destroys rosin. They also use small amounts in permanent bond sheets, but not regularly, and they are not aware of any problems.

2. BRGST - Alkaline sizing has been tested, but not enough to establish its true utility.

3. CHAMP - Some neutral and alkaline sizing is used.

4. CONCC - Neutral and alkaline sizing usage is increasing. They are applying for a patent on a material they have developed. If it is granted they will license a chemical company to manufacture it. No details could be given.

5. FIBPP - Aquapel was evaluated four to five years ago, but a number of problems arose which made its use impractical. The respondent reported that Champion had an extensive installation for milk carton and cup stock production, but could not depend upon the results; the cups failed with hot coffee. Although Hercules was said to have improved the product, apparently they are no longer trying to sell FIBPP on the use of Aquapel.

6. FITCH - Aquapel is used in some grades.

7. FOXRV - Aquapel is their main sizing agent, and within a few years they may charge a premium for grades which have to be sized with rosin. Aquapel and calcium carbonate at pH 7.1 give excellent results in accelerated aging tests, but neutral pH contributes only about one-third of the improvement; fiber nature and type of treatment have a major role.

8. HOLVO - Small amounts of Aquapel are used.

9. KNOWL - Small amounts of Aquapel are used occasionally if a customer wants a neutral sheet.

10. MANNG - Aquapel is the only synthetic sizing used.

11. MONSN - In 1965 MONSN should have a new agent for wet end sizing, not a rosin derivative, easier to repulp and with better alum tolerance

than Aquapel. Scripset 540 is an excellent sizing agent under slightly alkaline conditions. It is a styrene/maleic anhydride copolymer, a free-flowing powder that dissolves in ammonia, works well with starch, requires no alum or additional sizing agent, and is applied at the size press rather than at the wet end. It gives greatly improved printability and ink holdout. The resin is ordinarily used at a level of 5-10% of the starch. Trials with hydroxyethylated starch and Scripset 540 for electrostatic paper coatings show good toluene holdout. Scripset 500 is unusually resistant to penetration by waxes and oils.

12. MOSNE - Aquapel is not used regularly. They have tried Cyanosize, and will switch to it on one or two products when the necessary equipment arrives.

13. POTLF - Harder sizing can be obtained with Aquapel at lower cost, and thereby prevent edge-wicking in milk carton stock.

14. RIEGJ - Their grade structure, which includes a major proportion of glassine, does not lead to the use of much sizing. Alkaline sizing is used only in a few specialities, mainly in printing papers where it might be desirable to use calcium carbonate and to recover the broke without difficulty.

15. STREG - They have not had much experience with neutral sizing, but expect the use of alkaline sizing to grow, and new developments are coming. They have no interest in Cyanosize or Chemsize as substitutes for Aquapel.

16. STRNG - No alkaline sizing is done as yet, but a little Aquapel is applied at a calender stack for surface sizing.

17. THILM - Few grades require alkaline sizing, so consumption is small.

18. WARNC - They are switching more and more to alkaline sizing with Aquapel.

B. Comments on "Cyanosize" and "Chemsize"

1. CONCC - These materials are in the same price range as Aquapel and are not being used by CONCC. The Monsanto material is not yet available commercially.

2. CONPG - They have some familiarity with Cyanosize, but not with Chemsize.

3. CRANE - Small to medium quantities of Aquapel and Cyanosize are used, more being consumed by the Byron Weston Mill.

4. FITCH - They are interested in Cyanosize, which has a tolerance for alum, but their usage is not yet large enough to make a switch from Aquapel worth while.

5. FOXRV - A Cyanamide size, believed to be number 2437, was tested, but it lost its effectiveness with calcium carbonate.

6. HAMRM - American Cyanamid is believed to be having some trouble with Cyanosize, and it is not being pushed.

7. MOSNE - They will switch to Cyanosize on one or two products when the required equipment arrives. The respondent was not aware of any tendancy for American Cyanamid to be holding back on this product.

8. PKGCA - They use no Aquapel, but are looking at Cyanosize. American Cyanamid will not disclose its composition, and the respondent would like to know it.

9. POTLF - Cyanosize was unsuccessfully tested over a year ago, and the manufacturer has not suggested that they be repeated. He knows nothing about Chemsize.

10. WALDF - Neutral and alkaline sizing agents have been tried only on an experimental basis, and their experience with Cyanosize indicated that it had some alum tolerance, whereas Aquapel does not. The Cyanosize does not look too bad, but there has not been enough economic incentive to continue to use it commercially.

C. Permanent papers

1. ALBEM - Standard Paper Company makes 300-year bond and book papers, apparently using alkaline wet-strength agents and Aquapel.

2. BADGR - Small amounts of alkaline sizing are used in permanent bond sheets, but not regularly; they are not aware of any problems.

3. FOXRV - Aquapel and calcium carbonate at pH 7.1 give excellent results in accelerated aging tests, but neutral pH contributes only about one-third of the improvement; fiber nature and type of treatment have a major role. Within a few years he believes that intermediate rag-content papers will have disappeared and only 100% and 25% rag papers will remain; eventually the 25% content will disappear also, to be replaced by sulfite.

4. HAMRM - They have a definite interest in non-acid sizing for higher quality bonds and permanent book grades, such as those made by Standard Paper Company and the Eastern Fine Paper and Pulp Division of Standard Packaging.

5. NWPCO - Have tested on long-life bond and ledger, and might use commercially if the cost decreases.

6. RIEGJ - The major use of alkaline sizing is in printing papers where it might be desirable to use calcium carbonate without interfering with broke recovery. The respondent regarded the use in so-called "permanent" papers as more of a sales gimmick than anything else.

D. Milk carton stock

1. EASTX - Aquapel is used for one product, milk carton stock.

2 FIBPP - See A. General comments.

3. POTLF - Aquapel is used as an alkaline size for milk carton stock. He did not think that this usage was particularly large, since the only manufacturers known to him to be using Aquapel are Weyerhaeuser and Potlatch, although there may be others, he felt sure that International Paper Company does not do so, and they have 60% of the Purepak business. He was not sure about Champion Paper Company's situation.

4. PUBPC - Aquapel had been used with kraft for several years, for example by mills in Longview and St. Helens, primarily for milk cartons, but PUBPC has been the first to apply it to unbleached sulfite, for meat wraps.

E. Meat wrap

1. GULFS - They probably made the first trials of Aquapel, but are not using it now. The product was a butchers' wrap that would retain fluids until the meat rotted, but it didn't feel like ordinary butchers' paper and did not sell well, as a result the product was dropped from their line.

2. PUBPC - Recent trials of Aquapel with meat wrap have been very satisfactory. Among the benefits are increased drainage rate. They were the first to apply Aquapel to unbleached sulfite, which previously had been difficult or impossible to do because of slickness produced in the product as well as sticking on the press rolls. With Aquapel ink penetration test results have increased to an 8-hour rating from the previous 2-3 hours, and the sizing cost has been cut in half. About nine months ago they began using 5 pounds per ton, and are now producing a more uniform product with less than four pounds at a cost of between 6 and 11 dollars per ton. The use of meat wrap is decreasing since only small butchers are still using it, however PUBPC has a volume of 600 tons per month, and it is a profitable business.

3 STREG - Neutral sizing is successful with butchers' wrap, but it is not an important product for STREG.

F. Surface sizing

1. CONPG - Some Aquapel is used for surface sizing, but the product was unnamed.

2. STRNG - A little Aquapel is applied at a calender stack for surface sizing.

3. WSTKC - Aquapel is used occasionally on heavy weight sheets where they wish to have good repellency on one surface and a slack size on the back in order to get higher speeds on the corrugators. They would be interested in cheaper sizing agents of the Aquapel type.

G. Tire wrap

1. ALBEM - Aquapel is used for these products, where they want alkaline strength, high density, and high tensile strength.

H. Fiber drum stock

1. CHESP - Alkaline sizing agents may be tried, particularly for fiber drum stock.

SIZING: ROSIN

The companies listed below stated that fortified grades of rosin size were employed, with the exceptions noted by the footnote. A few respondents expressed a desire for cheaper fortified grades (footnote). Unless a statement is made to the contrary, fortified rosins were said to give satisfactory results.

1. BADGR -

2. BLAND - They do not use much size, a little rosin, no synthetic. Typically they use a conventional type of fortified rosin, 70% Pexol Paste, which they purchase in tank truck quantities. The main application is for uncoated web offset, a light coating to prevent feathering.

3. BOWAT - Fortified rosins give satisfactory results but are used only in specialities. No alkaline sizing agents are employed. The Institute knows of their unsuccessful efforts to size a sheet of groundwood.

4. BRGST - Rosins are doing a good job, and they find little difference among the various products offered. Suppliers are doing a lot of research.

5. CHAMP -

6. CHESP*- Only a blend of regular rosins is used.

7. CONCC**- Some of their mills used fortified rosin size and find it satisfactory, but would like it to be cheaper. Usage is mainly a matter of economics. When rosin was high priced and they were using 5 pounds per ton of B grade rosin they were able to substitute 2.5 pounds of fortified rosin more cheaply; when the price of rosin dropped they went back to B grade.

8. CONPG - Fortified rosins are generally satisfactory. Some problems exist, but the specifications for automotive board are rigid and hard to meet.

9. CRAND - This mill makes essentially one product: corrugating medium, which requires no sizing. However a little rosin/alum size is used for a special grade, and the rosin is a dark, conventional type.

10. CRANE -

11. DIERK*- Only dark rosin is used. They do not find any economic advantage in the use of fortified rosin for unbleached kraft, although it may be worthwhile to do so with bleached grades.

* Use no fortified grade.

** Cheaper fortified grade desired.

12. DINAT**-

13. EASTX -

14. FIBPP - In general fortified rosins are satisfactory, although in some cases the formation was not too good for free stocks at high speed operation; in these cases dark rosins seem to work better. Dark and light grades are used, both fortified and unfortified.

15. FITCH - Fortified types are generally good and they use thousands of pounds of them. Still they would like to be able to get along with one pound per ton, but are unable to.

16. FOXRV - Because of their switching to Aquapel, within a few years they may charge a premium for grades which have to be sized with rosin. The size they use is Hercules' T-size (protein-stabilized, high free-rosin emulsion, 40% solids).

17. GRBAY*- Only small amounts of rosin are used in special grades of paper, none of it fortified.

18. GULFS**- Fortified rosins are reasonably satisfactory at both mills, but there is a question whether they are the most economical, especially in board for coating. Many uncertainties exist with respect to sizing and the tests used to evaluate it. For example, lactic acid, which is used to speed up the testing of milk carton stock, leads to the use of fortified rosin, but other test materials indicate that fortified rosin is not satisfactory; among the latter are alcohols of different kinds and concentrations, which tend to destroy sizing rapidly. Dampening agents for offset printing use 25% isopropanol.

19. HAMRM**- Fortified rosins represent an improvement, and have resulted in substantial improvements in cost per ton of product. They would like still greater efficiency.

20. HOLVO -

21. KCSTR**- Fortified rosins are used but still greater economy is desired; they use only 4 pounds per ton on some grades, 6 pounds per ton on the average. The respondent thought they may be using too much on mimeo and duplicating grades.

22. KNOWL -

23. LIRAP**- Improved sizes have been used for two years and they are lower in cost; still greater economy is desired.

24. MANDO - In the acid range, fortified rosins are definitely superior. Consumption in 1964 represented about $1 million. Perhaps one-half of the size used is wasted. The fortified grades represent better buys.

* Use no fortified grade.

** Cheaper fortified grade desired.

25. MANNG -

26. MICAR -

27. MMMCO - Fortified rosins are used in carbonless carbon paper for a reason other than the ordinary one, and it could not be exactly answered whether they are completely satisfactory or not.

28. MOHWK - Modified types are highly satisfactory and they use no more than 0.5-0.75 per cent.

29. MONRO - Automotive board is heavily sized, and the fortified grades work fairly well. They are thinking of doing their own emulsification.

30. MONSN - They manufacture gum rosin and tall oil. Their share of the rosin market is 30-35%, and Hercules' is 60%. Monsanto's "Mersize" is their largest selling paper industry product. It is the maleic and fumaric derivative of rosin, and is 20% more efficient; hence less physical volume of sizing is being sold.

31. MOSNE -

32. NIPCC*- A small amount of rosin size is used, none of it fortified. They have been working on the effect of rosin and alum in curing pin holes, mainly by decreasing the amount of size. For most grades 0.5% is added, but they have been going to additions of 0.2% with 50-60% retained.

33. NWPCO**- Present fortified rosins are satisfactory, although they might be cheaper. They use about 9 pounds per ton at $0.15 per pound, dry basis ($ .35 per ton). Sizing is a less of a problem than it formerly was.

34. OILGC - Rosin is probably fortified except for liner board; for the latter, usage is 2-3 pounds per ton. Acid sizing is at pH 5-5.5.

35. PKGCA -

36. POTLF - Fortified rosins are satisfactory; there have been many improvements in sizing during the last five years. However they can obtain harder sizing with Aquapel at lower cost.

37. SIMTM - Fortified rosins are satisfactory, although SIMTM has gone to heat treated fortified types, because their foam index is lower than that of straight fortified rosin. For insulating boards, this represents a slight premium as compared with F grade rosin; however sheet treated types might not be regarded as premium priced in grades used for paper.

* Use no fortified grade.

** Cheaper fortified grade desired.

38. SONCO**- Rosin is the only type of size used, some of it fortified; they wish the latter were cheaper.

39. THILM - Fortified rosin is used but not exclusively. They may switch entirely when they encounter "summer sickness". The research done by the three major suppliers has been quite exhaustive. However customers are still looking for a universal material, which is an impossibility.

40. UNBAG - On an average the industry recovers 75% of the tall oil produced, but UNBAG recovers 85%. The respondent did not expect a drop to occur in the price of rosin because it is not likely that more trees will be tapped in order to obtain more turpentine, which is currently in short supply.

41. UNMIL - Consumption is about 100-200 pounds per year.

42. WALDF - Fortified rosin is satisfactory. They also use some dark rosin, but the two contacts did not agree as to whether it is fortified or not. The fortified rosin type is Cyfor, which is effective. They have found reverse sizing to be very satisfactory and it has reduced rosin consumption 40-50%. No synthetic sizing is used.

43. WARDP -

44. WARNC - Fortified types are satisfactory, but WARNC is going more and more to alkaline sizing with Aquapel. They used to make their own size.

45. WESTN - Fortified rosins and starch are used to some extent for calender sizing at St. Marys. No sizing agents are employed at Terra Haute.

46. WSTKC - Fortified rosins will be satisfactory until something better comes along. Douglas-fir does not have the natural sizing properties that exist in Southern pine.

47. WVAPP**- There is much salesmanship involved in rosin size. It is over priced, based on West Virginia's experience as a small producer.

* Use no fortified grade.

** Cheaper fortified grade desired.

SIZING: MISCELLANEOUS

Carboxymethyl cellulose and polyvinyl alcohol appear to be the most frequently used synthetic sizing agent in addition to those previously discussed.

1. ALBEM - Alum produced an interesting problem in an unsized paper for battery separators, with which they were getting an increase in water repellency. This may have been due to a combination of alum plus sized newspaper broke, or perhaps due to the use of straight kraft, containing no size, but in which some component was reacting with alum to form a repellent sheet.

2. CONSP - Little or no sizing of sheets is done. Mersize has been tried.

3. DINAT - Polyvinyl alcohol as a surface treatment produces ink holdout on uncoated board. Under coatings it seems to increase internal board strength, which eliminates blistering or liner lifting. They may combine polyvinyl alcohol with ethylated starch in a calender stack treatment. The PVA phenomenon is not understood. A polyisobutylene fluid is used instead of ink for pick testing, and uncoated boxboard which has a velocity-viscosity product of, say, 150 before coating, may drop to 75 after coating, with the failure in the sheet. Suppliers differ widely in explaining the effect and proposing remedies. If a coating is properly formulated it will not pick itself, but if the liner should lift, the coating will pop. The respondent did not know whether this effect occurs with Fourdrinier board also. With proper wet end use of starches and proper degree of refining they obtain a strong enough sheet, but sometimes variables seem to interact and trouble results. One of their men noted that true coating pick always went through to the base stock, but often did not when the sheet was put through the tester in the cross-machine direction. He surmises that stress/strain relationships may be responsible and the effect should be investigated. One layer may stretch more than the other, and splitting occurs at some interface. Coated cellophane does not pick when it is glued to another surface, but coated cellophane does pick when it is tested in the free state. All layers must stretch similarly, including the plys of the cylinder board; the behavior with Fourdrinier board is not known. They do not know whether polyvinyl alcohol improves matters because it penetrates well and provides bond strength, or whether it may operate by preventing moisture penetration from subsequent coatings.

4. FIBPP - They use carboxymethyl cellulose or polyvinyl alcohol as sizing agents for patent coated board on the bottom liner, or as a functional barrier. CMC is more effective as a curl-control agent than is starch, and is applied at the calender stack; a variety of viscosities are used. CMC has also been used as a beater additive in the past, but not now.

5. HAMRM - Synthetic surface sizes have been tried experimentally, and some small specialties use polyvinyl alcohol.

6. HOLVO - A small amount of polyvinyl alcohol is used for glass fiber paper.

7. MASON - Masonite board consumes substantial quantities of petrolatum for binding and waterproofing. It is usually 150° to 160° F melting point, and Tex H-40 slack wax was mentioned. It is added in the stock tank, after explosion of the chips, disc refining, and washing out of soluble constituents. For some grades phenolic resins are added at the head box in alkali-soluble form; acid precipitates the resin and it remains in the board. These phenolic resins are made by a Masonite subsidiary designated as Alpine, of Gulfport, Mississippi. Small volumes of special resins, including epoxies, are used for laminating boards after they have been formed, which therefore is an example of a converting operation. Tempering of the board is done with unsaturated and also some saturated oils, often with clay fillers to seal the product prior to painting; Hercules or Velsicol materials are used, probably derived from pine oil.

8. MICAR - Some polyvinyl alcohol is used as calender sizing. Experimentally, carboxymethyl cellulose is being tried for curl control and for gloss ink holdout on board. It forms stronger films than does starch.

9. MMMCO - Synthetic resins are used to improve the properties of starch for external sizing of their carbonless carbon paper. The resin is Scripset, a styrene/maleic anhydride copolymer.

10. MONRO - No polyvinyl alcohol is used in making their automotive board.

11. MONSN - The 500 Series of Scripsets are styrene copolymers. No. 500 is unusually resistant to penetration by waxes and oils. No. 530 is suggested to obtain wax-holdout on board. No. 100 is a methylated methylol melamine polymer which is used in coatings for wet-rub resistance; when added to casein, etc., it acts as a formaldehyde donor and crosslinking agent.

12. OILGC - Some starch is used in calender sizing to provide a smoother printing surface and scuff resistance. No synthetics are used as yet for this purpose. Some polyvinyl alcohol is used as a functional, non-pigmented coating.

13. PKGCA - CMC is used as a surface size on the uncoated side of a few grades, to prevent curl, where starch is not acceptable to the customer. At one time CMC was used extensively for this purpose, but now starch is the common material.

14. POTLF - Polyvinyl alcohol is employed in size presses and calender stacks for surface sizing, both alone and in combination with starch.

15. WALDF - Synthetic sizing agents have been investigated but are not employed. They formerly used carboxymethyl cellulose on jute liner to improve strength.

16. WARNC - Some CMC is used as well as polyvinyl alcohol. PVA consumption may amount to 5,000 pounds per day for all uses.

17. WESTN - CMC may enter into specialties at times.

18. WOODC - Synthetic sizing agents might be of some value in their products.

STARCH

Comments on starches have been subdivided into seven categories. Cationic starches were stated to have been used by 19 companies, the major purpose being to improve strength in some manner. Comments on oxidized starches appear to indicate that a low degree of interest exists; however, reports received thus far from the quantitative survey show that purchases of oxidized and hydroxyethylated starches are comparable and very substantial. Although there were indications that unmodified tapioca and potato starches may be somewhat preferred over cornstarch, price and availability appear to be the main considerations.

A. Cationic starch (see also Retention Aids)

1. BADGR - Used as a wet end additive for strength improvement; only small amounts are consumed.

2. BRGST - Cato 2 (National Starch) is added in the wet end. In 1963 and 1964, consumption averaged about 750,000 pounds per year. In 1965 it has been used at the rate of 900,000 pounds per year.

3. CONPG - They were said to be too complicated although they show some promise. CONPG does not want to use cooked material at the wet end.

4. CONSP - Usage is for internal bond strength improvement and to control press stickiness; retentive properties in the savealls are secondary.

5. CONCC - It is hard to give an evaluation of the effectiveness of cationic starch, since a change in the pH with alum can reduce the effectiveness from the optimum, and also what is effective in one mill is not in another.

6. CRANE - Cationic starch is used more as a strength and sizing aid than for retention; it has no noticeable effect on formation.

7. DINAT - Five trial runs have been made in nine months, not for retention but for ply-bonding. With litho and rotogravure printing the shear forces cause internal splitting. The cationics have evabled them to maintain product performance in a less expensive manner than would otherwise be possible, but they did not improve quality. They could not get good results until they used one supplier's techniques with a second supplier's product.

8. FITCH - Used for interfiber-bonding rather than as a pigment retention aid. Some Epic N (imported) has been used for filler retention and bonding. The respondent described this material as a "gum".

9. GLATF - Cato is used for both bonding and retention. It is effective, and about the only retention aid that is satisfactory in flota-

tion type savealls. However it is too expensive, and National Starch Company is attempting to produce a cheaper form.

10. GULFS - Cationic starch was used at one time to improve mullen and retain tear properties. It was added to the mixing chest ahead of the jordans, but had no advantage pound-for-pound over other cheaper additives, e.g., ethylated starch. Once a supplier introduced a cationic starch so effective that it made light papers stick to the rolls, and it was withdrawn from the market; the name could not be recalled.

11. KCSTR - Little cationic starch is used; it does retain pigment better, but seems not to be uniform in behavior, and they get all the starch that is needed by size press applications.

12. KNOWL - Small amounts are used essentially experimentally, but it definitely improves strength. Since a size press is not available, they must produce improvements at the wet end.

13. MANDO - In 1964, 70,000 pounds of Cato 8 was consumed for bonding purposes; however gums are preferred for obtaining closer formation and higher strength.

14. MICAR - Some cationic starch is used along with or in place of gums.

15. NWPCO - See Retention Aids item C-9.

16. PKGCA - Very little cationic starch is used and it is being replaced with polyacrylamide resin, which is far better for improving strength.

17. POTLF - Cationic starch is used to obtain improved bond strength and some improvement in stiffness.

18. STREG - See Retention Aids item C-11.

19. WALDF - Cationic starch is no longer used; their interest was strength, not retention.

B. Oxidized Starch

1. BADGR - Small amounts of chlorinated starch are kept on hand as a standby material which can be prepared quickly in case the enzyme-converted starch is consumed before a run is completed.

2. CAREY - A major outlet is in asbestos felt for pipeline coverings.

3. CRANE - Oxidized starch in the beater prevents good retention of fillers through a dispersing effect.

4. NEKED - The consumption of oxidized (hypochlorite) starches was said to be decreasing.

5. PKGCA - This contact is interested in knowing trends in the use of chlorinated starch.

6. TILES - A few grades, mainly book papers, require pigmented starch to fill the surface a little. Most of the material applied is removed by the size press rolls, and it probably should not be classed as a coating. A formulation often used is 2-3 pounds of starch per pound of clay. Among the starches used is oxidized or chlorinated, alternatively Staley's Stayco M and National Starch's Flocote.

C. Hydroxyethylated starch

1. BIRDS - Small amounts of starch ethers are used at the calender stack.

2. BRGST - Modified starches are used in emergencies when cooking time is not available. Tests are now being made of Corn Products Company's "Eosize", which was described as "ethylated". Purchases of modified starches are kept to a minimum. Some Penford Gum (hydroxyethylated starch) is used for size press coatings and safety papers. Consumption was about 120,000 pounds in 1963, 192,000 in 1964, and will probably amount to 425,000 pounds in 1965.

3. CHAMP - The respondent said that there is a great deal of interest in starch consumption data because the Penick and Ford patent on ethylated starch expires in 1967. Other companies will then make it, and the price will decline.

4. CRANE - Hydroxyethylated starch was said to be used in the tub with papers containing titanium dioxide. Although oxidized starch in the beater prevents good retention of fillers through a dispersing effect, hydroxyethylated starch does not.

5. GULFS - Hydroxyethylated starch at 9 cents is more advantageous pound-for-pound than cationic at 17 cents. Usage is mainly in bag grades to increase mullen, where they wish to leave the stock unrefined to increase speed and yet retain tear strength. Starches seem to help slightly, although machine operators may put forth greater effort when they have employed an additive that is expected to improve strength. Even though starches reduce tear strength, the net result seems to be an improvement. Starches definitely result in fewer winter complaints about bag brittleness in the Northeastern and North Central states. Starch may exert a humectant effect, resulting in better fold strength; complaints appear to correspond to low folding endurance ratings. Manufacturers can not control the conditions under which bags are stored.

D. Starch in corrugated paperboard.

1. DIERK - Nothing is added to increase crush resistance of corrugated board, but if this improvement were requested, they would probably add starch or gums at the wet end.

2. LNGVF - In corrugating they use 1.7-2.2 pounds of starch per thousand square feet of salable board. Some corrugated board manufacturers use purchased prepared starch as the base to which raw starch is added in the Stein, Hall process.

3. OILGC - The respondent thinks that pearl starch represents 98% of corrugating adhesive; very few companies, mainly smaller ones use silicate, which is claimed to give better compression strength than starch. Tapioca starch and sodium silicate are the only competitors to pearl starch. No one is using enzyme conversion for corrugating; the technology is not suitable for corrugating plant operators. Staley makes a modified (thin-boiling) starch that is said to be a little easier for undependable workers to use, since less exact temperature control is needed than in the regular cooking process. Some companies combine pre-gelatinized starch with unmodified, thus producing a one-bag product which requires only one tank for processing, and gives better control over viscosity, pickup and cost. The goal of corrugating plant operators is to use 2 pounds per thousand square feet of A flute, double-faced (two glue lines); apparently salesmen for one-bag type adhesives practically guarantee that this level can be achieved regularly by the use of their product. Much research is being done on finding replacements for starch adhesives in corrugating. Manufacturers are trying to decrease or avoid the use of water in order to control the capital cost of dryer sections as machine speeds increase (1,000 feet per minute may be achieved commercially in a few years). Hot melts are ideal for fast operation, but are now expensive, present creep problems, and are difficult to process in repulping operations; the latter factor is very important, and starch and so called "cold-set" adhesives can be reworked. The cold-sets differ from hot melts in that they contain solvent or water.

E. Dry milled starch.

1. CONPG - Dry milled starch does not seem to be used for corrugating, but the respondent did not know the reason.

2. CRAND - This mill makes corrugating medium. The respondent thinks that statements indicating that dry milled starches are not satisfactory for corrugating is nonsense.

3. MONRO - This company makes test liner board and corrugated board. The papermill superintendent said they used about one car per month of a "modified wheat starch", which apparently is an intermediate grade of flour called "Dugan Beater Binder". It was said to be manufactured near Cincinnati, Ohio, and is priced at about 1-1.5 cents per pound cheaper than starch. It is used in stock preparation for stiffening and improving bond strength of the paper made for corrugating. It is shipped in cars holding about 600 bags weighing 100 pounds each.

4. OILGC - They have had no visits from dry millers for 10-15 years, with a possible exception of Huron Milling, who were trying out an experimental soy protein. Protein may produce clotting and clogging when used for corrugating. When dry milled products were used on bag machines they caused a "fiber" buildup on moving parts.

5. PKGCA - The respondent had no definite information on the use of dry milled starch for corrugating, but thought that Hercules Powder Company makes a material at Harbor Beach, Michigan, that may be of this nature.

6. STREG - The respondent understands that dry milled starch is coming back for use in certain products, but he has had no experience with its use in corrugating.

F. Comments on starch markets and marketing.

1. AMMAZ - The 1963 Census of Manufactures reports should be starting to appear by the end of October. They will not include a breakdown by type of starch, but paper industry usage will be reported separately. The census may not make regional figures available, even on special order, because there is some question about their accuracy in this census. They said that the Corn Industries Research Foundation reports that 321 million pounds of starch is used for paper converting, but this does not include sales by a nonmember of CIRF, the Grain Processing Company. Total paper usage reported is 1.2 billion pounds.

2. CONCC - The respondent believes that Corn Products Company markets ordinary corn starch under the name "milo" in the West in order to be able to meet the lower price of tapioca starch without upsetting the price structure of corn starch. As far as he can tell, specifications and performance of the two are identical. (These comments were made by an apparently non-technical member of the purchasing department.)

3. CORNP - A company representative confirmed my impression that the Corn Industries Research Foundation did not collect market information on varieties of starch other than corn, or on consumption specifically by the paper industry. Another representative

confirmed statements that Corn Products Company is the only producer of milo starch, and he indicated that the company would probably not like to have the paper industry consumption of milo starch revealed.

4. CROWN - Although considerable potato starch was used in 1964, little is available in 1965. Potato starch comes on the market around September and October. Although the total demand for starch may remain constant, the relative consumption of the different varieties may vary widely depending on price and availability.

5. MOHWK - A liquor supplier in the Midwest is reported to be responsible for the drop in price of starch, which currently is $1.35 per hundredweight below that of two months prior to October. A 2% discount policy also is followed for quantity purchases. The company is owned by two men, and until recently it had only three big paper accounts. Although the description might fit Grain Processing Company, the respondents were not certain.

6. STREG - Tapioca starch is available on the East Coast at 4 cents per pound. Apparently their West Coast mills but not all their Eastern mills are using tapioca starch.

G. Starch, miscellaneous comments.

1. BADGR - Difficulties were encountered with their enzyme conversion process during a period when city water had been used. They are wondering whether the enzyme is sensitive to the chlorine in this water.

2. BBRDA - The association is sponsoring research which might increase starch consumption considerably, but no further description could be obtained.

3. BRGST - Root starches, particularly potato, have been best for their purposes, but they can now use corn, tapioca or potato. This starch is used mainly for surface sizing, and most of their grades today are tub sized. The use of faster printing presses and more color printing have necessitated better fiber tack-down, even in letter press. This starch is enzyme-converted, using about 2400 enzyme "pills" per month in 1964, and 1850 per month during the first four months of 1965; the cost is 4 cents per pill.

4. CROWN - Dextrins are used for box or bag making. Tapioca and potato starch are used mainly for beater addition, but milo and corn starch for coating.

5. DINAT - The respondent believes that only the Gardner Division consumes starches, latexes, and pigment binders. The molded products may have used starch at one time but it is likely that mold problems led to its elimination; waxes and alum are thought to be used.

6. FITCH - Starch, casein and protein are consumed in a size press application consisting of 2.5 parts of pigment to one of binder (equivalent to 40 parts of binder to 100 of pigment). Although this is a high binder content, they definitely regard the application as a coating rather than as a pigmented size.

7. GLATF - An off-machine coating plant will be in operation by the fall of 1965. Initially the pigment binder will be starch/latex, and the latex will be "an expensive variety"; they will switch to less expensive types only after they have proved out the initial formulations. Changes in formulations are dangerous, because it is impossible to know all the variables that may affect product quality for each and every customer.

8. GRBAY - Starch is used in coatings made in the folding carton division, and also as a corrugating adhesive. As yet they do not use any starch in the manufacture of paper, but may do so in a new mill being built near Little Rock, Arkansas. Pearl corn-starch, not enzyme-converted, is used as a binder for satin white type clay in the off-machine production of white coated core stock sent to Scott Paper Company.

9. GULFS - See section on "Hydroxyethylated starch".

10. INLAT - A representative of this company, which now owns Morningstar-Paisley, says that interest in pre-gelatinized starch is currently at a very high level.

11. KCSTR - Staley No. 1 pearl starch is presently being converted in a pressure system, but they are switching to Stein, Hall F-1. These starches contain an acidic material, and are sold at a slightly higher price than raw starch, but they will be classed as "unmodified" in the present survey. Application is by size press.

12. KVPSP - There are strong trends toward coating as compared to internal filling of paper, which would diminish the importance of retention aids, and also toward the use of starch as a binder. The company is coating an 18-pound sheet on both sides to eliminate show-through on papers applicable to credit card and motel directories. Starch will take up much of the gap left by the shortage and high price of casein, although prior to the advent of synthetic binders this would not have been feasible. There is still much that can be done with starch to achieve new uses. Dialdehyde starch is very promising, and adipaldehyde is often preferred to glyoxal for insolubilizing starch. It might be well to talk with William Hoover of the Corn Industries Research Foundation, although they may not have data on consumption of starch in paper per se.

13. MANDO - They regard the Insulite operation as one of primary paper operation, and starch is added in the beaters. They also use starch to coat tiles. The use of enzymes is decreasing as pressure cooking becomes more prevalent; Joseph Thomas of S. D. Warren knows the enzyme situation well.

14. MICAR - A small amount of dextrin goes into gluing operations.

15. NICPC - Starch is applied in a size press only, the type being pearl corn, none of it enzyme-converted. Kelgin is used alternately or in combination with starch. Some starch and resin adhesives may be used in wrappings for rolls of products.

16. PKGCA - Filer City Fourdrinier machines use no beater starch, only size press and calender addition. Their cylinder mills use beater and calender starch. The respondent is interested in knowing the proportion of pearl corn starch that is cooked for use in beaters; that is enzyme-converted for size press, calender stack, or pigment coating; and that is subjected to thermo-conversion for size press or calender applications. He was told that this detailed breakdown would not be available from the present survey.

17. POTLF - A great deal of work is being done in the industry on a combination of regular unmodified starch with polyamide wet strength and retention aid resins such as Kymene 557, or a type made by Nalco. These combinations are effective at low cost. Polyvinyl alcohol is used in size presses and calender stacks for surface sizing, both alone and in combination with starch.

18. SIMTM - The company uses starch as a binder for rough pigments which are spray-coated on tiles at the rate of about 2500 gallons per day in a water base. Simpson was said to be a rather small producer of tiles, and there are 22 plants in operation throughout the country, representing all companies in the business. The majors are Celotex, which produces about 1 billion feet per year, Armstrong Cork at about 1/2 billion feet per year, and Simpson at 100 million. The tiles are made mainly from groundwood pulp, some on cylinder machines, but most of them on Fourdrinier. Other binders are latexes, mainly polyvinyl acetate. They wish to improve dimensional stability of their building boards. Starches are excellent binders, but they lose strength when humid conditions are encountered, and sagging results. Dialdehyde starches did not produce the desired results but are still of interest. Xanthate starches are extremely interesting when used with their rough fibers, and they are interested in whatever information IPC might be able to provide on these derivatives. Melamine resins at a level of 3-4% were not entirely effective in

preventing tile sagging. Most of the industry obtains better performance with tapioca starch for use in mineral boards, but potato and wheat starches are also used. Cornstarch gives excessive sagging in high humidity. The starch content is about 8-10%. The SIMTM mill uses 15 tons/day of starch every day of the year; larger manufacturers probably use double this amount (presumably per mill); WOODC uses more binder than SIMTM.

19. TILES - Neither Tapioca or cornstarch is used for enzyme-converting, mainly on the basis of cost and availability. Tapioca is preferred to some extent because of its ease of handling, primarily because of a lesser tendency toward retrogradation.

20. WVAPP - Starch has been over priced. The increase announced several months ago by Corn Products did not stick, and the price dropped from 6.25 cents per pound to 5.32 cents (contracts may be 0.4 cent less than that). Within two years they may purchase only pearl starch and do their own modification and upgrading; a lot of research effort is proceeding in this direction. Grain Processing Company consistently sells below list price and still makes a profit. Corn Products Company was believed to be the only producer of milo starch, in Corpus Christi, Texas. One mill of WVAPP is the largest single consumer of starch.

SURFACTANTS

Various uses were described for surfactants, as described below. Few problems were mentioned that pertained to the properties of the surface active agents themselves.

A. Felt washing

1. ALBEM - Felt washing consumes fair amounts in all mills.
2. CRANE -
3. DINAT -
4. FIBPP - Surfactants are used for felt washing, especially where the Sandy-Hill continuous washing process is used.
5. FOXRV -
6. GULFS - Used at Demopolis.
7. HAMRM -
8. KNOWL -
9. MICAR - Their only use is for felt washing on-machine.
10. MOHWK - Some synthetics are probably present in felt washing soaps that are used.
11. MMMCO - Oakite cleansers are used for felts.
12. MOSNE - Small amounts are employed.
13. NWPCO -
14. PUBCO -
15. WALDF -
16. WARDP - Ciba FW-1 is used.

B. Absorbency

1. DINAT - Surfactants are used to lower the water resistance in calender treatments applied to waste stocks where hard sizing may have been present.
2. FITCH - Surfactants have been used in the past to improve absorbency.

3. HOLVO -

4. LIRAP - Conventional wet strength agents and surfactants are used for windshield wiper papers, although details could not be discussed. The surfactants are used as beater additives and could cause pollution trouble. The supplier claims that the type now being used is biodegradable, but they suspect that this is not really the case. Their present cost is 17.4 cents per pound in truckloads, liquid, and bulk, and the active concentration is unknown. The drum cost would be 22-23 cents, and biodegradable types would be somewhat higher. However the cost per ton of paper is the item of importance to them, and the efficiency of various detergents differs greatly in wiper applications. Since their mill effluents do not go through municipal sewage plants, they have not yet been subjected to pressures to adopt biodegradable types, but are interested in opinions as to when governmental pressures may arise. IPC recommendations concerning both the legal and technical matters would be welcome.

5. MOSNE -

6. NWPCO - Surfactants were used in a now-discontinued grade, a high-bulk saturating paper (4, 10, 20 point) sold for making phenol/formaldehyde laminating board.

7. PKGCA - Surfactants are used to improve the absorbency of corrugating medium, at the rate of 1-2 pounds per ton.

8. WESTN -

C. Softening

1. NWPCO -

2. PUBPC - Surfactants are coming into increasing use with toweling, napkins and tissues. Igepal and Surfax are used, the former being cheaper. Igepal also accelerates broke treatment.

3. WESTN -

D. Deinking

1. BRGST -

2. FIBPP -

3. FITCH - No surfactants are used.

4. HAMRM - May be used at Lock Haven.

5. MOHWK - The respondents implied that none are used in deinking, but added that Dicalite is used in school papers to absorb ink when subsequent deinking is required; none goes into light grades.

6. WALDF -

7. WARDP - Kopanex DIS-20 is used for deinking. They also use a Solvox product in their solvent base deinking system.

E. Corrosion inhibition

1. GULFS - Surfactants are not used in paper processing, but for corrosion control in dryers and boilers. Although they and foaming amines both work for this purpose, they are not panaceas. The field for these products is highly competitive, and the suppliers are doing much research.

2. WALDF -

F. Pulping

1. MANNG - Used in cooking rope.

2. NWPCO - The company has never been able to show any benefit from the use of surfactants in the digesters.

3. UNMIL - Surfactants are added in order to obtain better impregnation of the rope during the cooking process. The one used is Triton X-100, which holds up under the temperature and alkalinity they employ. They examined 25-30 surfactants, and none of the others stood up under these conditions. The same results might actually be accomplished without surfactants by the use of higher temperatures, pre-impregnation in the vapor phase, etc.

4. WALDF -

G. Coatings and sizing

1. ALBEM - Some surfactants are involved in metallic coatings.

2. FOXRV - Some surfactants are used in surface sizing to give penetration coatings.

3. GULFS - Demopolis is evaluating them in coating formulations.

4. SIMTM - Surfactants are used in some of their coatings. The types include the Santosizer series, Igepals, and phosphates.

H. Miscellaneous

1. ALBEM - The Hollywood Mill makes filter sheets containing wool flock, and some surfactants are used to scour wool.

2. BLAND - Surfactants are used mainly for pulp washing. Sometimes they boil out the system with Oakites, etc. when the mill is being shut down.

3. MANNG - Surfactants are used for washing rope.

4. OILGC - Surfactants are used in corrugating medium to improve glueability.

5. PUBPC - Igepal accelerates broke treatment.

6. CONCC - Surfactants are used only in their tall oil recovery process.

WET-STRENGTH RESINS

Although information was not requested on the quantities of wet-strength resins consumed, the impression gained was that urea/formaldehyde types lead, followed by polyamide/epichlorohydrin and melamine/formaldehyde types, probably in that order. U/F types are most economical, but the polyamide/epichlorohydrin can be used in neutral or alkaline processes. Users of the resins and the comments provided are as follows:

A. Urea/formaldehyde resins

1. ALBEM - Urea/formaldehyde represents about 80% of their wet-strength agent consumption, and it is also used at pH 5 to set a nitrile latex.

2. BLAND - Wet-strength agents are used, not for the nominal purpose, but as dry-strength additives. The results are better than those obtained from cationic starch. It is understood that Southern Newsprint Mills are doing something similar. The types employed are Kymene 234 and Parez 615B, which have the advantage of requiring no cooking or other preparation. Their cost is 25-27 cents per pound, dry basis.

3. CHAMP - Used occasionally.

4. CRAND - Small amounts are employed.

5. CRANE - Very little is used.

6. DINAT - Large amounts are consumed when they make their own board exclusively, but little is required when they buy Fourdrinier board. U/F provides the best economics as compared with M/F and Kymene 557.

7. EATON - A few drums of Kymene have been used (it is not certain which type of Kymene was meant).

8. FIBPP -

9. FOXRV - The main type is Kymene 234.

10. GULFS - Tuscaloosa uses some U/F for wet-strength improvement; others have been tried but can't be justified. At Demopolis the purpose is to insolubilize protein.

11. HAMRM - There is very limited use of U/F or M/F at Lock Haven and Strathmore, especially for blueprint.

12. KNOWL - Some Kymene is used, but the reference is probably to number 557.

13. MANNG -

14. MICAR - Consumption is small.

15. MOHWK - Kymene 234 is used.

16. NICPC -

17. NWPCO - Some U/F resins are used for lower wet-strength products, such as billboard poster paper, which requires a low degree of wet-strength to keep the paper together until it has been put up on the billboards.

18. POTLF -

19. PUBPC -

20. SCOTT - They are reported to be the largest manufacturer of wet-strength resins, and statements about urea during the interview leads to the conclusion that these may be primarily of the U/F type. All these resins are used capitively. It was emphasized that in future surveys of wet-strength resins we must request a statement which will indicate what percentage of the total resin consumption is purchased and what is manufactured within the company. There is some loss of U/F wet-strength resin which escapes attached to fibers. There is some question whether these resins are too highly polymerized for their nitrogen content to be available as nutrient for plants, or if not immediately available, whether it might become so through the action of microorganisms on the resins; the presence of available nitrogen could represent "plus" values in considering recovered fibrous material for agricultural applications.

21. SIMTM - They have tried all existing wet-strength agents, and higher concentrations must be used than are required for paper.

22. SONCO - U/F resins are used as wet-strength agents and also for coatings.

23. STREG - The respondent stated that the Kymene flurry is dying off, and the trend is back to amino resins, urea types more than melamine.

24. TILES - U/F resin of American Cyanamid Company is employed to a small extent for beater addition for surface sizing, because of its ability to insolubilize starch.

25. WALDF - Kymene 917 is used where the customer specifies high wet-strength, such as in liner for government usage. The consumption is small.

26. WARNC - Wet-strength agents in decreasing order of consumption are U/F, M/F, and Kymene 557.

27. WSTKC - U/F resin is used in the production of box liners.

B. Melamine/formaldehyde resins

1. ALBEM - Only small amounts are used because their mills do not have the proper equipment for preparing M/F additives.

2. CHAMP - M/F resins are used occasionally.

3. CRANE - Substantial quantities are consumed.

4. DINAT - Trials have been made with M/F resins, but they are less economical than U/F.

5. EATON - This company is a small manufacturer of specialties, primarily industrial filters, from purchased pulp. Their main chemical requirements outside of boiler treatment applications is wet-strength resins. Parez 607 is the principal type, which requires hydrochloric acid to make up the additive.

6. FOXRV - Some Parez 607 is used.

7. GULFS - Notes made during the interview are not definitive as to whether M/F or U/F or both are used to insolubilize protein.

8. HAMRM - There is very limited use of U/F or M/F resins at Lock Haven and Strathmore, especially for blueprint.

9. HOLVO - Consumption was described as large.

10. KNOWL - Parez 607 is used in largest quantity.

11. NWPCO - M/F resins were used during the war for making high wet-strength map paper. They are no longer being used.

12. SIMTM - Melamine resins at a level of 3-4% as a binder were not entirely effective in preventing the sagging of tiles.

13. WARNC - Less M/F resin is used than U/F.

C. Polyamide/epichlorohydrin resins

1. ALBEM - Kymene 557 is used as an alkaline wet-strength agent.

2. CELFI - The use of Kymene types with a neutral cure must be regarded as particularly confidential.

3. CHESP - Kymene 557 is used as the wet-strength agent in paperboard.

4. CONCC - Kymene is preferred for wet-strength applications because it is simpler to use and has less odor.

5. CONPG - Kymene 557 is used on the alkaline side. It is priced at 75 cents per dry pound now.

6. CONSP - The board machines use Kymene 557.

7. CRANE - Kymene 557 has been tried, but broke recovery is very difficult, requiring cooking with chemicals and hypochlorite oxidation.

8. DIERK - Kymene 557 is used as an alkaline wet-strength agent.

9. DINAT - Trials have been made with Kymene 557, but U/F provides the best economics.

10. EASTX -

11. FIBPP - Kymene 557 has been examined.

12. FITCH - Some Kymene 557 is used.

13. FOXRV - Some Kymene 557 is used.

14. GRBAY - Kymene 557 is used in corrugating medium to the extent of about 1/2 ton of solids per year. This resin is added on-machine in an alkaline process. The level is less than 5%, and the resin works well with their recirculating system. In general they adjust their refining system to give the required degree of strength, since resins may make it difficult to get the proper rate of penetration of adhesives in their converting operations.

15. HAMRM - Kymene has been used in blueprint stock.

16. HOERN - Some Kymene 557 is used under neutral conditions.

17. HOLWO - Much M/F resin is used in the East Walpole Mill. A smaller quantity of Kymene 557 is used in the West Groton mill.

18. KNOWL - Some Kymene 557 is used.

19. OILGC - All their mills have converted to the Kymene 557 type in order to be able to avoid low pH.

20. POTLF - Kymene 557 is used as a retention aid together with Aquapel in milk cartons. A lot of work is being done in the industry on a combination of regular unmodified starch with polyamide wet-strength and retention aid resins such as Kymene 557 and a Nalco product. These combinations are effective at low cost for improving strength.

21. TILES - Kymene 709 has been used instead of U/F resins.

22. WARNC - Some Kymene 557 is used.

23. WSTKC - A little Kymene 557 is used for producing box liners.

D. Miscellaneous comments or uses of wet-strength resins.

1. FOXRV - All blueprint paper uses glue in the first tub with formaldehyde second; however blueprint paper has been decreasing at the rate of 20% per year for about 10 years.

2. MMMCO - Wet-strength agents were believed to be used in certain grades at the Hartford Mill.

3. MONSN - (supplier) At present wet-strength improvement constitutes the major application for Scripset 540, which is a styrene/maleic anhydride copolymer. However in the form of its ammonium salt it is used with starch as a sizing agent. It should be noted that some products formerly called Scripset are now called Scriptite; these are U/F or M/F resin products.

4. PRGAM - Although this contact would give practically no definite information, he said that rather simple chemical analyses would disclose that they probably use polyamide wet-strength agents. Their use of these resins is large, and they recently have had a lot of difficulty with a supplier whose resin efficiency was going down, and yet who was making no effort to correct the difficulty. He was told to correct the situation or they would make the material themselves. They hesitate to release consumption data on wet-strength resins because a simple calculation could disclose their production of a competitive consumer product; the lack of diversity in their product line offers no camouflage.

5. STRNG - Use of wet-strength agents is essentially nil, although it is needed for military board and weather proof board for outdoor signs.

6. WOODC - Retention of U/F or M/F resins is a problem because of the cost, and the fact that stream pollution must be avoided. Resins improve the water resistance of starch used as a binder in their board and cushioning material, but they do not give complete control. U/F resin costs about 20 cents per pound as compared with 6-7 cents for starch.

7. WVAPP - The production of grades requiring wet-strength resins is minor.

MISCELLANEOUS SUBJECTS

1. CNTNR - Has a market research group which spends most of its time in studies of the packaging field. The Battelle multi-client study of packaging cost $3000, and gave them little information not already known. The study concluded that low density polyethylene will drop to 12 cents/pound by 1970, and this decrease will have an adverse effect upon the paperboard market. Plastics are predicted to capture 25% of the market for milk cartons by 1970.

2. CONSP - Their production of coated board is very small, about 1-2% of their total, none on-machine.

3. DINAT - Waxes and alum are probably used in the manufacture of molded products.

4. DOWCC - Government statistics are likely to be understated. This respondent believes that manufacturers are not sure that their data will be held in confidence, and disclosure would reveal too much about their production costs. Hence his company and many others tend to report low tonnages. If the paper industry follows this practice, it might account for the lack of agreement between clay consumption data reported by the Bureau of Mines, and that which is estimated from back calculations based on statistics of the annual production of paper and paperboard published by the Bureau of the Census (M26A).

5. GRBAY - The Diversified Products department performs converting operations with plastics, including thermoforming and extrusion of Styrofoam, cellulose butyrates and others. The Folding Carton Division ships out board after printing, for special overcoating.

6. GULFS - As a guesstimate, one-half of the cost of paper is raw materials. Of this raw material cost, two-thirds represents wood; one-third, chemicals.

7. KNOWL - Their automotive filters require 20% of phenolic resin. The resin suppliers do not understand the requirements, which include proper stiffness after curing, and good "runnability" in the resin "B" stage (e.g., proper fold characteristics). Knowlton also makes high-quality boards which may contain equal weights of resin and cellulose, and which are suitable for making printing plates. Laminators may combine up to four thicknesses of board in their products. Decorative laminates are of lower value, and Knowlton does not make them.

8. MICAR - Their 1964 production of paperboard was 92,000 tons, of which 21,000 was bending chip board, and 71,000 mainly white lined board of various kinds. Thus about 60-70% of their board is clay coated, and of the white grades the percentage would be 80.

9. MOSNE - Some melamine (not M/F resin) is used in transformer papers. Three systems are used for this type of product, and details were said to be available in the literature.

10. NICPC - Plasticizers are incorporated in glassine in levels of up to 16%, which makes the size press operation akin to saturation. The main plasticizers are urea and urea/sodium nitrate, which serve both as humectants and to provide an inherent softening effect; glycerine and sometimes sugar may be employed. Solid wax is used in waxing and laminating operations, and a small amount of wax emulsion is applied on-machine.

11. NVFCO - Large quantities of zinc chloride are consumed in their vulcanized sheets, also a little bleach. Vulcanized fiber products are made in thicknesses ranging up to two inches, and end uses include abrasive paper backing, fiber gears and walls for trucks and carts. Their business also includes filament winding, phenolic and polyester resin impregnating of fibrous materials, and the manufacture of plastic rods, tubes and sheets.

12. PKGCA - About 60-70% of bleached paperboard made at Filer City is coated. Total company coated board production may represent 10% of cylinder mill output.

13. PUBPC - For consumer-grade towelling, brightness of 81-82 was desired without degrading strength. Optical brighteners at the rate of 3 pounds per ton in the beaters gave an increase of 3-4 points. Sandoz and American Cyanamid were helpful in the development. PUBPC demands supplier evaluation of products, or else the submission of data obtained in other mills. Their production is about 85% newsprint. Zinc hydrosulfite is less corrosive than the sodium compound. Copperized pear wrap requires 120 pounds of copper sulfate and alum per beater (1200 pounds per ton). A diphenylamine fruit wrap consumes about two pounds of oil per ton, applied at the calender stack. Suppliers such as Houghton, Nalco and Buckman say only that wire life extenders are high polymers. Alum has been used to stiffen the wet web in making newsprint, but about 1-1.5 points brightness was lost from the zinc hydrosulfite treatment; alum is used in wet-strength grades.

14. SCOTT - The recovered material from clarifiers is difficult to dewater and to burn, it must be hauled and buried, and represents a complete economic loss. There is inadequate information on the utilization of bark, which generally is burned to recover heat values. They are interested in mulch products, possibly fortified with waste liquors from ammonia-base pulp mills.

15. SIMTM - Carboxymethyl and hydroxyethyl cellulose are used as thickening agents for coatings. Tests of new chemicals cost them roughly $10,000, because of the extensive field evaluation needed for building products. The relative production rates of common forms of ceiling tile might be 5 for Armstrong Cork Co., 3-4 for Celotex Corp., and 1 for Simpson Timber Co.

16. SONCO - They produce 300-350 tons per day of corrugating medium, sold to box makers. Eight cylinder machines produce 500 tons per day from waste paper. Two fourdrinier machines are in operation SONCO produces 8-10 million pounds per year (dry basis) of acetic acid, one million of 72% formic acid, and 13,000 tons of sodium sulfate which is sold to mills in the black liquor residue after removal of the fatty acids. They are considering the production of anhydrous sodium sulfate. Marketing of these chemicals was briefly discussed. SONCO is the largest manufacturer of spiral and convolute-wound tubes. Large quantities of starch are used in converting operations Their sodium silicate consumption amounts to 10 million pounds of solid glass, 5 million of it being used in Hartsville, it is applied as a 38% solution with a high SiO_2/Na_2O ratio (3.2 1). Their adhesives also may contain polyvinyl acetate, polyvinyl alcohol, latexes, starch, dextrin, hot melts, etc. Phenol and formaldehyde go into resins for captive use. They engage in compression and injection molding and extrusion of polystyrene, polyethylene and polypropylene, including extrusion coating of paper. A list of chemicals purchased by the Chemical Department was provided.

17. TENNR - Among the chemicals noted in the mill were Buckman Laboratories' K Ortho 50, Nalcon 240, 243 and others, sodium nitrite, and a Borol by Metal Hydrides, Inc.

18. UNBAG - They sell considerable amounts of crude fatty acids, and are planning a market survey.

19 WALDF - They are trying to reduce chemical consumption wherever possible as a cost-reduction measure. Solid bleached board requires about $25-30 in added chemicals, including coating but not pulping chemicals. The figure for cylinder board is about $20/ton. Comparisons were made of the

relative costs of coating board with polyethylene, polyvinylidene chloride, and styrene/butadiene; polyethylene is least expensive, and development of an on-machine method of application will be needed in order for PVDC to be successful. About one-third of Waldorf's cylinder boxboard is coated, and about one-eighth of the fourdrinier. (see also Pigments:Clay)

20. WARNC - The dollar volume of enzyme sales has probably decreased greatly due to price-cutting tactics of newcomers to the field (brewers?) who have been less particular about quality control.

21 ATLAS - They are not impressed with the market survey of water-soluble polymers made by Roger Williams Technical and Economic Services, Inc. The section dealing with paper applications is best, probably because a high proportion of the clients expressed great interest in this industry.

22. APLTN - The electrostatic printing development has involved about 40 paper companies. Market surveys have been made by A. D. Little, Battelle, and the government; one of the finest studies was made by Robert S. First, Inc. None of these studies defined the free market.

18. WOODC - They need information on the use of jet cookers, and have some interest in radiation chemistry.

19. APLTN - Offer market research services to IPC members.

20. STDPK - What constitutes an efficient level of raw material (including wood) consumption for each pulping process?

B. Sizing

1. HAMRM - More efficient fortified rosin size desired.

2. KCSTR - Cheaper fortified rosin size desired.

3. NWPCO - Cheaper fortified rosin size desired.

4. PKGCA - Want to know composition of "Cyanosize".

5. TENNR - Cheaper fortified rosin desired.

6. WSTKC - Cheaper alkaline size desired.

7. WOODC - Wax sizing may be a good research area.

C. Starch products

1. PKGCA - Want to know: trends in use of chlorinated starch; proportions of pearl cornstarch that is cooked for use in beaters, enzyme-converted for size press, calender stack or coating colors, and that is subjected to thermal conversion for size press or calender applications.

2. SIMTM - Starches or other cheap binders that will prevent sagging of wall and ceiling products under humid conditions.

3. WALDF - An interest appears to exist in dry milled starch.

4. WOODC - Flameproof or non-hygroscopic starch could be consumed in carloads if the cost increase were moderate.

D. Retention aids.

1. FITCH - Interested in research on retention aids. One aspect is their tendency to produce flocculation; this forms objectionable visible clots in papers which are transparentized in making decorative laminates.

2. RIEGJ - Retention aids intensify two-sidedness in colored papers, because they cause coagulation on one side without preventing the washing away of pigment on the other. (Hercules contacts

stated that the aids reduced this problem, but when questioned further, acknowledged that a balance existed, since the agents can cause the fibers to floc and thereby open the sheet, but as the retention of fines and pigments increases the sheet becomes more closed.)

3. WSTKC - Use a cheap clay to lighten sheets, and would like improved retention aids to give better control of sheet color.

E. Strength improvement

1. CELFI - Generally operate in the neutral range, with no sizing and little chemical material other than wet-strength resins. These resins require four weeks to approach their ultimate strength, and they would like this to occur in half that time; two weeks would be about the minimum, or broke reprocessing would be difficult. High wet strength is a necessity and present resins of this type are not soft enough.

2. EATON - Their primary product is industrial filter paper, and melamine/formaldehyde wet-strength resin is used. The slow cure causes quality control problems because properties of the filters change over a period of weeks. Resins that are easier to apply are desired, as well as non-nitrogenous types, although the latter would require FDA approval. Resins are wanted that are stable over a broader pH range than M/F types. Although EATON is a small manufacturer, they have numerous larger competitors that probably have similar problems.

3. GULFS - A major need is an additive to increase tear strength. Latex is the only one that will do so, but it produces limpness, and existing fiber-bonding agents reduce tear strength. Wires fill with deposits before they wear out, and chemicals that would clean efficiently during a run would be of great benefit; the only effective agent seems to be 66° Baumé sulfuric acid, which itself adversely affects the screens.

4. SONCO - Want cheaper beater additives, mainly to improve internal bonding and tensile strength.

F. Coatings

1. ALTON - See Item A-1.

2. GULFS - More information is needed on rheology of coatings.

3. STRNG - More knowledge on methods for obtaining good wet-rub characteristics.

G. Miscellaneous applications for additives

1. BLAND - Although three or four wire-life extenders are available, improvements would be desirable. They operate a 146-foot wire which lasts about one week An additive that would extend this life by even one day would be worthwhile. Most of the materials in use are cheap. (See also Item E-3, GULFS).

2. BOWAT - A major problem is the improvement of opacity to permit lowering of coating and sheet weights Southern newsprint consumes pulp with larger, more transparent fibers, and there is also a demand for 25-pound sheets instead of 32-pound. Acceptable additives are few because newsprint must be cheap and additive retention is poor. One approach is modification of pigment crystal structure to give increased bulk per unit weight, but the problem is not yet solved. Synthetic fillers, asbestos, clay, zeolites, etc have been tried. A 3% addition of Huber's "Zeolex" made considerable improvement in "strike-through." (On a subsequent mill tour, perhaps at Kimberly, the guide mentioned that a few Southern mills are having opacity problems because they are using the wrong type of grinders or are operating them improperly).

3. OILGC - Better foam killers are needed.

4. RIEGJ - Better plasticizers are needed, which could meet FDA requirements, be reasonable in cost, and not increase the equilibrium moisture content of paper.

5. SONCO - A very important need is for a water-soluble or -dispersible adhesive for making automatic or flying splices on their paper machines. The present polyisobutylene-based adhesive produces tacky and gummy particles in chip board when waste paper is reprocessed.

6. THILM - Greater overall economy in the use of foam control agents is desired.

APPENDIX II

Identification of Respondents

ALBEM - Albemarle Paper Manufacturing Company
ALTON - Alton Box Board Company
AMMAZ - American Maize-Products Company
APLTN - The Appleton Coated Paper Company
ATLAS - Atlas Chemical Industries
BADGR - Badger Paper Mills, Inc.
BBRDA - Boxboard Research & Development Association
BIRDS - Bird & Son, Inc.
BLAND - Blandin Paper Company
BRGST - Bergstrom Paper Company
BOWAT - Bowaters Southern Paper Corporation
CAREY - The Philip Carey Manufacturing Company
CELFI - Cel-Fibe
CHAMP - Champion Papers, Inc.
CHESP - The Chesapeake Corporation
CNTNR - Container Corporation of America
CONCC - Continental Can Company, Inc.
CONPG - Consolidated Packaging Corporation
CONSP - Consolidated Papers, Inc.
CORNP - Corn Products Company
CRAND - Crandon Mill Division, Consolidated Packaging Corporation
CRANE - Crane & Co., Inc.
CROWN - Crown Zellerbach Corporation
DINAT - Diamond National Corporation, The Gardner Division
DIERK - Dierks Paper Company
DOWCC - The Dow Chemical Company
EASTX - EasTex, Inc.
EATON - The Eaton-Dikeman Company
ECUST - Ecusta Paper Division (Olin Mathieson Chemical Corporation)
FIBPP - Fibreboard Paper Products Corporation
FITCH - Fitchburg Paper Company
FOXRV - Fox River Paper Corporation
GLATF - P. H. Glatfelter Co.
GRACE - W. R. Grace & Co.
GRBAY - Green Bay Packaging Inc.
GULFS - Gulf States Paper Corporation
HAMRM - Hammermill Paper Company
HERCL - Hercules Powder Company
HOERN - Hoerner Boxes, Inc.
HOLVO - Hollingsworth & Vose Company
INLAT - International Latex & Chemical Corporation
KCLRK - Kimberly-Clark Corporation
KCSTR - The Kansas City Star Company, Flambeau Paper Division
KNOWL - Knowlton Brothers, Inc.
KVPSP - KVP Sutherland Paper Company
LAFIB - Latex Fiber Industries, Inc.
LIRAP - Little Rapids Pulp Company
LNGVF - Longview Fibre Company

MANDO - MANDO, A Division of Boise Cascade Corporation
MANNG - John A. Manning Paper Company, Inc.
MASON - Masonite Corporation
MICAR - Michigan Carton Company
MMMCO - Minnesota Mining and Manufacturing Company
MOHWK - Mohawk Paper Mills, Inc.
MONRO - Monroe Paper Products Div., Time Container Corporation
MONSN - Monsanto Company
MOSNE - Mosinee Paper Mills Company
NVFCO - NVF Co.
NEKED - Nekoosa-Edwards Paper Company
NICPC - Nicolet Paper Company
NWPCO - The Northwest Paper Company
OMCCO - Olin Mathieson Chemical Corporation
OILGC - Owens-Illinois, Inc.
PKGCA - Packaging Corporation of America
PMOID - Premoid Corporation
POTLF - Potlatch Forests, Inc.
PRGAM - The Procter & Gamble Company
PUBPC - Publishers' Paper Co.
RIEGJ - Riegel Paper Corporation, New Jersey
RIEGC - Riegel Paper Corporation, North Carolina
STREG - St. Regis Paper Company
SCOTT - Scott Paper Company
SIMLE - Simpson Lee Paper Company
SIMTM - Simpson Timber Company
SONCO - Sonoco Products Company
STDPK - Standard Packaging Corporation
STRNG - John Strange Paper Company
TENNR - Tennessee River Pulp & Paper Company
THILM - Thilmany Pulp & Paper Company
TILES - Tileston & Hollingsworth Company
UNBAG - Union Bag-Camp Paper Corporation
UNMIL - Union Mills Paper Manufacturing Company
WALDF - Waldorf Paper Products Company
WARDP - Ward Paper Company
WARNC - S. D. Warren Company, Cumberland Mills, Maine
WESTN - The Weston Paper and Manufacturing Co.
WEYER - Weyerhaeuser Company
WOODC - Wood Conversion Company
WSTKC - Western Kraft Corporation
WVAPP - West Virginia Pulp and Paper Company