PerUsa EnviroMet Inc., 228 Pinellas Street, Lakeland, FL 33803-4832, USA Phone/Fax: (863) 646-5096 E-mail: fsotillo@msn.com

TO: Mr. Marten Walters, President, KEMWorks Technology, Inc.
CC. Mr.Charlie Snyder, General Manager, KEMWorks Technology, Inc.
Mr. Neville Bergin, General Manager, Minemakers Limited.
Mr. Paul Richardson, Resident Manager, Minemakers, Limited.

FROM: Dr. Francisco J. Sotillo, President, PerUsa EnviroMet, Inc.

SUBJECT: Report on Activities Carried Out at Adelaide and Perth, Australia - Mathematical Model for Feed/Beneficiated Grade, Project No. PN 2039.

DATE: April 1, 2013

SUMMARY

The main purpose of this visit was to review and incorporate to the Mine Blocks model of AMC the Beneficiation model for the feed-product relationship required by the IHP process. Thus, the IHP process requirements on P_2O_5 grade (15%), Al_2O_3 content (<2% Al_2O_3), and SiO_2 enough to reduce the P_2O_5 content to that required by the process, and the overall Al_2O_3 in the IHP feed to 1.7%. For this purpose, the initial Mine Blocks model was modified by the Beneficiation model to flag those blocks that may content high Al_2O_3.

Since the designed beneficiation process was able to reduce kaolinite without significantly affecting P_2O_5 content, it was necessary to determine indirectly the source of Al_2O_3 and P_2O_5 that may affect the feed to the IHP process, crandallite. The development of an Optimized Beneficiation model, its incorporation to the AMC's Mine Blocks model, and a control of blocks based on the requirements of the IHP process was carried out, and tested on the AMC's Mine Blocks Model.

In addition, this trip to Australia considered a visit to the laboratory facilities at the University of South Australia, reviewed of procedures at the lab, established the Conceptual Flowsheets for both phosphate ore and sand, and suggested potential process improvements.

INTRODUCTION

Upon the request of Mr. Neville Bergin, General Manager Projects Development of Minemakers Limited, Dr. Francisco J. Sotillo (Paco) of PerUsa EnviroMet Inc. Sub-Contractor of KEMWorks Technology, Inc. traveled to Australia from March 15 to 24, 2013. Once arrived at Adelaide, Australia on March 17, 2013, a meeting with Mr. Paul Richardson, Resident Manager, Minemakers Limited took place to delineate the activities to be carried out, define certain details, and establish a working schedule that considered:

- Visit the University of South Australia, Adelaide, Australia guided by Dr. Kwan Wong on Monday; March 18, 2013.
- Travel to Perth, West Australia, Australia on the evening of March 18, 2013.

- Initial coordination meeting with Mr. Neville Bergin and Mr. Paul Richardson to determine the working agenda; March 19, 2013.
- Prepare the modified Conceptual Flowsheets for both phosphate ore and sand beneficiation plants, including modifications, upgrades according to new data, and water recovery requirements; March 19, 2013.
- Review the General Layout of the Industrial Site with emphasis on the beneficiation areas, according to the Conceptual Flowsheets; March 19-20, 2013.
- Prepare the corresponding material necessary for AMC-Minemakers Mine Blocks model and potential working procedure; March 19, 2013.
- AMC-Minemakers Limited meeting to determine the most important parameters to be considered, Feed-Beneficiated Product relationship, and IHP considerations; March 20, 2013.
- Reevaluate the Feed-Beneficiaion model according to the optimization tests, and Flag System for the AMC's Mine Blocks model; Mach 21, 2013.
- Validation of the Flag System for the AMC's Mine Blocks model, application of the Beneficiation model to the AMC's Mine Blocks model, and results considerations; March 22, 2013.
- Return to Lakeland, Florida, USA; March 23-24, 2013.

This brief report will highlight the most important aspects of the beneficiation processes for the phosphate ore and sand developments, the Beneficiation model modifications, and the interrelation with the AMC's Mine Blocks model.

Visit of the University of South Australia – Adelaide Laboratory

This visit was guided by Dr. Kwan Wong with the objective of observing the scrubbing/desliming/sizing tests, discussing the tests results, showing the raw materials of both phosphate ore and sand, and discussing potential modifications to the Conceptual Flowsheets for the beneficiation of the phosphate ore and sand.

Upon observing the scrubbing/desliming/sizing tests, it was concluded that the materials were handled properly and that the tests were conducted adequately. This resulted in high quality data for the project, and reproducible results. Technical aspects of the recent results obtained were discussed, and some potential problems were considered in order to modify the Conceptual Flowsheets. The following objectives were delineated for the Conceptual Flowsheets modifications:

- Reduce cost.
- Increase water recovery and minimized evaporation.
- Maximized efficiencies.
- Reduce energy consumption.
- Potential reduction of Pb on the beneficiated product.

Figure 1 and 2 attached presented the Conceptual Flowsheets for the phosphate ore and sand, respectively. The following potential modifications were considered:

- Use of a longitudinal single side scraper store - reclaimer.
- Potential use of a High Pressure Grinding Roll (HPGR) instead of a SAG mill to take advantage of the nature of the ore (soft). This may required the use of a secondary crusher to produce a <55 mm crushed product to feed the HPGR. Testing is required.
- Improvement of hydrocyclone efficiency by using Polymer 1111 dispersant (ArrMaz Custom Chemicals).
- Potential chelating of Pb using Custofloat PC-50 (ArrMaz Custom Chemicals) to improve Pb rejection during beneficiation.
- Dewatering cones and high capacity thickeners for water recovery and recycling to reduce evaporation.
- Potential tailing disposal using paste.

Based on the modifications suggested, it was clear that Minemakers Limited required fulfilling the addressed questions for the Bankable Feasibility Study presented in the Memorandum/e-mail of Monday, January 18, 2013. Still, some additional aspects needed to be considered:

- The capacity of the beneficiation plants with respect to that of the IHP processing units (181,000 ton/y). Should the beneficiation plants be designed for a larger capacity than that required (1.72 ton/y of phosphate ore and the corresponding sand beneficiation capacity, to be defined by JDC requirements), and reduce operating time efficiency?
- Select certain pieces of equipment to be considered for future process expansions, so an initial increase in CAPEX may be compensated by an overall reduce in costs upon the expansion.
- Revisit and select comminution parameters for HPGR.
- Grades and particle size distribution of feed materials (ROM, crushed ore, etc.).

LAYOUT OF INDUSTRIAL AREA

Based on the conceptual flowsheets developed, some observations were made on the original layout of the Industrial Area:

- No space was considered for the stockpile of the crushed phosphate ore and reclaiming system.
- It was estimated that at least a 100 m x 200 m extension for the phosphate ore and 100 x 200 m for the sand beneficiation plant were required based on the potential use of transfer bins (10 m of ϕ x 5 m of H), the returning belt conveyor to the screening and log-washer area, the use of hydrosizers (about 144 m long x 20 m wide, including expansions), and the use of a thickener of about 35 m ϕ.
- Beneficiated silica sand stockpile should be considered Item 22 on Minemakers Limited layout.
- Beneficiated Phosphate ore stockpile should be considered Item 23 on Minemakers Limited layout.

AMC's MINE BLOCKS MODEL, FEED-BENEFICIATED PRODUCT MODEL RELATIONSHIP, FLAGS, AND PARAMETERS

This section corresponded to the calculations and meetings carried out at AMC and Minemakers Offices. The assistants to the AMC office meetings were:

- Mr. Neville Bergin and Mr. Paul Richardson for Minemakers Limited.
- Dr. Francisco J. Sotillo (Paco) for KEMWorks Technology, Inc.
- Ms. Kelly McCombie for Optimum Capital.
- Mr. David Varcoe and Mr. Jonathan Dry for AMC Consultants.

The coordination with AMC for the development of the Mine Blocks model was carried out in two stages:

- First meeting was aimed at clarifying the objectives and requirements of the IHP process, the beneficiated products results, and the corresponding mine blocks.
- Second meeting was aimed at the application of the modified Beneficiation model incorporating the optimization tests, the effect of crandallite phosphate mineral present in the ore, and the presence of high Al_2O_3 clay sources, mainly kaolinite into the AMC's Mine Blocks model.

The initial meeting on Wednesday, March 20, 2013 was carried out to inform AMC of the requirements of IHP process, and the mathematical model developed for the beneficiated product. This rendered a different concept on the evaluation of the mine blocks, not based on the cut-off grade concept normally used in mining, but on the supplied of beneficiated phosphate rock suitable to be fed to the IHP process. Thus, it was considered that the feed (mineral phosphate ore) – Beneficiated phosphate rock should be based on a phosphate rock feed of P_2O_5 grade of 15% to 30% with about 4% Al_2O_3 to produce a beneficiated product of about the same P_2O_3 grade, but <2% Al_2O_3. Therefore, the mine blocks required to achieve this objective were based mainly on Al_2O_3 grade to be produced after beneficiation, continuity of blocks, potential washable Al_2O_3 (Al_2O_3 originated from kaolinite, not crandallite), and representation of the total resources (percentage of resources).

To upgrade the Beneficiation model, a set of 11 intersections was selected considering a range of P_2O_5, Al_2O_3, and SiO_2 grades of the feed, and Shell 31 Composite from the Mine Blocks model. The application of the optimized conditions was used to adjust the parameters to the new type of feed as a first step. Then, a new set of feed-beneficiated product was developed. Since crandallite was a source of Al_2O_3, its presence in significant amounts may be a source of concern. Therefore, the new mathematical model included a Flag System to blocks with high crandallite, and its actual Al_2O_3 content. This Flag System was based on the SiO_2/Al_2O_3 ratio in the ore since:

- Good correlation between P_2O_5 and SiO_2 was obtained for the overall deposit.
- SiO_2 originated by kaolinite was possible to be calculated using Ammtec Mineralogical Report – $Al_2Si_2O_5(OH)_4$.
- The remaining silica should be originated from other clayed minerals.
- Al_2O_3 calculated by the Beneficiated Product model based on the Al_2O_3 in the feed including the Al_2O_3 originated by the presence of crandallite.

- It is assumed that crandallite did not contain SiO_2, as reported by Ammtec Mineralogical report ($CaAl_3(PO_4)_2(OH)_5.(H_2O)$).

Therefore, by calculating the SiO_2 originated from all other clayed minerals in relation to the projected Al_2O_3 in the beneficiated product, the ratio could be:

- $SiO_2/Al_2O_3 > 0$, Al_2O_3 is related to all other clayed minerals, but crandallite.
- $SiO_2/Al_2O_3 < 0$, Al_2O_3 comes from crandallite; **thus Flag the block**.
- If Al_2O_3 of the beneficiated product is calculated to be <2%, it conforms IHP process, and **the flag is removed.**

Applying these concepts to the AMC's Mine Blocks model would also need to consider those flag blocks containing high Al_2O_3 for the calculated beneficiated product, but high in P_2O_5, to be combined with blocks of low Al_2O_3 and low P_2O_5 to obtain appropriate P_2O_5, Al_2O_3, and SiO_2 material to be fed to the IHP process, increasing resources significantly. In addition, the AMC's Mine Blocks model also included estimated costs of mining and beneficiation as well as costs of transportation of raw materials and products.

Table 1 showed the application of the Beneficiation model to the 11 Intersection selected of various feed grades on P_2O_5 and Al_2O_3, and the Shell 31 of the Main Zone Phosphate deposit to determine potential resources. The distribution of the beneficiated product according to the model showed a rejection of 69.57% of Al_2O_3, 57.52% of Fe_2O_3, and a recovery of 67.32% of SiO_2, 30.43% of K_2O, and 65.04% of P_2O_5. It was decided that actual laboratory tests be conducted by Dr. Kwan Wong to validate the Beneficiation model for the 11 Intersections selected.

Table 1. Variability Analysis of Intersections for Mine Modeling – Beneficiated Product.

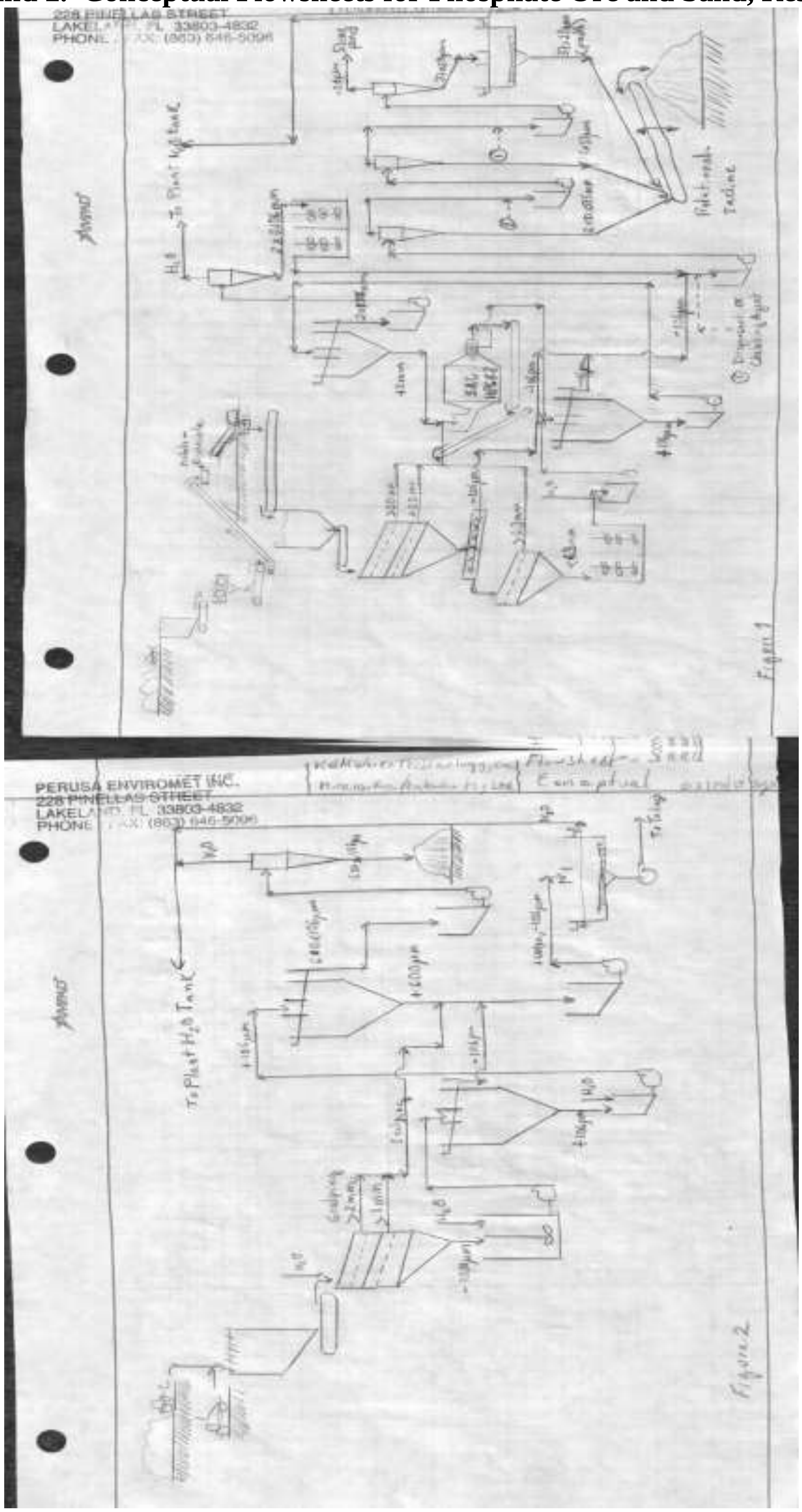
			Grade Raw Feed					Grade Product Modeled					Ratio**
	Sample	Oxide	Al_2O_3	Fe_2O_3	SiO_2	K_2O	P_2O_5	Al_2O_3	Fe_2O_3	SiO_2	K_2O*	P_2O_5	SiO_2/
Hole ID, From-To	Number	%	%	%	%	%	%	%	%	%	%	%	Al_2O_3
WNDD071, 44-45	6	98.53	1.12	0.40	45.30	0.08	22.10	0.49	0.23	42.87	0.05	23.89	17.41
WNDD070, 44.9-46	2	97.81	1.18	0.69	47.40	0.10	20.80	0.52	0.41	44.89	0.06	22.51	14.26
WNDD071, 45-46	7	97.89	3.02	0.85	54.50	0.18	16.80	1.43	0.50	51.74	0.10	18.25	2.54
WNDD084, 37-38	11	97.17	4.63	0.63	59.30	0.57	13.50	2.23	0.37	56.37	0.31	14.75	-0.26
WNDD071, 41-42	5	96.31	5.07	2.11	20.70	0.53	29.20	2.45	1.28	19.13	0.29	31.44	-0.17
WNDD074, 56-57	9	97.32	5.12	0.75	68.90	0.57	9.07	2.47	0.44	65.63	0.31	10.03	-0.91
WNDD078, 32-33	10	96.90	5.84	0.38	60.60	0.64	12.20	2.83	0.22	57.63	0.35	13.36	-1.12
WNDD071, 40-41	4	94.74	6.47	3.18	22.70	0.52	26.50	3.14	1.94	21.06	0.28	28.57	-1.84
WNDD074, 47-48	8	95.66	7.28	1.12	50.20	0.53	15.40	3.54	0.67	47.59	0.29	16.77	-1.80
WNDD070, 43-43.5	1	95.45	9.46	1.54	56.20	0.90	11.70	4.62	0.93	53.38	0.48	12.83	-2.32
WNDD071, 39.6-40	3	94.11	13.30	0.92	37.40	1.55	17.90	6.52	0.55	35.24	0.82	19.42	-2.49
Composite MPH			4.06	0.66	42.76	0.54	20.70	1.95	0.39	40.42	0.29	22.40	0.54
Shell No. 31, 214.1 Mt			4.23	1.30	40.10	0.41	17.72	2.03	0.78	37.85	0.23	19.23	-4.31

* K_2O was considered to be recovery as Al_2O_3 for the distribution of the Product.

** Corrected for quartz.

Finally, the application of the Beneficiation model and Flag System to the AMEC's Mine Blocks model resulted in 279Mt in resources (not considering the potential combined flag blocks).

Figures 1 and 2. Conceptual Flowsheets for Phosphate Ore and Sand, Respectively.



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TO: Mr. Marten Walters, President, KEMWorks Technology, Inc.
CC. Mr. Neville Bergin, General Manager, MINEMAKERS Limited.

FROM: Dr. Francisco J. Sotillo, President, PerUsa EnviroMet, Inc.

SUBJECT: Analysis of Attrition Scrubbing Tests for APH and MPH Composites for the Development of a Preliminary Mathematical Model for Feed/Beneficiated Grade.

DATE: January 18, 2013

As requested by Minemakers Limited on the Wonarah Phosphate Project discussions and by e-mail communications (December 18, 2012), the analysis of the Attrition Scrubbing tests for APH and MPH Composites were conducted to develop a Preliminary Mathematical Model of the relationship Feed/Beneficiated Grades for all compounds. The information was to be used in the AMC System and Model for mining optimization.

The summary of data for building the mathematical model for APH Composite and for MPH Composite samples is showed on Excel Files, KEMWorks-PN2039-K12023 APH AT07_08_09 and KEMWorks-PN2039-K12023 MPH AT34_35_36, respectively. The General Procedure for the development of the algorithm for each compound analyzed is presented in a bullet form:

- Process the information on the data for APH and MPH composites. (Finished)
- Determine the feed/beneficiated grades relationship for the optimum theoretical attrition scrubbing, desliming, sizing conditions. (Finished, herein reported).
- Use the data of the Attrition Scrubbing tests as the database for checking, improving and validation of the empirical relationship for each of the compounds. (Finished, herein reported).
- Test the mathematical model into the AMC System. (To be carried out by Minemakers).

This is a preliminary approximation to be tested for the limits of accuracy of the AMC System. If the model performs and looks promising as required for Minemakers' Mining Optimization model, we may need to follow a more comprehensive approach and require to run more Attrition Scrubbing tests using a wider feed grade range of several different areas of the deposit.

Summary of Results

Table 1 presented the summary of the algorithms for each of the compounds analyzed. Since As, Cd, Zn and U (minor elements) are present in the ore at the ppm level, Pb evaluation was used to represent the potential relationship of the feed/beneficiated grades to be used in the mining optimization model for these minor elements.

The evaluation of the results for both APH and MPH Composites showed that the beneficiation process could be simulated using a polynomial second order equation for all compounds studied using the main parameters of the Attrition Scrubbing tests performed (rpm, solids contents, and scrubbing time). Based on this finding and in technical considerations, the relationship of the feed/beneficiated grades seemed to follow a linear relationship. Thus, parameters for the preliminary model were calculated based on linear relationships for each compound considered. Small differences in the grades obtained for the Model Product compared to those of the actual analyzed products were encouraging. However, this empirical model is only valid on the range of feed studied (quite limited). The raw data is shown in the attached excel files, as mentioned above.

Table 1. Summary of Model Relationships for All Compounds Studied.

Compound	**Deposit**	**Model relationship**	**Analyzed Feed Grade**	**Model Product Grade**
P_2O_5, %	APH Comp.	= 1.1360(Feed) + 0.30	20.02	22.74
P_2O_5, %	MPH Comp.	= 1.0351(Feed) + 0.38	21.01	22.13
Al_2O_3, %	APH Comp.	= 0.3394(Feed) – 0.05	4.91	1.62
Al_2O_3, %	MPH Comp.	= 0.4879(Feed) – 0.06	4.10	1.94
Fe_2O_3, %	APH Comp.	= 0.7772(Feed) – 0.03	0.89	0.66
Fe_2O_3, %	MPH Comp.	= 0.6912(Feed) – 0.02	0.66	0.44
SiO_2, %	APH Comp.	= 0.9806(Feed) – 0.21	42.23	41.20
SiO_2, %	MPH Comp.	= 1.0749(Feed) – 0.03	43.07	45.37
CaO, %	APH Comp.	= 1.1406(Feed) + 0.01	27.13	30.95
CaO, %	MPH Comp.	= 1.0195(Feed) + 0.01	28.68	29.24
MgO, %	APH Comp.	= 0.3352(Feed) + 0.01	0.47	0.17
MgO, %	MPH Comp.	= 0.5258(Feed) + 0.01	0.13	0.08
K_2O, %	APH Comp.	= 0.3821(Feed) + 0.01	0.47	0.19
K_2O, %	MPH Comp.	= 0.5253(Feed) + 0.01	0.41	0.23
Na_2O, %	APH Comp.	= 1.0550(Feed) – 0.01	0.10	0.10
Na_2O, %	MPH Comp.	= 0.7453(Feed) + 0.01	0.09	0.08
MnO, %	APH Comp.	= 1.1543(Feed) – 0.01	0.04	0.04
MnO, %	MPH Comp.	= 0.8159(Feed) + 0.01	0.02	0.03
TiO_2, %	APH Comp.	= 0.4079(Feed) – 0.01	0.20	0.07
TiO_2, %	MPH Comp.	= 0.6229(Feed) – 0.01	0.18	0.10
LOI, %	APH Comp.	= 0.5497(Feed) – 0.01	3.70	2.02
LOI, %	MPH Comp.	= 0.6485(Feed) + 0.01	2.48	1.62
Pb, ppm	APH Comp.	= 1.0692(Feed) + 16.79	162	190
Pb, ppm	MPH Comp.	= 0.8911(Feed) + 8.72	223	207
Sum, %	**APH Comp.**	**---**	**100.18**	**99.78**
Sum,%	**MPH Comp.**	**---**	**100.85**	**101.28**

The sum of compounds includes an estimated of the minor elements in ppm. However, the total includes compounds expressed as oxides. Therefore, it is expected to be above 100% since the compounds do not represent the right composition of the ore.

Recommendation

It is recommended that this preliminary approximation be tested for the limits of accuracy of the AMC System. If this algorithms show promising results, further tests on a wider range of feed grades and areas of the deposit should be conducted to improve and validate the mathematical model.

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CC. Mr. Neville Bergin, General Manager, MINEMAKERS Limited.

FROM: Dr. Francisco J. Sotillo, President, PerUsa EnviroMet, Inc.

SUBJECT: Laboratory Tests to Determine the Potential Use of High Pressure Grinding Roll (HPGR) for MPH Samples from Arruwurra Wonarah Phoshate Project. – JK Tech Interim Results Analysis

DATE: September 05, 2013

INTRODUCTION

As requested by Minemakers Australia PTY LTD, the analysis of the Interim Test Results of laboratory tests carried out by JK Tech was performed. These tests were aimed at determining the feasibility of using High Pressure Grinding Roll (HPGR) on the PFD for the beneficiation of a composite sample of the Main Zone (MPH), Arruwurra, Wonarah, Phosphate Project, Composite C:>9% Al_2O_3.

The data analysis is presented in an Excel File, KEMWorks-PN2069-HPGR Interim Results-09-05-13. For this analysis, the data are presented as a function of the Rolls Pressure, comparing the tests results at Low Rolls Speed, 0.38 m/s with those at high Rolls Speed, 0.77 m/s. The comments, observations, and recommendations are presented in a bullet form for easy following.

COMMENTS AND OBSERVATIONS

In general, the Interim Tests Results showed that the use of HPGR may be possible, the results being encouraging. Apparently, it is possible to produce an adequate product with low energy consumption, medium-high throughput, and high ratio of reduction (about 17.5 for Test 6). Under these conditions, the use of a SAG Grinding Mill may not be necessary due to this high ratio of reduction obtained using HPGR (modifying the present PFDs). However, in an Industrial Scale plant a grinding mill may be still required. This piece of equipment may take advantage of the micro-cracks produced during HPGR crushing significantly reducing the energy required, and increasing the production of fines (increase in liberation of the mineral species).

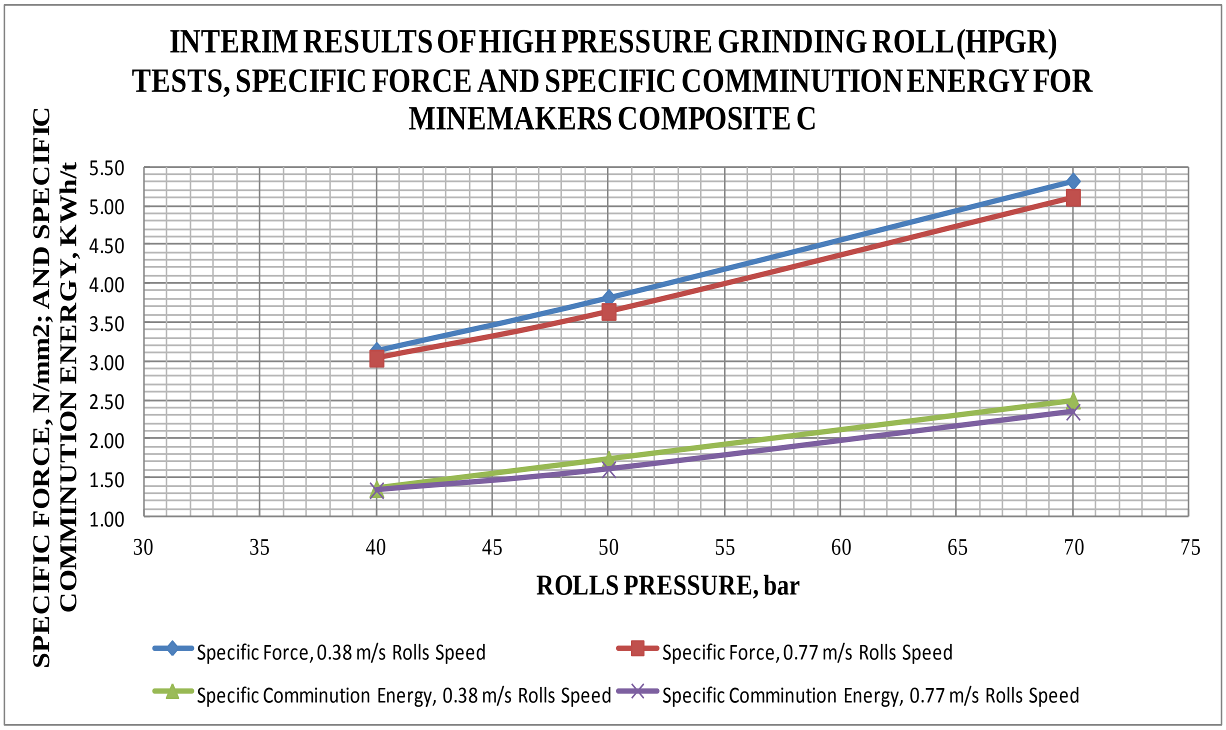
The analysis of the data resulted in the following comments and observations:

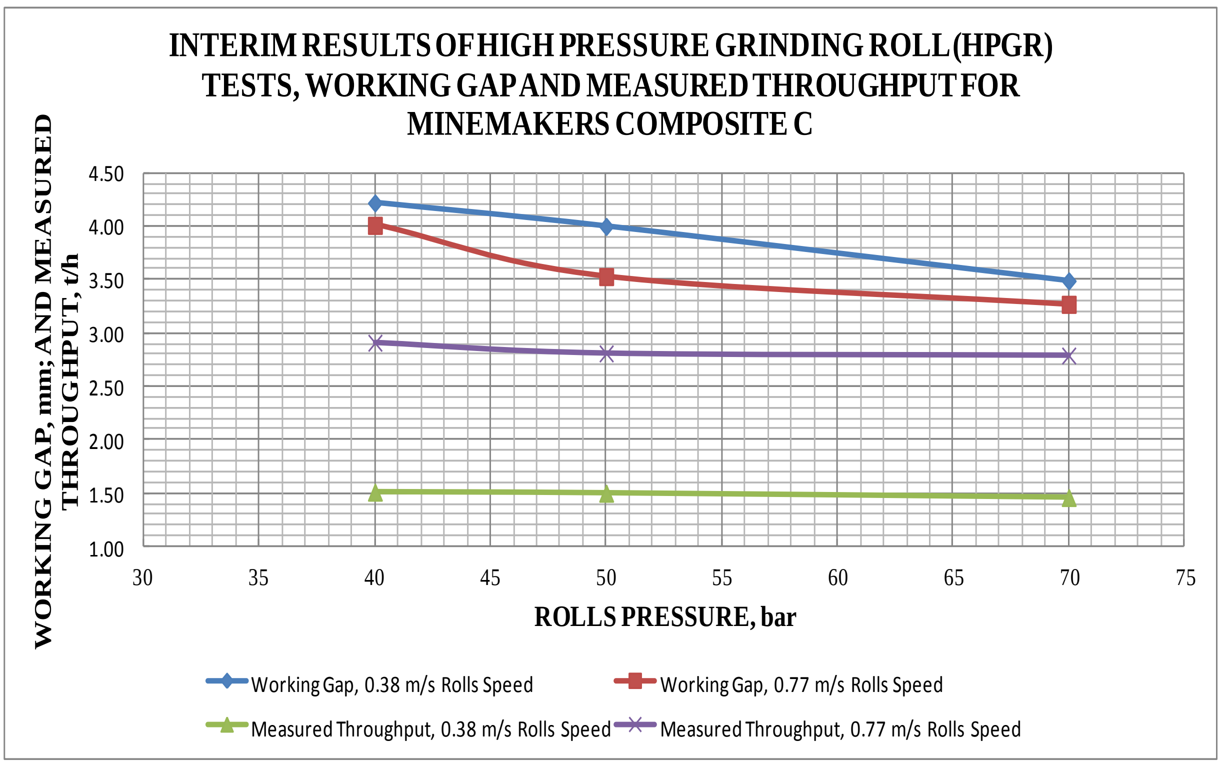
- The data for the Specific Force obtained for the different Roll Pressures and Rolls Speeds applied is within the desire range of 2 N/mm^2 to 6 N/mm^2.
- The Specific Comminution Energy is also within the desire range of 1 KWh/t to 4 KWh/t, the Specific Comminution Energies obtained for the different Roll Pressures and Rolls Speed applied being in the lower range of energy.
- The Specific Forces and Specific Comminution Energies obtained in these HPGR Tests confirmed that the selected Rolls Pressures were adequate for this type of phosphate ore.

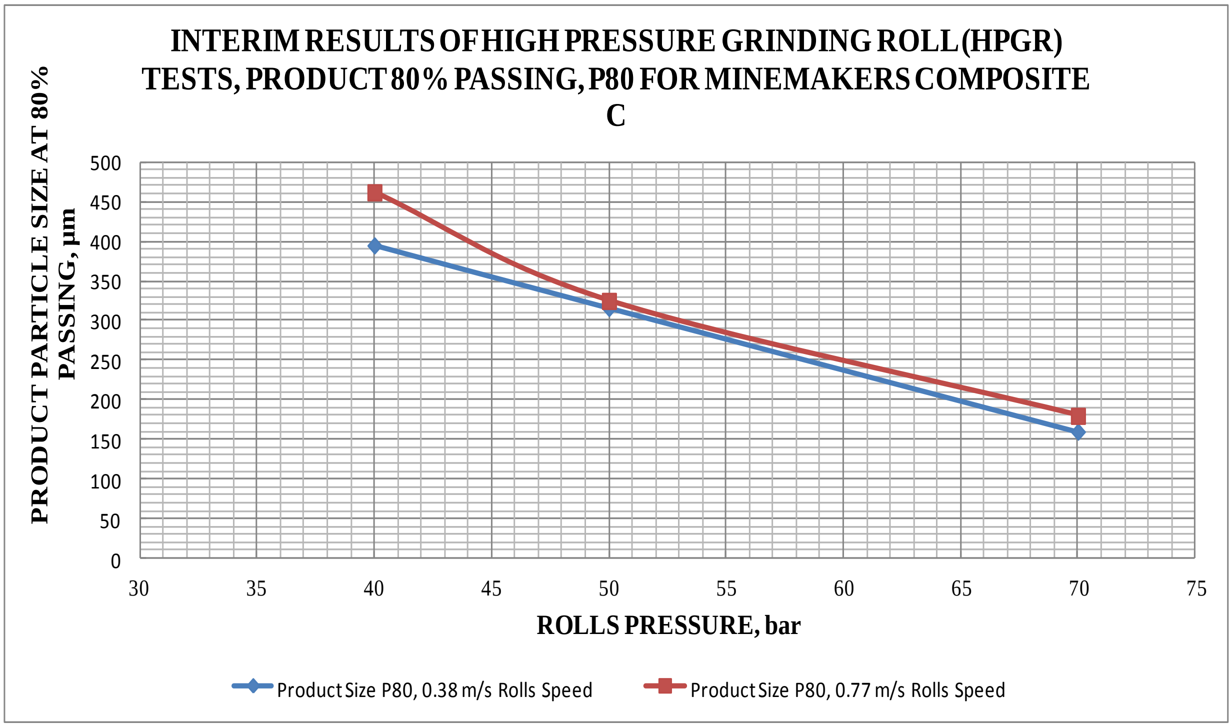
- It was considered that the material may exhibit plastic behavior at low Rolls Speed due to the presence of clay minerals (high Al_2O_3). Therefore, it was recommended the use of high Rolls Speed to enhance the compression mechanism during crushing. The data obtained in the HPGR Tests confirmed this assumption by showing higher Specific Forces and Specific Comminution Energies at low Rolls Speed, 0.38 m/s for all Rolls Pressures applied. In addition, this plasticity was indicated by a larger Working Gap at low Rolls Speed (Tests 1, 2, and 3) than that obtained at high Rolls Speed (Tests 4, 5, and 6) for all Rolls Pressures applied.
- The use high Rolls Speed (0.77 m/s) resulted in higher Measured Throughput than that obtained at low Rolls Speed (0.38 m/s), the Measured Throughput at high Rolls Speed Tests almost doubling that of their corresponding Rolls Pressure at low Rolls Speed Tests.
- The effect of high Rolls Speed (0.77 m/s) on the particle size obtained in the HPGR Tests was shown by a slightly coarser product P_{80} than that obtained at low Rolls Speed (0.38 m/s) for all Rolls Pressure tested. This effect was more pronounced at the lowest Rolls Pressure used (40 bar). As the Rolls Pressure increased, the P_{80} difference with that obtained for the low Rolls Speed decreased. Here, the plasticity of this phosphate ore may play a role since by doubling the Rolls Speed (from 0.38 m/s to 0.77 m/s), it was possible to double the Measured Throughput but it did not affect the product P_{80} size, significantly. Thus, a larger time of applied force did not result in significantly finer product for the same Rolls Pressure tested. Probably, the Specific Force applied decreased as the retention time in the compression zone increased due to the plasticity of the material. This comminution behavior is typical of high clays phosphate ores.
- Based on energy efficiency, Test 6 was the most promising, the results showing the lowest Specific Force, Specific Comminution Energy, and Working Gap. Also, Test 6 showed higher Measured Throughput than that obtained at 0.38 m/s of Rolls Speed.
- It must be bear in mind that the objective of these tests is to obtain the best Al_2O_3 liberation with the minimum P_2O_5 losses, and the best grinding efficiency. Thus, Screen Assays of the crushed products are of utmost importance for the analysis of this information.
- The attrition scrubbing under our Optimized Attrition Scrubbing conditions of the HPGR Tests products are expected to result in lower Al_2O_3 grade, higher Al_2O_3 rejection, and higher P_2O_5 recovery in the beneficiated product than those obtained in conventional crushed phosphate ore submitted to our Optimized Attrition Scrubbing Tests.

RECOMMENDATIONS

- Attrition Scrubbing Tests and Screen Assays are recommended to be applied first to Test 6 and Test 3, followed by Test 5 and Test 2, and finally to Test 4 and Test 1.
- The conditions of the HPGR Test that renders the lowest Al_2O_3 grade, highest Al_2O_3 rejection, and highest P_2O_5 recovery in the beneficiated product should be used for Composite A and B.


INTERIM RESULTS OF HIGH PRESSURE GRINDING ROLL (HPGR) TESTS, SPECIFIC FORCE AND SPECIFIC COMMINUTION ENERGY FOR MINEMAKERS COMPOSITE C
SPECIFIC FORCE, N/mm2; AND SPECIFIC COMMINUTION ENERGY, KWh/t
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
30
35
40
45
50
55
60
65
70
75
ROLLS PRESSURE, bar
Specific Force, 0.38 m/s Rolls Speed
Specific Force, 0.77 m/s Rolls Speed
Specific Comminution Energy, 0.38 m/s Rolls Speed
Specific Comminution Energy, 0.77 m/s Rolls Speed


INTERIM RESULTS OF HIGH PRESSURE GRINDING ROLL (HPGR) TESTS, WORKING GAP AND MEASURED THROUGHPUT FOR MINEMAKERS COMPOSITE C
WORKING GAP, mm; AND MEASURED THROUGHPUT, t/h
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
30
35
40
45
50
55
60
65
70
75
ROLLS PRESSURE, bar
Working Gap, 0.38 m/s Rolls Speed
Working Gap, 0.77 m/s Rolls Speed
Measured Throughput, 0.38 m/s Rolls Speed
Measured Throughput, 0.77 m/s Rolls Speed


INTERIM RESULTS OF HIGH PRESSURE GRINDING ROLL (HPGR) TESTS, PRODUCT 80% PASSING, P80 FOR MINEMAKERS COMPOSITE C
PRODUCT PARTICLE SIZE AT 80% PASSING, µm
500
450
400
350
300
250
200
150
100
50
0
30
35
40
45
50
55
60
65
70
75
ROLLS PRESSURE, bar
Product Size P80, 0.38 m/s Rolls Speed
Product Size P80, 0.77 m/s Rolls Speed

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TO: Mr. Marten Walters, President, KEMWorks Technology, Inc.
CC. Mr. Neville Bergin, General Manager, MINEMAKERS Limited.

FROM: Dr. Francisco J. Sotillo, President, PerUsa EnviroMet, Inc.

SUBJECT: Laboratory Tests to Determine the Potential Use of High Pressure Grinding Roll (HPGR) and Attrition Tests 86 to 89 for MPH Samples from Arruwurra Wonarah Phoshate Project,.Composite C and Duplicates – Data Analysis .

DATE: November 11, 2013

INTRODUCTION

As requested by Minemakers Australia PTY LTD, the analysis of the Interim Test Results of results of HPGR Test 3 (70 bar Applied Pressure and 0.38 m/s Rolls Speed) and Test 6 (70 bar Applied Pressure and 0.77 m/s Rolls Speed), and their corresponding Attrition Scrubbing of HPGR Tests 3 and 6 products (47.5% solids content, 1200 rpm, and 15 minutes) was performed. The processed information is presented in the following Excel Files:

- KEMWorks-PN2069-HPGR Results-K12023SA12.
- KEMWorks-PN2069-HPGR Results-K12023SA13.
- KEMWorks-PN2069-HPGR Results-K12023SA14.
- KEMWorks-PN2069-HPGR Results-K12023SA15.
- KEMWorks-PN2069-HPGR-K12023 MPH AT86_87.
- KEMWorks-PN2069-HPGR-K12023 MPH AT88_89.

These tests results were part of tests that were aimed at determining the feasibility of using High Pressure Grinding Roll (HPGR) on the PFD for the beneficiation of a composite sample of the Main Zone (MPH), Arruwurra, Wonarah, Phosphate Project. For these tests, MPH Phosphate Ore Composite C:>9% Al_2O_3 were submitted to HPGR testing program. Test 3 and Test 6 deferred on the Rolls Speed, 0.38 m/s and 0.77 m/s, respectively. The following paragraphs presented the comments, observations, and recommendations in a bullet form for easy following.

COMMENTS AND OBSERVATIONS

General comments

- As mentioned in previous report (September 05, 2013) for the Interim Tests Results, the use of HPGR may be possible due to these encouraging results. Thus, a SAG mill could be replaced.
- Generally, the results showed that the selective grinding of Al_2O_3 minerals took place during these tests, P_2O_5 and SiO_2being ground at a slower rate than Al_2O_3.
- Data showed that at 70 bar of Applied Pressure, excessive grinding of P_2O_5 occurred, increasing P_2O_5 losses.

- It was also shown that grinding at slower Rolls Speed was beneficial since Al_2O_3 rejection was similar at 0.38 m/s and 0.77 m/s of Rolls Speed, but more P_2O_5 was recovered.
- Capacity decreased at slower Rolls Speed and P_{80} of the ground product was significantly affected, 250 µm for Test 3 versus 150 µm for Test 6.
- It must also bear in mind that Composite C was high in Al_2O_3 and low in P_2O_5, which may increase the overall grindability of the material, resulting in high P_2O_5 losses for 70 bar of Applied Pressure.
- Attrition of the HPGR products significantly reduced the particle size demonstrating the micro-cracking and residual stresses in the particles generated by the Bed Comminution Mechanism of the HPGR.
- In general, the analysis of the results was complicated by the different size fractions chosen for the HPGR Tests 3 and 6 and those size fractions used for the Attrition Scrubbing Tests 86 to 89. As a consequence, plotting of the results was a better way to analyze the information.
- The results of Duplicates for both HPGR Tests 3 and 6, and the Attrition Scrubbing Tests 87 and 89 were virtually identical to those of the Original samples studied. However, average data for the Original and Duplicate tests were used for the analysis.
- For this evaluation, we must be aware that the data on Distribution and Grades takes into consideration the rejection of the +2360-µm size fraction and the -38 µm or -20-µm size fraction for the HPGR and Attrition tests, respectively for the calculations.

Preliminary Analysis

To put in an appropriate context the data generated on these HPGR tests, Table 1 presented the Nominal, F_{80}, and P_{80} values of the Standard MPH Phosphate Ore prepared at different nominal sizes in comparison with those produced by preparing Composite C at nominal -9-mm feed size.

TABLE 1. NOMINAL, F_{80}, AND P_{80} VALUES FOR MPH COMPOSITE SAMPLES

Composite MPH Ore Type	Nominal Feed Size mm	Ratio of Nominal Size	Particle F_{80} µm	Ratio of F_{80} Particle	Ratio of Nominal / F_{80}	Crushing HPGR P_{80}, µm	Ratio of Reduction HPGR, R_{80}	Attrition P_{80} µm	Ratio of Reduction Attrition, R_{80}
Standard	-12.7	--	8900.00	--	1.43	--	--	--	--
Standard	-2	6.35	1410.00	6.31	1.42	--	--	550.00	2.56
Composite C, 0.38 m/s	-9	1.41	3152.00	2.82	2.86	250.00	12.61	65.00	3.85
Composite C, 0.77 m/s	-9	1.41	3152.00	2.82	2.86	150.00	21.01	39.00	3.85

- This table showed that the feed preparation procedure was quite consistent for the Standard Phosphate Ore Composites producing the same Ratio of F_{80} Sizes than that obtained for the Nominal Sizes, and the same Ratio of Nominal Sizes to F_{80} Sizes for the Standard MPH Phosphate Ore Composite Samples.
- The Ratio of Nominal Sizes of the Standard -12.7 mm to Composite C, -9 mm was only 1.41, but the Ratio of F_{80} produced for Composite C was 2.82, and that of Nominal to F_{80} for Composite C was 2.86. This data indicated that the preparation procedure of the

MPH Phosphate Ore, Composite C produced material twice finer than that produced with the Standard MPH Composite samples, probably due to the presence of higher Al_2O_3.

- This is reflected in the HPGR grinding with high reduction ratios. The data in Table 1 clearly showed the effect of plasticity on HPGR comminution since Test 3 (at 0.38 m/s Rolls Speed) resulted in a much lower R_{80} (12.61) than that R_{80} (21.01) of Test 6 (0.77 m/s Rolls Speed).
- The effect of micro-cracking and residual stresses produced during HPGR comminution in the Attrition Scrubbing was demonstrated by the increase in the R_{80} of both Test 3 and Test 6 (3.85) with respect to the Attrition of the Standard MPH Phosphate Ore Composite (2.86). Since Attrition Scrubbing should clean the surfaces and break agglomerates of particles of different mineralogical species from fines not actually ground, the higher R_{80} for attrition of Composite C samples could be attributed to the weakening of the grain border between different mineral species (micro-cracks).
- Consequently, the selection of the operating conditions of the HPGR will have to take into consideration the Al_2O_3 content to be able to extrapolate the operating parameters to MPH Composite A and B to avoid under or over-grinding of the material, and limiting grinding of P_2O_5. Under these conditions, it will be possible to obtain the highest recovery of P_2O_5 with the highest rejection of Al_2O_3; thus, the lowest Al_2O_3 grade in the Phosphate Concentrate.

HPGR Test 3 and Attrition Scrubbing Tests 86 and 87

- From the HPGR Test 3 and Duplicate Test plots of Particle Size Distribution (PSD) Al_2O_3, P_2O_5, and SiO_2 Distributions for MPH Phosphate Ore Composite C, the locus of the curves clearly showed that Al_2O_3 minerals were preferentially ground resulting in lower recovery in the 2360x38-µm material, 13.42% (84.93% rejection in the -38-µm size fraction); whereas, P_2O_5 recovery on the 2360x38-µm size fraction was 38.11% (55.88% losses in the -38-µm material). The SiO_2 recovery in the 2360x38-µm size fraction being somewhere in between at 29.62% (64.63% rejection in the -38-µm size fraction). SiO_2 Distribution curve was almost identical to that of the Weight Distribution (yield), reporting 27.87% yield in the 2360x38-µm size fraction. This demonstrates that selective grinding of Al_2O_3 takes place upon using HPGR due to the Bed Comminution mechanism.
- HPGR Test 3 (0.38 m/s Rolls Speed) resulted in a drop in the Al_2O_3 grade in the 2360x38-µm product from a feed grade of 11.95% Al_2O_3 to a product containing 5.75% Al_2O_3, a reduction of 2.08 times, which is the same as that for the Standard MPH Composite sample submitted to crushing and Attrition (4.10% Al_2O_3 to 1.98% Al_2O_3).
- When the product of the HPGR Test 3 and Duplicate were submitted to our attrition process as reported in MPH Attrition Tests 86 and 87, respectively, the results were improved. These tests showed that the locus of the PSD, Al_2O_3, P_2O_5, and SiO_2 for MPH Phosphate Ore Composite C were in agreement with the concept of selective grinding with the Al_2O_3 minerals being preferentially ground with respect to P_2O_5 and SiO_2 bearing minerals. The data showed that Al_2O_3 recovery in the 2360x20-µm size fraction decreased to 9.47% (89.67% of Al_2O_3 rejected in the -20-µm material), the P_2O_5 recovery in the 2360x20-µm product being 35.30% with P_2O_5 losses of 61.26% in

the -20-µm size fraction. SiO_2 Distribution showed a recovery in the 2360x20-µm material of 31.41% (63.84% rejection in the -20-µm size fraction). As in the case of the HPGR Test 3 results, the locus of the Distributions curves for SiO_2 was somewhere in between that of the P_2O_5 and Al_2O_3, and closer to the locus of the Weight Distribution curve (yield), showing 27.76% yield in the 2360x20-µm size fraction.

- MPH Phosphate Attrition Tests 86 and 87 reported a further drop in the Al_2O_3 grade to 4.09% Al_2O_3 in the 2360x20-µm product from an overall reduction of Al_2O_3 of 2.93 times from 11.98% Al_2O_3 in the feed to the system. These results corresponded to a better reduction in Al_2O_3 grade than that obtained for the Standard MPH Phosphate Ore Composite sample after crushing and attrition (2.08 times).
- Even though over-grinding occurred due to the soft MPH Phosphate Ore Composite C and the high pressure applied (70 bar), the recovery of P_2O_5 (35.30%) was significantly higher than that of the yield (27.76%) with 84.67% rejection of Al_2O_3. This also demonstrated that selective grinding took place, the right HPGR operating conditions (Applied Pressure and Rolls Speed) requiring to be determined.
- In the case of the HPGR Test 6 and Duplicate Test, the PSD, Al_2O_3, P_2O_5, and SiO_2 locus of the Distribution curves showed similar results than those presented for HPGR Test 3 and Duplicate. However, Al_2O_3 minerals were further ground resulting in a recovery of 12.15% in the 2360x38-µm size fraction (86.66% of Al_2O_3 rejection in the -38-µm material). On the other hand, P_2O_5 recovery also decreased but in a smaller proportion to 35.57% in the 2360x38-µm product with P_2O_5 losses of 60.33% in the -38-µm material. Again, SiO_2 locus of the Distribution curve was in between, and similar to that of the Weight Distribution (yield). SiO_2 recovery in the 2360x38-µm size fraction was 28.49% with rejection of SiO_2 of 67.12% in the -38-µm material.
- By using 0.77 m/s Rolls Speed in the HPGR Test 6, the Al_2O_3 grade drop to 5.51% Al_2O_3 in the 2360x38-µm product from a feed of 12.08% Al_2O_3; thus, a reduction of 2.32 times. This is higher than the reduction in Al_2O_3 grade obtained by the Standard System (2.08 times).
- The Attrition process was applied to the HPGR Test 6 and its Duplicate as shown in the results of Attrition Tests 88 and 89, respectively. Here, the locus of the curves for the PSD, Al_2O_3, P_2O_5, and SiO_2 Distributions showed that selective grinding of Al_2O_3 minerals resulted in a recovery of 9.40% of Al_2O_3 for the 2360x20-µm product with a rejection of 89.96% of Al_2O_3 in the -20-µm size fraction. P_2O_5 recovery in the 2360x20-µm product was decreased to 34.59% with an increase in losses to 62.74% in the -20-µm size fraction. SiO_2 recovery in the 2360x20-µm product was 31.41% with higher rejection in the -20-µm material of 64.83% than that obtained for Tests 86 and 87, indicating additional grinding of this material, but with similar Weight Distribution (yield) of 27.63% in the 2360x20-µm product, and 69.42% in the -20-µm size fraction.
- The Al_2O_3 grade for the HPGR Attrition Tests 88 an 89 resulted in 4.11% Al_2O_3 grade for the 2360x20-µm size fraction, and a reduction of Al_2O_3 grade of 2.93 times. Thus, a marginal improvement over those reductions in Al_2O_3 obtained for HPGR + Attrition Test 86 and 87, but superior than that for the Standard MPH Phosphate Ore Composite samples.
- Further over-grinding of Composite C sample using 0.77 m/s Rolls Speed at 70 bar of Applied Pressure resulted in a lower P_2O_5 recovery (34.59%) than that obtained for 0.38

m/s Rolls Speed (35.30%) on the 2360x20-µm size fraction. On the other hand, a marginal increase in Al_2O_3 in the -20-µm was observed from 89.67% to 89.96% for 0.38 m/s and 0.77 m/s Rolls Speed, respectively with almost the same yields, 27.76% for 0.38 m/s Rolls Speed, and 27.63% for 0.77 m/s Rolls Speed.

RECOMMENDATIONS

- For Composite C (soft phosphate ore), the use of 0.38 m/s Rolls Speed shows an advantage, producing higher P_2O_5 recovery and Al_2O_3 rejection in the 2360x20-µm product.
- Processing of HPGR Tests 1 and 4 results should be carried out next followed by HPGR Tests 2 and 5 to determine the effect of applied pressure. However, all data are required to try to determine the best operating conditions for HPGR to be used for Composite A and Composite B.
- Since the operating conditions of the HPGR crushing (Applied Pressure and Rolls Speed) depends on the hardness of the ore (Al_2O_3 content), it is of utmost importance to determine the F_{80}s of Composites A and B prepared at Nominal size -9 mm for the HPGR tests, and compare them with the Standard and Composite C. This requires to correlate P_2O_5 recovery and Al_2O_3 rejection with the Applied Pressure and Rolls Speed to be used for HPGR testing of Composite A and B.

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CC. Mr. Neville Bergin, General Manager, MINEMAKERS Limited.

FROM: Dr. Francisco J. Sotillo, President, PerUsa EnviroMet, Inc.

SUBJECT: Screen Analysis and Assays of the HPGR Head Samples for Composite A, B, and C for MPH Samples from Arruwurra Wonarah Phosphate Project–Data Analysis.

DATE: March 05, 2014

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

- The analysis of the data on the particle size distributions (PSD) and screen assays of the HPGR Head Samples of Composite A, B, and C indicated that the Model prepared could predict the HPGR + Attrition Scrubbing results for MPH Phosphate Ore for Composites A and B.
- The data analysis confirmed that selective grinding occurred due to the difference in hardness of the mineral species. The data indicated the P_2O_5 bearing minerals were the hardest, followed by SiO_2 bearing minerals, Al_2O_3 bearing minerals being the softest.
- The Head Samples data supported the selected HPGR operating conditions chosen to carry out the comminution tests for Composite A and B: **40 bars of Applied Pressure and 0.77 m/s of Rolls Speed.**

INTRODUCTION

Following recommendations on the report of January 27, 2014, screen analysis and assays of the Head Samples of Composites A, B, and C were carried out to validate the Model prepared to predict the results of the HPGR + Attrition Scrubbing on Composite A and B from data obtained from HPGR + Attrition Scrubbing of Composite C. Moreover, these tests were suggested to confirm the HPGR operating conditions selected to be used for Composites A and B. The following Excel Files were prepared on screen analysis of Composite A, B, and C; and screen assays of Composite A, Composite B and Composite C, respectively:

- KEMWorks-PN2069-K12013 HPGR Comp A-C Head Sizing-1.
- KEMWorks-PN2069-K12023SA20.
- KEMWorks-PN2069-K12023SA21.
- KEMWorks-PN2069-K12023SA22.

As in previous reports, a bullet form for easy following is presented in the following paragraphs.

SCREEN ANALYSIS

- Screen analyses of the HPGR Head Samples are presented in Figures 1 and 2, and in Table 5. The data included for completion the Head Samples chemical analysis obtained from the Screen Assays. Composite A reported 2.65% Al_2O_3 and 22.82% P_2O_5, Composite B analyzed 5.49% Al_2O_3 and 16.26% P_2O_5, and Composite C reported 11.87% Al_2O_3 and 6.04% P_2O_5.

- The data showed that the higher the P_2O_5 content and the lower the Al_2O_3 content, the lower the value of the Ratio of F_{80} and the Ratio of Nominal/F_{80}, indicating that a stronger-harder phosphate ore will be submitted to HPGR comminution.
- Knowing that the Standard process produces 63.45% of P_2O_5 recovery and 69.82% of Al_2O_3rejection at about 1.42 Ratio of Nominal/F_{80}, larger ratio should result in better liberation under similar conditions; thus, improved results. This is in agreement with the concept of the effect of Al_2O_3 and P_2O_5 contents on the hardness of the ore.
- Since selective comminution of Al_2O_3 bearing minerals by P_2O_5 and SiO_2 bearing minerals was demonstrated in previous reports, it is expected that the results predicted by the Model be achieved.

TABLE 5. NOMINAL, F_{80}, AND P_{80} VALUES FOR MPH COMPOSITE SAMPLES

TEST 4

Composite MPH Ore Type	Nominal Feed Size mm	Ratio of Nominal Size	Particle F_{80} µm	Ratio of F_{80} Particle	Ratio of Nominal / F_{80}	Crushing HPGR P_{80}, µm	Ratio of Reduction HPGR, R_{80}	Attrition P_{80} µm	Ratio of Reduction Attrition, R_{80}	Head Grades P_2O_5 %	Head Grades Al_2O_3 %
Standard	-12.7	--	8900.00	--	1.43	--	--	--	--		
Standard	-2	6.35	1410.00	6.31	1.42	--	--	550.00	2.56	20.8	4.1
Composite A	-9.5	1.34	6590.00	1.35	1.44					22.82	2.65
Composite B	-9.5	1.34	5529.00	1.61	1.72					16.26	5.49
Composite C, 0.77 m/s	-9.5	1.34	3625.00	2.46	2.62	395.00	9.18	95.00	4.16	6.25	11.87

FIGURE 1. PARTICLE SIZE DISTRIBUTIONS FOR COMPOSITES A, B, AND C OF MPH PHOSPHATE ORE OF MINEMAKERS

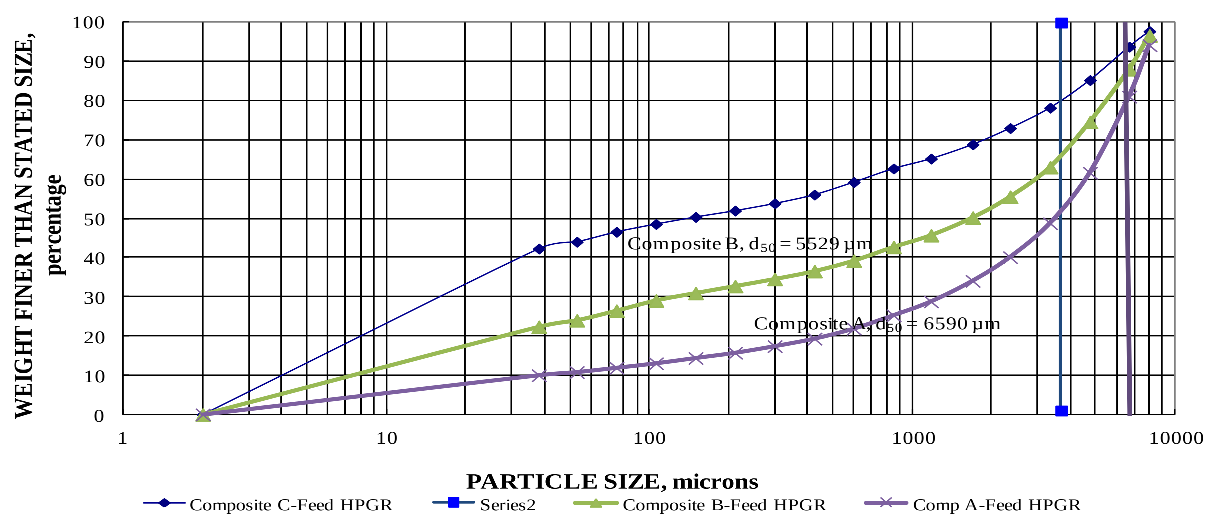
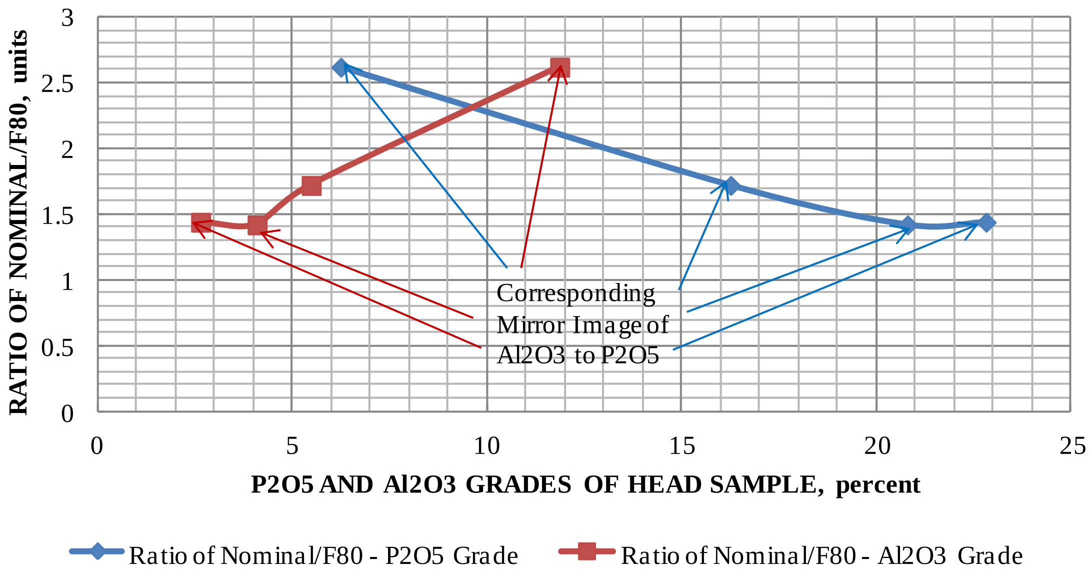


FIGURE 2. CORRELATION OF GRADES OF P2O5 AND AL2O3 WITH RATIO OF REDUCTION FOR HPGR HEAD SAMPLES OF MPH PHOSPHATE ORE OF MINEMAKERS



- Figure 2 showed that there was clear proportionality of the Head Samples Ratio of Nominal/F_{80} with the P_2O_5 and Al_2O_3 Head Samples grades, validating the basis for the applied Model. **Moreover, this information confirmed the HPGR operating conditions selected 40 bars of Applied Pressure and 0.77 m /s of Rolls Speed.**

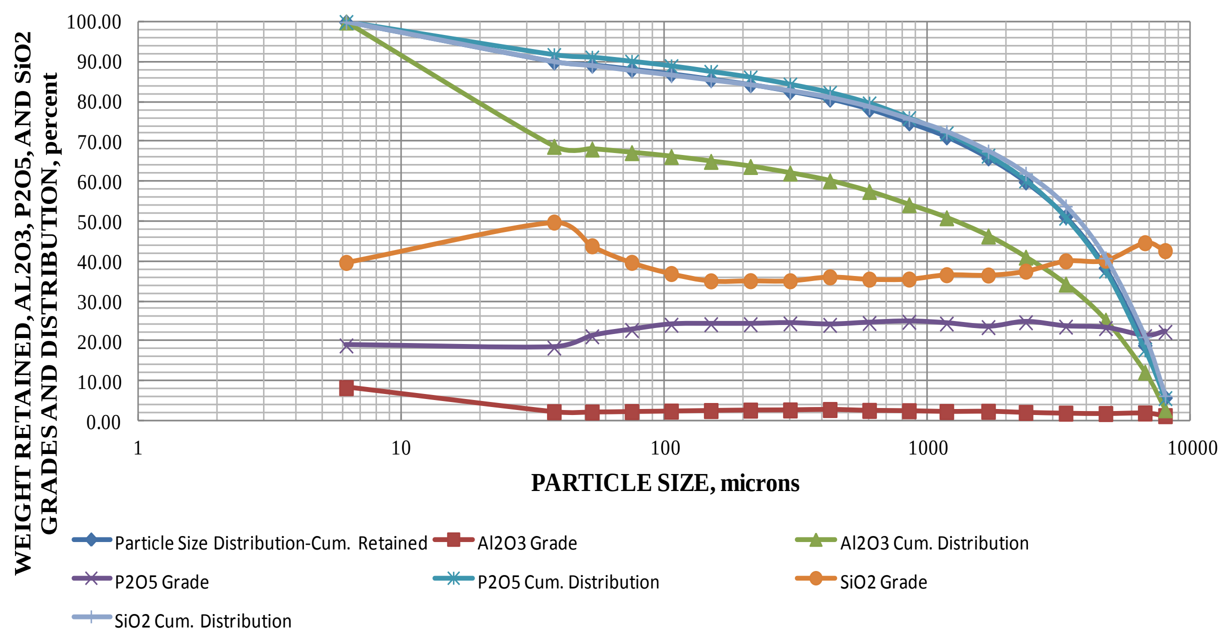
SCREEN ASSAYS

Composite A

- Composite A Head Samples analyzed 2.65% Al_2O_3 and 22.82% P_2O_5. Clearly, this composite corresponded to the hardest phosphate ore since only 10.01% by weight reported to the -38-µm size fraction. Moreover, Al_2O_3 material concentrated in this size fraction, resulting in 8.27% Al_2O_3 with 18.86% P_2O_5. Thus, 31.19% of Al_2O_3 is present in the -38-µm size fraction containing only 8.27% of P_2O_5.
- Again, the +2360-µm size fraction of the Composite A Head Sample showed a hard phosphate ore as indicated by 59.87% by weight in this size fraction. This material was low in Al_2O_3 (1.82%) and high in P_2O_5 (22.97%). Therefore, it appeared that after submitting Composite A to HPGR most of the +2360-µm material will report to the product (2360x38 µm). In the +2360-µm size fraction, 41.01% of Al_2O_3 with 60.26% of P_2O_5 was reported, P_2O_5 being expected to be recovered in the 2360x38-µm size fraction after comminution in a HPGR.

- Product size, 2360x38 µm corresponded to 30.11% by weight with 2.45% Al_2O_3 and 23.85% P_2O_5. This size fraction contained 27.80% of Al_2O_3 and 31.46% of P_2O_5. After HPGR comminution, it is expected to reduce Al_2O_3 below 2.00%, the Al_2O_3 reporting in the -38-µm size fraction; whereas, most of the P_2O_5 content remaining in the product, 2360x38 µm.
- Consequently, it is expected above 90% of the Al_2O_3 being reported in the -38-µm size fraction with a total recovered in the 2360x38-µm size fraction of P_2O_5 of about 87%.
- Figure 3 presented the Distributions of Al_2O_3, P_2O_5, and SiO_2 for Composite A. These Distributions showed that the weight Retained (PSD) was dominated by the P_2O_5 and SiO_2 bearing minerals species (same locus of the curve); whereas, the Al_2O_3 corresponded to a different locus, indicating that Al_2O_3 bearing minerals will be preferentially comminuted by the harder material (P_2O_5 and SiO_2). The locus of the Grade Distribution Curves showed that P_2O_5 was slightly higher in grade in the 2360x38-µm size fraction decreasing in grade in the -38-µm size fraction. SiO_2 grade increased in the +2360 µm and -38-µm size fractions; whereas, Al_2O_3 was flat for all size fractions increasing only at -38 µm.

FIGURE 3. DISTRIBUTIONS OF PARTICLE SIZE, Al2O3, P2O5, AND SiO2 FOR HPGR HEAD SAMPLE FOR MPH PHOSPHATE ORE COMPOSITE A

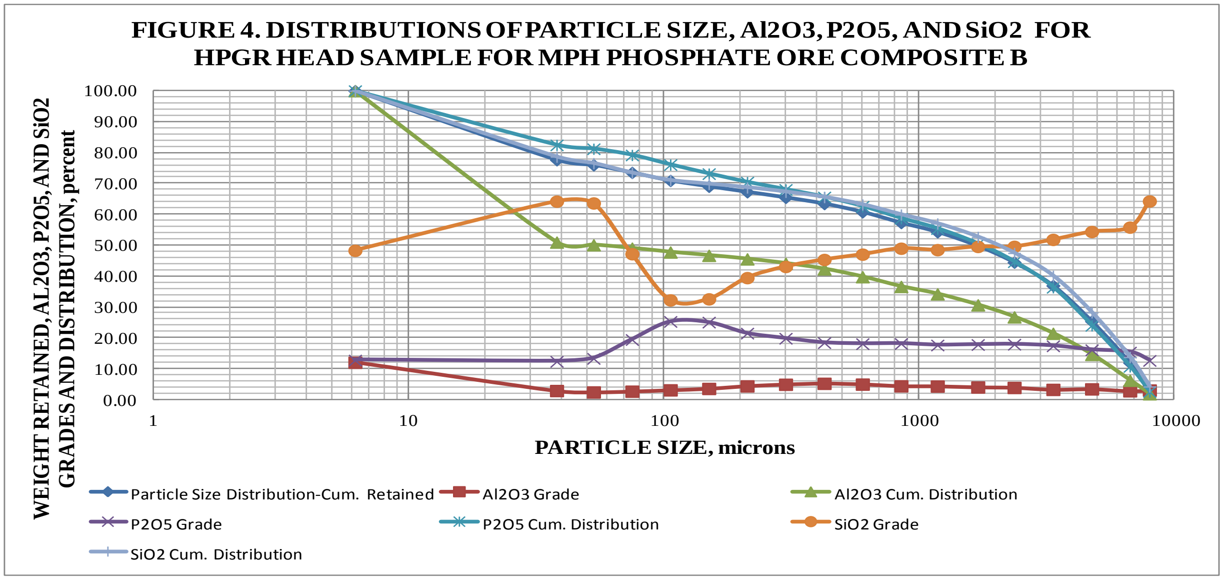


Composite B

- Composite B Head Sample behaved similar than Composite A. This composite reported 5.49% Al_2O_3 and 16.26% P_2O_5 and higher weight fraction retained in the -38µm, 22.37%; thus, a medium-hard phosphate ore. As expected, Al_2O_3 concentrated in the -

38-µm size fraction, reporting 12.04% Al_2O_3 and 12.76% P_2O_5 corresponding to 49.05% of Al_2O_3 content and 17.55% of P_2O_5 content.

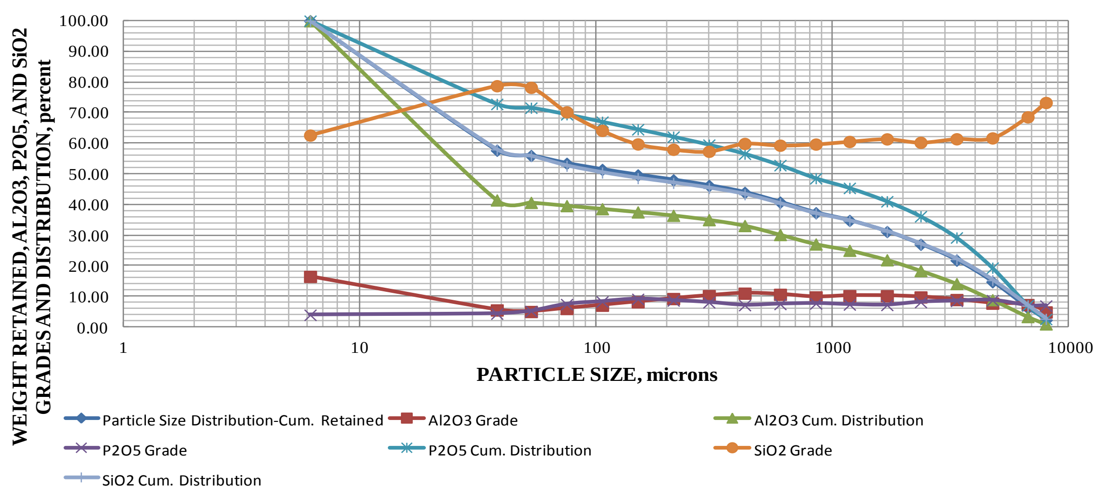
- The +2360-µm size fraction corresponded to 44.45% by weight of the material with higher Al_2O_3 (3.30%) and lower P_2O_5 (16.32%) than those observed for Composite A. Again, it is assumed that by submitting this size fraction to HPGR comminution most of the material will report to the Product, 2360x38 µm. The +2360-µm material contained 26.74% of Al_2O_3 and 44.62% of P_2O_5 that it is expected to be recovered in the 2360x38-µm size fraction after HPGR comminution.
- The Product size fraction, 2360x38 µm, was 33.18% by weight, similar than that reported for the Composite A, which may indicate that the +2360-µm material may trend to report in the 2360x38 µm after comminution. 2360x38-µm material analyzed 4.01% Al_2O_3 and 18.54% P_2O_5, containing 24.21% of Al_2O_3 and 37.82% of P_2O_5 similar values than those of the Standard process. Thus, it is expected that Al_2O_3 grade will drop below 2.00%, the Al_2O_3 reporting in the -38-µm size fraction; whereas, the P_2O_5 remaining in the 2360x38-µm size fraction.
- It is expected that about 92% of Al_2O_3 being reported in the -38-µm size fraction and above 82% of P_2O_5 being recovered in the 2360x38 µm.
- Figure 4 presented the Distributions of Al_2O_3, P_2O_5, and SiO_2 for Composite B. Similar to Composite A, the Distributions Curves showed that the PSD and the SiO_2 Distribution shared the same locus; whereas, the locus of the P_2O_5 Distribution Curve was slightly above the PSD, indicating that the phosphate bearing minerals were the hardest species (coarser material), the Al_2O_3 bearing minerals being the softest (finer material). Thus, it was expected that the Al_2O_3 bearing minerals will be preferentially ground by the harder P_2O_5 and SiO_2 bearing minerals. The Grade Distribution Curves showed that P_2O_5 grade remained almost constant from 2360x200 µm, increasing at 200x75 µm, and decreasing in the -75-µm size range. SiO_2 decreased in grade from 8000 µm to 106 µm, increasing at -106-µm size fraction. Al_2O_3 grade increased in the size fraction 1700x150 µm, increasing again in the -38-µm size fraction.



Composite C

- HPGR effect on Composite C has been analyzed in previous reports (January 27, 2014). However, Composite C Head Sample showed some important information that needed to be addressed. First, it was found that the P_{80} for Composite C was 3625 µm instead of 3152 µm reported by JK Tech. Since the difference corresponded to a coarser Head sample, the results clearly demonstrated that Composite C was the softest phosphate ore producing even large Ratio of Nominal/F_{80} than those already reported, and that selective comminution of Al_2O_3 bearing minerals occurred, P_2O_5 bearing minerals being ground at a slower rate. Therefore, Composite C Head Sample reported 11.87% Al_2O_3 and 6.04% P_2O_5, the -38-µm size fraction weight being 42.32%. Composite C Al_2O_3 grade in the -38-µm size fraction was 16.43% and that of P_2O_5 was 3.88%. This corresponded to 58.58% of Al_2O_3 and 27.19% of P_2O_5 contents.
- Composite C +2360-µm size fraction corresponded to 26.93% by weight with 8.08% Al_2O_3 and 8.09% P_2O_5. The size fraction contained 18.33% of Al_2O_3 and 36.74% of P_2O_5.
- The 2360x38-µm size fraction reported 30.74% by weight analyzing 8.92% Al_2O_3 and 7.21% P_2O_5, corresponding to 23.10% of Al_2O_3 and 36.72% of P_2O_5.
- Figure 5 presented the Distributions of Al_2O_3, P_2O_5, and SiO_2 for Composite C. The Distributions Curves showed that the locus of the P_2O_5 Distribution Curve corresponded to a much coarser product than that of other minerals. The PSD and SiO_2 locus of the Distribution Curves were identical; whereas, the locus of the Al_2O_3 Distribution showed the finest material in the phosphate ore. In the case of the Grade Distribution Curves, it was clear that SiO_2 grade decreased in the 8000x4000-µm size fraction, maintaining a constant grade for the 400x200-µm size range, the SiO_2 grade increasing in the -200-µm fine fraction. P_2O_5 grade increased from 800x500-µm, level off from 500x200 µm, and decreased in the -200-µm size fraction. Al_2O_3 grade increased in the 800x400-µm range, decreased from 400x38 µm, and increased again in the -38-µm size fraction.

FIGURE 5. DISTRIBUTIONS OF PARTICLE SIZE, Al2O3, P2O5, AND SiO2 FOR HPGR HEAD SAMPLE FOR MPH PHOSPHATE ORE COMPOSITE C



K12023 SIZE-ASSAY RESULTS (Composite C HPGR Test 3 Product)

PRODUCT	WEIGHT g	WEIGHT %	ASSAY Al_2O_3 %	CaO %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	As ppm	Cd ppm	Pb ppm	Zn ppm	U ppm	LOI %
Product Size +3350 µm Fr	20.95	2.49	3.27	6.56	6.31	0.27	0.14	0.05	0.02	4.91	#####	0.15	1.50	0.44	194	188	13	2.71
Product Size +2360 µm Fr	21.25	2.53	3.82	9.22	3.39	0.31	0.18	0.02	0.03	6.85	#####	0.16	0.02	0.60	182	178	19	2.74
Product Size +1700 µm Fr	20.26	2.41	5.22	#####	4.56	0.48	0.27	0.03	0.03	7.85	#####	0.21	3.90	0.69	207	183	21	3.83
Product Size +1180 µm Fr	26.73	3.18	6.75	#####	4.54	0.65	0.38	0.05	0.04	8.20	#####	0.28	0.90	0.72	219	262	22	4.19
Product Size +850 µm Fra	20.91	2.49	7.05	#####	4.85	0.68	0.41	0.06	0.04	8.67	#####	0.29	1.00	0.81	257	218	25	4.61
Product Size +600 µm Fra	17.89	2.13	6.87	#####	4.56	0.66	0.41	0.06	0.04	8.67	#####	0.28	4.70	0.81	277	210	25	4.70
Product Size +425 µm Fra	16.43	1.96	7.01	#####	4.66	0.66	0.42	0.07	0.04	9.19	#####	0.28	4.60	0.79	298	200	25	4.65
Product Size +300 µm Fra	13.19	1.57	6.58	#####	4.54	0.60	0.38	0.07	0.04	9.63	#####	0.26	0.50	0.86	300	211	26	4.58
Product Size +212 µm Fra	18.43	2.19	6.90	#####	4.24	0.65	0.43	0.08	0.04	#####	#####	0.29	2.70	0.85	321	205	25	4.53
Product Size +150 µm Fra	16.13	1.92	6.38	#####	3.75	0.62	0.45	0.06	0.04	9.63	#####	0.29	3.50	0.67	300	242	23	4.26
Product Size +106 µm Fra	15.90	1.89	5.44	#####	3.31	0.50	0.36	0.05	0.04	9.21	#####	0.26	0.20	0.64	289	156	23	3.83
Product Size +75 µm Frac	17.04	2.03	4.60	#####	2.74	0.42	0.27	0.04	0.15	8.74	#####	0.25	0.20	0.54	266	133	21	3.20
Product Size +53 µm Frac	32.86	3.91	3.82	8.01	1.93	0.36	0.20	0.02	0.03	6.08	#####	0.28	0.20	0.44	175	107	16	2.40
Product Size +38 µm Frac	18.18	2.16	4.17	6.32	1.90	0.43	0.24	0.01	0.04	4.81	#####	0.41	4.30	0.33	149	93	14	2.49
Product Size -38 µm Fract	######	67.13	#####	6.47	3.38	1.68	0.87	0.01	0.07	5.10	#####	0.76	1.70	0.40	201	160	18	6.35
(Calculated Head)	######	######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	(213)	(167)	(19)	#####
Assayed Head																		

PRODUCT	DISTRIBUTION, % Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	As	Cd	Pb	Zn	U	LOI
Product Size +3350 µm Fr	0.69	2.10	4.44	0.52	0.51	5.75	0.82	2.04	3.04	0.63	2.13	2.29	2.27	2.80	1.71	1.24
Product Size +2360 µm Fr	0.81	2.99	2.42	0.61	0.66	2.33	1.24	2.89	2.97	0.68	0.03	3.16	2.16	2.69	2.54	1.27
Product Size +1700 µm Fr	1.06	3.26	3.10	0.89	0.95	3.34	1.19	3.16	2.62	0.85	5.34	3.47	2.34	2.64	2.68	1.69
Product Size +1180 µm Fr	1.81	4.41	4.07	1.60	1.76	7.34	2.09	4.35	3.27	1.49	1.63	4.78	3.27	4.98	3.70	2.44
Product Size +850 µm Fra	1.48	3.71	3.40	1.31	1.48	6.89	1.63	3.60	2.48	1.21	1.41	4.20	3.00	3.24	3.29	2.10
Product Size +600 µm Fra	1.23	3.21	2.74	1.08	1.27	5.89	1.40	3.08	1.98	1.00	5.69	3.60	2.77	2.67	2.81	1.83
Product Size +425 µm Fra	1.15	3.16	2.57	1.00	1.20	6.31	1.28	3.00	1.90	0.92	5.11	3.22	2.74	2.34	2.58	1.66
Product Size +300 µm Fra	0.87	2.64	2.01	0.73	0.87	5.07	1.03	2.52	1.51	0.68	0.45	2.82	2.21	1.98	2.16	1.31
Product Size +212 µm Fra	1.27	3.66	2.62	1.10	1.37	8.09	1.44	3.67	2.11	1.07	3.37	3.89	3.31	2.69	2.90	1.82
Product Size +150 µm Fra	1.03	3.18	2.03	0.92	1.26	5.31	1.26	3.08	1.91	0.93	3.82	2.68	2.71	2.77	2.33	1.50
Product Size +106 µm Fra	0.87	3.06	1.77	0.73	0.99	4.36	1.24	2.91	1.95	0.82	0.22	2.53	2.57	1.76	2.30	1.33
Product Size +75 µm Frac	0.79	3.08	1.57	0.66	0.80	3.74	4.99	2.95	2.21	0.85	0.23	2.28	2.53	1.61	2.25	1.19
Product Size +53 µm Frac	1.26	4.02	2.13	1.09	1.14	3.61	1.92	3.96	4.77	1.84	0.44	3.59	3.21	2.50	3.31	1.72
Product Size +38 µm Frac	0.76	1.76	1.16	0.72	0.76	1.00	1.42	1.73	2.74	1.49	5.29	1.49	1.51	1.20	1.60	0.99
Product Size -38 µm Fract	84.92	55.76	63.98	87.06	84.99	30.96	77.05	57.07	64.54	85.54	64.85	56.00	63.38	64.14	63.85	77.94
(Calculated Head)	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
Assayed Head																

K12023 SIZE-ASSAY RESULTS Duplicate (Composite C HPGR Test 3 Product)

PRODUCT	WEIGHT	WEIGHT	ASSAY															
	g	%	Al_2O_3 %	CaO %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	As ppm	Cd ppm	Pb ppm	Zn ppm	U ppm	LOI %
Product Size +3350 µm Fr	17.95	2.14	4.21	5.65	4.91	0.28	0.12	0.01	0.02	4.86	#####	0.15	2.10	0.43	143	119	14	2.80
Product Size +2360 µm Fr	21.43	2.55	4.45	#####	3.41	0.38	0.19	0.01	0.03	7.83	#####	0.17	0.20	0.63	197	163	21	3.03
Product Size +1700 µm Fr	22.07	2.63	5.01	#####	3.99	0.47	0.27	0.01	0.03	7.78	#####	0.21	1.00	0.66	198	149	22	3.47
Product Size +1180 µm Fr	26.29	3.13	6.70	#####	4.96	0.63	0.37	0.04	0.04	8.04	#####	0.27	5.50	0.74	230	195	24	4.39
Product Size +850 µm Fra	20.88	2.49	7.07	#####	4.73	0.67	0.41	0.07	0.04	8.65	#####	0.28	3.30	0.82	230	201	25	4.65
Product Size +600 µm Fra	17.84	2.12	7.15	#####	4.65	0.68	0.42	0.06	0.04	8.95	#####	0.28	1.10	0.86	291	207	27	4.76
Product Size +425 µm Fra	15.98	1.90	6.98	#####	4.65	0.64	0.40	0.08	0.04	9.26	#####	0.27	2.40	0.88	295	218	27	4.65
Product Size +300 µm Fra	13.27	1.58	6.66	#####	4.58	0.59	0.37	0.08	0.04	9.65	#####	0.26	0.20	0.84	329	195	27	4.50
Product Size +212 µm Fra	16.91	2.01	6.43	#####	4.23	0.56	0.36	0.08	0.04	9.96	#####	0.27	2.00	0.83	314	189	26	4.31
Product Size +150 µm Fra	15.56	1.85	6.04	#####	3.74	0.56	0.39	0.06	0.04	9.51	#####	0.26	1.20	0.70	303	165	24	4.07
Product Size +106 µm Fra	16.12	1.92	5.06	#####	3.20	0.46	0.32	0.05	0.04	9.44	#####	0.25	2.10	0.68	305	146	24	3.65
Product Size +75 µm Fract	17.43	2.07	4.45	#####	2.76	0.41	0.24	0.04	0.04	8.67	#####	0.24	0.20	0.57	271	133	21	3.05
Product Size +53 µm Fract	33.07	3.94	3.97	7.71	1.99	0.39	0.22	0.02	0.04	5.89	#####	0.30	0.20	0.36	176	94	16	2.49
Product Size +38 µm Fract	18.92	2.25	4.45	6.59	1.99	0.46	0.25	0.01	0.04	5.05	#####	0.41	0.20	0.35	153	98	15	2.57
Product Size -38 µm Fract	######	67.42	#####	6.33	3.40	1.65	0.85	0.01	0.06	5.00	#####	0.76	0.90	0.41	195	155	19	6.24
(Calculated Head)	######	######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	(208)	(156)	(20)	#####
Assayed Head																		

PRODUCT	DISTRIBUTION, %															
	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	As	Cd	Pb	Zn	U	LOI
Product Size +3350 µm Fr	0.75	1.57	2.98	0.47	0.38	1.07	0.81	1.75	2.63	0.54	3.98	1.88	1.47	1.63	1.50	1.11
Product Size +2360 µm Fr	0.94	3.49	2.47	0.76	0.72	1.27	1.46	3.36	2.87	0.73	0.45	3.30	2.41	2.66	2.69	1.43
Product Size +1700 µm Fr	1.09	3.59	2.98	0.97	1.06	1.31	1.50	3.44	2.87	0.92	2.33	3.56	2.50	2.51	2.90	1.69
Product Size +1180 µm Fr	1.74	4.28	4.41	1.54	1.72	6.24	2.38	4.23	3.22	1.41	15.25	4.75	3.45	3.91	3.77	2.54
Product Size +850 µm Fra	1.46	3.73	3.34	1.30	1.52	8.68	1.89	3.61	2.48	1.17	7.27	4.18	2.74	3.20	3.12	2.14
Product Size +600 µm Fra	1.26	3.32	2.81	1.13	1.33	6.36	1.62	3.20	2.07	1.00	2.07	3.75	2.96	2.81	2.88	1.87
Product Size +425 µm Fra	1.10	3.11	2.51	0.95	1.13	7.59	1.45	2.96	1.84	0.86	4.04	3.43	2.69	2.66	2.58	1.64
Product Size +300 µm Fra	0.87	2.70	2.06	0.73	0.87	6.30	1.20	2.56	1.53	0.69	0.28	2.72	2.49	1.97	2.14	1.32
Product Size +212 µm Fra	1.08	3.55	2.42	0.88	1.08	8.03	1.53	3.37	1.92	0.91	3.57	3.43	3.03	2.44	2.62	1.61
Product Size +150 µm Fra	0.93	3.14	1.97	0.81	1.08	5.54	1.41	2.96	1.85	0.81	1.97	2.66	2.69	1.96	2.23	1.40
Product Size +106 µm Fra	0.81	3.03	1.75	0.69	0.91	4.79	1.46	3.05	1.98	0.80	3.57	2.68	2.81	1.79	2.31	1.30
Product Size +75 µm Fract	0.77	3.14	1.63	0.67	0.74	4.14	1.58	3.02	2.29	0.83	0.37	2.43	2.70	1.77	2.18	1.17
Product Size +53 µm Fract	1.30	3.95	2.23	1.20	1.29	3.93	3.00	3.90	4.88	1.98	0.70	2.91	3.32	2.37	3.16	1.81
Product Size +38 µm Fract	0.83	1.93	1.27	0.81	0.84	1.12	1.71	1.91	2.86	1.55	0.40	1.62	1.65	1.41	1.69	1.07
Product Size -38 µm Fract	85.05	55.48	65.17	87.08	85.33	33.63	77.00	56.68	64.71	85.81	53.77	56.71	63.08	66.92	64.24	77.91
(Calculated Head)	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
Assayed Head																

K12023 SIZE-ASSAY RESULTS (Composite C HPGR Test 6 Product)

PRODUCT	WEIGHT	WEIGHT	ASSAY																DISTRIBUTION, %															
	g	%	Al_2O_3 %	CaO %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	As ppm	Cd ppm	Pb ppm	Zn ppm	U ppm	LOI %	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	As	Cd	Pb	Zn	U	LOI
Product Size +3350 µm Fr	15.16	1.80	3.48	#####	5.09	0.31	0.15	0.13	0.02	7.90	#####	0.13	4.40	1.03	418	217	26	2.26	0.53	2.43	2.55	0.44	0.40	9.81	0.68	2.33	2.23	0.38	9.60	3.59	3.56	2.47	2.32	0.73
Product Size +2360 µm Fr	16.92	2.01	3.98	8.87	4.08	0.33	0.16	0.03	0.03	6.64	#####	0.17	0.20	0.56	168	189	19	3.00	0.67	2.26	2.28	0.52	0.48	2.53	1.14	2.18	2.34	0.55	0.49	2.18	1.60	2.41	1.89	1.08
Product Size +1700 µm Fr	18.27	2.17	4.81	#####	4.85	0.42	0.23	0.04	0.03	7.95	#####	0.21	1.20	0.71	196	182	23	3.49	0.88	2.94	2.93	0.71	0.74	3.64	1.23	2.82	2.38	0.74	3.15	2.98	2.01	2.50	2.47	1.36
Product Size +1180 µm Fr	22.88	2.72	6.15	#####	5.26	0.57	0.31	0.06	0.04	8.13	#####	0.26	3.00	0.72	229	209	26	4.27	1.40	3.60	3.98	1.21	1.25	6.83	2.06	3.61	2.83	1.15	9.88	3.79	2.95	3.60	3.49	2.09
Product Size +850 µm Fra	18.78	2.23	6.38	#####	5.17	0.58	0.34	0.07	0.03	8.53	#####	0.25	2.10	0.83	238	252	26	4.39	1.20	3.26	3.21	1.01	1.13	6.54	1.27	3.11	2.23	0.90	5.68	3.58	2.51	3.56	2.87	1.76
Product Size +600 µm Fra	15.44	1.84	6.27	#####	4.83	0.54	0.32	0.07	0.03	9.17	#####	0.27	2.10	0.89	262	215	27	4.66	0.97	2.65	2.47	0.77	0.87	5.38	1.04	2.75	1.81	0.80	4.67	3.16	2.27	2.50	2.45	1.54
Product Size +425 µm Fra	14.77	1.76	6.12	#####	4.83	0.52	0.31	0.08	0.04	9.70	#####	0.25	#####	0.90	234	222	29	4.59	0.90	2.87	2.36	0.71	0.81	5.88	1.33	2.78	1.73	0.71	21.25	3.06	1.94	2.47	2.52	1.45
Product Size +300 µm Fra	11.87	1.41	5.72	#####	4.62	0.49	0.28	0.09	0.04	9.86	#####	0.24	0.20	0.96	323	233	28	4.42	0.68	2.35	1.81	0.54	0.59	5.32	1.07	2.27	1.38	0.55	0.34	2.62	2.16	2.08	1.95	1.12
Product Size +212 µm Fra	16.63	1.98	6.00	#####	4.41	0.50	0.31	0.09	0.04	#####	#####	0.27	3.90	0.86	332	207	28	4.58	1.00	3.42	2.43	0.77	0.91	7.45	1.50	3.24	1.90	0.86	9.33	3.29	3.10	2.59	2.74	1.63
Product Size +150 µm Fra	16.12	1.92	5.59	#####	3.83	0.49	0.33	0.07	0.04	9.82	#####	0.27	5.90	0.73	304	172	25	4.35	0.90	3.21	2.04	0.73	0.94	5.62	1.45	3.07	1.90	0.84	13.69	2.71	2.76	2.09	2.37	1.50
Product Size +106 µm Fra	15.35	1.82	4.84	#####	3.41	0.42	0.27	0.05	0.04	9.42	#####	0.26	0.20	0.69	387	153	23	3.85	0.74	2.96	1.73	0.60	0.73	3.82	1.38	2.81	1.92	0.77	0.44	2.44	3.34	1.77	2.07	1.26
Product Size +75 µm Fract	17.47	2.08	4.23	#####	2.76	0.37	0.21	0.04	0.04	8.90	#####	0.26	1.20	0.57	262	126	22	3.23	0.74	3.15	1.60	0.60	0.65	3.48	1.57	3.02	2.28	0.87	3.02	2.29	2.57	1.66	2.26	1.21
Product Size +53 µm Fract	36.07	4.29	3.76	7.92	2.01	0.35	0.19	0.02	0.04	6.01	#####	0.31	0.20	0.40	173	94	16	2.77	1.35	4.30	2.40	1.17	1.21	3.59	3.25	4.21	5.25	2.15	1.04	3.32	3.51	2.55	3.39	2.13
Product Size +38 µm Fract	15.59	1.85	4.08	6.75	2.04	0.41	0.22	0.01	0.04	5.12	#####	0.42	0.20	0.36	153	104	15	3.02	0.63	1.59	1.05	0.59	0.61	0.78	1.40	1.55	2.28	1.26	0.45	1.29	1.34	1.22	1.37	1.01
Product Size -38 µm Fract	######	70.13	#####	6.64	3.44	1.64	0.85	0.01	0.06	5.26	#####	0.77	0.20	0.44	194	150	19	6.36	87.42	59.01	67.15	89.64	88.67	29.36	79.63	60.25	67.56	87.46	16.98	59.70	64.36	66.56	65.85	80.14
(Calculated Head)	######	######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	(211)	(158)	(20)	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
Assayed Head																																		

K12023 SIZE-ASSAY RESULTS Duplicate (Composite C HPGR Test 6 Product)

PRODUCT	WEIGHT	WEIGHT	ASSAY																DISTRIBUTION, %															
	g	%	Al_2O_3 %	CaO %	Fe_2O_3 %	K_2O %	MgO %	MnO %	Na_2O %	P_2O_5 %	SiO_2 %	TiO_2 %	As ppm	Cd ppm	Pb ppm	Zn ppm	U ppm	LOI %	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	As	Cd	Pb	Zn	U	LOI
Product Size +3350 µm Fr	11.71	1.40	3.46	7.88	2.08	0.27	0.12	0.01	0.03	6.12	#####	0.13	0.60	0.43	126	72	16	2.26	0.40	1.43	0.84	0.29	0.24	0.66	1.02	1.41	1.73	0.30	0.32	1.07	0.84	0.63	1.11	0.57
Product Size +2360 µm Fr	17.86	2.14	4.41	8.23	4.18	0.36	0.17	0.03	0.03	6.47	#####	0.17	3.20	0.51	163	158	21	3.00	0.77	2.27	2.56	0.59	0.52	3.00	1.56	2.28	2.48	0.59	2.57	1.93	1.66	2.10	2.23	1.15
Product Size +1700 µm Fr	17.77	2.13	5.22	#####	4.06	0.49	0.27	0.03	0.07	7.67	#####	0.21	2.10	2.52	225	699	23	3.49	0.91	2.82	2.48	0.80	0.81	2.99	3.82	2.69	2.32	0.73	1.68	9.49	2.28	9.22	2.43	1.34
Product Size +1180 µm Fr	24.67	2.95	6.66	#####	4.95	0.63	0.34	0.05	0.05	7.78	#####	0.26	4.50	0.74	223	197	24	4.27	1.61	3.87	4.19	1.42	1.42	6.92	3.58	3.79	3.07	1.25	4.99	3.87	3.13	3.61	3.51	2.27
Product Size +850 µm Fra	19.56	2.34	6.62	#####	4.89	0.62	0.36	0.06	0.04	8.65	#####	0.25	6.60	0.83	257	228	27	4.39	1.27	3.49	3.28	1.11	1.20	6.58	2.27	3.34	2.34	0.95	5.81	3.44	2.86	3.31	3.13	1.85
Product Size +600 µm Fra	16.84	2.01	6.83	#####	4.89	0.64	0.38	0.07	0.04	8.69	#####	0.27	2.70	0.87	284	214	28	4.66	1.12	3.05	2.83	0.98	1.09	6.61	1.96	2.89	1.99	0.89	2.04	3.10	2.73	2.68	2.80	1.69
Product Size +425 µm Fra	15.56	1.86	6.68	#####	4.98	0.61	0.36	0.09	0.06	9.07	#####	0.25	3.30	0.94	300	238	28	4.59	1.02	2.93	2.66	0.87	0.95	7.85	2.71	2.78	1.83	0.76	2.31	3.10	2.66	2.75	2.59	1.54
Product Size +300 µm Fra	11.90	1.42	6.32	#####	4.72	0.55	0.33	0.09	0.05	9.63	#####	0.24	3.40	0.92	320	217	28	4.42	0.73	2.37	1.93	0.60	0.67	6.00	1.73	2.26	1.39	0.56	1.82	2.32	2.17	1.92	1.98	1.13
Product Size +212 µm Fra	16.80	2.01	6.62	#####	4.50	0.59	0.38	0.08	0.04	9.68	#####	0.27	3.90	0.85	324	191	28	4.58	1.09	3.41	2.59	0.91	1.08	7.54	1.95	3.21	1.93	0.88	2.95	3.03	3.10	2.38	2.79	1.66
Product Size +150 µm Fra	17.01	2.03	6.25	#####	3.98	0.59	0.42	0.06	0.04	9.33	#####	0.27	3.10	0.69	302	160	25	4.35	1.04	3.32	2.32	0.92	1.21	5.72	1.98	3.13	2.02	0.90	2.37	2.49	2.93	2.02	2.52	1.59
Product Size +106 µm Fra	15.84	1.89	5.52	#####	3.49	0.50	0.35	0.05	0.04	9.14	#####	0.26	3.50	0.71	284	145	24	3.85	0.85	3.05	1.90	0.72	0.94	4.44	1.84	2.86	1.99	0.80	2.49	2.38	2.56	1.71	2.26	1.31
Product Size +75 µm Fract	18.56	2.22	4.75	#####	2.90	0.43	0.28	0.04	0.04	8.41	#####	0.26	3.00	0.51	262	110	22	3.23	0.86	3.26	1.85	0.73	0.88	4.16	2.16	3.08	2.43	0.94	2.50	2.01	2.77	1.52	2.42	1.29
Product Size +53 µm Fract	37.25	4.45	4.47	7.67	2.21	0.45	0.26	0.02	0.04	5.82	#####	0.31	0.20	0.36	169	91	16	2.77	1.63	4.42	2.82	1.53	1.64	4.18	4.33	4.28	5.45	2.25	0.34	2.84	3.59	2.52	3.54	2.22
Product Size +38 µm Fract	16.01	1.91	5.14	6.59	2.26	0.54	0.32	0.01	0.04	5.02	#####	0.42	0.20	0.39	155	112	15	3.02	0.80	1.63	1.24	0.79	0.87	0.90	1.86	1.59	2.35	1.31	0.14	1.32	1.41	1.33	1.43	1.04
Product Size -38 µm Fract	######	69.22	#####	6.55	3.35	1.66	0.88	0.01	0.04	5.29	#####	0.77	2.60	0.47	198	145	19	6.36	85.91	58.67	66.52	87.76	86.47	32.45	67.24	60.42	66.68	86.89	67.67	57.63	65.30	62.32	65.27	79.33
(Calculated Head)	######	######	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	(210)	(161)	(20)	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
Assayed Head																																		

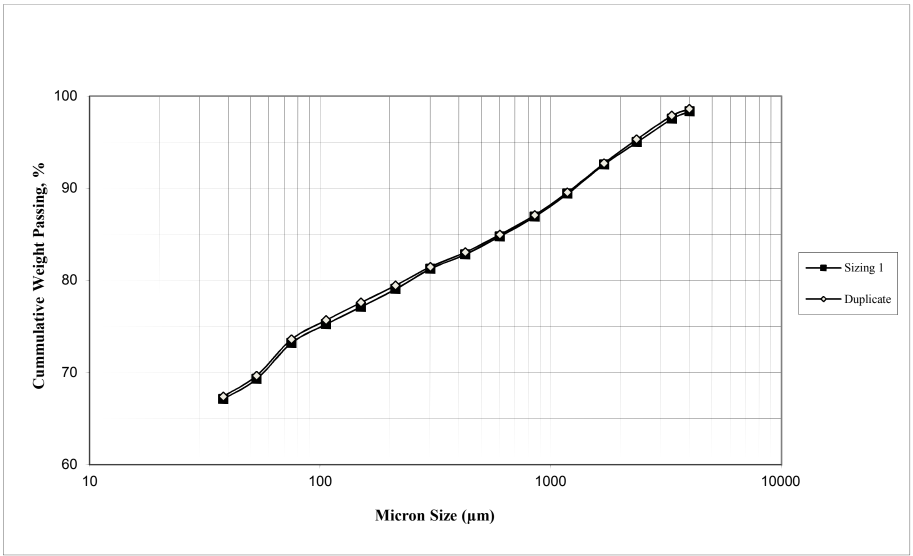
KYSPY Investments
Sizing Data and Results

DATE	**4/10/2013**
PROJECT	**K12023**
SAMPLE	Composite C - HPGR Test 3
EQUIPMENT	
PULP DENSITY	

Grind Time	Sizing 1		
Size	**Weight Retained**		**Cumulative Wt.**
µm	**g**	**%**	**Passing, %**
4000	14.00	1.67	98.33
3350	6.95	0.83	97.51
2360	21.25	2.53	94.98
1700	20.26	2.41	92.57
1180	26.73	3.18	89.38
850	20.91	2.49	86.90
600	17.89	2.13	84.77
425	16.43	1.96	82.81
300	13.19	1.57	81.24
212	18.43	2.19	79.05
150	16.13	1.92	77.13
106	15.90	1.89	75.23
75	17.04	2.03	73.21
53	32.86	3.91	69.29
38	18.18	2.16	67.13
-38	564.00	67.13	
Total	840.15	100.00	

Grind Time	Duplicate		
Size	**Weight Retained**		**Cumulative Wt.**
µm	**g**	**%**	**Passing, %**
4000	11.89	1.42	98.58
3350	6.06	0.72	97.86
2360	21.43	2.55	95.31
1700	22.07	2.63	92.68
1180	26.29	3.13	89.55
850	20.88	2.49	87.07
600	17.84	2.12	84.95
425	15.98	1.90	83.04
300	13.27	1.58	81.46
212	16.91	2.01	79.45
150	15.56	1.85	77.60
106	16.12	1.92	75.68
75	17.43	2.08	73.60
53	33.07	3.94	69.67
38	18.92	2.25	67.41
-38	566.28	67.41	
Total	840.00	100.00	

16.19	4.3	11.89	
10.39	4.33	6.06	
25.79	4.36	21.43	
26.5	4.43	22.07	
30.72	4.43	26.29	
25.29	4.41	20.88	
22.3	4.46	17.84	
20.33	4.35	15.98	
17.66	4.39	13.27	
21.26	4.35	16.91	
19.88	4.32	15.56	
20.53	4.41	16.12	
21.82	4.39	17.43	
37.46	4.39	33.07	
23.35	4.43	18.92	
		273.72	566.28



KYSPY Investments
Sizing Data and Results

DATE	4/10/2013
PROJECT	K12023
SAMPLE	Composite C - HPGR Test 6
EQUIPMENT	
PULP DENSITY	

Grind Time	Sizing 1		
Size	Weight Retained		Cumulative Wt.
µm	g	%	Passing, %
4000	8.99	1.07	98.93
3350	6.17	0.73	98.20
2360	16.92	2.01	96.18
1700	18.27	2.18	94.01
1180	22.88	2.72	91.28
850	18.78	2.24	89.05
600	15.44	1.84	87.21
425	14.77	1.76	85.45
300	11.87	1.41	84.04
212	16.63	1.98	82.06
150	16.12	1.92	80.14
106	15.35	1.83	78.31
75	17.47	2.08	76.23
53	36.07	4.29	71.94
38	15.59	1.86	70.08
-38	588.68	70.08	
Total	840.00	100.00	

Grind Time	Duplicate		
Size	Weight Retained		Cumulative Wt.
µm	g	%	Passing, %
4000	5.47	0.65	99.35
3350	6.24	0.74	98.61
2360	17.86	2.13	96.48
1700	17.77	2.12	94.36
1180	24.67	2.94	91.43
850	19.56	2.33	89.10
600	16.84	2.00	87.09
425	15.56	1.85	85.24
300	11.90	1.42	83.83
212	16.80	2.00	81.83
150	17.01	2.03	79.80
106	15.84	1.89	77.91
75	18.56	2.21	75.70
53	37.25	4.43	71.27
38	16.01	1.91	69.36
-38	582.66	69.36	
Total	840.00	100.00