



AZURESKY PTY LTD PROFICIENCY TESTING

GENERAL ANALYSIS REPORT

LABORATORY CODE:

Report No: 1

Final Report

Date Issued: 02nd June 2025

Document compiled by:

Laboratory Manager - Sifiso Nyambi

Signature:

Document authorised by:

Managing Director - Nonhlanhla Msibi

Signature:

1. Letter to participant

Azuresky (Pty) Ltd is thankful thatLaboratory participated in this round of proficiency testing scheme.

Each participant is allocated a random unique number for the programme to enable total confidentiality of results.

Your laboratory has been allocated unique identification number

The participant is encouraged to submit any comments and queries regarding results or the operation of the scheme to email:
info@azuresky.it.com

■

2. Executive summary

Azuresky entity is a proficiency testing scheme provider and certified reference material producer. We aim to produce a homogenous proficiency test sample and stable certified reference material to be used for the evaluation of participant performance against pre-defined criteria in interlaboratory comparison programs specific to coal testing methods and calibration of coal testing equipment. The laboratory operation or proficiency testing scheme started in March 2025 and it is not currently accredited.

The source of the coal samples for this round was acquired from an analytical coal laboratory situated in Mpumalanga, and the coal type is bituminous.

The identity of the samples dispatched for this round was: "Coal: General Analysis 04/2025".

The number of participants for this round was 28.

When n is large enough, the sampling distribution will follow normal distribution curve regardless of the original population distribution. This assumption is applied to all statistical calculations in this report.

An outlier was identified on Calorific Value analysis data and Volatile Matter analysis data. This could be attributed to a fault with the measurement process or a system producing the data.

Homogeneity test was conducted prior to distribution of proficiency testing samples and stability test were conducted after a month. Both were satisfactorily achieved.

Kindly note that no z-scores graphs for the individual labs have been included in this report as we currently have only one point.

3. List of participants

1. Siza Coal Dundee	15. UAS Overlooked Lab
2. Sibonisiwe Coal Laboratory Services RMC	16. SGS Koornfontein
3. SGS Belfast	17. Siza Coal Leeuwpan
4. Umzamo Laboratory Services Main Lab	18. Siza Coal Analytical Services Mgayo
5. Cotecna Ubumbene	19. Noko Analytical Services
6. SGS Pullenshope	20. Sibonisiwe Coal Laboratory Services Clewer
7. Cotecna Middelburg Laboratory	21. UAS A re shomeng
8. Labrite	22. Siza Middelburg
9. Sibonisiwe Coal Main Lab	23. Eskom Arnot Power Station
10. SGS Kego	24. SGS Kranspan
11. SA Lab Middelburg	25. Ronewa Wescoal
12. SGS Palesa	26. Siza Coal Services Umlalazi
13. Umzamo Laboratory Services Dorinda	27. Ronewa Gugulethu
14. SGS Chilwavhusiku Colliery	28. Cotecna Richards Bay

4. Homogeneity check

10 random samples were extracted from the batch during packaging. These were used to test for homogeneity prior distribution.

# Sample	Initial Test	Final Test	Sample av (Xt)	Range (Wt)	Range sqd
1	31.14	31.12	31.13	0.02	0.0004
2	30.87	30.76	30.815	0.11	0.0121
3	30.92	30.65	30.785	0.27	0.0729
4	30.74	31	30.87	0.26	0.0676
5	30.42	31.02	30.72	0.6	0.3600
6	30.56	30.76	30.66	0.2	0.0400
7	31	30.73	30.865	0.27	0.0729
8	30.73	30.86	30.795	0.13	0.0169
9	30.99	30.91	30.95	0.08	0.0064
10	30.97	30.97	30.97	0	0.0000
Overall Average			30.86		
Standard Deviation			0.14		
SSwithin			0.475		
SSbetween			0.012		
$\tilde{\sigma}^2$			7.992		
Check value			2.398		

where: $\tilde{\sigma}$ is the standard deviation from the pt assessment

Conclusion: Since $SS_{\text{between}} < \text{Check value}$. Thus, homogeneity is sufficient.

5. Stability check

10 Random samples from the batch sent to the participants were selected to check for stability a month later.

# Sample	Initial Test	Final Test	Sample av (Xt)	Range (Wt)	Range sqd
1	31.41	31.23	31.32	0.18	0.0324
2	31.83	31.36	31.595	0.47	0.2209
3	31.18	31.24	31.21	0.06	0.0036
4	31.3	31.62	31.46	0.32	0.1024
5	31.48	31.43	31.455	0.05	0.0025
6	31.31	31.31	31.31	0	0
7	31.2	31.36	31.28	0.16	0.0256
8	31.27	31.31	31.29	0.04	0.0016
9	31.37	31.5	31.435	0.13	0.0169
10	31.31	31.81	31.56	0.5	0.25
Overall Average			31.39		
Standard Deviation			0.128		
SSwithin			0.611		
SSbetween			0.013		
$\bar{\sigma}^2$			8.07		
Check value			2.424		

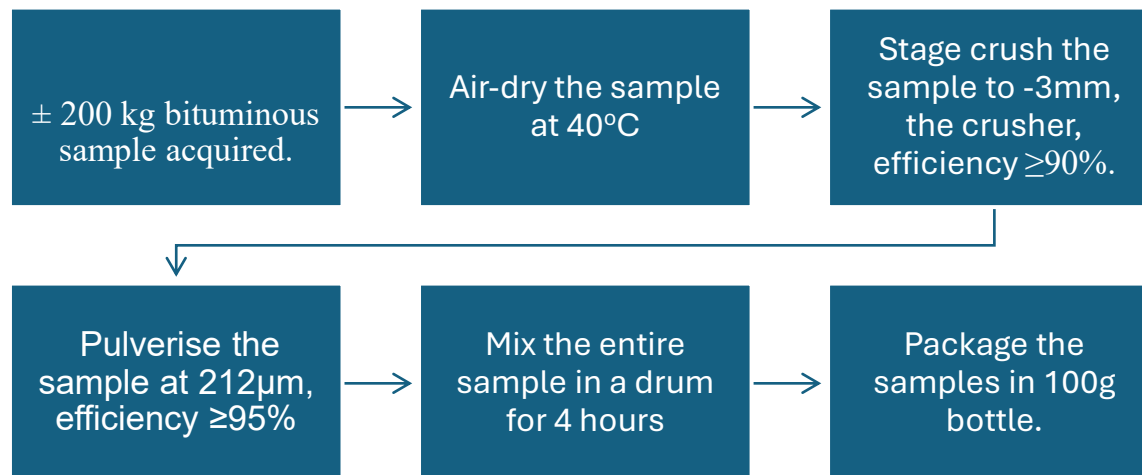
SSbetween < Check value. Thus, samples are stable.

6. Sample preparation

Sample preparation method followed the guidelines stipulated as per ISO 13909-4, ISO/IEC 17025, ISO/IEC 17043 and ISO 17034. Prior to the distribution of the samples, 10 random samples of 60g were extracted by the flat-and-heap method from the 600g taken from the drum.

None of the activities for the PT program were subcontracted.

Sample preparation process flow:



7. Measurement Protocol and identification of the measurement standard

The analysis performed for this round together with the SI units are stipulated below:

- Calorific Value measured in MJ/Kg
- ISO Ash in % m/m
- Quick Ash in % m/m
- Total Sulphur %
- Ash Fusion Temperature (°C)
- Moisture in Analysis sample % m/m

8. Measurement Results

	Air-dry basis								
Lab ID	%Moisture	%Ash	%Volatile	Calorific Value MJ/Kg	%Total Sulfur	DT	ST	HT	FT
9	3,54	31,12	22,12	20,46	0,76	-	-	-	-
10	3,00	31,78	24,09	20,77	-	-	-	-	-
11	3,40	31,30	22,40	20,45	0,71	1500	>1500	>1500	>1500
12	3,90	31,00	22,60	20,45	0,83	>1500	>1500	>1500	>1500
13	3,60	31,20	22,40	20,30	0,79	-	-	-	-
14	3,20	30,77	17,28	26,55	0,73	-	-	-	-
15	3,80	31,00	19,50	20,70	0,89	-	-	-	-
16	3,78	30,92	22,10	20,26	0,82	-	-	-	-
17	3,50	31,00	22,60	20,72	0,85	-	-	-	-
18	3,00	31,20	22,85	20,36	0,86	1500	1500	1500	1500
19	3,60	31,10	22,43	20,06	0,84	1500	1500	1500	1500
20	3,10	31,20	24,30	20,17	0,75	-	-	-	-
21	3,90	31,40	22,10	20,26	0,86	-	-	-	-
22	3,13	31,68	22,72	20,15	0,84	-	-	-	-
23	3,14	31,38	25,62	20,39	0,76	-	-	-	-
24	3,40	31,60	-	20,33	-	-	-	-	-
25	2,93	31,20	20,41	20,41	0,75	1500	1500	1500	1500
26	4,75	31,52	21,06	19,87	0,82	-	-	-	-
27	4,00	31,50	22,20	20,13	0,90	-	-	-	-
28	3,54	31,53	22,29	20,20	0,90	1500	1500	1500	1500
29	3,42	31,60	22,39	20,25	0,89	-	-	-	-
30	3,30	31,50	22,40	20,52	0,81	-	-	-	-
31	3,58	31,28	22,90	20,18	0,80	-	-	-	-
32	3,46	31,12	23,10	20,13	0,89	-	-	-	-
33	3,30	31,20	22,50	20,44	-	-	-	-	-
34	3,60	31,40	22,50	20,84	1,01	-	-	-	-
35	3,31	31,75	22,58	20,33	0,81	-	-	-	-
36	3,70	31,51	22,74	20,17	0,80	-	-	-	-

Key: “ - “ or “ *** “represents no participation

	Dry-basis										
Lab ID	% ISO Moisture	% Quick Ash	Z-score	% ISO Ash	Z-score	%Volatile	Z-score	Calorific Value (MJ/Kg)	Z-score	%Total Sulfur	Z-score
9	3,54	***	***	32,26	-0,52	22,93	-0,33	21,21	0,58	0,79	-1,03
10	3,00	***	***	32,76	1,18	24,84	1,33	21,41	1,49	***	***
11	3,40	***	***	32,40	-0,05	23,19	-0,11	21,17	0,39	0,73	-1,79
12	3,90	***	***	32,26	-0,54	23,52	0,18	21,28	0,89	0,86	0,05
13	3,60	***	***	32,37	-0,17	23,24	-0,07	21,06	-0,12	0,82	-0,58
14	3,20	***	***	31,79	-2,14	17,85	-4,79	27,43	28,87	0,75	-1,51
15	3,80	***	***	32,22	-0,65	20,27	-2,67	21,52	1,97	0,93	0,93
16	3,78	***	***	32,13	-0,96	22,97	-0,30	21,06	-0,13	0,85	-0,11
17	3,50	***	***	32,12	-0,99	23,42	0,09	21,47	1,76	0,88	0,30
18	3,00	***	***	32,16	-0,85	23,56	0,21	20,99	-0,43	0,89	0,38
19	3,60	***	***	32,26	-0,53	23,27	-0,04	20,81	-1,25	0,87	0,16
20	3,10	***	***	32,20	-0,74	25,08	1,55	20,82	-1,22	0,77	-1,23
21	3,90	***	***	32,67	0,88	23,00	-0,28	21,08	-0,01	0,89	0,50
22	3,13	***	***	32,70	0,98	23,45	0,12	20,80	-1,29	0,87	0,10
23	3,14	***	***	32,40	-0,06	26,45	2,75	21,05	-0,15	0,78	-1,08
24	3,40	***	***	32,71	1,01	***	***	21,05	-0,17	***	***
25	2,93	***	***	32,14	-0,93	21,03	-2,01	21,03	-0,26	0,77	-1,25
26	4,75	***	***	33,09	2,30	22,11	-1,05	20,86	-1,01	0,86	0,01
27	4,00	***	***	32,81	1,35	23,13	-0,16	20,97	-0,52	0,94	1,11
28	3,54	***	***	32,69	0,92	23,11	-0,18	20,94	-0,65	0,93	1,04
29	3,42	***	***	32,72	1,03	23,18	-0,11	20,97	-0,53	0,92	0,88
30	3,30	***	***	32,57	0,54	23,16	-0,13	21,22	0,62	0,84	-0,32
31	3,58	***	***	32,44	0,09	23,75	0,38	20,93	-0,70	0,83	-0,43
32	3,46	***	***	32,24	-0,61	23,93	0,54	20,85	-1,06	0,92	0,88
33	3,30	***	***	32,26	-0,51	23,27	-0,04	21,14	0,24	***	***

	Dry-basis											
	Lab ID	% ISO Moisture	% Quick Ash	Z- score	% ISO Ash	Z- score	%Volatile	Z- score	Calorific Value (MJ/Kg)	Z- score	%Total Sulfur	Z- score
	34	3,60	32,57	-1,04	***	***	23,34	0,02	21,62	2,43	1,05	2,68
	35	3,31	32,84	0,96	***	***	23,35	0,03	21,03	-0,26	0,84	-0,32
	36	3,70	32,72	0,08	***	***	23,61	0,26	20,95	-0,62	0,83	-0,42
# of participants	28	28	3	-	25	-	27	-	28	-	25	-
Outliers			0	-	0	-	1	-	1	-	0	-
# of participants after outlier elimination	-	-	3	-	25	-	26	-	27	-	25	-
Average	-	3,49	32,71	-	32,42	-	23,31	-	21,08	-	0,86	-
Standard deviation	-	-	0,13	-	0,29	-	1,14	-	0,22	-	0,07	-
%RSD	-	-	0,40	-	0,91	-	4,89	-	1,04	-	8,14	-
Median	-	3,60	32,72	-	32,37	-	23,27	-	21,05	-	0,86	-
Min	-	2,93	32,57	-	31,79	-	17,85	-	20,80	-	0,73	-
Max	-	4,75	32,84	-	33,09	-	26,45	-	27,43	-	1,05	-
standard error	-	-	0,33	-	0,12	-	0,46	-	0,09	-	0,03	-
Standard error*3	-	-	-	-	0,36	-	1,38	-	0,27	-	0,09	-
LCL	-	-	-	-	32,05	-	21,93	-	20,82	-	0,77	-
UCL	-	-	-	-	32,78	-	24,70	-	21,35	-	0,95	-

ASH FUSION TEMPERATURS (°C)									
	LAB ID	DEFORMATION TEMP	Z-score	SOFTENING TEMP	Z-score	HEMISPHERE TEMP	Z-score	FLOW TEMP	Z-score
	11	1500	0	1500	0	1500	0	1500	0
	12	1500	0	1500	0	1500	0	1500	0
	18	1500	0	1500	0	1500	0	1500	0
	19	1500	0	1500	0	1500	0	1500	0
	26	1500	0	1500	0	1500	0	1500	0
	28	1500	0	1500	0	1500	0	1500	0
# Participants	6	6	-	6	-	6	-	6	-
Outliers	-	0	-	0	-	0	-	0	-
Average	-	1500	-	1500	-	1500	-	1500	-
Median	-	1500	-	1500	-	1500	-	1500	-
Standard deviation	-	0	-	0	-	0	-	0	-

9. Evaluation of the measurement results

- There were few outliers throughout the series of tests, one on Calorific value and one on volatile matter. The outliers were removed from the calculations.
- All results are accepted as correct and cannot be changed after the release of the report.

Z-scores evaluation criteria:

- A z-score that lies between +1 and -1 is deemed acceptable.
- A z-score that lies between +2 and -2 is deemed satisfactory.
- A z-score that lies between +2/+3 and -2/-3 is questionable.
- A z-score >3 / <-3 is unsatisfactory (outlier).

Figure 1: Volatile matter z-scores

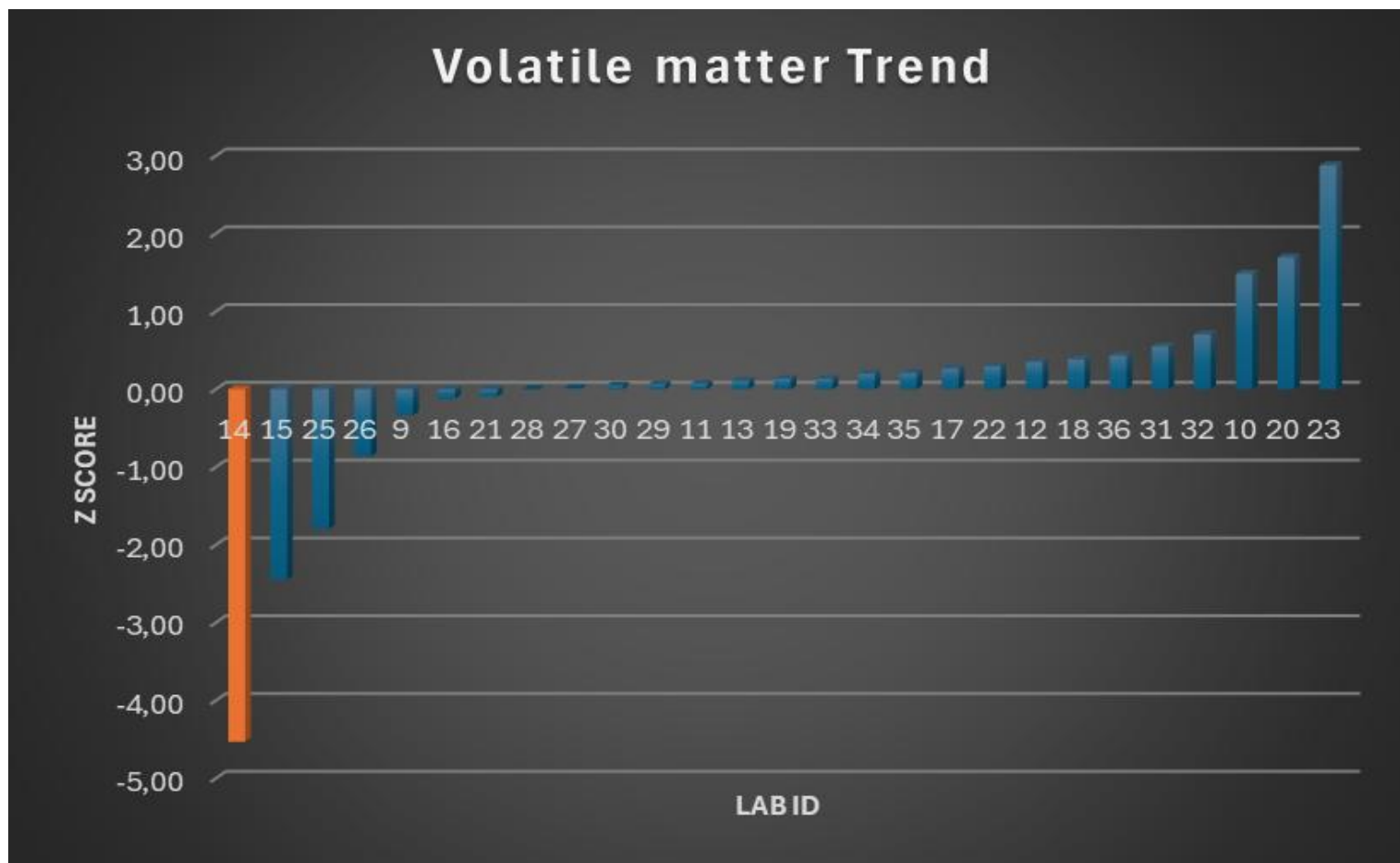


Figure 2: ISO ash z-scores



Figure 3: Calorific Value z-scores

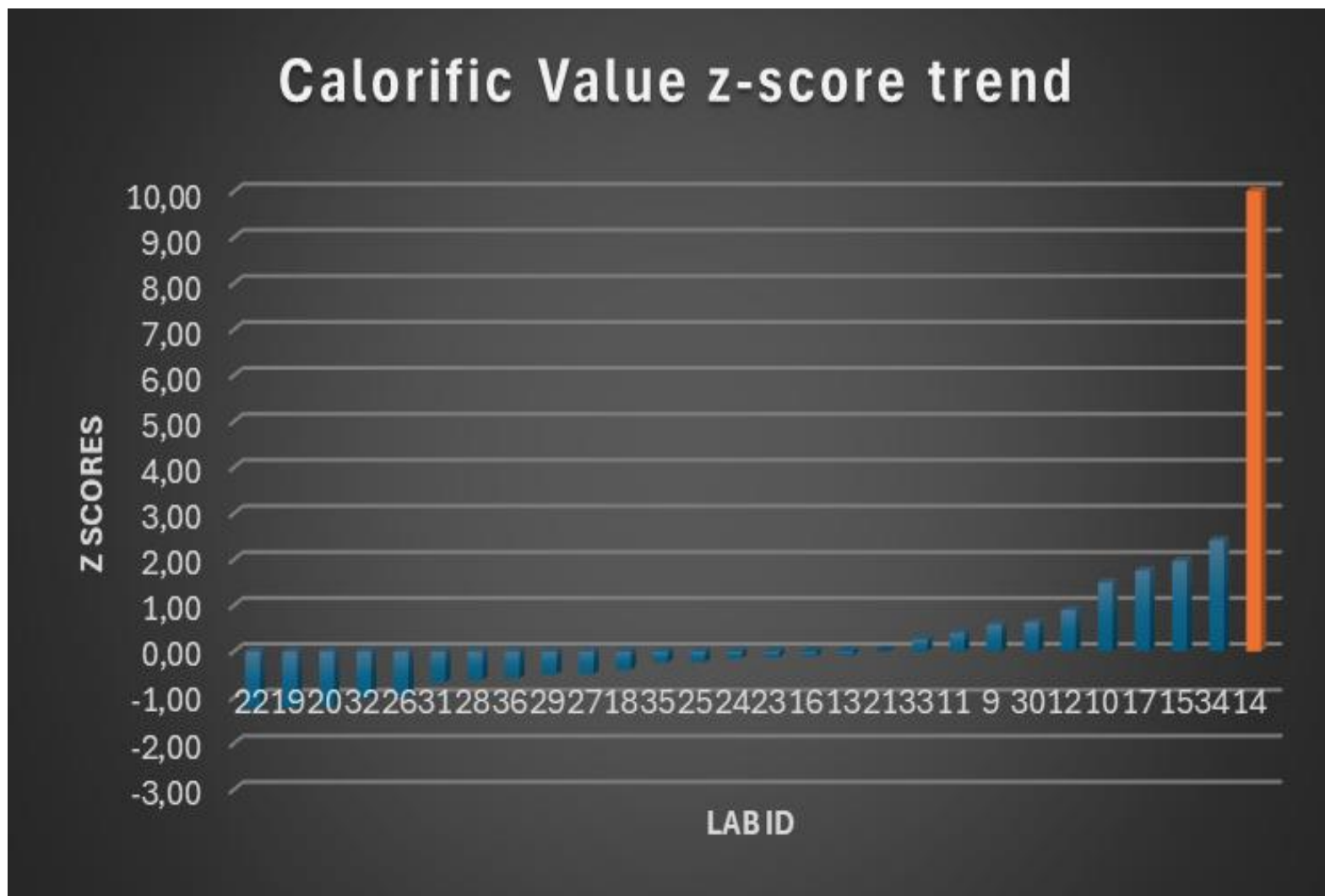


Figure 4: Total Sulphur z-scores

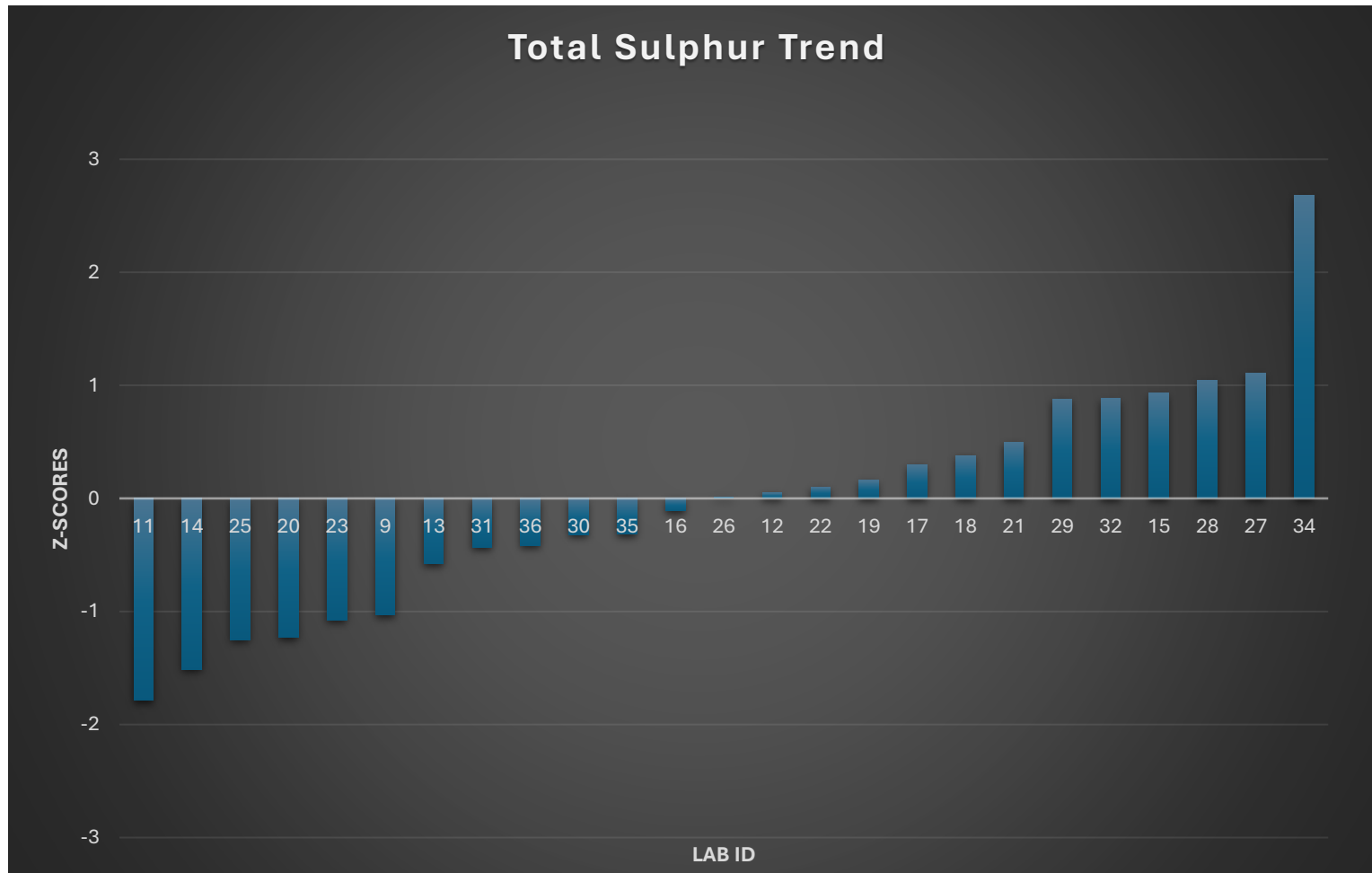
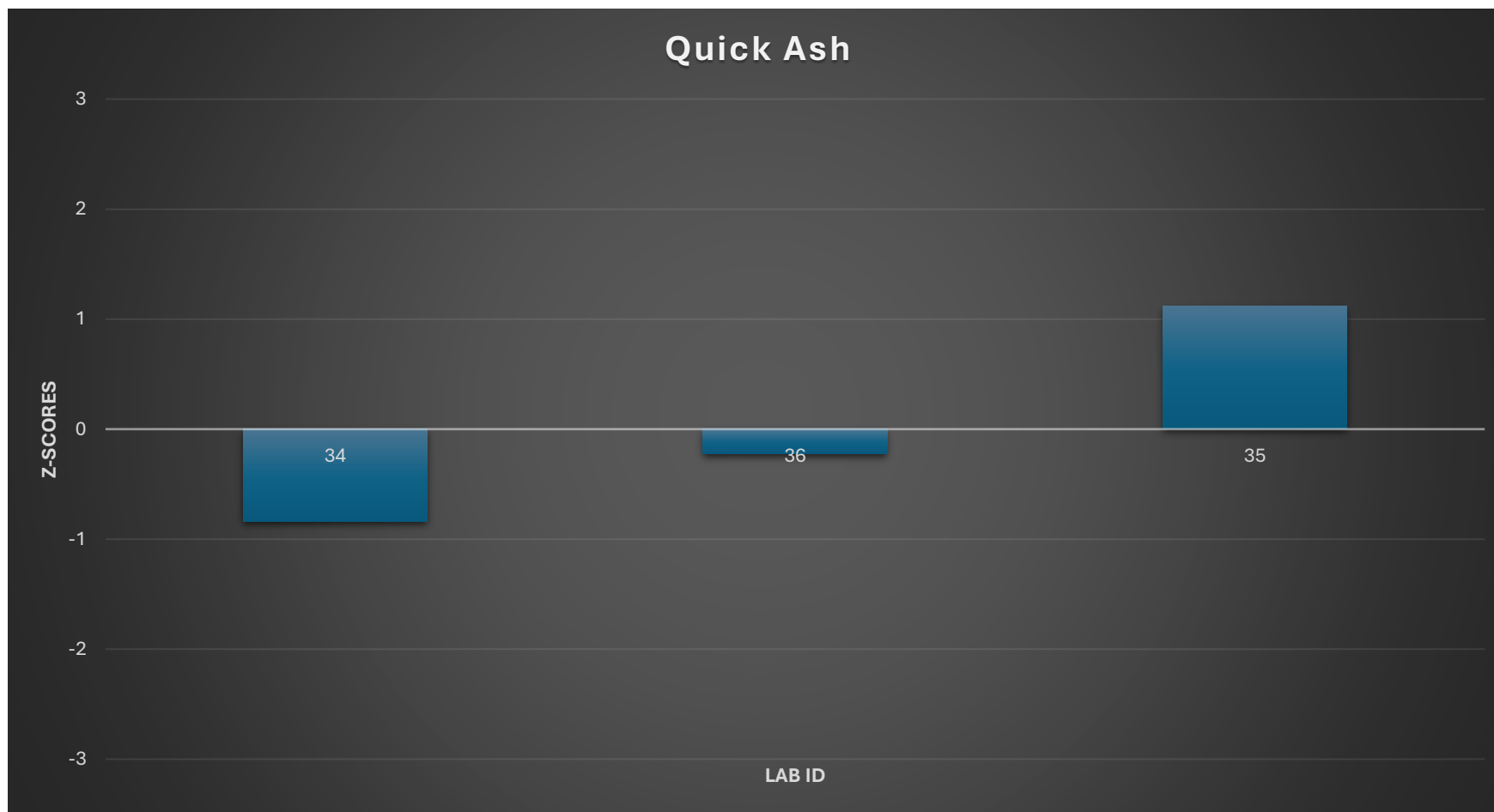


Figure 5: Quick Ash z-scores



10. General Conclusions

- 10.1. All the z-scores for the ISO Ash analysis and Total Sulphur analysis fall within the acceptance criteria and there were no outliers identified.
- 10.2. An outlier of 28.87 and -4.79 (z-scores) on the calorific value and volatile matter, respectively; were identified during the statistical evaluation. This could be an indication of a serious fault within the measurement process or the system producing the data.
- 10.3. All participants of Ash Fusion Temperature analysis performed well and produced identical results of 1500°C deformation.
- 10.4. There were only 3 participants for the quick Ash analysis. Since n is so small these results may not accurately represent the entire population.
- 10.5. The standard error obtained for ISO Ash, CV, VM and TS were too small which is an indication that each of the X_i values lie around the population mean.
- 10.6. The RSD value of 8.14% on the total sulphur is an indication that the data points are more spread out from the mean, thus they are less consistent (even though there was no outlier identified)