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Metallurgical Testwork Relating to the Development of the Blötberget Iron Ore Deposit, Sweden

Phase 3 – Pilot scale testing of a Blötberget composite sample

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EXECUTIVE SUMMARY

Nordic Iron Ore AB (NIO) are aiming to redevelop the Blötberget iron ore deposit near Ludvika, Central Sweden, which was the site of a historical underground iron ore mining operation.

In the course of the preparation of a Technical Report and Feasibility Study, NIO had contracted GTK to carry out a programme of bench-scale metallurgical testwork on drill core samples. The results of this testwork had been used by the process consultants to NIO, Tata Steel Consulting (TSC), to develop a process flowsheet for production of iron ore concentrates. Subsequently, NIO contracted GTK to operate a small-scale processing plant or pilot plant according to this process flowsheet under the supervision of TSC. The principal objective was the demonstration, on a continuous basis, that the plant could produce satisfactory iron ore concentrates and to obtain substantial quantities of such concentrates. Other, lesser objectives of the demonstration plant included generation of samples for vendor testing and collection of design data.

Essentially, the initial process flowsheet comprised grinding of the iron ore to a particle size of less than 1mm followed by wet low intensity magnetic separation (LIMS) to recover magnetite. The intermediate magnetic pre-concentrate was reground to a particle size less than 150µm before cleaning by LIMS to produce a final magnetite concentrate. The non-magnetic material was passed to wet high intensity magnetic separation (WHIMS or HGMS) to recover hematite which was also reground to a size less than 150µm before cleaning by a second stage of WHIMS to produce a final hematite concentrate. Depending upon the phosphorus content of the concentrates, either or both concentrates would be treated by froth flotation to remove phosphorus, present as the mineral apatite, into the froth.

The bulk sample of Blötberget iron ore was obtained by blasting and excavating outcrops of the orebodies including the adjacent Guldkannan/Sandell orebodies. The materials excavated from the outcrops were processed to remove dilution derived from the hanging and footwall rocks before blending in proportions necessary to generate a composite bulk sample that was typical of the ore to be mined. The composite bulk sample was typical with respect to the principal assays of the ore namely %Fe, %P_2O_5 and the ratio of magnetite to hematite. For the composite bulk sample, these principal assays were;

32.5% Fe, 0.56% P_2O_5, 41.5% SiO_2 and 79% of the iron bound to magnetite.

At the time, the assay of the Run-of-Mine (RoM) ore was predicted to be; 35% Fe and 1.0% P_2O_5 with 80% of the iron bound to magnetite.

The small-scale plant operated for about 24 hours and treated approximately 22 tonnes of the composite bulk sample.

The plant has demonstrated that the process can produce very high grade concentrates on a continuous basis. For example, the best result in terms of concentrate grade was a bulk concentrate (magnetite +

hematite) containing 70.3% Fe, 2.15% SiO_2 and 0.13% P_2O_5 without flotation. This concentrate was obtained at a yield of 45.7wt%.

The magnetite concentrate alone was of exceptionally high grade containing as much as 70.5% Fe but only 0.1% P_2O_5 and therefore did not require flotation. Without flotation, the hematite concentrate had a grade up to 67.0% Fe but a very high content of phosphorus, up to 0.95% P_2O_5. Nevertheless, small-scale continuous froth flotation was able to produce a final hematite concentrate containing 66% Fe and only 0.135% P_2O_5 (0.06% P).

A major finding of the operation was that the wet high intensity magnetic separators (WHIMS), in this case SLon equipment, were very much less effective than predicted by bench-scale metallurgical testwork using Sala HGMS equipment. The reasons have not been fully explained and there was insufficient time and sample to investigate this problem thoroughly. Nevertheless, the replacement of the SLon separators by spiral concentrators to recover hematite proved to be very successful.

The plant operation demonstrated that the process was very effective in recovering magnetite from the ore with recovery in all cases exceeding 98.5%. Recovery of hematite was less effective and estimated at 50% or less even when spiral concentrators replaced the SLon separators. The ultimate losses of hematite were attributed to the generation, during regrinding, of very fine hematite particles sized less than 37µm, too finely sized to be recovered by spiral concentrators.

Although not entirely successful, an attempt was made to determine the effect of a coarser primary grind in order to reduce grinding power consumption and produce a coarser tailings for dam construction and to facilitate disposal. The results indicated that the quality of the concentrate would deteriorate because the bulk concentrate contained 68.8% Fe and 0.23% P_2O_5 and the yield decreased marginally to 43.6%.

The small-scale plant was periodically sampled for the purpose of calculating mass balances and this information has been made available to NIO for the purpose of design of a full-scale processing plant.

The plant produced 7 tonnes of magnetite concentrate and 300kg of hematite concentrate.

A number of samples were recovered for vendor testing including samples for tests related to design of autogenous mills, HPGR, stirred media mills, vacuum and pressure filters and the tailings dam.

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List of Abbreviations

NIO – Nordic Iron Ore AB

TSC – Tata Steel UK Consulting Ltd

GTK Mintec – Geologian Tutkimuskeskus (Geological Survey of Finland); Mineral Processing

LIMS – Low intensity magnetic separation

WMIMS/WHIMS – Wet medium/high intensity magnetic separation

DMIMS – Dry medium/high intensity magnetic separation

HGMS – High gradient magnetic separation

RoM – Run-of-mine

PSD – Particle size distribution

XRF – X-ray fluorescence

ICP – Inductively Coupled Plasma

EMPA – Electron microprobe analysis

MLA – Mineral liberation analyser

CWi – Bond crushability work index

AI – Abrasion Index

EDS – Energy dispersive X-ray spectroscopy

XBSE – Extended backscattered secondary electron analysis

REE – Rare earth elements

TAG – Total acid gangue

D_{80} – Particle size equivalent to 80 percent passing by weight

LOI – Loss on ignition

1 INTRODUCTION

GTK Mintec was appointed by Nordic Iron Ore AB (NIO) to carry out a programme of mineral processing testwork relating to the development of the Blötberget iron ore deposit in Ludvika, Central Sweden.

The GTK Mineral Processing Laboratory (GTK Mintec) located in Outokumpu, Finland, is a renowned test centre specialised in the characterisation and processing of mineral ores. It offers a wide range of services including mineralogical studies, bench scale beneficiation testwork and pilot testing for a wide range of minerals, including iron ores.

GTK have undertaken several preceding bench-scale test programmes on Blötberget iron ore. The pilot plant testwork was undertaken to test the flowsheet as developed during bench-scale metallurgical testwork. The concentrate would be produced in bulk and made available to NIO for purposes of marketing and further extractive metallurgical testwork.

The objectives of the pilot plant testing were:

- Confirmation of the process flow sheet in a pilot plant environment/on a continuous operation,
- Generation of design data suitable for engineering work where possible,
- Production of sufficient amounts of intermediate and final products for:
    - Vendor testing e.g. grindability, solid-liquid separation
    - Marketing of concentrate(s)
    - Sintering and pelletising testwork

The programme of pilot plant testing was undertaken during November 2014. The testwork was overseen by Tata Steel UK Consulting Ltd (TSC) acting on behalf of NIO.

2 SUMMARY OF TESTWORK

The pilot-scale test programme comprised of the following elements:

1. Production of a suitable composite sample for testing
    a. Extraction of several bulk samples by blasting
    b. Crushing and assay of blasted bulk sample material
    c. Selection of bulk samples to composite
    d. Dry MIMS of selected bulk samples
    e. Blending to create desired composite bulk sample
2. Small scale processing testwork undertaken using the proposed flowsheet
    a. Material was processed in one continuous operation from introduction to the rod mill at a particle size of <6mm to the collection of flotation feeds
    b. Flotation was carried out continuously as a separate stage
3. Dewatering of products using filtration
4. Production of final products

3 TEST METHODOLOGY AND EQUIPMENT

3.1 Analytical Methods

The following analytical methods were employed during this programme of work:

- XRF – Multi-element analysis by XRF from pressed pellets (Labtium method 180X) for main elements, particularly Fe, SiO_2, Al_2O_3, CaO, MgO, P, Na, K, Mn, TiO_2, V
- ICP – Total dissolution (Labtium method 309) followed by multi-element analysis by ICP-OES (Labtium method 000P) or ICP-MS (Labtium method 000M), for minor elements, particularly Co, Ni, Cu, Zn, Pb, As, REE
- Eltra S – Sulphur analysis by pyrolytical method (Labtium method 810L)
- Satmagan – Saturation magnetisation ('magnetite equivalents' content) by Satmagan (Labtium method 891G)

All chemical analyses were performed by Labtium Oy at their laboratories in Outokumpu (XRF, Eltra S, and Satmagan) or Espoo (ICP). Chemical analysis certificates are presented in the Phase 1 Report, Appendix B. Copies of Labtium's sampling and assaying procedures are provided in the Phase 1 Report, Appendix J.

3.2 QA/QC

Labtium Oy is a FINAS-accredited testing laboratory T025 and calibration laboratory K056 meeting the requirements of standard SFS-EN ISO/IEC 17025:2005.

The QA/QC procedures in XRF are as follows:

- Reference standards:
  - CANMET CCU-1c, daily
  - QCMetal and QCGAL-6, weekly (Monday)
  - In house reference material, Quartz, QCKyl, QCSok monthly
- Duplicates every 20 samples.

The ICP analytics were performed by accredited methods.

60 reference samples were sent to an independent lab (ALS) for verification; see Table 73 in Appendix 3. Eight reference samples were also sent to increase confidence (4 Blanks and 4 GIOP-126 standard samples). One of the reference samples was to be tested every 5th sample. The correlation between the assays undertaken at GTK Mintec/Labtium and ALS are plotted in Figures 1 to 110. The following conclusions were drawn:

- Figures 1, 2 & 3 demonstrate that, in general, there is good interlaboratory correlation for the analytes of principal interest, %Fe, %SiO_2 and %P.
- The correlation for %Fe in the hematite concentrates was excellent (Figure 4).
- There was an element of systematic bias in regards to %Fe in the magnetite concentrates, as indicated by Figure 8.
- It must also be noted that all hematite concentrates contained ~1% TiO_2 on average (Figure 7).

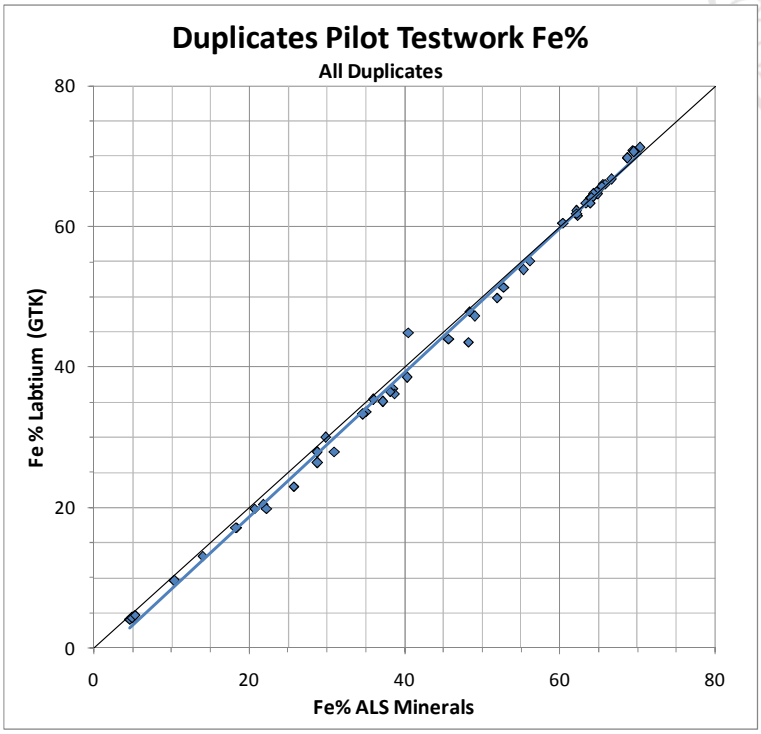


Figure 1: Fe Duplicates (linear-linear scale)

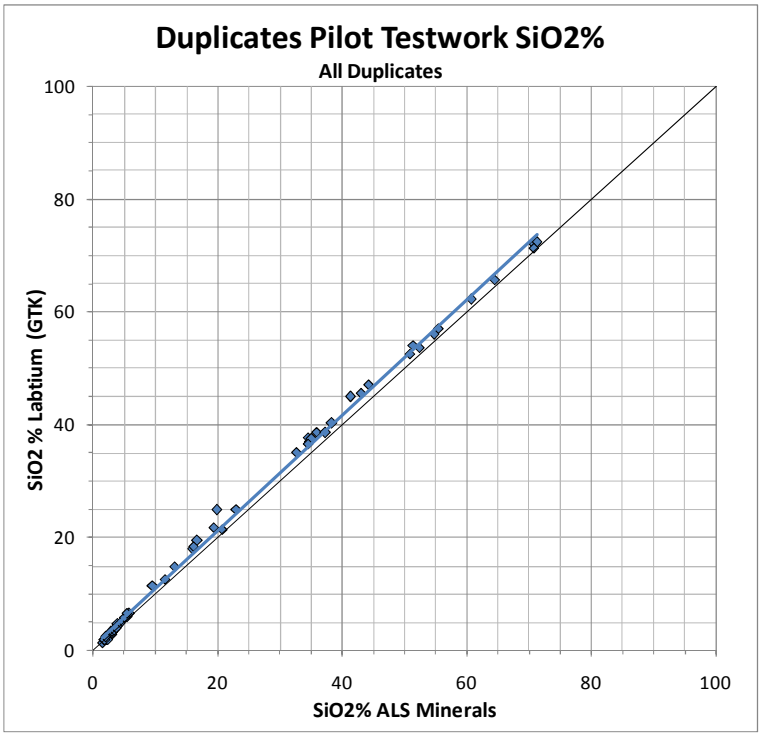


Figure 2: SiO_2 Duplicates (linear-linear scale)

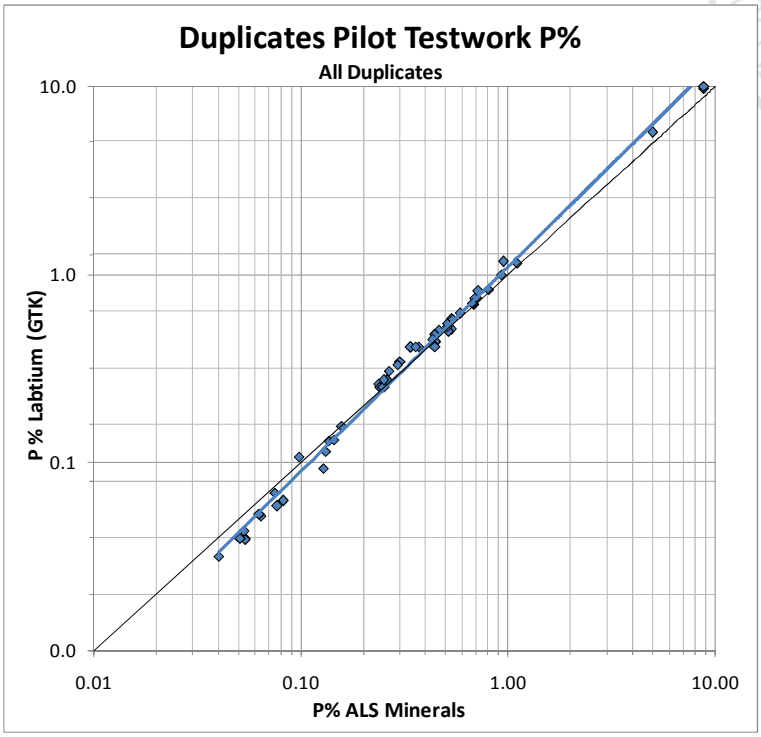


Figure 3: P Duplicates (log-log scale)

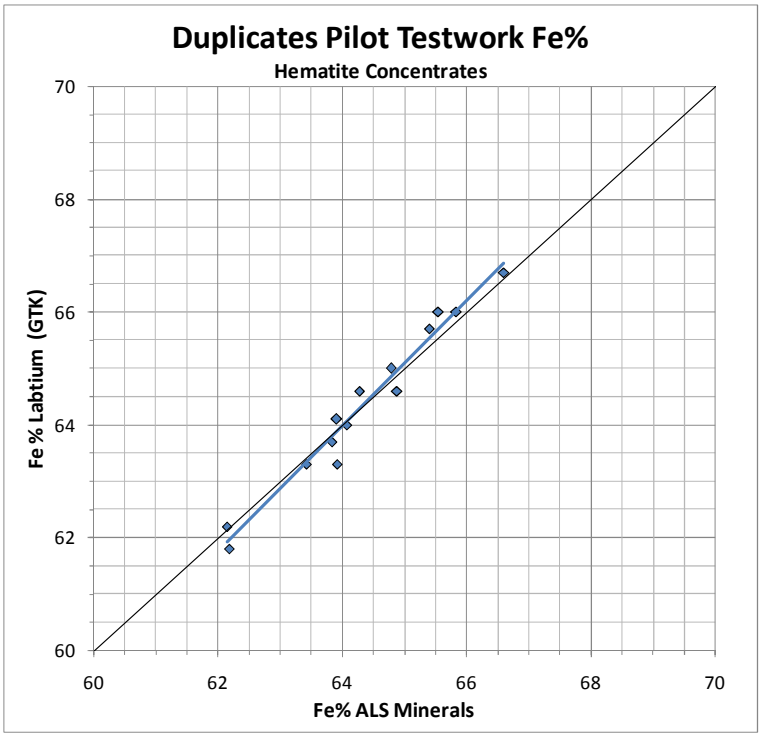


Figure 4: Fe Duplicates (linear-linear scale) – Hematite Concentrates only

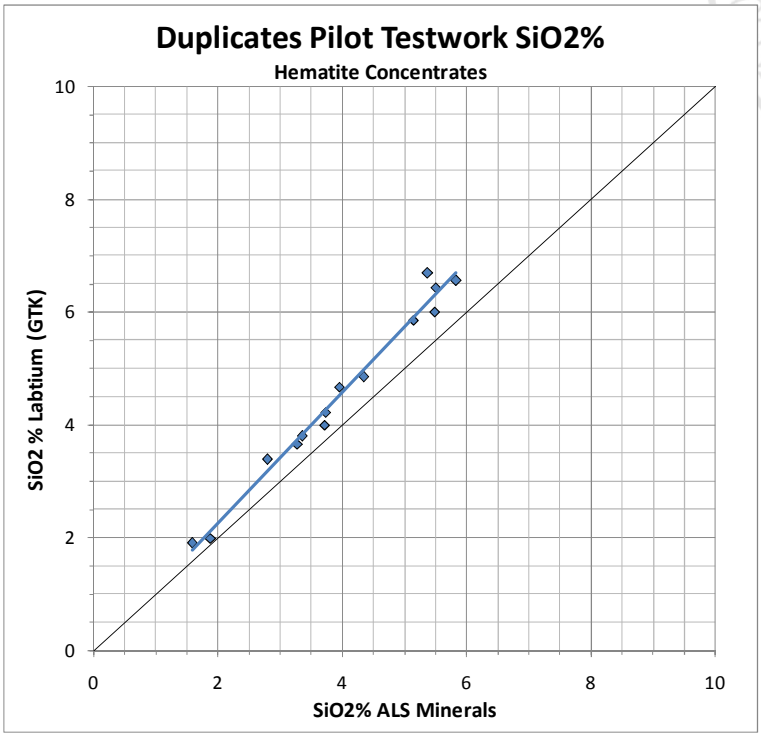


Figure 5: SiO_2 Duplicates (linear-linear scale) – Hematite Concentrates only

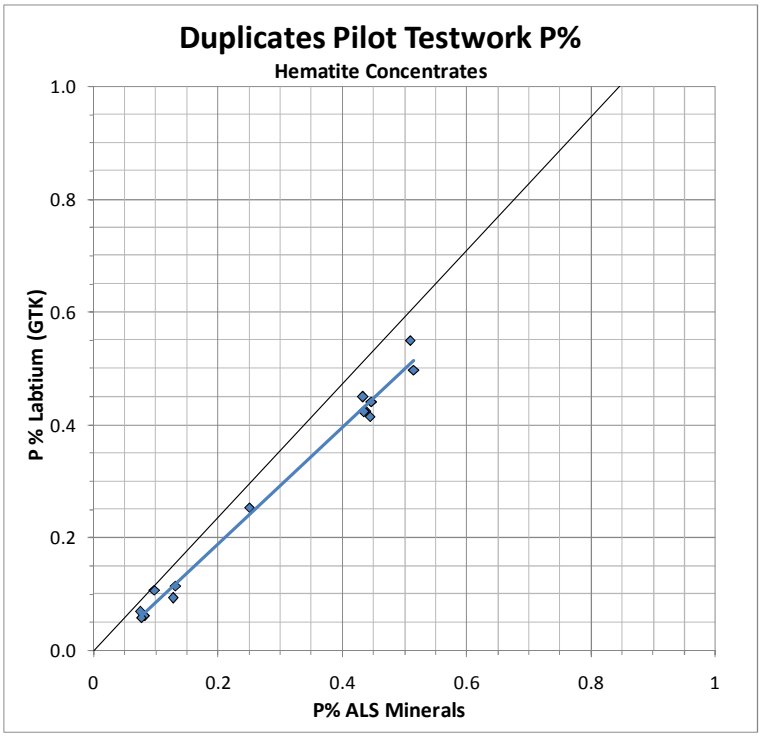


Figure 6: P Duplicates (linear-linear scale) – Hematite Concentrates only

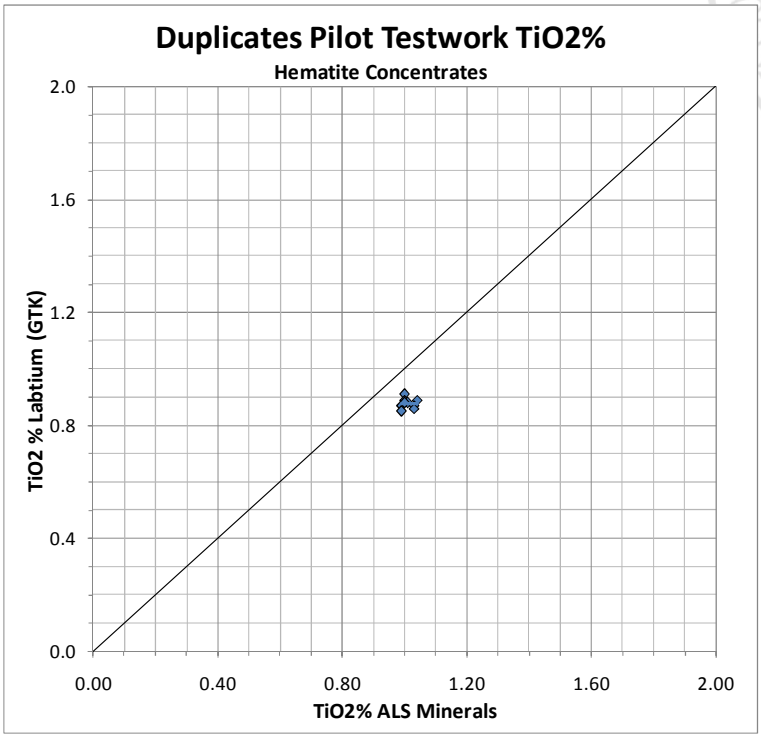


Figure 7: TiO_2 Duplicates (linear-linear scale) – Hematite Concentrates only

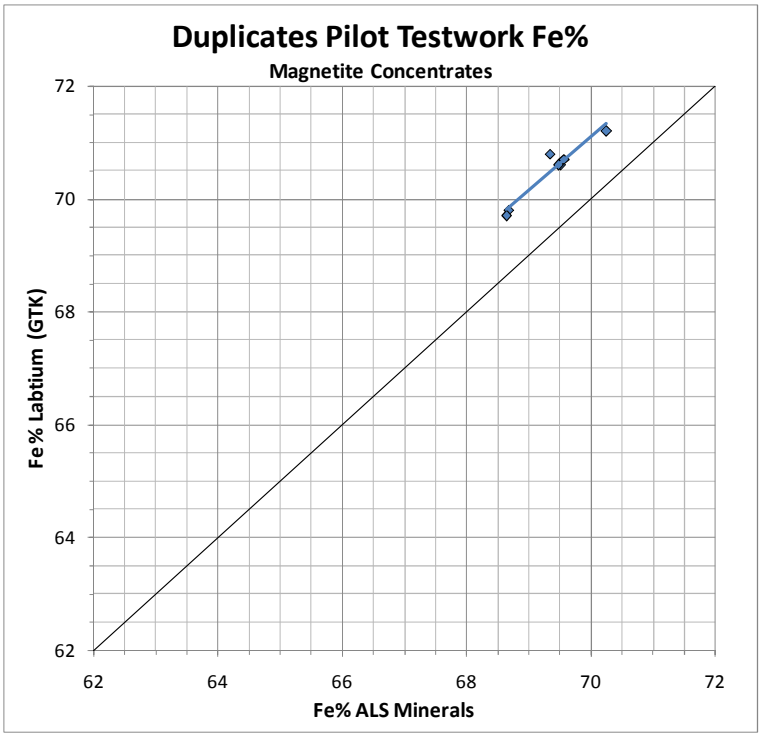


Figure 8: Fe Duplicates (linear-linear scale) – Magnetite Concentrates only

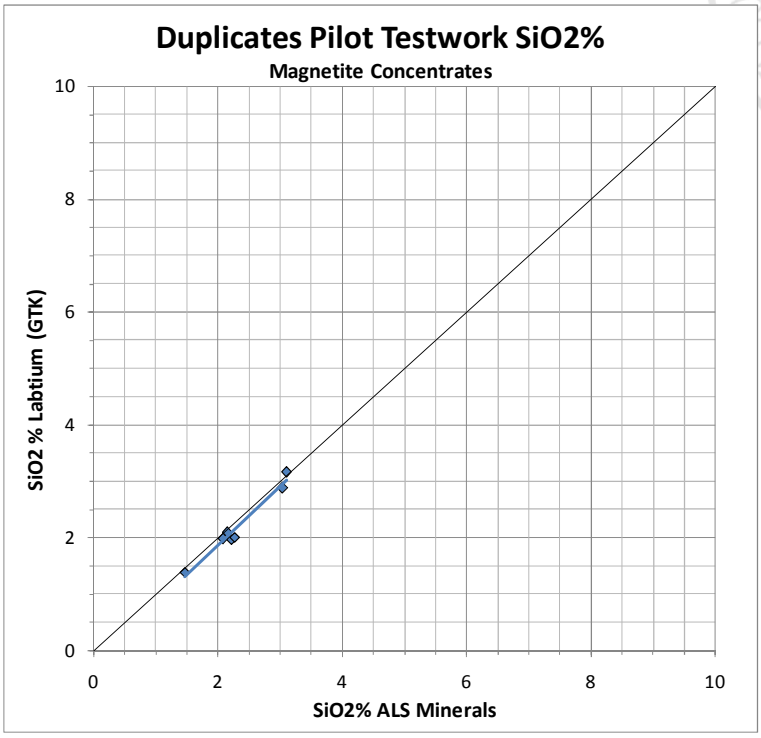


Figure 9: SiO_2 Duplicates (linear-linear scale) – Magnetite Concentrates only

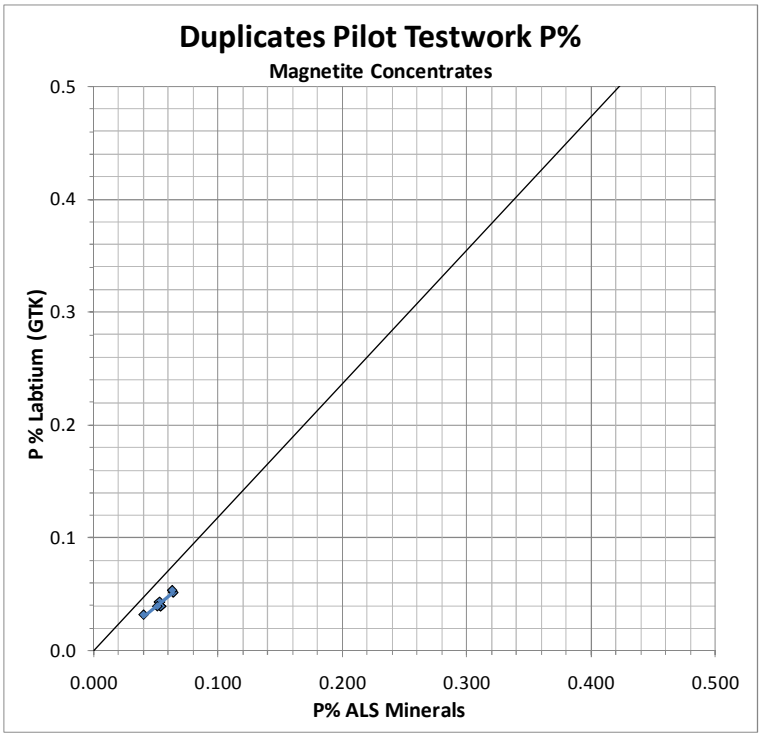


Figure 10: P Duplicates (linear-linear scale) – Magnetite Concentrates only

Table 1: ALS Internal Repeatability

Sample Code	ALS Duplicate Assay, %			ALS Original Assay, %		
	Fe	SiO2	P	Fe	SiO2	P
QA/QC	70.21	1.40	0.041	70.25	1.46	0.040
QA/QC	68.64	3.02	0.062	68.68	3.04	0.064
QA/QC	4.53	71.3	0.260	4.68	71.1	0.266
QA/QC	65.61	1.82	0.419	65.54	1.88	0.435

Table 2: ALS – Analysis of Standards / Blanks

Sample Code	ALS %			Certified / NIO Reference, %		
	Fe	SiO2	P	Fe	SiO2	P
QA/QC (GIOP-126)	49.74	17.9	0.106	49.61	17.93	0.101
QA/QC (Blank)	2.63	73.0	0.022	2.09	73.9	0.02
QA/QC (GIOP-126)	49.35	18.3	0.100	49.61	17.93	0.101
QA/QC (Blank)	2.21	73.8	0.021	2.09	73.9	0.02
QA/QC (GIOP-126)	49.65	17.9	0.102	49.61	17.93	0.101
QA/QC (Blank)	2.24	73.7	0.023	2.09	73.9	0.02
QA/QC (GIOP-126)	48.65	19.0	0.100	49.61	17.93	0.101
QA/QC (Blank)	2.20	73.6	0.022	2.09	73.9	0.02

3.3 Equipment List

The equipment used during the crushing and pilot plant operations is displayed in Table 3 below. Photographs of the equipment used can be seen in Appendix 5.

Table 3: Equipment used during the pilot plant operation

Equpiment	**Brand**	**Job**	Number	D mm	L mm	CSS mm	Motor kW, gross	Magnet	Gauss	Type
Jaw Crusher	Lokomo C 63 B	Crush from blasted ore to -70mm	1	630	440	50	75			
Cone Crusher	Lokomo G 158	Crush from -70mm to -19mm	1	800		10	75			
Cone Crusher	Lokomo G 108	Crush from -19mm to -6mm								
Vibrating Screen	Lokomo B 230	19mm mesh	1	1000	3000		10			
Vibrating Screen	Lokomo B 130	6mm mesh								
Stacker/Reclaimer	Outokummun metalli	Feed ore homogenising/reclaiming	1	4000	3000					
Rod Mill 1	SALA SRR 1000 X 1800 RP-DR	Primary grinding	1	840	1750		20			
Ball Mill	SALA SRR 1000 X 1500 BG-WR	Secondary grinding	1	840	1350		20			
Tower Mill (SAM)	SALA SAM 7.5 kW	Re-grinding	1				7.5			
Vibrating screen	SWECO 800	Treating SAM mill product	1	800						
Vibrating Screen	DERRICK J24-36MS-1	Screening Rod Mill product	1	600	600					
Hydro Cyclone	AKW	Treating Ball mill product	2	75						
Spiral	Carpco H9000W	Treating -150µm material	1							
Spiral	Reichert WW6	Treating -1mm material								
LIMS 1	Roxon	-1mm LIMS rougher	1	900	500			Ferrite	800	CR
LIMS 2	Roxon	-1mm LIMS scavenger	1	900	500			Ferrite	800	CR
LIMS 3	Metso	-150um LIMS rougher	1	920	310			Ferrite	800	CR
LIMS 4	Metso	-150um LIMS scavenger	1	920	310			Ferrite	800	CR
SLon 1	Double carousel	Rougher SLon								
SLon 2	Single carousel	Cleaner SLon								
Thickener	SALA SFC M3-4	Used for tailings	1	4000		2500				
Thickener	Outotec Supaflo 1 m3	SLon 2 Mags	1	1000		1300				
Lamella Thickener	SALA LTS 15/55	Thickening	1							
Outotec Flotation tank	50l twin tanks	Flotation	3							
Pressure Filter Press	Choquenet	Dewatering	1							

4 SAMPLE PREPARATION

4.1 Sample origin

Owing to the inability to extract a sufficiently large sample from the underground orebodies by core-drilling within the time restraints, a series of samples were taken from the area where the ore bodies outcropped at the surface. The NIO geologist identified five zones of ore as well as the surrounding hanging and foot wall rocks. Each ore zone was subdivided into two although, in the bulk samples, these subdivisions were combined.

Table 4: Geological descriptions of the ore types and sub-divisions

Location	sample ID	Description
Orange West 1	L466351	Fine to medium grained magnetite/hematite mix 70/30 with a quartz matrix and occasional quartz veins
Orange West 2	L466352	Fine to medium grained magnetite/hematite mix 75/25 with a quartz matrix and occasional quartz veins and micas
Orange East 1	L466353	Medium to coarse grained magnetite/hematite mix 60/40 with occasional martite, quartz/granite veins and micas
Orange East 2	L466354	Medium to coarse grained magnetite/hematite mix 60/40 with quartz matrix and occasional martite, quartz/granite veins and micas
Yellow 1	L466355	Fine to coarse predominantly magnetite with hematite (as martite) 80/20 with a quartz matrix, quartz veins, mica bands and chlorite/amphibolite alteration in places
Yellow 2	L466356	Fine to coarse predominantly magnetite with hematite (as martite) 80/20 with a quartz matrix, quartz veins, mica bands and chlorite/amphibolite alteration in places
White 1	L466357	Medium to coarse grained magnetite/hematite mix 60/40 with occasional martite, quartz/granite veins and micas
White 2	L466358	Medium to coarse grained magnetite/hematite mix 60/40 with occasional martite, quartz/granite veins and micas
Sandell 1	L466359	Predominantly fine grained magnetite with some chlorite/amphibolite alteration.
Sandell 2	L466360	Predominantly fine grained magnetite with some chlorite/amphibolite alteration.
Foot/Hanging wall 1	L466361	Rhyolite/Dacite predominantly quartz

4.1.1 Crushing of the samples

NIO blasted the ore, using blast mats to minimise the movement of the material and cross-contamination. The six samples were sent to GTK Mintec via overland truck for assaying. In all, approximately 143 tonnes of material were sent. Upon receipt at GTK, over-sized and frozen material was broken up using a hydraulic hammer attached to an excavator. All material was then crushed to <70mm by the use of a jaw crusher.

4.1.2 Bulk sample assays

The assay results of the crushed bulk sample materials are displayed below in Table 3.

The following conclusions were made about the samples:

- All samples taken from the main (Blötberget) sampling location (YELLOW, WHITE, ORANGE WEST, ORANGE EAST) contain considerably less iron (Fe) than what GTK was informed to be the Run-of-Mine (RoM) average (34-37% Fe).
- All samples taken from the main (Blötberget) sampling location (YELLOW, WHITE, ORANGE WEST, ORANGE EAST) contain considerably less phosphorus than what GTK was informed to be the RoM average (0.4-0.5% P).
- The maximum iron (Fe) content reported was 30.3% (ORANGE EAST) which meant that, without further pre-treatment, it was impossible to form a blend matching the expected composition of the RoM in terms of iron (34-37%), phosphorus (0.4-0.5% P) and ratio of magnetite to hematite (80%:20%).

Table 5: Initial chemical analyses of the crushed blasted ores

Contents (%)	Footwall Waste	Yellow	White	Orange West	Orange East	Sandell Guldkannan
SiO2	64.1	57.3	50.9	50.1	45.1	40.8
TiO2	0.19	0.19	0.22	0.15	0.18	0.35
Al2O3	10.7	8.93	8.13	7.07	6.4	7.3
MgO	2.70	2.76	2.99	1.85	2.68	6.76
CaO	0.79	0.71	0.98	0.48	0.57	3.85
Na2O	4.29	3.45	2.69	2.67	2.17	1.56
K2O	1.22	0.93	1.00	1.09	0.99	0.94
P2O5	0.06	0.08	0.11	0.10	0.13	1.77
P	0.026	0.033	0.046	0.043	0.056	0.771
V	0.00	0.00	0.01	0.00	0.00	0.06
Fe(tot)	11.6	18.5	23.9	26.3	30.3	26.5
Mn	0.02	0.02	0.04	0.03	0.04	0.04
Satmagan	12.9	17.8	27.7	27.3	31.7	31.1
Eltra S	0.03	0.04	<0.05	<0.05	<0.05	<0.05
Fe bound to Magnetite, %	81%	70%	84%	75%	76%	85%
tonnes	10.5	21.9	25.2	29.5	22.9	33.5

Thus, in order to match, as nearly as possible, the expected grade of iron and the magnetite:hematite ratio of the ore to be mined, a composite bulk sample had to be made from the individual bulk samples.

4.2 Preparation of the composite bulk sample

From the results it appeared that the individual bulk samples of ore had been contaminated with hanging/foot wall rock during the blasting. Observers at the blasting site stated that the blast mats did not fully contain the blasted material and blasting of all samples occurred before any samples were removed, making contamination a distinct possibility.

It was consequently decided to investigate whether some of the footwall dilution could be removed at a coarse size so as to simulate the anticipated RoM more closely.

To that end, bulk samples ORANGE WEST and ORANGE EAST which, of the hematite-bearing samples, contain the highest level of iron (Fe), were subjected to a stage of dry magnetic separation using a NdFeB belt separator (medium intensity magnetic separator, MIMS). The procedure employed was as follows:

- Dry screening at 19mm
- MIMS of -70mm+19mm fraction
- Prepare and submit for assaying:
    a. -70mm+19mm Magnetic fraction
    b. -70mm+19mm Non-Magnetic fraction
    c. -19mm fraction

Treating only the +19mm fractions was anticipated to minimise the iron and, in particular, the hematite losses on the assumption that, at that coarse particle size, the hematite would be substantially interlocked with magnetite and, thereby, collected by the medium-intensity field as well. The results of MIMS are presented in Tables 4 and 5.

The most important facts relating to the treatment of the materials by MIMS are summarised below:

- The -70mm+19mm MIMS magnetic fractions assayed ~37% Fe.
- The phosphorus contents in the -70mm+19mm magnetic fractions were comparable to those of the overall feeds (ORANGE WEST and ORANGE EAST).
- 76% and 79% of the iron in the magnetic fractions were bound to magnetite.
- The removal of the <19mm fractions had not biased the assays of the coarser fractions with respect to % phosphorus and magnetite:hematite ratio so these materials were discarded.

Table 6: Material Balance dry MIMS for ORANGE WEST bulk sample

Grade-Recovery Balance Calculation for the Screening - Dry MIMS beneficiation test

GTK Mintec

Sample:	NIO Pilot, 'Orange West' ore type	Notes:	*NdFeB permanent magnet Dry Belt MIMS*
Project:	1281282 / 2402		Nominal magnetic field strength ca. 0.25 Tesla
Date:	8.-9.11.2014		
Test:	Preparation of the Pilot Test Work Feed Composite		
By:	M. Kuusisto		
Feed batch:	18.5 tons	Preparations:	Pre-screening # 19 mm for the Dry MIMS
Top size:	70 mm [by pilot jaw crushing]		19-70 mm Screen O/S to Dry MIMS

Test product(s)	Weight		XRF MP-10, Eltra S and Satmagan analyses																						*%Fe bound to Mgt*
			Fe		SiO_2		P_2O_5		MgO		MnO		Al_2O_3		CaO		Na_2O		K_2O		Eltra S		Satmagan		
	tons	wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	
Dry MIMS Mags	9.99	54.91	37.40	68.5	39.30	46.9	0.137	48.9	2.28	55.6	0.053	63.6	4.01	36.1	0.261	25.1	1.11	30.4	0.77	42.4	0.050	54.9	39.27	71.6	76%
Dry MIMS Non-Mags	3.98	21.89	16.60	12.1	59.10	28.1	0.105	14.9	1.75	17.0	0.020	9.6	9.65	34.6	0.71	27.3	3.79	41.4	1.37	30.1	0.050	21.9	12.97	9.4	57%
(Dry MIMS Feed)	13.97	76.79	31.47	80.6	44.94	75.0	0.128	63.8	2.13	72.6	0.044	73.1	5.62	70.7	0.389	52.4	1.87	71.8	0.94	72.5	0.050	76.8	31.77	81.0	73%
Screen # 19 mm U/S	4.22	23.21	25.00	19.4	49.50	25.0	0.240	36.2	2.66	27.4	0.053	26.9	7.70	29.3	1.17	47.6	2.43	28.2	1.18	27.5	0.050	23.2	24.66	19.0	71%
Back Calc'd Feed	*18.19*	*100.00*	*29.97*	*100.0*	*46.00*	*100.0*	*0.154*	*100.0*	*2.25*	*100.0*	*0.046*	*100.0*	*6.10*	*100.0*	*0.57*	*100.0*	*2.00*	*100.0*	*1.00*	*100.0*	*0.050*	*100.0*	*30.12*	*100.0*	73%
Feed Assays			26.25		50.15		0.099		1.85		0.037		7.07		0.482		2.67		1.09		0.050		27.28		75%

Table 7: Material Balance dry MIMS for ORANGE EAST bulk sample

Grade-Recovery Balance Calculation for the Screening - Dry MIMS beneficiation test

GTK Mintec

Sample:	NIO Pilot, 'Orange East' ore type	Notes:	*NdFeB permanent magnet Dry Belt MIMS*
Project:	1281282 / 2402		Nominal magnetic field strength ca. 0.25 Tesla
Date:	9.11.2014		
Test:	Preparation of the Pilot Test Work Feed Composite		
By:	M. Kuusisto		
Feed batch:	13.5 tons	Preparations:	Pre-screening # 19 mm for the Dry MIMS
Top size:	70 mm [by pilot jaw crushing]		19-70 mm Screen O/S to Dry MIMS

Test product(s)	Weight		XRF MP-10, Eltra S and Satmagan analyses																						*%Fe bound to Mgt*
			Fe		SiO_2		P_2O_5		MgO		MnO		Al_2O_3		CaO		Na_2O		K_2O		Eltra S		Satmagan		
	tons	wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	
Dry MIMS Mags	6.69	51.11	36.90	64.8	39.50	43.4	0.142	47.1	2.55	50.5	0.052	59.3	4.28	34.1	0.296	24.3	1.21	29.8	0.80	39.1	0.050	51.1	40.28	69.1	79%
Dry MIMS Non-Mags	2.98	22.77	12.70	9.9	62.10	30.4	0.096	14.2	2.25	19.8	0.025	12.7	10.80	38.3	1.06	38.8	4.01	44.1	1.50	32.7	0.050	22.8	8.24	6.3	47%
(Dry MIMS Feed)	9.67	73.87	29.44	74.7	46.46	73.9	0.128	61.3	2.46	70.3	0.044	72.0	6.29	72.5	0.53	63.1	2.07	73.9	1.02	71.8	0.050	73.9	30.41	75.4	75%
Screen # 19 mm U/S	3.42	26.13	28.20	25.3	46.50	26.1	0.228	38.7	2.93	29.7	0.048	28.0	6.76	27.5	0.88	36.9	2.07	26.1	1.13	28.2	0.050	26.1	28.09	24.6	72%
Back Calc'd Feed	*13.09*	*100.00*	*29.12*	*100.0*	*46.47*	*100.0*	*0.154*	*100.0*	*2.58*	*100.0*	*0.045*	*100.0*	*6.41*	*100.0*	*0.62*	*100.0*	*2.07*	*100.0*	*1.05*	*100.0*	*0.050*	*100.0*	*29.80*	*100.0*	74%
Feed Assays			30.25		45.05		0.128		2.68		0.045		6.36		0.57		2.17		0.99		0.050		31.71		76%

Thus, from the results of the dry MIMS cobbing (<70mm) and the previous assay data on the other distinct geological ore types, a composite feed was determined with the following proportions to match the expected RoM grade:

- 6,100kg of ORANGE EAST dry MIMS Mags (28wt-% of blend)
- 9,800kg of ORANGE WEST dry MIMS Mags (45wt-% of blend)
- 5,900kg of Sandell/Guldkannan (27wt-% of blend). N.B. An extra 200kg of this material was added to compensate for the moisture content.

This procedure generated 21,800kg of total composite bulk sample (22,000kg including the extra 200kg mentioned above).

The blending procedure was as follows:

1. Blend the three samples in the proportions stated above
2. Homogenisation
3. Remove 1/8th subsample (c. 2,700kg) sized <70mm for vendor testwork at external site
4. Stage-wise crushing to a particle size suitable to feed the rod mill (<6mm, see Table 13)
5. Removal of two representative subsamples from the crushed feed for confirmation of head assay (chemical analysis for Fe, SiO2, Al2O3, CaO, MgO, P, S, Na2O, K2O, Mn, TiO2, V, Magnetite (Satmagan), LOI) (see Table 8 below).
6. Size-by-size chemical analysis of rod mill fee using ~10 screen sizes between 10mm and c.50microns (see Table 12).

Table 8: Chemical assay of the composite bulk sample blend

Labtium Oy
REPORT OF XRF ANALYSIS 13.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121188
Method : 180X-O
Date : 13.11.2014
Comment : NIO Pilot. Pilot Test Work. Composite Blend - Feed samples

Contents (%)

	Assay 1 L14076961	Assay 2 L14076962	Average Feed Assay
SiO2	42.1000	40.8000	41.45
TiO2	**0.1980**	**0.2040**	**0.201**
Al2O3	**5.5100**	**5.3600**	**5.44**
Cr2O3	0.0026	0.0072	
V2O3	0.0270	0.0280	
MnO	0.0500	0.0520	
MgO	**3.6100**	**3.5300**	**3.57**
CaO	**1.3300**	**1.3200**	**1.33**
Rb2O	0.0140	0.0130	
SrO	0.0007	0.0000	
BaO	0.2030	0.1790	
Na2O	**1.5100**	**1.3700**	**1.44**
K2O	**0.8800**	**0.8900**	**0.89**
ZrO2	0.0110	0.0100	
P2O5	0.5700	0.5400	0.56
OxSumm	97.2000	97.0000	
Cu	0.0000	0.0010	
Ni	0.0050	0.0050	
Co	0.0300	0.0170	
Zn	0.0040	0.0050	
Pb	0.0000	0.0000	
Ag	0.0000	0.0000	
S	0.0080	0.0090	
As	0.0000	0.0010	
Sb	0.0140	0.0130	
Bi	0.0020	0.0030	
Te	0.0000	0.0000	
Y	0.0038	0.0042	
Nb	0.0000	0.0000	
Mo	0.0000	0.0000	
Sn	0.0050	0.0050	
W	0.0010	0.0000	
Cl	0.0060	0.0070	
Th	0.0039	0.0040	
U	0.0032	0.0035	
Cs	0.0030	0.0030	
La	0.0090	0.0140	
Ce	0.0200	0.0230	
Ta	0.0010	0.0010	
LOI	0.0000	0.0000	
Ga	0.0019	0.0027	
Si	19.7000	19.1000	
Ti	0.1190	0.1230	
Cr	0.0018	0.0049	
V	**0.0180**	**0.0190**	**0.0185**
Fe	31.9000	33.1000	32.50
Mn	**0.0390**	**0.0410**	**0.040**
Mg	2.1800	2.1300	
Ca	0.9500	0.9400	
Ba	0.1810	0.1600	
Satmagan	**34.77**	**35.51**	**35.14**
Eltra S	**<0.05**	**<0.05**	**< 0.05**

5 PILOT PLANT PROCESS DESCRIPTION

The Pilot Plant was operated in three stages:

- **Stage 1:** Crushing of the composite bulk sample from blasted ore to <6mm rod mill feed
- **Stage 2:** A continuous operation of several different flowsheets, taking material from the rod mill to intermediate concentrate formation, i.e. prior to flotation
- **Stage 3:** Flotation, thickening and filtration

5.1 Stage 1

As mentioned previously, individual bulk samples underwent crushing to <70mm before selected samples were submitted to dry screening at 19mm followed by dry MIMS of the 19mm oversize material. After the composite sample was formed (ORANGE EAST dry MIMS Mags, ORANGE WEST dry MIMS Mags, Sandell-Guldkannan) and homogenised, the material underwent several stages of crushing before a <6mm sample was deposited into a stockpile ahead of the day bin. The crushing flowsheet is shown in Figure 11.

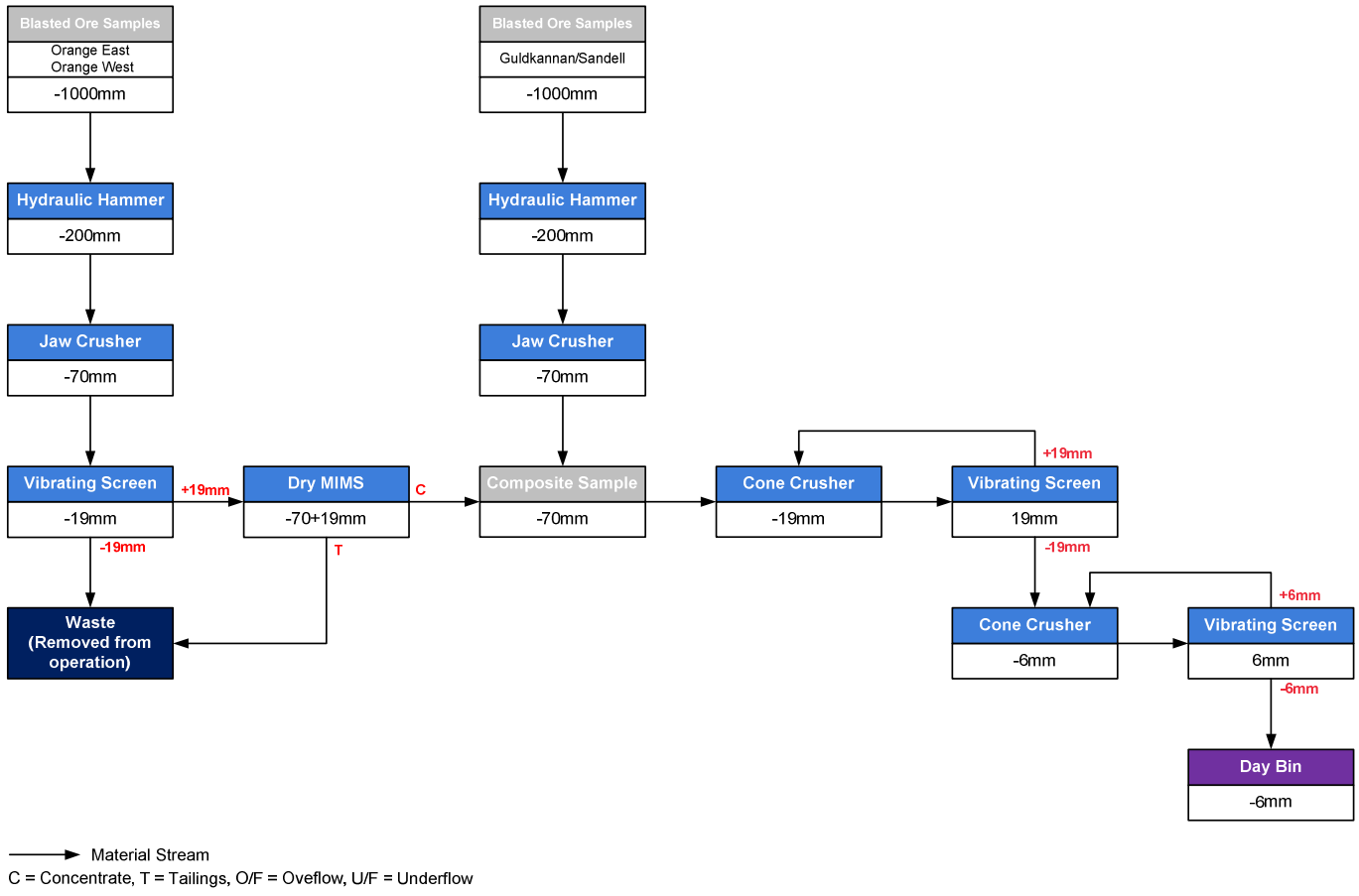


Figure 11: Process flow diagram for preparation of composite bulk sample

5.2 Stage 2

Several revisions of the initial flowsheet, which had been developed from the results of bench-scale testwork, were then investigated. Modifications were made in response to the release of assay results (chemical and PSD) which gave information upon the circuit performance, especially, concentrate grades, recovery and yield.

5.2.1 Flowsheet version 1a

The <6mm material was fed to a 20kW rod mill (drawing approx. 5kW) at a rate of 700kg/h. The crushed material was fed onto a Derrick screen supporting a mesh of 1mm aperture. The oversize was returned to the rod mill while the undersize passed to two wet LIMS drums operating in series as rougher/scavenger (M1 and M2).

The wet LIMS non-magnetic portion was fed to a SLon rougher (WHIMS or HGMS) unit (SLon 1) with a vertical carousel and a field strength of 0.05T. The non-magnetic portion was considered to be a tailing at this point whilst the magnetic portion was sent to the Lamella thickener.

The wet LIMS drum magnetic portion was fed to a 20kW ball mill (drawing 4.2-4.6kW, see process data, Appendix 4). The ball mill product was fed through a cyclone operating at a cut-point of 150µm. The overflow product (<150µm material) was fed to a pair of cleaner LIMS drums operating in series as rougher/cleaner (M3 and M4). Here, the magnetic portion was collected in barrels as an intermediate magnetite product, whilst the tailings were also sent to the Lamella thickener.

The Lamella thickener underflow was fed to a re-grinding mill of the Sala Agitated Mill (SAM) type, also referred to as a tower mill, which discharged on to a SWECO circular screen having apertures of 150µm. The screen oversize was returned to the SAM mill and screen undersize was fed to a SLon WHIMS unit, SLon 2. The SLon 2 magnetic concentrate was collected in the Outotec Supaflo thickener for subsequent phosphate flotation if necessary. Initially, the SLon II tailings were sent towards the final Sala tailing thickener. However, as there were concerns over the efficiency of the SLon II unit, a Carpco H9000W spiral was introduced to treat the SLon 2 tailings and act as a scavenger.

The finely sized, intermediate magnetite product (M4) was originally destined for processing via phosphate flotation. However this was not required because the concentrate contained very little phosphorus. Thus, ultimately, this material was recovered from the barrels and processed by pressure filtration to produce a final magnetite concentrate as filter cake.

The finely sized SLon 2 magnetic concentrate was of a poor grade owing to the disappointing performance of SLon 2 and required further up-grading before it could be subjected to phosphate flotation. This material was collected in the Outotec Supaflo concentrate thickener, where it awaited further processing.

All tailings were collected together in the Sala SFC tailings thickener.

The part of the flowsheet between the day bin and the intermediate concentrates is represented as a flow diagram in Figure 12 and further processing to create final concentrates is shown in Figure 13.

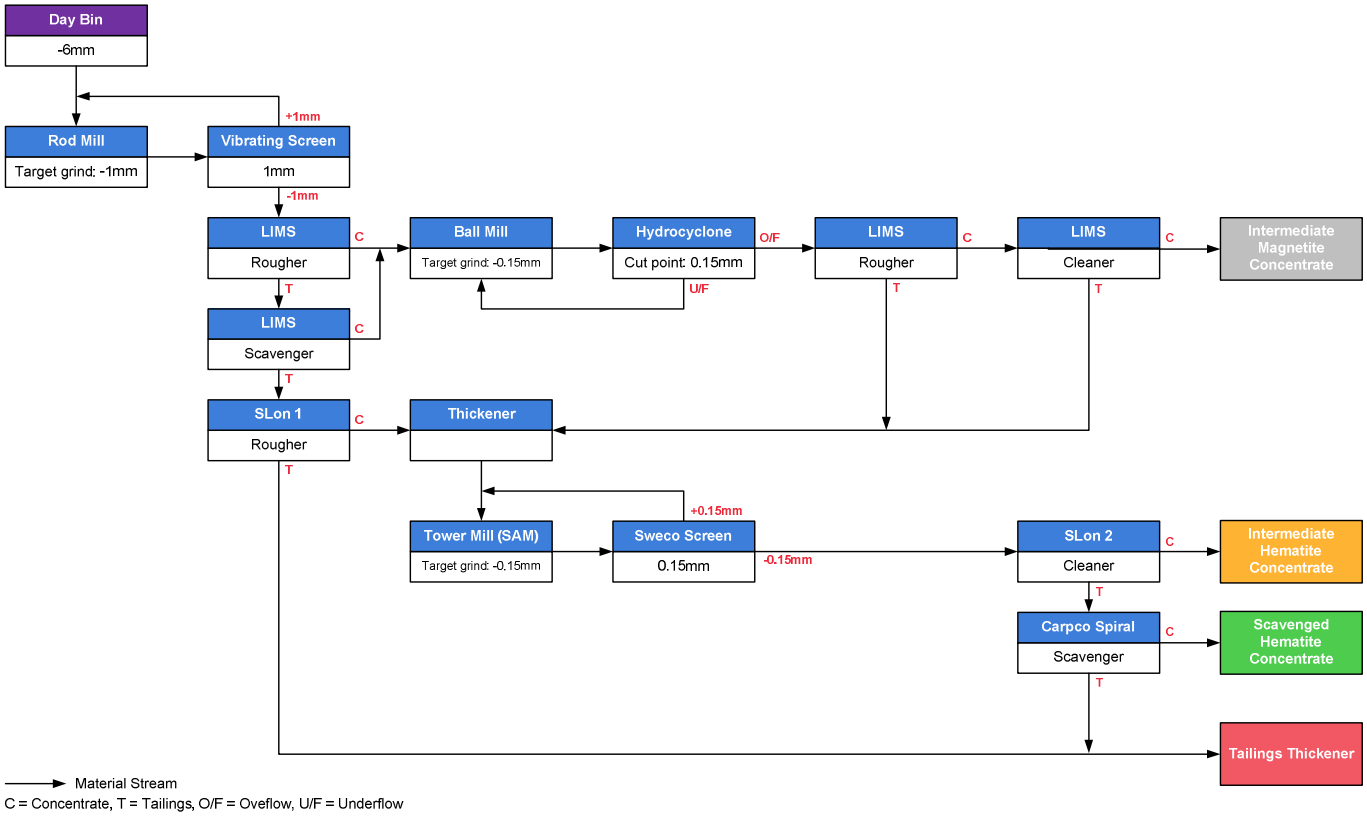


Figure 12: Process flow diagram of flowsheet Version 1a

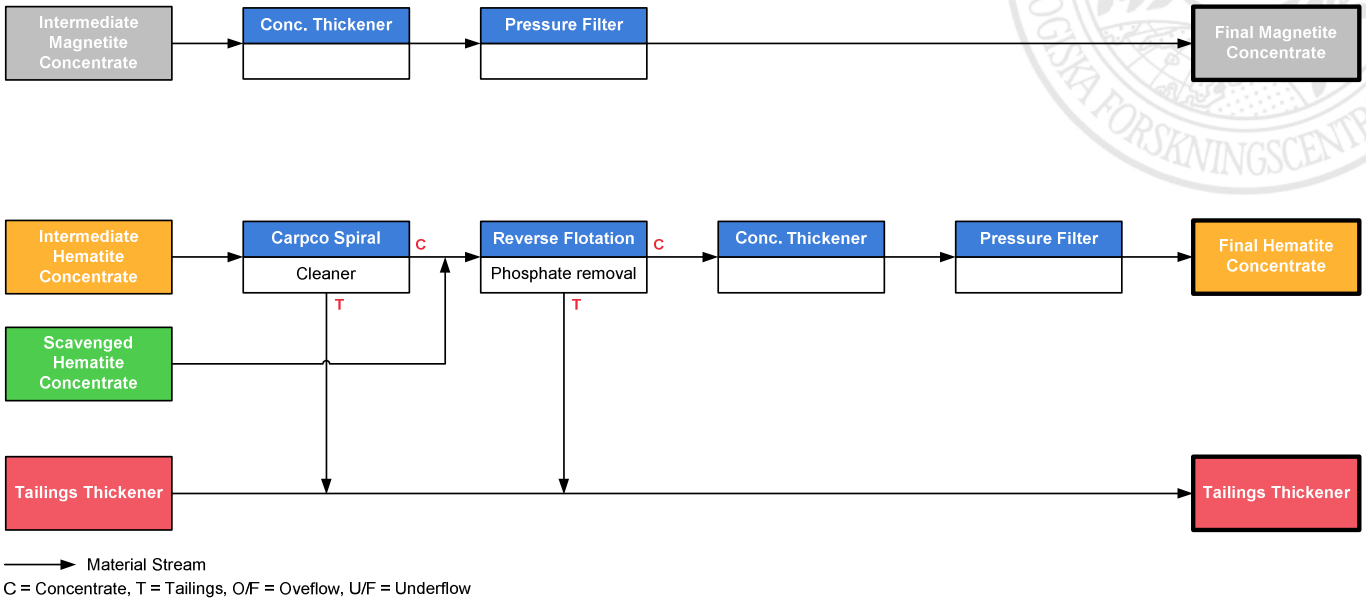


Figure 13: Version 1 Process flow diagram for processing of intermediate concentrates to create final concentrates

Flowsheet version 1b

This flowsheet was very similar to version 1a. However, as the assay results became available and showed that the scavenger spiral was performing well on the <150µm tailing produced by SLon 2, another spiral was introduced to treat the SLon 1 non-magnetic tailings to see if any material could be reclaimed from the coarse tailings stream. All other process parameters were kept constant. Intermediate concentrates were created via the flowsheet as represented by the flow diagram in Figure 14. Further processing to create final concentrates was the same as above and represented in Figure 13.

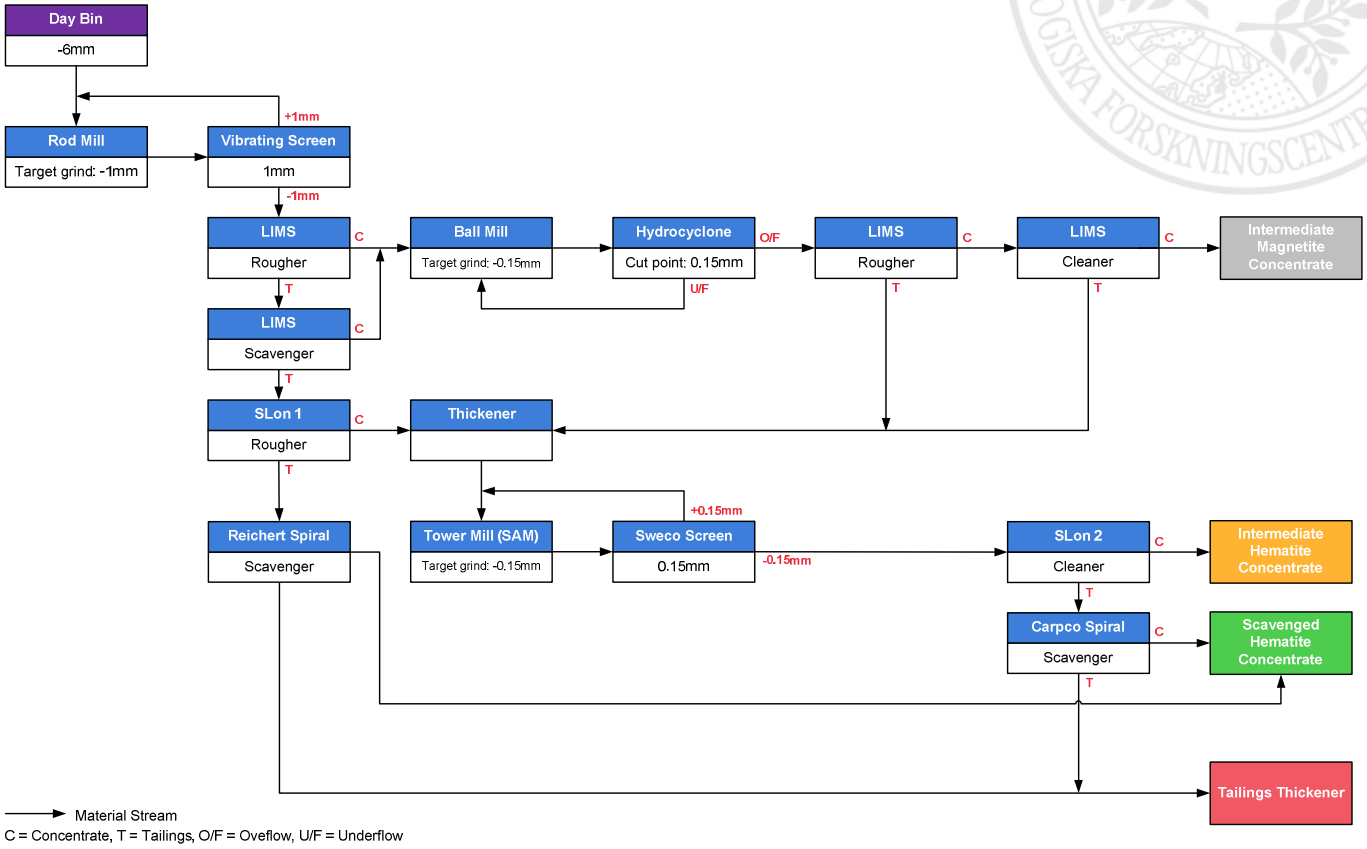


Figure 14: Process flow diagram showing flowsheet version 1b

5.2.2 Flowsheet version 2a

A third version of the flowsheet was tested when it became clear that the two SLon WHIMS/HGMS machines were not performing as expected or as predicted from the results of bench-scale testing of a Sala HGMS laboratory unit. To improve recovery of the hematite it was decided that the SLon units should be replaced by concentrating spirals. A Reichert WW6 spiral was utilised instead of SLon 1 and a Carpco H9000W spiral was used instead of SLon 2. The revised flowsheet is presented in Figure 15 and Figure 16.

The improvement of this flowsheet design is discussed in later sections.

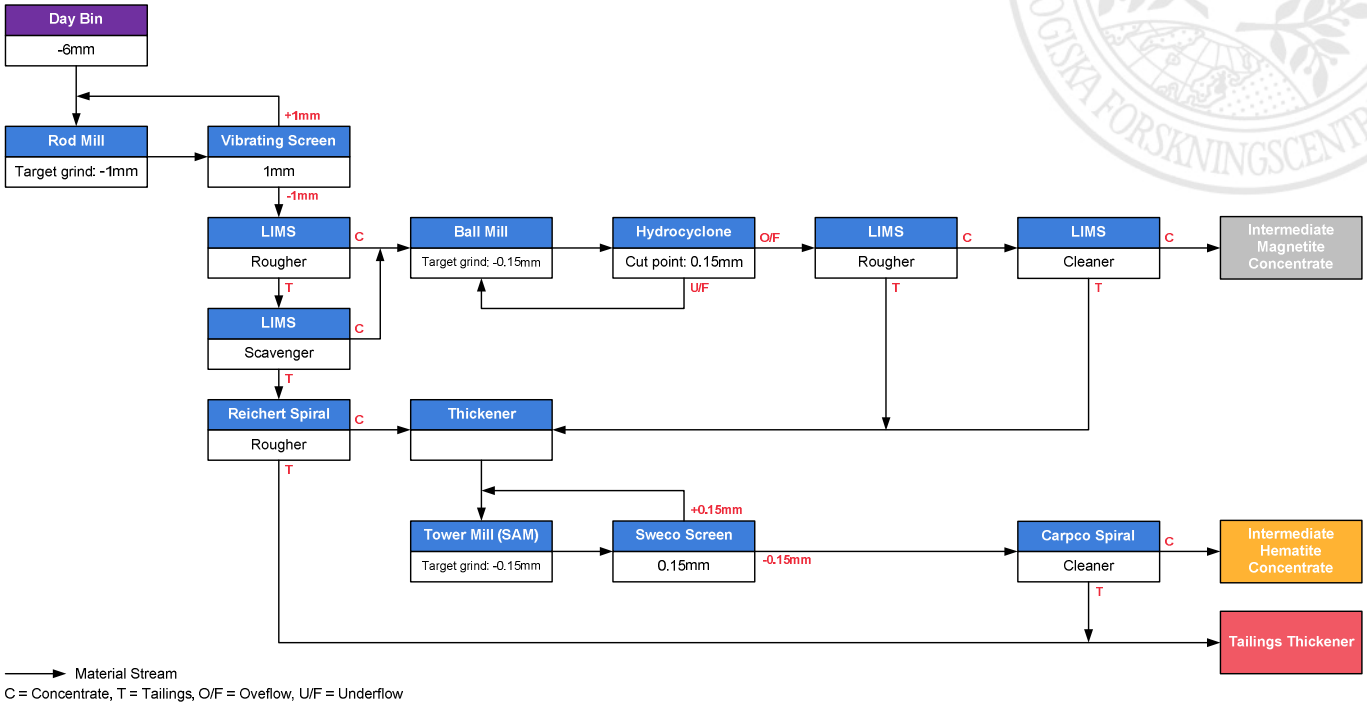


Figure 15: Process flow diagram of the flowsheet version 2a

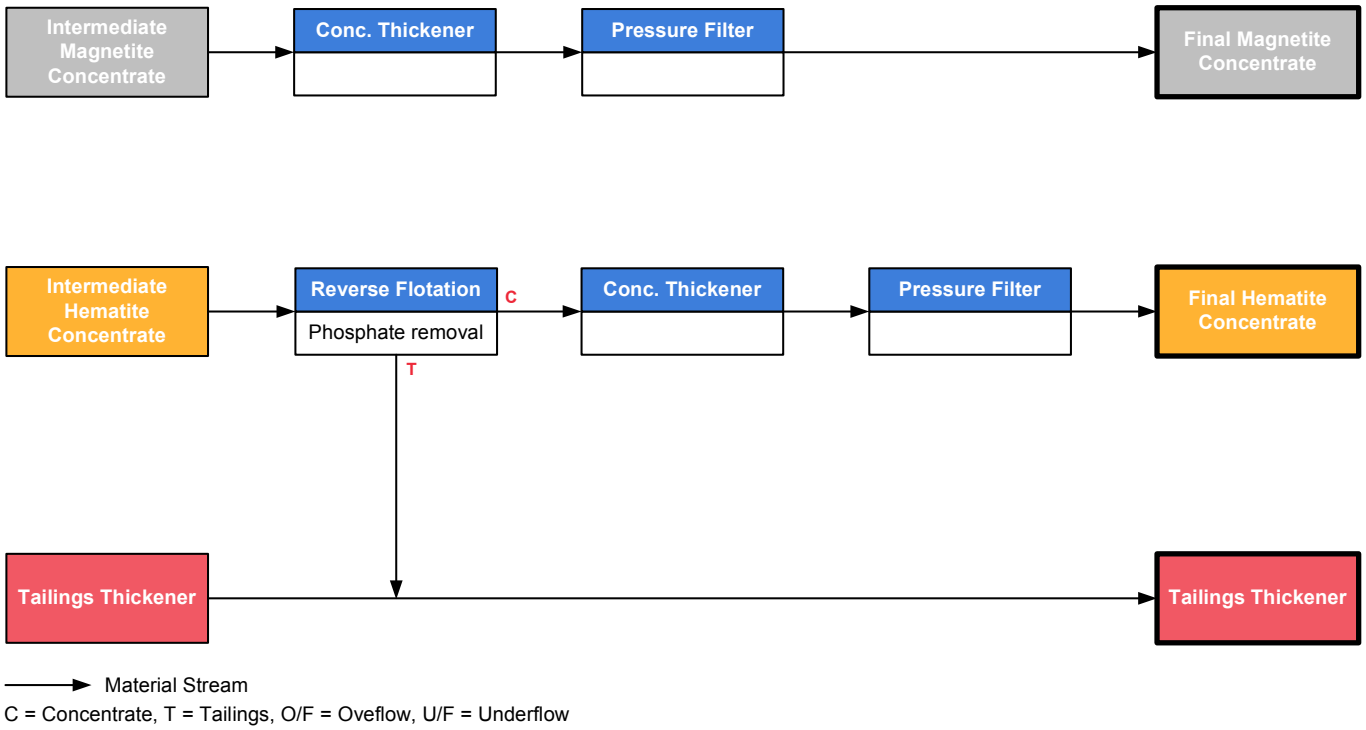


Figure 16: Process flow diagram of the processing of intermediate concentrates to final concentrates for flowsheet version 2

5.2.3 Flowsheet version 2b

A fourth flowsheet was trialled for the last few hours of the pilot run. This involved the same flowsheet as version 2a. However, the feed rate to the rod mill was increased to 1000kg/h (from 700 kg/h) and the Derrick screen aperture was increased to 2mm. This was done to determine whether an increased feed rate to the rod mill would increase the D_{80} of the grind with the objectives of saving energy and producing a coarser tailings material for dam construction and disposal. The flow diagram for this flowsheet is represented in Figure 17 and Figure 16.

The implications of the changes are discussed in later sections.

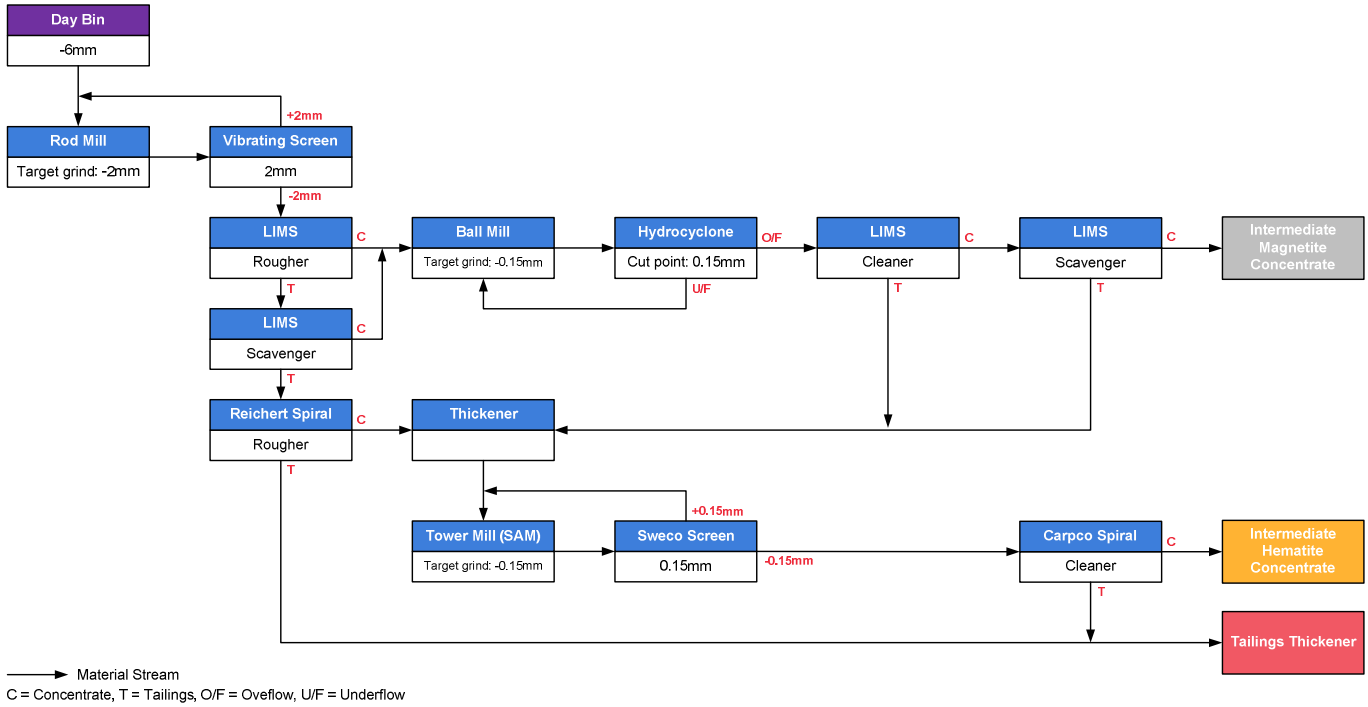


Figure 17: Process flow diagram representing Flowsheet 2b up to the intermediate concentrate production

5.3 Stage 3

5.3.1 Flotation

Flotation to remove phosphorus present as the phosphate mineral, apatite, was undertaken as a separate phase which ran over two days in the following week. The magnetite intermediate concentrate did not require treating owing to its low $\%P_2O_5$ content. Only the hematite intermediate concentrate was treated but this stream had a relatively low mass flowrate.

6 DISCUSSION OF THE PLANT OPERATION

6.1 Client representation and supervision

The client, NIO, was represented at GTK by Dr Robert Milne and Dr Mike Smith of Tata Steel Consulting between Monday 17th November and Thursday 20th November 2014 inclusive, and Mr Matthias Reisinger during 24th-26th November. Mr Paul Marsden, NIO Project Director for the Blötberget Feasibility Study, was present during Wednesday 19th and Thursday 20th November and the CEO of NIO, Mr Christer Lindqvist, was present on Wednesday 19th November.

All results of the plant operation were disclosed to the Client as they became available and no changes were made to the process flowsheet or equipment without prior discussion with and the agreement of the Client or his representative.

6.2 Crushing of the composite sample

As mentioned in Section 4, the bulk sample materials obtained from the six zones arrived in trucks from the mine site via an intermediate storage location in an as-blasted state. Frozen and oversize material required breaking down with a hydraulic hammer attached to an excavator. Each bulk sample was then separately crushed to <70mm using a Lokomo C 63 B jaw crusher. Assay samples were taken of the six bulk samples and the selected material was dry screened at 19mm prior to dry MIMS to produce a sample with the desired magnetite:hematite ratio, %Fe and %P2O5 contents. Once the dry MIMS products were combined in the correct proportion along with other selected blasted ore samples (Sandell/Guldkannan), the composite bulk sample was crushed to <19mm using a Lokomo G 158 cone crusher and then crushed to <6mm using a Lokomo G 108 cone crusher. The resulting finely crushed composite bulk sample was deposited in a covered stockpile as a windrow and reclaimed by a rabble to fill the day bin for the process plant. This procedure would have achieved a measure of blending/homogenisation.

The combined <6mm composite feed had a D80 of 3750µm and the screen analysis is displayed in Table 13. The grade-distribution balance of the composite bulk sample is displayed in Table 14 and size-by-size analysis is displayed in Table 53.

6.3 Commissioning of the magnetite and hematite circuits

6.3.1 Commissioning the magnetite circuit

Commissioning of the magnetite circuit was undertaken on Friday 14th November with results available on 17th and 18th November. The objective was to calibrate the 20kW regrind ball mill operating in closed-circuit with the hydrocyclone to produce the desired grind of <150µm.

The expected mass balance and grades of products were determined at bench-scale using the Sala Blue Ribbon LIMS. The bench-scale LIMS test produced a rougher magnetic concentrate of 65.2% Fe, 0.253% P_2O_5 and a cleaner concentrate of 71.4% Fe with 0.074% P_2O_5 at a yield of 39.2 wt%, see Table 15. Full assays are presented in Table 56 and Table 57.

In comparison, the ultimate results from commissioning the pilot plant were; for the wet LIMS Cleaner (M3) a concentrate containing 70.9% Fe and 0.077% P_2O_5 and, for the recleaner LIMS (M4), a concentrate containing 71.2% Fe and 0.073% P_2O_5. The non-magnetic tailings contained 20-25% Fe and 1.4-1.7% P_2O_5.

Thus, the conclusion of the commissioning of the magnetite circuit was that a very satisfactory magnetite concentrate could be produced using the selected equipment, as predicted by bench-scale metallurgical testwork. Furthermore, it was unlikely that flotation of phosphate would be necessary.

6.3.2 Commissioning of the hematite circuit

A bench-scale Sala HGMS test on the composite feed, after removal of magnetite by wet LIMS, had indicated that one rougher stage followed by regrinding and two stages of cleaning could produce a product containing 62.1% Fe with a P_2O_5 content of 0.277%. See Table 58.

Initially, field strength testing was undertaken on Friday 14th using the SLon 1 (rougher) fed with the non-magnetic product of the rougher wet LIMS at a rate of 150kg/hr. The results of the field strength tests are displayed in Table 9.

Table 9: SLon 1 field strength testing during hematite circuit commissioning

Field, T	0.05	0.1	0.3	0.6	1
Concentrate, Fe%	45	30	21.6	17.5	15.9

It was concluded that rougher SLon 1 would need to be operated at a very low field strength of 0.05T at a feed rate of 150-200kg/hr.

Cleaner SLon testing (SLon 2) was undertaken on Monday 17th in conjunction with the SAM regrind mill. The cleaner SLon 2 was operated at a field strength of 0.025T and produced results as shown in Table 10 below.

Table 10: SLon 2 results during commissioning of the hematite circuit

	% Fe	% P_2O_5
Feed	32.8	0.82
Magnetics	47.9	1.17
Non-magnetics	23.0	0.95

During this test, the unexpected and relatively high iron content of the tailings was noted so a scavenger spiral was installed to treat the SLon 2 non-magnetic stream which, otherwise, would be a tailings stream.

6.4 Pilot plant operation

6.4.1 Flowsheet version 1

The pilot plant operation using the SLon machines in the hematite circuit extended from the morning of Tuesday 18th to 3:30pm Wednesday 19th. In total, the version 1 flowsheet was run for approximately 16 hours.

Version 1 a
This exact flowsheet only ran for the morning of the 18th and consisted of the flowsheet as shown in Figure 12, in which the SLon 2 non-magnetics were being treated via a scavenging spiral but the SLon 1 non-magnetics were passing directly to tailings. As shown in the mass balance, Table 19, it can be noted that the hematite concentrate produced by SLon 2 had a very disappointing grade of 44% Fe and that the iron lost by SLon 2 amounted to a loss of 7.7% iron recovery. It can be estimated that the recovery of hematite by SLon 2 was less than 25%. On the other hand, it can be noted that the scavenger spiral concentrate had a grade of 62% Fe and achieved 3.3% iron recovery.

The magnetite circuit, however, recovered 98.5% of the magnetite into a concentrate with a grade of 70.5% Fe, 0.09% P_2O_5.

Samples were collected at 9:15am to check that the grind sizes (PSD) were satisfactory, see Table 20. It can be noted that the PSD of the rod mill product had a D_{80} of 227µm and that of the reground magnetite had a D_{80} = 82µm. The latter is as required but the PSD of the rod mill product suggested that the rod mill was over grinding the feed compared to the target grind as established through bench-scale testwork which had a D_{80} of 500µm. Regrettably, although this problem was recognised, it was not possible to increase the feed rate to the rod mill above 700kg/hr without overloading the SLon separators and the operators were very concerned that the feed to the rougher SLon separators should contain no particles greater than 1mm.

The measurement of the particle size distribution taken from the Tower Mill/SAM regrind mill between SLon 1 and SLon 2 gave a D_{80} of 90µm which was also seen as satisfactory, see Table 21.

Assays of samples collected during the first sampling session between 12:30 and 1:15pm are shown in Table 62.

Version 1 b

Owing to the high grade of %Fe in the concentrate produced by the scavenging spiral compared to that produced by SLon 2, a second scavenging spiral was included on the SLon 1 non-magnetics stream (<1mm) which was previously considered as a tailings. This configuration, see Figure 14, ran from approx 2pm on 18th until approx 3pm on the 19th. This second spiral upgraded the 10.3% Fe content of the tailings from SLon 1 to 43.7% Fe but also concentrated the P_2O_5 level from 0.95% to 2.69% which indicated reverse flotation might be required to reduce this level, see Table 63 for full assays.

The summarised assays of samples collected during the second sampling session of the first day (18/11/2014) and the calculated mass balance are presented in Table 22.

The magnetite circuit continued to perform very well recovering 98.5% of the magnetite into a concentrate containing 70.2% Fe, 0.09% P_2O_5.

However, it can be noted that the performance of SLon 2 continued to be disappointing, producing concentrate containing only 50% Fe (see Table 22) whilst, at the same time, the scavenger spiral concentrate graded 64.8% Fe. Owing to this poor performance by SLon 2, a sample of the feed to SLon 2 was sent for testing by the bench scale Sala HGMS (results see Table 17).

The results became available on Wednesday 19th November (see also Table 59 and Table 60). The bench-scale Sala HGMS unit increased the %Fe from 48.4% to 53.1% recovering 92% of the weight.

In comparison, bench-scale HGMS on the tailings of the bench-scale LIMS achieved a concentrate grade of 56.3% Fe in a single stage and 62.1% Fe by a second recleaning stage (see Table 16). Thus, it was concluded that it was unlikely that the performance of SLon 2 could be significantly improved. No immediate explanation was available for this poor performance compared to previous testwork using the bench-scale Sala HGMS and ore samples derived from drill core (see Phase 2 Report).

Data produced during the first sampling of Wednesday 19th between 13:15-14:00, see Table 23 and Table 64, show a similar performance to that determined from the second campaign of sampling on 18th November (16:45-17:30). Thus, the continuing poor grade of the SLon 2 concentrate was discussed with the Client and it was agreed to make a change to the flowsheet. It should be noted that no third SLon machine was available to act as a recleaner so the decision was taken to replace the SLon magnetic separators by concentrating spirals. This decision was implemented at about 3.30pm on Wednesday 19th November.

Checks upon the PSD of milled materials, see Table 24, conducted during the morning of 19th November (10:30am) showed comparable PSD to those seen previously namely; a D_{80} of 234µm for the Derrick screen undersize and 91µm for the Cyclone overflow and 93µm for the SLon 2 feed.

6.4.2 Flowsheet version 2

Flowsheet version 2 ran from 3.30pm on 19th November until the end of the pilot plant testwork (12pm on 20th November). This flowsheet was run for approximately 8 hours in total.

Version 2a

The flowsheet was altered to replace the SLon machines with spirals. SLon 1 was replaced with the Reichert WW6 spiral as a rougher treating <1mm material whilst SLon 2 was replaced by the Carpco H9000W treating <150µm material. The first sampling of this flowsheet occurred on the 19th Nov between 17:15-18:00. The mass balance is presented in Table 25 and full assays of material streams are presented in Table 65.

The replacement of the SLon machines with the spirals improved the Fe grade of the hematite concentrate and simplified the process configuration. Overall, the concentrate at this stage represented 45.7 wt% of the feed, and contained 70.3% Fe and 0.13% P_2O_5 (Table 25). Previous measurements when the SLon machines had been utilised were 47.4 wt% yield to a concentrate containing 68.5% Fe, 0.29% P_2O_5 (Table 23). A slight reduction in yield had led to a higher %Fe concentrate containing significantly less P_2O_5.

Measurements of the PSD of the cleaner spiral (hematite) concentrate and tailings were a D_{80} of 98µm and 91µm respectively (Table 26 and Table 27) which broadly matched the previously seen PSD of the feed to SLon 2 of D_{80} = 93µm (Table 24).

Extra attention was applied to the cleaner spiral due to concerns over the ability to recover the fine material on the spirals. The spiral tailings contained 42.0 wt% <32µm material which graded 37.1% Fe (see Table 29) whereas the concentrate contained only 7.7 wt% of material sized <32µm which graded 66.6% Fe (see Table 28). It was concluded that the majority of the losses of iron were in the form of fine hematite too fine to be recovered by concentrating spirals.

Version 2b

Prior to restarting the pilot plant operation on the morning of 20th November, at the request of the Client, the Derrick screen aperture size was increased to 2mm and the feed rate was increased to 1000kg/h. This was undertaken in an attempt to increase the D_{80} of the rod mill product to replicate the D_{80} of 500µm which had been used for design purposes.

The increase in feed rate to the rod mill had a small effect on the D_{80} of the Derrick screen undersize increasing it to 289µm (Table 32) from 234µm as measured previously (Table 21). The best illustration of the slight increase is shown in Table 36 and Table 37 where the D_{80} is compared between the afternoon of 19th November and the morning of 20th November. The D_{80} of the rougher spiral tailings increased from 236µm to 318µm and the D_{80} of the Lamella thickener feed increased from177µm to 218µm.

The magnetite concentrate had a D_{80} of 100µm (Table 33) which increased from 86µm previously (Table 26). However, the D_{80} of the hematite concentrate remained similar at 97µm and 98µm respectively. The cleaner spiral concentrate contained 6.9 wt% <32µm material grading 63.7% Fe (Table 34), whilst the tailing contained 38.2 wt% <32µm having an assay of 29.8% Fe (Table 35), suggesting that less <32µm hematite material was being produced, see Table 28 and Table 29 and the full assays in Table 67 and Table 68.

The PSD of the Derrick screen undersize, cyclone overflow and the Sweco screen undersize were the same as before (Table 32). The size analysis of the hematite cleaner tails also changed little with a D_{80} = 92µm (Table 31) compared to 91µm (Table 27).

There was a slight decrease in overall yield of concentrate from 45.7 wt% containing 70.26% Fe (Table 25) to 43.6 wt% containing 68.8% Fe (Table 30) prior to flotation. The P_2O_5 content had also increased in the overall concentrate from 0.13% to 0.23%. Full assays are presented in Table 66.

6.5 Pilot Plant Flotation

It had already been agreed with the Client that there was no purpose in subjecting the intermediate magnetite concentrate (M4) to flotation owing to the very low phosphorus content; typically less than 0.1% P_2O_5 or 0.044% P.

6.5.1 Preparation of flotation feed

When the assays for the SLon 2 (hematite) concentrate produced by version 1 of the flowsheet (17-19th November) became available, it was clear that, owing to the poor performance of SLon 2, retreatment of the 'hematite' concentrate using the Carpco spiral concentrator would be required prior to flotation. This was undertaken on Friday 21st November. The spiral upgraded the SLon 2 concentrate from 47.2% Fe to 66.0% Fe and reduced the phosphorus content from 1.91% P_2O_5 to 0.97%, see Table 69.

6.5.2 Flotation

A sample of the spiral concentrate produced by recleaning the SLon 2 concentrate was subjected to a batch flotation test in the laboratory to establish the approximate flotation conditions for the continuous small-scale flotation plant, see Table 18. The results show that a concentrate containing 66% Fe, 0.023% P_2O_5 (0.01%P) could be produced after 11 minutes of treatment by flotation from a feed containing 64.6% Fe, 0.95% P_2O_5. As indicated by previous bench-scale tests, flotation was extremely effective in rapidly removing phosphate.

The Carpco spiral concentrate produced by retreating of the SLon 2 concentrate was combined with the hematite concentrates produced by the plant operating according to flowsheet Versions 2a and 2b to

produce the feed to the continuous flotation plant. The feed rate was approximately 100kg/h of solids and three banks of Outokumpu 50L cells were used. The particle size distribution of the flotation feed is presented in Table 38 showing a D80 = 97µm.

The assays of 'grab samples' taken from the flotation circuit early in the campaign are presented in Table 70 and the assays of the definitive samples taken during the operation are presented in Table 71. Finally, the assays of the collected products of flotation are presented in Table 72.

The assays confirm that a high grade of iron ore concentrate (66% Fe) containing low levels of phosphorus (0.135% P_2O_5 or 0.06% P) can be produced from the hematite concentrate by flotation at a satisfactory yield of in excess of 95wt% (see Table 39). However, it was observed that the flotation rate was much slower in the small-scale plant than in the bench-scale batch flotation tests. It was suspected that the cause was a difference in the preparation of the reagents and/or conditioning but lack of sample prevented investigation of this difference.

6.6 Product dewatering

The two concentrates, magnetite and hematite, were recovered from their respective collection vessels (200L barrels) and filtered upon a Choquenet filter press to produce approximately 7 tonnes of magnetite concentrate and approximately 300kg of hematite concentrate as filter cake, see Table 42. The average moisture content of the magnetite concentrate after filtration was 6.9wt%.

A subsample of the magnetite concentrate (M4) was taken and tested on a bench-scale Larox filter press; see Table 43. The average moisture content of the concentrate after dewatering was 4.65wt%.

6.7 Bulk density

The bulk density of the concentrates (magnetite, hematite, bulk tailings, and collected rougher spiral tailings) were measured in the as dried, un-compressed and compressed form as shown in Table 44. Filter cake bulk densities in the compressed and uncompressed form were also measured for the magnetite and hematite concentrates.

7 VENDOR SAMPLES

The following samples were collected and despatched;

7.1 Filtration testwork

20kg of magnetite concentrate (M4) and 2kg of the final hematite concentrate following flotation were sent to the laboratories of Metso Minerals in Sala, Sweden for filtration testwork.

7.2 Tailings dam design testwork

Two 200L barrels containing bulk tailings extracted from the Sala final tailings thickener were sent to the laboratory COMPLAB, Technical University of Lulea, Sweden for the attention of Klas Stromberg where testing related to the design of the tailings dam would be carried out on behalf of Ramboll.

7.3 Autogenous grinding testwork

180 pieces were selected from the >19mm composite bulk sample before crushing and sent to SGS Lakefield Laboratory, Ontario, Canada for the SMC test.

7.4 Vertimill Testwork

'Vertimill' is a trademark name for tower mills (stirrer agitated media mills) manufactured by Metso. Two 15 kg samples were required by Metso Minerals, York, Pennsylvannia, USA for a pot milling test related to the measurement of grindability with respect to the design and selection of tower mills. The first was the rougher LIMS magnetite concentrate of which 68kg was collected and the second was the rougher spiral hematite concentrate of which 38kg was collected.

7.5 High Pressure Grinding Rolls Testwork (HPGR)

2700kg of the <70mm composite bulk sample was set aside before crushing for HPGR testwork. In the event, 1070kg was sent to Weir Minerals (KHD) laboratories in Cologne, Germany for testing.

8 CONCLUSIONS

The small-scale processing plant operated for about 24 hours and treated approximately 22 tonnes of the composite bulk sample which had principal assays of; 32.5% Fe, 0.56% P_2O_5, 41.5% SiO_2 and 79% of the iron bound to magnetite compared to the expected assays of the Run-of-Mine (RoM) ore namely 35% Fe and 1.0% P_2O_5 with 80% of the iron bound to magnetite.

The principal objective was the demonstration, on a continuous basis, that the plant could produce satisfactory iron ore concentrates and to obtain substantial quantities of such concentrates. Other, lesser objectives of the demonstration plant included generation of samples for vendor testing and collection of design data.

With respect to the objectives, the plant clearly demonstrated that the process could produce very high grade concentrates on a continuous basis. For example, the best result in terms of concentrate grade was a bulk concentrate (magnetite + hematite) containing 70.26% Fe, 2.15% SiO_2 and 0.13% P_2O_5 without flotation. This concentrate was obtained at a yield of 45.7wt%.

The magnetite concentrate alone was of exceptionally high grade containing as much as 70.5% Fe but only 0.1% P_2O_5 and therefore did not require flotation. Without flotation, the hematite concentrate had a grade up to 67.0% Fe but a very high content of phosphorus, up to 0.95% P_2O_5. However, the small-scale continuous froth flotation plant was able to produce a final hematite concentrate containing 66% Fe and only 0.135% P_2O_5 (0.06% P).

A major finding of the operation was that the wet high intensity magnetic separators (WHIMS), in this case SLon equipment, were very much less effective than predicted by bench-scale metallurgical testwork using Sala HGMS equipment. The reasons have not been fully explained and there was insufficient time and sample to thoroughly investigate this problem. Nevertheless, the replacement of the SLon separators by spiral concentrators to recover hematite proved to be very successful.

The plant operation demonstrated that the process was very effective in recovering magnetite from the ore with recovery in all cases exceeding 98.5%. Recovery of hematite was less effective and estimated at 50% or less even when spiral concentrators replaced the SLon separators. The ultimate losses of hematite were attributed to the generation, during regrinding, of very fine hematite particles sized less than 37µm, too finely sized to be recovered by spiral concentrators.

Although not entirely successful, an attempt was made to determine the effect of a coarser primary grind in order to reduce grinding power consumption and produce a coarser tailings for dam construction and to facilitate disposal. The results indicated that the quality of the concentrate would deteriorate to a concentrate which contained 68.8% Fe and 0.23% P_2O_5. The yield also decreased marginally to 43.6%.

The small-scale plant was periodically sampled for the purpose of calculating mass balances and this information has been made available to NIO for the purpose of design of a full-scale processing plant.

The plant produced 7 tonnes of magnetite concentrate and 300kg of hematite concentrate.

A number of samples were recovered for vendor testing including samples for tests related to design of autogenous mills, HPGR, stirred media mills, vacuum and pressure filters and the tailings dam.

9 APPENDIX 1 – TABULATED RESULTS

Please note: There may be small discrepancies between the mass balance assays and the full assays due to the use of BILCO data reconciliation software by Caspeo (see http://www.caspeo.net/BILCO).

9.1 DMIMS Scalping

Table 11: Dry MIMS Scalping of the Orange East ore

Grade-Recovery Balance Calculation for the Screening - Dry MIMS beneficiation test

GTK Mintec

Sample:	NIO Pilot, 'Orange East' ore type
Project:	1281282 / 2402
Date:	9.11.2014
Test:	Preparation of the Pilot Test Work Feed Composite
By:	M. Kuusisto
Feed batch:	13.5 tons
Top size:	70 mm [by pilot jaw crushing]

Notes: *NdFeB permanent magnet Dry Belt MIMS*
Nominal magnetic field strength ca. 0.25 Tesla

Preparations: Pre-screening # 19 mm for the Dry MIMS
19-70 mm Screen O/S to Dry MIMS

Test product(s)	Weight		XRF MP-10, Eltra S and Satmagan analyses																			
			Fe		SiO_2		P_2O_5		MgO		MnO		Al_2O_3		CaO		Na_2O		K_2O		Eltra S		Satmagan	
	tons	wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%
Dry MIMS Mags	6.69	51.11	36.90	64.8	39.50	43.4	0.142	47.1	2.55	50.5	0.052	59.3	4.28	34.1	0.296	24.3	1.21	29.8	0.80	39.1	0.050	51.1	40.28	69.1
Dry MIMS Non-Mags	2.98	22.77	12.70	9.9	62.10	30.4	0.096	14.2	2.25	19.8	0.025	12.7	10.80	38.3	1.06	38.8	4.01	44.1	1.50	32.7	0.050	22.8	8.24	6.3
(Dry MIMS Feed)	9.67	73.87	29.44	74.7	46.46	73.9	0.128	61.3	2.46	70.3	0.044	72.0	6.29	72.5	0.53	63.1	2.07	73.9	1.02	71.8	0.050	73.9	30.41	75.4
Screen # 19 mm U/S	3.42	26.13	28.20	25.3	46.50	26.1	0.228	38.7	2.93	29.7	0.048	28.0	6.76	27.5	0.88	36.9	2.07	26.1	1.13	28.2	0.050	26.1	28.09	24.6
Back Calc'd Feed	*13.09*	*100.00*	*29.12*	*100.0*	*46.47*	*100.0*	*0.154*	*100.0*	*2.58*	*100.0*	*0.045*	*100.0*	*6.41*	*100.0*	*0.62*	*100.0*	*2.07*	*100.0*	*1.05*	*100.0*	*0.050*	*100.0*	*29.80*	*100.0*
Feed Assays			30.25		45.05		0.128		2.68		0.045		6.36		0.57		2.17		0.99		0.050		31.71	

Table 12: Dry MIMS Scalping of the Orange West ore

Grade-Recovery Balance Calculation for the Screening - Dry MIMS beneficiation test

GTK Mintec

Sample:	NIO Pilot, 'Orange West' ore type
Project:	1281282 / 2402
Date:	8.-9.11.2014
Test:	Preparation of the Pilot Test Work Feed Composite
By:	M. Kuusisto
Feed batch:	18.5 tons
Top size:	70 mm [by pilot jaw crushing]

Notes: *NdFeB permanent magnet Dry Belt MIMS*
Nominal magnetic field strength ca. 0.25 Tesla

Preparations: Pre-screening # 19 mm for the Dry MIMS
19-70 mm Screen O/S to Dry MIMS

Test product(s)	Weight		XRF MP-10, Eltra S and Satmagan analyses																			
			Fe		SiO_2		P_2O_5		MgO		MnO		Al_2O_3		CaO		Na_2O		K_2O		Eltra S		Satmagan	
	tons	wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%
Dry MIMS Mags	9.99	54.91	37.40	68.5	39.30	46.9	0.137	48.9	2.28	55.6	0.053	63.6	4.01	36.1	0.261	25.1	1.11	30.4	0.77	42.4	0.050	54.9	39.27	71.6
Dry MIMS Non-Mags	3.98	21.89	16.60	12.1	59.10	28.1	0.105	14.9	1.75	17.0	0.020	9.6	9.65	34.6	0.71	27.3	3.79	41.4	1.37	30.1	0.050	21.9	12.97	9.4
(Dry MIMS Feed)	13.97	76.79	31.47	80.6	44.94	75.0	0.128	63.8	2.13	72.6	0.044	73.1	5.62	70.7	0.389	52.4	1.87	71.8	0.94	72.5	0.050	76.8	31.77	81.0
Screen # 19 mm U/S	4.22	23.21	25.00	19.4	49.50	25.0	0.240	36.2	2.66	27.4	0.053	26.9	7.70	29.3	1.17	47.6	2.43	28.2	1.18	27.5	0.050	23.2	24.66	19.0
Back Calc'd Feed	*18.19*	*100.00*	*29.97*	*100.0*	*46.00*	*100.0*	*0.154*	*100.0*	*2.25*	*100.0*	*0.046*	*100.0*	*6.10*	*100.0*	*0.57*	*100.0*	*2.00*	*100.0*	*1.00*	*100.0*	*0.050*	*100.0*	*30.12*	*100.0*
Feed Assays			26.25		50.15		0.099		1.85		0.037		7.07		0.482		2.67		1.09		0.050		27.28	

9.2 Composite Blend

Table 13: Screen analysis of the <6mm crushed composite bulk sample feed to the rod mill

SCREEN ANALYSIS TABLE

Eastern Finland office
Mintec

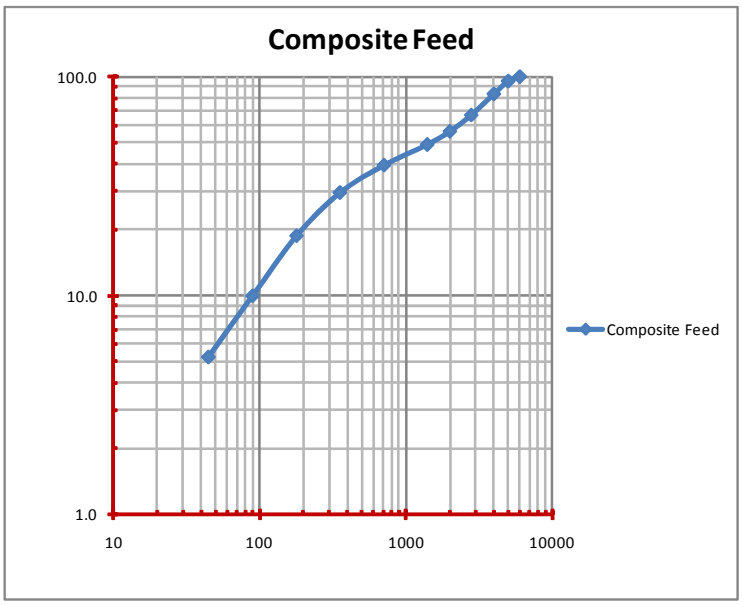
Project name : **NIO Pilot**
Code : **1281282 / 2402**

Date : 13.11.2014
By : MEK

Note : Combination of elutriation screening and Ro-Tap dry screening for 10 min

Sample data : **Composite Blend Feed < 6 mm**

Screen opening (µm)	NIO Pilot Composite Blend Feed Top size 6 mm Weight (g)	Pass. (%)	Frac. (%)
	Composite Feed		
6000	0.0	100.0	0.0
5000	25.2	95.6	4.4
4000	69.3	83.5	12.1
2800	94.7	66.9	16.6
2000	60.5	56.3	10.6
1400	41.1	49.1	7.2
710	54.9	39.5	9.6
355	56.5	29.6	9.9
180	61.4	18.8	10.8
90	50.3	10.0	8.8
45	27.1	5.3	4.7
- 45	30.0		5.3
Total	571.0		100.0



Calc'd
P 80
(µm) 3750

Table 14: Grade-distribution balance of the composite bulk sample feed (<6mm)

Grade-Distribution Balance Calculation by Sieve Size Fractions

GTK Mintec

Sample:	NIO Pilot, Composite Feed (< 6.0 mm)
Project:	1281282 / 2402
Date:	14.11.2014
Test:	Pilot Test Work
By:	M. Kuusisto

Notes: Product fineness P(80) = 3,750 microns
Sieve fractions of the Composite Feed to chemical assaying

Sieve fraction	Weight		Grades & Distributions (XRF MP-10 and Satmagan)																			
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
µm	g	wt.-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%
+ 5000	25.2	4.41	27.50	3.7	47.90	5.2	0.224	1.7	2.72	3.3	0.038	4.2	6.85	5.7	1.00	3.4	2.21	6.8	0.95	4.9	0.168	3.7	30.50	3.7
- 5000	545.8	95.59	33.16	96.3	40.71	94.8	0.60	98.3	3.68	96.7	0.040	95.8	5.28	94.3	1.32	96.6	1.40	93.2	0.85	95.1	0.199	96.3	36.70	96.3
4000/5000	69.3	12.14	30.60	11.3	44.40	13.1	0.439	9.2	3.14	10.5	0.036	11.0	5.73	13.0	1.15	10.7	1.66	14.0	0.89	12.6	0.184	11.3	33.93	11.3
+ 4000	94.5	16.55	29.77	15.0	45.33	18.3	0.382	10.9	3.03	13.8	0.037	15.2	6.03	18.6	1.11	14.0	1.81	20.8	0.91	17.5	0.180	15.0	33.02	15.0
- 4000	476.5	83.45	33.53	85.0	40.17	81.7	0.62	89.1	3.76	86.2	0.041	84.8	5.22	81.4	1.35	86.0	1.36	79.2	0.85	82.5	0.202	85.0	37.10	85.0
2800/4000	94.7	16.58	30.20	15.2	44.30	17.9	0.51	14.6	3.48	15.9	0.035	14.6	5.82	18.0	1.25	15.9	1.68	19.4	0.88	17.0	0.195	16.3	33.87	15.4
+ 2800	189.2	33.13	29.99	30.2	44.82	36.2	0.446	25.5	3.25	29.6	0.036	29.7	5.92	36.7	1.18	29.9	1.74	40.3	0.89	34.5	0.187	31.4	33.44	30.4
- 2800	381.8	66.87	34.35	69.8	39.15	63.8	0.65	74.5	3.83	70.4	0.042	70.3	5.07	63.3	1.37	70.1	1.28	59.7	0.84	65.5	0.203	68.6	37.90	69.6
2000/2800	60.5	10.60	29.00	9.3	45.90	11.9	0.50	9.1	3.46	10.1	0.037	9.8	5.80	11.5	1.30	10.5	1.64	12.1	0.93	11.5	0.191	10.2	31.76	9.2
+ 2000	249.7	43.73	29.75	39.5	45.08	48.0	0.459	34.6	3.30	39.7	0.036	39.6	5.89	48.2	1.21	40.4	1.72	52.4	0.90	45.9	0.188	41.6	33.04	39.7
- 2000	321.3	56.27	35.36	60.5	37.88	52.0	0.67	65.4	3.90	60.3	0.043	60.4	4.93	51.8	1.38	59.6	1.21	47.6	0.82	54.1	0.206	58.4	39.06	60.3
1400/2000	41.1	7.20	28.50	6.2	46.40	8.1	0.52	6.5	3.54	7.0	0.036	6.5	5.85	7.9	1.36	7.5	1.68	8.4	0.91	7.6	0.206	7.5	30.55	6.0
+ 1400	290.8	50.93	29.57	45.8	45.27	56.2	0.468	41.1	3.34	46.7	0.036	46.1	5.89	56.0	1.23	47.9	1.71	60.8	0.90	53.6	0.191	49.1	32.68	45.7
- 1400	280.2	49.07	36.37	54.2	36.63	43.8	0.70	58.9	3.95	53.3	0.044	53.9	4.79	44.0	1.39	52.1	1.14	39.2	0.81	46.4	0.205	50.9	40.31	54.3
710/1400	54.9	9.61	31.00	9.1	44.00	10.3	0.479	7.9	3.51	9.3	0.038	9.2	5.40	9.7	1.17	8.6	1.51	10.1	0.86	9.6	0.182	8.8	34.28	9.0
+ 710	345.7	60.54	29.80	54.8	45.06	66.5	0.469	49.0	3.36	56.0	0.036	55.2	5.81	65.7	1.22	56.5	1.68	71.0	0.90	63.2	0.189	57.9	32.94	54.7
- 710	225.3	39.46	37.68	45.2	34.83	33.5	0.75	51.0	4.06	44.0	0.045	44.8	4.64	34.3	1.44	43.5	1.06	29.0	0.80	36.8	0.211	42.1	41.78	45.3
355/710	56.5	9.89	39.60	11.9	34.60	8.3	0.323	5.5	3.23	8.8	0.040	9.9	4.23	7.8	0.80	6.1	1.13	7.8	0.68	7.8	0.170	8.5	44.43	12.1
+ 355	402.2	70.44	31.18	66.7	43.59	74.8	0.449	54.6	3.35	64.8	0.037	65.1	5.59	73.6	1.16	62.6	1.60	78.7	0.87	71.0	0.187	66.4	34.55	66.8
- 355	168.8	29.56	37.03	33.3	34.91	25.2	0.89	45.4	4.33	35.2	0.047	34.9	4.78	26.4	1.66	37.4	1.03	21.3	0.84	29.0	0.225	33.6	40.89	33.2
180/355	61.4	10.75	41.80	13.7	31.20	8.2	0.382	7.1	3.80	11.2	0.042	11.3	3.97	8.0	0.90	7.4	0.94	7.0	0.75	9.4	0.177	9.6	46.29	13.7
+ 180	463.6	81.19	32.58	80.4	41.95	83.0	0.440	61.6	3.41	76.0	0.038	76.5	5.37	81.6	1.13	70.0	1.52	85.8	0.85	80.4	0.185	76.0	36.11	80.5
- 180	107.4	18.81	34.31	19.6	37.03	17.0	1.18	38.4	4.64	24.0	0.050	23.5	5.25	18.4	2.09	30.0	1.08	14.2	0.89	19.6	0.252	24.0	37.80	19.5
90/180	50.3	8.81	38.80	10.4	33.20	7.1	0.97	14.7	4.28	10.4	0.044	9.7	4.28	7.0	1.68	11.3	0.93	5.7	0.82	8.4	0.196	8.7	43.42	10.5
+ 90	513.9	90.00	33.19	90.8	41.10	90.2	0.492	76.4	3.49	86.4	0.038	86.2	5.27	88.6	1.18	81.3	1.46	91.5	0.85	88.8	0.186	84.7	36.82	91.0
- 90	57.1	10.00	30.35	9.2	40.40	9.8	1.37	23.6	4.95	13.6	0.055	13.8	6.10	11.4	2.45	18.7	1.22	8.5	0.96	11.2	0.302	15.3	32.85	9.0
45/90	27.1	4.75	35.50	5.1	36.20	4.2	1.51	12.4	3.91	5.1	0.043	5.1	4.54	4.0	2.48	9.0	1.06	3.5	0.80	4.4	0.229	5.5	39.90	5.2
+ 45	541.0	94.75	33.31	95.9	40.85	94.3	0.54	88.8	3.51	91.5	0.038	91.3	5.23	92.6	1.25	90.3	1.44	95.0	0.85	93.3	0.189	90.2	36.98	96.2
- 45	30.0	5.25	25.70	4.1	44.20	5.7	1.24	11.2	5.89	8.5	0.066	8.7	7.51	7.4	2.42	9.7	1.36	5.0	1.10	6.7	0.368	9.8	26.49	3.8
Calc.Bulk	571.0	100.00	32.91	100.0	41.03	100.0	0.58	100.0	3.64	100.0	0.040	100.0	5.35	100.0	1.31	100.0	1.43	100.0	0.86	100.0	0.198	100.0	36.43	100.0
Bulk Assay			32.50		41.45		0.56		3.57		0.040		5.44		1.33		1.44		0.89		0.201		35.14	

9.3 Bench-scale testwork

Table 15: Bench-scale Wet LIMS testwork for initial magnetic recovery estimates

Grade-Recovery Balance Calculation for the WLIMS Beneficiation test

GTK Mintec

Sample:	NIO Pilot, Composite Feed
Project:	1281282 / 2402
Date:	17.-18.11.2014
Test:	WLIMS rougher-cleaner test
By:	MEK, AEN, MPK
Feed batch:	5.0 kg; Pilot Crushed ore feed (< 6 mm)
Top sizes:	0.71 mm in one-stage Roughing
	0.150 mm in three-stage Cleaning (steps 2 to 4)

Notes: *Sala "Blue Ribbon" permanent ferrite magnet Wet LIMS*
Nominal magnetic field strength ca. 0.07 Tesla
Basin bottom flow restrictor dia. 4 mm (Rgh & Cln stages)
Volumetric slurry feed rate ca. 1.3 liter/min

Preparations: For Rougher WLIMS - Screening & Mergan Rod Milling of Crushed Ore Feed (< 6 mm)
For Cleaner WLIMS - Screenings & Lab Ball Millings of "Rgh Mags"

Test product(s)	Weight		XRF MP-10 and Satmagan analyses																			
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
	grams	wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%
Cln Mags 4 Conc.	1951.2	39.17	71.40	79.1	1.16	1.2	0.074	4.8	0.22	2.7	0.050	50.8	0.25	2.0	0.118	3.3	0.00	0.0	0.019	0.8	0.045	8.4	97.27	99.3
Cln Non-Mags 2-4	234.4	4.71	15.20	2.0	58.20	7.1	2.06	15.9	6.64	10.0	0.046	5.6	5.07	4.9	3.75	12.6	0.75	3.1	0.98	5.1	0.399	8.9	0.77	0.1
(Rgh Mags)	2185.6	43.87	65.37	81.1	7.28	8.3	0.287	20.7	0.91	12.7	0.050	56.4	0.77	6.9	0.51	15.9	0.08	3.1	0.122	5.9	0.083	17.3	86.92	99.4
(Rgh Mags assayed)			*65.20*		*7.71*		*0.253*		*1.04*		*0.053*		*0.80*		*0.454*		*0.10*		*0.109*		*0.082*		*86.07*	
Rgh Non-Mags	2796.3	56.13	11.90	18.9	62.80	91.7	0.86	79.3	4.88	87.3	0.030	43.6	8.04	93.1	2.10	84.1	1.96	96.9	1.51	94.1	0.309	82.7	0.41	0.6
Calc'd Feed	*4981.9*	*100.00*	*35.36*	*100.0*	*38.44*	*100.0*	*0.61*	*100.0*	*3.14*	*100.0*	*0.039*	*100.0*	*4.85*	*100.0*	*1.40*	*100.0*	*1.14*	*100.0*	*0.901*	*100.0*	*0.210*	*100.0*	*38.36*	*100.0*
Feed Assays			32.50		41.45		0.56		3.57		0.040		5.44		1.33		1.44		0.89		0.201		35.14	

Table 16: Bench-scale HGMS testing of rougher LIMS tailings produced from NIO composite sample

Grade-Recovery Balance Calculation for the HGMS Beneficiation test

GTK Mintec

Sample:	NIO Pilot, Composite Feed, WLIMS rougher NM
Project:	1281282 / 2402
Date:	18.-20.11.2014
Test:	HGMS rougher-cleaner test
By:	AEN, MPK, MEK
Target:	Preparation of fine hematite concentrate
	[for phosphate removal flotation ?]
Feed batch:	1.50 kg; WLIMS rougher non-mags product
Top sizes:	0.71 mm in one-stage HGMS Roughing
	0.150 mm in two-stage HGMS Cleaning

Notes: *Sala HGMS 10-15-20 SCR Wet HIMS separator*
Magnetic field strength set to 0.10 Tesla (Rgh) vs. 0.06 Tesla (Cln)
Feed pulp solids set to ca. 8 wt.-% (Rgh) vs. 7-4.5 wt.-% (Cln)
Basin bottom flow restrictor dia. 8 mm (Rgh) vs. 12 mm (Cln)
Slurry velocity within the matrix ca. 49 mm/sec (Rgh) vs. 83 mm/sec (Cln)
Matrix loading parameter adjusted to ca. 0.30 g/cm3 (Rgh) vs. 0.25-0.15 g/cm3 (Cln)
Matrix canister '3.5XRO' (Rgh) vs. '3.5XMO' (Cln) - both expanded metal types
Recommended matrix-specific top grain size 0.85 mm (Rgh) vs. 0.30 mm (Cln)

Preparations: For Rougher HGMS stage - none
For Cleaner HGMS stages - Screening & SS Ball Milling of "HGMS Rgh Mags"

Test product(s)	Weight		XRF MP-10 and Satmagan analyses																					
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
	grams	wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%
HGMS Cln M2	154.7	10.39	62.10	51.8	7.07	1.2	0.277	3.3	1.30	2.9	0.015	5.0	1.07	1.5	0.54	2.6	0.15	0.8	0.176	1.2	0.82	28.6	2.19	49.6
HGMS Cln NM2	17.4	1.17	14.80	1.4	54.50	1.0	0.84	1.1	9.06	2.3	0.057	2.2	7.85	1.2	2.53	1.4	1.24	0.8	1.89	1.4	0.379	1.5	0.34	0.9
(HGMS Cln M1)	172.1	11.56	57.32	53.2	11.87	2.2	0.334	4.4	2.08	5.2	0.019	7.2	1.76	2.7	0.74	4.0	0.26	1.6	0.349	2.6	0.78	30.1	2.00	50.5
(HGMS Cln M1 assayed)			*56.30*		*12.90*		*0.337*		*2.30*		*0.020*		*1.88*		*0.73*		*0.32*		*0.340*		*0.79*		*2.20*	
HGMS Cln NM1	324.5	21.80	17.10	29.9	57.10	19.8	1.04	25.6	5.63	26.4	0.040	28.2	5.63	16.4	2.52	25.5	1.51	17.8	1.31	18.6	0.374	27.4	0.40	19.0
(HGMS Rgh Mags)	496.6	33.36	31.04	83.1	41.42	22.0	0.80	30.0	4.40	31.6	0.033	35.4	4.29	19.1	1.90	29.5	1.08	19.4	0.98	21.2	0.51	57.5	0.96	69.5
(HGMS Rgh Mags assayed)			*29.90*		*41.50*		*0.78*		*4.80*		*0.031*		*5.33*		*1.84*		*1.22*		*0.97*		*0.53*		*0.67*	
HGMS Rgh Non-Mags	992.0	66.64	3.15	16.9	73.50	78.0	0.93	70.0	4.78	68.4	0.030	64.6	9.11	80.9	2.28	70.5	2.24	80.6	1.82	78.8	0.190	42.5	0.21	30.5
Calc'd Feed	*1488.6*	*100.00*	*12.45*	*100.0*	*62.80*	*100.0*	*0.89*	*100.0*	*4.65*	*100.0*	*0.031*	*100.0*	*7.50*	*100.0*	*2.15*	*100.0*	*1.85*	*100.0*	*1.54*	*100.0*	*0.298*	*100.0*	*0.46*	*100.0*
Feed Assays			11.90		62.80		0.86		4.88		0.030		8.04		2.10		1.96		1.51		0.309		0.41	
[WLIMS Rgh NM]																								

Table 17: Bench-scale HGMS testing of SLon 2 concentrate ('Mags B') produced during 19th November pilot plant operation

GTK
Eastern Finland Office
Mintec
Markku Kuusisto

Sala HGMS 10-15-20 SCR Wet HIMS Separator / GTK Mintec Outokumpu
Material balance calculation based on XRF MP10 and Satmagan analyses of products

Client(s) : TSC / M. Reisinger
NIO / P. Marsden

Project : **1281282 / 2402**

Test Feed : **Pilot Test Composite Feed'**
HGMS 'Mags B' product at 100% minus 150 µm

Target : **HGMS cleaning for hematite upgrade**

Test Conditions : One-stage HGMS cleaning using feed solids at ca. 2 wt.-%
Magnetic field strength set to 0.06 Tesla
Basin bottom flow restrictor dia. 12 mm
Slurry velocity within the matrix ca. 83 mm/sec
Matrix loading parameter ca. 0.20 g/cm3 [dry solids/canister volume]
Matrix canister type '3.5XMO' expanded metal construction - recommended top grain size 300 microns

Date : Nov. 19th 2014

HGMS Cleaning, in one stage

Test No.	Product	Weight		Grades & Recoveries (based on XRF MP10 and Satmagan analyses)																					
				Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		TiO_2		CaO		Na_2O		K_2O		V		Satmagan	
		g	Wt.-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%	%	Rec-%
HGMS Cln	Mags B - M	44.05	91.96	53.10	98.5	15.70	73.7	1.27	92.8	2.47	77.2	0.019	79.8	1.60	73.1	0.78	96.8	1.95	88.0	0.24	71.8	0.270	64.5	0.012	95.7	4.57	99.4
	Mags B - NM	3.85	8.04	9.00	1.5	64.20	26.3	1.13	7.2	8.33	22.8	0.055	20.2	6.74	26.9	0.297	3.2	3.04	12.0	1.08	28.2	1.70	35.5	0.006	4.3	0.32	0.6
	[Calc.Feed]	47.90	100.00	49.56	100.0	19.60	100.0	1.26	100.0	2.94	100.0	0.022	100.0	2.01	100.0	0.74	100.0	2.04	100.0	0.31	100.0	0.385	100.0	0.012	100.0	4.23	100.0
	Feed Assay			48.40		20.80		1.26		3.21		0.022		2.19		0.72		2.06		0.35		0.389		0.013		4.84	
	[Mags B]																										

Note : Iron assay results are Satmagan corrected values

Table 18: Results of bench-scale flotation testwork on pilot plant spiral concentrate (hematite)

FLOTATION TEST REPORT

Mintec

Sample : NIO Pilot - Hematite Pre-Conc.
Project : 1281282 / 2402
Date : 26/11/2014
Done by : MPK, MEK
Test No. : 1

Grinding : Mill :
Charge :
Water :
Fineness : P100 = 150 µm

Remarks : NIO Pilot - hematite pre-conc sample
Spiral cleaned hematite product concentrate as the feed to flotation (batch size ca. 600 g)
Apatite removal by reverse flotation (at pH around 9.5, plus close to 32 wt.-% feed solids at start)

Feed size	Condit. min	Reagents (g/t)					Cell l	Air l/min	Rotor rpm	pH	Flot'n min	Product	Weight		Grades and Recoveries (by XRF and Satmagan)																			
				Water glass	Atrac 1563	Flotanol C-7							g	wt.-%	Fe %	Fe Rec%	SiO_2 %	SiO_2 Rec%	P_2O_5 %	P_2O_5 Rec%	MgO %	MgO Rec%	Mn %	Mn Rec%	Al_2O_3 %	Al_2O_3 Rec%	CaO %	CaO Rec%	Na_2O %	Na_2O Rec%	K_2O %	K_2O Rec%	TiO_2 %	TiO_2 Rec%	Satmagan %	Satmagan Rec%
< 150 µm				(5-%)	(100-%)	(100-%)																													
							1.5		1100	8.0	natural																								
	10			580						9.7	due to water glass																								
	5				29			1.5		9.7	1																								
	1					12				9.6																									
								1.5			1	**ApF1**	12.4	2.06	**3.88**	0.1	1.02	0.6	**37.60**	77.9	0.39	2.3	0.006	2.1	0.18	0.8	**50.60**	73.7	0.05	1.6	0.021	1.4	0.076	0.2	1.19	2.3
										9.6		(RT1)	590.0	97.94	65.94	99.9	3.55	99.4	0.224	22.1	0.35	97.7	0.006	97.9	0.46	99.2	0.379	26.3	0.07	98.4	0.031	98.6	0.86	99.8	1.04	97.7
	2				58					9.5																									
						-																													
								1.5			3	**ApF2**	18.5	3.07	**56.10**	2.7	3.32	2.9	**5.67**	17.5	0.98	8.7	0.007	3.7	0.66	4.4	**5.67**	12.3	0.01	0.5	0.088	8.8	0.86	3.1	1.19	3.5
												(ApF1+2)	30.9	5.13	35.14	2.8	2.40	3.5	18.48	95.4	0.74	11.0	0.007	5.8	0.47	5.2	23.70	86.1	0.03	2.1	0.061	10.2	0.55	3.3	1.19	5.8
										9.5		**(RT2)**	571.5	**94.87**	**66.25**	**97.2**	3.56	96.5	**0.048**	4.6	0.33	89.0	0.006	94.2	0.46	94.8	0.207	13.9	0.07	97.9	0.029	89.8	0.86	96.7	1.04	94.2
	2				58					9.4																									
						-																													
								1.5			3	ApF3	29.8	4.95	66.10	5.1	2.45	3.5	0.386	1.9	0.57	8.1	0.006	5.1	0.47	5.1	0.412	1.4	0.01	0.8	0.042	6.8	0.91	5.4	1.29	6.1
												(ApF1...3)	60.7	10.08	50.34	7.8	2.42	7.0	9.60	97.3	0.66	19.1	0.006	10.9	0.47	10.3	12.27	87.5	0.02	2.8	0.052	17.0	0.72	8.7	1.24	12.0
										9.4		(RT3)	541.7	89.92	66.26	92.2	3.62	93.0	0.029	2.7	0.31	80.9	0.006	89.1	0.46	89.7	0.196	12.5	0.07	97.2	0.028	83.0	0.85	91.3	1.02	88.0
	2				58					9.3																									
	1					24				9.3																									
								1.5			3	ApF4	109.1	18.11	67.30	18.9	2.16	11.2	0.055	1.0	0.36	18.8	0.005	15.5	0.36	14.3	0.208	2.7	0.03	8.4	0.018	10.6	0.87	18.7	1.19	20.6
												(ApF1...4)	169.8	28.19	61.24	26.7	2.25	18.1	3.47	98.3	0.47	37.9	0.005	26.3	0.40	24.6	4.52	90.2	0.03	11.2	0.030	27.6	0.82	27.4	1.21	32.6
										9.2		**Cell Conc.**	432.6	**71.81**	**66.00**	**73.3**	**3.99**	**81.9**	**0.023**	**1.7**	0.30	62.1	0.006	73.7	0.48	75.4	**0.193**	9.8	0.08	88.8	0.031	72.4	0.85	72.6	**0.98**	**67.4**
Totals	23			580	203	36				Total	11	**Calc'd Head**	602.4	100.00	64.66	100.0	3.50	100.0	0.99	100.0	0.35	100.0	0.006	100.0	0.46	100.0	1.41	100.0	0.06	100.0	0.031	100.0	0.84	100.0	1.04	100.0
												Assayed Head			**64.60**		**3.66**		**0.95**		**0.36**		**0.006**		**0.46**		**1.25**		**0.06**		**0.030**		**0.88**		**1.14**	

9.4 Pilot plant operation

9.4.1 Flowsheet Version 1a - 18/11/2014

Table 19: Mass balance for flowsheet Version 1a calculated from first sampling campaign on 18th November)

Nordic Iron ore
PILOT PLANT 2014

DATE 18.11.2014
HOUR 12:30-13:15

Product	kg/h	wt%	Fe %	Fe Rec. %	Fe3O4 %	Fe3O4 Rec. %	P2O5 %	P2O5 Rec. %	SiO2 %	SiO2 Rec. %
Feed	688	100.0	35.17	100.0	36.21	100.0	0.64	100.0	38.44	100.0
Non-Mags	355	51.5	12.60	18.5	0.43	0.6	0.92	73.6	62.15	83.3
Mags	333	48.5	59.17	81.5	74.25	99.4	0.35	26.4	13.23	16.7
I SLon Mags	44	6.4	33.98	6.1	1.44	0.3	1.26	12.5	39.16	6.5
I SLon NM	311	45.2	9.59	12.3	0.3	0.4	0.87	61.1	65.4	76.8
LIMS CNM 1	72	10.5	19.23	5.7	3.16	0.9	1.26	20.6	52.64	14.3
LIMS CM 1	261	38.0	70.17	75.8	93.84	98.5	0.10	5.8	2.38	2.3
LIMS CNM 2	1.9	0.3	22.10	0.2	2.68	0.02	1.48	0.65	49.11	0.4
LIMS CM 2	259	37.7	70.5	75.6	94.5	98.5	0.09	5.2	2.0	2.0
II SLon Feed	118	17.1	24.76	12.0	2.52	1.2	1.26	33.7	47.57	21.2
II SLon Tails	94	13.6	19.88	7.7	0.50	0.2	1.05	22.4	53.32	18.9
II SLon Mags	24	3.5	44.0	4.3	10.5	1.0	2.10	11.3	24.9	2.2
II Spiral Con	13	1.9	62.2	3.3	0.5	0.03	1.13	3.31	6.0	0.3
II Spiral Tails	81	11.8	13.1	4.4	0.5	0.2	1.04	19.1	60.9	18.6
Bulk Con	296	43.1	68.04	83.3	83.66	99.5	0.30	19.8	4.04	4.5
Bulk Tails	392	56.9	10.32	16.7	0.33	0.5	0.90	80.2	64.46	95.5

Table 20: Particle size distributions of first samples of cyclone overflow and Derrick screen undersize produced by flowsheet Version 1a

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 18.11.2014

Mineral Processing KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the critical process finenesses***

Sieve Opening	18.11.2014 09.15AM Cyclone O/F			18.11.2014 09.15AM Derrick U/S											
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000		**100.0**		**0.0**	**100.0**	0.0									
710		**100.0**	0.0	**0.8**	**99.6**	0.4									
500	**0.0**	**100.0**	0.0	**2.5**	**98.5**	1.1									
250	**0.2**	**99.7**	0.3	**29.1**	**85.2**	13.3									
125	**3.7**	**94.1**	5.6	**63.0**	**56.5**	28.8									
90	**6.2**	**84.8**	9.3	**27.5**	**43.9**	12.6									
75	**6.3**	**75.4**	9.5	**15.8**	**36.7**	7.2									
32	**25.4**	**37.2**	38.1	**39.0**	**18.9**	17.8									
-32	**24.8**		37.2	**41.4**		18.9									
Tot	**66.6**		100.0	**219.1**		100.0									
Calc'd D 80 (µm)		**82**			**227**										

Table 21: Particle size distribution of the first sample of Sweco screen undersize produced by flowsheet Version 1a

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 18.11.2014

Mineral Processing KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the critical process finenesses***

Sieve Opening	18.11.2014 10.50AM Sweco U/S														
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000		**100.0**	0.0												
710		**100.0**	0.0												
500		**100.0**	0.0												
250	**0.0**	**100.0**	0.0												
125	**2.8**	**95.0**	5.0												
90	**8.4**	**79.9**	15.1												
75	**6.1**	**68.9**	11.0												
32	**18.5**	**35.6**	33.3												
-32	**19.8**		35.6												
Tot	**55.6**		100.0												
Calc'd D 80 (µm)		**90**													

9.4.2 Flowsheet Version 1b – 18 & 19/11/2014

Table 22: Mass balance for flowsheet Version 1b calculated from second sampling campaign on 18th November

Nordic Iron ore
PILOT PLANT 2014

DATE 18.11.2014
HOUR 16:45-17:30

Product	kg/h	wt%	Fe %	Fe Rec. %	Fe3O4 %	Fe3O4 Rec. %	P2O5 %	P2O5 Rec. %	SiO2 %	SiO2 Rec. %
Feed	689	100.0	36.6	100.0	37.8	100.0	0.66	100.0	37.1	100.0
Non-Mags	352	51.1	14.0	19.6	0.5	0.6	0.98	75.8	61.3	84.3
Mags	337	48.9	60.1	80.4	76.8	99.4	0.33	24.2	11.9	15.7
I SLon Mags	49	7.1	37.1	7.2	1.4	0.3	1.14	12.3	37.0	7.1
I SLon NM	303	44.0	10.3	12.4	0.3	0.4	0.95	63.4	65.2	77.2
I Spiral Con	46	6.7	43.7	8.0	0.5	0.1	2.69	27.4	25.0	4.5
I Spiral Tails	257	37.3	4.3	4.4	0.3	0.3	0.64	36.0	72.5	72.7
LIMS CNM 1	64	9.4	18.8	4.8	3.5	0.9	1.27	18.1	52.1	13.1
LIMS CM 1	272	39.5	69.9	75.6	94.2	98.5	0.10	6.2	2.4	2.6
LIMS CNM 2	1.7	0.2	23.0	0.2	2.6	0.0	1.60	0.6	47.9	0.3
LIMS CM 2	271	39.3	70.2	75.4	94.7	98.5	0.09	5.6	2.1	2.3
II SLon Feed	161	23.4	31.5	20.2	2.0	1.2	1.64	58.4	39.7	25.0
II SLon Tails	125	18.2	26.2	13.0	0.5	0.2	1.64	45.2	45.5	22.3
II SLon Mags	36	5.3	50.0	7.2	7.3	1.0	1.66	13.2	19.5	2.8
Spiral Con	24	3.4	64.8	6.1	0.5	0.05	1.02	5.32	3.4	0.31
Spiral Tails	102	14.7	17.3	7.0	0.5	0.2	1.78	39.8	55.3	22.0
Bulk Con	330	48.0	67.68	88.7	78.45	99.5	0.34	24.1	4.37	5.3
Bulk Tails	358	52.0	7.96	11.3	0.33	0.5	0.96	75.9	67.61	94.7

Table 23: Mass balance for flowsheet Version 1b calculated from first sampling campaign on 19th November

Nordic Iron ore
PILOT PLANT 2014

DATE 19.11.2014
HOUR 13:15-14:00

Product	kg/h	wt%	Fe %	Fe Rec. %	Fe3O4 %	Fe3O4 Rec. %	P2O5 %	P2O5 Rec. %	SiO2 %	SiO2 Rec. %
Feed	697	100.0	36.5	100.0	36.8	100.0	0.62	100.0	37.45	100.0
Non-Mags	350	50.2	12.9	17.7	0.5	0.6	0.91	74.3	62.32	83.5
Mags	348	49.8	60.3	82.3	73.5	99.4	0.32	25.7	12.41	16.5
I SLon Mags	39	5.6	30.0	4.6	1.6	0.2	1.27	11.4	43.40	6.4
I SLon NM	311	44.6	10.8	13.2	0.3	0.4	0.87	62.9	64.67	77.1
I Spiral Con	40	5.7	54.0	8.4	0.5	0.1	1.56	14.4	14.88	2.3
I Spiral Tails	272	38.9	4.5	4.8	0.3	0.3	0.77	48.5	71.94	74.8
LIMS CNM 1	67	9.6	18.8	4.9	3.1	0.8	1.22	18.9	54.29	13.9
LIMS CM 1	281	40.3	70.2	77.4	90.2	98.6	0.10	6.7	2.46	2.7
LIMS CNM 2	2.1	0.3	22.8	0.2	2.1	0.0	1.71	0.8	48.60	0.4
LIMS CM 2	279	40.0	70.6	77.2	90.9	98.6	0.09	5.9	2.12	2.3
II SLon Feed	147	21.1	31.3	18.1	2.0	1.1	1.33	45.6	40.72	22.9
II SLon Tails	118	17.0	26.4	12.3	0.5	0.2	1.26	34.9	46.22	21.0
II SLon Mags	29	4.1	51.4	5.8	8.1	0.9	1.61	10.7	18.03	2.0
II Spiral Con	23	3.3	64.3	5.8	0.5	0.0	1.01	5.4	4.22	0.4
II Spiral Tails	95	13.7	17.3	6.5	0.5	0.2	1.32	29.5	56.35	20.6
Bulk con	330	47.4	68.46	88.8	77.38	99.5	0.29	22.1	3.65	4.6
Bulk Tails	367	52.6	7.79	11.2	0.35	0.5	0.91	77.9	67.88	95.4

Table 24: Check of particle size distributions of Derrick screen undersize, Cyclone overflow and SLon 2 feed (Sweco underflow) on 19th November, flowsheet Version 1b

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office
Mineral Processing

Project : NIO Pilot

Date : 19.11.2014
KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the critical process finenesses***

Sieve Opening	19.11.2014 10.30AM Derrick U/S			19.11.2014 10.30AM Cyclone O/F			19.11.2014 10.30AM SLon 2 Feed								
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000	0.0	100.0			100.0	0.0		100.0	0.0						
710	0.5	99.8	0.2		100.0	0.0		100.0	0.0						
500	2.1	99.1	0.7	0.0	100.0	0.0		100.0	0.0						
250	40.3	84.7	14.3	0.7	98.8	1.2	0.0	100.0	0.0						
125	106.6	46.8	37.9	4.4	91.2	7.6	2.7	95.2	4.8						
90	35.4	34.2	12.6	6.7	79.6	11.6	9.3	78.7	16.5						
75	23.0	26.0	8.2	6.0	69.2	10.4	6.7	66.8	11.9						
32	35.3	13.5	12.6	20.2	34.3	34.9	19.3	32.5	34.3						
-32	37.8		13.5	19.8		34.3	18.3		32.5						
Tot	281.0		100.0	57.8		100.0	56.3		100.0						
Calc'd D 80 (µm)		234			91			93							

9.4.3 Flowsheet Version 2a – 19/11/2014 pm

Table 25: Mass balance for flowsheet Version 2a calculated from second sampling campaign on 19th November

Nordic Iron ore
PILOT PLANT 2014

DATE 19.11.2014
HOUR 17:15-18:00

Product	kg/h	wt%	Fe %	Fe Rec. %	Fe3O4 %	Fe3O4 Rec. %	P2O5 %	P2O5 Rec. %	SiO2 %	SiO2 Rec. %
Feed	689	100.0	36.7	100.0	38.8	100.0	0.60	100.0	37.31	100.0
Non-Mags	333	48.3	10.4	13.6	0.4	0.5	0.91	72.8	64.97	84.1
Mags	356	51.7	61.3	86.4	74.7	99.5	0.32	27.2	11.50	15.9
WW6 Con	56	8.1	40.5	8.9	0.6	0.1	1.69	22.6	28.88	6.2
WW6 Tails	277	40.2	4.34	4.8	0.4	0.4	0.75	50.3	72.20	77.8
LIMS ClnNM 1	61	8.9	18.4	4.4	3.1	0.7	1.32	19.5	55.07	13.1
LIMS ClnM1	295	42.9	70.2	81.9	89.5	98.8	0.11	7.7	2.49	2.9
LIMS ClnNM2	2.1	0.3	23.1	0.2	2.6	0.0	1.71	0.9	48.05	0.4
LIMS ClnM 2	293	42.6	70.5	81.7	90.1	98.7	0.10	6.8	2.17	2.5
SAM Product	119	17.2	28.8	13.5	1.9	0.9	1.50	42.9	42.70	19.7
HC Con	22	3.1	67.0	5.7	0.9	0.1	0.58	3.0	1.91	0.2
HC Tails	97	14.1	20.3	7.8	2.1	0.8	1.70	39.9	51.78	19.6
Bulk con	315	45.7	70.26	87.4	83.96	98.8	0.13	9.8	2.15	2.6
Bulk Tails	374	54.3	8.49	12.6	0.85	1.2	1.00	90.2	66.90	97.4

Table 26: Particle size distributions of the magnetite concentrate and hematite concentrate on 19th November produced by flowsheet Version 2a

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 21.11.2014

Mineral Processing KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the end product finenesses***

Sieve Opening	19.11.2014 5.15-6.00PM M4 Magnetite Conc.			19.11.2014 5.15-6.00PM Spir. 2 R Hematite Conc.											
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000															
710															
500	0.0	100.0	0.0												
250	0.3	99.7	0.3	0.0	100.0	0.0									
125	4.6	94.5	5.2	5.3	95.0	5.0									
90	9.8	83.5	11.0	20.2	75.8	19.2									
75	10.5	71.7	11.8	18.2	58.5	17.3									
32	36.9	30.4	41.4	53.5	7.7	50.8									
-32	27.1		30.4	8.1		7.7									
Tot	89.2		100.0	105.3		100.0									
Calc'd D 80 (µm)		86			98										

Table 27: Particle size distribution for hematite (cleaner spiral) tailings produced by flowsheet Version 2a

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 24.11.2014

Mineral Processing KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the Hematite Cln Tails fineness***

Sieve Opening	19.11.2014 5.15-6.00PM Spir. 2 VT+J Hematite Cln Tails														
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000															
710															
500		100.0	0.0												
250		100.0	0.0												
125	1.9	95.1	4.9												
90	6.1	79.4	15.7												
75	3.8	69.6	9.8												
32	10.7	42.0	27.6												
-32	16.3		42.0												
Tot	38.8		100.0												
Calc'd D 80 (µm)		91													

Table 28: Size-by-size analysis of cleaner spiral (hematite) concentrate produced by flowsheet Version 2a

Grade-Distribution Balance Calculation by Sieve Size Fractions

GTK Mintec

Sample:	NIO Pilot, Composite, Spiral Cln Conc. (< 150 µm)
Project:	1281282 / 2402
Date:	24.11.2014
Test:	Pilot test work 19.11.2014 at 5.15PM-6.00PM
By:	M. Kuusisto

Notes: Product fineness P(80) = 98 microns
Sieve fractions of the hematitic spiral cln product conc. to chemical assaying

Sieve fraction	Weight		Grades & Distributions (XRFMP-10 and Satmagan)																			
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
µm	g	wt.-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%
+ 90	25.5	24.22	67.90	24.6	0.99	12.9	0.402	17.2	0.08	12.8	0.002	12.7	0.27	19.5	0.419	14.9	0.00	1.0	0.009	16.2	0.85	23.9	0.70	19.2
- 90	79.8	75.78	66.56	75.4	2.13	87.1	0.62	82.8	0.17	87.2	0.004	87.3	0.36	80.5	0.77	85.1	0.03	99.0	0.015	83.8	0.87	76.1	0.94	80.8
75/90	18.2	17.28	67.00	17.3	1.47	13.7	0.67	20.5	0.15	17.1	0.004	18.1	0.30	15.5	0.78	19.8	0.00	0.7	0.012	15.5	0.87	17.4	0.69	13.5
+ 75	43.7	41.50	67.53	41.9	1.19	26.6	0.51	37.7	0.11	29.9	0.003	30.8	0.28	35.1	0.57	34.6	0.00	1.7	0.010	31.7	0.86	41.3	0.70	32.6
- 75	61.6	58.50	66.43	58.1	2.32	73.4	0.60	62.3	0.18	70.1	0.005	69.2	0.37	64.9	0.76	65.4	0.04	98.3	0.016	68.3	0.86	58.7	1.02	67.4
32/75	53.5	50.81	66.40	50.4	2.25	61.7	0.65	58.4	0.18	60.4	0.004	53.2	0.37	56.2	0.82	61.0	0.04	85.3	0.015	56.8	0.87	51.3	0.87	50.0
+ 32	97.2	92.31	66.91	92.3	1.77	88.3	0.59	96.1	0.15	90.3	0.003	83.9	0.33	91.3	0.71	95.7	0.02	87.1	0.013	88.5	0.86	92.6	0.79	82.6
- 32	8.1	7.69	66.60	7.7	2.82	11.7	0.284	3.9	0.19	9.7	0.008	16.1	0.38	8.7	0.386	4.3	0.04	12.9	0.020	11.5	0.83	7.4	2.00	17.4
Calc.Bulk	105.3	100.00	66.88	100.0	1.85	100.0	0.57	100.0	0.15	100.0	0.004	100.0	0.33	100.0	0.68	100.0	0.02	100.0	0.013	100.0	0.86	100.0	0.88	100.0
Bulk Assay ("Spir 2 R")			66.70		1.91		0.58		0.17		0.004		0.35		0.69		0.03		0.016		0.88		0.93	

Table 29: Size-by-size analysis of cleaner spiral (final) tailings produced by flowsheet Version 2a

Grade-Distribution Balance Calculation by Sieve Size Fractions

GTK Mintec

Sample:	NIO Pilot, Composite, Spiral Cln Tails (< 150 µm)
Project:	1281282 / 2402
Date:	24.11.2014
Test:	Pilot test work 19.11.2014 at 5.15PM-6.00PM
By:	M. Kuusisto

Notes: Product fineness P(80) = 91 microns
Sieve fractions of the hematitic spiral cln tails product to chemical assaying

Sieve fraction	Weight		Grades & Distributions (XRFMP-10 and Satmagan)																			
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
µm	g	wt.-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%
+ 90	8.0	20.62	6.03	5.9	69.60	27.4	2.52	27.8	4.98	24.1	0.031	20.4	6.32	25.4	4.50	27.4	1.45	25.0	1.32	30.6	0.178	9.4	1.00	8.6
- 90	30.8	79.38	24.89	94.1	47.94	72.6	1.70	72.2	4.07	75.9	0.031	79.6	4.83	74.6	3.10	72.6	1.13	75.0	0.78	69.4	0.444	90.6	2.77	91.4
75/90	3.8	9.79	6.30	2.9	67.60	12.6	3.00	15.7	4.71	10.8	0.033	10.3	5.89	11.2	5.18	15.0	1.39	11.4	1.14	12.6	0.197	5.0	0.91	3.7
+ 75	11.8	30.41	6.12	8.9	68.96	40.0	2.67	43.5	4.89	35.0	0.032	30.7	6.18	36.6	4.72	42.3	1.43	36.4	1.26	43.2	0.184	14.4	0.97	12.3
- 75	27.0	69.59	27.51	91.1	45.18	60.0	1.52	56.5	3.98	65.0	0.031	69.3	4.68	63.4	2.81	57.7	1.09	63.6	0.73	56.8	0.479	85.6	3.03	87.7
32/75	10.7	27.58	12.90	16.9	61.90	32.6	2.25	33.2	4.69	30.4	0.033	29.0	5.64	30.3	4.00	32.5	1.34	30.9	1.01	31.3	0.309	21.9	0.90	10.3
+ 32	22.5	57.99	9.34	25.8	65.60	72.6	2.47	76.6	4.80	65.4	0.032	59.8	5.92	66.9	4.38	74.9	1.39	67.3	1.14	74.5	0.244	36.3	0.94	22.6
- 32	16.3	42.01	37.10	74.2	34.20	27.4	1.04	23.4	3.51	34.6	0.030	40.2	4.05	33.1	2.03	25.1	0.93	32.7	0.54	25.5	0.59	63.7	4.43	77.4
Calc.Bulk	38.8	100.00	21.00	100.0	52.41	100.0	1.87	100.0	4.26	100.0	0.031	100.0	5.14	100.0	3.39	100.0	1.20	100.0	0.89	100.0	0.389	100.0	2.40	100.0
Bulk Assay ("Spir 2 VT+J")			20.20		53.00		1.84		4.87		0.033		5.44		3.23		1.25		0.97		0.388		2.13	

9.4.4 Flowsheet Version 2b – 20/11/2014 am

Table 30: Mass balance for flowsheet Version 2b calculated from sampling campaign on 20th November

Nordic Iron ore
PILOT PLANT 2014

DATE 20.11.2014
HOUR 11:30-12:00

Product	kg/h	wt%	Fe %	Fe Rec. %	Fe3O4 %	Fe3O4 Rec. %	P2O5 %	P2O5 Rec. %	SiO2 %	SiO2 Rec. %
Feed	1100	100.0	34.1	100.0	35.8	100.0	0.63	100.0	40.26	100.0
Non-Mags	546	49.6	10.7	15.6	0.5	0.6	0.89	69.9	64.15	79.0
Mags	554	50.4	57.0	84.4	70.5	99.4	0.38	30.1	16.75	21.0
WW6 Con	68	6.1	53.4	9.6	0.7	0.1	0.90	8.7	14.28	2.2
WW6 Tails	478	43.5	4.71	6.0	0.4	0.5	0.89	61.2	71.19	76.9
LIMS ClnNM 1	131	11.9	18.3	6.4	1.8	0.6	1.16	21.9	58.09	17.2
LIMS ClnM1	423	38.5	69.1	78.0	91.9	98.8	0.13	8.1	3.92	3.7
LIMS ClnNM2	3.5	0.3	18.8	0.2	1.3	0.0	1.36	0.7	55.20	0.4
LIMS ClnM 2	419	38.1	69.5	77.8	92.6	98.8	0.12	7.5	3.48	3.3
SAM Product	202	18.4	30.0	16.2	1.4	0.7	1.08	31.3	43.42	19.8
HC Con	60	5.5	63.9	10.2	1.0	0.1	0.94	8.1	4.67	0.6
HC Tails	142	12.9	15.7	6.0	1.6	0.6	1.14	23.3	59.74	19.2
Bulk con	479	43.6	68.8	88.0	81.18	98.9	0.23	15.5	3.63	3.9
Bulk Tails	621	56.4	7.24	12.0	0.68	1.1	0.95	84.5	68.56	96.1

Table 31: Particle size distribution of cleaner spiral (final) tailings from flowsheet Version 2b

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 24.11.2014

Mineral Processing KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the Hematite Cln Tails fineness***

Sieve Opening	20.11.2014 11.30-12.00AM Spir. 2 VT+J Hematite Cln Tails														
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
500		**100.0**	0.0												
250		**100.0**	0.0												
125	**1.9**	**96.0**	4.0												
90	**8.0**	**79.2**	16.8												
75	**5.4**	**67.9**	11.3												
32	**14.1**	**38.2**	29.6												
-32	**18.2**		38.2												
Tot	**47.6**		100.0												
Calc'd D 80 (µm)		**92**													

Table 32: Particle size distribution of the Derrick screen undersize, cyclone oversize and Sweco screen undersize produced by flowsheet Version 2b.

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 20.11.2014

Mineral Processing AJTM & KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the critical process finenesses***

Sieve Opening	20.11.2014 9.30AM Derrick U/S			20.11.2014 9.30AM Cyclone O/F			20.11.2014 9.30AM Sweco U/S								
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
2000	**0.0**	**100.0**			**100.0**	0.0		**100.0**	0.0						
710	**0.7**	**99.5**	0.5		**100.0**	0.0		**100.0**	0.0						
500	**2.4**	**97.6**	1.8	**0.0**	**100.0**	0.0		**100.0**	0.0						
250	**27.4**	**76.8**	20.9	**0.9**	**99.3**	0.7	**0.0**	**100.0**	0.0						
125	**47.9**	**40.3**	36.5	**8.6**	**92.9**	6.5	**1.3**	**96.5**	3.5						
90	**15.8**	**28.3**	12.0	**12.7**	**83.3**	9.5	**6.8**	**78.5**	18.1						
75	**7.4**	**22.7**	5.6	**15.1**	**72.0**	11.3	**4.8**	**65.7**	12.8						
32	**16.1**	**10.4**	12.3	**56.3**	**29.7**	42.3	**14.3**	**27.7**	38.0						
-32	**13.7**		10.4	**39.6**		29.7	**10.4**		27.7						
Tot	**131.4**		100.0	**133.2**		100.0	**37.6**		100.0						
Calc'd D 80 (µm)		**289**			**86**			**93**							

Table 33: Particle size distribution for magnetite and hematite concentrates produced by flowsheet Version 2b

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 21.11.2014

Mineral Processing KJS

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize Samples : ***Checking the end product finenesses***

Sieve Opening	20.11.2014 11.30-12.00AM M4 Magnetite Conc.			20.11.2014 11.30-12.00AM Spir. 2 R Hematite Conc.											
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
500	0.0	100.0	0.0												
250	0.5	99.1	0.9	0.0	100.0	0.0									
125	4.6	90.9	8.2	2.0	97.1	2.9									
90	8.7	75.5	15.5	14.8	75.7	21.4									
75	7.2	62.7	12.8	14.3	55.1	20.7									
32	20.1	27.0	35.7	33.3	6.9	48.1									
-32	15.2		27.0	4.8		6.9									
Tot	56.3		100.0	69.2		100.0									
Calc'd D 80 (µm)		100			97										

Table 34: Size-by-size analysis of cleaner spiral (hematite) concentrate produced by flowsheet Version 2b

Grade-Distribution Balance Calculation by Sieve Size Fractions

GTK Mintec

Sample: NIO Pilot, Composite, Spiral Cln Conc. (< 150 µm) Notes:
Project: 1281282 / 2402 Product fineness P(80) = 97 microns
Date: 24.11.2014 *Sieve fractions of the hematitic spiral cln product conc. to chemical assaying*
Test: Pilot test work 20.11.2014 at 11.30AM-12.00AM
By: M. Kuusisto

Sieve fraction	Weight		Grades & Distributions (XRFMP-10 and Satmagan)																			
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
µm	g	wt.-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%
+ 90	16.8	24.28	65.90	24.9	2.00	12.0	1.08	26.2	0.18	13.1	0.005	19.5	0.37	17.4	1.33	24.7	0.02	6.4	0.016	11.1	0.85	23.8	0.73	19.9
- 90	52.4	75.72	63.75	75.1	4.68	88.0	0.97	73.8	0.38	86.9	0.007	80.5	0.56	82.6	1.30	75.3	0.09	93.6	0.041	88.9	0.87	76.2	0.94	80.1
75/90	14.3	20.66	64.80	20.8	2.99	15.3	1.17	24.2	0.30	18.5	0.005	16.6	0.44	17.6	1.52	24.0	0.04	10.9	0.023	13.6	0.87	20.7	0.69	16.0
+ 75	31.1	44.94	65.39	45.7	2.46	27.4	1.12	50.4	0.24	31.6	0.005	36.0	0.40	35.0	1.42	48.7	0.03	17.3	0.019	24.7	0.86	44.5	0.71	35.8
- 75	38.1	55.06	63.35	54.3	5.32	72.6	0.90	49.6	0.42	68.4	0.007	64.0	0.61	65.0	1.22	51.3	0.11	82.7	0.048	75.3	0.87	55.5	1.04	64.2
32/75	33.3	48.12	63.30	47.4	5.24	62.5	0.97	46.7	0.41	59.0	0.007	54.0	0.60	56.0	1.30	47.8	0.11	69.9	0.046	63.2	0.88	48.8	0.88	47.5
+ 32	64.4	93.06	64.31	93.1	3.90	89.9	1.04	97.1	0.33	90.7	0.006	90.0	0.50	91.0	1.36	96.4	0.07	87.2	0.033	87.9	0.87	93.4	0.80	83.3
- 32	4.8	6.94	63.70	6.9	5.87	10.1	0.416	2.9	0.45	9.3	0.009	10.0	0.67	9.0	0.67	3.6	0.14	12.8	0.061	12.1	0.83	6.6	2.15	16.7
Calc.Bulk	69.2	100.00	64.27	100.0	4.03	100.0	1.00	100.0	0.33	100.0	0.006	100.0	0.52	100.0	1.31	100.0	0.08	100.0	0.035	100.0	0.87	100.0	0.89	100.0
Bulk Assay ("Spir 2 R")			63.70		4.67		0.97		0.41		0.005		0.56		1.32		0.10		0.041		0.86		0.98	

Table 35: Size-by-size analysis of cleaner spiral (final) tailings produced by flowsheet Version 2b

Grade-Distribution Balance Calculation by Sieve Size Fractions

GTK Mintec

Sample:	NIO Pilot, Composite, Spiral Cln Tails (< 150 µm)	Notes:	
Project:	1281282 / 2402		Product fineness P(80) = 92 microns
Date:	24.11.2014		*Sieve fractions of the hematitic spiral cln tails product to chemical assaying*
Test:	Pilot test work 20.11.2014 at 11.30AM-12.00AM		
By:	M. Kuusisto		

Sieve fraction	Weight		Grades & Distributions (XRFMP-10 and Satmagan)																			
			Fe		SiO_2		P_2O_5		MgO		Mn		Al_2O_3		CaO		Na_2O		K_2O		TiO_2		Satmagan	
µm	g	wt.-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%	%	dist-%
+ 90	9.9	20.80	3.00	4.1	74.80	25.8	1.55	23.9	5.39	24.2	0.032	20.4	6.95	24.3	3.14	23.9	1.53	23.1	1.62	30.9	0.126	8.4	0.50	6.5
- 90	37.7	79.20	18.47	95.9	56.61	74.2	1.30	76.1	4.44	75.8	0.033	79.6	5.68	75.7	2.63	76.1	1.34	76.9	0.95	69.1	0.359	91.6	1.90	93.5
75/90	5.4	11.34	3.39	2.5	75.10	14.1	1.76	14.8	4.70	11.5	0.032	11.1	6.49	12.4	3.52	14.6	1.57	12.9	1.31	13.6	0.130	4.7	0.46	3.2
+ 75	15.3	32.14	3.14	6.6	74.91	39.9	1.62	38.7	5.15	35.7	0.032	31.5	6.79	36.7	3.27	38.5	1.54	36.1	1.51	44.5	0.127	13.2	0.49	9.7
- 75	32.3	67.86	20.99	93.4	53.51	60.1	1.22	61.3	4.40	64.3	0.033	68.5	5.54	63.3	2.48	61.5	1.30	63.9	0.89	55.5	0.397	86.8	2.14	90.3
32/75	14.1	29.62	9.62	18.7	67.60	33.2	1.53	33.6	4.67	29.8	0.029	26.3	6.11	30.5	3.04	32.9	1.50	32.3	1.14	31.0	0.239	22.8	0.50	9.2
+ 32	29.4	61.76	6.25	25.3	71.40	73.0	1.58	72.2	4.92	65.5	0.031	57.8	6.46	67.2	3.16	71.4	1.52	68.3	1.33	75.5	0.181	36.0	0.49	18.9
- 32	18.2	38.24	29.80	74.7	42.60	27.0	0.98	27.8	4.19	34.5	0.036	42.2	5.10	32.8	2.05	28.6	1.14	31.7	0.70	24.5	0.52	64.0	3.41	81.1
Calc.Bulk	47.6	100.00	15.25	100.0	60.39	100.0	1.35	100.0	4.64	100.0	0.033	100.0	5.94	100.0	2.74	100.0	1.38	100.0	1.09	100.0	0.311	100.0	1.61	100.0
Bulk Assay ("Spir 2 VT+J")			15.70		59.30		1.27		5.08		0.034		6.09		2.65		1.36		1.17		0.328		1.59	

9.4.5 Comparison between Version 2a and 2b

Table 36: Particle size distributions of the coarse rougher spiral tailings produced by flowsheet Versions 2a and 2b (19th and 20th November)

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office
Mineral Processing

Project : NIO Pilot

Date : 26.11.2014
JTP

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : *Checking the Coarse Tailings finenesses*

Sieve Opening	19.11.2014 5.15-6.00PM Spir. 1 J Coarse Rgh Spir Tailings			20.11.2014 11.30-12.00AM Spir. 1 J Coarse Rgh Spir Tailings											
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1400		100.0	0.0	0.0	100.0	0.0									
1000	0.0	100.0	0.0	0.2	99.7	0.3									
710	0.1	99.7	0.3	0.6	98.6	1.0									
500	0.5	98.3	1.4	1.9	95.3	3.3									
250	5.2	83.3	14.9	12.2	74.3	21.1									
125	10.5	53.2	30.2	16.9	45.1	29.2									
90	4.6	39.9	13.2	7.0	33.0	12.1									
75	1.8	34.8	5.2	2.8	28.2	4.8									
32	5.6	18.7	16.1	7.8	14.7	13.5									
-32	6.5		18.7	8.5		14.7									
Tot	34.8		100.0	57.9		100.0									
Calc'd D 80 (µm)		236			318										

Table 37: Particle size distributions for the lamella feed of flowsheet Versions 2a and 2b (19th and 20th)

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office
Mineral Processing

Project : NIO Pilot

Date : 27.11.2014
JTP

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize

Samples : ***Checking the hematite circuit feed finenesses***

Sieve Opening	19.11.2014 5.15-6.00PM Lamella Feed (Spir 1 R + EM3 + EM4)			20.11.2014 11.30-12.00AM Lamella Feed (Spir 1 R + EM3 + EM4)											
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000		**100.0**	0.0	**0.0**	**100.0**	0.0									
710	**0.0**	**100.0**	0.0	**0.1**	**99.9**	0.1									
500	**0.1**	**99.8**	0.2	**1.0**	**98.9**	1.0									
250	**3.5**	**93.2**	6.7	**11.4**	**87.1**	11.7									
125	**11.8**	**70.7**	22.4	**27.2**	**59.2**	28.0									
90	**9.1**	**53.4**	17.3	**16.8**	**41.9**	17.3									
75	**4.0**	**45.8**	7.6	**6.7**	**35.0**	6.9									
32	**12.9**	**21.3**	24.5	**18.4**	**16.0**	18.9									
-32	**11.2**		21.3	**15.6**		16.0									
Tot	**52.6**		100.0	**97.2**		100.0									
Calc'd D 80 (µm)		**177**			**218**										

9.4.6 Flotation

Table 38: Particle size distribution of hematite flotation feed

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office
Mineral Processing

Project : NIO Pilot

Date : 27.11.2014
JTP

Notes. : Elutriation screening # 32 µm, plus
Ro-Tap dry screening of the oversize

Samples : *Checking the hematite flotation feed fineness*

Sieve Opening	25.11.2014 2.50-3.10PM Hematite Flotation Feed														
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000															
710															
500		100.0	0.0												
250	0.0	100.0	0.0												
125	3.5	97.2	2.8												
90	27.4	75.7	21.5												
75	19.4	60.5	15.3												
32	67.2	7.6	52.8												
-32	9.7		7.6												
Tot	127.2		100.0												

Calc'd
D 80
(µm) 97

Table 39: Results of flotation of apatite (phosphorus) from hematite concentrate

Nordic Iron Ore Pilot Plant

DATE 25.11.2014
HOUR 12.30

Water Glass (5%) 500 g/t
Atrac (2%) 160 g/t
pH 8.8

Flotation volume 200 litres

Product	kgh	wt%	Fe %	Fe Rec%	P2O5 %	P2O5 Rec%	SiO2 %	SiO2 Rec%
Feed	100.0	100.0	64.52	100.0	0.933	100.0	3.86	100.0
ApRgh1 Float	2.2	2.2	30.00	1.0	22.20	51.3	3.41	1.9
ApRgh1 Non-Float	97.8	97.8	65.28	99.0	0.464	48.7	3.87	98.1
ApRgh2 Float	2.1	2.1	42.00	1.4	15.70	35.7	2.19	1.2
Hematite Con	95.7	95.7	65.80	97.6	0.127	13.0	3.90	96.9

9.4.7 Tailing production (combined tailings produced by all flowsheet versions) 18th-20th November

Table 40: Particle size distribution of bulk tailings

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 15.12.2014
Mineral Processing JTP

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize
Samples : *Checking the Basin Thickener Tails fineness*

Sieve Opening	18.-21.11.2014 [from basin thickener] Overall (Bulk) Tails														
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000	0.0	100.0	0.0												
710	0.1	99.9	0.1												
500	0.5	99.6	0.3												
250	9.9	92.7	6.9												
125	31.9	70.6	22.1												
90	22.1	55.3	15.3												
75	9.4	48.8	6.5												
32	33.2	25.8	23.0												
-32	37.3		25.8												
Tot	144.4		100.0												
Calc'd D 80 (µm)		178													

Table 41: Check particle size distributions of samples of bulk tailings

GTK

PARTICLE SIZE DISTRIBUTION TABLE

Eastern Finland Office Project : NIO Pilot Date : 15.-18.12.2014
Mineral Processing JTP, AJTM

Notes. : Elutriation screening # 32 µm, plus Ro-Tap dry screening of the oversize
Samples : *Checking the Basin Thickener Tails finenesses*

Sieve Opening	17.-20.11.2014 [grabbed from the thickener] Overall (Bulk) Tails			17.-20.11.2014 Barrel 1 Overall (Bulk) Tails			17.-20.11.2014 Barrel 2 Overall (Bulk) Tails								
(µm)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)	Weight(g)	Pass.(%)	Ret. (%)
1000	0.0	100.0	0.0												
710	0.1	99.9	0.1	0.0	100.0	0.0	0.0	100.0	0.0						
500	0.5	99.6	0.3	2.6	98.3	1.7	2.5	97.9	2.1						
250	9.9	92.7	6.9	25.6	81.8	16.5	21.9	79.6	18.3						
125	31.9	70.6	22.1	55.6	45.8	35.9	44.4	42.5	37.1						
90	22.1	55.3	15.3	19.2	33.4	12.4	14.1	30.7	11.8						
75	9.4	48.8	6.5	8.8	27.7	5.7	6.6	25.2	5.5						
32	33.2	25.8	23.0	20.6	14.4	13.3	14.7	12.9	12.3						
-32	37.3		25.8	22.3		14.4	15.4		12.9						
Tot	144.4		100.0	154.7		100.0	119.6		100.0						
Calc'd D 80 (µm)		178			244			255							

9.5 Miscellaneous

Table 42: Filtration and production of final magnetite concentrate

NIO - Blötberget project - GTK Mintec / Pilot Test Work — November 2014

Magnetite Concentrate production data (Nov. 18th - 20th 2014)

Filtration by Choquenet press filter

Filtration date	Bigbag No.	Filter cake weight, kg	Moisture, %	Dry weight, kg
24/11/2014	1	675	8.1	620.3
-"-	2	732	7.2	679.3
25/11/2014	3	727	7.6	671.7
-"-	4	731	7.1	679.1
26/11/2014	5	726	6.8	676.6
-"-	6	741	6.7	691.4
-"-	7	733	6.7	683.9
27/11/2014	8	727	5.7	685.6
-"-	9	857	7.2	795.3
-"-	10	847	6.1	795.3
	Totals	7496	Totals	6978.5
			Average moisture, %	6.9

Table 43: Larox bench-scale filter press results

Pressure Filter Test - Test Report
LAROX PF 0.1 H 2

Date : **22.12.2014**
Sample : **NIO Pilot - Magnetite Conc. "M4"**

Test No.		1	2	Avg.	
Pumping, time	min	0.5	0.5		
Compression, time	min	3	2		
Drying, time	min	3	3		
Emptying, time	min	4	4		
Total	min	10.5	9.5		
Input pressure	bar	4	4		
Compression pressure	bar	15	15		
Drying pressure	bar	5	5		
Slurry volume	l	8.46	8.28		
Filtrate water, filtration	l	4.200	3.900		
Filtrate water, compression	l	0.310	0.280		
Filtrate water, drying	l	0.840	0.900		
Air flow	l/min	500	425		
Solids content	**%**	**66.9**	**66.9**		
Pulp weight	g/l	**2150**	**2150**		
Specific gravity of solids	kg/l	5.00	5.00		
Cake thickness	mm	42	40		
Cake wet weight	kg	12.752	12.487		
Cake dry weight	kg	12.165	11.900		
Cake moisture	**%**	**4.60**	**4.70**	**4.65**	
Filtration area	m2	0.1	0.1		
Capacity	**kg/m2/h**	**695**	**752**		
Filter cloth type		unknown	unknown		

Table 44: Bulk density measurements

NIO Pilot - Blötberget project
Bulk Density measurements

Dec. 9th 2014

GTK
Mintec

Measuring glass volume : 250 mL
Sample volume at start : 100...200 mL
(as poured)

Sample	State	Bag or Barrel No.	Moisture %	Bulk Density values [kg/L] Without compression	"As compressed"
Hematite Product Conc. ["J2"]	dried	1		2.249	2.884
Filtration made using : ***Larox PF 0.1 H2 Filter Press*** / ***Suction in Büchner funnel***	filter cake	1 2 Avg.	6.7 11.9	1.910 2.068 1.989	2.491 2.482 2.487
Magnetite Product Conc. ["M4"]	dried	9		2.247	3.139
Filtration made using : ***Choquenet Filter Press***	filter cake	1 8 Avg.	8.1 5.7	1.785 1.797 1.791	 2.407 2.407
Overall (Bulk) Tails [From basin thickener]	dried			1.141	1.571
Coarse Tails [Rougher Spiral Tails]	dried			1.273	1.606

10 APPENDIX 2 – ASSAYS

10.1 Feed Assays

Table 45: Assay of footwall waste bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 31.10.2014

Customer : Markku Kuusisto, GTK Mintek
Order : 121110
Method : 180X-O
Date : 31.10.2014
Comment **: NIO Pilot. Pilot Test Work. Footwall Waste sample**

Contents (%)

	Feed A L14073263	Feed B L14073264	Average Feed
SiO2	64.0000	64.1000	64.05
TiO2	0.1890	0.1880	0.189
Al2O3	10.6000	10.7000	10.65
Cr2O3	0.0035	0.0035	
V2O3	0.0038	0.0032	
MnO	0.0230	0.0230	
MgO	2.7500	2.6500	2.70
CaO	0.7800	0.7900	0.79
Rb2O	0.0100	0.0096	
SrO	0.0037	0.0037	
BaO	0.0630	0.0620	
Na2O	4.2300	4.3400	4.29
K2O	1.2100	1.2200	1.22
ZrO2	0.0260	0.0260	
P2O5	0.0600	0.0610	0.061
OxSumm	99.0000	99.1000	
Cu	0.0000	0.0000	
Ni	0.0030	0.0030	
Co	0.0180	0.0100	
Zn	0.0020	0.0030	
Pb	0.0050	0.0050	
Ag	0.0010	0.0020	
S	0.0040	0.0030	
As	0.0000	0.0000	
Sb	0.0110	0.0100	
Bi	0.0020	0.0020	
Te	0.0000	0.0010	
Y	0.0038	0.0035	
Nb	0.0015	0.0013	
Mo	0.0000	0.0000	
Sn	0.0040	0.0030	
W	0.0000	0.0010	
Cl	0.0090	0.0080	
Th	0.0026	0.0022	
U	0.0000	0.0000	
Cs	0.0010	0.0000	
La	0.0060	0.0070	
Ce	0.0110	0.0100	
Ta	0.0000	0.0020	
LOI	0.0000	0.0000	
Ga	0.0026	0.0019	
Si	29.9000	30.0000	
Ti	0.1140	0.1130	
Cr	0.0024	0.0024	
V	0.0026	0.0022	0.0024
Fe	11.6000	11.5000	11.55
Mn	0.0180	0.0180	0.018
Mg	1.6600	1.6000	
Ca	0.5600	0.5600	
Ba	0.0560	0.0560	
Satmagan	12.87	12.87	12.87
Eltra S	0.035	0.032	0.034

Table 46: Assay of Yellow bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 5.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121135
Method : 180X-O
Date : 5.11.2014
Comment **: NIO Pilot. Pilot Test Work. Yellow sample**

Contents (%)

	Feed A L14075069	Feed B L14075070	Average Feed
SiO2	57.5000	57.1000	57.30
TiO2	0.1840	0.1860	0.185
Al2O3	8.9100	8.9400	8.93
Cr2O3	0.0034	0.0058	
V2O3	0.0049	0.0047	
MnO	0.0290	0.0290	
MgO	2.7200	2.8000	2.76
CaO	0.7000	0.7100	0.71
Rb2O	0.0100	0.0091	
SrO	0.0020	0.0028	
BaO	0.0910	0.1010	
Na2O	3.4200	3.4700	3.45
K2O	0.9200	0.9400	0.93
ZrO2	0.0220	0.0220	
P2O5	0.0720	0.0780	0.075
OxSumm	98.3000	98.3000	
Cu	0.0000	0.0000	
Ni	0.0030	0.0040	
Co	0.0240	0.0090	
Zn	0.0040	0.0030	
Pb	0.0030	0.0040	
Ag	0.0010	0.0020	
S	0.0360	0.0080	
As	0.0000	0.0000	
Sb	0.0100	0.0130	
Bi	0.0020	0.0020	
Te	0.0000	0.0000	
Y	0.0033	0.0039	
Nb	0.0005	0.0008	
Mo	0.0000	0.0000	
Sn	0.0030	0.0040	
W	0.0010	0.0010	
Cl	0.0060	0.0080	
Th	0.0025	0.0032	
U	0.0006	0.0002	
Cs	0.0020	0.0000	
La	0.0060	0.0080	
Ce	0.0100	0.0100	
Ta	0.0030	0.0000	
LOI	0.0000	0.0000	
Ga	0.0011	0.0019	
Si	26.9000	26.7000	
Ti	0.1100	0.1110	
Cr	0.0023	0.0040	
V	0.0033	0.0032	0.0033
Fe	18.4000	18.5000	18.45
Mn	0.0230	0.0220	0.023
Mg	1.6400	1.6900	
Ca	0.5000	0.5100	
Ba	0.0820	0.0900	
Satmagan	18.11	17.51	17.81
Eltra S	0.039	0.041	0.040

Table 47: Assay of White bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 5.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121138
Method : 180X-O
Date : 5.11.2014
Comment **: NIO Pilot. Pilot Test Work. White sample**

Contents (%)

	Feed A L14075369	Feed B L14075370	Average Feed
SiO2	50.6000	51.1000	50.85
TiO2	0.2170	0.2190	0.218
Al2O3	8.0400	8.2100	8.13
Cr2O3	0.0064	0.0067	
V2O3	0.0069	0.0081	
MnO	0.0470	0.0490	
MgO	2.8800	3.1000	2.99
CaO	0.9700	0.9800	0.98
Rb2O	0.0130	0.0140	
SrO	0.0018	0.0017	
BaO	0.1310	0.1280	
Na2O	2.6600	2.7200	2.69
K2O	1.0100	0.9900	1.00
ZrO2	0.0140	0.0130	
P2O5	0.1010	0.1110	0.106
OxSumm	97.9000	98.1000	
Cu	0.0000	0.0000	
Ni	0.0040	0.0040	
Co	0.0060	0.0080	
Zn	0.0040	0.0040	
Pb	0.0020	0.0030	
Ag	0.0000	0.0010	
S	0.0060	0.0060	
As	0.0000	0.0000	
Sb	0.0110	0.0130	
Bi	0.0020	0.0020	
Te	0.0000	0.0000	
Y	0.0028	0.0019	
Nb	0.0000	0.0000	
Mo	0.0000	0.0000	
Sn	0.0050	0.0040	
W	0.0000	0.0000	
Cl	0.0080	0.0060	
Th	0.0028	0.0025	
U	0.0017	0.0017	
Cs	0.0040	0.0020	
La	0.0100	0.0070	
Ce	0.0110	0.0100	
Ta	0.0020	0.0010	
LOI	0.0000	0.0000	
Ga	0.0020	0.0020	
Si	23.6000	23.9000	
Ti	0.1300	0.1310	
Cr	0.0044	0.0046	
V	0.0047	0.0055	0.0051
Fe	24.2000	23.6000	23.90
Mn	0.0360	0.0380	0.037
Mg	1.7400	1.8700	
Ca	0.6900	0.7000	
Ba	0.1170	0.1140	
Satmagan	27.38	27.98	27.68
Eltra S	< 0.05	< 0.05	< 0.05

Table 48: Assay of Orange West bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 6.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121147
Method : 180X-O
Date : 6.11.2014
Comment : **NIO Pilot. Pilot Test Work. Orange West Sample**

Contents (%)

	Feed A L14075715	Feed B L14075716	Average Feed
SiO2	49.9000	50.4000	50.15
TiO2	0.1490	0.1450	0.147
Al2O3	7.0100	7.1300	7.07
Cr2O3	0.0041	0.0035	
V2O3	0.0054	0.0051	
MnO	0.0360	0.0370	
MgO	1.8700	1.8300	1.85
CaO	0.4830	0.4810	0.48
Rb2O	0.0130	0.0130	
SrO	0.0004	0.0000	
BaO	0.2560	0.2390	
Na2O	2.6200	2.7100	2.67
K2O	1.0700	1.1100	1.09
ZrO2	0.0100	0.0110	
P2O5	0.1030	0.0950	0.099
OxSumm	97.7000	97.7000	
Cu	0.0010	0.0000	
Ni	0.0020	0.0040	
Co	0.0040	0.0120	
Zn	0.0030	0.0040	
Pb	0.0020	0.0020	
Ag	0.0000	0.0000	
S	0.0090	0.0060	
As	0.0010	0.0000	
Sb	0.0110	0.0100	
Bi	0.0020	0.0020	
Te	0.0000	0.0000	
Y	0.0030	0.0026	
Nb	0.0002	0.0000	
Mo	0.0000	0.0000	
Sn	0.0040	0.0050	
W	0.0000	0.0010	
Cl	0.0070	0.0050	
Th	0.0029	0.0032	
U	0.0031	0.0023	
Cs	0.0020	0.0010	
La	0.0080	0.0060	
Ce	0.0100	0.0140	
Ta	0.0050	0.0030	
LOI	0.0000	0.0000	
Ga	0.0028	0.0006	
Si	23.3000	23.5000	
Ti	0.0890	0.0870	
Cr	0.0028	0.0024	
V	0.0037	0.0035	0.0036
Fe	26.5000	26.0000	26.25
Mn	0.0280	0.0290	0.029
Mg	1.1300	1.1000	
Ca	0.3450	0.3430	
Ba	0.2300	0.2140	
Satmagan	27.6800	26.8800	27.28
Eltra S	< 0.05	< 0.05	< 0.05

Table 49: Assay of Orange East bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 7.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121153
Method : 180X-O
Date : 7.11.2014
Comment **: NIO Pilot. Pilot Test Work. Orange East Sample**

Contents (%)

	Feed A L14076285	Feed B L14076286	Average Feed
SiO2	44.5000	45.6000	45.05
TiO2	0.1880	0.1810	0.185
Al2O3	6.2000	6.5100	6.36
Cr2O3	0.0088	0.0042	
V2O3	0.0068	0.0060	
MnO	0.0450	0.0450	
MgO	2.5600	2.7900	2.68
CaO	0.5600	0.5700	0.57
Rb2O	0.0150	0.0140	
SrO	0.0000	0.0002	
BaO	0.1560	0.1730	
Na2O	2.1100	2.2200	2.17
K2O	0.9500	1.0300	0.99
ZrO2	0.0110	0.0120	
P2O5	0.1250	0.1310	0.128
OxSumm	97.2000	97.4000	
Cu	0.0010	0.0000	
Ni	0.0040	0.0020	
Co	0.0200	0.0060	
Zn	0.0050	0.0040	
Pb	0.0020	0.0010	
Ag	0.0000	0.0000	
S	0.0070	0.0050	
As	0.0000	0.0000	
Sb	0.0100	0.0120	
Bi	0.0020	0.0020	
Te	0.0000	0.0000	
Y	0.0036	0.0043	
Nb	0.0000	0.0000	
Mo	0.0000	0.0000	
Sn	0.0050	0.0050	
W	0.0010	0.0000	
Cl	0.0070	0.0090	
Th	0.0028	0.0025	
U	0.0033	0.0028	
Cs	0.0020	0.0020	
La	0.0090	0.0110	
Ce	0.0140	0.0120	
Ta	0.0030	0.0030	
LOI	0.0000	0.0000	
Ga	0.0019	0.0004	
Si	20.8000	21.3000	
Ti	0.1130	0.1080	
Cr	0.0060	0.0029	
V	0.0046	0.0041	0.0044
Fe	30.9000	29.6000	30.25
Mn	0.0350	0.0350	0.035
Mg	1.5400	1.6800	
Ca	0.3980	0.4070	
Ba	0.1390	0.1550	
Satmagan	32.01	31.41	31.71
Eltra S	<0.05	<0.05	< 0.05

Table 50: Assay of Guldkannan/Sandell bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 7.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121155
Method : 180X-O
Date : 7.11.2014
Comment : **NIO Pilot. Pilot Test Work. Sandell Sample**

Contents (%)

	Feed A L14076294	Feed B L14076295	Average Feed
SiO2	40.9000	40.6000	40.75
TiO2	0.3490	0.3530	0.351
Al2O3	7.3300	7.3500	7.34
Cr2O3	0.0026	0.0031	
V2O3	0.0830	0.0840	
MnO	0.0560	0.0580	
MgO	6.8500	6.6600	6.76
CaO	3.8700	3.8300	3.85
Rb2O	0.0100	0.0089	
SrO	0.0047	0.0054	
BaO	0.0370	0.0360	
Na2O	1.5700	1.5400	1.56
K2O	0.9300	0.9500	0.94
ZrO2	0.0130	0.0120	
P2O5	1.7800	1.7500	1.77
OxSumm	97.8000	97.7000	
Cu	0.0010	0.0000	
Ni	0.0060	0.0050	
Co	0.0050	0.0050	
Zn	0.0040	0.0040	
Pb	0.0020	0.0020	
Ag	0.0020	0.0030	
S	0.0090	0.0150	
As	0.0010	0.0020	
Sb	0.0120	0.0130	
Bi	0.0020	0.0020	
Te	0.0000	0.0000	
Y	0.0110	0.0110	
Nb	0.0000	0.0000	
Mo	0.0000	0.0000	
Sn	0.0040	0.0040	
W	0.0000	0.0010	
Cl	0.0130	0.0130	
Th	0.0033	0.0038	
U	0.0018	0.0017	
Cs	0.0020	0.0010	
La	0.0200	0.0150	
Ce	0.0300	0.0290	
Ta	0.0010	0.0030	
LOI	0.0000	0.0000	
Ga	0.0026	0.0019	
Si	19.1000	19.0000	
Ti	0.2090	0.2120	
Cr	0.0018	0.0021	
V	0.0560	0.0570	0.0565
Fe	26.3000	26.7000	26.50
Mn	0.0430	0.0450	0.044
Mg	4.1300	4.0100	
Ca	2.7700	2.7300	
Ba	0.0330	0.0330	
Satmagan	31.21	31.01	31.11
Eltra S	<0.05	<0.05	< 0.05

10.2 DLIMS Scalping

Table 51: Assay of <19mm fractions of Orange East and Orange West bulk samples

Labtium Oy
REPORT OF XRF ANALYSIS 10.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121165
Method : 180X-O
Date : 10.11.2014
Comment : **NIO Pilot - Orange East vs. Orange West, # 19 mm screen undersizes**

Contents (%)

	OE < 19mm L14076497	OW < 19mm L14076498		
SiO2	46.5000	49.5000		
TiO2	0.2400	0.2920		
Al2O3	6.7600	7.7000		
Cr2O3	0.0099	0.0053		
V2O3	0.0087	0.0085		
MnO	0.0480	0.0530		
MgO	2.9300	2.6600		
CaO	0.8800	1.1700		
Rb2O	0.0140	0.0130		
SrO	0.0031	0.0096		
BaO	0.1790	0.2590		
Na2O	2.0700	2.4300		
K2O	1.1300	1.1800		
ZrO2	0.0140	0.0130		
P2O5	0.2280	0.2400	<===	Roughly 2...2.5-fold grades compared to the ore head grades !
OxSumm	97.4000	97.7000		
Cu	0.0020	0.0000		
Ni	0.0050	0.0030		
Co	0.0060	0.0100		
Zn	0.0050	0.0040		
Pb	0.0010	0.0010		
Ag	0.0000	0.0000		
S	0.0170	0.0270		
As	0.0010	0.0000		
Sb	0.0090	0.0090		
Bi	0.0030	0.0020		
Te	0.0000	0.0000		
Y	0.0029	0.0034		
Nb	0.0000	0.0000		
Mo	0.0000	0.0000		
Sn	0.0050	0.0050		
W	0.0010	0.0010		
Cl	0.0090	0.0160		
Th	0.0029	0.0027		
U	0.0027	0.0016		
Cs	0.0020	0.0020		
La	0.0090	0.0070		
Ce	0.0140	0.0130		
Ta	0.0030	0.0030		
LOI	0.0000	0.0000		
Ga	0.0011	0.0016		
Si	21.7000	23.1000		
Ti	0.1440	0.1750		
Cr	0.0068	0.0036		
V	0.0059	0.0058		
Fe	28.2000	25.0000		
Mn	0.0370	0.0410		
Mg	1.7600	1.6000		
Ca	0.6300	0.8300		
Ba	0.1610	0.2320		
Satmagan	28.09	24.66		
Eltra S	< 0.05	< 0.05		

Table 52: Assays of dry magnetic separation (MIMS) magnetic products of Orange East and Orange West bulk samples

Labtium Oy
REPORT OF XRF ANALYSIS 10.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121166
Method : 180X-O
Date : 10.11.2014
Comment : **NIO Pilot, Orange East vs. West, Dry MIMS Mags Products**

Contents (%)

	OE MIMS Mags L14076499	OW MIMS Mags L14076500
SiO2	39.5000	39.3000
TiO2	0.1330	0.1270
Al2O3	4.2800	4.0100
Cr2O3	0.0047	0.0042
V2O3	0.0072	0.0060
MnO	0.0520	0.0530
MgO	2.5500	2.2800
CaO	0.2960	0.2610
Rb2O	0.0140	0.0140
SrO	0.0000	0.0000
BaO	0.1780	0.2820
Na2O	1.2100	1.1100
K2O	0.8000	0.7700
ZrO2	0.0090	0.0080
P2O5	0.1420	0.1370
OxSumm	96.7000	96.6000
Cu	0.0010	0.0010
Ni	0.0030	0.0040
Co	0.0030	0.0020
Zn	0.0070	0.0060
Pb	0.0000	0.0000
Ag	0.0000	0.0000
S	0.0050	0.0050
As	0.0020	0.0010
Sb	0.0100	0.0090
Bi	0.0010	0.0020
Te	0.0000	0.0000
Y	0.0017	0.0017
Nb	0.0000	0.0000
Mo	0.0000	0.0000
Sn	0.0050	0.0050
W	0.0010	0.0000
Cl	0.0070	0.0040
Th	0.0033	0.0033
U	0.0041	0.0048
Cs	0.0010	0.0020
La	0.0110	0.0110
Ce	0.0140	0.0170
Ta	0.0030	0.0000
LOI	0.0000	0.0000
Ga	0.0004	0.0031
Si	18.5000	18.4000
Ti	0.0800	0.0760
Cr	0.0032	0.0029
V	0.0049	0.0041
Fe	36.9000	37.4000
Mn	0.0400	0.0410
Mg	1.5400	1.3800
Ca	0.2120	0.1860
Ba	0.1590	0.2530
Satmagan	40.28	39.27
Eltra S	< 0.05	< 0.05

Table 53 Assays of dry magnetic separation (MIMS) non-magnetic products of Orange East and Orange West bulk samples

Labtium Oy
REPORT OF XRF ANALYSIS 10.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121169
Method : 180X-O
Date : 10.11.2014
Comment : **NIO Pilot, Orange East vs. West, Dry MIMS Non-Mags products**

Contents (%)

	OE MIMS NM L14076651	OW MIMS NM L14076652
SiO2	62.1000	59.1000
TiO2	0.2420	0.1930
Al2O3	10.8000	9.6500
Cr2O3	0.0053	0.0042
V2O3	0.0051	0.0060
MnO	0.0250	0.0200
MgO	2.2500	1.7500
CaO	1.0600	0.7100
Rb2O	0.0120	0.0120
SrO	0.0043	0.0022
BaO	0.1300	0.2050
Na2O	4.0100	3.7900
K2O	1.5000	1.3700
ZrO2	0.0210	0.0130
P2O5	0.0960	0.1050
OxSumm	98.7000	98.4000
Cu	0.0000	0.0010
Ni	0.0030	0.0030
Co	0.0060	0.0120
Zn	0.0020	0.0020
Pb	0.0040	0.0030
Ag	0.0000	0.0000
S	0.0040	0.0040
As	0.0000	0.0000
Sb	0.0080	0.0070
Bi	0.0020	0.0020
Te	0.0000	0.0000
Y	0.0064	0.0045
Nb	0.0016	0.0007
Mo	0.0000	0.0000
Sn	0.0050	0.0040
W	0.0010	0.0010
Cl	0.0090	0.0070
Th	0.0027	0.0030
U	0.0000	0.0013
Cs	0.0010	0.0010
La	0.0100	0.0070
Ce	0.0100	0.0120
Ta	0.0020	0.0010
LOI	0.0000	0.0000
Ga	0.0015	0.0011
Si	29.0000	27.6000
Ti	0.1450	0.1160
Cr	0.0036	0.0029
V	0.0035	0.0041
Fe	12.7000	16.6000
Mn	0.0190	0.0160
Mg	1.3500	1.0600
Ca	0.7600	0.5000
Ba	0.1160	0.1840
Satmagan	8.24	12.97
Eltra S	< 0.05	< 0.05

10.3 Composite Blend

Table 54: Assays of composite bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 13.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121188
Method : 180X-O
Date : 13.11.2014
Comment : NIO Pilot. Pilot Test Work. Composite Blend - Feed samples

Contents (%)

	Assay 1 L14076961	Assay 2 L14076962	Average Feed Assay
SiO2	42.1000	40.8000	41.45
TiO2	0.1980	0.2040	0.201
Al2O3	5.5100	5.3600	5.44
Cr2O3	0.0026	0.0072	
V2O3	0.0270	0.0280	
MnO	0.0500	0.0520	
MgO	3.6100	3.5300	3.57
CaO	1.3300	1.3200	1.33
Rb2O	0.0140	0.0130	
SrO	0.0007	0.0000	
BaO	0.2030	0.1790	
Na2O	1.5100	1.3700	1.44
K2O	0.8800	0.8900	0.89
ZrO2	0.0110	0.0100	
P2O5	0.5700	0.5400	0.56
OxSumm	97.2000	97.0000	
Cu	0.0000	0.0010	
Ni	0.0050	0.0050	
Co	0.0300	0.0170	
Zn	0.0040	0.0050	
Pb	0.0000	0.0000	
Ag	0.0000	0.0000	
S	0.0080	0.0090	
As	0.0000	0.0010	
Sb	0.0140	0.0130	
Bi	0.0020	0.0030	
Te	0.0000	0.0000	
Y	0.0038	0.0042	
Nb	0.0000	0.0000	
Mo	0.0000	0.0000	
Sn	0.0050	0.0050	
W	0.0010	0.0000	
Cl	0.0060	0.0070	
Th	0.0039	0.0040	
U	0.0032	0.0035	
Cs	0.0030	0.0030	
La	0.0090	0.0140	
Ce	0.0200	0.0230	
Ta	0.0010	0.0010	
LOI	0.0000	0.0000	
Ga	0.0019	0.0027	
Si	19.7000	19.1000	
Ti	0.1190	0.1230	
Cr	0.0018	0.0049	
V	0.0180	0.0190	0.0185
Fe	31.9000	33.1000	32.50
Mn	0.0390	0.0410	0.040
Mg	2.1800	2.1300	
Ca	0.9500	0.9400	
Ba	0.1810	0.1600	
Satmagan	34.77	35.51	35.14
Eltra S	<0.05	<0.05	< 0.05

Table 55: Size-by-size analysis of finely crushed (<6mm) composite bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 14.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121198
Method : 180X-O
Date : 14.11.2014
Comment **: NIO Pilot. Pilot Test Work. Composite Blend Feed - size-by-size analysis**

Contents (%)

	5.0-6.0 mm L14077024	4.0-5.0 mm L14077025	2.8-4.0 mm L14077026	2.0-2.8 mm L14077027	1.4-2.0 mm L14077028	0.71-1.4 mm L14077029	0.355-0.71 mm L14077030	0.18-0.355 mm L14077031	0.09-0.18 mm L14077032	0.045-0.09 mm L14077033	< 0.045 mm L14077034
SiO2	47.9000	44.4000	44.3000	45.9000	46.4000	44.0000	34.6000	31.2000	33.2000	36.2000	44.2000
TiO2	0.1680	0.1840	0.1950	0.1910	0.2060	0.1820	0.1700	0.1770	0.1960	0.2290	0.3680
Al2O3	6.8500	5.7300	5.8200	5.8000	5.8500	5.4000	4.2300	3.9700	4.2800	4.5400	7.5100
Cr2O3	0.0032	0.0042	0.0032	0.0038	0.0029	0.0035	0.0022	0.0032	0.0032	0.0053	0.0075
V2O3	0.0130	0.0220	0.0250	0.0250	0.0260	0.0240	0.0240	0.0350	0.0440	0.0410	0.0280
MnO	0.0490	0.0470	0.0460	0.0480	0.0470	0.0490	0.0520	0.0550	0.0570	0.0560	0.0860
MgO	2.7200	3.1400	3.4800	3.4600	3.5400	3.5100	3.2300	3.8000	4.2800	3.9100	5.8900
CaO	1.0000	1.1500	1.2500	1.3000	1.3600	1.1700	0.8000	0.9000	1.6800	2.4800	2.4200
Rb2O	0.0100	0.0130	0.0130	0.0130	0.0120	0.0120	0.0140	0.0160	0.0160	0.0130	0.0110
SrO	0.0021	0.0006	0.0009	0.0013	0.0007	0.0004	0.0000	0.0000	0.0000	0.0000	0.0034
BaO	0.1870	0.1980	0.1970	0.1940	0.2130	0.1950	0.1500	0.1580	0.1680	0.1640	0.1790
Na2O	2.2100	1.6600	1.6800	1.6400	1.6800	1.5100	1.1300	0.9400	0.9300	1.0600	1.3600
K2O	0.9500	0.8900	0.8800	0.9300	0.9100	0.8600	0.6800	0.7500	0.8200	0.8000	1.1000
ZrO2	0.0090	0.0100	0.0100	0.0100	0.0100	0.0090	0.0070	0.0060	0.0070	0.0130	0.0300
P2O5	0.2240	0.4390	0.5100	0.5000	0.5200	0.4790	0.3230	0.3820	0.9700	1.5100	1.2400
OxSumm	97.7000	97.3000	97.4000	97.4000	97.5000	97.3000	96.5000	96.3000	96.6000	96.8000	97.7000
Cu	0.0000	0.0020	0.0020	0.0000	0.0010	0.0020	0.0000	0.0010	0.0020	0.0030	0.0220
Ni	0.0030	0.0040	0.0040	0.0020	0.0050	0.0090	0.0070	0.0050	0.0040	0.0060	0.0120
Co	0.0020	0.0080	0.0080	0.0080	0.0050	0.0110	0.0050	0.0090	0.0120	0.0170	0.0110
Zn	0.0050	0.0050	0.0050	0.0040	0.0040	0.0030	0.0050	0.0050	0.0030	0.0030	0.0080
Pb	0.0020	0.0000	0.0020	0.0010	0.0020	0.0000	0.0000	0.0000	0.0000	0.0020	0.0040
Ag	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000
S	0.0060	0.0060	0.0070	0.0080	0.0070	0.0070	0.0050	0.0050	0.0070	0.0110	0.0170
As	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000
Sb	0.0140	0.0090	0.0100	0.0110	0.0130	0.0090	0.0080	0.0090	0.0070	0.0160	0.0110
Bi	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0030	0.0030	0.0010	0.0020
Te	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Y	0.0025	0.0040	0.0043	0.0030	0.0040	0.0040	0.0033	0.0033	0.0056	0.0099	0.0120
Nb	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.0050	0.0040	0.0030	0.0040	0.0050	0.0040	0.0050	0.0030	0.0030	0.0060	0.0050
W	0.0000	0.0000	0.0010	0.0010	0.0010	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000
Cl	0.0070	0.0040	0.0090	0.0050	0.0060	0.0080	0.0060	0.0070	0.0080	0.0100	0.0090
Th	0.0026	0.0035	0.0038	0.0030	0.0035	0.0035	0.0040	0.0031	0.0032	0.0043	0.0032
U	0.0019	0.0024	0.0032	0.0028	0.0026	0.0035	0.0053	0.0052	0.0041	0.0033	0.0027
Cs	0.0010	0.0020	0.0020	0.0020	0.0010	0.0020	0.0020	0.0030	0.0020	0.0040	0.0020
La	0.0080	0.0100	0.0100	0.0100	0.0120	0.0110	0.0110	0.0100	0.0160	0.0200	0.0260
Ce	0.0110	0.0180	0.0170	0.0190	0.0180	0.0150	0.0160	0.0130	0.0230	0.0320	0.0470
Ta	0.0040	0.0010	0.0020	0.0000	0.0010	0.0030	0.0040	0.0020	0.0010	0.0000	0.0030
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0014	0.0014	0.0007	0.0013	0.0021	0.0015	0.0009	0.0034	0.0010	0.0027	0.0032
Si	22.4000	20.8000	20.7000	21.5000	21.7000	20.6000	16.2000	14.6000	15.5000	16.9000	20.7000
Ti	0.1010	0.1100	0.1170	0.1140	0.1240	0.1090	0.1020	0.1060	0.1180	0.1370	0.2210
Cr	0.0022	0.0029	0.0022	0.0026	0.0020	0.0024	0.0015	0.0022	0.0022	0.0036	0.0051
V	0.0087	0.0150	0.0170	0.0170	0.0180	0.0170	0.0170	0.0240	0.0300	0.0280	0.0190
Fe	27.5000	30.6000	30.2000	29.0000	28.5000	31.0000	39.6000	41.8000	38.8000	35.5000	25.7000
Mn	0.0380	0.0360	0.0350	0.0370	0.0360	0.0380	0.0400	0.0420	0.0440	0.0430	0.0660
Mg	1.6400	1.8900	2.1000	2.0900	2.1400	2.1100	1.9500	2.2900	2.5800	2.3600	3.5500
Ca	0.7100	0.8200	0.8900	0.9300	0.9700	0.8400	0.5700	0.6500	1.2000	1.7700	1.7300
Ba	0.1680	0.1780	0.1760	0.1730	0.1900	0.1740	0.1340	0.1410	0.1510	0.1470	0.1600
Satmagan	30.50	33.93	33.87	31.76	30.55	34.28	44.43	46.29	43.42	39.90	26.49

10.4 Bench Scale Testwork

Table 56: Assays of products of bench-scale rougher WLIMS upon composite bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 17.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121223
Method : 180X-O
Date : 17.11.2014
Comment **: NIO Pilot. Composite Feed. Bench WLIMS Roughing**

Contents (%)

	Mags L14077775	NM L14077776
SiO2	7.7100	62.8000
TiO2	0.0820	0.3090
Al2O3	0.8000	8.0400
Cr2O3	0.0280	0.0057
V2O3	0.0490	0.0087
MnO	0.0690	0.0390
MgO	1.0400	4.8800
CaO	0.4540	2.1000
Rb2O	0.0140	0.0140
SrO	0.0000	0.0056
BaO	0.0360	0.3200
Na2O	0.1000	1.9600
K2O	0.1090	1.5100
ZrO2	0.0040	0.0150
P2O5	0.2530	0.8600
OxSumm	94.7000	98.4000
Cu	0.0030	0.0000
Ni	0.0150	0.0040
Co	0.0010	0.0050
Zn	0.0080	0.0030
Pb	0.0000	0.0050
Ag	0.0020	0.0000
S	0.0050	0.0090
As	0.0000	0.0000
Sb	0.0090	0.0100
Bi	0.0020	0.0020
Te	0.0000	0.0000
Y	0.0018	0.0062
Nb	0.0000	0.0012
Mo	0.0000	0.0000
Sn	0.0020	0.0050
W	0.0010	0.0010
Cl	0.0020	0.0120
Th	0.0052	0.0027
U	0.0086	0.0000
Cs	0.0030	0.0020
La	0.0060	0.0190
Ce	0.0090	0.0290
Ta	0.0000	0.0020
LOI	0.0000	0.0000
Ga	0.0037	0.0022
Si	3.6000	29.4000
Ti	0.0490	0.1860
Cr	0.0190	0.0039
V	0.0340	0.0059
Fe	65.2000	11.9000
Mn	0.0530	0.0300
Mg	0.6200	2.9400
Ca	0.3240	1.5000
Ba	0.0330	0.2870
Satmagan	**88.07**	**0.41**

Table 57: Assays of products of bench-scale cleaner WLIMS upon composite bulk sample

Labtium Oy
REPORT OF XRF ANALYSIS 18.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121248
Method : 180X-O
Date : 18.11.2014
Comment **: NIO Pilot. Composite Feed. Bench WLIMS Cleaning**

Contents (%)

	M4 L14078507	NM2-4 L14078508
SiO2	1.1600	58.2000
TiO2	0.0450	0.3990
Al2O3	0.2500	5.0700
Cr2O3	0.0340	0.0051
V2O3	0.0490	0.0120
MnO	0.0640	0.0590
MgO	0.2200	6.6400
CaO	0.1180	3.7500
Rb2O	0.0110	0.0120
SrO	0.0000	0.0022
BaO	0.0070	0.2780
Na2O	0.0000	0.7500
K2O	0.0190	0.9800
ZrO2	0.0040	0.0200
P2O5	0.0740	2.0600
OxSumm	94.0000	97.9000
Cu	0.0030	0.0010
Ni	0.0140	0.0060
Co	0.0020	0.0030
Zn	0.0060	0.0060
Pb	0.0000	0.0040
Ag	0.0030	0.0000
S	0.0050	0.0200
As	0.0010	0.0010
Sb	0.0070	0.0090
Bi	0.0020	0.0020
Te	0.0000	0.0000
Y	0.0009	0.0130
Nb	0.0000	0.0011
Mo	0.0000	0.0000
Sn	0.0010	0.0070
W	0.0000	0.0000
Cl	0.0020	0.0090
Th	0.0039	0.0036
U	0.0084	0.0007
Cs	0.0030	0.0020
La	0.0030	0.0260
Ce	0.0050	0.0500
Ta	0.0040	0.0040
LOI	0.0000	0.0000
Ga	0.0034	0.0016
Si	0.5400	27.2000
Ti	0.0270	0.2390
Cr	0.0230	0.0035
V	0.0340	0.0083
Fe	71.4000	15.2000
Mn	0.0500	0.0460
Mg	0.1400	4.0100
Ca	0.0850	2.6800
Ba	0.0060	0.2490
Satmagan	**97.27**	**0.77**

Table 58: Assays of products of bench-scale, two-stage HGMS upon feed to SLon 2

Labtium Oy
REPORT OF XRF ANALYSIS 20.-21.11.2014

Customer : Markku Kuusisto, GTK Mintec
Orders : 121262, 121265, 121272, 121276
Method : 180X-O
Date : 20.-21.11.2014
Comment **: NIO Pilot. Composite Feed. Bench HGMS Rougher & Cleaner products**

Contents (%)

	HGMS Rgh Mags L14079262	HGMS Rgh Non-Mags L14079263	HGMS Cln M1 L14079248	HGMS Cln NM1 L14079454	HGMS Cln M2 L14079449	HGMS Cln NM2 L14079450
SiO2	41.5	73.5	12.9	57.1	7.07	54.5
TiO2	0.53	0.190	0.79	0.374	0.82	0.379
Al2O3	5.33	9.11	1.88	5.63	1.07	7.85
Cr2O3	0.0076	0.0026	0.034	0.0064	0.031	0.0058
V2O3	0.012	0.0068	0.016	0.0091	0.017	0.011
MnO	0.040	0.039	0.026	0.052	0.019	0.073
MgO	4.80	4.78	2.30	5.63	1.30	9.06
CaO	1.84	2.28	0.73	2.52	0.54	2.53
Rb2O	0.015	0.015	0.014	0.015	0.015	0.025
SrO	0.0009	0.0088	0.0000	0.0038	0.0000	0.0030
BaO	0.204	0.388	0.065	0.277	0.034	0.325
Na2O	1.22	2.24	0.32	1.51	0.15	1.24
K2O	0.97	1.82	0.340	1.31	0.176	1.89
ZrO2	0.015	0.015	0.013	0.017	0.010	0.018
P2O5	0.78	0.93	0.337	1.04	0.277	0.84
OxSumm	95.90	99.50	92.30	97.60	91.60	98.00
Cu	0.001	0.000	0.002	0.002	0.000	0.001
Ni	0.004	0.004	0.015	0.005	0.017	0.005
Co	0.018	0.020	0.000	0.023	0.016	0.018
Zn	0.004	0.004	0.003	0.005	0.001	0.006
Pb	0.002	0.007	0.000	0.005	0.000	0.004
Ag	0.000	0.000	0.001	0.000	0.001	0.000
S	0.014	0.011	0.008	0.017	0.007	0.017
As	0.000	0.000	0.000	0.000	0.001	0.000
Sb	0.014	0.009	0.009	0.012	0.009	0.008
Bi	0.002	0.002	0.004	0.003	0.001	0.002
Te	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0074	0.0066	0.0033	0.0096	0.0013	0.010
Nb	0.0008	0.0015	0.0000	0.0011	0.0000	0.0017
Mo	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000
Sn	0.012	0.002	0.018	0.007	0.018	0.005
W	0.000	0.000	0.004	0.001	0.001	0.001
Cl	0.009	0.013	0.004	0.014	0.004	0.020
Th	0.0030	0.0010	0.0031	0.0026	0.0048	0.0035
U	0.0030	0.0000	0.0081	0.0003	0.0095	0.0004
Cs	0.002	0.002	0.003	0.002	0.000	0.004
La	0.020	0.015	0.007	0.024	0.006	0.029
Ce	0.030	0.030	0.014	0.038	0.009	0.048
Ta	0.007	0.001	0.001	0.001	0.002	0.000
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0019	0.0010	0.0023	0.0010	0.0046	0.0016
Si	19.4	34.3	6.03	26.7	3.31	25.5
Ti	0.318	0.114	0.472	0.224	0.493	0.227
Cr	0.0052	0.0018	0.023	0.0044	0.021	0.0040
V	0.0083	0.0046	0.011	0.0062	0.012	0.0074
Fe	29.9	3.15	56.3	17.1	62.1	14.8
Mn	0.031	0.030	0.020	0.040	0.015	0.057
Mg	2.89	2.89	1.38	3.40	0.78	5.46
Ca	1.32	1.63	0.52	1.80	0.385	1.81
Ba	0.182	0.347	0.058	0.248	0.031	0.291
Satmagan	**0.67**	0.21	**2.20**	0.40	**2.19**	0.34

Table 59: Assays of feed and products of SLon 1 and SLon 2

Labtium Oy
REPORT OF XRF ANALYSIS 19.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121255
Method : 180X-O
Date : 19.11.2014
Comment : **NIO Pilot - HGMS testing on 19.11.2014. *** SLon Feed samplings to HGMS 'rougher' tests made 18.11.2014 at 4:00PM**

HGMS parameters : **For SLon 1 Feed, producing "Mags A" : Field 0.10 Tesla / Matrix 3.5XRO / Flow restrictor dia. 8 mm / Feed time 11 sec / Rinse time 6 sec / Feed solids < 5 wt.-%**
For SLon 2 Feed, producing "Mags B" : Field 0.06 Tesla / Matrix 3.5XMO / Flow restrictor dia. 12 mm / Feed time 6 sec / Rinse time 5 sec / Feed solids < 5 wt.-%

Contents (%)

	SLon 1 Feed L14078546 Time 12:30PM-1:15PM	SLon 1 Feed L14078567 Time 4:45PM-5:30PM	Mags A L14079177	SLon 2 Feed L14078553 Time 12:30PM-1:15PM	SLon 2 Feed L14078574 Time 4:45PM-5:30PM	Mags B L14079178
SiO2	61.5	59.5	49.7	48.5	39.8	20.8
TiO2	0.309	0.323	0.433	0.464	0.54	0.72
Al2O3	7.71	7.27	5.84	5.04	4.00	2.19
Cr2O3	0.0037	0.0041	0.0047	0.0083	0.0075	0.012
V2O3	0.0078	0.0087	0.011	0.013	0.013	0.019
MnO	0.039	0.036	0.041	0.041	0.035	0.029
MgO	4.83	4.95	5.35	4.87	3.94	3.21
CaO	2.02	2.01	2.09	2.45	2.82	2.06
Rb2O	0.015	0.015	0.015	0.013	0.012	0.014
SrO	0.0035	0.0041	0.0008	0.0002	0.0000	0.0000
BaO	0.319	0.314	0.252	0.219	0.176	0.088
Na2O	1.88	1.75	1.26	1.07	0.92	0.35
K2O	1.45	1.41	1.14	0.92	0.69	0.389
ZrO2	0.015	0.014	0.014	0.016	0.016	0.017
P2O5	0.90	0.91	0.89	1.27	1.67	1.26
OxSumm	98.20	98.00	96.90	96.70	95.70	93.50
Cu	0.000	0.000	0.000	0.001	0.000	0.001
Ni	0.003	0.004	0.004	0.004	0.003	0.003
Co	0.008	0.002	0.001	0.017	0.003	0.016
Zn	0.004	0.005	0.003	0.005	0.004	0.005
Pb	0.004	0.004	0.002	0.002	0.002	0.000
Ag	0.000	0.000	0.000	0.000	0.000	0.001
S	0.009	0.011	0.008	0.011	0.015	0.007
As	0.000	0.000	0.000	0.000	0.000	0.000
Sb	0.010	0.012	0.011	0.009	0.012	0.012
Bi	0.002	0.002	0.003	0.002	0.002	0.002
Te	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0067	0.0069	0.0072	0.0092	0.011	0.0075
Nb	0.0010	0.0014	0.0011	0.0004	0.0012	0.0004
Mo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.006	0.006	0.009	0.009	0.012	0.017
W	0.001	0.001	0.001	0.000	0.001	0.001
Cl	0.011	0.010	0.012	0.012	0.008	0.004
Th	0.0030	0.0021	0.0031	0.0025	0.0044	0.0050
U	0.0001	0.0000	0.0018	0.0021	0.0038	0.0070
Cs	0.001	0.001	0.002	0.003	0.003	0.000
La	0.018	0.018	0.018	0.017	0.030	0.016
Ce	0.027	0.030	0.031	0.032	0.047	0.025
Ta	0.001	0.002	0.000	0.002	0.003	0.003
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0010	0.0010	0.0028	0.0015	0.0028	0.0024
Si	28.8	27.8	23.3	22.7	18.6	9.71
Ti	0.185	0.194	0.260	0.278	0.326	0.434
Cr	0.0025	0.0028	0.0032	0.0057	0.0051	0.0082
V	0.0053	0.0059	0.0076	0.0087	0.0089	0.013
Fe	13.2	15.0	23.1	24.6	31.8	48.4
Mn	0.030	0.028	0.032	0.032	0.027	0.022
Mg	2.91	2.98	3.23	2.94	2.38	1.94
Ca	1.45	1.43	1.49	1.75	2.01	1.47
Ba	0.286	0.281	0.226	0.196	0.158	0.079
Satmagan	0.41	0.45	0.68	2.46	1.86	4.84

Table 60: Assays of products of bench-scale HGMS applied to magnetic concentrate from SLon 2

Labtium Oy
REPORT OF XRF ANALYSIS 19.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121257
Method : 180X-O
Date : 19.11.2014
Comment : NIO Pilot - HGMS CIn testing. "SLon 2 Feed" sampling for HGMS 18.11.2014 at 4:00PM

HGMS parameters : For "Mags B" Feed : Field 0.06 Tesla / Matrix 3.5XMO / Flow restrictor dia. 12 mm / Feed time 6 sec / Rinse time 5 sec / Feed solids ~2 wt.-%
Top size 150 microns

Contents (%)

	Mags B - M L14079182	Mags B - NM L14079183	Mags B (Feed) L14079178
SiO2	15.7	64.2	20.8
TiO2	0.78	0.297	0.72
Al2O3	1.60	6.74	2.19
Cr2O3	0.011	0.0060	0.012
V2O3	0.018	0.0090	0.019
MnO	0.024	0.071	0.029
MgO	2.47	8.33	3.21
CaO	1.95	3.04	2.06
Rb2O	0.012	0.021	0.014
SrO	0.0000	0.0037	0.0000
BaO	0.066	0.348	0.088
Na2O	0.24	1.08	0.35
K2O	0.270	1.70	0.389
ZrO2	0.018	0.017	0.017
P2O5	1.27	1.13	1.26
OxSumm	92.90	98.70	93.50
Cu	0.000	0.000	0.001
Ni	0.003	0.005	0.003
Co	0.012	0.007	0.016
Zn	0.004	0.005	0.005
Pb	0.000	0.005	0.000
Ag	0.001	0.000	0.001
S	0.009	0.014	0.007
As	0.002	0.000	0.000
Sb	0.009	0.010	0.012
Bi	0.002	0.002	0.002
Te	0.000	0.000	0.000
Y	0.0074	0.012	0.0075
Nb	0.0013	0.0009	0.0004
Mo	0.0000	0.0000	0.0000
Sn	0.018	0.004	0.017
W	0.000	0.001	0.001
Cl	0.007	0.017	0.004
Th	0.0044	0.0028	0.0050
U	0.0078	0.0000	0.0070
Cs	0.000	0.005	0.000
La	0.014	0.034	0.016
Ce	0.022	0.054	0.025
Ta	0.001	0.002	0.003
LOI	0.0000	0.0000	0.0000
Ga	0.0013	0.0017	0.0024
Si	7.32	30.0	9.71
Ti	0.466	0.178	0.434
Cr	0.0072	0.0041	0.0082
V	0.012	0.0061	0.013
Fe	53.1	9.00	48.4
Mn	0.019	0.055	0.022
Mg	1.49	5.02	1.94
Ca	1.39	2.17	1.47
Ba	0.059	0.311	0.079
Satmagan	**4.57**	0.32	**4.84**

Table 61: Assays of froths (ApF) and final hematite concentrate (Cell Conc) produced by bench-scale flotation test

Labtium Oy
REPORT OF XRF ANALYSIS 26.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121319
Method : 180X-O
Date : 26.11.2014
Comment : **NIO Pilot. Hematite pre-concentrate, bench flotation test products. Fineness < 150 µm**

Contents (%)

	ApF1 L14081155	ApF2 L14081156	ApF3 L14081157	ApF4 L14081158	Cell Conc. L14081159
SiO2	1.02	3.32	2.45	2.16	3.99
TiO2	0.076	0.86	0.91	0.87	0.85
Al2O3	0.18	0.66	0.47	0.36	0.48
Cr2O3	0.0029	0.013	0.015	0.012	0.0061
V2O3	0.0062	0.016	0.017	0.016	0.016
MnO	0.007	0.009	0.008	0.007	0.008
MgO	0.39	0.98	0.57	0.36	0.30
CaO	50.6	5.67	0.412	0.208	0.193
Rb2O	0.0015	0.012	0.013	0.0094	0.0096
SrO	0.016	0.0000	0.0000	0.0000	0.0000
BaO	0.025	0.021	0.012	0.010	0.015
Na2O	0.05	0.01	0.01	0.03	0.08
K2O	0.021	0.088	0.042	0.018	0.031
ZrO2	0.004	0.012	0.013	0.016	0.019
P2O5	37.6	5.67	0.386	0.055	0.023
OxSumm	97.30	92.00	90.90	90.80	91.10
Cu	0.004	0.006	0.000	0.002	0.000
Ni	0.005	0.006	0.004	0.002	0.004
Co	0.000	0.011	0.012	0.018	0.013
Zn	0.002	0.001	0.002	0.002	0.004
Pb	0.007	0.004	0.000	0.000	0.000
Ag	0.025	0.040	0.009	0.003	0.004
S	0.132	0.242	0.080	0.019	0.005
As	0.009	0.002	0.000	0.003	0.000
Sb	0.011	0.010	0.009	0.008	0.009
Bi	0.002	0.003	0.000	0.002	0.002
Te	0.000	0.001	0.000	0.000	0.000
Y	0.159	0.071	0.020	0.0055	0.0022
Nb	0.0000	0.0000	0.0000	0.0000	0.0012
Mo	0.051	0.0000	0.0000	0.0000	0.0000
Sn	0.004	0.021	0.022	0.020	0.022
W	0.312	0.000	0.001	0.001	0.000
Cl	0.060	0.010	0.004	0.002	0.003
Th	0.024	0.044	0.015	0.0066	0.0052
U	0.0016	0.012	0.011	0.0096	0.0083
Cs	0.000	0.000	0.002	0.000	0.003
La	0.52	0.75	0.165	0.023	0.009
Ce	0.73	1.04	0.232	0.032	0.011
Ta	0.001	0.002	0.001	0.004	0.002
LOI	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0002	0.0000	0.0015	0.0035	0.0020
Si	0.48	1.55	1.14	1.01	1.86
Ti	0.045	0.52	0.54	0.52	0.51
Cr	0.0020	0.0086	0.010	0.0079	0.0042
V	0.0042	0.011	0.012	0.011	0.011
Fe	3.88	56.1	66.1	67.3	66.0
Mn	0.006	0.007	0.006	0.005	0.006
Mg	0.23	0.59	0.34	0.22	0.18
Ca	36.1	4.05	0.294	0.148	0.138
Ba	0.022	0.019	0.011	0.009	0.014
Satmagan	**1.19**	**1.19**	**1.29**	**1.19**	**0.98**

10.5 Pilot sampling

Table 62: Assays of samples produced by flowsheet Version 1a taken during first sampling campaign on 18th November

Labtium Oy
REPORT OF XRF ANALYSIS 18.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121249
Method : 180X-O
Date : 18.11.2014
Comment : **NIO Pilot. Pilot Test Work - Sampling 18.11.2014 from 12:30PM to 1:15PM**

Contents (%)

PRODUCT	Derrick U/S, or	WLIMS	WLIMS	SLon 1 Mags	SLon 1 Non-Mags	Cyclone O/F, or	WLIMS Cln M4, or	WLIMS Cleaner	WLIMS Cleaner	Sweco U/S, or	SLon 2 Mags	SLon 2 Non-Mags	Carpco H9000W wash water	
	Composite Ore Feed	Rougher Mags	Rougher Non-Mags, or SLon 1 Feed (hematitic)			WLIMS Cleaner Feed	Final Magnetite Conc.	Non-Mags 3 (hematitic)	Non-Mags 4 (hematitic)	SLon 2 Feed	Hematitic product		scavenger spiral products from "SLon 2 Non-Mags"	
													Spiral Conc. Hematitic	Middlings + Tailings
	DA L14078544	M1+M2 L14078545	Slon1 EM2 L14078546	Slon1 M L14078547	Slon1 EM L14078548	SY L14078549	M4 L14078550	EM3 L14078551	EM4 L14078552	SY2 L14078553	Slon2 M L14078554	Slon2 EM L14078555	Spir R L14078556	Spir VT+J L14078557
SiO2	38.7	11.5	61.5	38.5	65.7	12.3	1.97	54.3	48.8	48.5	25.0	54.1	6.00	62.2
TiO2	0.197	0.106	0.309	0.57	0.262	0.113	0.048	0.412	0.51	0.464	0.66	0.417	0.91	0.318
Al2O3	4.86	1.29	7.71	3.79	8.19	1.36	0.29	5.77	5.95	5.04	2.22	5.61	0.62	6.38
Cr2O3	0.0035	0.0031	0.0037	0.0060	0.0032	0.0051	0.0038	0.0061	0.0096	0.0083	0.018	0.0058	0.0070	0.0067
V2O3	0.028	0.048	0.0078	0.013	0.0081	0.048	0.050	0.013	0.017	0.013	0.022	0.010	0.017	0.010
MnO	0.054	0.068	0.039	0.029	0.039	0.067	0.064	0.049	0.071	0.041	0.043	0.041	0.013	0.050
MgO	3.40	1.34	4.83	3.48	4.95	1.40	0.27	5.49	6.47	4.87	3.11	5.24	0.59	5.75
CaO	1.28	0.57	2.02	2.12	2.14	0.58	0.159	2.61	2.84	2.45	3.42	2.38	1.60	2.48
Rb2O	0.014	0.013	0.015	0.012	0.015	0.013	0.012	0.014	0.014	0.013	0.011	0.014	0.012	0.015
SrO	0.0000	0.0000	0.0035	0.0000	0.0063	0.0000	0.0000	0.0015	0.0013	0.0002	0.0000	0.0018	0.0000	0.0035
BaO	0.180	0.050	0.319	0.172	0.358	0.053	0.012	0.252	0.226	0.219	0.093	0.253	0.022	0.297
Na2O	1.28	0.25	1.88	0.91	1.96	0.27	0.01	1.18	0.95	1.07	0.43	1.18	0.12	1.28
K2O	0.79	0.177	1.45	0.63	1.60	0.196	0.029	1.07	1.05	0.92	0.340	1.07	0.048	1.27
ZrO2	0.009	0.005	0.015	0.015	0.015	0.006	0.002	0.017	0.023	0.016	0.019	0.016	0.022	0.014
P2O5	**0.59**	0.309	0.90	1.18	0.94	0.298	**0.091**	1.31	1.48	1.27	**2.29**	1.16	**1.14**	1.11
OxSumm	96.70	95.20	98.20	95.40	98.70	94.90	94.10	97.50	97.10	96.70	94.40	97.30	91.30	98.20
Cu	0.002	0.001	0.000	0.000	0.000	0.001	0.002	0.001	0.002	0.001	0.003	0.000	0.000	0.000
Ni	0.004	0.004	0.003	0.005	0.004	0.006	0.003	0.003	0.006	0.004	0.003	0.004	0.003	0.004
Co	0.019	0.019	0.008	0.020	0.018	0.020	0.004	0.003	0.010	0.017	0.020	0.013	0.013	0.020
Zn	0.006	0.008	0.004	0.003	0.004	0.005	0.005	0.004	0.006	0.005	0.004	0.004	0.002	0.005
Pb	0.000	0.000	0.004	0.002	0.005	0.000	0.000	0.002	0.002	0.002	0.000	0.002	0.000	0.004
Ag	0.000	0.001	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.001	0.000	0.004	0.000
S	0.007	0.004	0.009	0.010	0.009	0.004	0.002	0.011	0.014	0.011	0.013	0.010	0.017	0.010
As	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.002	0.000	0.000	0.000
Sb	0.008	0.006	0.010	0.009	0.009	0.008	0.006	0.009	0.010	0.009	0.008	0.010	0.009	0.010
Bi	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Te	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0045	0.0023	0.0067	0.0072	0.0075	0.0029	0.0016	0.0093	0.012	0.0092	0.011	0.0083	0.0094	0.0086
Nb	0.0000	0.0000	0.0010	0.0007	0.0009	0.0000	0.0000	0.0008	0.0003	0.0004	0.0000	0.0010	0.0005	0.0010
Mo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.003	0.001	0.006	0.012	0.004	0.003	0.001	0.007	0.008	0.009	0.013	0.008	0.022	0.006
W	0.001	0.000	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.001
Cl	0.005	0.005	0.011	0.006	0.013	0.004	0.002	0.009	0.011	0.012	0.010	0.010	0.005	0.008
Th	0.0030	0.0044	0.0030	0.0049	0.0020	0.0045	0.0047	0.0026	0.0035	0.0025	0.0041	0.0027	0.0062	0.0024
U	0.0050	0.0090	0.0001	0.0044	0.0000	0.0084	0.0086	0.0016	0.0024	0.0021	0.0067	0.0015	0.0094	0.0001
Cs	0.002	0.002	0.001	0.001	0.002	0.002	0.001	0.000	0.002	0.003	0.003	0.001	0.003	0.001
La	0.013	0.008	0.018	0.018	0.016	0.007	0.004	0.022	0.021	0.017	0.018	0.017	0.037	0.016
Ce	0.021	0.010	0.027	0.028	0.027	0.011	0.005	0.036	0.041	0.032	0.032	0.035	0.053	0.029
Ta	0.003	0.006	0.001	0.003	0.001	0.004	0.002	0.003	0.004	0.002	0.003	0.002	0.001	0.002
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0020	0.0030	0.0010	0.0024	0.0003	0.0019	0.0019	0.0010	0.0014	0.0015	0.0031	0.0015	0.0028	0.0014
Si	18.1	5.39	28.8	18.0	30.7	5.77	0.92	25.4	22.8	22.7	11.7	25.3	2.80	29.1
Ti	0.118	0.064	0.185	0.341	0.157	0.068	0.029	0.247	0.306	0.278	0.393	0.250	0.55	0.191
Cr	0.0024	0.0021	0.0025	0.0041	0.0022	0.0035	0.0026	0.0042	0.0066	0.0057	0.012	0.0040	0.0048	0.0046
V	0.019	0.033	0.0053	0.0085	0.0055	0.032	0.034	0.0090	0.012	0.0087	0.015	0.0069	0.012	0.0069
Fe	**35.1**	61.7	13.2	34.1	9.59	60.7	**70.8**	19.3	22.1	24.6	**44.0**	19.9	**62.2**	13.1
Mn	0.042	0.052	0.030	0.022	0.030	0.052	0.050	0.038	0.055	0.032	0.033	0.032	0.010	0.038
Mg	2.05	0.81	2.91	2.10	2.98	0.84	0.16	3.31	3.90	2.94	1.88	3.16	0.36	3.47
Ca	0.91	0.407	1.45	1.51	1.53	0.413	0.114	1.86	2.03	1.75	2.44	1.70	1.14	1.77
Ba	0.161	0.045	0.286	0.154	0.321	0.047	0.011	0.225	0.202	0.196	0.083	0.226	0.019	0.266
Satmagan	**33.84**	87.97	0.41	1.43	0.29	78.79	**95.26**	2.90	2.67	2.46	**12.35**	0.49	**0.52**	0.51

Table 63: Assays of samples produced by flowsheet Version 1b taken during second sampling campaign on 18th November

Labtium Oy
REPORT OF XRF ANALYSIS 19.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121251
Method : 180X-O
Date : 19.11.2014
Comment : **NIO Pilot. Pilot Test Work - Sampling 18.11.2014 from 4:45PM to 5:30PM**

Contents (%)

PRODUCT	Derrick U/S, or Composite Ore Feed	WLIMS Rougher Mags	WLIMS Rougher Non-Mags, or SLon 1 Feed (hematitic)	SLon 1 Mags	SLon 1 Non-Mags	Cyclone O/F, or WLIMS Cleaner Feed	WLIMS Cln M4, or Final Magnetite Conc.	WLIMS Cleaner Non-Mags 3 (hematitic)	WLIMS Cleaner Non-Mags 4 (hematitic)	Sweco U/S, or SLon 2 Feed	SLon 2 Mags Hematitic product	SLon 2 Non-Mags	Carpco H9000W wash water spiral products from "SLon 2 Non-Mags"		Reichert WW6 wash water spiral products from "SLon 1 Non-Mags"	
													Spiral Conc. Hematitic	Middlings + Tailings	Spiral Conc. Hematitic	Tailings
	DA	M1+M2	EM2(Slon2SY)	Slon1 M	Slon1 EM	SY	M4	EM3	EM4	SY2	Slon2 M	Slon2 EM	Spir R	Spir VT+J	Spir2 R	Spir2 J
	L14078565	L14078566	L14078567	L14078568	L14078569	L14078570	L14078571	L14078572	L14078573	L14078574	L14078575	L14078576	L14078577	L14078578	L14078579	L14078580
SiO2	38.6	11.5	59.5	36.8	65.5	11.5	2.09	53.0	47.7	39.8	19.5	45.6	3.39	56.0	24.9	72.2
TiO2	0.193	0.107	0.323	0.58	0.262	0.109	0.046	0.427	0.52	0.54	0.70	0.498	0.89	0.365	0.66	0.197
Al2O3	4.72	1.27	7.27	3.58	8.12	1.29	0.31	5.70	5.63	4.00	1.77	4.76	0.48	5.74	2.59	8.87
Cr2O3	0.0031	0.0031	0.0041	0.0057	0.0025	0.0037	0.0038	0.0064	0.010	0.0075	0.018	0.0044	0.0061	0.0053	0.0066	0.0042
V2O3	0.030	0.047	0.0087	0.012	0.0066	0.049	0.051	0.015	0.018	0.013	0.020	0.011	0.015	0.011	0.014	0.0062
MnO	0.054	0.066	0.036	0.027	0.041	0.067	0.065	0.054	0.071	0.035	0.031	0.035	0.007	0.046	0.018	0.045
MgO	3.45	1.41	4.95	3.50	5.25	1.35	0.34	5.58	6.32	3.94	2.34	4.38	0.33	5.33	2.28	5.68
CaO	1.31	0.55	2.01	2.03	2.12	0.55	0.162	2.75	3.06	2.82	2.53	3.02	1.33	3.36	3.50	1.94
Rb2O	0.013	0.012	0.015	0.011	0.015	0.012	0.012	0.013	0.014	0.012	0.010	0.012	0.0098	0.010	0.011	0.017
SrO	0.0000	0.0000	0.0041	0.0000	0.0063	0.0000	0.0000	0.0015	0.0009	0.0000	0.0000	0.0002	0.0000	0.0028	0.0000	0.0073
BaO	0.187	0.046	0.314	0.160	0.356	0.048	0.010	0.248	0.226	0.176	0.070	0.210	0.014	0.274	0.096	0.426
Na2O	1.21	0.24	1.75	0.85	1.89	0.26	0.02	1.09	0.89	0.92	0.36	1.06	0.06	1.25	0.74	1.97
K2O	0.80	0.174	1.41	0.61	1.61	0.181	0.031	1.06	1.02	0.69	0.254	0.82	0.027	1.09	0.317	1.91
ZrO2	0.011	0.005	0.014	0.014	0.015	0.005	0.003	0.019	0.024	0.016	0.017	0.017	0.026	0.015	0.021	0.015
P2O5	**0.63**	0.299	0.91	1.13	0.91	0.299	**0.099**	1.33	1.61	1.67	**1.71**	1.72	**1.03**	1.87	**2.68**	0.70
OxSumm	96.80	94.90	98.00	95.20	98.70	94.80	94.10	97.30	96.90	95.70	93.60	96.40	91.10	97.70	94.10	99.40
Cu	0.001	0.002	0.000	0.000	0.000	0.002	0.002	0.001	0.004	0.000	0.002	0.002	0.001	0.000	0.001	0.001
Ni	0.004	0.004	0.004	0.004	0.004	0.003	0.006	0.004	0.005	0.003	0.004	0.004	0.003	0.003	0.001	0.003
Co	0.018	0.005	0.002	0.021	0.016	0.013	0.012	0.008	0.022	0.003	0.011	0.019	0.016	0.017	0.005	0.022
Zn	0.005	0.006	0.005	0.004	0.004	0.008	0.003	0.006	0.006	0.004	0.004	0.005	0.003	0.003	0.001	0.004
Pb	0.001	0.000	0.004	0.001	0.007	0.000	0.000	0.003	0.003	0.002	0.000	0.002	0.000	0.005	0.000	0.007
Ag	0.000	0.001	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.001	0.000	0.007	0.001	0.002	0.000
S	0.006	0.005	0.011	0.011	0.011	0.004	0.002	0.012	0.015	0.015	0.012	0.015	0.028	0.009	0.022	0.006
As	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Sb	0.011	0.007	0.012	0.010	0.011	0.006	0.006	0.013	0.012	0.012	0.010	0.010	0.008	0.013	0.006	0.008
Bi	0.001	0.003	0.002	0.003	0.003	0.003	0.003	0.002	0.003	0.002	0.001	0.002	0.003	0.002	0.002	0.002
Te	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001
Y	0.0046	0.0019	0.0069	0.0064	0.0071	0.0025	0.0000	0.011	0.013	0.011	0.0090	0.011	0.011	0.010	0.013	0.0062
Nb	0.0000	0.0000	0.0014	0.0008	0.0021	0.0000	0.0000	0.0008	0.0014	0.0012	0.0004	0.0011	0.0007	0.0019	0.0000	0.0017
Mo	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0003
Sn	0.004	0.003	0.006	0.012	0.004	0.001	0.002	0.008	0.009	0.012	0.016	0.010	0.021	0.006	0.014	0.002
W	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.000
Cl	0.009	0.001	0.010	0.007	0.009	0.004	0.003	0.009	0.011	0.008	0.005	0.010	0.002	0.009	0.011	0.013
Th	0.0028	0.0046	0.0021	0.0036	0.0019	0.0042	0.0035	0.0027	0.0035	0.0044	0.0044	0.0032	0.0083	0.0024	0.0061	0.0008
U	0.0048	0.0080	0.0000	0.0051	0.0000	0.0083	0.0092	0.0016	0.0018	0.0038	0.0072	0.0026	0.010	0.0000	0.0062	0.0000
Cs	0.003	0.003	0.001	0.000	0.004	0.001	0.003	0.002	0.003	0.003	0.000	0.002	0.002	0.002	0.001	0.000
La	0.013	0.006	0.018	0.018	0.018	0.007	0.003	0.021	0.024	0.030	0.016	0.030	0.070	0.019	0.057	0.013
Ce	0.020	0.011	0.030	0.026	0.031	0.010	0.005	0.040	0.044	0.047	0.031	0.048	0.095	0.031	0.081	0.026
Ta	0.004	0.004	0.002	0.003	0.002	0.000	0.004	0.002	0.003	0.003	0.000	0.002	0.001	0.000	0.001	0.002
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0014	0.0009	0.0010	0.0022	0.0007	0.0002	0.0031	0.0022	0.0024	0.0028	0.0032	0.0014	0.0008	0.0009	0.0023	0.0014
Si	18.0	5.39	27.8	17.2	30.6	5.37	0.98	24.8	22.3	18.6	9.12	21.3	1.58	26.2	11.6	33.7
Ti	0.116	0.064	0.194	0.348	0.157	0.065	0.027	0.256	0.314	0.326	0.419	0.299	0.53	0.219	0.398	0.118
Cr	0.0021	0.0021	0.0028	0.0039	0.0017	0.0025	0.0026	0.0044	0.0069	0.0051	0.012	0.0030	0.0042	0.0036	0.0045	0.0029
V	0.020	0.032	0.0059	0.0083	0.0045	0.033	0.035	0.0099	0.012	0.0089	0.013	0.0076	0.010	0.0072	0.0094	0.0042
Fe	**35.4**	61.5	15.0	35.5	9.64	61.5	**70.6**	20.1	23.0	31.8	**49.8**	26.4	**64.6**	17.2	**43.5**	4.09
Mn	0.042	0.051	0.028	0.021	0.032	0.052	0.051	0.042	0.055	0.027	0.024	0.027	0.006	0.036	0.014	0.035
Mg	2.08	0.85	2.98	2.11	3.17	0.82	0.21	3.37	3.81	2.38	1.41	2.64	0.20	3.21	1.37	3.43
Ca	0.94	0.396	1.43	1.45	1.52	0.391	0.116	1.96	2.18	2.01	1.80	2.15	0.95	2.40	2.50	1.39
Ba	0.167	0.041	0.281	0.143	0.319	0.043	0.009	0.222	0.202	0.158	0.062	0.188	0.013	0.245	0.086	0.381
Satmagan	**37.68**	81.47	0.45	1.35	0.33	78.98	**99.80**	3.20	2.55	1.86	**10.08**	0.50	**0.52**	0.45	**0.47**	0.27

Table 64: Assays of samples produced by flowsheet Version 1b taken during the first sampling campaign on 19th November

Labtium Oy
REPORT OF XRF ANALYSIS 19.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121258
Method : 180K-O
Date : 19.11.2014
Comment : **NIO Pilot. Pilot Test Work - Sampling 19.11.2014 from 1:15PM to 2:00PM**

Contents (%)

PRODUCT	Derrick U/S, or Composite Ore Feed	WLIMS Rougher Mags	WLIMS Rougher Non-Mags, or SLon 1 Feed (hematitic)	SLon 1 Mags	SLon 1 Non-Mags	Cyclone O/F, or WLIMS Cleaner Feed	WLIMS Cleaner M3	WLIMS Cln M4, or Final Magnetite Conc.	WLIMS Cleaner Non-Mags 3 (hematitic)	WLIMS Cleaner Non-Mags 4 (hematitic)	Sweco U/S, or SLon 2 Feed	SLon 2 Mags Hematitic product	SLon 2 Non-Mags	Carpco H9000W wash water spiral products from "SLon 2 Non-Mags"		Reichert WW6 wash water spiral products from "SLon 2 Non-Mags"	
														Spiral Conc. Hematitic	Middlings + Tailings	Spiral Conc. Hematitic	Tailings
	DA L14079184	M1+M2 L14079185	EM2 L14079186	SLon1 M L14079187	SLon1 EM L14079188	SY L14079189	M3 L14079200	M4 L14079190	EM3 L14079191	EM4 L14079192	SY2 L14079193	SLon2 M L14079194	SLon2 EM L14079195	Spir R L14079196	Spir VT + J L14079197	Spir2 R L14079198	Spir2 J L14079199
SiO2	37.7	14.9	61.4	43.6	65.1	12.6	2.72	1.98	54.0	48.0	40.9	18.0	45.0	4.22	57.0	14.9	72.1
TiO2	0.193	0.116	0.304	0.51	0.269	0.112	0.053	0.047	0.417	0.52	0.53	0.70	0.496	0.87	0.360	0.75	0.195
Al2O3	4.66	1.57	7.60	4.50	8.11	1.37	0.35	0.28	5.76	5.65	4.24	1.62	4.63	0.51	5.92	1.54	8.73
Cr2O3	0.0038	0.0039	0.0053	0.0038	0.0020	0.0057	0.0060	0.0042	0.0058	0.0091	0.0079	0.019	0.0060	0.0069	0.0057	0.0072	0.0019
V2O3	0.030	0.046	0.0085	0.012	0.0075	0.047	0.049	0.050	0.012	0.016	0.013	0.021	0.012	0.016	0.010	0.015	0.0071
MnO	0.053	0.065	0.037	0.032	0.041	0.067	0.064	0.062	0.050	0.065	0.033	0.033	0.034	0.008	0.045	0.015	0.044
MgO	3.37	1.64	4.93	3.97	5.00	1.40	0.37	0.29	5.44	6.27	4.01	2.20	4.23	0.38	5.32	1.17	5.39
CaO	1.24	0.68	2.05	2.35	2.03	0.58	0.188	0.152	2.62	3.12	2.33	2.43	2.29	1.33	2.69	2.30	2.11
Rb2O	0.013	0.013	0.015	0.011	0.015	0.013	0.013	0.012	0.013	0.014	0.013	0.0098	0.012	0.011	0.012	0.011	0.017
SrO	0.0000	0.0000	0.0041	0.0004	0.0058	0.0000	0.0000	0.0000	0.0021	0.0014	0.0000	0.0000	0.0000	0.0000	0.0025	0.0000	0.0077
BaO	0.176	0.059	0.330	0.195	0.344	0.054	0.011	0.013	0.254	0.221	0.177	0.067	0.198	0.018	0.275	0.066	0.412
Na2O	1.23	0.33	1.83	1.08	1.94	0.29	0.03	0.02	1.16	0.90	0.96	0.30	1.05	0.07	1.25	0.42	2.03
K2O	0.76	0.221	1.45	0.78	1.59	0.198	0.038	0.026	1.06	1.02	0.73	0.234	0.81	0.037	1.13	0.187	1.84
ZrO2	0.009	0.004	0.015	0.016	0.015	0.005	0.003	0.003	0.017	0.023	0.016	0.015	0.016	0.021	0.015	0.019	0.014
P2O5	**0.58**	0.357	0.91	1.30	0.87	0.302	0.106	**0.090**	1.33	1.71	1.30	**1.59**	1.21	**1.01**	1.34	**1.61**	0.79
OxSumm	96.70	94.80	98.20	96.10	98.60	94.90	94.20	94.10	97.40	97.00	95.80	93.40	96.20	91.20	97.70	92.60	99.40
Cu	0.001	0.000	0.000	0.001	0.000	0.002	0.002	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000
Ni	0.003	0.004	0.004	0.004	0.003	0.004	0.003	0.005	0.004	0.004	0.005	0.002	0.003	0.004	0.003	0.005	0.003
Co	0.004	0.019	0.009	0.003	0.022	0.019	0.022	0.016	0.019	0.019	0.019	0.017	0.004	0.006	0.015	0.009	0.023
Zn	0.005	0.007	0.005	0.002	0.004	0.008	0.006	0.008	0.004	0.005	0.004	0.003	0.003	0.000	0.004	0.002	0.004
Pb	0.000	0.000	0.004	0.002	0.005	0.000	0.000	0.000	0.003	0.003	0.002	0.000	0.002	0.000	0.003	0.000	0.006
Ag	0.000	0.002	0.000	0.000	0.000	0.001	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.002	0.000
S	0.006	0.004	0.011	0.010	0.010	0.003	0.001	0.002	0.011	0.013	0.013	0.011	0.014	0.025	0.009	0.026	0.007
As	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.002	0.000	0.001	0.000
Sb	0.007	0.005	0.007	0.009	0.010	0.006	0.006	0.006	0.010	0.009	0.008	0.008	0.007	0.009	0.008	0.010	0.008
Bi	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.002	0.002	0.002	0.003	0.001	0.002	0.002	0.004	0.002
Te	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0048	0.0024	0.0072	0.0070	0.0075	0.0021	0.0005	0.0000	0.0086	0.013	0.0082	0.0092	0.0083	0.0093	0.0093	0.012	0.0064
Nb	0.0000	0.0000	0.0009	0.0006	0.0010	0.0000	0.0000	0.0000	0.0005	0.0008	0.0003	0.0000	0.0014	0.0002	0.0011	0.0000	0.0014
Mo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.004	0.001	0.005	0.011	0.004	0.002	0.002	0.000	0.008	0.008	0.011	0.016	0.010	0.022	0.006	0.018	0.002
W	0.000	0.001	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001
Cl	0.008	0.004	0.008	0.006	0.011	0.003	0.002	0.002	0.008	0.012	0.008	0.008	0.008	0.003	0.009	0.005	0.015
Th	0.0040	0.0043	0.0023	0.0037	0.0024	0.0051	0.0041	0.0026	0.0031	0.0032	0.0047	0.0048	0.0045	0.0087	0.0027	0.0069	0.0014
U	0.0046	0.0074	0.0000	0.0028	0.0001	0.0082	0.0088	0.0084	0.0017	0.0025	0.0034	0.0072	0.0026	0.0096	0.0012	0.0074	0.0000
Cs	0.002	0.000	0.000	0.002	0.000	0.000	0.003	0.001	0.003	0.002	0.002	0.001	0.002	0.003	0.000	0.000	0.002
La	0.012	0.007	0.020	0.015	0.020	0.006	0.005	0.004	0.023	0.020	0.028	0.017	0.028	0.062	0.018	0.063	0.012
Ce	0.018	0.012	0.034	0.029	0.029	0.011	0.004	0.004	0.039	0.041	0.044	0.025	0.044	0.088	0.031	0.086	0.025
Ta	0.003	0.005	0.002	0.003	0.002	0.002	0.006	0.000	0.001	0.002	0.002	0.003	0.002	0.003	0.002	0.001	0.002
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0028	0.0023	0.0012	0.0009	0.0017	0.0043	0.0022	0.0028	0.0011	0.0007	0.0016	0.0009	0.0005	0.0029	0.0016	0.0015	0.0013
Si	17.6	6.98	28.7	20.4	30.4	5.89	1.27	0.92	25.2	22.4	19.1	8.41	21.0	1.97	26.6	6.98	33.7
Ti	0.116	0.069	0.182	0.307	0.161	0.067	0.032	0.028	0.250	0.314	0.319	0.421	0.297	0.52	0.216	0.452	0.117
Cr	0.0026	0.0027	0.0036	0.0026	0.0014	0.0039	0.0041	0.0029	0.0040	0.0062	0.0054	0.013	0.0041	0.0047	0.0039	0.0049	0.0013
V	0.020	0.031	0.0058	0.0081	0.0051	0.032	0.033	0.034	0.0081	0.011	0.0088	0.014	0.0082	0.011	0.0070	0.010	0.0048
Fe	**36.2**	58.1	13.4	29.3	10.2	60.5	70.0	**70.7**	19.5	22.8	31.3	**51.3**	28.0	**64.1**	17.2	**53.8**	4.32
Mn	0.041	0.051	0.029	0.025	0.032	0.052	0.050	0.048	0.039	0.050	0.025	0.025	0.026	0.006	0.035	0.012	0.034
Mg	2.04	0.99	2.97	2.39	3.01	0.84	0.22	0.18	3.28	3.78	2.42	1.33	2.55	0.23	3.21	0.71	3.25
Ca	0.88	0.484	1.47	1.68	1.45	0.415	0.134	0.108	1.87	2.23	1.67	1.74	1.63	0.95	1.92	1.65	1.51
Ba	0.157	0.052	0.295	0.175	0.308	0.049	0.010	0.012	0.228	0.198	0.158	0.060	0.177	0.016	0.246	0.059	0.368
Satmagan	**36.63**	66.39	0.40	1.61	0.33	77.35	94.92	**95.82**	2.77	2.13	1.96	**10.39**	0.50	**0.55**	0.52	**0.49**	0.31

Table 65: Assays of samples produced by flowsheet Version 2a taken during the second sampling campaign on 19th November

Labtium Oy
REPORT OF XRF ANALYSIS 20.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121261
Method : 180X-O
Date : 20.11.2014
Comment : **NIO Pilot. Pilot Test Work - Sampling 19.11.2014 from 5:15PM to 6:00PM**

Contents (%)

PRODUCT	Derrick U/S, or Composite Ore Feed	WLIMS Rougher Mags	WLIMS Rougher Non-Mags, or Rgh Spiral Feed (hematitic)	Reichert WW6 wash water rougher spiral products from "WLIMS Rougher Non-Mags" Spiral Rgh Conc. (hematitic)	Coarse Tailings	Cyclone O/F, or WLIMS Cleaner Feed	WLIMS Cleaner M3	WLIMS Cln M4, or Final Magnetite Conc.	WLIMS Cleaner Non-Mags 3 (hematitic)	WLIMS Cleaner Non-Mags 4 (hematitic)	Sweco U/S, or Cln Spiral Feed (hematitic)	Carpco H9000W wash water cleaner spiral products from "Sweco U/S" Spiral Cln Conc., or Final Hematite Conc.	Fine Midds + Tails
	DA L14079231	M1+M2 L14079232	EM2 L14079233	Spir. 1 R L14079234	Spir. 1 J L14079235	SY L14079236	M3 L14079237	M4 L14079238	EM3 L14079239	EM4 L14079240	Sweco alite L14079241	Spir. 2 R L14079242	Spir. 2 VT+J L14079243
SiO2	37.5	13.5	64.6	29.6	72.3	12.8	2.73	2.01	53.7	47.5	39.2	1.91	53.0
TiO2	0.193	0.113	0.271	0.62	0.194	0.109	0.051	0.045	0.417	0.52	0.55	0.88	0.388
Al2O3	4.58	1.52	7.84	2.93	8.66	1.48	0.37	0.29	5.72	5.55	4.21	0.35	5.44
Cr2O3	0.0038	0.0047	0.0034	0.0060	0.0029	0.0048	0.0044	0.0045	0.0045	0.0076	0.0072	0.0091	0.0066
V2O3	0.029	0.046	0.0081	0.013	0.0060	0.046	0.049	0.048	0.012	0.017	0.014	0.017	0.012
MnO	0.054	0.067	0.040	0.019	0.041	0.066	0.061	0.062	0.047	0.062	0.032	0.005	0.042
MgO	3.29	1.66	5.00	2.11	5.25	1.53	0.41	0.30	5.29	6.29	3.78	0.17	4.87
CaO	1.22	0.62	2.12	2.63	2.07	0.58	0.185	0.156	2.66	3.12	2.44	0.69	3.23
Rb2O	0.013	0.011	0.015	0.012	0.015	0.012	0.011	0.0098	0.014	0.014	0.012	0.012	0.011
SrO	0.0000	0.0000	0.0058	0.0000	0.0071	0.0000	0.0000	0.0000	0.0022	0.0011	0.0000	0.0000	0.0018
BaO	0.173	0.055	0.344	0.124	0.406	0.051	0.013	0.014	0.250	0.223	0.168	0.009	0.245
Na2O	1.23	0.31	1.89	0.89	2.05	0.31	0.02	0.01	1.18	0.90	0.99	0.03	1.25
K2O	0.74	0.216	1.54	0.399	1.82	0.197	0.039	0.029	1.05	1.02	0.68	0.016	0.97
ZrO2	0.009	0.006	0.014	0.015	0.014	0.005	0.002	0.002	0.017	0.024	0.016	0.020	0.015
P2O5	**0.58**	0.340	0.92	**1.68**	0.76	0.313	0.118	**0.091**	1.33	1.70	1.42	**0.58**	1.84
OxSumm	96.70	95.00	98.50	94.40	99.40	94.90	94.10	94.00	97.40	96.90	95.60	90.80	97.40
Cu	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000
Ni	0.004	0.004	0.003	0.003	0.004	0.006	0.001	0.005	0.004	0.004	0.004	0.000	0.002
Co	0.019	0.005	0.005	0.007	0.022	0.015	0.005	0.014	0.005	0.019	0.002	0.013	0.002
Zn	0.006	0.007	0.005	0.000	0.005	0.008	0.008	0.006	0.005	0.005	0.004	0.004	0.003
Pb	0.000	0.000	0.006	0.000	0.008	0.000	0.000	0.000	0.004	0.002	0.001	0.000	0.003
Ag	0.000	0.002	0.000	0.001	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.007	0.000
S	0.006	0.004	0.007	0.015	0.008	0.004	0.002	0.002	0.011	0.014	0.014	0.021	0.010
As	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000
Sb	0.011	0.007	0.009	0.011	0.006	0.005	0.005	0.005	0.012	0.010	0.010	0.009	0.010
Bi	0.002	0.002	0.002	0.003	0.002	0.001	0.003	0.001	0.002	0.001	0.003	0.003	0.002
Te	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0041	0.0016	0.0073	0.0090	0.0063	0.0018	0.0011	0.0009	0.0096	0.012	0.0090	0.0069	0.011
Nb	0.0000	0.0000	0.0018	0.0012	0.0020	0.0000	0.0000	0.0000	0.0007	0.0007	0.0007	0.0004	0.0007
Mo	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.005	0.002	0.004	0.015	0.001	0.002	0.001	0.000	0.008	0.007	0.011	0.022	0.007
W	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.001
Cl	0.008	0.004	0.010	0.008	0.010	0.003	0.002	0.002	0.011	0.013	0.009	0.002	0.011
Th	0.0034	0.0041	0.0018	0.0045	0.0012	0.0038	0.0045	0.0050	0.0029	0.0042	0.0040	0.0088	0.0030
U	0.0040	0.0081	0.0000	0.0057	0.0000	0.0081	0.0086	0.0087	0.0016	0.0020	0.0044	0.0092	0.0018
Cs	0.003	0.004	0.001	0.003	0.003	0.002	0.001	0.002	0.000	0.001	0.001	0.003	0.001
La	0.011	0.009	0.018	0.036	0.012	0.005	0.004	0.003	0.021	0.021	0.029	0.058	0.018
Ce	0.021	0.010	0.029	0.050	0.022	0.011	0.008	0.006	0.038	0.044	0.044	0.074	0.032
Ta	0.003	0.000	0.003	0.004	0.001	0.003	0.002	0.000	0.002	0.000	0.002	0.009	0.004
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0001	0.0031	0.0009	0.0019	0.0014	0.0007	0.0041	0.0033	0.0011	0.0016	0.0017	0.0035	0.0020
Si	17.5	6.33	30.2	13.8	33.8	6.00	1.28	0.94	25.1	22.2	18.3	0.89	24.8
Ti	0.116	0.068	0.162	0.372	0.116	0.066	0.030	0.027	0.250	0.313	0.328	0.52	0.233
Cr	0.0026	0.0032	0.0023	0.0041	0.0020	0.0033	0.0030	0.0031	0.0031	0.0052	0.0049	0.0062	0.0045
V	0.020	0.032	0.0055	0.0090	0.0041	0.032	0.033	0.033	0.0083	0.012	0.0093	0.011	0.0083
Fe	**36.5**	59.4	10.7	**41.3**	4.33	60.1	70.0	**70.6**	19.9	23.2	32.6	**66.7**	20.2
Mn	0.042	0.052	0.031	0.015	0.031	0.051	0.048	0.048	0.036	0.048	0.025	0.004	0.033
Mg	1.99	1.00	3.01	1.28	3.17	0.92	0.25	0.18	3.19	3.79	2.28	0.10	2.94
Ca	0.87	0.446	1.51	1.88	1.48	0.411	0.132	0.111	1.90	2.23	1.74	0.493	2.31
Ba	0.155	0.049	0.308	0.111	0.364	0.046	0.011	0.012	0.224	0.200	0.150	0.008	0.219
Satmagan	**38.68**	76.45	0.47	**0.57**	0.38	76.7	93.22	**93.67**	3.17	2.60	1.92	**0.93**	2.13

Table 66: Assays of samples produced by flowsheet Version 2b taken during the sampling campaign on 20th November

Labtium Oy
REPORT OF XRF ANALYSIS 20.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121271
Method : 180X-O
Date : 20.11.2014
Comment : **NIO Pilot. Pilot Test Work - Sampling 20.11.2014 from 11:30AM to 12:00AM**

Contents (%)

PRODUCT	Derrick U/S, or Composite Ore Feed	WLIMS Rougher Mags	WLIMS Rougher Non-Mags, or Rgh Spiral Feed (hematitic)	Reichert WW6 wash water rougher spiral products from "WLIMS Rougher Non-Mags" Spiral Rgh Conc. (hematitic)	Coarse Tailings	Cyclone O/F, or WLIMS Cleaner Feed	WLIMS Cleaner M3	WLIMS Cln M4, or Final Magnetite Conc.	WLIMS Cleaner Non-Mags 3 (hematitic)	WLIMS Cleaner Non-Mags 4 (hematitic)	Sweco U/S, or Cln Spiral Feed (hematitic)	Carpco H9000W wash water cleaner spiral products from "Sweco U/S" Spiral Cln Conc., or Final Hematite Conc	Fine Midds + Tails
	DA L14079436	**M1+M2 L14079437**	**EM2 L14079438**	**Spir. 1 R L14079439**	**Spir. 1 J L14079440**	**SY L14079441**	**M3 L14079442**	**M4 L14079443**	**EM3 L14079444**	**EM4 L14079445**	**Sweco alite L14079446**	**Spir. 2 R L14079447**	**Spir. 2 VT+J L14079448**
SiO2	40.3	13.6	64.0	14.3	71.3	18.5	4.50	3.16	54.9	54.4	43.3	4.67	59.3
TiO2	0.198	0.122	0.286	0.74	0.209	0.134	0.061	0.053	0.399	0.423	0.50	0.86	0.328
Al2O3	5.09	1.46	8.33	1.63	8.79	1.91	0.48	0.36	5.75	5.86	4.53	0.56	6.09
Cr2O3	0.0031	0.0023	0.0029	0.0066	0.0034	0.0047	0.0041	0.0044	0.0047	0.0051	0.0067	0.0072	0.0058
V2O3	0.028	0.045	0.0081	0.015	0.0069	0.042	0.050	0.050	0.011	0.013	0.012	0.017	0.010
MnO	0.052	0.065	0.037	0.010	0.043	0.063	0.069	0.066	0.043	0.055	0.032	0.006	0.044
MgO	3.44	1.38	4.69	1.16	5.11	1.79	0.52	0.39	4.90	5.88	3.77	0.41	5.08
CaO	1.34	0.59	2.05	1.30	2.37	0.72	0.249	0.211	2.24	2.62	2.08	1.32	2.65
Rb2O	0.014	0.011	0.014	0.013	0.016	0.012	0.013	0.013	0.013	0.015	0.013	0.013	0.013
SrO	0.0000	0.0000	0.0056	0.0000	0.0082	0.0000	0.0000	0.0000	0.0025	0.0022	0.0001	0.0000	0.0032
BaO	0.189	0.055	0.327	0.065	0.393	0.073	0.020	0.013	0.263	0.257	0.194	0.021	0.282
Na2O	1.38	0.31	2.11	0.43	2.11	0.46	0.05	0.02	1.27	1.09	1.10	0.10	1.36
K2O	0.83	0.203	1.56	0.220	1.79	0.287	0.061	0.040	1.05	1.13	0.76	0.041	1.17
ZrO2	0.010	0.006	0.015	0.016	0.015	0.006	0.003	0.003	0.015	0.019	0.015	0.019	0.014
P2O5	**0.63**	0.316	0.84	**0.87**	0.95	0.359	0.138	**0.122**	1.09	1.35	1.11	**0.97**	1.27
OxSumm	97.00	94.90	98.50	92.40	99.30	95.30	94.30	94.20	97.40	97.50	96.00	91.20	97.90
Cu	0.001	0.001	0.002	0.001	0.001	0.003	0.004	0.001	0.000	0.002	0.000	0.001	0.001
Ni	0.006	0.005	0.003	0.004	0.003	0.003	0.005	0.004	0.004	0.004	0.004	0.002	0.003
Co	0.019	0.011	0.005	0.015	0.021	0.020	0.008	0.004	0.002	0.020	0.019	0.012	0.019
Zn	0.005	0.005	0.004	0.002	0.004	0.008	0.008	0.005	0.004	0.005	0.003	0.004	0.005
Pb	0.001	0.000	0.005	0.000	0.006	0.000	0.000	0.000	0.003	0.003	0.003	0.000	0.003
Ag	0.000	0.002	0.000	0.004	0.000	0.000	0.002	0.003	0.000	0.000	0.000	0.004	0.000
S	0.008	0.003	0.009	0.018	0.009	0.004	0.002	0.002	0.010	0.009	0.012	0.022	0.009
As	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Sb	0.006	0.007	0.009	0.008	0.008	0.006	0.007	0.007	0.009	0.007	0.009	0.009	0.009
Bi	0.002	0.003	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002
Te	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0050	0.0030	0.0067	0.0080	0.0070	0.0028	0.0015	0.0000	0.0084	0.0086	0.0080	0.0081	0.0092
Nb	0.0000	0.0000	0.0014	0.0007	0.0014	0.0000	0.0000	0.0000	0.0008	0.0011	0.0007	0.0000	0.0009
Mo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.003	0.002	0.004	0.017	0.003	0.002	0.001	0.000	0.008	0.007	0.011	0.022	0.006
W	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.000	0.001
Cl	0.007	0.002	0.010	0.005	0.012	0.003	0.001	0.003	0.011	0.012	0.008	0.004	0.012
Th	0.0025	0.0040	0.0022	0.0067	0.0018	0.0047	0.0043	0.0049	0.0033	0.0026	0.0037	0.0072	0.0027
U	0.0036	0.0077	0.0000	0.0083	0.0000	0.0072	0.0085	0.0093	0.0016	0.0018	0.0033	0.0092	0.0008
Cs	0.001	0.002	0.003	0.000	0.001	0.003	0.003	0.002	0.002	0.001	0.002	0.003	0.002
La	0.013	0.009	0.015	0.051	0.015	0.007	0.005	0.004	0.019	0.018	0.029	0.050	0.015
Ce	0.019	0.012	0.025	0.073	0.023	0.011	0.006	0.005	0.034	0.035	0.042	0.070	0.029
Ta	0.003	0.006	0.002	0.004	0.002	0.000	0.003	0.004	0.001	0.001	0.002	0.000	0.002
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0018	0.0041	0.0014	0.0008	0.0013	0.0006	0.0033	0.0034	0.0017	0.0017	0.0015	0.0021	0.0011
Si	18.8	6.35	29.9	6.67	33.3	8.67	2.10	1.48	25.7	25.4	20.2	2.19	27.7
Ti	0.118	0.073	0.172	0.446	0.125	0.081	0.036	0.032	0.239	0.253	0.301	0.52	0.197
Cr	0.0021	0.0016	0.0020	0.0045	0.0023	0.0032	0.0028	0.0030	0.0032	0.0035	0.0046	0.0049	0.0040
V	0.019	0.030	0.0055	0.011	0.0047	0.029	0.034	0.034	0.0072	0.0090	0.0082	0.011	0.0069
Fe	**33.7**	59.6	10.9	**55.5**	4.70	55.1	68.4	**69.7**	19.6	18.8	29.8	**63.7**	15.7
Mn	0.040	0.051	0.029	0.007	0.033	0.049	0.054	0.051	0.033	0.043	0.025	0.005	0.034
Mg	2.08	0.83	2.83	0.70	3.08	1.08	0.31	0.23	2.96	3.54	2.27	0.25	3.06
Ca	0.95	0.421	1.47	0.93	1.69	0.51	0.178	0.151	1.60	1.87	1.49	0.95	1.90
Ba	0.169	0.050	0.293	0.058	0.352	0.065	0.018	0.012	0.235	0.230	0.174	0.018	0.253
Satmagan	**35.79**	73.97	0.48	**0.66**	0.41	68.51	91.93	**94.18**	1.76	1.27	1.34	**0.98**	1.59

10.6 Pilot plant sampling

Table 67: Size-by-size analyses of cleaner spiral (hematite) concentrates

Labtium Oy
REPORT OF XRF ANALYSIS 24.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121291
Method : 180X-O
Date : 24.11.2014
Comment : **NIO Pilot. "Spir 2 R" hematite cleaner conc's - size-by-size chemistry**

Contents (%)

	Sampling Wed Nov 19th at 5.15PM - 6.00PM				Sampling Thu Nov 20th at 11.30AM - 12.00AM			
	+90 um	75/90 um	32/75 um	-32 um	+90 um	75/90 um	32/75 um	-32 um
	L14079805	L14079806	L14079807	L14079808	L14079809	L14079810	L14079811	L14079812
SiO2	0.99	1.47	2.25	2.82	2.00	2.99	5.24	5.87
TiO2	0.85	0.87	0.87	0.83	0.85	0.87	0.88	0.83
Al2O3	0.27	0.30	0.37	0.38	0.37	0.44	0.60	0.67
Cr2O3	0.0080	0.0075	0.0088	0.012	0.0066	0.0066	0.0085	0.012
V2O3	0.016	0.015	0.017	0.017	0.016	0.015	0.016	0.017
MnO	0.002	0.006	0.005	0.011	0.007	0.007	0.009	0.012
MgO	0.08	0.15	0.18	0.19	0.18	0.30	0.41	0.45
CaO	0.419	0.78	0.82	0.386	1.33	1.52	1.30	0.67
Rb2O	0.012	0.012	0.011	0.012	0.012	0.013	0.013	0.011
SrO	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
BaO	0.010	0.006	0.013	0.009	0.009	0.012	0.016	0.023
Na2O	0.00	0.00	0.04	0.04	0.02	0.04	0.11	0.14
K2O	0.009	0.012	0.015	0.020	0.016	0.023	0.046	0.061
ZrO2	0.010	0.014	0.023	0.023	0.010	0.014	0.024	0.029
P2O5	0.402	0.67	0.65	0.284	1.08	1.17	0.97	0.416
OxSumm	90.70	90.80	90.90	91.00	91.00	91.10	91.30	91.30
Cu	0.002	0.002	0.003	0.004	0.001	0.001	0.001	0.002
Ni	0.002	0.005	0.004	0.003	0.000	0.008	0.002	0.003
Co	0.005	0.005	0.013	0.013	0.005	0.013	0.012	0.030
Zn	0.001	0.003	0.000	0.003	0.003	0.001	0.002	0.000
Pb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ag	0.005	0.007	0.007	0.005	0.004	0.005	0.004	0.004
S	0.022	0.026	0.023	0.019	0.020	0.022	0.024	0.021
As	0.000	0.000	0.000	0.002	0.003	0.002	0.000	0.003
Sb	0.009	0.011	0.008	0.010	0.011	0.008	0.007	0.014
Bi	0.002	0.002	0.002	0.002	0.003	0.004	0.002	0.002
Te	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.0055	0.0081	0.0081	0.0047	0.0064	0.0099	0.0082	0.0073
Nb	0.0000	0.0002	0.0011	0.0006	0.0000	0.0000	0.0004	0.0000
Mo	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.022	0.023	0.022	0.022	0.022	0.022	0.021	0.022
W	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.000
Cl	0.003	0.003	0.004	0.004	0.004	0.004	0.001	0.003
Th	0.0087	0.0073	0.0068	0.0060	0.0071	0.0088	0.0077	0.0060
U	0.010	0.0092	0.0095	0.0094	0.0098	0.010	0.0089	0.0089
Cs	0.002	0.003	0.003	0.002	0.001	0.003	0.001	0.003
La	0.063	0.064	0.051	0.034	0.050	0.055	0.051	0.034
Ce	0.083	0.087	0.075	0.047	0.066	0.077	0.071	0.051
Ta	0.008	0.008	0.005	0.002	0.006	0.003	0.009	0.012
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0005	0.0029	0.0015	0.0032	0.0036	0.0024	0.0045	0.0041
Si	0.46	0.69	1.05	1.32	0.93	1.40	2.45	2.74
Ti	0.51	0.52	0.52	0.496	0.51	0.52	0.53	0.499
Cr	0.0055	0.0051	0.0060	0.0085	0.0045	0.0045	0.0058	0.0084
V	0.011	0.011	0.011	0.012	0.011	0.010	0.011	0.012
Fe	67.9	67.0	66.4	66.6	65.9	64.8	63.3	63.7
Mn	0.002	0.004	0.004	0.008	0.005	0.005	0.007	0.009
Mg	0.05	0.09	0.11	0.11	0.11	0.18	0.25	0.27
Ca	0.299	0.55	0.59	0.275	0.95	1.08	0.93	0.480
Ba	0.009	0.005	0.012	0.008	0.008	0.011	0.014	0.021
Satmagan	0.70	0.69	0.87	2.00	0.73	0.69	0.88	2.15

Table 68: Size-by-size analyses of cleaner spiral (final) tailings

Labtium Oy
REPORT OF XRF ANALYSIS 24.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121295
Method : 180X-O
Date : 24.11.2014
Comment : NIO Pilot. "Spir 2 VT+J" hematite cleaner tails - size-by-size chemistry

Contents (%)

	Sampling Wed Nov 19th at 5.15PM - 6.00PM				Sampling Thu Nov 20th at 11.30AM - 12.00AM			
	+90 um L14079877	75/90 um L14079878	32/75 um L14079879	-32 um L14079880	+90 um L14079881	75/90 um L14079882	32/75 um L14079883	-32 um L14079884
SiO2	69.6	67.6	61.9	34.2	74.8	75.1	67.6	42.6
TiO2	0.178	0.197	0.309	0.59	0.126	0.130	0.239	0.52
Al2O3	6.32	5.89	5.64	4.05	6.95	6.49	6.11	5.10
Cr2O3	0.0031	0.0035	0.0032	0.014	0.0022	0.0029	0.0028	0.013
V2O3	0.0069	0.0071	0.0085	0.016	0.0049	0.0049	0.0085	0.015
MnO	0.040	0.042	0.043	0.039	0.041	0.041	0.037	0.046
MgO	4.98	4.71	4.69	3.51	5.39	4.70	4.67	4.19
CaO	4.50	5.18	4.00	2.03	3.14	3.52	3.04	2.05
Rb2O	0.012	0.0065	0.0090	0.012	0.016	0.0098	0.011	0.011
SrO	0.0060	0.0069	0.0038	0.0000	0.0062	0.0067	0.0046	0.0008
BaO	0.345	0.328	0.288	0.144	0.394	0.357	0.312	0.187
Na2O	1.45	1.39	1.34	0.93	1.53	1.57	1.50	1.14
K2O	1.32	1.14	1.01	0.54	1.62	1.31	1.14	0.70
ZrO2	0.008	0.009	0.011	0.023	0.007	0.007	0.009	0.023
P2O5	2.52	3.00	2.25	1.04	1.55	1.76	1.53	0.98
OxSumm	99.10	97.80	98.20	95.10	99.50	99.50	98.70	96.10
Cu	0.001	0.001	0.002	0.001	0.000	0.000	0.000	0.002
Ni	0.004	0.004	0.003	0.005	0.004	0.004	0.003	0.006
Co	0.027	0.038	0.023	0.018	0.018	0.022	0.021	0.016
Zn	0.004	0.006	0.004	0.005	0.004	0.003	0.003	0.005
Pb	0.005	0.008	0.004	0.000	0.006	0.006	0.004	0.002
Ag	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S	0.011	0.013	0.010	0.014	0.005	0.006	0.007	0.013
As	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sb	0.010	0.009	0.008	0.007	0.007	0.007	0.008	0.006
Bi	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.003
Te	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Y	0.012	0.013	0.012	0.0085	0.0070	0.0083	0.0079	0.0097
Nb	0.0011	0.0024	0.0009	0.0011	0.0013	0.0009	0.0010	0.0009
Mo	0.0001	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sn	0.004	0.003	0.005	0.011	0.002	0.001	0.004	0.010
W	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.000
Cl	0.012	0.012	0.014	0.006	0.013	0.014	0.011	0.007
Th	0.0017	0.0018	0.0027	0.0035	0.0010	0.0012	0.0017	0.0033
U	0.0000	0.0000	0.0000	0.0052	0.0000	0.0000	0.0000	0.0040
Cs	0.001	0.002	0.002	0.001	0.001	0.002	0.003	0.002
La	0.010	0.015	0.018	0.024	0.007	0.011	0.015	0.025
Ce	0.025	0.026	0.031	0.041	0.017	0.022	0.023	0.041
Ta	0.000	0.001	0.002	0.002	0.002	0.002	0.001	0.001
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0009	0.0012	0.0009	0.0011	0.0006	0.0010	0.0010	0.0026
Si	32.5	31.6	28.9	16.0	35.0	35.1	31.6	19.9
Ti	0.107	0.118	0.185	0.352	0.076	0.078	0.143	0.315
Cr	0.0021	0.0024	0.0022	0.0097	0.0015	0.0020	0.0019	0.0090
V	0.0047	0.0048	0.0058	0.011	0.0033	0.0033	0.0058	0.010
Fe	6.03	6.30	12.9	37.1	3.00	3.39	9.62	29.8
Mn	0.031	0.033	0.033	0.030	0.032	0.032	0.029	0.036
Mg	3.00	2.84	2.83	2.12	3.25	2.83	2.81	2.53
Ca	3.21	3.70	2.86	1.45	2.24	2.52	2.17	1.47
Ba	0.309	0.294	0.258	0.129	0.353	0.320	0.279	0.167
Satmagan	**1.00**	**0.91**	**0.90**	**4.43**	**0.50**	**0.46**	**0.51**	**3.41**

10.7 Recleaning of SLon 2 hematite concentrate by Carpco H9000W spiral concentrator

Table 69: Assays of feed and products of spiral concentrator recleaning the SLon 2 hematite concentrate

Labtium Oy
REPORT OF XRF ANALYSIS 21.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121281
Method : 180X-O
Date : 21.11.2014
Comment : NIO Pilot. 17-19.11.2014 "SLon 2 Mags" hematite pre-concentrate
Wash water spiral recleaning (Carpco H9000W) - Fri 21.11.2014

Contents (%)

	Spiral Feed Spir. SY L14079573	Spiral Conc. Spir. R L14079574	Spiral Tails Spir. J L14079575
SiO2	21.8	**1.99**	**36.6**
TiO2	0.68	0.89	0.452
Al2O3	2.08	0.35	3.31
Cr2O3	0.019	0.011	0.029
V2O3	0.020	0.019	0.022
MnO	0.037	0.011	0.060
MgO	2.76	0.24	4.52
CaO	2.88	1.28	4.20
Rb2O	0.012	0.011	0.011
SrO	0.0000	0.0000	0.0000
BaO	0.084	0.010	0.151
Na2O	0.38	0.02	0.60
K2O	0.309	0.017	0.57
ZrO2	0.016	0.018	0.016
P2O5	1.91	**0.97**	**2.64**
OxSumm	93.90	90.90	96.20
Cu	0.001	0.004	0.002
Ni	0.007	0.004	0.006
Co	0.016	0.009	0.015
Zn	0.002	0.003	0.005
Pb	0.000	0.000	0.002
Ag	0.000	0.004	0.000
S	0.013	0.011	0.010
As	0.003	0.000	0.000
Sb	0.007	0.009	0.008
Bi	0.002	0.002	0.002
Te	0.000	0.000	0.000
Y	0.010	0.0066	0.013
Nb	0.0000	0.0000	0.0000
Mo	0.0000	0.0000	0.0000
Sn	0.014	0.021	0.009
W	0.001	0.000	0.000
Cl	0.005	0.002	0.010
Th	0.0055	0.0057	0.0043
U	0.0064	0.0091	0.0038
Cs	0.004	0.003	0.003
La	0.020	0.017	0.017
Ce	0.032	0.027	0.034
Ta	0.006	0.006	0.004
LOI	0.0000	0.0000	0.0000
Ga	0.0000	0.0020	0.0023
Si	10.2	0.93	17.1
Ti	0.405	0.54	0.271
Cr	0.013	0.0072	0.020
V	0.014	0.013	0.015
Fe	47.2	**66.0**	**33.3**
Mn	0.029	0.008	0.047
Mg	1.66	0.14	2.73
Ca	2.06	0.92	3.00
Ba	0.075	0.009	0.135
Satmagan	10.25	**0.50**	**17.00**

10.8 Phosphate flotation from hematite concentrate

Table 70: Assays of 'grab samples' taken from phosphate flotation circuit on 25th November; ApF = froth, Cell Con = Cell contents or concentrate; Rgh = Rougher, Cln = Cleaner, Scav = Scavenger

LABTIUM

Labtium Oy
REPORT OF XRF ANALYSIS 25.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121305
Method : 180X-O
Date : 25.11.2014
Comment : **Hematite Pre-Conc - Apatite Flotation - rapid grab samples 25.11.2014 at 10.40AM and 2.00PM**

Contents (%)

	Cln Cell Con J2/10.40 L14080400	Rgh Cell ApF R1/10.40 L14080401	Rgh Cell Con J1/10.40 L14080402	Cln Cell ApF R2/10.40 L14080403	Scav Cell ApF RR/10.40 L14080404	Scav Cell Con RJ/10.40 L14080405	Cln Cell Con J2/14.00 L14080406
SiO2	9.39	2.66	4.12	2.41	1.20	6.74	4.85
TiO2	0.88	0.61	0.86	0.82	0.477	0.58	0.87
Al2O3	0.87	0.59	0.48	0.53	0.27	1.62	0.52
Cr2O3	0.0086	0.0099	0.0080	0.016	0.0072	0.0077	0.0072
V2O3	0.017	0.012	0.016	0.013	0.0076	0.011	0.017
MnO	0.014	0.008	0.009	0.008	0.003	0.026	0.007
MgO	0.75	0.85	0.39	0.73	0.31	2.65	0.44
CaO	0.55	23.6	0.67	13.4	30.4	23.2	0.410
Rb2O	0.0097	0.0071	0.013	0.0090	0.0067	0.012	0.011
SrO	0.0000	0.0041	0.0000	0.0000	0.0062	0.0039	0.0000
BaO	0.037	0.032	0.016	0.019	0.020	0.059	0.016
Na2O	0.21	0.03	0.08	0.00	0.01	0.08	0.09
K2O	0.071	0.109	0.032	0.062	0.029	0.376	0.033
ZrO2	0.030	0.010	0.019	0.011	0.007	0.011	0.022
P2O5	0.152	19.9	0.417	13.0	26.5	19.5	0.144
OxSumm	91.60	95.10	91.20	93.50	96.40	95.70	91.20
Cu	0.000	0.010	0.000	0.005	0.008	0.013	0.001
Ni	0.004	0.007	0.005	0.005	0.006	0.007	0.003
Co	0.013	0.000	0.012	0.004	0.000	0.000	0.000
Zn	0.003	0.004	0.004	0.002	0.002	0.005	0.003
Pb	0.000	0.009	0.000	0.011	0.012	0.010	0.000
Ag	0.004	0.034	0.005	0.070	0.049	0.024	0.002
S	0.014	0.309	0.013	0.269	0.290	0.293	0.008
As	0.001	0.006	0.000	0.004	0.006	0.005	0.002
Sb	0.008	0.015	0.009	0.009	0.012	0.014	0.009
Bi	0.002	0.003	0.002	0.002	0.002	0.002	0.003
Te	0.000	0.000	0.000	0.002	0.000	0.000	0.000
Y	0.0068	0.106	0.0060	0.127	0.146	0.096	0.0029
Nb	0.0003	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Mo	0.0000	0.027	0.0000	0.0008	0.033	0.010	0.0000
Sn	0.020	0.015	0.021	0.019	0.012	0.013	0.022
W	0.000	0.161	0.000	0.001	0.242	0.007	0.009
Cl	0.004	0.030	0.005	0.019	0.042	0.031	0.003
Th	0.0069	0.041	0.0066	0.081	0.063	0.032	0.0053
U	0.0091	0.0084	0.0083	0.013	0.0084	0.0070	0.0092
Cs	0.003	0.001	0.004	0.000	0.000	0.001	0.003
La	0.029	0.82	0.038	1.51	1.31	0.60	0.020
Ce	0.046	1.10	0.051	2.04	1.78	0.83	0.028
Ta	0.006	0.007	0.005	0.003	0.005	0.005	0.002
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0024	0.0014	0.0021	0.0019	0.0003	0.0011	0.0001
Si	4.39	1.24	1.92	1.13	0.56	3.15	2.27
Ti	0.53	0.368	0.51	0.489	0.286	0.350	0.52
Cr	0.0059	0.0068	0.0055	0.011	0.0049	0.0053	0.0049
V	0.012	0.0081	0.011	0.0085	0.0052	0.0077	0.012
Fe	61.0	34.0	65.2	44.9	25.2	30.1	65.0
Mn	0.011	0.006	0.007	0.006	0.003	0.020	0.005
Mg	0.45	0.52	0.23	0.44	0.18	1.60	0.27
Ca	0.390	16.8	0.480	9.56	21.7	16.6	0.293
Ba	0.033	0.029	0.014	0.017	0.018	0.053	0.015
Satmagan	n.m.	0.98	1.23	0.93	0.93	1.29	**1.23**

Table 71: Assays of samples taken from phosphate flotation circuit on 25th November; ApF = froth, Cell Con = Cell contents or concentrate; Rgh = Rougher, Cln = Cleaner, Scav = Scavenger

Labtium Oy
REPORT OF XRF ANALYSIS 25.11.2014

Customer : Markku Kuusisto, GTK Mintec
Order : 121313
Method : 180X-O
Date : 25.11.2014
Comment : **Hematite Pre-Conc - Apatite Flotation - Sampling 25.11.2014 at 2.50PM - 3.10PM**

Contents (%)

	Rgh Cell ApF R1 L14080502	Rgh Cell Con J1 L14080503	Cln Cell ApF R2 L14080504	Cln Cell Con J2 L14080505	Scav Cell ApF RR L14080506	Scav Cell Con RJ L14080507	Flot Feed Syöte L14080508
SiO2	3.41	4.22	2.19	3.80	3.76	14.4	3.66
TiO2	0.55	0.87	0.73	0.86	0.64	0.78	0.88
Al2O3	0.74	0.51	0.45	0.46	0.53	2.09	0.46
Cr2O3	0.011	0.0082	0.014	0.0067	0.0092	0.027	0.0083
V2O3	0.011	0.017	0.014	0.016	0.013	0.019	0.016
MnO	0.019	0.011	0.010	0.008	0.013	0.036	0.007
MgO	1.13	0.38	0.70	0.31	0.72	2.70	0.36
CaO	26.2	0.68	18.0	0.333	21.7	4.56	1.25
Rb2O	0.0074	0.011	0.0089	0.0098	0.0082	0.012	0.011
SrO	0.0057	0.0000	0.0000	0.0000	0.0025	0.0000	0.0000
BaO	0.040	0.016	0.016	0.015	0.027	0.079	0.015
Na2O	0.06	0.08	0.03	0.06	0.08	0.32	0.06
K2O	0.141	0.032	0.052	0.027	0.056	0.345	0.030
ZrO2	0.009	0.019	0.010	0.019	0.014	0.029	0.020
P2O5	22.2	0.441	15.7	0.135	18.4	3.61	0.95
OxSumm	95.70	91.10	94.00	91.10	94.80	93.20	91.10
Cu	0.015	0.002	0.005	0.000	0.007	0.007	0.000
Ni	0.006	0.003	0.009	0.003	0.003	0.010	0.007
Co	0.000	0.017	0.006	0.004	0.000	0.017	0.010
Zn	0.003	0.003	0.000	0.004	0.002	0.005	0.002
Pb	0.006	0.000	0.003	0.000	0.004	0.000	0.000
Ag	0.029	0.004	0.032	0.004	0.024	0.004	0.005
S	0.335	0.014	0.203	0.047	0.216	0.069	0.022
As	0.006	0.000	0.006	0.003	0.005	0.000	0.005
Sb	0.009	0.009	0.012	0.010	0.012	0.008	0.010
Bi	0.003	0.002	0.004	0.002	0.004	0.002	0.002
Te	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Y	0.106	0.0063	0.085	0.0045	0.088	0.025	0.0073
Nb	0.0000	0.0010	0.0000	0.0002	0.0006	0.0006	0.0003
Mo	0.030	0.0000	0.0021	0.0000	0.011	0.0000	0.0000
Sn	0.012	0.021	0.016	0.021	0.016	0.016	0.022
W	0.198	0.000	0.000	0.001	0.026	0.001	0.001
Cl	0.035	0.002	0.024	0.002	0.029	0.011	0.005
Th	0.036	0.0079	0.034	0.0048	0.026	0.0097	0.0069
U	0.0074	0.010	0.0091	0.0090	0.0076	0.0077	0.0093
Cs	0.000	0.004	0.000	0.002	0.000	0.001	0.002
La	0.66	0.033	0.58	0.013	0.425	0.111	0.049
Ce	0.91	0.044	0.81	0.023	0.61	0.159	0.069
Ta	0.004	0.001	0.007	0.007	0.002	0.004	0.007
LOI	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Ga	0.0026	0.0004	0.0014	0.0016	0.0005	0.0026	0.0000
Si	1.59	1.97	1.02	1.77	1.76	6.75	1.71
Ti	0.332	0.52	0.435	0.51	0.383	0.470	0.53
Cr	0.0073	0.0056	0.0099	0.0046	0.0063	0.018	0.0057
V	0.0075	0.012	0.0097	0.011	0.0088	0.013	0.011
Fe	30.0	65.0	42.0	66.0	36.7	49.5	64.6
Mn	0.015	0.009	0.008	0.006	0.010	0.028	0.006
Mg	0.68	0.23	0.42	0.19	0.43	1.63	0.22
Ca	18.7	0.485	12.9	0.238	15.5	3.26	0.90
Ba	0.036	0.014	0.015	0.013	0.024	0.071	0.014
Satmagan	1.19	1.21	1.19	**1.09**	1.12	4.04	1.14

10.9 Products

Table 72: Assays of samples of final hematite concentrate after flotation to remove phosphates

Labtium Oy
REPORT OF XRF ANALYSIS 27.11.2014

Customer	: Markku Kuusisto, GTK Mintec
Order	: 121336
Method	: 180X-O
Date	: 27.11.2014
Comment	**: NIO Pilot. 25. & 26.11.2014 - Hematite End Product Concentrate lots - sampling of the two product barrels (after apatite removal flotations)**

Dry weight (kg) **192** **96** estimated, prior to filtration

Contents (%)

	25.11. L14081432	26.11. L14081433
SiO2	4.00	6.69
TiO2	0.86	0.87
Al2O3	0.48	0.66
Cr2O3	0.0079	0.0091
V2O3	0.016	0.016
MnO	0.009	0.010
MgO	0.36	0.60
CaO	0.373	0.56
Rb2O	0.011	0.013
SrO	0.0000	0.0000
BaO	0.014	0.023
Na2O	0.07	0.14
K2O	0.029	0.048
ZrO2	0.020	0.022
P2O5	0.158	0.247
OxSumm	91.10	91.40
Cu	0.001	0.001
Ni	0.003	0.001
Co	0.015	0.003
Zn	0.002	0.004
Pb	0.000	0.000
Ag	0.004	0.003
S	0.008	0.008
As	0.001	0.003
Sb	0.009	0.009
Bi	0.002	0.004
Te	0.000	0.000
Y	0.0028	0.0031
Nb	0.0014	0.0012
Mo	0.0000	0.0000
Sn	0.021	0.020
W	0.000	0.001
Cl	0.002	0.002
Th	0.0054	0.0047
U	0.0085	0.0088
Cs	0.003	0.003
La	0.017	0.015
Ce	0.028	0.024
Ta	0.002	0.001
LOI	0.0000	0.0000
Ga	0.0000	0.0023
Si	1.87	3.13
Ti	0.51	0.52
Cr	0.0054	0.0062
V	0.011	0.011
Fe	65.7	63.3
Mn	0.007	0.008
Mg	0.22	0.36
Ca	0.267	0.402
Ba	0.013	0.020
Satmagan	**1.19**	**1.39**

11 APPENDIX 3 – QA/QC

Table 73: QA/QC samples sent for independent verification

Mintec
Outokumpu

Outokumpu

Nordic Iron Ore - GTK Pilot Test Work on Blötberget magnetite-hematite iron ore sample

Client & contact person : Nordic Iron Ore (NIO), Paul Marsden
Project supervision : Tata Steel Consulting (TSC), Matthias Reisinger
Project name : "NIO Pilot"
Project code (GTK) : 1281282
Contact person at GTK : Markku Kuusisto

QA/QC Duplicates of Labtium Assay Samples from Pilot Test Work - Listing for ALS Sweden

Sample Code	Pilot Sampling Data		Labtium Assay Code	Explanation	ALS					Labtium (GTK)				
	Date	Time			Fe	SiO2	P	P2O5	TiO2	Fe	SiO2	P	P2O5	TiO2
Derrick U/S	13/11/2014	11.30	L14076975	Head ore feed	38.47	34.7	0.244	0.559		36.90	36.90	0.253	0.580	
Derrick U/S	13/11/2014	14.10	L14077044	Head ore feed	40.34	32.6	0.237	0.543		38.50	35.10	0.262	0.600	
M4	14/11/2014	12.30	L14077146	Final Magnetite Conc.	68.68	3.04	0.064	0.147		69.80	2.88	0.052	0.119	
EM3	14/11/2014	14.20	L14077397	Magnetite Cln Tails	21.80	50.8	0.587	1.344		20.40	52.60	0.620	1.420	
M4	14/11/2014	14.20	L14077398	Final Magnetite Conc.	70.25	1.46	0.040	0.092		71.20	1.39	0.032	0.073	
SLon 2 Mags	17/11/2014	14.40 - 15.05	L14078302	Hematite Pre-Conc.	48.36	20.7	0.534	1.223		47.90	21.50	0.511	1.170	
SLon 2 EM	17/11/2014	14.40 - 15.05	L14078303	Hematite Cln Tails	25.70	44.2	0.369	0.845		23.00	47.10	0.415	0.950	
Derrick U/S	18/11/2014	12.30 - 13.15	L14078544	Head ore feed	37.18	35.9	0.250	0.573		35.1	38.7	0.258	0.59	
SLon 1 EM	18/11/2014	12.30 - 13.15	L14078548	Hematite Rgh Tails	10.42	64.5	0.339	0.776		9.59	65.7	0.410	0.94	
M4	18/11/2014	12.30 - 13.15	L14078550	Final Magnetite Conc.	69.34	2.21	0.054	0.124		70.8	1.97	0.040	0.091	
SLon 2 M	18/11/2014	12.30 - 13.15	L14078554	Hematite Pre-Conc.	45.68	23.0	0.927	2.123		44.0	25.0	1.000	2.29	
SLon 2 EM	18/11/2014	12.30 - 13.15	L14078555	Hematite Cln Tails	22.25	51.4	0.464	1.063		19.9	54.1	0.507	1.16	
Spir R	18/11/2014	12.30 - 13.15	L14078556	Hematite Pre-Conc.	62.15	5.48	0.515	1.179	1.00	62.2	6.00	0.498	1.14	0.91
Spir VT+J	18/11/2014	12.30 - 13.15	L14078557	Hematite Cln Tails	14.04	60.7	0.441	1.010		13.1	62.2	0.485	1.11	
Derrick U/S	18/11/2014	16.45 - 17.30	L14078565	Head ore feed	35.93	37.3	0.26	0.595		35.4	38.6	0.275	0.63	
M1+M2	18/11/2014	16.45 - 17.30	L14078566	Magnetite Rgh Conc.	62.23	9.57	0.136	0.311		61.5	11.5	0.131	0.299	
M4	18/11/2014	16.45 - 17.30	L14078571	Final Magnetite Conc.	69.51	2.15	0.053	0.121		70.6	2.09	0.043	0.099	
SLon 2 M	18/11/2014	16.45 - 17.30	L14078575	Hematite Pre-Conc.	51.88	16.7	0.705	1.614		49.8	19.5	0.747	1.71	
SLon 2 EM	18/11/2014	16.45 - 17.30	L14078576	Hematite Cln Tails	28.80	43.0	0.694	1.589		26.4	45.6	0.751	1.72	
Spir R	18/11/2014	16.45 - 17.30	L14078577	Hematite Pre-Conc.	64.88	2.79	0.433	0.992	1.00	64.6	3.39	0.450	1.03	0.89
Spir VT+J	18/11/2014	16.45 - 17.30	L14078578	Hematite Cln Tails	18.42	54.7	0.72	1.649		17.2	56.0	0.817	1.87	
Spir 2 R	18/11/2014	16.45 - 17.30	L14078579	Hematite Pre-Conc.	48.21	19.85	0.948	2.171		43.5	24.9	1.170	2.68	
Spir 2 J	18/11/2014	16.45 - 17.30	L14078580	Hematite Cln Tails	4.68	71.1	0.266	0.609		4.09	72.2	0.306	0.70	
Derrick U/S	19/11/2014	13.15 - 14.00	L14079184	Head ore feed	38.66	34.5	0.253	0.579		36.2	37.7	0.253	0.58	
SY	19/11/2014	13.15 - 14.00	L14079189	Magnetite Cln Feed	60.41	11.45	0.144	0.330		60.5	12.6	0.132	0.302	
M4	19/11/2014	13.15 - 14.00	L14079190	Final Magnetite Conc.	69.57	2.08	0.054	0.124		70.7	1.98	0.039	0.09	
SLon 2 M	19/11/2014	13.15 - 14.00	L14079194	Hematite Pre-Conc.	52.78	15.9	0.684	1.566		51.3	18.0	0.694	1.59	
SLon 2 EM	19/11/2014	13.15 - 14.00	L14079195	Hematite Cln Tails	30.97	41.3	0.508	1.163		28.0	45.0	0.528	1.21	
Spir R	19/11/2014	13.15 - 14.00	L14079196	Hematite Pre-Conc.	63.91	3.73	0.447	1.024	0.99	64.1	4.22	0.441	1.01	0.87
Spir VT+J	19/11/2014	13.15 - 14.00	L14079197	Hematite Cln Tails	18.32	55.4	0.534	1.223		17.2	57.0	0.585	1.34	
Spir 2 R	19/11/2014	13.15 - 14.00	L14079198	Hematite Pre-Conc.	55.26	13.0	0.679	1.555		53.8	14.9	0.703	1.61	
Spir 2 J	19/11/2014	13.15 - 14.00	L14079199	Hematite Cln Tails	5.02	70.7	0.302	0.692		4.32	72.1	0.345	0.79	
Derrick U/S	19/11/2014	17.15 - 18.00	L14079231	Head ore feed	38.13	35.1	0.239	0.547		36.5	37.5	0.253	0.58	
Spir 1 J	19/11/2014	17.15 - 18.00	L14079235	Hematite Rgh Tails	4.96	71.3	0.292	0.669		4.33	72.3	0.332	0.76	
M4	19/11/2014	17.15 - 18.00	L14079238	Final Magnetite Conc.	69.47	2.27	0.051	0.117		70.6	2.01	0.040	0.091	
EM3	19/11/2014	17.15 - 18.00	L14079239	Magnetite Cln Tails	20.68	52.4	0.538	1.232		19.9	53.7	0.581	1.33	
Spir 2 R	19/11/2014	17.15 - 18.00	L14079242	Hematite Conc.	66.60	1.58	0.250	0.573	1.01	66.70	1.91	0.253	0.58	0.88
Derrick U/S	20/11/2014	11.30 - 12.00	L14079436	Head ore feed	35.07	38.3	0.251	0.575		33.7	40.3	0.275	0.63	
Spir 1 J	20/11/2014	11.30 - 12.00	L14079440	Hematite Rgh Tails	5.27	70.8	0.357	0.818		4.7	71.3	0.415	0.95	
SY	20/11/2014	11.30 - 12.00	L14079441	Magnetite Cln Feed	56.13	16.15	0.158	0.362		55.1	18.5	0.157	0.359	
M4	20/11/2014	11.30 - 12.00	L14079443	Final Magnetite Conc.	68.64	3.10	0.063	0.144		69.7	3.16	0.053	0.122	
Spir 2 R	20/11/2014	11.30 - 12.00	L14079447	Hematite Conc.	63.83	3.95	0.438	1.003	0.99	63.7	4.67	0.424	0.97	0.85
Spir SY	21/11/2014	11.00 - 11.30	L14079573	Hematite Re-Cln Feed	49.08	19.30	0.81	1.848		47.2	21.8	0.834	1.91	
Spir R	21/11/2014	11.00 - 11.30	L14079574	Hematite Conc.	65.54	1.88	0.44	0.996	1.04	66.0	1.99	0.424	0.97	0.89
Spir J	21/11/2014	11.00 - 11.30	L14079575	Hematite Re-Cln Tails	34.66	34.50	1.11	2.542		33.3	36.6	1.153	2.64	
R2	25/11/2014	10.40	L14080403	Apatite Froth Product	40.52	1.99	4.97	11.381		44.9	2.41	5.677	13	
J2	25/11/2014	14.00	L14080406	Hematite Cln Conc.	64.78	4.34	0.082	0.188	1.03	65.0	4.85	0.063	0.144	0.87
R1	25/11/2014	14.50 - 15.10	L14080502	Apatite Froth Product	29.82	2.94	8.77	20.083		30.0	3.41	9.694	22.2	
J2	25/11/2014	14.50 - 15.10	L14080505	Hematite Cln Conc.	65.83	3.35	0.077	0.176	1.03	66.0	3.80	0.059	0.135	0.86
Syöte	25/11/2014	14.50 - 15.10	L14080508	Hematite Flotation Feed	64.27	3.28	0.444	1.017	1.00	64.6	3.66	0.415	0.95	0.88
Syöte	26/11/2014	13.10 - 13.40	L14081284	Hematite Flotation Feed	62.18	5.50	0.509	1.166	1.00	61.8	6.43	0.550	1.26	
R1	26/11/2014	13.10 - 13.40	L14081285	Apatite Froth Product	28.73	3.80	8.83	20.221		27.9	4.39	10.000	22.9	
J2	26/11/2014	13.10 - 13.40	L14081288	Hematite Cln Conc.	63.42	5.83	0.132	0.302	1.02	63.3	6.56	0.114	0.262	
J2	26/11/2014	12.30 - 14.00	L14081274	Hematite Cln Conc.	64.07	5.14	0.128	0.293	1.02	64.0	5.85	0.093	0.214	
J2	27/11/2014	Barrel 25.11.2014	L14081432	Hematite Cln Conc.	65.40	3.71	0.075	0.172	1.02	65.7	4.00	0.069	0.158	
J2	27/11/2014	Barrel 26.11.2014	L14081433	Hematite Cln Conc.	63.92	5.37	0.098	0.224	1.02	63.3	6.69	0.108	0.247	

12 APPENDIX 4 – PROCESS DATA

12.1 Process data for 14/11/2014

NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

Feed	0.30	t/h	Date:	14.11.2014	Note:
Feed S.G.	**3.60**	t/m3	Time:	12:00	
Non-Mags S.G.	2.90	t/m3			
Mags S.G.	5.00	t/m3			

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h
Feed Ore	**0.0**		30.0		100.0	**0.000**
Feed	1960	1.0	10.1	0.36	67.8	**0.474**
BM Discharge	1410	3.4	16.0	0.77	40.3	**0.434**
Cyclone O/F	1070	10.0	5.2	6.92	9.1	0.671
Cyclone U/F	1715	1.0	8.4	0.43	57.7	0.424
WLCon3	1435	1.0	6.4	0.56	37.9	0.306
WLTail3	1015	3.4	2.7	4.53	2.3	0.104
WLCon4	1455	1.0	9.6	0.38	43.3	0.236
WLTail4	1010	3.4	16.3	0.75	1.5	0.011
WLCon1	1860	1.0	8.3	0.43	57.8	0.466
WLTail1	1100	3.4	8.9	1.38	13.9	0.210
WLCon2	1012	1.0	7.4	0.49	1.5	0.007
WLTail2	1100	3.4	6.2	1.97	13.9	0.301

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**0.00**	**2.20**	0.00	**0.0**	0.0	
BM301	**6.20**	**1.83**	4.37	**9.2**	100.0	
Grinding	**6.20**	**4.03**	4.37	**9.2**	100.0	

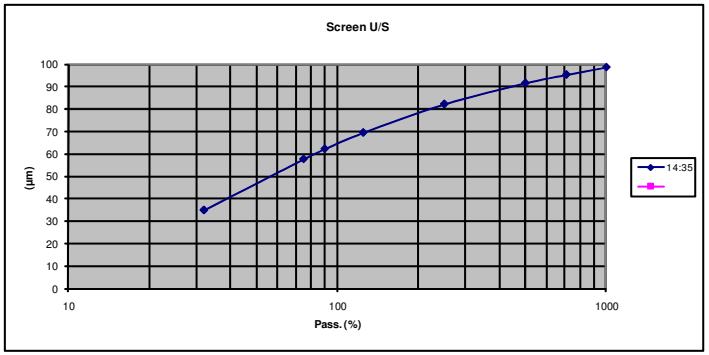
	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

0.607
0.248
240

780
2060
69.66875
36.4
120

Screen	20.10.2014 14:35
1000	98.6
710	95.3
500	91.5
250	82.2
125	69.5
90	62.3
75	57.7
32	35

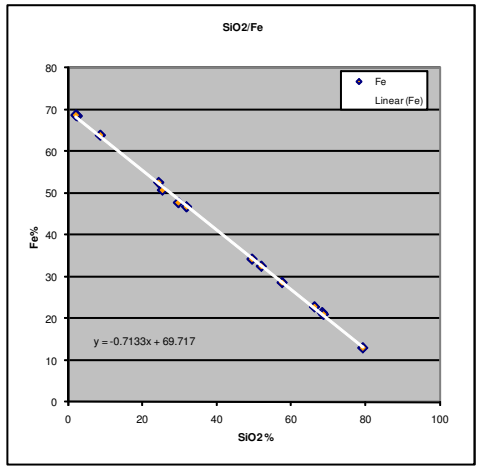
240
200
0.8333333
19.09
10
5
39.166667



28.6 1716
0.05
85.8
0.12
715
109.79167
165

-0.7116
69.681

SiO2	5.0
Fe	66.1
SiO2	Fe
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13



NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

Feed	0.30	t/h		Date:	14.11.2014	Note:
Feed S.G.	**3.60**	t/m3		Time:	14:00:00 PM	
Non-Mags S.G.	2.90	t/m3				
Mags S.G.	5.00	t/m3				

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h	
Feed Ore	**0.0**		30.0		100.0	**0.000**	
Feed	1700	1.0	16.3	0.22	57.0	**0.214**	
BM Discharge	1555	3.4	28.8	0.43	49.4	**0.327**	
Cyclone O/F	1040	10.0	5.6	6.43	5.3	0.356	
Cyclone U/F	1920	1.0	13.7	0.26	66.3	0.335	0.456
WLCon3	1300	1.0	8.7	0.41	28.8	0.155	
WLTail3	1010	3.4	2.1	5.83	1.5	0.089	0.244
WLCon4	1280	1.0	10.9	0.33	30.3	0.128	0.128
WLTail4	1002	3.4	17.0	0.72	0.3	0.002	
WLCon1	1860	1.0	8.3	0.43	57.8	0.466	
WLTail1	1100	3.4	8.9	1.38	13.9	0.210	
WLCon2	1012	1.0	7.4	0.49	1.5	0.007	
WLTail2	1100	3.4	6.2	1.97	13.9	0.301	

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**0.00**	**2.20**	0.00	**0.0**	0.0	
BM301	**6.20**	**1.83**	4.37	**12.3**	100.0	
Grinding	**6.20**	**4.03**	4.37	**12.3**	100.0	

	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

240

2060

780

69.66875

36.4

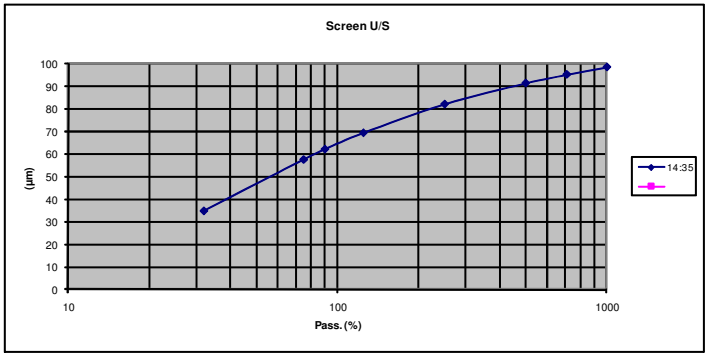
120

Screen	20.10.2014 14:35
1000	98.6
710	95.3
500	91.5
250	82.2
125	69.5
90	62.3
75	57.7
32	35

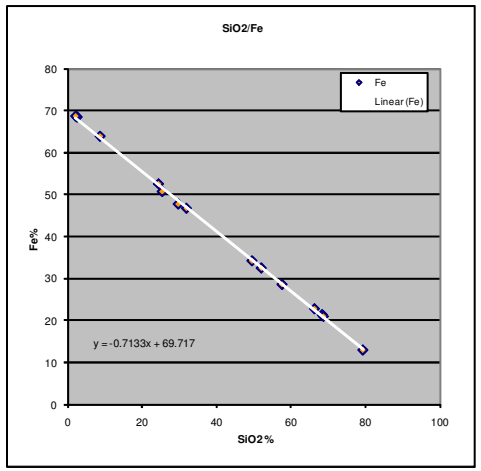
240
200
0.8333333
19.09
10
5
39.166667

28.6 1716
0.05
85.8
0.12
715

109.79167
165



	-0.7116
	69.681
SiO2	***5.0***
Fe	***66.1***
SiO2	*Fe*
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13



12.2 Process data for 18/11/2014

GTK

NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

2060

Feed	0.30	t/h		Date:	18.11.2014	Note:	
Feed S.G.	**3.60**	t/m3		Time:	**12:00**		
Non-Mags S.G.	2.90	t/m3					
Mags S.G.	**5.00**	t/m3					

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h	
Feed Ore	**5.7**		30.0		100.0	**0.684**	
RM Discharge	1720	3.4	16.4	0.75	58.0	**0.744**	
BM Discharge	1740	3.4	29.7	0.41	53.2	**0.381**	
Derrick o/s	1010	3.4	21.3	0.57	1.4	**0.008**	
Derrick u/s	1270	3.4	6.4	1.91	29.4	**0.715**	
Cyclone O/F	1070	10.0	5.2	6.92	9.1	0.671	
Cyclone U/F	1715	1.0	8.4	0.43	57.7	0.424	0.607
WLCon1	1630	1.0	10.0	0.36	48.3	0.284	
WLTail1	1130	3.4	7.2	1.70	17.6	0.337	
WLCon2	1015	1.0	94.0	0.04	1.8	0.001	
WLTail2	1105	3.4	5.5	2.23	14.5	0.357	
WLCon3	1510	1.0	7.1	0.51	42.2	0.323	
WLTail3	1010	3.4	2.4	5.10	1.5	0.078	0.279
WLCon4	1480	1.0	8.7	0.41	44.9	0.275	
WLTail4	1005	3.4	21.0	0.58	0.8	0.004	
I SLon M	1005	3.4	6.4	1.91	0.7	0.013	
I SLon EM	1105	3.4	6.1	2.01	13.2	0.292	0.078
II SLon M	1005	1.0	4.1	0.88	0.7	0.006	
II SLon EM	1030	3.4	6.5	1.88	4.0	0.078	0.053
Skako o/s	1205	1.0	19.3	0.19	23.6	0.053	
Skako u/s	1045	3.4	7.6	1.61	6.0	0.100	
SpirCon	1090	1.0	31.4	0.11	11.4	0.014	
SpirTails	1025	3.4	6.6	1.85	3.4	0.064	
Lamella o/f	1001	40.0	25.8	5.58	0.1	0.004	
Lamella u/f	1040	1.0	2.8	1.29	5.3	0.071	

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**4.50**	**2.20**	2.30	**3.4**	35.5	
BM301	**6.00**	**1.83**	4.17	**6.1**	64.5	
Grinding	**10.50**	**4.03**	6.47	**9.5**	100.0	

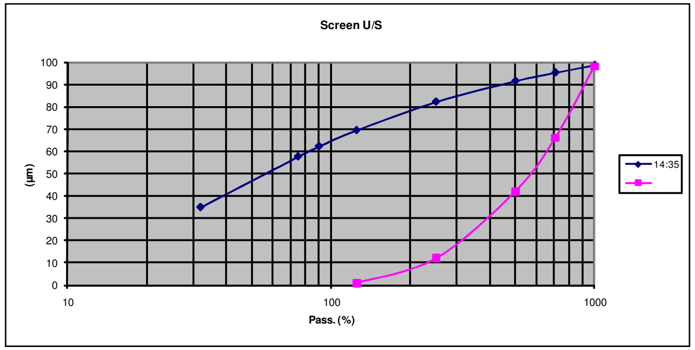
	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

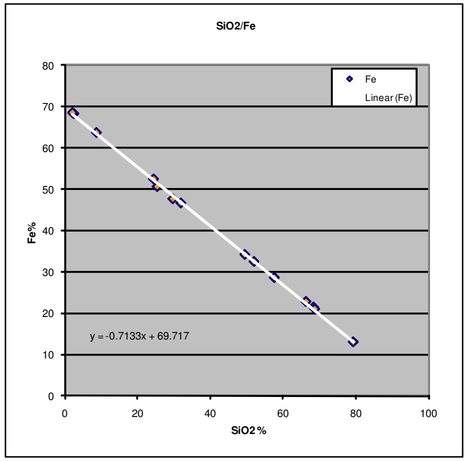
780

69.66875
36.4
40.5

Screen	20.10.2014		240		
	14:35		200		
1000	98.6	98	0.8333333		36.4
710	95.3	66	19.09		
500	91.5	42	10		
250	82.2	12	5	120	
125	69.5	1	39.166667		
90	62.3				
75	57.7				
32	35				

	-0.7116
	69.681
SiO2	***5.0***
Fe	***66.1***
SiO2	*Fe*
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13





	28.6	1716	
		0.05	109.79167
		85.8	165
240		0.12	
		715	

NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

Feed	0.30	t/h
Feed S.G.	**3.60**	t/m3
Non-Mags S.G.	2.90	t/m3
Mags S.G.	5.00	t/m3

Date: **18.11.2014**
Time: **17:00:00 PM**
Note:

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h	
Feed Ore	**5.6**		30.0		100.0	**0.672**	
RM Discharge	1740	3.4	19.3	0.63	58.9	**0.650**	
BM Discharge	1720	3.4	31.0	0.39	52.3	**0.355**	
Derrick o/s	1030	3.4	24.1	0.51	4.0	**0.021**	
Derrick u/s	1280	3.4	7.5	1.63	30.3	**0.633**	
Cyclone O/F	1060	10.0	6.5	5.54	7.8	0.460	
Cyclone U/F	2200	1.0	15.4	0.23	75.5	0.388	0.849
WLCon1	1610	1.0	8.2	0.44	47.4	0.335	
WLTail1	1150	3.4	6.4	1.91	19.9	0.438	
WLCon2	1020	1.0	73.6	0.05	2.5	0.001	
WLTail2	1120	3.4	7.1	1.72	16.4	0.316	
WLCon3	1550	1.0	7.6	0.47	44.4	0.326	0.291
WLTail3	1010	3.4	2.5	4.90	1.5	0.075	
WLCon4	1520	1.0	9.5	0.38	47.4	0.273	
WLTail4	1020	3.4	21.1	0.58	3.0	0.018	
I SLon M	1010	3.4	7.1	1.72	1.4	0.024	
I SLon EM	1090	3.4	5.9	2.07	11.4	0.259	0.282
II SLon M	1030	3.4	14.2	0.86	4.0	0.036	
II SLon EM	1050	3.4	7.5	1.63	6.6	0.113	0.149
Skako o/s	1270	1.0	24.4	0.15	29.4	0.055	
Skako u/s	1060	3.4	8.2	1.49	7.8	0.124	
HW SpirCon	1190	1.0	30.0	0.12	22.1	0.032	
HW SpirTails	1030	3.4	5.3	2.31	4.0	0.096	
WW SpirCon	1110	1.0	11.7	0.31	13.7	0.047	
WW SpirTails	1070	3.4	6.1	2.01	9.1	0.194	
Lamella o/f	1001	40.0	23.0	6.26	0.1	0.004	
Lamella u/f	1080	3.4	8.8	1.39	10.3	0.154	

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**4.50**	**2.20**	2.30	**3.4**	35.2	
BM301	**6.07**	**1.83**	4.24	**6.3**	64.8	
Grinding	**10.57**	**4.03**	6.54	**9.7**	100.0	

	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

780

2060

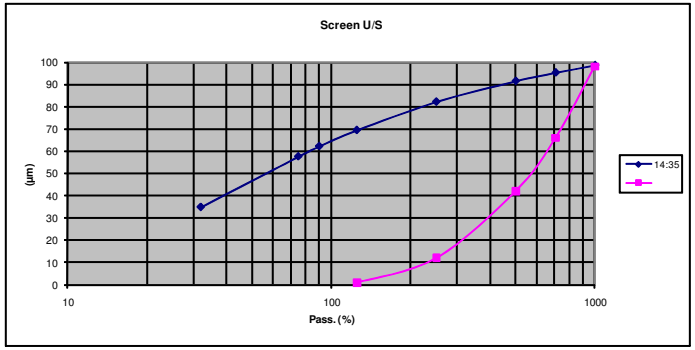
69.66875

36.4

40.5

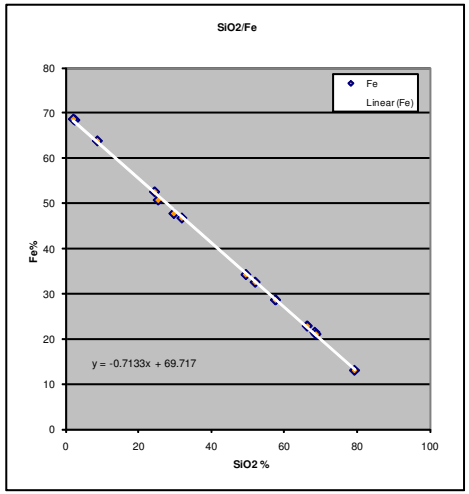
36.4

Screen	20.10.2014			
	14:35		240	
1000	98.6	98	200	
710	95.3	66	0.8333333	
500	91.5	42	19.09	
250	82.2	12	10	
125	69.5	1	5	120
90	62.3		39.166667	
75	57.7			
32	35			



-0.7116
69.681

SiO2	*5.0*
Fe	*66.1*
SiO2	*Fe*
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13



12.3 Process data for 19/11/2014

NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

Feed	0.30	t/h	Date:	19.11.2014	Note:	
Feed S.G.	**3.60**	t/m3	Time:	12:00		
Non-Mags S.G.	2.90	t/m3				
Mags S.G.	**5.00**	t/m3				

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h	
Feed Ore	**5.9**		30.0		100.0	**0.708**	
RM Discharge	1680	3.4	16.2	0.76	56.0	**0.711**	
BM Discharge	1750	3.4	28.3	0.43	53.6	**0.405**	
Derrick o/s	1010	3.4	23.0	0.53	1.4	**0.007**	
Derrick u/s	1290	3.4	7.0	1.75	31.1	**0.702**	
Cyclone O/F	1055	10.0	5.6	6.43	7.2	0.490	
Cyclone U/F	2190	1.0	14.5	0.25	75.2	0.409	
WLCon1	1580	1.0	12.6	0.29	45.9	0.207	
WLTail1	1165	3.4	7.2	1.70	21.6	0.428	0.635
WLCon2	1005	1.0	79.0	0.05	0.6	0.000	
WLTail2	1120	3.4	6.1	2.01	16.4	0.368	
WLCon3	1400	1.0	6.9	0.52	35.7	0.261	
WLTail3	1010	3.4	2.5	4.90	1.5	0.075	0.369
WLCon4	1430	1.0	5.9	0.61	41.6	0.363	
WLTail4	1005	1.0	5.2	0.69	0.8	0.005	
I SLon M	1010	3.4	7.0	1.75	1.4	0.024	
I SLon EM	1100	3.4	6.0	2.04	12.6	0.282	0.087
II SLon M	1015	1.0	4.6	0.78	2.0	0.016	
II SLon EM	1035	3.4	6.8	1.80	4.7	0.087	0.060
SAM Discharge	1140	1.0	11.6	0.31	17.0	0.060	
Skako u/s	1045	3.4	7.6	1.61	6.0	0.100	
1 SpirCon	1200	1.0	28.4	0.13	23.1	0.035	
1 SpirTails	1025	3.4	5.5	2.23	3.4	0.077	
2 SpirCon	1200	1.0	28.4	0.13	23.1	0.035	
2 SpirTails	1025	3.4	5.5	2.23	3.4	0.077	
Lamella o/f	1001	40.0	21.0	6.86	0.1	0.009	
Lamella u/f	1060	3.4	9.3	1.32	7.8	0.109	

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**4.30**	**2.20**	2.10	**3.0**	33.1	
BM301	**6.07**	**1.83**	4.24	**6.0**	66.9	
Grinding	**10.37**	**4.03**	6.34	**9.0**	100.0	

	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

780

2060

69.66875

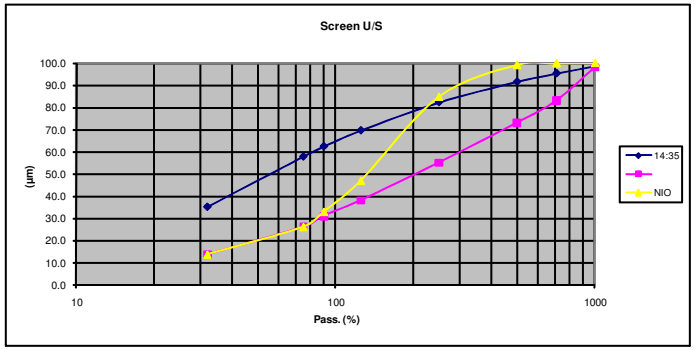
36.4

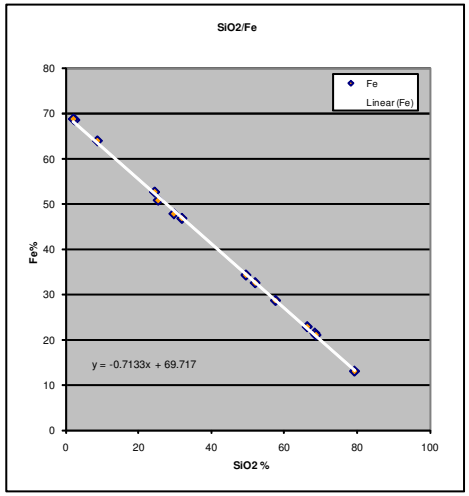
40.5

36.4

120

Screen	20.10.2014 14:35		NIO	240 200
1000	98.6	98.0	100.0	0.8333333
710	95.3	83.0	99.8	19.09
500	91.5	73.0	99.1	10
250	82.2	55.0	84.7	5
125	69.5	38.0	46.8	39.166667
90	62.3	31.0	32.8	
75	57.7	26.0	26.0	
32	35.0	13.5	13.5	





	-0.7116
	69.681
SiO2	***5.0***
Fe	***66.1***
SiO2	*Fe*
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13

NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

Feed	0.30	t/h
Feed S.G.	**3.60**	t/m3
Non-Mags S.G.	2.90	t/m3
Mags S.G.	**5.00**	t/m3

Date: **19.11.2014**
Time: **16:45:00 PM**
Note:

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h	
Feed Ore	**5.6**		30.0		100.0	**0.672**	
RM Discharge	1670	3.4	14.8	0.83	55.6	**0.767**	
BM Discharge	1640	3.4	24.7	0.50	48.8	**0.396**	
Derrick o/s	1020	3.4	22.9	0.53	2.7	**0.015**	
Derrick u/s	1320	3.4	7.1	1.72	33.6	**0.764**	
Cyclone O/F	1050	10.0	5.4	6.67	6.6	0.462	
Cyclone U/F	2130	1.0	15.4	0.23	73.5	0.366	0.827
WLCon1	1600	1.0	13.3	0.27	46.9	0.203	
WLTail1	1120	3.4	7.7	1.59	16.4	0.291	0.494
WLCon2	1030	1.0	62.0	0.06	3.6	0.002	
WLTail2	1130	3.4	6.4	1.91	17.6	0.379	0.382
WLCon3	1420	1.0	6.8	0.53	37.0	0.278	
WLTail3	1020	3.4	2.8	4.37	3.0	0.133	0.411
WLCon4	1350	1.0	7.1	0.51	35.9	0.246	
WLTail4	1010	3.4	14.3	0.86	1.5	0.013	0.259
						0.147	
		3.4	7.1	1.72	0.0	0.000	
		3.4	5.9	2.07	0.0	0.000	0.000
		3.4	14.2	0.86	0.0	0.000	
		3.4	7.5	1.63	0.0	0.000	0.000
Skako o/s	1130	1.0	12.4	0.29	15.9	0.052	
Skako u/s	1060	3.4	7.3	1.68	7.8	0.139	
HW SpirCon	1140	1.0	23.3	0.15	17.0	0.030	
HW SpirTails	1030	3.4	5.1	2.40	4.0	0.100	0.130
WW SpirCon	1050	1.0	3.7	0.97	6.6	0.067	
WW SpirTails	1030	3.4	4.7	2.60	4.0	0.108	0.176
Lamella o/f	1001	40.0	25.5	5.65	0.1	0.004	
Lamella u/f	1080	3.4	9.5	1.29	10.3	0.143	

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**4.50**	**2.20**	2.30	**3.4**	35.2	
BM301	**6.07**	**1.83**	4.24	**6.3**	64.8	
Grinding	**10.57**	**4.03**	6.54	**9.7**	100.0	

	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

780

2060

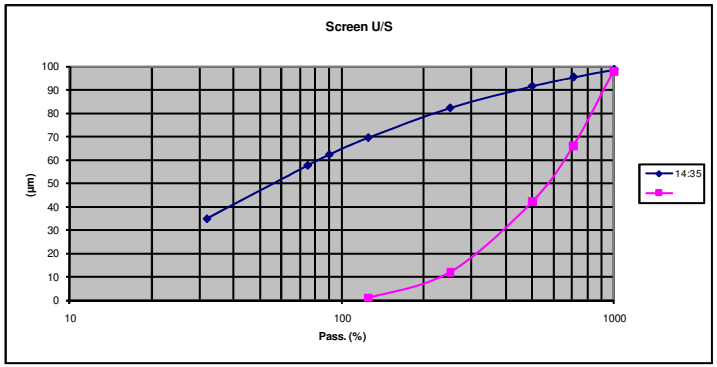
69.66875

36.4

40.5

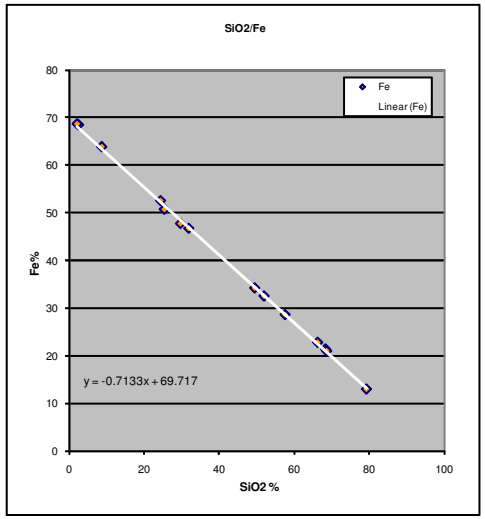
36.4

Screen	20.10.2014 14:35		240 200		
1000	98.6	98	0.8333333		
710	95.3	66	19.09		
500	91.5	42	10		
250	82.2	12	5	120	
125	69.5	1	39.166667		
90	62.3				
75	57.7				
32	35				



14

	-0.7116
	69.681
SiO2	***5.0***
Fe	***66.1***
SiO2	*Fe*
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13



12.4 Process data for 20/11/2014

NIO PILOT 2014
PROCESS FLOW RATE MEASUREMENTS

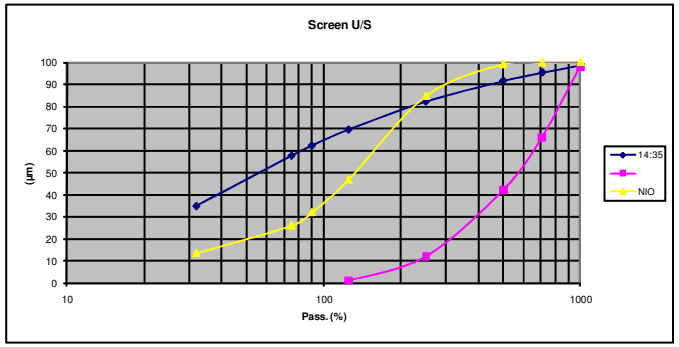
Feed	0.30	t/h		Date:	20.11.2014	Note:	# 2 mm
Feed S.G.	**3.60**	t/m3		Time:	11:45		d 10 mm
Non-Mags S.G.	2.90	t/m3					
Mags S.G.	**5.00**	t/m3					

	Slurry SG g/l (**kg**)	Bucket l	Time s (**min**)	Flow m3/h	Solids %	Solids t/h	
Feed Ore	**5.9**		20.4		100.0	**1.041**	
RM Discharge	1830	3.4	10.9	1.12	62.8	**1.291**	
BM Discharge	2160	3.4	12.0	1.02	67.1	**1.479**	
Derrick o/s	1005	1.0	5.2	0.69	0.7	**0.005**	
Derrick u/s	1335	3.4	5.2	2.35	34.7	**1.092**	
Cyclone O/F	1090	10.0	5.6	6.43	11.4	0.801	
Cyclone U/F	2715	1.0	5.4	0.67	87.5	1.583	2.384
WLCon1	1890	1.0	6.2	0.58	58.9	0.646	
WLTail1	1165	3.4	5.4	2.27	21.6	0.571	1.217
WLCon2	1010	1.0	65.0	0.06	1.2	0.001	
WLTail2	1160	3.4	5.1	2.40	21.1	0.586	0.587
WLCon3	1770	1.0	11.2	0.32	54.4	0.309	
WLTail3	1020	3.4	2.9	4.22	3.0	0.129	0.438
WLCon4	1535	1.0	5.5	0.65	48.3	0.485	
WLTail4	1005	1.0	6.2	0.58	0.8	0.004	0.489
		3.4	7.1	1.72	0.0	0.000	
		3.4	5.9	2.07	0.0	0.000	0.000
		3.4	14.2	0.86	0.0	0.000	
		3.4	7.5	1.63	0.0	0.000	0.000
Skako o/s	1300	1.0	8.3	0.43	32.0	0.180	
Skako u/s	1070	3.4	6.9	1.77	9.1	0.172	4.7778E-05
							0.04777778
HW SpirCon	1240	1.0	18.0	0.20	26.8	0.066	
HW SpirTails	1030	3.4	4.9	2.50	4.0	0.104	0.170
WW SpirCon	1050	1.0	3.2	1.13	6.6	0.078	
WW SpirTails	1090	3.4	3.8	3.22	11.4	0.401	0.479
Lamella o/f	1001	40.0	31.4	4.59	0.1	0.003	
Lamella u/f	1085	3.4	9.0	1.36	10.8	0.160	

	Power kW, Gross	Idle kW	Power kW, Net	Energy kWh/t, Net	%	Solids t/h
RM302	**4.63**	**2.20**	2.43	**2.3**	34.2	
BM301	**6.50**	**1.83**	4.67	**4.5**	65.8	
Grinding	**11.13**	**4.03**	7.10	**6.8**	100.0	

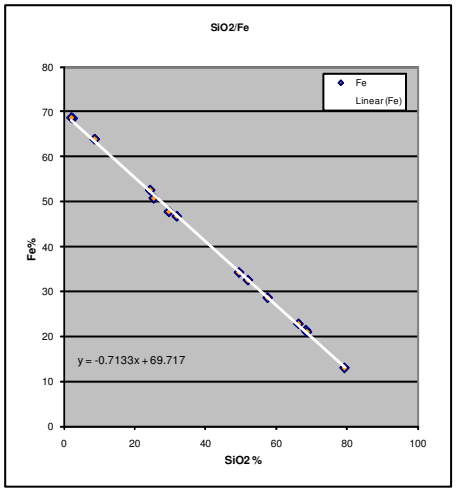
	Slurry SG g/l (**kg**)			Flow m3/h	Solids %	Solids t/h
Derrick U/S	1238			1.60	26.6	**0.527**

Screen	20.10.2014 14:35		NIO
1000	98.6	98.0	100.0
710	95.3	66.0	99.8
500	91.5	42.0	99.1
250	82.2	12.0	84.7
125	69.5	1.0	46.8
90	62.3		32.0
75	57.7		26.0
32	35		13.5



	21.8	
	-2.7	
	-15.8	
	3.3	
	5730	
	650	
	11.343805	

	-0.7116
	69.681
SiO2	5.0
Fe	66.1
SiO2	Fe
57.6	28.6
8.7	63.8
31.9	46.7
2.52	68.4
25.4	50.7
2.14	68.6
52	32.5
66.3	22.8
29.7	47.7
68.4	21.4
49.5	34.2
68.7	21
24.4	52.5
79.3	13



		11.466667	4	
			172	
		1.3	2.8666667	
		26	28.666667	
			28.666667	10.766667
	9.7666667			
			0.295	32