ALEXCO

March 17, 2009

Yukon Environmental and Socio-economic Assessment Board
Mayo Designated Office
PO Box 297
Mayo, YT Y0B 1M0

Attention: Loralee Johnstone, Project Assessment Officer

Dear Ms. Johnstone:

Re: YESAA Project Proposal for Type A Water Use & Quartz Mining Licence Applications Bellekeno Mine Development, Keno Hill Silver District, Yukon, YESAA Project 2009-0030 Supplemental Information for Response to YESAB Information Request (February 27, 2009)

Alexco Keno Hill Mining Corp's March 10, 2009 response to the YESAB information request dated February 27, 2009, addressed questions regarding tailings management, including expectations of water quality from the dry stack tailings facility (DSTF).

Please find attached Process Research Associates Ltd.'s (PRA's) final report received March 13, 2009, which includes supplemental information on environmental characteristics of tailings including acid-base analysis (ABA) of tailings and tailings water assay results.

If you have any questions or require further details, please contact the undersigned at (604) 633-4888.

Sincerely,
ALEXCO KENO HILL MINING CORP.

for

Brad A. Thrall, B.Sc., MBA
Chief Operating Officer

Attachment

cc: S. Mervyn, Chief, NNDFN
D. Buyck, Director, Lands, NNDFN
C. Nauman, Alexco
D. Cornett, Access Consulting Group

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METALLURGICAL TESTING OF SAMPLES ORIGINATING FROM THE BELLEKENO PROJECT

Prepared for:	**ALEXCO RESOURCE CORP.** Suite 1150 – 200 Granville St. Vancouver, BC V6C 1S4
Attention**:**	**Mr. Brad A. Thrall** **Dr. John Huang, WARDROP**
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Date: March 13, 2009

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1.0 SUMMARY

Systematic metallurgical and environmental testing has been conducted on mineral samples originating from Alexco’s Bellekeno property located in central Yukon. A Bellekeno master blend made up of 68% of SW zone sample and 32% East zone sample and its separate components were tested. A third sample (Onek) was blended and assayed only.

The head assay showed a master composite with considerable values (1041.2 g/t Ag, 15.5% Pb, 12.4% Zn). The East zone and Onek composites showed high Zn grades mainly, while the SW composite contributed to all the metal values as shown in the following table.

Element Unit	**Au** g/mt	**Ag** ppm	**Pb** %	**Zn** %	**Fe** %	**S(tot)** %
Master Comp	0.40	1041.2	15.45	12.39	12.18	9.6
East Zone Comp	0.39	328.8	2.53	16.12	18.77	10.3
SW Zone Comp	0.48	1375.4	25.41	9.21	9.22	9.1
Onek Composite	0.51	183.2	1.26	22.36	19.12	12.6

The scoping flotation tests indicated that a Pb/Zn differential scheme worked very well on Bellekeno samples. Recoveries of all major metal values were well above 90%. Zn depression in the Pb flotation stage was successful with the addition of ZnSO4 alone. The upgrading of the rougher concentrates proved to be satisfactory with Pb concentrate grades generally higher than 70% Pb and Zn concentrate grades around 60% Zn.

The test results also indicated that the performance was slightly particle size sensitive. Coarser materials (>130µm) floated quite selectively but were better liberated after a light regrind.

Three locked cycle flotation tests were conducted to evaluate the performance considering the recycling streams. The products were of high grades and the recoveries were all above 90%.

Variability tests on two zone composites and eight level composites yielded similar results. Reagent dosages and flotation time may need to be adjusted to fit the feed characteristics.

The BMI (Bond Ball Mill Index) of three zone composites, ranging between 7.7 – 8.2 kWh/t, showed that the materials are soft. However, these materials are moderately abrasive, with an abrasion index (AI) of 0.438 g for the Master comp. Settling tests and filtration tests were also conducted. In addition, environmental tests such as ABA and TCLP were performed to assess potential environmental impact of tailing materials. The preliminary results indicated that the final tailings are unlikely acid generating.

Further optimization is recommended to improve the overall performance, especially reagent dosages. Kinetic environmental simulation tests such as humidity cell and/or column leaching should ensure that longer term disposal problem will not arise.

2.0 INTRODUCTION

Process Research Associates Ltd. was commissioned by Alexco Rescource Corp. to undertake a precious and base metal recovery study on three samples originating from the Bellekeno/Onek project. The purpose of this testing is to determine the responses of these samples to flotation and to evaluate the environmental effects of the process tailings.

A metallurgical study on Bellekeno and Silver King ore samples was conducted by PRA in 1996 (PRA project number 96-095). At the request of the client, the Bellekeno samples were to be tested first while the Onek samples were deferred to the second phase of study.

This report summarizes the procedures and results of the test program.

3.0 PROCEDURES

3.1 SAMPLE PREPARATION AND CHARACTERIZATION

The received samples (including core samples, assay rejects, and bulk samples) were sorted, weighed and logged in. The sample receiving sheets are provided in Appendix 1.

To ensure a representative master composite and leaving enough sub-samples in case of irregular metallurgical responses, zone and sub-zone components were grouped by drill holes and depths. The samples were first combined into 16 level composites. These composites were then proportionally grouped into 5 sub-zone composites. Three zone samples were composited by combining part of the sub-zone composites. In addition, a Master composite, containing 68% of SW zone comp and 32% East zone comp, was prepared. For flotation development only core samples were used. Assay reject samples were primarily used in the hardness testing and for bulk tailings generation purpose. The compositing instructions provided by the client are summarized in Appendix 1. Each sample was stage crushed individually at a 10-mesh setting, then blended by riffling, and split into 2.0 kg test charges to be used for laboratory bench scale studies.

Approximately 300g of sub-sample was split out from each of the four main composites and pulverized for head assay. Precious metals analyses primarily consisting of gold (Au) and silver (Ag) were performed by standard fire assay procedures with both a gravimetric and an atomic absorption (AA) finish.

Head analyses on various product samples were performed by aggressive digestion in a suite of four mineral acids for ICP scanning by induced coupled plasma spectrophotometry. The ICP scans provide quantitative determinations of multi-element metal species that include silver. Particular metals of interest were also assayed by titration or atomic absorption spectrometry (AA). Total sulfur was measured in a Leco furnace, and sulfides were assayed by wet chemical gravimetry. The quality control and assurance procedures included submission of laboratory standards and blanks with each batch of samples analyzed.

3.2 GRINDING AND SIZE ANALYSES

Primary grinding was performed in a stainless steel laboratory rod mill. Test grinds were used to calculate the time requirements to meet specified targeted particle size distribution. A standard charge to the mill was prepared at ~65% by weight solids content, and a particle size analysis was performed on the ground product.

Particle size analyses were conducted for each ground sample using a Rotap™ equipped with 20 cm (8”) diameter test sieves, stacked in ascending mesh sizes. Each sample was initially wet screened at 37 microns (400 Tyler™ mesh). The +37 micron fraction was then dried and re-screened through the stacked sieves. Each sieved fraction was collected, weighed, and the individual and cumulative percent retained calculated. A Coulter® analyzer was used for providing particle size in finer product streams.

3.3 BENCH-SCALE FLOTATION

Batch flotation testing on the samples was conducted in a Denver D12 laboratory flotation machine. Commonly 2 kg of feed was slurried to approximately 33 wt% with municipal water at ambient temperature. The D12 impeller speed was set based on the cell size selected and the airflow was controlled manually to maintain the froth level.

MIBC (methyl isobutyl carbinol) was used as the frother. Collectors and modifying agents were evaluated and these are outlined in the specific test reports that are appended. The typical circuit consisted of staged rougher flotation with the resulting concentrate reground and cleaned in several stages. A series of open cycle kinetic and cleaning tests were undertaken for the program, which was followed by locked cycle tests. Detailed test reports including test procedures, metallurgical balances and particle size analyses are provided for open and locked cycle testing respectively in Appendix 3 and 4.

3.4 ANCILLARY TESTS

Settling tests were performed in 2-liter graduated cylinders equipped with a rake mechanism after the flocculent screening test.

A Bico mill was used to determine the standard Bond ball mill index. Acid Base Accounting procedures using the Modified Sobek method were applied on selected process tailing samples. TCLP tests were conducted according to EPA 1311 protocol.

Abrasion index and Bond work index determinations were conducted at SGS in Lakefield, Ontario. Mineralogical examinations were performed by Dr. Rainer Lehne & Associates in Germany.

3.5 BULK FLOTATION TESTS

Larger-scale flotation was conducted in a dual-compartment flotation machine of 57L capacity. Feed for testing was prepared from leftover samples, including the assay rejects. The main objective was to produce sufficient quantities of the primary Zn-scavenger tailings and a high pyrite tailing from the Zn-cleaner circuit for backfill testing. As per the client's directions, the cleaner test procedures were modified to produce adequate amounts of the latter product. A single-stage of Pb-cleaning without regrinding was to be followed by forwarding the Pb-cleaner tails to a single-stage Zn-cleaning test. Three additional Zn-cleaner scavenger stages were needed to produce the tailing sample. Details of testing are shown in Appendix 5.

4.0 RESULTS AND DISCUSSION

4.1 SAMPLE PREPARATION AND CHARACTERIZATION

Two batches of samples were received on September 16 and 22, 2008 respectively. Sorted sample lots were blended as per the client's instructions and labeled accordingly. The head assay results are summarized in Table 1.

Table 1. Summary of Head Assays

Element Unit	Au g/mt	Ag ppm	Pb %	Zn %	Fe %	S(tot) %
Master Comp	0.40	1041.2	15.45	12.39	12.18	9.6
East Zone Comp	0.39	328.8	2.53	16.12	18.77	10.3
SW Zone Comp	0.48	1375.4	25.41	9.21	9.22	9.1
Onek Composite	0.51	183.2	1.26	22.36	19.12	12.6

The Bellekeno SW zone composite contains much higher Ag and Pb than the East zone and Onek zone composites, while the latter two have higher Zn grades. The Master Composite was blended from 68% of SW and 32% of East composite, and better balanced in metal grades. All samples have Au contents in the range of 0.4 - 0.5 g/t and 9.1-12.6% total sulfur.

4.2 GRINDABILITY STUDY

The Bond ball mill work indices for individual zone-composites and the Bond rod mill and Abrasion index for the Master blend are listed in Table 2. From the data shown it can be seen that the Master composite is moderately abrasive and very soft towards rod milling. The three zone composites are also soft in terms of ball mill grinding. Details of the grindability test results are presented in Appendix 2.

Table 2. Grindability Tests Results

Sample Name	RWI (kWh/t)	AI (g)	BWI (kWh/t)
Master Comp	8.7	0.438	-
East Zone Comp	-	-	7.9
SW Zone Comp	-	-	8.2
Onek Comp	-	-	7.7

4.3 FLOTATION TESTING

An initial study conducted at PRA (Project #96-095) showed that a blend of Bellekeno and Silver King materials responded readily to sequential flotation. The depression of Zn minerals was achieved by adding Na_2SO_3 and $ZnSO_4$, while CMC was used for graphite control. Considering the earlier results, it was contemplated that a simplified reagent regime could be introduced.

4.3.1 Primary Flotation Tests

Tests F1 through F4, inclusive, are preliminary tests on Bellekeno Master composite. The purposes of these tests were to develop an effective scheme for processing the Master composite and to find the optimum primary grind size. Collectors used in the testing include potassium ethyl xanthate (PEX) and Cytec AEROFLOAT 242 (A242) for Ag/Pb flotation, and sodium isopropyl xanthate (SiPX) for Zn flotation, with MIBC as the frother. Two rougher floats plus one scavenger float were performed for both the Pb and Zn stages.

Table 3. Summary of Kinetic Rougher Flotation Tests

Test ID	Grind P_{80}	Specific Product Mass Pulls (%)		Specific Product Grades (%)		Specific Product Recoveries (%)			Zn-Tails Grade (%), (ppm Ag)		
	(µm)	Pb	Zn	Pb	Zn	Ag	Pb	Zn	Ag	Pb	Zn
F1	100	21.8	24.6	66.66	39.55	96.2	99.2	92.9	11.4	0.06	0.10
F2	79	23.6	24.6	61.45	43.95	97.2	99.4	90.5	8.4	0.05	0.14
F3	144	24.0	24.4	56.36	43.26	96.4	99.3	89.6	13.3	0.07	0.20
F4	126	23.2	26.2	61.78	43.19	96.2	99.0	91.3	14.4	0.15	0.11

As shown in Table 3 and Figure 1, all major metal values recovered very well into their appropriate products. Over 96% of Ag and ≥99% Pb reported to the Pb-rougher concentrates. Depression with $ZnSO_4$ alone in the Pb circuit was very effective as up to 93% Zn was recovered in the Zn-rougher concentrates. Finer grinding yielded subtle improvements only, suggesting that adequate liberation was already achieved at the coarsest P_{80} of 144 µm tested. At a medium fine P_{80} of 100µm in F1, the best Pb-rougher grade was obtained in this series. However, the selectivity against Zn worsened slightly at the finest grind in F2. For economic reasons a primary P_{80} of 140μm would be preferred, as the overall Pb-recoveries appeared quite stable (Figure 1). Cleaning would then reject more of the Zn into its ultimate product. Lower Zn-tailing grades generally occurred at finer primary grinds (Figure 2), but further optimization could easily equalize performances at all grind sizes tested.

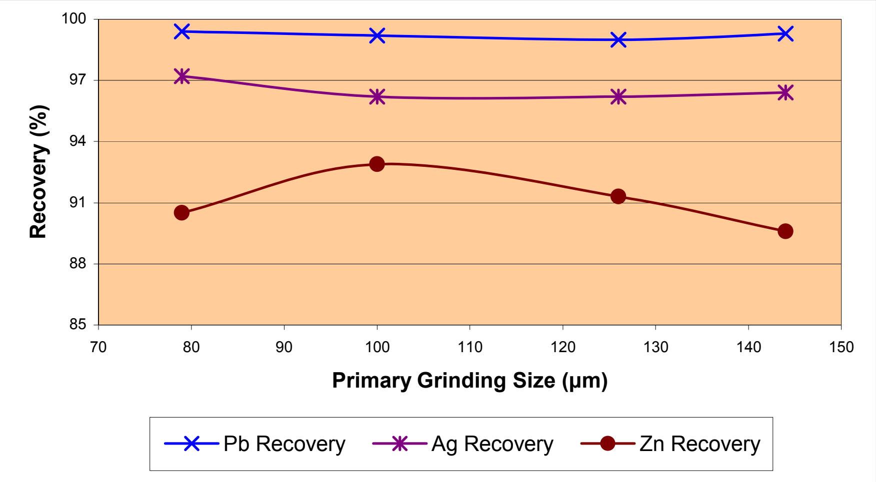

Figure 1. Metal recoveries vs. primary grinding sizes

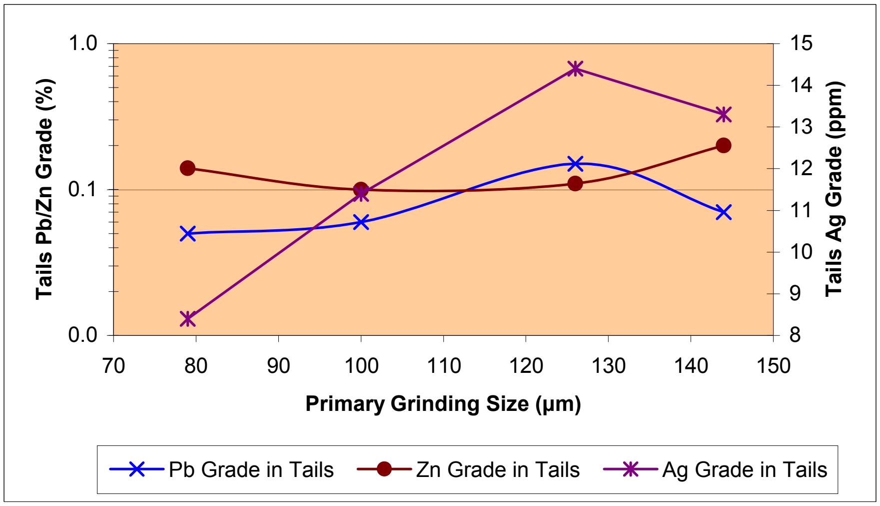

Figure 2. Tailings grades vs. primary grinding sizes

4.3.2 Cleaner Flotation

In F5 to F7 the effects of regrinding on the cleaner product grades were studied (Table 4). Test F6 was done at a fine primary grind without any regrinds, and this achieved very respectable results. At 148μm also without Pb-regrinding (F10), the grade dropped slightly but a favorable grade-recovery curve (Figure 3) was maintained. Progressively finer regrinds in F5 and F7 showed few benefits.

Table 4. Effects of Regrinding

Test ID	Primary Size (μm)	Regrind Time (min)		Mass Pull (%)		Grade (%)		Recovery in Pb Conc(%)		Zn Recovery in Zn Conc(%)
		Pb Conc	Zn Conc	Pb	Zn	Pb in Pb Conc	Zn in Zn Conc	Ag	Pb	
F5	143	10	0	22.6	25.1	82.33	57.81	95.0	98.6	91.0
F6	102	0	0	23.2	25.7	81.79	64.13	96.7	99.3	90.9
F7	148	20	10	24.2	25.7	81.25	67.74	96.7	99.2	89.1
F10	148	0	0	24.0	24.8	75.69	64.37	96.5	99.3	90.0

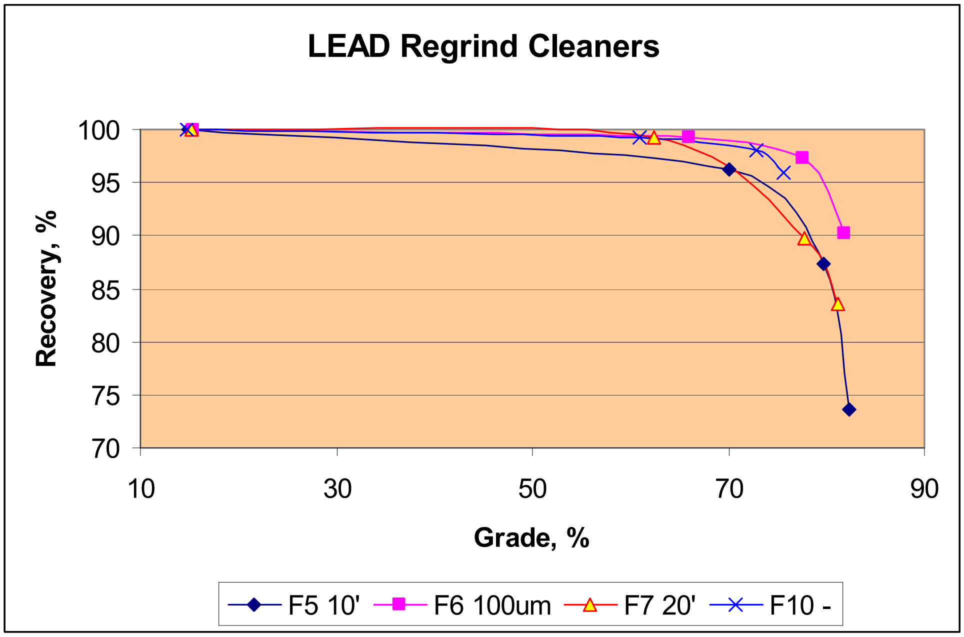

Figure 3. Effect of Regrind on Pb-Cleaning

As indicated in Figure 4, the Zn-upgrading also responded poorly to regrinding. The slight grade-improvement in F7 was at the expense of increased cleaner losses. A small regrind facility, however, would be prudent to keep at hand.

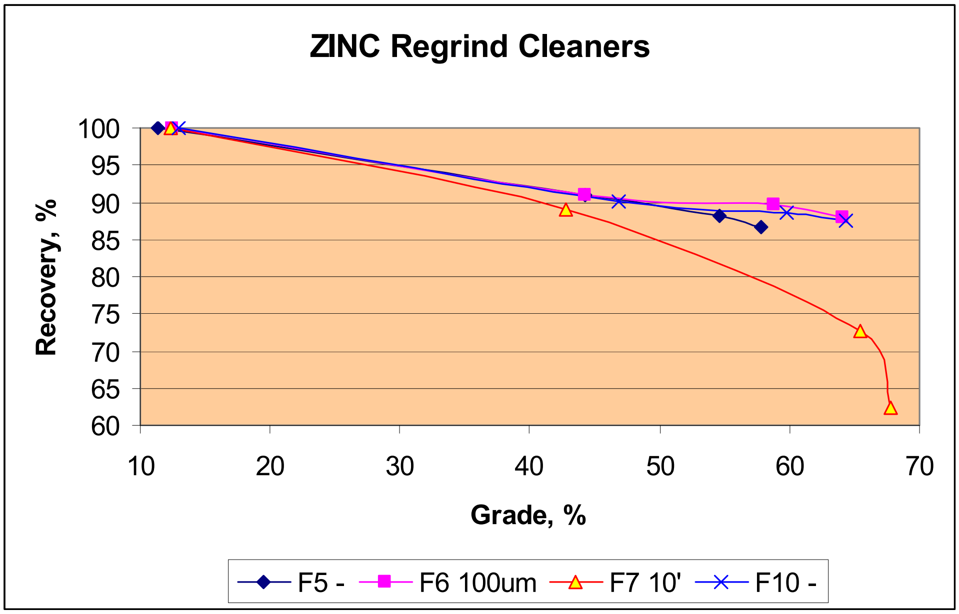

Figure 4. Stable Zn-Cleaner Performances without Regrind

4.3.3 Reagent Regime Optimization

Reagent regimes were tested in F8, F9, F11, and F12 at 150μm primary grinds and with 10-minutes of regrinding each. The effort mainly focused on two aspects: the optimization of collector addition rates and the reduction of copper sulfate dosage in primary (rougher) flotation.

Test F11 (Table 5) represents the baseline reagent levels used in F10, whilst the collector additions were reduced across the board in F8. Copper sulfate dosages were reduced, with low Pb-collector additions in F9 and a slightly increased SiPX dosage in F12.

Table 5. Effects of Rougher Dosage Variations

Test ID	Reagent Dosages (g/t)				Cleaner Grades (%)		Recovery in Pb Ro. Conc. (%)		Zn Recovery in Zn Ro. Conc. (%)
	PEX	A242	SiPX	CuSO4	Pb in Pb Conc	Zn in Zn Conc	Ag	Pb	
F8	35	20	80	550	69.75*	67.52	96.3	99.3	88.8
F9	35	20	110	250	78.61	67.47	92.5	98.9	90.0
F11	50	25	110	550	73.52	58.60	94.9	99.3	89.2
F12	50	25	120	500	73.88	59.62	96.1	99.2	88.4

* One stage Pb cleaning

Regrinding in F11 slightly deteriorated its performance compared to F10, as is evident from a comparison to Table 4 results. However, the lower reagent levels seem to have minor impacts only and can be implemented without concern. The 1st Pb-rougher concentrates were not reground in F8 and F11, leading to slightly better results than in F9 and F12 (Figure 5).

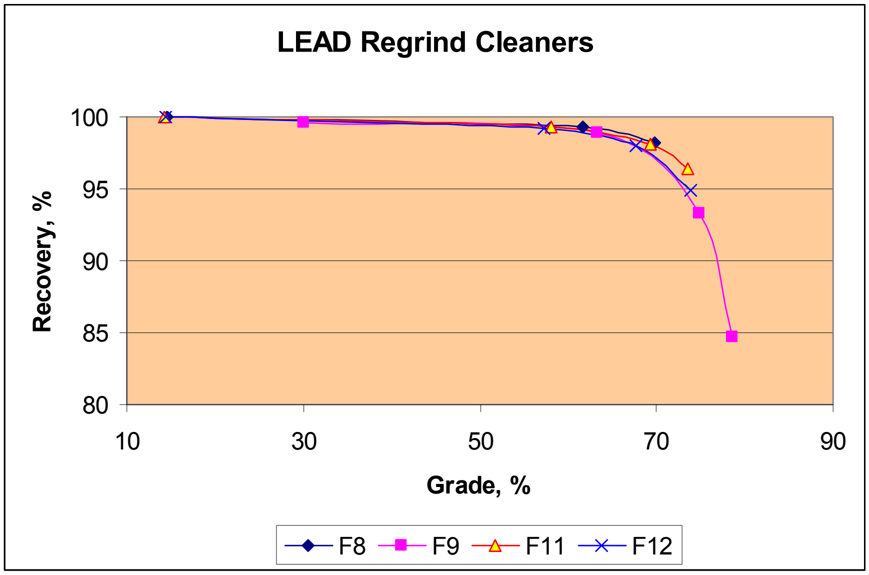

Figure 5. Lack of Reagent Regime Effects on Pb-Cleaning

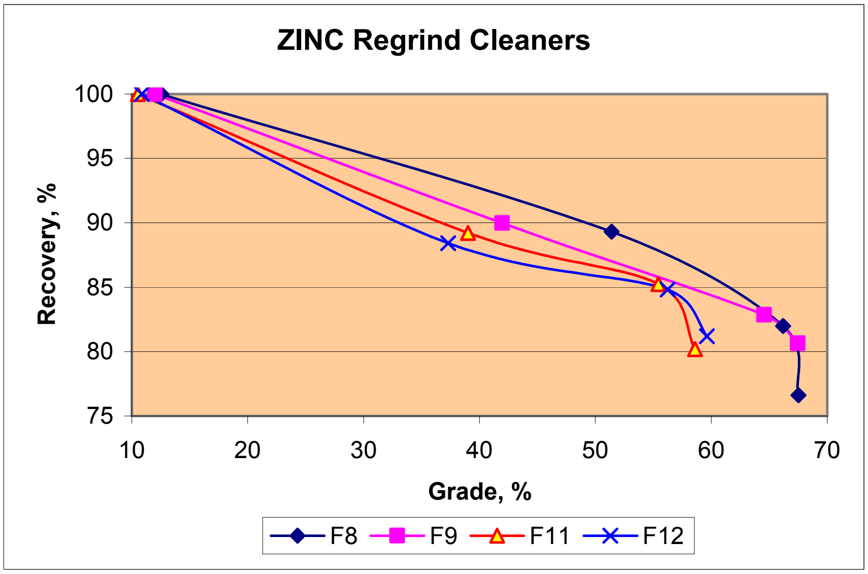

Figure 6. Benefits of Lower Reagents on Zn-Cleaning

Lowering of reagent levels benefitted the Zn-Cleaner performance (Figure 6), as the results for F8 and F9 were superior to those of F11 and F12. The pH of the Zn-rougher was varied in the latter, without much impact. However, regrinding is not beneficial, as a comparison to results in Table 4 would quickly demonstrate.

4.3.4 Pyrite Scavenging

A major purpose of testing is to address environmental impacts. The flotation removes sulfides and rejected pyrite controls the acid generation potential of the primary tailings. Several Zn-scavenger tests were run to minimize the residual sulfide levels and to produce a high pyrite tailing for special disposal. Thus, low-pH Zn-rougher scavenging and a 1st Zn-cleaner scavenger stage were tested.

In F11 the Zn-rougher pH was lowered to <8, and in F12 the SiPX dosage was increased (Table 6). Test F13 was run with PAX in the Zn-rougher at pH 10 and the reduced $CuSO_4$ dosage. The Ag/Pb- and Zn-product recoveries and grades were materially unaffected (see Appendix 3) and thus omitted from review. Since the overall performance is excellent with baseline F12 conditions, only the extra acid and $CuSO_4$ consumption costs in the pyrite-scavenger stage might be of concern. This could be addressed by lowering the flotation pH in the Zn-rougher and/or the use of PAX, with minor penalties in selectivity.

Table 6. Primary and Secondary Zn-Scavenger Tailings

Test ID	Zn Ro-Sc. Dosages, g/t				Zn Cl.Sc. Grade (%)		Py Conc. Recovery (%)		Primary Tails Recovery Fe (%)
	Ro.pH	Sc.pH	SiPX	CuSO4	Zn	Fe	Zn	Fe	
F11	7.7	7.5	110	550	1.33	18.9	1.2	7.0	63.2
F12	11	7.5	120	500	0.75	20.2	1.0	12.3	59.4
F13	10	10	90*	350	1.07	22.0	2.1	10.8	61.8

*PAX used in F13 Zn-circuits instead of SiPX; assume special disposal of combined high pyrite tailing.

4.3.5 Variability Testing

Locked-cycle testing further explored relative merits of the F12 versus the F13 approach on the Master blend, followed by a variability campaign on the East

Zone Composite (see below). Open-cycle variability tests were then conducted on Bellekeno zone- and level- composites, in that order. Work on Onek material was deferred at the request of the client. Test F14 was performed on East Zone composite and F15 on SW Zone composite (Table 7). Both tests were based on the F12 procedures, without the low-pH Zn-scavenger stage.

Table 7. Summary of Variability Test – Zone Composites

Test ID	Belllekeno Composite ID	Cleaner Grade (%)		Recovery in Pb Cl. Conc. (%)		Zn Cl. Recovery in Zn Conc. (%)	Primary Tails Grade		
		Pb in Pb Conc	Zn in Zn Conc	Ag	Pb		Ag (ppm)	Pb (%)	Zn (%)
F12	Master Blend	73.88	59.62	90.7	94.9	81.2	6.9	0.04	0.10
F14	East Zone	59.70	57.59	71.6	79.6	82.9	3.0	0.03	0.13
F15	SW Zone	71.96	60.30	94.5	96.4	77.7	3.0	0.06	0.07

With lower Ag/Pb values than in the Master blend, the East Zone composite F14 results yielded similar tailings grades as F12. Hence the Pb grade and recovery was correspondingly affected, while the Zn-performance remained stable. Whilst cleaner losses would be reduced in locked-cycle mode, higher Pb-grades could likely be obtained by an additional stage of Pb cleaning. Test F15 on SW Zone composite matched the performance of F12 closely. Mass pulls (in Appendix 3) and recoveries reflect differences in head grades; reagent regimes were kept at baseline levels for variability testing.

Level composites from three Bellekeno sub-zones were also tested at baseline conditions (Tables 8 and 9). In general, the tailings grades were relatively stable in view of the varying head grades, with a single major exception. In F21, the Zn head was 32.2% and 14.6% of Zn was left in the final tails along with 39g/t Ag, most likely due to collector starvation. By adding another stage of Zn roughing almost all of the Zn minerals were floated, which would reduce primary Zn-losses to normal levels. One additional variability test on composite ENE-3 was omitted, since adequate amounts of this sample were not available.

Test F17, on the other hand, had a 31.4% Pb head grade and a 55.5% mass pull in the Pb-rougher, which entrained 38% of the Zn into the Pb-cleaner circuit at a relatively fine primary grind size of 126μm (see Appendix 3). Elevated losses of values to the primary tailings were also observed for the similar test F19. Higher Pb-grades may have resulted in collector starvation in the primary circuit causing a shift away from optimal process conditions through the use of baseline levels.

Table 8. Summary of Level Testing - Bellekeno SW Zone

Test	Sample	Calculated Heads (%)		Cl. Grade (%)		Pb Cl.Conc. Recovery (%)		Zn Cl. Recovery	Tails Grade		
ID	ID	Pb	Zn	Pb in Pb Conc	Zn in Zn Conc	Ag	Pb	in Zn Conc(%)	Ag (ppm)	Pb (%)	Zn (%)
F17*	SW-1	33.3	6.4	68.9	43.9	87.2	92.1	58.6	60.1	0.23	0.14
F18	SW-2	2.3	1.2	78.1	57.1	76.5	84.1	73.1	1.5	0.04	0.05
F19*	SW-3	27.8	7.0	73.9	54.3	90.5	92.5	72.7	23.7	0.11	0.09
F20*	SW-4	12.7	12.6	80.0	55.4	90.3	93.8	70.5	4.5	0.05	0.1

* Samples with head grades in excess of 0.9kg/t Ag; no regrind on 1^{st} Pb-rougher conc.

Table 9. Summary of Level Testing - Bellekeno East Sub-Zones

Test	Sample	Calculated Heads (%)		Cl. Grade (%)		Pb Cl.Conc. Recovery (%)		Zn Cl. Recovery	Tails Grade		
ID	ID	Pb	Zn	Pb in Pb Conc	Zn in Zn Conc	Ag	Pb	in Zn Conc(%)	Ag (ppm)	Pb (%)	Zn (%)
F21	ESW-1	1.08	32.5	78.8	60.9	49.5	76.7	48.1	38.7	0.02	14.6
F22	ESW-2	2.81	10.1	80.8	59.9	63.4	77.0	69.1	3.4	0.03	0.24
F23	ENE-1	0.20	9.85	13.4	63.1	26.8	36.2	68.6	10.1	0.01	0.09
F24*	ENE-2	3.77	9.34	63.6	60.0	77.0	86.1	63.9	11.6	0.06	0.15

* Sample with head grade of 0.57kg/t Ag

In Table 8, regrinding of the entire Pb-rougher concentrate was conducted in F18 only, as related to very light mass pulls from the low-grade SW-2 composite (see Appendix 3). In Table 9, on the other hand, only F24 had a Pb-rougher mass pull of 12.2% and regrinding of entire rougher concentrates was routinely applied. A very low Pb-content in composite ENE-1 (F23) resulted in the only poor Pb-cleaner product grade, although the Ag-grade remained respectable. It could be concluded that blending of feed to maintain steady head grades will be of benefit, and that all components of these blends should perform very well, if over-grinding of soft galena is avoided and if optimum reagent regimes are maintained.

4.3.6 Locked Cycle Flotation Tests

Primary objectives of the locked-cycle campaigns were focused on metallurgical performance mainly, to produce realistic product grades and recoveries, assess the stability of continuous operations, and prove the proposed plant configuration. Thus the basic procedures for test F12 were selected, with 1st Pb-rougher to be cleaned without regrinding, ending with a conventional Zn-rougher flotation at a reduced $CuSO_4$ dosage of 350g/t. The standard recycling practices are outlined in the LC1 schematic (Figure 7). As a separate pyritic waste, the 1st Scavenger tails were rejected from Zn-Cleaner circuit to avoid any undue buildup of sulfides in the primary tailings. An alternative flowsheet that was tested in LC2 (Figure 8) reduced the re-circulating load by sending the 1st Pb-rougher product directly to the 2nd Cleaner stage. No regrinding was performed in LC2, and the 1st Pb-Cleaner Scavenger stage was also eliminated.

Figure 9 shows the variations of metal grades and recoveries into the appropriate LC1 products over 6-cycles. Multiplication by 6 would provide the approximate recovery by cycle, which was observed to increase for all metal values over the first half of the LC1 campaign. Recycling, however, built up the density in the Pb-cleaners requiring a change to a larger cell size in cycle 5. This lowered the recoveries in cycles 5 and 6, but improved the Pb-grade mainly.

Steady-state results over the last three LC1 cycles are shown in Table 10, and the grades approximate those of optimized open-cycle tests in Table 5. The LC1 locked-cycle cleaner recoveries matched those of the rougher recoveries in that same table. It is deduced that LC1 confirms the basic applicability of the developed scheme for the Master Blend, and the simplified LC2 strategy shown in Figure 8 was tested to eliminate buildup in the Pb-cleaners and to eliminate all re-grinding. Designed on the basis of test F13, the Zn-rougher circuit was run at a reduced pH 10 but with PAX instead of SiPX to maximize sulfide recovery.

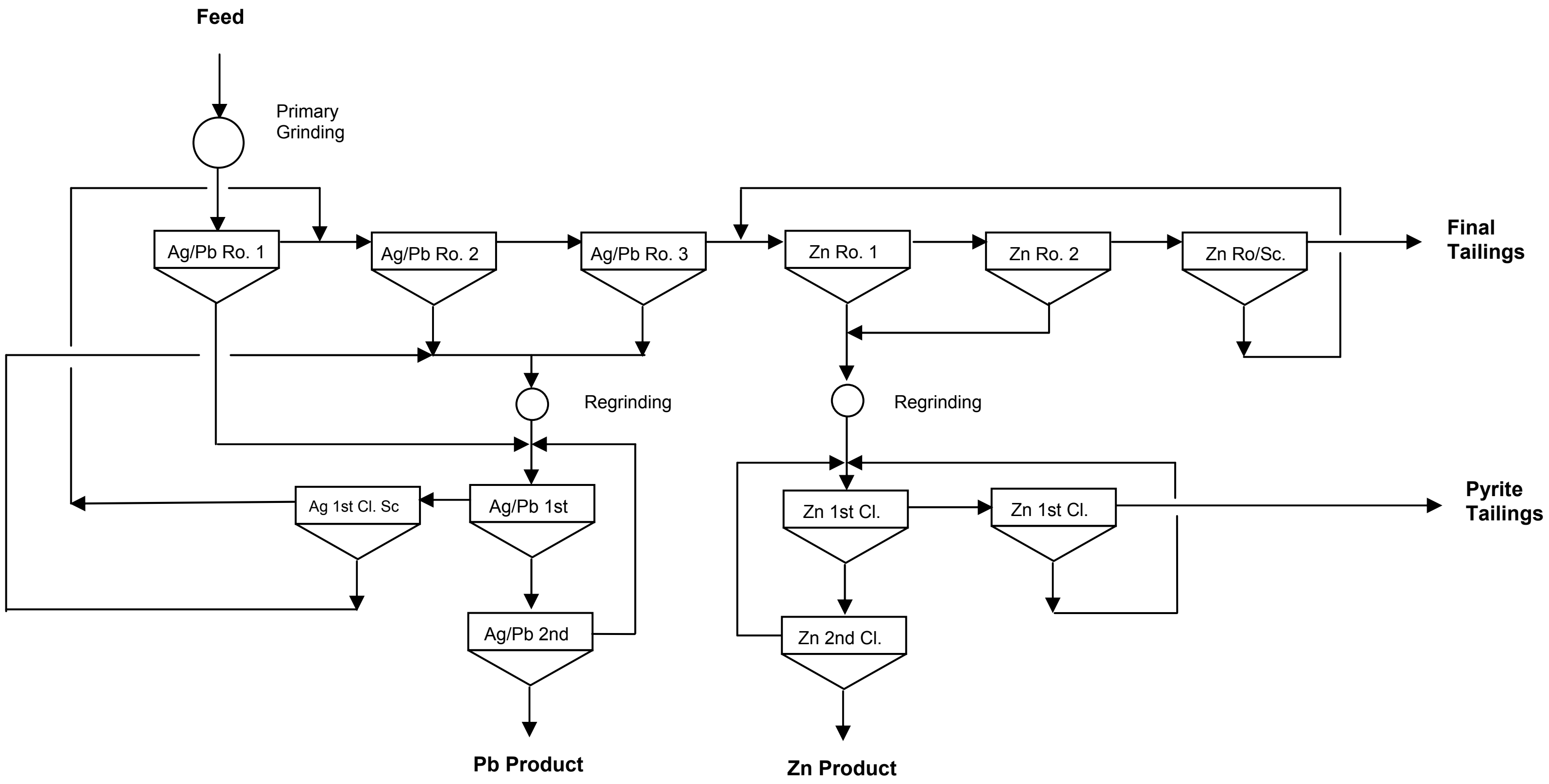

Figure 7. LC1 Flowsheet

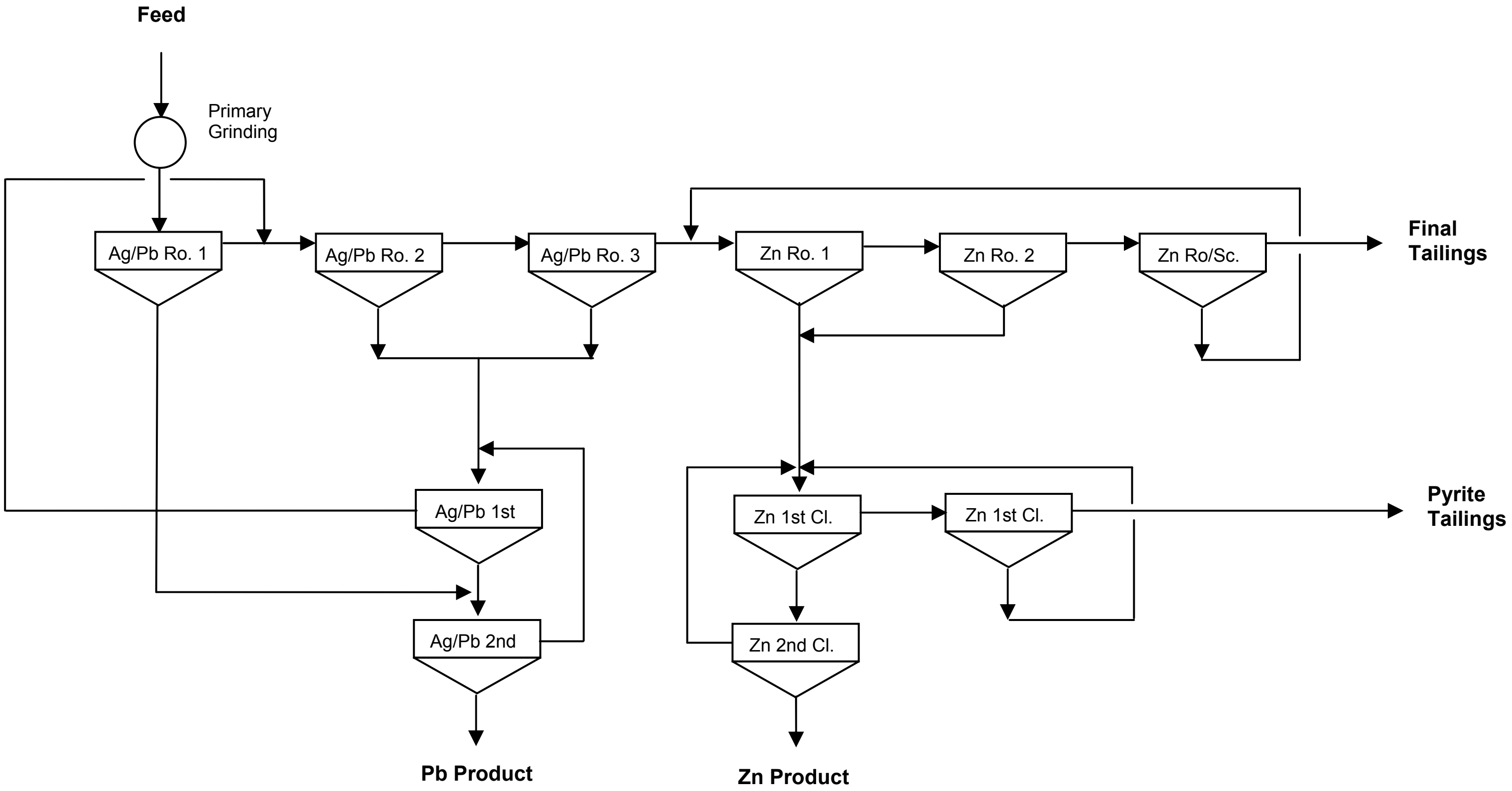

Figure 8. LC2 Flowsheet

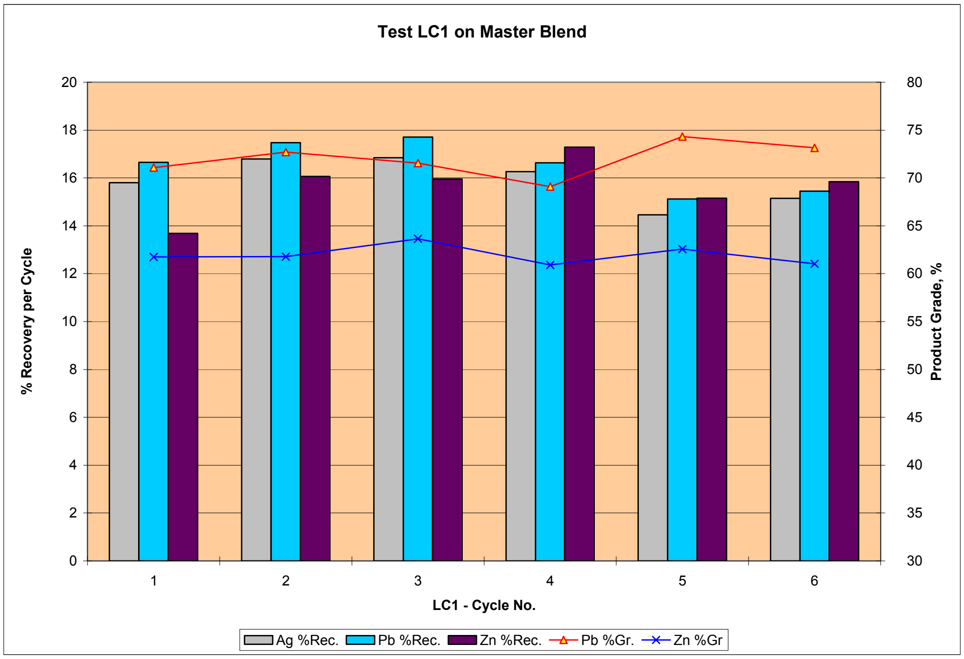

Figure 9. 6-cycle Grade & Recovery Profiles, LC1

Table 10. LC1 Flotation Test Results Summary (Cycle 4-6)

Product	Wt	Assay				Distribution			
		Ag	Pb	Zn	S(T)	Ag	Pb	Zn	S(T)
	(%)	g/t	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2nd Pb Cleaner Conc.	18.0	4871.4.	72.0	2.2	13.0	94.0	98.8	3.6	25.4
2nd Zn Cleaner Conc.	17.1	200.7	0.4	61.5	32.5	3.7	0.5	94.4	60.3
1st Zn Cleaner Scavenger Tails	8.1	80.8	0.3	0.8	10.9	0.7	0.2	0.6	9.5
Bulk Flotation Tails	56.8	27.4	0.1	0.3	0.8	1.7	0.5	1.5	4.8
Calculated Head		933.1	13.1	11.2	9.2	100	100	100	100

As could be expected from test F13 results, test LC2 performed slightly less selectively in the Zn-circuit only (Table 11) as compared to F12-based LC1. Recoveries and metal grades are comparable except for the lower Zn grade. Flotation stability was quite acceptable (Figure 10), with a slight drift towards higher grades in the last cycle. Steady state would likely require a few additional cycles to achieve, but the current results are quite representative already. Therefore, it is deduced that re-grinding is not required, although retention of a more flexible circuit with a small re-grind capacity is strongly recommended

Table 11. LC2 Flotation Test Results Summary (Cycle 4-6)

Product	Wt	Assay				Distribution			
		Ag	Pb	Zn	S(T)	Ag	Pb	Zn	S(T)
	(%)	g/t	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2nd Pb Cleaner Conc.	18.8	4877.7	72.0	3.1	14.0	95.2	98.2	5.6	30.1
2nd Zn Cleaner Conc.	18.2	157.9	0.3	53.1	31.3	3.0	0.4	92.2	65.3
1^{st} Zn Cleaner Scavenger Tails	7.4	36.5	0.3	0.7	2.9	0.3	0.2	0.5	2.5
Bulk Flotation Tails	55.6	31.6	0.3	0.4	0.7	1.8	1.3	2.2	4.5
Calculated Head		963.5	13.8	10.5	8.7	100	100	100	100

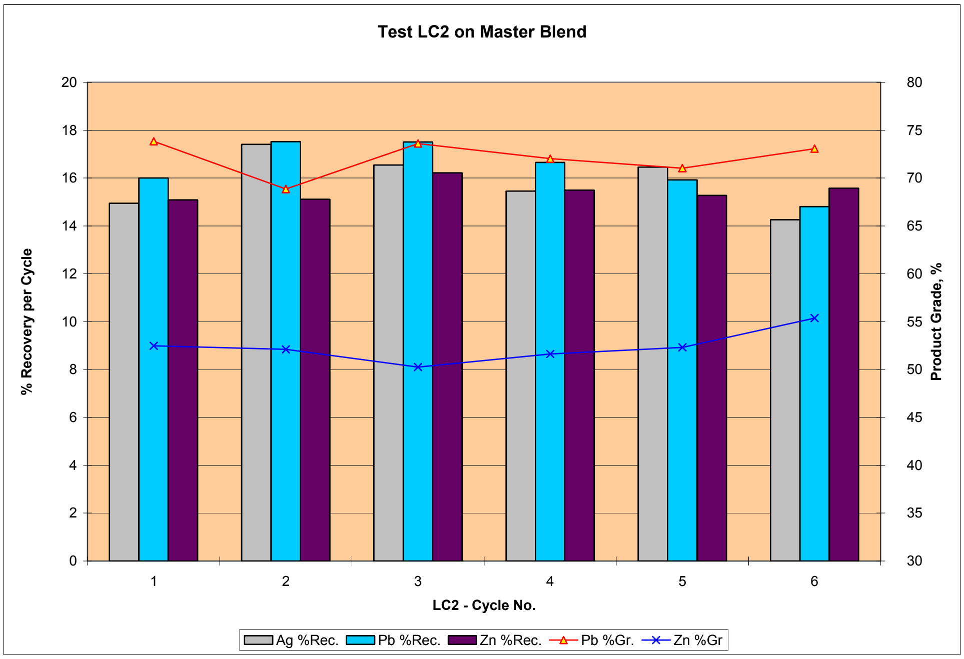

Figure 10. 6-cycle Grade & Recovery Profiles, LC2

Another locked-cycle test (LC3) was conducted on East Zone material, to assess further simplifications to the Pb-circuit at a primary grind of 130 µm. The same procedures as LC2 were followed, but with more conventional Pb-rougher cleaning without any re-grind, and recycle of the Pb-scavenger concentrate.

LC3 steady-state results (Table 12) must be compared to those of F14 (Table 7) as Ag/Pb head grades for the East Zone Composite are significantly lower than in LC1 and LC2. Comparable metal grades and recoveries are noted, profiles of which are shown in Figure 11. Adequate stability of flotation is evident.

Table 12. LC3 Flotation Test Results Summary (Cycle 4-6)

Product	Wt	Assay				Distribution			
		Ag	Pb	Zn	S(T)	Ag	Pb	Zn	S(T)
	(%)	g/t	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2nd Pb Cleaner Conc.	3.2	5705.5	53.1	5.0	23.8	68.3	89.6	1.0	7.4
2nd Zn Cleaner Conc.	28.1	254.8	0.5	59.1	33.2	26.5	7.0	97.6	89.8
1st Zn Cleaner Scavenger Tails	3.9	45.1	0.3	1.4	1.7	0.6	0.6	0.3	0.6
Bulk Flotation Tails	64.8	19.0	0.1	0.3	0.3	4.6	2.8	1.1	2.2
Calculated Head		270.2	1.9	17.0	10.4	100	100	100	100

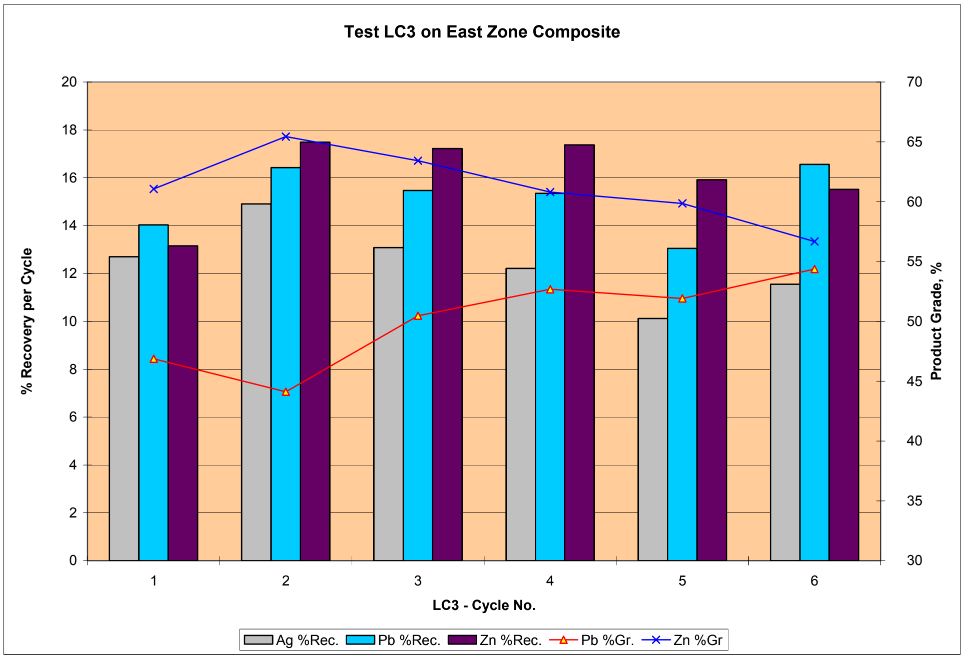

Figure 11. 6-cycle Grade & Recovery Profiles, LC3

Whilst higher Zinc grades could be achieved with more selective rejection of iron, products grading below 60% Zn provide an additional pyrite outlet from the site. Thus the primary tailings would have practically all of its sulfide removed, and a coarser 1st Zn-cleaner Scavenger tails could be more suitable for back fill. Tests have shown several ways of controlling product grades and distributions in quite a reliable manner. Further fine–tuning in the field will be required, but a viable baseline treatment scheme has been established. A few critical considerations pertaining to water recycle, and site management remain to be addressed.

4.4 TAILING GENERATION

A large scale flotation test (F16) was performed to produce enough tailings for backfill testing. Since not enough core samples were available a mixture of core samples and assay rejects were used to produce about 50 kg of feed. The client suggested that single-stage cleaning without any regrind would maximize the weight of cleaner tailings. To this end, the Pb-cleaner tails would have to be forwarded to the Zn-cleaner.

As such, the abbreviated mode of operation produced larger losses in the cleaner circuits. Whilst the final tailing grade is similar those obtained from bench testing, the Zn cleaner tails contained high Pb and Zn values that were recovered in three scavenger stages (Table 13). The barren primary tailings and the 3rd Zn-Cleaner Scavenger tails were shipped out for backfill testing in Denver.

Table 13. Large Flotation Test Results, F16

Product	Mass Pull	Assay			Distribution		
	%	Ag (ppm)	Pb (%)	Zn (%)	Ag (%)	Pb (%)	Zn (%)
Ag/Pb Ro. Conc	23.7	3,497	53.8	5.23	91.9	98.1	10.9
Zn Ro. Conc.	21.0	217.3	0.53	47.7	5.1	0.8	88.3
Zn Cl.Sc. Conc. 1-3	19.9	1,755	31.1	29.9	26.5	27.8	59.2
3rd Zn Cl.Sc. Tails	5.1	560.0	7.22	3.73	2.9	2.4	1.9
Total Flotation Conc	**44.7**	**2,183**	**33.8**	**22.5**	**97.0**	**98.9**	**99.2**
Final Tails	55.3	48.9	0.25	0.16	3.0	1.1	0.8
Calculated Head	**100.0**	**901.3**	**13.0**	**11.3**	**100.0**	**100.0**	**100.0**

4.5 SETTLING TESTS

Three settling tests were conducted, one on LC1 Pb concentrate, LC1 Zn concentrate, and LC1 tailings each. After the screening tests Percol 351 was chosen as the flocculant at a dose of 20 g/t. The required unit thickener areas were calculated using the modified Coe and Clevenger Method. Table 14 shows the results of the estimated unit thickener area for these samples. It can be seen that both concentrates and the tails settled fast with flocculant addition.

Table 14. Thickener Sizing Results

Test ID	Sample ID	Flocculant Dosage g/t	Unit Thickener Area m^2/tpd solids
ST-1	LC1 Ag/Pb Conc.	20	0.01
ST-2	LC1 Zn Conc.	20	0.02
ST-3	LC1 Final Tails	20	0.03

4.6 VACUUM FILTRATION TESTS

Two vacuum filtration tests were performed on the settled Pb and Zn concentrates produced in LC1. Cake capacity was determined to be 192.8 and 274.0 kg/m^2/h for Pb and Zn concentrates respectively while the filtrate capacity was 653 and 643 L/m^2/h respectively.

4.7 MINERALOGICAL EXAMINATION

Three zone composites and two tailing samples were submitted for ore microscopic examinations, carried out by Lehne & Associates. As expected, it is concluded that SW zone composite contains predominant galena while East zone and Onek zone composites carry prevailing sphelerite. Ag exists in native form or in proustite-pyrargyrite minerals. Other minerals present are pyrite, arsenopyrite, chalkpyrite, pyrrhotite, limonite, native silver and gold.

The observations on LC1 bulk tails revealed a mostly gangue material with only trace amounts of minerals (pyrite, sphelerite, galena, etc). This observation showed the flotation recovery is complete, which is accordance with the chemical analysis.

The scavenger tails from Zn cleaning stage in LC1 was observed to be predominantly gangue materials with some pyrite and arsenopyrite.

Detailed mineralogical report is included in Appendix 2.

4.8 CHARACTERIZATION OF FLOTATION CONCENTRATES

The Pb and Zn concentrates generated in last two cycles of LC1 were assayed for the interested elements. Table 15 lists part of the results. Some Indium was found in the Zn product which also contains 0.43% Sb.

Table 15. Pb/Zn Products Assay

Element	Unit	Pb Conc	Zn Conc
As	%	0.08	0.056
Sb	%	0.425	0.016
In	ppm	<5	371
Ga	ppm	<10	77
Ge	ppm	<10	<10
Se	%	<0.01	<0.01
Te	ppm	<5	30

4.9 CHARACTERIZATION OF FLOTATION TAILINGS

Acid-Base accounting was conducted on two tailing samples from LC1, i.e. bulk tails and Zn cleaner scavenger tails. As shown in Table 16, the bulk tails is not likely acid-generating, while Zn cleaner scavenger tails may pose some acid generation potential. It is therefore recommended that further environmental tests be conducted to characterize the kinetics of the acid generation.

Table 16. ABA on LC1 Tailings

Sample ID	Acid Potential	Neutralization Potential (NP)		
		Actual	Ratio	Net
LC1 Cyc 5 Bulk Tailings	22.2	43.3	2.0	21.1
LC1 Cyc 5 Zn Cl Sc Tailings	146.9	65.9	0.4	- 81.0

Whole rock assay and ICP analysis on aqua regia digested tailing sample were performed to further characterize the tailings generated in LC1. An abbreviated summary is given in Table 17 It can be seen that the main components are silicone and iron.

An ICP scan on F13 tailing water revealed that the only concern is Zn concentration. Since it is planned to recycle the water back to the start of the flotation circuit it should not be a problem.

Table 17. LC1 Tailings Assay

Elements	Units	LC1 Bulk Tails
TIC	%	0.55
Al2O3	%	1.72
CaO	%	2.28
Fe2O3	%	22.25
MgO	%	0.88
SiO2	%	51.16
LOI	%	15.14
As	ppm	409
Sb	ppm	19
Cu	ppm	338
Fe	ppm	162448
Mg	ppm	5587

Table 18. F13 Tailing Water Assay

Elements	Units	LC1 Bulk Tails
Sb	mg/L	<0.1
As	mg/L	<0.2
Bi	mg/L	<0.1
Cd	mg/L	0.12
Ca	mg/L	145
Cr	mg/L	<0.01
Cu	mg/L	0.64
Fe	mg/L	4.77
Pb	mg/L	0.45
Ag	mg/L	<0.02
Zn	mg/L	20.31

Two TCLP tests were conducted on the combined LC1 (cycle 5 and cycle 6) tails, one on filtered wet tails and one on tails dried at about 50°C. The leachates were assayed for dissolved metals by ICP-MS. The results are summarized in Table 19. It can be seen that all metal concentrates are less than TCLP limits.

Table 19. TCLP Leachates Assay

Elements	Units	Sample ID	
		Leachate (Dry Sample)	Leachate (Wet Sample)
SO4	mg/L	19.1	16.4
Sb	µg/L	5.2	4.3
As	µg/L	6.0	4.0
Cd	µg/L	150.2	144.8
Cr	µg/L	<0.5	<0.5
Pb	µg/L	10004.7	10554.7
Hg	µg/L	<0.1	<0.1
Se	µg/L	<0.5	<0.5
Ag	µg/L	<0.05	<0.05

5.0 CONCLUSIONS AND RECOMMENDATIONS

Excellent response to standard differential flotation was demonstrated for the master composite containing 1 kg/t Ag, 15% Pb and 12% Zn. As shown in the locked cycle test, over 95% Ag, 99% Pb and 94% Zn were recovered at grades of 71.9 %Pb and 61.9% Zn, leaving only 0.1% Pb and 0.2% Zn in the tails. Consistent and encouraging differential flotation results were obtained in limited variability studies as well.

Test results indicated that the master composite is generally not primary grind particle size sensitive in the range from 100 to 200 mesh. Regrinding was proved not essential to achieve good separation and high recoveries. The depression of Zn in Pb circuit was very successful with sole addition of zinc sulfate.

Variability test showed that overall the differential flotation flowsheet is suitable for the beneficiation of the lower grade East zone sample. Nevertheless, process refinement is needed to improve the Pb grade.

Based on the testwork the following flowsheet is recommended for the processing of the Bellekeno ore: a primary grind at 100 mesh; Pb float with PEX, A242 and $ZnSO_4$ as a modifier; Zn float with SIPX/PAX and $CuSO_4$ as a modifier; slight regrind for both Zn and part of Pb rougher concentrates; and pyrite rejection from Zn cleaning circuit.

ABA tests indicated the final tailings are not likely to produce acid while the scavenger tails from Zn cleaning might be potentially acid generating. Two TCLP tests on the final tailings from the locked cycle test indicated that this material is nontoxic.

Although the basic process layout can be defined based on the testwork, further refinements and optimization on the lower variability ore are recommended.