CONFIDENTIAL

006936 March 16, 1971
Technical Services

To Pete Brown

TO: R. E. Thurmond

FROM: W. A. Hamilton

SUBJECT: Report by Lyle . s Dated February 11, 1971

I have the above report and have read it with considerable interest.

I agree generally with that portion of the report dc ng with the concentrate thickener, filters and dryers. It has been apparent for some time that the thickener-filter-dryer complex has and is contributing very substantially to overall metal losses and production problems. These losses can occur in three principal ways :

1- Direct loss to tailings in thickener o'flow.

2- Indirect loss to tailings because of non-recovery of recirculated fines in the o'flow return to circuit.

3- Indirect loss to tailings by flotation inefficiencies caused by interference with new mineral by returned fines.

In addition to the above there is the possibility of excess circulating load in the complex because of recirculation of fines via the dust collectors on the dryers. Some measurement or estimate of the dust return should be made.

It is also possible that recirculated fines from the dust collectors could be partially oxidized compounding any recovery problem if they in turn are recirculated through the float circuit via the concentrate thickener o'flows.

In any work leading to improvement of the dryer situation the future metallurgy and potential feed to the dryers should be considered.

We must assume that the future will produce better metallurgy than the past. If this is accomplished then (1) The feed tonnage to the thickener and dryers will increase (2) The feed to the complex will also change structure and become finer sized. My reasoning for the statement in (2) above is that improvements in lead recovery must come from more successful

flotation of the finer sized mineral fraction. In the case of zinc the improvement must come from better recovery of middling subsequently treated in the regrind section to maintain grade with a net result of fines sized zinc concentrate. Successful operation of the bulk circuit should aggravate the condition for the selective concentrates with respect to size range.

In summary the equipment involved may be discussed as follows:

Thickening

As discussed previously all of the thickeners were sized from samples of much finer size consist than what you are treating now. All of the test work employed flocculants. Eimco, Dorr-Oliver, Peterson and Hazen Research all ran samples. The thickeners were sized using the most conservative figures.

During any of my visits to Anvil I have never seen the thickeners flocculated properly. I realize this is a tricky business when running overloaded as they usually are.

However, assuming following capacity of filter-dryer is or will be made adequate and the thickeners can then be operated in a proper manner then the size of the thickeners should be adequate for the job. Proper thickener operation means adequately flocced pulp removed as underflow and overflow at a rate consistent with the feed rate.

In order to insure flocculation it may be necessary to combine thickener feed and circulating products at one point prior to entry into the feed well before addition of flocculant.

It may also be advantageous to improve the feed entry. A tangential entry will assist in alleviating frothing and improve settling by elimination of the present pulp diving into the feed well causing air entrainment and liquid currents upsetting the stilling condition necessary for good settling.

The application of heat might show some startling benefits. When we started up the White Pine copper concentrator we were, even at reduced tonnage, unable to thicken to any desirable density with low solids in the overflow and were totally unable to filter the material using two filters. Fortunately our power plant could provide live steam and we introduced a steam jet into the thickener u'flow. The pulp filtered beautifully on one filter and the filtrate return to the thickener warmed up this area and the settling problem vanished. Warm pulp will almost invariably show dramatic improvement in both settling and filtration characteristics resulting in faster

settling rates, higher densities, cleaner o'flow and also higher filtration rates and drier product.

Filtering

Since the filters are presently operating with up to 1/2 of the leaves removed there seems no question of filter area being more than adequate. In this area then the maintenance of proper feed densities, best vacuum conditions and other operating factors are what is required. Proper flocculation, cake thickness with relation to output etc. are all operating variables that when properly applied will give maximum output at minimum moisture.

The use of heated pulp and certain liquid chemicals such as wetting agents could improve normal operating discharge moistures.

As the expected tonnage increases along with finer size feed the filter surfaces can be increased by replacing segments to increase rate.

However, we all know that the filter rate was deliberately restricted by removal of filter segments in order to bring the filter cake production down to match the dryer capacities. This in a sense, and under the present condition, the more than adequate filter capacity cannot be used because of dryer limitations and absence of surge between filter and dryer.

Dryers

The dryer capacity regulates the filter rate and this is important in any future planning on the dryer section. The present dryers must be improved to the maximum thruput and it is possible that some of the means mentioned above to improve the dryer feed might be required.

Basically the dryers should have the capacity to accept surges in the thickeners caused by ore grade fluctuation or down time on filters and dryers or other causes.

As a very rough approximation the lead concentrate may require 1 1/2 dryers normal with 2 dryers to catch up on surges. The zinc might require 2 1/2 dryers with 3 at full capacity for surge.

It has be advocated that 1 large zinc dryer (equal to 2 present dryers) might be installed which could provide one present zinc dryer for intermittent

or constant use on zinc and one of the present zinc dryers could be used intermittent or constant for lead. This seemingly solves the problem but what happens when the big dryer goes down or its filter is down.

It would appear to me that the safest course might be to provide both lead and zinc with sufficient dryer overcapacity to handle normal feed surge. The bulk dryer would appear to be adequate and in times of abnormal lost time in this area the production of bulk concentrate could be suspended for a period.

The above would appear to hold true with or without surge capacity between the thickener-filter or filter dryers. The production must be handled on a basis of tons required in hours total — hours downtime — hourly factor for moisture variation. — reasonable safety hourly safety factor. This may result in possibly 120% or more design capacity. Even with this a breakdown resulting in substantial lost time could necessitate shutting down the plant

Summary Thickeners - Filter - Dryer

Thickeners

1- Adequate in size.

2- Could be improved with flocculation, heat and improved feed entry.

Filters

1- Ample size.

2- Operating parameters can be improved.

3- Flocculation, heat, filter aid (chemical) all could improve rate and moisture content. Lower moisture will assist drying.

Dryers

1- Apparently inadequate for normal production.

2- Have no excess capacity for surge correction.

3- Study of operation, operating parameters and equipment could show means for substantial improvement.

4- Need for added dryers seems well defined.

5- Addition of one large zinc dryer may not provide best overall answer.

6- Operational improvements in filtration could help dryer output rate as noted above.

7- Possible means of reducing dust recirculation might be rewarding. Investigation of dry dust collection with dry dust to production and only following wet scrubber product to return to thickener might prove interesting.

General

Improvements in metallurgy will result in increased tonnage of concentrates and at a finer size consist. This will increase burden on all equipment and should be recognized in analysing the thickener-filter-dryer complex and any proposed addition.

Entire system must be analysed to provide enough overcapacity to iron out surges caused by ore fluctuations, minor maintenance or other normal operating lost time factors.

Metallurgy

In this area of the Ames report I agree that the problems of lead recovery can possibly be solved within the scope of the present equipment with possible changes in techniques, operator efficiency, reagent modification and similar factors.

It might be well to consider Graham Eby's suggestion of adding additional mechanisms to the rougher tanks. This would have the effect of increasing flotation time or putting it another way it should increase the flotation efficiency over the same time period.

I also agree with the Ames report that the zinc flotation apparently has a slime problem.

I, of course, have no idea of what direction the laboratory is pursuing in solving the various problems but I do get the impression that the only real effort is in the direction of Soda Ash use as a cure. I sincerly hope that this is not so and that other methods are also under investigation of which there are very many to work on.

If the Cyananid report is valid the recovery of zinc from the slimy fraction is reasonably good the bulk of the zinc losses is in the plus 200 mesh size range. It seems quite possible that the fine size mineral might be absorbing all or most of the reagent leaving little or none for the coarser fraction. Also added to this could be normal slime interference with flotation. In any case it apparently addes up to critical losses in the coarser sizes.

In developing the flow sheet for White Pine Copper we ran into much the same problem. We were able to float fine sized mineral quite quickly but good recovery of the coarser fraction was obtained only with a very long flotation period and very large quantities of stage added reagents.

We solved the problem by cycloning the rougher tailing after a short float period, discarded the slime fraction and refloated for a short time the cyclone sands. This practice gave results equivalent to those obtained with more than double the number of flotation machines and much less than half of the reagents. This technique would appear to be very applicable to Anvil ore. It might be possible to deslime the rougher tail and float the sands in the present scavenger raws. If such a scheme is possible the net float time would be increased by over 30% because of slime tonnage rejection and increased scavenger efficiency.

Theoretically the circuit indicated use of 2-regrind mills on the zinc.

Only one is being used simply because not enough middling is floated to keep two mills busy.

Where does this idea originate?

I notice that in recent periods when zinc bulk concentrate is produced. that no great improvement in overall zinc is being made. This is a further indication that the proportion of new zinc mineral floated in the roughers and scavengers in relatively the same regardless of the middlings being bled out in the bulk concentrate.

There is no evidence whatever to support the

I would be inclined to think that use of Soda Ash might provide results evidence of middles somewhat along the following lines.

1- Dispersed pulp with probable less recovery of fine sized zinc. Overall recovery should be improved.

There is no reason to suppose that this is true Avoid fine quite well. naturally floats

2- Concentrate grade may be more difficult to maintain since pyrite rejection might prove more difficult.

True but we handle it.

3- Reagent costs would tend to increase with Soda Ash being more expensive and higher consumption of cyanide per ton indicated. Collector and frother consumption should decline. Copper sulfate consumption would also tend to decrease.

Yes good

4- Thickening, filtering and drying might become more difficult if pulp dispersion is not overcome with lime or other addition in concentrate.

Summary of Metallurgy

Possible methods of improving recoveries of metals might be benefited by the following investigation:

1- Water quality — Damn all could be done about it - to access
Discussed in previous memos. 25 tons/minute of water would take a treatment station the size of Shiloh Inn. Water Treatment Centre

2- Pulp temperatures
Elevated temperatures for both flotation and thicking-filtering and drying.

Mama Mia! 10^8 BTU/hour!

3- Lead flotation
   a- Reagent modification.
   b- Float conditions.
   c- Float time or increased efficiency.

4- Zinc flotation

a- Reagent modifications, including calcium and/or sodium sulfite. Soda Ash, sodium aerofloat.

b- Technique ← Presumably he refers to 242

1- Desliming and refloat of rougher sands.

2- Increase of float time.

3- Elimination of midds thickener -
Note that desliming (1) above is a neat way of dewatering without a thickener.

4- Regrind requirements.

5- General
In general while the mill is hampered in experimentation by economic reasons this does not apply to the laboratory and in this case the field is wide open.

W. A. Hamilton

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WAH/dt

cc: E. S. Allen
P. W. Allen