



COAL CONCEPTS PROFICIENCY TESTING

METALLURGICAL COKE

REPORT TWENTY-NINE

Revision 00

Final report

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THINKING QUALITY, QUALITY THINKING

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EXECUTIVE SUMMARY

1. Ten samples were sent to participants with 9 timeous result submissions
2. Outliers were determined using Grubbs estimate.
3. Due to data limitation, robust statistics could not be applied
4. Your z-score trending is as follows:

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Dear

RE: PROFICIENCY TESTING RESULTS FOR THE MONTH OF DECEMBER 2018

Thank you for your participation in the Coal Concepts proficiency testing scheme.

Your laboratory code is xx

All results are totally confidential. Any results in ***Bold, Italics and Underlined*** are outliers. Where applicable, the most extreme outliers have been eliminated from calculations using the Grubbs estimate for outliers. Robust statistics has been applied where possible. Analysis results have been reported on air dry and dry base. The dry base results have been used to calculate the z-scores.

Please take note of the following:

1. Z-scores between -1 and +1 is deemed acceptable
2. Z-scores between -2 and -3 should serve as a warning that the analysis result could get worse
3. Z-scores between +2 and +3 should also serve as a warning that analysis results could get worse.
4. Z- scores lower than -3 and exceeding +3 should warrant an investigation
5. Compare your result to the robust average which will be the assigned value. The measurement of uncertainty (UoM) of the results is also stated.
6. All calculations can be made available upon request

The Coal Concepts scheme adheres to the requirements of ISO/IEC 17043:2010 – Conformity assessment – General requirements for proficiency testing.

Statistical analysis has been carried out using ISO/IEC 13528:2015-Statistical methods for use in proficiency testing by interlaboratory comparisons

Please find results attached together with Z-score trends.

Best Regards

R Baboolal

LIST OF PARTICIPANTS IN ALPHABETICAL ORDER

1. ArcelorMittal Newcastle
2. ArcelorMittal Vanderbijl Park
3. ArcelorMittal Pretoria
4. Glencore Boshhoek
5. Glencore Lion
6. Glencore Lydenburg
7. Glencore Rustenburg
8. Glencore Wonderkop
9. Intertek - Mozambique
10. South 32 – Mamantwan
11. UIS Analytical Services

1. PREPARATION OF SAMPLE

Approximately 100kg's of sample with an approximate topsize of 50mm was sourced. This was crushed to -4mm using a jaw crusher. The -4mm material was reduced to -212um using a cross beat pulveriser. The 212 material was sieved using a 212um screen. Any +212um material was pulverised and sieved until all material passed through the 212 um sieve.

All the -212um material was then mixed in a 210 litre mixing drum for 2 hours.

2. HOMOGENEITY CHECK

There were 10 participants in this round, 10 portions of sample were randomly extracted from the 10Kg sample. These were packaged in their final form i.e. in 100 ml sample bottles. The bottles were labelled 1 to 10. The results were as follows:

Sample no.	Test Portion 1	Test Portion 2	Sample av (Xt)	Range (Wt)	Range sqd
1	11,59	11,76	11,68	0,17	0,0289
2	11,64	11,74	11,69	0,10	0,0100
3	11,77	11,75	11,76	0,02	0,0004
4	11,76	11,76	11,76	0,00	0,0000
5	11,69	11,75	11,72	0,06	0,0036
6	11,73	11,74	11,74	0,01	0,0001
7	11,70	11,79	11,75	0,09	0,0081
8	11,71	11,76	11,74	0,05	0,0025
9	11,86	11,80	11,83	0,06	0,0036
10	11,78	11,84	11,81	0,06	0,004
General Average			11,75		
Standard Deviation			0,048		
Within Sample Standard Deviation			0,055		
Between Sample Standard Deviation			0,028		

The between sample standard deviation must be $\leq 0.3 \times \sigma$
(σ = std deviation for the proficiency assessment)

$\sigma = 0.23$ was used, which is the repeatability for ISO ash (2% of the mean result)

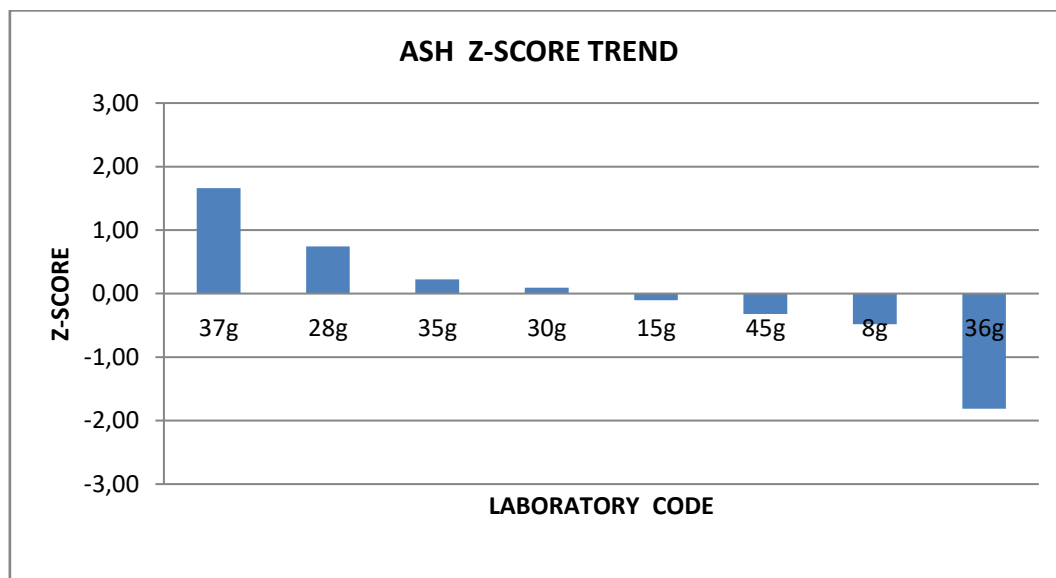
Hence $0.23 \times 0.3 = 0.069$

Since 0.028 < 0.069 the samples are homogenous

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ANALYTICAL PARAMETER : ASH (%)

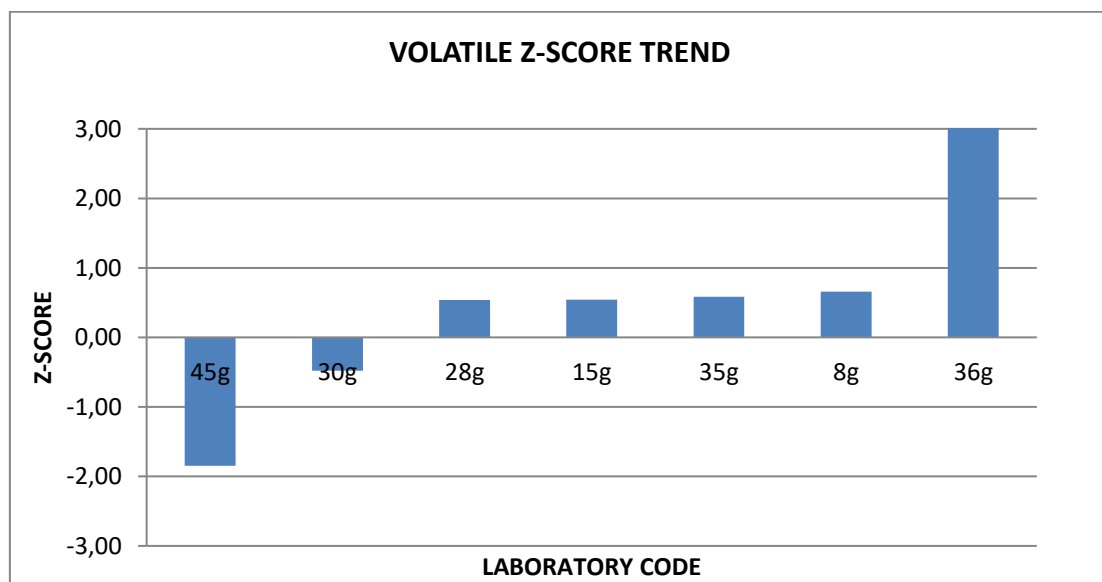
	LAB ID	MOISTURE IN ANALYSIS SAMPLE (%)	AIR DRY (%)	DRY BASE (%)	Z-SCORE (DRY BASE)
	8g	1,07	11,43	11,55	-0,48
	15g	0,60	11,70	11,77	-0,10
	28g	0,52	12,19	12,25	0,74
	30g	0,70	11,80	11,88	0,09
	35g	0,55	11,89	11,96	0,22
	36g	0,50	10,74	10,79	-1,81
	37g	0,37	12,73	12,78	1,66
	45g	0,83	11,55	11,65	-0,32
OUTLIERS	-		0	0	-
AVERAGE	-	0,64	11,75	11,83	-
STD DEVIATION	-	0,22	0,58	0,57	-
MEDIAN			11,75	11,83	



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ANALYTICAL PARAMETER : VOLATILE MATTER (%)

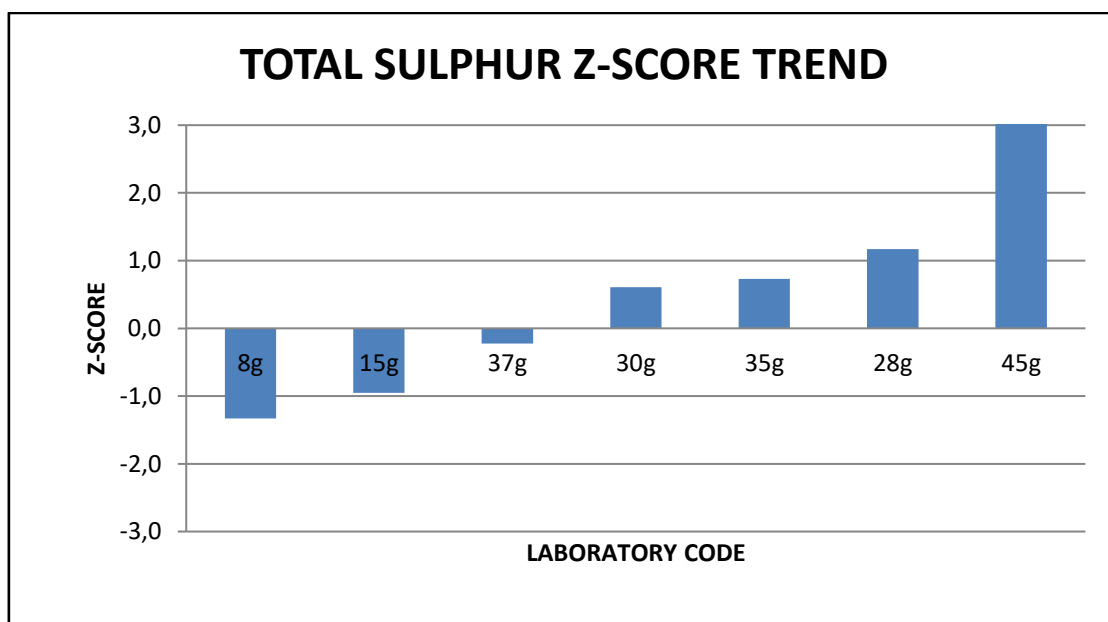
	LAB ID	MOISTURE IN ANALYSIS SAMPLE (%)	AIR DRY	DRY BASE	Z-SCORE (DRY BASE)
	8g	1,07	1,10	1,11	0,7
	15g	0,60	1,08	1,09	0,54
	28g	0,52	1,08	1,09	0,54
	30g	0,70	0,90	0,91	-0,48
	35g	0,55	1,09	1,09	0,58
	36g	0,50	7,09	7,13	34,83
	45g	0,83	0,66	0,67	-1,85
OUTLIERS	-		1	1	
AVERAGE	-	0,68	0,98	0,99	-
STD DEVIATION	-	0,21	0,18	0,18	-
MEDIAN			1,08	1,09	-



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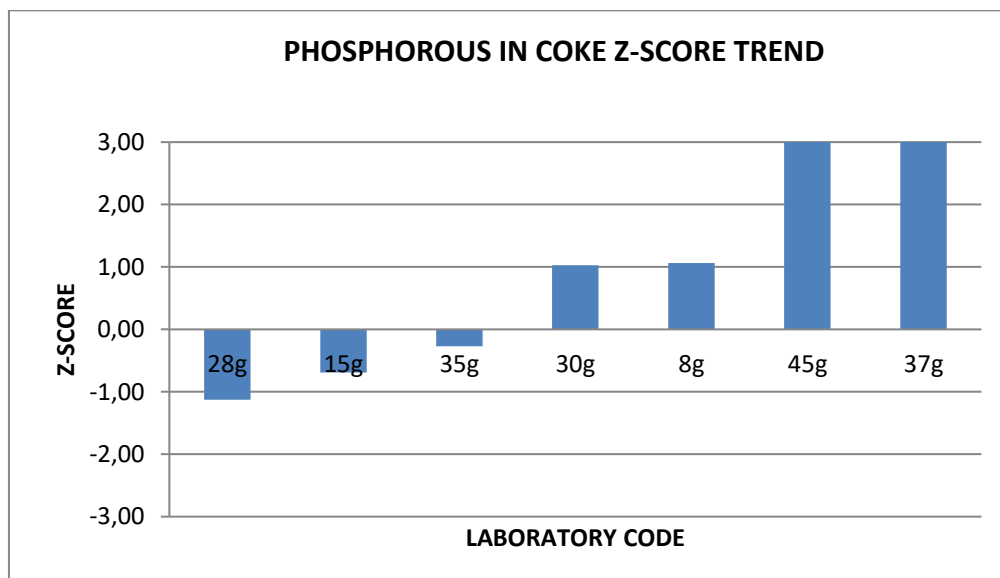
ANALYTICAL PARAMETER : TOTAL SULPHUR (%)

	LAB ID	MOISTURE IN ANALYSIS SAMPLE (%)	AIR DRY	DRY BASE	Z-SCORE (DRY BASE)
	8g	1,07	0,75	0,76	-1,3
	15g	0,60	0,76	0,77	-0,95
	28g	0,52	0,81	0,81	1,17
	30g	0,70	0,80	0,80	0,61
	35g	0,55	0,80	0,80	0,73
	37g	0,37	0,78	0,78	-0,23
	<u>45g</u>	0,83	<u>1,78</u>	<u>1,79</u>	<u>44,85</u>
OUTLIERS	-	-	1	1	-
AVERAGE	-	0,66	0,78	0,79	-
STD DEVIATION		0,23	0,02	0,02	-
MEDIAN			0,79	0,79	



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ANALYTICAL PARAMETER : PHOSPHOROUS IN COKE (%)

	LAB ID	MOISTURE IN	AIR DRY	DRY BASE	Z-SCORE (DRY BASE)
		ANALYSIS SAMPLE (%)			
	8g	1,07	0,024	0,024	1,06
	15g	0,60	0,020	0,020	-0,69
	28g	0,52	0,019	0,019	-1,13
	30g	0,70	0,024	0,024	1,02
	35g	0,55	0,021	0,021	-0,27
	<u>37g</u>	0,37	<u>0,185</u>	<u>0,186</u>	<u>69,53</u>
	<u>45g</u>	0,83	<u>0,043</u>	<u>0,043</u>	<u>8,95</u>
OUTLIERS	-	-	2	2	-
AVERAGE	-	0,66	0,022	0,022	-
STD DEVIATION	-	0,23	0,002	0,002	-
MEDIAN			0,021	0,021	



CONCLUSIONS

1. Ash: The average and the median are the same, indicating that any extreme results do not affect the centralised values.
2. Volatile Matter Results: The mean and median for volatiles are similar, indicating that the extreme results reported did not affect the centralized values. No outliers were detected.
3. Results for Sulphur: The average and median is the same indicating that the centralised values were not altered by extreme values. One outlier was detected due to a swopped sample.
4. Phosphorous was also well done, the mean and median were similar. Two outliers were determined by Grubbs.

COAL CONCEPTS: Terms and ConditionsReturn of results:

Laboratories participate in proficiency testing programs on the understanding that they will be sharing their results and information **anonymously** with other laboratories performing the same analysis. No return of results compromises the spirit of the programs, and reports will not be sent to laboratories unless they return results. Payment in full is required from all laboratories enrolling whether they return results or not.

Errors in Participant Proficiency Testing Results:

Proficiency testing reports should reflect the level of accuracy that a regular testing client would receive.

If a participant finds an error in their proficiency testing results, they may notify us in writing and change their submission **PRIOR** to the due date for return. Changes after this time will not be accepted.

Coal Concepts' reports results *as submitted* by participants.

On occasion, it seems as though participants have mixed up the samples or not processed the samples according to the instructions. Coal Concepts cannot make assumptions of this nature and change results 'to suit'. We also cannot compromise the integrity of the programs by suggesting to some participants that they should review their results prior to the due date. (This is unfair to other participants) It is the responsibility of the participants to check all aspects of the program, including sample identification, preparation, testing instructions, calculations and reporting of the results prior to results submission.

If samples are not in good condition on arrival to the participant laboratory, Coal Concepts must be notified in writing IMMEDIATELY, as often samples can be replaced in good time. Claims about samples received in bad condition will not be accepted after the report has been issued.

Late Enrolments and Late Results:

Late enrolment requests cannot always be accommodated, as sample manufacture must be scheduled well in advance to the shipping date of the program to allow all necessary quality assurance activities to be carried out.

Shipping of PT materials and evaluating test results from PTPs out of cycle with the mainstream programs is considerably time consuming and therefore costly.

In order not to disadvantage participants able to comply with time frames, Coal Concepts may charge a late fee in the following circumstances:

Requests that Coal concepts staff enters results on behalf of participants

Requests to record results after the due date

Requests for PTP participation that is out of cycle with the scheduled dates

Shipping fees and Customs clearance:

Costs incurred for shipping samples and clearance of same through customs are the responsibility of the participating laboratory unless otherwise indicated

Non-payment of fees:

Coal Concepts retains the right to withhold reports and/or test materials and services when invoices are outstanding.

Confidentiality of results:

All data and information received by Coal Concepts from its clients are considered confidential unless the client has given express permission to pass on information.

Definitions:

The dictionary definitions of "collusion" and "falsification" are as follows.

- *Collusion*: A secret agreement or cooperation for a fraudulent or deceitful purpose.

- *Falsification*: Deliberately changing something to be false. In proficiency testing terms, collusion is comparing data (and perhaps changing data) to fit in with a believed "correct" result. This is contrary to the spirit of proficiency testing programs, which are issued with the intention of providing an objective comparison of a laboratory's performance with others. Coal Concepts tries to minimise the occurrence of collusion by being aware that laboratories should be objective when they report their results, and should therefore not know the intended results at the time they are reporting to us.

Answers are not provided to clients until results have been submitted.

To prevent collusion and falsification our advice to clients is:

DON'T confer with others about PT samples or results.

DO accept the fact that everyone makes errors.

DON'T average the results or opinions of every person in the laboratory before selecting the answer to be submitted. Instead, use one of the answers AS SUBMITTED to you and take advantage of the Coal Concepts internal QA services and submit all answers generated by the technicians.

DO have confidence in your own results.

Proficiency Testing (PT) is a compulsory part of laboratory accreditation, but it is also an important tool for giving you confidence in your results.

"Enhancing" your PT results with assistance from another participant cannot increase confidence in your laboratory's performance.

Coal concepts' testing staff are not told what the expected results are, nor what we are expecting.

We subject ALL results to analysis, even if they are different.

The staff have the right to check that the results we enter on their behalf are correctly transcribed.

Clients are always welcome to contact Coal Concepts to seek advice or information about collusion or falsification of data.

Policy for Participant Appeal of PT Performance Assessment:

If participants disagree with their performance assessment in a proficiency report, they should inform Coal Concepts in writing.

The response will include Coal Concepts interpretation of the outcome of the reassessment and an explanation of that outcome. (For example, explanation of a calculation, or the rationale for the outcome of the evaluation.)

If a mistake has been made by Coal Concepts, it will be dealt with via Coal Concepts' non-conformance system.

Liability

In no event shall a party's liability to the other party for direct damages exceed an amount equal to the value of the amount for the PT Programme, under that specific month

End of report