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H. LYALL AMES LIMITED

1573 BROADMOOR AVENUE
PORT CREDIT
MISSISSAUGA, ONTARIO
TELEPHONE 416 278-9314

006940

CONSULTING SERVICES IN MINERAL PROCESSING

February 18, 1974

TO: Mr. R. L. Haffner

FROM: H. Lyall Ames

SUBJECT: Anvil Corporation Mill

C. C.: Messrs. P. J. Brown, N. G. Cornish, H. H. Cox,
J. F. Olk, P. Taggart and R. E. Thurmond.

This report deals with my visit to the Anvil mill February 6 - 11, 1974, to assist the mill staff in conducting a mill test with ammonia on 30,000 tons of ore from the "Yellow" Low Grade Stockpile.

The overall metallurgical and operational results were encouraging. Zinc metallurgy was good following elimination of lime to the zinc roughing circuit early in the test. Lead metallurgy was acceptable. A great deal of information was obtained regarding the technique of using ammonia as a substitute for a substantial portion of the normal soda ash requirements.

Unfortunately however conclusions from the mill test must be considered somewhat conditional with respect to the treatment of oxidized ore because a laboratory test on February 10 indicated that

the ore was not particularly oxidized. However even if we do not have at this time conclusive evidence the mill test indicated that (1) normal soda ash requirements can be reduced by 50% with the use of ammonia on any Anvil ore, (2) Low Grade "Yellow" stockpile ore (and quite possibly also "Red" stockpile ore) can be milled with better metallurgy than predicted for oxidized ore in my September 12, 1973, report, (3) zinc metallurgy can be improved on any ore with the use of ammonia, (4) the use of lime can be reduced or eliminated in the zinc roughing circuit and (5) normal operation and froth condition in all the zinc circuits can be improved with the use of ammonia in the primary grinding circuits and/or lower alkalinities.

The foregoing comments and grade recovery data in the following outline of the mill test should not be used literally in serious predictions for future mine planning until confirmed by another mill test to be run in the near future on ore from another stockpile which is definitely known to be oxidized and refractory. These results would be more meaningful as the new primary grinding units as well as more flotation circuits will be in service and the milling rate will be 8000 - 10,000 T.P.D. as against about 6000 T.P.D. during this last test.

1. RECOVERIES

For three days, February 8 - 10, (except for several periods when the circuits were temporarily upset by pump troubles, blockage of 2-11 reagent lines and new mill section stoppages) the estimated lead recovery was in the 83% - 87% range with a 65% - 70% Pb concentrate and the zinc recovery was in the 84% - 89% range with a 51% Zn concentrate (third cleaner). These zinc recoveries are very good considering that we had predicted from the first mill test with ammonia that they might be 10% below average even with fresh ore.

2. REAGENTS

(1) Conditioning Reagents - The main reagents under consideration were the conditioners (a) soda ash, (b) sodium sulphite, (c) ammonia, and (d) lime. A general idea of the various combinations of these conditioning or modifying reagents in lb. per ton of ore used prior to and during the test is presented in the following table.

	<u>Soda Ash</u>	<u>Sodium Sulphite</u>	<u>Ammonia</u>	<u>Lime to Zn Rougher</u>
Normal Ore	2	2	-	Yes
Stockpile Oxidized Ore	2.5-7.0	3.0-3.5	-	Yes
Feb. 6 - Normal Ore	1.0	1.0	1.0-2.0	Yes
Feb. 7 - Start of S. P. Ore	2.7	1.7	1.0	Yes

	<u>Soda Ash</u>	<u>Sodium Sulphite</u>	<u>Ammonia</u>	<u>Lime to Zn Roughers</u>
Feb. 7 - Test Abandoned	6.0-7.5	2 - 3.5	-	Yes
Feb. 8 - Test restarted S. P. Ore	3.5	3.5	.7	None
	3.0	3.0	.8	None
Feb. 9 - S. P. Ore	2.5	3.0	.8	None
	2.0	3.0	.8	None
	2.0	3.0	1.0	None
Feb. 10 - S. P. Ore	2.0	2.5	1.0	None
	1.5	2.5	1.0	None
	1.0	2.0	1.0	None
Feb. 11 - Start Pit Ore	1.0	2.0	.9	None

(2) Lime - The most important reagent change other than the use of ammonia in the grinding circuits was the elimination of lime entirely from the zinc roughing circuit. This was done more or less as a last resort when the circuit became completely unmanageable at the normal pH of about 11.3 which was previously thought necessary to maintain a satisfactory flotation differential. Actually it was found that a good grade zinc rougher concentrate could now be obtained with a pH as low as 9.3 and all the zinc circuits were more stable than I have ever seen them before.

(3) Frother MIBC - Another reagent besides lime which appeared incompatible with the use of ammonia was frother 1012 in the lead roughing circuit. This was replaced with MIBC.

(4) Z - 200 - Early in the test the use of Z - 200 as a secondary collector in the zinc roughing circuit was discontinued because its strong frothing characteristics made circuit control difficult.

(5) Lime to Lead Cleaners - The alkalinity in the lead cleaning circuits is normally maintained at about pH 9.3 in the first cleaner, pH 9.7 in the second cleaner and pH 11.4 in the last cleaner by adding lime only to this last stage. Laboratory tests showed that very little iron was being rejected in the first cleaners with the low 9.3 pH. We tried raising this in the mill but discontinued it in order not to introduce another variable into the main mill test.

(6) MIBC - I tried with moderate success to promote the use of minute quantities (1 drop every 5 - 20 seconds) of MIBC to the lead final cleaner to replace the "yo - yo juggling" of the pH to this circuit with lime largely for froth control. I think that the use of MIBC would permit keeping the pH a point or so higher and thereby improve pyrite rejection without endangering froth overflow from the cells.

3. EXPERIMENTAL RECOMMENDATIONS

The current preliminary success with ammonia on stock-pile ore has opened up new avenues of experimentation. I would not recommend too much of this in the mill anyway until all the new grinding

and flotation circuits are in operation. I think that it would be better to concentrate on minor adjustments of reagents to consolidate the over-all operation as it has been most of the time since February 9. Some ideas for future experimentation were discussed.

- (1) Reduce or eliminate copper sulphate to the zinc roughing circuit pump box. *done*
- (2) Ammonia to the zinc rougher feed.
- (3) Ammonia to the zinc cleaning circuits. *Test work?*
- (4) I think it may be important to feed all three main conditioning reagents - soda ash, sodium sulphite and ammonia - to all three rod mills instead of the present practice.
- (5) Install a micro MIBC feeder to the last lead cleaner circuit. *CLARKSON PROJECT FOR SAM BOWE?*
- (6) Lime to the first as well as last lead cleaners.
- (7) Reduce ammonia from 1 lb. per ton to .75 lb. and 0.5 lb.

H. Lyall Ames