

006959

TO: Mr. R. E. Thurmond

FROM: H. Lyall Ames

SUBJECT: Visit to the Anvil Corporation Mill at Faro, May 8 - 10,  
1972

C.C.: Mr. R. L. Haffner, Mr. N. G. Cornish, Mr. H. H. Cox,  
Mr. P. Taggart and Mr. P. J. Brown

This report covers my visit to the Anvil mill on the above dates and preliminary comments regarding the proposed mill expansion. The main items are summarized as follows, with more details being given in the text.

#### 1. SUMMARY

(1) Mill Expansion - At a special meeting May 10 Mr. Thurmond requested that we proceed with the design of a mill expansion to bring the mill capacity to 10,000 TPD with optimized flotation circuits and to make the layout so that it could be further expanded for an overall capacity of 15,000 TPD if required at a later date.

(2) Bulk Concentrate - It may be advisable or even necessary to reduce the production of bulk concentrate by 50%. The effect of this on the overall metal recovery in the selective concentrates was estimated at 2% less for the zinc and 1% less for the lead.

(3) Regrinding Lead Circuit Tailing - Following laboratory testing which has indicated a significant improvement in zinc recovery with finer grinding, a mill test was started on May 10 using the spare regrinding mill to regrind a portion of the lead circuit tailing. If the results of this test are promising a series of circuit changes are planned to permit using a second and probably even all three regrinding mills for this purpose.

(4) Sodium Sulphite - Laboratory tests continue to give interesting results with this reagent particularly in the differential flotation of all three metals - copper, lead and zinc in that order. A mill test some time ago was not successful but this may have been due to other difficulties at the time. A second mill test is being planned and a quantity of sodium sulphite has been ordered.

(5) Lead Regrinding - On May 10 regrinding of the lead scavenger concentrate and the retreatment tailing was suspended. This is an important test as it may release one regrinding mill for grinding the zinc circuit feed.

(6) Collecting Reagent Test - Z-11 is being substituted for Z-200 at three day intervals and I would expect it to help maintain a higher zinc grade in the zinc concentrate.

2. MILL EXPANSION

On my last visit to Faro in March, Peter Taggart, Peter Brown and I were asked to consider the requirements for increasing the mill capacity to a nominal 10,000 TPD and at the same time provide adequate flotation capacities and circuit changes which are considered economically advisable.

Following some rough plans and calculations Peter Taggart submitted a preliminary estimate of the cost of such an expansion at \$2,000,000 in a letter dated April 25. At a meeting with Mr. Thurmond, Mr. Haffner and Mr. Cornish on May 10th we were advised to proceed with the 10,000 TPD plan so that concentrate production could be maintained at the present level after 1973 when the grade of ore milled will be lower than the current 10.4% combined lead and zinc. We were also advised to make the 10,000 TPD layout applicable to a further expansion to 15,000 TPD at a later date if required. The following comments cover the main items discussed at this meeting and some recommendations regarding immediate work to be done.

(1) Project Schedule

May 15 - July 15, 1972, Flowsheet development,  
functional equipment selection, basic concept of  
circuit arrangement by P. T., P. J. B. and H. L. A.

July 15 - Engineering started

Jan. 15, 1973 - Engineering completed

Jan. 15 - Feb. 15 - Construction contract bids

April 1973 - Construction started.

(2) Personnel

Peter Taggart and Peter Brown will be essentially in charge of the first phase of the project. Mr. Thurmond will obtain the services of an experienced layout draftsman from Wright Engineering or other company to work at the mine site with P. T. and P. J. B. in developing alternative equipment layouts for consideration and finally one which will form the basis for the actual detail engineering.

Although I will not personally become involved with details of the project I will assist these men in any way I can. If I am kept informed continually of their work by telephone, letter and draft arrangements I will be prepared to spend an average of about one day a week while in Port Credit. This would extend through the planning stage and on occasion I could meet for a day or so with P. T. and P. J. B. in Vancouver during engineering.

(3) Preliminary Layout

The first general plan considered was based on the following circuit locations.

(a) Completely new lead roughing and scavenging circuits consisting of all new large cells in the extension with space left for additional cells if mill capacity were raised to 15,000 TPD.

(b) For the 10,000 TPD plant the lead cleaning circuits could remain in their present location with a few additions to the existing cell banks. However space is not available here to accommodate the necessary cells for a 15,000 TPD operation so if this were required a completely new lead cleaning system would have to be installed in the extension. Whether or not this should be done in the first place is open to question.

(c) The new zinc roughing circuit would consist of new large cells in the extension with space left for additional cells later.

(d) The zinc scavenging circuit would consist of the present zinc first cleaner, retreatment, and rougher-scavenger cells (5 rows in all).

(e) Zinc cleaning would be done with a rearrangement of the cells in the current lead roughing - scavenging section and the existing final zinc cleaner banks.

The foregoing changes appear rather complicated and no doubt will be revised or completely changed before the planning stage of the project is completed. I think that both roughing sections are sound but the cleaning circuits required for 10,000 TPD and 15,000 TPD will have to be analyzed carefully. Of course if the head assays decrease in the same proportion as the tonnage of ore milled increases the cleaning circuits would not be too different.

(4) Mill Visits

Because of the tight planning and engineering schedules it is important to decide as soon as possible what type of new flotation cells are to be used (Denver DR 200 or 300 CF, Agitair #120 or #120 A, or Wemco #76). Several companies using these cells were to be phoned on May 12 and hopefully a few plant visits could be arranged for the next week or two. The question of which cells to use is really a decision for the operators (P. T. and P. J. B.). Personally I have a preference for Fagergren or Agitair for making optimum tailings and Denver for final cleaning (possibly for roughing or most cleaning).

but not for scavenging. However I have only been actively involved to a limited extent with Denver DR. In any case I agreed with the larger cell but emphasized that P. T. and P. J. B. must actually see the type of cell they intend to use, in operation, on a massive sulphide high grade ore at a relatively coarse grind as at Anvil. Cell arrangement is important and although I can assist along these lines other operations should be studied and discussed with the operators.

(5) Office

I suggest that if at all possible another office be set up outside the mill building where P. T. and P. J. B. could work for about 80% of their time the next two months on the project without operating distraction, except in emergencies. The new layout draftsman would also work in this office. I cannot over-emphasize the importance of thorough detail work at this stage.

(6) Grinding

Unfortunately final test work regarding the economics of further grinding of either the mill feed or the lead scavenger tailing to improve metal recoveries is not complete. The current regrinding test on the zinc circuit feed which was started on May 10 may produce some indicative results in time to assist in planning the ultimate flowsheet.

We know that the current primary grinding is too coarse. I am even concerned that the grinding for the extra tonnage for the new 10,000 TPD plant depends entirely on increasing the speed of the present three primary ball mills. However I think that this is the only course to follow as it would be unwise to rush into a new costly grinding circuit, unless a much more thorough economic study were made, than we have time to do. There is a possibility of course that the planned circuit testing may show that one or both of the two regrinding mills are not required in their present capacity and can be used to regrind the zinc circuit feed. This would really be worthwhile. In any case the extension circuits should be planned for more grinding sometime in the future, probably even with a new large mill operating as a second stage of primary ball milling.

(7) On-Stream Analyzer

The new circuit layouts should be compatible to sampling for an on-stream analyzer installation even if it is not installed at the time.

(8) Aeration

Space should be left in the extension for the installation of one or two Noranda type aerators at least if another grinding unit is

added either for 15,000 TPD or before if more grinding is found necessary for 10,000 TPD.

### 3. BULK CONCENTRATE

Mr. Thurmond has been advised by the German purchaser of Anvil's bulk concentrate that because of I.S.F. problems they would like to reduce their contracted bulk tonnage by 50%, to about 125 TPD. We were asked for an estimate of the loss which would be incurred to Anvil by such a curtailment of the bulk concentrate. Laboratory tests have shown that the fourth zinc cleaner tailing (which all goes to bulk and assays 42% zinc and represents about 12% of the total zinc recovered) can be upgraded to 52% by three stages of cleaning with a metal loss of 25%. This represents therefore 3% of the recovered zinc. We estimate that in mill practice this loss would be 4% and therefore on one half of the bulk concentrate would be 2%.

There is little laboratory evidence as to how much lead would be lost due to curtailing the bulk concentrate but both P. T. and P. V. B. think that it would be less than for the zinc and have estimated a 1% loss for a one half reduction in bulk concentrate.

It is to be noted that in the case of the lead anyway and to some extent for the zinc it would be a more serious matter to eliminate all the bulk concentrate as a certain amount of so called garbage products go into the making of the bulk concentrate. In time, with better sump and pumping arrangements for spillages; there should be less of this type of material to dispose of one way or another.

#### 4. REGRINDING ZINC CIRCUIT FEED

We have known for a long time that finer grinding would improve metal recoveries, particularly of the zinc. This has become more noticeable and serious as the milling rate has been increased gradually to 8500 TPD. As new grinding equipment is expensive various ideas have been explored in the laboratory and some are now being initiated in the mill to produce a finer zinc circuit feed. Peter Brown covers the subject quite well in his report, "Regrinding the Lead Scavenger Tailing" which I have read in draft form. The next steps in the mill test were discussed previously in paragraph (6) in the Mill Expansion section.

#### 5. SODIUM SULPHITE

I have always been interested in the use of sodium sulphite at Anvil. It is not an active reagent but occasionally improves zinc

grade on this type of ore. Now there is another aspect to its use, that of floating a copper concentrate prior to the lead. I observed a laboratory test where three separate concentrates - copper, lead and zinc - were floated differentially following a grind with 2.5 lb. sodium carbonate and 2.5 lb. sodium sulphite. No cyanide was used as it apparently promotes the flotation of lead too quickly. The collector used for the copper float was a very small dosage of Z-200. Although I did not see the assays from this test the concentrates looked good and on similar tests 20% copper concentrates have been produced with a 50% recovery. Even with a mill head of only 0.17% copper this represents a worthwhile potential source of revenue and the investigation should be continued when time permits. Also, a small space should be left in the new extension for some copper cells. In the meantime a sufficient supply of sodium sulphite has been ordered for another mill test in the near future.

#### 6. LEAD REGRINDING

There is nothing much to add to the note in the summary of this report until some metallurgical results are forthcoming from the present mill test.

## 7. COLLECTING REAGENT

They are currently running a three day on and three day off test with Z-200 vs. Z-11 in the zinc circuit. Because of the high circulating loads it is difficult to assess small differences in metallurgy. However almost all mills on heavy sulphide ores eventually find that some fairly critical proportion of different collecting reagents give slightly better average metallurgy. If a benefit is consistently obtained in the laboratory (as at Anvil) the reagent combination should be tried for longer periods in the mill. I suggest two weeks as a minimum time once mill dosages are more or less established.

## 8. LEAD CONCENTRATE GRADE

At the meeting noted above we were advised that the lead concentrate grade of 72% may not be too critical and that we could reduce this to 70%. I appreciate that, as the grade has been raised gradually from 67.1% in 1971 to 72.6% last month, there has been no sudden apparent loss in lead recovery noted. However there is no doubt from the very tight froth all through the lead circuits that a higher metal recovery would be effected if the grade were not forced to the steep slope section of the Grade-Recovery curve where operation is critical.

## 9. BARIUM AND MERCURY

These two impurities in some Anvil products are worrisome to say the least as there are few avenues of attacking the problem. The limit for BaO in the bulk concentrate is 0.3%. The concentration of barium in the fourth zinc cleaner tailing (which constitutes most of the bulk concentrate) shows that it, like most non-sulphides, can be reduced by water cleaning. If barium continues to be economically critical from a sales standpoint further cleaning could be incorporated into the circuits and a final tailing cell product discarded completely. With test programmes temporarily limited to the practical aspects of the mill expansion no time is available to test possible depressing reagents for these impurities. In the meantime I will try to obtain some information regarding the mercury.

## 10. ZINC RECOVERY

Zinc recovery remains the most serious metallurgical problem. Although the zinc selective concentrate grade of 51.9% for March is only 0.1% lower than the forecast for 1972, the overall recovery of 72.0% is 7.4% below the 79.4% predicted. Furthermore this recovery has been falling the last three months. At an estimated revenue loss of \$400,000 per year for each 1% loss in recovery it is apparent that major steps can be afforded in attempting to improve zinc

recovery. At these high milling rates (even 8,000 TPD) the grinding is much too coarse and forces the operation to the edge of the steep slope of the Grade-Recovery curve. From a practical standpoint this means that mill metallurgy is critical to small interfering conditions such as type of ore, inexperience of operators or mechanical problems. Until recent months I have concerned myself mainly to circuitry, reagents, general operation and test programmes because I wanted these factors stabilized first. Now with the background of metallurgical information on Anvil ore from their test work and the larger mill through-put grinding becomes a major issue and the mill testing noted elsewhere in the report is extremely important to the whole economics of Anvil ore treatment. I like the decision made on May 10 to reduce the nominal milling rate slightly to 8,000 TPD with 10.4% combined ore grade.

May 17, 1972