PLAINTIFF'S EXHIBIT

GP-765

SIX MONTHS REPORT
PRODUCT DEVELOPMENT &
TECHNICAL SERVICE DEPARTMENT

JULY thru DECEMBER 1977

HIGHLIGHTS



1 1/2 HOUR FIREDOOR AFTER SUCCESSFUL FIRE AND HOSE STREAM TEST.



A PILOT PLANT IS BEING ASSEMBLED TO EVALUATE THE MANUFACTURE OF FIBROUS GYPSUM.

TABLE OF CONTENTS

	Page
Six Months Summary	1
Six Months Sales & Profits From New Products	3
New Product Section	
Firedoor Cores	4
Ready Mix	5
Gypsum Fibers	5
Casein Joint Compounds	6
Manufacturing Services	
Ready Mix Spoilage	7
By-Product Gypsum	7
Continuous Calcination of Alpha Gypsum	8
Water Resistant Wallboard	8
Roofing	9
Pre-Dec Paint	9
General	9
Sales Service Section	
Firedoor	10
Polystyrene Texture	10
I-Stud Shaft Wall	10
Ready Mix Market Testing	10
General	11

(OVER)

Table of Contents cont.

Page

Industry Representation

ASTM 12

Gypsum Association 12

Patent and Legal Section

National Gypsum Shaft Wall Patents 13

Firedoor Core Patent Applications 13

Wallboard Accelerator Patent Application 13

SIX MONTHS SUMMARY

New products developed at the Tigard Gypsum Laboratory during the past five years contributed $565,186 to net sales and $173,596 to the profits for the last half of 1977. Cost savings of about $27,000 were also generated.

Major efforts in the past six months have involved the 1 1/2 hour firedoor, the continued formulation of asbestos free ready mix; resolving a disastrous spoilage problem, the gypsum fiber pilot plant, survey to determine sources of waste gypsum and continuous alpha gypsum calcination process. The latter three projects were conducted in cooperation with Gypsum Operations.

The 1 1/2 hour firedoor rating was achieved and currently a pilot plant is being assembled for production of the special gypsum edge component. The target date for having 1 1/2 hour doors available is February 1978.

The first asbestos free ready mix was not universally accepted so further reformulation was necessary. The latest formula is receiving much better acceptance but there is stiff competition from manufacturers who are still using asbestos in their products. A serious spoilage problem developed in the asbestos free ready mix. Replacement of corroded lines and use of a more effective preservative has brought the problem under control. Also, a test to measure bacterial growth was adopted and will serve as an early warning system to prevent any recurrence.

A pilot plant is being assembled to manufacture about 10 lbs. per hour of gypsum fiber crystals on a continuous basis. This will permit an accurate projection of production costs and also provide a quantity of fibers for evaluation. We will evaluate the gypsum fibers for existing products such as metal casting plaster, joint compounds and textures. Other products that might utilize the gypsum fibers are spray fireproofing plaster, spray insulation and fireproof Christmas tree flocking.

We are assisting Operations in a survey of waste gypsum in areas that would be good markets for gypsum products. Our best possibility at the present time is the utility plants which burn coal to generate steam to run turbines for electric power. The effluent from burning of high sulphur coal is sulphur dioxide which under EPA edict must be removed. The removal of the sulphur dioxide by most processes results in calcium sulfite which can be oxidized to gypsum. Some exploratory discussions are in progress with Louisville Gas & Electric, a utility which is removing SO_2 and is also located in a good market for gypsum board.

Some work has been done on a process to calcine gypsum in a slurry form to the alpha crystal (Denscal). If successful, this could fit in with the waste gypsum since the utilities discharge calcium sulfite or gypsum as a sludge.

Important patent developments are the application covering the firedoor core, a yet to be filed patent on our edge banding and a negotiation with the owners of the Cordon patent to reach an agreement that will permit more flexibility in manufacturing firedoor cores.

The projects above as well as other less significant activities reflect our continued close cooperation with the operating and sales departments. 1978 should be a crucial year in bringing many of the current projects to fruition.

SIX MONTHS SALES & PROFITS FROM NEW
PRODUCTS DEVELOPED WITHIN THE PAST FIVE YEARS

PRODUCT	UNIT	SALES VOLUME	LIST SALES AMOUNT	GROSS PROFIT AMOUNT
Sentinel Wallboard (all)	MSF	420	$ 41,954	$ 6,451
Polystyrene Texture	BGS	6,218	24,984	5,174
Firedoor Cores (raw)	EA	7,212	98,316	25,937
Firedoor Cores (banded)	EA	14,165	375,731	128,962
Fire Retardant Edge Banding	LN.FT.	68,516	24,201	7,072
			$565,186	$173,596

Cost Savings For Last Six Months

Pre-Dec $27,223 M sq. feet x $1.00 = $27,223

PRODUCT DEVELOPMENT

1. Firedoor Cores

a. 1 1/2 Hour Fire Rating

Two fire tests were conducted at Warnock Hersey in July. The doors were constructed with a combination of 1" thick poured gypsum and 5/8" fire retardant wood edge bands. The first door failed the fire test when the face veneer burst into flame at the end of the test. The second door passed the fire test but failed the hose stream portion of the test when the gypsum edge component failed to adhere to the unexposed veneer. After those failures, several possibilities were investigated:

1) A pressed edge banding with Urea formaldehyde resin was evaluated. This edge composition had some advantages but it became obvious that there would be a lot more time required to overcome all the obstacles and we were anxious to obtain the 1 1/2 hour rating.

2) A new formula for the cast gypsum edge component was investigated. It was found that addition of ground wood shavings and paper fiber resulted in a better bond to veneer. Also, the new gypsum edge component gave good fire resistance and eroded away gradually in the hose stream test. We felt this was better than having complete sections separate as a result of the force of the hose stream.

3) The 5/8" fire retardant wood in the first tests was cut from 1" regular treated hemlock but we purchased 5/8" treated wood for the next test so there would be less chance of trimming away the fire retardant salts.

4) There was some consideration given to testing a door with only the gypsum edge component. It was finally decided that a door with a gypsum edge might not be acceptable and it would be a risk to test it until there is better knowledge of its acceptance.

5) Another question to be answered was the type adhesive used in laminating the veneer. Pilot fire tests were performed with both vinyl and casein veneer laminating adhesives. The vinyl held up well on the unexposed side, but the bond of the casein at the end of the test weakened considerably. As a result, we chose to use Borden's cross linked vinyl WB-904 for the test door.

The re-formulated 1" thick cast gypsum and 5/8" thick fire retardant hemlock comprised the edge that was finally tested. The gypsum component had high strength, good screw holding properties, and good glueability. This door passed the 1 1/2 hour rating and now the effort is being concentrated on methods of manufacturing the edge banding. Initially the gypsum component will be cast on the pilot wallboard machine which is being modified for that purpose. It has not yet been determined how the gypsum and wood components

SGP 0015447

will be bonded together. There is every reason to believe that a door manufactured with this edge system should be stronger, have more secure hinge attachment and better all around serviceability than the 1 hour door.

2. Ready Mix

The first asbestos free ready mix formulas had only moderate acceptance. A so-called magnesium oxide formula was then developed. Field and market testing indicated that it compared favorably with other asbestos free products. All plants except Acme have now been converted to this formula. Field testing of Acme's magnesium oxide formula is underway.

Early next year a competitive ready mix survey will be made. All of our plants products will be compared against the primary competitive products in each market. Practically all of the products have been received (20 in all) and testing will commence shortly. There are still products containing asbestos being sold and some of them have been submitted for the survey. This survey should give us a better picture how our ready mix measures up in the various markets.

Further ready mix developments which are underway are the investigation of a deareated ready mix at Milford and the development of a ready mix which excludes sorbitol. Now that we market ready mix by weight (62 lbs.) instead of volume (5 gal.) it is possible to increase the density without altering the economics. There appear to be some quality advantages to be gained by de-airing which may help our sales. Sorbitol is necessary to protect products having polyvinyl alcohol for application over wallboard containing boric acid. The boric acid migrates to the paper surface and the PVA reacts with it causing poor application properties. The sorbitol has undoubtedly aggravated recent spoilage problems at Acme. A special formula eliminating both sorbitol and PVA is being developed but it is significantly more costly. However, it is advisable to have such a formula in the unlikely event that we are unable to control the spoilage by the measures already taken.

3. Gypsum Fibers

Some years ago we investigated a gypsum fiber development in which Certain-teed Products Corporation held a patent. A patent search unearthed information which in our view and that of our patent counsel, undermines Certain-teed's patent, and if contested, it would probably be found to be invalid. Some small scale apparatus was set up to produce a few fibers which were used in various products. We also procured a larger amount of gypsum fibers from Certain-teed which were used in a plant trial of metal casting plaster that was very successful. Exploratory work indicated that the fibers could be used in dry joint compounds and textures. The one product which would use a large volume of fibers is ready mix, but a trial conducted indicated a

SGP 0015448

breakdown of the fibers after a couple of months. This was not exhaustive so additional testing should be done.

The interest in gypsum fibers has been renewed as a possible substitute for asbestos fibers which are now environmentally unsound. Some exploratory experiments by the Operating Department indicated that gypsum fibers could be produced continuously. A pilot plant was designed and approval was given to build a unit that would produce about 10 lbs. of fiber per hour. The purchase and assembly of the equipment is now nearing completion and the final shakedown runs are being made. The objectives are to estimate the economics of manufacturing the fiber projected to a full scale plant and to produce enough gypsum fiber to evaluate all the potential uses.

4. Asbestos Free Casein Joint Compounds

We have not had good acceptance of our asbestos free casein products. In addition, the contamination problem of caseins and vinyls is ever present. It has been decided to phase out the casein products at Akron as soon as our raw material supply is depleted.

SGP 0015449

MANUFACTURING SERVICES

1. Ready Mix Spoilage

We have just experienced a most serious and expensive ready mix problem. The major difficulty was in Acme, but there were complaints of ready mix spoilage from Akron and Chicago. Marietta had changed to a preservative called Proxyl CRL and this may be the reason they had no spoilage. Milford had only a couple isolated complaints and we attribute their relatively new equipment as being the reason. Contributing causes for the spoilage at the other locations were:

a. The asbestos free ready mix contains sorbitol, which is a sugar and thereby is a nutrient for bacteria to feed on. Acme's ready mix also contains a guar gum thickener which is also a food for bacteria.

b. Spoiled material accumulating in the lines between the mixer and the pail filler caused fresh material to be infected as it was being manufactured. Even though a program for steam cleaning had been adopted, the material clinging to the inside walls of the lines was never completely removed. It was found that in many cases the lines were badly corroded which prevented thorough cleaning of the lines.

   Increases in preservative level were tried, but once the ready mix was infected, it was almost impossible to contain the bacterial growth. As soon as we found spoiled material in the lines, a total clean-out at each plant was recommended. In some cases new lines (plastic) were installed and every effort was made to eliminate any dead areas where accumulation could take place. Also, every effort was made to get the new liquid preservative addition systems installed so we could begin using Proxyl CRL which was found to be an extremely effective microbial. The new system is interlocked in the mixing cycle so it is difficult to omit the preservative addition. A test has been set up to check for bacteria growth on production samples. This along with a periodic check of the retained samples is an early warning system that should prevent any recurrence of the spoilage problem.

2. By-Product or Synthetic Gypsum

We have been assisting in a search for a source of usable by-product gypsum which is economical and available in good market for gypsum wallboard. Producers of phosphate fertilizers, titanium dioxide, hydrofluoric acid, and utilities who must scrub SO_2 from their stack gas are all potential sources. The utilities offer more and a better choice of locations than the other industries. There is a regulation concerning SO_2 from the burning of high

SGP 0015450

sulphur coal so the power companies are already beginning to desulfurize their stack gases. This is done by scrubbing and then reacting with lime, limestone, soda ash, or magnesium oxide. Lime is the commonly used reactant and this produces calcium sulfite which could be oxidized to gypsum. The amount of gypsum generated depends upon the size of the generator and the sulphur content of the coal. The gypsum would come from the scrubber in the form of sludge at probably 30% solids. Since there are chlorides in the coal, the sludge would contain a given amount of chloride and that is something that will have to be considered. There is one other criteria that is necessary for a utility to be able to service us and that is a precipitator to remove the fly ash. There are only a few power companies that have precipitators so that limits the choice of a utility to negotiate with. We have visited Columbus and Southern Gas & Electric in Columbus, Ohio; the Tennessee Valley Authority power generating station and pilot plant scrubber operation at Paducah, Kentucky; Bechtel Engineering who is involved in power plant design; and Louisville Gas & Electric Company in Louisville, Kentucky. It appears that Louisville Gas & Electric offers the best combination of having precipitators, scrubbers, a willingness to consider oxidizing to gypsum and is a good location for gypsum board markets. We have indicated a desire to explore the possibility of a gypsum wallboard plant utilization of waste gypsum sludge from one of their power generating units.

3. Continuous Calcination to Alpha Gypsum

The Operating Department has developed a method for calcining gypsum in a slurry or suspension under pressure to the alpha hemihydrate. The objective is to save energy lost in the heat of vaporization and to subsequently thicken and cool the slurry or suspension so that it can go directly into the wallboard manufacturing process. Some small scale experiments have indicated that the calcination in slurry form is certainly possible but would require grinding of the wet mix to achieve the lower water requirement. Some work has been done but more needs to be done to fully explore all the ramifications of this calcining method. Also, some short runs of wallboard using Denscal (alpha gypsum) were made at Blue Rapids and these runs seem to indicate that wallboard can be manufactured from alpha gypsum.

This project could tie in beautifully with by-product gypsum which would be available in a slurry (sludge) form, however, more work needs to be done to prove out the process.

4. Water Resistant Wallboard

All plants are currently manufacturing sheathing and tile backer with the lignosite/land plaster/potash accelerator and sufficient runs have been made to confirm that the ASTM standards for water absorption can be met. We have had to back off on loadmaster for roofdecks because the accelerator apparently affects the wet bond and when the board is subjected to a soaking rain, the paper separates.

SGP 0015451

5. Roofing

All of the asphalt testing equipment was purchased including a Weatherometer. When Ryan Preble transferred to Franklin, Ohio in November, all the equipment except the Weatherometer was shipped to Franklin. The Weatherometer was installed in Tigard so some testing could be done before the Franklin lab was ready. As of this time the Weatherometer is in operation and sample asphalts with various amounts of limestone filler are being exposed.

Ryan Preble's training period included trips to Chevron, 3M and Flintkote lab and the GAF and Malarkey roofing plants prior to relocating to Ohio.

6. New Pre Dec Paint

All plants have now adopted the new formula Pre Dec paint. Some touch up problems occurred initially, but these appear to be resolved so the cost savings of more than $1.00 per M sq. feet are being realized at all plants where Pre Dec is being manufactured.

7. General

Analyses are still conducted on a regular basis at the request of the plants and Operating Department. Recently a number of waste or synthetic gypsum samples have been analyzed in conjunction with the survey of potential sources.

SGP 0015452

SALES SERVICE

1. Firedoor

One of our customers, Cal Wood Door, has developed a special edge banding for our firedoor core. This edge material consists of 5 layers of 1/4" hardboard laminated together. They passed a 1 hour fire rating and with a modification of this special edge have passed a 1 1/2 hour rating. Cal Wood made a proposition to have us band and sell cores with their edge material. We conducted a number of tests and subsequently manufactured about 45 cores with Cal Wood's material. A report was submitted covering the advantages and disadvantages and it was decided not to become involved in another edge banding. Our primary interest was in the 1 1/2 hour door which Cal Wood was not ready to produce and eventually we obtained our own 1 1/2 hour rating anyway.

2. Polystyrene Texture

At the request of sales we upgraded our polystyrene texture by increasing the hiding power and improving the spray properties. Trials were held in Seattle and in Florida. Both trials were successful so the formula was changed.

3. I-Stud Shaft Wall

We had planned to participate in a co-operative fire test of the I-Stud shaft wall system with Domtar and Westroc in Canada. However, a year has passed and the test still isn't underway. In the interim there was an opportunity to co-sponsor a test with Flintkote and Studco at Warnock Hersey. Sales asked us to co-operate in the test series which ultimately produced a 2 hour rating from both sides. This appears to have satisfied the sales need and we will probably back out of the Domtar-Westroc test which we understand is still in the works. In any event, we now have a test which will permit full promotion of the I-Stud system.

4. Ready Mix - Field & Market Testing

Field tests were made to Memphis, Chicago and Baltimore-Washington to respond to sales requests in regard to asbestos free ready mix. We believe that we may be losing business to ready mix suppliers who are still using asbestos in their products. In order to make a better assessment of where we stand in the markets served by the plants, a competitive survey is planned. Sales is arranging for all of the major competitive products from each market to be sent to Tigard. Thus far there are about 20 ready mix products including those from our own plants. The testing will take place shortly after the first of the year.

SGP 0015453

5. General

We have responded to the usual numerous field requests for technical information and in one case (Embarcadero Center job) have conducted witnessed tests to satisfy the San Francisco code authorities.

We also arranged for some photographs to be taken at the Tigard Lab which may appear in the G-P Annual Report.

SGP 0015454

INDUSTRY REPRESENTATION

ASTM

The negative ballots regarding the application of 1/2" board on 24" centers on textured ceilings have resulted in the proposed application standard being tabled by ASTM Committee C-11.

We have voted negative on the type X bench test addition to the sheathing and water resistant board specifications on the basis that these products were not included in the round robin tests.

Gypsum Association

The major subjects being considered by the Technical Committee are:

1. The Fire Resistance Manual (1978 edition) has been issued and again is the best most up-to-date compilation of fire and sound test data available.

2. We have requested that the Association test a 24" wide 5/8" type X board in a wall assembly to get U.L. to permit the narrower width.

3. The Gypsum Association is moving toward a continuity in metrication and is proposing a series of rounded soft conversion units that would go into Association literature and could also be used on member company's literature. We should establish a company view toward metrication and also determine whether we will begin including metric dimensions on our products.

SGP 0015455

PATENTS & LEGAL SECTION

1. National Gypsum Patents 3,740,912 & 3,921,346

Studco, the manufacturer of the I-Studs, has taken a license from National so this clears up National's claim that we are infringing their patent on shaft walls by our promotion of the I-Stud system.

2. Firedoor Core

A continuation-in-part application is being prepared based on a suggestion by Synnestvedt. This should provide adequate patent protention if the examiner allows the claims. Our initial application ran into problems with the Ware patent involving a fire resistant composition which contains many of the same ingredients as our core.

Also, we are currently negotiating with Cordon and his group, which includes Paul Mills, our perlite supplier, for an immunity from their patent. We presented Paul Mills, owner of Oneida Perlite, with a specification for fineness which would put us outside the scope of the Cordon patent. He has continued to furnish us with fine perlite, not meeting the specifications, so we will either have to reach an agreement on the patent or find another source of perlite.

We have sent information to Synnestvedt to begin preparing a patent application for the 1 1/2 hour firedoor core.

3. Lignosite-Land Plaster Accelerator

We were planning to offer licenses under our patent application to Canadian companies. The Patent Gazette recently listed a patent that has just been issued to USG covering a lignosite-land plaster accelerator. We have sent for the patent and will study it carefully before deciding whether to pursue the offering of licenses. This will undoubtedly have some affect on our own patent application on the use of lignosite and land plaster.