ERIMSA INTERLABORATORY PROFICIENCY TEST REPORT

DETERMINATION OF METALLIC AND NON-METALLIC ELEMENTS IN QUARTZ SAMPLES

31th EDITION
2023

Erimsa

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LIST OF ABBREVIATIONS

ASTM	American Society for Testing and Materials
Avg	Average
ECLab	Erimsa Central Laboratory
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
ICP-OES	Inductively Coupled Plasma - Optical Emission Spectrometry
ISO	International Organization for Standardization
ITL	Interlaboratory comparison programme
LL	Lower Limit
LLD	Low Limit Detection
PT	Proficiency Test
RM	Reference Material
SD	Standard Deviation
UL	Upper Limit
XRF	X-Ray Fluorescence

1. INTRODUCTION

Interlaboratory comparison programme (ITL) studies are an essential and very important element of laboratory quality assurance, which allow individual laboratories to compare their analytical results with those from other laboratories while providing them objective standards to perform against. This in turn allows them to demonstrate performance.

One of the core duties of Erimsa Central Laboratory (ECLab) is to organize ITLs which allow Erimsa to includes this programme in its quality assurance system as a service to the customer for the correct and updated control of its product.

2. SCOPE

The scope of this comparison is to test the competence of the appointed laboratories to analyze quartz samples, which once analyzed with the report can be used as an important support tool to improve methods and systems.

The reporting results were assessed following the administrative and logistic procedures of the ECLab Unit in charge of the Erimsa ITL, following the rules for PTs according to ISO 17043:2010 [1].

3. PLANNING

3.1. TIME FRAME

The organization of the Erimsa ITL-21 exercise was launched in January 2021 Samples were sent to participants on March 30, 2021. The deadline reporting of results was set to July 31, 2021.

3.2. CONFIDENTIALITY

The procedures used for the organization of PTs are accredited according to ISO 17043:2011 [1] and guarantee that the identity of the participants and the information provided by them is treated as confidential.

Samples for a new exercise were prepared and homogeneity tests were performed. The samples were dispatched to participants together with instruction letter (Annex 1). An email with an excel file were also send for the compilation of results to be return with the analytical results (Annex 2)

3.3. INTRUCTIONS TO PARTICIPANTS

Detailed instructions were given to participants in the “Test item accompanying letter” mentioned above.

Participants were asked to perform two or three independent measurements, to report their calculated mean (x_i) and the associated standard deviation (u) and the analytical technique used for analysis.

Participants received an individual code to report their measurement results.

Participants were informed that the procedure used for the analysis should resemble as closely as possible their routine procedures for this type of matrix/analytes.

The laboratory codes were given randomly and communicated to the participants by e-mail.

4. TEST MATERIAL

4.1. PREPARATION

The preparation of the material was done by ECLab.

The final powder material was mixed in a rotation mixer for 4 hours.

Portions of 35 g were manually filled into 100 mL transparent bag using acid washed plastic spoons.

Each bag was identified with a unique number of the PT exercise.

4.2. HOMOGENITY ASSESSMENT

For testing interlaboratory comparisons the objective of homogeneity testing is to establish suitably small sample variability, where the samples are sufficiently homogenous.

Homogeneity was evaluated according to ISO 13528:2015 [2] and ISO 5725-2:2019 [3]. The test item proved to be adequately homogeneous for the investigated analytes.

Once the samples have been prepared and packaged, at least 10 samples are selected at random for homogeneity testing. The tests selected are those that are considered to best indicate any significant differences in the samples. All testing is performed at least in duplicate and under repeatability conditions i.e., same laboratory; same operator; same method; over as short a time interval as possible.

For the samples to be accepted as suitable for use, the results of this testing and any applicable statistical analysis (e.g., Anova) of the results must indicate that no significant variability existed. Thus, any outlier results subsequently identified in a program will not be attributable to sample variability.

The samples were tested for homogeneity by ECLab.

The statistical treatment of data was performed by the ECLab. Analysis of Variance F test at α=0.05 was used for check statistically significant differences between proficiency test items.

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_j$$

$$H_1: otherwise$$

The expressions for the calculation of the elements that intervene in the Anova are the following:

$$\bar{x} = \frac{\sum_{j=1}^{k}\sum_{i=1}^{nj} x_{ij}}{n} \quad (1)$$

$$M_b = \frac{\sum_{j=1}^{J} n_j(\bar{x}_j - \bar{x})^2}{J-1} \quad (2)$$

$$M_w = \frac{\sum_{j=1}^{J}\sum_{i=1}^{n_j}(x_{ij} - \bar{x}_j)^2}{n-J} \quad (3)$$

$$F_{J-1,n-J} = \frac{M_b}{M_w} \quad (4)$$

Where,

$\bar{x}$ = is the global average.

M_b = Mean square Between-groups.

M_w = Mean square Within-groups.

Assuming true H_0, this statistic follows a F of Snedecor with J-1 and n-J degrees of freedom; so, given a significance level α, critical region will be determinated by values such that $F > F_{J-1,n-J}^{1-\alpha}$, where $P\left[F > F_{J-1,n-J}^{1-\alpha}\right] = 1 - \alpha$.

Homogeneity was tested for those elements that at least eight laboratories, according ASTM E 691-99 [5], have performed the analysis referenced to historical data of ITL (Annex 1).

4.3. DISTRIBUTION

Each participant received:

- Envelope containing 4 samples of the test items (containing approx. 35 g each);
- The "Test item accompanying letter" (Annex 2);
- The "Confirmation of receipt" form to be sent back to Erimsa-ITL-21 Coordinator after receipt of the test items (Annex 3); and
- The form for reporting the results (Annex 4) (via email).

5. LIST OF PARTICIPANTS

In alphabetical order:

List of participants	Country
AlexStewart International	Spain
Dorfner Anzaplan	Germany
Elkem ASA Tana	Norway
Elkem Chicoutimi	Canada
Elkem Iceland	Iceland
Elkem Paraguay	Paraguay
Elkem Technology Lab	Norway
Elkem Yongdeng	China
Erimsa	Spain
Ferroatlántica Sabón	Spain
Ferroglobe Cuarzos Industriales	Spain
FerroPem LCA	France
Metrohm Hispania	Spain
Nemko Norlab AS	Norway
Norwegian University for Science and Technology (NTNU)	Norway
OFZ	Slovaquia
PCC Bakkisilicon	Iceland
Quebec Silicon LP	Canada
Research Institutes of Sweden (RI.SE)	Sweden
SGS	Netherlands
Simcoa	Australia
Spectro	Germany
University of A Coruña (UdC)	Spain
University of Bergen	Norway
University of Santiago de Compostela (USC-RIADT)	Spain
University of Vigo (UVigo)	Spain
Wacker Chemicals Holla AS	Norway
XEAL	Spain

6. EVALUATION OF RESULTS

6.1. APPLIED STATISTICAL DESCRIPTION

The guide to the expression of uncertainty in measurement ISO/IEC Guide 98-3 [4] gives guidance on evaluation measurement uncertainties.

When σ_{pt} is calculated as the standard deviation of participant results, the uncertainty components due to inhomogeneity, transport and instability are in large reflected in the variability of participant results.

In this case the assigned value x_{pt} for the proficiency test item is derived as a robust analysis. This algorithm yields robust estimates of the mean and standard deviation of the data to which it is applied according to ISO 13528:2015 [2].

Denote the *p* items of data, sorted into increasing order by,

$$x_{\{1\}}, x_{\{2\}}, \ldots, x_{\{p\}}$$

Denote the robust average and robust standard deviation of these data by x^* and s^*.

Calculate initial values for x^* and s^* as:

x^*= median of x_i (i = 1, 2, ..., p) (5)

s^* = 1.483 median of $|x_i - x^*|$ with (i = 1, 2, ..., p) (6)

Update the values of x^* and s^* as follows. Calculate:

$$\delta = 1.5 s^* \quad (7)$$

For each x_i (i = 1, 2, ..., p), calculate:

$$x_i^* = \begin{cases} x^* - \delta \; when \; x_i < x^* - \delta \\ x^* + \delta \; when \; x_i > x^* + \delta \\ x_i \; otherwise \end{cases} \quad (8)$$

Calculate the new values of x^* and s^* from:

$$x^* = \sum_{i=1}^{p} \frac{x_i^*}{p} \quad (9)$$

$$s^* = 1.134 \sqrt{\sum_{i=1}^{p} \frac{(x_i^* - x^*)^2}{(p-1)}} \quad (10)$$

The robust estimates x^* and s^* may be derived by an iterative calculation, i.e., by updating the values of x^* and s^* several times until the process converges.

From this result the assigned value and the standard deviation for reproducibility are obtained.

The standard uncertainty of the assigned value is estimated as:

$$u(x_{pt}) = 1.25 \frac{s^*}{\sqrt{p}} \quad (11)$$

where s^* is the robust standard deviation of the results. (Here a "result" for a participant is the average of all their measurements on the proficiency test item.)

For results reported as "smaller than" (< - values), the reported value was not used in any calculations and no evaluation of the measurement results was made. No scores were given.

Values of x^* and s^* will be displayed when there is more than one result.

6.2. SCORES AND EVALUATION CRITERIA

The individual laboratory performance was expressed in terms of z and z' scores according to ISO 13528:2015 [2]:

$$z = \frac{x_i - x_{pt}}{\sigma_{pt}} \quad (12)$$

Where:

x_i = is the measurement results reported by a participant;

x_{pt} = is the assigned value (calculated mean based on participant's results);

σ_{pt} = is the standard deviation for proficiency test assessment (standard deviation based on participant's results);

According to ISO 13528:2015 [2], when $u(x_{pt}) > 0.3\sigma_{pt}$ the uncertainty of the assigned value ($u(x_{pt})$) can be considered by expanding the denominator of the z score and calculating the z' score, as follows:

$$z' = \frac{x_i - x_{pt}}{\sqrt{\sigma_{pt}^2 + u^2(x_{pt})}} \quad (13)$$

Where:

x_i = is the measurement results reported by a participant;

x_{pt} = is the assigned value (calculated mean based on participant's results);

σ_{pt} = is the standard deviation for proficiency test assessment (standard deviation based on participant's results);

$u(x_{pt})$ = is the standard measurement uncertainty of the assigned value.

$$u(x_{pt}) = \sqrt{\frac{\sum_{k=1}^{n}(x_i - x_{pt})^2}{n(n-1)}} \quad (14)$$

The interpretation of the z (or z') performance scores is done according ISO 13528:2015 [2]:

	|score|	≤ 2	Satisfactory performance
2 <	|score|	< 3	Questionable performance
	|score|	≥ 3	Unsatisfactory performance

The z (or z') scores compare the participant's deviation from the assigned value with the standard deviation for proficiency test assessment (σ_{pt}) used as common quality criterion. The scores and charts for those elements that at least eight laboratories, according to ASTM E 691-99 [5], have performed the analysis on are shown. The z (or z') scores higher than 100 will not be represented in the charts, since such

values completely distort the scales and make it impossible to correctly display the performance of different labs.

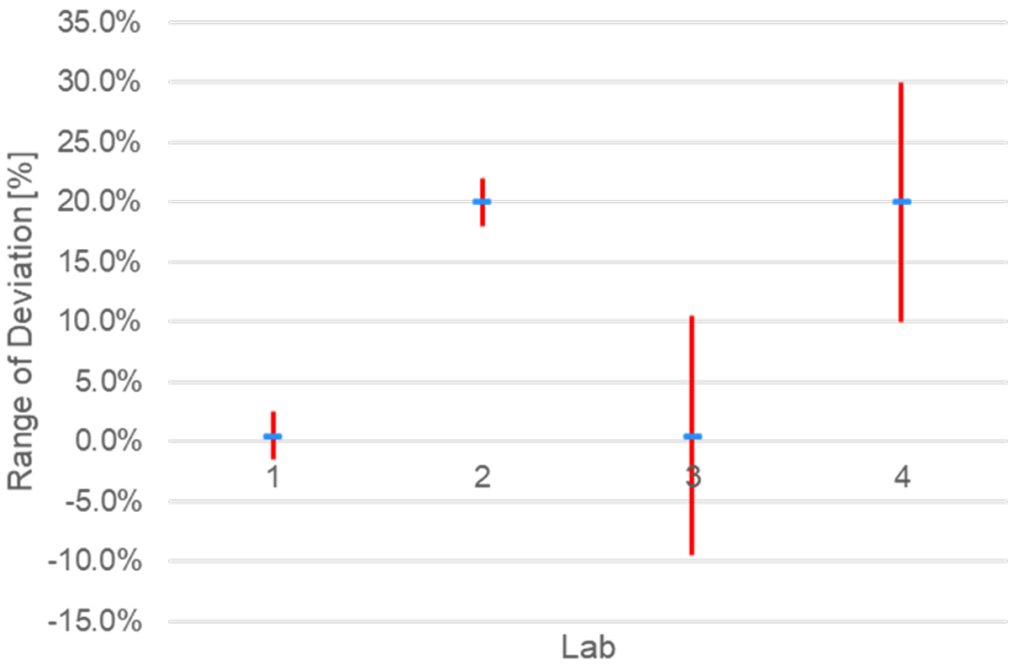
6.3. INTERSAMPLE AVERAGES

Intersamples Average of differences show the trend of the laboratory. The charts show the accuracy (capacity of getting the real value) as the average of the differences, and the precision (capacity of getting the same results on different tests) as the range of deviations (Annex 6).

They can be balanced if some of the differences of the same laboratory and elements are positive and some other are negative if it shows big differences referring to the true analysis.

In this case the intersample standard deviation must be checked, because that means that the above-mentioned laboratory could get analysis too deviated from the real value (the average is considered as the real value in the present study), although in a long term (more analysis) the deviation could be balanced. At any case, even if the average of differences trends to zero, they would never be sure when they are getting the correct result. Usually, this fact is due to random errors which are difficult to solve. They can be due to the method, or the equipment used to have not enough precision for the value pretended to be measured.

Example: In the attached chart the intersample averages of an analysis can be seen for four laboratories. In the case of lab 3, the intersample average is 0.5%, however the standard deviation is 10.0%. In such case the differences for the samples A, B, C and D could be something like 20.0%, -22.0%, 12.0% and -16.0%. That is, the analysis varies around +25 and -25 %. Hence the intersample average is 0.5 % even though the individual analysis performed by this lab are more deviated.



Lab	1	2	3	4
Upper Limit	2.5%	22.0%	10.5%	30.0%
Lower Limit	-1.5%	18.0%	-9.5	10.0%
Avg	0.5%	20.0%	0.5%	20.0%
Std Dev	2.0%	2.0%	10.0%	10.0%

See the lab 2 analysis in the attached chart where the intersample average of differences is too high, 20.0%, but the standard deviation is only 2.0%.

The opposite situation would take place when a laboratory gets an intersample average considerably far from 0, but the standard deviation of differences is too low. In this case the solution of the problem seems to be easier, because the lab gets analysis deviated, but the deviation is always the same. This fact usually implies the evidence of systematic error. This kind of error is often easy to solve by finding the fact creating the error or using a correction factor.

Referring to the differences as percentage, they must be considered the absolute value of the analysis and the accuracy of the equipment used. For instance, a difference of +10% for Fe_2O_3 in a sample with 0.010% Fe_2O_3 means to give 0.011% Fe_2O_3 as a result. This error could be considered as an acceptable precision for the equipment or the purpose of the laboratory depending on its needs and usual products.

Of course, the best situation is to get low intersample average of differences and low standard deviation. Consistently, the worst situation would be to get high intersample average and standard deviation of differences.

6.4. ANALYTICAL METHODS

It has been noticed along the using of the interlab programme that some deviations or trends are shown very often whenever the analytical procedures of the participants labs are the same. Data with average's deviation upper than 1000% will be not represented in charts. In order to get all the participants aware of this fact a new chart displaying the analytical methods/equipments of each element analysis is included in the report (Annex 7).

7. CERTIFICATE VALUES

Referring to this point the aim of this certified value is to offer the possibility of making use of the samples sent as RM to calibrate additionally the equipment of each lab. In order to achieve a certain level of security the uncertainty of each sample was calculated according EURACHEM / CITAC Guide CG 4 [6]. Certified value is obtained as follows:

$$Cv = x_{pt} \pm U \quad (15)$$

Where,

Cv = Certified value;

x_{pt} = is the assigned value (calculated mean based on participant's results);

U = Expanded Uncertainty

The expanded uncertainty provides an interval within which the value of the measurand is believed to lie with a higher level of confidence. U is obtained as follows:

$$U = k * u_{pt} \quad (16)$$

Where,

k = is a factor depending on the level of confidence and the number of the data used and it is equivalent to t-Student for 95% confidence range.

u_{pt} = is the standard uncertainty of the sample, and it is calculated as follows:

$$u_{pt} = \frac{\sigma_{pt}}{\sqrt{n}} \quad (17)$$

Where,

σ_{pt} = is the standard deviation for proficiency test assessment (standard deviation based on participant's results);

n = number of data performed for each sample and analysis.

With this certified value the samples can be used as a comparison system but not as exclusive calibration standard samples (Annex 8).

8. REFERENCES

[1] ISO/IEC 17043 *"Conformity assessment – General requirements for proficiency testing"*, issued by ISO-Geneva (CH), International Organization for Standardization, 2010.

[2] ISO 13528:2015 *"Statistical methods for use in proficiency testing by interlaboratory comparisons"*, issued by ISO-Geneva (CH), International Organization for Standardization, 2015.

[3] ISO 5725-2:2019 *"Accuracy (trueness and precision) of measurement method sand results"*. *Part2: Basic methods for determination of repeatability and reproducibility of a standard measurement method*, issued by ISO-Geneva (CH), International Organization for Standardization, 2019.

[4] ISO/IEC Guide 98-3 *"Uncertainty of measurement". Part3: Guide to the expression of uncertainty in measurement*, issued by ISO-Geneva (CH), International Organization for Standardization, 2008.

[5] ASTM E 691-99, *"Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method"*.

[6] EURACHEM / CITAC Guide CG 4 *"Quantifying Uncertainty in Analytical Measurement"*.

ANNEX 1: HOMOGENEITY

	Al_2O_3		Fe_2O_3		TiO_2		CaO		Na_2O	
	%		%		%		%		%	
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
1	0.015	0.011	0.003	0.002	2.49	2.40	0.004	0.004	0.005	0.004
2	0.011	0.010	0.002	0.002	2.42	2.24	0.004	0.003	0.004	0.004
3	0.011	0.014	0.002	0.002	2.27	2.13	0.003	0.004	0.004	0.005
4	0.011	0.013	0.002	0.003	2.56	2.24	0.004	0.004	0.005	0.005
5	0.010	0.013	0.002	0.002	2.60	2.52	0.004	0.004	0.004	0.004
6	0.010	0.013	0.002	0.001	2.62	2.05	0.004	0.004	0.004	0.004
7	0.010	0.013	0.002	0.002	2.07	2.20	0.004	0.004	0.004	0.005
8	0.017	0.013	0.002	0.002	2.19	2.64	0.004	0.004	0.004	0.004
9	0.017	0.014	0.002	0.003	2.23	2.58	0.004	0.004	0.004	0.004
10	0.011	0.014	0.002	0.002	2.42	2.48	0.004	0.004	0.004	0.004
M_b	1.56068E-06		2.1544E-09		0.007367475		1.40845E-09		7.68851E-08	
M_w	4.7162E-06		2.24507E-07		0.038222057		6.71913E-08		1.38258E-07	
F	0.331		0.010		0.193		0.021		0.556	
F_{crit}	4.414		4.414		4.414		4.414		4.414	
Sample A	passed		passed		passed		passed		passed	

	Al_2O_3		Fe_2O_3		TiO_2		CaO		Na_2O	
	%		%		%		%		%	
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
1	0.026	0.023	0.004	0.004	3.773	4.988	0.035	0.037	0.003	0.004
2	0.022	0.023	0.003	0.004	3.862	4.905	0.035	0.036	0.003	0.004
3	0.022	0.023	0.003	0.004	4.451	5.135	0.036	0.037	0.003	0.004
4	0.021	0.024	0.003	0.005	4.594	4.840	0.036	0.037	0.003	0.004
5	0.022	0.023	0.004	0.005	3.539	4.887	0.036	0.038	0.003	0.004
6	0.022	0.024	0.005	0.004	5.669	4.717	0.037	0.035	0.004	0.004
7	0.022	0.023	0.004	0.004	5.036	4.934	0.037	0.036	0.004	0.004
8	0.022	0.023	0.004	0.005	4.391	4.879	0.037	0.035	0.004	0.004
9	0.022	0.024	0.005	0.018	4.557	5.119	0.039	0.036	0.004	0.004
10	0.027	0.024	0.004	0.004	5.491	4.684	0.044	0.036	0.005	0.004
M_b	3.67993E-06		1.38088E-05		0.693417179		4.58197E-06		4.07164E-07	
M_w	2.17172E-06		9.6067E-06		0.261460142		4.13304E-06		2.63309E-07	
F	1.694		1.437		2.652		1.109		1.546	
F_{crit}	4.414		4.414		4.414		4.414		4.414	
Sample B	passed		passed		passed		passed		passed	

	Al_2O_3		Fe_2O_3		TiO_2		CaO		Na_2O	
	%		%		%		%		%	
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
1	0.304	0.225	0.065	0.063	78.861	74.667	0.031	0.023	0.011	0.009
2	0.316	0.227	0.068	0.065	75.453	71.595	0.033	0.024	0.012	0.009
3	0.223	0.230	0.062	0.067	71.439	75.879	0.024	0.024	0.008	0.009
4	0.225	0.220	0.062	0.064	69.473	76.736	0.025	0.024	0.008	0.009
5	0.222	0.216	0.066	0.064	71.960	79.233	0.024	0.022	0.008	0.009
6	0.222	0.222	0.067	0.067	76.635	76.531	0.024	0.024	0.008	0.010
7	0.230	0.222	0.064	0.066	76.601	74.641	0.025	0.023	0.008	0.009
8	0.226	0.218	0.062	0.067	67.226	73.589	0.024	0.024	0.008	0.009
9	0.224	0.215	0.064	0.068	71.564	75.849	0.024	0.023	0.009	0.009
10	0.217	0.216	0.062	0.065	71.623	72.756	0.023	0.024	0.009	0.009
M_b	0.00192612		8.79937E-06		21.30477945		2.14163E-05		8.60195E-07	
M_w	0.000692018		3.45132E-06		9.063681064		5.70063E-06		1.06329E-06	
F	2.783		2.550		2.351		3.757		0.809	
F_{crit}	4.414		4.414		4.414		4.414		4.414	
Sample C	passed		passed		passed		passed		passed	

	Al_2O_3		Fe_2O_3		TiO_2		CaO		Na_2O	
	%		%		%		%		%	
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
1	0.147	0.145	0.006	0.005	2.222	2.338	0.008	0.009	0.004	0.004
2	0.145	0.148	0.005	0.009	2.522	2.488	0.008	0.008	0.004	0.004
3	0.148	0.148	0.006	0.006	2.132	2.439	0.008	0.009	0.004	0.004
4	0.154	0.151	0.006	0.006	2.222	2.551	0.008	0.009	0.004	0.004
5	0.145	0.145	0.006	0.007	2.007	2.307	0.008	0.008	0.004	0.004
6	0.151	0.145	0.006	0.005	2.621	2.449	0.008	0.008	0.004	0.004
7	0.148	0.145	0.005	0.006	2.429	2.413	0.008	0.008	0.004	0.004
8	0.147	0.148	0.006	0.006	2.221	2.448	0.008	0.008	0.003	0.004
9	0.146	0.152	0.005	0.006	2.705	2.455	0.008	0.008	0.004	0.004
10	0.147	0.148	0.005	0.006	2.018	2.522	0.008	0.008	0.004	0.004
M_b	3.10544E-07		2.79408E-06		0.086056398		2.06261E-07		7.1378E-08	
M_w	6.21664E-06		6.44332E-07		0.033072888		9.75873E-08		5.31139E-08	
F	0.050		4.336		2.602		2.114		1.344	
F_{crit}	4.414		4.414		4.414		4.414		4.414	
Sample D	passed		passed		passed		passed		passed	

ANNEX 2: TEST ITEM ACCOMPANYING LETTER

A Coruña, 31 January 2022

<<Title>> <<Firstname>> <<Surname>>
<<Organisation>>
<<Department>>
<<Address>>
<< Address 2>>
<<Zip>> <<Town>>
<<Country>>

Subject: Participation in Erimsa Interlaboratory comparison programme (Erimsa-ITL-22)

Dear <<Title>> <<Surname>>,

Thank you for participation in the Erimsa-ITL-21 Interlaboratory comparison programme.

The parcel you receive contains, in addition to this letter:

- 4 samples of the test item (approx. 35 g each); and
- The "Confirmation of receipt" form.

Upon arrival of this parcel, please check whether the test item is undamaged after transport, and send us by email the "Confirmation of receipt" form at your earliest convenience.

The procedure used for the analyses should resemble as closely as possible the one you use in routine analyses.

Perform two or three independent measurements and report:

- the mean of your two or three measurements results,
- the associated standard deviation,
- the analytical technique used.

Excel file to report the results will be sent to email. In case you have not received them or the file is damaged, please contact to us as soon as possible.

The deadline for submission of results is **July 31, 2022**.

Your participation in this project is greatly appreciated.

Do not to hesitate to contact us, in case of questions/doubts,

Yours sincerely,

/signed electronically /

Alejandro Arenosa

Lab Manager, Erimsa-ITL-22 Coordinator

ANNEX 3: CONFIRMATION OF RECEIPT

A Coruña, 31 January 2022

Attn.: <<Title>> <<Firstname>> <<Surname>>
<<Organisation>>
<<Department>>
<<Address>>
<< Address 2>>
<<Zip>> <<Town>>
<<Country>>

Subject: "Confirmation receipt" form Erimsa Interlaboratory comparison programme (Erimsa-ITL-22)

Please return this form at your earliest convenience, to confirm that the package arrived well. If samples are damaged, mention it under "Remarks" and contact us as soon as possible.

Date of package arrival _____

Remarks _____

_____

Signature _____

Thank you for returning this form by email to:

Mr. Alejandro Arenosa

Lab Manager, Erimsa-ITL-22 Coordinator

e-mail: alejandro.arenosa@erimsa.com

ANNEX 4: FORM FOR REPORTING THE RESULTS

Interlab 2022 LabX Sample A
Main Elements

Element	Units	Average	StdDev	Ner Data
Al_2O_3	%			
As_2O_3	%			
B_2O_3	%			
BaO_2	%			
Bi_2O_3	%			
CaO	%			
CdO	%			
CoO	%			
Cr_2O_3	%			
CuO	%			
Fe_2O_3	%			
K_2O	%			
La_2O_3	%			
LOI	%			
MgO	%			
MnO	%			
MoO_3	%			
Na_2O	%			
NiO	%			
P_2O_5	%			
PbO	%			
Sb_2O_3	%			
SiO_2	%			
SnO_2	%			
SrO	%			
TiO_2	%			
V_2O_5	%			
ZnO	%			
ZrO_2	%			

Additional Elements

Element	Units	Average	StdDev	Ner Data
	%			
	%			
	%			
	%			
	%			

ANNEX 5

ANNEX 5.1. MEASUREMENTS SAMPLE A

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
	%	%	%	%	%	%	%	ppm	ppm	ppm
x_{pt}	0.0177	0.0038	0.0004	0.0054	0.0040	0.0034	0.0012	2.05	10.22	4.69
σ_{pt}	0.0057	0.0019	0.0002	0.0019	0.0008	0.0012	0.0003	0.89	9.61	3.93
N	29	26	23	27	21	24	25	21	17	6

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
	%	%	%	%	%	%	%	ppm	ppm	ppm
Lab 1	0.0118	0.0019	0.0003	0.0045	0.0042	0.0027	0.0009	1.3	5.0	2.5
Lab 2	0.0167	0.0025	0.0003	0.0055	0.0037	0.0024	0.0012	1.4	0.1	
Lab 3	0.0147	0.0021	0.0003	0.0055			0.0011	1.2		7.1
Lab 4										
Lab 5	0.0240	0.0360	0.0010	0.0049	0.0035	0.0030		10.0	20.0	
Lab 6	0.0149	0.0022	0.0003	0.0052	0.0041	0.0033	0.0012	2.0	2.0	3.0
Lab 7	0.0180	0.0026	0.0003	0.0048	0.0046	0.0029	0.0012	1.4	4.0	
Lab 8	0.0074	0.0026	0.0003	0.0067		0.0046	0.0013	1.5	5.5	
Lab 9	0.0125	0.0005	0.0009	0.0051	0.0041	0.0019	0.0003	2.2		
Lab 10	0.0150		0.0027			0.0040	0.0050			
Lab 11	0.0174	0.0081		0.0003	0.0020	0.0018	0.0004	2.0	3.0	
Lab 12	0.0327	0.0386	0.0000	0.0028			0.0005			
Lab 13	0.0231	0.0067	0.0007	0.0043	0.0038	0.0027	0.0018			
Lab 14	0.1480	0.0170	0.0050	0.0220	0.0340	0.0060	0.0520		20.0	
Lab 15										
Lab 16	0.0135	0.0024	0.0004	0.0047	0.0037	0.0026	0.0012		2.0	
Lab 17	0.0144	0.0021	0.0003	0.0051	0.0036	0.0029	0.0012	1.7		
Lab 18	0.0190	0.0040	0.0030	0.0070	0.0070	0.0060	0.0020		20.0	
Lab 19										
Lab 20	0.0320	0.0045	0.0015	0.0154			0.0012	17.0	101.0	
Lab 21	0.0139	0.0026	0.0004	0.0038	0.0034	0.0022	0.0007	1.2		
Lab 22	0.0138	0.0029	0.0003	0.0050	0.0039		0.0010	1.4	14.7	4.1
Lab 23	0.0310	0.0140	0.0009	0.0070	0.0040	0.0040			5.0	
Lab 24	0.0166	0.0033	0.0008	0.0028	0.0034	0.0029	0.0011	1.6	6.1	
Lab 25	0.0284			0.0100		0.0045				
Lab 26	0.0321	0.0033		0.1067	0.0102	0.0135	0.0032	2.9	238.3	107.8
Lab 27	0.0147	0.0053		0.0064		0.0039		2.8		
Lab 28	0.0128			0.0050	0.0058	0.0033	0.0183	5.0	8.0	
Lab 29	0.0140	0.0020	0.0003			0.0150	0.0011	1.3		
Lab 30										
Lab 31										
Lab 32	0.0151	0.0044	0.0005	0.0031	0.0040	0.0026	0.0013	5.1	8.9	0.8
Lab 33	0.0160	0.0026	0.0003	0.0050	0.0046	0.0041	0.0011	1.5		
Lab 34	0.0210	0.0056		0.1000	0.0028		0.0010	10.0		
Lab 35										

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	2.08	0.24	1.12	2.82	2.07	1.18	13.60	1.30	131.63	0.90
σ_{pt}	1.67	0.10	1.34	3.93	2.66	0.25		1.27	210.33	1.26
N	5	7	8	10	10	10	1	9	2	15

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lab 1	1.0	<0.71	0.6	1.0	0.4	1.1		1.1	0.5	1.2
Lab 2		0.1	0.1		0.1			0.3		
Lab 3				5.4		0.9				0.1
Lab 4										
Lab 5										
Lab 6		1.0			1.0					0.2
Lab 7										
Lab 8	4.0	0.2	0.1		0.2	1.1		0.4		0.1
Lab 9										7.6
Lab 10										
Lab 11										7.7
Lab 12										
Lab 13										
Lab 14										
Lab 15										
Lab 16										
Lab 17	0.3	0.2	0.1	0.1	0.1	1.2		0.2		
Lab 18										
Lab 19										
Lab 20			3.0	50.0	24.0	1.0		19.0		46.3
Lab 21				0.1		0.9				0.1
Lab 22			2.5		3.1			2.5		0.1
Lab 23										
Lab 24										0.1
Lab 25				60.0						
Lab 26	2.7	0.2	0.7	0.8	5.8	1.5		1.8	262.8	0.3
Lab 27				0.4	1.0					
Lab 28										7.0
Lab 29		0.2		0.1		1.2		0.2		0.1
Lab 30										
Lab 31										
Lab 32	2.4	0.7	2.3	8.7	6.4	1.7	13.6	2.0		0.2
Lab 33						1.3				0.1
Lab 34										
Lab 35										

	LiO_2	SO_3	MoO_3	HfO_2	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	0.22	24.64	4.20	0.05	4.99	5.31	12.42	1.68	2.40	0.52
σ_{pt}	0.08	9.69	3.12		4.98	4.29	1.79	2.44	3.69	0.11
N	2	5	3	1	10	3	2	2	2	8

	LiO_2	SO_3	MoO_3	HfO_2	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lab 1	<1.37	19.5	3.5	<0.47	3.2					
Lab 2										
Lab 3										
Lab 4										
Lab 5		30.0								
Lab 6										
Lab 7										
Lab 8					1.4					0.6
Lab 9		16.7			14.6					
Lab 10										
Lab 11					10.0					
Lab 12										
Lab 13					8.0					
Lab 14										
Lab 15										
Lab 16										
Lab 17	0.3				0.6					0.5
Lab 18										
Lab 19										
Lab 20		37.0								
Lab 21										0.4
Lab 22							13.5			0.4
Lab 23										
Lab 24										
Lab 25										30.0
Lab 26				0.1	1.8	9.8		0.2	0.1	
Lab 27										
Lab 28		20.0			10.0					
Lab 29	0.2				0.6					0.5
Lab 30										
Lab 31										
Lab 32			27.5		1.9	4.1	11.3	3.2	4.7	0.5
Lab 33			1.9			2.1				0.6
Lab 34										
Lab 35										

	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%
x_{pt}	0.16	1.03	0.84	0.04	0.05	0	0.0072	0.2793	99.7397
σ_{pt}			1.24					0.1144	0.3515
N	1	1	2	1	1	1	1	6	14

	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%
Lab 1								0.2600	99.9694
Lab 2									
Lab 3									
Lab 4									
Lab 5									99.9320
Lab 6									
Lab 7									
Lab 8									
Lab 9									99.9639
Lab 10									
Lab 11									99.9632
Lab 12									
Lab 13									99.9561
Lab 14								0.2300	99.4000
Lab 15								0.4400	99.4700
Lab 16									
Lab 17									
Lab 18									
Lab 19									
Lab 20							0.0072		99.8700
Lab 21									
Lab 22									
Lab 23								0.2100	99.2400
Lab 24									
Lab 25								0.1819	98.3343
Lab 26	0.2	1.0	1.6	0.0					
Lab 27									99.9500
Lab 28									99.9488
Lab 29			0.1		0.0	0.0			
Lab 30									
Lab 31									
Lab 32								0.3790	99.6383
Lab 33									
Lab 34									99.8500
Lab 35									

ANNEX 5.1.1. Z-SCORE SAMPLE A

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO
Lab 1	-1.0	-0.9	-0.9	-0.5	0.2	-0.6	-0.9	-0.8
Lab 2	-0.2	-0.7	-0.5	0.0	-0.5	-0.9	0.0	-0.7
Lab 3	-0.5	-0.8	-0.9	0.0			-0.3	-1.0
Lab 4								
Lab 5	1.1	16.7	2.8	-0.3	-0.7	-0.4		8.9
Lab 6	-0.5	-0.8	-0.7	-0.1	0.1	-0.1	0.0	-0.1
Lab 7	0.0	-0.6	-0.7	-0.3	0.7	-0.5	0.0	-0.7
Lab 8	-1.8	-0.6	-0.6	0.6		1.0	0.4	-0.6
Lab 9	-0.9	-1.7	2.2	-0.2	0.0	-1.3	-2.6	0.2
Lab 10	-0.5	48.2	11.3			0.5	11.1	
Lab 11	-0.1	2.3		-2.6	-2.6	-1.4	-2.3	-0.1
Lab 12	2.6	18.1	-2.2	-1.4			-2.1	
Lab 13	0.9	1.5	1.3	-0.6	-0.3	-0.6	1.7	
Lab 14	23.0	6.9	22.8	8.5	38.9	2.2	148.2	
Lab 15								
Lab 16	-0.7	-0.7	-0.2	-0.4	-0.4	-0.7	0.0	
Lab 17	-0.6	-0.9	-0.7	-0.2	-0.6	-0.5	0.0	-0.4
Lab 18	0.2	0.1	12.8	0.8	3.8	2.2	2.3	
Lab 19								
Lab 20	2.5	0.4	5.3	5.1			0.0	16.7
Lab 21	-0.7	-0.6	-0.3	-0.8	-0.8	-1.1	-1.3	-0.9
Lab 22	-0.7	-0.5	-0.8	-0.2	-0.2		-0.6	-0.7
Lab 23	2.3	5.3	2.3	0.8	0.0	0.5		
Lab 24	-0.2	-0.2	1.6	-1.3	-0.8	-0.4	-0.4	-0.5
Lab 25	1.9			2.4		0.9		
Lab 26	2.5	-0.2		52.0	8.0	8.6	5.7	1.0
Lab 27	-0.5	0.8		0.5		0.4		0.9
Lab 28	-0.9			-0.2	2.3	-0.1	49.9	3.3
Lab 29	-0.7	-0.9	-0.7			9.8	-0.2	-0.9
Lab 30								
Lab 31								
Lab 32	-0.5	0.4	0.0	-1.2	-0.1	-0.7	0.4	3.4
Lab 33	-0.3	-0.6	-0.7	-0.2	0.7	0.6	-0.2	-0.6
Lab 34	0.6	1.0		48.5	-1.6		-0.6	8.9
Lab 35								

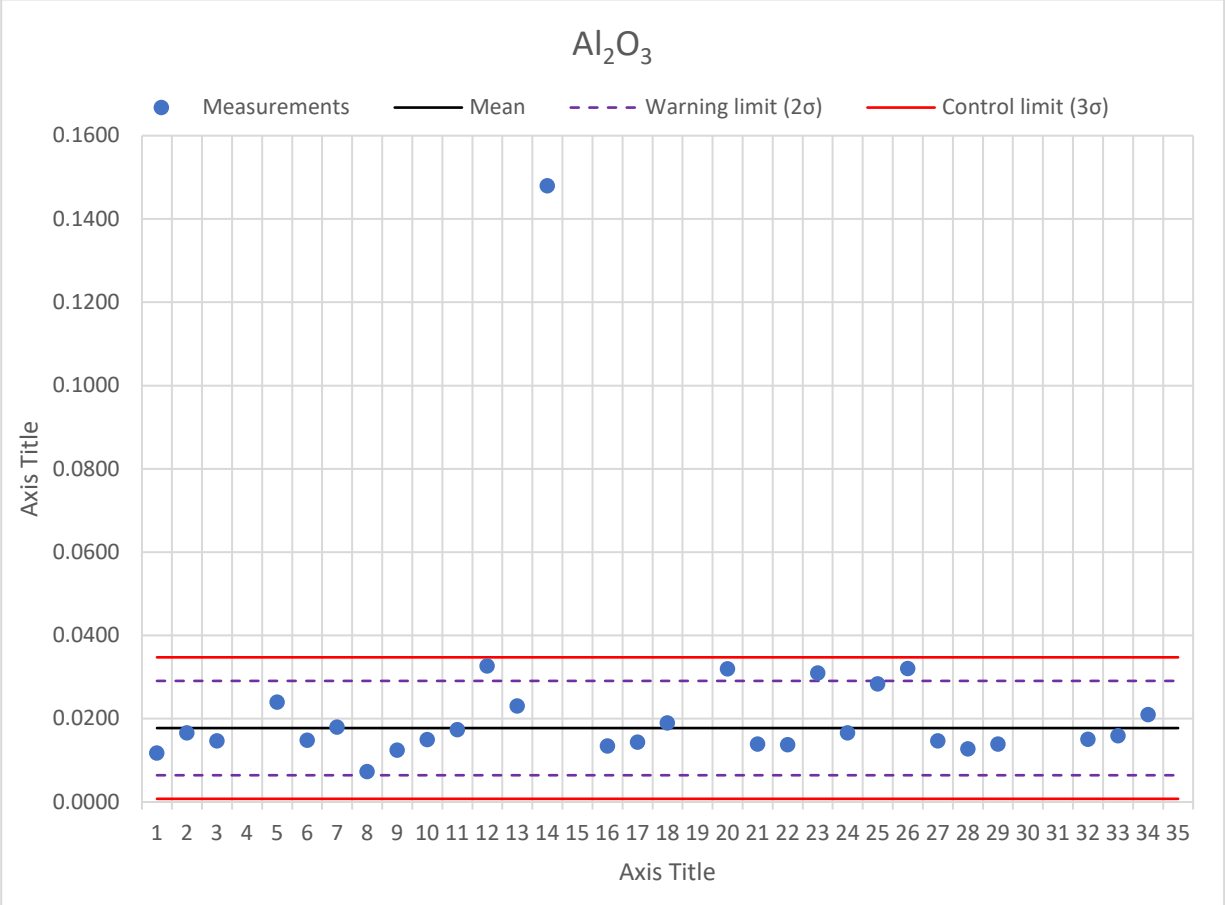
Satisfactory performance
Questionable performance
Unsatisfactory performance

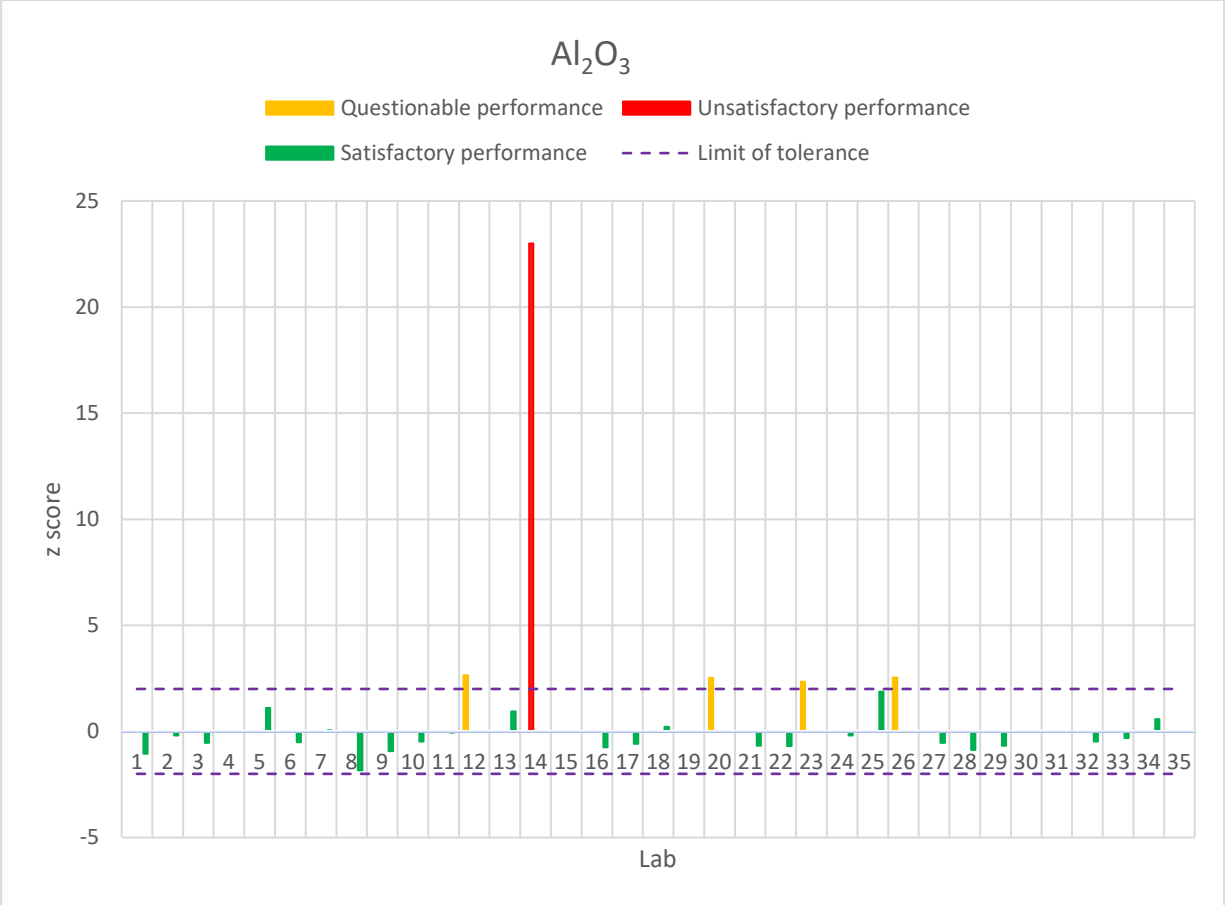
ANNEX 5.1.2. Z'-SCORE SAMPLE A

	P_2O_5	NiO	PbO	CuO	CoO	Cr_2O_3	BaO	ZrO_2	SrO	SiO_2
Lab 1	-0.5	-0.4	-0.4	-0.6	-0.1	-0.1	0.3	-0.3		0.6
Lab 2	-1.0	-0.7		-0.7		-0.7				
Lab 3			0.6		-1.1		-0.6			
Lab 4										
Lab 5	1.0									0.5
Lab 6	-0.8			-0.4			-0.5			
Lab 7	-0.6									
Lab 8	-0.5	-0.7		-0.7	-0.3	-0.7	-0.6	-0.7	0.7	
Lab 9							5.0	1.8		0.6
Lab 10										
Lab 11	-0.7						5.1	0.9		0.6
Lab 12										
Lab 13								0.6		0.6
Lab 14	1.0									-0.9
Lab 15										-0.7
Lab 16	-0.8									
Lab 17		-0.7	-0.7	-0.7	0.1	-0.8		-0.8	-0.1	
Lab 18	1.0									
Lab 19										
Lab 20	9.0	1.3	11.2	7.7	-0.7	12.9	34.2			0.4
Lab 21			-0.6		-0.9		-0.6		-0.8	
Lab 22	0.4	0.9		0.4		0.9	-0.6		-1.1	
Lab 23	-0.5									-1.3
Lab 24	-0.4						-0.6			
Lab 25			13.5						241.0	-3.8
Lab 26	22.7	-0.3	-0.5	1.3	1.3	0.3	-0.5	-0.6		
Lab 27			-0.6	-0.4						0.6
Lab 28	-0.2						4.6	0.9		0.6
Lab 29			-0.7		-0.1	-0.8	-0.6	-0.8	-0.2	
Lab 30										
Lab 31										
Lab 32	-0.1	0.8	1.4	1.5	1.9	0.5	-0.6	-0.6	-0.2	-0.3
Lab 33					0.5		-0.6		0.4	
Lab 34										0.3
Lab 35										

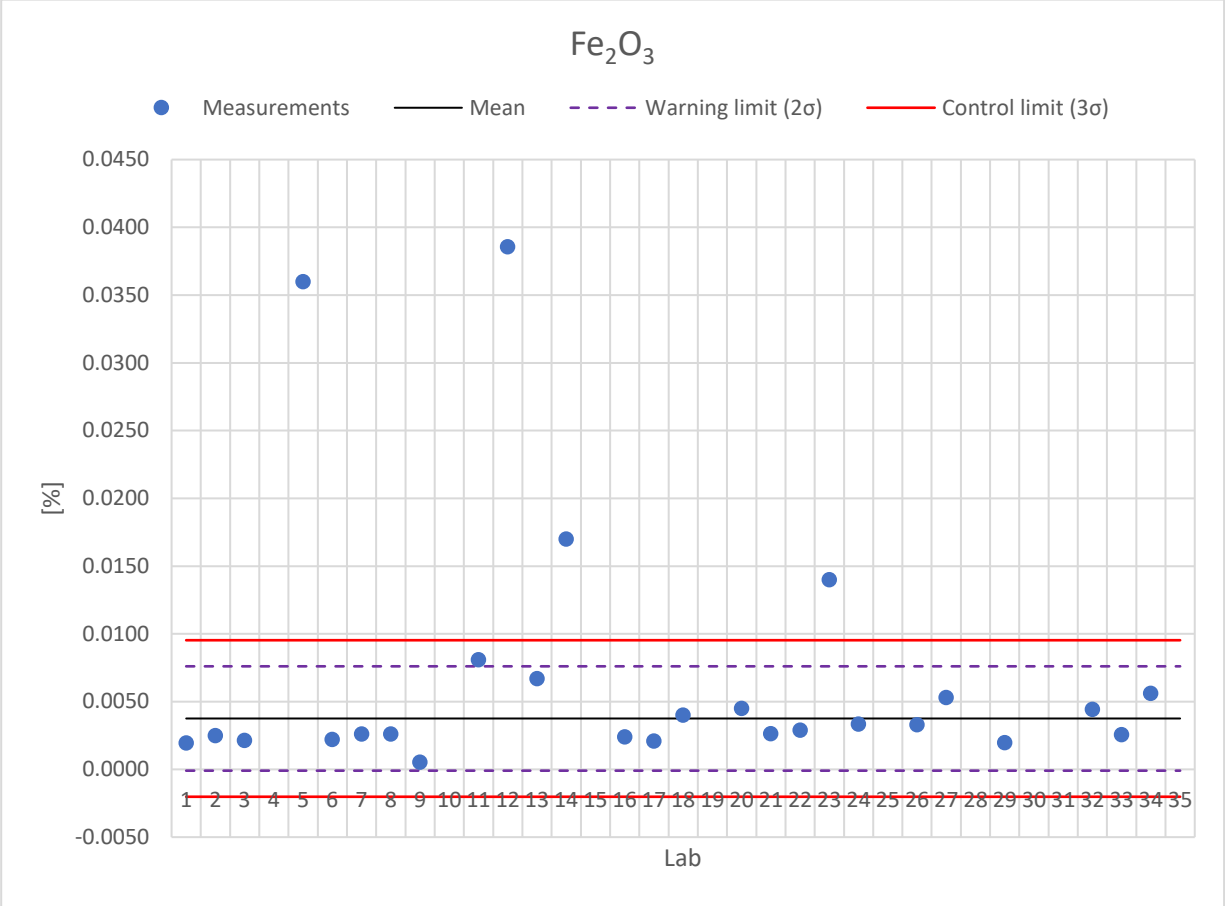
Satisfactory performance
Questionable performance
Unsatisfactory performance

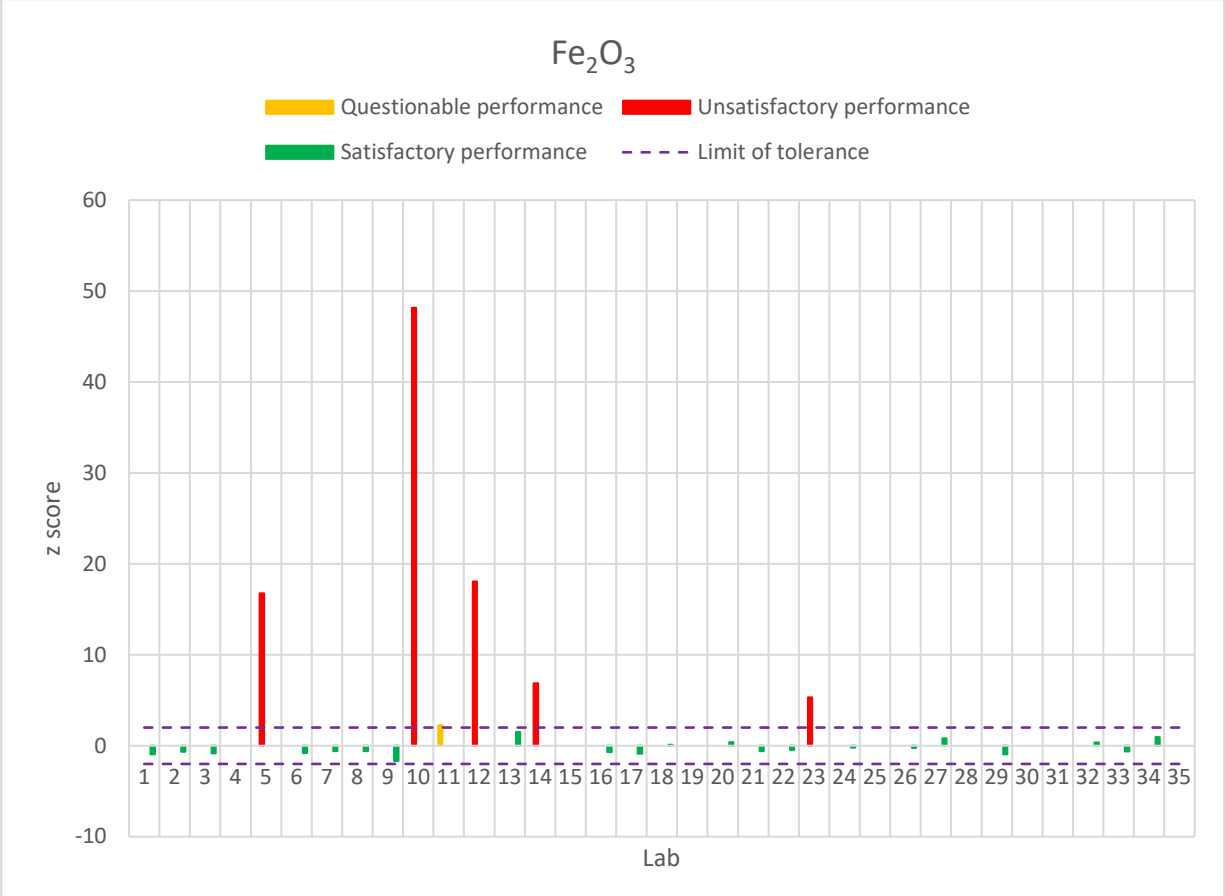
ANNEX 5.1.3. CHARTS SAMPLE A



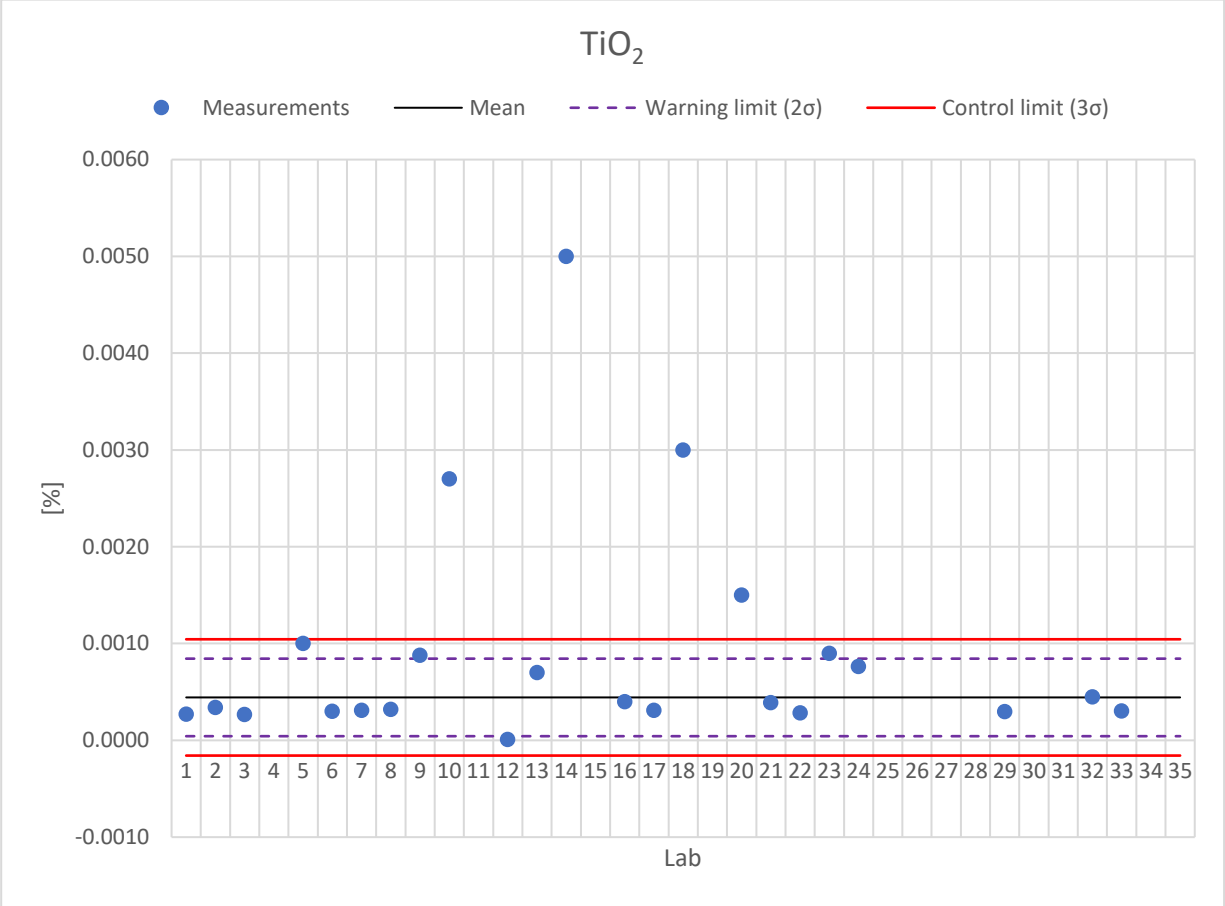


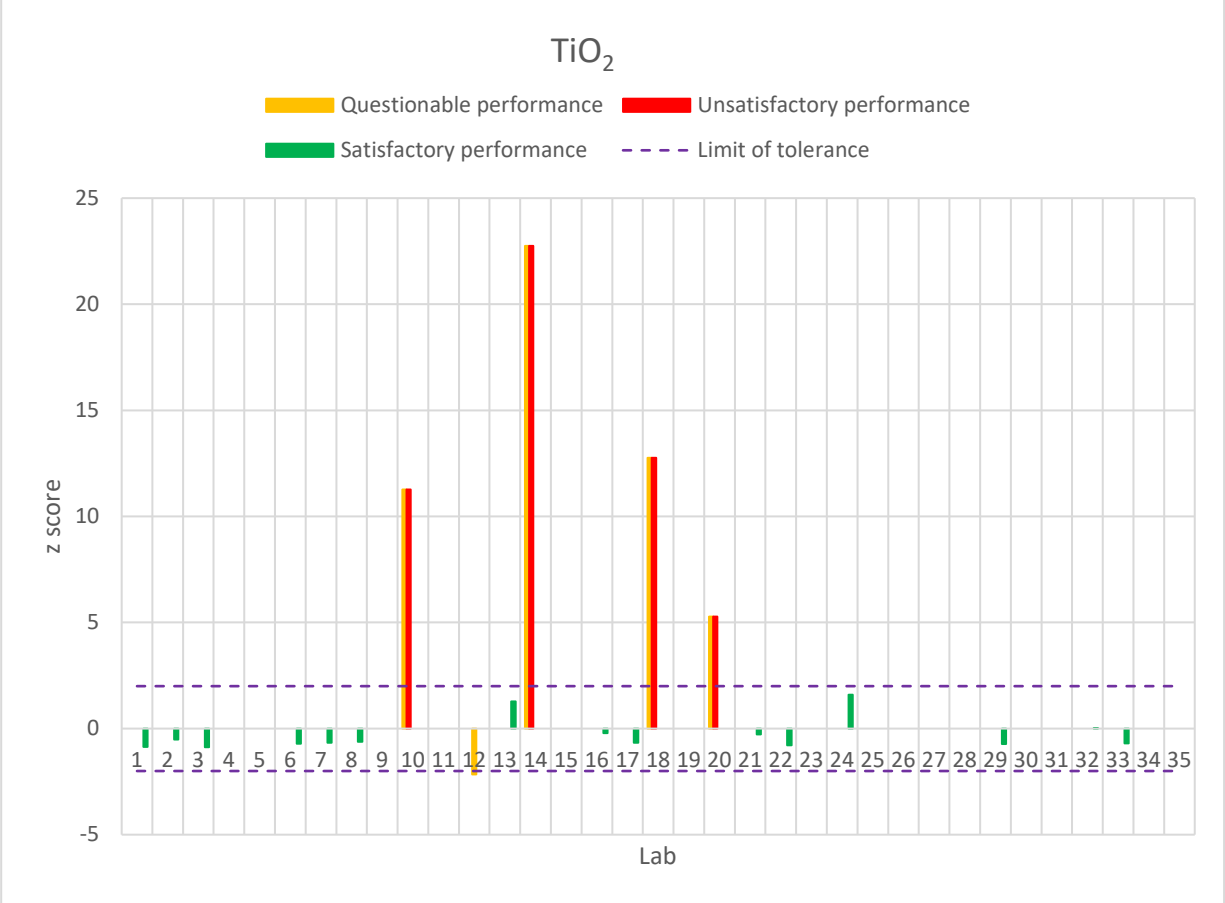
CHARTS SAMPLE A



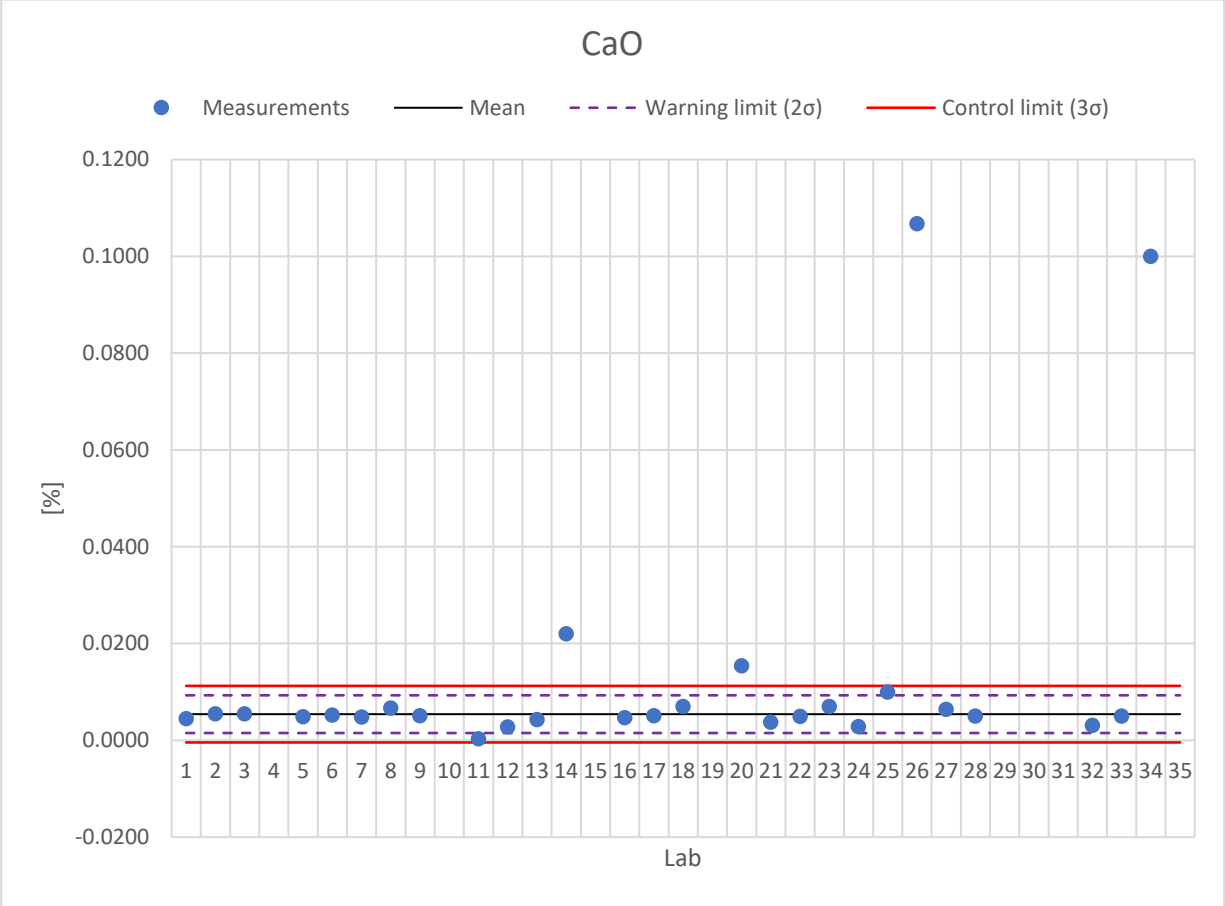


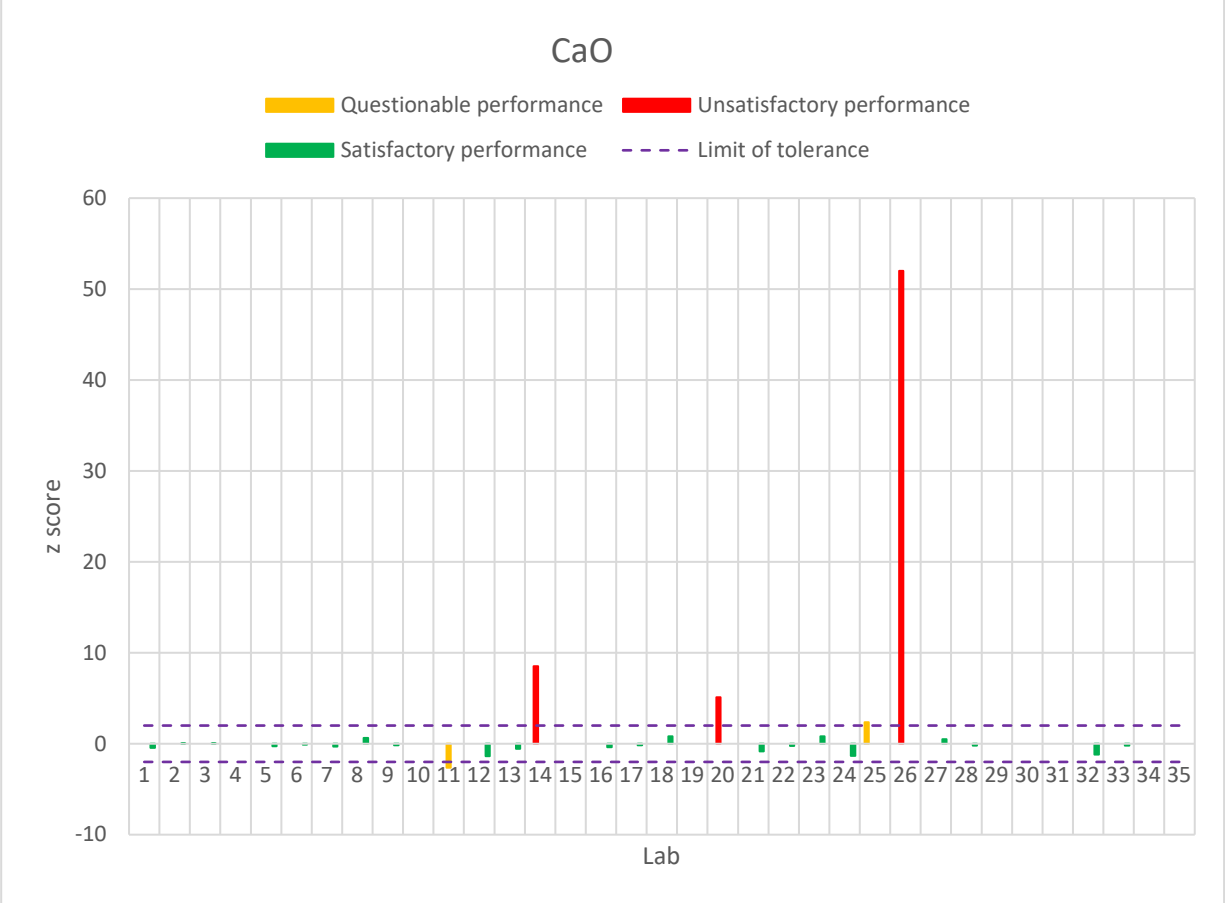
CHARTS SAMPLE A





CHARTS SAMPLE A





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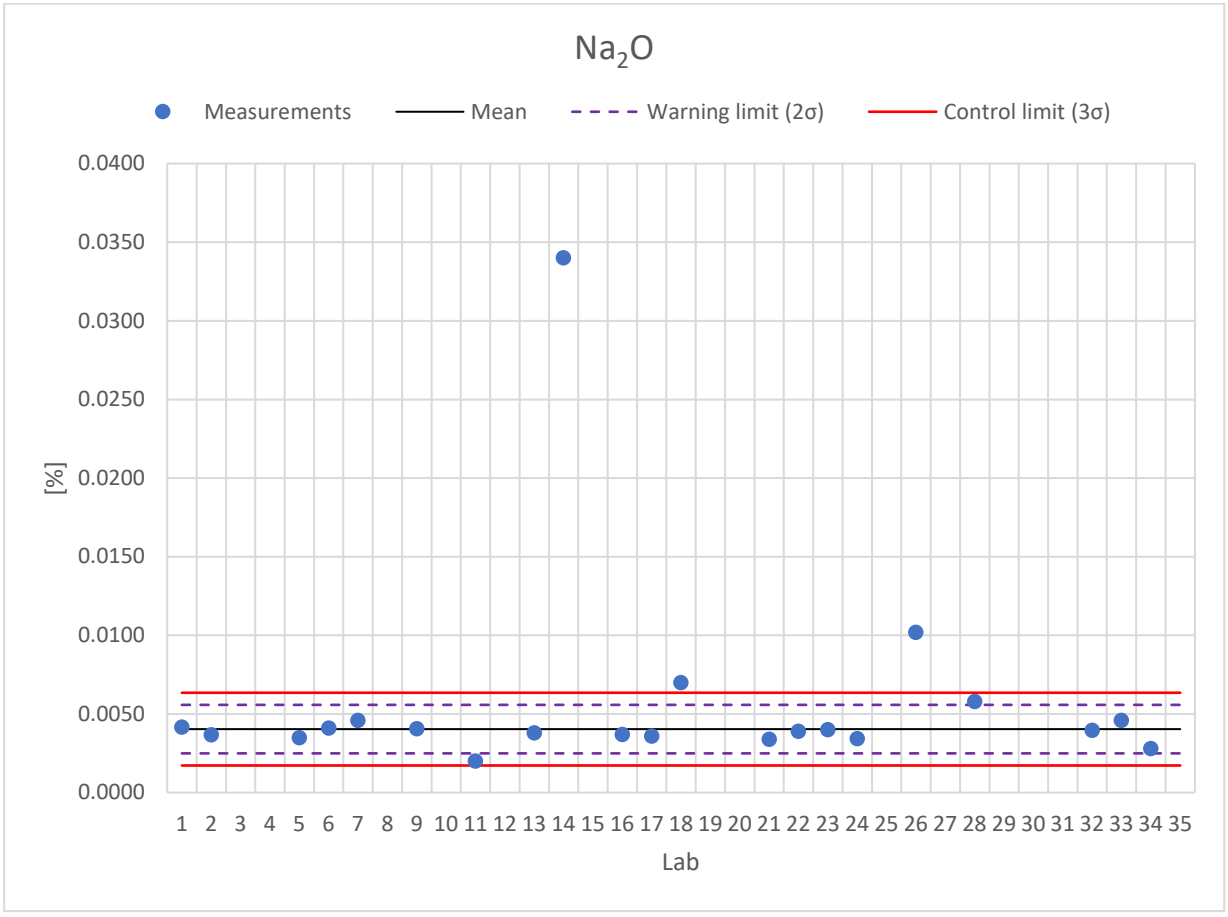

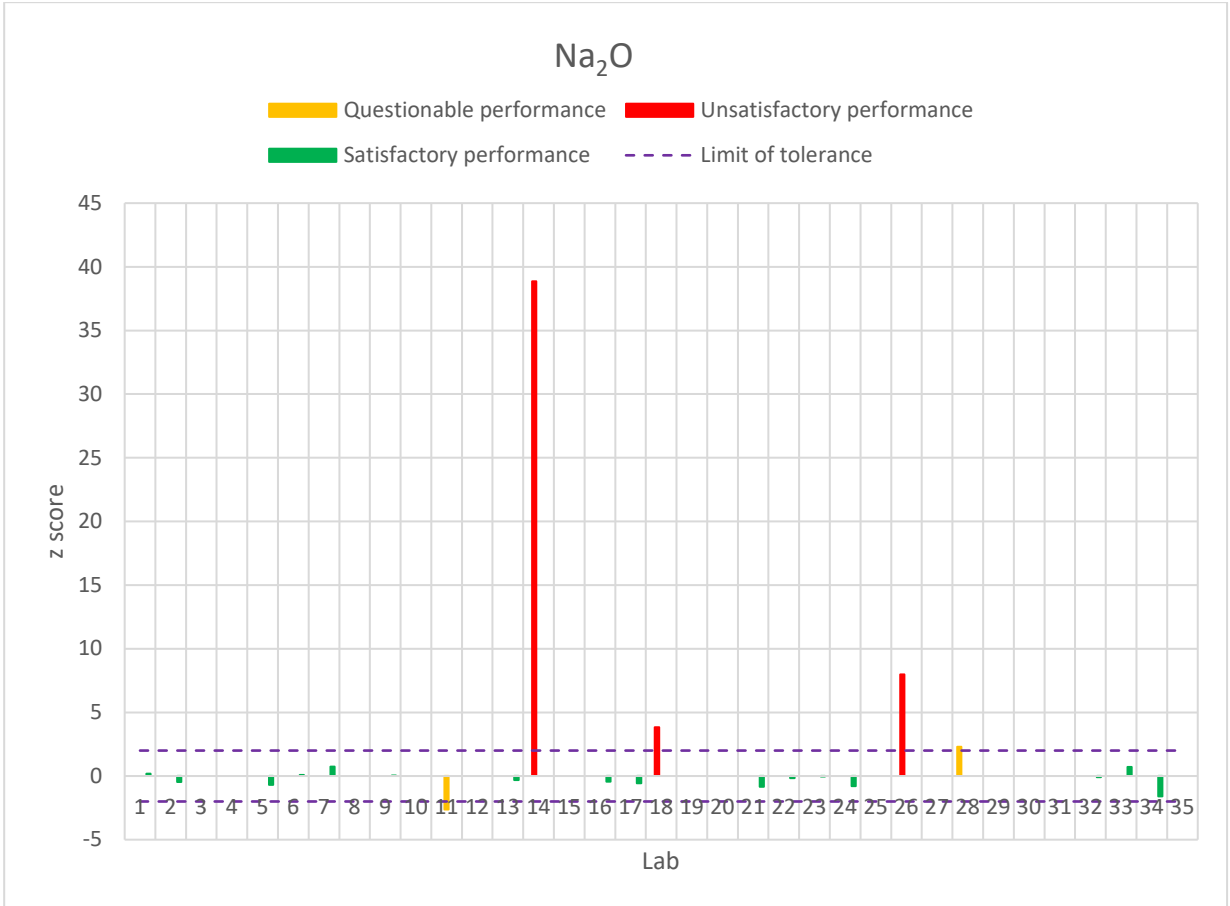

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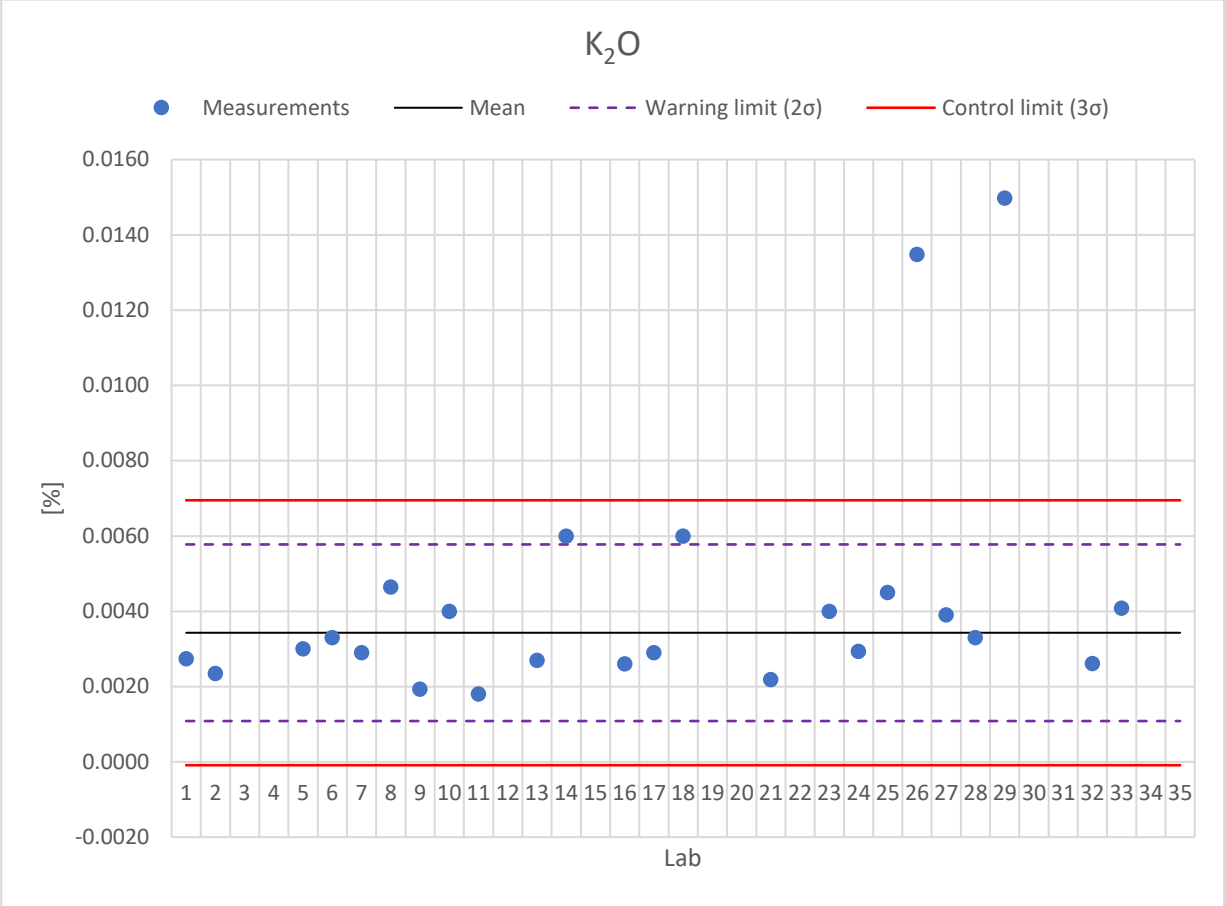
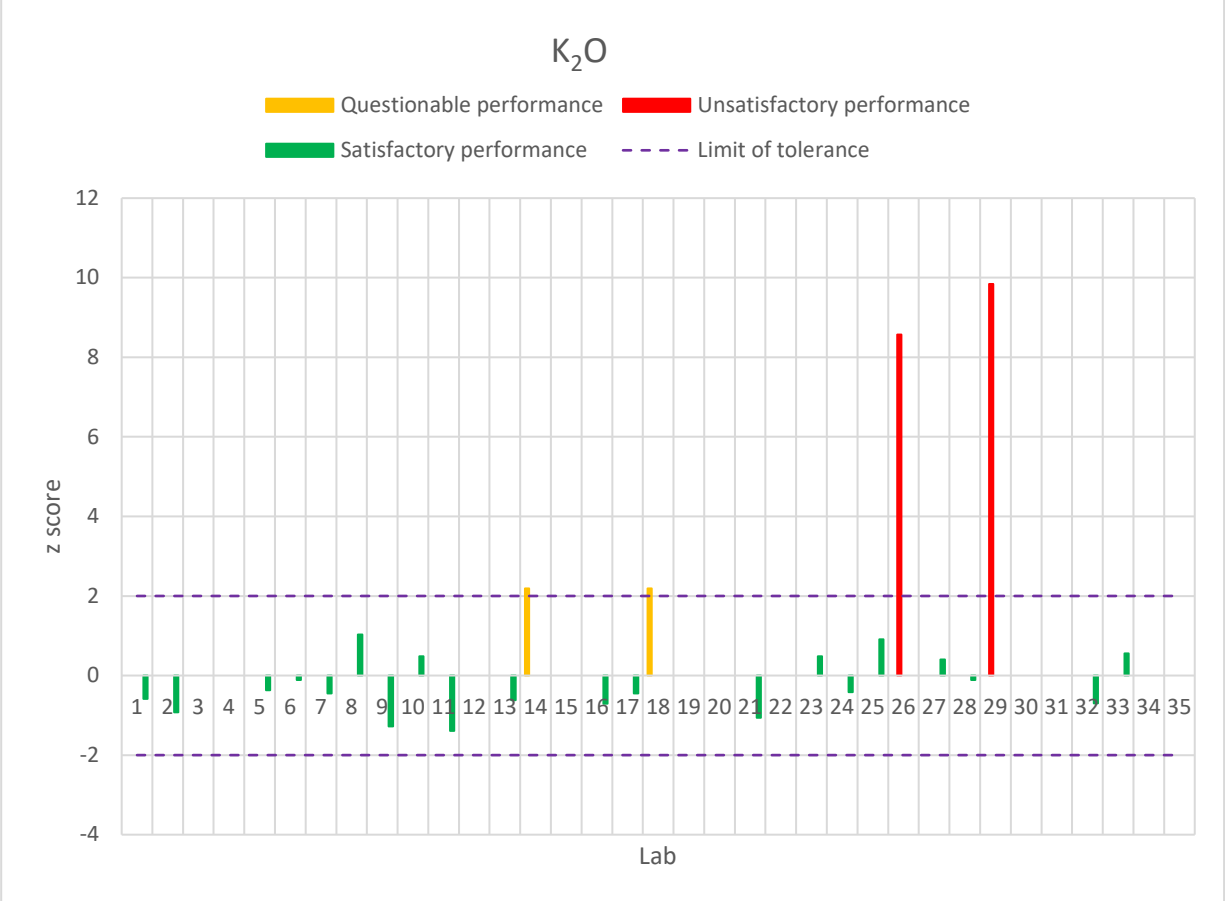
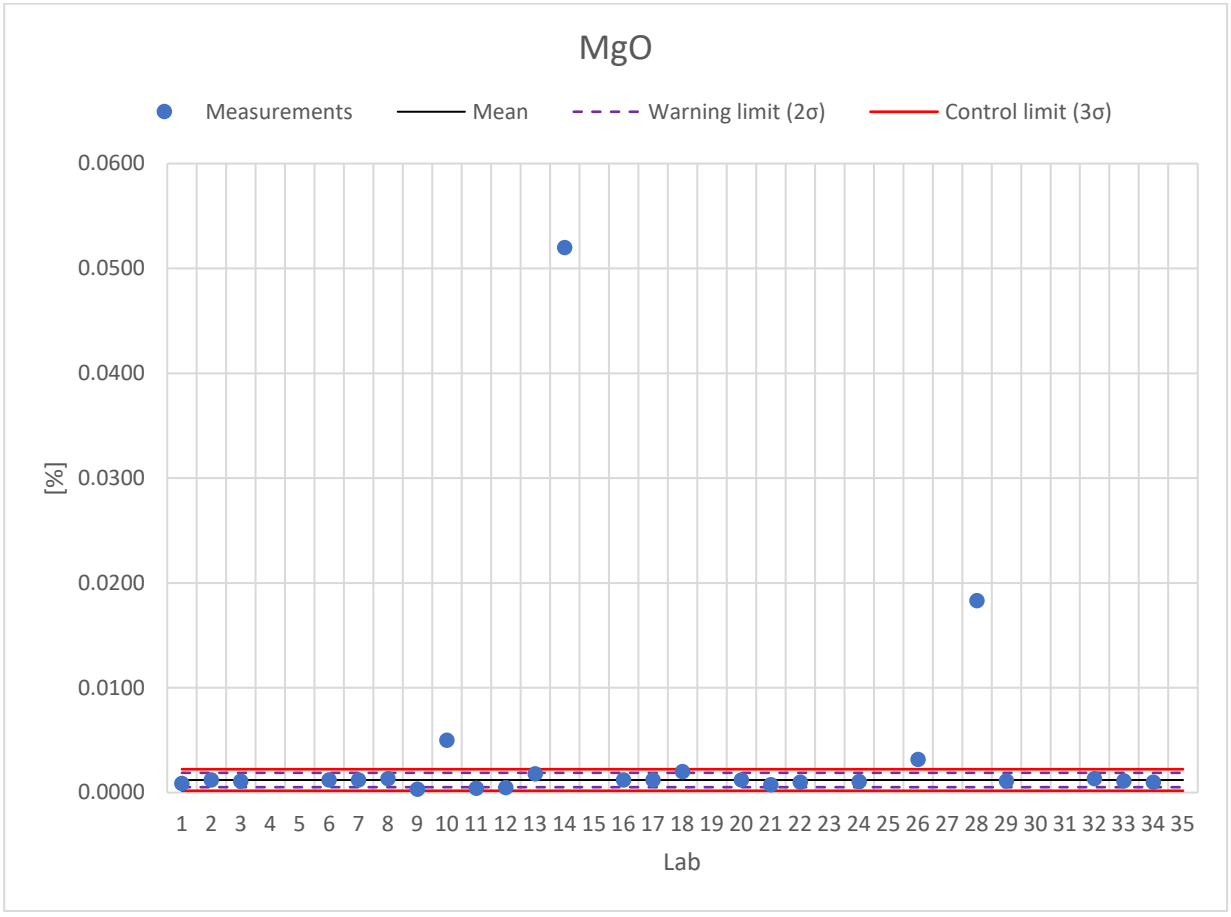
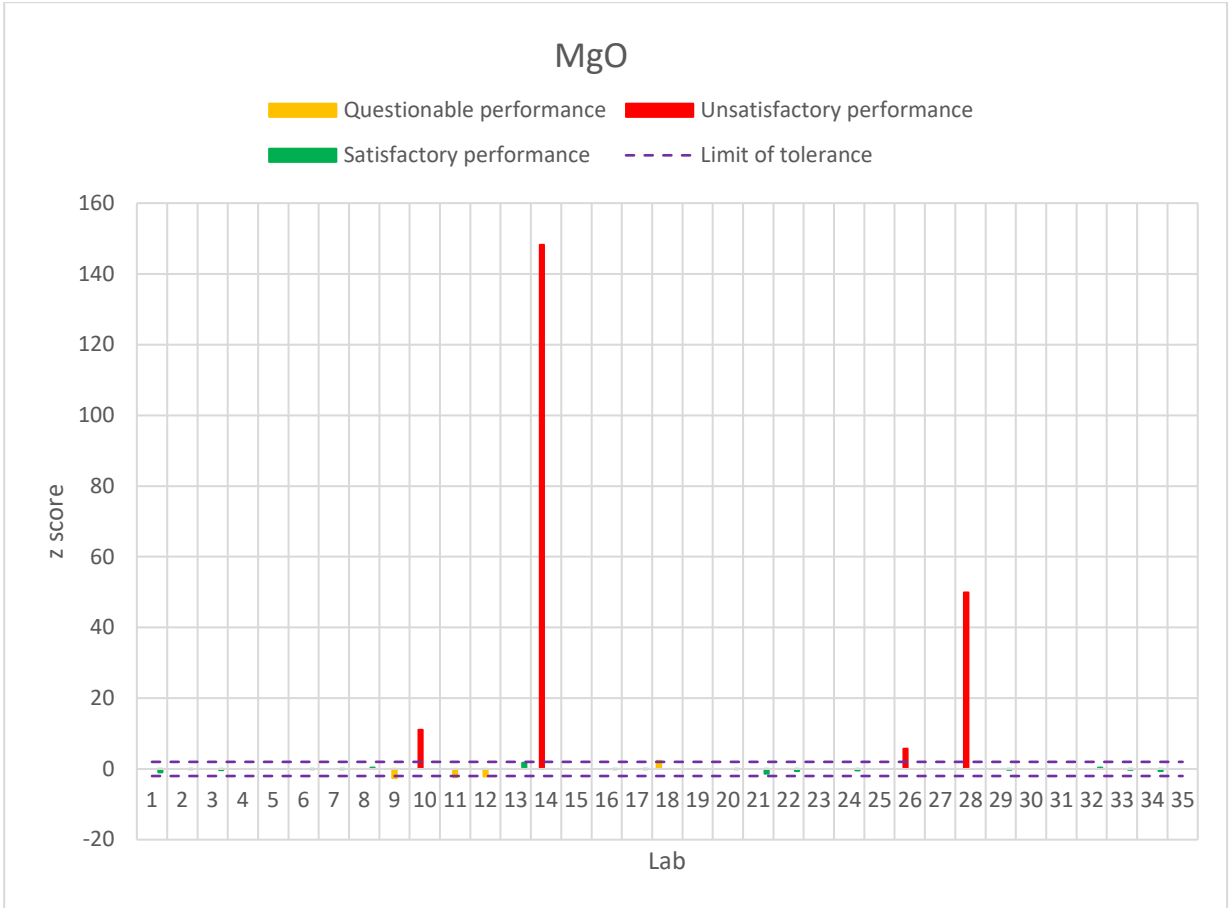


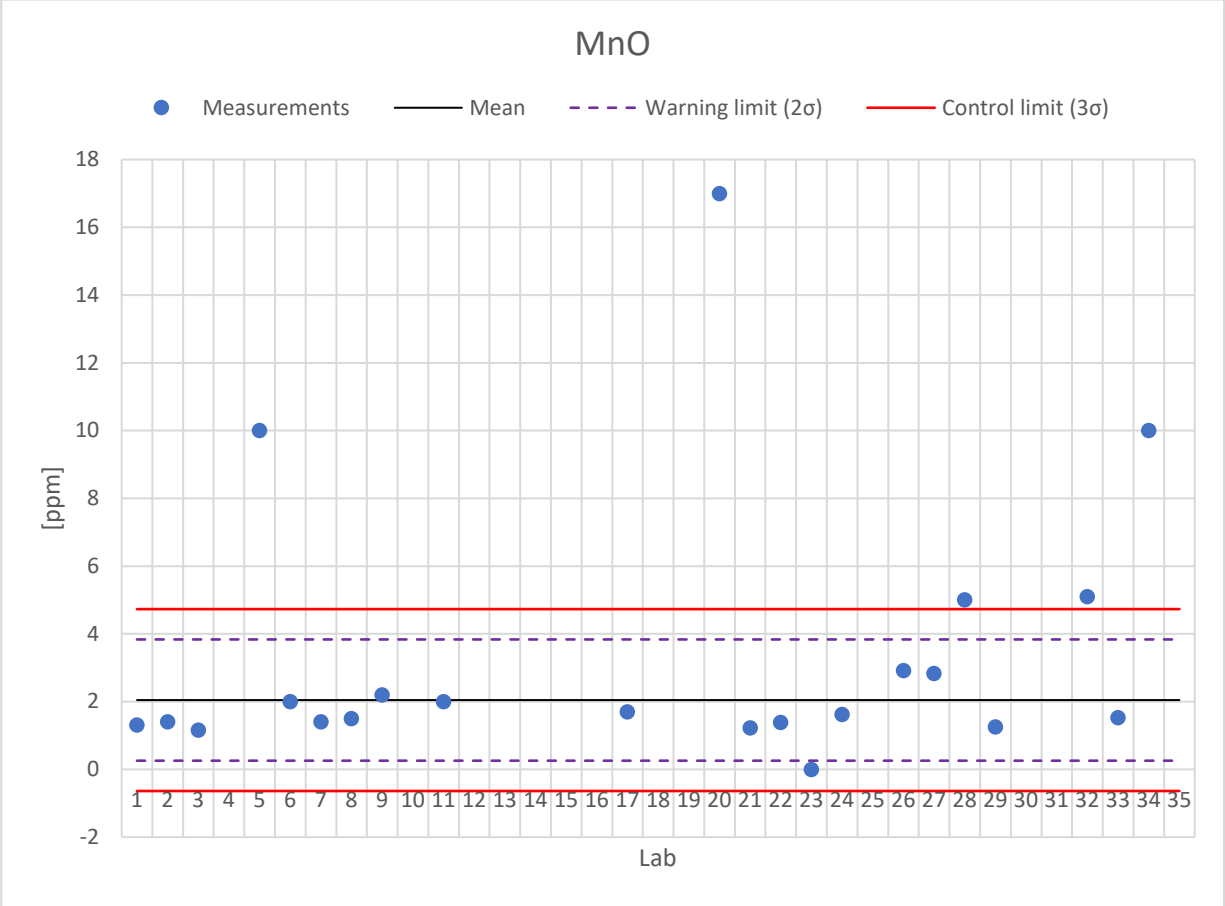


CHARTS SAMPLE A

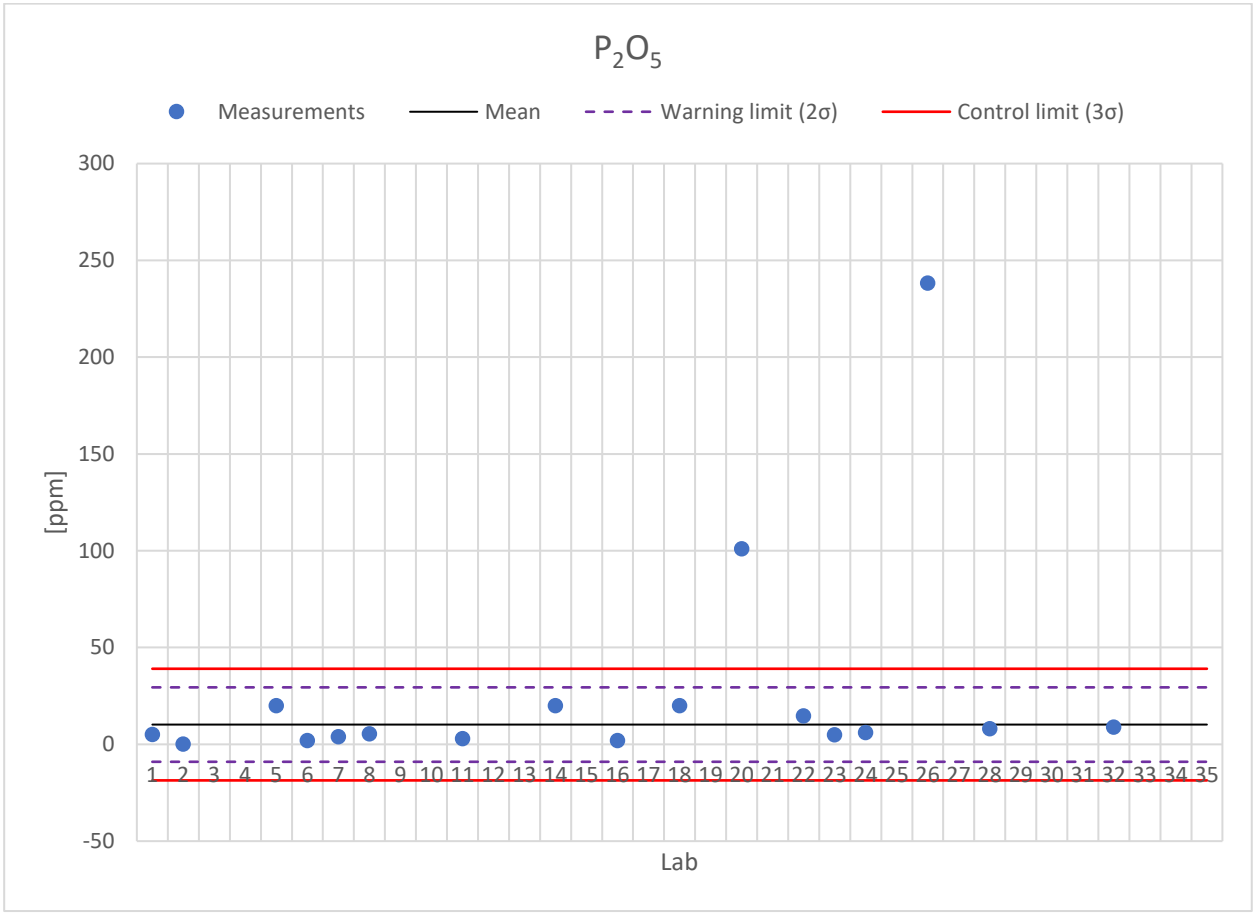


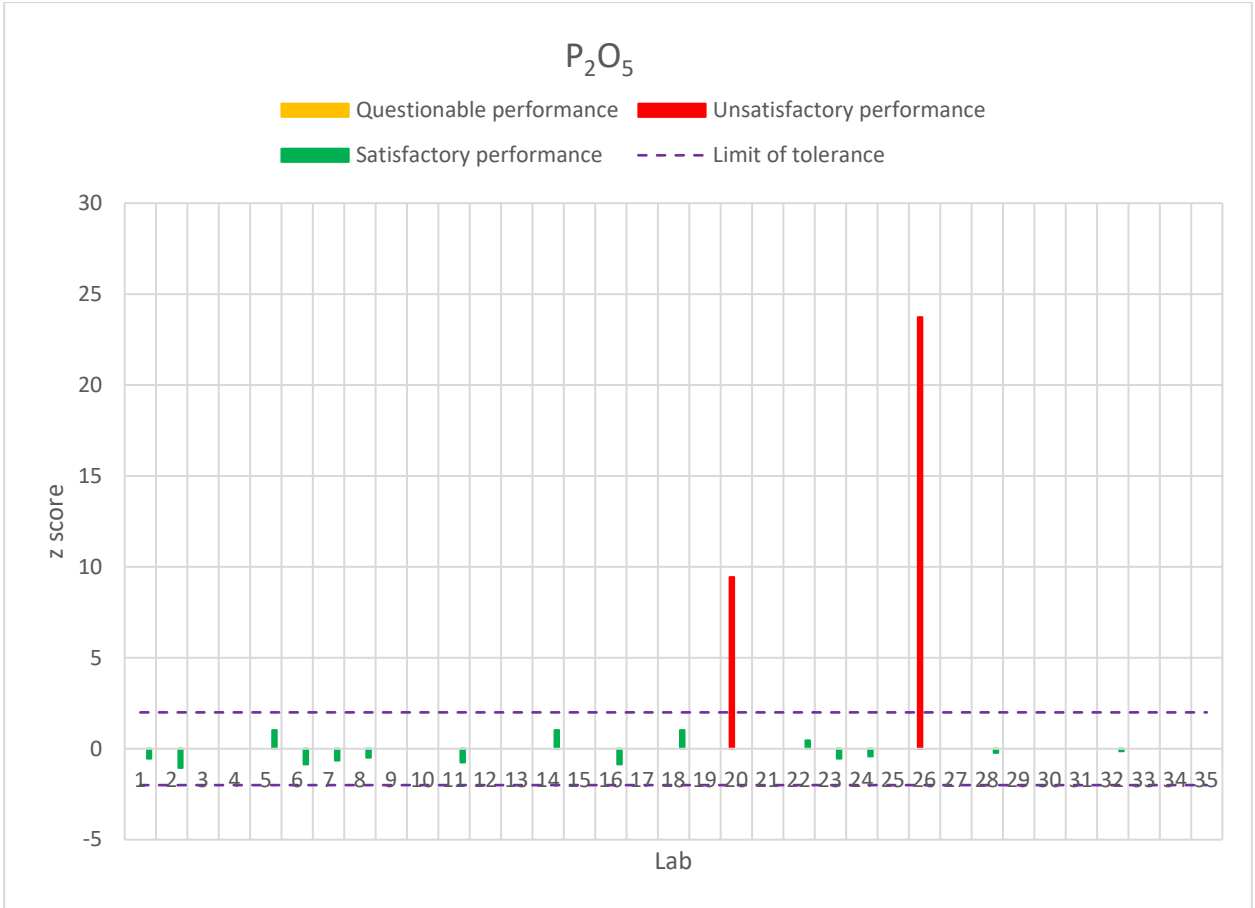


CHARTS SAMPLE A

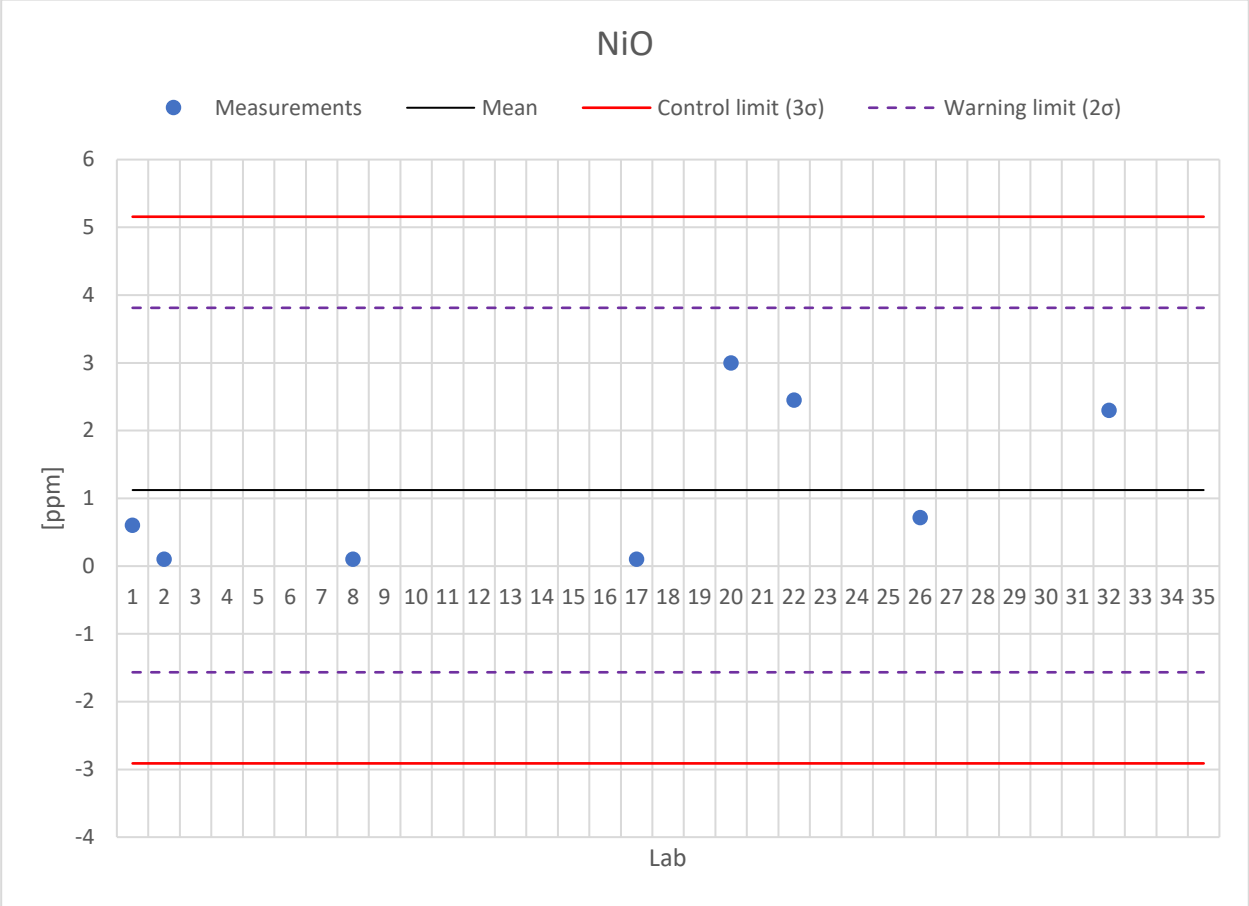


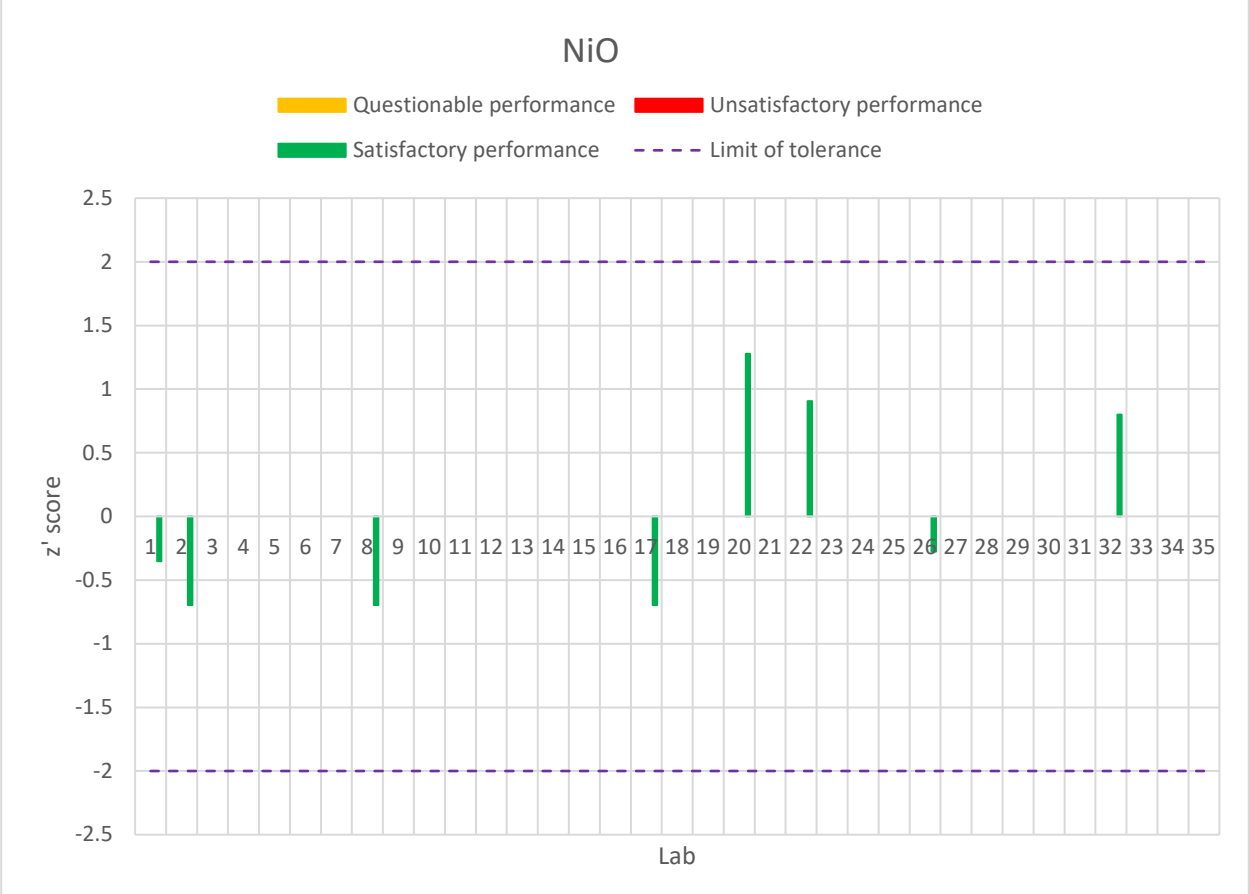
CHARTS SAMPLE A





CHARTS SAMPLE A





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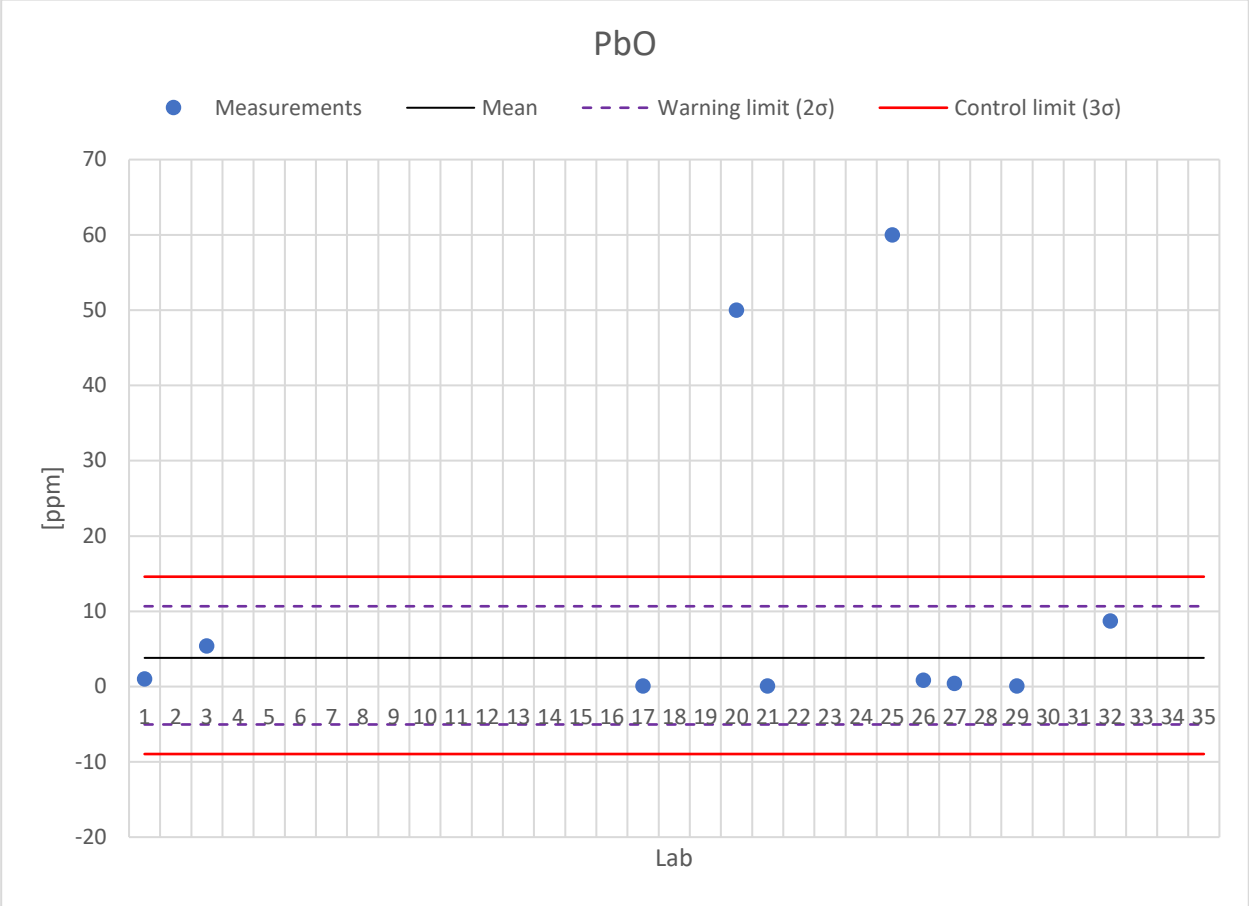

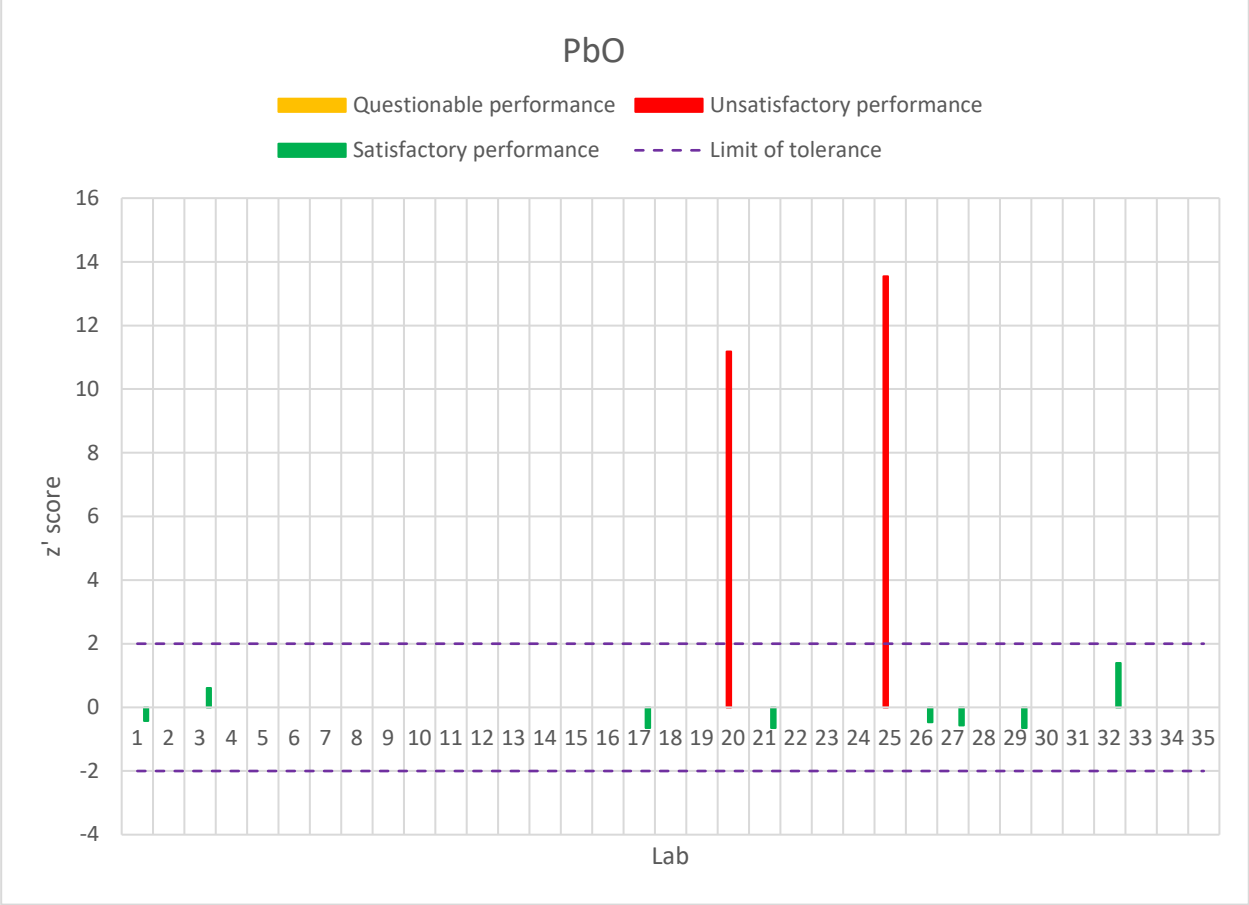

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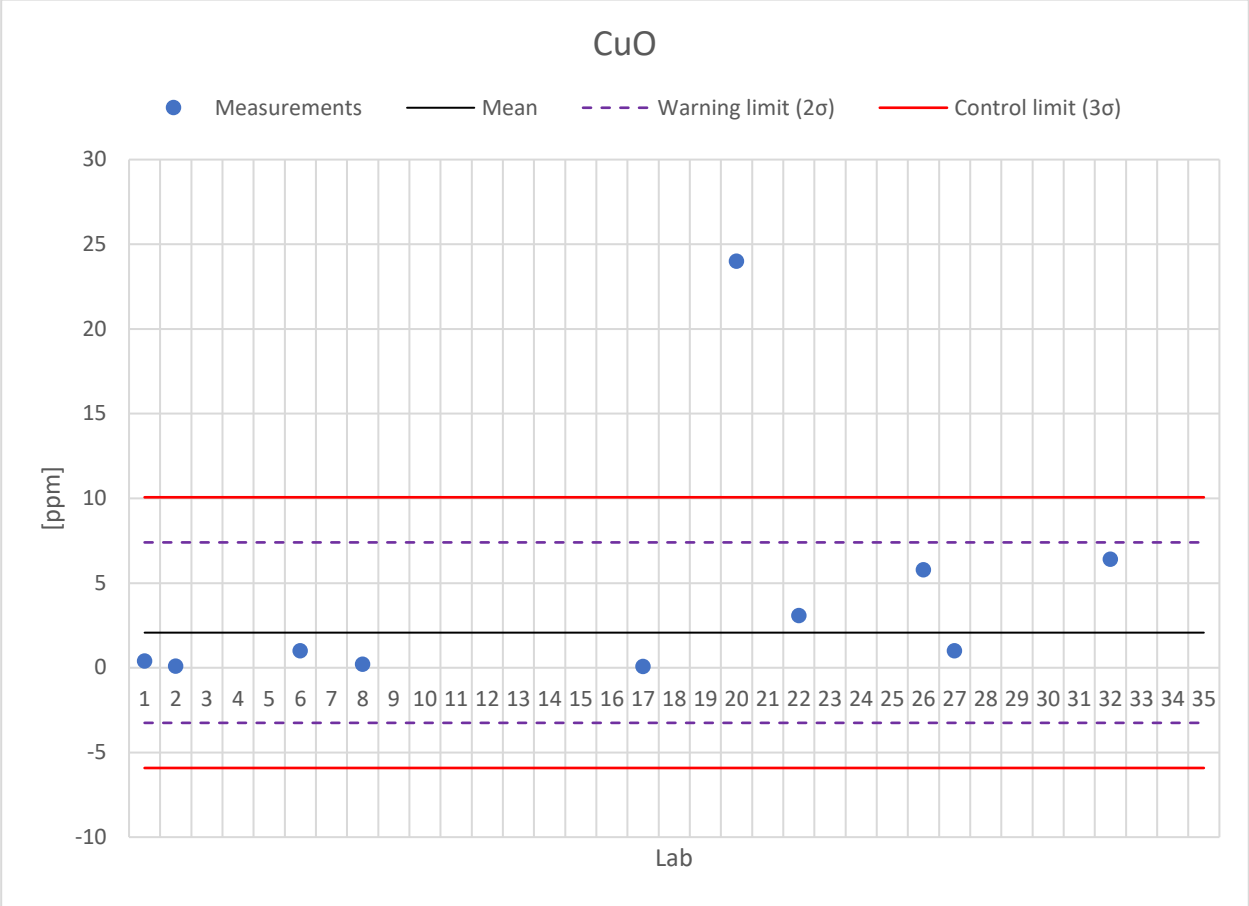

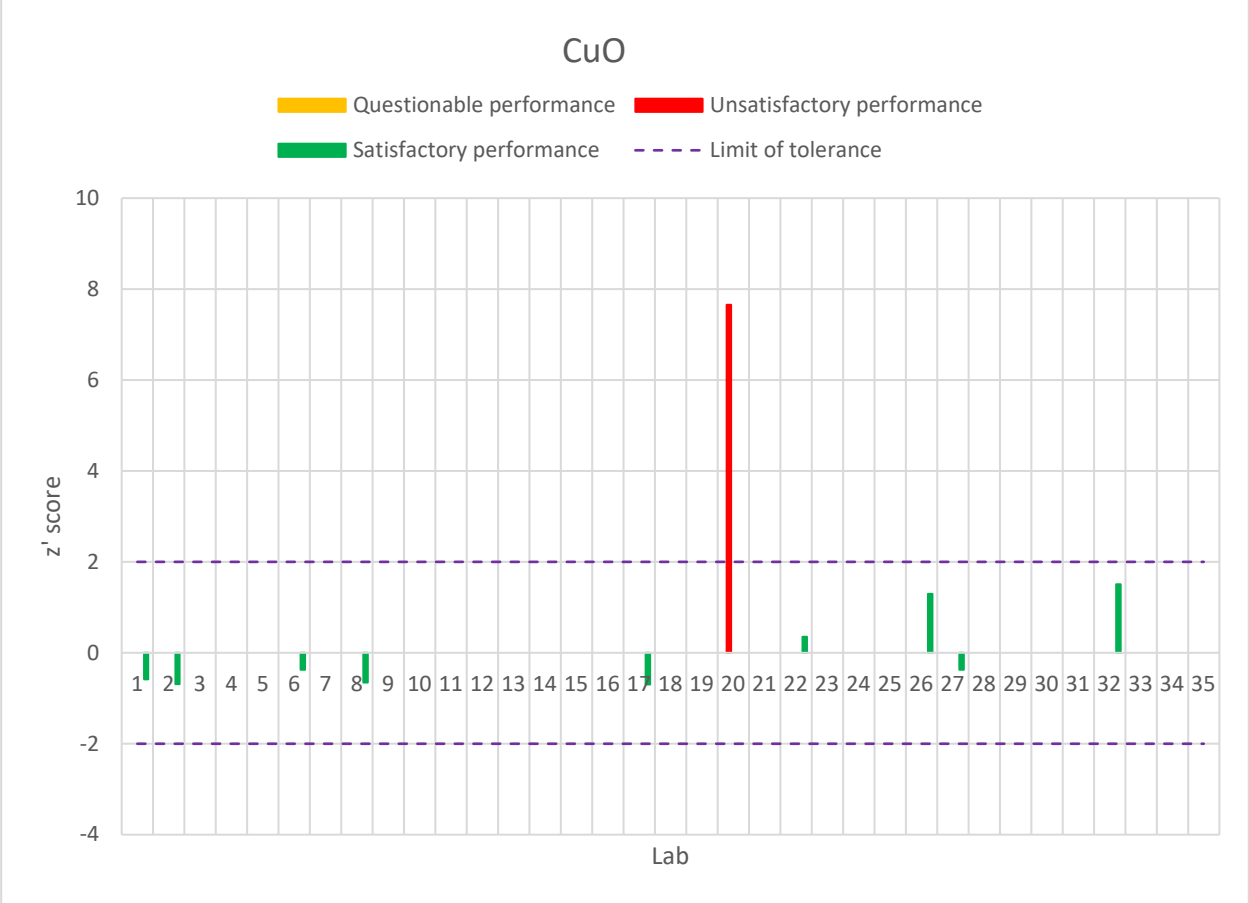

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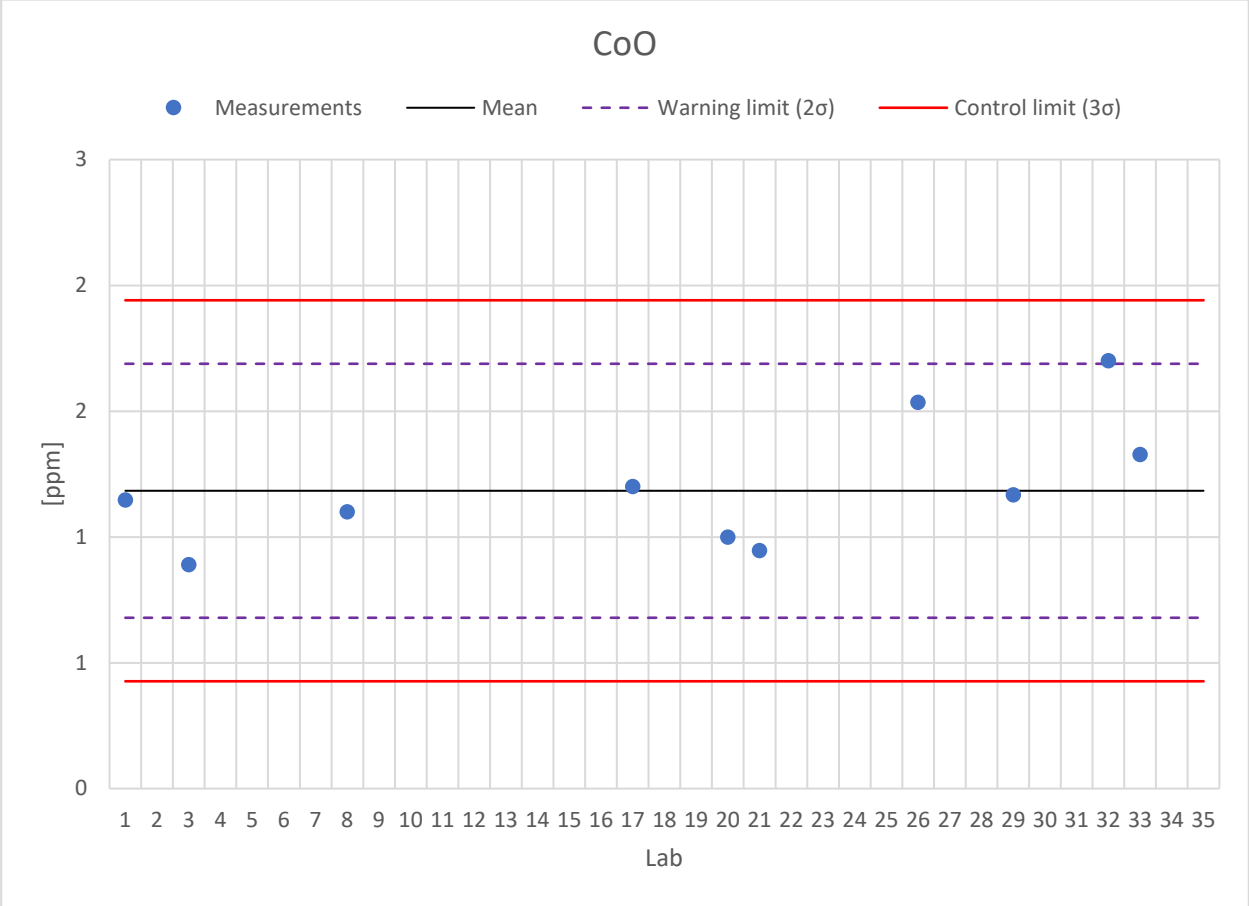

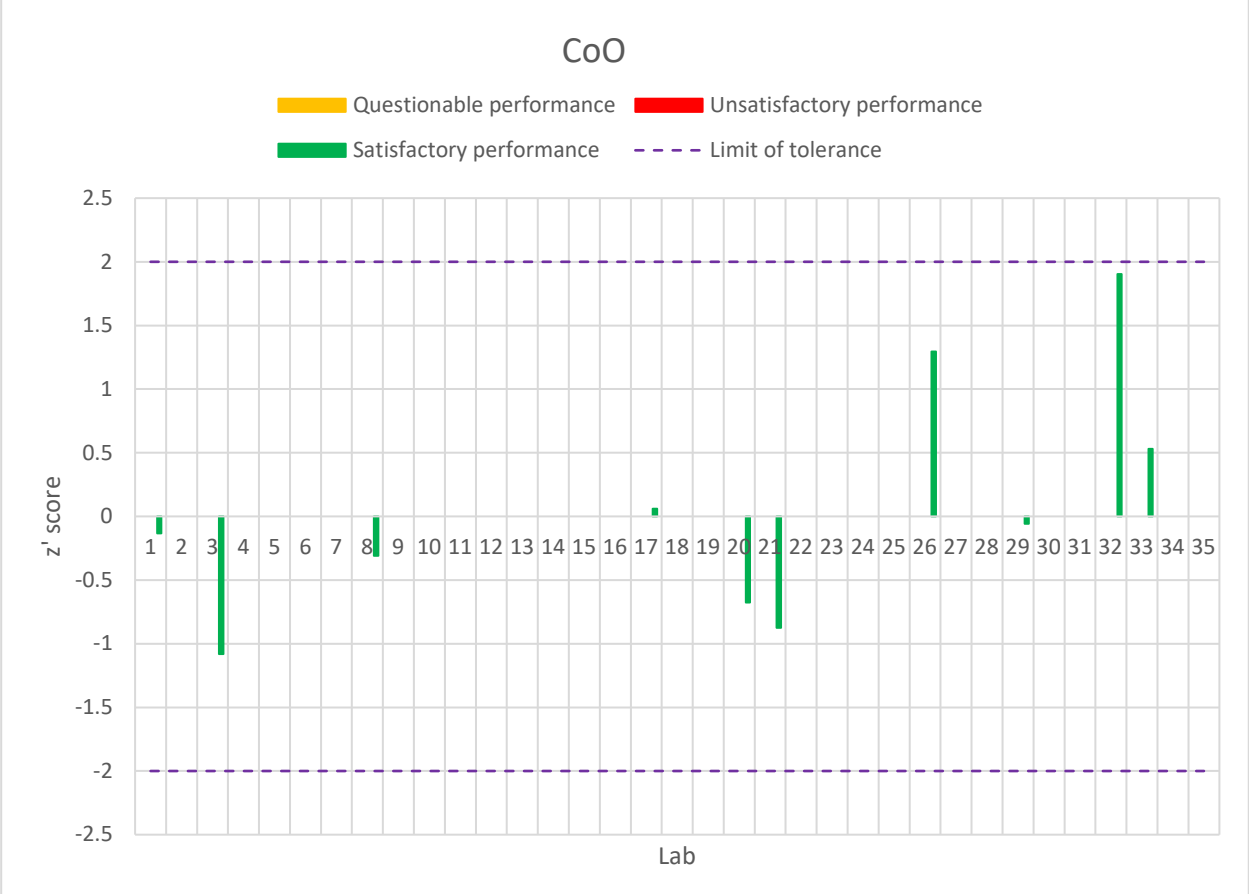

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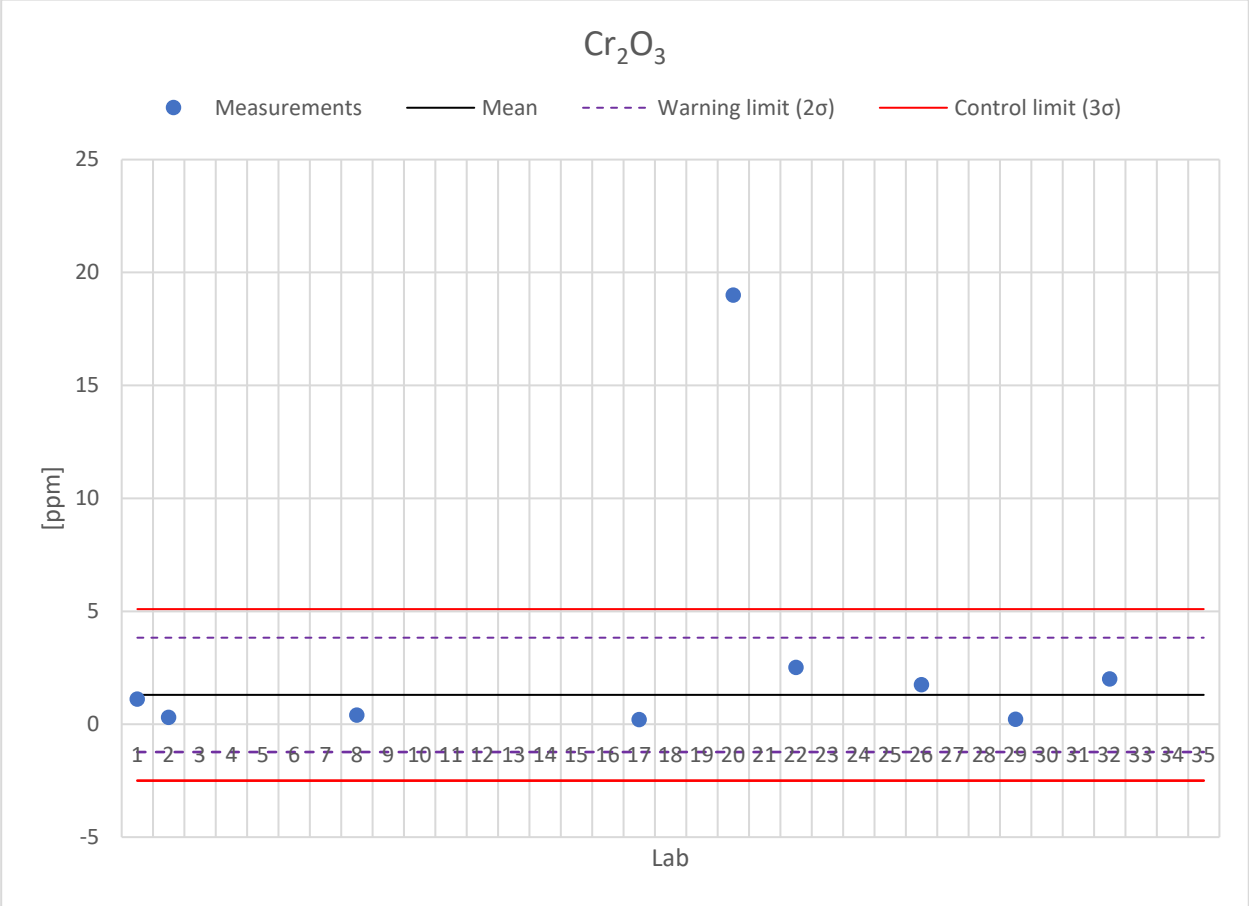

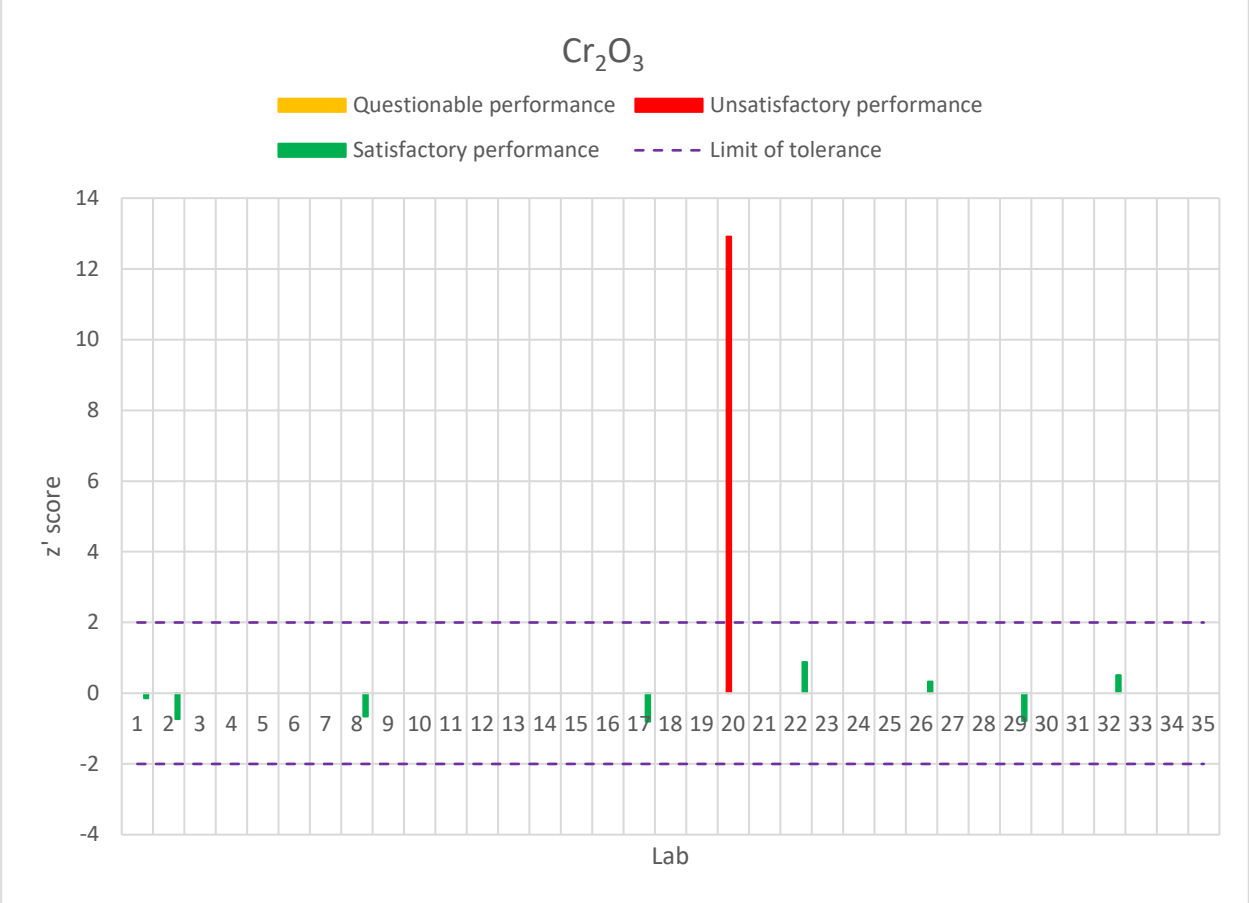

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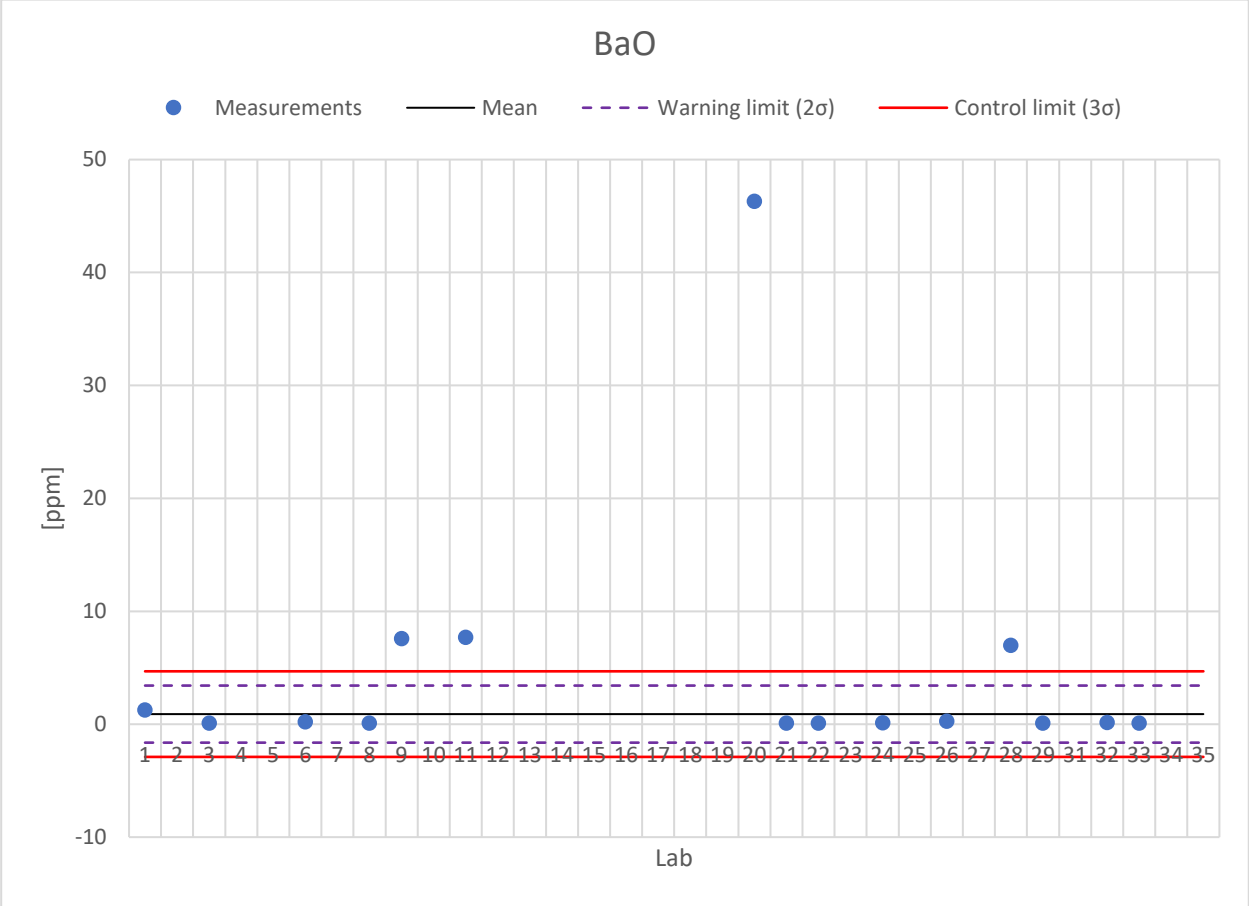

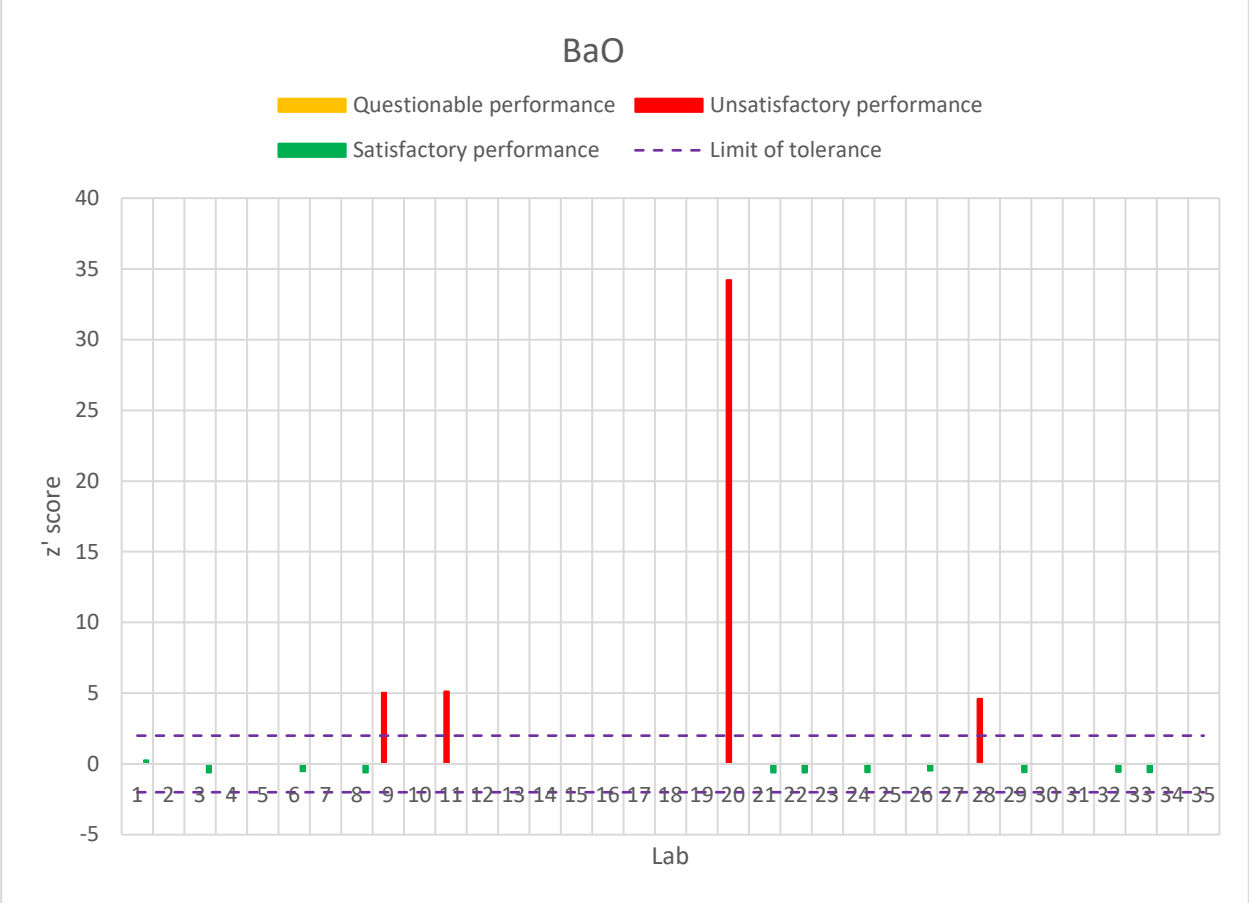

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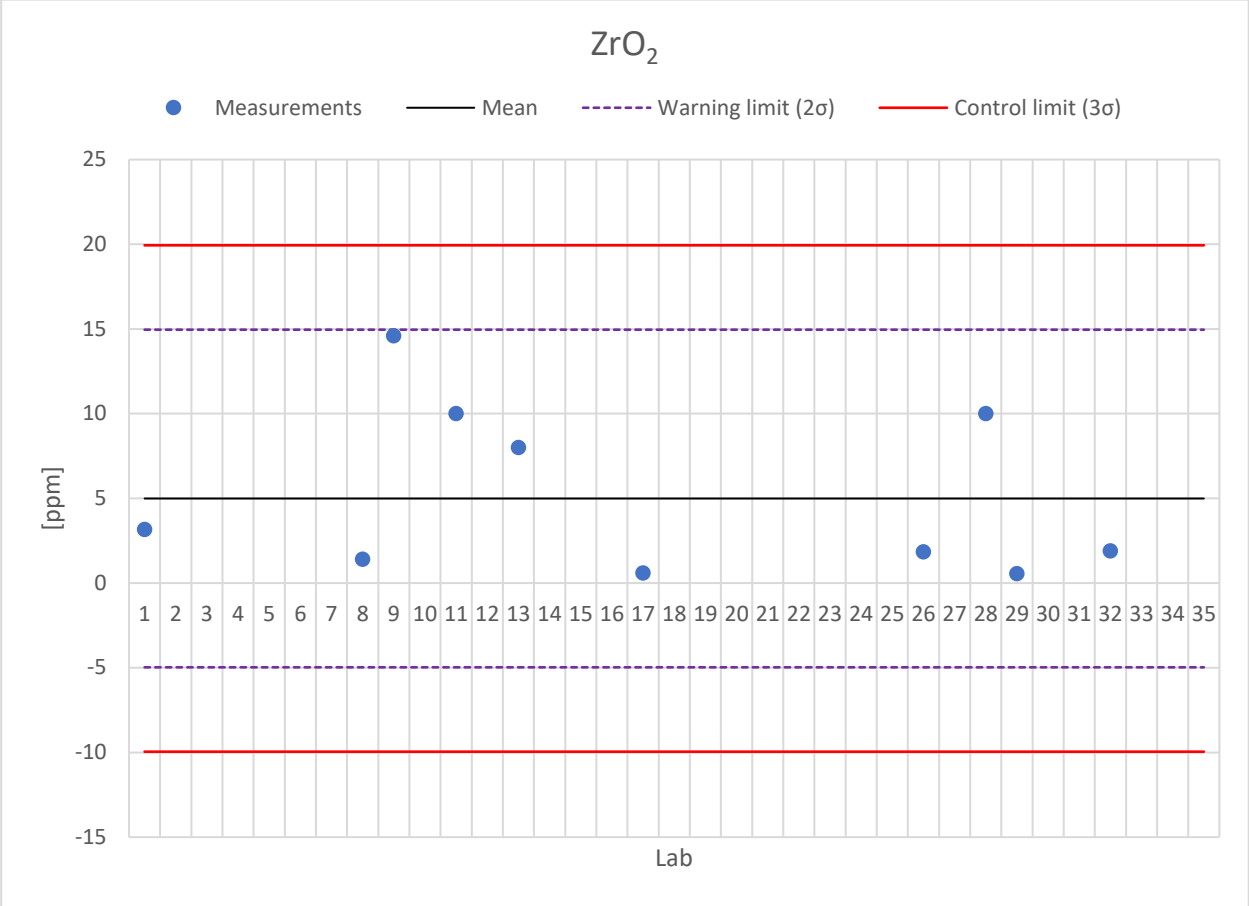
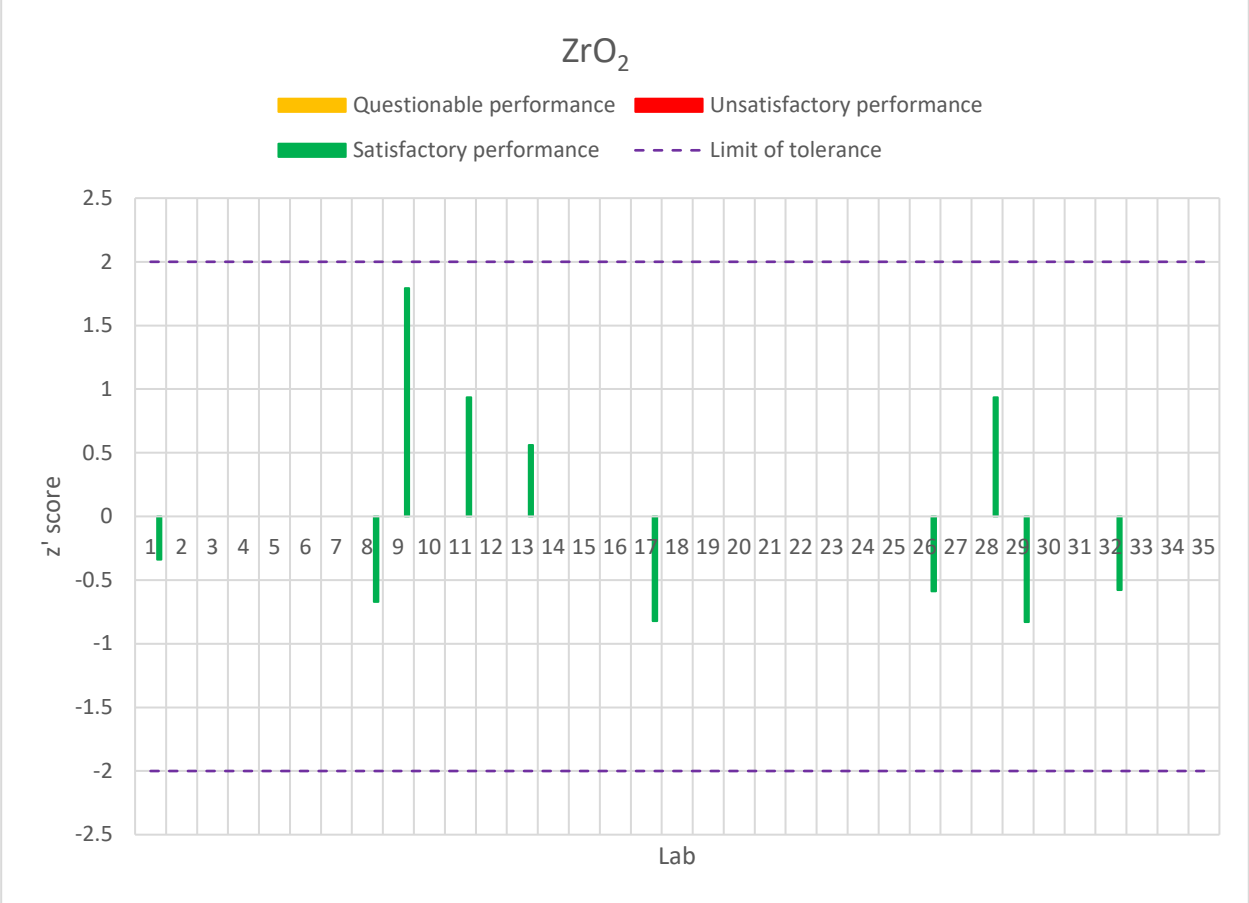
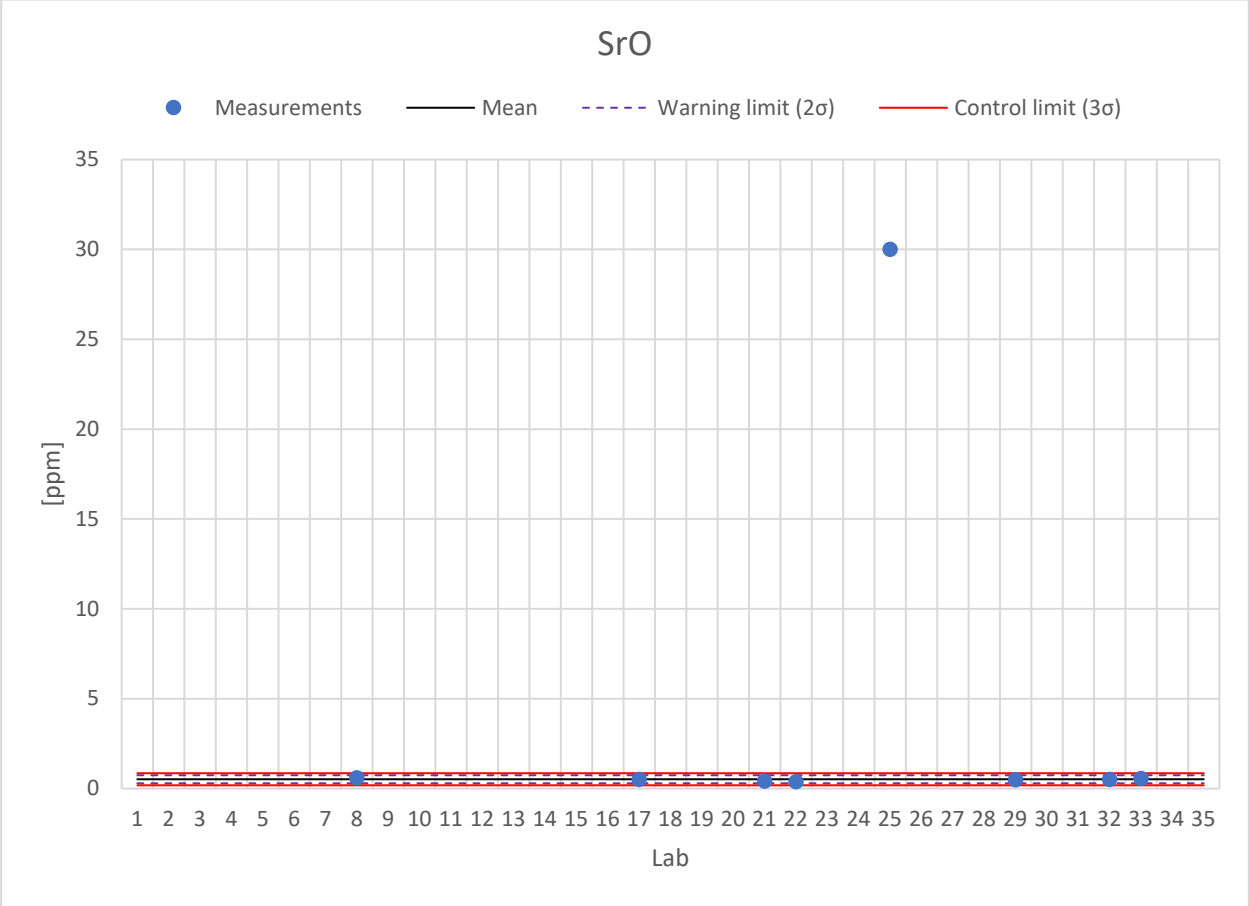
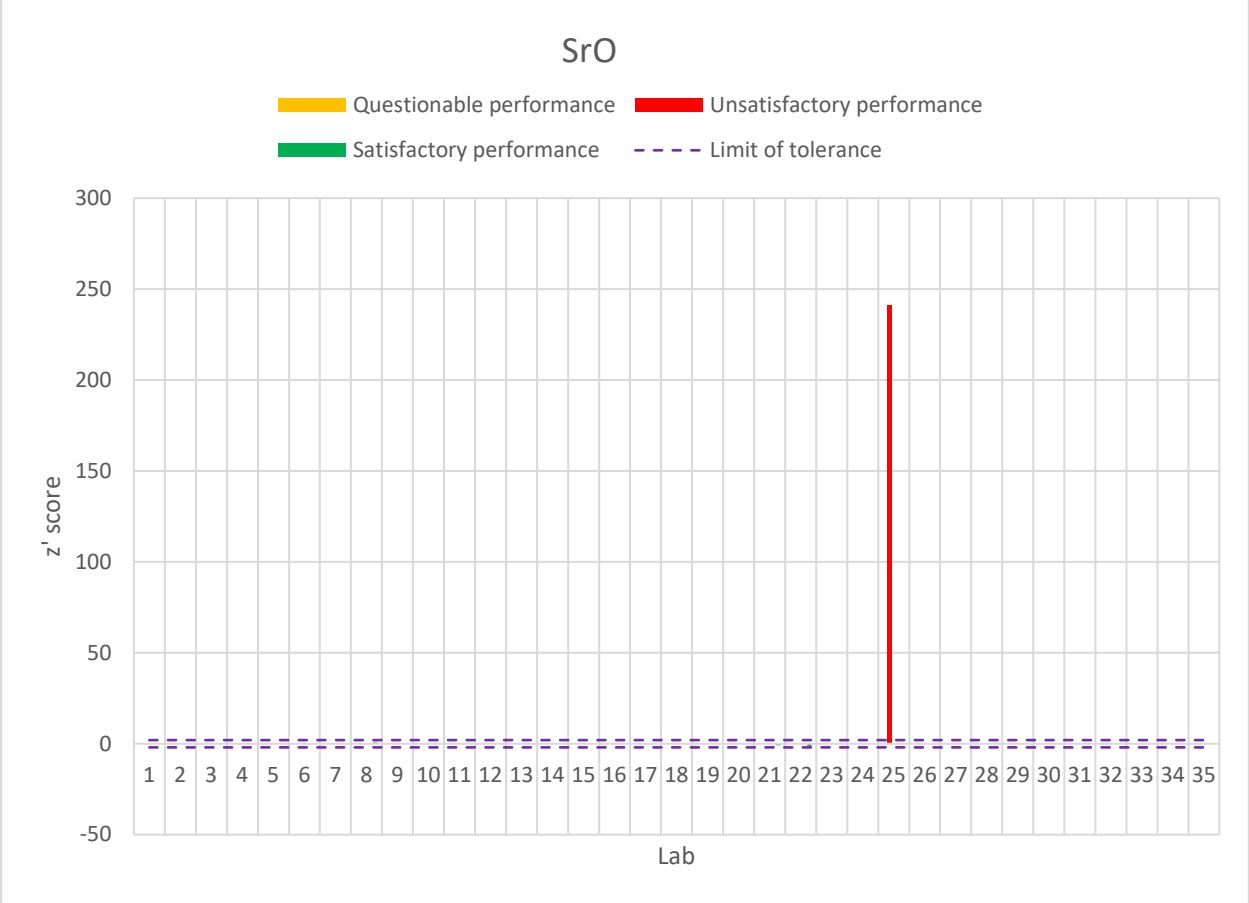


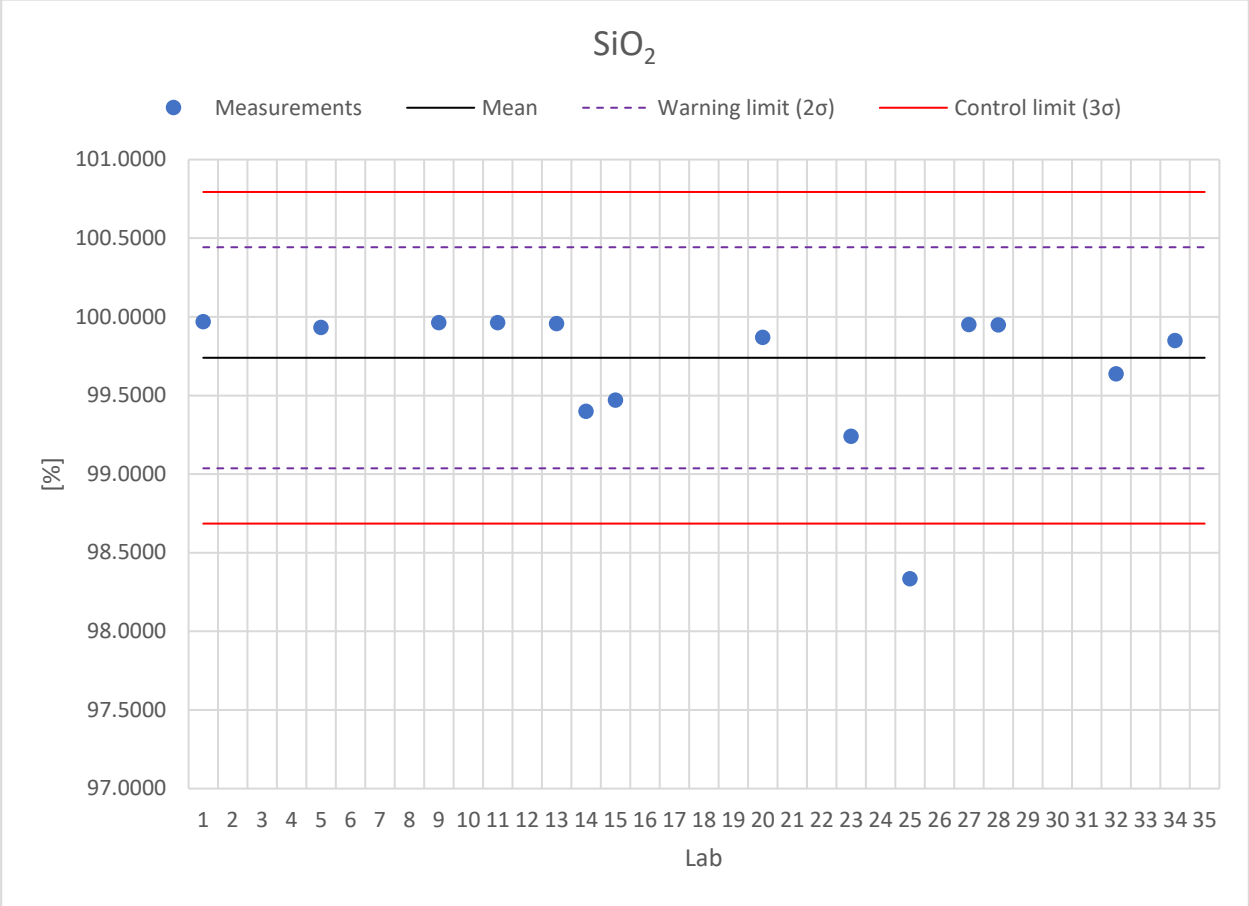


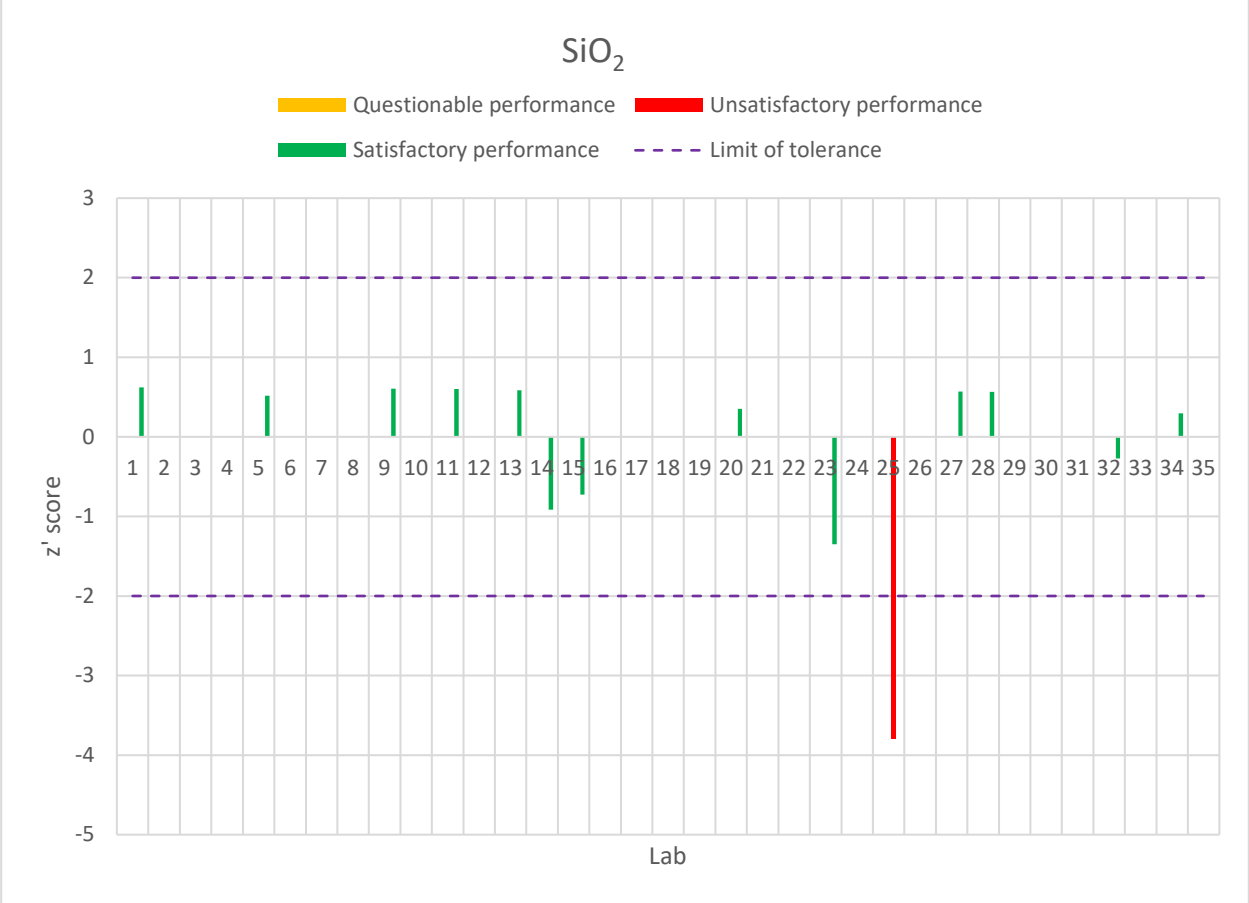
CHARTS SAMPLE A





CHARTS SAMPLE A





ANNEX 5.2. MEASUREMENTS SAMPLE B

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
	%	%	%	%	%	%	%	ppm	ppm	ppm
x_{pt}	0.0263	0.0062	0.0007	0.0368	0.0039	0.0055	0.0017	3.01	11.27	4.31
σ_{pt}	0.0054	0.0020	0.0003	0.0049	0.0007	0.0012	0.0004	1.30	10.46	3.26
N	29	27	25	28	22	24	26	20	16	6

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
Lab 1	0.0229	0.0048	0.0005	0.0368	0.0039	0.0052	0.0012	1.8	4.3	3.3
Lab 2	0.0263	0.0051	0.0007	0.0362	0.0038	0.0042	0.0017	2.4	0.1	
Lab 3	0.0238	0.0047	0.0006	0.0350			0.0017	1.9		6.4
Lab 4										
Lab 5	0.0350	0.0170	0.0010	0.0350	0.0033	0.0050	0.0004	10.0	20.0	
Lab 6	0.0249	0.0044	0.0005	0.0378	0.0040	0.0057	0.0017	2.0	2.0	3.0
Lab 7	0.0280	0.0052	0.0007	0.0395	0.0044	0.0055	0.0019	1.4	15.0	
Lab 8	0.0180	0.0069	0.0005	0.0398		0.0068	0.0017	2.6	4.5	
Lab 9	0.0191	0.0038	0.0010	0.0377	0.0036	0.0041	0.0007	2.8		
Lab 10	0.0260	0.0560	0.0042		0.0020	0.0040	0.0081			
Lab 11	0.0279	0.0092	0.0008	0.0318	0.0018	0.0045	0.0016	4.0	3.0	
Lab 12	0.0396	0.0385	0.0003	0.0285			0.0005			
Lab 13	0.0346	0.0075	0.0007	0.0319	0.0041	0.0046	0.0022			
Lab 14	0.1480	0.0170	0.0060	0.0620	0.0390	0.0090	0.0590		20.0	
Lab 15										
Lab 16	0.0222	0.0049	0.0005	0.0352	0.0037	0.0047	0.0016			
Lab 17	0.0237	0.0046	0.0006	0.0379	0.0037	0.0054	0.0017	2.8	1.5	
Lab 18	0.0270	0.0060	0.0030	0.0370	0.0060	0.0070	0.0020		20.0	
Lab 19										
Lab 20	0.0460	0.0068	0.0020	0.0743			0.0017	17.0	100.0	
Lab 21	0.0230	0.0046	0.0006	0.0437	0.0034	0.0047	0.0012	1.9		
Lab 22	0.0222	0.0048	0.0005	0.0323	0.0039		0.0014	2.1	14.9	3.2
Lab 23	0.0400	0.0180	0.0010	0.0370	0.0050	0.0070			7.0	
Lab 24	0.0266	0.0048	0.0010	0.0322	0.0038	0.0054	0.0015	2.4	5.1	
Lab 25	0.0075		0.0065	0.0354		0.0045				
Lab 26	0.0301	0.0066		0.1163	0.0119	0.0143	0.0031	4.3	241.5	94.4
Lab 27	0.0255	0.0074		0.0448		0.0069		3.9		
Lab 28	0.0215			0.0325	0.0030	0.0050	0.0093			
Lab 29	0.0225	0.0041	0.0005	0.0361		0.0168	0.0016	2.3		
Lab 30										
Lab 31										
Lab 32	0.0260	0.0068	0.0007	0.0223	0.0043	0.0050	0.0016	5.1	9.0	0.8
Lab 33	0.0290	0.0058	0.0006	0.0416	0.0048	0.0070	0.0017	2.9		
Lab 34	0.0245	0.0060		0.0360	0.0040		0.0010	5.0		
Lab 35										

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	2.11	0.79	1.20	1.63	2.39	1.16	12.20	3.64	122.99	1.94
σ_{pt}	1.66	0.21	1.09	1.54	0.89	0.24		0.89	196.90	1.65
N	6	7	9	7	8	10	1	15	2	15

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
Lab 1	1.2	1.0	5.3	1.6	0.4	1.0		8.1	0.2	1.8
Lab 2		0.6	0.3		0.1			3.3		
Lab 3	1.0		0.6			0.9		3.5		0.9
Lab 4										
Lab 5										
Lab 6		1.0			1.0			3.0		1.1
Lab 7										
Lab 8	4.2					1.3		2.9		0.8
Lab 9										40.3
Lab 10										
Lab 11										40.2
Lab 12										
Lab 13										
Lab 14										
Lab 15										
Lab 16										
Lab 17	0.5	0.6	0.3	0.5	0.1	1.2		3.1		
Lab 18										
Lab 19										
Lab 20			2.0	40.0	24.0	1.0		22.0		265.1
Lab 21				0.5		0.9		2.7		1.0
Lab 22			2.1		2.9			3.5		0.9
Lab 23										
Lab 24								3.5		0.8
Lab 25										
Lab 26	3.2	0.8	1.5	1.5	2.8	1.4		4.5	245.8	1.7
Lab 27								3.0		
Lab 28										38.5
Lab 29		0.6	0.2	0.5		1.1		3.0		1.0
Lab 30										
Lab 31										
Lab 32	2.6	0.9	1.0	16.4	5.2	1.9	12.2	4.0		0.7
Lab 33						1.3		4.8		1.0
Lab 34										
Lab 35										

	LiO_2	SO_3	MoO_3	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO	Ga_2O_3
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	0.25	23.50	4.99	5.04	2.15	12.85	2.38	2.60	0.79	0.23
σ_{pt}	0.06	11.18	5.42	5.46	2.22	0.72	3.56	4.00	0.29	
N	2	5	3	9	3	2	2	2	8	1

	LiO_2	SO_3	MoO_3	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO	Ga_2O_3
Lab 1	<1.37	18.1	3.8	2.5						
Lab 2										
Lab 3										
Lab 4										
Lab 5		30.0								
Lab 6										
Lab 7										
Lab 8									1.2	
Lab 9		12.4		13.8						
Lab 10										
Lab 11				9.0						
Lab 12										
Lab 13				8.0						
Lab 14										
Lab 15										
Lab 16										
Lab 17	0.3			0.1					0.7	
Lab 18										
Lab 19										
Lab 20		37.0								
Lab 21									0.6	
Lab 22						13.3			0.6	
Lab 23										
Lab 24										
Lab 25									20.0	
Lab 26				1.2	0.5		0.2	0.1		0.2
Lab 27										
Lab 28		20.0		10.0						
Lab 29	0.2			0.1					0.7	
Lab 30										
Lab 31										
Lab 32			14.6	1.2	5.0	12.4	4.6	5.1	0.6	
Lab 33			0.9		1.7				0.8	
Lab 34										
Lab 35										

	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
	ppm	ppm	ppm	ppm	ppm	%	%	%
x_{pt}	1.05	0.92	0.02	0.02	0.01	0.0069	0.2196	99.6822
σ_{pt}		1.29					0.0418	0.3519
N	1	2	1	1	1	1	6	14

	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
Lab 1							0.2050	99.9194
Lab 2								
Lab 3								
Lab 4								
Lab 5								99.9070
Lab 6								
Lab 7								
Lab 8								
Lab 9								99.9200
Lab 10								
Lab 11								99.9152
Lab 12								
Lab 13								99.9137
Lab 14							0.2400	99.4000
Lab 15							0.6400	99.2200
Lab 16								
Lab 17								
Lab 18								
Lab 19								
Lab 20						0.0069		99.7900
Lab 21								
Lab 22								
Lab 23							0.2200	98.8800
Lab 24								
Lab 25							0.2016	98.5854
Lab 26	1.1	1.7	0.0					
Lab 27								99.8967
Lab 28								99.9243
Lab 29		0.1		0.0	0.0			
Lab 30								
Lab 31								
Lab 32							0.0770	99.7030
Lab 33								
Lab 34								99.7300
Lab 35								

ANNEX 5.2.1. Z-SCORE SAMPLE B

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO
Lab 1	-0.6	-0.7	-1.0	0.0	-0.1	-0.3	-1.2	-1.0
Lab 2	0.0	-0.6	-0.3	-0.1	-0.2	-1.1	0.1	-0.5
Lab 3	-0.5	-0.8	-0.7	-0.4			0.0	-0.8
Lab 4								
Lab 5	1.6	5.5	1.1	-0.4	-0.9	-0.4	-3.1	5.4
Lab 6	-0.3	-0.9	-0.9	0.2	0.1	0.1	0.1	-0.8
Lab 7	0.3	-0.5	-0.2	0.5	0.6	0.0	0.6	-1.2
Lab 8	-1.5	0.3	-0.9	0.6		1.0	0.0	-0.3
Lab 9	-1.3	-1.3	1.3	0.2	-0.5	-1.1	-2.3	-0.2
Lab 10	-0.1	25.4	13.7		-2.8	-1.3	15.8	
Lab 11	0.3	1.5	0.3	-1.0	-3.0	-0.8	-0.1	0.8
Lab 12	2.5	16.5	-1.8	-1.7			-2.7	
Lab 13	1.5	0.6	-0.1	-1.0	0.2	-0.8	1.3	
Lab 14	22.5	5.5	20.8	5.2	49.8	2.8	140.3	
Lab 15								
Lab 16	-0.8	-0.7	-0.9	-0.3	-0.3	-0.7	-0.1	
Lab 17	-0.5	-0.8	-0.6	0.2	-0.3	-0.1	0.1	-0.2
Lab 18	0.1	-0.1	9.0	0.0	2.9	1.2	0.8	
Lab 19								
Lab 20	3.6	0.3	5.1	7.7			0.1	10.8
Lab 21	-0.6	-0.9	-0.5	1.4	-0.7	-0.6	-1.1	-0.8
Lab 22	-0.8	-0.7	-0.8	-0.9	-0.1		-0.6	-0.7
Lab 23	2.5	6.0	1.1	0.0	1.5	1.2		
Lab 24	0.1	-0.7	1.3	-0.9	-0.2	-0.2	-0.3	-0.5
Lab 25	-3.5		22.8	-0.3		-0.8		
Lab 26	0.7	0.2		16.3	11.4	7.1	3.5	1.0
Lab 27	-0.1	0.6		1.6		1.1		0.7
Lab 28	-0.9			-0.9	-1.3	-0.4	18.7	
Lab 29	-0.7	-1.1	-0.8	-0.1		9.2	-0.2	-0.6
Lab 30								
Lab 31								
Lab 32	-0.1	0.3	-0.3	-3.0	0.5	-0.4	-0.1	1.6
Lab 33	0.5	-0.2	-0.5	1.0	1.2	1.2	0.2	-0.1
Lab 34	-0.3	-0.1		-0.2	0.1		-1.6	1.5
Lab 35								

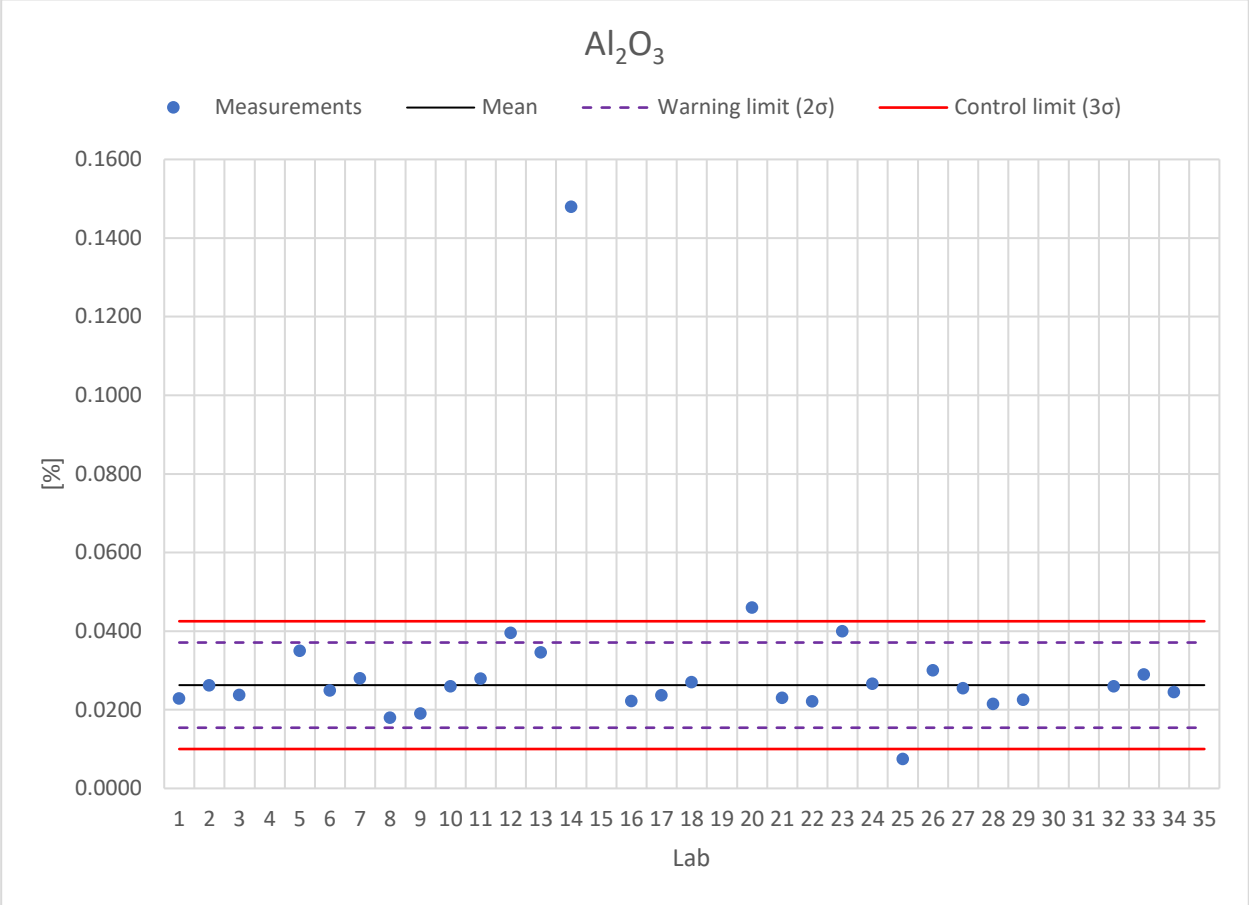
Satisfactory performance
Questionable performance
Unsatisfactory performance

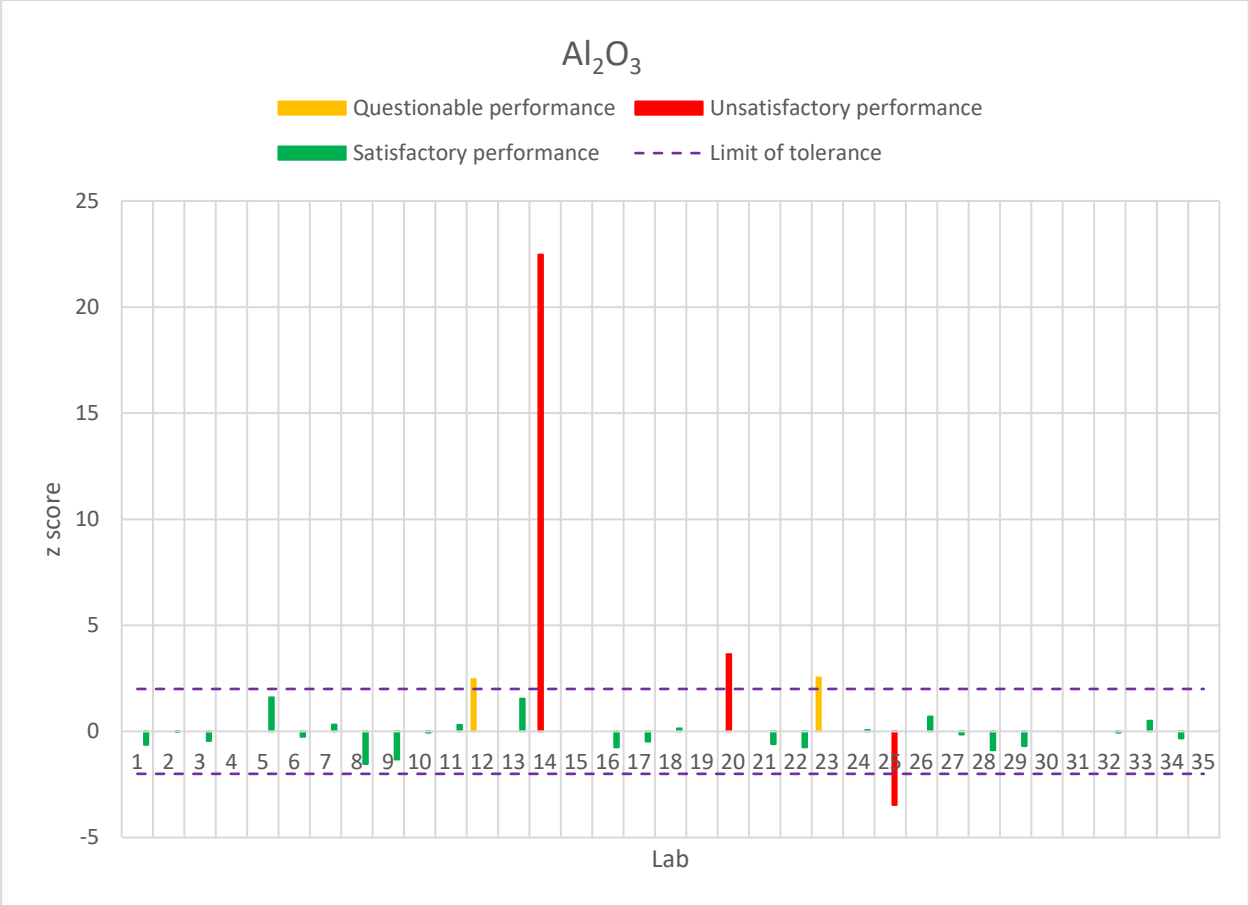
ANNEX 5.2.2. Z'-SCORE SAMPLE B

	P_2O_5	NiO	CuO	CoO	Cr_2O_3	BaO	ZrO_2	SrO	SiO_2
Lab 1	-0.6	3.4	-2.0	-0.5	4.7	-0.1	-0.4		0.6
Lab 2	-1.0	-0.8	-2.3		-0.4				
Lab 3		-0.5		-1.1	-0.1	-0.6			
Lab 4									
Lab 5	0.8								0.6
Lab 6	-0.8		-1.4		-0.7	-0.5			
Lab 7	0.3								
Lab 8	-0.6			0.5	-0.8	-0.6		1.3	
Lab 9						22.1	1.5		0.6
Lab 10									
Lab 11	-0.8					22.0	0.7		0.6
Lab 12									
Lab 13							0.5		0.6
Lab 14	0.8								-0.8
Lab 15									-1.2
Lab 16									
Lab 17	-0.9	-0.8	-2.3	0.2	-0.6		-0.8	-0.3	
Lab 18	0.8								
Lab 19									
Lab 20	8.1	0.7	22.2	-0.6	19.6	151.8			0.3
Lab 21				-1.1	-1.0	-0.6		-0.6	
Lab 22	0.3	0.8	0.5		-0.1	-0.6		-0.6	
Lab 23	-0.4								-2.2
Lab 24	-0.6				-0.1	-0.7			
Lab 25								60.2	-3.0
Lab 26	21.0	0.2	0.4	1.0	0.9	-0.1	-0.7		
Lab 27					-0.7				0.6
Lab 28						21.1	0.8		0.7
Lab 29		-0.9		-0.3	-0.7	-0.6	-0.8	-0.4	
Lab 30									
Lab 31									
Lab 32	-0.2	-0.2	2.9	2.9	0.4	-0.7	-0.6	-0.6	0.1
Lab 33				0.5	1.2	-0.5		-0.1	
Lab 34									0.1
Lab 35									

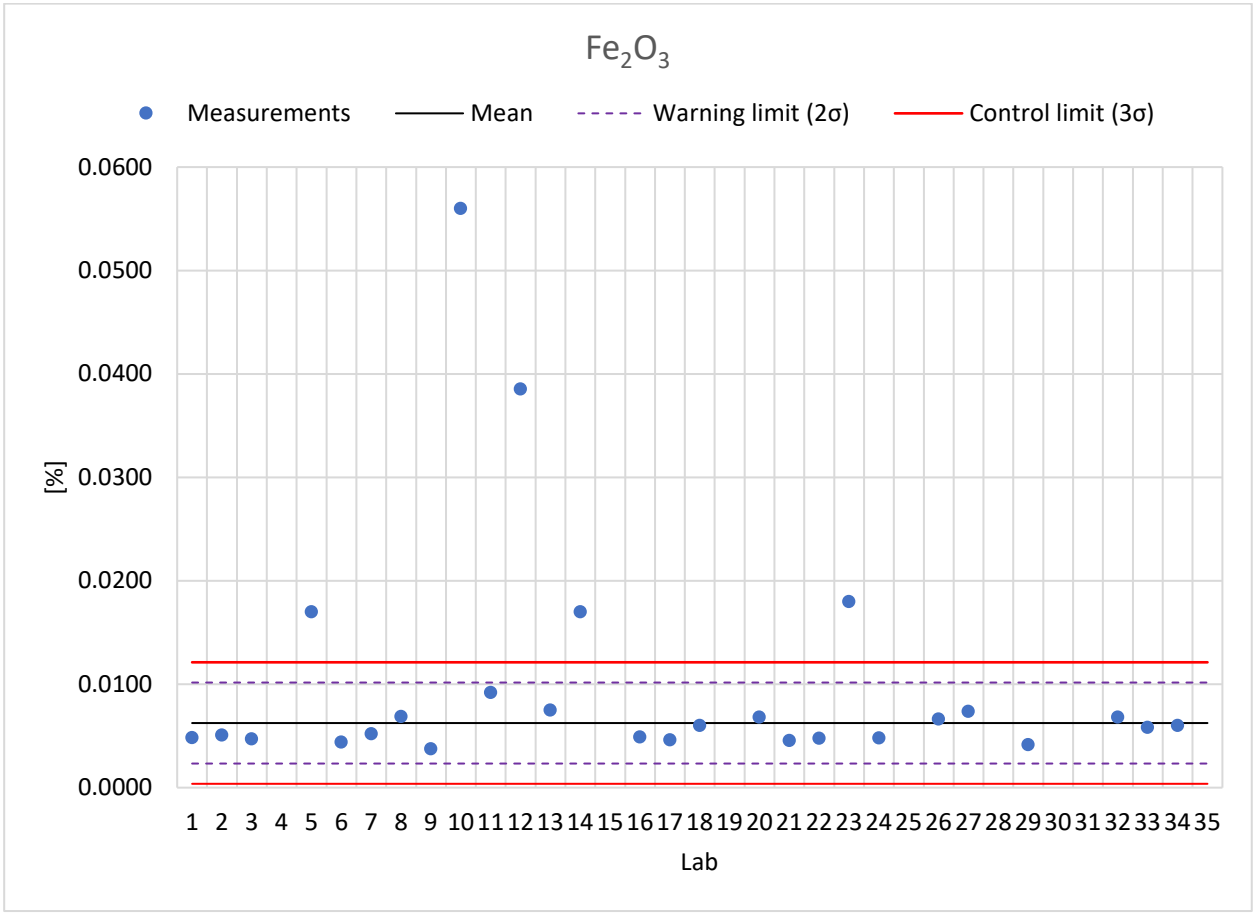
Satisfactory performance
Questionable performance
Unsatisfactory performance

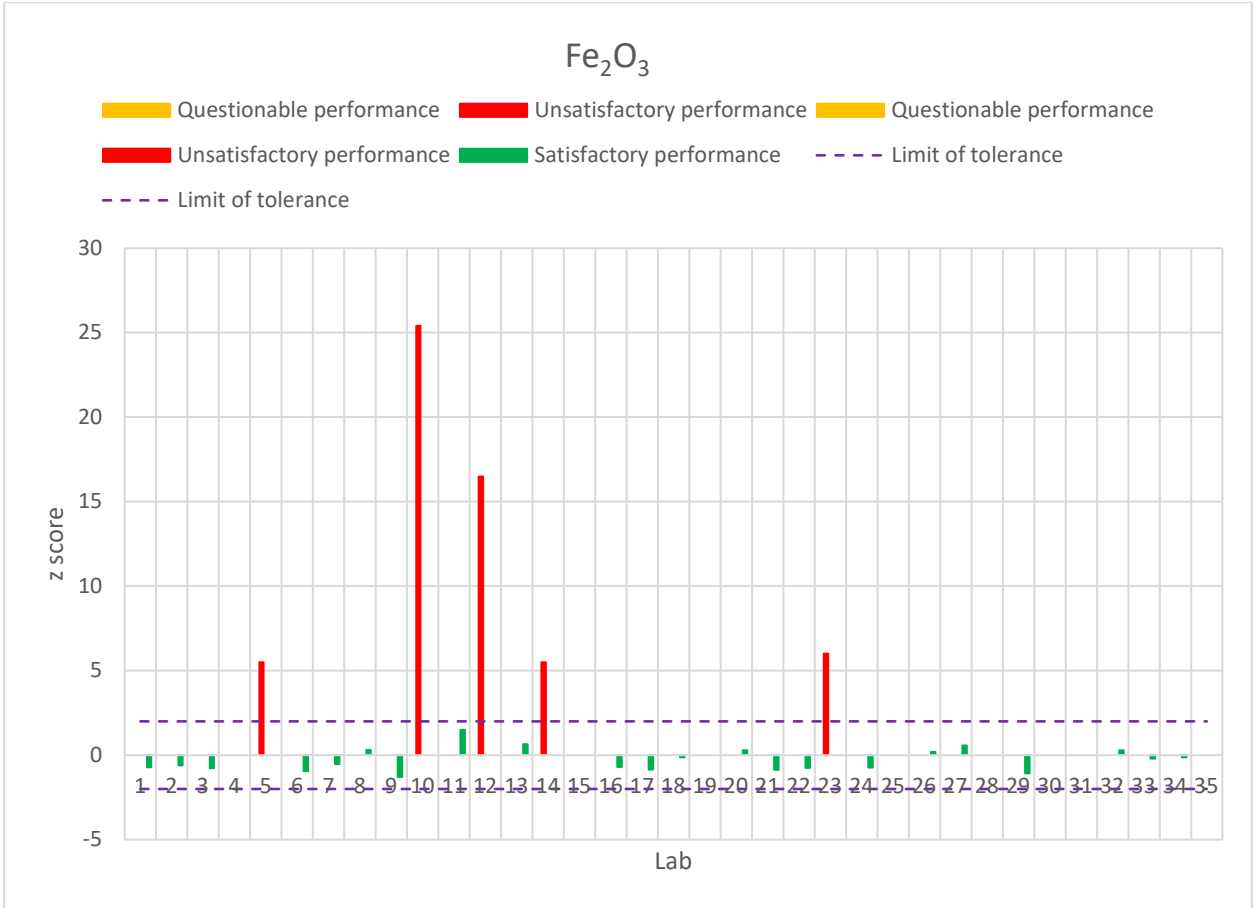
ANNEX 5.2.3. CHARTS SAMPLE B



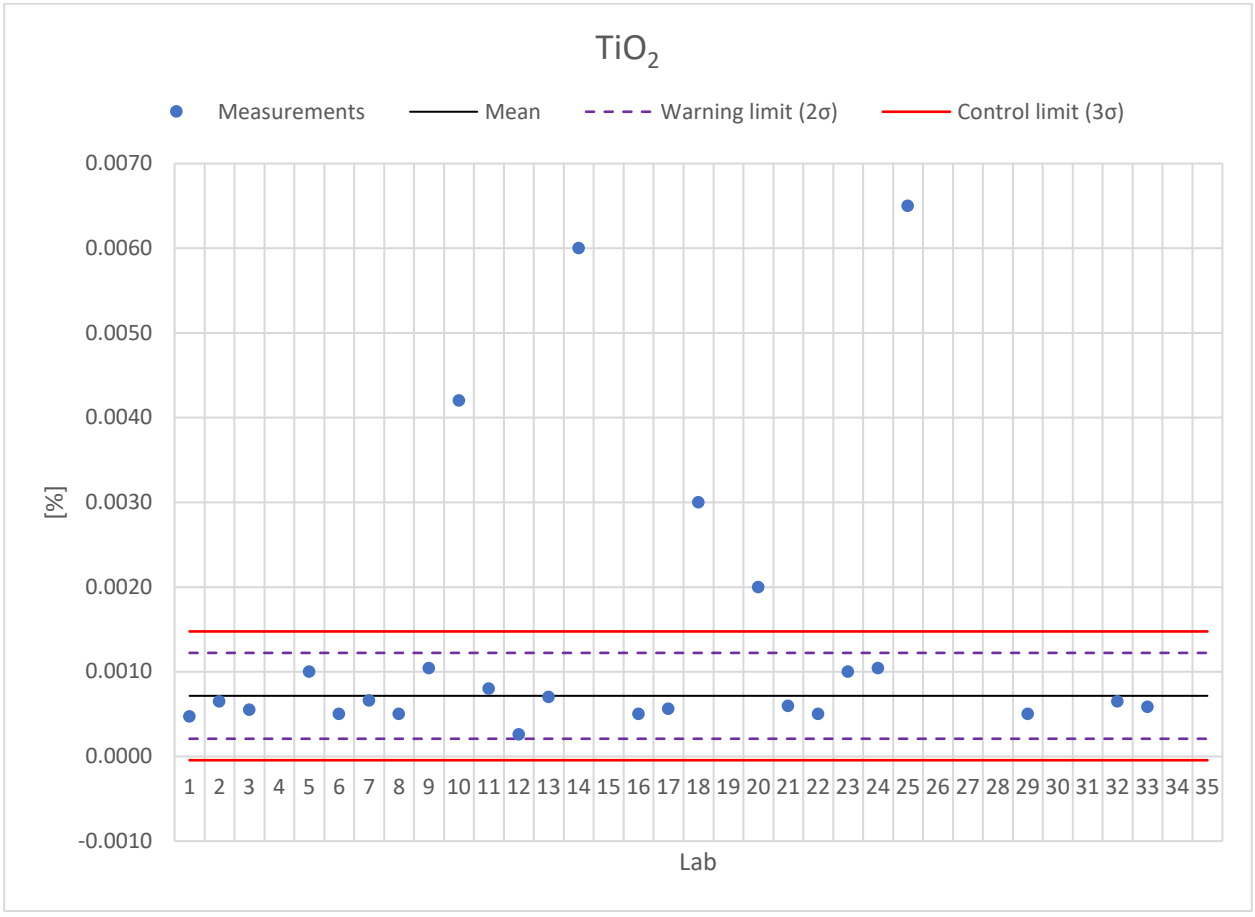


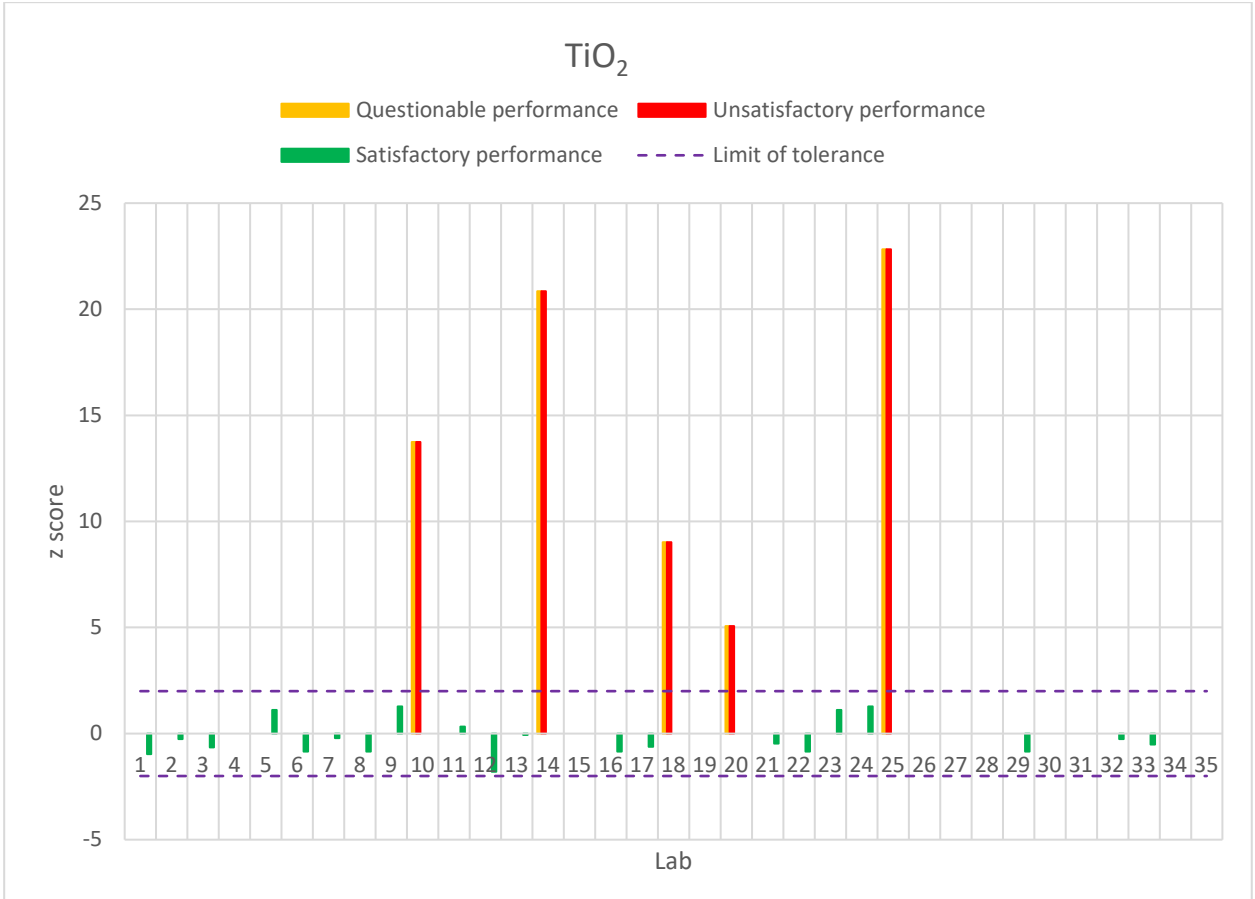
CHARTS SAMPLE B



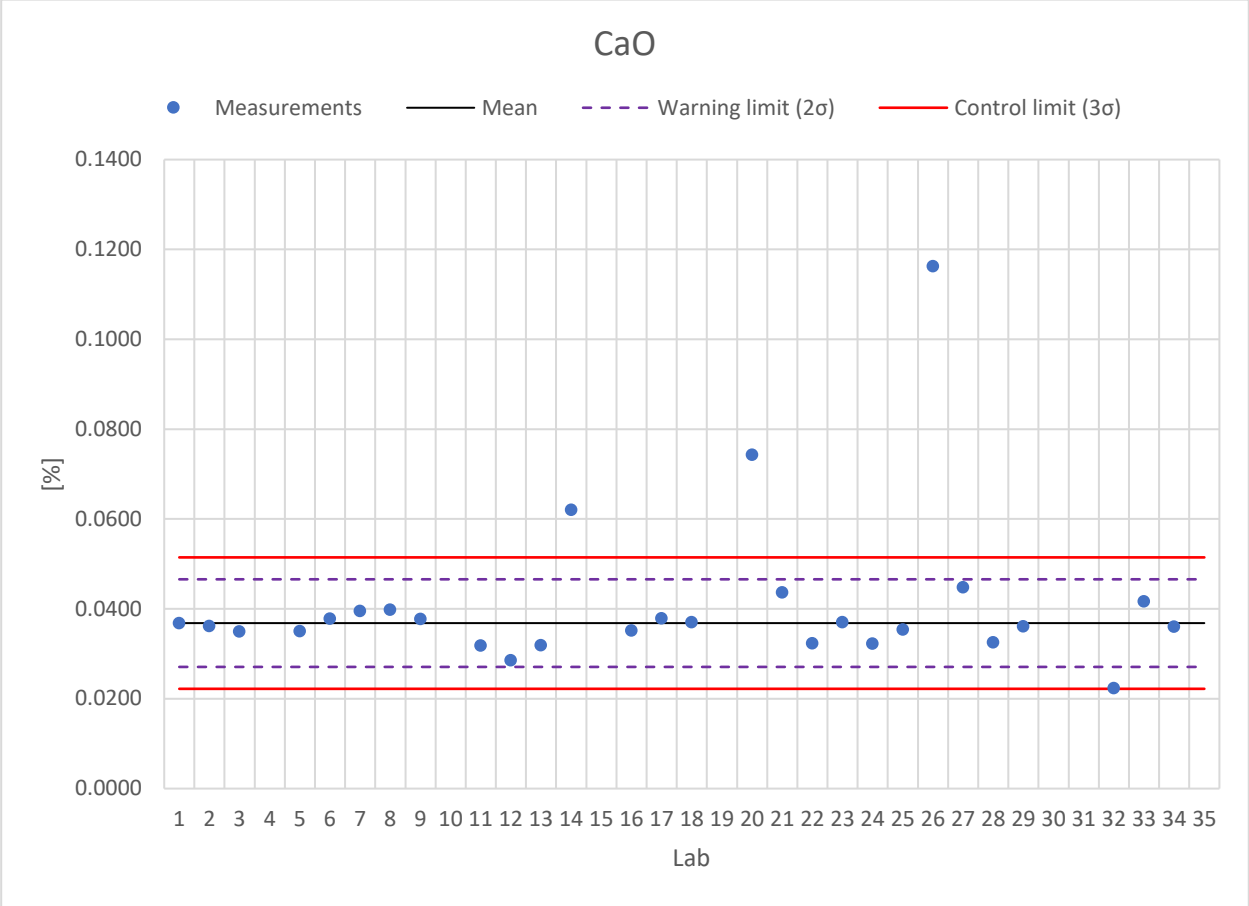


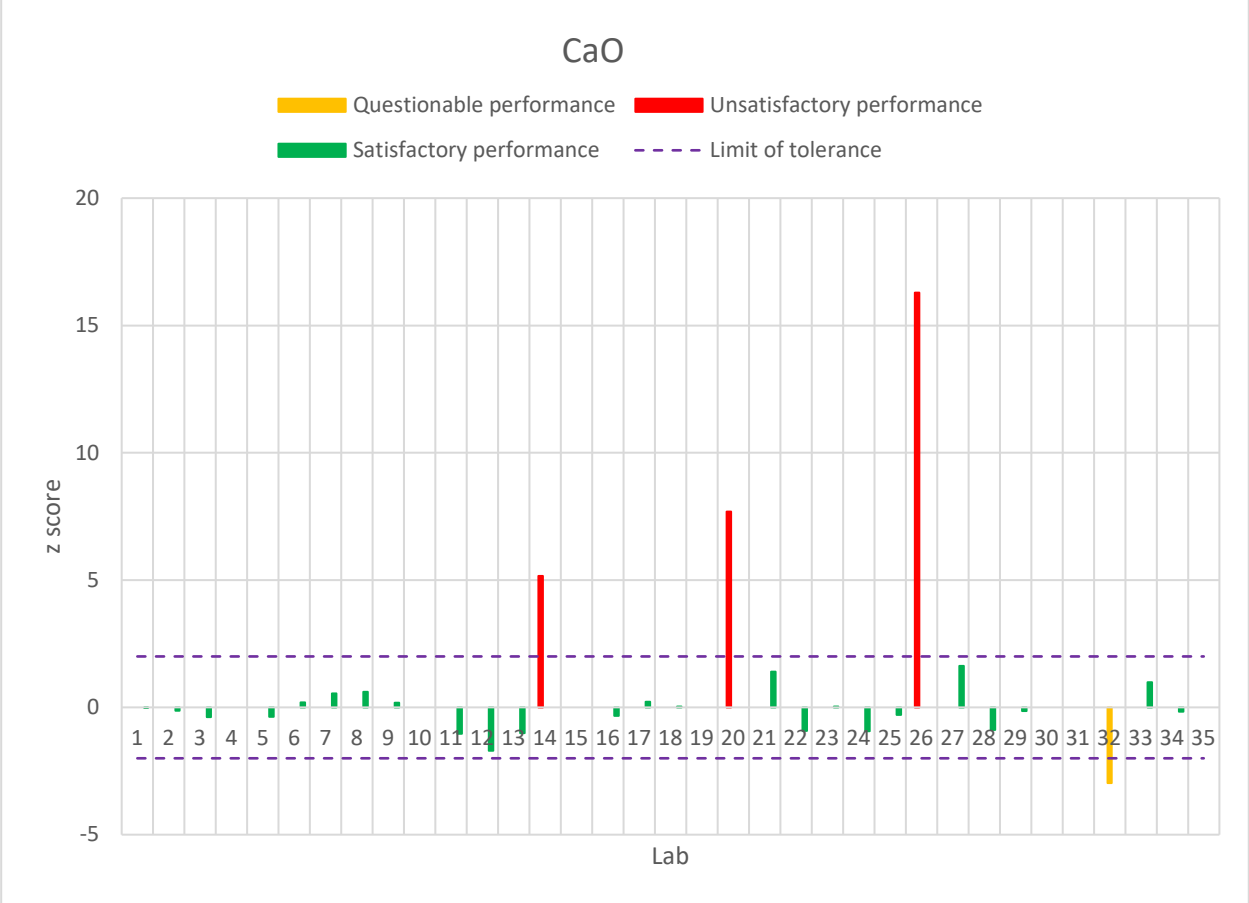
CHARTS SAMPLE B



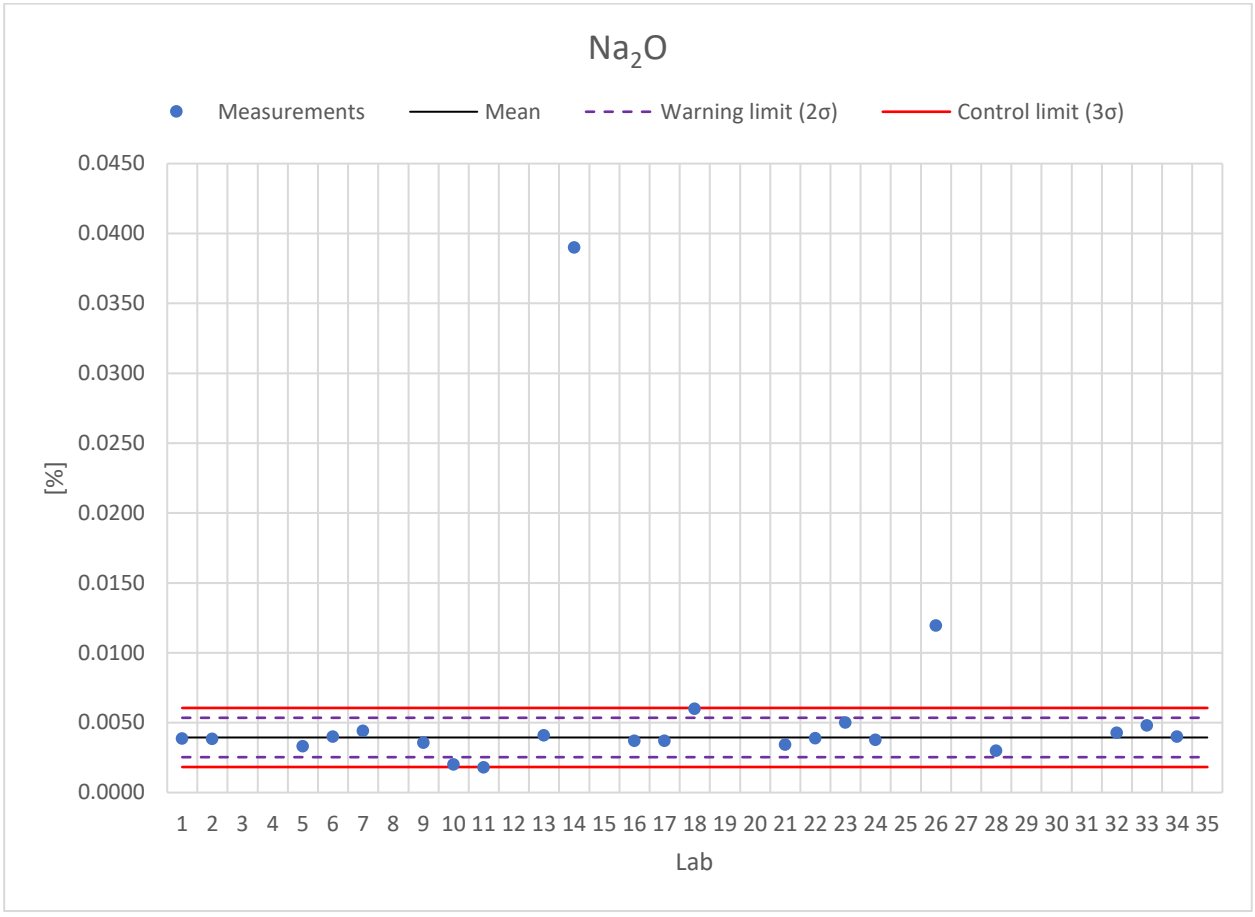


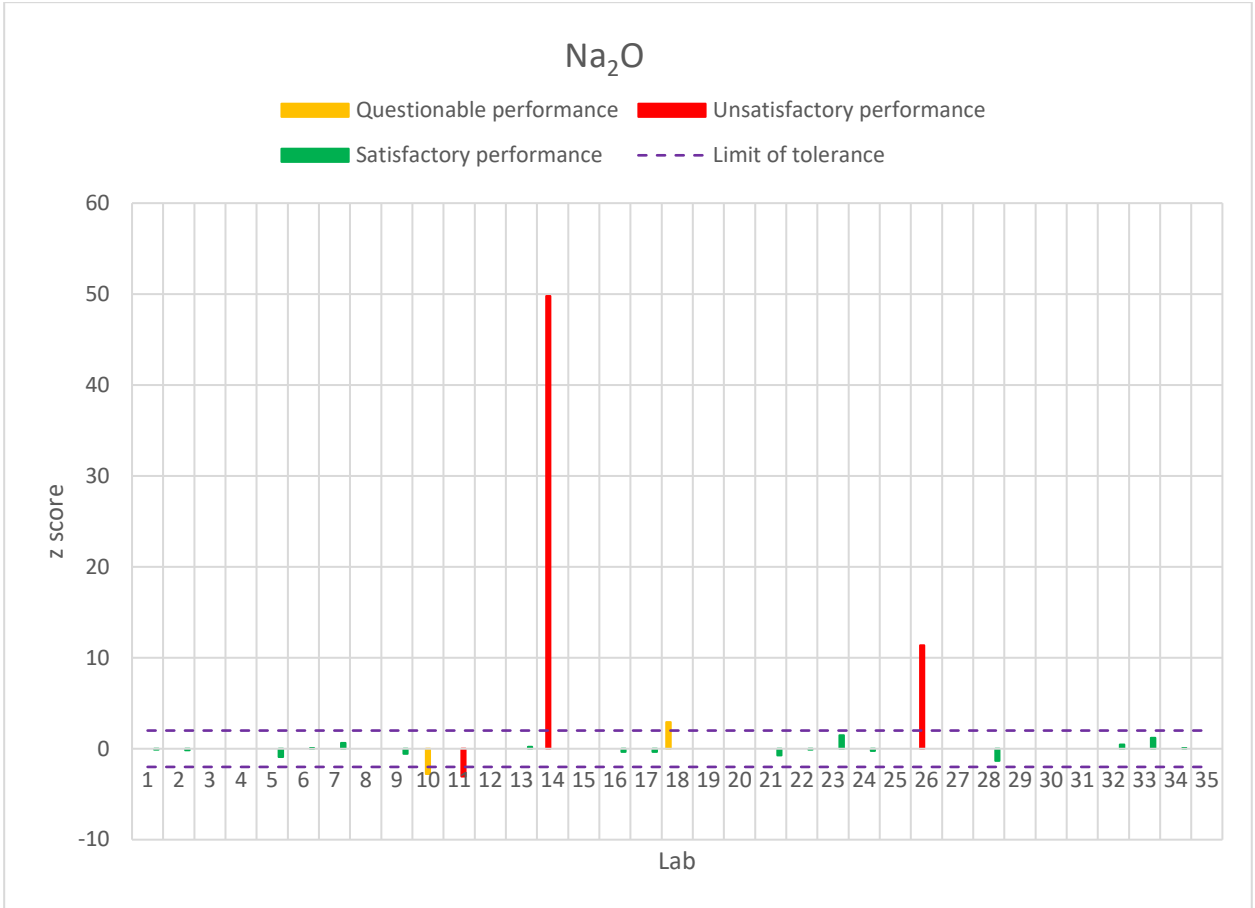
CHARTS SAMPLE B



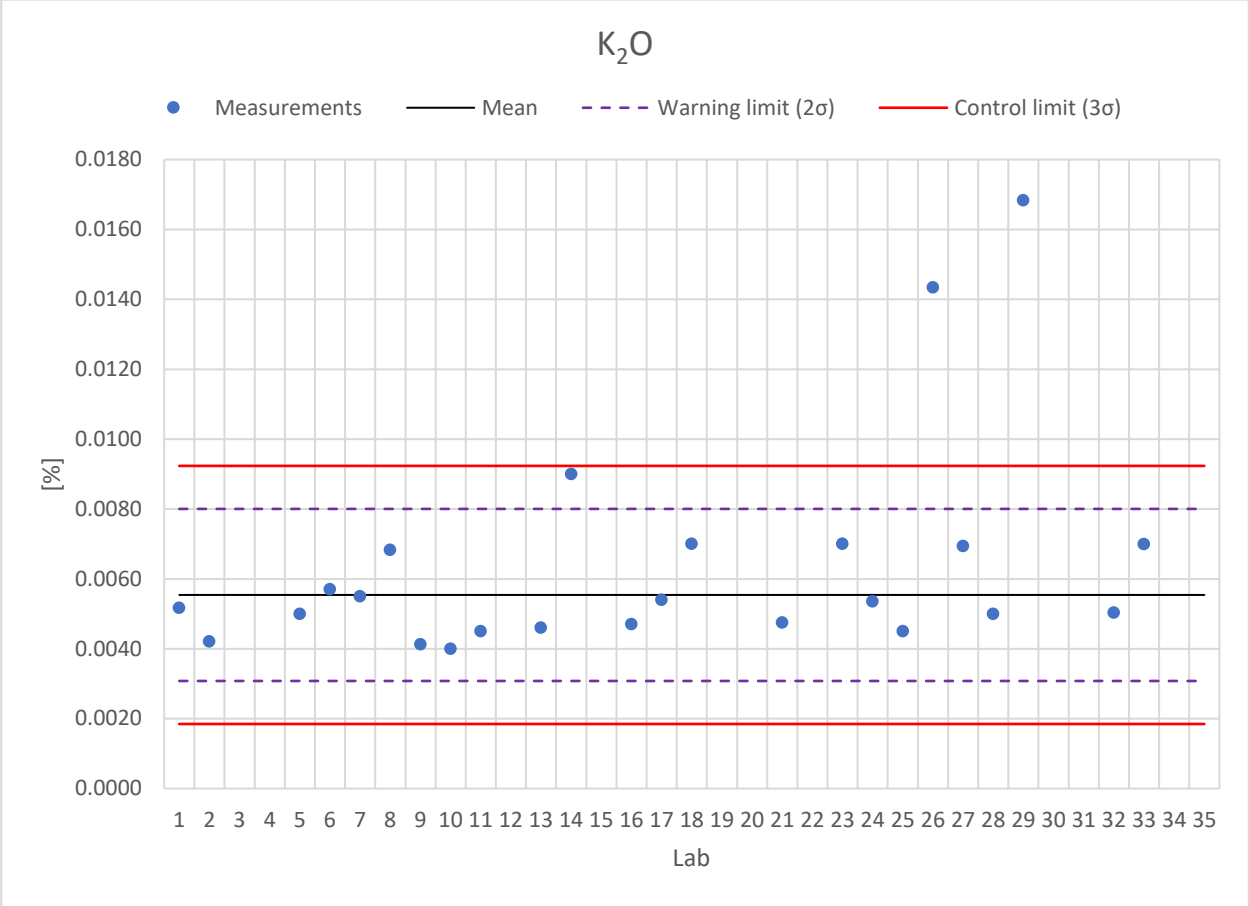


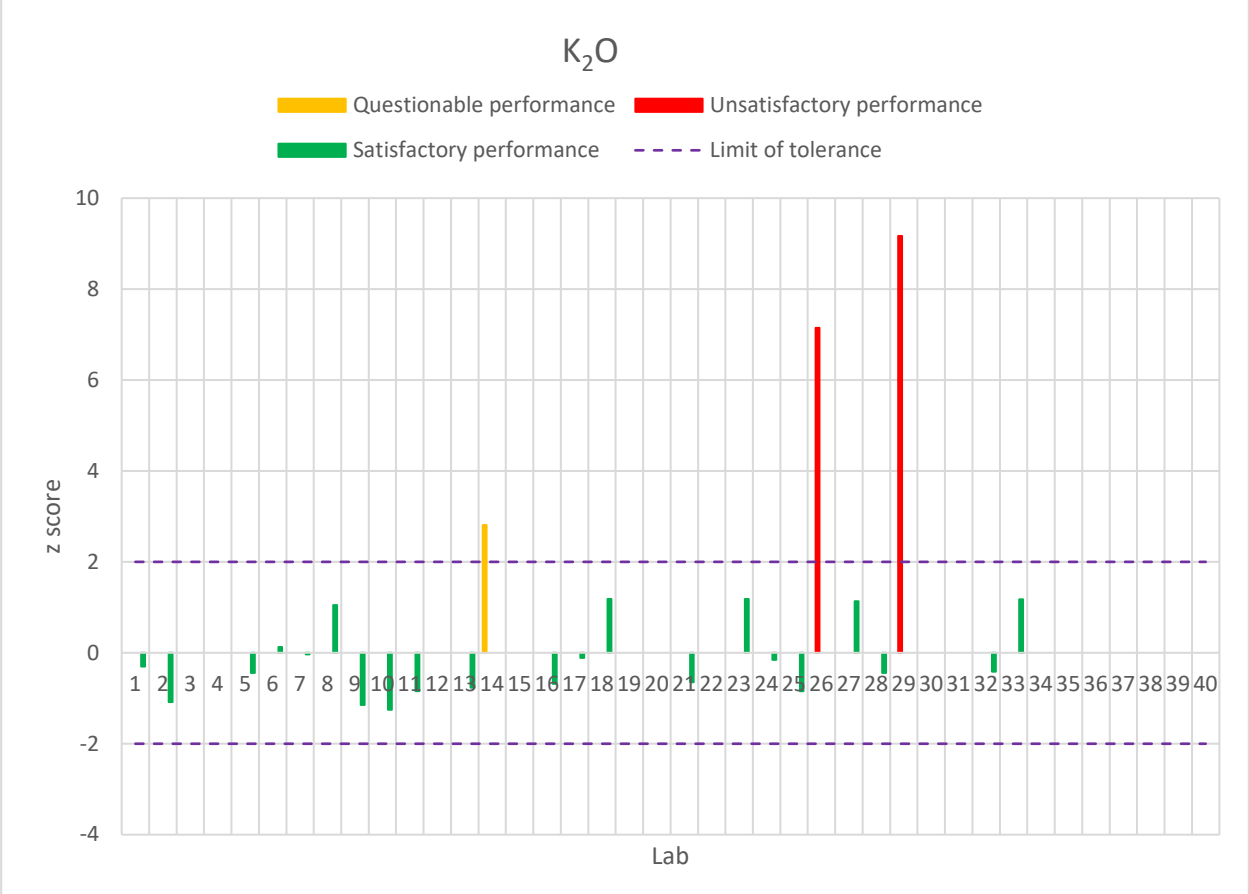
CHARTS SAMPLE B



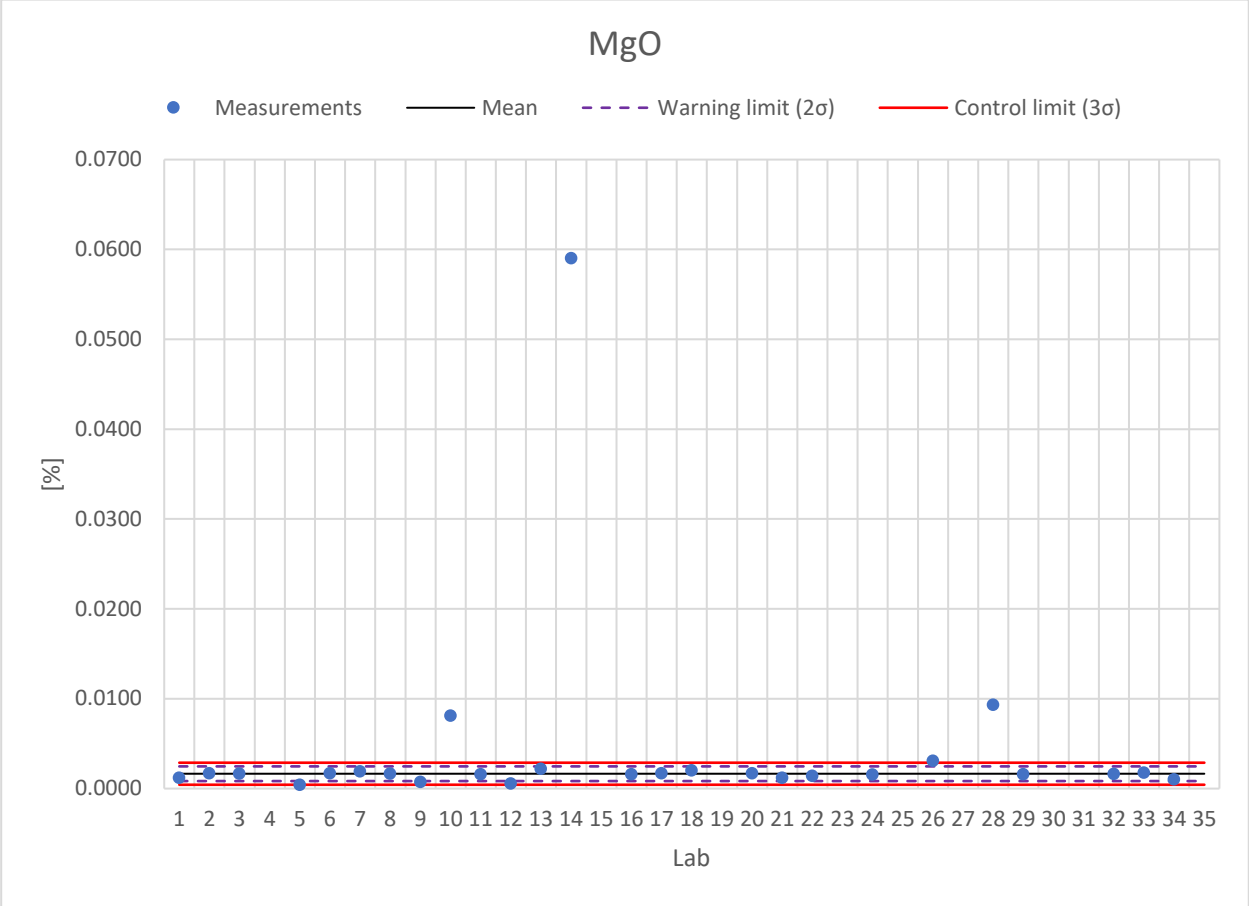


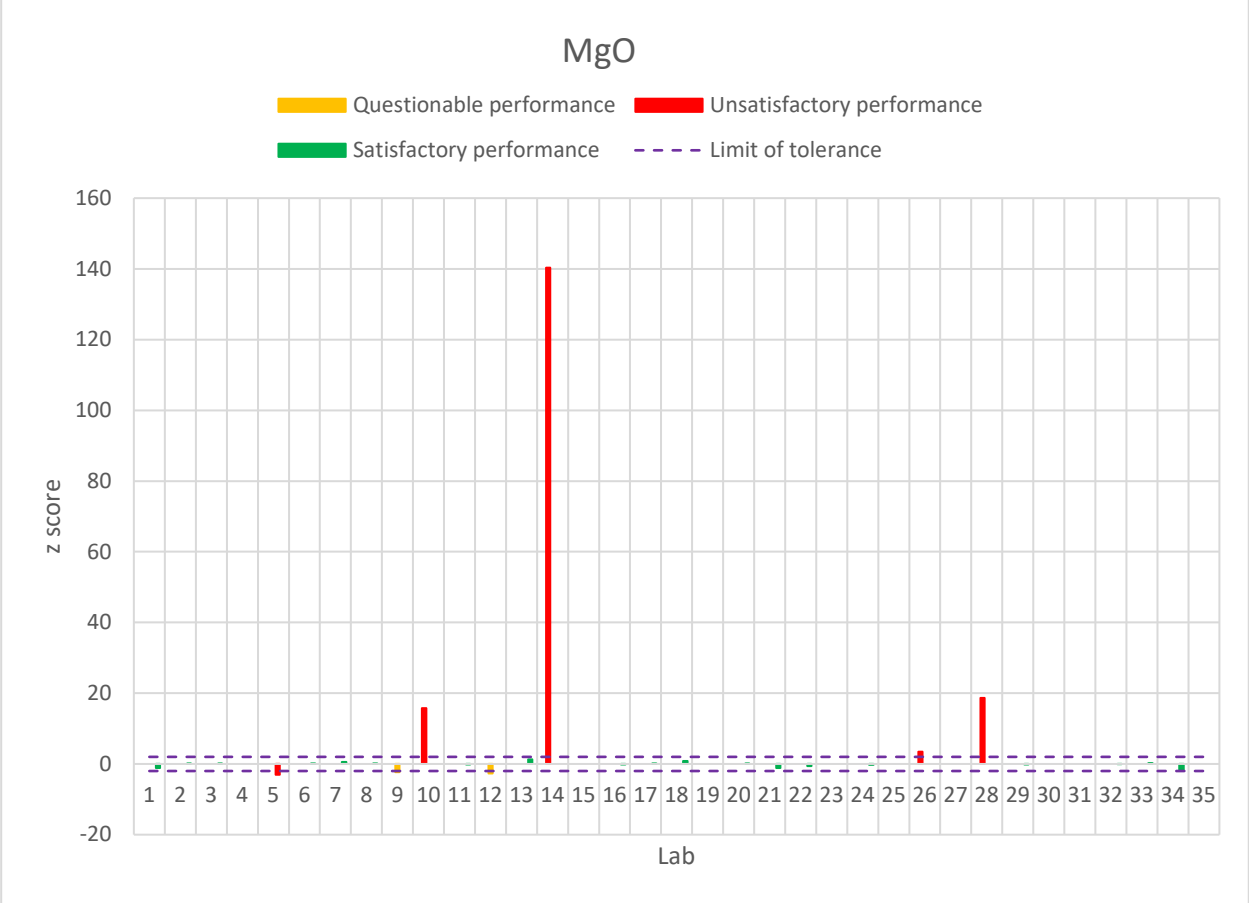
CHARTS SAMPLE B



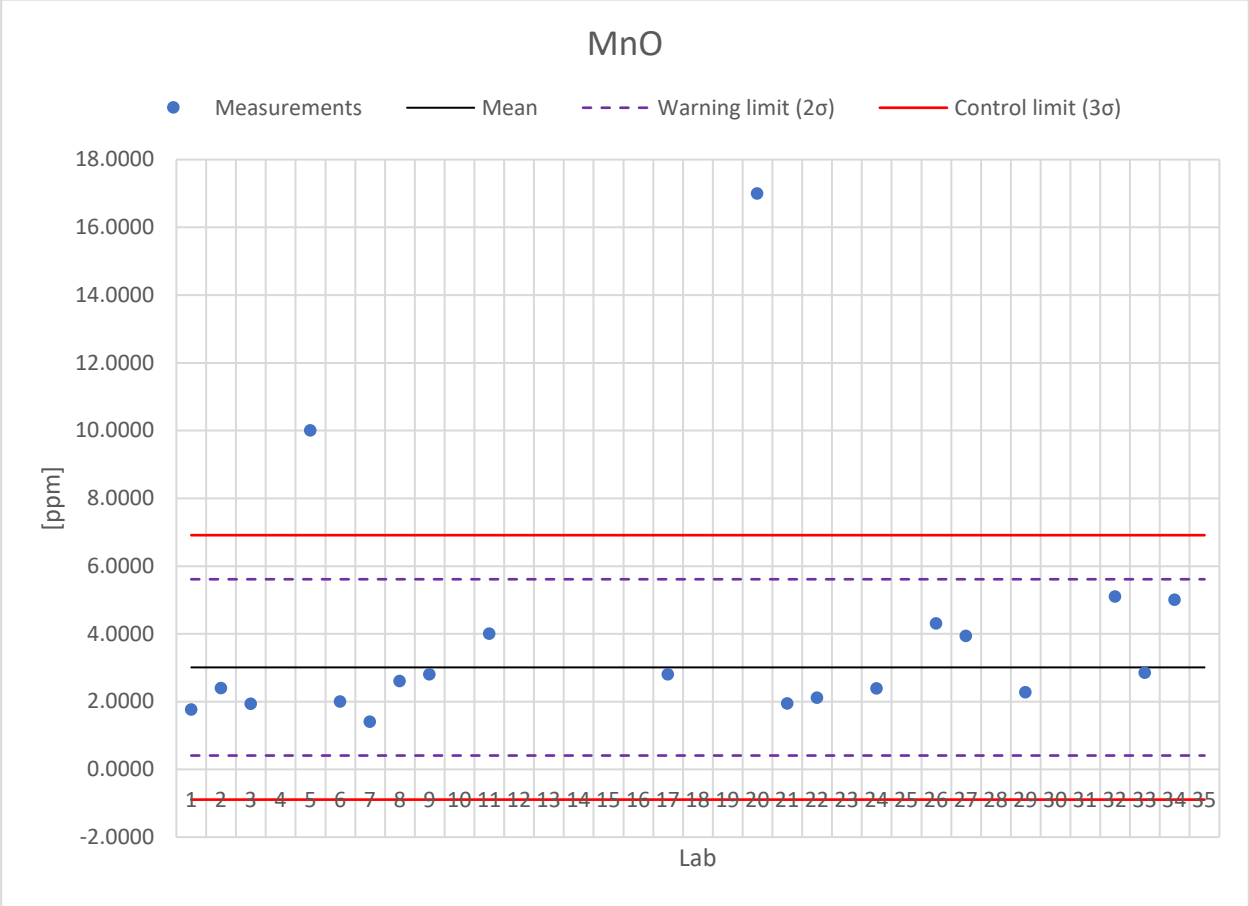


CHARTS SAMPLE B

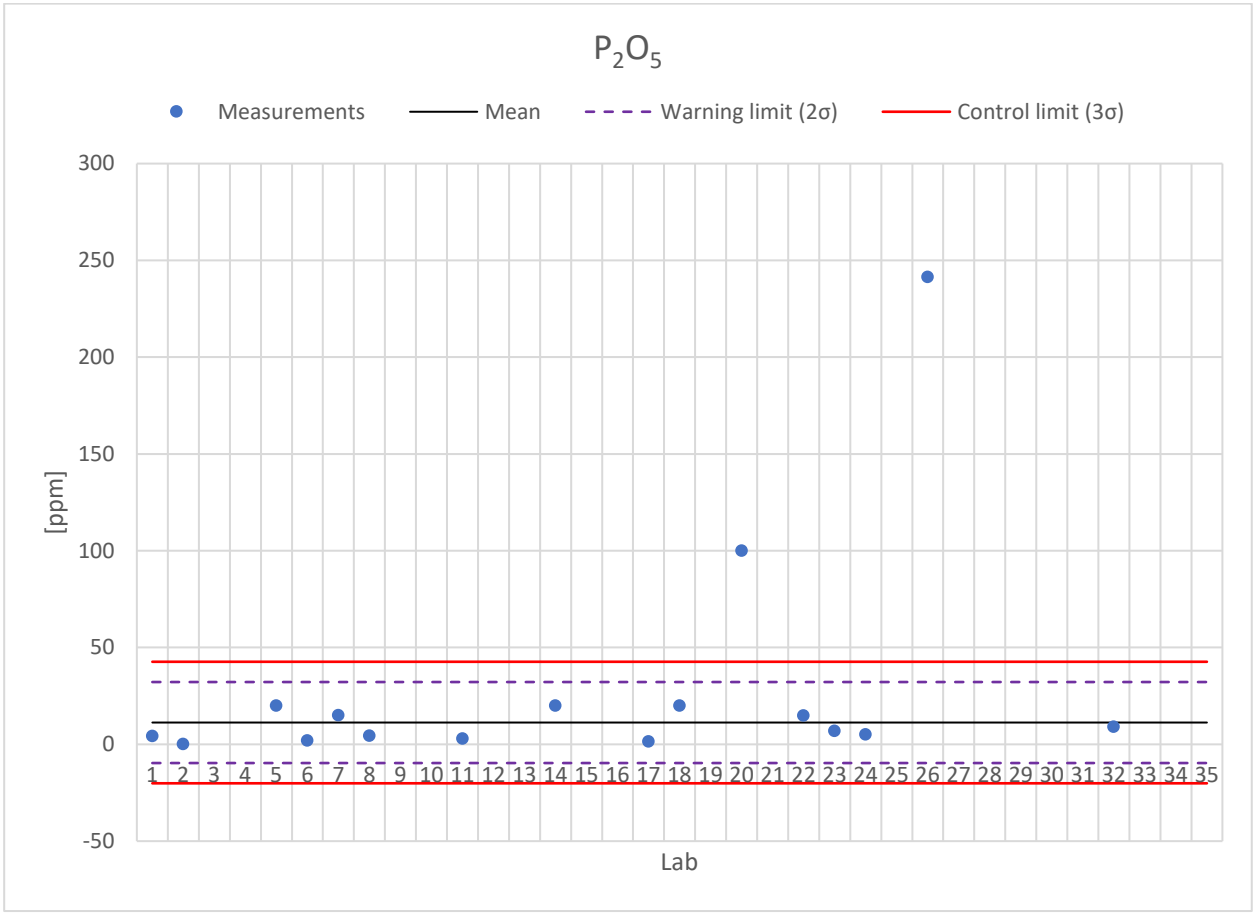


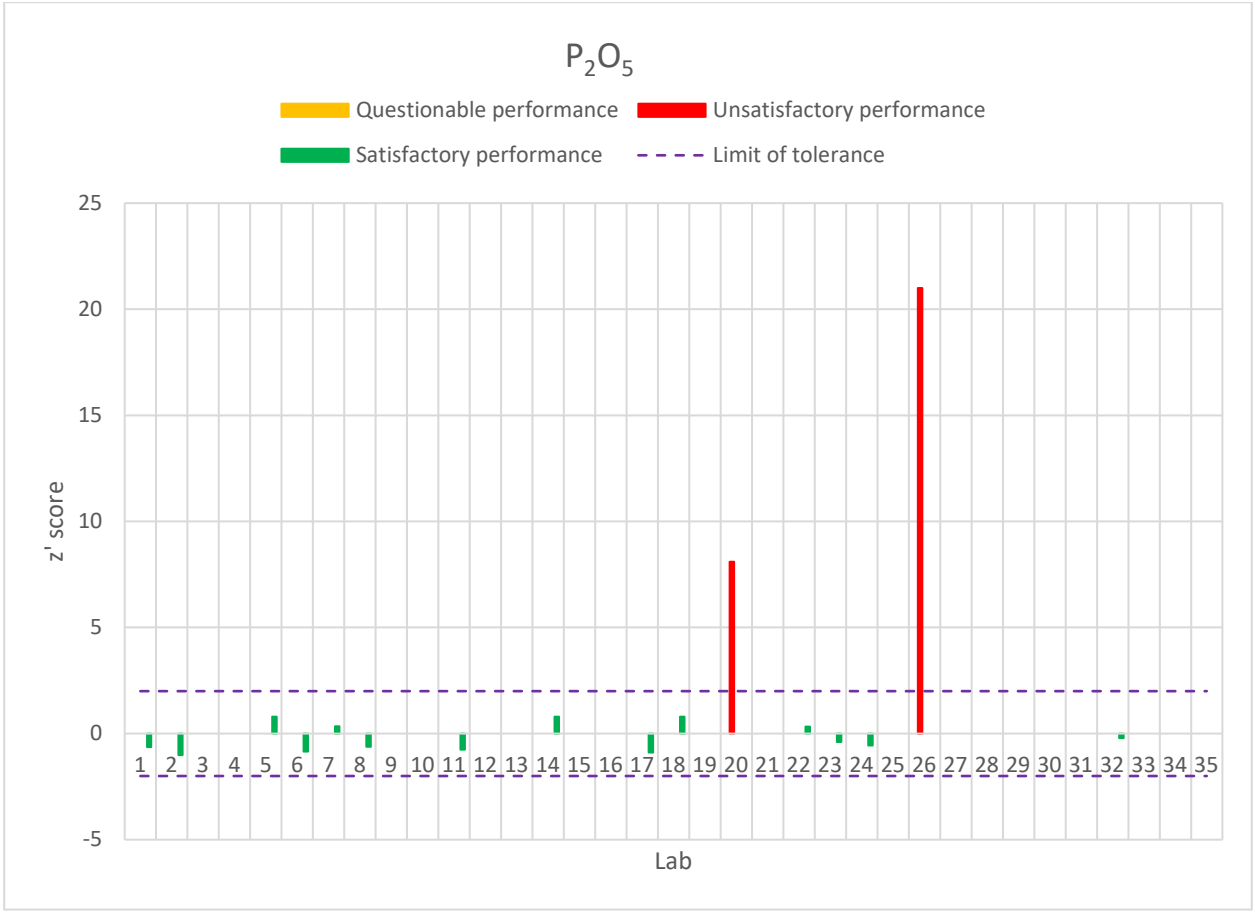


CHARTS SAMPLE B

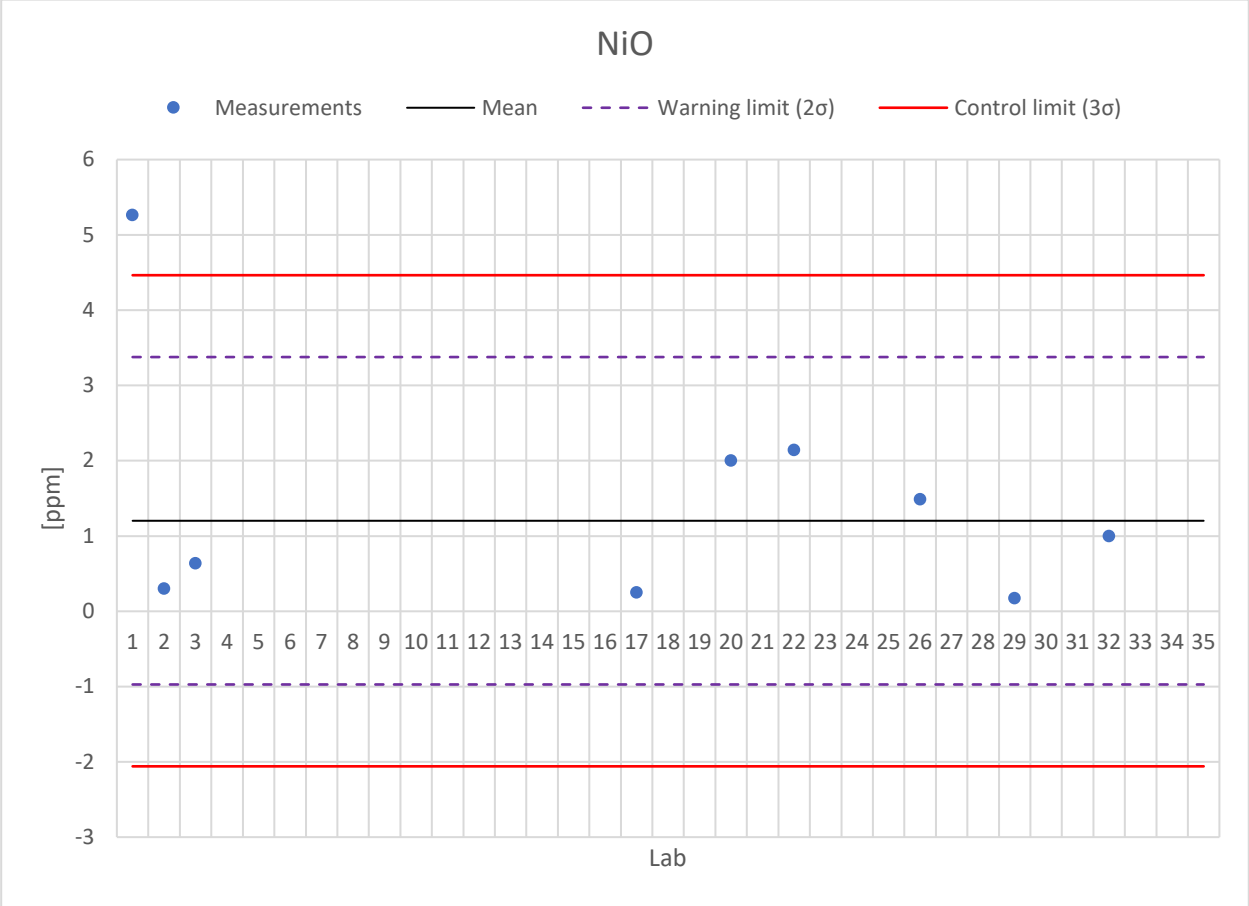


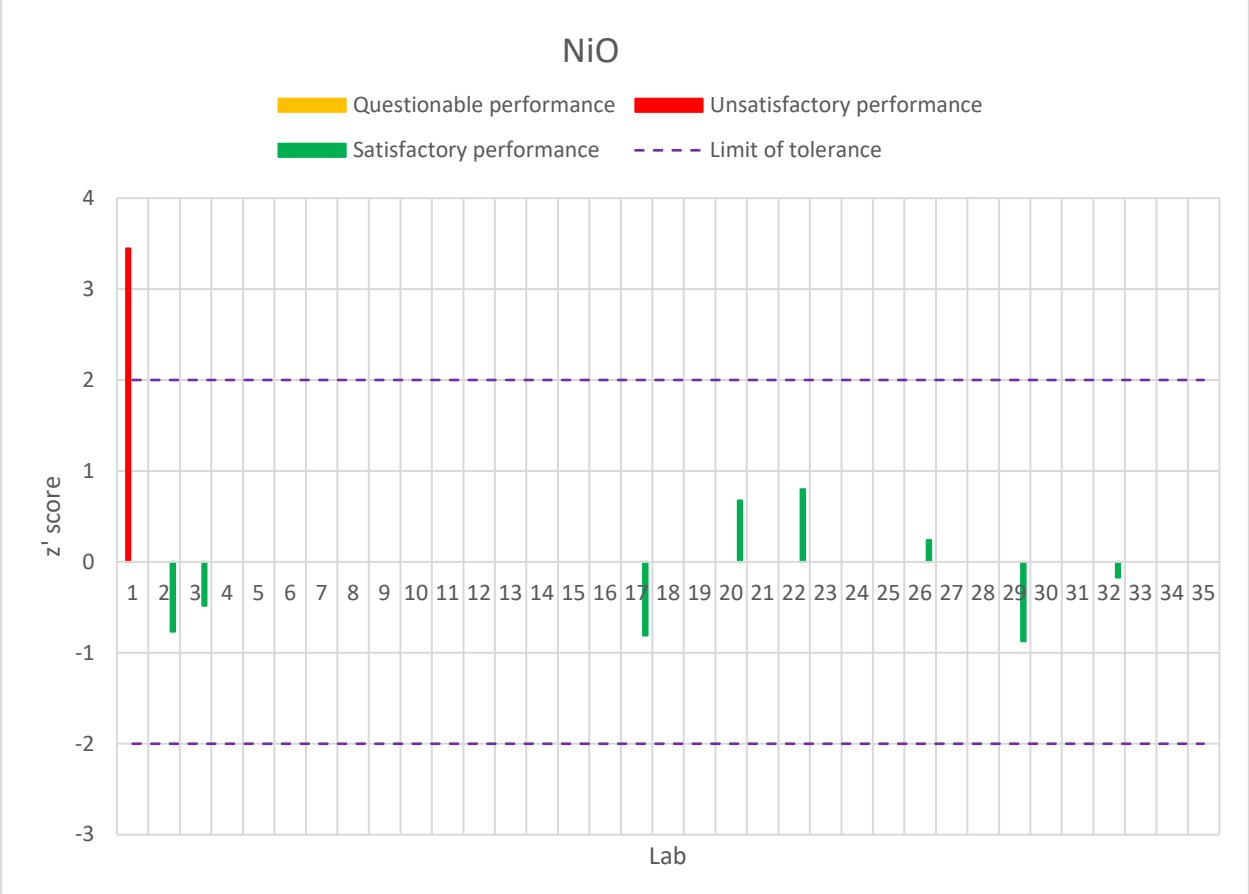
CHARTS SAMPLE B



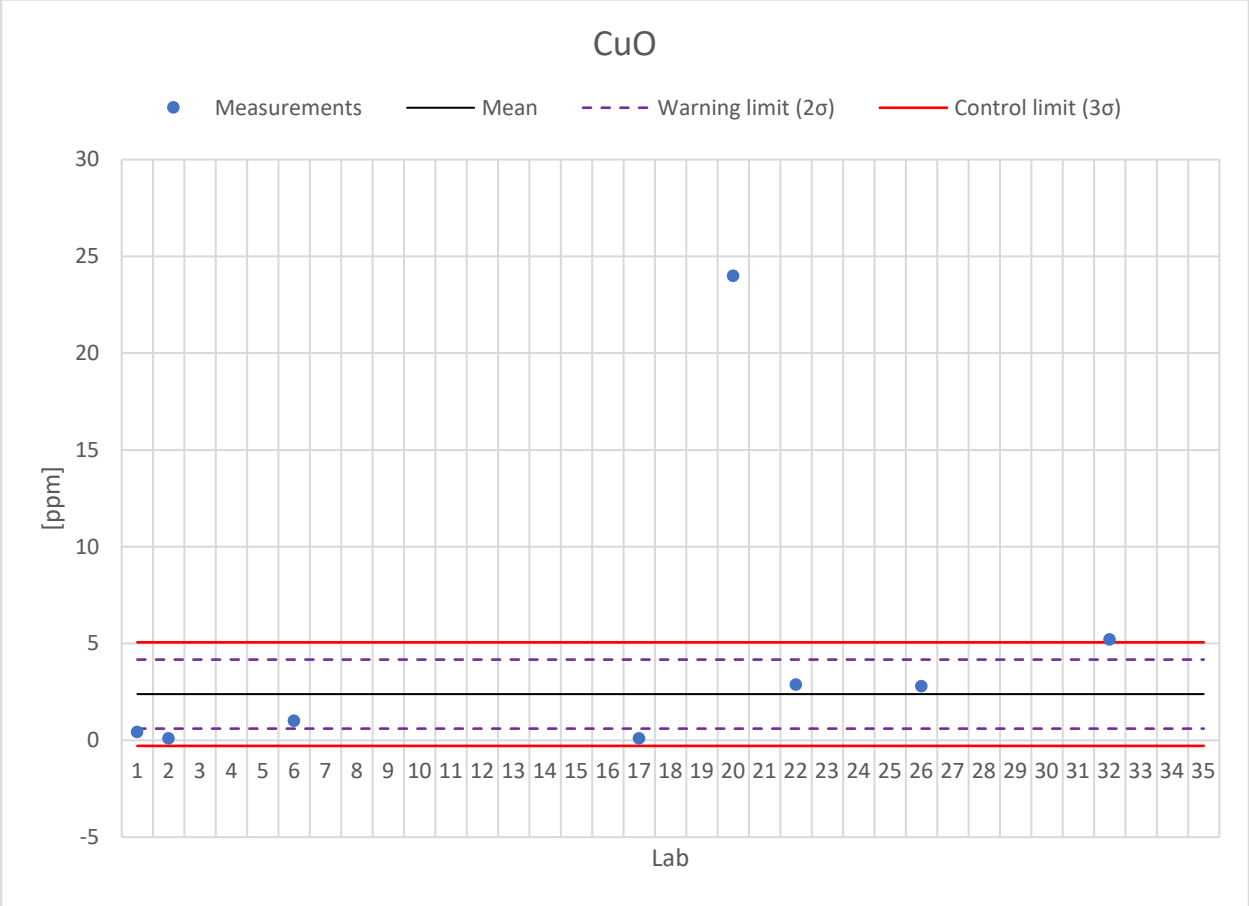


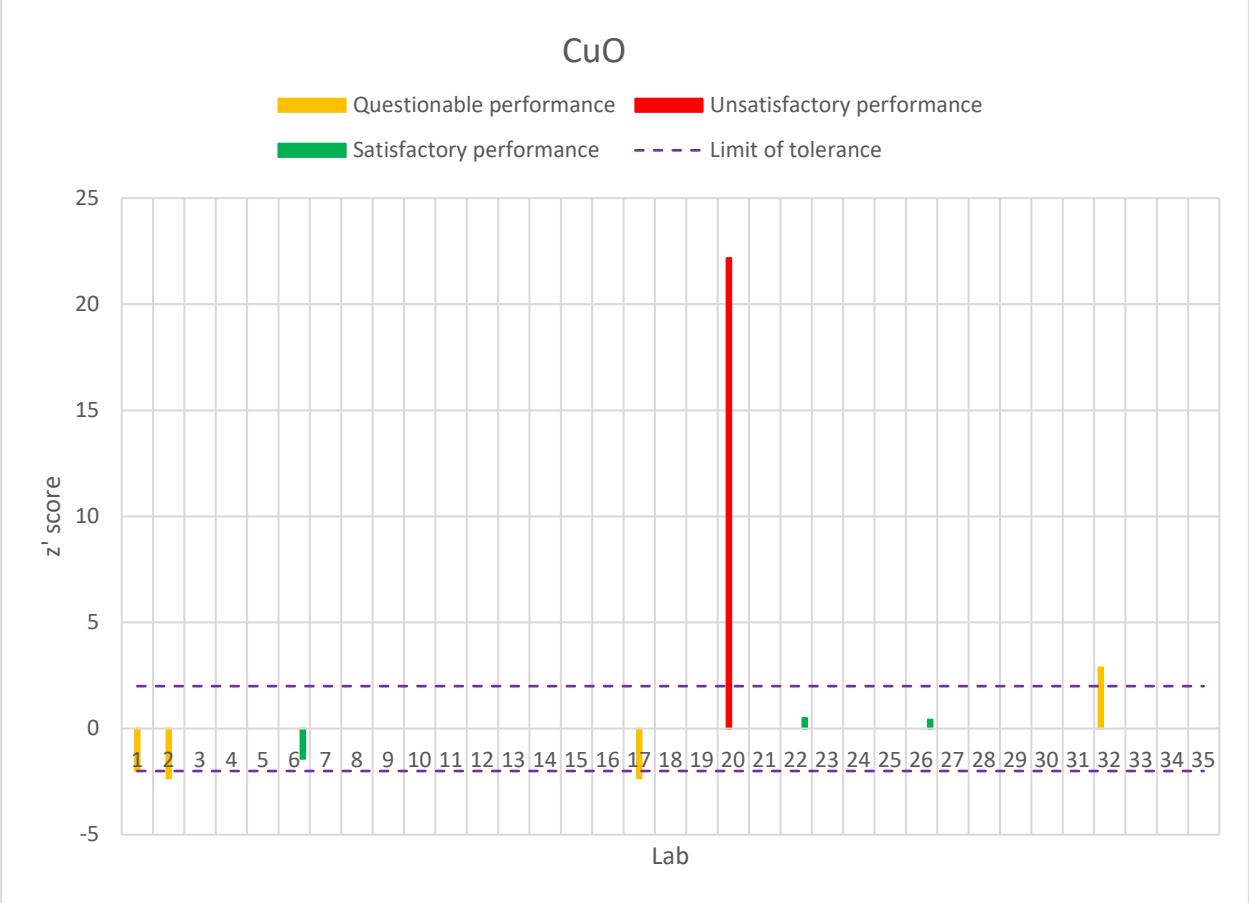
CHARTS SAMPLE B



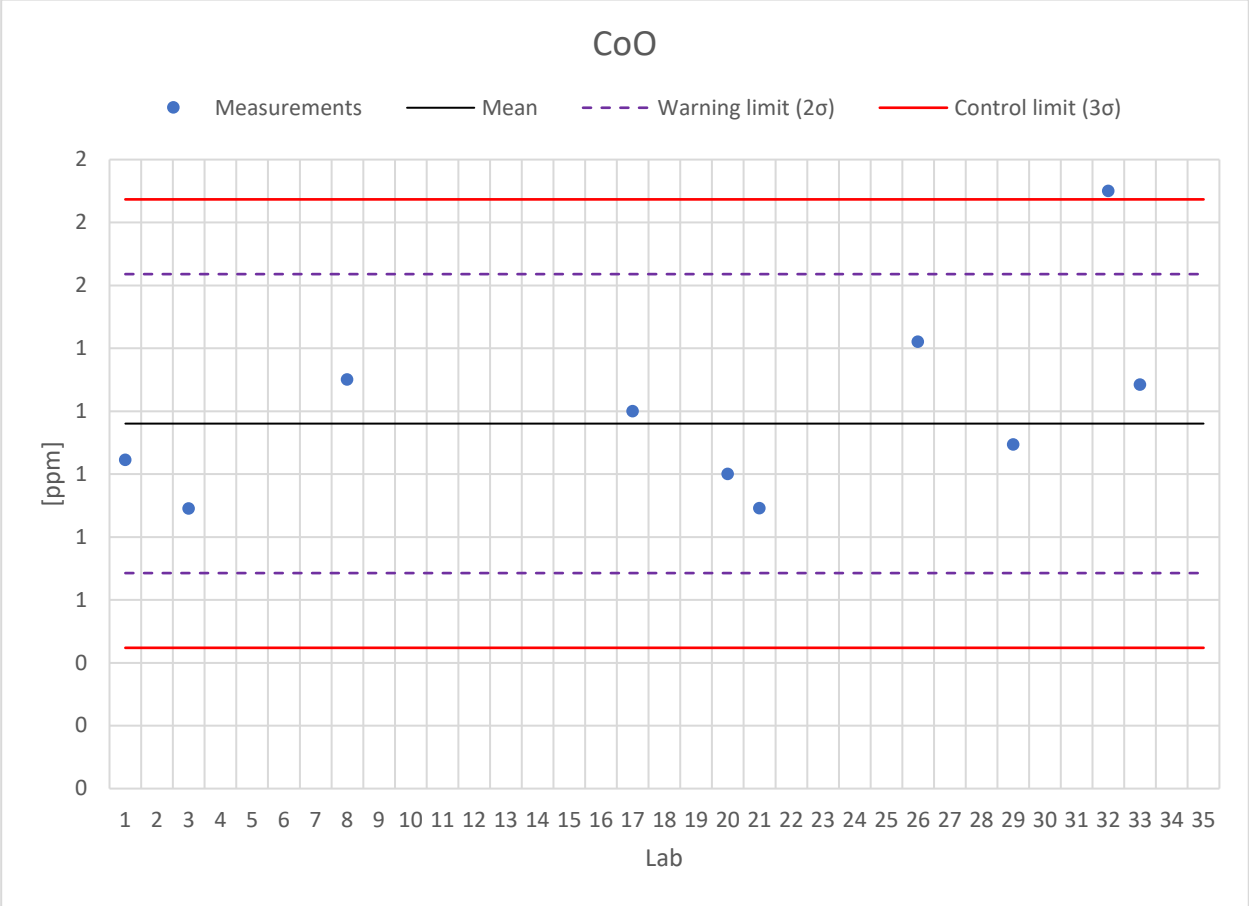


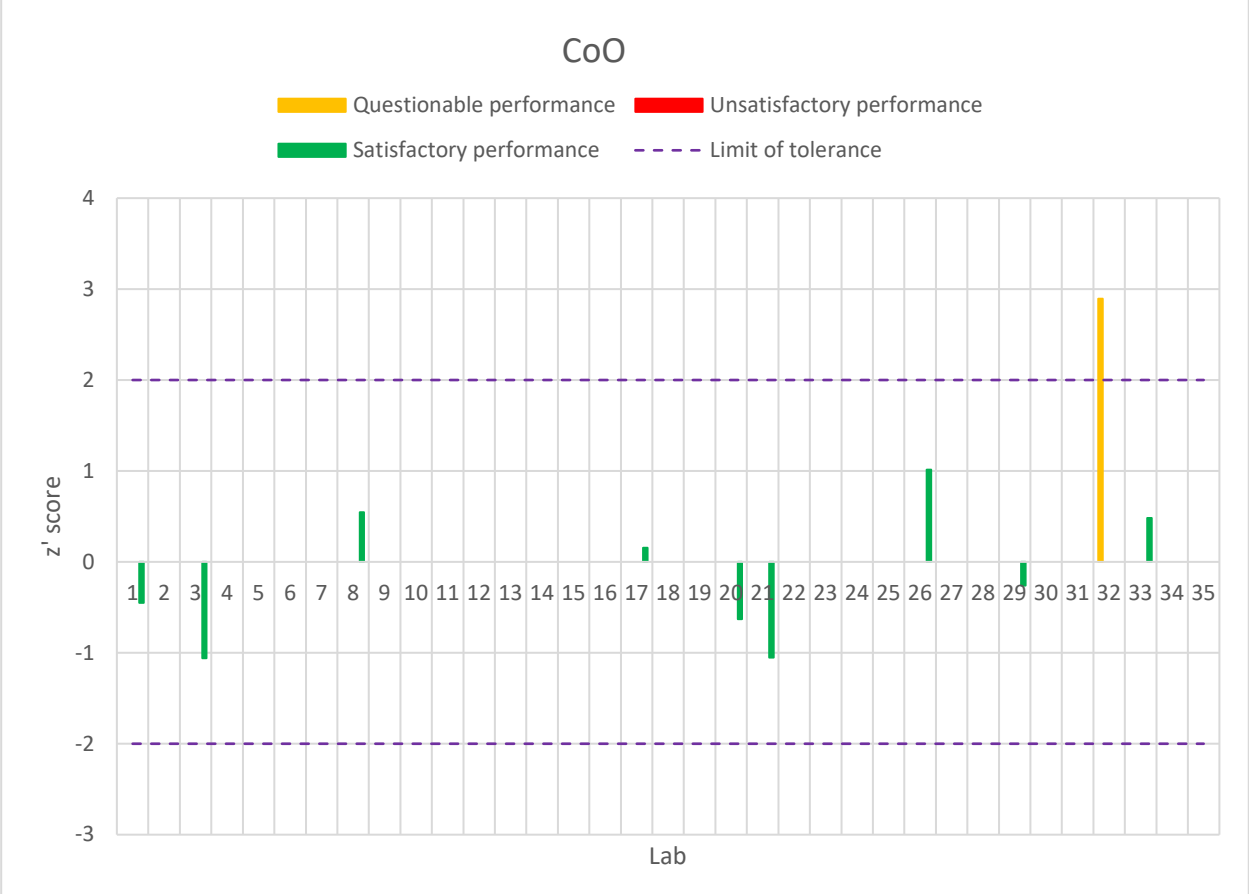
CHARTS SAMPLE B



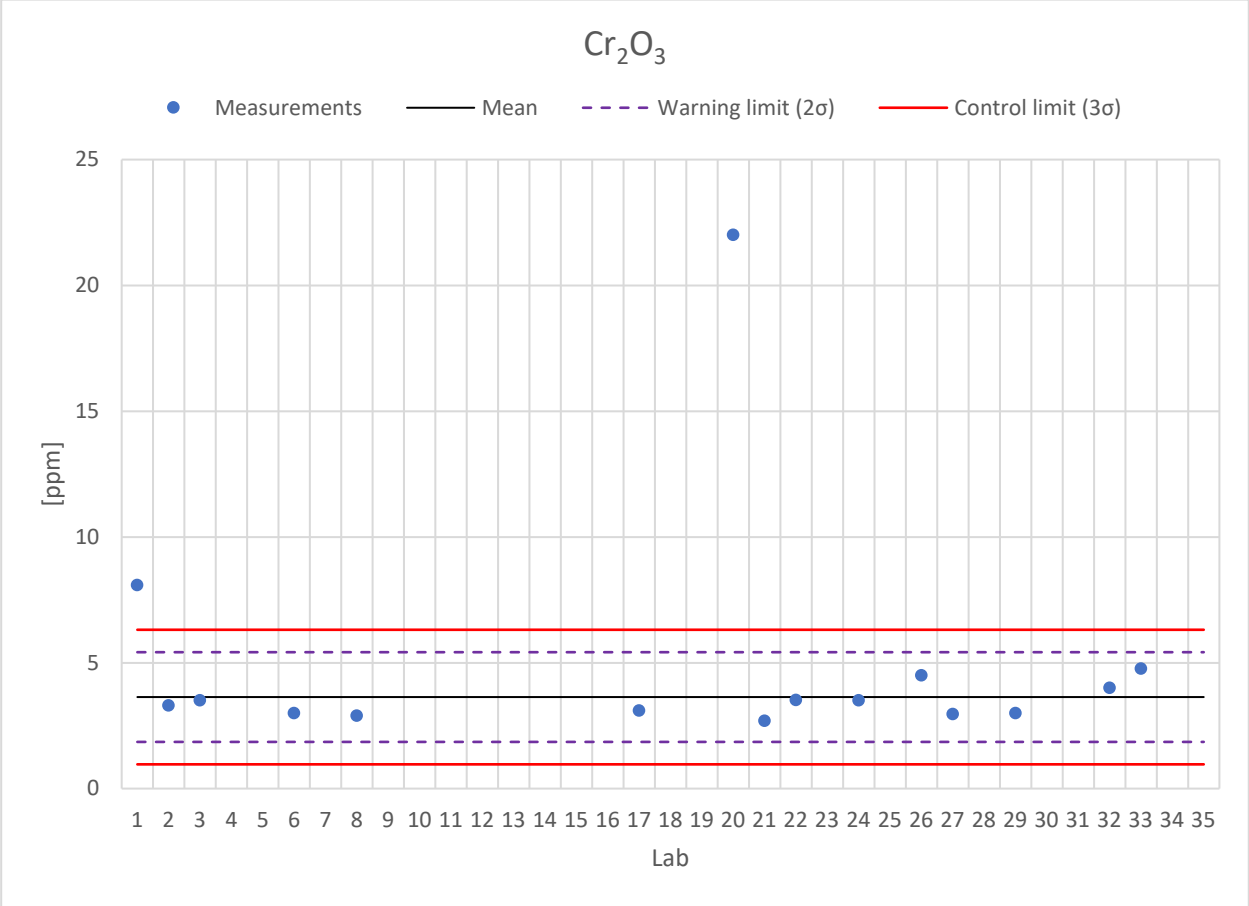


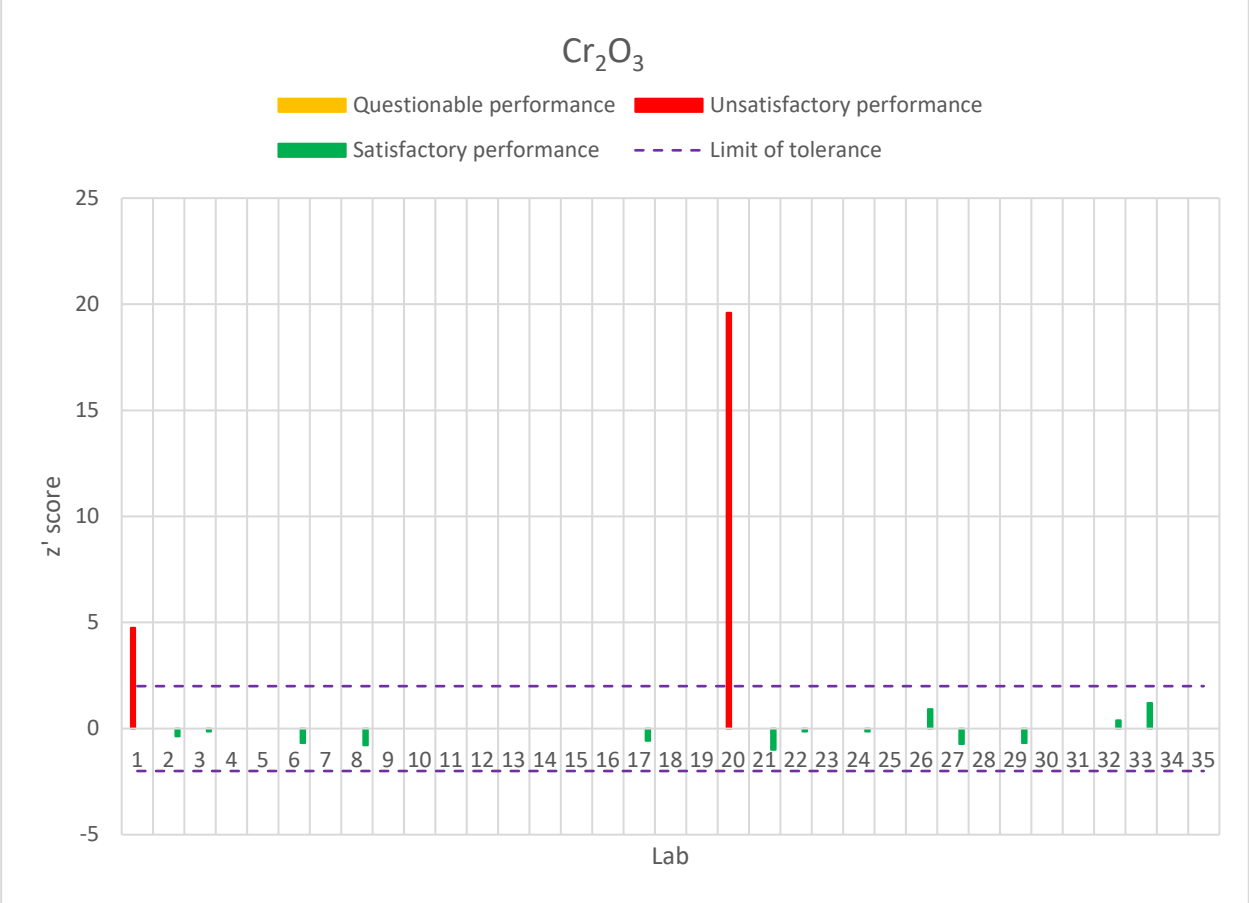
CHARTS SAMPLE B



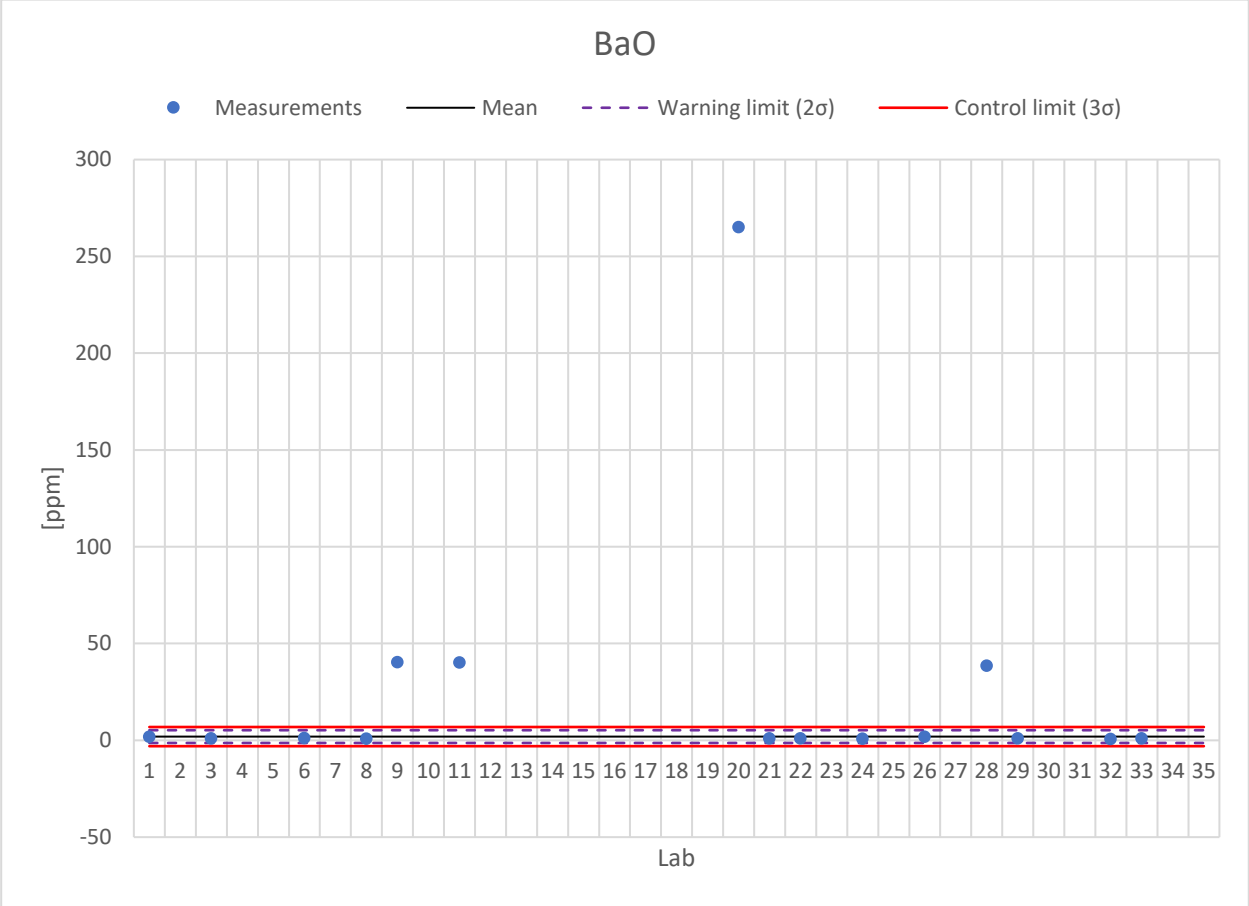


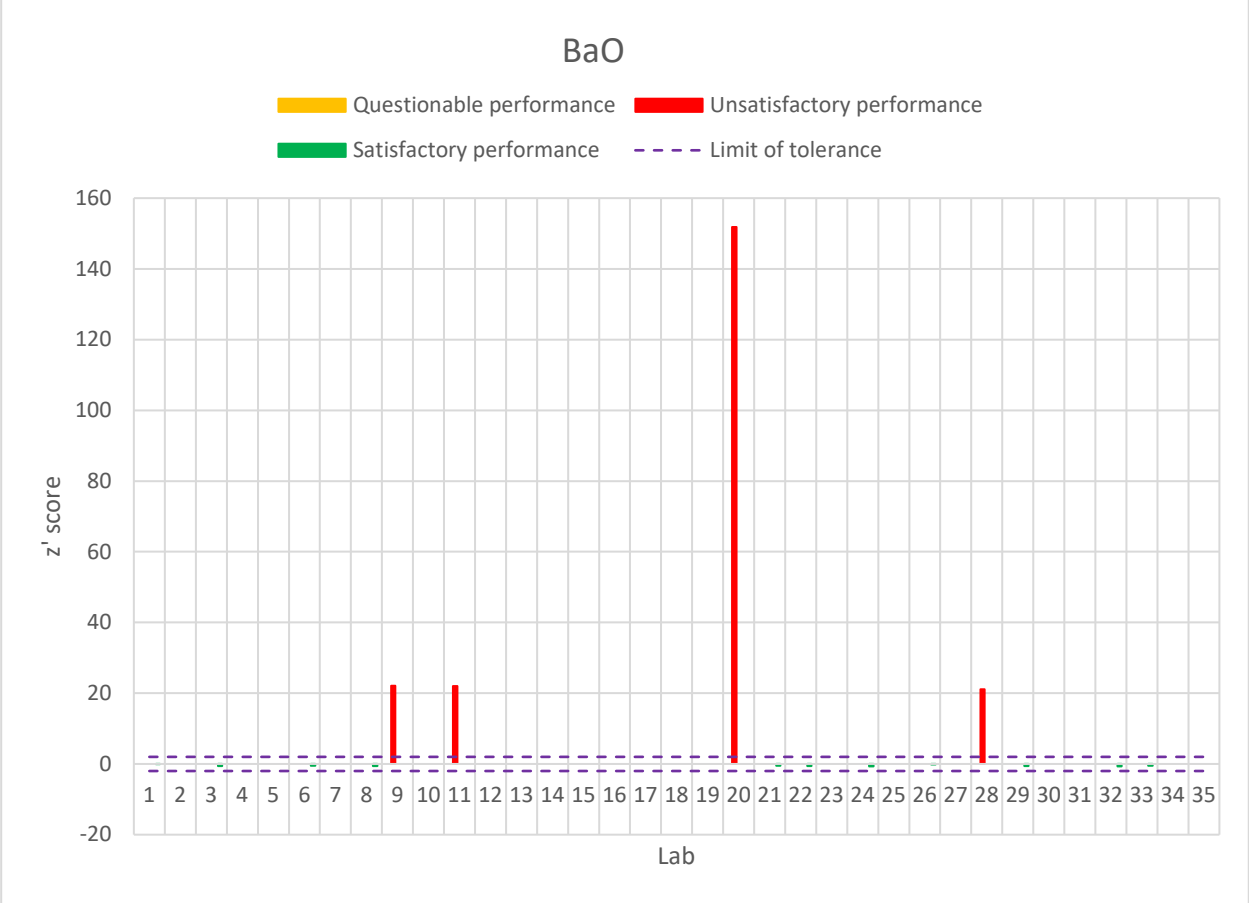
CHARTS SAMPLE B



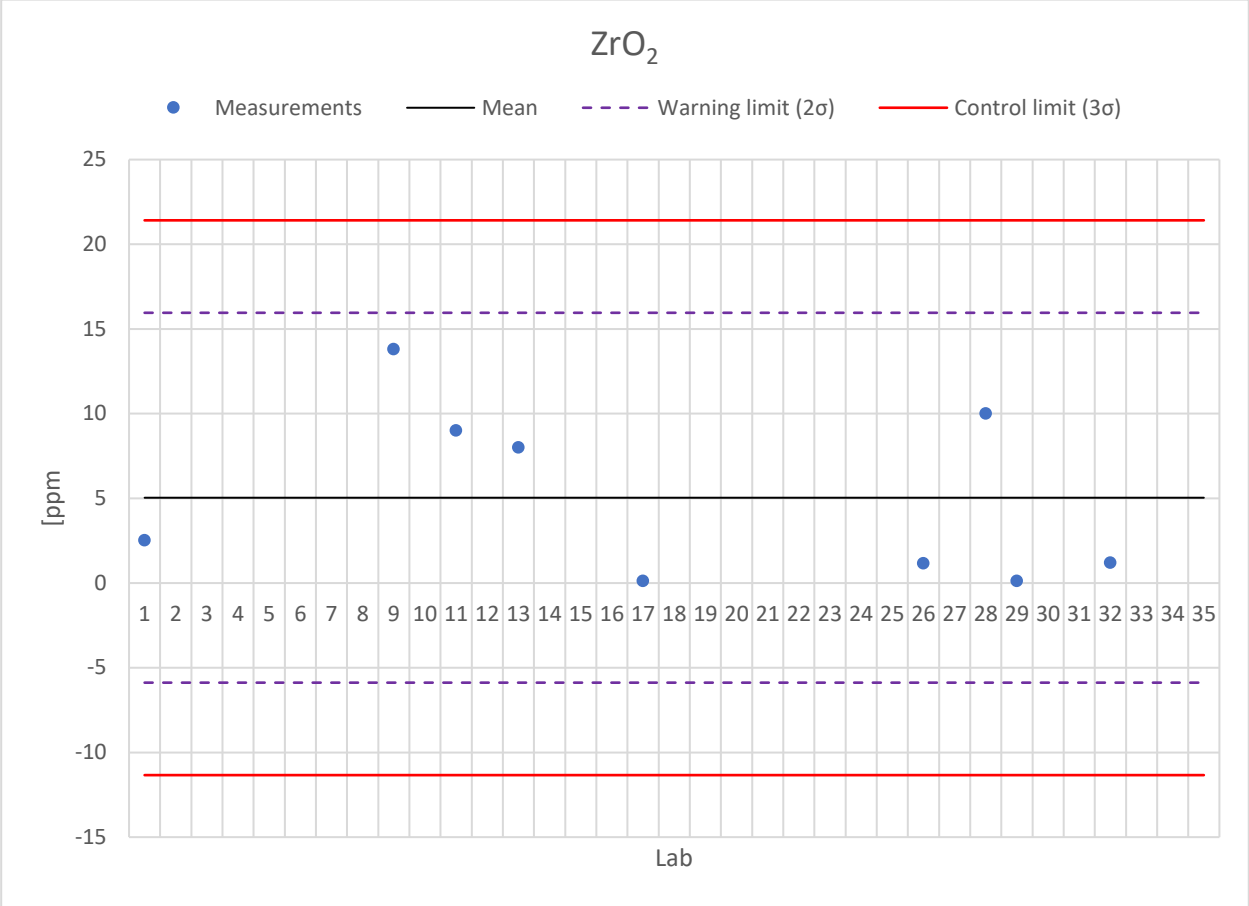


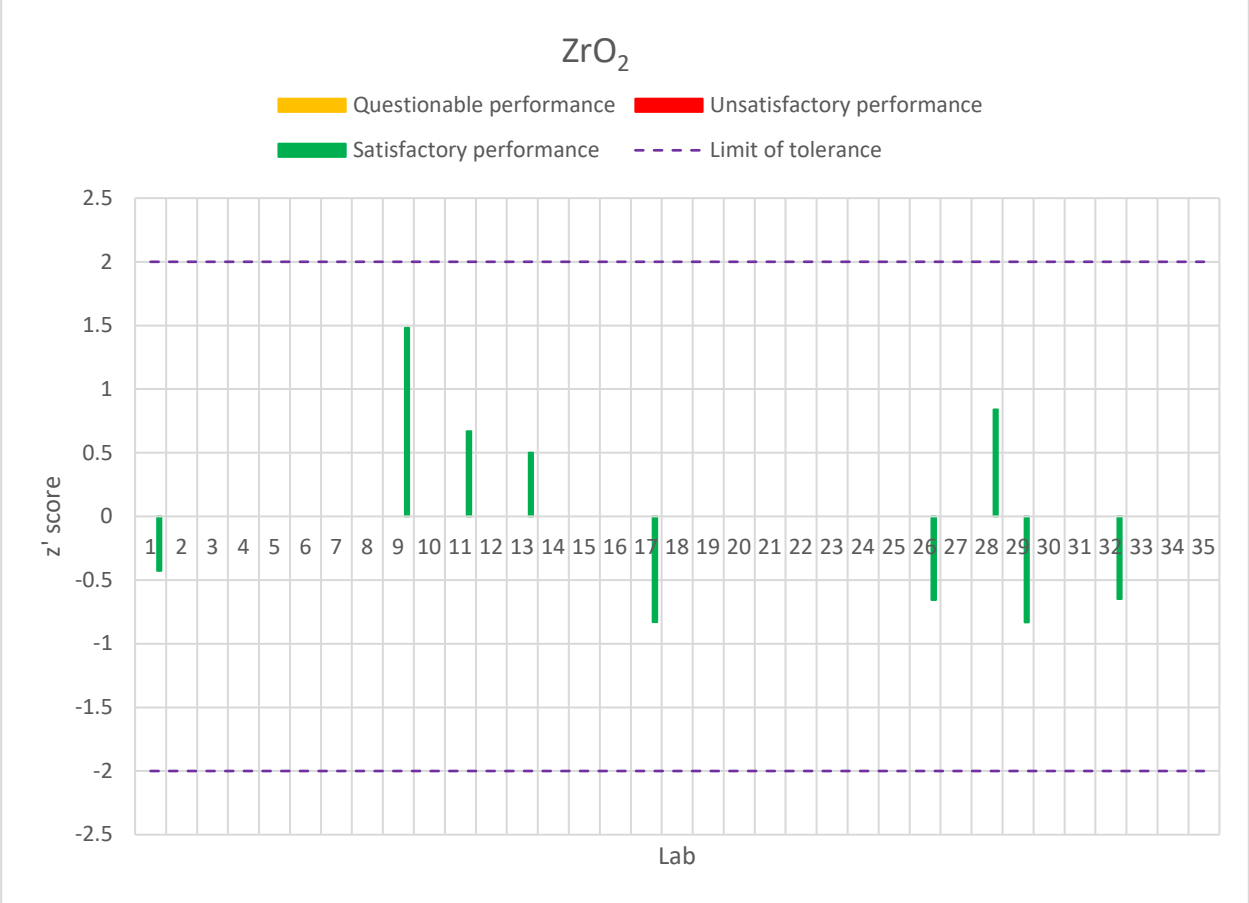
CHARTS SAMPLE B



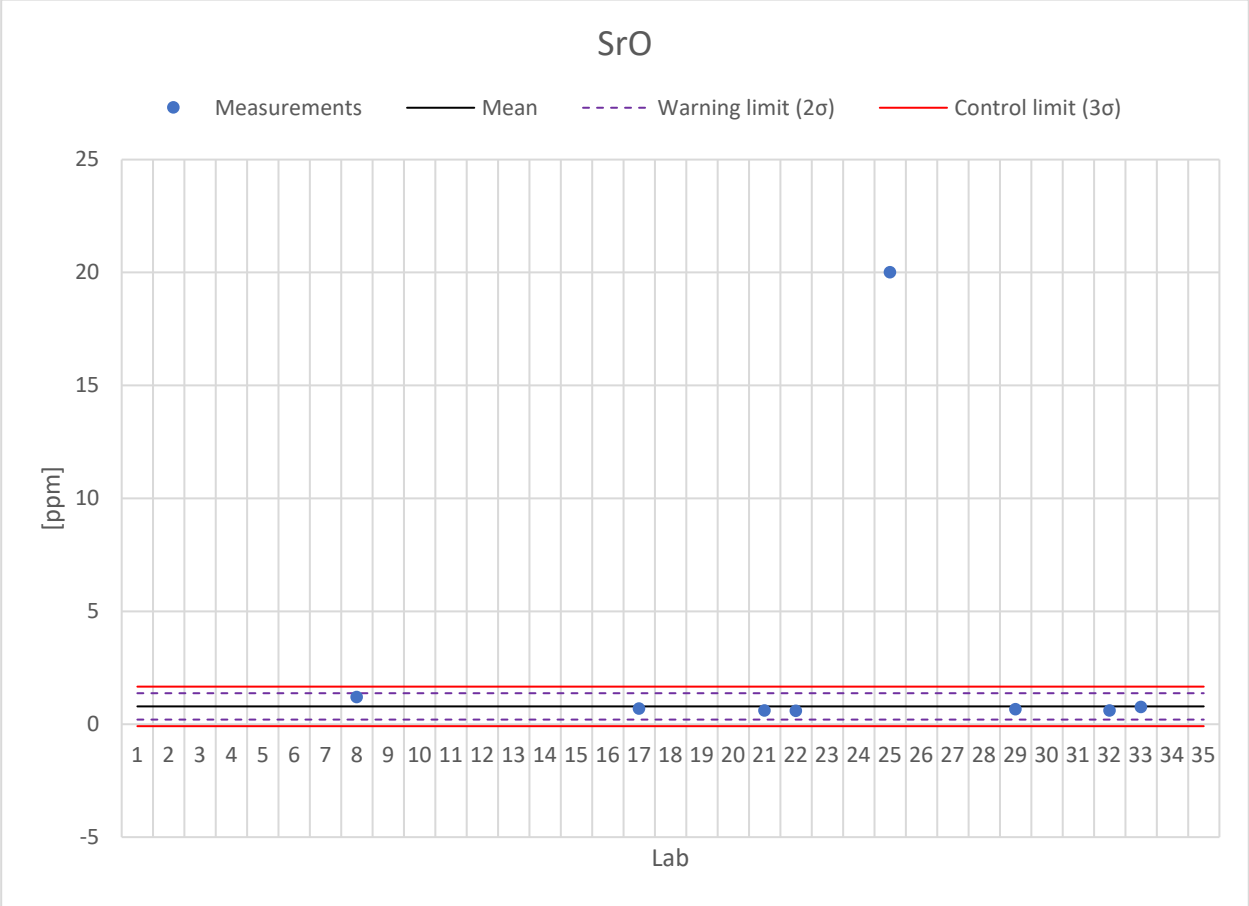


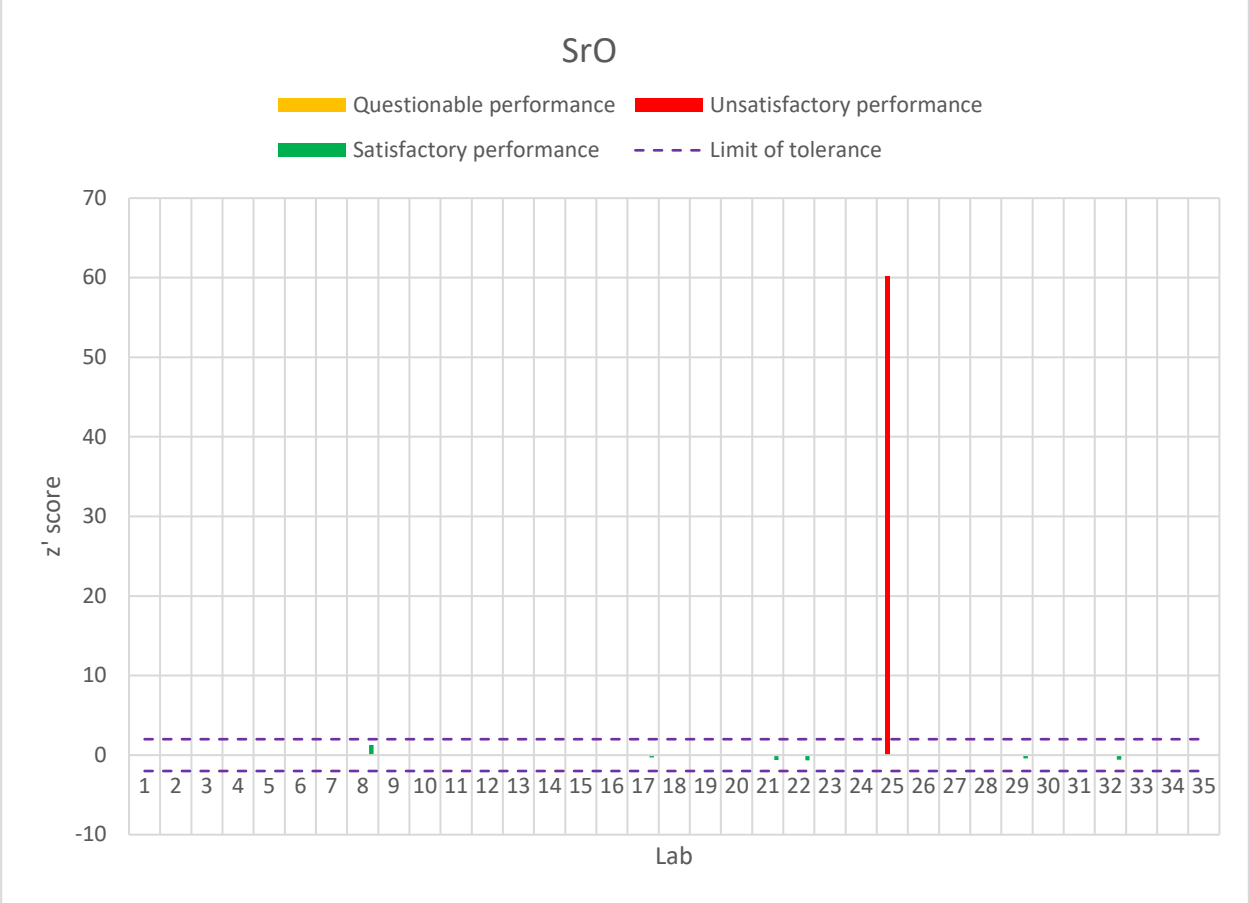
CHARTS SAMPLE B



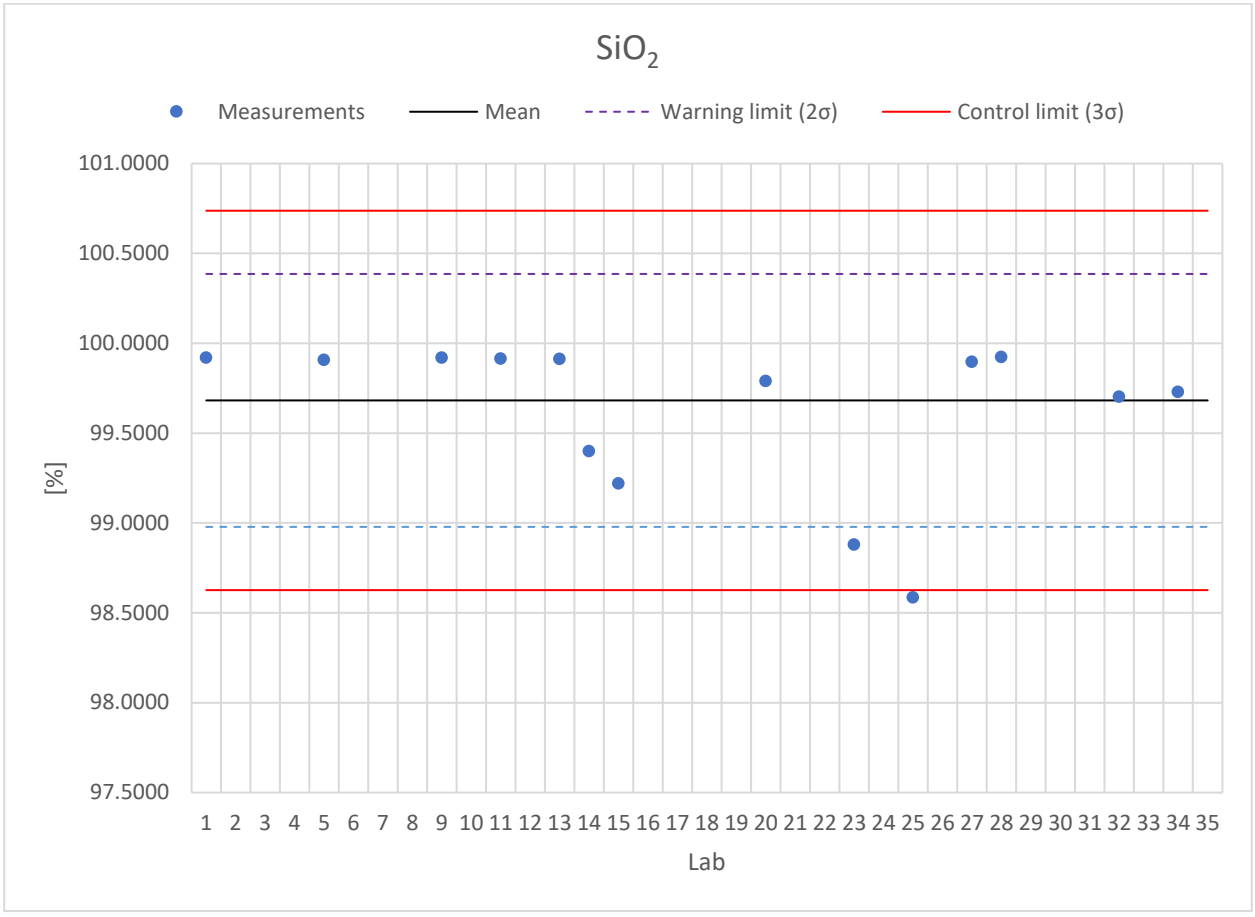


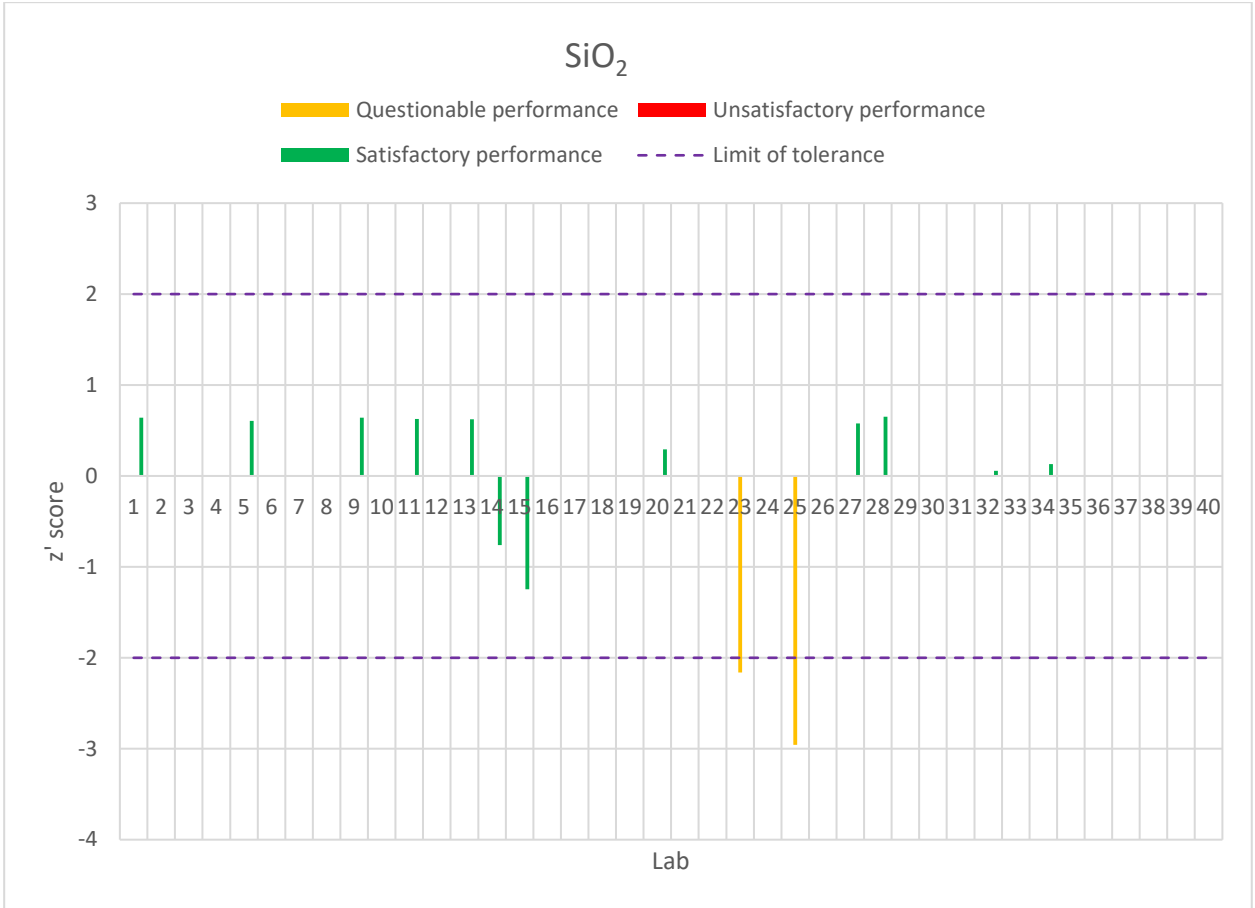
CHARTS SAMPLE B





CHARTS SAMPLE B





ANNEX 5.3. MEASUREMENTS SAMPLE C

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
	%	%	%	%	%	%	%	ppm	ppm	ppm
x_{pt}	0.2295	0.0669	0.0078	0.0243	0.0090	0.0634	0.0091	8.29	67.84	32.00
σ_{pt}	0.0200	0.0073	0.0011	0.0043	0.0014	0.0037	0.0016	1.44	10.00	9.59
N	30	29	28	29	23	28	27	22	25	8

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
Lab 1	0.2310	0.0645	0.0076	0.0245	0.0091	0.0636	0.0090	7.4	50.6	34.5
Lab 2	0.2497	0.0706	0.0086	0.0238	0.0095	0.0598	0.0101	7.9	67.8	
Lab 3	0.2267	0.0679	0.0083	0.0231			0.0083	7.6	66.5	28.3
Lab 4										
Lab 5	0.2730	0.0750	0.0080	0.0228	0.0079	0.0670	0.0072	10.0	83.0	
Lab 6	0.2266	0.0655	0.0073	0.0241	0.0090	0.0632	0.0091	7.0	68.0	36.0
Lab 7	0.2300	0.0698	0.0070	0.0240	0.0100	0.0687	0.0086	8.1	62.0	
Lab 8	0.2222	0.0658	0.0055	0.0253		0.0654	0.0081	7.4	67.3	
Lab 9	0.2165	0.0694	0.0091	0.0246	0.0090	0.0620	0.0085	8.2	62.7	
Lab 10	0.2600		0.0061			0.0300	0.0143			
Lab 11	0.2213	0.0764	0.0083	0.0162	0.0076	0.0631	0.0072	10.0	68.0	
Lab 12	0.1710	0.0464	0.0072	0.0164			0.0052			
Lab 13	0.2390	0.0712	0.0074	0.0213	0.0089	0.0626	0.0096	7.0	63.0	
Lab 14	0.2930	0.0720	0.0110	0.0380	0.0390	0.0130	0.0500		60.0	
Lab 15	0.2200	0.0620		0.0270		0.0680				
Lab 16	0.2142	0.0644	0.0072	0.0241	0.0097	0.0653	0.0097		67.0	
Lab 17	0.2329	0.0713	0.0084	0.0252	0.0092	0.0610	0.0104	8.8	69.0	
Lab 18	0.2180	0.0640	0.0090	0.0260	0.0110	0.0640	0.0090		70.0	
Lab 19										
Lab 20	0.2810	0.0957	0.0107	0.0447	0.0046	0.0719	0.0106	21.0	125.0	20.0
Lab 21	0.2358	0.0621	0.0075	0.0279	0.0091	0.0660	0.0090	6.3	75.3	30.8
Lab 22	0.2100	0.0602	0.0081	0.0197	0.0098	0.0518	0.0084	6.5	79.7	37.3
Lab 23	0.2110	0.0540	0.0070	0.0210	0.0080	0.0640			50.0	
Lab 24	0.2124	0.0633	0.0082	0.0213	0.0098	0.0580	0.0097	8.5	67.8	
Lab 25	0.2247	0.0589	0.0305	0.0794		0.0629	0.0364			
Lab 26	0.2791	0.0786	0.0057	0.1023	0.0054	0.0824	0.0152	11.7	317.6	77.0
Lab 27	0.2016	0.0713	0.0057	0.0282		0.0641		7.4	65.8	
Lab 28	0.2267	0.0587	0.0080	0.0207	0.0077	0.0633	0.0010	10.0	70.0	
Lab 29	0.2231	0.0644		0.0241	0.0089	0.0587	0.0096	7.6	86.0	
Lab 30										
Lab 31										
Lab 32	0.2214	0.0616	0.0074	0.0145	0.0140	0.0626	0.0074	8.2	55.3	0.5
Lab 33	0.2770	0.0797	0.0086	0.0273	0.0102	0.0714	0.0106	9.4		
Lab 34	0.2230	0.0650	0.0055	0.0250	0.0070	0.0620	0.0080	8.0	40.0	
Lab 35										

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	3.02	2.56	0.88	3.22	1.10	1.26	4.80	3.38	123.12	9.45
σ_{pt}	1.33	0.34	0.47	1.33	0.61	0.27		0.69	196.83	1.99
N	11	9	10	8	12	10	1	14	2	16

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
Lab 1	10.2	2.9	1.0	3.1	1.0	1.5		3.2	0.4	8.2
Lab 2		2.5	0.8		0.6			3.0		
Lab 3	3.0	2.1	0.4		0.5	1.0		2.9		8.8
Lab 4										
Lab 5										
Lab 6		3.0			1.0			3.0		9.0
Lab 7										
Lab 8	4.8	2.2	0.3		0.8	1.1		2.7		8.4
Lab 9										75.8
Lab 10										
Lab 11										66.0
Lab 12										
Lab 13										
Lab 14										
Lab 15										
Lab 16										
Lab 17	2.6	2.4	0.8	2.5	0.7	1.2		2.8		
Lab 18										
Lab 19										
Lab 20			1.0	40.0	25.0	1.0		46.0		477.0
Lab 21	1.5			2.6		1.0		3.1		8.7
Lab 22	1.9		2.1		3.2			3.8		7.7
Lab 23										
Lab 24	3.4							3.6		8.6
Lab 25										
Lab 26	4.1	2.7	1.3	2.8	1.6	1.6		4.6	245.9	9.7
Lab 27				3.8						
Lab 28										73.0
Lab 29	2.6	2.4	0.5	2.8	0.7	1.2		2.7		8.6
Lab 30										
Lab 31										
Lab 32	1.9	2.8	1.2	11.6	4.5	1.9	4.8	3.6		1.5
Lab 33	2.4				0.8	1.4		4.3		8.5
Lab 34										8.0
Lab 35										

	LiO_2	SO_3	MoO_3	HfO_2	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	29.55	22.42	2.04	0.45	7.69	3.23	2.30	0.80	2.48	1.90
σ_{pt}	22.58	12.76	1.79	0.52	5.91	1.38	2.64	0.91	3.08	0.38
N	3	5	5	2	11	3	5	3	2	9

	LiO_2	SO_3	MoO_3	HfO_2	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO
Lab 1	54.7	16.8	3.7	0.8	2.4					
Lab 2										
Lab 3			1.8		5.7					1.3
Lab 4										
Lab 5		30.0								
Lab 6										
Lab 7		8.3								
Lab 8			0.2		5.0		0.7	0.6		2.2
Lab 9					19.6					
Lab 10										
Lab 11					15.0					
Lab 12										
Lab 13					13.0					
Lab 14										
Lab 15										
Lab 16										
Lab 17	19.8				2.0					1.9
Lab 18										
Lab 19										
Lab 20		37.0								
Lab 21							1.0			1.8
Lab 22							14.2			1.7
Lab 23										
Lab 24					2.7					
Lab 25										85.0
Lab 26				0.1	4.6	3.5	1.2	0.1	0.6	
Lab 27										
Lab 28		20.0			10.0					
Lab 29	14.1									1.9
Lab 30										
Lab 31										
Lab 32			3.6		7.6	5.1	9.3	3.9	4.4	1.6
Lab 33			0.9			2.6				2.1
Lab 34										
Lab 35										

	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%
x_{pt}	0.96	1.94	5.22	0.71	0.61	0.36	0.0057	0.1603	99.4448
σ_{pt}			1.65					0.0751	0.1948
N	1	1	2	1	1	1	1	7	14

	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
Lab 1								0.1350	99.5706
Lab 2									
Lab 3									
Lab 4									
Lab 5									99.5760
Lab 6									
Lab 7									
Lab 8									
Lab 9									99.5836
Lab 10									
Lab 11									99.5823
Lab 12									
Lab 13									99.5717
Lab 14								0.1950	99.2000
Lab 15								0.2000	99.3600
Lab 16									
Lab 17									
Lab 18									
Lab 19									
Lab 20							0.0		99.4100
Lab 21									
Lab 22									
Lab 23								0.1400	99.0400
Lab 24									
Lab 25								0.1419	98.3951
Lab 26	1.0	1.9	6.3	0.7					
Lab 27									99.6067
Lab 28									99.5857
Lab 29			4.2		0.6	0.4		0.0500	
Lab 30									
Lab 31									
Lab 32								0.4810	99.3477
Lab 33									
Lab 34									99.4900
Lab 35									

ANNEX 5.3.1. Z-SCORE SAMPLE C

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5
Lab 1	0.1	-0.3	-0.1	0.0	0.0	0.1	-0.1	-0.6	-1.7
Lab 2	1.0	0.5	0.7	-0.1	0.3	-1.0	0.6	-0.3	0.0
Lab 3	-0.1	0.1	0.5	-0.3			-0.5	-0.5	-0.1
Lab 4									
Lab 5	2.2	1.1	0.2	-0.4	-0.8	1.0	-1.2	1.2	1.5
Lab 6	-0.1	-0.2	-0.4	-0.1	0.0	0.0	0.0	-0.9	0.0
Lab 7	0.0	0.4	-0.7	-0.1	0.7	1.4	-0.3	-0.1	-0.6
Lab 8	-0.4	-0.2	-2.0	0.2		0.5	-0.6	-0.6	-0.1
Lab 9	-0.7	0.4	1.1	0.0	-0.1	-0.4	-0.4	-0.1	-0.5
Lab 10	1.5		-1.5			-9.0	3.3		
Lab 11	-0.4	1.3	0.5	-1.9	-1.0	-0.1	-1.2	1.2	0.0
Lab 12	-2.9	-2.8	-0.5	-1.9			-2.5		
Lab 13	0.5	0.6	-0.3	-0.7	-0.1	-0.2	0.3	-0.9	-0.5
Lab 14	3.2	0.7	2.9	3.2	20.7	-13.7	25.7		-0.8
Lab 15	-0.5	-0.7		0.6		1.3			
Lab 16	-0.8	-0.3	-0.5	-0.1	0.5	0.5	0.4		-0.1
Lab 17	0.2	0.6	0.6	0.2	0.1	-0.6	0.8	0.4	0.1
Lab 18	-0.6	-0.4	1.1	0.4	1.4	0.2	-0.1		0.2
Lab 19									
Lab 20	2.6	4.0	2.6	4.8	-3.1	2.3	0.9	8.8	5.7
Lab 21	0.3	-0.7	-0.3	0.8	0.0	0.7	-0.1	-1.4	0.7
Lab 22	-1.0	-0.9	0.3	-1.1	0.6	-3.1	-0.5	-1.2	1.2
Lab 23	-0.9	-1.8	-0.7	-0.8	-0.7	0.2			-1.8
Lab 24	-0.9	-0.5	0.4	-0.7	0.5	-1.4	0.4	0.2	0.0
Lab 25	-0.2	-1.1	20.2	13.0		-0.1	17.1		
Lab 26	2.5	1.6	-1.8	18.3	-2.5	5.2	3.8	2.4	25.0
Lab 27	-1.4	0.6	-1.9	0.9		0.2		-0.6	-0.2
Lab 28	-0.1	-1.1	0.2	-0.9	-0.9	0.0	-5.1	1.2	0.2
Lab 29	-0.3	-0.3		-0.1	-0.1	-1.3	0.3	-0.5	1.8
Lab 30									
Lab 31									
Lab 32	-0.4	-0.7	-0.3	-2.3	3.5	-0.2	-1.1	-0.1	-1.3
Lab 33	2.4	1.8	0.7	0.7	0.8	2.2	0.9	0.8	
Lab 34	-0.3	-0.3	-2.0	0.2	-1.4	-0.4	-0.7	-0.2	-2.8
Lab 35									

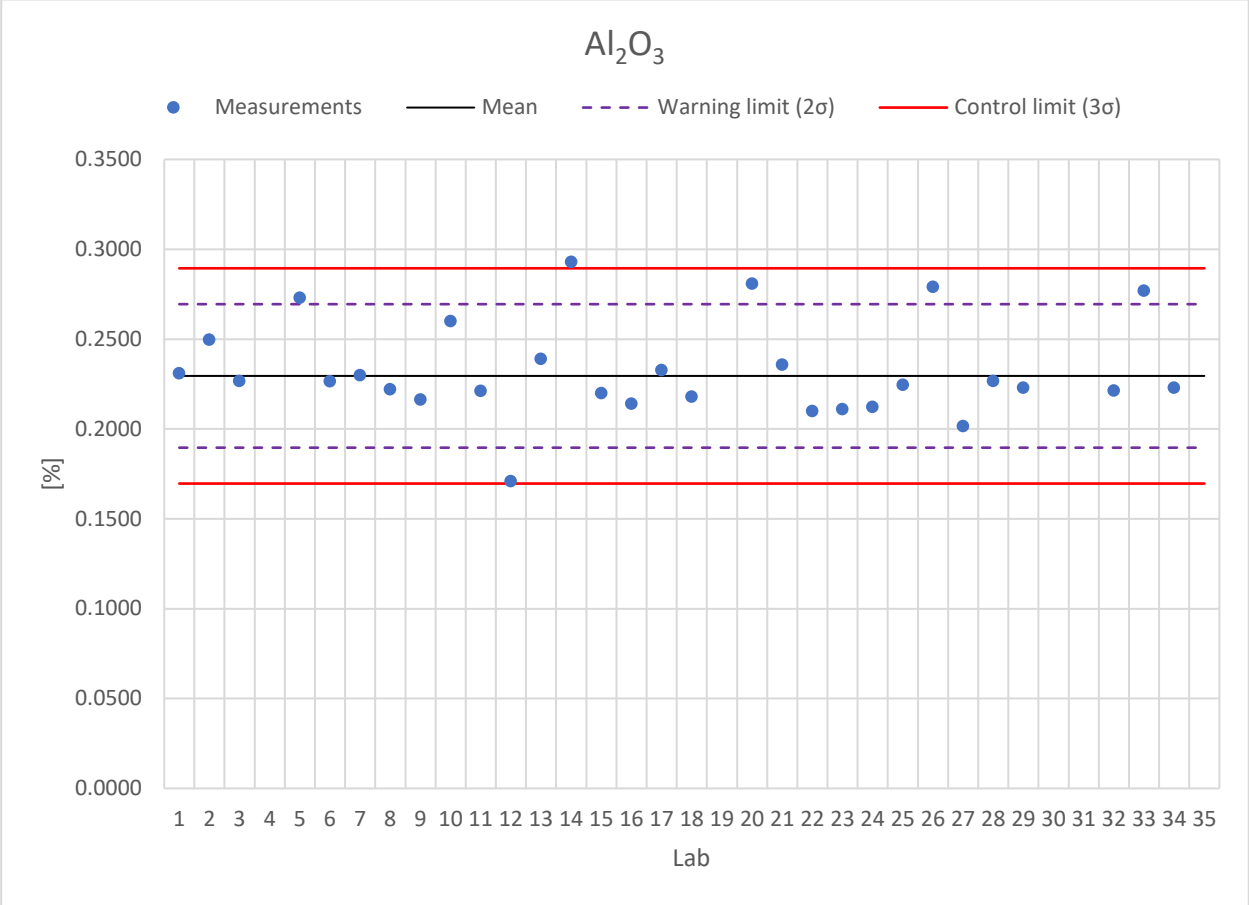
Satisfactory performance
Questionable performance
Unsatisfactory performance

ANNEX 5.3.2. Z'-SCORE SAMPLE C

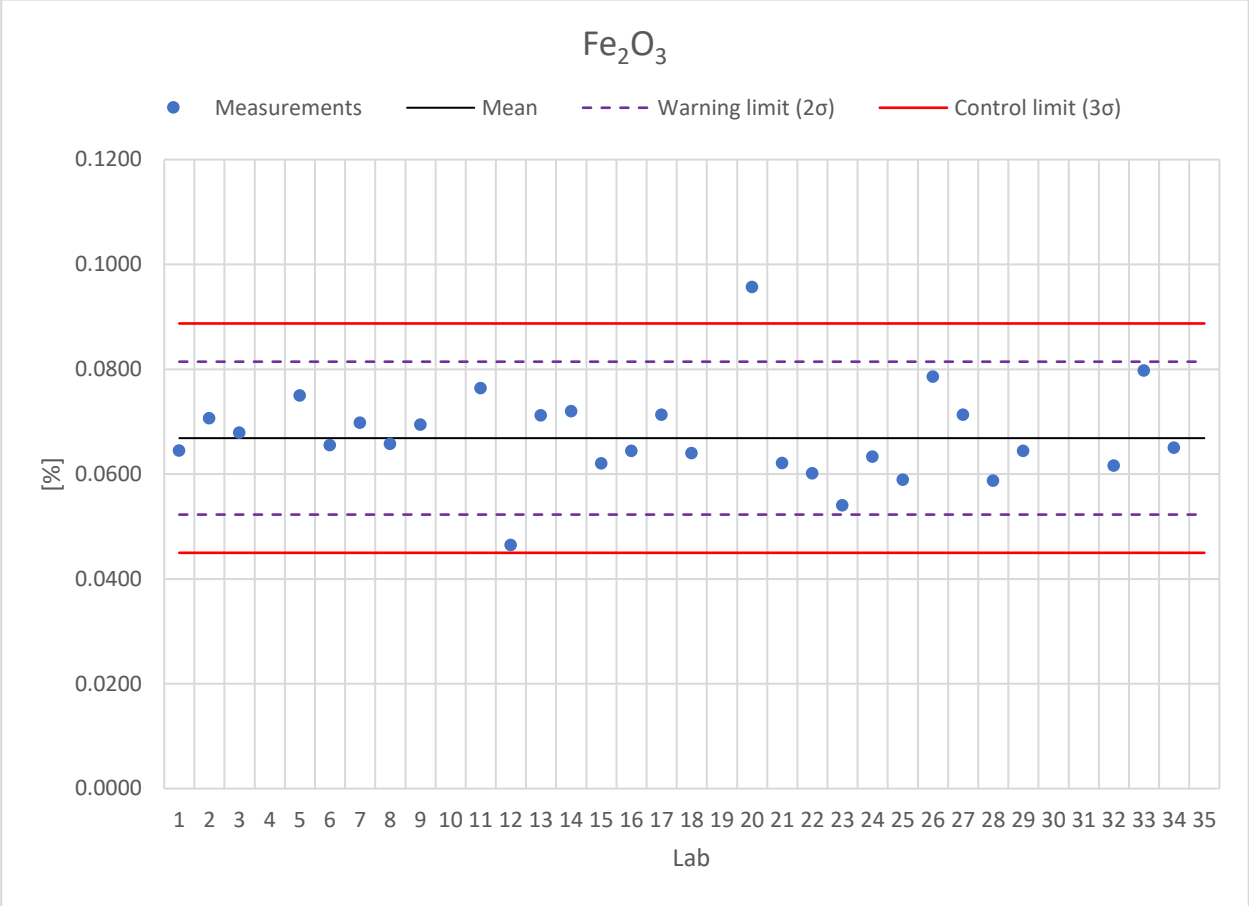
	B_2O_3	ZnO	V_2O_5	NiO	PbO	CuO	CoO	Cr_2O_3	BaO	ZrO_2	SrO	SiO_2
Lab 1	0.2	5.1	0.8	0.2	-0.1	-0.2	0.7	-0.3	-0.6	-0.8		0.6
Lab 2			-0.2	-0.2		-0.8		-0.5				
Lab 3	-0.3	0.0	-1.1	-1.0		-0.9	-0.7	-0.6	-0.3	-0.3	-1.5	
Lab 4												
Lab 5												0.6
Lab 6	0.4		1.2			-0.2		-0.5	-0.2			
Lab 7												
Lab 8		1.3	-1.0	-1.1		-0.5	-0.5	-0.9	-0.5	-0.4	0.7	
Lab 9									31.7	1.9		0.7
Lab 10												
Lab 11									27.1	1.2		0.7
Lab 12												
Lab 13										0.8		0.6
Lab 14												-1.2
Lab 15												-0.4
Lab 16												
Lab 17		-0.3	-0.4	-0.1	-0.5	-0.6	-0.2	-0.8		-0.9	0.0	
Lab 18												
Lab 19												
Lab 20	-1.1			0.2	25.3	36.8	-0.9	58.5	223.7			-0.2
Lab 21	-0.1	-1.1			-0.4		-0.9	-0.3	-0.3		-0.2	
Lab 22	0.5	-0.8		2.5		3.2		0.6	-0.8		-0.4	
Lab 23												-2.0
Lab 24		0.3						0.2	-0.4	-0.8		
Lab 25											203.1	-5.1
Lab 26	4.3	0.8	0.4	0.8	-0.3	0.7	1.1	1.7	0.1	-0.5		
Lab 27					0.4							0.8
Lab 28									30.4	0.4		0.7
Lab 29		-0.3	-0.4	-0.8	-0.3	-0.7	-0.2	-1.0	-0.4		0.1	
Lab 30												
Lab 31												
Lab 32	-3.0	-0.8	0.6	0.6	5.8	5.2	2.2	0.3	-3.8	0.0	-0.7	-0.5
Lab 33		-0.4				-0.4	0.5	1.3	-0.4		0.5	
Lab 34									-0.7			0.2
Lab 35												

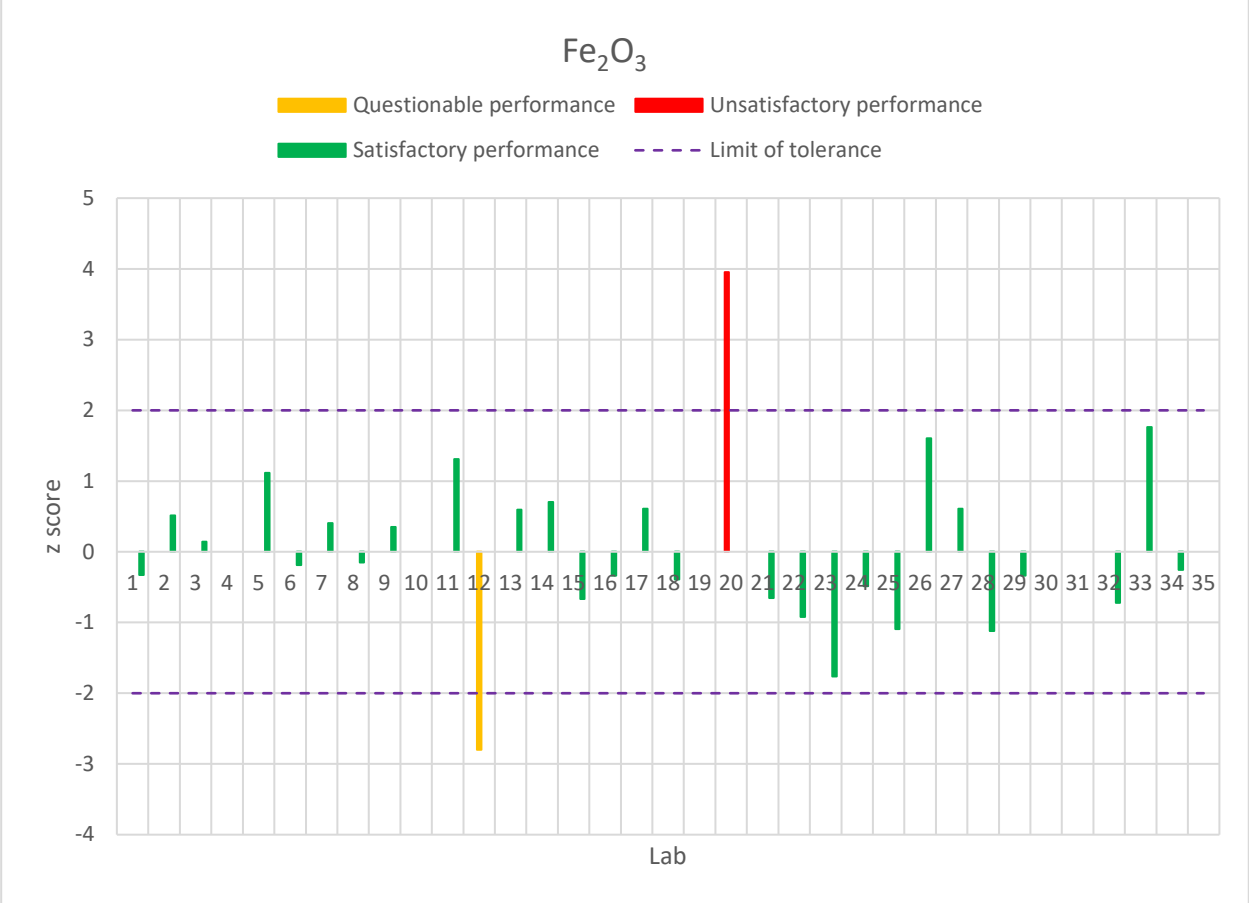
Satisfactory performance
Questionable performance
Unsatisfactory performance

ANNEX 5.3.3. CHARTS SAMPLE C

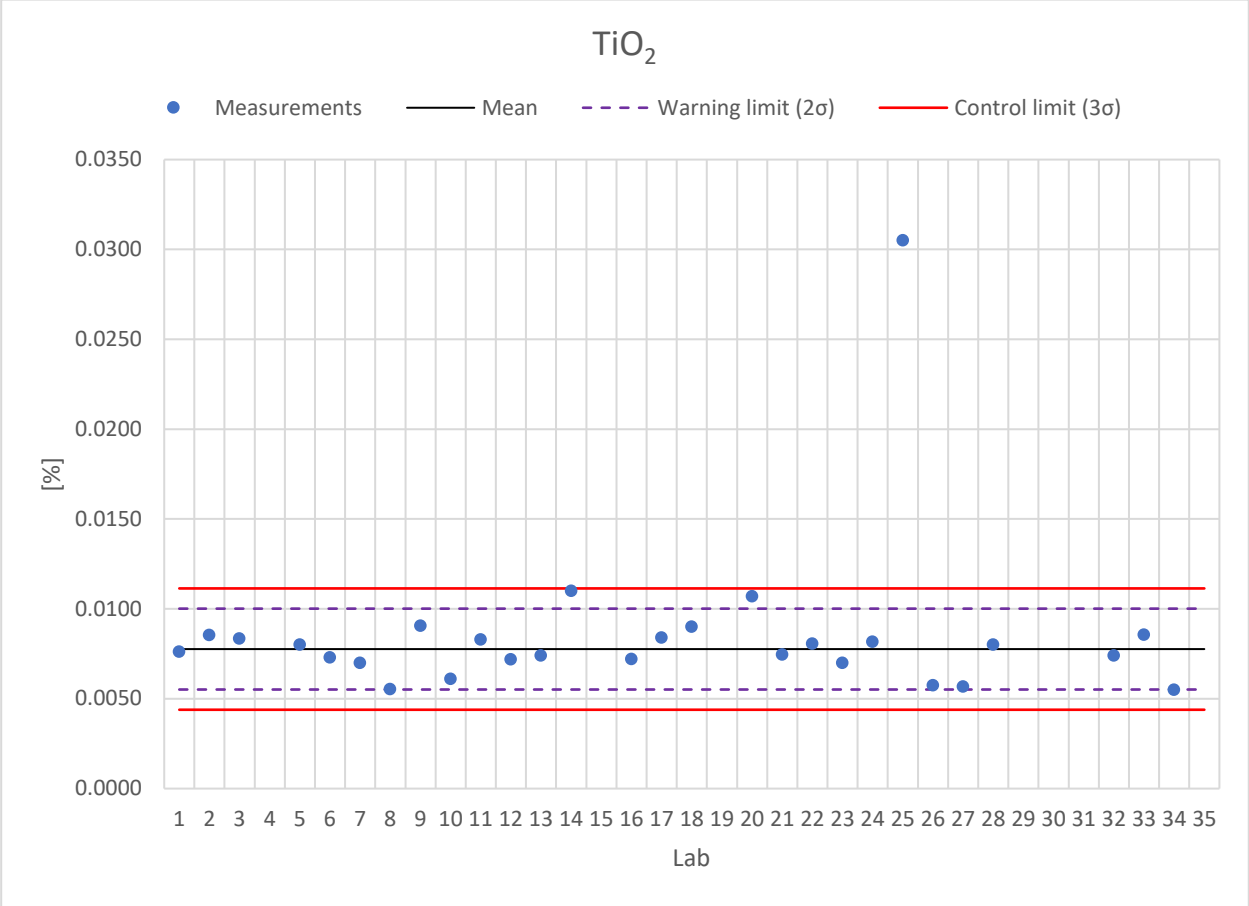


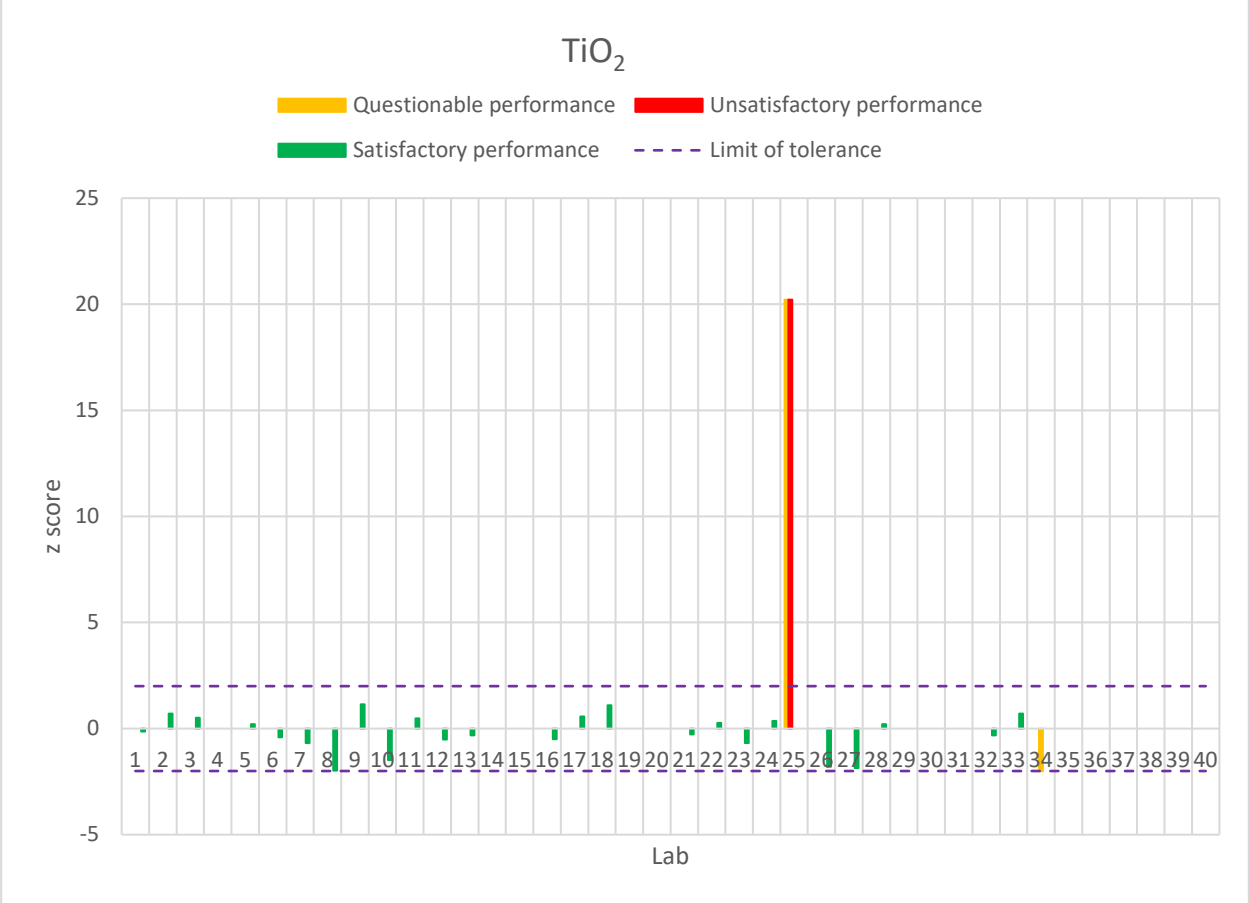
CHARTS SAMPLE C



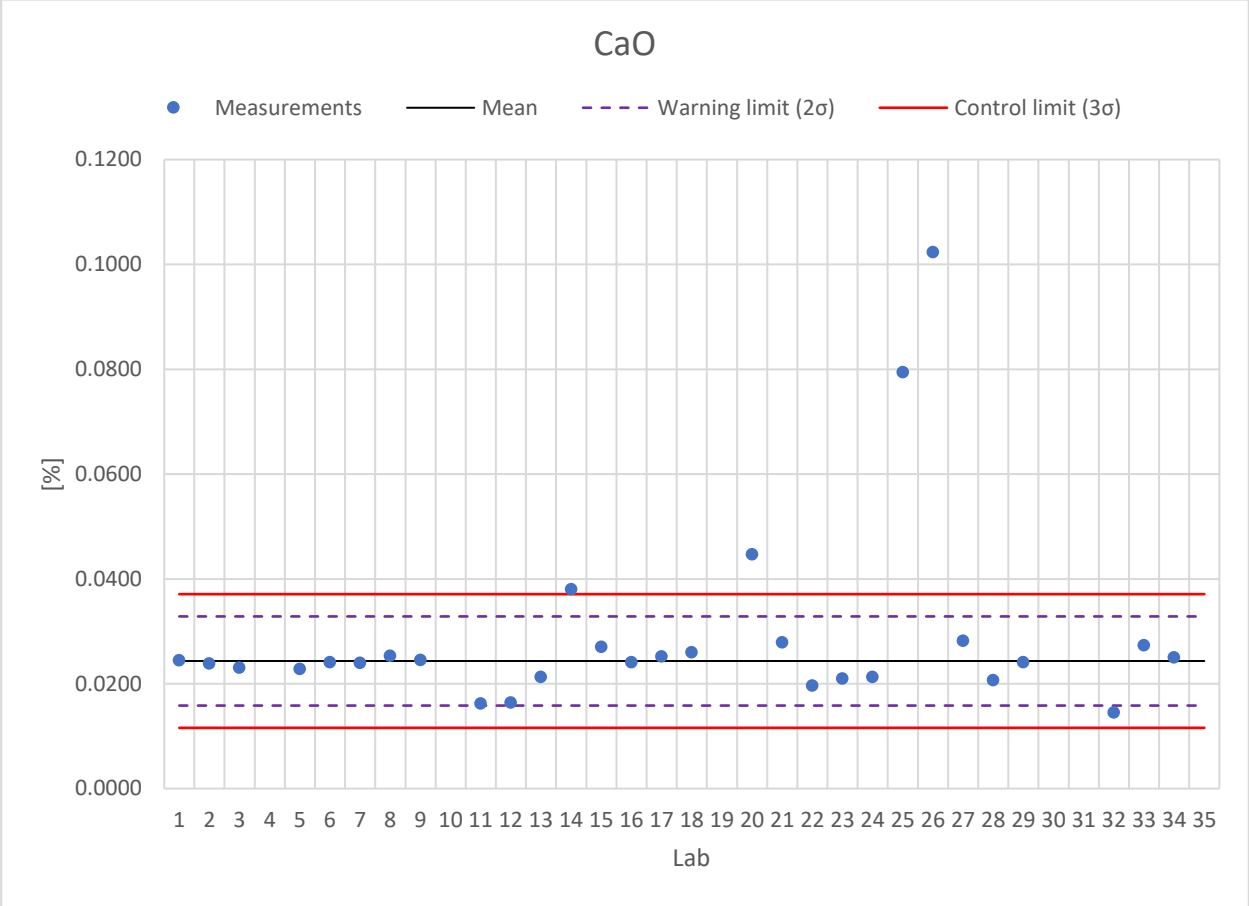


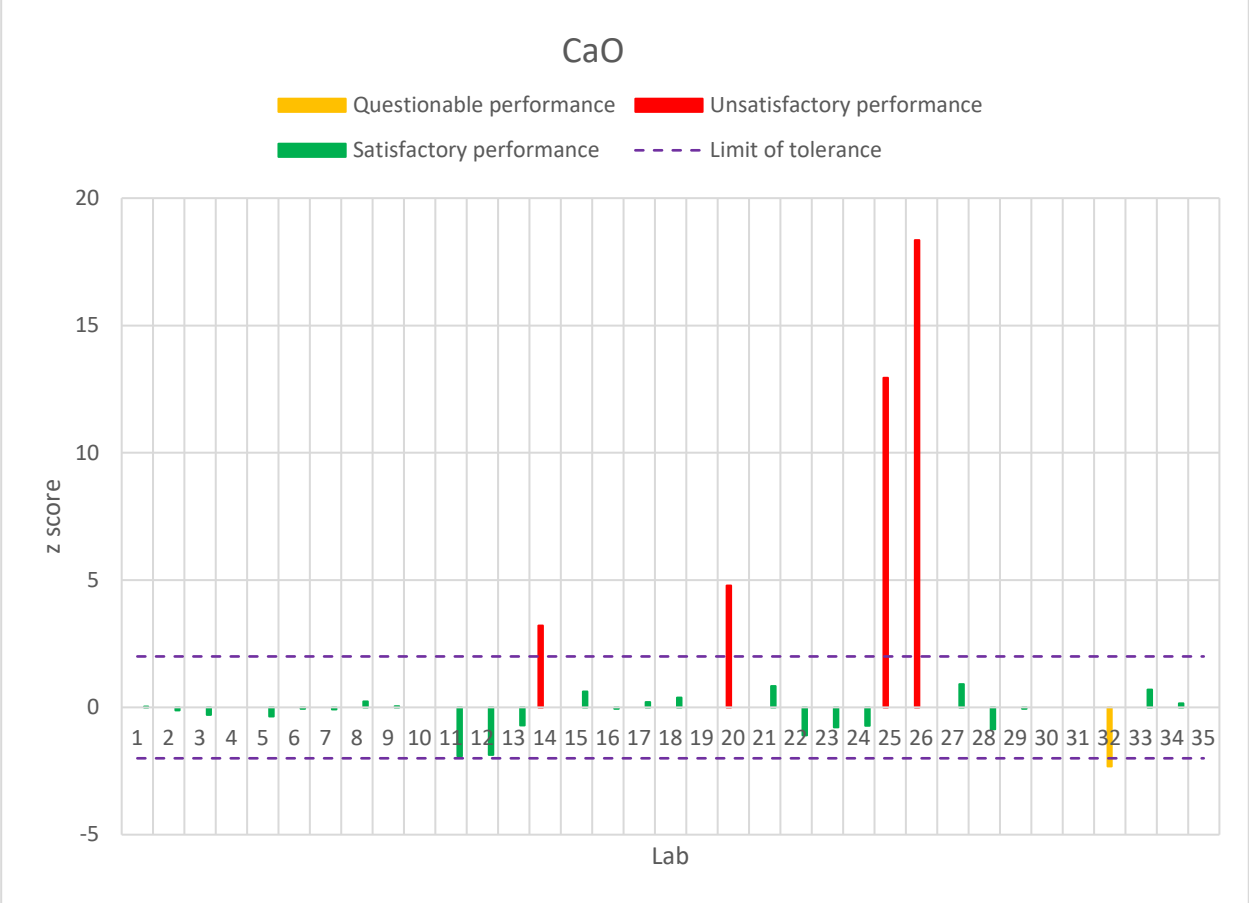
CHARTS SAMPLE C



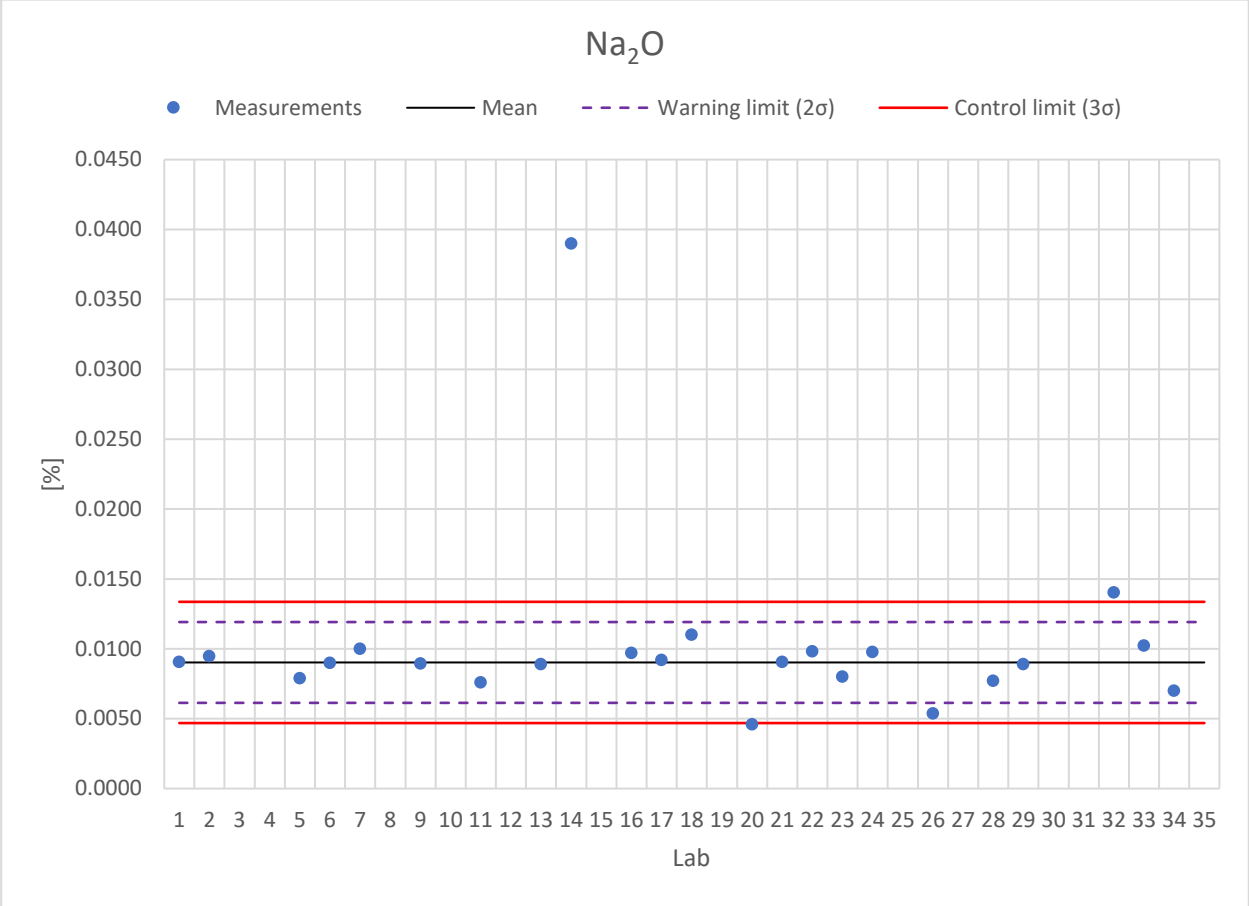


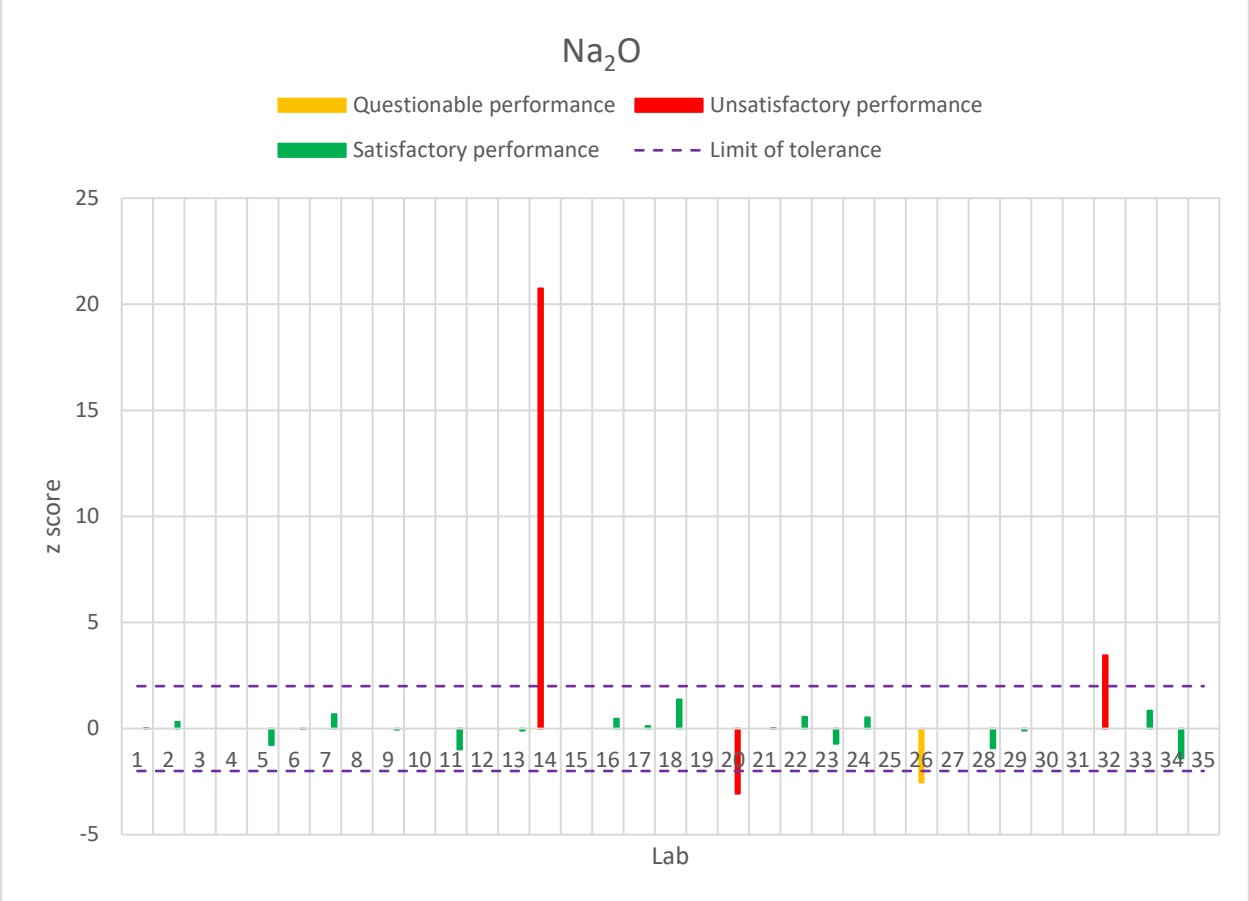
CHARTS SAMPLE C



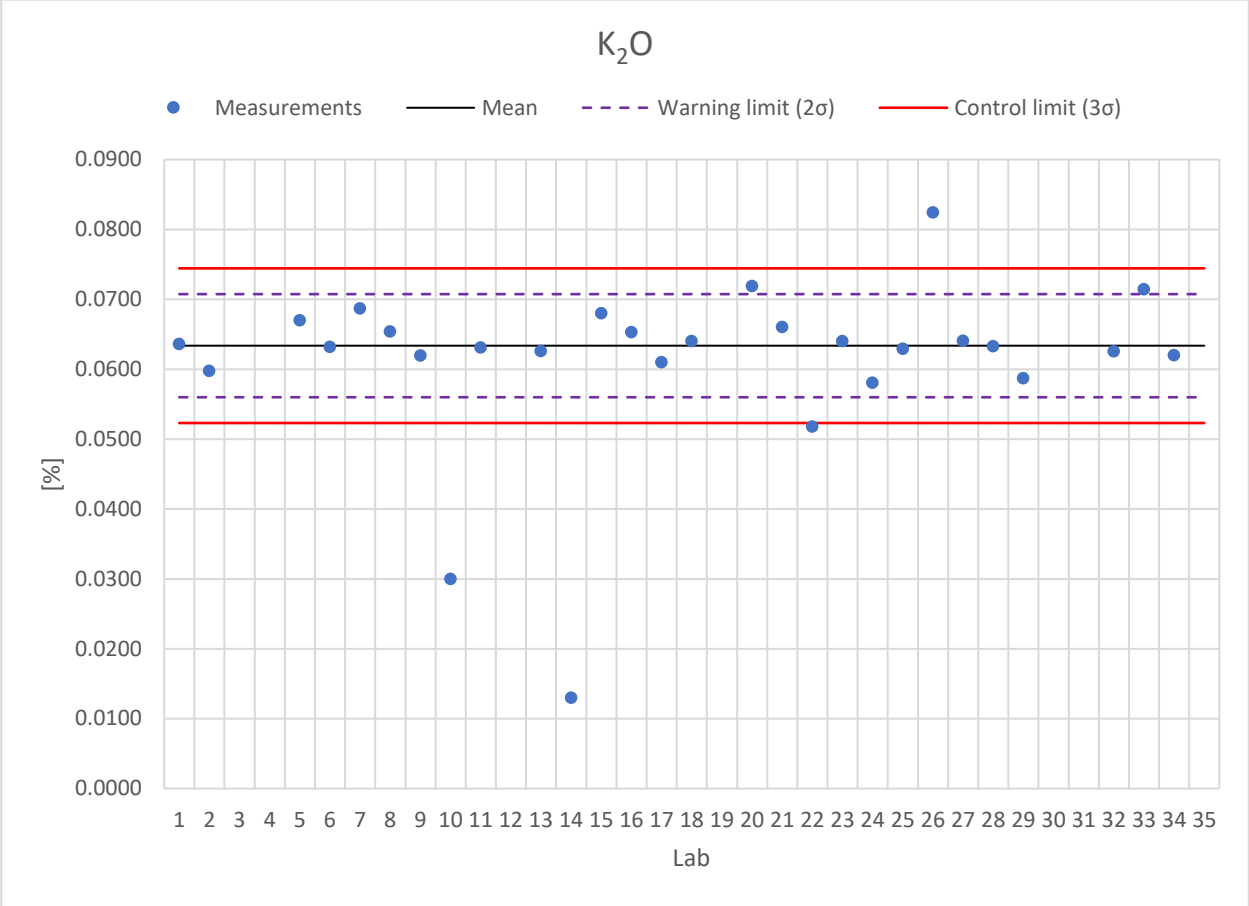


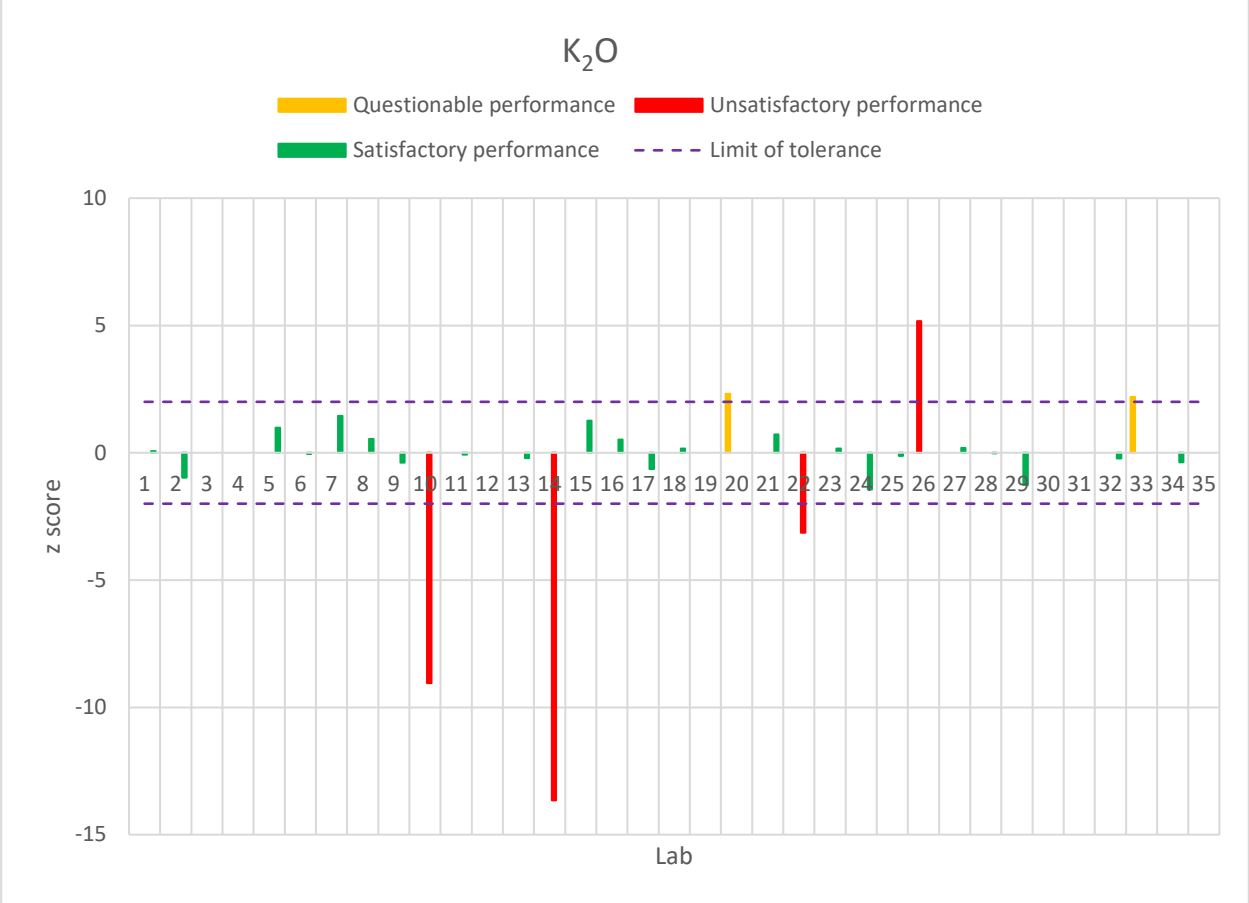
CHARTS SAMPLE C



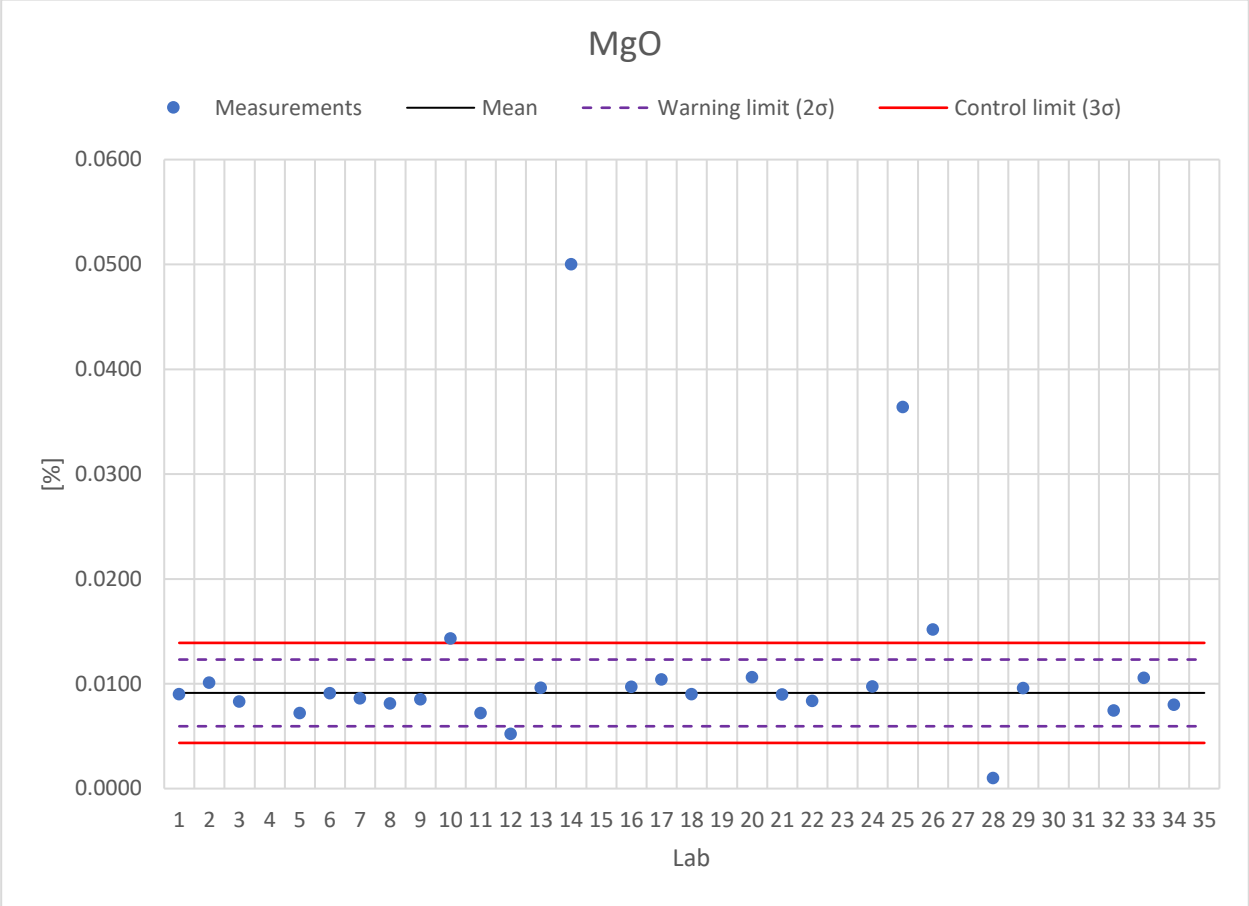


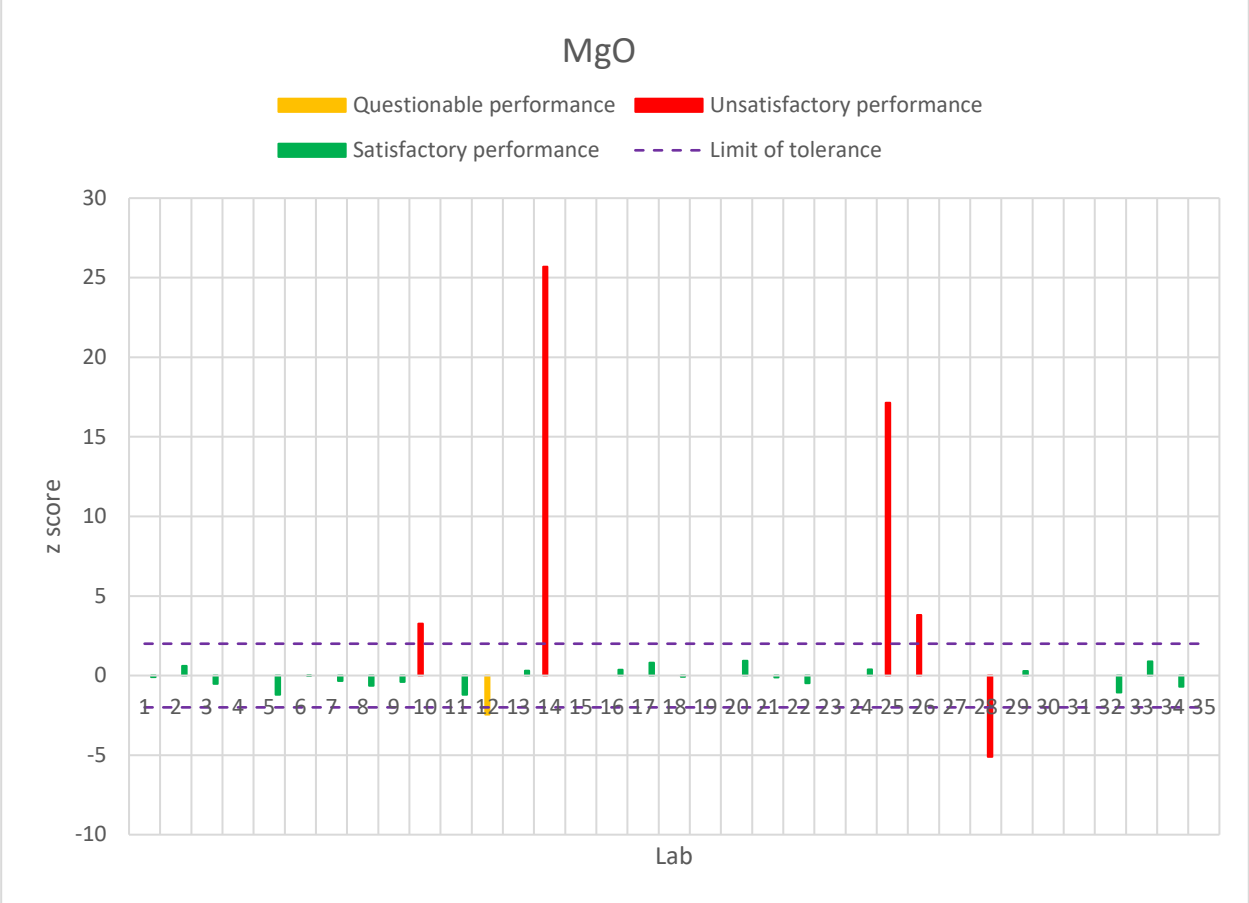
CHARTS SAMPLE C



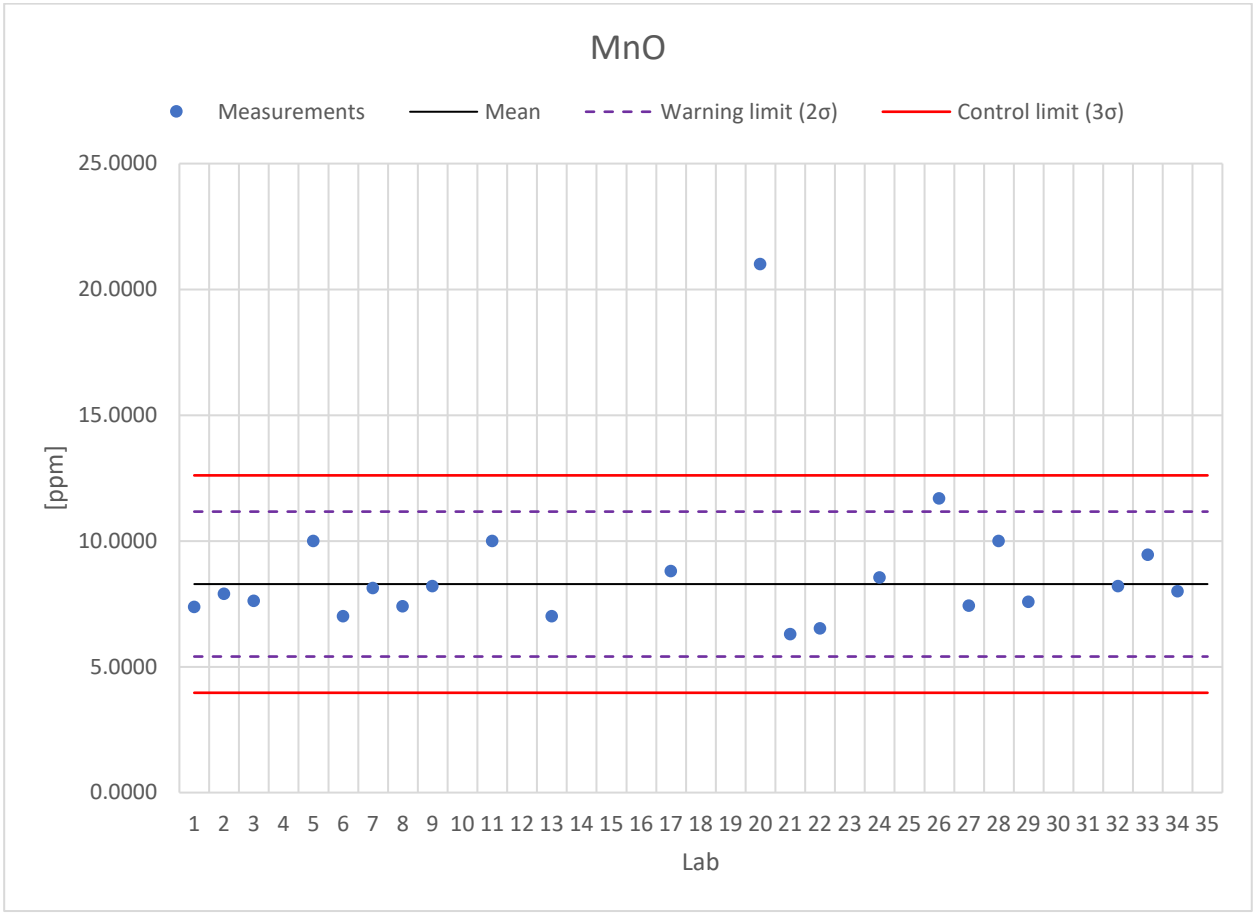


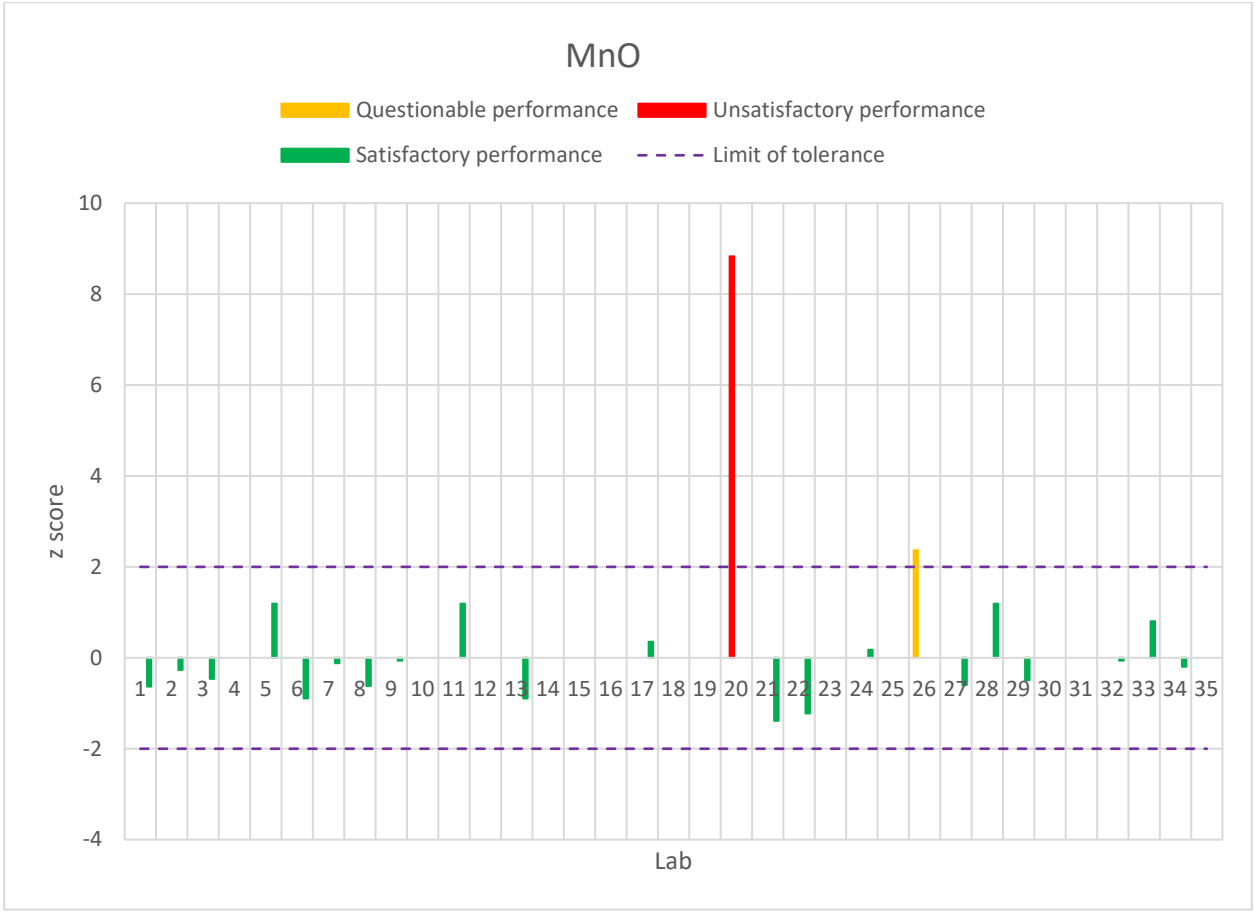
CHARTS SAMPLE C



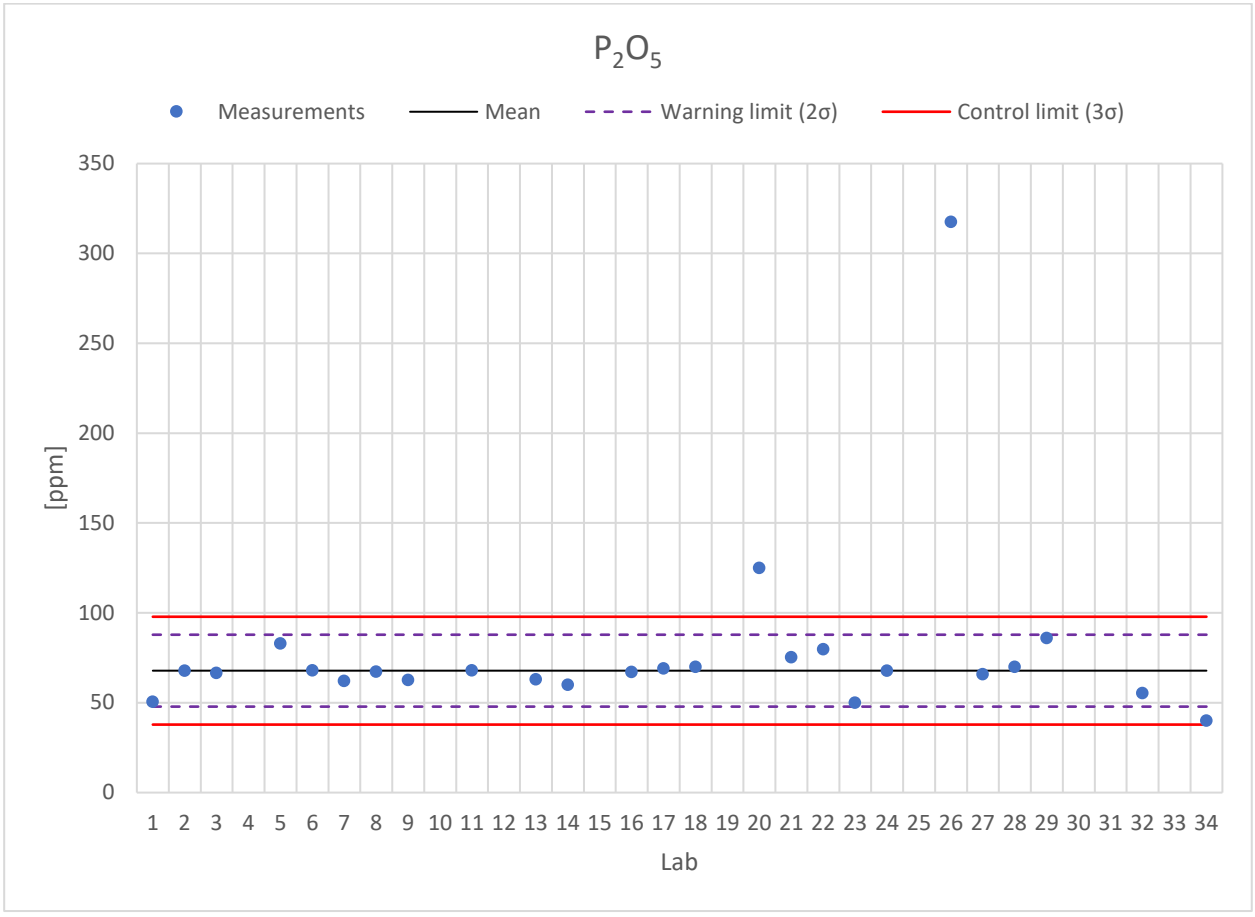


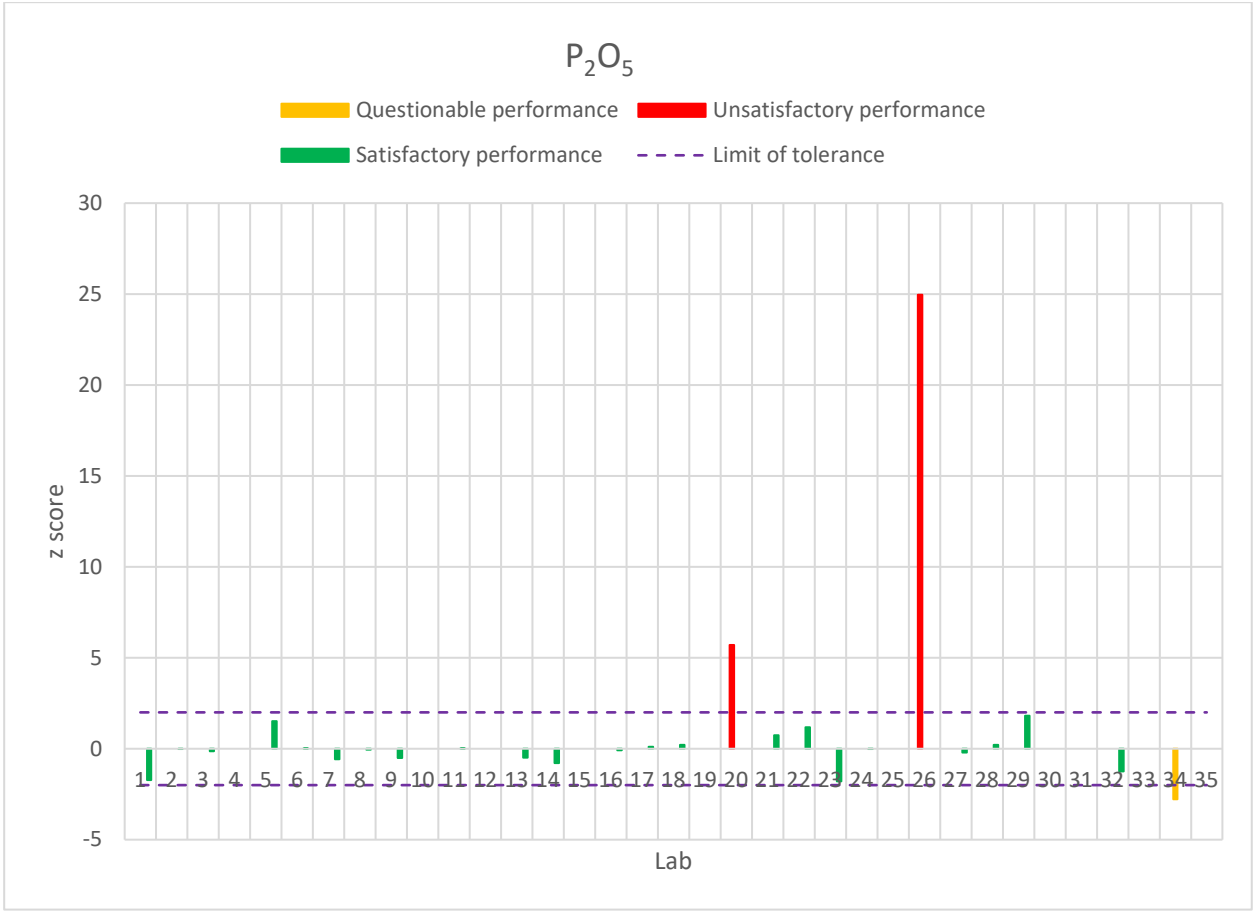
CHARTS SAMPLE C



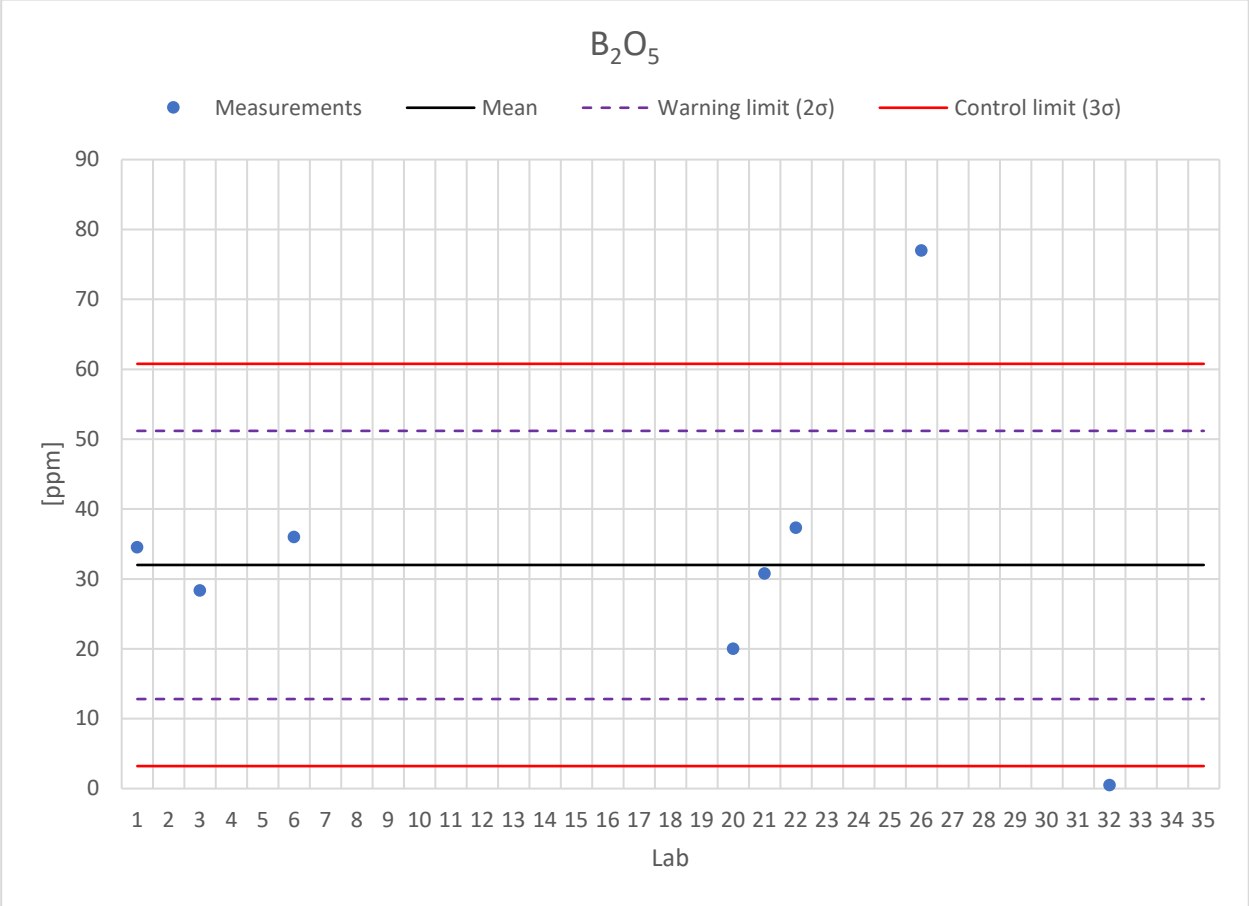


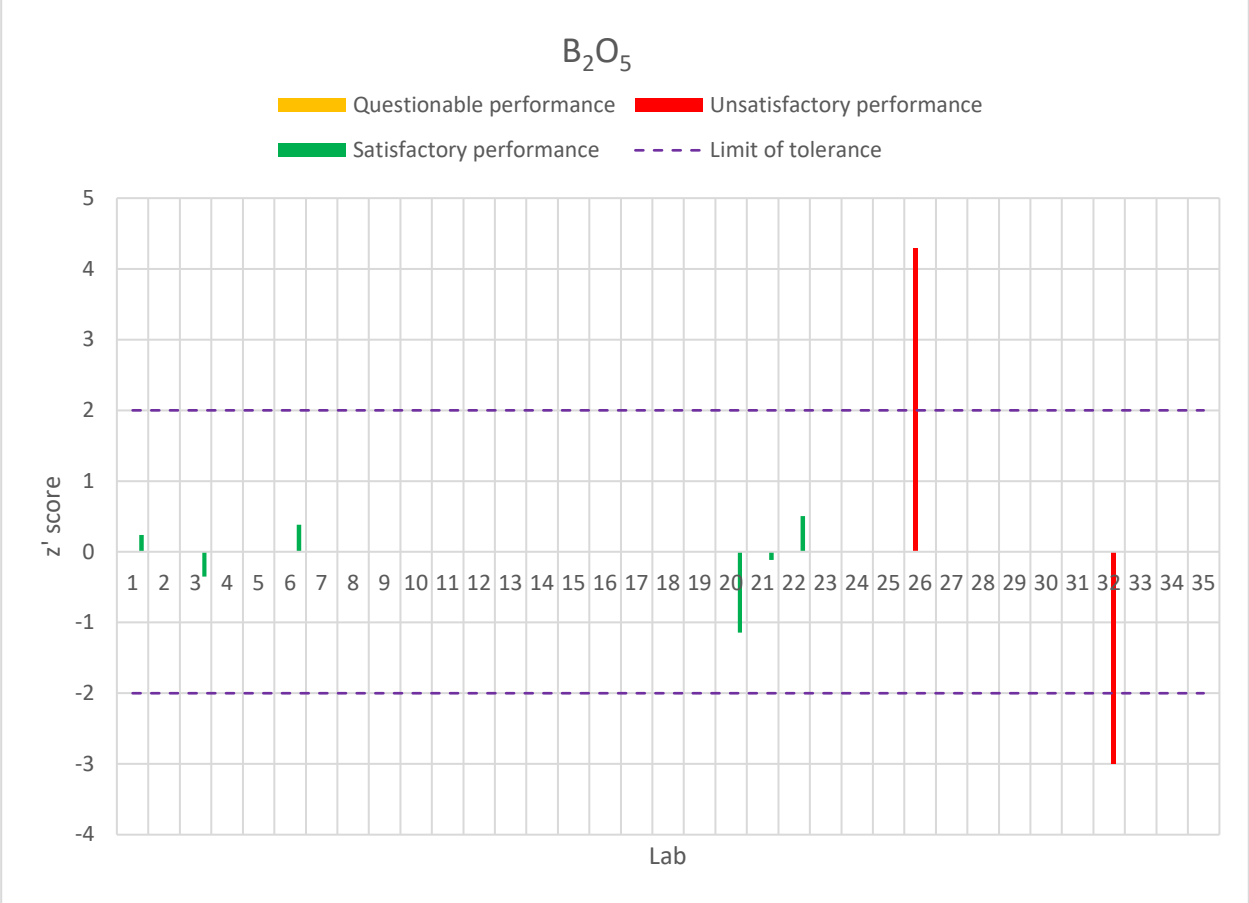
CHARTS SAMPLE C



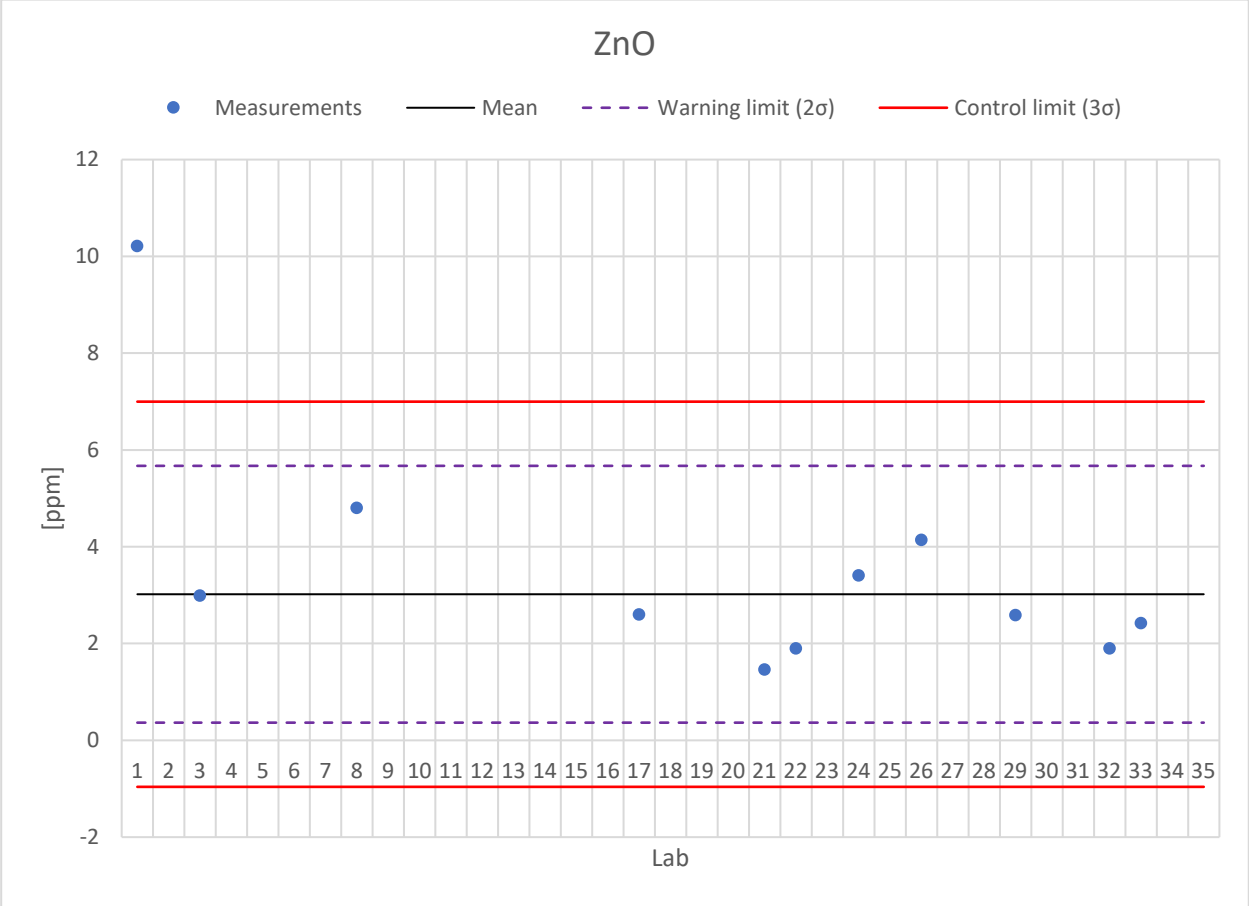


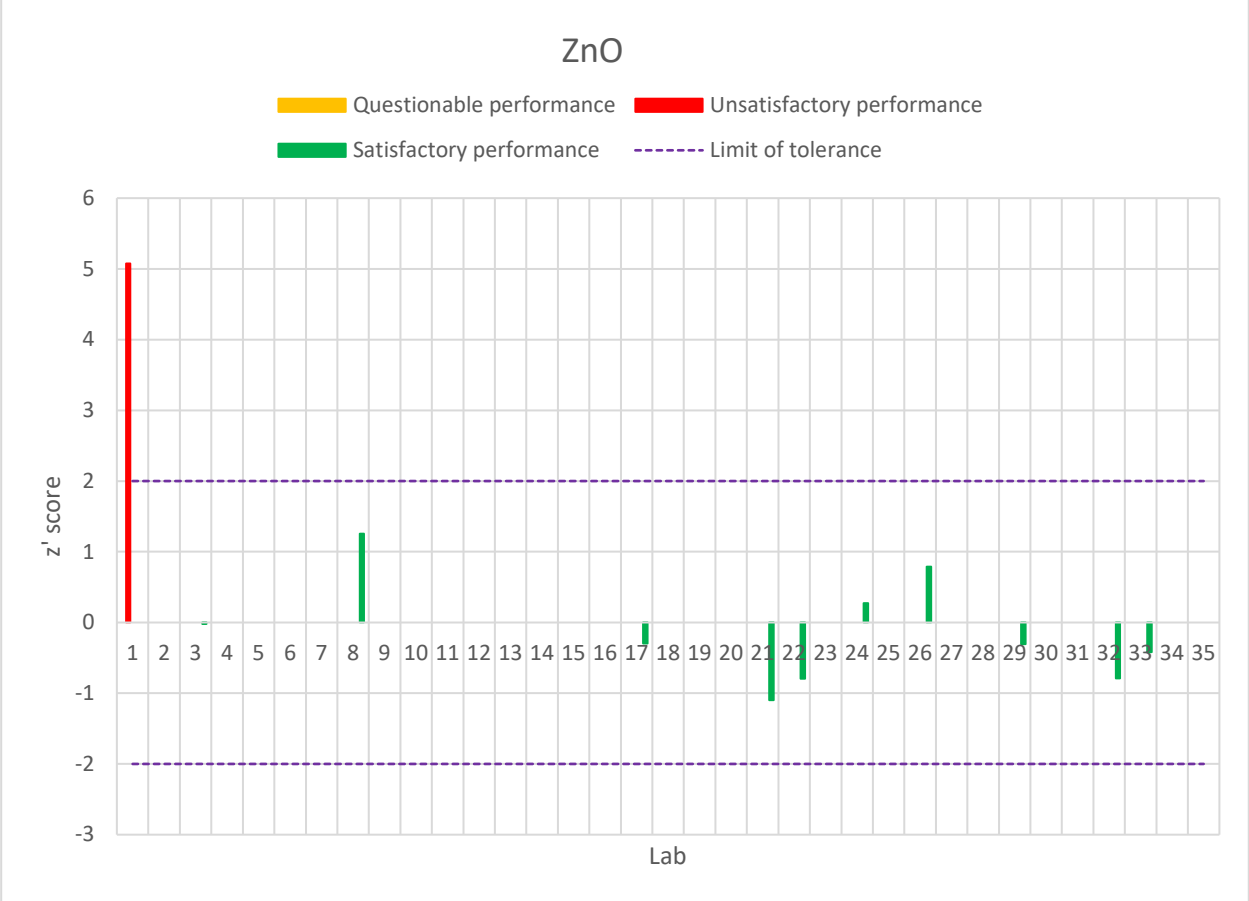
CHARTS SAMPLE C



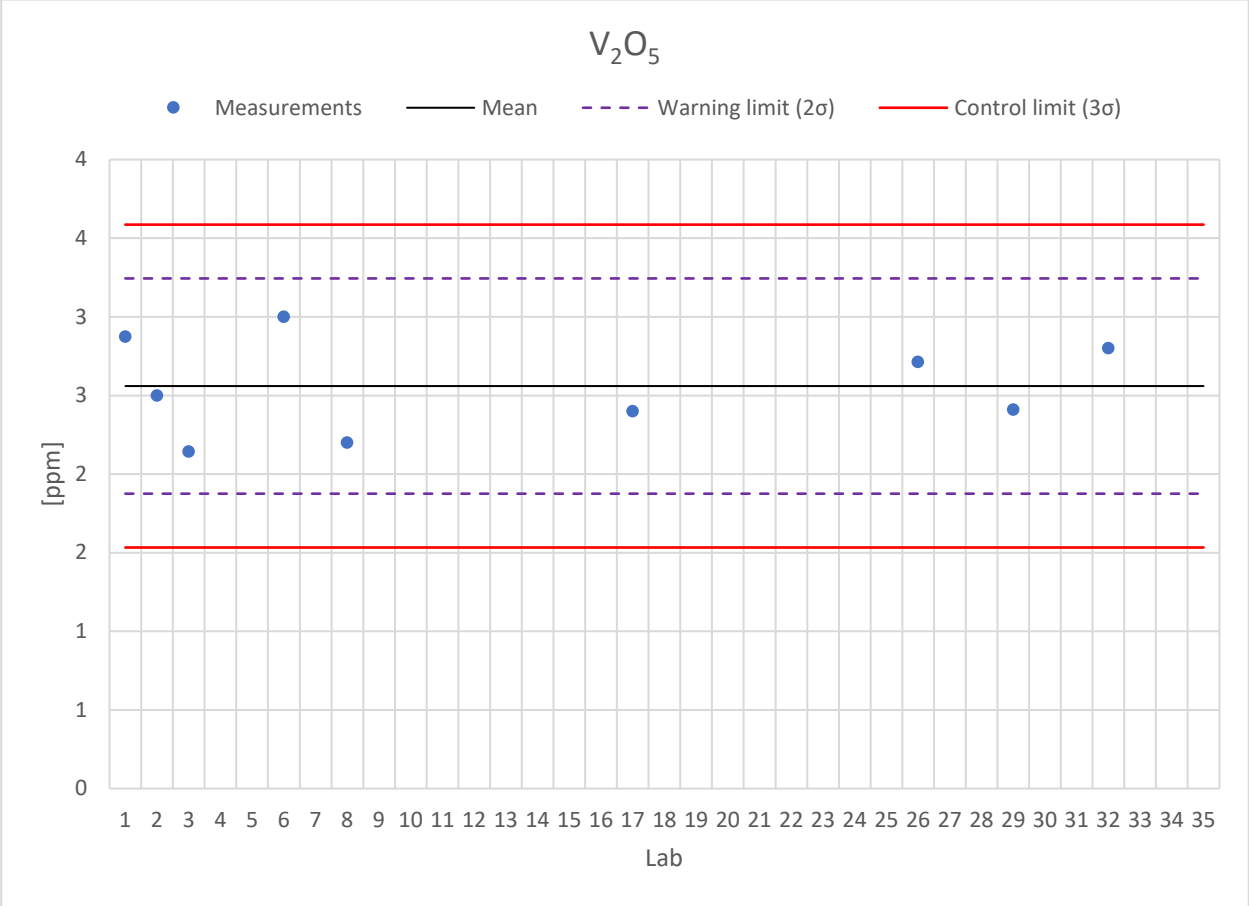


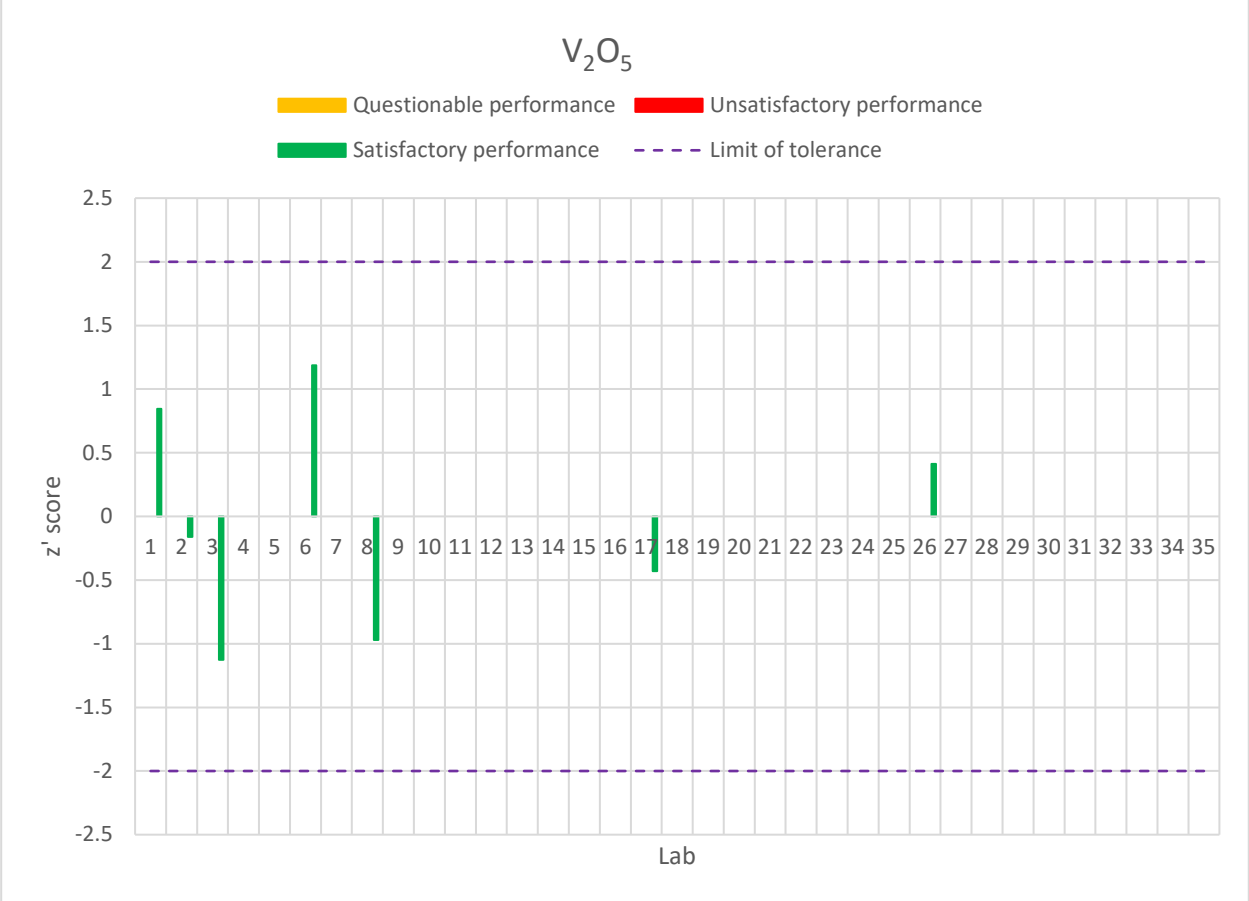
CHARTS SAMPLE C



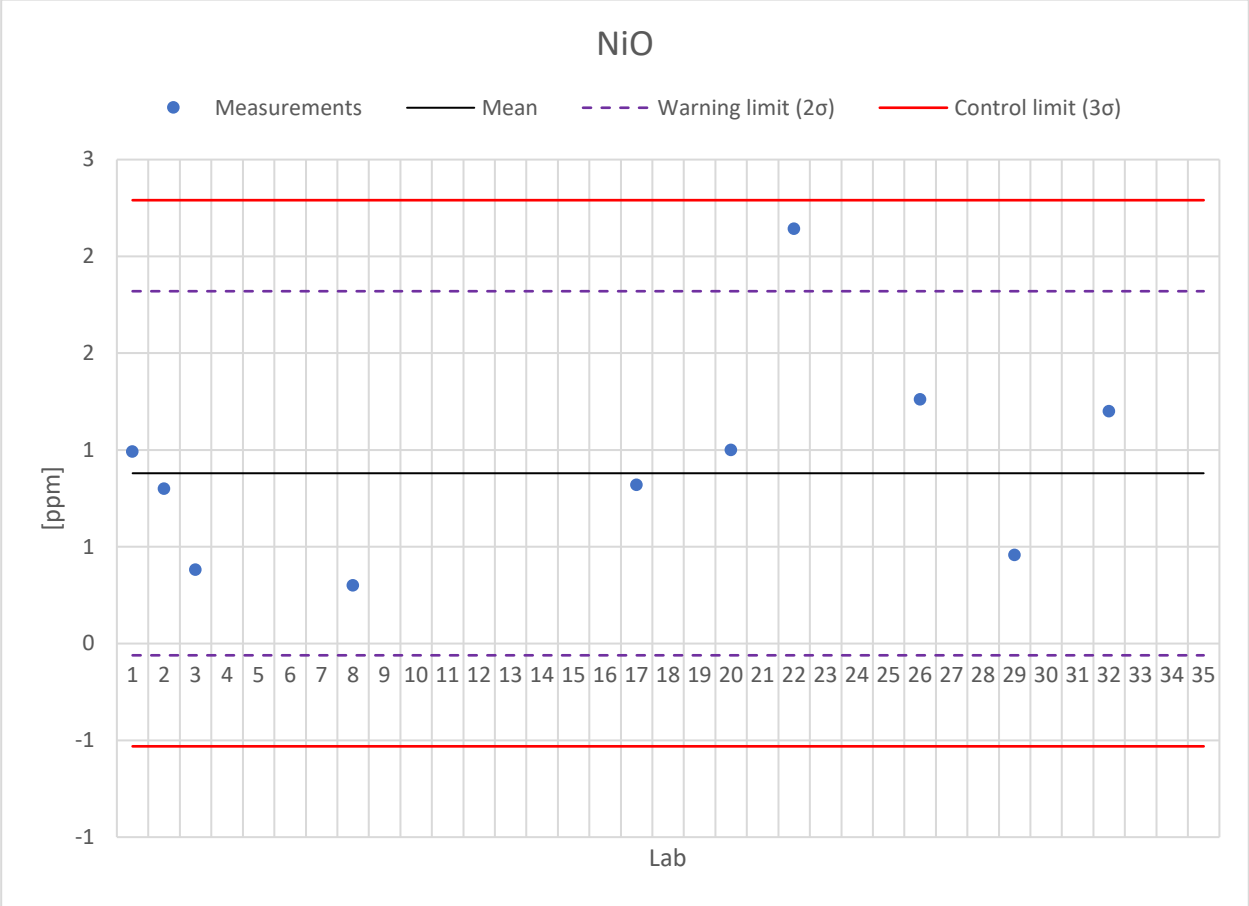


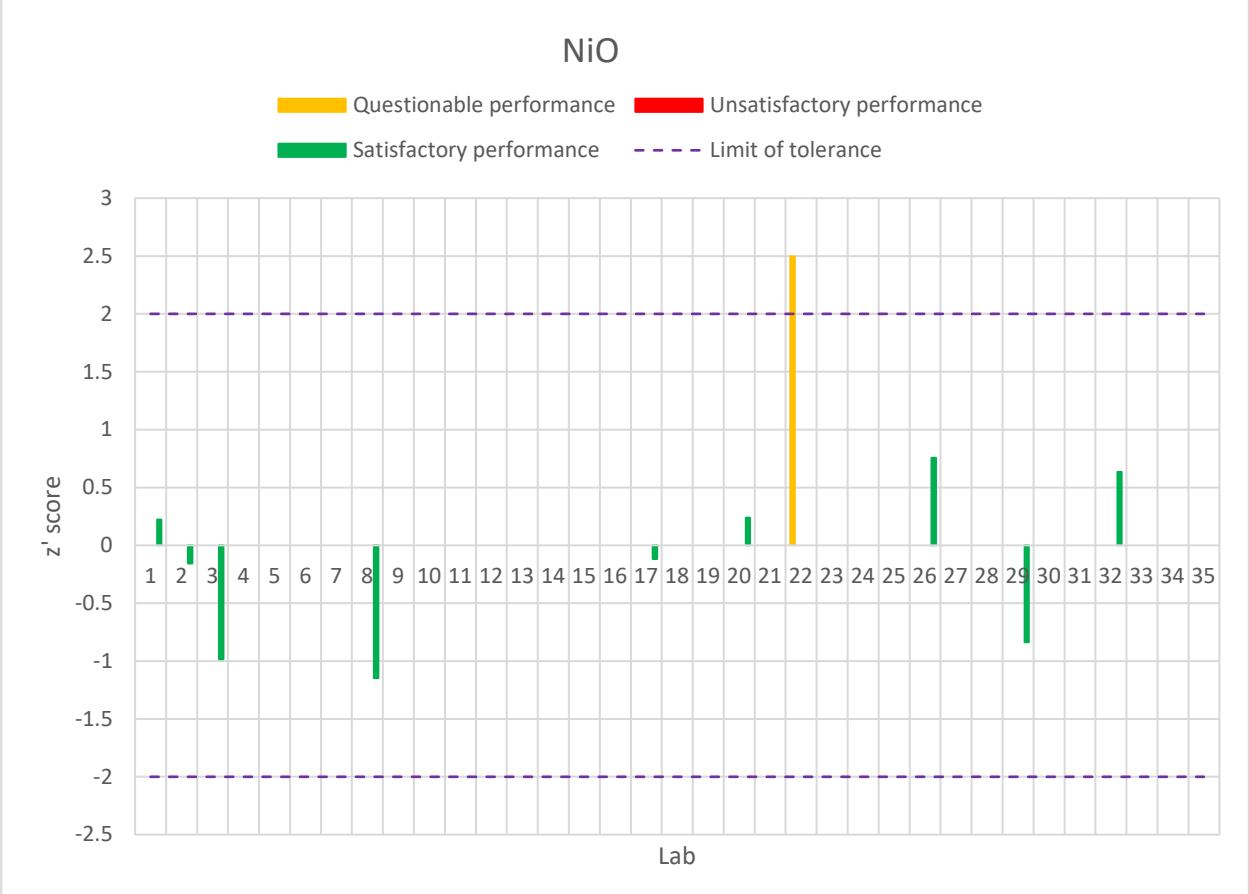
CHARTS SAMPLE C





CHARTS SAMPLE C





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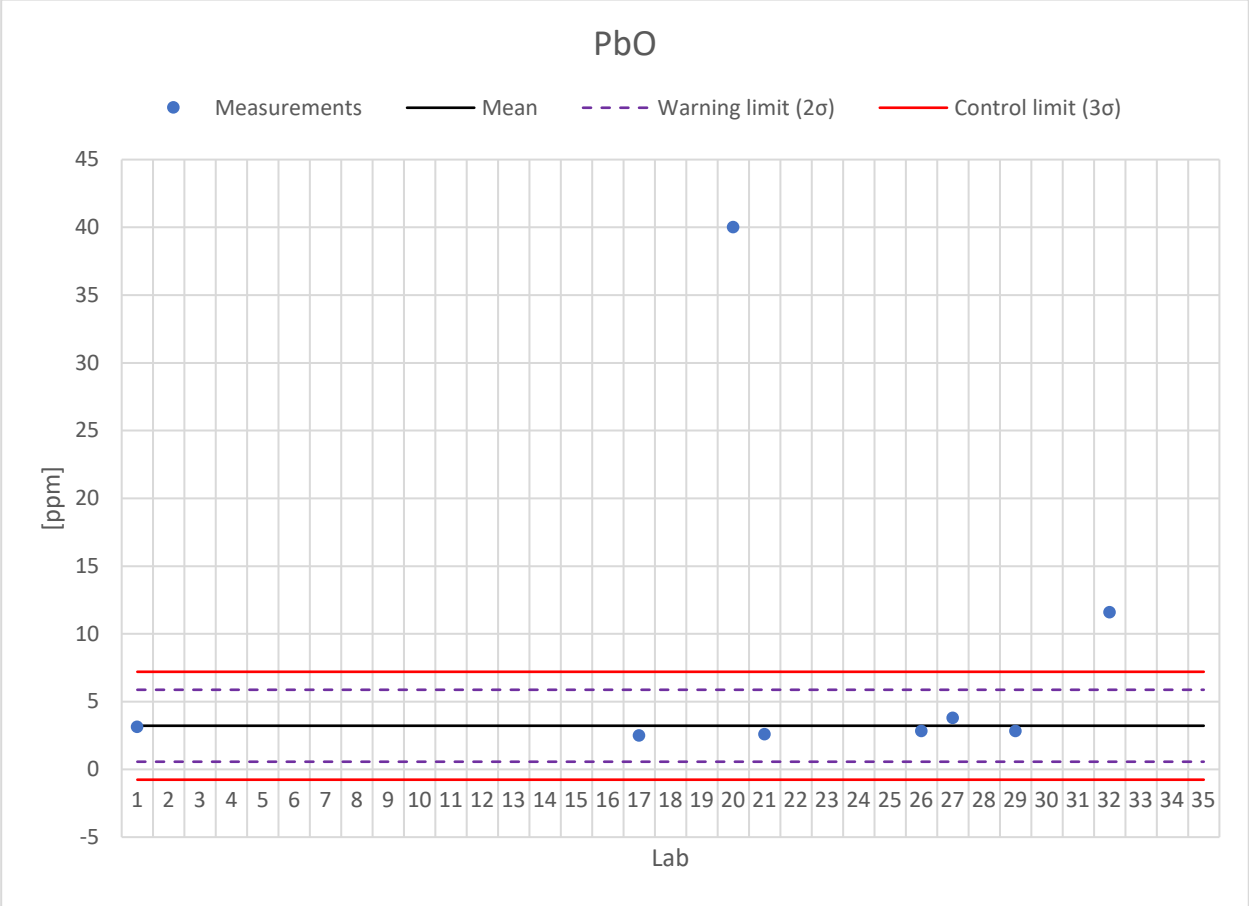
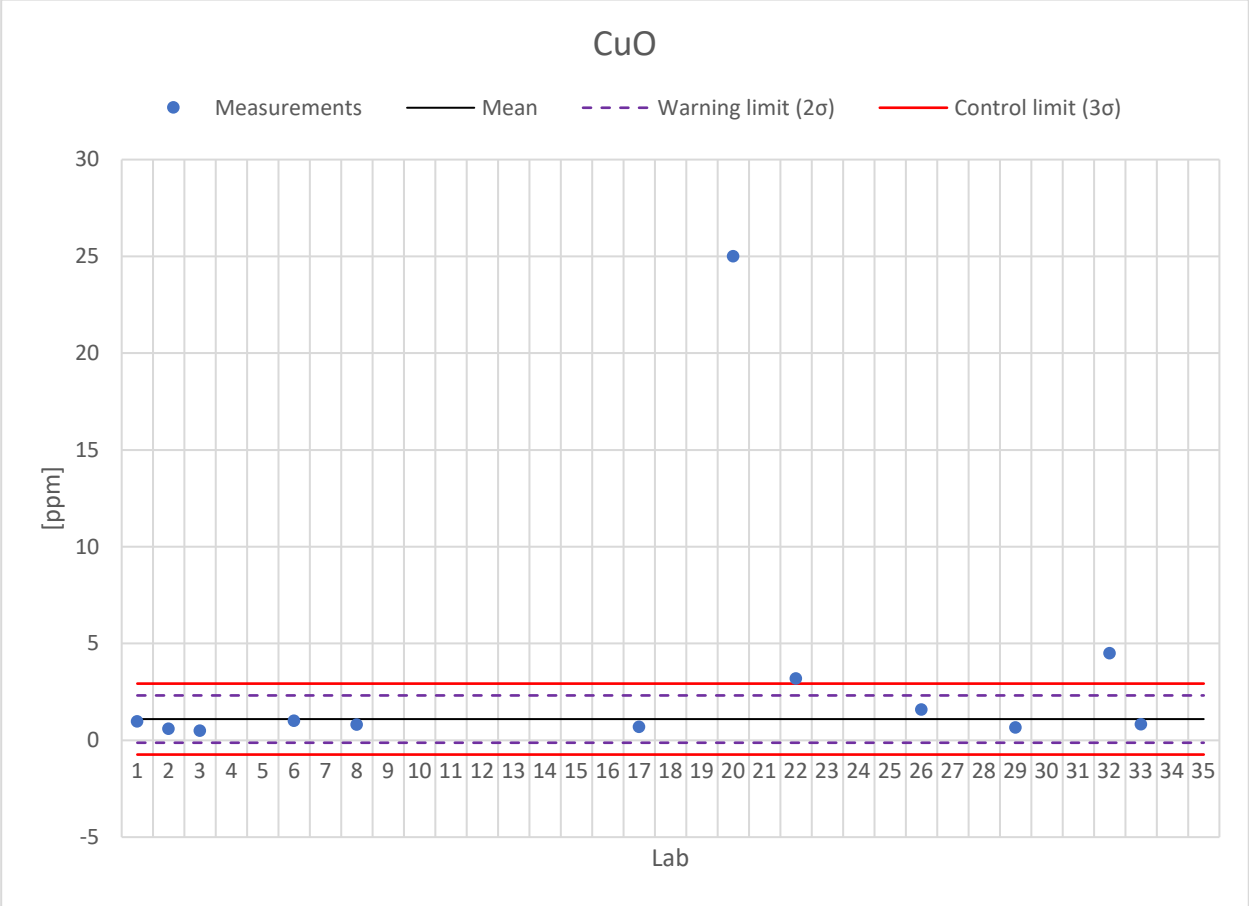
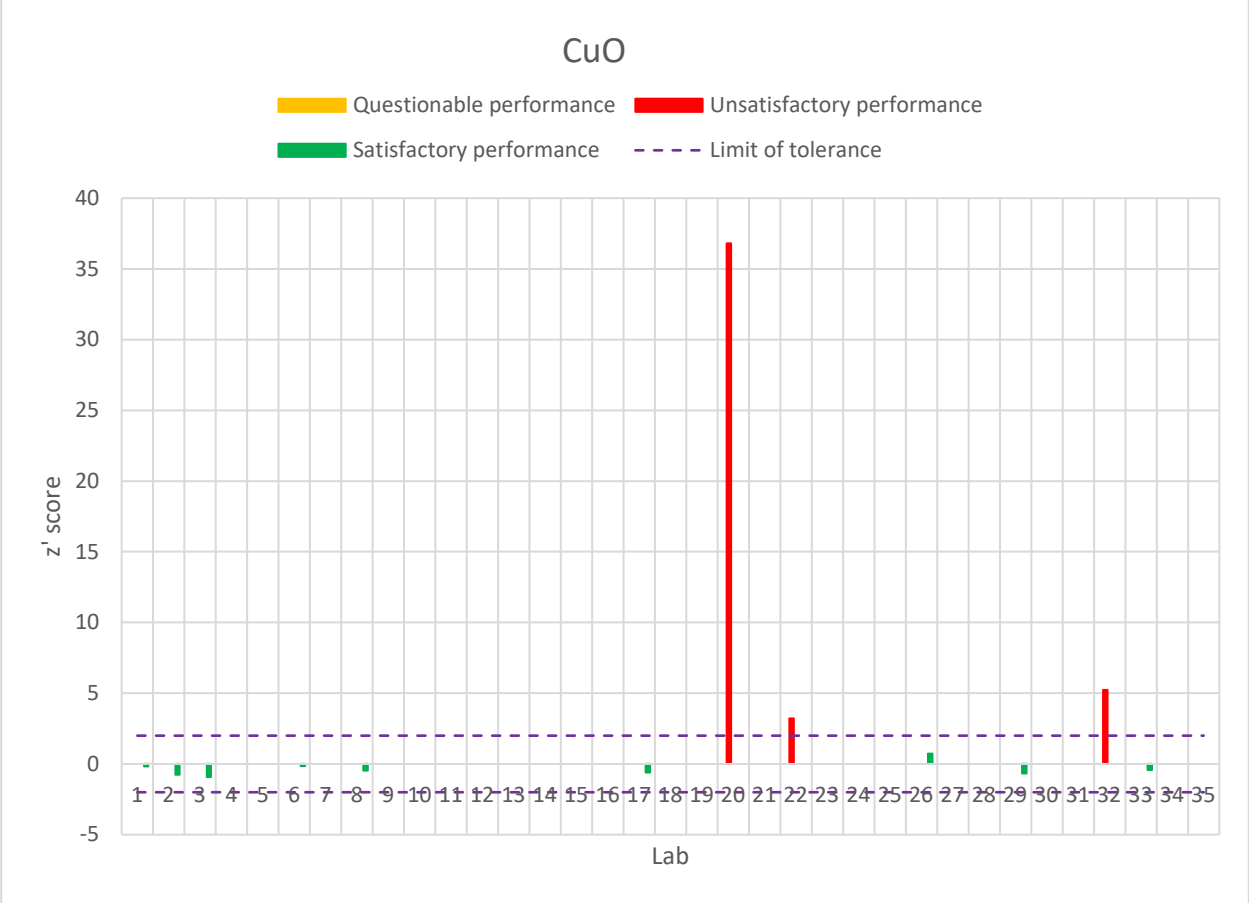


CHARTS SAMPLE C





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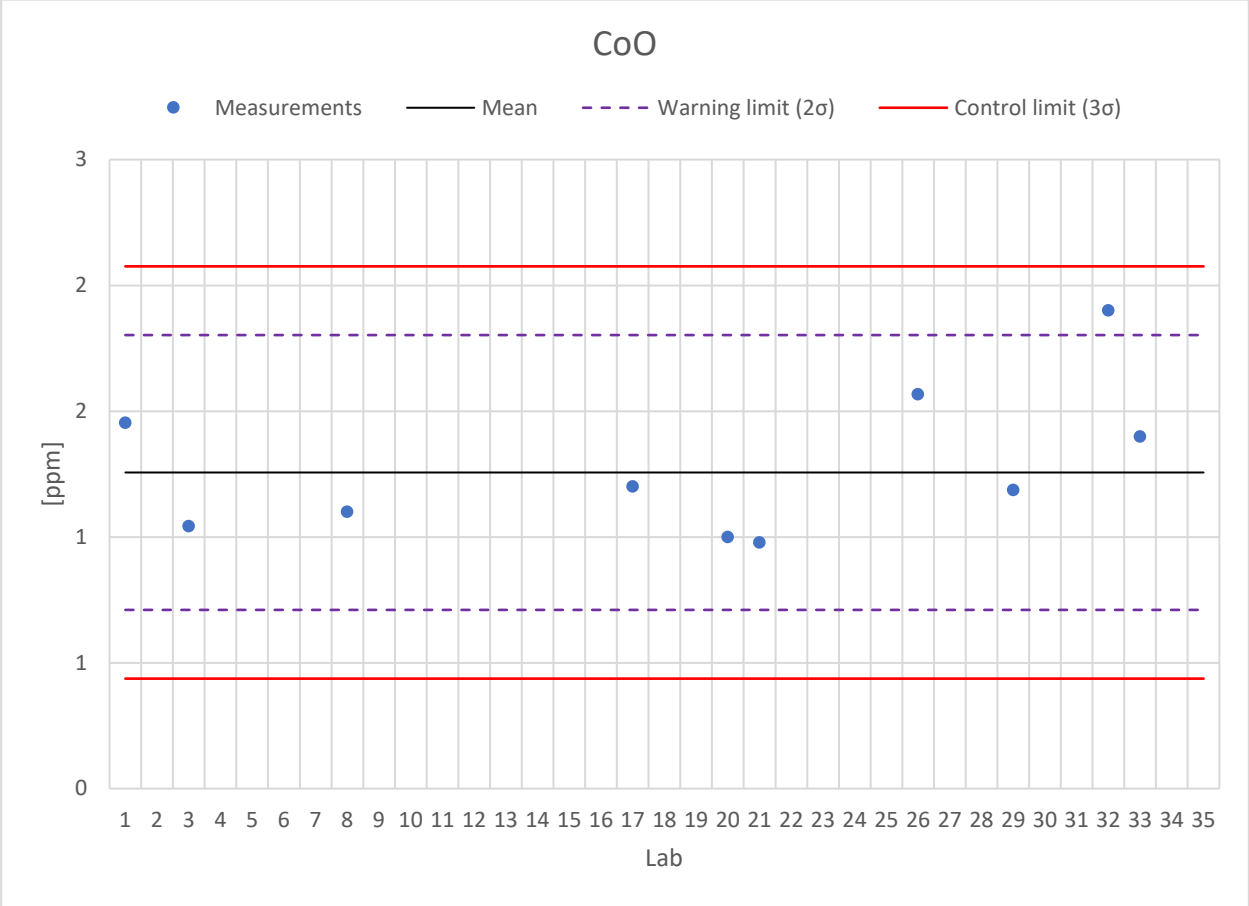

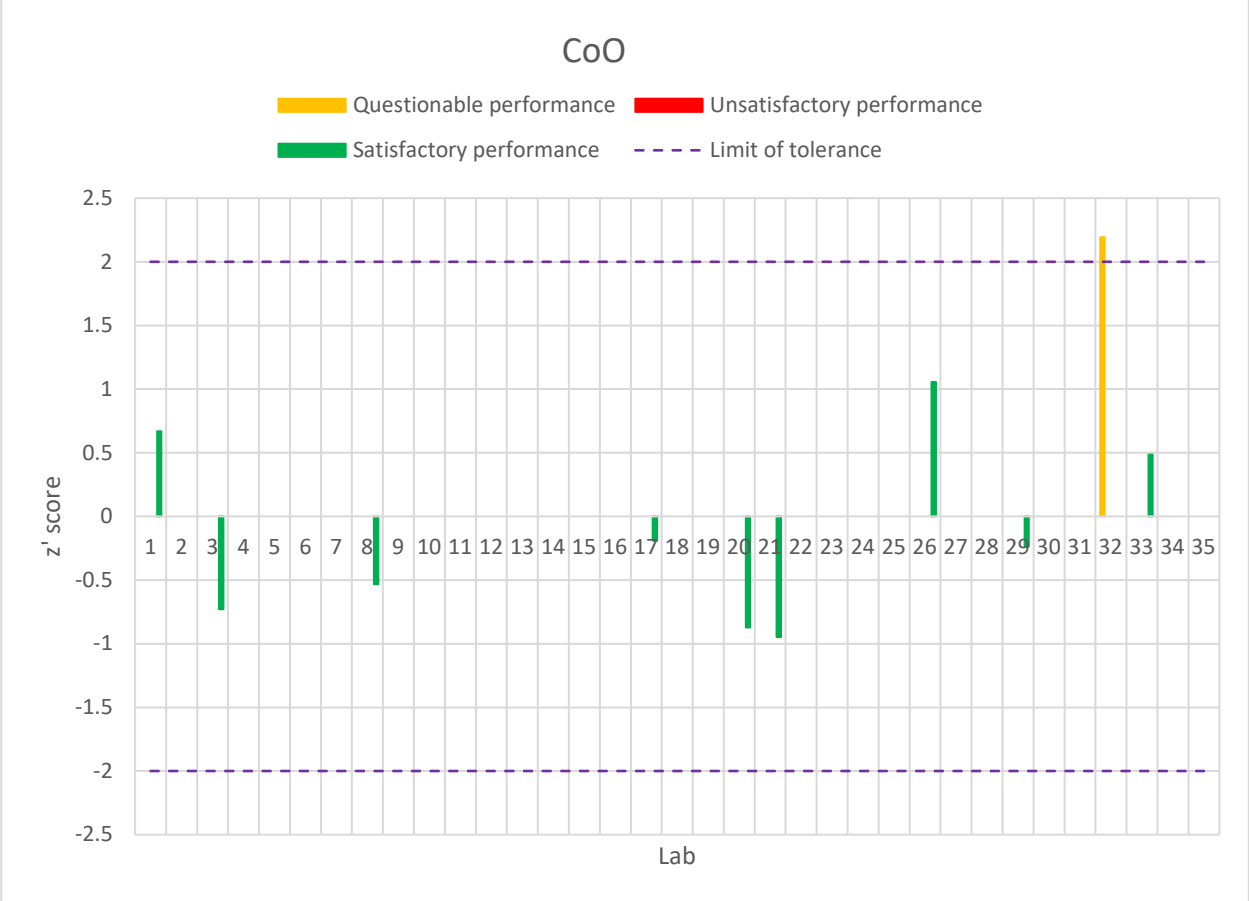

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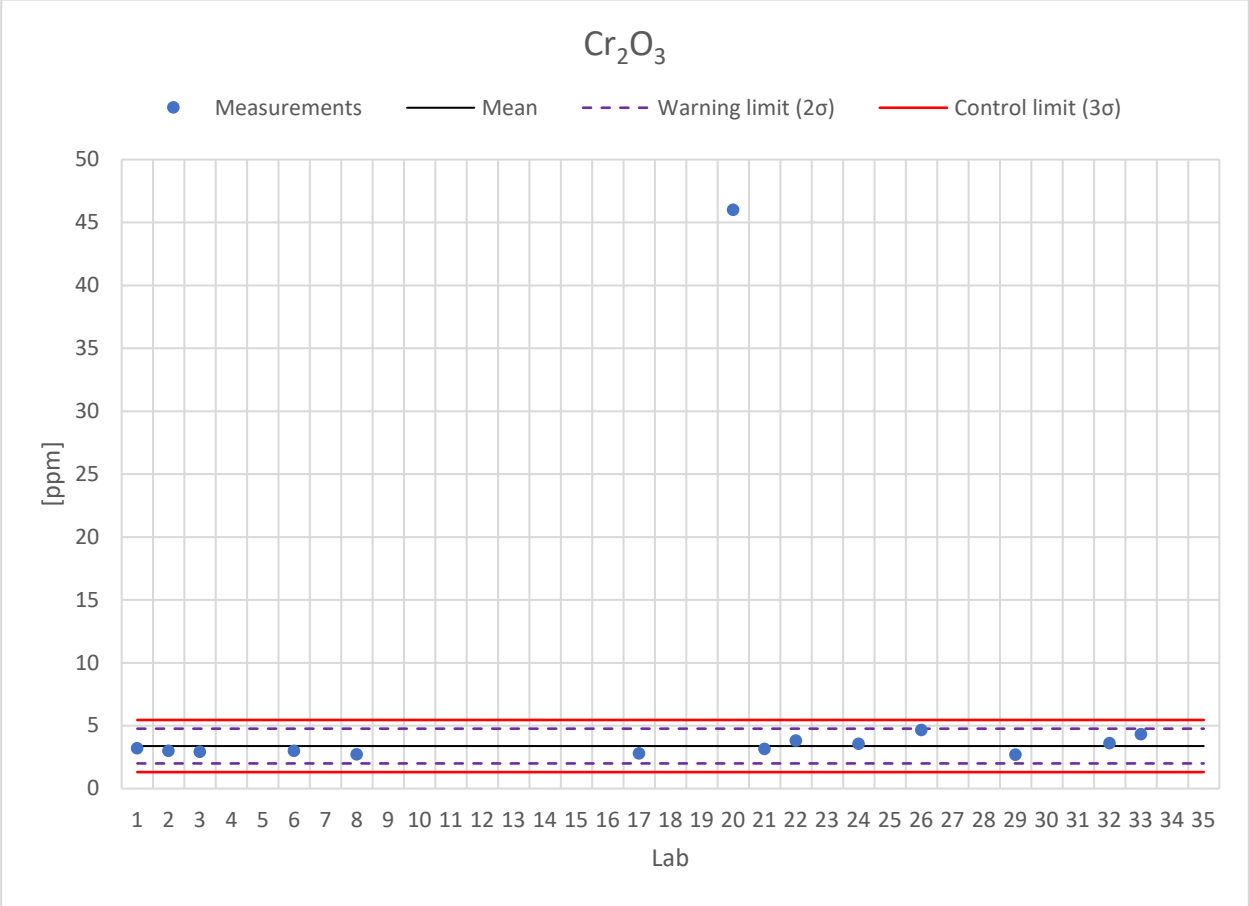
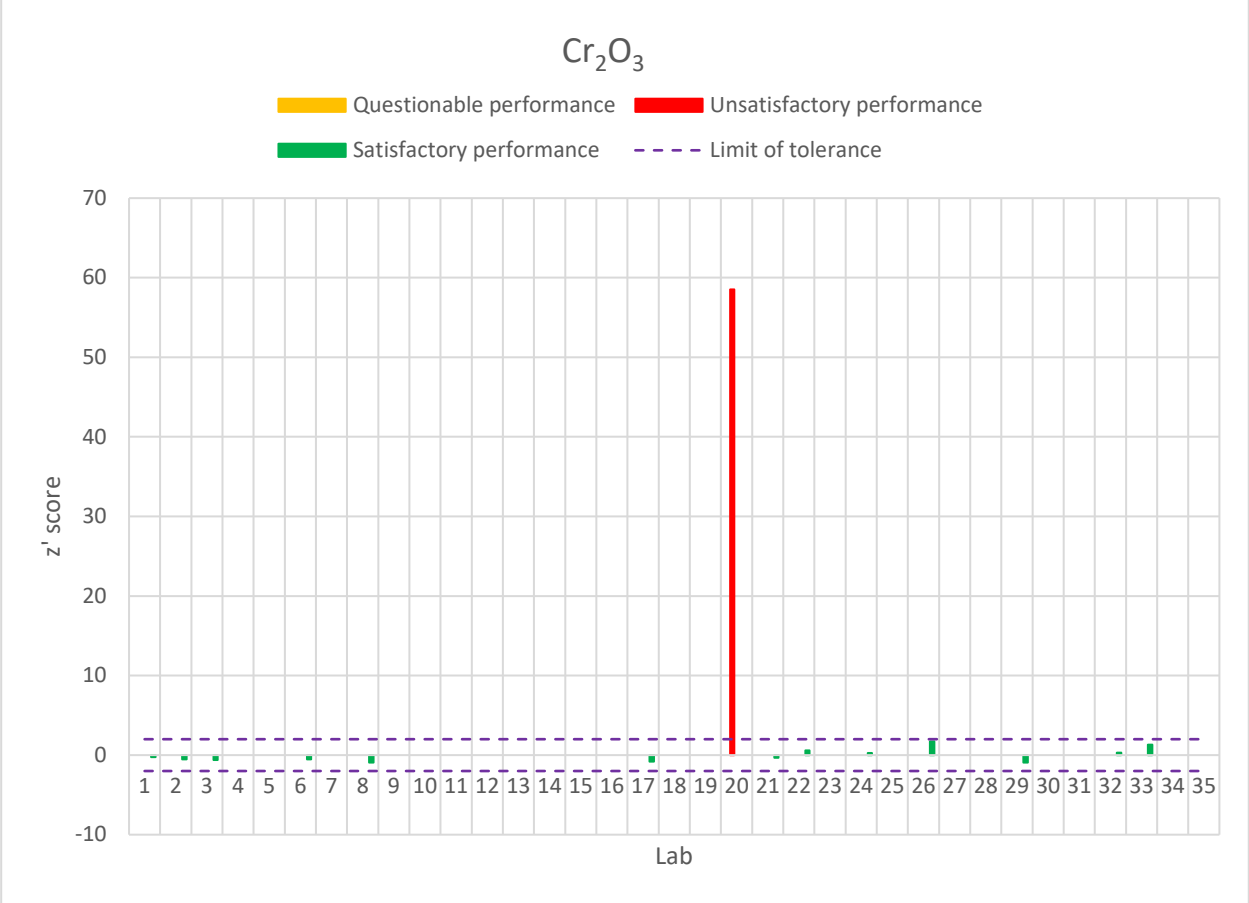
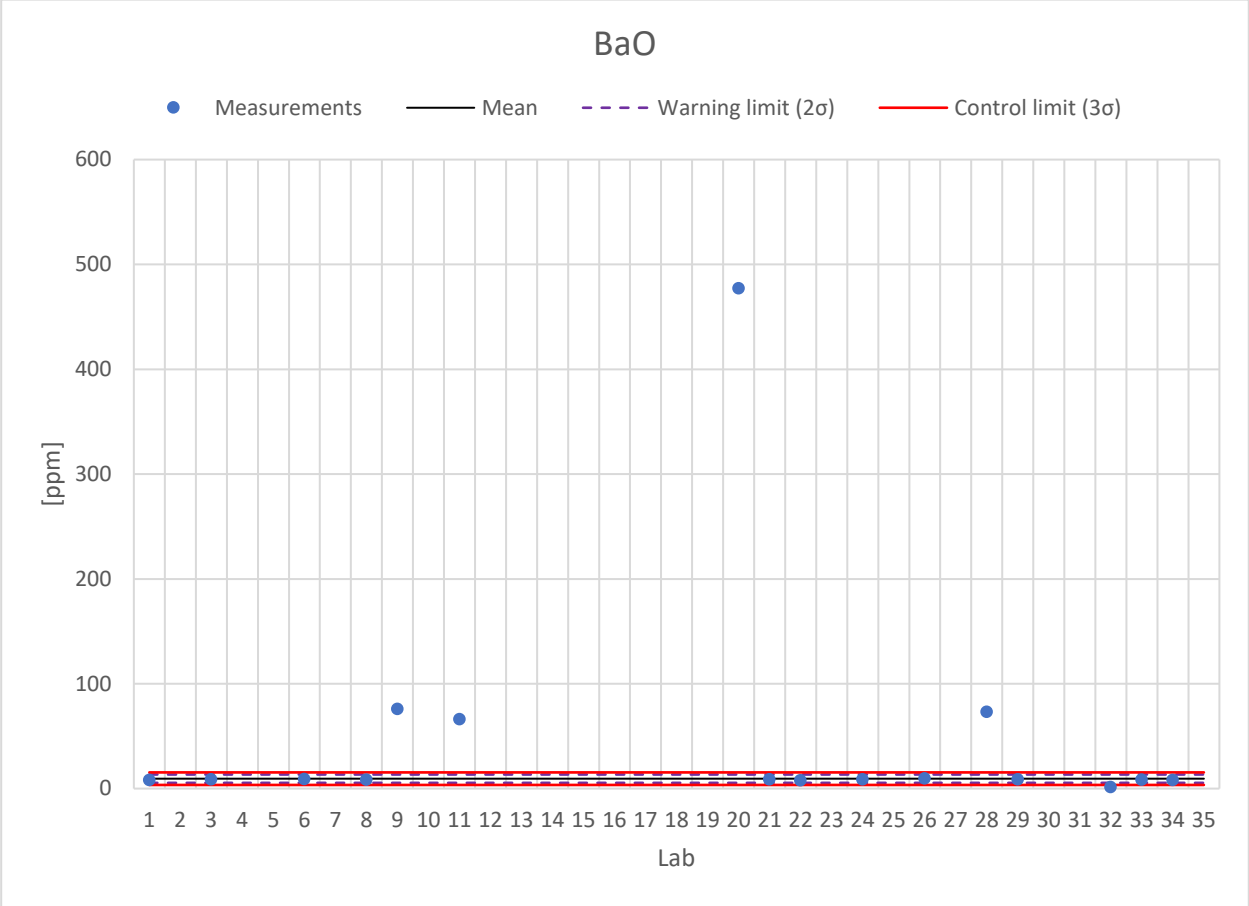
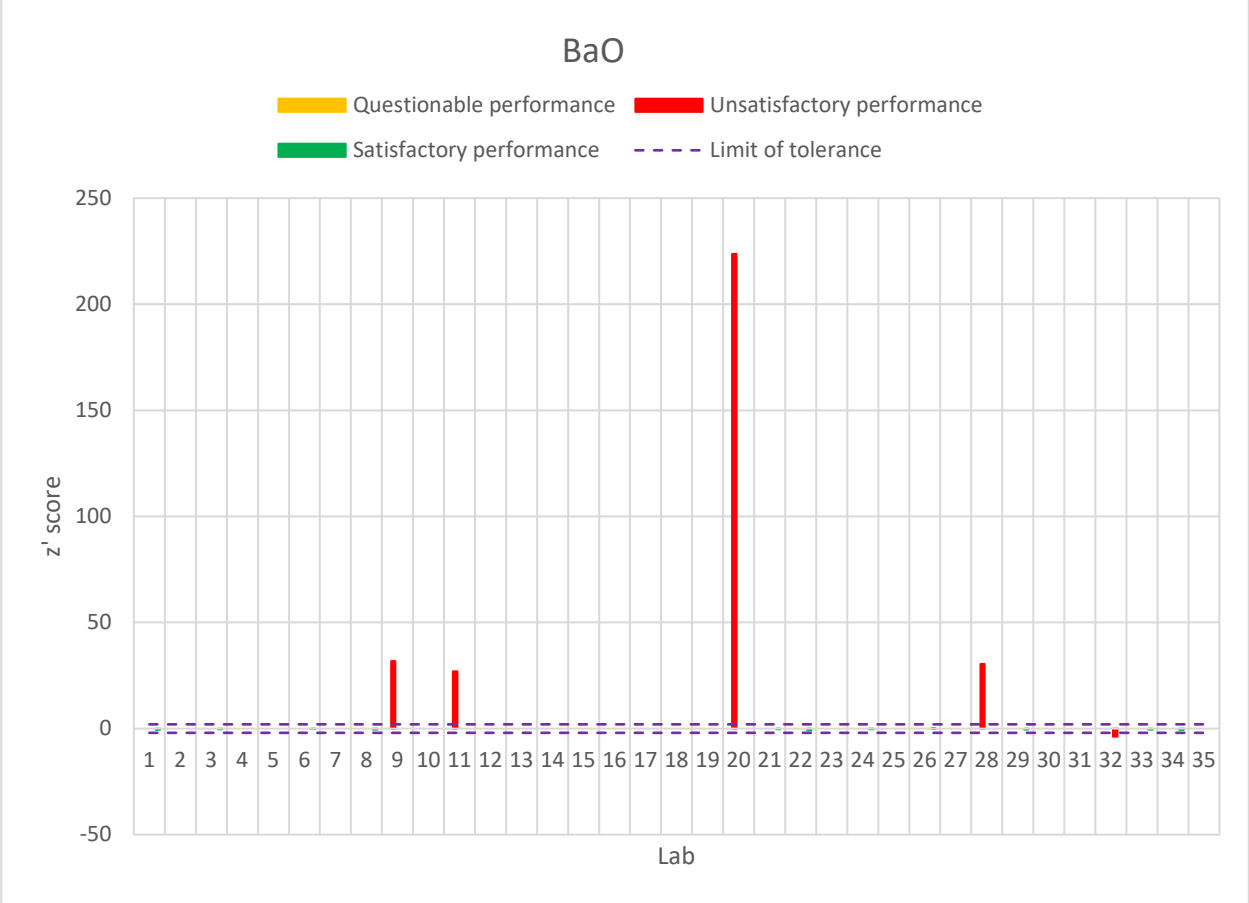


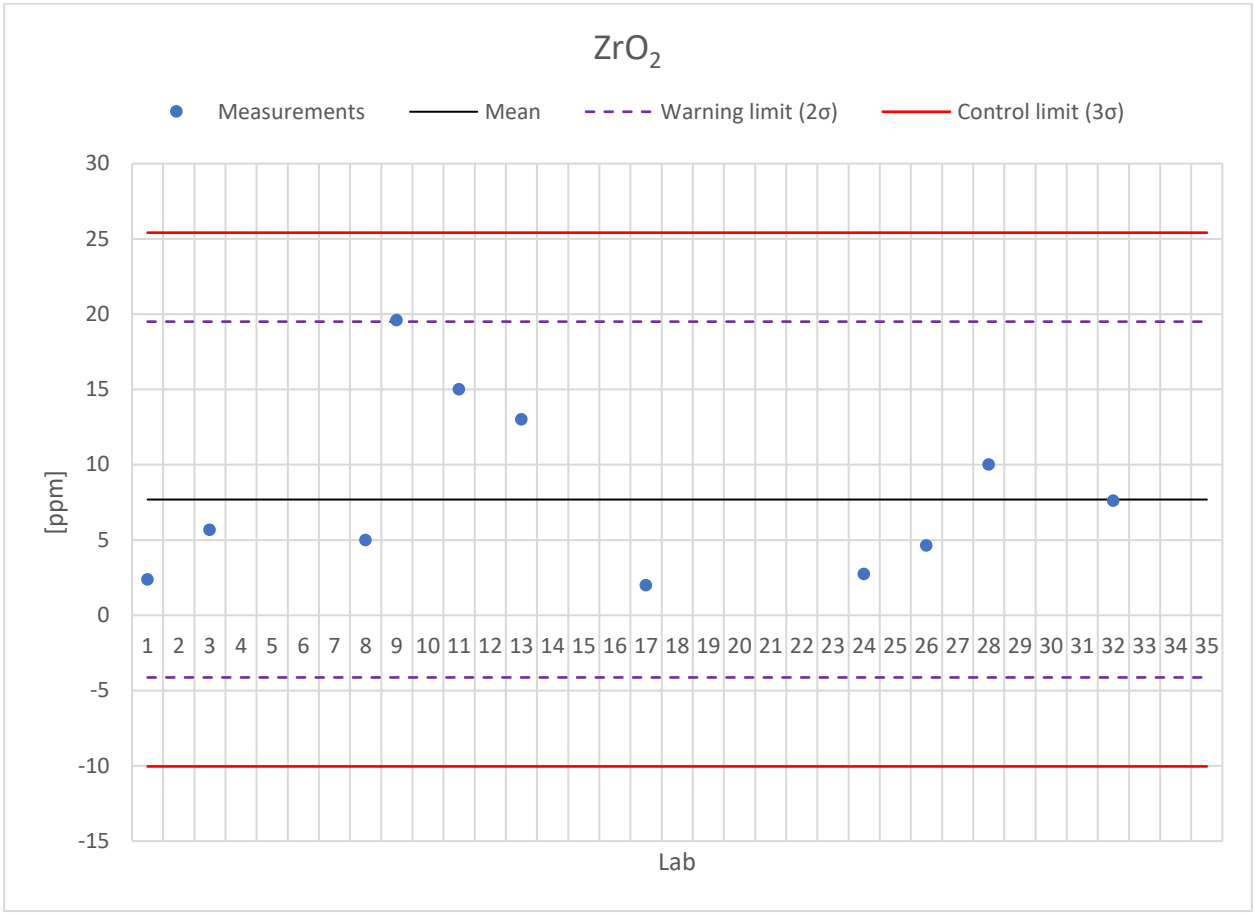


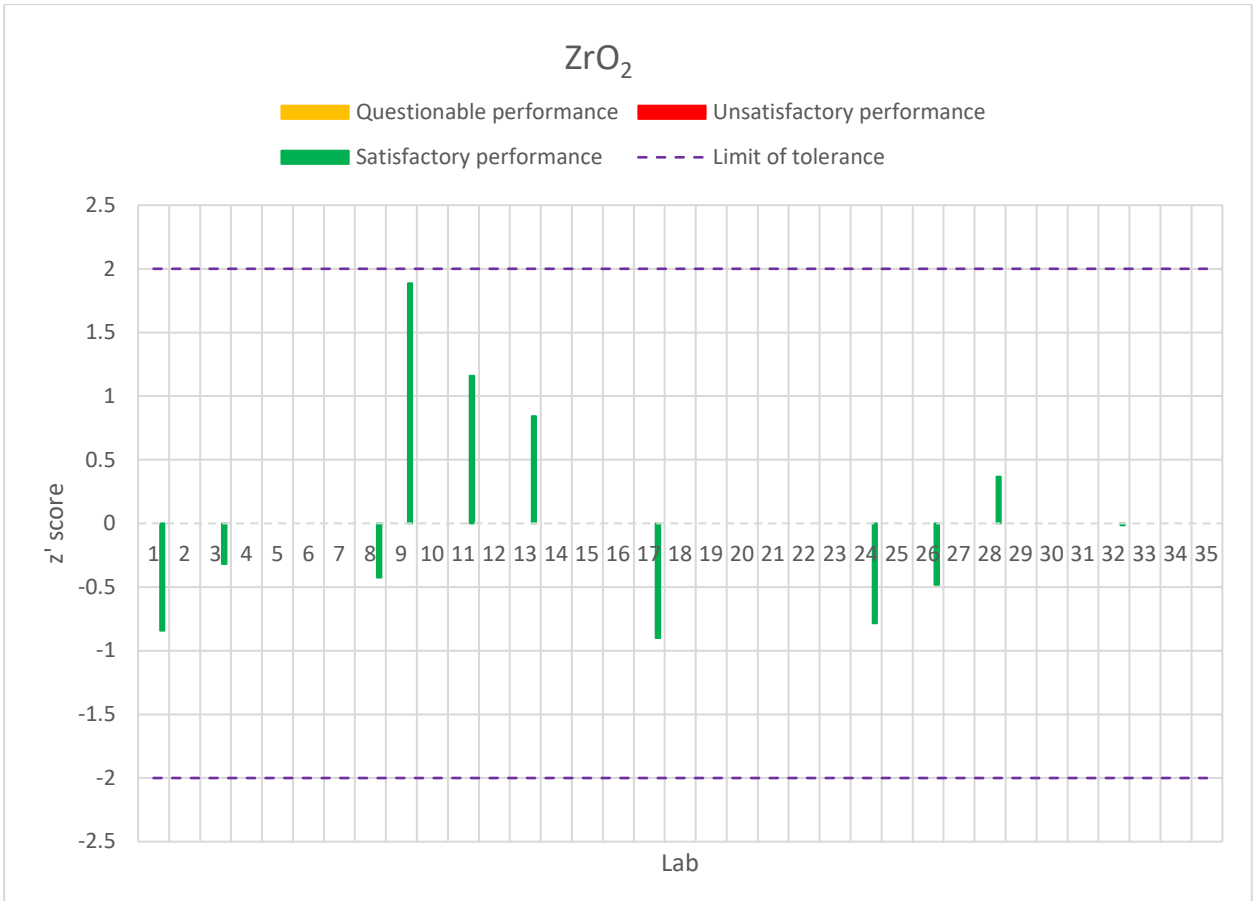
CHARTS SAMPLE C



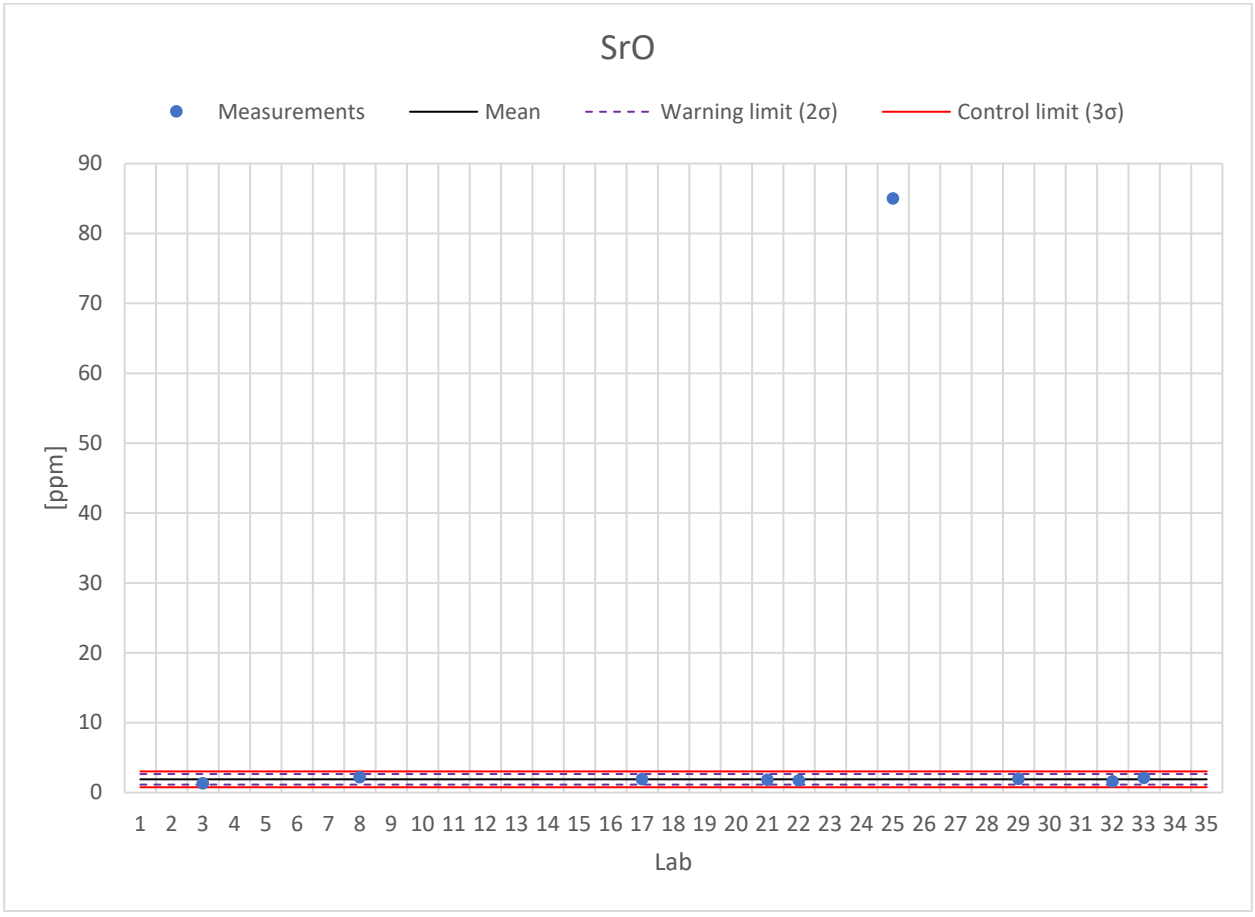


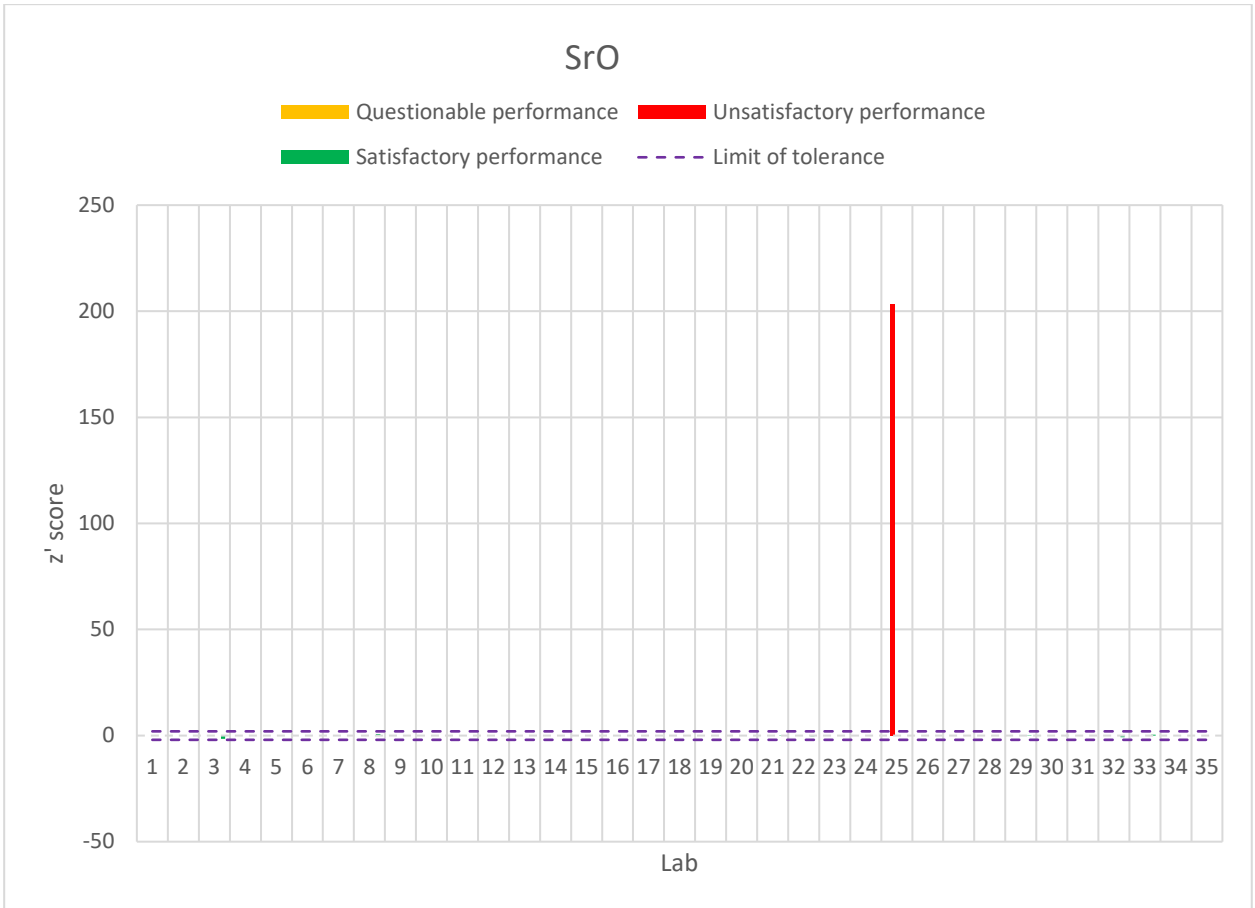
CHARTS SAMPLE C



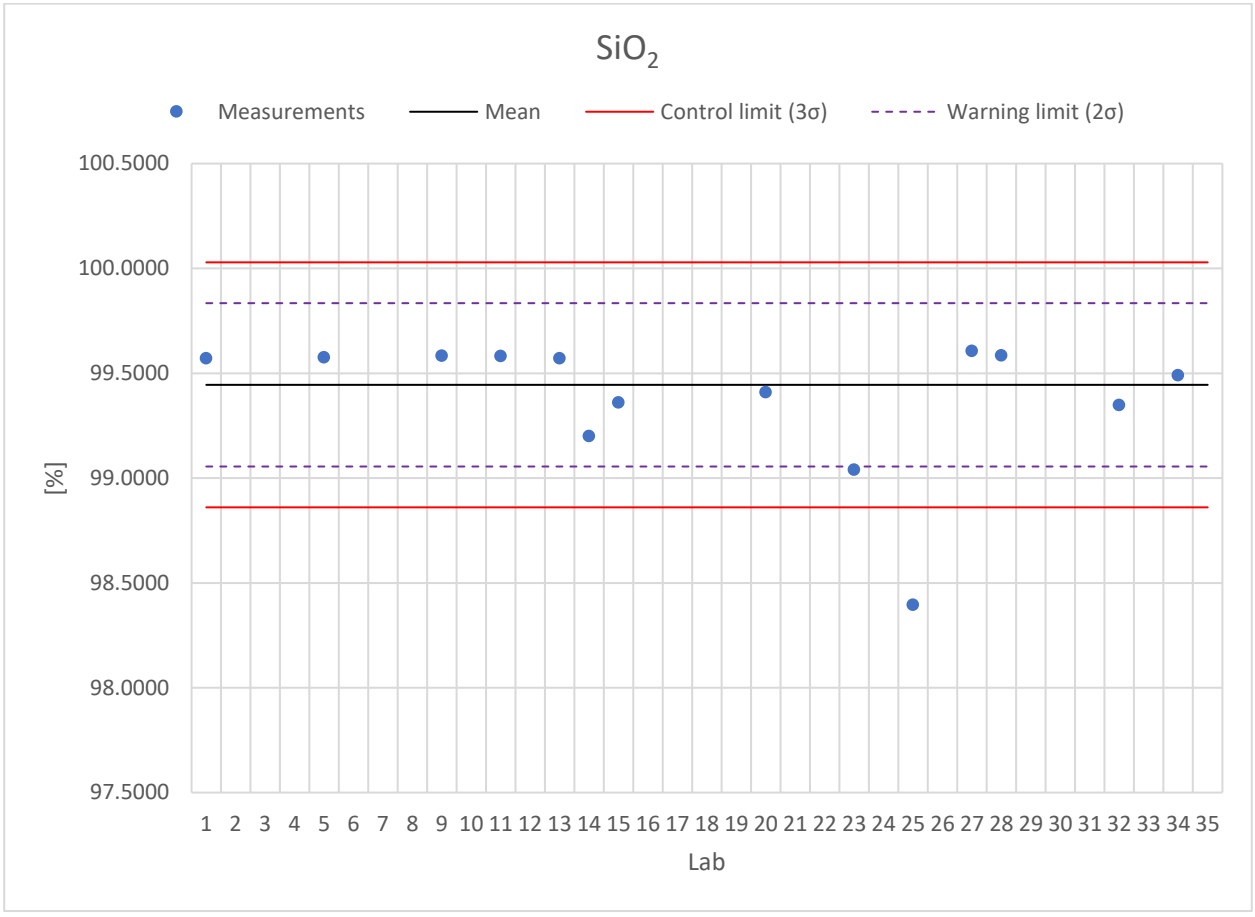


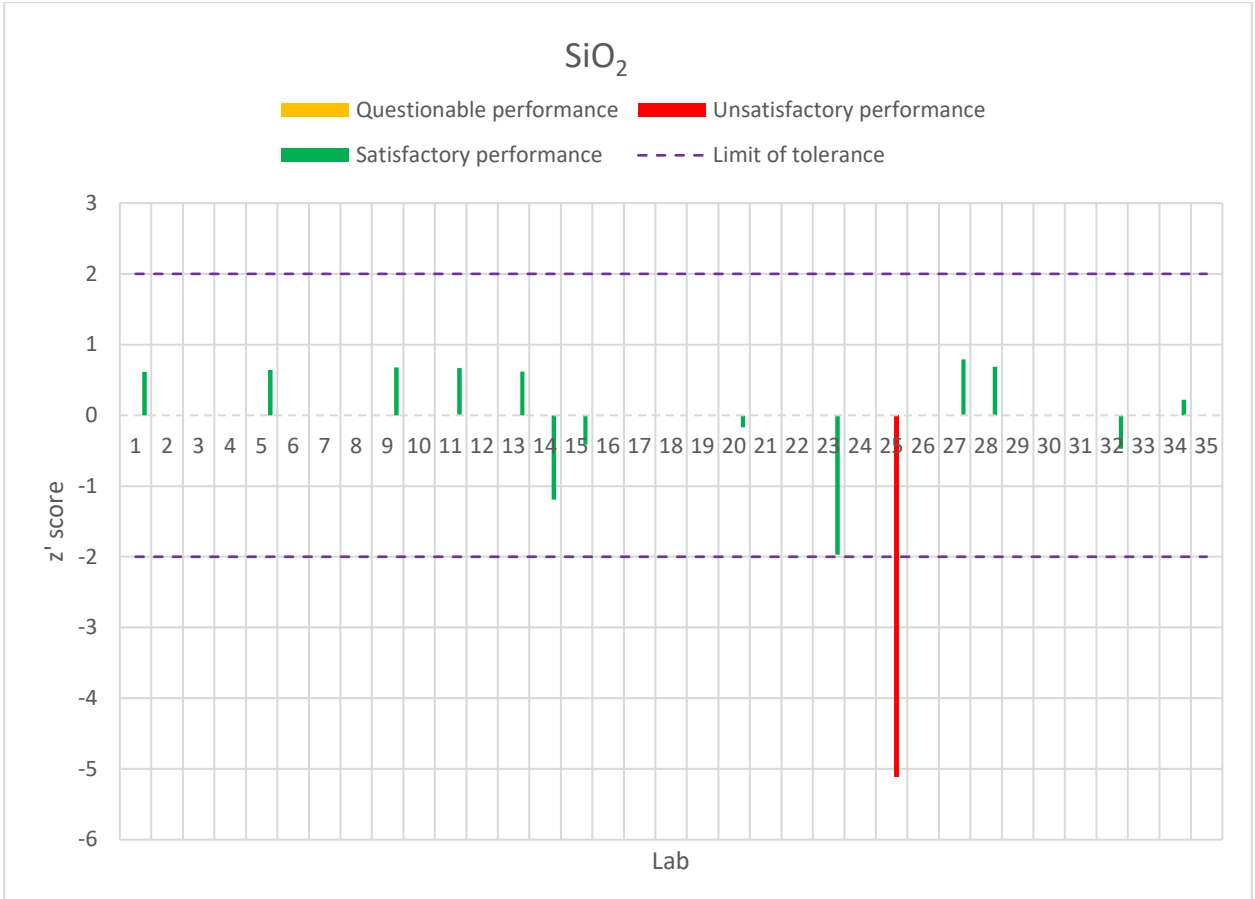
CHARTS SAMPLE C





CHARTS SAMPLE C





ANNEX 5.4. MEASUREMENTS SAMPLE D

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
	%	%	%	%	%	%	%	ppm	ppm	ppm
x_{pt}	0.1586	0.0071	0.0006	0.0087	0.0037	0.0126	0.0030	1.11	20.60	1.43
σ_{pt}	0.0178	0.0021	0.0004	0.0020	0.0006	0.0021	0.0005	0.61	24.94	1.14
N	30	27	23	28	21	26	26	20	17	4

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
Lab 1	0.1477	0.0057	0.0002	0.0081	0.0037	0.0118	0.0028	0.7	6.3	1.3
Lab 2	0.1633	0.0064	0.0003	0.0083	0.0037	0.0104	0.0031	0.8	1.7	
Lab 3	0.1485	0.0057	0.0003	0.0090			0.0030	0.5		
Lab 4										
Lab 5	0.1860	0.0090	0.0010	0.0083	0.0018	0.0120	0.0027	10.0	22.0	
Lab 6	0.1574	0.0056	0.0003	0.0090	0.0035	0.0126	0.0030	1.0	3.0	1.0
Lab 7	0.1630	0.0082	0.0008	0.0090	0.0043	0.0124	0.0031	1.3		
Lab 8	0.1597	0.0074	0.0003	0.0091		0.0137	0.0030	0.7	4.7	
Lab 9	0.1459	0.0029	0.0008	0.0090	0.0038	0.0111	0.0032	0.6		
Lab 10	0.1852	0.0562	0.0027			0.0065	0.0090			
Lab 11	0.1585	0.0114	0.0002	0.0028	0.0041	0.0137	0.0033	1.0	67.0	
Lab 12	0.1424	0.0026	0.0002	0.0077			0.0022			
Lab 13	0.1619	0.0069	0.0006	0.0077	0.0036	0.0120	0.0031			
Lab 14	0.2500	0.0160	0.0050	0.0260	0.0300	0.0150	0.0780		20.0	
Lab 15	0.1280			0.0110		0.0130				
Lab 16	0.1514	0.0056	0.0003	0.0081	0.0034	0.0110	0.0031		4.0	
Lab 17	0.1546	0.0058	0.0027	0.0090	0.0034	0.0123	0.0030	0.9	2.9	
Lab 18	0.1580	0.0070	0.0030	0.0110	0.0060	0.0150	0.0040		20.0	
Lab 19										
Lab 20	0.2230	0.0089	0.0015	0.0223			0.0032	14.0	102.0	
Lab 21	0.1575	0.0053	0.0004	0.0070	0.0033	0.0116	0.0025	0.6		
Lab 22	0.1398	0.0054	0.0003	0.0067	0.0037		0.0025	0.6	14.5	3.0
Lab 23	0.1720	0.0220	0.0008	0.0090	0.0040	0.0150			8.0	
Lab 24	0.1329	0.0063	0.0008	0.0035	0.0028	0.0128	0.0022	0.9	947.0	
Lab 25	0.1427			0.0105		0.0100				
Lab 26	0.1825	0.0082		0.0724	0.0012	0.0189	0.0051	2.6	234.5	
Lab 27	0.1650	0.0090		0.0012		0.0146		2.8		
Lab 28	0.1487			0.0073	0.0030	0.0113	0.0073		3.0	
Lab 29	0.1430	0.0052				0.0209	0.0028	0.7		
Lab 30										
Lab 31										
Lab 32	0.1563	0.0079	0.0004	0.0056	0.0037	0.0112	0.0027	5.8	9.2	0.5
Lab 33	0.1829	0.0065	0.0003	0.0092	0.0040	0.0143	0.0031	0.9		
Lab 34	0.1520	0.0080		0.0100	0.0050	0.0100	0.0020	5.0		
Lab 35										

	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	0.30	1.01	4.10	1.77	0.84	3.10	6.06	118.79	4.46
σ_{pt}	0.21	0.75	6.11	0.80	0.22		1.02	190.06	2.00
N	6	10	8	13	10	1	15	2	16

	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
Lab 1	<0.71	1.3	1.1	1.7	1.0		7.3	0.3	3.5
Lab 2	0.1	0.7		1.1			6.0		
Lab 3		0.3		1.0	0.5		6.1		3.5
Lab 4									
Lab 5									
Lab 6				2.0			6.0		4.0
Lab 7									
Lab 8	0.2	0.3		1.3	0.8		5.3		3.6
Lab 9									73.8
Lab 10									
Lab 11									83.0
Lab 12									
Lab 13									
Lab 14									
Lab 15									
Lab 16									
Lab 17	0.2	0.7	0.8	1.3	0.8		5.8		
Lab 18									
Lab 19									
Lab 20		1.0	40.0	26.0	0.7		24.0		474.0
Lab 21			0.8		0.7		4.7		4.4
Lab 22		2.0					5.6		3.8
Lab 23									
Lab 24				1.2			6.3		2.2
Lab 25			105.0						
Lab 26	0.6	1.6	0.5	3.1	1.1		8.0	237.3	3.7
Lab 27							5.3		
Lab 28									70.0
Lab 29	0.2	0.4	0.9	1.2	0.8		5.0		3.7
Lab 30									
Lab 31									
Lab 32	0.5	3.8	32.2	6.4	1.8	3.1	5.6		1.5
Lab 33				1.5	0.9		6.8		3.6
Lab 34				10.0					3.0
Lab 35									

	LiO_2	SO_3	MoO_3	HfO_2	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
x_{pt}	28.74	22.64	1.59	0.73	3.45	1.66	8.95	1.35	2.05	0.62
σ_{pt}	15.68	11.39	1.69		4.18	1.62	8.00	2.00	3.12	0.06
N	3	4	5	1	10	3	3	2	2	7

	LiO_2	SO_3	MoO_3	HfO_2	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2	SrO
Lab 1	45.7	13.6	4.0	0.7	4.8					
Lab 2										
Lab 3			0.8							
Lab 4										
Lab 5		20.0								
Lab 6										
Lab 7										
Lab 8			0.3		0.5		0.1			0.7
Lab 9					13.9					
Lab 10										
Lab 11					9.0					
Lab 12										
Lab 13					7.0					
Lab 14										
Lab 15										
Lab 16										
Lab 17	23.0				0.1					0.6
Lab 18										
Lab 19										
Lab 20		37.0								
Lab 21										0.6
Lab 22							13.6			0.6
Lab 23										
Lab 24										
Lab 25										
Lab 26					0.6	0.4		0.1	0.1	
Lab 27										
Lab 28		20.0			1.0					
Lab 29	17.5				0.1					0.6
Lab 30										
Lab 31										
Lab 32			7.3		1.7	4.0	13.2	2.6	4.0	0.6
Lab 33			0.9			1.3				0.7
Lab 34										
Lab 35										

	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%
x_{pt}	0.32	0.22	1.42	0.26	0.09	0.04	0.0110	0.2389	99.6168
σ_{pt}			1.36					0.1899	0.3108
N	1	1	2	1	1	1	1	7	14

	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
Lab 1								0.1800	99.8106
Lab 2									
Lab 3									
Lab 4									
Lab 5									99.7820
Lab 6									
Lab 7									
Lab 8									
Lab 9									99.8151
Lab 10									
Lab 11									99.7938
Lab 12									
Lab 13									99.8035
Lab 14								0.0750	99.4000
Lab 15								0.7200	99.0700
Lab 16									
Lab 17									
Lab 18									
Lab 19									
Lab 20							0.0		99.6600
Lab 21									
Lab 22									
Lab 23								0.1900	98.7100
Lab 24									
Lab 25								0.2020	98.7526
Lab 26	0.3	0.2	2.3	0.3					
Lab 27									99.7833
Lab 28									99.8153
Lab 29			0.6		0.1	0.0		0.0900	
Lab 30									
Lab 31									
Lab 32								0.5370	99.5215
Lab 33									
Lab 34									99.9000
Lab 35									

ANNEX 5.4.1. Z-SCORE SAMPLE D

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO
Lab 1	-0.6	-0.7	-0.9	-0.3	0.1	-0.4	-0.5	-0.7
Lab 2	0.3	-0.3	-0.7	-0.2	0.0	-1.0	0.2	-0.5
Lab 3	-0.6	-0.7	-0.9	0.1			-0.1	-1.0
Lab 4								
Lab 5	1.5	0.9	1.2	-0.2	-3.4	-0.3	-0.7	14.6
Lab 6	-0.1	-0.7	-0.8	0.1	-0.3	0.0	-0.1	-0.2
Lab 7	0.3	0.5	0.7	0.1	1.1	-0.1	0.2	0.3
Lab 8	0.1	0.1	-0.8	0.2		0.5	-0.1	-0.7
Lab 9	-0.7	-2.0	0.6	0.1	0.2	-0.7	0.4	-0.8
Lab 10	1.5	23.0	5.9			-2.9	13.1	
Lab 11	0.0	2.0	-1.0	-3.0	0.7	0.5	0.6	-0.2
Lab 12	-0.9	-2.2	-1.0	-0.5			-1.9	
Lab 13	0.2	-0.1	0.1	-0.5	-0.2	-0.3	0.2	
Lab 14	5.1	4.2	12.3	8.7	46.8	1.2	164.9	
Lab 15	-1.7			1.1		0.2		
Lab 16	-0.4	-0.7	-0.8	-0.3	-0.5	-0.8	0.2	
Lab 17	-0.2	-0.6	5.9	0.1	-0.5	-0.1	-0.1	-0.4
Lab 18	0.0	-0.1	6.7	1.1	4.1	1.2	2.1	
Lab 19								
Lab 20	3.6	0.8	2.6	6.8			0.4	21.1
Lab 21	-0.1	-0.9	-0.3	-0.9	-0.7	-0.5	-1.2	-0.8
Lab 22	-1.1	-0.8	-0.8	-1.0	0.0		-1.1	-0.8
Lab 23	0.8	7.0	0.6	0.1	0.6	1.2		
Lab 24	-1.4	-0.4	0.7	-2.6	-1.5	0.1	-1.9	-0.4
Lab 25	-0.9			0.9		-1.3		
Lab 26	1.3	0.5		32.0	-4.4	3.1	4.6	2.4
Lab 27	0.4	0.9		-3.8		1.0		2.8
Lab 28	-0.6			-0.7	-1.2	-0.6	9.4	
Lab 29	-0.9	-0.9				4.0	-0.6	-0.7
Lab 30								
Lab 31								
Lab 32	-0.1	0.4	-0.5	-1.6	0.0	-0.7	-0.7	7.7
Lab 33	1.4	-0.3	-0.9	0.2	0.6	0.8	0.2	-0.4
Lab 34	-0.4	0.4		0.6	2.3	-1.3	-2.3	6.4
Lab 35								

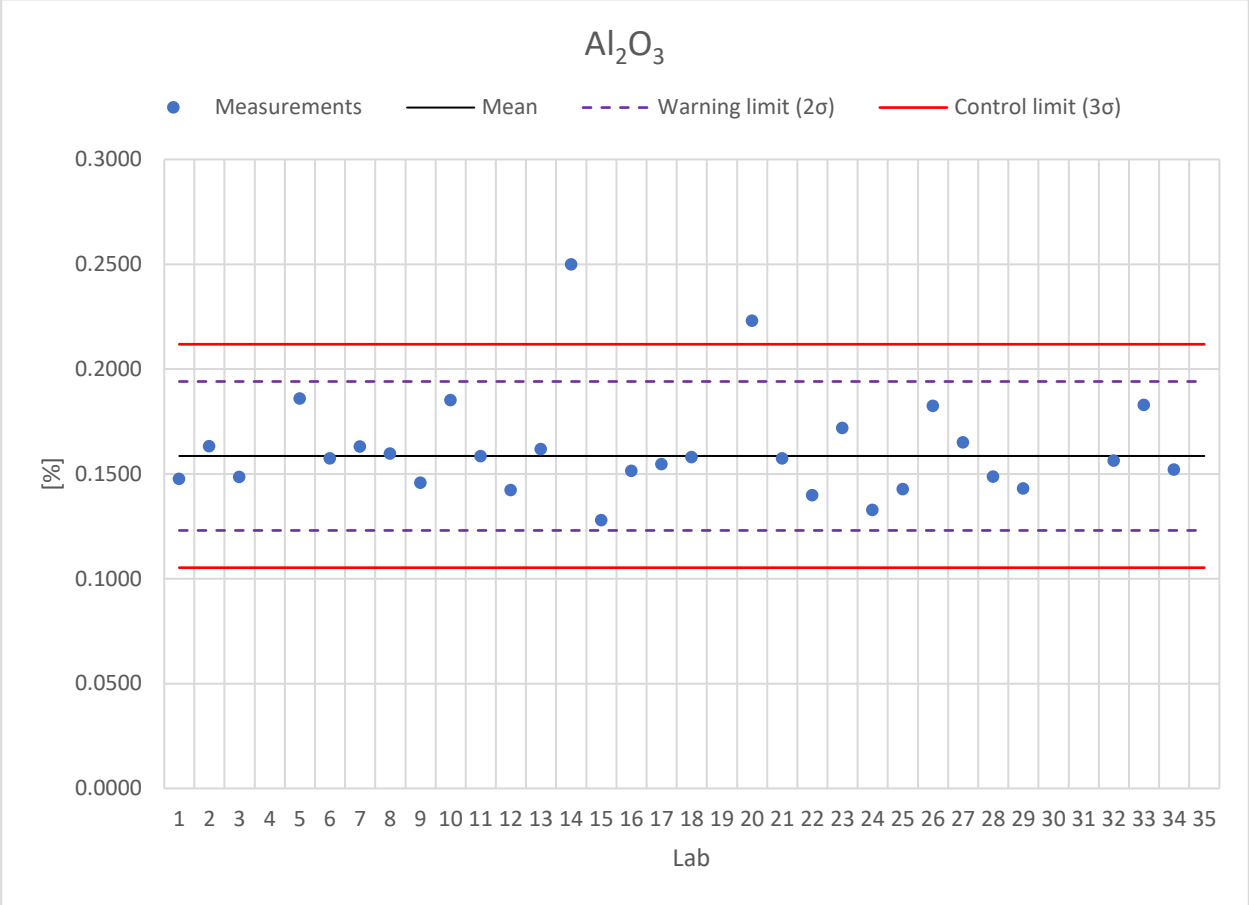
Satisfactory performance
Questionable performance
Unsatisfactory performance

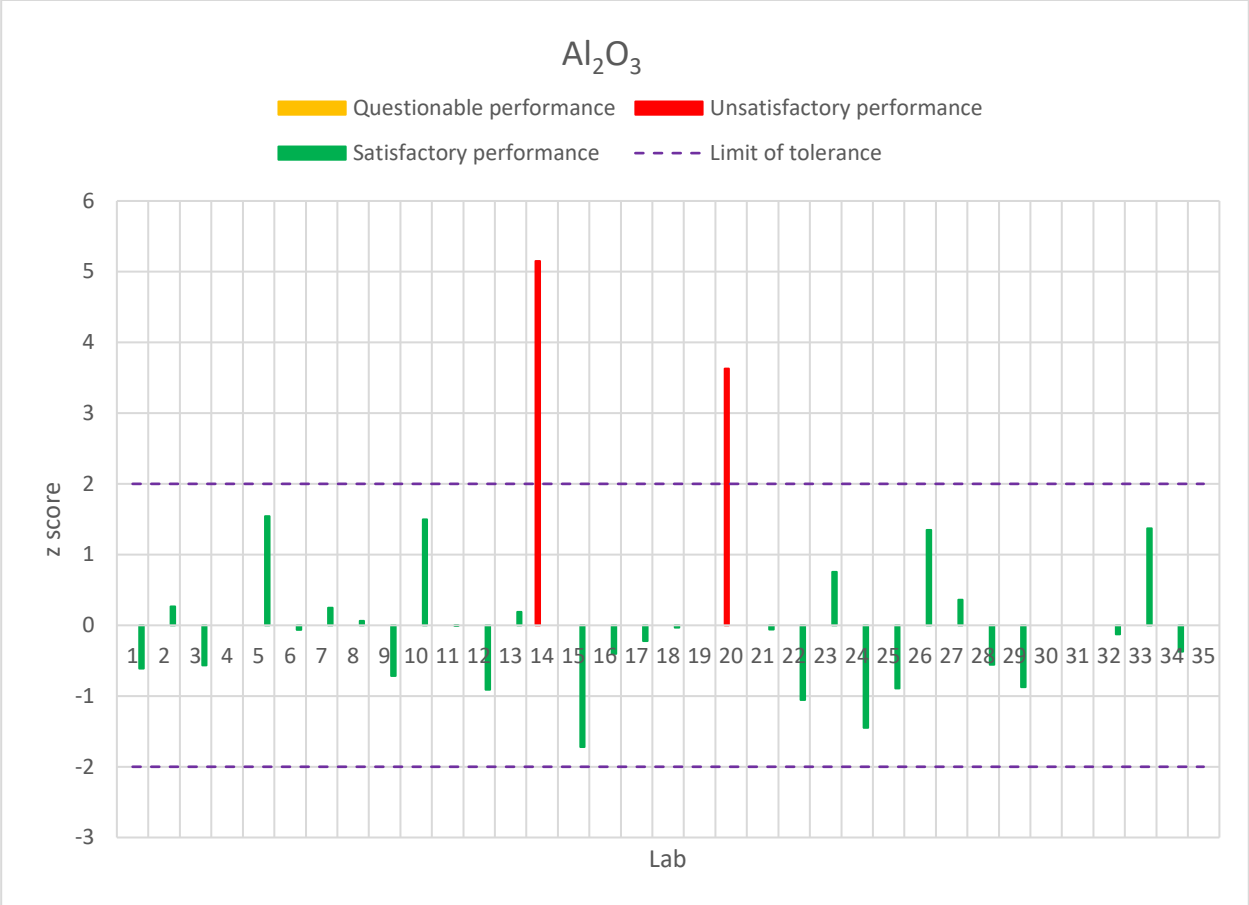
ANNEX 5.4.2. Z'-SCORE SAMPLE D

	P_2O_5	NiO	PbO	CuO	CoO	Cr_2O_3	BaO	ZrO_2	SrO	SiO_2
Lab 1	-0.5	0.3	-0.5	0.0	0.6	1.1	-0.4	0.3		0.6
Lab 2	-0.7	-0.4		-0.8		-0.1				
Lab 3		-0.9		-0.9	-1.4	0.1	-0.5			
Lab 4										
Lab 5	0.1									0.5
Lab 6	-0.7			0.3		-0.1	-0.2			
Lab 7										
Lab 8	-0.6	-0.9		-0.6	-0.1	-0.7	-0.4	-0.7	1.3	
Lab 9							33.1	2.3		0.6
Lab 10										
Lab 11	1.8						37.5	1.2		0.5
Lab 12										
Lab 13								0.8		0.6
Lab 14	0.0									-0.7
Lab 15										-1.7
Lab 16	-0.6									
Lab 17	-0.7	-0.4	-0.5	-0.6	-0.1	-0.2		-0.7	0.0	
Lab 18	0.0									
Lab 19										
Lab 20	3.1	0.0	5.4	28.7	-0.6	16.7	224.1			0.1
Lab 21			-0.5		-0.8	-1.3	0.0		-0.8	
Lab 22	-0.2	1.2				-0.4	-0.3		-0.7	
Lab 23	-0.5									-2.8
Lab 24	35.5			-0.7		0.2	-1.1			
Lab 25			15.1							-2.6
Lab 26	8.2	0.7	-0.5	1.6	1.2	1.8	-0.3	-0.6		
Lab 27						-0.7				0.5
Lab 28	-0.7						31.3	-0.5		0.6
Lab 29		-0.8	-0.5	-0.6	-0.3	-1.0	-0.4	-0.7	-0.3	
Lab 30										
Lab 31										
Lab 32	-0.4	3.4	4.2	5.5	4.0	-0.4	-1.4	-0.4	-0.3	-0.3
Lab 33				-0.3	0.3	0.7	-0.4		1.1	
Lab 34				9.7			-0.7			0.9
Lab 35										

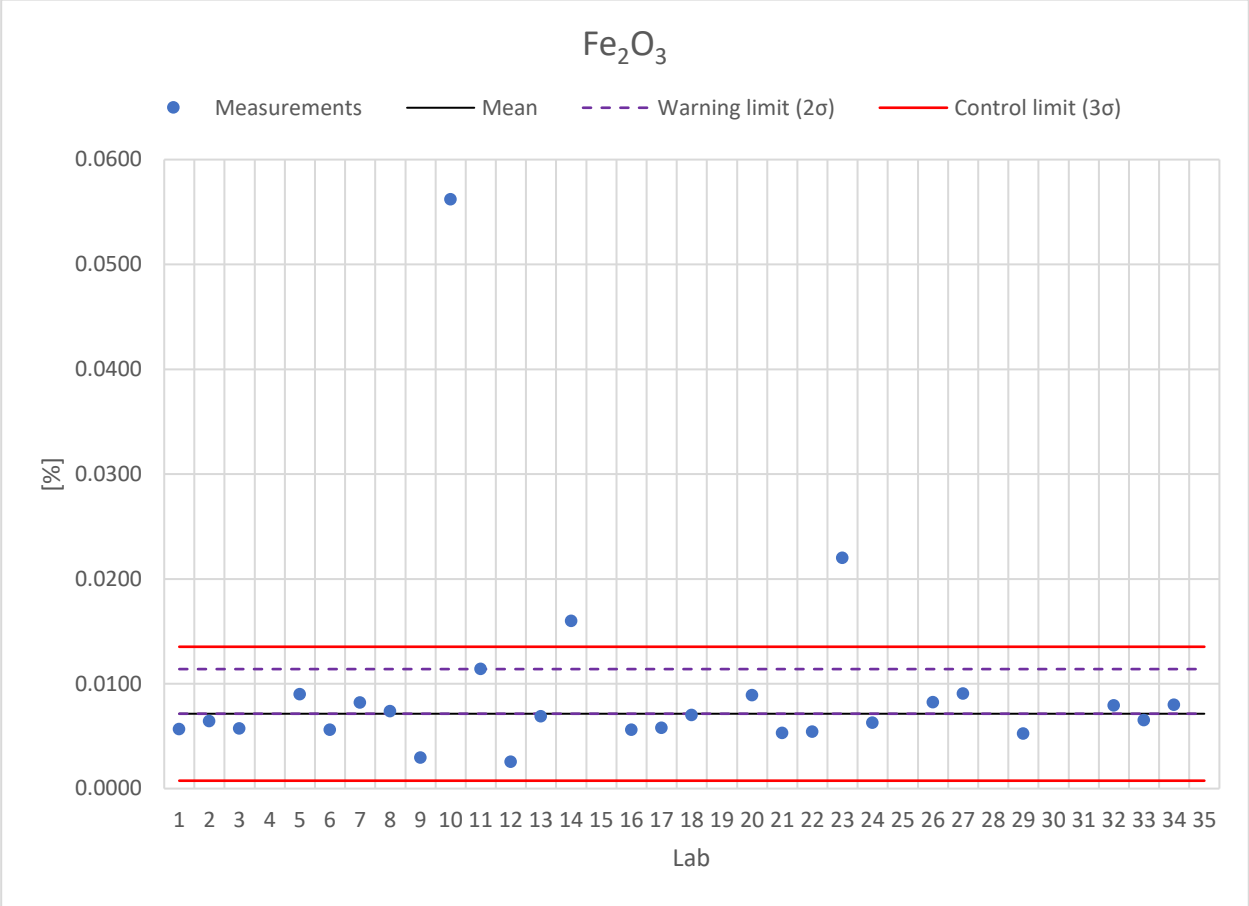
Satisfactory performance
Questionable performance
Unsatisfactory performance

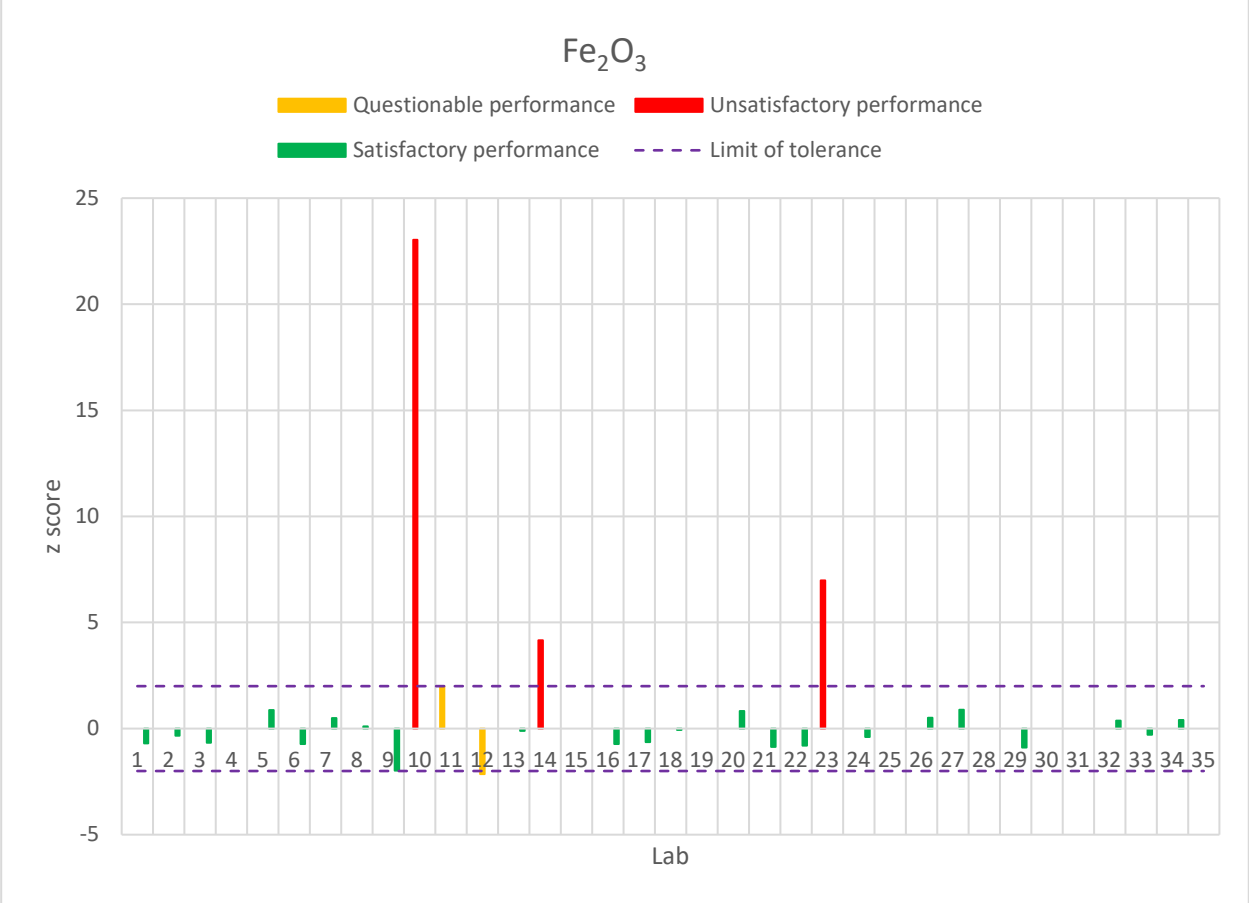
ANNEX 5.4.3. CHARTS SAMPLE D



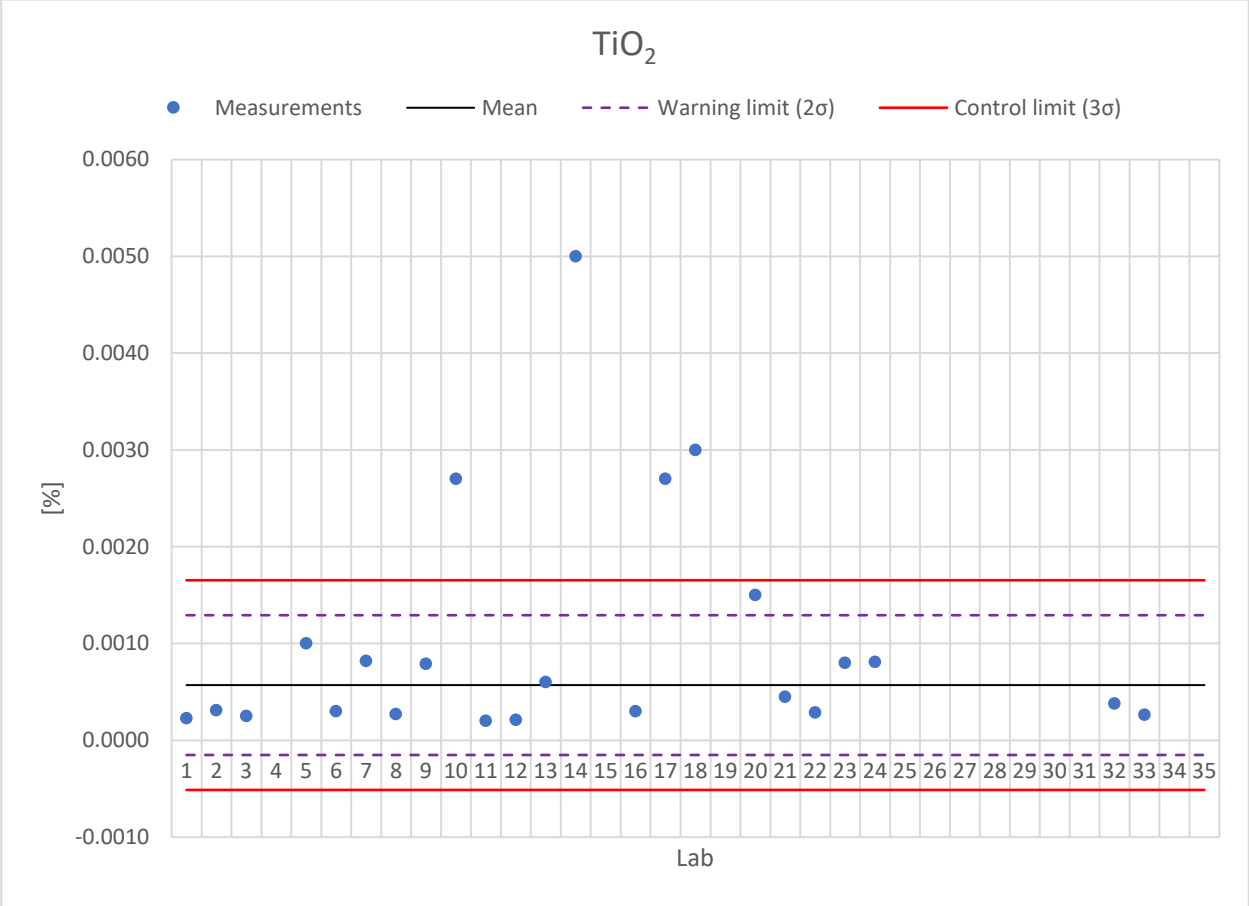


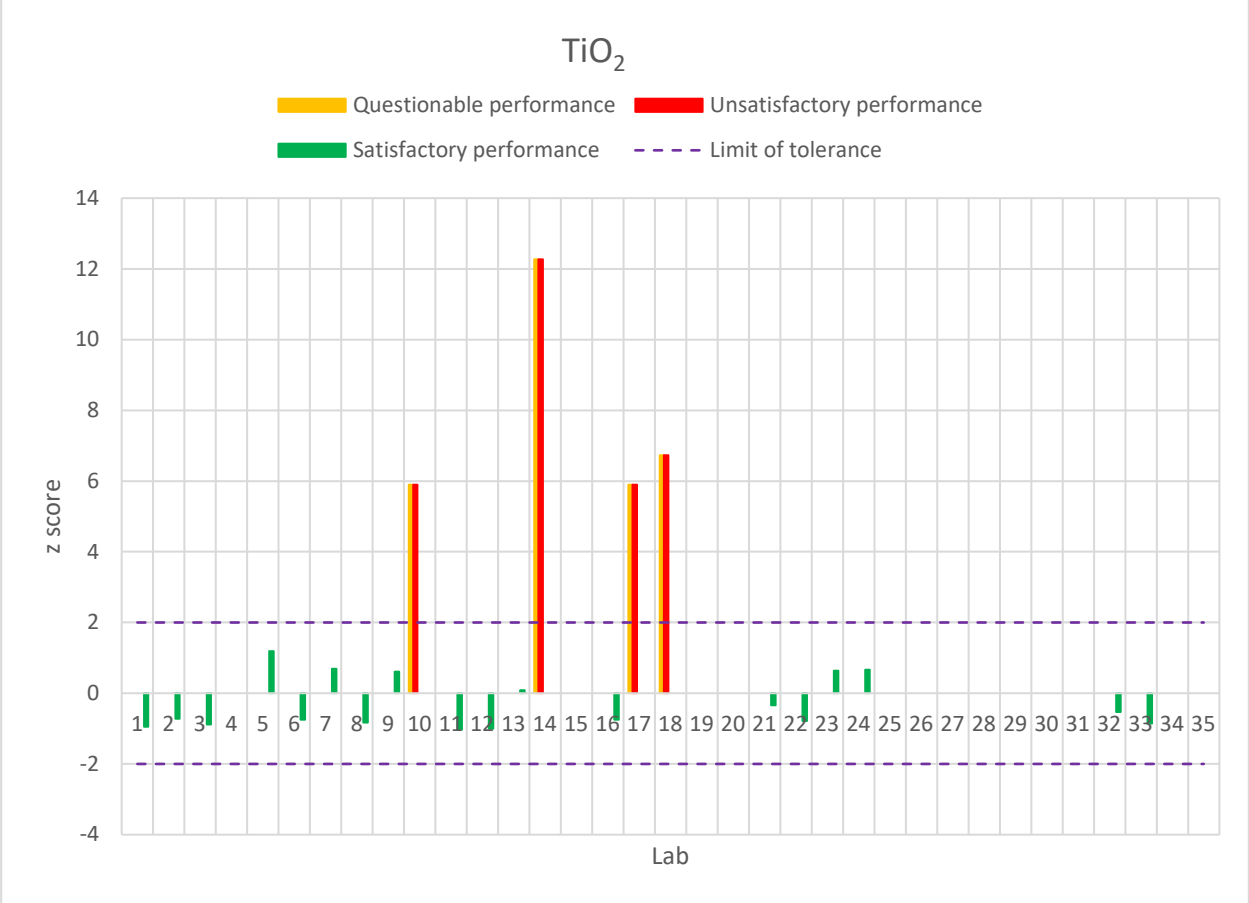
CHARTS SAMPLE D



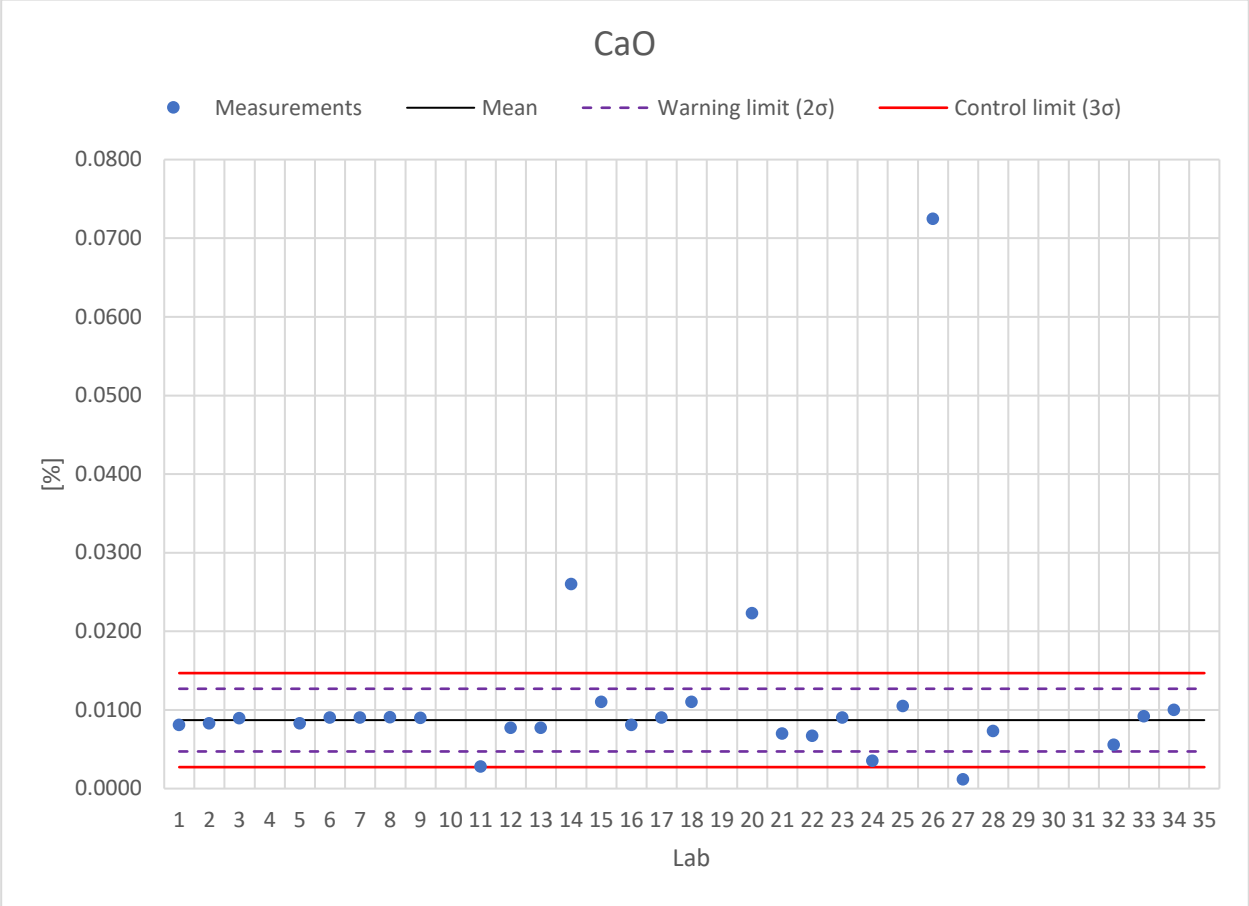


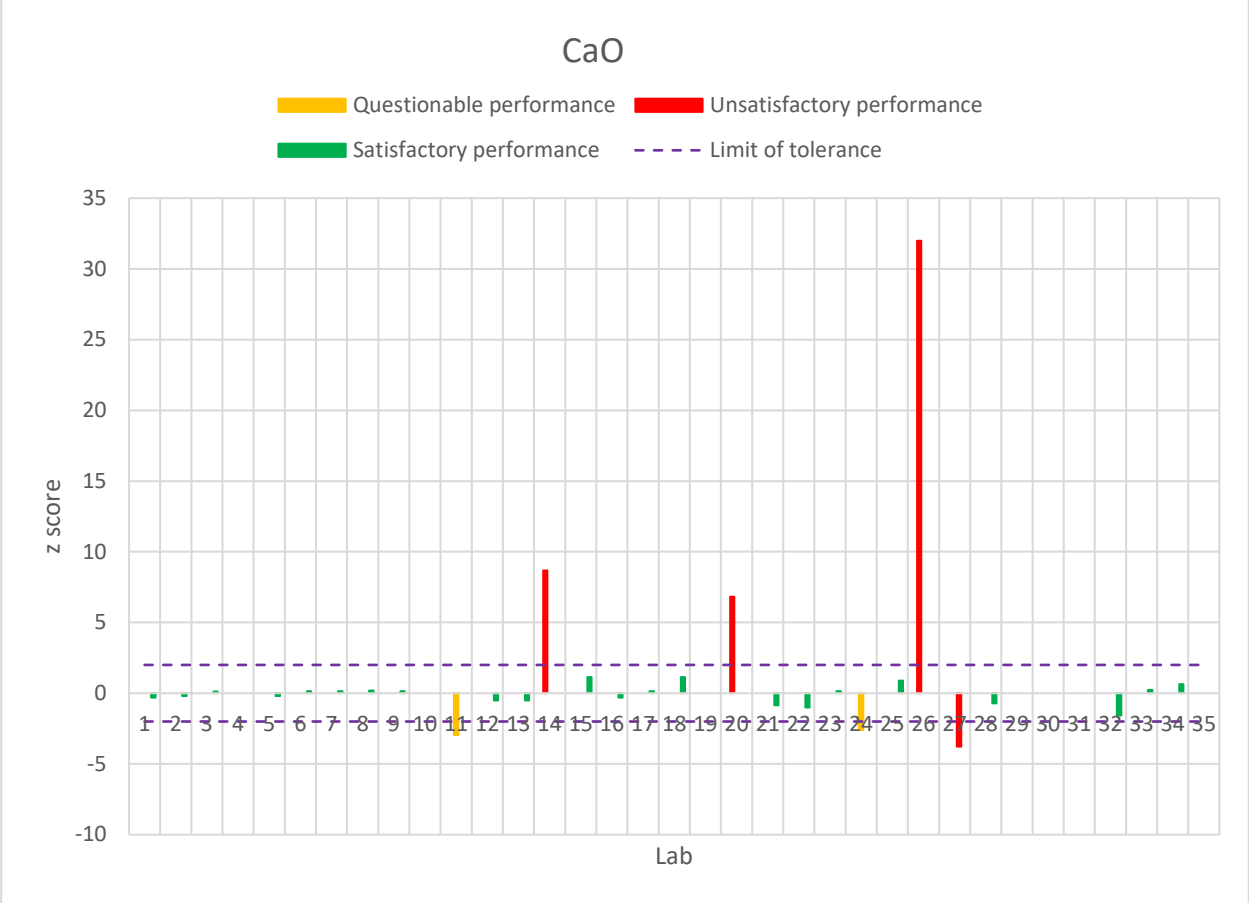
CHARTS SAMPLE D



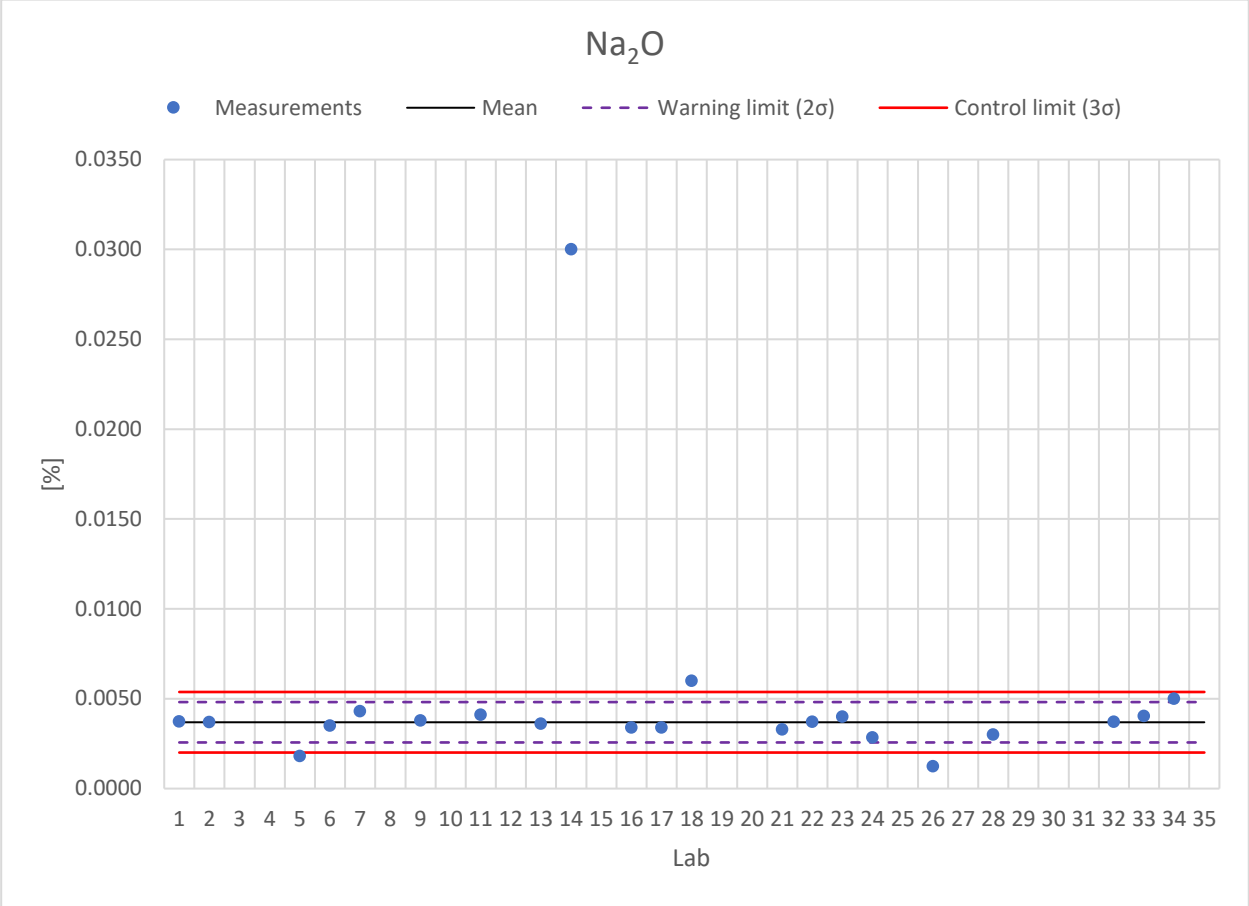


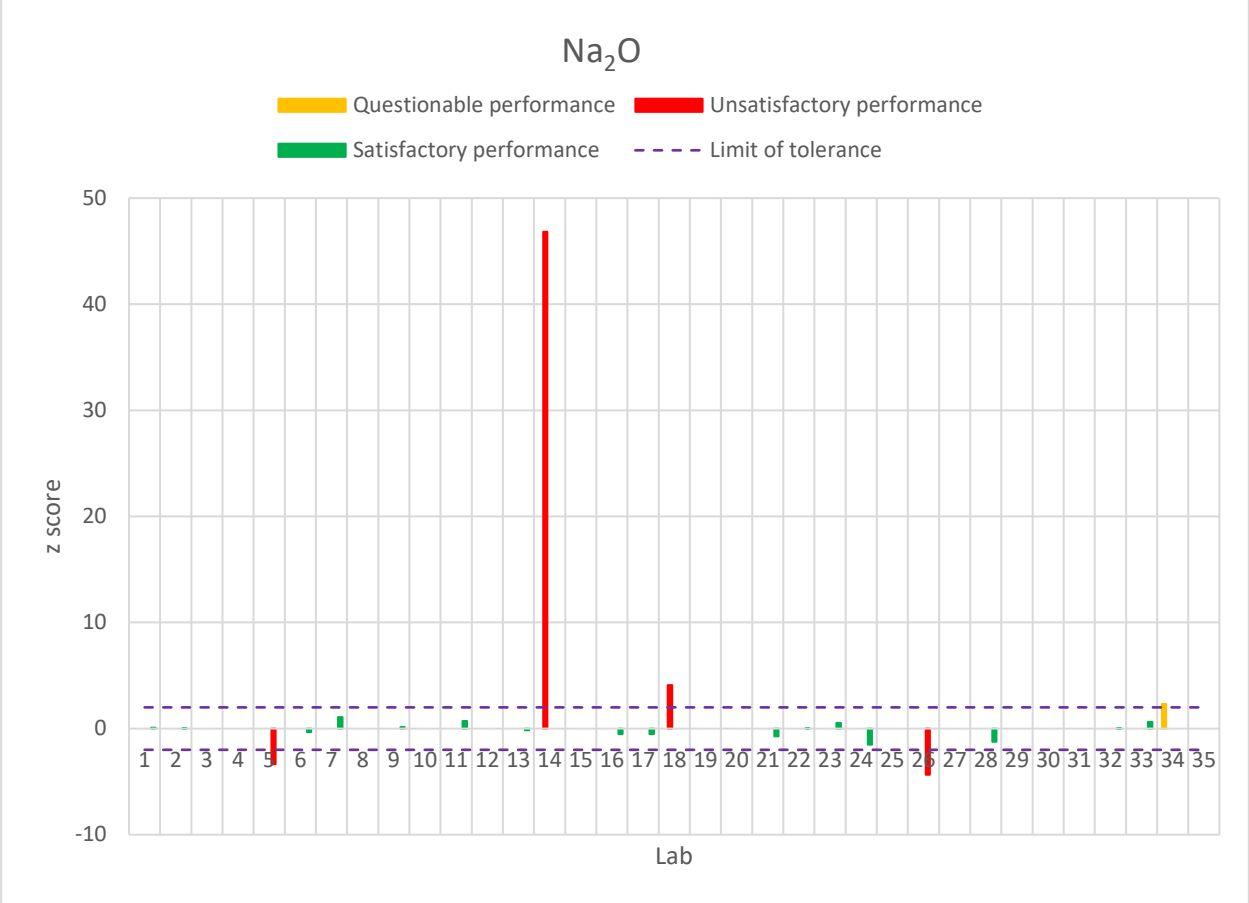
CHARTS SAMPLE D



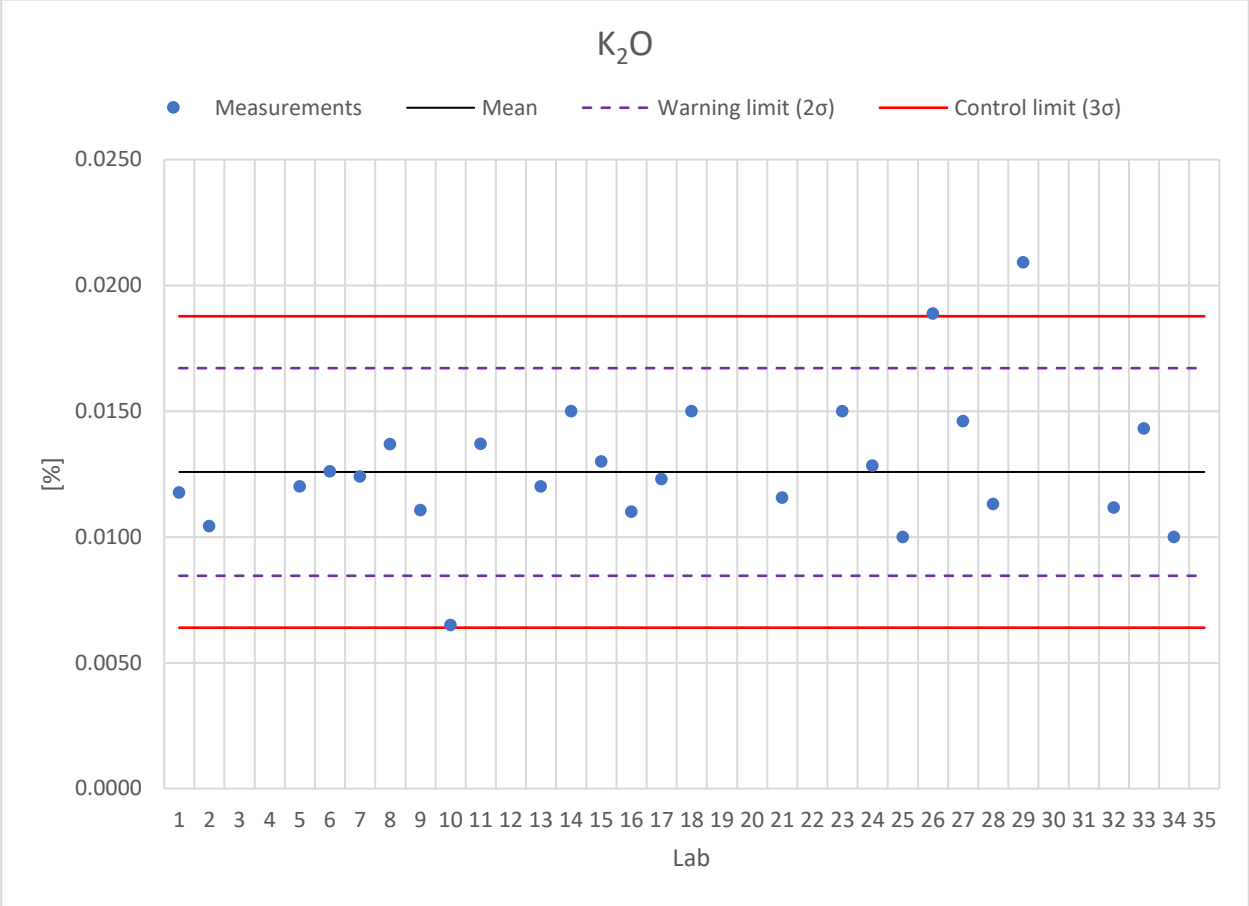


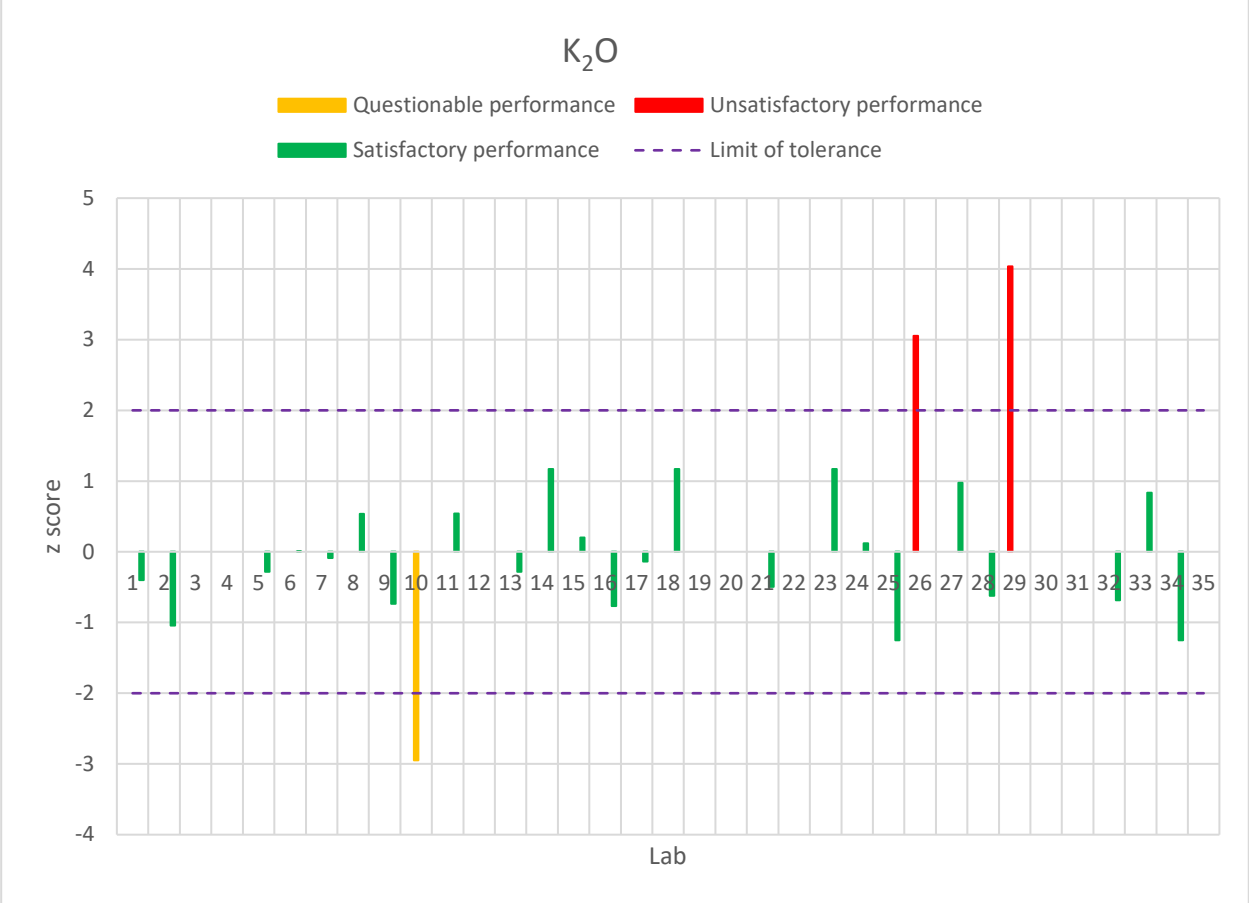
CHARTS SAMPLE D





CHARTS SAMPLE D





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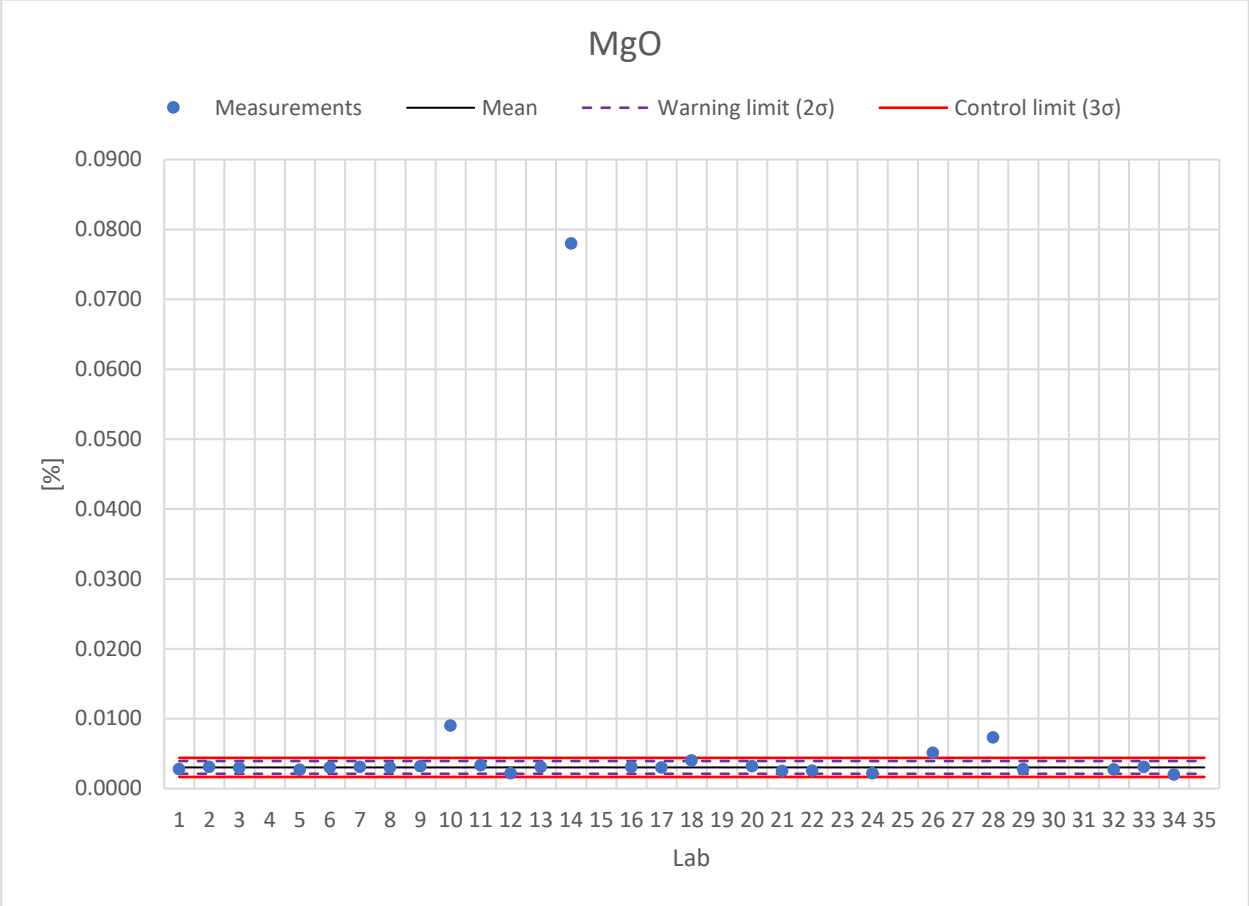
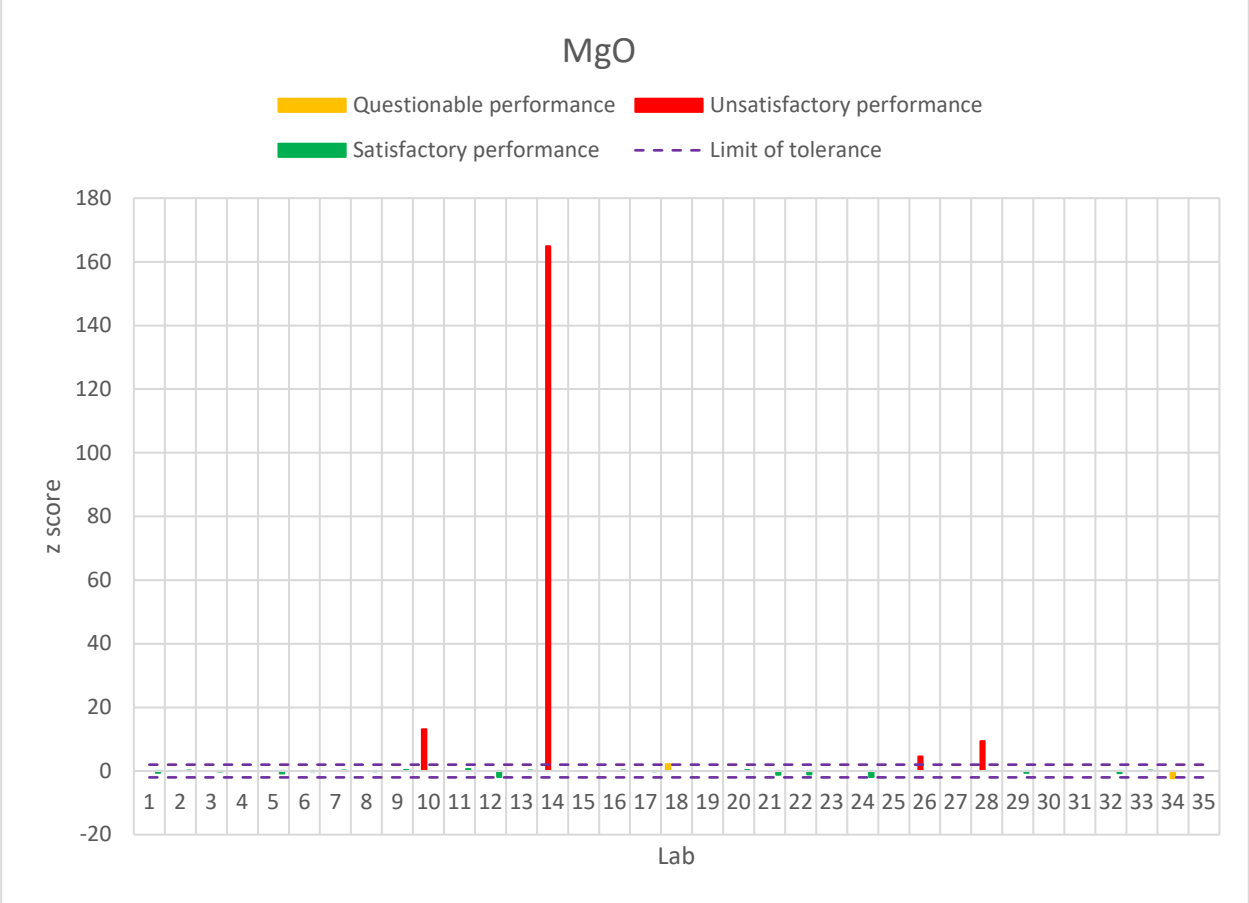
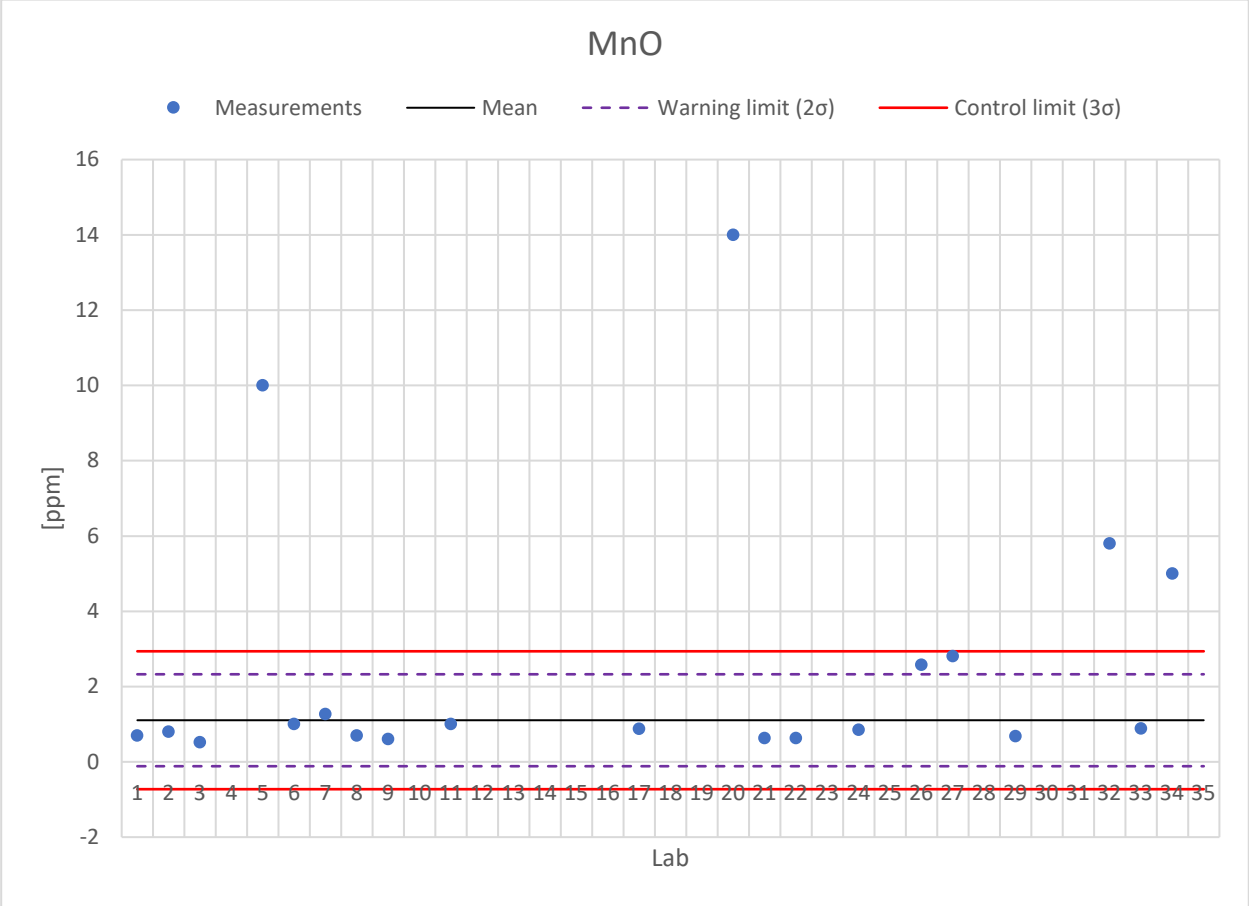
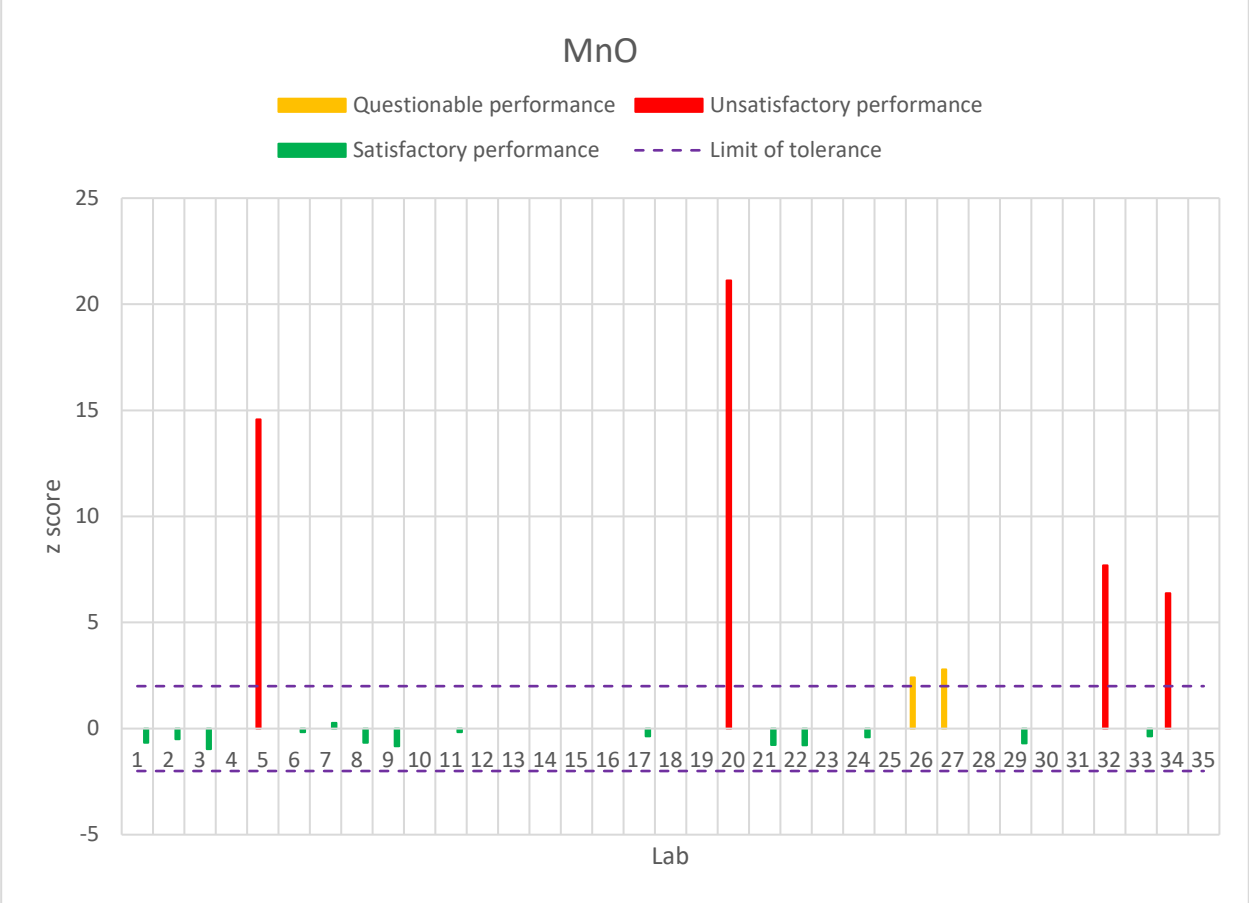


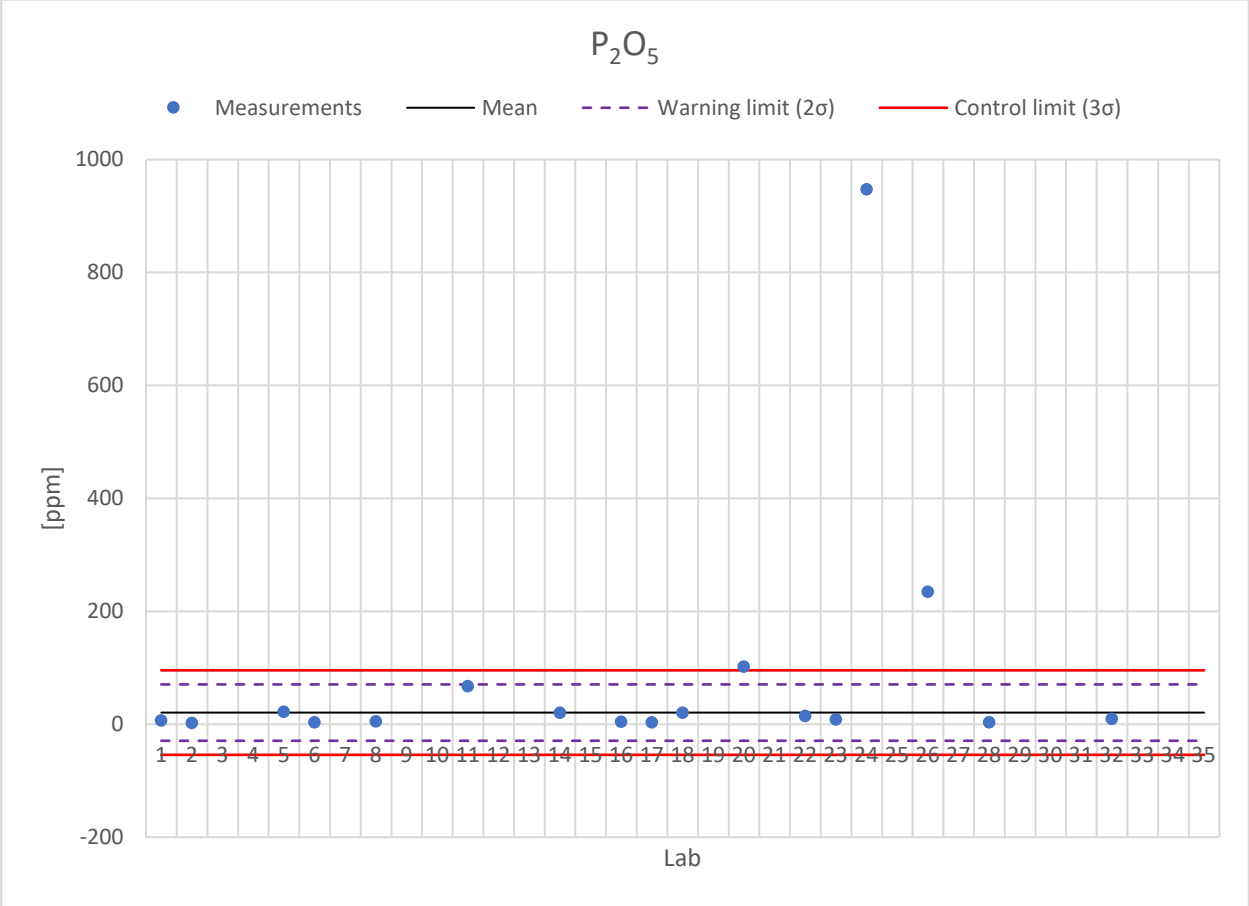


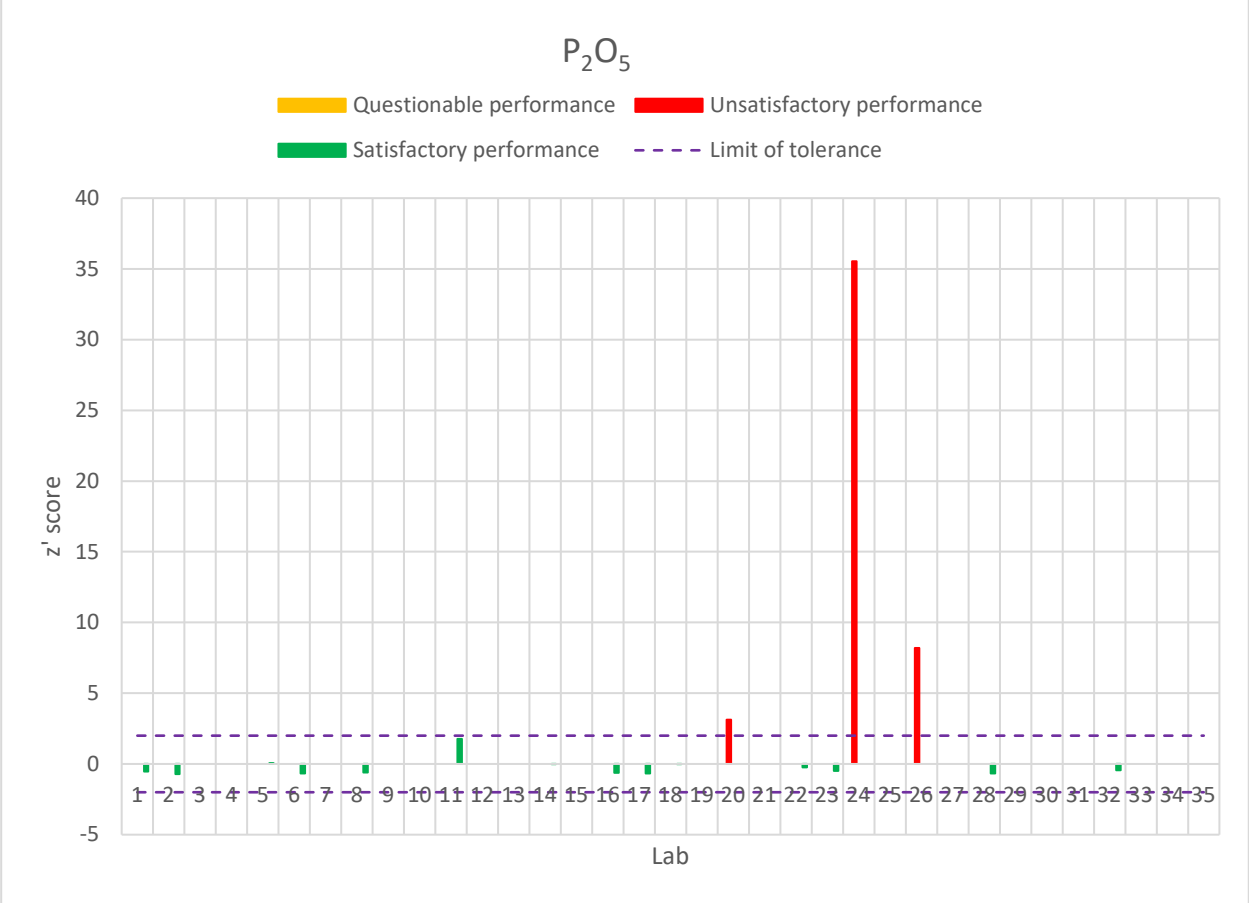
CHARTS SAMPLE D



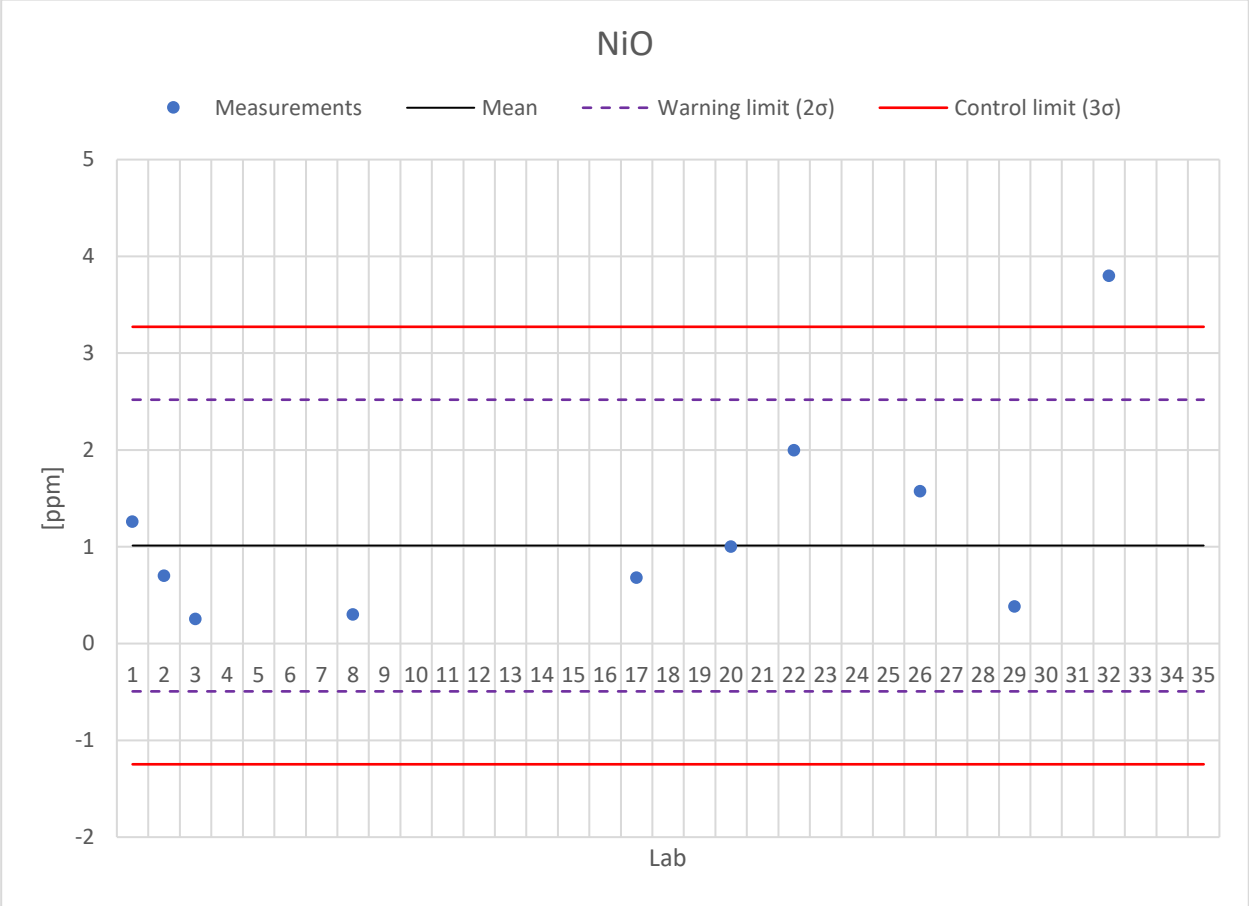


CHARTS SAMPLE D

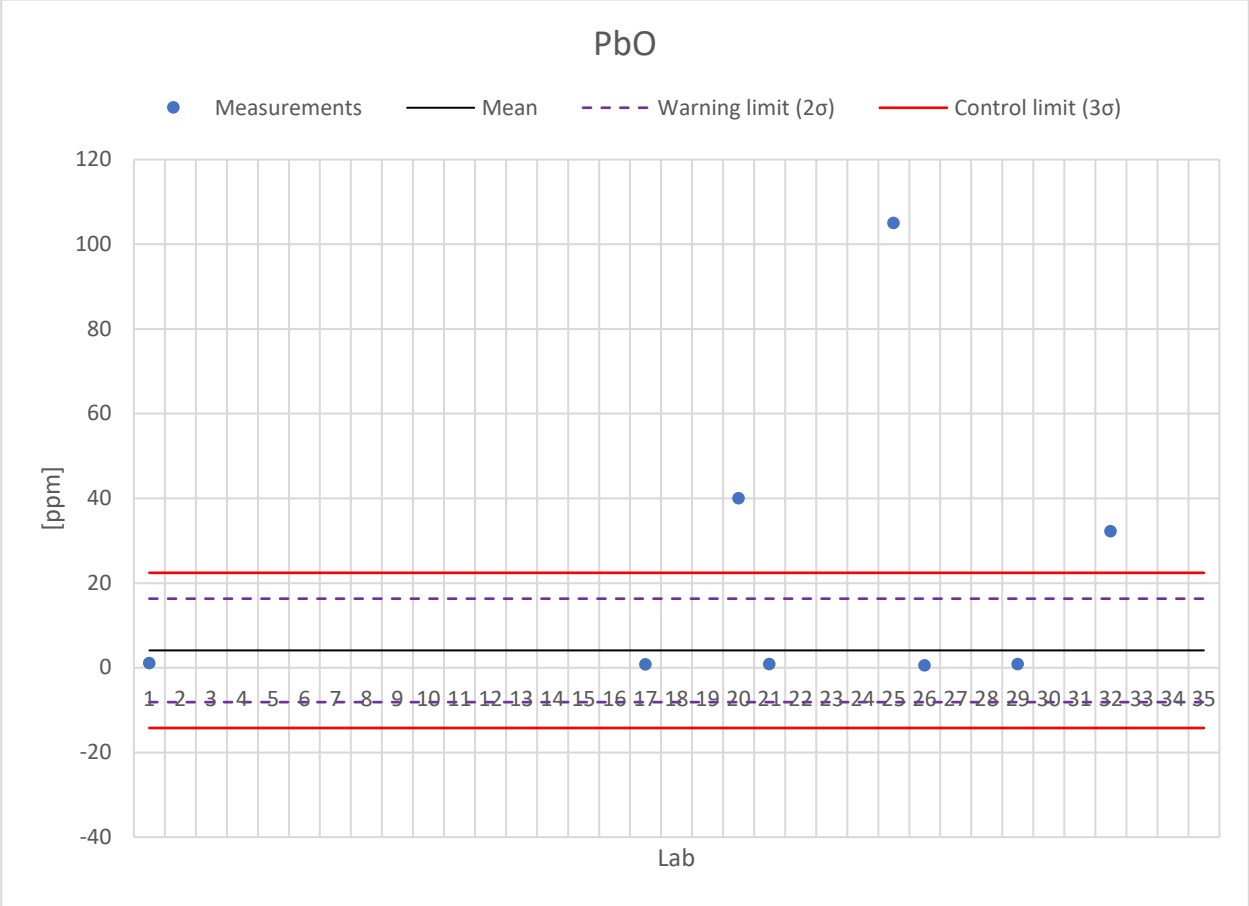


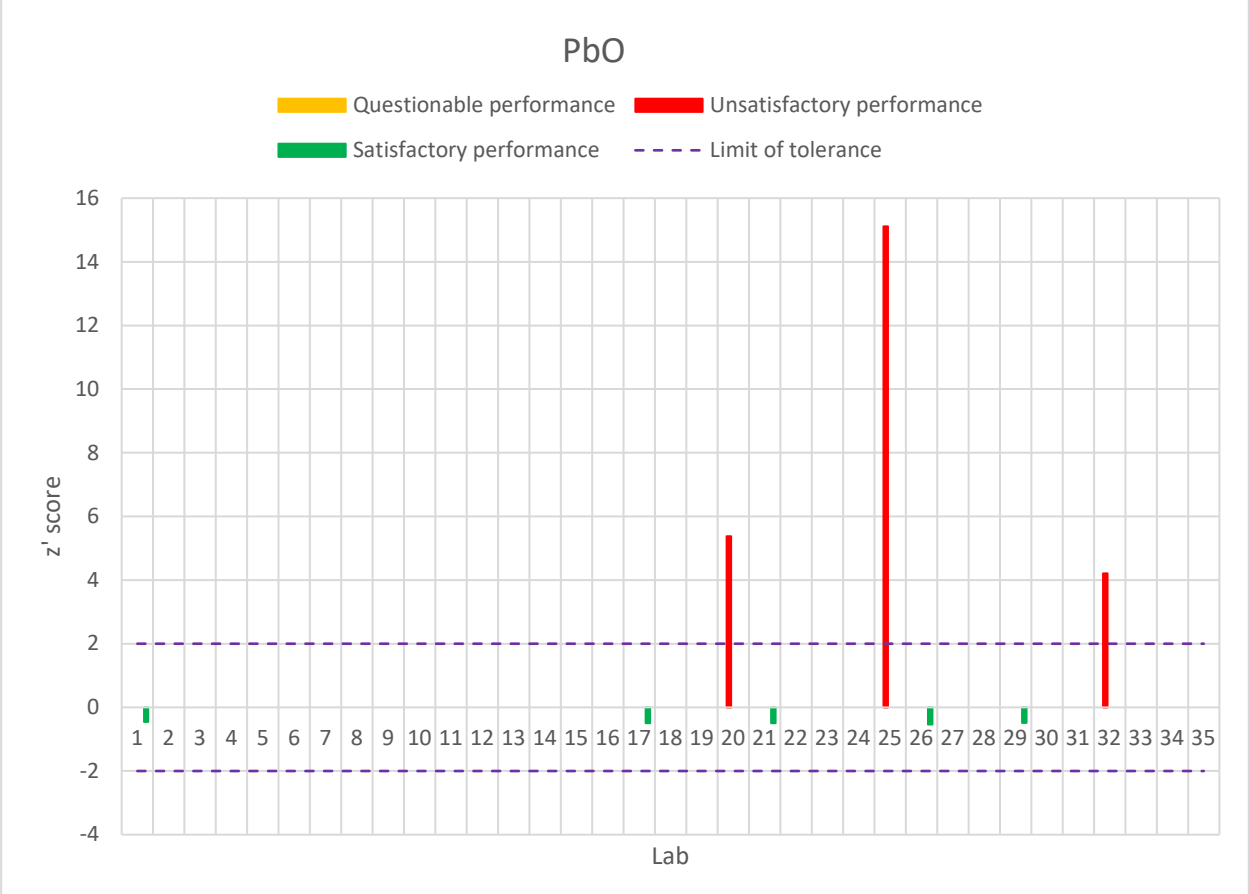


CHARTS SAMPLE D

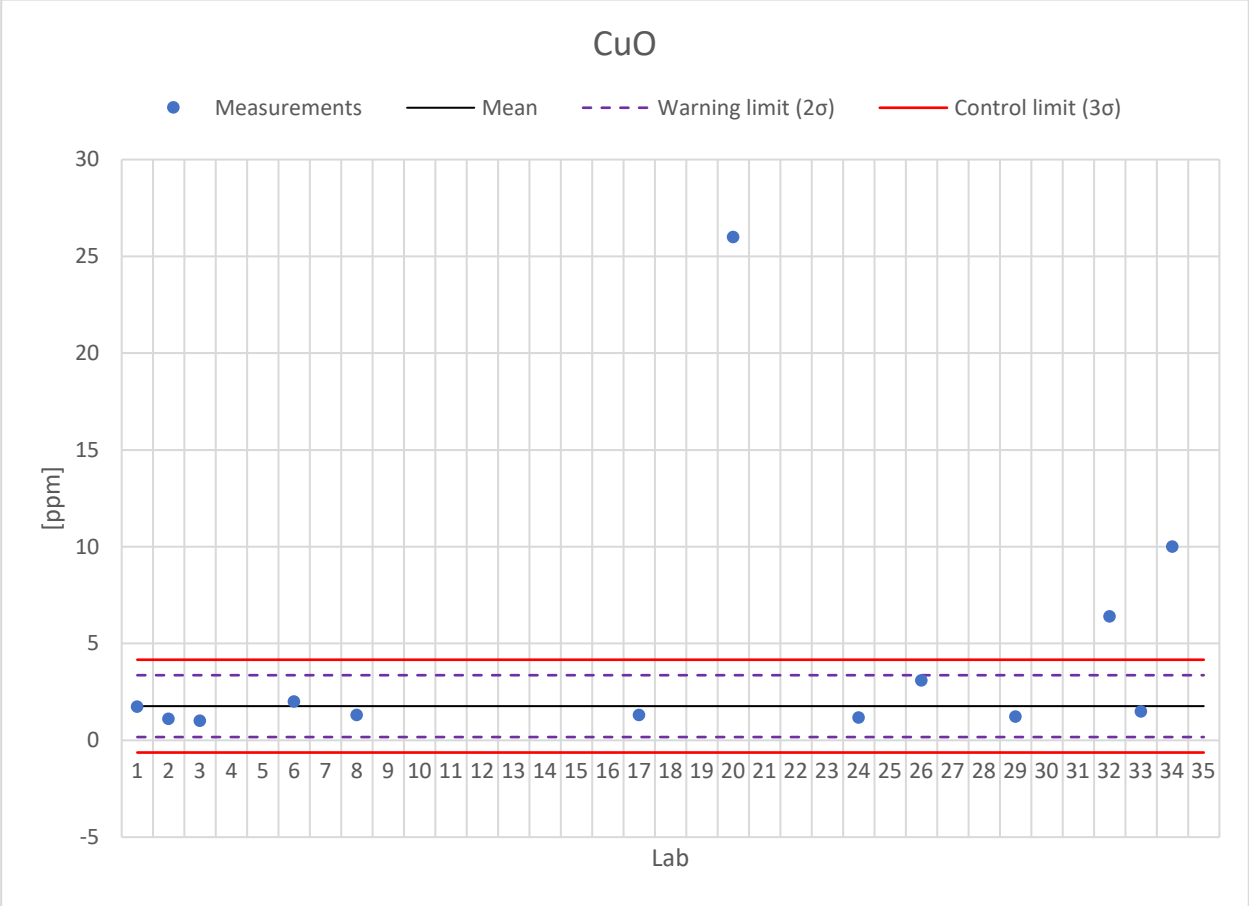


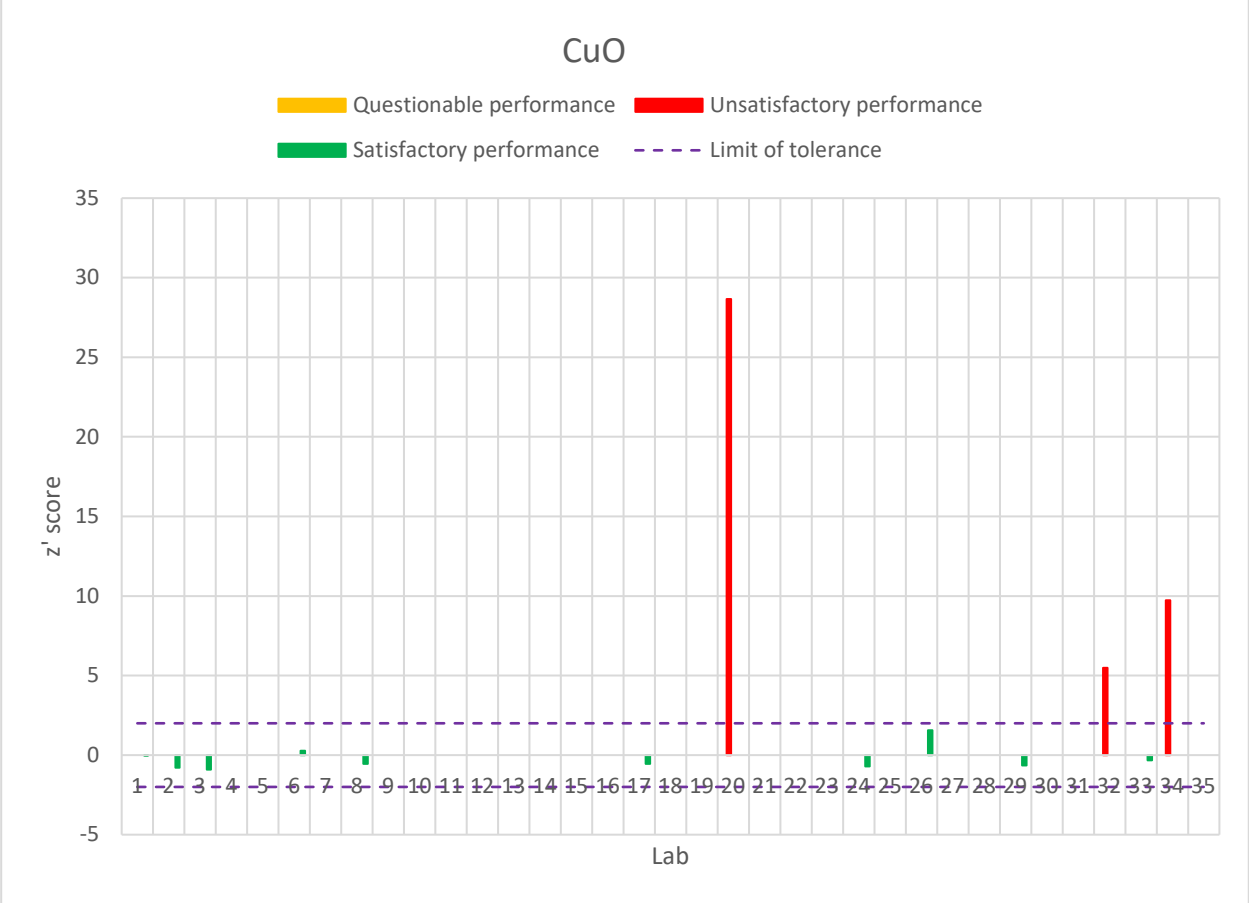
CHARTS SAMPLE D



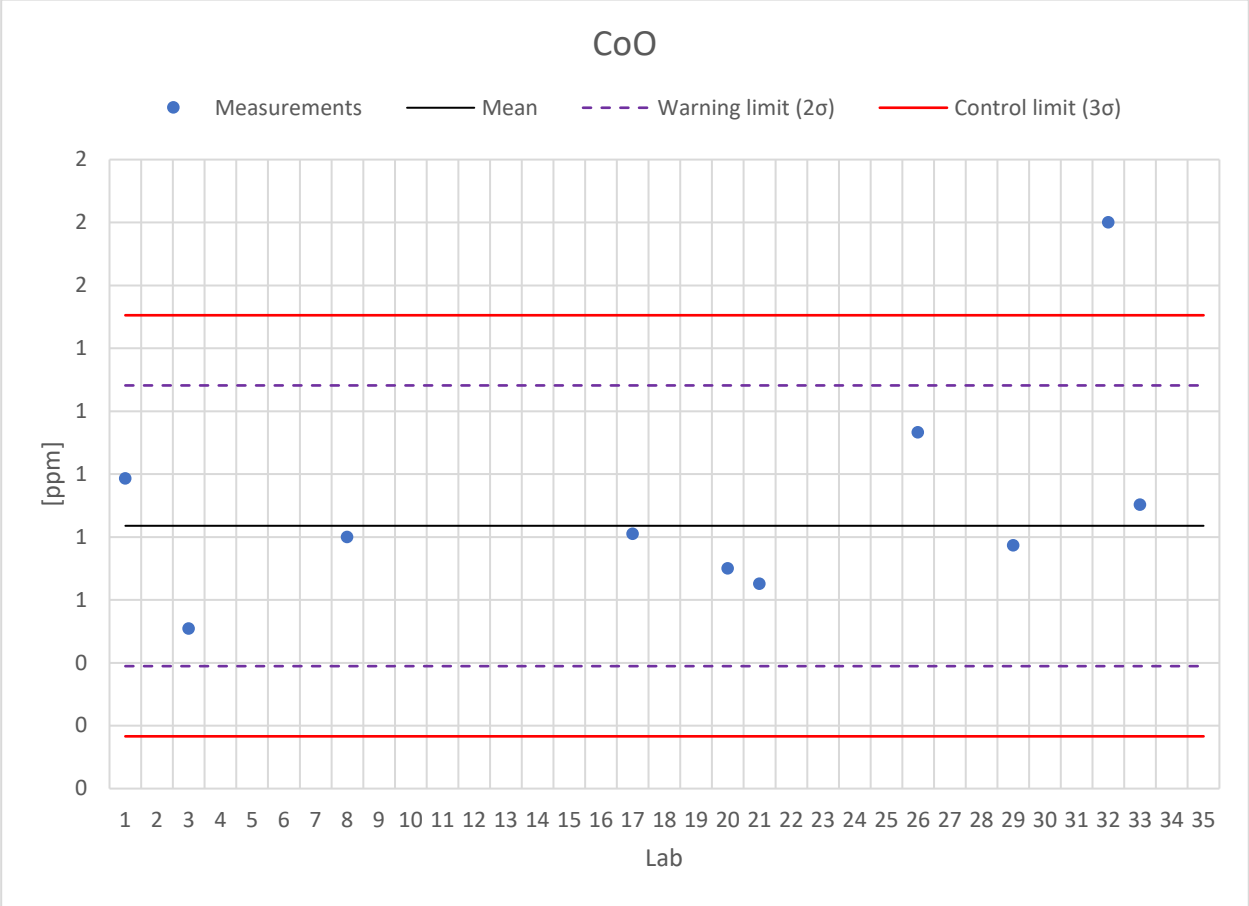


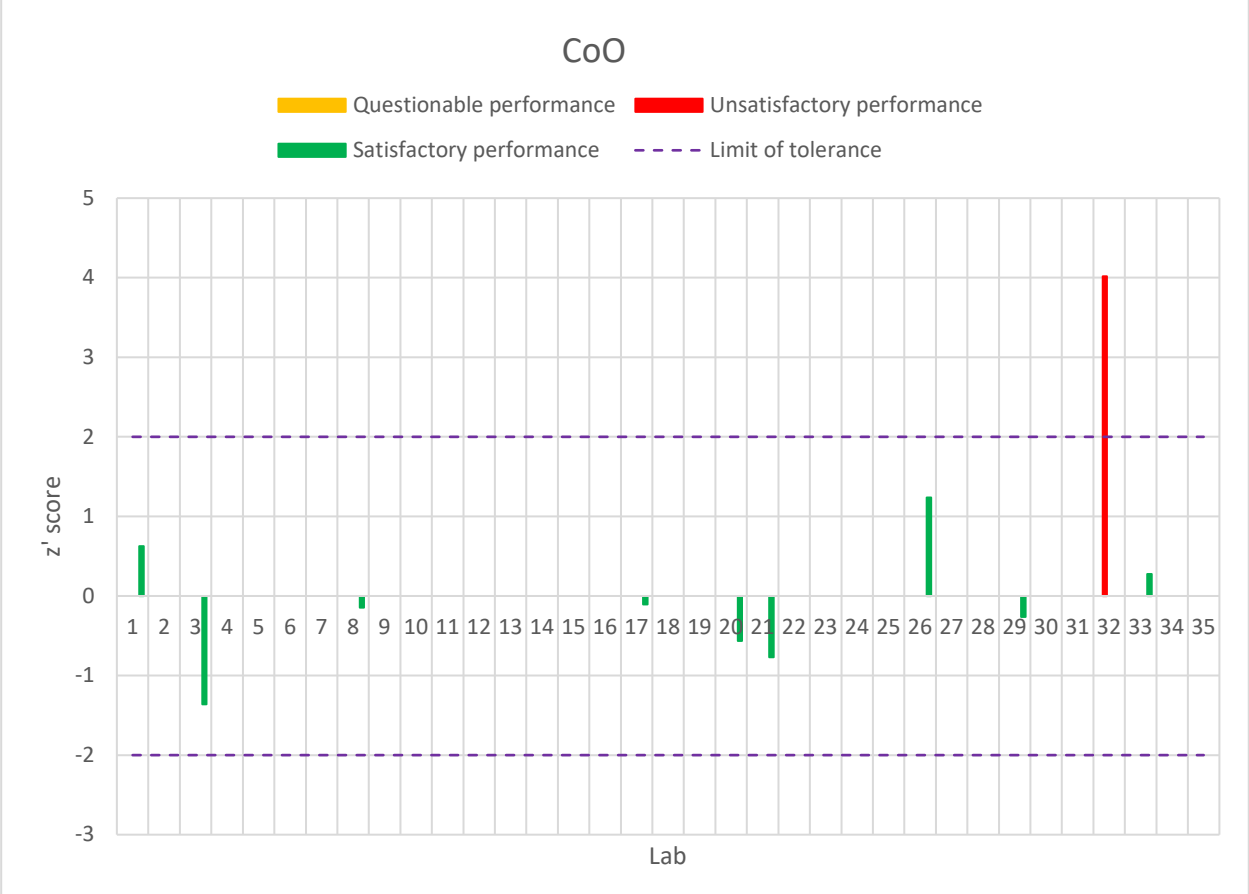
CHARTS SAMPLE D



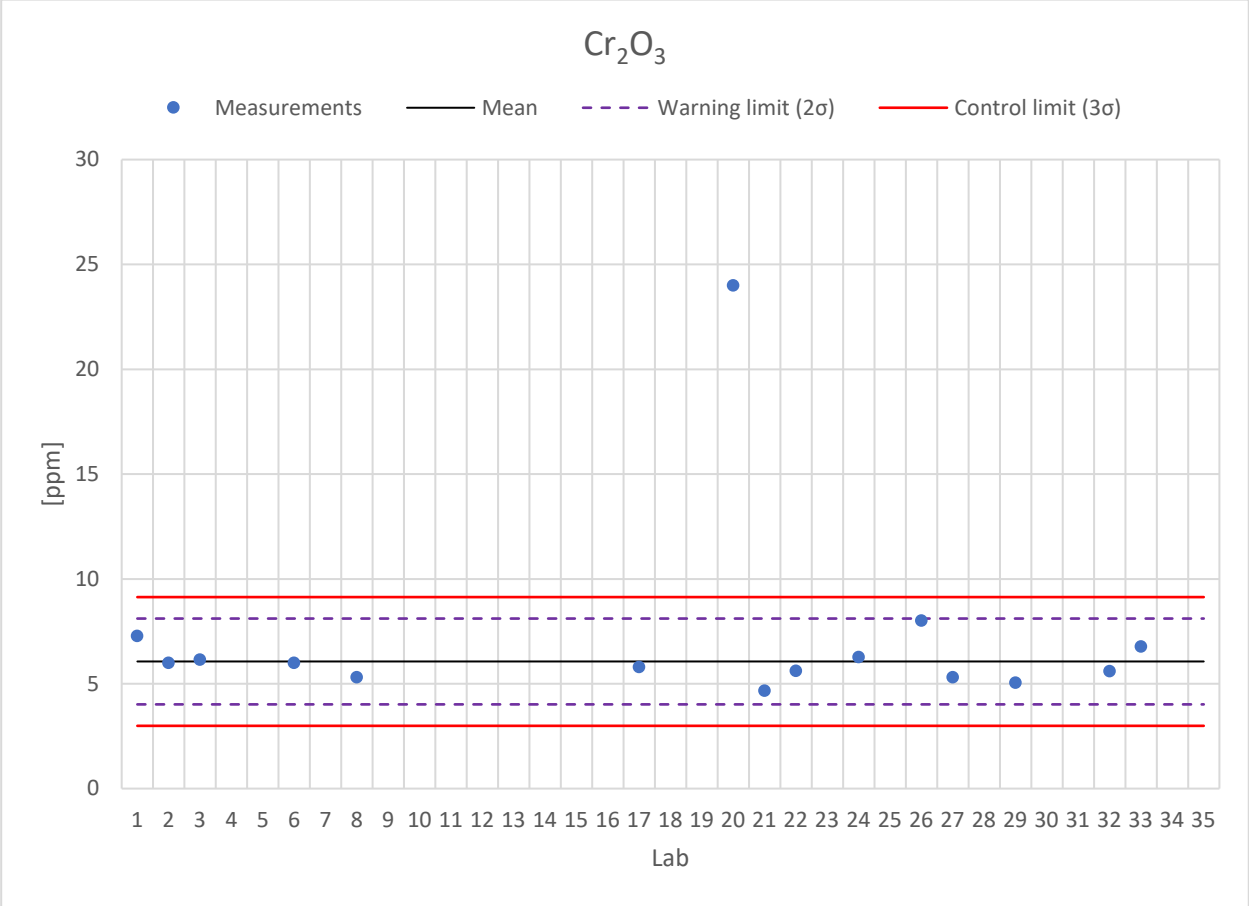


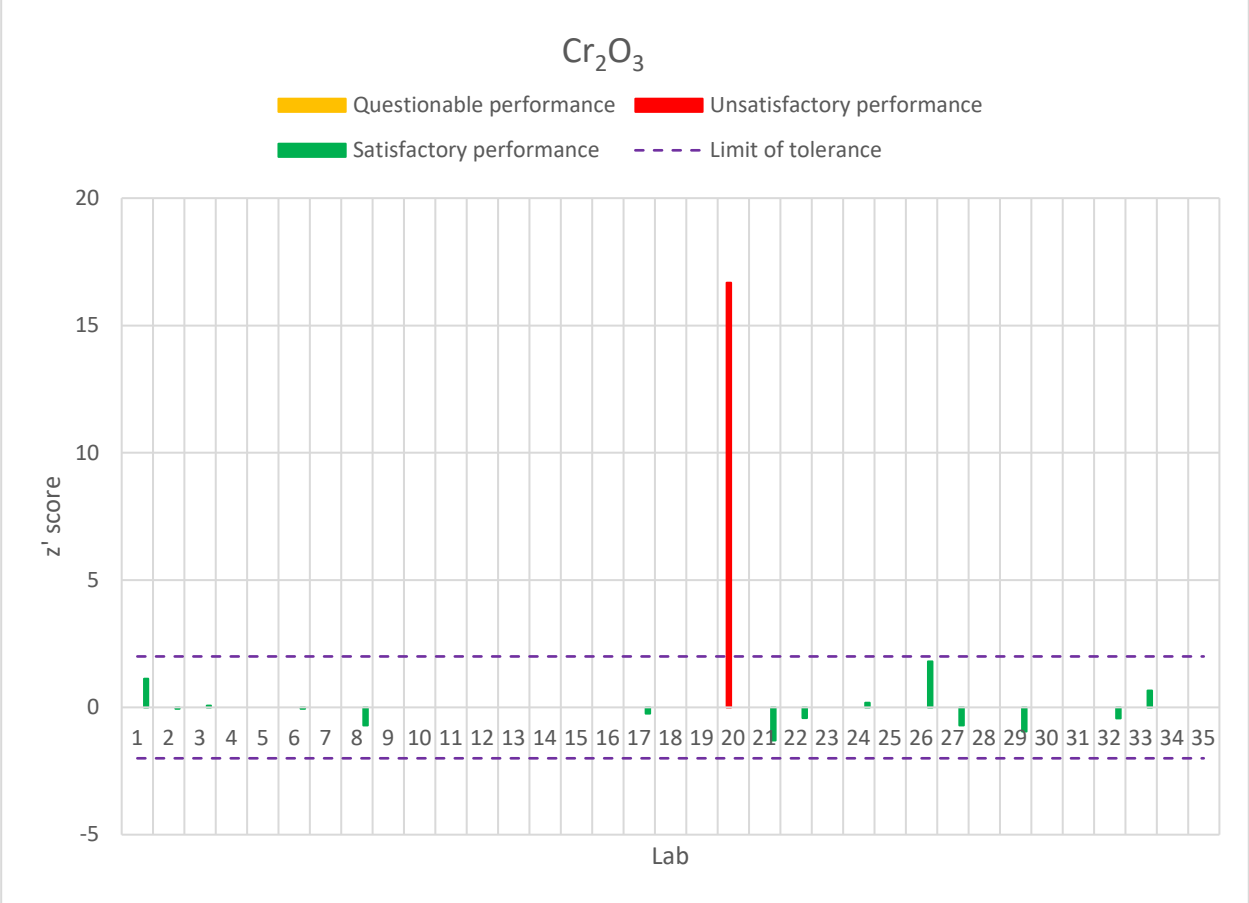
CHARTS SAMPLE D



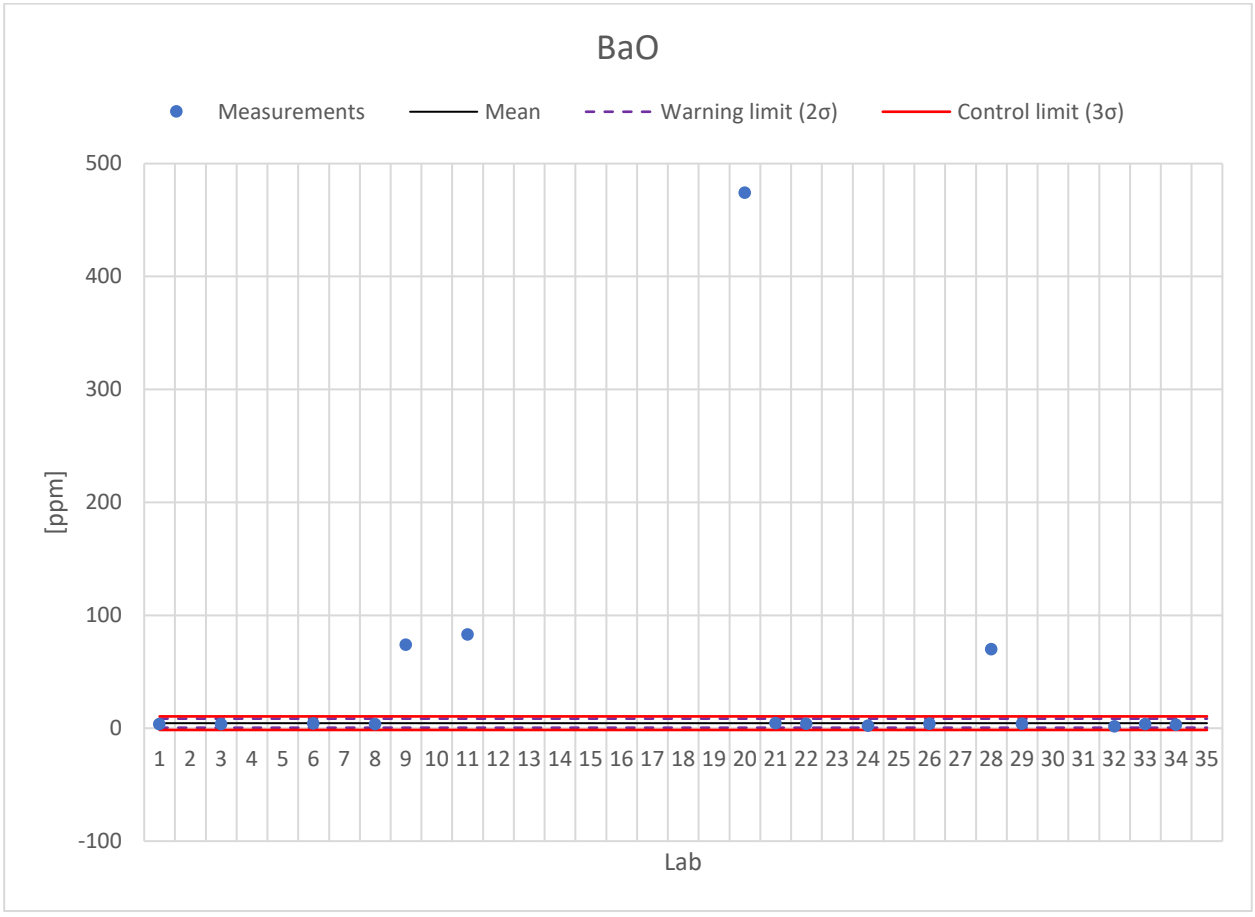


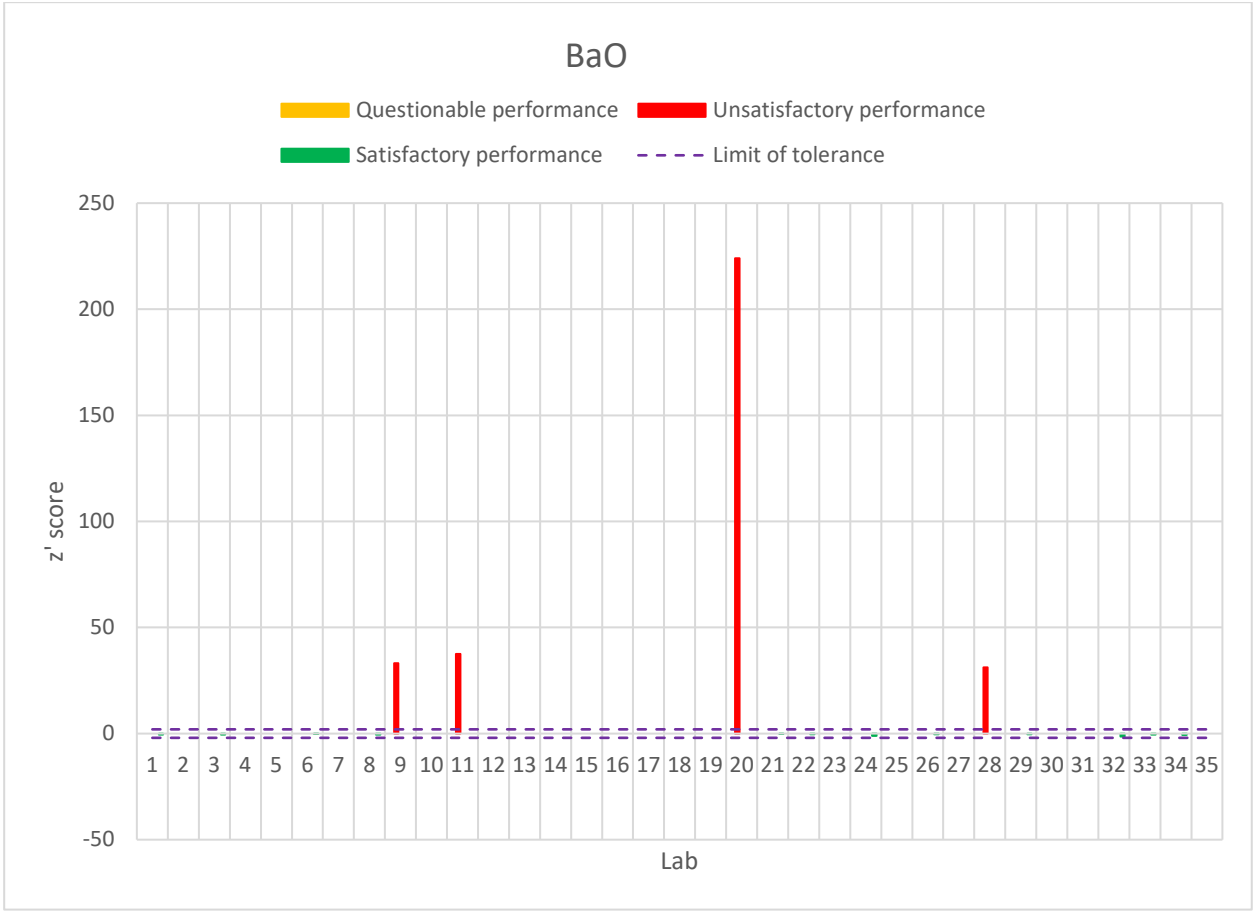
CHARTS SAMPLE D



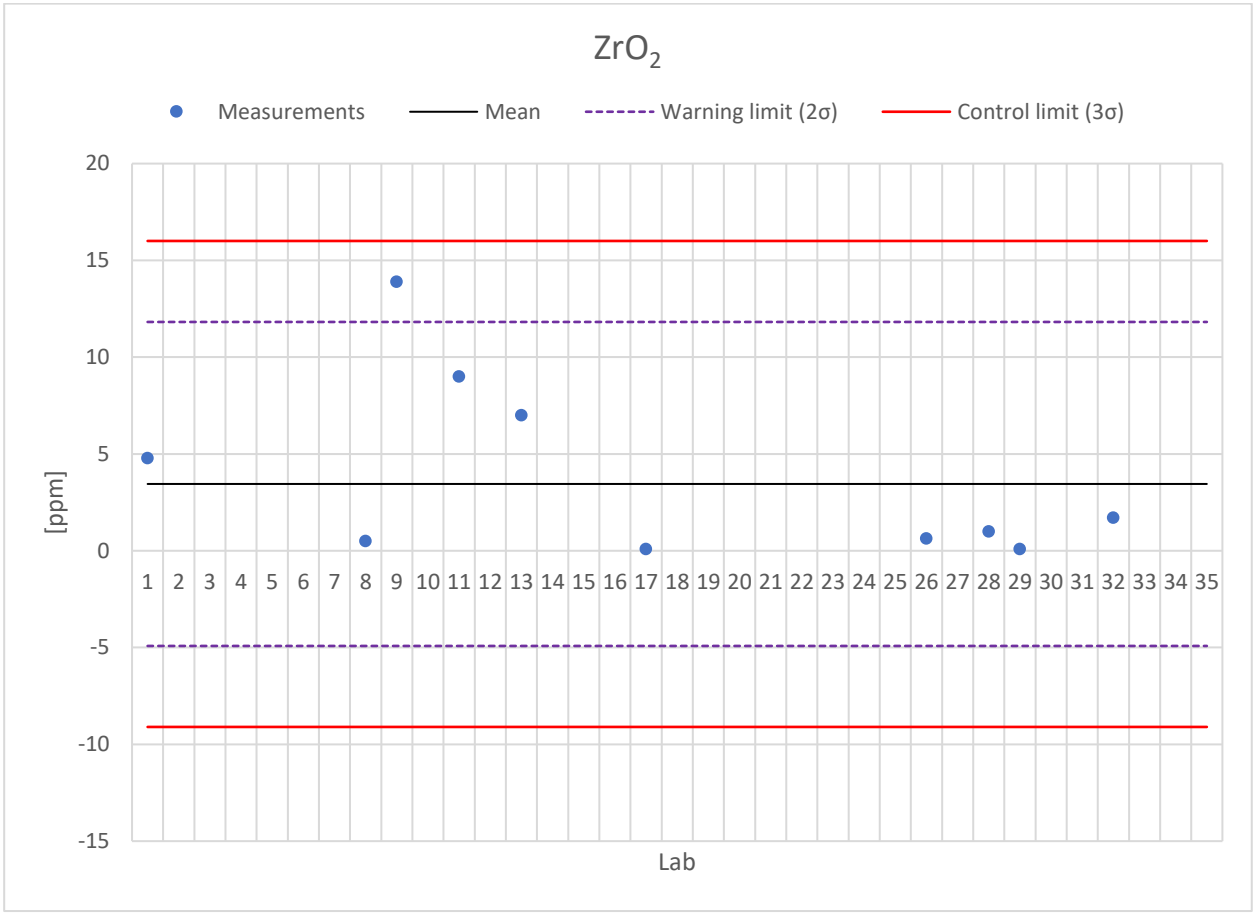


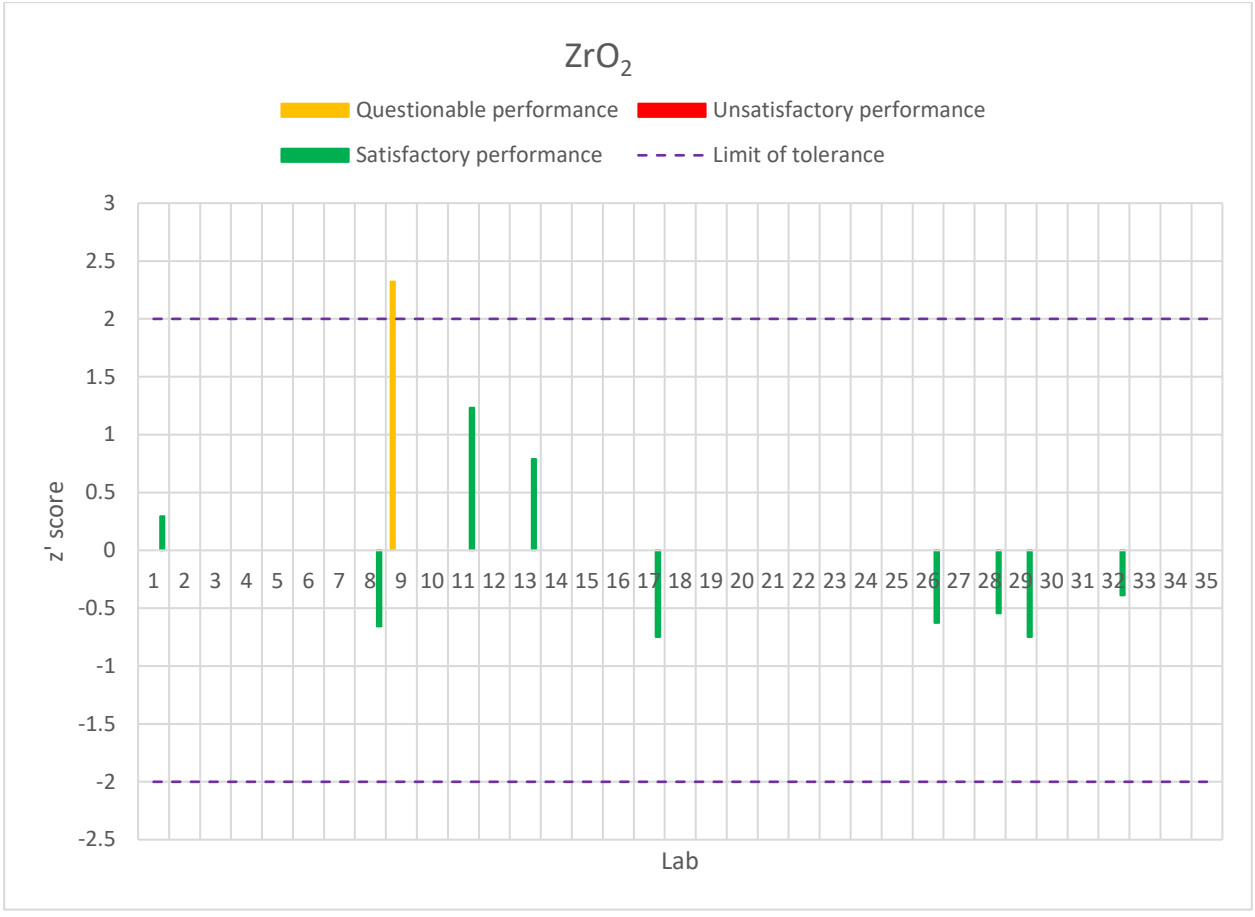
CHARTS SAMPLE D



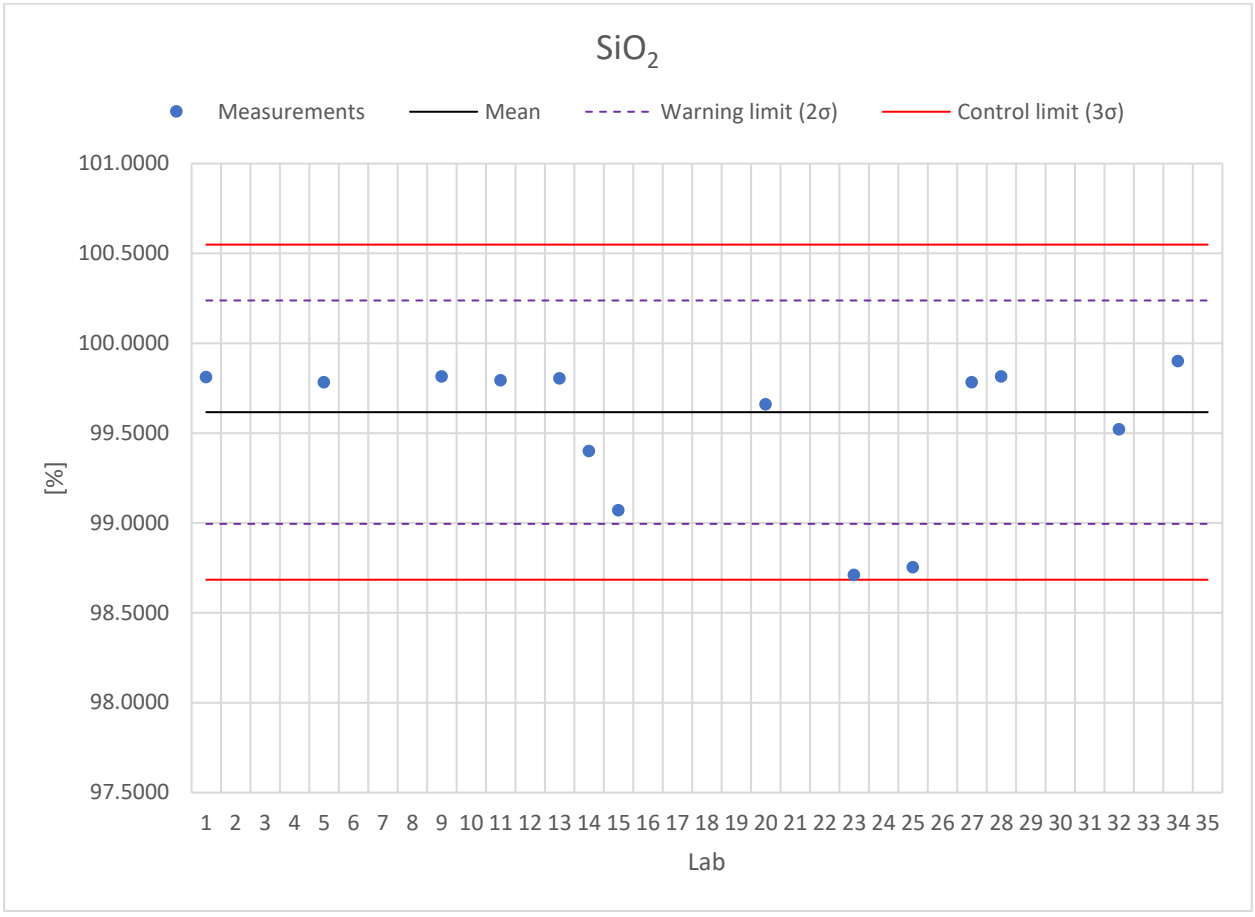


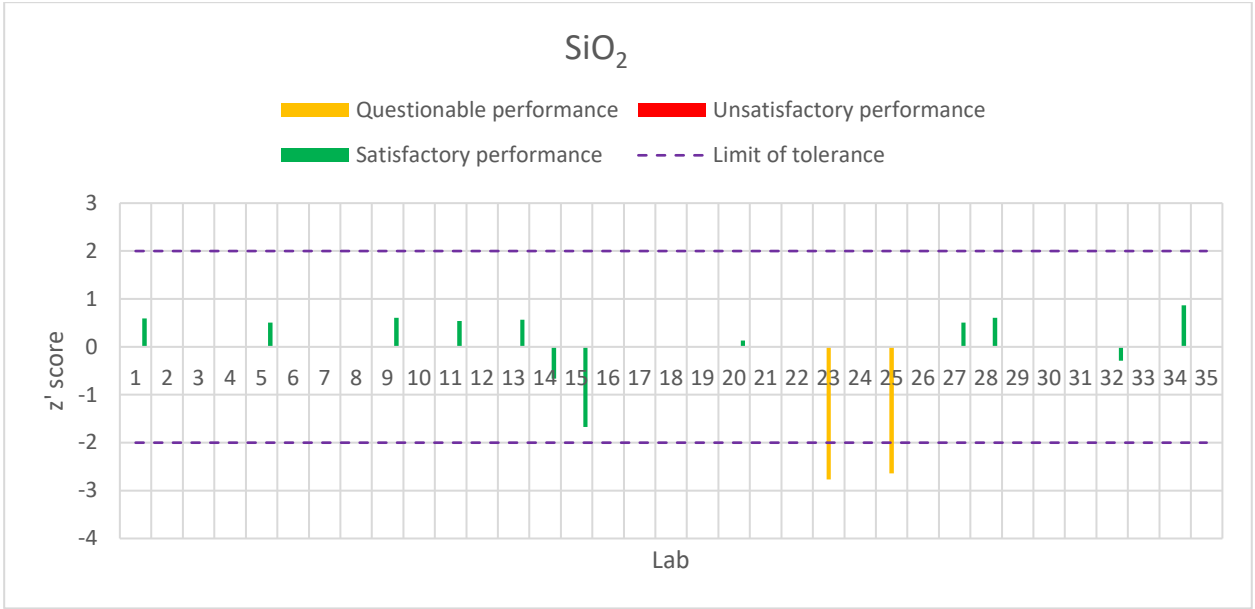
CHARTS SAMPLE D



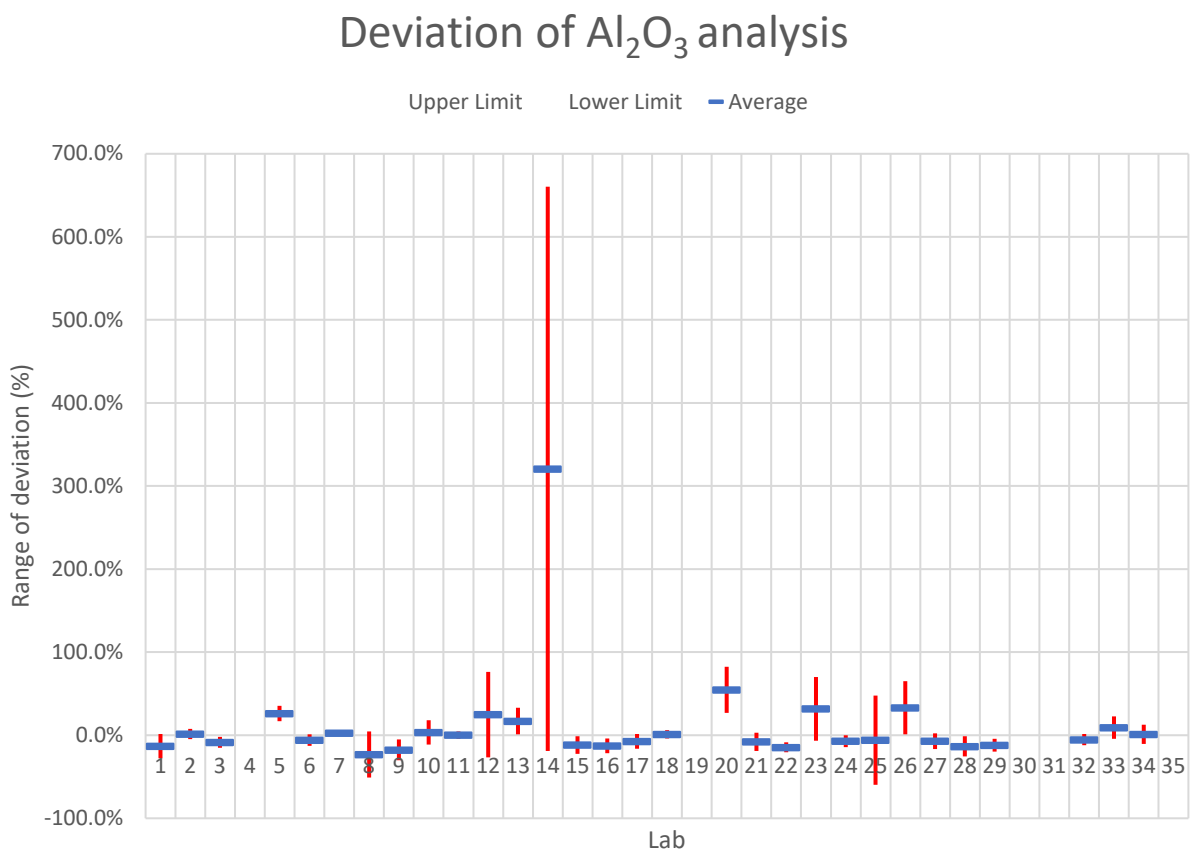


CHARTS SAMPLE D





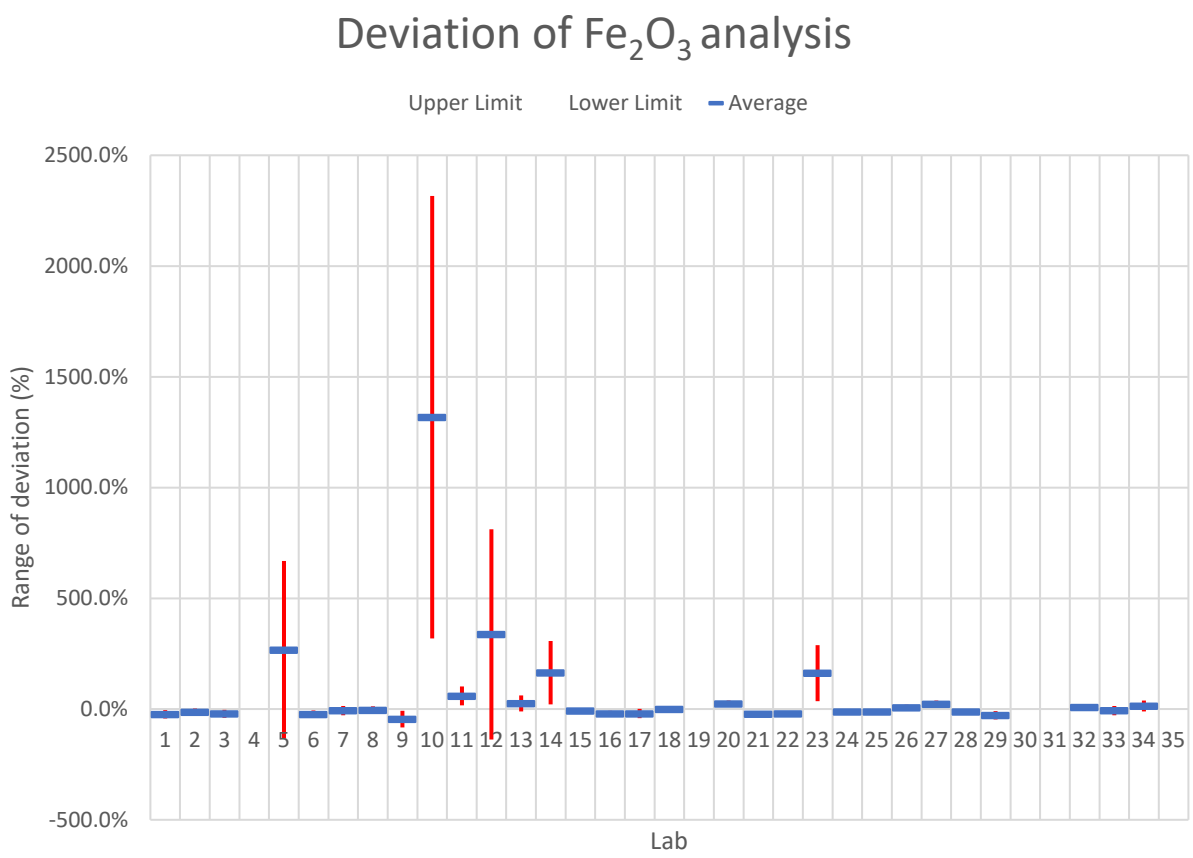
ANNEX 6. INTERSAMPLE AVERAGE



	1	2	3	4	5	6	7	8	9	10	11	12
UL	1%	8%	-2%		36%	1%	6%	4%	-5%	18%	4%	76%
UL	-28%	-5%	-15%		17%	-13%	0%	-51%	-30%	-11%	-4%	-27%
Avg	-13%	1%	-8%		26%	-6%	3%	-23%	-18%	3%	0%	25%
SD	15%	6%	7%		9%	7%	3%	28%	13%	15%	4%	52%

	13	14	15	16	17	18	19	20	21	22	23	24
UL	33%	660%	-1%	-4%	2%	6%		82%	3%	-9%	70%	0%
UL	1%	-19%	-22%	-22%	-16%	-4%		27%	-19%	-20%	-6%	-14%
Avg	17%	321%	-12%	-13%	-7%	1%		55%	-8%	-15%	32%	-7%
SD	16%	340%	11%	9%	9%	5%		28%	11%	6%	38%	7%

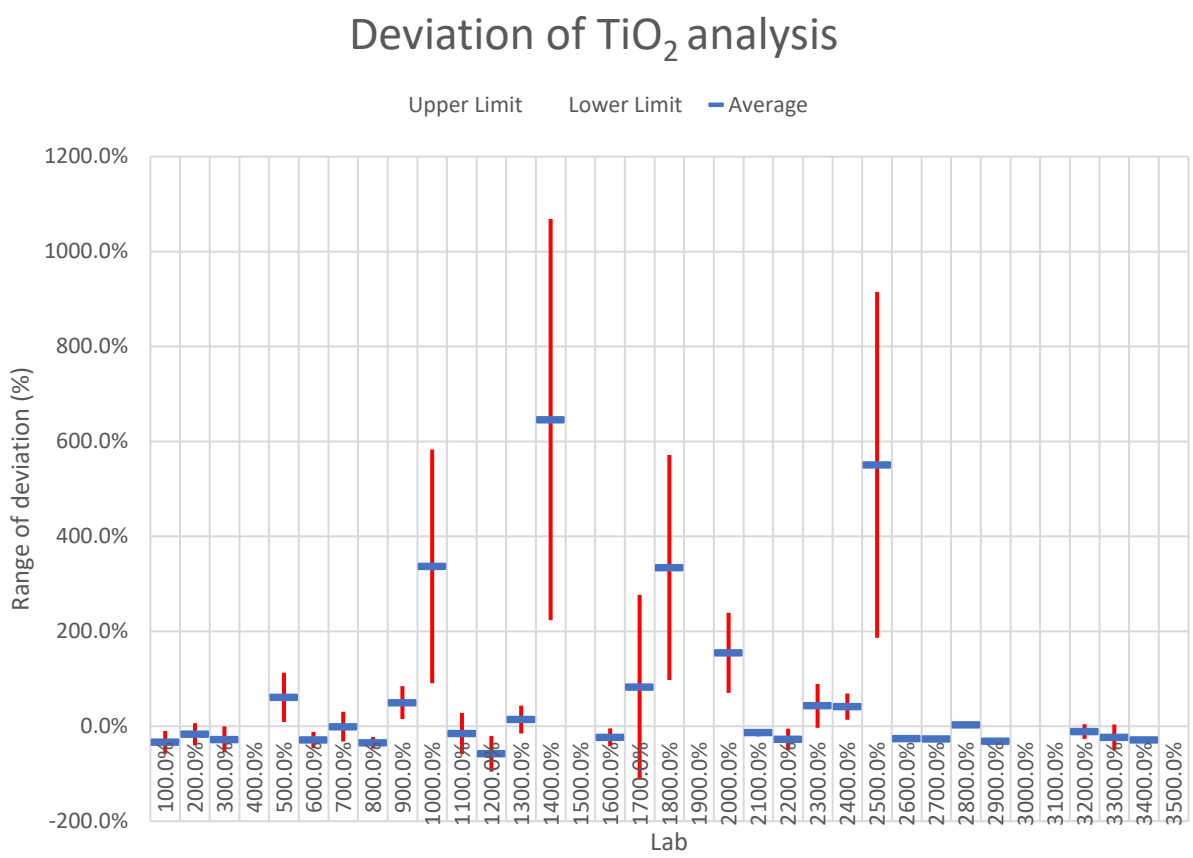
	25	26	27	28	29	30	31	32	33	34	35
UL	48%	65%	2%	-1%	-4%			1%	23%	13%	
UL	-60%	1%	-17%	-25%	-20%			-12%	-4%	-10%	
Avg	-6%	33%	-7%	-13%	-12%			-5%	9%	1%	
SD	54%	32%	9%	12%	8%			7%	13%	12%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	-5%	2%	-3%		668%	-7%	13%	13%	-7%	2316%	101%	812%
UL	-42%	-31%	-40%		-134%	-40%	-28%	-23%	-83%	319%	17%	-138%
Avg	-24%	-14%	-21%		267%	-24%	-7%	-5%	-45%	1318%	59%	337%
SD	18%	16%	18%		401%	17%	21%	18%	38%	999%	42%	475%

	13	14	15	16	17	18	19	20	21	22	23	24
UL	62%	308%		-7%	0%	4%		38%	-12%	-13%	289%	-5%
UL	-11%	21%		-34%	-42%	-6%		10%	-33%	-27%	36%	-20%
Avg	25%	164%	-7%	-21%	-21%	-1%		24%	-23%	-20%	162%	-13%
SD	37%	143%		13%	21%	5%		14%	10%	7%	126%	7%

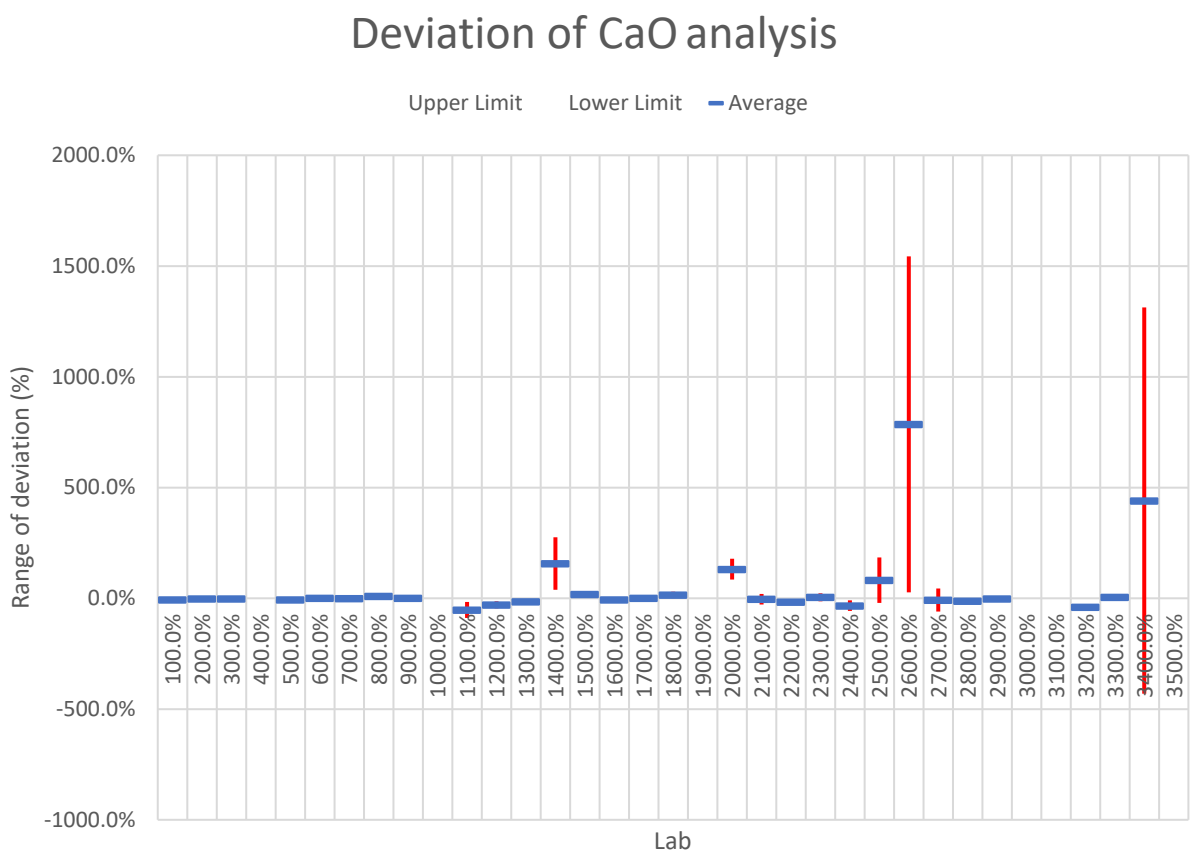
	25	26	27	28	29	30	31	32	33	34	35
UL		20%	38%		-10%			19%	14%	38%	
UL		-7%	9%		-46%			-3%	-28%	-11%	
Avg	-12%	7%	23%	-12%	-28%			8%	-7%	14%	
SD		13%	15%		18%			11%	21%	25%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	-10%	7%	-1%		113%	-12%	30%	-23%	84%	583%	28%	-21%
UL	-58%	-41%	-55%		9%	-46%	-32%	-47%	15%	91%	-58%	-95%
Avg	-34%	-17%	-28%		61%	-29%	-1%	-35%	50%	337%	-15%	-58%
SD	24%	24%	27%		52%	17%	31%	12%	35%	246%	43%	37%

	13	14	15	16	17	18	19	20	21	22	23	24
UL	44%	1069%		-5%	277%	571%		239%	-6%	-5%	89%	69%
UL	-15%	223%		-43%	-112%	97%		70%	-21%	-50%	-3%	14%
Avg	14%	646%		-24%	82%	334%		155%	-14%	-28%	43%	41%
SD	30%	423%		19%	194%	237%		84%	7%	23%	46%	28%

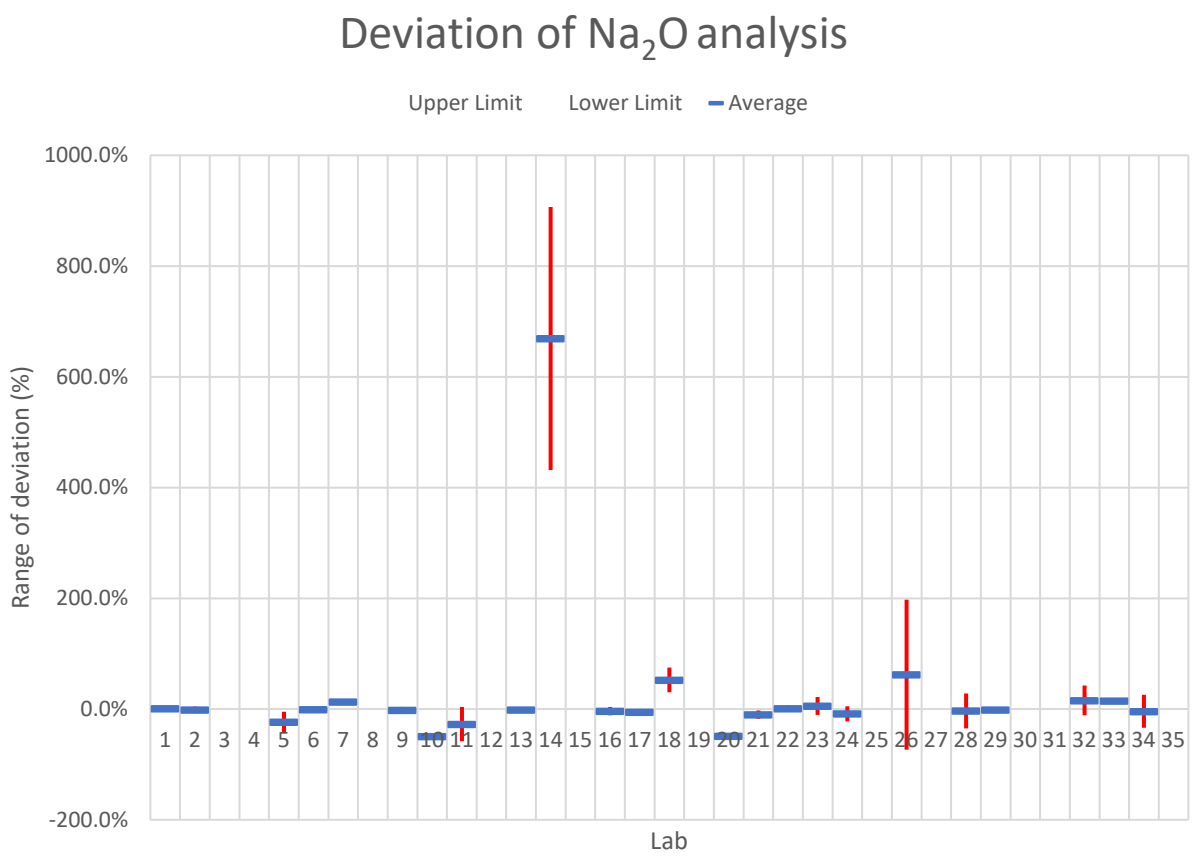
	25	26	27	28	29	30	31	32	33	34	35
UL	915%				-30%			4%	3%		
UL	186%				-33%			-27%	-50%		
Avg	550%	-26%	-27%	3%	-31%			-11%	-23%	-29%	
SD	364%				2%			15%	27%		



	1	2	3	4	5	6	7	8	9	10	11	12
UL	2%	0%	2%		-4%	4%	7%	19%	4%		-16%	-13%
UL	-14%	-4%	-6%		-9%	-3%	-9%	1%	-4%		-88%	-45%
Avg	-6%	-2%	-2%		-6%	0%	-1%	10%	0%		-52%	-29%
SD	8%	2%	4%		2%	3%	8%	9%	4%		36%	16%

	13	14	15	16	17	18	19	20	21	22	23	24
UL	-10%	276%	29%	-1%	6%	30%		178%	20%	-9%	23%	-9%
UL	-19%	39%	8%	-12%	-4%	1%		85%	-29%	-22%	-13%	-57%
Avg	-15%	157%	19%	-6%	1%	16%		132%	-4%	-16%	5%	-33%
SD	4%	119%	11%	5%	5%	14%		47%	24%	7%	18%	24%

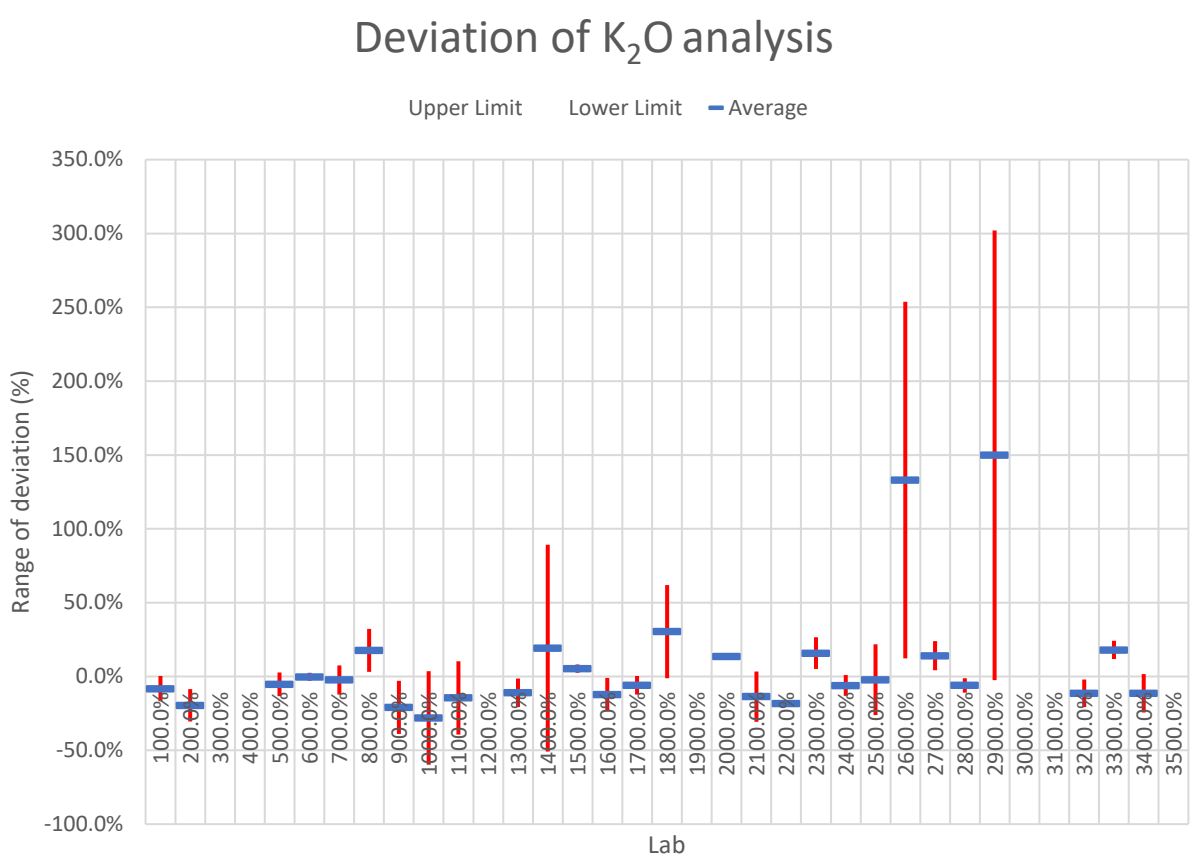
	25	26	27	28	29	30	31	32	33	34	35
UL	185%	1544%	45%	-9%	-1%			-37%	15%	1312%	
UL	-21%	27%	-60%	-16%	-2%			-42%	-4%	-431%	
Avg	82%	785%	-8%	-13%	-1%			-40%	6%	441%	
SD	103%	758%	53%	4%	1%			3%	10%	872%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	3%	4%			-5%	3%	16%		4%		4%	
UL	-1%	-7%			-42%	-4%	11%		-7%		-58%	
Avg	1%	-2%			-23%	-1%	13%		-2%	-49%	-27%	
SD	2%	6%			19%	3%	3%		5%		31%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL	3%	907%		4%	0%	75%			-3%	6%	22%	5%
UL	-6%	432%		-11%	-11%	30%			-17%	-4%	-10%	-22%
Avg	-1%	669%		-4%	-6%	53%		-49%	-10%	1%	6%	-9%
SD	4%	238%		8%	5%	22%			7%	5%	16%	14%

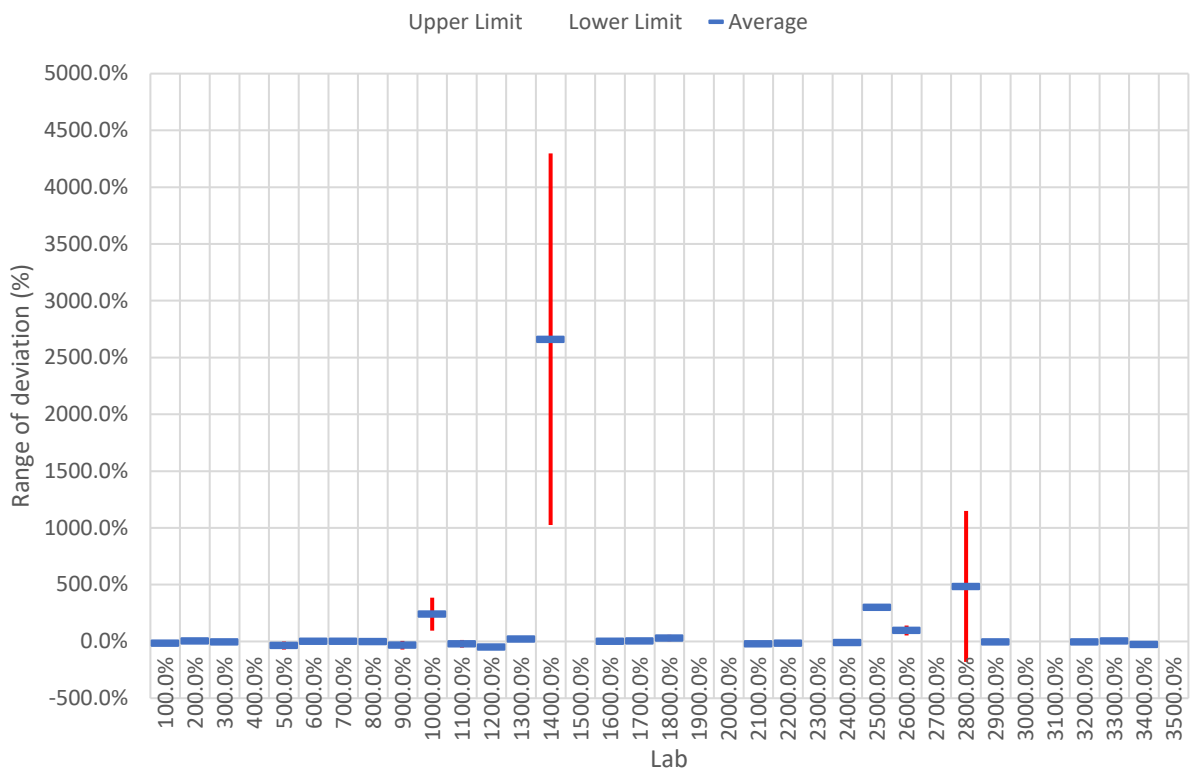
	25	26	27	28	29	30	31	32	33	34	35
UL		198%		28%				42%	20%	26%	
UL		-73%		-35%				-11%	9%	-34%	
Avg		62%		-3%	-1%			16%	15%	-4%	
SD		135%		32%				27%	5%	30%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	0%	-9%			3%	2%	8%	32%	-3%	4%	10%	
UL	-17%	-31%			-13%	-3%	-12%	3%	-39%	-60%	-39%	
Avg	-8%	-20%			-5%	0%	-2%	18%	-21%	-28%	-14%	
SD	9%	11%			8%	3%	10%	15%	18%	32%	25%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL	-1%	89%	8%	-1%	0%	62%			3%		26%	1%
UL	-21%	-51%	2%	-24%	-12%	-1%			-31%		5%	-13%
Avg	-11%	19%	5%	-12%	-6%	30%		13%	-14%	-18%	16%	-6%
SD	10%	70%	3%	11%	6%	32%			17%		11%	7%

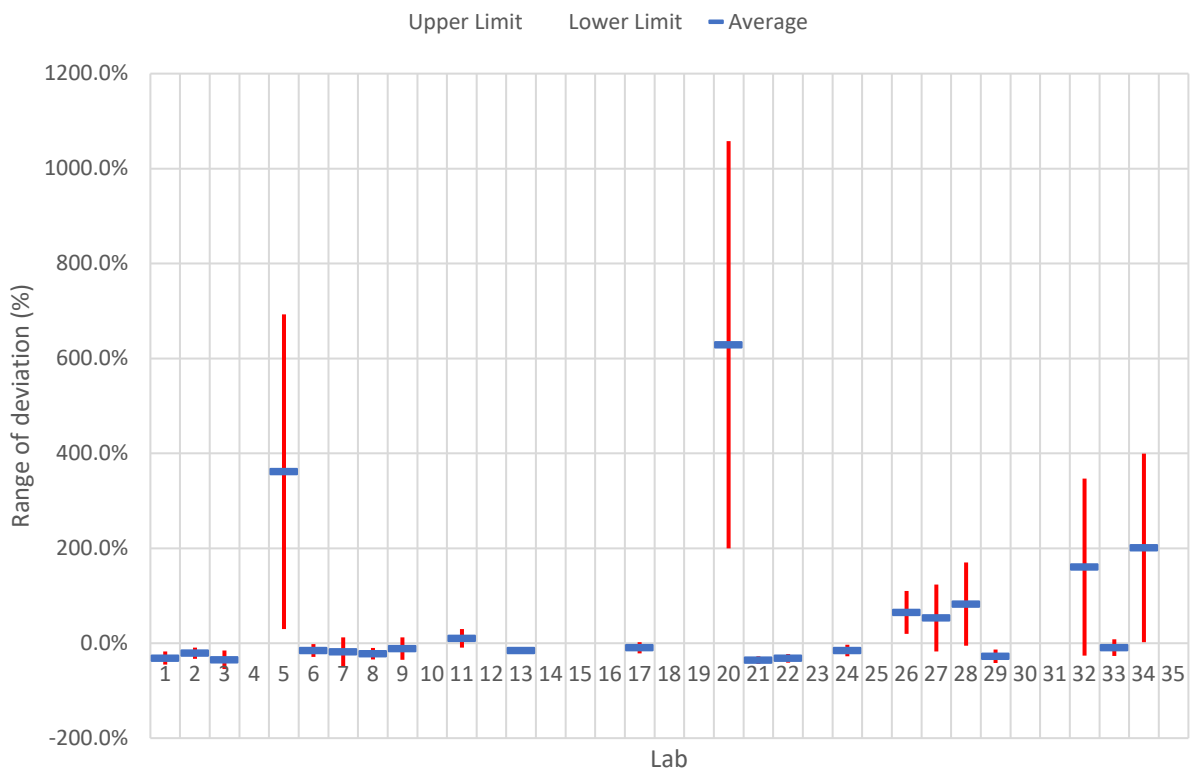
	25	26	27	28	29	30	31	32	33	34	35
UL	22%	254%	24%	-1%	302%			-2%	24%	2%	
UL	-26%	12%	4%	-11%	-2%			-21%	12%	-24%	
Avg	-2%	133%	14%	-6%	150%			-11%	18%	-11%	
SD	24%	121%	10%	5%	152%			9%	6%	13%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	-3%	9%	0%		-1%	2%	12%	9%	5%	386%	13%	-32%
UL	-30%	-1%	-10%		-71%	-1%	-6%	-9%	-71%	94%	-54%	-68%
Avg	-16%	4%	-5%		-36%	0%	3%	0%	-33%	240%	-21%	-50%
SD	14%	5%	5%		35%	2%	9%	9%	38%	146%	33%	18%

	13	14	15	16	17	18	19	20	21	22	23	24
UL	45%	4291%		5%	11%	58%		13%	-6%	-10%		4%
UL	0%	1018%		-3%	-3%	1%		-1%	-37%	-18%		-24%
Avg	23%	2654%		1%	4%	30%		6%	-22%	-14%		-10%
SD	23%	1637%		4%	7%	28%		7%	15%	4%		14%

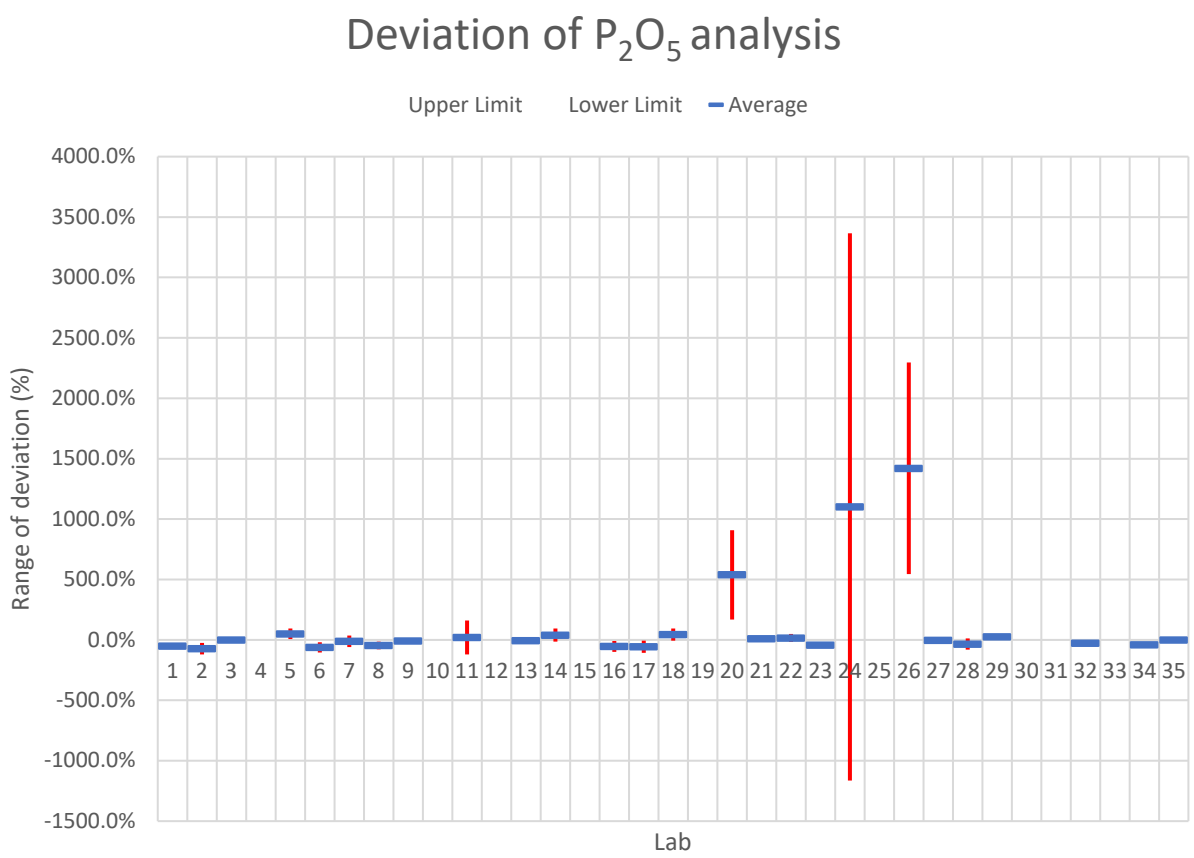
	25	26	27	28	29	30	31	32	33	34	35
UL		141%		1150%	2%			8%	13%	-13%	
UL		51%		-181%	-10%			-18%	-5%	-39%	
Avg	299%	96%		484%	-4%			-5%	4%	-26%	
SD		45%		666%	6%			13%	9%	13%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	-18%	-9%	-16%		693%	-2%	12%	-10%	12%		30%	
UL	-45%	-33%	-54%		30%	-29%	-49%	-34%	-35%		-9%	
Avg	-31%	-21%	-35%		361%	-15%	-18%	-22%	-12%		10%	
SD	14%	12%	19%		332%	13%	30%	12%	24%		20%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL					2%			1058%	-27%	-23%		-3%
UL					-21%			200%	-44%	-41%		-28%
Avg	-16%				-10%			629%	-36%	-32%		-15%
SD					12%			429%	8%	9%		12%

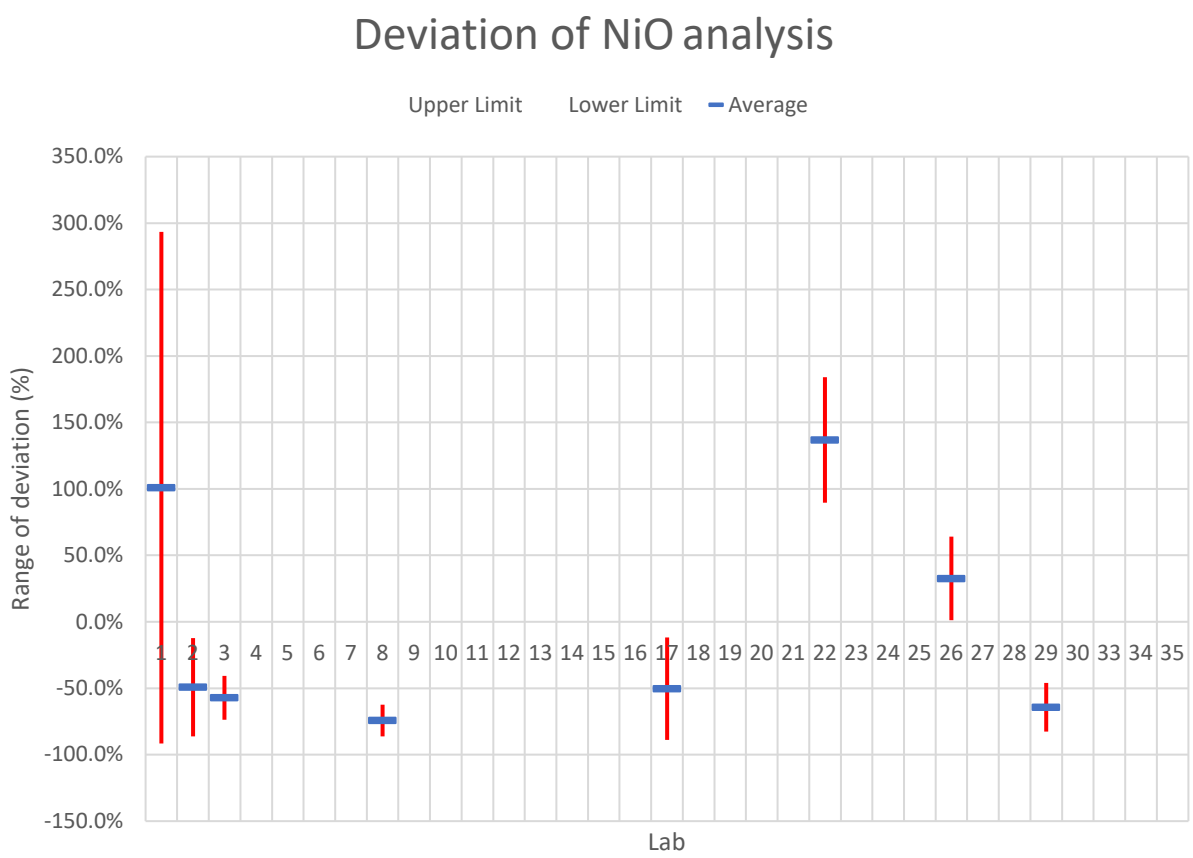
	25	26	27	28	29	30	31	32	33	34	35
UL		110%	124%	170%	-13%			347%	9%	399%	
UL		19%	-17%	-5%	-42%			-26%	-27%	2%	
Avg		65%	53%	83%	-28%			161%	-9%	201%	
SD		45%	71%	87%	14%			186%	18%	198%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	-33%	-24%			93%	-20%	35%	-13%			161%	
UL	-71%	-121%			8%	-103%	-59%	-79%			-120%	
Avg	-52%	-72%	-2%		51%	-62%	-12%	-46%	-8%		20%	
SD	19%	48%			43%	42%	47%	33%			141%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL		95%		-8%	-6%	94%		909%		48%	-29%	3365%
UL		-15%		-100%	-108%	-7%		169%		-16%	-59%	-1164%
Avg	-7%	40%		-54%	-57%	43%		539%	11%	16%	-44%	1101%
SD		55%		46%	51%	51%		370%		32%	15%	2265%

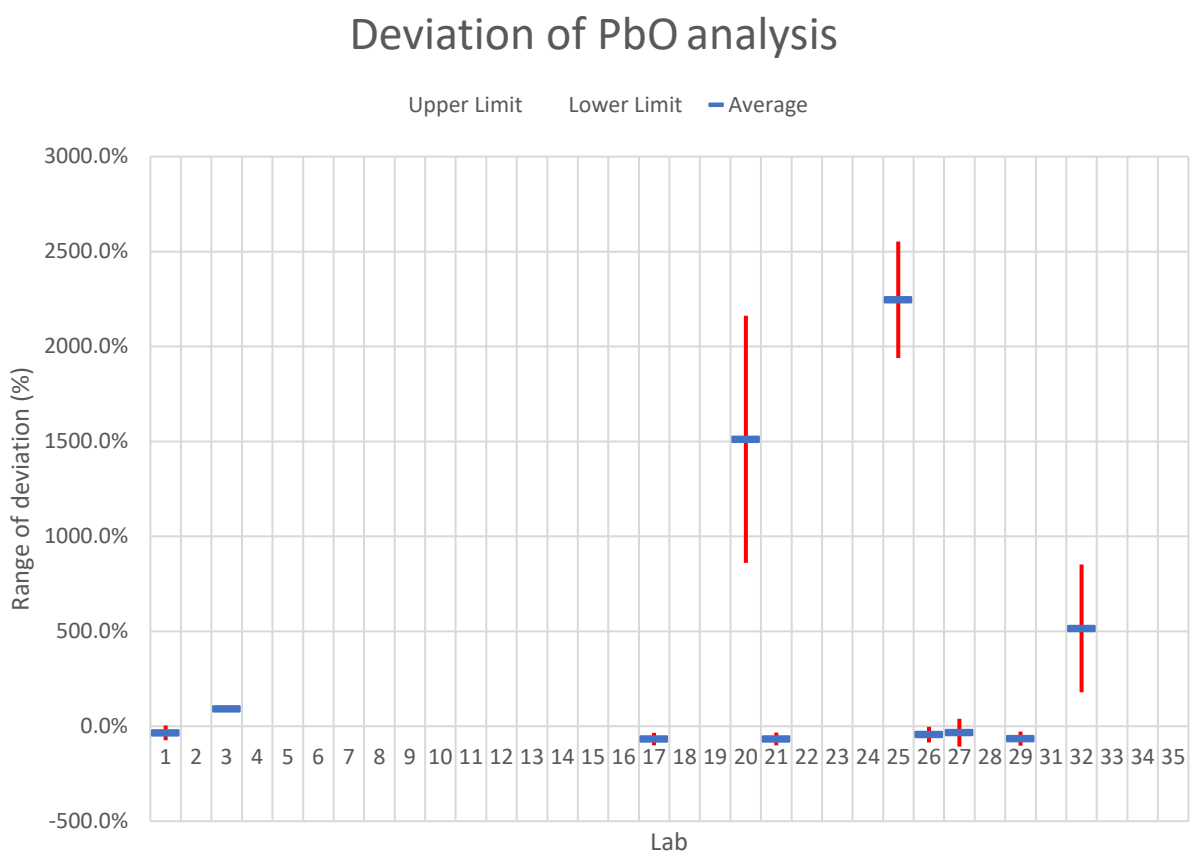
	25	26	27	28	29	30	31	32	33	34	35
UL		2296%		11%				-7%			
UL		545%		-80%				-46%			
Avg		1420%	-3%	-35%	27%			-27%		-41%	
SD		876%		46%				19%			



	1	2	3	4	5	6	7	8	9	10	11	12
UL	255%	-13%	-45%					-62%				
UL	-91%	-90%	-74%					-89%				
Avg	82%	-52%	-60%					-76%				
SD	173%	38%	14%					13%				

	13	14	15	16	17	18	19	20	21	22	23	24
UL					-13%			138%		137%		
UL					-92%			-15%		81%		
Avg					-52%			61%		109%		
SD					39%			76%		28%		

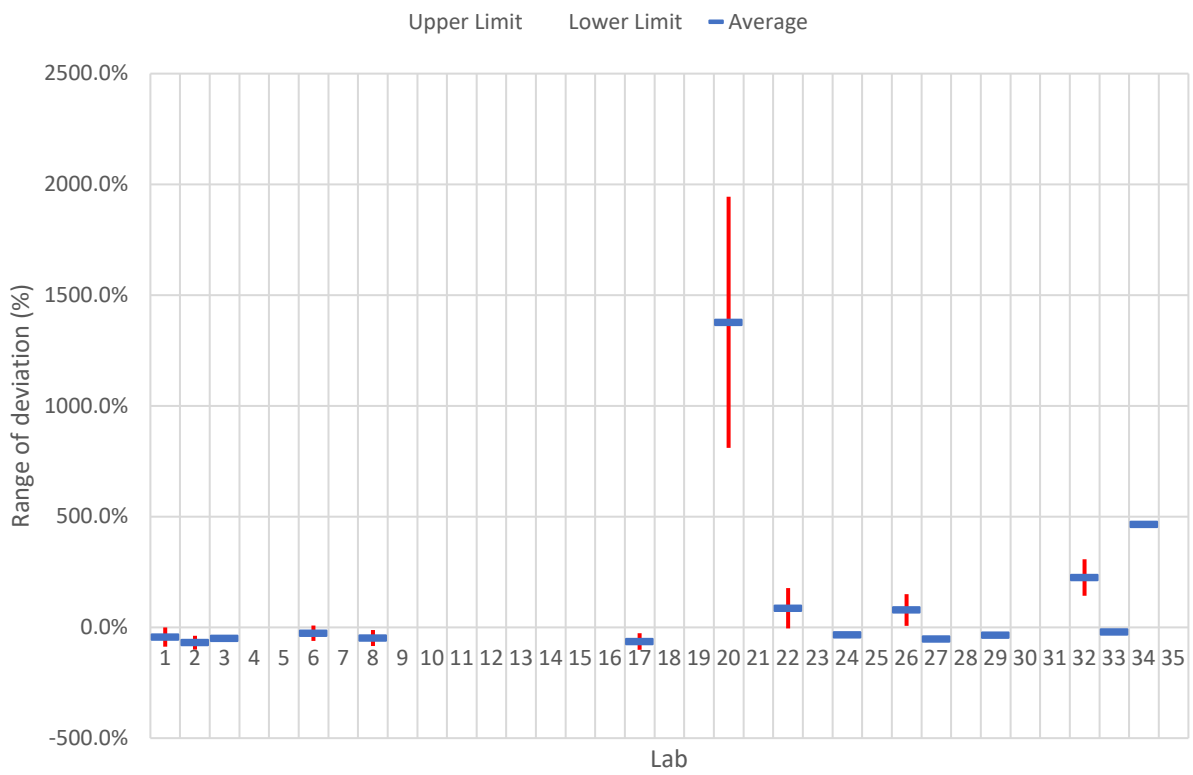
	25	26	27	28	29	30	31	32	33	34	35
UL		62%			-46%			227%			
UL		-19%			-84%			-27%			
Avg		22%			-65%			100%			
SD		41%			19%			127%			



	1	2	3	4	5	6	7	8	9	10	11	12
UL	3%											
UL	-74%											
Avg	-35%		91%									
SD	39%											

	13	14	15	16	17	18	19	20	21	22	23	24
UL					-35%			2162%	-34%			
UL					-100%			860%	-101%			
Avg					-68%			1511%	-67%			
SD					32%			651%	34%			

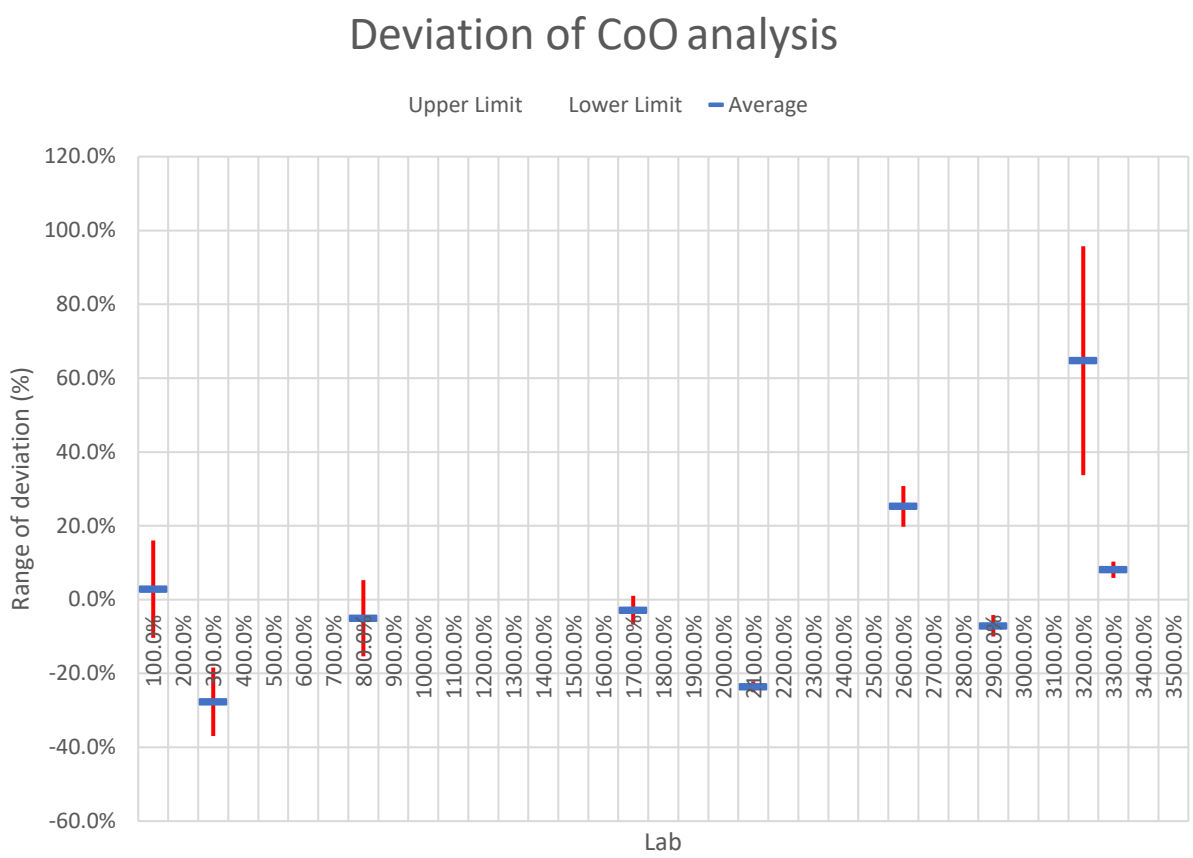
	25	26	27	28	29	30	31	32	33	34	35
UL	2553%	-3%	40%		-28%			852%			
UL	1940%	-85%	-107%		-102%			178%			
Avg	2246%	-44%	-34%		-65%			515%			
SD	307%	41%	73%		37%			337%			



	1	2	3	4	5	6	7	8	9	10	11	12
UL	0%	-37%	-41%			8%		-11%				
UL	-88%	-100%	-57%			-61%		-85%				
Avg	-44%	-69%	-49%			-26%		-48%				
SD	44%	31%	8%			34%		37%				

	13	14	15	16	17	18	19	20	21	22	23	24
UL					-26%			1944%		178%		
UL					-101%			811%		-5%		
Avg					-64%			1377%		87%		-34%
SD					38%			567%		91%		

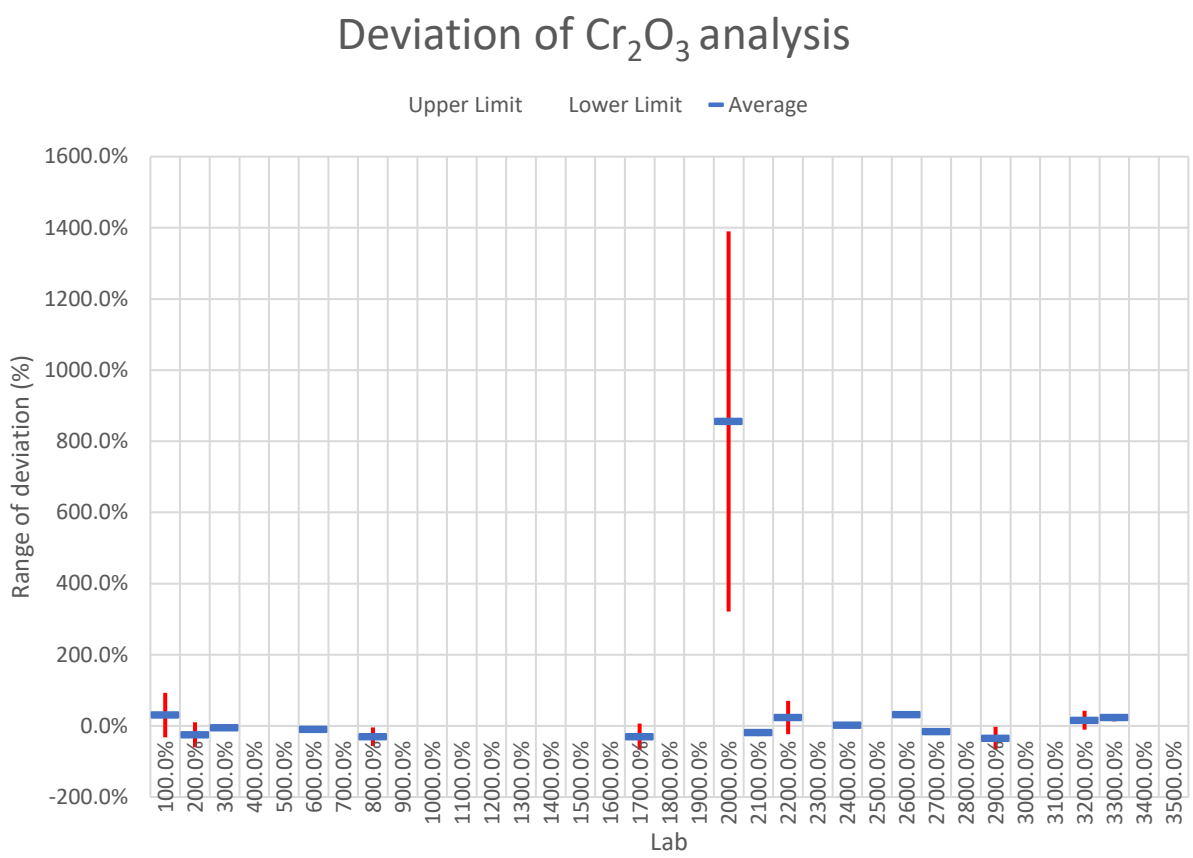
	25	26	27	28	29	30	31	32	33	34	35
UL		150%			-29%			307%	-14%		
UL		8%			-42%			142%	-27%		
Avg		79%	-52%		-36%			225%	-20%	466%	
SD		71%			6%			82%	7%		



	1	2	3	4	5	6	7	8	9	10	11	12
UL	19%		-17%					8%				
UL	-9%		-35%					-13%				
Avg	5%		-26%					-3%				
SD	14%		9%					11%				

	13	14	15	16	17	18	19	20	21	22	23	24
UL					3%			-14%	-21%			
UL					-4%			-19%	-23%			
Avg					-1%			-16%	-22%			
SD					4%			3%	1%			

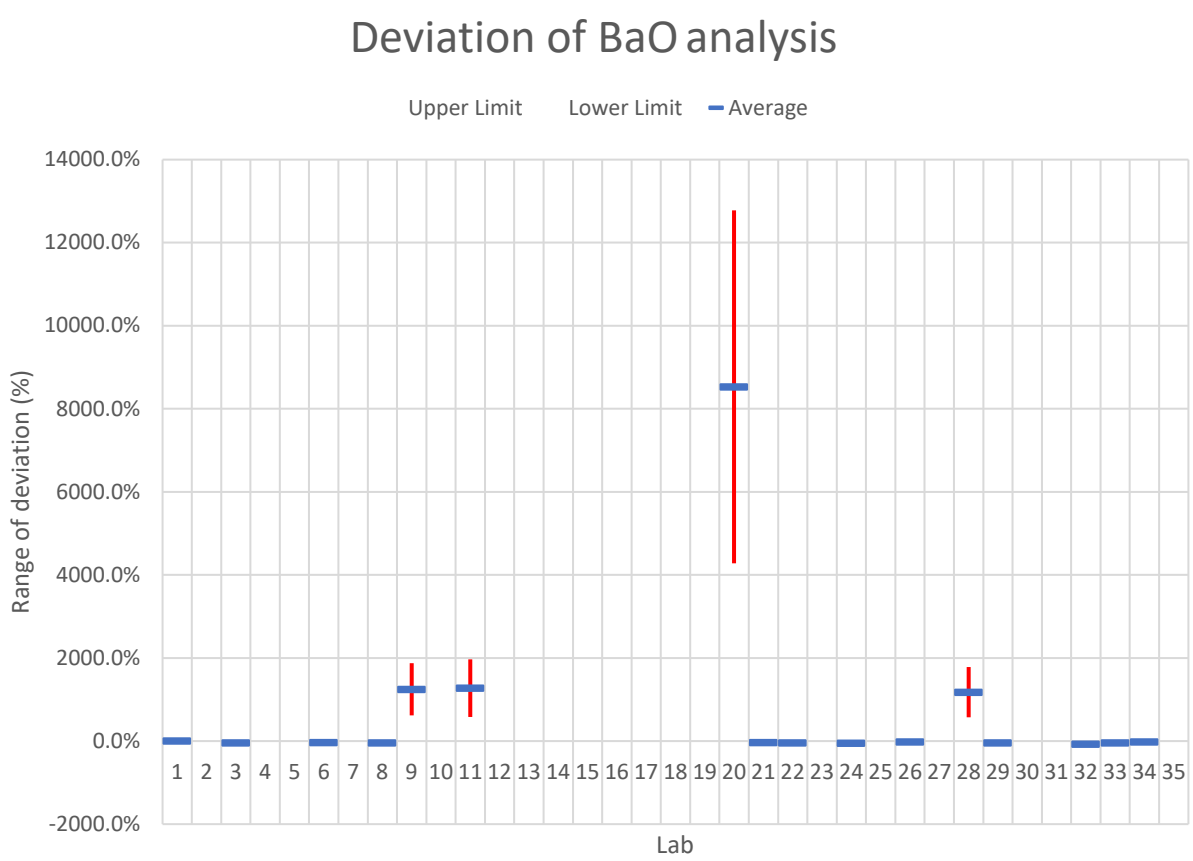
	25	26	27	28	29	30	31	32	33	34	35
UL		34%			-2%			101%	12%		
UL		22%			-8%			36%	9%		
Avg		28%			-5%			68%	11%		
SD		6%			3%			32%	2%		



	1	2	3	4	5	6	7	8	9	10	11	12
UL	93%	10%	2%			-2%		-5%				
UL	-32%	-60%	-13%			-18%		-57%				
Avg	31%	-25%	-5%			-10%		-31%				
SD	63%	35%	8%			8%		26%				

	13	14	15	16	17	18	19	20	21	22	23	24
UL					6%			1390%	-9%	71%		6%
UL					-67%			321%	-29%	-23%		-3%
Avg					-30%			856%	-19%	24%		2%
SD					37%			534%	10%	47%		5%

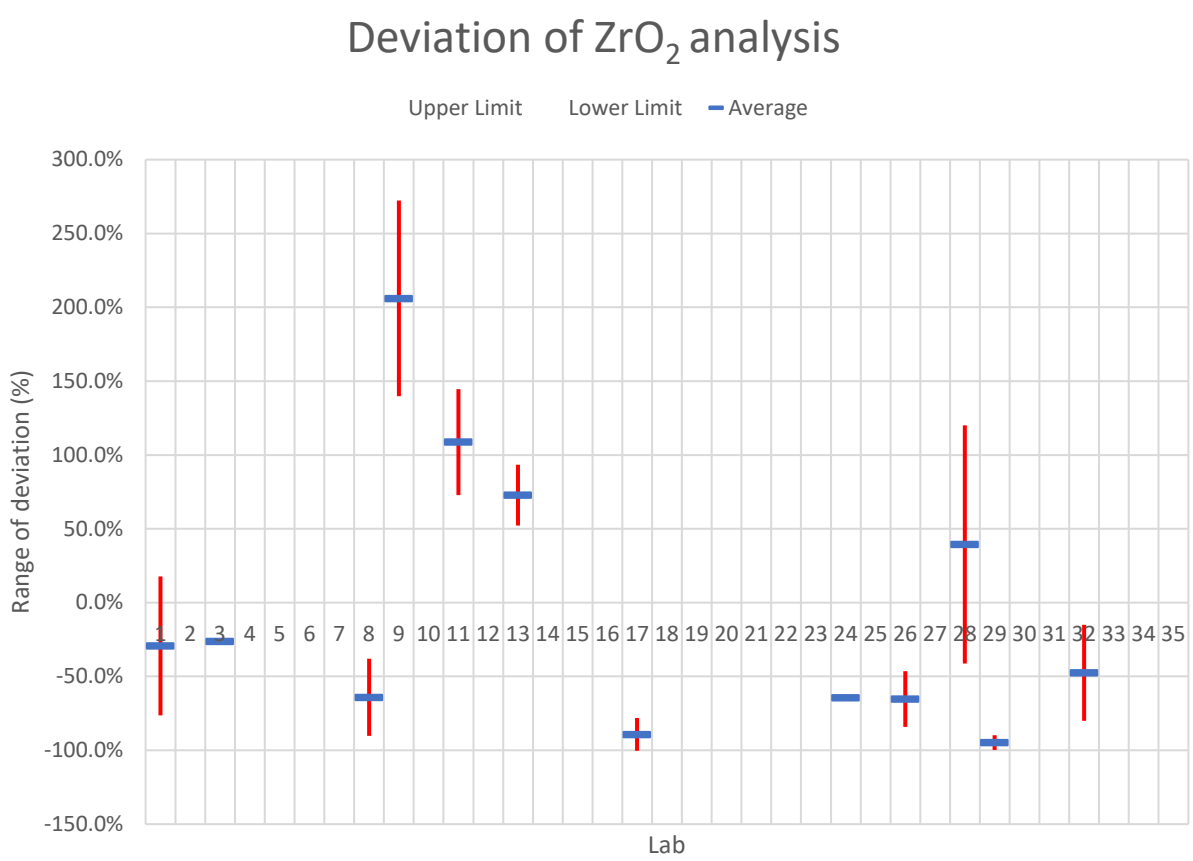
	25	26	27	28	29	30	31	32	33	34	35
UL		38%	-11%		-2%			42%	34%		
UL		26%	-20%		-67%			-11%	13%		
Avg		32%	-16%		-34%			16%	23%		
SD		6%	4%		32%			27%	10%		



	1	2	3	4	5	6	7	8	9	10	11	12
UL	26%		-7%			0%		-8%	1872%		1966%	
UL	-28%		-78%			-68%		-80%	618%		579%	
Avg	-1%		-43%			-34%		-44%	1245%		1272%	
SD	27%		36%			34%		36%	627%		693%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL								12778%	4%	-9%		-19%
UL								4278%	-78%	-79%		-84%
Avg								8528%	-37%	-44%		-52%
SD								4250%	41%	35%		33%

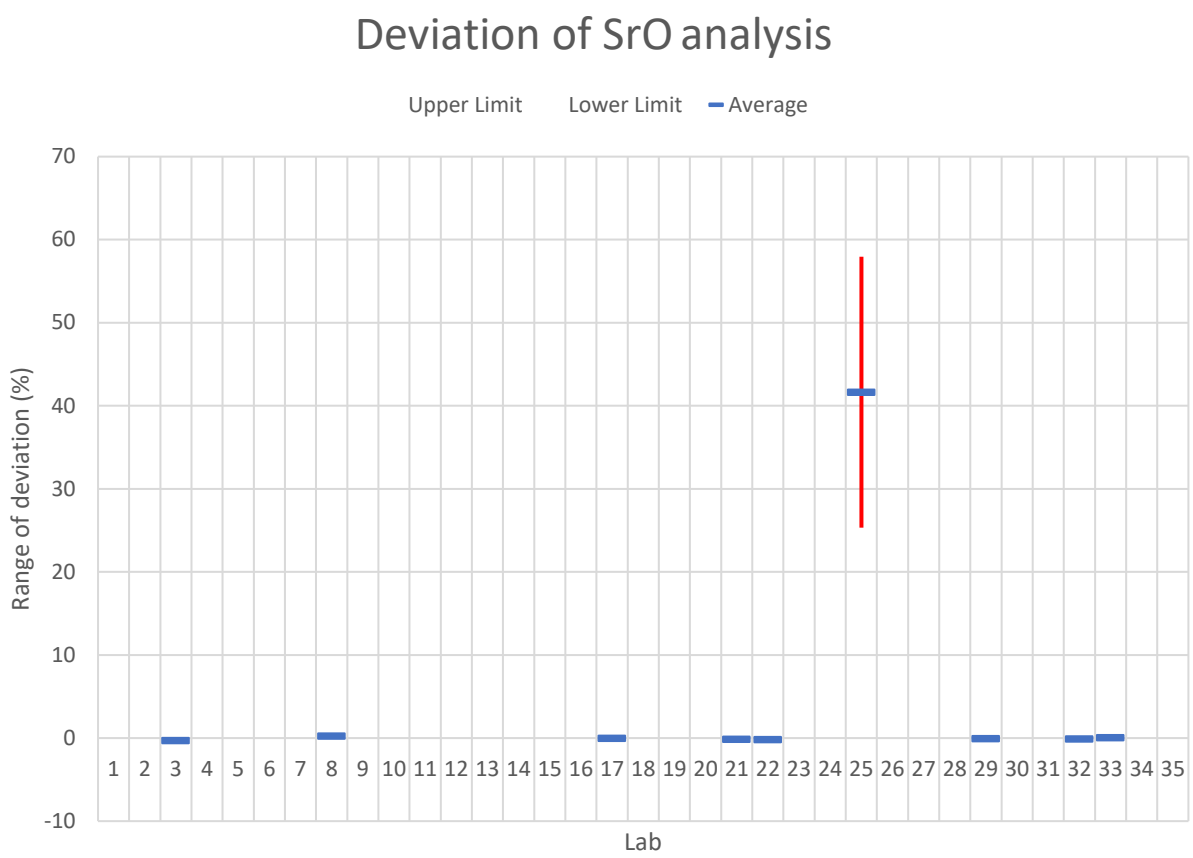
	25	26	27	28	29	30	31	32	33	34	35
UL		9%		1779%	-6%			-63%	-6%	-12%	
UL		-56%		575%	-77%			-85%	-76%	-36%	
Avg		-23%		1177%	-41%			-74%	-41%	-24%	
SD		32%		602%	36%			11%	35%	12%	



	1	2	3	4	5	6	7	8	9	10	11	12
UL	18%							-38%	272%		145%	
UL	-76%							-90%	140%		73%	
Avg	-29%		-26%					-64%	206%		109%	
SD	47%							26%	66%		36%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL	93%				-78%							
UL	52%				-100%							
Avg	73%				-89%							-64%
SD	21%				11%							

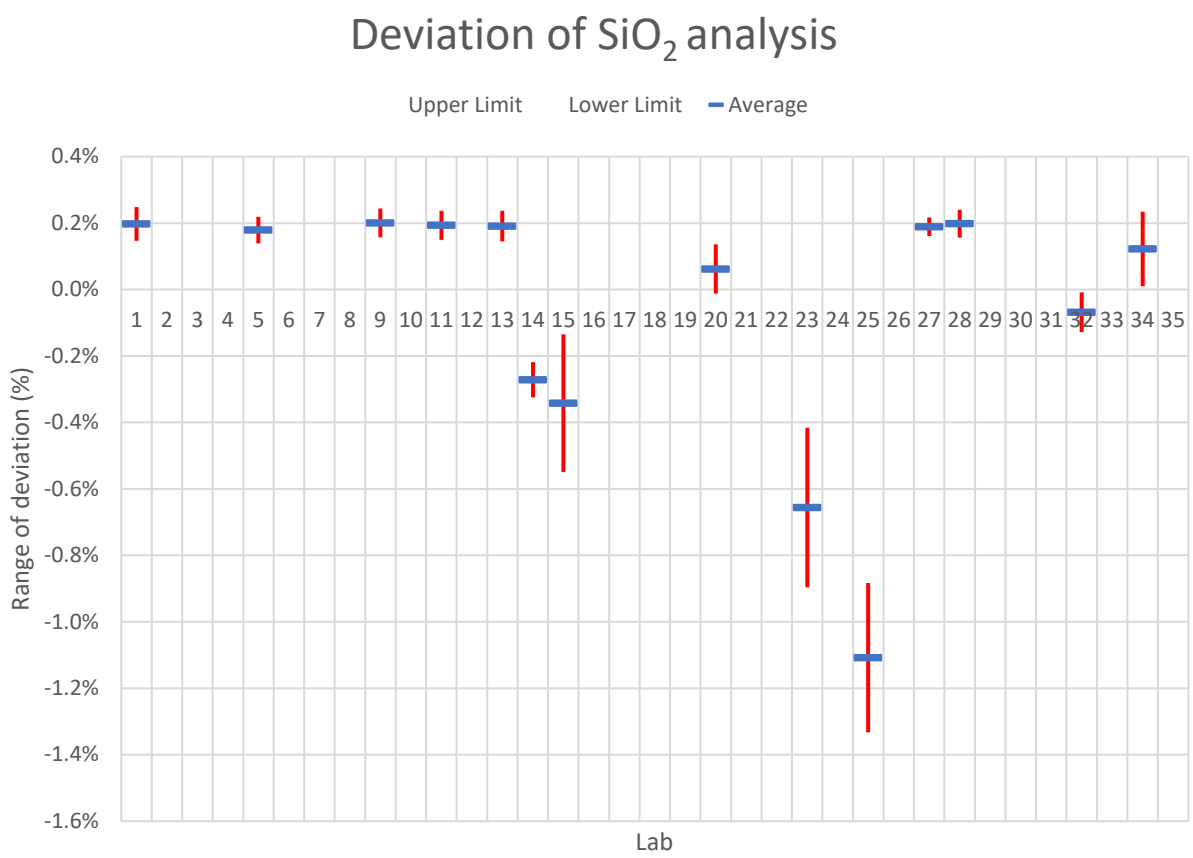
	25	26	27	28	29	30	31	32	33	34	35
UL		-47%		120%	-90%			-15%			
UL		-84%		-41%	-100%			-80%			
Avg		-65%		39%	-95%			-48%			
SD		19%		81%	5%			33%			



	1	2	3	4	5	6	7	8	9	10	11	12
UL								43%				
UL								5%				
Avg			-31%					24%				
SD								19%				

	13	14	15	16	17	18	19	20	21	22	23	24
UL					2%				-4%	-6%		
UL					-10%				-24%	-28%		
Avg					-4%				-14%	-17%		
SD					6%				10%	11%		

	25	26	27	28	29	30	31	32	33	34	35
UL	5795%				3%			-2%	14%		
UL	2532%				-13%			-22%	-1%		
Avg	4163%				-5%			-12%	6%		
SD	1632%				8%			10%	7%		



	1	2	3	4	5	6	7	8	9	10	11	12
UL					0.2%				0.2%		0.2%	
UL	0.1%				0.1%				0.2%		0.1%	
Avg	0.2%				0.2%				0.2%		0.2%	
SD	0.1%				0.0%				0.0%		0.0%	

	13	14	15	16	17	18	19	20	21	22	23	24
UL	0.2%	-0.2%	-0.1%					0.1%			-0.4%	
UL	0.1%	-0.3%	-0.5%					0.0%			-0.9%	
Avg	0.2%	-0.3%	-0.3%					0.1%			-0.7%	
SD	0.0%	0.1%	0.2%					0.1%			0.2%	

	25	26	27	28	29	30	31	32	33	34	35
UL	-0.9%		0.2%	0.2%				0.0%		0.2%	
UL	-1.3%		0.2%	0.2%				-0.1%		0.0%	
Avg	-1.1%		0.2%	0.2%				-0.1%		0.1%	
SD	0.2%		0.0%	0.0%				0.1%		0.1%	

ANNEX 7. ANALYTICAL METHODS

	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	MgO	MnO	P_2O_5	B_2O_3
	%	%	%	%	%	%	%	ppm	ppm	ppm
Lab 1	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES
Lab 2	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	
Lab 3	ICP-OES	ICP-OES	ICP-OES	ICP-OES			ICP-OES	ICP-OES	ICP-OES	ICP-OES
Lab 4										
Lab 5	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	
Lab 6	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES
Lab 7										
Lab 8	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES	ICP-OES	ICP-OES	ICP-OES	
Lab 9	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	
Lab 10	XRF	XRF	XRF			XRF	XRF			
Lab 11	XRF	XRF	XRF	XRF	XRF	XRF	XRF		XRF	
Lab 12	XRF	XRF	XRF	XRF			XRF			
Lab 13	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	
Lab 14	XRF	XRF	XRF	XRF	XRF	XRF	XRF		XRF	
Lab 15	XRF	XRF		XRF		XRF				
Lab 16	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES	
Lab 17	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	
Lab 18	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES	
Lab 19										
Lab 20	XRF	XRF	XRF	XRF	XRF	XRF	ICP-OES	XRF	XRF	ICP-OES
Lab 21	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
Lab 22	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES
Lab 23	XRF	XRF	XRF	XRF	XRF	XRF			XRF	
Lab 24	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	
Lab 25	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES	
Lab 26	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
Lab 27	XRF	XRF	XRF	XRF		XRF		XRF		
Lab 28	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	
Lab 29	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-MS	ICP-OES	
Lab 30										
Lab 31										
Lab 32	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	XRF	XRF	ICP-OES	ICP-OES	ICP-OES
Lab 33	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		
Lab 34		ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	
Lab 35										

	ZnO	V_2O_5	NiO	PbO	CuO	CoO	CdO	Cr_2O_3	Sc_2O_3	BaO
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lab 1	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES	ICP-OES	ICP-OES
Lab 2		ICP-OES	ICP-OES		ICP-OES			ICP-OES		
Lab 3	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES		ICP-OES
Lab 4										
Lab 5										
Lab 6		ICP-OES	ICP-OES		ICP-OES			ICP-OES		ICP-OES
Lab 7										
Lab 8	ICP-OES	ICP-OES	ICP-OES		ICP-OES	ICP-OES		ICP-OES		ICP-OES
Lab 9										
Lab 10										
Lab 11	XRF	XRF		XRF						XRF
Lab 12										
Lab 13										
Lab 14										
Lab 15										
Lab 16										
Lab 17	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES		
Lab 18										
Lab 19										
Lab 20	XRF		ICP-OES	XRF	XRF	ICP-OES		XRF		XRF
Lab 21	ICP-MS		ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS		ICP-MS
Lab 22	ICP-OES		ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES
Lab 23										
Lab 24	ICP-OES		ICP-OES		ICP-OES			ICP-OES		ICP-OES
Lab 25	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES			ICP-OES		
Lab 26	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
Lab 27								XRF		
Lab 28										XRF
Lab 29	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS		ICP-MS		ICP-MS
Lab 30										
Lab 31										
Lab 32	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES
Lab 33	ICP-OES		ICP-OES		ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES
Lab 34	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES		ICP-OES
Lab 35										

	LiO_2	SO_3	MoO_3	HfO_2	Nb_2O_5	ZrO_2	As_2O_3	Bi_2O_3	Sb_2O_3	SnO_2
	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
Lab 1	ICP-OES		ICP-OES	ICP-OES	ICP-OES	ICP-OES				
Lab 2										
Lab 3			ICP-OES			ICP-OES	ICP-OES			
Lab 4										
Lab 5										
Lab 6										
Lab 7										
Lab 8			ICP-OES			ICP-OES		ICP-OES	ICP-OES	
Lab 9						XRF				
Lab 10										
Lab 11						XRF				
Lab 12										
Lab 13						XRF				
Lab 14										
Lab 15										
Lab 16										
Lab 17	ICP-OES					ICP-OES				
Lab 18										
Lab 19										
Lab 20		XRF					ICP-OES			
Lab 21						ICP-MS		ICP-MS		
Lab 22								ICP-OES		
Lab 23										
Lab 24						ICP-OES				
Lab 25						ICP-OES				
Lab 26			ICP-MS	ICP-MS		ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS
Lab 27										
Lab 28		XRF				XRF				
Lab 29	ICP-OES					ICP-MS				
Lab 30										
Lab 31										
Lab 32			ICP-OES			ICP-OES	ICP-OES	ICP-OES	ICP-OES	ICP-OES
Lab 33			ICP-OES				ICP-OES	ICP-OES		ICP-OES
Lab 34			ICP-OES					ICP-OES		ICP-OES
Lab 35										

	SrO	Ga_2O_3	GeO_2	Rb_2O	La_2O_3	Y_2O_3	Cs_2O	Cl	LOI	SiO_2
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%
Lab 1									Other	Diff.
Lab 2										
Lab 3	ICP-OES	ICP-OES								
Lab 4										
Lab 5										Diff.
Lab 6										
Lab 7										
Lab 8	ICP-OES	ICP-OES								
Lab 9										XRF
Lab 10										
Lab 11										XRF
Lab 12										
Lab 13										XRF
Lab 14										XRF
Lab 15									TGA	XRF
Lab 16										
Lab 17	ICP-OES	ICP-OES								
Lab 18										
Lab 19										
Lab 20								XRF		Other
Lab 21	ICP-MS	ICP-MS								
Lab 22	ICP-OES	ICP-OES								
Lab 23									Other	XRF
Lab 24										
Lab 25	ICP-OES	ICP-OES								
Lab 26	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS					
Lab 27										XRF
Lab 28										Diff.
Lab 29	ICP-MS	ICP-MS		ICP-MS		ICP-MS	ICP-MS			
Lab 30										
Lab 31										
Lab 32	ICP-OES	ICP-OES							TGA	XRF
Lab 33	ICP-OES	ICP-OES								
Lab 34	ICP-OES	ICP-OES								Gravi.
Lab 35										

ANNEX 8. CERTIFIED VALUES

SAMPLE A

Elem.	Unit	Certified value	±	Uncertainty	Analytical method
Al_2O_3	%	0.017745758	±	0.002154091	ICP-OES, ICP-MS, XRF
Fe_2O_3	%	0.003756045	±	0.000777592	ICP-OES, ICP-MS, XRF
TiO_2	%	0.000443498	±	0.000086601	ICP-OES, ICP-MS, XRF
CaO	%	0.005410682	±	0.000770834	ICP-OES, ICP-MS, XRF
Na_2O	%	0.004036566	±	0.000350954	ICP-OES, ICP-MS, XRF
K_2O	%	0.003429921	±	0.000495299	ICP-OES, ICP-MS, XRF
MgO	%	0.001201375	±	0.000141442	ICP-OES, ICP-MS, XRF
MnO	%	0.000204626	±	0.000040732	ICP-OES, ICP-MS, XRF
P_2O_5	%	0.001021576	±	0.000494168	ICP-OES, ICP-MS, XRF
NiO	%	0.000112268	±	0.000112421	ICP-OES, ICP-MS, XRF
PbO	%	0.000281774	±	0.000280838	ICP-OES, ICP-MS, XRF
CuO	%	0.000207334	±	0.000190535	ICP-OES, ICP-MS, XRF
CoO	%	0.000118372	±	0.000018054	ICP-OES, ICP-MS, XRF
Cr_2O_3	%	0.000129964	±	0.000097291	ICP-OES, ICP-MS, XRF
BaO	%	0.000089523	±	0.000069964	ICP-OES, ICP-MS, XRF
ZrO_2	%	0.000499236	±	0.000356432	ICP-OES, ICP-MS, XRF
SrO	%	0.000051927	±	0.000009354	ICP-OES, XRF
SiO_2	%	99.739723762	±	0.202938244	XRF, Difference

SAMPLE B

Elem.	Unit	Certified value	±	Uncertainty	Analytical method
Al_2O_3	%	0.026272647	±	0.002060576	ICP-OES, ICP-MS, XRF
Fe_2O_3	%	0.006246337	±	0.000774562	ICP-OES, ICP-MS, XRF
TiO_2	%	0.000715821	±	0.000104614	ICP-OES, ICP-MS, XRF
CaO	%	0.036833270	±	0.001890558	ICP-OES, ICP-MS, XRF
Na_2O	%	0.003942682	±	0.000312219	ICP-OES, ICP-MS, XRF
K_2O	%	0.005541708	±	0.000519792	ICP-OES, ICP-MS, XRF
MgO	%	0.001654070	±	0.000165074	ICP-OES, ICP-MS, XRF
MnO	%	0.000301066	±	0.000060885	ICP-OES, ICP-MS, XRF
P_2O_5	%	0.001126965	±	0.000557499	ICP-OES, ICP-MS, XRF
NiO	%	0.000120246	±	0.000083577	ICP-OES, ICP-MS, XRF
CuO	%	0.000238848	±	0.000074526	ICP-OES, ICP-MS, XRF
CoO	%	0.000116055	±	0.000017000	ICP-OES, ICP-MS, XRF
Cr_2O_3	%	0.000363830	±	0.000049366	ICP-OES, ICP-MS, XRF
BaO	%	0.000193919	±	0.000091363	ICP-OES, ICP-MS, XRF
ZrO_2	%	0.000503822	±	0.000419606	ICP-OES, ICP-MS, XRF
SrO	%	0.000078886	±	0.000024404	ICP-OES, XRF
SiO_2	%	99.682193734	±	0.203160710	XRF, Difference

SAMPLE C

Elem.	Unit	Certified value	±	Uncertainty	Analytical method
Al_2O_3	%	0.229528262	±	0.007454560	ICP-OES, ICP-MS, XRF
Fe_2O_3	%	0.066858681	±	0.002774014	ICP-OES, ICP-MS, XRF
TiO_2	%	0.007762849	±	0.000436255	ICP-OES, ICP-MS, XRF
CaO	%	0.024341912	±	0.001617156	ICP-OES, ICP-MS, XRF
Na_2O	%	0.009024372	±	0.000625098	ICP-OES, ICP-MS, XRF
K_2O	%	0.063373518	±	0.001430280	ICP-OES, ICP-MS, XRF
MgO	%	0.009127629	±	0.000629095	ICP-OES, ICP-MS, XRF
MnO	%	0.000828755	±	0.000063853	ICP-OES, ICP-MS, XRF
P_2O_5	%	0.006784462	±	0.000412861	ICP-OES, ICP-MS, XRF
B_2O_3	%	0.003199792	±	0.000801972	ICP-OES, ICP-MS, XRF
ZnO	%	0.000301876	±	0.000089118	ICP-OES, ICP-MS, XRF
V_2O_5	%	0.000255983	±	0.000026305	ICP-OES, ICP-MS, XRF
NiO	%	0.000087974	±	0.000033635	ICP-OES, ICP-MS, XRF
PbO	%	0.000322011	±	0.000110964	ICP-OES, ICP-MS, XRF
CuO	%	0.000109824	±	0.000038814	ICP-OES, ICP-MS, XRF
CoO	%	0.000109824	±	0.000019536	ICP-OES, ICP-MS, XRF
Cr_2O_3	%	0.000338189	±	0.000039877	ICP-OES, ICP-MS, XRF
BaO	%	0.000945385	±	0.000106299	ICP-OES, ICP-MS, XRF
ZrO_2	%	0.000768796	±	0.000396900	ICP-OES, ICP-MS, XRF
SrO	%	0.000189846	±	0.000029027	ICP-OES, XRF
SiO_2	%	99.444777525	±	0.112450203	XRF, Difference

SAMPLE D

Elem.	Unit	Certified value	±	Uncertainty	Analytical method
Al_2O_3	%	0.158559638	±	0.006631844	ICP-OES, ICP-MS, XRF
Fe_2O_3	%	0.007140687	±	0.000842332	ICP-OES, ICP-MS, XRF
TiO_2	%	0.000570836	±	0.000156127	ICP-OES, ICP-MS, XRF
CaO	%	0.008709741	±	0.000772827	ICP-OES, ICP-MS, XRF
Na_2O	%	0.003690622	±	0.000255668	ICP-OES, ICP-MS, XRF
K_2O	%	0.012584536	±	0.000833336	ICP-OES, ICP-MS, XRF
MgO	%	0.003029380	±	0.000183653	ICP-OES, ICP-MS, XRF
MnO	%	0.000110564	±	0.000028579	ICP-OES, ICP-MS, XRF
P_2O_5	%	0.002059751	±	0.001282461	ICP-OES, ICP-MS, XRF
NiO	%	0.000101260	±	0.000053886	ICP-OES, ICP-MS, XRF
PbO	%	0.000409681	±	0.000510594	ICP-OES, ICP-MS, XRF
CuO	%	0.000176765	±	0.000048274	ICP-OES, ICP-MS, XRF
Cr_2O_3	%	0.000606338	±	0.000056670	ICP-OES, ICP-MS, XRF
BaO	%	0.000446132	±	0.000106573	ICP-OES, ICP-MS, XRF
ZrO_2	%	0.000345126	±	0.000299312	ICP-OES, ICP-MS, XRF
SrO	%	0.000061981	±	0.000005104	ICP-OES, XRF
SiO_2	%	99.616815771	±	0.179430029	XRF, Difference