February 2, 1963

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E. D. Lovick — Libby

Asbestos

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A contract was signed with the Industrial Research Division of Washington State University in June with the thought that they would work concurrently with us on a metallurgical process for flotation recovery of tremolite.

At the time the pilot plant was built in our mill building, the program as developed in our lab showed better promise than what WSU had come up with to that time, although this would have been expected because of the relative time we and they had put in on the program.

The pilot plant was installed in the mill building and as various components were ready for operation we began operating them to gather data. The schedule on this was somewhat behind on time and it was not until October that any runs began. Since that time the plant has been run to gather data on equipment in use and to test the flow sheet as originally designed and installed. While the flow sheet remains essentially the same, some changes have been made and more work remains to be done to prove it out.

Information gathered has been allthrough the circuit starting with feed to the mill--crushing ore to determine best size to feed the mill, feed bin and feeder arrangement to mill, initial screening when ore received in mill, secondary crushing of oversize (# 1/2 in.), classification of -1/2 inch material. From there it is fed by disc feeder to disc pulverizer (currently); previously it was rod milled. Information was gathered on each method. More information is needed both on costs of operation and variance in metallurgical results in preservation of vermiculite.

At this point in our present scheme from a metallurgical standpoint the disc mill will be the better unit, although we do not have sufficient information as yet to know whether it is the most economic unit. If the WSU flotation scheme can be refined to the point where it is superior to our scheme, probably the rod mill will be the most desirable.

After the grinding stage the material is pumped to the top floor, the slime fraction is taken off, sent to the Bird for recovery of the fines. The coarse material is screened on a 14 mesh screen to recover the vermiculite. Material passing the screen is tabled on a Wilfley table, where most of the pyroxene is separated, the middling then goes to cells.

Work has been done with both Galigher and Denver cells, more work remains to be done at this stage. We have not been able to get the results from the cells in the pilot plant that were obtained in the laboratory. Probably some cell redesign will have to be done for results from neither set of cells is satisfactory.

In connection with cells, work has also been done on related items such as conditioning, scrubbing, etc. More time is required to prove out results and get results that are satisfactory as to recovery and within economic limits as to use of reagents.

A Bird Centrifuge is in the plant on a lease basis. This unit has proved that recovery of fines from the slime feed can be made. Both slimes and cell concentrate have been sent to this unit for testing. With a straight slime feed, a discharge of product containing approximately 50% moisture can be obtained. However, recovery of product from the Bird is only about 50%. The primary reason for this is the extreme dilute material which is fed to it. The feed on straight slimes contains only about .5% solids. Some means of feeding the machine a higher percent solids feed must be devised. There are some ideas as to how this could be improved, but will take time to carry out tests. Incidentally, when cell concentrate is added to the Bird feed, there is apparently 100% recovery on this and the discharge is at a higher degree solids than the straight slimes, which is desirable. A combination of the two seems to discharge at about 60% solids.

An engineer from Bird Machine Co. spent several days with us this month and set up a series of tests to check efficiency, capacity and utilization of the machine. Not all of them were completed before he had to leave and should be run when time is available.

The dryer is installed and in operating condition but to this time no product has been put through it.

The present schedule is to run the pilot plant to make samples during the next two weeks and the dryer will be run during this period.

Some drying tests have been conducted. Samples were put through the tailings mill dryer, samples were sent and run through a flash dryer at Combustion Engineering Company near Chicago. Samples will be prepared and forwarded to C. G. Sargent and Sons in Massachusetts for testing results in a belt dryer which they manufacture. Incidentally, this is the type dryer used by Asbestos Corporation Ltd. in their wet process plant.

From data gathered in the pilot mill some cost (capital and operating) estimates of a very preliminary nature have been prepared. These are extremely rough and more data must be gathered so they can be recalculated.

On a production basis right now, weighing problems at the mine and milling, it is our judgment that design should be based on a 3-ton per hour basis (although we have also calculated for 7 tons). On this design, it could be possible to produce from 2 to 3 tons depending on grade of ore and recovery. Below 3 tons per hour it would not be an economic operation, above 3 tons it would be. At a design below 3 tons capacity with what information we have available, we do not believe we could design for much less capital cost, nor do we believe we could produce a product at a profitable cost. With more data this belief could change.

Our estimate on a capital cost of a plant of this size is $680,000 with nothing included for a transfer point, which would probably be necessary if we went into asbestos production, and using one or two of the present vermiculite mill feed bins.

We have tried to gather such information as has been available on the asbestos operations which have been or are being built. What we have gathered is on the plants in California. While the articles we have seen are of quite a general nature and at times are in conflict with one another, some definite information can be obtained from them.

Jefferson Lake seems to be the largest operation. This is a chrysotile operation producing grades 4, 5,6 and 7 so is really not comparable.

Coalinga Asbestos Company, the joint venture of Johns-Manville and Kern County Land Company, will produce only group 7 shorts by dry process. One report states that they will produce 12,000 tons annually, another 25,000 tons. This would be an hourly capacity of from 2 to 4 tons depending on which figure is correct. However, all reports state their mill investment is $1.5 million.

This past week there apparently was a release stating that the Nuclear Division of Union Carbide Company is going to build a pilot mill at King City, California, to utilize short fibre ores from the Coalinga area deposits. The purpose of the plant is to recover the short fibre asbestos and build a market for it. I have seen nothing in print on this.

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The work at WSU shows promise. They have actually come up with a break-through in the flotation of asbestos. However, here again they do not have sufficient information to be put to practice in our pilot plant. Mr. Jaekel of WSU spent two days here two weeks ago observing our pilot plant and working with Dan on our process. At that time he could not state when he felt his work would be far enough along so it could be transposed to our pilot mill. He did feel that this could be done but would probably take from one to two months, estimated. As this scheme is a possibility, it definitely should be given a chance in our pilot plant if possible, before final design is made.

Because the scheme differs from ours, flotation of tremolite vs. flotation of vermiculite, depending on which scheme is used would make some differences in the flow sheet.

As we feel a definite need for more information exists and must be obtained before a plant can be justified, a review has been conducted as to a schedule for obtaining this information. It is the concensus that six months time is required to complete the tests necessary to gather and evaluate the data.

At that time we should know the metallurgy and economics of the present scheme. We will know what recoveries are and whether we have an economic process. The data will be available and relatively accurate costs of production can be calculated so we can know whether we can profitably produce at various levels of production, whether it be 1, 2, 3 tons per hour or at some other figure. In other words, a break-even point of production can be determined. There will be sufficient engineering data to be able to scale up to a production unit of whatever size desired and we will be able to compute the capital cost for a production mill of a specified size.

These things we are not able to do now with any degree of accuracy and to justify a mill must be known.

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