AZURESKY PTY LTD PROFICIENCY TESTING

GENERAL ANALYSIS REPORT

LABORATORY CODE: 16

Report No: 2

Final Report

Date Issued: 03rd June 2025

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1. **Letter to participant**

Azuresky (Pty) Ltd is thankful that ……laboratory participated in this round of the 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

There were two outliers identified, one on calorific value analysis and the other on volatile matter analysis.

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 05/2025”.

The number of participants for this round was 15.

When n is large (n~30), the sampling distribution will follow normal distribution regardless of the original population distribution. Since there were only 15 participants in this round, the results presented in this report may not be an accurate representation of the lot. However, the sample preparation has met the requirements of the homogeneity and stability checks (see tables in sections, 4 and 5).

3. List of participants

1.SGS Koornfontein
2.SGS Kranspan
3.SGS Palesa
4.SGS Pullenshope
5.SGS Kego
6.SGS Chilwavhusiku Colliery
7.Eskom Holdings Kriel Power station
8.Seriti New Vaal
9.Eskom Kendal Power Station
10.Medupi Power Station
11.Matla Power Station
12.Eskom Lethabo Power Station
13.Zomhlaba Lakeside
14.SGS Brakfontein Lab
15.Eskom Research and Testing

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	21.62	21.77	21.695	0.15	0.0225
2	22.22	22.26	22.24	0.04	0.0016
3	22.39	22.13	22.26	0.26	0.0676
4	22.23	22.22	22.225	0.01	0.0001
5	22.35	22.31	22.33	0.04	0.0016
6	22.57	22.19	22.38	0.38	0.1444
7	22.22	22.45	22.335	0.23	0.0529
8	22.28	22.27	22.275	0.01	0.0001
9	22.09	22.01	22.05	0.08	0.0064
10	22.09	22.45	22.27	0.36	0.1296
Overall Average			22.21		
Standard Deviation			0.22		
SSwithin			0.935		
SSbetween			1.110E-16		
õpt			6.448		
Check value			1.934		

where: õpt is the standard deviation from the pt

Conclusion: **Since SSbetween < Check value. Thus, homogeneity is sufficient.**

5. Stability check

10 random samples were analysed from the retained material for certification of reference material. These were used to test for stability three weeks after distribution.

# Sample	Initial Test	Final Test	Sample av (Xt)	Range (Wt)	Range sqd
1	22.77	22.65	22.71	0.12	0.0144
2	22.92	22.66	22.79	0.26	0.0676
3	22.99	22.98	22.985	0.01	1E-04
4	22.94	22.93	22.935	0.01	0.0001
5	22.33	22.06	22.195	0.27	0.0729
6	22.62	22.48	22.55	0.14	0.0196
7	22.69	22.72	22.705	0.03	0.0009
8	22.8	22.43	22.615	0.37	0.1369
9	22.52	22.55	22.535	0.03	0.0009
10	22.53	22.93	22.73	0.40	0.16
Overall Average			22.68		
Standard Deviation			0.224		
SSwithin			1.113		
SSbetween			0.026		
õpt			6.584		
Check value			1.975		

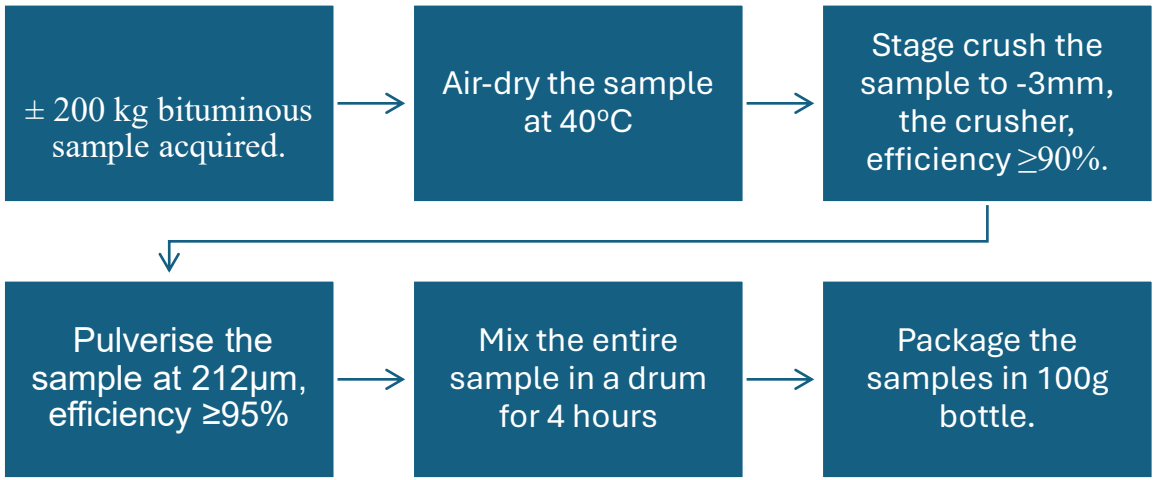
SSbetween < Check value. Thus, samples are stable.

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 %
- Moisture in Analysis sample % m/m

8. Measurement Results

	Air-dry basis				
Lab ID	**%Moisture**	**%Ash**	**%Volatile**	**Calorific Value MJ/Kg**	**%Total Sulphur**
16	3.59	21.65	25.39	24.08	1.35
21	3.80	22.60	25.10	24.15	1.44
22	3.01	22.63	25.38	23.95	1.43
23	3.23	22.42	28.61	23.92	1.36
24	3.30	22.60	***	24.19	
26	4.68	22.53	24.24	24.11	1.35
38	3.57	22.36	***	21.27	***
39	3.10	22.50	25.10	24.14	***
40	2.76	22.65	25.49	24.28	1.42
41	3.50	22.65	24.99	24.06	1.47
42	3.34	22.51	25.43	24.35	1.27
43	3.00	22.70	25.30	24.09	***
44	3.00	23.10	25.10	23.41	***
45	3.50	22.70	26.20	24.20	1.57
46	3.60	22.40	25.20	24.10	1.47

Key: " –" or " * "represents no participation**

		Dry-basis								
	Lab ID	% ISO Moisture	% ISO Ash	Z-score	%Volatile	Z-score	Calorific Value (MJ/Kg)	Z-score	%Total Sulphur	Z-score
	16	3.59	22.46	-2.91	26.34	0.50	24.98	0.32	1.40	-0.74
	21	3.80	23.49	0.56	26.09	-0.10	25.10	0.48	1.50	0.38
	22	3.01	23.33	0.02	26.17	0.09	24.69	-0.04	1.47	0.12
	23	3.23	23.17	-0.53	**29.56**	**8.51**	24.72	-0.01	1.41	-0.68
	24	3.30	23.37	0.15	***	***	25.02	0.37	***	***
	26	4.68	23.64	1.04	25.43	-1.74	25.29	0.72	1.42	-0.55
	38	3.57	23.19	-0.46	***	***	**22.06**	**-3.40**	***	***
	39	3.10	23.22	-0.36	25.90	-0.57	24.91	0.24	***	***
	40	2.76	23.29	-0.11	26.21	0.20	24.97	0.31	1.46	-0.05
	41	3.50	23.47	0.49	25.90	-0.59	24.93	0.26	1.52	0.68
	42	3.34	23.29	-0.13	26.31	0.44	25.19	0.59	1.31	-1.74
	43	3.00	23.40	0.25	26.08	-0.13	24.84	0.14	***	***
	44	3.00	23.81	1.63	25.88	-0.64	24.13	-0.75	***	***
	45	3.50	23.52	0.66	27.15	2.52	25.08	0.45	1.63	1.88
	46	3.60	23.24	-0.30	26.14	0.02	25.00	0.35	1.52	0.70
# of participants	-	15	15	-	13	-	15	-	10	-
Outliers	-	0	0	-	1	-	1	-	0	-
# of participants after outlier elimination	-	15	15	-	12	-	14	-	10	-
Average	-	3.40	23.33	-	26.13	-	24.73	-	1.46	-
Standard deviation	-	0.46	0.30	-	0.40	-	0.79	-	0.09	-
%RSD	-	-	1.28	-	1.54	-	3.18	-	5.91	-
Median	-	-	23.33	-	26.12	-	24.97	-	1.46	-
Min	-	-	22.46	-	25.43	-	22.06	-	1.31	-

		Dry-basis								
	Lab ID	% ISO Moisture	% ISO Ash	Z-score	%Volatile	Z-score	Calorific Value (MJ/Kg)	Z-score	%Total Sulphur	Z-score
Max	-	-	23.81	-	27.15	-	25.29	-	1.63	-
standard error	-	-	0.17	-	0.26	-	0.46	-	0.06	-
standard error x3	-	-	0.50	-	0.77	-	1.37	-	0.18	-
Lower confidence limit	-	-	22.83	-	25.36	-	23.35	-	1.28	-
Upper confidence limit	-	-	23.83	-	26.90	-	26.10	-	1.64	-

9. Evaluation of the measurement results

- There were two outliers, one on calorific value analysis (z-score = -3.40) and the other on ISO volatile matter analysis (z-score = 8.51).
- 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

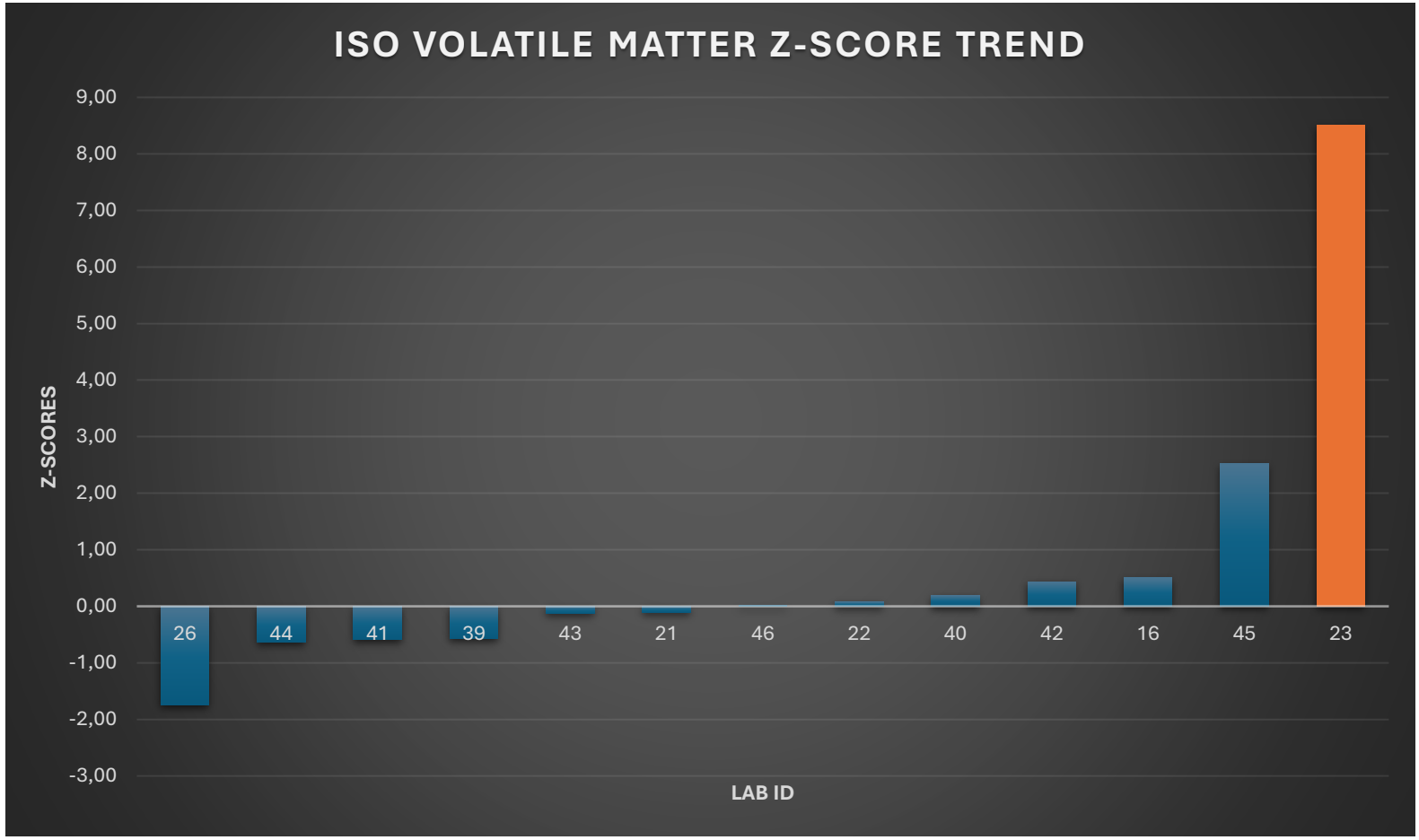


figure 2: ISO ash z-scores

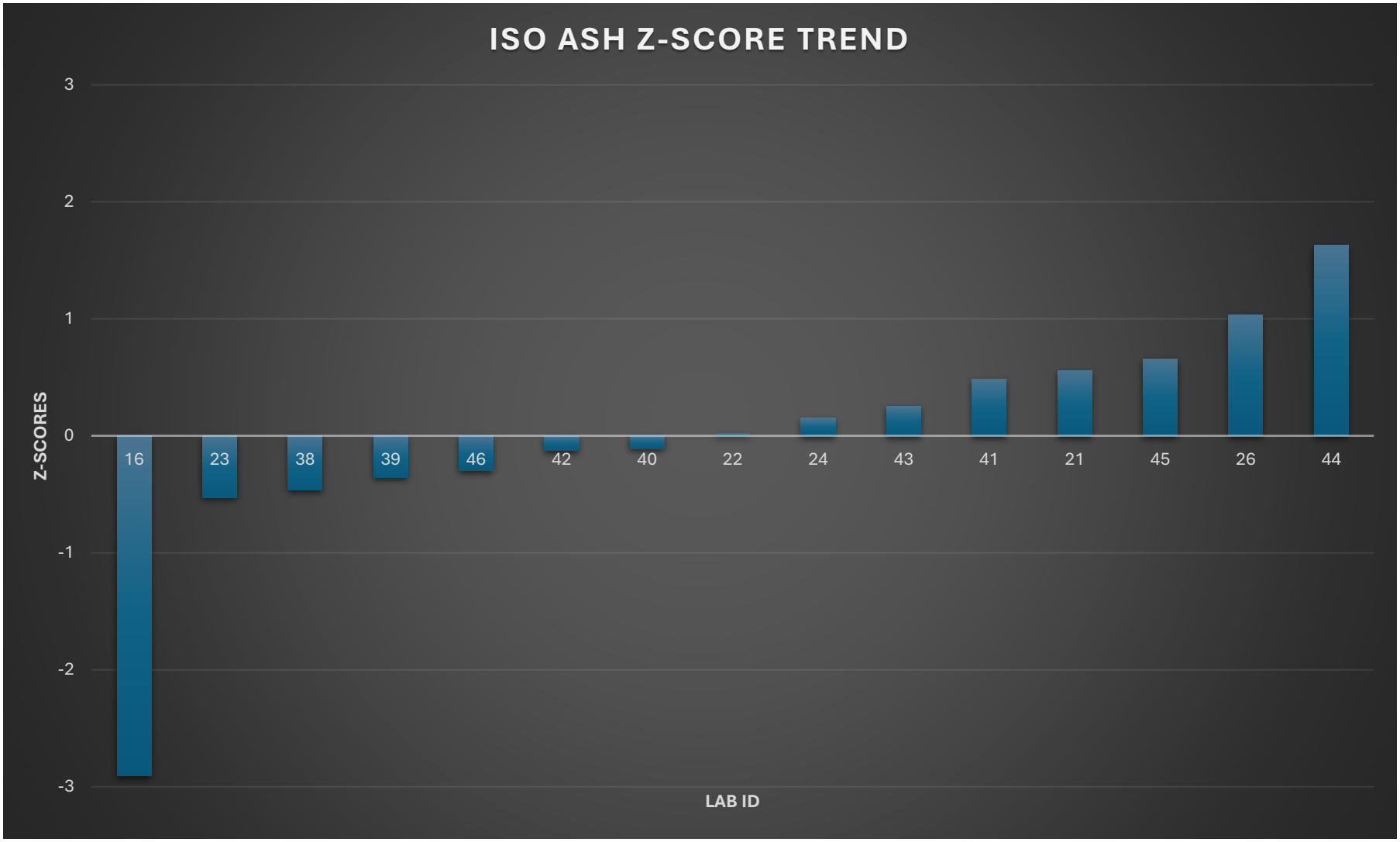


Figure 3: Calorific Value z-scores

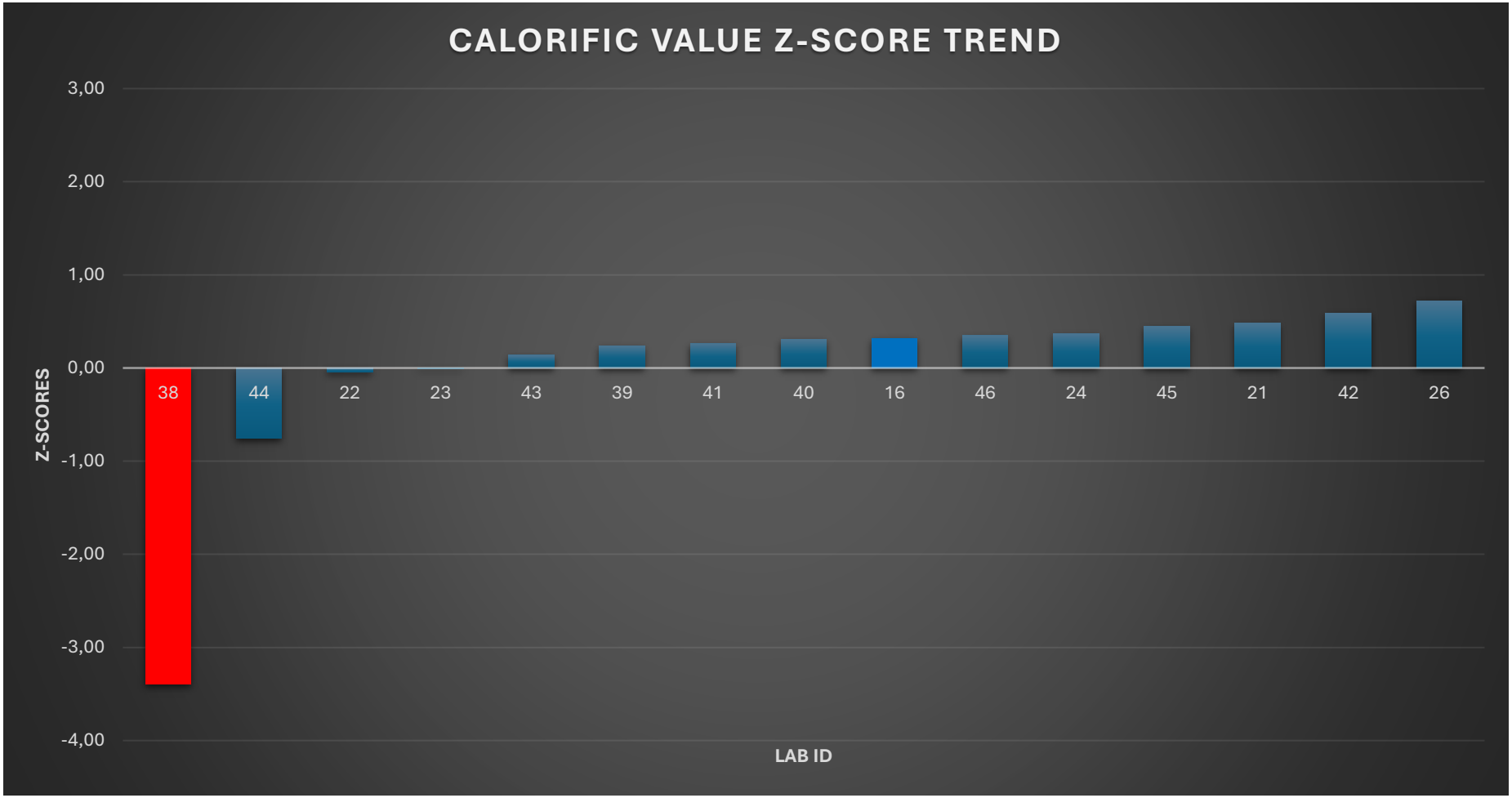
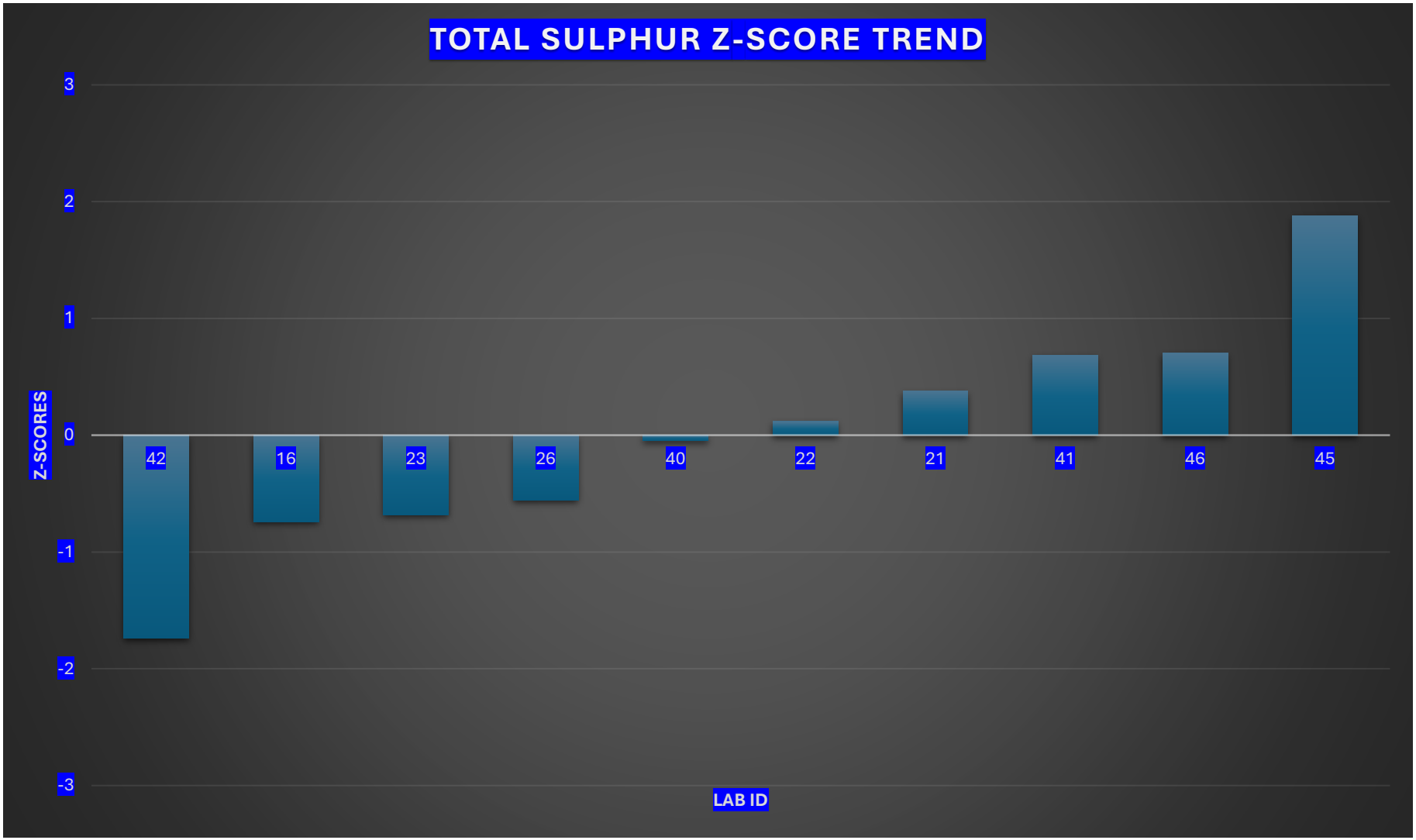


Figure 4: Total Sulphur z-scores



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 -3.40 and 8.51 (z-scores) on the calorific value and volatile matter, respectively; were identified during the statistical evaluation. This could be an indication of a fault within the measurement process or the system producing the data.

10.3. The standard error obtained for ISO Ash, CV, VM and TS were too small which is an indication that each of the *Xi* values lie around the population mean.

10.4. However the obtained RSD value of 5.91% on the total sulphur is an indication that the data points are less consistent (even though there was no outlier and standard error was too small).