CRB

Analyse Service GmbH

RFA Ringversuch AMIS, Südafrika - Kyanite AMIS0561

Veranstalter des Ringversuchs:	AMIS - African Mineral Standard - Südafrika
Ringversuchsmaterial:	Kyanite AMIS0561
RV geschlossen:	2018 – 6
Literatur:	Proficiency Testing Final Report (Laborcode CRB = U)

Hauptelemente [MA%]

	CRB	RV	1sRV	Z-Score
Na_2O	0,090	0,109	0,011	-1,040
MgO	0,230	0,240	0,015	0,230
Al_2O_3	19,990	20,150	0,382	-0,170
SiO_2	66,730	67,420	1,140	-0,160
P_2O5	0,107	0,110	0,010	-0,320
SO_3	1,701	2,508	0,102	-2,500
K_2O	0,488	0,501	0,018	-0,750
CaO	0,059	0,035	0,006	1,960
TiO_2	0,578	0,584	0,010	0,580
Fe_2O_3tot	6,870	6,960	0,149	-0,580
Cr_2O_3	0,057	0,060	0,009	0,250
V_2O5	0,028	0,027	0,004	0,300
BaO	0,024	0,024	0,006	-0,160
ZrO_2	0,018	0,017	0,003	0,300
SrO	0,022	0,023	0,004	0,030
L.O.I.	2,800	3,080	0,250	-0,400

Legende

CRB: Ergebnisse CRB – **RV:** Ergebnisse Ringversuch -- **1s-RV:** Standardabweichung Ringversuch

Z-Score: Differenz des Messwertes vom Mittelwert des Ringversuchs -- * Wert nicht zertifiziert

AMIS_Documents Doc: ADOC_029 Originator: Quality Specialist	Approver: Managing Director	Revision No: 002 Revision Date:11.06.2018 Issued By: Quality Specialist

Proficiency Testing Report

Proficiency Testing Final Report

Report to participating laboratories on the results from

AMIS0561
Proficiency Testing

Kyanite

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Date: 13 June 2018
Signature:

TABLE OF CONTENTS

Version 0.00

1. Confidentiality

This report is strictly confidential. Individual laboratories are not identified in this report. Individual laboratories will be given their own identifying codes for the different tables and graphs, but not the codes for other laboratories.

2. Absolute average z scores

Average absolute z score
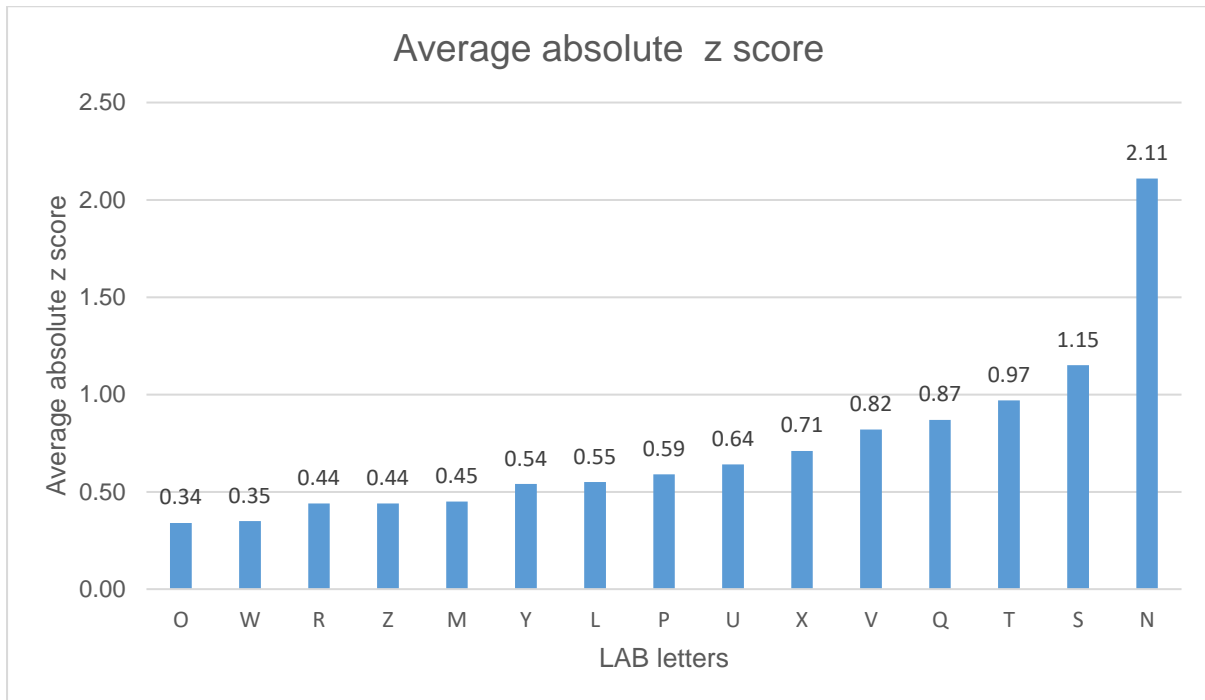
Based on the average of the absolute value of the z-scores

It is recommended by AMIS that should a laboratory's absolute average z-score be greater than 2, an internal investigation of possible root causes should be carried out by the laboratory.
The values highlighted in red on the data are considered outliers.

Labs that participated - NOT the same order as Lab Letter
ALS (Vancouver) - Analytical Laboratory Services - Vancouver, Canada
ALS Arabia
ALS Chemex Laboratory Group Lima (Peru)
ALS OMAC (Ireland)
American Assay Laboratories
Antech Zimbabwe
CRB Analyse Service GmbH
Dorfner Anzaplan Analysenzentrum und Anlagenplanungsgesellschaft mbH
Intertek Perth
LC2M – Pôle Analyses Chimiques de spécialité
Set Point Laboratories (Isando) SA
SGS India Private Limited
SGS Mineral Services Lakefield (Canada)
SGS South Africa
Spectrochemical Lab Material Evaluation

3. Explanation of statistical analysis

Five teen laboratories were each sent 8 samples of material taken scientifically from throughout the batch. Results from Five teen of the laboratories were received in time for the Certification.

Laboratories are indicated by letters L through to Z and are not listed in alphabetical order.

1.1 The data tables contain raw assay data from those labs plus:
- the lab mean,
- the lab standard deviation,
- the lab RSD (the laboratory standard deviation divided by the lab mean, expressed as a percentage),
- the z-scores of the individual analyses (the individual value minus the mean of the whole data divided by the standard deviation of the whole data),
- a laboratory ranking based on the average of the absolute values for the z-score of the AMIS0561 data,
- statistics for the un-iterated data set (mean, standard deviation and RSD),
- Statistics for the iterated data (mean, RSD percent, number of results, SD, 2SD, 3SD, Std mean±2SD and Std mean±3SD). This data can be used in conjunction with the graph
- simple statistics of the lab statistics (mean, standard deviation and RSD),
- Measurement of uncertainty

1.2 Some results were removed for the calculation of the mean and standard deviation presented on the graph. The general rules for exclusion were:
- If the z score >±2, the result is an outlier and it is removed.
- If 50% or less of the results from one laboratory have z scores >±2, those results are removed
- If 50% or more of the results from one laboratory have z scores >±2, the entire laboratory's results are removed.

1.3 Statistics on these tables are those for the whole data set. They differ from the "recommended concentrations" and two "between laboratory standard deviations" on the certificate independently calculated by the certifying geochemist. Some outlying results were excluded for the calculation of those values.

1.4 An independent geochemist Allan Fraser, was retained to provide recommended concentrations and limits at two standard deviations. These represent the values that a "good lab" should report, within acceptable limits of analytical accuracy. Allan Fraser was provided with the electronic versions of all assay reports and a spreadsheet containing the compiled data prepared by Mrs Melesha Gopi Mungaroo (PT Scheme Coordinator).

Disclaimer: While every precaution has been taken to ensure the accuracy of this data AMIS, a division of Torre Analytical Services (Pty) Ltd will not be held responsible for any errors. Laboratory managers are requested to carefully vet this report and to draw the author's attention to any mistakes or omissions that may be present.

4. Subcontracted activities

The following activities were subcontracted:

4.1 Preparation of Certified Reference Material
4.2 QC analysis to determine ranges for individual elements
4.3 Proficiency testing analysis performed by participating laboratories

5. Method of preparation, Homogeneity and Stability assessment

The particle size distribution for this material was shown to have a nominal top size of 54µm (95% passing 54µm). The procedure of preparation in brief is as follows: the material was crushed, dry-milled and air-classified to <54µm. It was then blended in a bi-conical mixer, systematically divided and sealed into 1kg Laboratory Packs. Explorer Packs are then subdivided from the Laboratory Packs as required. Final packaged units were then selected on a random basis and submitted for analysis to an independent laboratory accredited with the ISO17025:2005 standard of general requirements for the competence of testing and calibration laboratories. The results obtained from this laboratory are then evaluated statistically by AMIS for homogeneity. The stability of the material will be subject to continuous testing for the duration of the inventory. Should product stability become an issue, all customers will be notified and notification to that effect will be placed on the www.amis.co.za website.

6. Assigned value

The assigned values for the PT report are expressed as the mean calculated from the software as follows:

6.1 Calculated from all the raw data including outliers
6.2 Calculated after removal of outliers using z-scores (Refer to 1.4)

7. Standard Deviation For Proficiency Assessment

The Standard Deviation is a representation of the population standard deviation and provides the estimate of the repeatability of the data and it is calculated as follows;

7.1 The Standard deviation is calculated from the software
7.2 Standard Deviation from individual laboratories is calculated and represented as LAB_SD for that laboratory
7.3 The Standard Deviation For Proficiency Assessment is then calculated as a weighted mean standard deviation
7.4 The standard deviations are converted to variances by squaring the standard deviations and added by taking the root sum of squares and the number of labs into consideration

8. Metrological traceability and measurement of uncertainty

The values quoted herein are based on the consensus values derived from statistical analysis of the data from an inter-laboratory measurement program. Traceability to SI units is via the standards used by the individual laboratories the majority of which are accredited to the ISO17025:2005 general requirements for the competence of testing and calibration laboratories and who have maintained measurement traceability during the analytical process.

The samples used in this PT process have been selected in such a way as to represent the entire batch of material and were taken from the final packaged units; therefore, all possible sources of uncertainty (sample uncertainty and measurement uncertainty) are included in the final combined standard uncertainty determination. The uncertainty measurement takes into consideration the between lab and the within lab variances.

9. Design and implementation of the PT Scheme

At the beginning of each year, the Technical Personnel and Managing Director plan what possible Proficiency Testing Schemes will be sent to laboratories.

The samples are sent to an external laboratory to determine the range of the elements of interest and homogeneity.
An analysis request letter is compiled and sent to participating laboratories.

Samples are dispatched and results are returned within the given time frame by participating laboratories electronically.
Results are loaded onto the software.
A PT report is compiled and sent to participating laboratories.

10. Concentration ranges

Oxide	Al_2O_3	BaO	CaO	Cr_2O_3	Fe_2O_3	K_2O	MgO	Na_2O	P_2O_5	SO_3	SiO_2	TiO_2	LOI 1000
Unit	%	%	%	%	%	%	%	%	%	%	%	%	%
	17.35	0.02	0.026	0.05	5.94	0.43	0.22	0.10	0.10	2.32	57.81	0.49	2.43
Range	23.47	0.03	0.035	0.07	8.03	0.59	0.30	0.14	0.13	3.13	78.21	0.66	3.28

11. Element statistics

11.1   Aluminium Oxide with XRF finish-Al_2O_3 XRF

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
L	0.25	20.38	O	0.15	20.29	R	0.16	20.30
L	0.38	20.50	O	0.09	20.23	R	0.38	20.50
L	0.10	20.24	O	0.25	20.38	R	0.27	20.40
L	0.32	20.44	O	0.19	20.32	R	0.16	20.30
L	0.18	20.31	O	0.05	20.19	R	0.16	20.30
L	0.43	20.55	O	0.07	20.21	R	0.27	20.40
L	0.19	20.32	O	0.11	20.25	R	0.27	20.40
L	0.32	20.44	O	0.14	20.28	R	0.27	20.40
M	0.30	20.43	P	-0.15	20.01	S	0.06	20.20
M	0.42	20.54	P	-0.24	19.93	S	0.06	20.20
M	0.43	20.55	P	-0.13	20.02	S	-0.05	20.10
M	0.40	20.52	P	-0.06	20.09	S	0.49	20.60
M	0.37	20.49	P	-0.21	19.95	S	0.16	20.30
M	0.36	20.48	P	-0.15	20.01	S	0.16	20.30
M	0.39	20.51	P	-0.11	20.05	S	0.06	20.20
M	0.48	20.59	P	-0.04	20.11	S	0.06	20.20
N	-5.28	15.23	Q	-0.49	19.69	T	0.86	20.95
N	-6.01	14.55	Q	-0.29	19.88	T	0.88	20.97
N	-1.78	18.49	Q	-0.36	19.81	T	0.92	21.00
N	1.12	21.19	Q	0.02	20.17	T	0.88	20.97
N	-1.18	19.05	Q	-0.30	19.87	T	0.96	21.04
N	1.81	21.83	Q	-0.14	20.02	T	0.87	20.96
N	-3.12	17.24	Q	-0.24	19.92	T	1.13	21.20
N	-4.76	15.72	Q	-0.22	19.94	T	0.97	21.05

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
U	-0.15	20.01	X	-0.09	20.06
U	-0.18	19.98	X	-0.15	20.01
U	-0.19	19.97	X	-0.13	20.03
U	-0.16	20.00	X	-0.14	20.02
U	-0.15	20.01	X	-0.02	20.13
U	-0.16	20.00	X	-0.08	20.07
U	-0.19	19.97	X	-0.18	19.98
U	-0.17	19.99	X	-0.02	20.13
V	0.26	20.39	Y	0.38	20.50
V	0.25	20.38	Y	0.38	20.50
V	0.20	20.33	Y	0.38	20.50
V	0.35	20.47	Y	0.27	20.40
V	0.30	20.43	Y	0.49	20.60
V	0.37	20.49	Y	0.38	20.50
V	0.34	20.46	Y	0.38	20.50
V	0.37	20.49	Y	0.16	20.30
W	0.23	20.36	Z	0.27	20.40
W	0.14	20.28	Z	0.16	20.30
W	0.09	20.23	Z	0.04	20.18
W	0.16	20.30	Z	-0.01	20.14
W	0.09	20.23	Z	0.13	20.27
W	0.23	20.36	Z	0.10	20.24
W	0.23	20.36	Z	0.25	20.38
W	0.11	20.25	Z	0.15	20.29

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Al_2O_3	XRF	120	20.147	0.931	4.619	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
Al_2O_3	XRF	L	8	20.398	0.104	0.005	0.511
Al_2O_3	XRF	M	8	20.514	0.049	0.002	0.237
Al_2O_3	XRF	N	8	17.913	2.712	0.151	15.139
Al_2O_3	XRF	O	8	20.269	0.062	0.003	0.307
Al_2O_3	XRF	P	8	20.021	0.064	0.003	0.317
Al_2O_3	XRF	Q	8	19.913	0.142	0.007	0.714
Al_2O_3	XRF	R	8	20.375	0.071	0.003	0.347
Al_2O_3	XRF	S	8	20.263	0.151	0.007	0.743
Al_2O_3	XRF	T	8	21.018	0.082	0.004	0.392
Al_2O_3	XRF	U	8	19.991	0.016	0.001	0.082
Al_2O_3	XRF	V	8	20.430	0.058	0.003	0.285
Al_2O_3	XRF	W	8	20.296	0.058	0.003	0.285
Al_2O_3	XRF	X	8	20.054	0.055	0.003	0.273
Al_2O_3	XRF	Y	8	20.475	0.089	0.004	0.433
Al_2O_3	XRF	Z	8	20.275	0.089	0.004	0.441
			Average	20.147	0.705	0.014	1.367

Al$_2$O$_3$ % XRF
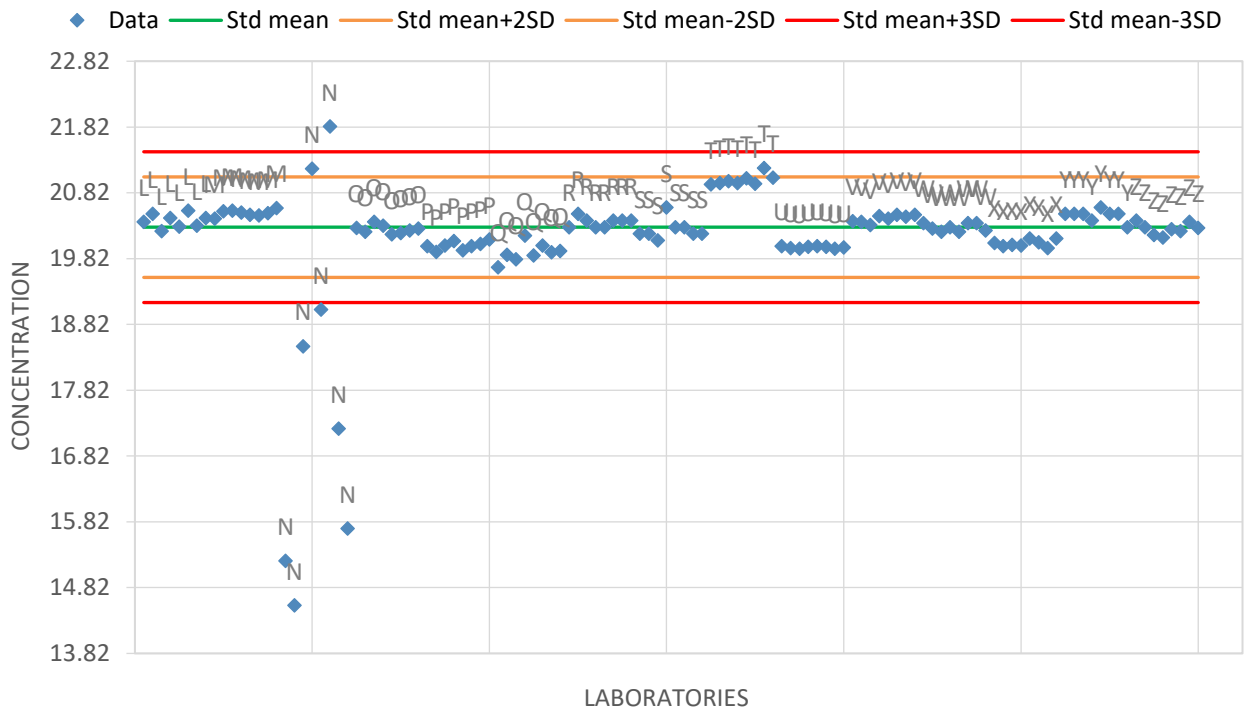
Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Al$_2$O$_3$	XRF	116	20.301	0.382	1.881	%

Std mean	20.301
SD	0.382
2SD	0.764
3SD	1.145
Std mean+2SD	21.064
Std mean-2SD	19.537
Std mean+3SD	21.446
Std mean-3SD	19.155

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
Al$_2$O$_3$	XRF	0.054	0.033	0.183	0.291	%

Comment: 4 of 180 results rejected as outliers using z score

11.2 Barium Oxide with XRF finish-BaO XRF

Lab_ID	Z_Score	Data
L	-0.80	0.02
L	-0.80	0.02
L	-0.80	0.02
L	-0.80	0.02
L	-0.80	0.02
L	1.00	0.03
L	-0.80	0.02
L	-0.80	0.02
M	-0.80	0.02
M	-0.80	0.02
M	1.00	0.03
M	-0.80	0.02
M	-0.80	0.02
M	-0.80	0.02
M	-0.80	0.02
M	1.00	0.03
O	1.00	0.03
O	1.00	0.03
O	1.00	0.03
O	1.00	0.03
O	1.00	0.03
O	1.00	0.03
O	-0.80	0.02
O	1.00	0.03

Lab_ID	Z_Score	Data
Q	-0.98	0.02
Q	-0.26	0.02
Q	-0.98	0.02
Q	-0.08	0.02
Q	-0.44	0.02
Q	-0.26	0.02
Q	0.10	0.03
Q	-0.80	0.02
U	-0.62	0.02
U	0.10	0.03
U	-0.08	0.02
U	0.64	0.03
U	0.10	0.03
U	-0.80	0.02
U	-0.08	0.02
U	-0.44	0.02
V	-0.80	0.02
V	1.00	0.03
V	1.00	0.03
V	-0.80	0.02
V	-0.80	0.02
V	-0.80	0.02
V	-0.80	0.02
V	1.00	0.03

Lab_ID	Z_Score	Data
X	1.00	0.03
X	1.00	0.03
X	2.79	0.04
X	1.00	0.03
X	2.79	0.04
X	1.00	0.03
X	1.00	0.03
X	2.79	0.04
Z	-0.80	0.02
Z	-0.80	0.02
Z	-0.80	0.02
Z	-0.80	0.02
Z	-0.80	0.02
Z	-0.80	0.02
Z	-0.80	0.02
Z	-0.80	0.02

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
BaO	XRF	64	0.024	0.006	22.800	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
BaO	XRF	L	8	0.021	0.004	0.166	16.638
BaO	XRF	M	8	0.023	0.005	0.206	20.574
BaO	XRF	O	8	0.029	0.004	0.123	12.298
BaO	XRF	Q	8	0.022	0.002	0.105	10.492
BaO	XRF	U	8	0.024	0.003	0.108	10.836
BaO	XRF	V	8	0.024	0.005	0.218	21.792
BaO	XRF	X	8	0.034	0.005	0.153	15.335
BaO	XRF	Z	8	0.020	0.000	0.000	0.001
			Average	**0.024**	**0.004**	**0.135**	**13.495**
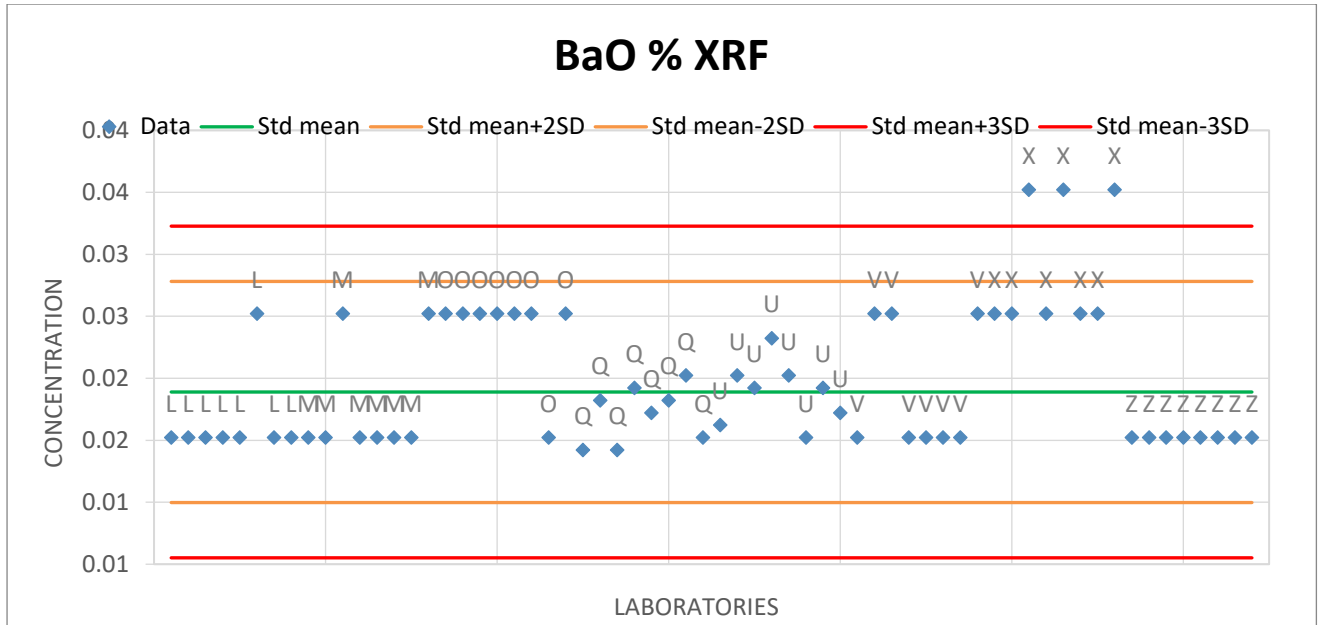
BaO % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
BaO	XRF	61	0.024	0.004	18.840	%

Std mean	0.024
SD	0.004
2SD	0.009
3SD	0.013
Std mean+2SD	0.033
Std mean-2SD	0.015
Std mean+3SD	0.037
Std mean-3SD	0.010

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
BaO	XRF	0.001	<0.001	0.003	0.003	%

Comment: 3 of 64 results rejected as outliers using z score

11.3 Calcium Oxide with XRF finish-CaO XRF

Lab_ID	Z_Score	Data
L	-0.80	0.03
L	-0.80	0.03
L	-0.80	0.03
L	-0.80	0.03
L	-0.80	0.03
L	-0.80	0.03
L	-0.80	0.03
L	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
M	-0.80	0.03
O	0.16	0.04
O	0.16	0.04
O	0.16	0.04
O	-0.80	0.03
O	0.16	0.04
O	0.16	0.04
O	0.16	0.04
O	0.16	0.04

Lab_ID	Z_Score	Data
Q	1.12	0.05
Q	1.12	0.05
Q	2.08	0.06
Q	1.12	0.05
Q	3.04	0.07
Q	2.08	0.06
Q	3.04	0.07
Q	1.12	0.05
R	0.16	0.04
R	0.16	0.04
R	1.12	0.05
R	0.16	0.04
R	0.16	0.04
R	0.16	0.04
R	0.16	0.04
R	0.16	0.04
S	0.16	0.04
S	0.16	0.04
S	0.16	0.04
S	0.16	0.04
S	0.16	0.04
S	0.16	0.04
S	0.16	0.04
S	0.16	0.04

Lab_ID	Z_Score	Data
T	-0.80	0.03
T	-0.80	0.03
T	-0.71	0.03
T	-0.52	0.03
T	-0.90	0.03
T	-0.52	0.03
T	-0.04	0.04
T	-0.90	0.03
U	2.08	0.06
U	2.08	0.06
U	2.08	0.06
U	1.12	0.05
U	2.08	0.06
U	2.08	0.06
U	2.08	0.06
U	2.08	0.06
V	-0.80	0.03
V	-0.80	0.03
V	-0.80	0.03
V	-0.80	0.03
V	-0.80	0.03
V	-0.80	0.03
V	-0.80	0.03
V	-0.80	0.03

Lab_ID	Z_Score	Data
X	0.16	0.04
X	0.16	0.04
X	0.16	0.04
X	0.16	0.04
X	0.16	0.04
X	0.16	0.04
X	0.16	0.04
X	0.16	0.04
Y	-0.80	0.03
Y	-0.80	0.03
Y	-0.80	0.03
Y	-0.80	0.03
Y	-0.80	0.03
Y	-0.80	0.03
Y	-0.80	0.03
Y	-0.80	0.03
Z	-0.80	0.03
Z	-0.80	0.03
Z	0.16	0.04
Z	0.16	0.04
Z	-0.80	0.03
Z	-0.80	0.03
Z	-0.80	0.03
Z	-0.80	0.03

Results with outliers

Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
CaO	XRF	96	0.038	0.010	27.099	%

Between Laboratory Statistics

Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
CaO	XRF	L	8	0.030	<0.001	<0.001	<0.001
CaO	XRF	M	8	0.030	<0.001	<0.001	<0.001
CaO	XRF	O	8	0.039	0.004	0.091	9.124
CaO	XRF	Q	8	0.058	0.009	0.154	15.416
CaO	XRF	R	8	0.041	0.004	0.086	8.571
CaO	XRF	S	8	0.040	<0.001	<0.001	<0.001
CaO	XRF	T	8	0.032	0.003	0.096	9.552
CaO	XRF	U	8	0.059	0.004	0.060	6.018
CaO	XRF	V	8	0.030	<0.001	<0.001	<0.001
CaO	XRF	X	8	0.040	<0.001	<0.001	<0.001
CaO	XRF	Y	8	0.030	<0.001	<0.001	<0.001
CaO	XRF	Z	8	0.033	0.005	0.142	14.243
			Average	**0.038**	**0.003**	**0.052**	**5.244**
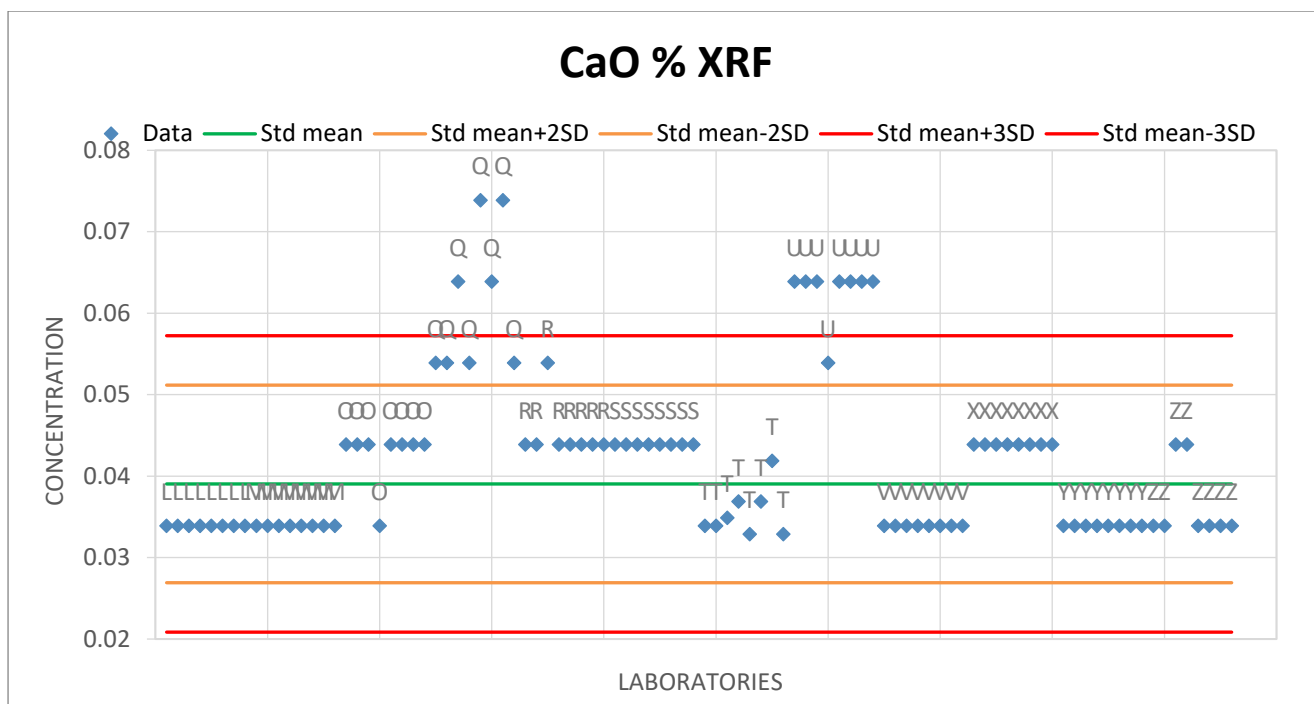
CaO % XRF

Results without outliers

Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
CaO	XRF	84	0.035	0.006	17.252	%

Std mean	0.035
SD	0.006
2SD	0.012
3SD	0.018
Std mean+2SD	0.047
Std mean-2SD	0.023
Std mean+3SD	0.053
Std mean-3SD	0.017

Measurement of uncertainty

Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
CaO	XRF	0.002	<0.001	0.005	0.003	%

Comment: 12 of 96 results rejected as outliers using z score

11.4 Chrome (III) Oxide with XRF finish-Cr_2O_3 XRF

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
L	-0.75	0.05	O	-0.08	0.06	R	-0.08	0.06	U	-0.21	0.06
L	-0.75	0.05	O	-0.08	0.06	R	-0.08	0.06	U	-0.21	0.06
L	-0.75	0.05	O	-0.08	0.06	R	-0.75	0.05	U	-0.28	0.06
L	-0.75	0.05	O	-0.08	0.06	R	-0.08	0.06	U	-0.28	0.06
L	-0.75	0.05	O	-0.08	0.06	R	-0.08	0.06	U	-0.28	0.06
L	-0.08	0.06	O	-0.08	0.06	R	-0.75	0.05	U	-0.21	0.06
L	-0.75	0.05	O	-0.08	0.06	R	-0.75	0.05	U	-0.28	0.06
L	-0.08	0.06	O	-0.08	0.06	R	-0.08	0.06	U	-0.28	0.06
M	-0.08	0.06	P	1.06	0.08	S	1.26	0.08	V	0.59	0.07
M	-0.08	0.06	P	1.13	0.08	S	-0.75	0.05	V	0.59	0.07
M	-0.08	0.06	P	1.26	0.08	S	-0.08	0.06	V	0.59	0.07
M	-0.08	0.06	P	1.06	0.08	S	7.94	0.18	V	0.59	0.07
M	-0.75	0.05	P	1.13	0.08	S	-0.08	0.06	V	0.59	0.07
M	-0.08	0.06	P	1.06	0.08	S	-0.08	0.06	V	0.59	0.07
M	-0.08	0.06	P	1.06	0.08	S	-0.08	0.06	V	0.59	0.07
M	-0.08	0.06	P	0.99	0.08	S	0.59	0.07	V	0.59	0.07
N	-0.75	0.05	Q	-1.55	0.04	T	-0.14	0.06	X	-0.08	0.06
N	0.59	0.07	Q	-1.41	0.04	T	0.06	0.06	X	-0.75	0.05
N	0.59	0.07	Q	-0.88	0.05	T	0.32	0.07	X	-0.08	0.06
N	0.59	0.07	Q	-1.28	0.04	T	-0.21	0.06	X	-0.08	0.06
N	0.59	0.07	Q	-1.08	0.05	T	-0.21	0.06	X	-0.08	0.06
N	0.59	0.07	Q	-1.08	0.05	T	-0.01	0.06	X	-0.75	0.05
N	0.59	0.07	Q	-1.55	0.04	T	-0.01	0.06	X	-0.75	0.05
N	0.59	0.07	Q	-1.35	0.04	T	-0.14	0.06	X	-0.75	0.05

Lab_ID	Z_Score	Data
Z	-0.08	0.06
Z	-0.08	0.06
Z	-0.08	0.06
Z	-0.08	0.06
Z	-0.08	0.06
Z	-0.08	0.06
Z	-0.08	0.06
Z	-0.08	0.06

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Cr_2O_3	XRF	104	0.061	0.015	24.477	%

Between Laboratory Statistics						
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
Cr_2O_3	XRF	L	8	0.053	0.005	0.088	8.817
Cr_2O_3	XRF	M	8	0.059	0.004	0.060	6.018
Cr_2O_3	XRF	N	8	0.068	0.007	0.105	10.476
Cr_2O_3	XRF	O	8	0.060	<0.001	<0.001	<0.001
Cr_2O_3	XRF	P	8	0.078	0.001	0.015	1.542
Cr_2O_3	XRF	Q	8	0.042	0.004	0.086	8.553
Cr_2O_3	XRF	R	8	0.056	0.005	0.092	9.201
Cr_2O_3	XRF	S	8	0.078	0.042	0.546	54.635
Cr_2O_3	XRF	T	8	0.061	0.003	0.044	4.418
Cr_2O_3	XRF	U	8	0.057	0.001	0.009	0.902
Cr_2O_3	XRF	V	8	0.070	<0.001	<0.001	<0.001
Cr_2O_3	XRF	X	8	0.055	0.005	0.097	9.719
Cr_2O_3	XRF	Z	8	0.060	0.000	0.000	0.000
		Average		0.061	0.012	0.088	8.791
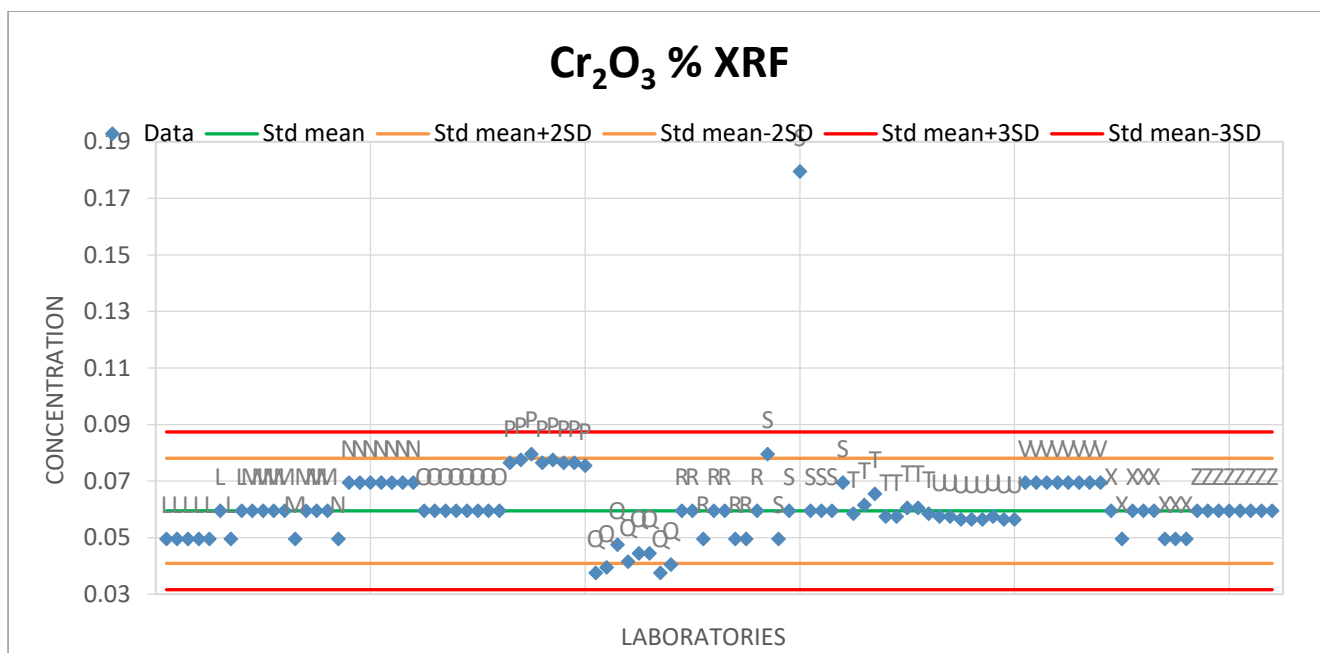
Cr₂O₃ % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Cr₂O₃	XRF	103	0.060	0.009	15.495	%

Std mean	0.060
SD	0.009
2SD	0.019
3SD	0.028
Std mean+2SD	0.079
Std mean-2SD	0.041
Std mean+3SD	0.088
Std mean-3SD	0.032

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
Cr₂O₃	XRF	0.003	<0.001	0.008	0.005	%

Comment: 1 of 104 results rejected as outliers using z score

13

11.5 Iron (III) Oxide with XRF finish-Fe_2O_3 XRF

Lab_ID	Z_Score	Data
L	-0.35	6.93
L	-0.28	6.95
L	-0.62	6.86
L	-0.39	6.92
L	-0.39	6.92
L	0.37	7.12
L	-0.35	6.93
L	-0.09	7.00
M	-0.39	6.92
M	-0.24	6.96
M	-0.31	6.94
M	-0.28	6.95
M	-0.35	6.93
M	-0.35	6.93
M	-0.31	6.94
M	-0.20	6.97
O	-0.47	6.90
O	-0.31	6.94
O	-0.50	6.89
O	-0.54	6.88
O	-0.35	6.93
O	-0.35	6.93
O	-0.43	6.91
O	-0.31	6.94

Lab_ID	Z_Score	Data
P	-0.33	6.94
P	-0.43	6.91
P	-0.38	6.92
P	-0.22	6.96
P	-0.31	6.94
P	-0.31	6.94
P	-0.31	6.94
P	-0.20	6.97
Q	-0.39	6.92
Q	-0.43	6.91
Q	-0.58	6.87
Q	-0.16	6.98
Q	-0.43	6.91
Q	-0.54	6.88
Q	-0.35	6.93
Q	-0.54	6.88
R	-0.20	6.97
R	0.14	7.06
R	-0.47	6.90
R	-0.43	6.91
R	-0.39	6.92
R	-0.12	6.99
R	-0.35	6.93
R	-0.31	6.94

Lab_ID	Z_Score	Data
S	-0.39	6.92
S	-0.69	6.84
S	-0.66	6.85
S	-0.43	6.91
S	-0.50	6.89
S	-0.69	6.84
S	-0.50	6.89
S	-0.73	6.83
T	3.02	7.82
T	3.02	7.82
T	3.18	7.86
T	3.06	7.83
T	3.02	7.82
T	3.21	7.87
T	1.51	7.42
T	2.76	7.75
U	-0.54	6.88
U	-0.54	6.88
U	-0.58	6.87
U	-0.50	6.89
U	-0.66	6.85
U	-0.50	6.89
U	-0.62	6.86
U	-0.66	6.85

Lab_ID	Z_Score	Data
V	1.75	7.48
V	1.74	7.48
V	1.51	7.42
V	1.69	7.47
V	1.37	7.39
V	1.34	7.38
V	1.43	7.40
V	1.38	7.39
X	-0.20	6.97
X	-0.20	6.97
X	-0.09	7.00
X	-0.05	7.01
X	-0.28	6.95
X	-0.35	6.93
X	-0.12	6.99
X	-0.28	6.95
Y	-0.58	6.87
Y	-0.50	6.89
Y	-0.62	6.86
Y	-0.81	6.81
Y	-0.50	6.89
Y	-0.50	6.89
Y	-0.50	6.89
Y	-0.81	6.81

Lab_ID	Z_Score	Data
Z	-0.31	6.94
Z	-0.43	6.91
Z	-0.54	6.88
Z	-0.66	6.85
Z	-0.43	6.91
Z	-0.50	6.89
Z	-0.31	6.94
Z	-0.39	6.92

Results with outliers					
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Fe_2O_3	XRF	104	7.023	0.264	3.755	%

Between Laboratory Statistics						
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
Fe_2O_3	XRF	L	8	6.954	0.077	0.011	1.114
Fe_2O_3	XRF	M	8	6.943	0.017	0.002	0.240
Fe_2O_3	XRF	O	8	6.915	0.023	0.003	0.337
Fe_2O_3	XRF	P	8	6.941	0.019	0.003	0.280
Fe_2O_3	XRF	Q	8	6.910	0.035	0.005	0.513
Fe_2O_3	XRF	R	8	6.953	0.053	0.008	0.760
Fe_2O_3	XRF	S	8	6.871	0.035	0.005	0.513
Fe_2O_3	XRF	T	8	7.774	0.147	0.019	1.896
Fe_2O_3	XRF	U	8	6.871	0.016	0.002	0.239
Fe_2O_3	XRF	V	8	7.425	0.045	0.006	0.611
Fe_2O_3	XRF	X	8	6.971	0.027	0.004	0.394
Fe_2O_3	XRF	Y	8	6.864	0.035	0.005	0.510
Fe_2O_3	XRF	Z	8	6.905	0.031	0.004	0.445
			Average	7.023	0.055	0.006	0.604
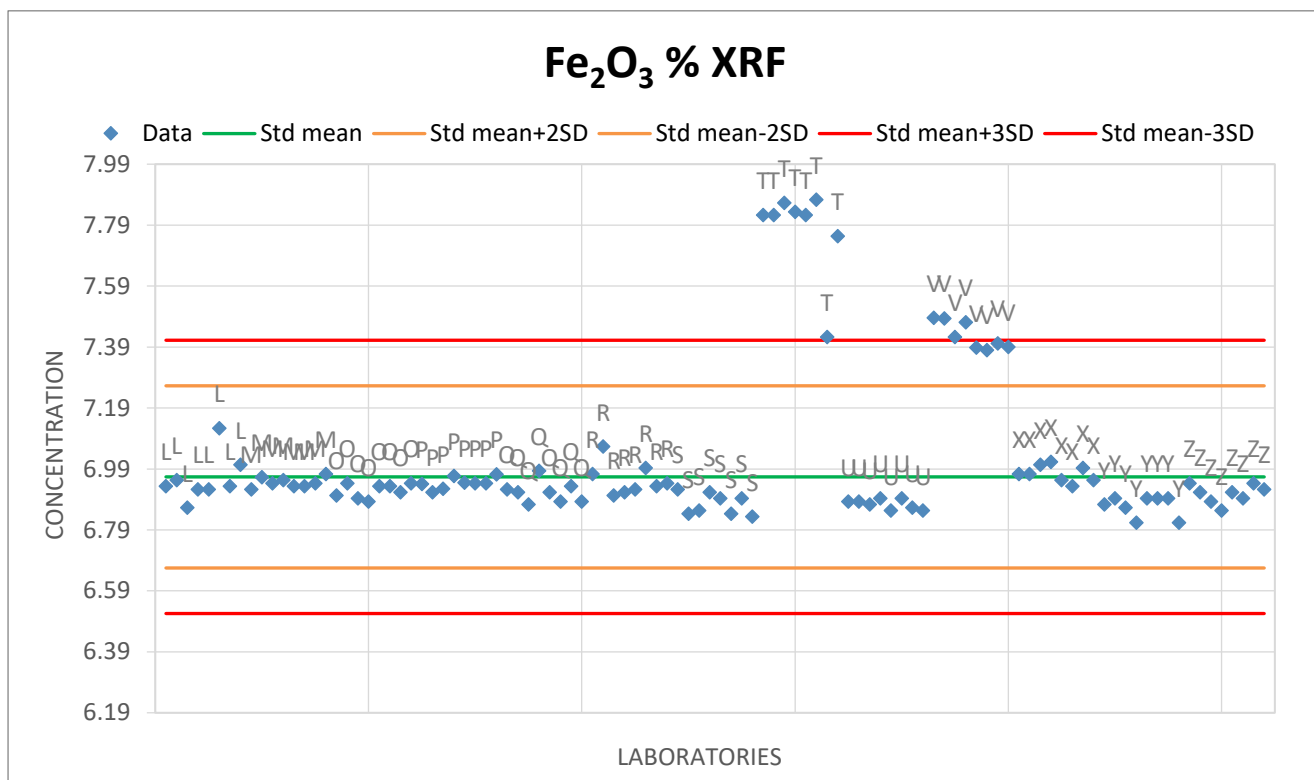
Fe$_2$O$_3$ % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Fe$_2$O$_3$	XRF	96	6.960	0.149	2.147	%

Std mean	6.960
SD	0.149
2SD	0.299
3SD	0.448
Std mean+2SD	7.259
Std mean-2SD	6.661
Std mean+3SD	7.408
Std mean-3SD	6.512

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
Fe$_2$O$_3$	XRF	0.036	0.015	0.123	0.038	%

Comment: 8 of 104 results rejected as outliers using z score

11.6   Potassium Oxide with XRF finish –K₂O XRF

Lab_ID	Z_Score	Data
L	-0.02	0.50
L	-0.02	0.50
L	-0.51	0.49
L	-0.02	0.50
L	-0.51	0.49
L	0.47	0.51
L	-0.51	0.49
L	-0.02	0.50
M	-0.02	0.50
M	-0.02	0.50
M	-0.02	0.50
M	-0.02	0.50
M	-0.51	0.49
M	-0.51	0.49
M	-0.51	0.49
M	-0.02	0.50
N	-3.46	0.43
N	-1.50	0.47
N	-2.97	0.44
N	-1.99	0.46
N	-1.00	0.48
N	-1.50	0.47
N	-1.50	0.47
N	-0.51	0.49

Lab_ID	Z_Score	Data
O	-0.51	0.49
O	-0.02	0.50
O	-0.51	0.49
O	-0.51	0.49
O	-0.51	0.49
O	-0.51	0.49
O	-0.51	0.49
O	-0.51	0.49
P	-0.46	0.49
P	-0.61	0.49
P	-0.56	0.49
P	-0.46	0.49
P	-0.61	0.49
P	-0.51	0.49
P	-0.12	0.50
P	-0.46	0.49
Q	-1.54	0.47
Q	-0.76	0.49
Q	-0.71	0.49
Q	-0.22	0.50
Q	0.22	0.51
Q	-0.91	0.48
Q	-0.37	0.49
Q	-0.56	0.49

Lab_ID	Z_Score	Data
R	-0.02	0.50
R	-0.02	0.50
R	0.47	0.51
R	0.47	0.51
R	-0.02	0.50
R	-0.02	0.50
R	-0.02	0.50
R	-0.02	0.50
S	-0.51	0.49
S	-0.51	0.49
S	-0.51	0.49
S	-0.02	0.50
S	-0.02	0.50
S	-0.02	0.50
S	-0.02	0.50
S	-0.51	0.49
T	1.45	0.53
T	1.94	0.54
T	2.43	0.55
T	1.94	0.54
T	1.94	0.54
T	1.94	0.54
T	1.94	0.54
T	1.94	0.54

Lab_ID	Z_Score	Data
U	-0.51	0.49
U	-0.51	0.49
U	-1.00	0.48
U	-1.00	0.48
U	-0.51	0.49
U	-0.51	0.49
U	-0.51	0.49
U	-0.51	0.49
V	1.45	0.53
V	1.45	0.53
V	1.94	0.54
V	1.45	0.53
V	1.45	0.53
V	1.45	0.53
V	1.45	0.53
V	1.45	0.53
X	0.96	0.52
X	0.96	0.52
X	0.96	0.52
X	1.45	0.53
X	0.96	0.52
X	0.96	0.52
X	1.45	0.53
X	1.45	0.53

Lab_ID	Z_Score	Data
Y	-0.02	0.50
Y	0.47	0.51
Y	0.47	0.51
Y	-0.02	0.50
Y	0.47	0.51
Y	0.47	0.51
Y	0.47	0.51
Y	-0.02	0.50
Z	-0.02	0.50
Z	-0.51	0.49
Z	-0.51	0.49
Z	-0.51	0.49
Z	-0.51	0.49
Z	-0.51	0.49
Z	-0.02	0.50
Z	-0.51	0.49

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
K₂O	XRF	112	0.500	0.020	4.070	%

Between Laboratory Statistics						
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
K₂O	XRF	L	8	0.498	0.007	0.014	1.421
K₂O	XRF	M	8	0.496	0.005	0.010	1.043
K₂O	XRF	N	8	0.464	0.020	0.043	4.303
K₂O	XRF	O	8	0.491	0.004	0.007	0.720
K₂O	XRF	P	8	0.491	0.003	0.007	0.651
K₂O	XRF	Q	8	0.488	0.011	0.022	2.175
K₂O	XRF	R	8	0.503	0.005	0.009	0.921
K₂O	XRF	S	8	0.495	0.005	0.011	1.080
K₂O	XRF	T	8	0.540	0.005	0.010	0.990
K₂O	XRF	U	8	0.488	0.005	0.009	0.950
K₂O	XRF	V	8	0.531	0.004	0.007	0.666
K₂O	XRF	X	8	0.524	0.005	0.010	0.988
K₂O	XRF	Y	8	0.506	0.005	0.010	1.022
K₂O	XRF	Z	8	0.493	0.005	0.009	0.940
		Average		**0.500**	**0.008**	**0.013**	**1.276**
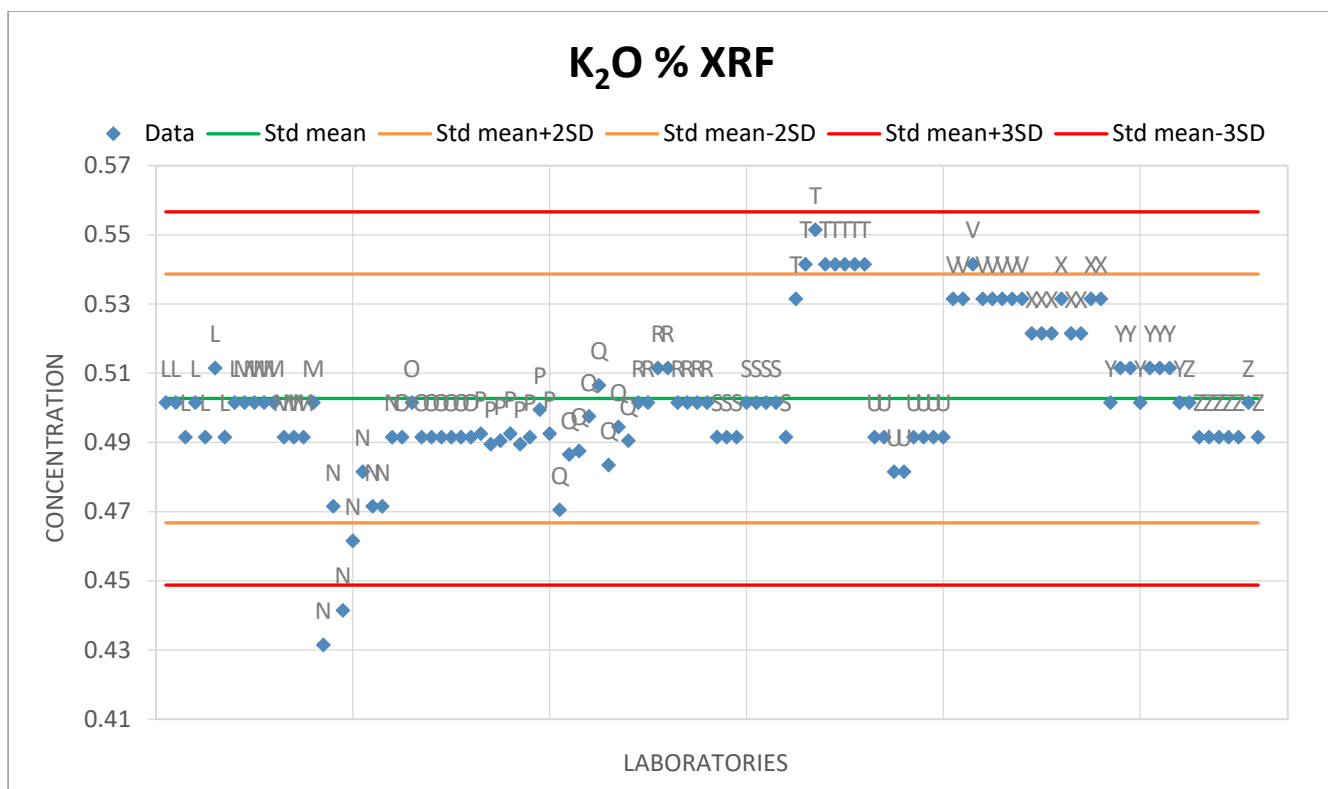
K$_2$O % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
K$_2$O	XRF	109	0.501	0.018	3.587	%

Std mean	0.501
SD	0.018
2SD	0.036
3SD	0.054
Std mean+2SD	0.537
Std mean-2SD	0.465
Std mean+3SD	0.555
Std mean-3SD	0.447

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
K$_2$O	XRF	0.004	<0.001	0.013	0.006	%

Comment: 3 of 112 results rejected as outliers using z score

11.7   Magnesium Oxide with XRF finish- MgO XRF

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
L	-1.13	0.22	Q	3.00	0.33	U	-0.76	0.23	Y	-0.03	0.25
L	-1.13	0.22	Q	2.16	0.31	U	-0.76	0.23	Y	-0.03	0.25
L	-1.13	0.22	Q	2.86	0.33	U	-0.76	0.23	Y	-0.03	0.25
L	-1.13	0.22	Q	2.42	0.32	U	-0.76	0.23	Y	-0.03	0.25
L	-1.13	0.22	Q	4.10	0.36	U	-0.76	0.23	Y	0.34	0.26
L	-0.76	0.23	Q	1.80	0.30	U	-0.76	0.23	Y	-0.03	0.25
L	-1.13	0.22	Q	2.53	0.32	U	-0.76	0.23	Y	0.34	0.26
L	-1.13	0.22	Q	1.80	0.30	U	-0.76	0.23	Y	-0.03	0.25
M	-0.03	0.25	R	-0.40	0.24	V	-0.76	0.23	Z	-0.03	0.25
M	0.34	0.26	R	-0.40	0.24	V	-0.03	0.25	Z	-0.40	0.24
M	0.34	0.26	R	-0.03	0.25	V	-0.40	0.24	Z	-0.40	0.24
M	0.34	0.26	R	-0.40	0.24	V	-0.40	0.24	Z	-0.40	0.24
M	0.34	0.26	R	-0.76	0.23	V	-1.13	0.22	Z	-0.40	0.24
M	0.34	0.26	R	-1.13	0.22	V	-0.76	0.23	Z	-0.40	0.24
M	-0.03	0.25	R	-0.76	0.23	V	-0.40	0.24	Z	-0.03	0.25
M	0.34	0.26	R	-0.40	0.24	V	-0.76	0.23	Z	-0.40	0.24
O	-0.03	0.25	S	-0.40	0.24	X	0.34	0.26			
O	-0.40	0.24	S	-0.76	0.23	X	1.07	0.28			
O	-0.03	0.25	S	-0.40	0.24	X	0.70	0.27			
O	-0.03	0.25	S	0.34	0.26	X	1.07	0.28			
O	-0.03	0.25	S	-0.40	0.24	X	1.07	0.28			
O	-0.03	0.25	S	-0.03	0.25	X	0.70	0.27			
O	-0.40	0.24	S	-0.03	0.25	X	0.70	0.27			
O	-0.40	0.24	S	-0.40	0.24	X	0.70	0.27			

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
MgO	XRF	88	0.251	0.027	10.917	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
MgO	XRF	L	8	0.221	0.004	0.016	1.598
MgO	XRF	M	8	0.258	0.005	0.018	1.798
MgO	XRF	O	8	0.246	0.005	0.021	2.102
MgO	XRF	Q	8	0.322	0.021	0.064	6.428
MgO	XRF	R	8	0.236	0.009	0.039	3.878
MgO	XRF	S	8	0.244	0.009	0.038	3.758
MgO	XRF	U	8	0.230	<0.001	<0.001	<0.001
MgO	XRF	V	8	0.235	0.009	0.039	3.940
MgO	XRF	X	8	0.273	0.007	0.026	2.595
MgO	XRF	Y	8	0.253	0.005	0.018	1.833
MgO	XRF	Z	8	0.243	0.005	0.019	1.909
			Average	**0.251**	**0.009**	**0.027**	**2.713**
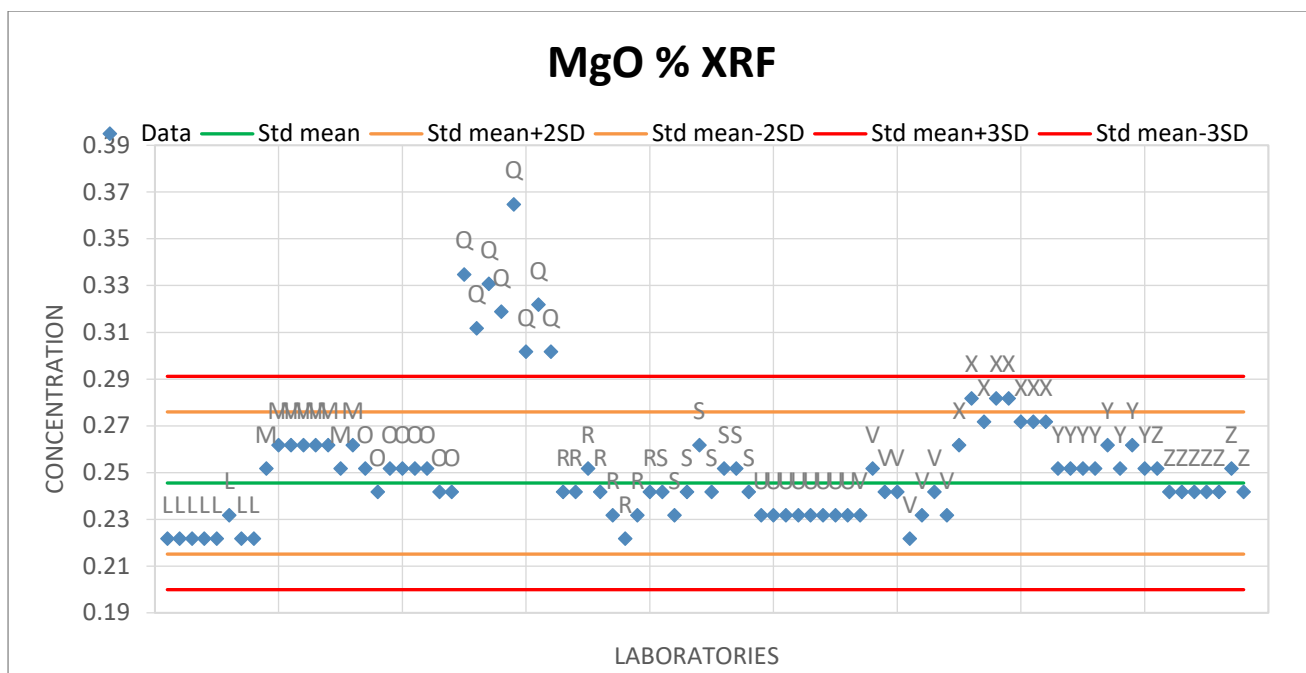
MgO % XRF

Results without outliers

Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
MgO	XRF	80	0.244	0.015	6.240	%

Std mean	0.244
SD	0.015
2SD	0.030
3SD	0.046
Std mean+2SD	0.274
Std mean-2SD	0.213
Std mean+3SD	0.289
Std mean-3SD	0.198

Measurement of uncertainty

| Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
MgO	XRF	0.005	<0.001	0.014	0.007	%

Comment: 8 of 88 results rejected as outliers using z score, recommend outliers be investigated

11.8 Sodium Oxide with XRF finish-Na$_2$O XRF

Lab_ID	Z_Score	Data
L	0.12	0.11
L	0.12	0.11
L	0.12	0.11
L	0.12	0.11
L	0.12	0.11
L	0.71	0.12
L	0.12	0.11
L	0.12	0.11
M	0.12	0.11
M	0.12	0.11
M	0.12	0.11
M	0.12	0.11
M	0.71	0.12
M	0.12	0.11
M	0.12	0.11
M	0.12	0.11
O	-0.46	0.10
O	0.12	0.11
O	0.12	0.11
O	-0.46	0.10
O	0.71	0.12
O	0.12	0.11
O	0.71	0.12
O	0.12	0.11

Lab_ID	Z_Score	Data
R	0.12	0.11
R	-0.46	0.10
R	0.71	0.12
R	0.12	0.11
R	-0.46	0.10
R	-0.46	0.10
R	0.71	0.12
R	0.12	0.11
S	-1.62	0.08
S	-2.20	0.07
S	-2.79	0.06
S	-1.04	0.09
S	-1.04	0.09
S	-2.20	0.07
S	-1.62	0.08
S	-2.20	0.07
U	-1.04	0.09
U	-1.04	0.09
U	-1.04	0.09
U	-1.04	0.09
U	-1.04	0.09
U	-1.04	0.09
U	-1.04	0.09
U	-1.04	0.09

Lab_ID	Z_Score	Data
V	1.29	0.13
V	-0.46	0.10
V	1.29	0.13
V	0.71	0.12
V	1.87	0.14
V	1.87	0.14
V	0.71	0.12
V	1.87	0.14
X	-0.46	0.10
X	0.12	0.11
X	-1.04	0.09
X	-0.46	0.10
X	-1.62	0.08
X	-0.46	0.10
X	3.03	0.16
X	-0.46	0.10
Y	0.71	0.12
Y	0.71	0.12
Y	0.71	0.12
Y	0.71	0.12
Y	0.71	0.12
Y	0.71	0.12
Y	0.71	0.12
Y	0.71	0.12

Lab_ID	Z_Score	Data
Z	0.71	0.12
Z	0.71	0.12
Z	0.71	0.12
Z	0.71	0.12
Z	0.12	0.11
Z	0.71	0.12
Z	0.71	0.12
Z	0.71	0.12

Results with outliers					
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Na$_2$O	XRF	80	0.108	0.017	15.933	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
Na$_2$O	XRF	L	8	0.111	0.004	0.032	3.178
Na$_2$O	XRF	M	8	0.111	0.004	0.032	3.178
Na$_2$O	XRF	O	8	0.110	0.008	0.069	6.872
Na$_2$O	XRF	R	8	0.109	0.008	0.077	7.674
Na$_2$O	XRF	S	8	0.076	0.011	0.139	13.910
Na$_2$O	XRF	U	8	0.090	<0.001	<0.001	<0.001
Na$_2$O	XRF	V	8	0.128	0.014	0.109	10.892
Na$_2$O	XRF	X	8	0.105	0.024	0.228	22.766
Na$_2$O	XRF	Y	8	0.120	<0.001	<0.001	<0.001
Na$_2$O	XRF	Z	8	0.119	0.004	0.030	2.977
			Average	0.108	0.010	0.071	7.145
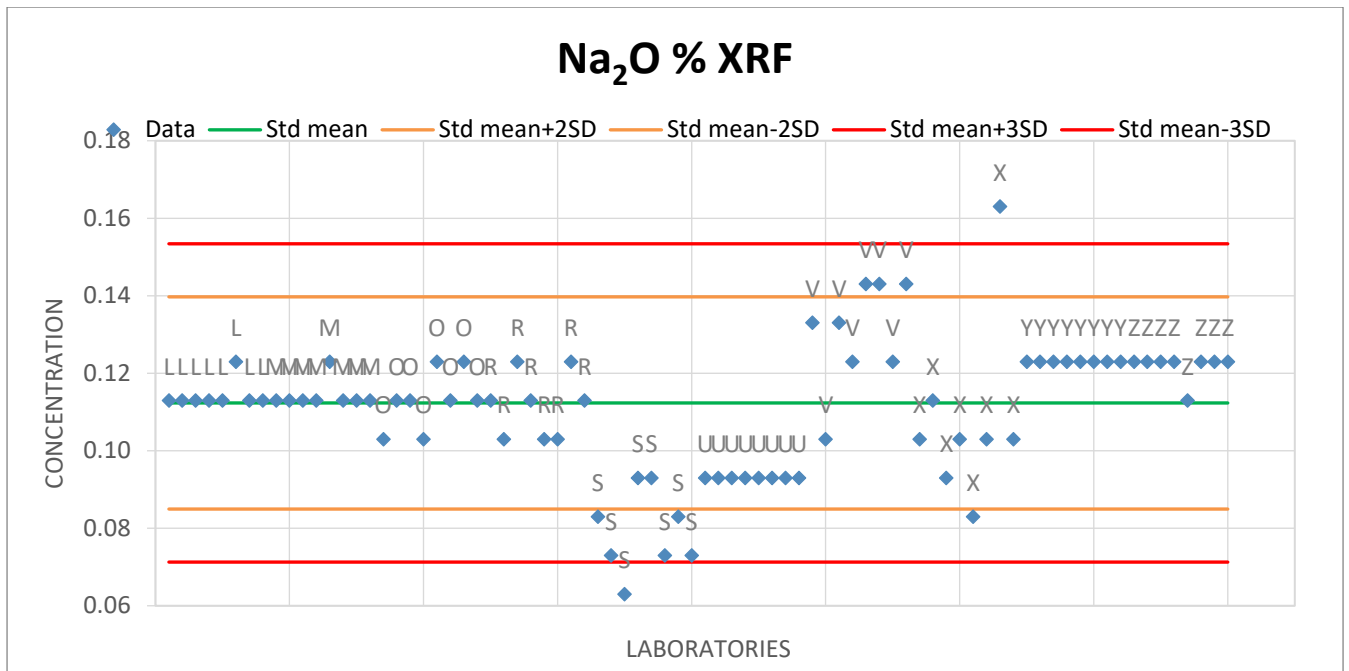
Na$_2$O % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Na$_2$O	XRF	75	0.109	0.014	12.520	%

Std mean	0.109
SD	0.014
2SD	0.027
3SD	0.041
Std mean+2SD	0.137
Std mean-2SD	0.082
Std mean+3SD	0.150
Std mean-3SD	0.068

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
Na$_2$O	XRF	0.004	<0.001	0.011	0.007	%

Comment: 5 of 80 results rejected as outliers using z score

11.9 Phosphorus (V) Oxide with XRF finish– P_2O_5 XRF

Lab_ID	Z_Score	Data
L	-0.30	0.11
L	-0.30	0.11
L	-0.30	0.11
L	-0.30	0.11
L	-0.30	0.11
L	-0.30	0.11
L	-0.30	0.11
L	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
M	-0.30	0.11
O	-0.23	0.12
O	-0.27	0.11
O	-0.25	0.12
O	-0.27	0.11
O	-0.29	0.11
O	-0.26	0.12
O	-0.27	0.11
O	-0.27	0.11

Lab_ID	Z_Score	Data
Q	-0.32	0.11
Q	-0.33	0.11
Q	-0.32	0.11
Q	-0.33	0.11
Q	-0.27	0.11
Q	-0.34	0.10
Q	-0.34	0.10
Q	-0.27	0.11
R	-0.37	0.10
R	-0.30	0.11
R	-0.30	0.11
R	-0.30	0.11
R	-0.30	0.11
R	-0.30	0.11
R	-0.30	0.11
R	-0.37	0.10
S	3.30	0.58
S	3.27	0.58
S	3.26	0.58
S	3.30	0.58
S	3.32	0.58
S	3.33	0.59
S	3.27	0.58
S	3.27	0.58

Lab_ID	Z_Score	Data
T	-0.14	0.13
T	-0.14	0.13
T	-0.14	0.13
T	-0.07	0.14
T	-0.14	0.13
T	-0.07	0.14
T	-0.14	0.13
T	-0.14	0.13
U	-0.31	0.11
U	-0.33	0.11
U	-0.31	0.11
U	-0.33	0.11
U	-0.32	0.11
U	-0.33	0.11
U	-0.33	0.11
U	-0.31	0.11
V	-0.30	0.11
V	-0.30	0.11
V	-0.30	0.11
V	-0.30	0.11
V	-0.30	0.11
V	-0.30	0.11
V	-0.30	0.11
V	-0.30	0.11

Lab_ID	Z_Score	Data
X	-0.53	0.08
X	-0.45	0.09
X	-0.45	0.09
X	-0.45	0.09
X	-0.53	0.08
X	-0.45	0.09
X	-0.45	0.09
X	-0.45	0.09
Y	-0.30	0.11
Y	-0.30	0.11
Y	-0.30	0.11
Y	-0.30	0.11
Y	-0.30	0.11
Y	-0.30	0.11
Y	-0.30	0.11
Y	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11
Z	-0.30	0.11

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
P_2O_5	XRF	96	0.149	0.131	87.948	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
P_2O_5	XRF	L	8	0.110	<0.001	<0.001	<0.001
P_2O_5	XRF	M	8	0.110	<0.001	<0.001	<0.001
P_2O_5	XRF	O	8	0.114	0.002	0.019	1.899
P_2O_5	XRF	Q	8	0.108	0.004	0.036	3.620
P_2O_5	XRF	R	8	0.108	0.005	0.043	4.306
P_2O_5	XRF	S	8	0.579	0.004	0.006	0.608
P_2O_5	XRF	T	8	0.133	0.005	0.035	3.494
P_2O_5	XRF	U	8	0.107	0.001	0.012	1.222
P_2O_5	XRF	V	8	0.110	<0.001	<0.001	<0.001
P_2O_5	XRF	X	8	0.088	0.005	0.053	5.290
P_2O_5	XRF	Y	8	0.110	<0.001	<0.001	<0.001
P_2O_5	XRF	Z	8	0.110	<0.001	<0.001	<0.001
			Average	**0.149**	**0.003**	**0.017**	**1.703**
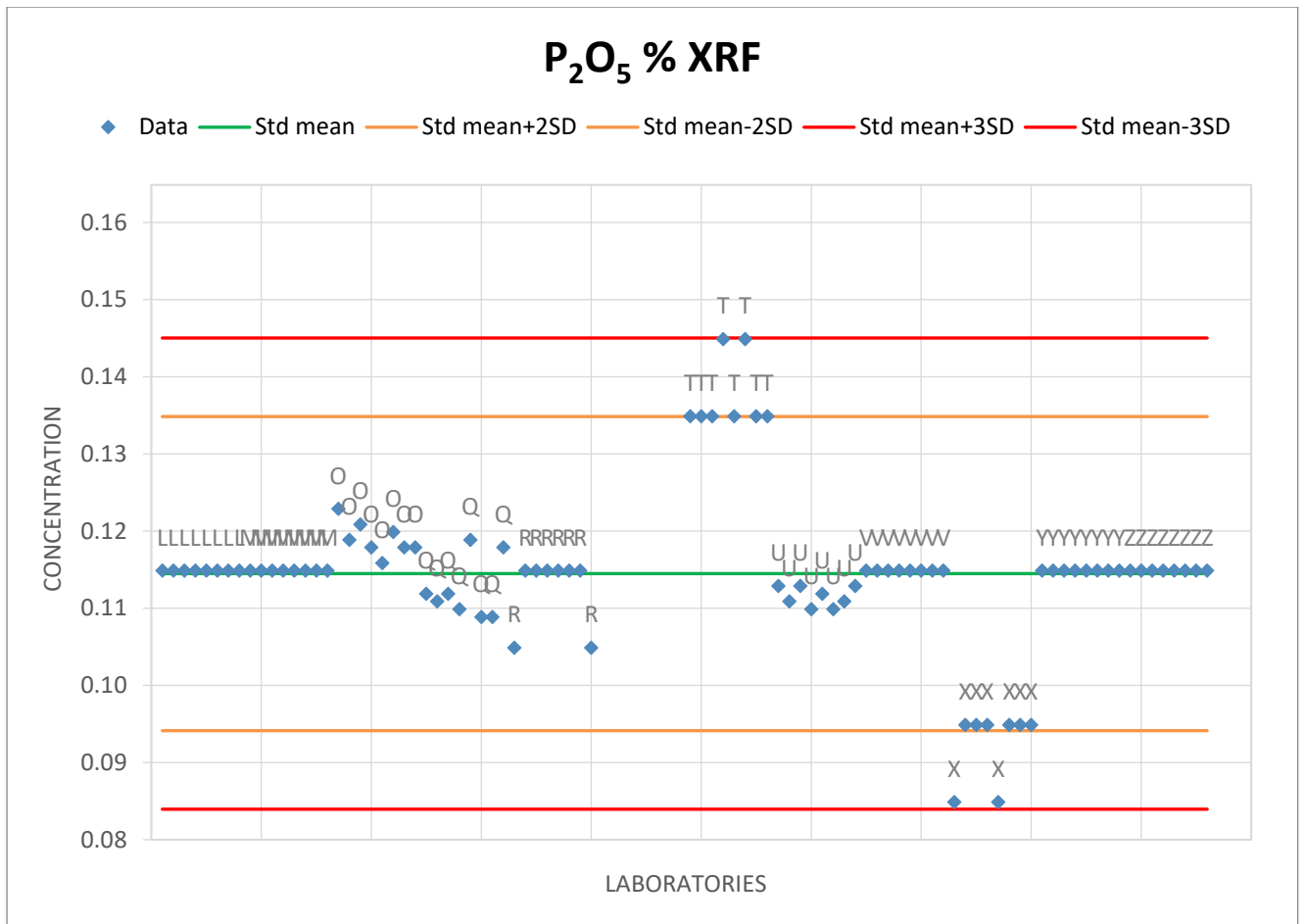
P₂O₅ % XRF

Results without outliers

Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
P₂O₅	XRF	88	0.110	0.010	9.287	%

Std mean	0.110
SD	0.010
2SD	0.020
3SD	0.031
Std mean+2SD	0.130
Std mean-2SD	0.089
Std mean+3SD	0.140
Std mean-3SD	0.079

Measurement of uncertainty

Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
P₂O₅	XRF	0.007	<0.001	0.017	0.004	%

Comment: 8 of 96 results rejected as outliers using z score, obvious outlier not included on graph.
Recommend outliers be investigated

11.10 Silicon Dioxide with XRF finish- SiO$_2$ XRF

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
L	0.38	68.10	O	0.17	67.58	R	0.38	68.10
L	0.58	68.61	O	0.29	67.88	R	0.54	68.50
L	0.14	67.50	O	0.26	67.79	R	0.38	68.10
L	0.43	68.23	O	0.27	67.83	R	0.30	67.90
L	0.21	67.68	O	0.25	67.77	R	0.34	68.00
L	0.41	68.17	O	0.17	67.58	R	0.50	68.40
L	0.27	67.83	O	0.20	67.65	R	0.46	68.30
L	0.41	68.17	O	0.25	67.78	R	0.38	68.10
M	0.25	67.78	P	-0.06	66.97	S	0.22	67.70
M	0.33	67.98	P	-0.02	67.08	S	-0.01	67.10
M	0.40	68.15	P	-0.09	66.91	S	0.06	67.30
M	0.36	68.06	P	0.07	67.30	S	0.26	67.80
M	0.25	67.76	P	-0.08	66.93	S	0.26	67.80
M	0.30	67.90	P	-0.06	66.99	S	0.22	67.70
M	0.31	67.92	P	0.24	67.74	S	0.22	67.70
M	0.40	68.15	P	0.01	67.17	S	0.10	67.40
N	-6.07	51.70	Q	-0.86	64.94	T	0.80	69.16
N	-4.11	56.70	Q	-0.89	64.88	T	0.79	69.14
N	3.13	75.10	Q	-0.82	65.06	T	0.77	69.09
N	-0.29	66.40	Q	-0.89	64.88	T	0.79	69.15
N	-0.01	67.10	Q	-1.00	64.60	T	0.78	69.12
N	2.27	72.90	Q	-0.86	64.96	T	0.77	69.09
N	-3.32	58.70	Q	-0.88	64.90	T	0.91	69.45
N	-3.95	57.10	Q	-0.82	65.06	T	0.80	69.17

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
U	-0.16	66.73	X	-0.74	65.26
U	-0.16	66.72	X	-0.82	65.04
U	-0.17	66.71	X	-0.78	65.16
U	-0.16	66.74	X	-0.82	65.06
U	-0.16	66.72	X	-0.73	65.27
U	-0.17	66.70	X	-0.82	65.06
U	-0.16	66.74	X	-0.84	65.00
U	-0.15	66.76	X	-0.76	65.21
V	0.18	67.60	Y	0.42	68.20
V	0.10	67.40	Y	0.50	68.40
V	0.06	67.30	Y	0.50	68.40
V	0.14	67.50	Y	0.30	67.90
V	0.22	67.70	Y	0.54	68.50
V	0.18	67.60	Y	0.46	68.30
V	0.14	67.50	Y	0.54	68.50
V	0.18	67.60	Y	0.18	67.60
W	0.24	67.75	Z	0.43	68.22
W	0.31	67.92	Z	0.32	67.94
W	0.23	67.71	Z	0.16	67.54
W	0.20	67.65	Z	0.07	67.32
W	0.15	67.52	Z	0.24	67.74
W	0.27	67.82	Z	0.26	67.80
W	0.21	67.66	Z	0.41	68.19
W	0.19	67.63	Z	0.33	67.98

Results with outliers					
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
SiO2	XRF	120	67.137	2.542	3.786	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
SiO$_2$	XRF	L	8	68.036	0.351	0.005	0.516
SiO$_2$	XRF	M	8	67.963	0.151	0.002	0.223
SiO$_2$	XRF	N	8	63.213	8.393	0.133	13.278
SiO$_2$	XRF	O	8	67.733	0.114	0.002	0.169
SiO$_2$	XRF	P	8	67.136	0.278	0.004	0.414
SiO$_2$	XRF	Q	8	64.910	0.145	0.002	0.223
SiO$_2$	XRF	R	8	68.175	0.205	0.003	0.301
SiO$_2$	XRF	S	8	67.563	0.262	0.004	0.387
SiO$_2$	XRF	T	8	69.171	0.117	0.002	0.168
SiO$_2$	XRF	U	8	66.728	0.019	<0.001	0.029
SiO$_2$	XRF	V	8	67.525	0.128	0.002	0.190
SiO$_2$	XRF	W	8	67.708	0.123	0.002	0.182
SiO$_2$	XRF	X	8	65.133	0.106	0.002	0.163
SiO$_2$	XRF	Y	8	68.225	0.320	0.005	0.468
SiO$_2$	XRF	Z	8	67.841	0.309	0.005	0.456
			Average	**67.137**	**2.177**	**0.011**	**1.144**
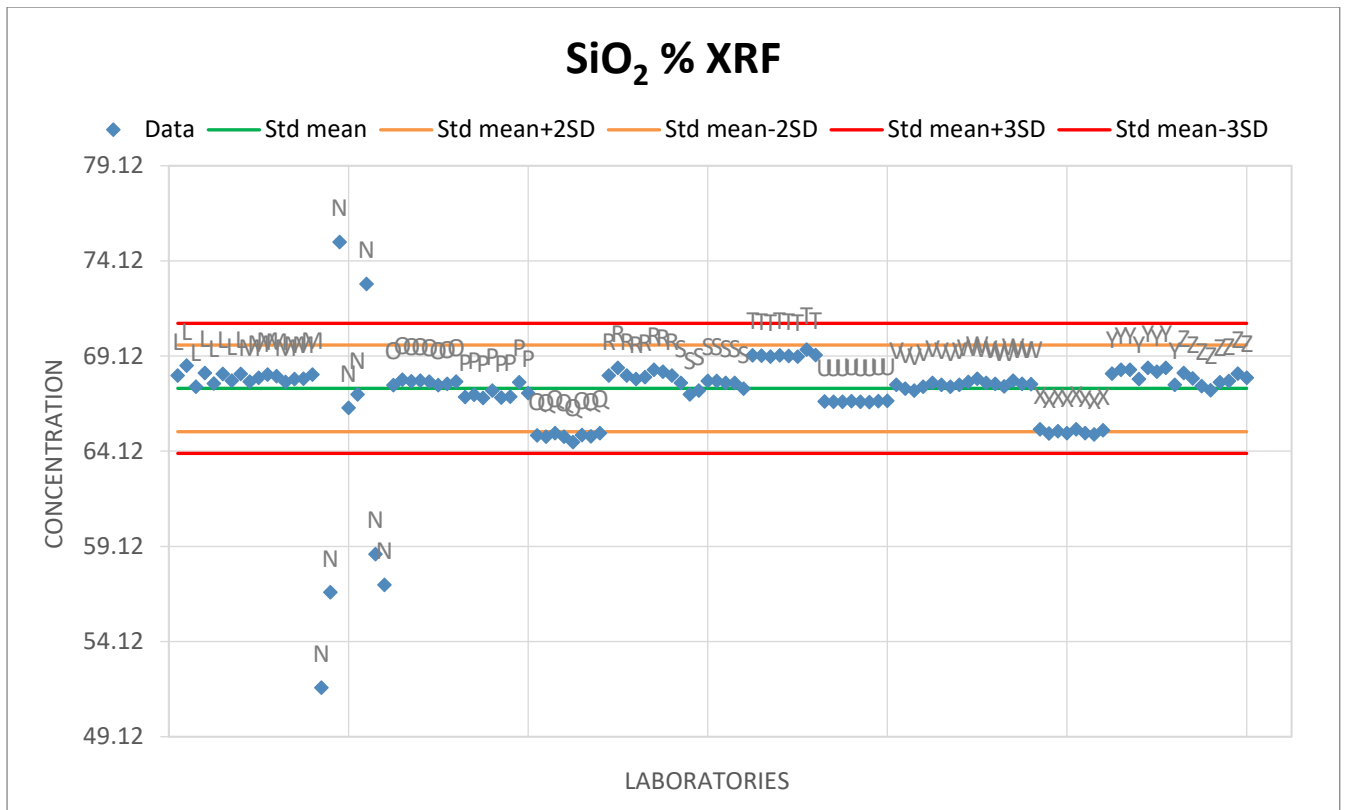
SiO$_2$ % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
SiO2	XRF	112	67.417	1.139	1.689	%

Std mean	67.417
SD	1.139
2SD	2.277
3SD	3.416
Std mean+2SD	69.695
Std mean-2SD	65.140
Std mean+3SD	70.833
Std mean-3SD	64.002

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
SiO2	XRF	0.234	0.763	0.874	0.211	%

Comment: 8 of 120 results rejected as outliers using z score

11.11 Sulphur Trioxide with XRF finish- SO_3 XRF

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
L	0.41	2.64	Q	-0.09	2.48	Y	0.85	2.78
L	0.44	2.65	Q	-0.21	2.44	Y	0.88	2.79
L	0.35	2.62	Q	-0.24	2.43	Y	0.88	2.79
L	0.47	2.66	Q	-0.09	2.48	Y	0.85	2.78
L	0.41	2.64	Q	-0.24	2.43	Y	0.91	2.80
L	0.69	2.73	Q	-0.30	2.41	Y	0.94	2.81
L	0.41	2.64	Q	-0.30	2.41	Y	0.94	2.81
L	0.60	2.70	Q	-0.24	2.43	Y	0.85	2.78
M	0.44	2.65	U	-2.51	1.70	Z	0.50	2.67
M	0.47	2.66	U	-2.48	1.71	Z	0.50	2.67
M	0.47	2.66	U	-2.48	1.71	Z	0.41	2.64
M	0.63	2.71	U	-2.54	1.69	Z	0.38	2.63
M	0.44	2.65	U	-2.51	1.70	Z	0.29	2.60
M	0.07	2.53	U	-2.45	1.72	Z	0.29	2.60
M	0.13	2.55	U	-2.54	1.69	Z	0.44	2.65
M	0.41	2.64	U	-2.54	1.69	Z	0.29	2.60
O	0.38	2.63	X	0.29	2.60			
O	0.38	2.63	X	0.32	2.61			
O	0.32	2.61	X	0.32	2.61			
O	0.35	2.62	X	0.29	2.60			
O	0.13	2.55	X	0.32	2.61			
O	0.32	2.61	X	0.32	2.61			
O	0.29	2.60	X	0.29	2.60			
O	0.13	2.55	X	0.32	2.61			

Results with outliers					
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
SO_3	XRF	64	2.508	0.322	12.832	%

Between Laboratory Statistics						
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
SO_3	XRF	L	8	2.660	0.037	0.014	1.378
SO_3	XRF	M	8	2.631	0.060	0.023	2.293
SO_3	XRF	O	8	2.600	0.033	0.013	1.251
SO_3	XRF	Q	8	2.439	0.027	0.011	1.127
SO_3	XRF	U	8	1.701	0.011	0.007	0.662
SO_3	XRF	X	8	2.606	0.005	0.002	0.199
SO_3	XRF	Y	8	2.793	0.013	0.005	0.459
SO_3	XRF	Z	8	2.633	0.030	0.011	1.144
			Average	**2.508**	**0.032**	**0.011**	**1.064**
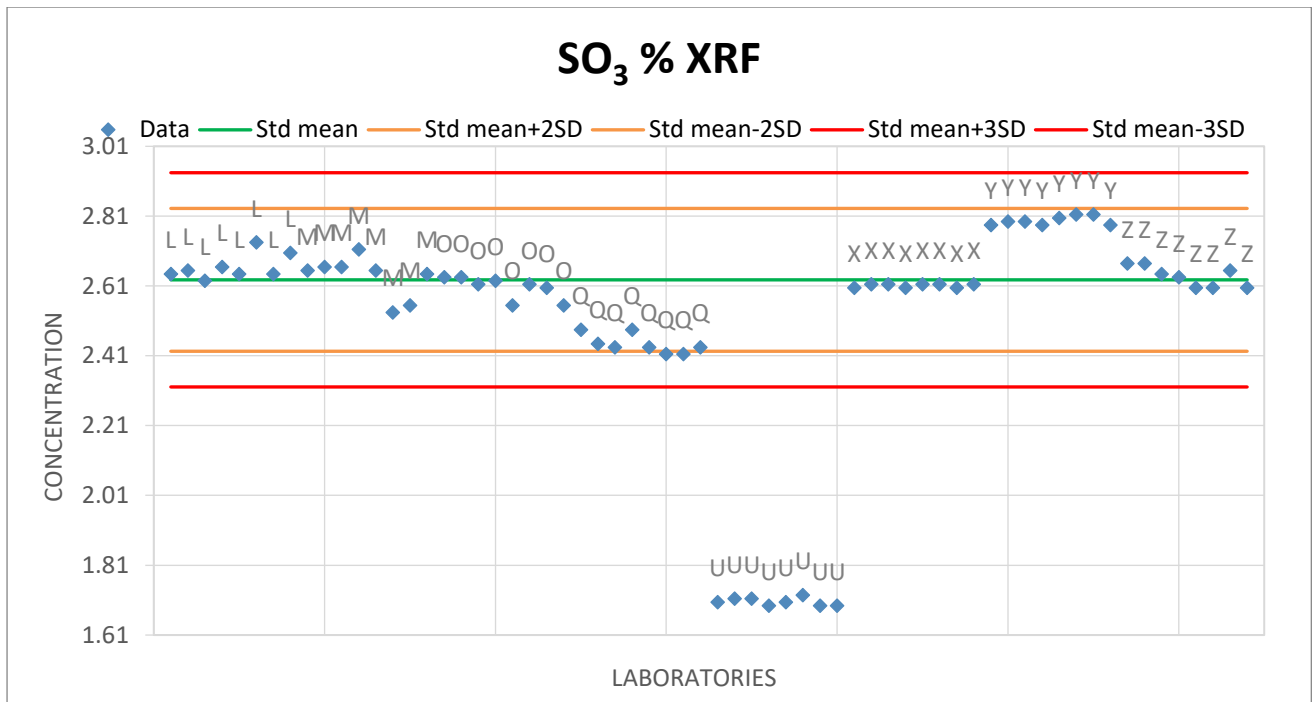
SO₃ % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
SO₃	XRF	56	2.623	0.102	3.899	%

Std mean	2.623
SD	0.102
2SD	0.205
3SD	0.307
Std mean+2SD	2.828
Std mean-2SD	2.418
Std mean+3SD	2.930
Std mean-3SD	2.316

Measurement of uncertainty					
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
SO₃	XRF	0.042	0.012	0.111	0.034	%

Comment: 8 of 64 results rejected as outliers using z score, recommend outliers be investigated

11.12 Strontium Oxide with XRF finish- SrO XRF

Lab_ID	Z_Score	Data
L	1.93	0.03
L	1.93	0.03
L	-0.82	0.02
L	1.93	0.03
L	-0.82	0.02
L	1.93	0.03
L	1.93	0.03
L	1.93	0.03
M	-0.82	0.02
M	-0.82	0.02
M	-0.82	0.02
M	-0.82	0.02
M	-0.82	0.02
M	-0.82	0.02
M	-0.82	0.02
M	-0.82	0.02
U	-0.27	0.02
U	-0.27	0.02
U	-0.27	0.02
U	-0.27	0.02
U	-0.27	0.02
U	-0.27	0.02
U	-0.27	0.02
U	-0.27	0.02

Lab_ID	Z_Score	Data
X	0.83	0.03
X	0.83	0.03
X	0.56	0.03
X	0.83	0.03
X	1.10	0.03
X	0.56	0.03
X	0.56	0.03
X	0.01	0.02
Z	-0.82	0.02
Z	-0.82	0.02
Z	-0.82	0.02
Z	-0.82	0.02
Z	-0.82	0.02
Z	-0.82	0.02
Z	-0.82	0.02
Z	-0.82	0.02

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
SrO	XRF	40	0.023	0.004	15.878	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
SrO	XRF	L	8	0.028	0.005	0.168	16.833
SrO	XRF	M	8	0.020	<0.001	<0.001	<0.001
SrO	XRF	U	8	0.022	<0.001	<0.001	<0.001
SrO	XRF	X	8	0.025	0.001	0.047	4.681
SrO	XRF	Z	8	0.020	<0.001	<0.001	<0.001
			Average	**0.023**	**0.002**	**0.043**	**4.303**
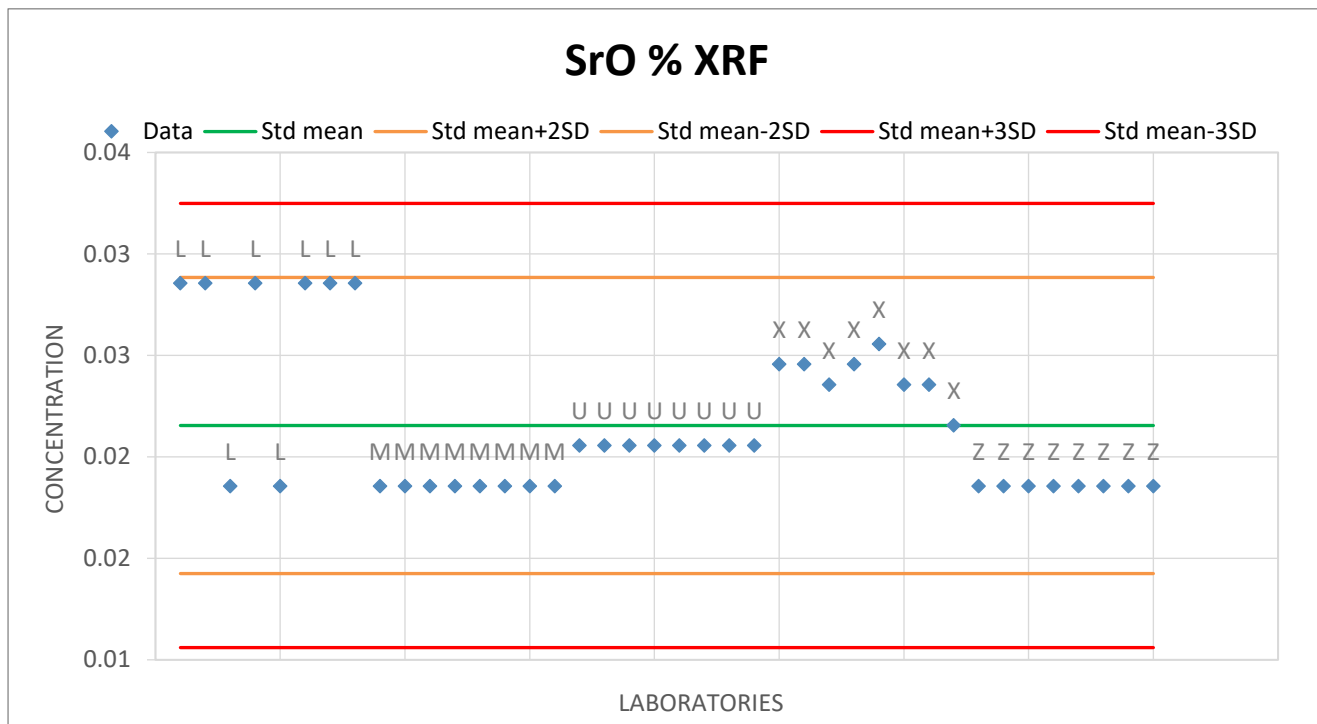
SrO % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
SrO	XRF	40	0.023	0.004	15.878	%

Std mean	0.023
SD	0.004
2SD	0.007
3SD	0.011
Std mean+2SD	0.030
Std mean-2SD	0.016
Std mean+3SD	0.034
Std mean-3SD	0.012

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
SrO	XRF	0.002	<0.001	0.004	0.002	%

Comment: No results rejected as outliers using z score, all results within the mean +- 3SD

11.13 Titanium Dioxide with XRF finish- TiO₂ XRF

Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data	Lab_ID	Z_Score	Data
L	0.27	0.58	P	0.37	0.59	S	-3.27	0.11	X	0.19	0.57
L	0.34	0.59	P	0.33	0.59	S	-3.35	0.10	X	0.27	0.58
L	0.19	0.57	P	0.33	0.59	S	-3.35	0.10	X	0.27	0.58
L	0.27	0.58	P	0.40	0.60	S	-3.27	0.11	X	0.27	0.58
L	0.19	0.57	P	0.37	0.59	S	-3.27	0.11	X	0.34	0.59
L	0.34	0.59	P	0.32	0.59	S	-3.27	0.11	X	0.27	0.58
L	0.12	0.56	P	0.41	0.60	S	-3.27	0.11	X	0.27	0.58
L	0.27	0.58	P	0.42	0.60	S	-3.27	0.11	X	0.19	0.57
M	0.34	0.59	Q	0.22	0.57	U	0.27	0.58	Y	0.27	0.58
M	0.34	0.59	Q	0.40	0.60	U	0.27	0.58	Y	0.27	0.58
M	0.34	0.59	Q	0.39	0.60	U	0.34	0.59	Y	0.27	0.58
M	0.34	0.59	Q	0.37	0.59	U	0.19	0.57	Y	0.34	0.59
M	0.34	0.59	Q	0.33	0.59	U	0.19	0.57	Y	0.27	0.58
M	0.34	0.59	Q	0.30	0.59	U	0.27	0.58	Y	0.34	0.59
M	0.34	0.59	Q	0.40	0.60	U	0.27	0.58	Y	0.27	0.58
M	0.34	0.59	Q	0.37	0.59	U	0.19	0.57	Y	0.27	0.58
O	0.27	0.58	R	0.27	0.58	V	0.42	0.60	Z	0.27	0.58
O	0.19	0.57	R	0.19	0.57	V	0.42	0.60	Z	0.27	0.58
O	0.27	0.58	R	0.27	0.58	V	0.49	0.61	Z	0.27	0.58
O	0.19	0.57	R	0.27	0.58	V	0.42	0.60	Z	0.27	0.58
O	0.19	0.57	R	0.19	0.57	V	0.49	0.61	Z	0.27	0.58
O	0.27	0.58	R	0.34	0.59	V	0.42	0.60	Z	0.27	0.58
O	0.27	0.58	R	0.19	0.57	V	0.42	0.60	Z	0.27	0.58
O	0.27	0.58	R	0.27	0.58	V	0.42	0.60	Z	0.27	0.58

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
TiO2	XRF	96	0.545	0.133	24.391	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
TiO₂	XRF	L	8	0.578	0.010	0.018	1.792
TiO₂	XRF	M	8	0.590	<0.001	<0.001	<0.001
TiO₂	XRF	O	8	0.576	0.005	0.009	0.898
TiO₂	XRF	P	8	0.594	0.005	0.008	0.850
TiO₂	XRF	Q	8	0.591	0.008	0.014	1.351
TiO₂	XRF	R	8	0.578	0.007	0.012	1.224
TiO₂	XRF	S	8	0.108	0.005	0.043	4.306
TiO₂	XRF	U	8	0.578	0.007	0.012	1.224
TiO₂	XRF	V	8	0.603	0.005	0.008	0.768
TiO₂	XRF	X	8	0.579	0.006	0.011	1.107
TiO₂	XRF	Y	8	0.583	0.005	0.008	0.795
TiO₂	XRF	Z	8	0.580	<0.001	<0.001	<0.001
		Average		0.545	0.006	0.012	1.193
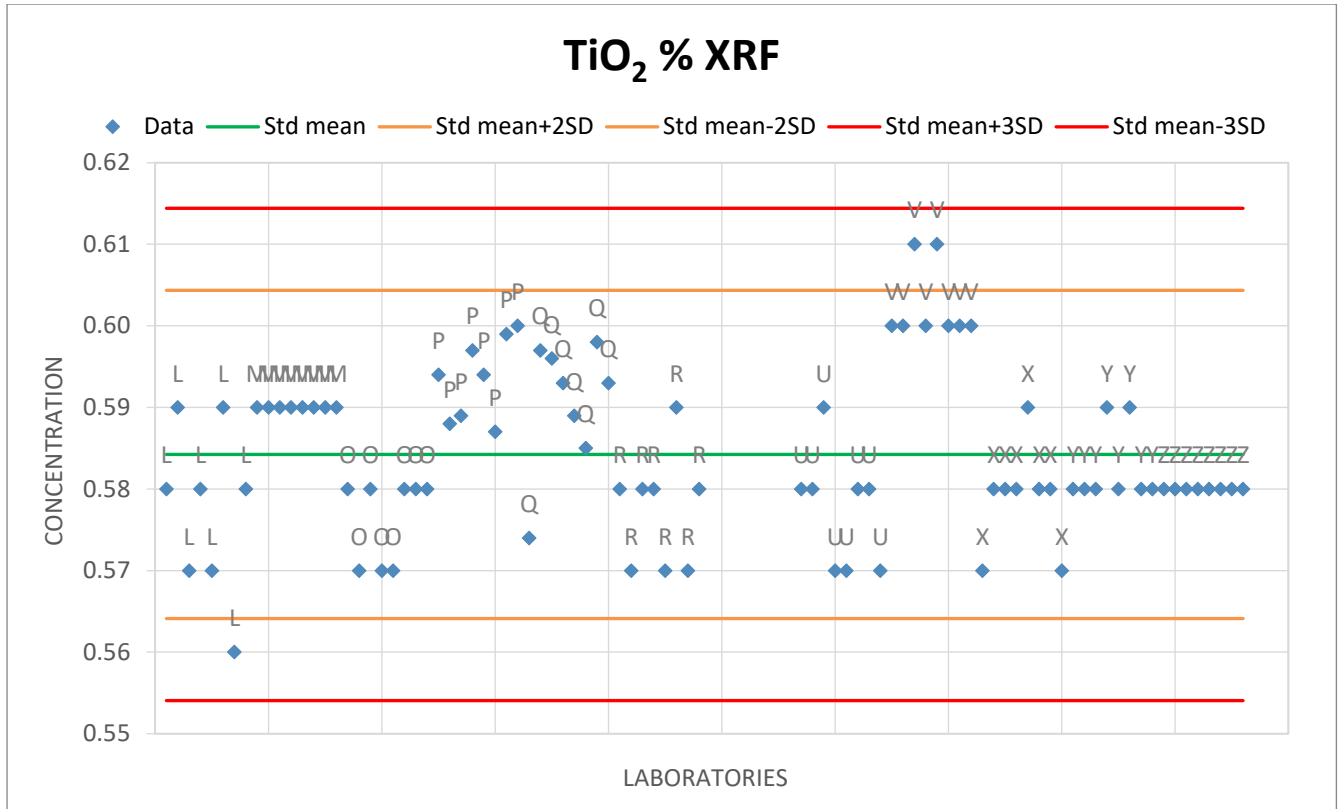
TiO₂ % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
TiO2	XRF	88	0.584	0.010	1.722	%

Std mean	0.584
SD	0.010
2SD	0.020
3SD	0.030
Std mean+2SD	0.604
Std mean-2SD	0.564
Std mean+3SD	0.614
Std mean-3SD	0.554

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
TiO2	XRF	0.003	<0.001	0.008	0.006	%

Comment: 8 of 96 results rejected as outliers using z score, outlier not represented on graph

11.14 Vanadium (V) Oxide with XRF finish- V_2O_5 XRF

Lab_ID	Z_Score	Data
R	0.88	0.03
R	-1.83	0.02
R	-1.83	0.02
R	0.88	0.03
R	0.88	0.03
R	0.88	0.03
R	-1.83	0.02
R	0.88	0.03
S	0.88	0.03
S	0.88	0.03
S	0.88	0.03
S	0.88	0.03
S	0.88	0.03
S	0.88	0.03
S	0.88	0.03
S	0.88	0.03
U	0.34	0.03
U	0.34	0.03
U	0.61	0.03
U	0.07	0.03
U	0.07	0.03
U	-0.20	0.03
U	0.61	0.03
U	0.07	0.03

Lab_ID	Z_Score	Data
X	-1.02	0.02
X	0.07	0.03
X	-0.75	0.02
X	-1.29	0.02
X	-0.75	0.02
X	-1.83	0.02
X	-1.02	0.02
X	-1.29	0.02

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
V2O5	XRF	32	0.027	0.004	13.793	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
V_2O_5	XRF	R	8	0.026	0.005	0.197	19.716
V_2O_5	XRF	S	8	0.030	<0.001	<0.001	<0.001
V_2O_5	XRF	U	8	0.028	0.001	0.038	3.839
V_2O_5	XRF	X	8	0.023	0.002	0.088	8.783
			Average	**0.027**	**0.003**	**0.081**	**8.085**
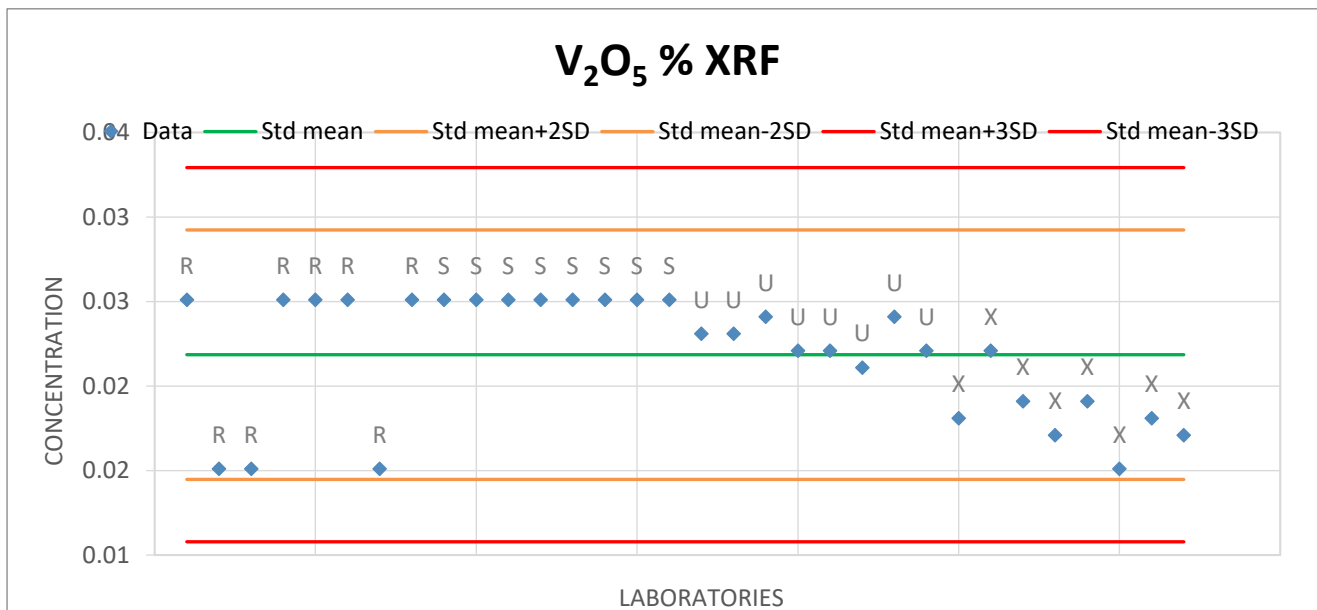
V₂O₅ % XRF

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
V2O5	XRF	32	0.027	0.004	13.793	%

Std mean	0.027
SD	0.004
2SD	0.007
3SD	0.011
Std mean+2SD	0.034
Std mean-2SD	0.019
Std mean+3SD	0.038
Std mean-3SD	0.016

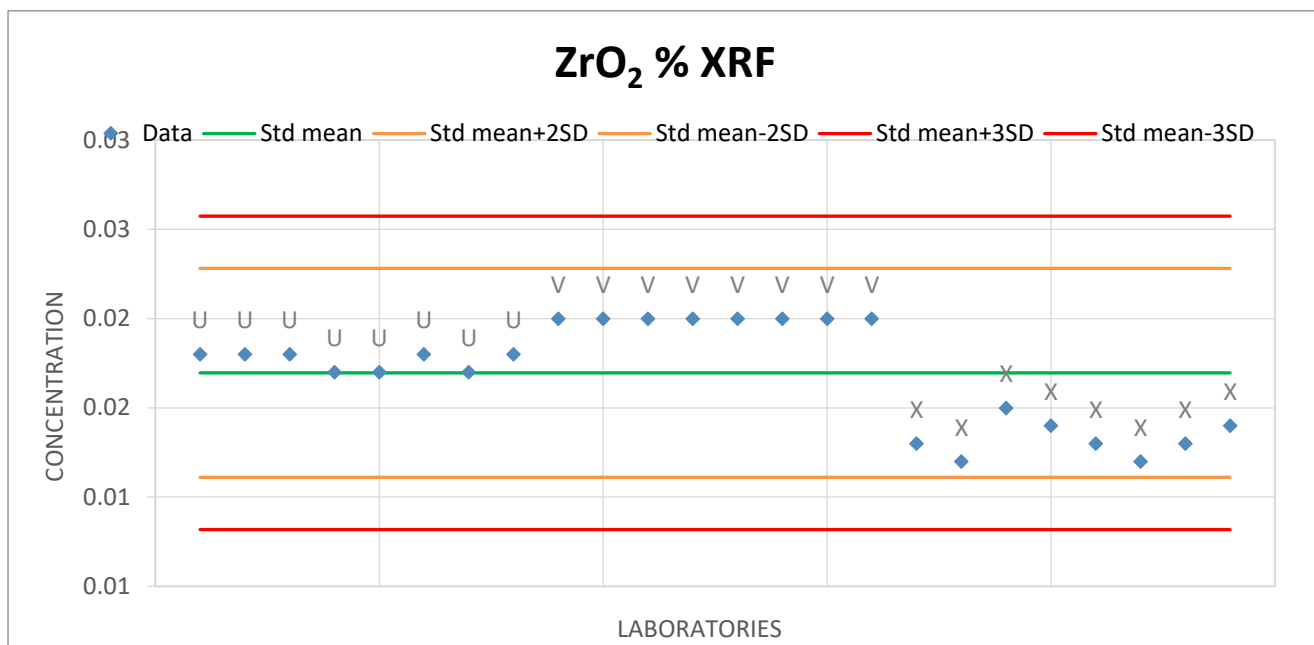| Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
V2O5	XRF	0.002	<0.001	0.004	0.003	%

Comment: No results rejected as outliers using z score, all results within the mean +- 3SD

11.15 Zirconium (II) Oxide with XRF finish- ZrO_2 XRF

Lab_ID	Z_Score	Data
U	0.36	0.02
U	0.36	0.02
U	0.36	0.02
U	0.01	0.02
U	0.01	0.02
U	0.36	0.02
U	0.01	0.02
U	0.36	0.02
V	1.04	0.02
V	1.04	0.02
V	1.04	0.02
V	1.04	0.02
V	1.04	0.02
V	1.04	0.02
V	1.04	0.02
V	1.04	0.02
X	-1.35	0.01
X	-1.69	0.01
X	-0.67	0.02
X	-1.01	0.01
X	-1.35	0.01
X	-1.69	0.01
X	-1.35	0.01
X	-1.01	0.01

Results with outliers					
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
ZrO_2	XRF	24	0.017	0.003	17.256	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
ZrO_2	XRF	U	8	0.018	0.001	0.029	2.936
ZrO_2	XRF	V	8	0.020	<0.001	<0.001	<0.001
ZrO_2	XRF	X	8	0.013	0.001	0.078	7.812
			Average	**0.017**	**0.001**	**0.036**	**3.583**

ZrO₂ % XRF

Results without outliers

Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
ZrO₂	XRF	24	0.017	0.003	17.256	%

Std mean	0.017
SD	0.003
2SD	0.006
3SD	0.009
Std mean+2SD	0.023
Std mean-2SD	0.011
Std mean+3SD	0.026
Std mean-3SD	0.008

Measurement of uncertainty

Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
ZrO₂	XRF	0.003	<0.001	0.006	0.001	%

Comment: No results rejected as outliers using z score, all results within the mean +- 3SD

11.16 Loss on Ignition-LOI

Lab_ID	Z_Score	Data
L	-0.19	3.03
L	0.17	3.12
L	-0.27	3.01
L	-0.07	3.06
L	-0.07	3.06
L	0.53	3.21
L	0.29	3.15
L	0.37	3.17
M	-0.87	2.86
M	-1.11	2.80
M	-0.95	2.84
M	-1.11	2.80
M	-1.11	2.80
M	-0.91	2.85
M	-0.99	2.83
M	-1.07	2.81
O	-0.67	2.91
O	-0.71	2.90
O	-0.71	2.90
O	-0.63	2.92
O	-0.71	2.90
O	-0.59	2.93
O	-0.67	2.91
O	-0.43	2.97

Lab_ID	Z_Score	Data
P	1.73	3.51
P	1.65	3.49
P	1.61	3.48
P	1.69	3.50
P	1.61	3.48
P	1.69	3.50
P	1.61	3.48
P	1.65	3.49
Q	1.13	3.36
Q	1.13	3.36
Q	0.89	3.30
Q	1.17	3.37
Q	1.05	3.34
Q	1.25	3.39
Q	1.37	3.42
Q	1.41	3.43
R	1.01	3.33
R	0.69	3.25
R	1.61	3.48
R	1.05	3.34
R	0.69	3.25
R	0.89	3.30
R	0.33	3.16
R	0.41	3.18

Lab_ID	Z_Score	Data
S	-0.99	2.83
S	-0.87	2.86
S	-0.91	2.85
S	-0.95	2.84
S	-1.15	2.79
S	-1.83	2.62
S	-0.99	2.83
S	-0.95	2.84
T	1.13	3.36
T	1.05	3.34
T	1.13	3.36
T	1.13	3.36
T	1.13	3.36
T	1.13	3.36
T	0.97	3.32
T	1.21	3.38
U	-0.47	2.96
U	-0.39	2.98
U	-0.35	2.99
U	-0.47	2.96
U	-0.35	2.99
U	-0.43	2.97
U	-0.35	2.99
U	-0.35	2.99

Lab_ID	Z_Score	Data
V	-1.03	2.82
V	-0.95	2.84
V	-1.07	2.81
V	-0.99	2.83
V	-0.95	2.84
V	-0.95	2.84
V	-0.95	2.84
V	-0.95	2.84
Y	-0.87	2.86
Y	-1.07	2.81
Y	-1.07	2.81
Y	-1.19	2.78
Y	-1.11	2.80
Y	-1.23	2.77
Y	-0.95	2.84
Y	-1.07	2.81
Z	-0.87	2.86
Z	-1.07	2.81
Z	-0.83	2.87
Z	-0.47	2.96
Z	-0.55	2.94
Z	-0.79	2.88
Z	-0.47	2.96
Z	-0.39	2.98

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
LOI	LOI	104	3.078	0.250	8.108	%
Between Laboratory Statistics						
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
LOI	LOI	L	8	3.101	0.072	0.023	2.315
LOI	LOI	M	8	2.824	0.024	0.009	0.866
LOI	LOI	O	8	2.918	0.024	0.008	0.814
LOI	LOI	P	8	3.491	0.011	0.003	0.323
LOI	LOI	Q	8	3.371	0.042	0.013	1.253
LOI	LOI	R	8	3.286	0.102	0.031	3.094
LOI	LOI	S	8	2.808	0.079	0.028	2.797
LOI	LOI	T	8	3.355	0.018	0.005	0.528
LOI	LOI	U	8	2.979	0.014	0.005	0.455
LOI	LOI	V	8	2.833	0.012	0.004	0.411
LOI	LOI	Y	8	2.810	0.029	0.010	1.042
LOI	LOI	Z	8	2.908	0.061	0.021	2.086
			Average	**3.078**	**0.049**	**0.013**	**1.318**
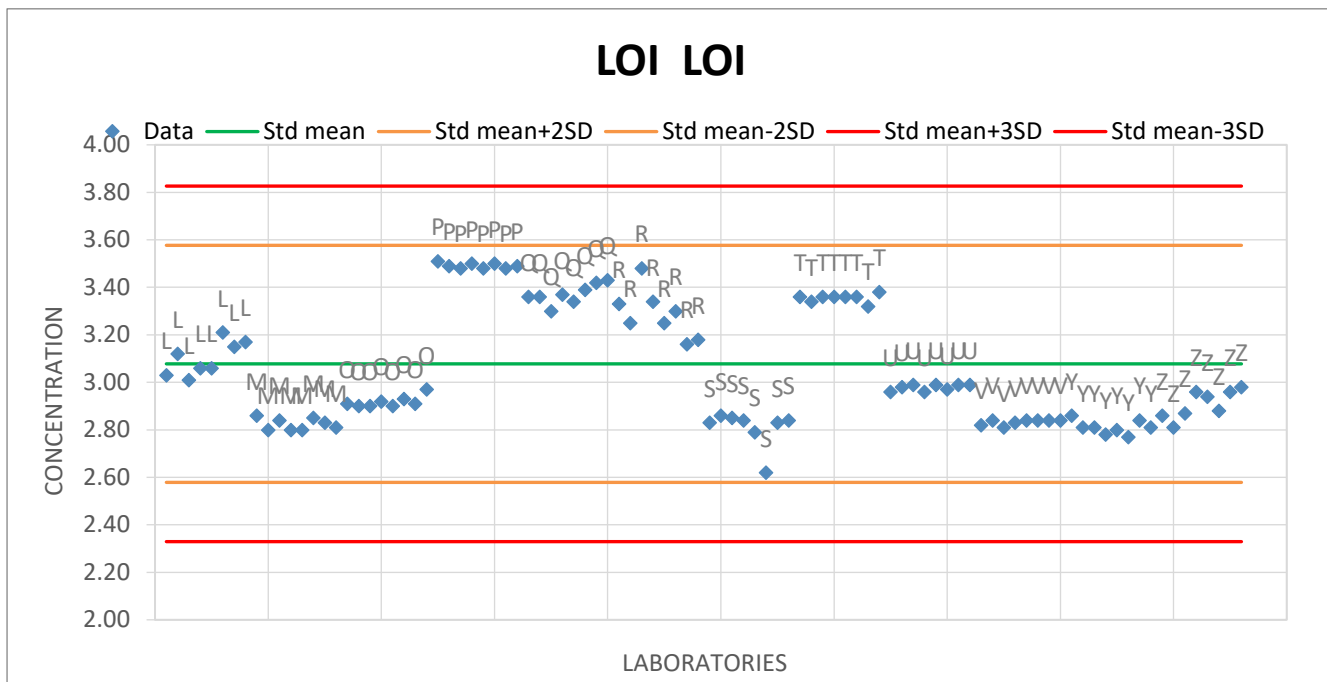
LOI LOI

Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
LOI	LOI	104	3.078	0.250	8.108	%
Std mean	3.078					
SD	0.250					
2SD	0.499					
3SD	0.749					
Std mean+2SD	3.577					
Std mean-2SD	2.579					
Std mean+3SD	3.826					
Std mean-3SD	2.329					

Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
LOI	LOI	0.055	0.040	0.199	0.049	%

Comment: No results rejected as outliers using z score, all results within the mean +- 3SD

11.17 Sulphur by Combustion/LECO- S Combustion/LECO

Lab_ID	Z_Score	Data
S	-1.31	0.98
S	-1.31	0.98
S	-1.50	0.97
S	-1.50	0.97
S	-1.31	0.98
S	-1.88	0.95
S	-1.88	0.95
S	-1.88	0.95
W	-0.04	1.05
W	-0.36	1.03
W	0.40	1.07
W	0.49	1.08
W	0.49	1.08
W	1.25	1.12
W	1.42	1.12
W	0.95	1.10
X	0.80	1.09
X	-0.09	1.04
X	0.11	1.06
X	-0.21	1.04
X	0.59	1.08
X	0.99	1.10
X	0.40	1.07
X	0.66	1.08

Lab_ID	Z_Score	Data
Y	0.40	1.07
Y	0.40	1.07
Y	0.40	1.07
Y	0.59	1.08
Y	0.59	1.08
Y	0.78	1.09
Y	0.78	1.09
Y	0.78	1.09

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
S	Combustion/LECO	32	1.049	0.053	5.032	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
S	Combustion/LECO	S	8	0.966	0.014	0.015	1.457
S	Combustion/LECO	W	8	1.079	0.032	0.030	2.983
S	Combustion/LECO	X	8	1.070	0.023	0.021	2.125
S	Combustion/LECO	Y	8	1.080	0.009	0.009	0.857
			Average	**1.049**	**0.021**	**0.019**	**1.856**

S % CombuLECO
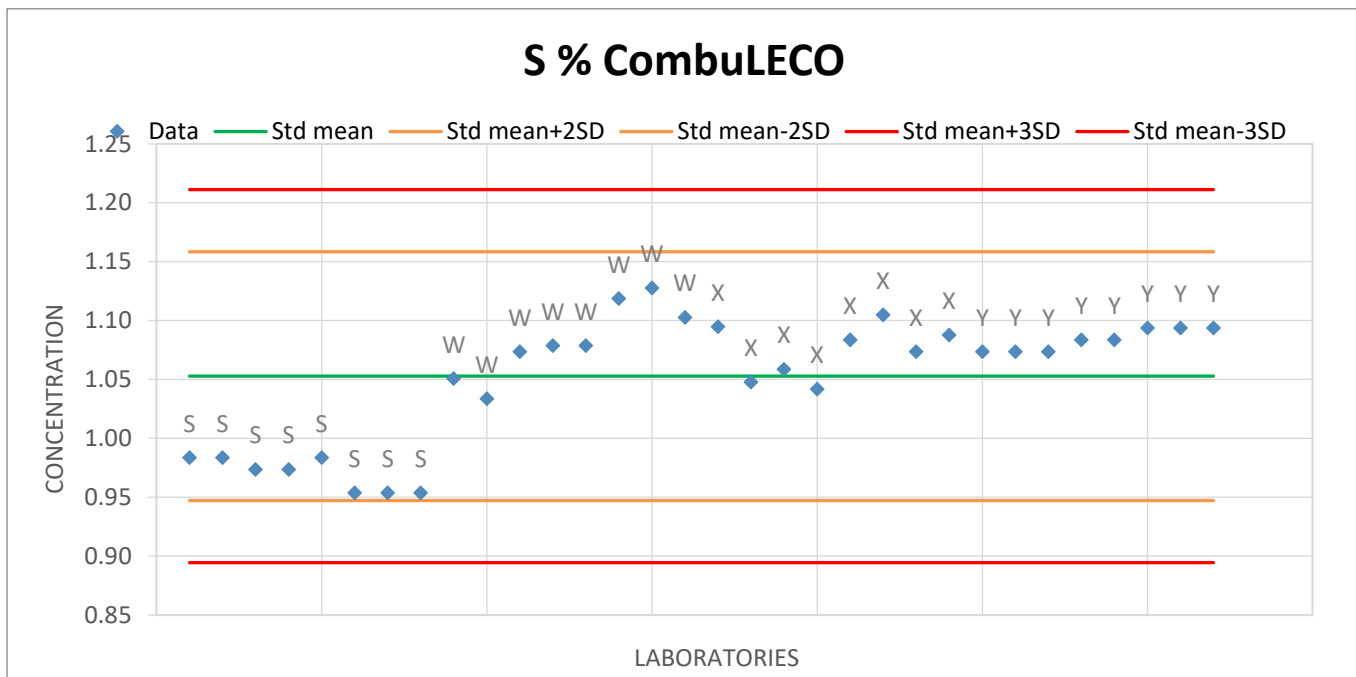
Results without outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
S	Combustion/LECO	32	1.049	0.053	5.032	%

Std mean	1.049
SD	0.053
2SD	0.106
3SD	0.158
Std mean+2SD	1.155
Std mean-2SD	0.943
Std mean+3SD	1.207
Std mean-3SD	0.891

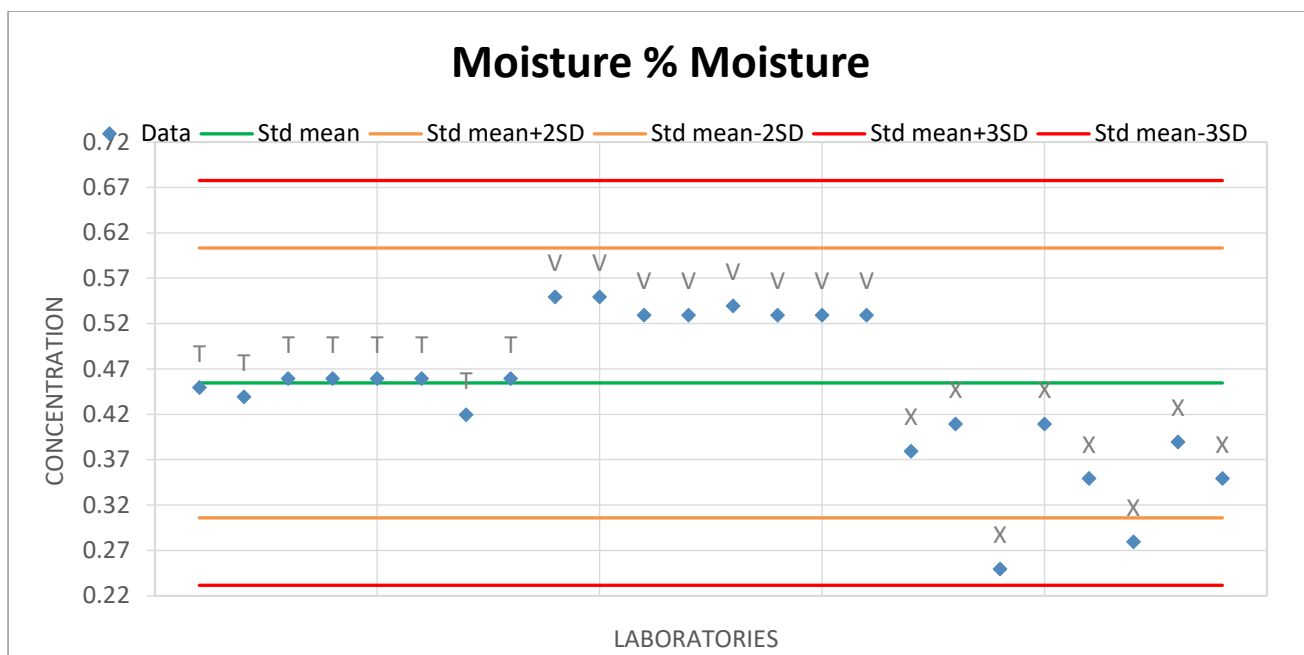| Measurement of uncertainty						
Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
S	Combustion/LECO	0.039	0.006	0.078	0.021	%

Comment: No results rejected as outliers using z score, all results within the mean +- 3SD

11.18 Moisture-Moisture

Lab_ID	Z_Score	Data
T	0.04	0.45
T	-0.08	0.44
T	0.16	0.46
T	0.16	0.46
T	0.16	0.46
T	0.16	0.46
T	-0.32	0.42
T	0.16	0.46
V	1.23	0.55
V	1.23	0.55
V	0.99	0.53
V	0.99	0.53
V	1.11	0.54
V	0.99	0.53
V	0.99	0.53
V	0.99	0.53
X	-0.79	0.38
X	-0.44	0.41
X	-2.34	0.25
X	-0.44	0.41
X	-1.15	0.35
X	-1.99	0.28
X	-0.68	0.39
X	-1.15	0.35

Results with outliers						
Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Moisture	Moisture	24	0.447	0.084	18.785	%

Between Laboratory Statistics							
Element	Gen Method	Lab ID	N	LAB_Mean	LAB_SD	RSD	RSD_%
Moisture	Moisture	T	8	0.451	0.015	0.032	3.230
Moisture	Moisture	V	8	0.536	0.009	0.017	1.708
Moisture	Moisture	X	8	0.353	0.059	0.168	16.800
			Average	**0.447**	**0.036**	**0.072**	**7.246**

Moisture % Moisture

Results without outliers

Element	Gen Method	N	Std_Mean	SD	RSD_%	Unit
Moisture	Moisture	23	0.455	0.074	16.330	%

Std mean	0.455
SD	0.074
2SD	0.149
3SD	0.223
Std mean+2SD	0.604
Std mean-2SD	0.307
Std mean+3SD	0.678
Std mean-3SD	0.232

Measurement of uncertainty

Element	Gen Method	CSU	BtwnLabVar	BtwnLabSD	WithinLabSD	Unit
Moisture	Moisture	0.077	0.018	0.133	0.027	%

Comment: 1 of 24 results rejected as outliers using z score, all results within the mean +- 3SD

End of report