COAL CONCEPTS

PTS0008

ASH CONSTITUENTS PROFICIENCY TESTING

REPORT EIGHTY-ONE

Revision: 00

Final report

31ST JANUARY 2026

LABORATORY CODE: b

S MAMABOLO (SCHEME COORDINATOR)

R BABOOLAL (SCHEME MANAGER)

EXECUTIVE SUMMARY

1. Fourteen samples were sent to participants with 11 results reported back.
2. The total number of outliers found were as follows:

    - SO_3 x1
    - Al_2O_3 x2
    - MgO x2
    - CaO x1
    - Mn_2O_2 1
    - Fe_2O_3 1
    - TiO_2 x 1
    - P2O5x2

3. Robust statistics were applied where ten or more results were available.
4. Use the z-score trend as an indication of the overall laboratory performance.

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Dear Participant

RE: PROFICIENCY TESTING RESULTS FOR THE MONTH OF JANUARY 2026

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

Your laboratory code is as per the cover page.

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. The z-scores are calculated by subtracting the average from the participant result then dividing by the standard deviation. Note: All decimals are carried in the z-score calculation and only rounded off at the end of the calculation.

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. Z-Score calculation : $z\ score = \frac{(Lab\ result - Average\ result)}{Standard\ Deviation}$

7. Measurement protocols (SANAS R80, ISO/IEC 17043:2023, clause 7.1.2); Analysis accredited parameters can be carried out using techniques as follows:

Determination of Major and Minor Elements in Ash - ASTM D3682

Determination of Phosphorous - BS 1016

Determination of Sulphur trioxide - ASTM D5016

Other internationally recognised techniques may be used as well.

8. Five consecutive z-scores above the zero line is considered a positive bias and five consecutive z-scores below the zero line is considered a negative bias. Note that this is guideline/suggestion form Coal Concepts and your quality system requirements may differ.

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

Statistical analysis has been carried out using ISO/IEC 13528-Statistical methods for use in proficiency testing by interlaboratory comparisons, including procedures used to statistically analyse data, establishment of any assigned value, standard deviation and its uncertainty.

Please find results attached together with Z-score trends.

Best Regards

R Baboolal

LIST OF PARTICIPANTS IN ALPHABETICAL ORDER

AfriSam (South Africa) (Pty) Ltd - Dudfield
AfriSam (South Africa) (Pty) Ltd - Ulco
Alfred H Knight Richards Bay Lab
Bureau Veritas Inspectorate Laboratories Alton
Castle Peak Hong Kong
Cigroup
Eskom Erid
Laboratory for solid fuels-Mining Institute Belgrade
Morupule Coal Mine - Botswana
Rafinerija Nafte Beograd AD
Rio Tinto –Richards Bay
Ronewa Middelburg
SABS Commercial SOC - CSIR Laboratory
SABS Commercial SOC - Richards Bay Laboratory
Sibonisiwe Coal Laboratory Services
Siza Coal Services - Middelburg
Siza Minerals Lab - Palapye
South 32 -Hotazel Manganese Mines
Standart Laboratuarlar İşletmeciliği A.Ş
UAS Main Lab
UIS Analytical Services
Vinca Institute of Nuclear Sciences – Serbia

1. TYPE OF SAMPLE USED

The ash used in this proficiency testing round was obtained from local thermal coal.

2. PREPARATION OF SAMPLE

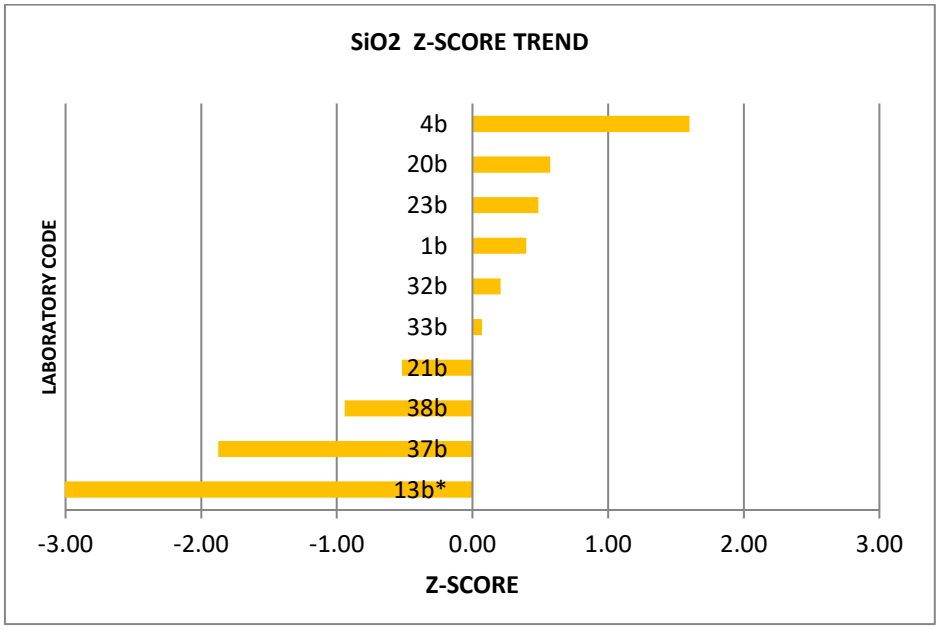
About 5kgs coal was pulverised to -212um. The coal was ashed in a furnace according to the ISO ashing programme. The bulk sample was transferred to a 5-litre container. The sample was homogenised by shaking the 5-litre container vigorously, for half an hour. Samples from the 5-litre container were then transferred into 100ml plastic bottles. Each sample weighed approximately 10 grams. Two hundred and seventy bottles of sample were weighed out. Five bottles were randomly selected and tested for homogeneity SO_3 as the analysed.

3. HOMOGENEITY CHECK

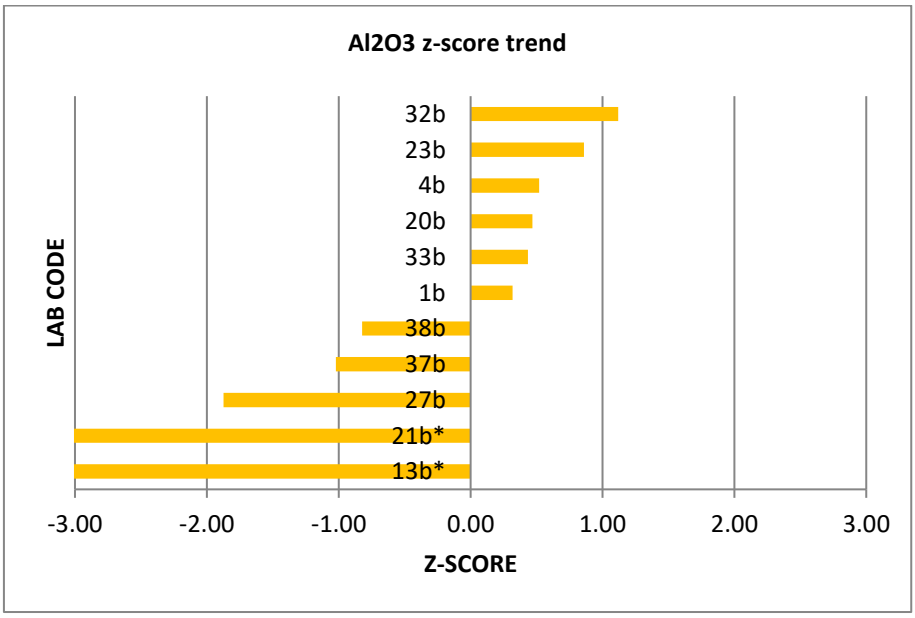
Sample no.	tp1	tp2	sample av (Xt)	range (Wt)	range sqd
1	3,21	3,23	3,22	0,02	0,0004
2	3,25	3,31	3,28	0,06	0,0036
3	3,14	3,19	3,17	0,05	0,0025
4	3,40	3,36	3,38	0,04	0,0016
5	3,23	3,28	3,26	0,05	0,0025
GENERAL AVERAGE			3,26		
STANDARD DEVIATION			0,080		
WITHIN SAMPLE STANDARD DEVIATION			0,033		
BETWEEN SAMPLE STANDARD DEVIATION			0,076		

The PT samples were found to be homogeneous.

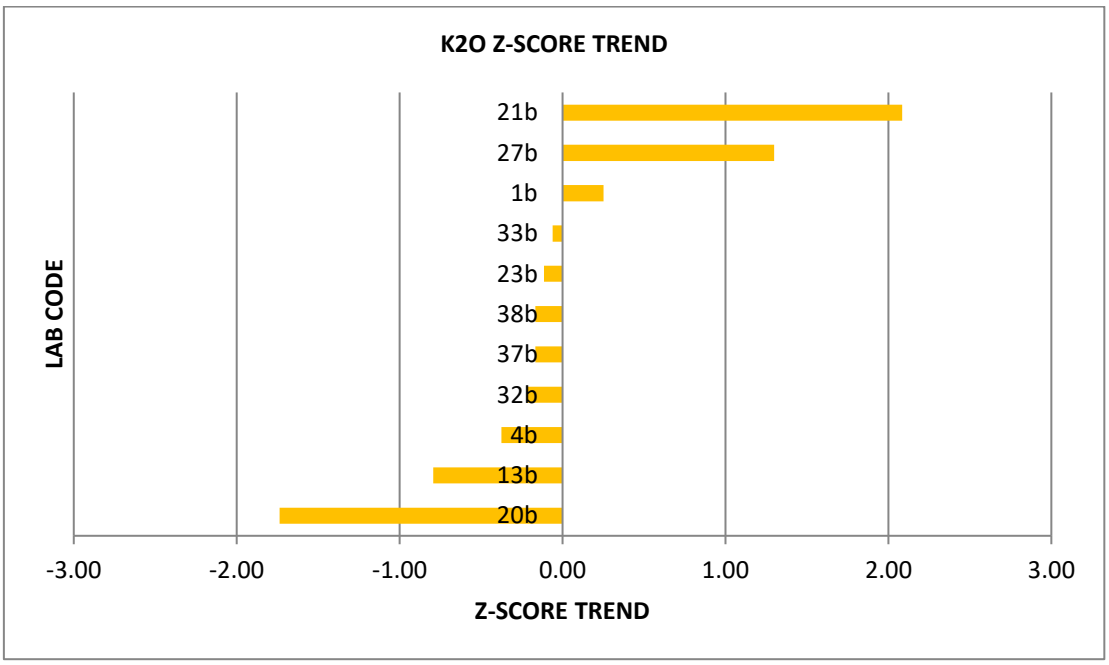
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : SiO2 (%)			
	LAB ID	**SiO2 %**	**Z-SCORE**
	1b	47,66	0,40
	4b	49,43	1,60
	13b*	***37,60***	***-6,44***
	20b	47,92	0,57
	21b	46,31	-0,52
	23b	47,79	0,49
	32b	47,38	0,21
	33b	47,18	0,07
	37b	44,32	-1,87
	38b	45,69	-0,94
Number of results	-	**10**	-
OUTLIERS	-	**1**	-
AVERAGE	-	**47,08**	-
MEDIAN		**47,38**	
STD DEVIATION	-	**1,47**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U,O,M	-	-	-



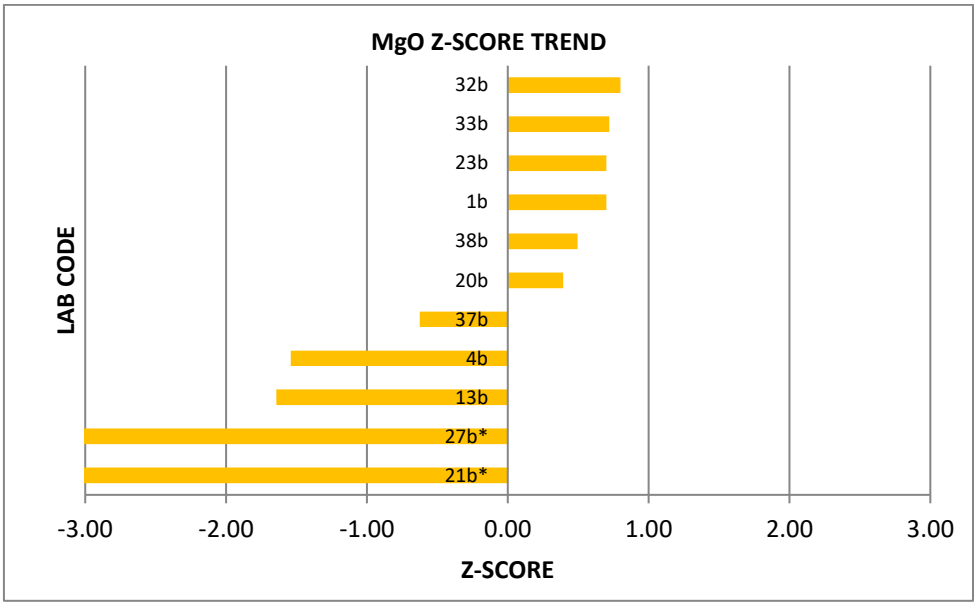
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : Al2O3 (%)			
	LAB ID	**Al2O3 %**	**Z-SCORE**
	1b	30,89	0,32
	4b	31,09	0,52
	13b*	***20,50***	***-10,08***
	20b	31,04	0,47
	21b*	***24,55***	***-6,03***
	23b	31,43	0,86
	27b	28,70	-1,87
	32b	31,69	1,12
	33b	31,01	0,43
	37b	29,55	-1,02
	38b	29,75	-0,82
Number of results	-	**11**	-
OUTLIERS	-	**2**	-
AVERAGE	-	**30,57**	-
MEDIAN	-	**31,01**	-
STD DEVIATION	-	**1,00**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U.O.M	-	-	-



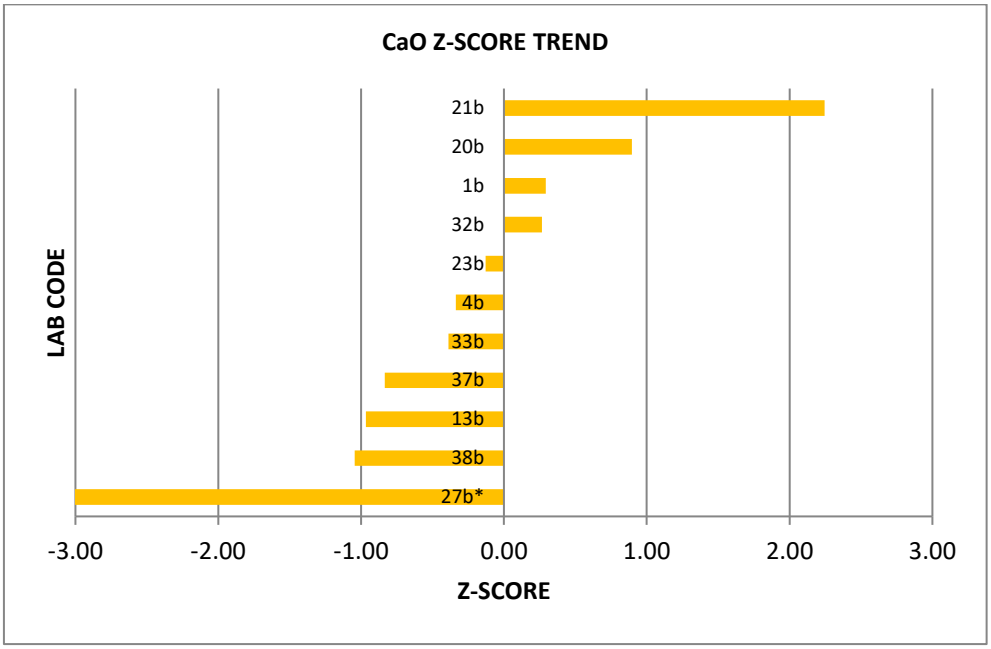
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : K2O (%)			
	LAB ID	**K2O %**	**Z-SCORE**
	1b	0,60	0,25
	4b	0,48	-0,38
	13b	0,40	-0,79
	20b	0,22	-1,74
	21b	0,95	2,08
	23b	0,53	-0,11
	27b	0,80	1,30
	32b	0,51	-0,22
	33b	0,54	-0,06
	37b	0,52	-0,17
	38b	0,52	-0,17
Number of results	-	**11**	-
OUTLIERS	-	**0**	-
AVERAGE	-	**0,55**	-
MEDIAN		**0,52**	-
STD DEVIATION	-	**0,19**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U,O,M	-	-	-



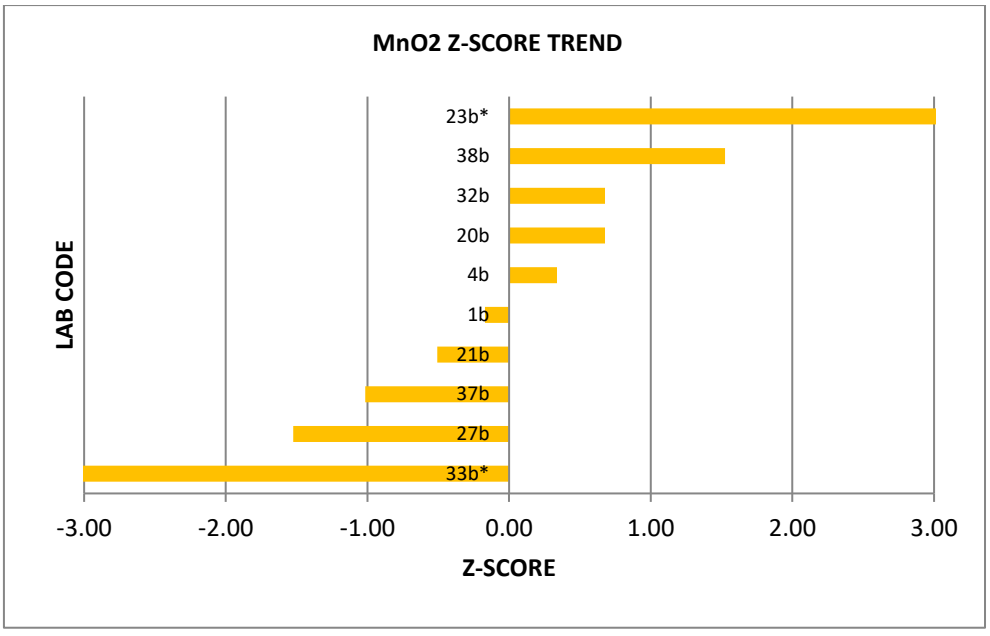
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : MgO (%)			
	LAB ID	**MgO %**	**Z-SCORE**
	1b	1,63	0,70
	4b	1,41	-1,54
	13b	1,40	-1,64
	20b	1,60	0,39
	21b*	***0,62***	***-9,58***
	23b	1,63	0,70
	27b*	***0,96***	***-6,12***
	32b	1,64	0,80
	33b	1,63	0,72
	37b	1,50	-0,62
	38b	1,61	0,50
Number of results	-	**11**	-
OUTLIERS	-	**2**	-
AVERAGE	-	**1,56**	-
MEDIAN		**1,61**	
STD DEVIATION	-	**0,10**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U,O,M	-	-	-



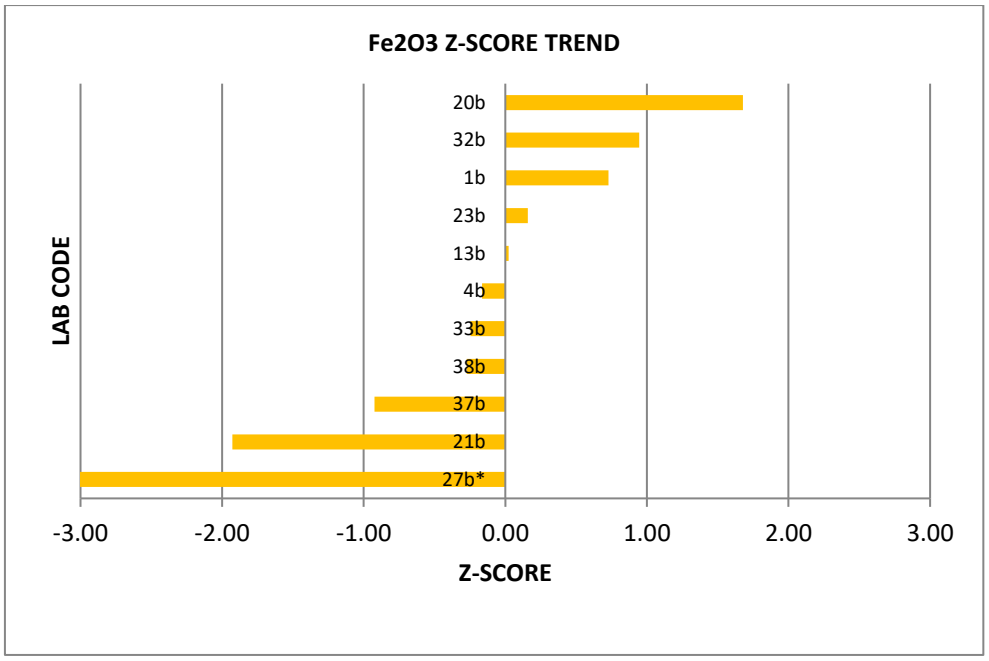
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : CaO (%)			
	LAB ID	**CaO %**	**Z-SCORE**
	1b	7,76	0,29
	4b	7,28	-0,34
	13b	6,80	-0,97
	20b	8,22	0,90
	21b	9,25	2,25
	23b	7,44	-0,13
	27b*	***0,36***	***-9,41***
	32b	7,74	0,27
	33b	7,24	-0,39
	37b	6,90	-0,83
	38b	6,74	-1,04
Number of results	-	**11**	-
OUTLIERS	-	**1**	-
AVERAGE	-	**7,54**	-
MEDIAN	-	**7,36**	-
STD DEVIATION	-	**0,76**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-		-
U.O.M	-		-



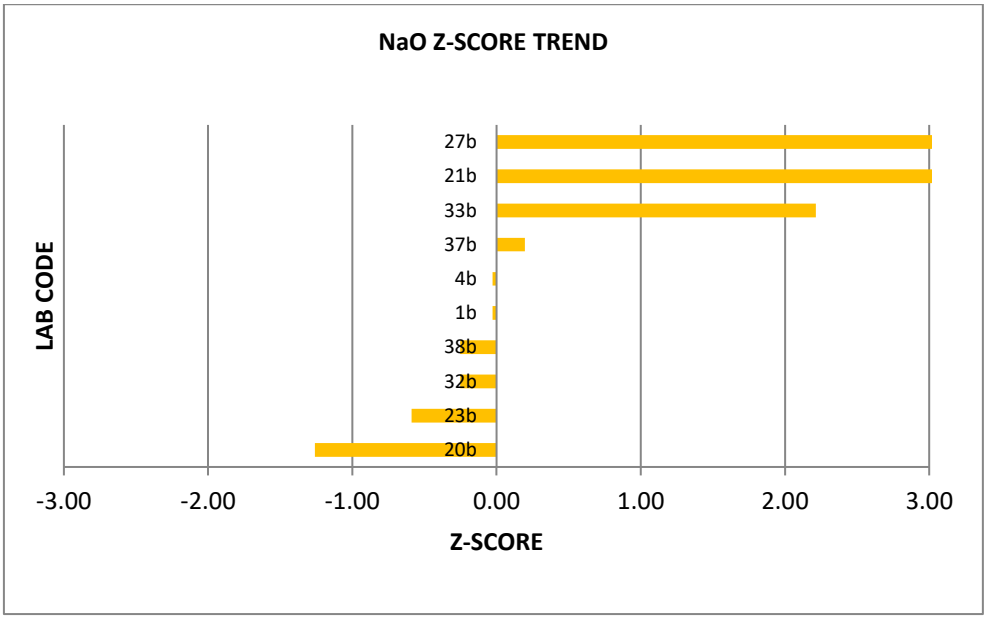
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : MnO2 (%)			
	LAB ID	**MnO2 %**	**Z-SCORE**
	1b	0,055	-0,17
	4b	0,058	0,34
	20b	0,060	0,68
	21b	0,053	-0,51
	23b*	***0,090***	***5,76***
	27b	0,047	-1,52
	32b	0,060	0,68
	33b*	***0,014***	***-7,11***
	37b	0,050	-1,02
	38b	0,065	1,52
Number of results	-	**10**	-
OUTLIERS	-	**2**	-
AVERAGE	-	**0,056**	-
MEDIAN	-	**0,057**	-
STD DEVIATION	-	**0,006**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U,O,M	-	-	-



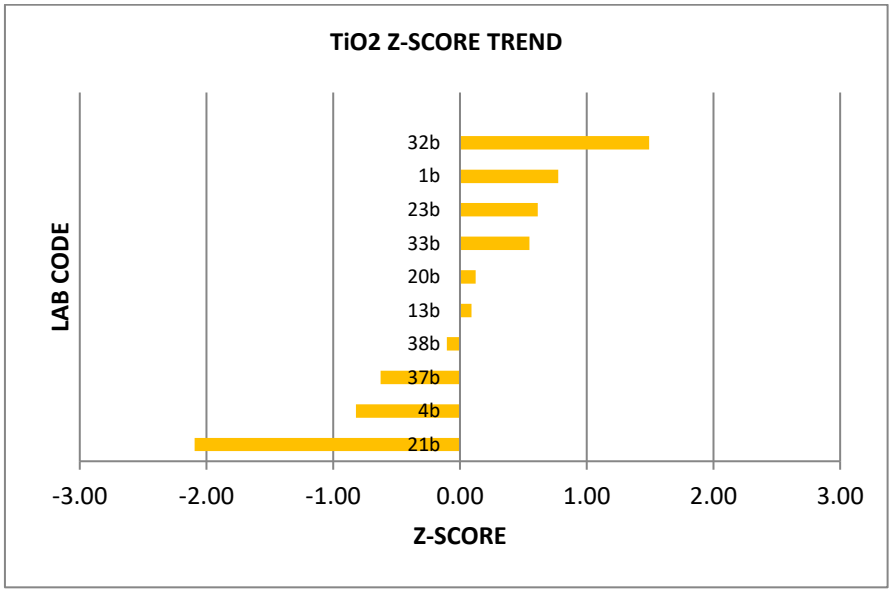
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : Fe2O3 (%)			
	LAB ID	**Fe2O3 %**	**Z-SCORE**
	1b	3,86	0,73
	4b	3,53	-0,17
	13b	3,60	0,02
	20b	4,21	1,68
	21b	2,88	-1,93
	23b	3,65	0,16
	27b*	***1,64***	***-5,29***
	32b	3,94	0,95
	33b	3,50	-0,25
	37b	3,25	-0,92
	38b	3,49	-0,27
Number of results	-	**11**	-
OUTLIERS	-	**1**	-
AVERAGE	-	**3,59**	-
MEDIAN	-	**3,57**	-
STD DEVIATION	-	**0,37**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U.O.M	-	-	-



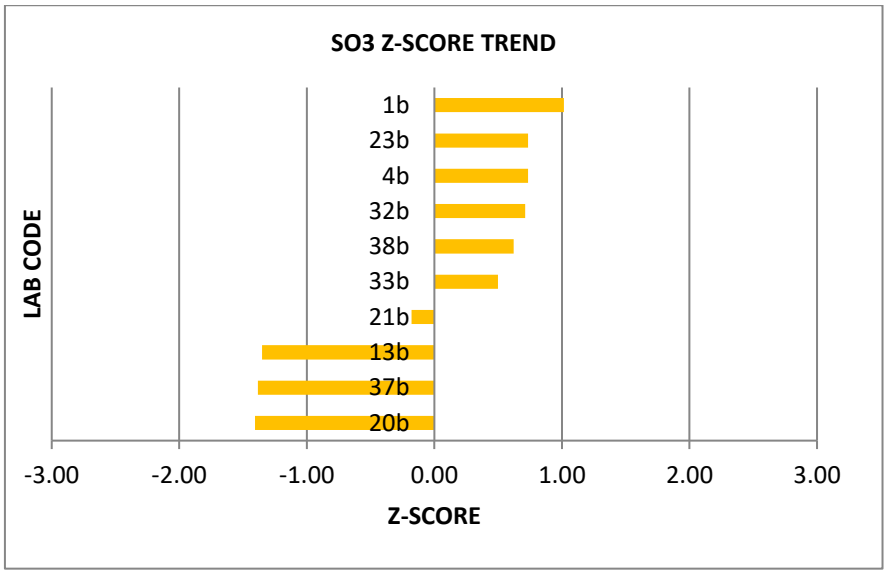
COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : Na2O (%)			
	LAB ID	**Na2O %**	**Z-SCORE**
	1b	0,14	-0,03
	4b	0,14	-0,03
	20b	0,03	-1,26
	21b	**1,23**	**12,19**
	23b	0,09	-0,59
	27b	**1,57**	**16,00**
	32b	0,12	-0,25
	33b	0,34	2,21
	37b	0,16	0,20
	38b	0,12	-0,25
Number of results	-	**10**	-
OUTLIERS	-	**2**	-
AVERAGE	-	**0,14**	-
MEDIAN	-	**0,13**	-
STD DEVIATION	-	**0,09**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U.O.M	-	-	-



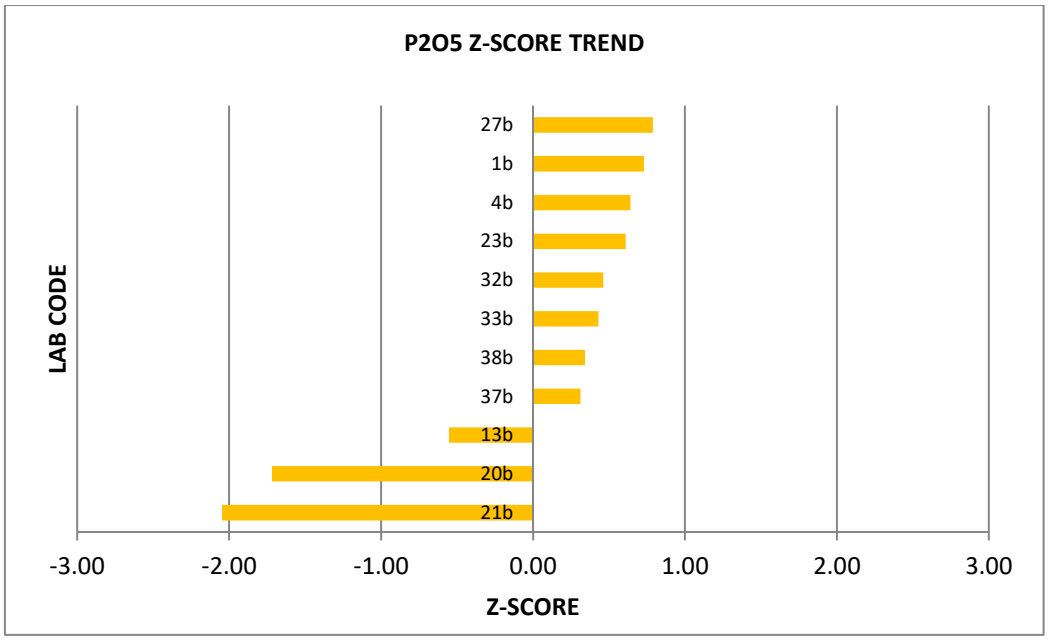
OAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : TiO2 (%)			
	LAB ID	**TiO2 %**	**Z-SCORE**
	1b	1,71	0,78
	4b	1,22	-0,82
	13b	1,50	0,09
	20b	1,51	0,12
	21b	0,83	-2,09
	23b	1,66	0,61
	27b*	***0,09***	***-4,51***
	32b	1,93	1,49
	33b	1,64	0,55
	37b	1,28	-0,63
	38b	1,44	-0,10
Number of results	-	**11**	-
OUTLIERS	-	**1**	-
AVERAGE	-	**1,47**	-
MEDIAN	-	**1,51**	-
STD DEVIATION	-	**0,31**	-
ROBUST AVERAGE	-	**1,50**	-
ROBUST STD DEV	-	**0,30**	-
U.O.M	-	**0,12**	-



COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : SO3 (%)			
	LAB ID	**SO3 %**	**Z-SCORE**
	1b	3,60	1,02
	4b	3,35	0,73
	13b	1,50	-1,35
	20b	1,45	-1,41
	21b	2,54	-0,18
	23b	3,35	0,73
	32b	3,33	0,71
	33b	3,14	0,50
	37b	1,47	-1,38
	38b	3,25	0,62
Number of results	-	**10**	-
OUTLIERS	-	**0**	-
AVERAGE	-	**2,70**	-
MEDIAN	-	**3,20**	-
STD DEVIATION	-	**0,89**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U.O.M	-	-	-



COAL CONCEPTS - PROFICIENCY TESTING - JANUARY 2026			
ANALYTICAL PARAMETER : P2O5 (%)			
	LAB ID	**P2O5 %**	**Z-SCORE**
	1b	1,38	0,73
	4b	1,35	0,64
	13b	0,95	-0,55
	20b	0,56	-1,72
	21b	0,45	-2,05
	23b	1,34	0,61
	27b	1,40	0,79
	32b	1,29	0,46
	33b	1,28	0,43
	37b	1,24	0,31
	38b	1,25	0,34
Number of results	-	**11**	-
OUTLIERS	-	**0**	-
AVERAGE	-	**1,14**	-
MEDIAN		**1,28**	-
STD DEVIATION	-	**0,33**	-
ROBUST AVERAGE	-	-	-
ROBUST STD DEV	-	-	-
U.O.M	-	-	-



4. CONCLUSIONS

4.1.1 SiO_2 analysis exhibited a satisfactory performance, characterized by a relatively even z-score distribution, one outlier was detected, and a minimal average-median difference of 0.30%.

4.1.2 Al_2O_3 analysis showed a relatively uneven z-score distribution, with two outliers detected, and a notable difference of 0.44% between the average and median values.

4.1.3 K_2O analysis showed uneven z-score distribution with no outlier detected. Average (0.55%) and median (0.52 %) are close. Results compare relatively well.

4.1.4 MgO analysis had two outliers, and the z-scores indicate that most results compare well excluding outliers. Average (1.56%) and median (1.61%) are close.

4.1.5 CaO analysis showed 1 outlier. Average (7.54%) & median (7.36%) are close

4.1.6 MnO_2 analysis Avg = 0.056%, Median = 0.057%, 0 outliers. Z-scores mostly within normal range.

4.1.7 Fe_2O_3 analysis: Avg = 3.59%, Median = 3.57%, 0 outliers. Z-scores mostly within normal range.

4.1.8 Na_2O – analysis showed a relatively even distribution, two outliers were detected, average and median values were similar.

4.1.9 TiO_2 analysis showed significant deviations, with one outlier detected, although the mean and median values were similar.

4.1.10 SO_3 : analysis showed a wide distribution of results, with no outliers were detected and a notable difference between the average and median values, indicating significant variability. with a standard deviation of 0.89 %.

4.1.11 P_2O_5: analysis showed a consistent distribution of results, with no outliers were detected, and similar average and median values

End of report

COAL CONCEPTS: Terms and Conditions

Return 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.