



**Georgina Phosphate
2012 Drilling
QA/QC Report**

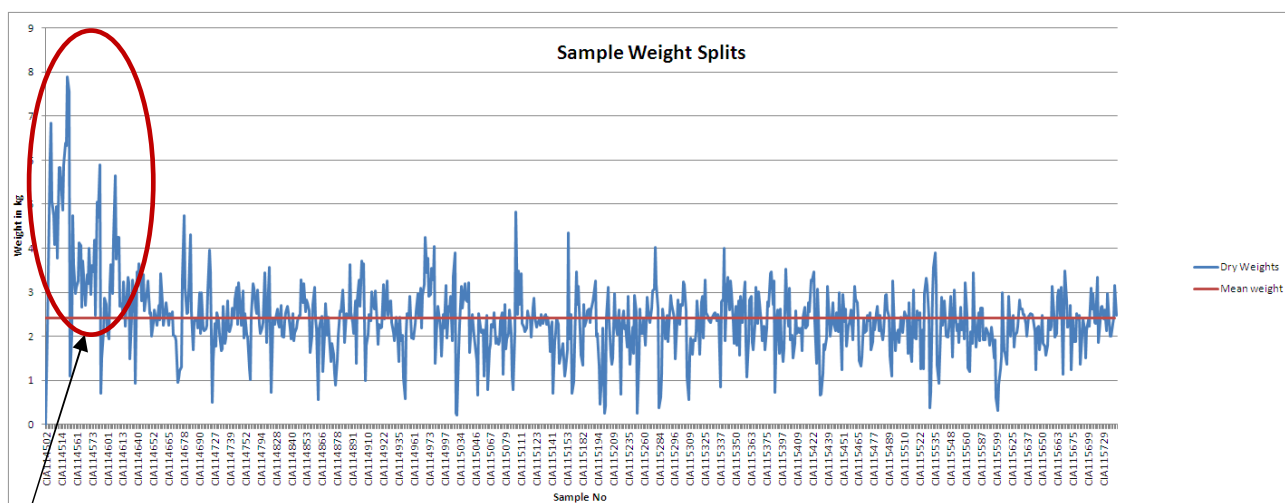
October, 2012

1. Introduction

This report covers the QAQC of the Georgina drilling project which was undertaken throughout the winter of 2012. It covers the collection and sample preparation of Phosphate samples delivered to the ALS Alice Springs Sample Preparation Facility in and the analytical analysis conducted by the ALS facility in Brisbane.

2. Sample Collection

A drill rig splitter was the main sample collection point for this project. Below is an indication of the average weights of the samples delivered to the laboratory.



The average weight per sample submitted for the testing to the lab was 2.42kg. However the first 50 samples have a weight of on average 4.30kg. This does not affect the overall outcome data, but best practise is to have a consistent sample weight throughout the program. This was addressed by the team upon discovery that sample weights were too large.

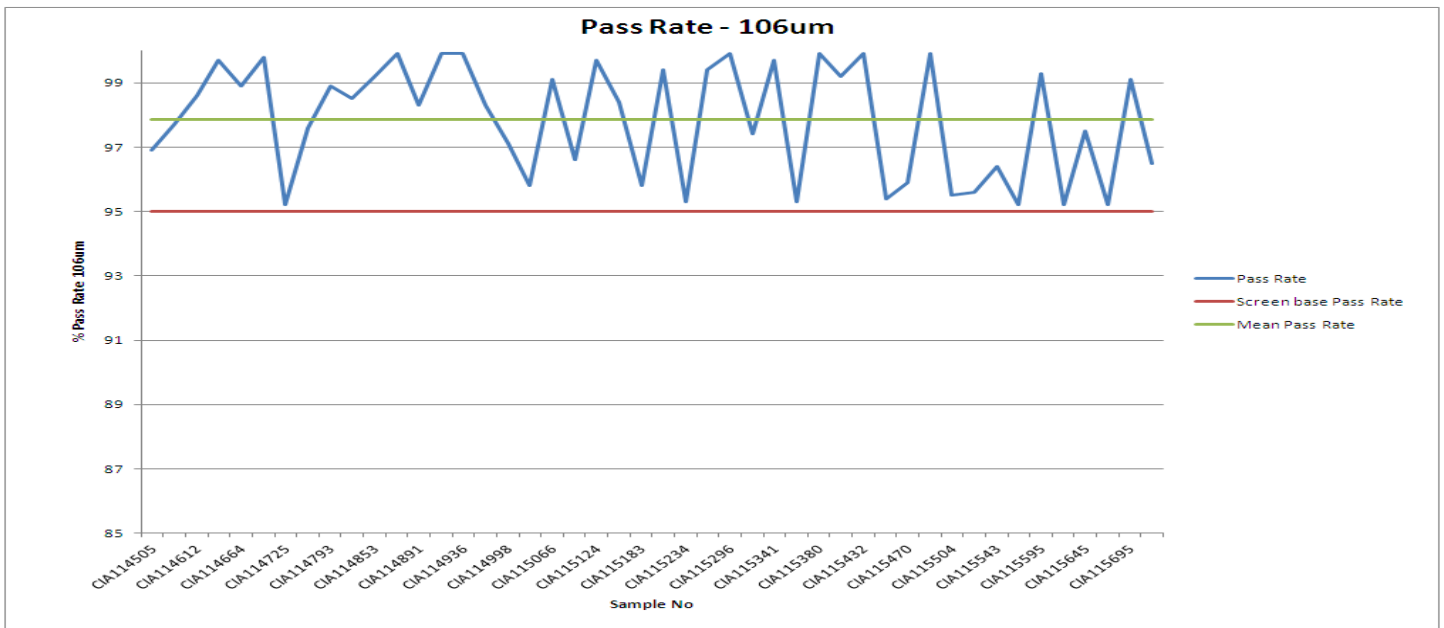
3. Sample Preparation

Samples, once bundled and collected at the drill site were then shipped to the ALS Sample preparation laboratory. QA checks undertaken at the Alice Spring lab include the following

- A 1/20 106um Pulp Screen Test
- A 1/40 Pulp Split
- A 1/40 Barren Wash

1. 106um Pulp Screen Test

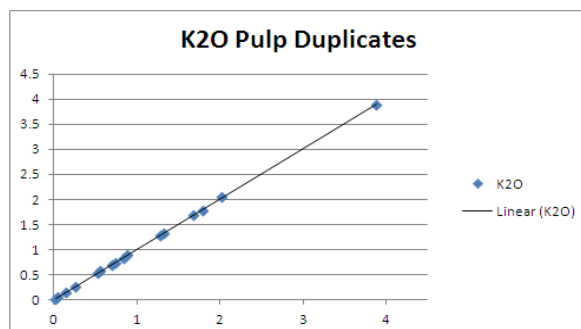
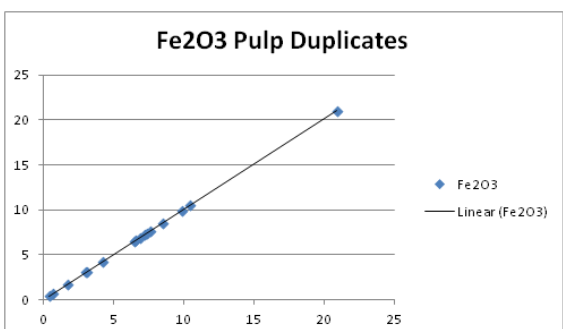
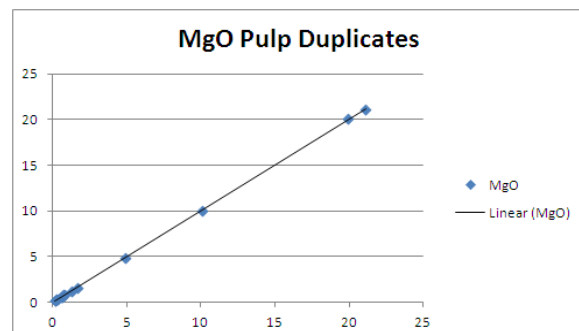
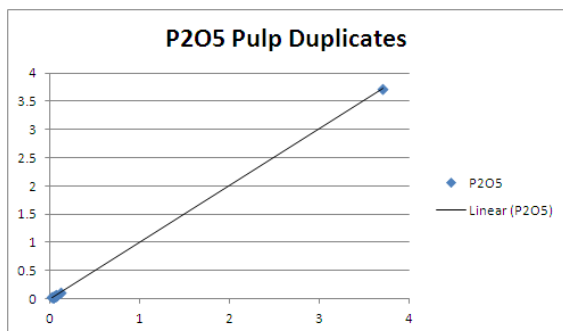
The 106um screen test is undertaken to ensure that the lab is milling the samples to a prescribed size. Vale Global Exploration has a base line for this at 95% 106um pass. This requirement was requested when submitting samples to the lab at Alice Springs. Charted below is the 1/20 pulp screen tests which were undertaken by the lab during the sample preparation process.

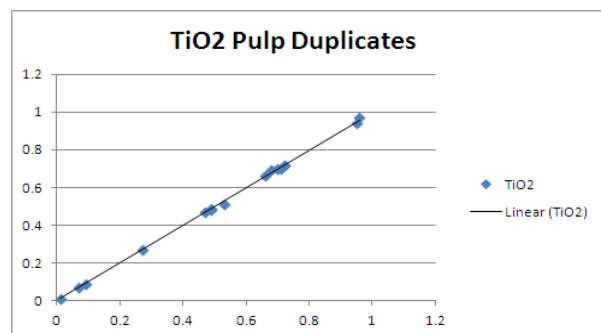
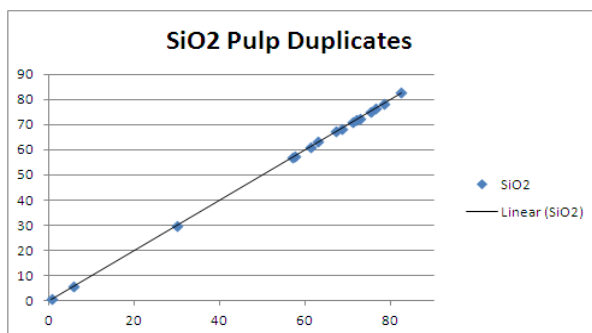
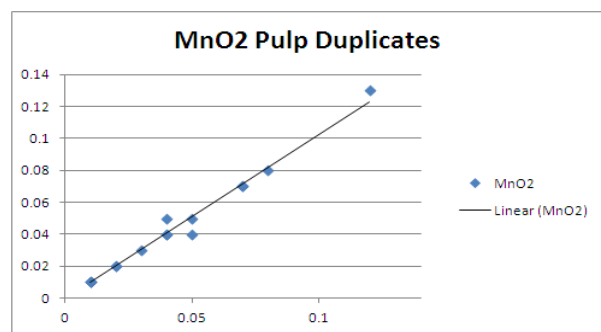
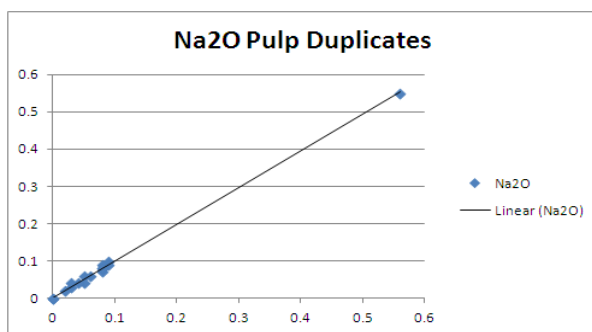
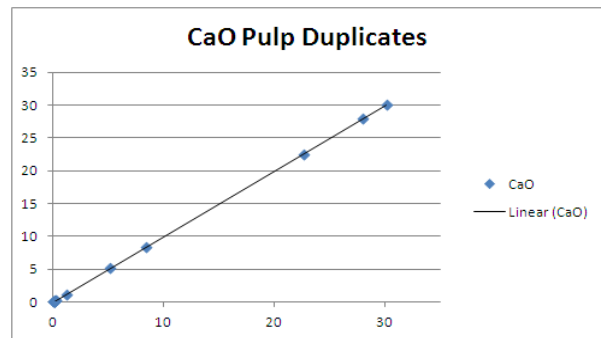
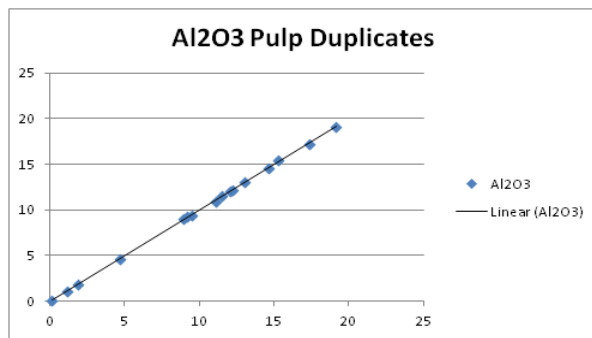


No sample failed the screen test. The average pass rate was 97.8% pass 106um. This indicates that the lab is milling the samples for the desired time. It also indicates that the bowls and pucks being used at the lab are of a high standard. One of the first indicators that there is wear to milling equipment in a preparation laboratory is that milling pass rates start to fail.

2. Pulp Split

A 1/40 pulp split was taken during sample preparation and this was tested via XRF. A pulp split is taken to determine how homogenous the milling which has been undertaken is. This can be a vital test in course gold. For Phosphates it is not as important given the style of mineralisation but it is still an excellent indicator that the samples are being milled appropriately.





The above graphs for each mineral tested show the duplicate data is tight. MnO₂ has the weakest R² of the mineralisation analysed but this still returned at 0.9831. There is no issue with the reproducibility of these samples at pulp level.

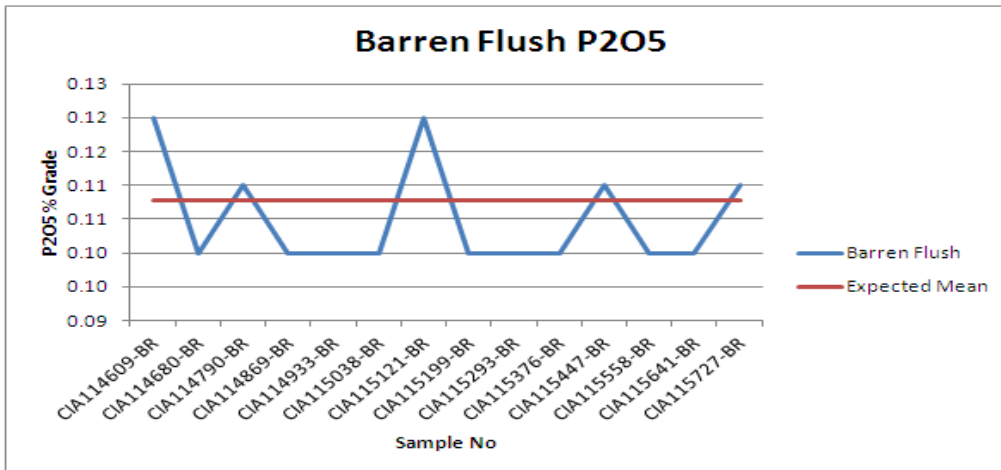
It was requested that a crush split also be undertaken during the prep stage when the original scope was being discussed with ALS. However the samples once submitted to the preparation lab were largely made up of fines that did not need to be crushed. Hence this QA step was not undertaken. The grab samples were however rock and one screen test to check the crushing rate was undertaken. This was at a 6.00mm pass rate. This passed at 95.2%. This is within Vale Global Exploration standards.

3. Barren Wash

A barren wash is undertaken during sample preparation to evaluate if the laboratory is cleaning correctly between samples. This Barren Wash Blank is not a blind check, as the sample is lab flush material and is labelled with a "BR". However it does indicate to the lab that cleaning and carryover from one sample to another is important.

In a high grade deposit, these Barren Wash samples are usually blind and knowledge of the barren washes base line is important, as a spike in grade can indicate that there may be sample carry over from one sample to the next. This can come from anywhere, examples can be sample spillage in drying ovens and crushers (and their collection bins) or

bowls not being correctly cleaned between samples. If there is carry over in the barren sample – it is likely that this is happening with other samples as well. The Barren Wash sample data was provided to Vale from ALS. This data was compared to the results Vale received for the 14 “BR” samples which were ran through the system. The results for Phosphate are below.



The expected mean of the BR samples is 0.11% P2O5. This matches the average grade returned on all 14 samples analysed. As can be seen on the graph above there has been no carry over between Barren samples and regular samples.

4. Sample Preparation Lab Conclusion

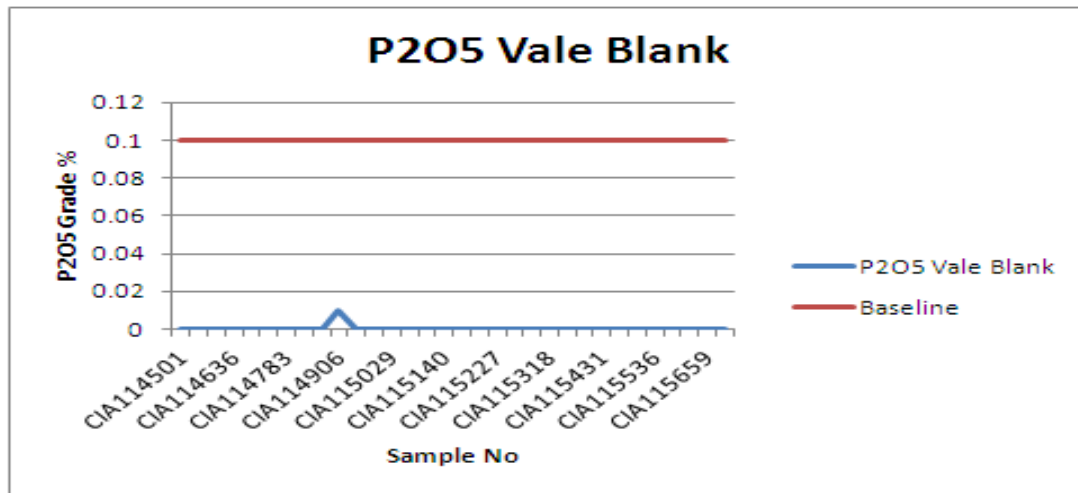
All three methods above are excellent indicators as to if a Sample Preparation lab is performing at a high standard. They do not however substitute going to the lab and looking first hand at how the facility is run and if simple housekeeping is undertaken. This after all is the best way to determine the overall quality of a sample preparation lab and its staff.

4. Blank and Standard Data

1. Phosphate Blank

An analytical blank is used to determine if the lab carries any analytical or mechanical bias by following the pulp samples through the laboratory process. Bias to an analytical blank can occur in two places. The first being during the preparation of the pulp sample. This can occur either through mixing of the blank with other samples, incorrect weighing of the sample or through the reagents that are used. Secondly, with machinery like ICP's and XRF's now becoming more reliant on software, background errors built into the systems can create a bias if these are not identified.

There were 32 blanks inserted into batches submitted to the ALS. No blank broke the 10 times detection limit set of 0.10%. This can be seen in the below graph. This indicates the analytical blanks were not affected but any analytical or mechanical bias in the system.

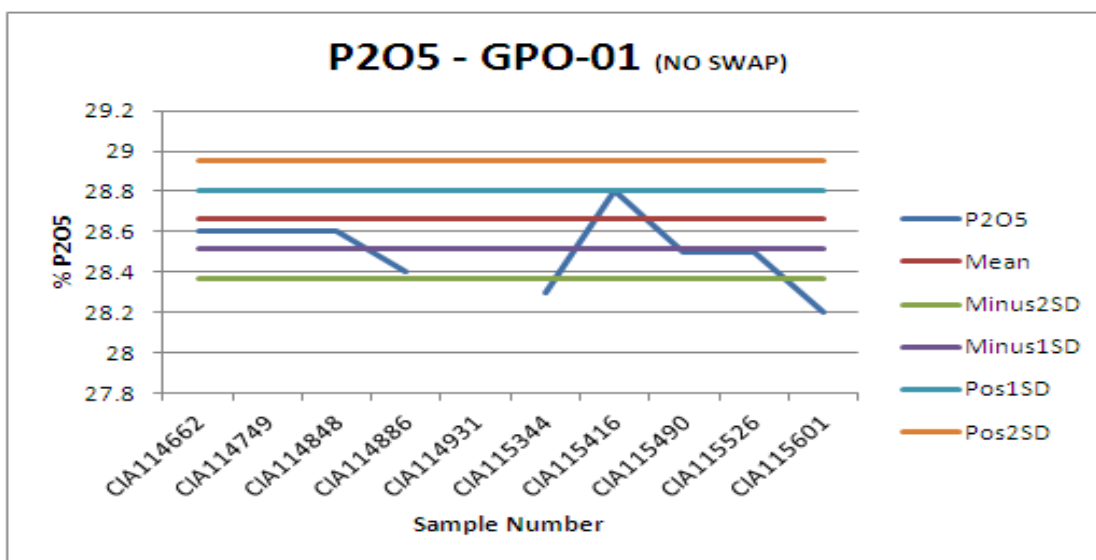


2. Phosphate Standards

Two standards were inserted into the sample batches and submitted to ALS for analysis. These were GPO-01 and GPO-13. These are both GeoStats standards and are certified reference materials.

1. GPO-01

-2SD (%)	-1SD (%)	Mean (%)	+1SD (%)	+2SD (%)
28.368	28.514	28.660	28.806	28.952



GPO-01 failed at two points during analysis - CIA115344 and CIA115601. Both were below 2SD of the mean. Sample number CIA114931 is missing from the chart. This was wrongly coded as GPO-01 but standard GPO-13 was submitted in its place. A positive here is that this point passed as GPO-13. This will however need to be changed in the Acquire database.

CIA115344 – This standard has failed in a barren P2O5 batch of material. There is no need to re-assay here.

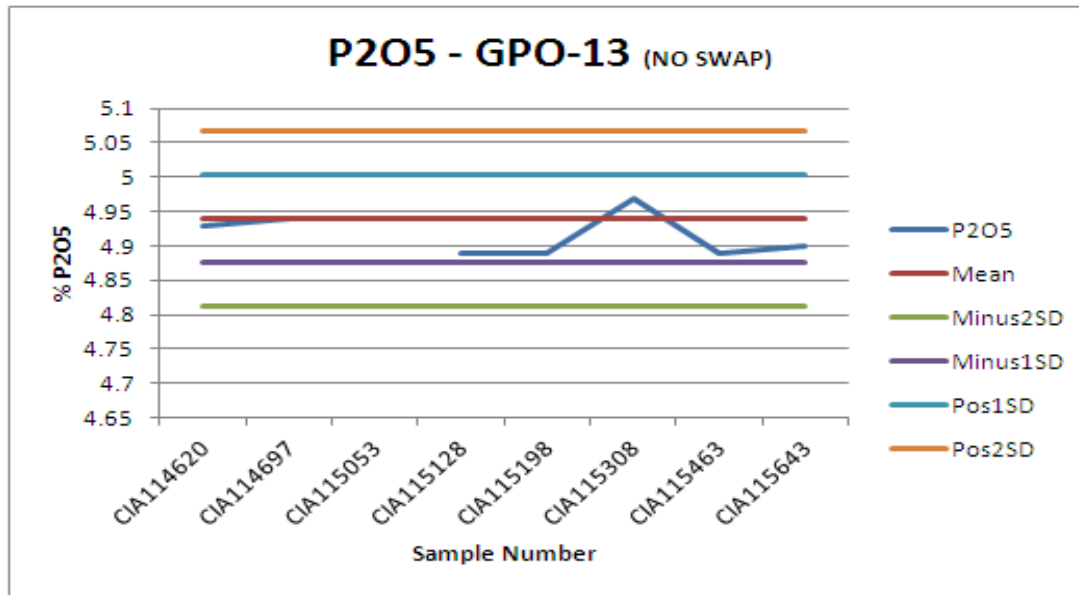
CIA115334	0.05
CIA115335	0.06
CIA115336	0.04
CIA115337	0.12
CIA115337-LP	0.12
CIA115338	0.11
CIA115339	0.12
CIA115340	0.11
CIA115341	0.11
CIA115342	0.11
CIA115343	0.11
CIA115344	28.3
CIA115345	0.11
CIA115346	0.1
CIA115347	0.13
CIA115348	0.12
CIA115349	0.07
CIA115350	0.06
CIA115351	0.02
CIA115352	0.08
CIA115353	0.05
CIA115354	0.03

CIA115601 – This standard has also failed in a barren P2O5 batch of material. There is no need to re-assay here.

CIA115592	0.04
CIA115593	0.03
CIA115594	0.06
CIA115595	0.26
CIA115596	0.57
CIA115597	0.07
CIA115598	0.08
CIA115599	0.2
CIA115600	0.07
CIA115601	28.2
CIA115602	0.07
CIA115603	0.05
CIA115604	0.08
CIA115605	0.06
CIA115617	<0.01
CIA115618	0.02
CIA115619	0.02
CIA115620	0.02
CIA115621	0.03
CIA115622	0.03
CIA115623	0.04
CIA115624	0.04
CIA115625	0.02

2. GPO-13

-2SD (%)	-1SD (%)	Mean (%)	+1SD (%)	+2SD (%)
4.812	4.876	4.940	5.004	5.068



There were no failures of GPO-13 in the submitted batches. CIA115053 was however swapped, and this has been removed from the chart. After investigation it looks as if CIA115055 is GPO-13 (CIA115053) as it has the same characteristics.

A request was placed with ALS to re-assay samples CIA115045 to CIA115055. This comparison is below.

	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215	BR12244215
Method	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-GRA05
Analyte	Al2O3	CaO	Fe2O3	K2O	MgO	MnO2	Na2O	P2O5	SiO2	TiO2	Total	LOI	
	%	%	%	%	%	%	%	%	%	%	%	%	%
	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
369 CIA115045	4.09	7.31	17.74	0.4	0.54	0.11	0.11	5.32	58.1	0.22	98.77	4.42	Repeat
369 CIA115045	4.06	7.3	17.6	0.4	0.54	0.11	0.1	5.32	57.9	0.22	98.33	4.34	Original
370 CIA115046	5.41	10.3	11.75	0.62	0.71	0.1	0.21	7.31	57	0.27	98.93	4.75	
370 CIA115046	5.3	10.2	11.44	0.61	0.7	0.09	0.2	7.3	56.4	0.27	97.63	4.62	
371 CIA115047	3.56	9.62	8.31	0.37	0.54	0.11	0.12	6.73	65.1	0.17	98.48	3.37	
371 CIA115047	3.53	9.62	8.2	0.36	0.53	0.12	0.13	6.74	65.1	0.17	98.27	3.3	
372 CIA115048	3.36	13.25	8.98	0.33	0.49	0.09	0.09	7.44	58.7	0.18	98.45	5.13	
372 CIA115048	3.38	13.2	8.88	0.33	0.5	0.09	0.09	7.42	58.5	0.18	98.24	5.23	
373 CIA115049	1.42	6.9	1.73	0.16	0.19	0.02	0.05	4.93	81.9	0.07	98.81	1.24	
373 CIA115049	1.42	6.91	1.77	0.16	0.19	0.02	0.06	4.95	81.7	0.07	98.59	1.13	
374 CIA115050	1.8	1.86	2.16	0.12	0.29	0.02	0.07	1.26	90.3	0.1	97.85	1.57	
374 CIA115050	1.76	1.82	2.11	0.12	0.29	0.02	0.09	1.25	90.8	0.1	100.35	1.86	
375 CIA115051	1.67	4.43	2.24	0.14	0.22	0.02	0.08	3.11	85.6	0.08	99.36	1.53	
375 CIA115051	1.65	4.34	2.23	0.13	0.22	0.02	0.08	3.05	85	0.07	98.5	1.47	
376 CIA115052	3.1	19.9	1.85	0.65	10.2	0.16	0.08	4.11	35.2	0.14	98.74	23	
376 CIA115052	3.06	19.85	1.73	0.64	10.05	0.16	0.07	4.13	35	0.14	99.1	23.91	
377 CIA115053	0.75	28.3	0.47	0.2	19.7	0.1	0.01	0.22	5.81	0.04	99.79	44.07	
377 CIA115053	0.79	28.3	0.46	0.2	19.55	0.1	<0.01	0.23	6.13	0.04	100	44.1	
378 CIA115054	0.16	30	0.27	0.05	20.8	0.08	<0.01	0.14	1.34	0.01	99.92	46.98	
378 CIA115054	0.15	30.2	0.26	0.05	20.9	0.08	<0.01	0.14	1.32	0.01	99.97	46.76	
379 CIA115055	9.98	6.79	5.29	3.69	0.68	0.03	1.43	4.98	62.6	0.16	99.55	3.57	
379 CIA115055	9.98	6.87	5.34	3.69	0.68	0.03	1.45	5.04	62.8	0.16	100	3.57	

This was to determine if the standard was swapped at the analytical lab, the sample preparation lab or on the drill rig. These re-assays were returned above and they came back the same. A request was then placed with ALS in Alice Springs to go back to the pulp splits and check if the standard (should be a missing bag) is in the same spot. ALS confirmed that there is no pulp sample in position CIA115055 and that there is a pulp residue located at CIA115053.

The most likely event that occurred is that the standard was accidentally placed in CIA115055 and not CIA115053 at the drill rig. The original data as assayed is below.

	WEI-22	OA-GRA05s	SCR-61	ROP-23	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24
SAMPLE	Dry Wt.	Moisture	-6 mm	Split Wt.	Al2O3	CaO	Fe2O3	K2O	MgO	MnO2	Na2O	P2O5	SiO2	TiO2	Total	LOI
DESCRIPTION	kg	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LDL	0.02	0.01	0.1	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
UDL	700	100	100	100	100	60	100	10	50	48	11	50	100	30	110	100
CIA115053	1.91	0.52			0.79	28.3	0.46	0.2	19.55	0.1	<0.01	0.23	6.13	0.04	100	44.1
CIA115054	2.47	0.4			0.15	30.2	0.26	0.05	20.9	0.08	<0.01	0.14	1.32	0.01	99.97	46.76
CIA115055	0.05	<0.01			9.98	6.87	5.34	3.69	0.68	0.03	1.45	5.04	62.8	0.16	100	3.57

It is advisable to swap the samples back as the arrows indicate below. If this is acceptable to the geology team a request will be made with IT to change this data in AcQuire.

	WEI-22	OA-GRA05s	SCR-61	ROP-23	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24	ME-XRF24
SAMPLE	Dry Wt.	Moisture	-6 mm	Split Wt.	Al2O3	CaO	Fe2O3	K2O	MgO	MnO2	Na2O	P2O5	SiO2	TiO2	Total	LOI
DESCRIPTION	kg	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LDL		0.02	0.01	0.1	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
UDL		700	100	100	100	100	60	100	10	50	48	11	50	100	30	110
CIA115053		0.05	<0.01			9.98	6.87	5.34	3.69	0.68	0.03	1.45	5.04	62.8	0.16	100
CIA115054		1.91	0.52			0.79	28.3	0.46	0.2	19.55	0.1	<0.01	0.23	6.13	0.04	100
CIA115055		2.47	0.4			0.15	30.2	0.26	0.05	20.9	0.08	<0.01	0.14	1.32	0.01	99.97

CIA115055 is the last sample for VGRC094. The next sample after CIA115055 is CIA115062 which is the first sample from VGRC095. It makes sense that the standard was accidentally placed in position CIA115055 as this was the last sample on that hole.

5. Conclusion

Overall, ALS's sample preparation and the analytical labs both performed well. There were no issues related to the preparation of the samples with all key indicators showing that the samples were prepared to a high standard for analysis. The swap related to CIA. Analytically both the analytical blank and the standards return good data. GPO-01 came back slightly low on two occasions but this was in barren material.

There were two standard swaps but this is not uncommon and neither had an effect on the overall outcome of the data.

ALS has as a company and a lab performed excellent and has been easy to contact and discuss issues with throughout the assay process. SGS struggled to correctly perform against the contract last season and combined with Global discount ALS provides Vale it is highly recommended that ALS be used again in the future for our analytical requirements.