

PROFICIENCY TESTING

Evaluation Report

Scheduled Study

WS18-4

Study Type

WSCHEM_MICRO

Open Date

2018-09-26

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Laboratory

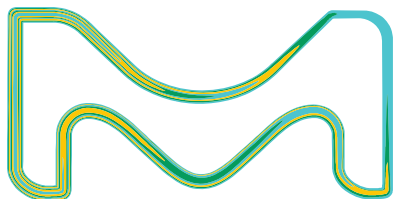
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US EPA Lab Code

WY00006



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Statistical analysis and reporting

QuoData GmbH Quality & Statistics!



Release of the report

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Sign:

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Accreditors

Evaluations of this study will be sent to the accreditor(s) listed below. If any of the information listed below is not correct, please contact Sigma-Aldrich RTC immediately.

Accrediting Agency

EPA Region 8

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Summary Results for WS18-4
MIC001-PA WS-Microbiological PT - Presence/Absence
LRAB9053

Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
SM 9223 B (Colilert®) 22nd ED (2004) 20212413				
Microbiology				
Coliforms, total - Sample 01 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 02 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 03 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 04 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 05 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 06 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 07 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 08 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				
Coliforms, total - Sample 09 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units		Acceptable
<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>				

* Evaluation parameters used for the statistical analysis: explanation at the end of report; A questionable result is acceptable but to be checked.

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Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
Coliforms, total - Sample 10 ^{1,2} 2500 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units		Acceptable
E. Coli - Sample 01 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 02 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 03 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 04 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 05 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 06 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	1 Units	1 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 07 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 08 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 09 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable
E. Coli - Sample 10 ^{1,2} 2525 Analyst: JW Analysis Date: 2018-10-02	0 Units	0 Units	<i>Evaluation Criteria – 7*</i> <i>Parameters*: a:1, b:0, c:0, d:0</i>	Acceptable

* Evaluation parameters used for the statistical analysis: explanation at the end of report; A questionable result is acceptable but to be checked.

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Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
Group Analysis Summary	Acceptable: 20/20		Score: 100% - Acceptable	

* Evaluation parameters used for the statistical analysis: explanation at the end of report; A questionable result is acceptable but to be checked.

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1 Aim of the Proficiency Test

This interlaboratory study is a proficiency test for the assessment of laboratory performance. It was conducted in the framework of external quality assurance and the report provides an external appraisal of the participant laboratories' competence in the particular testing field.

2 Sample Information

MIC001-PA WS-Microbiological PT - Presence/Absence LRAB9053

Analyte	Unit	Gravimetric Value	PTRL	Study Mean*	Study Std. Dev.*
Coliforms, total - Sample 01 2500	Units	1	---	---	---
Coliforms, total - Sample 02 2500	Units	1	---	---	---
Coliforms, total - Sample 03 2500	Units	0	---	---	---
Coliforms, total - Sample 04 2500	Units	1	---	---	---
Coliforms, total - Sample 05 2500	Units	1	---	---	---
Coliforms, total - Sample 06 2500	Units	1	---	---	---
Coliforms, total - Sample 07 2500	Units	0	---	---	---
Coliforms, total - Sample 08 2500	Units	0	---	---	---
Coliforms, total - Sample 09 2500	Units	1	---	---	---
Coliforms, total - Sample 10 2500	Units	0	---	---	---
E. Coli - Sample 01 2525	Units	1	---	---	---
E. Coli - Sample 02 2525	Units	0	---	---	---
E. Coli - Sample 03 2525	Units	0	---	---	---
E. Coli - Sample 04 2525	Units	0	---	---	---
E. Coli - Sample 05 2525	Units	1	---	---	---
E. Coli - Sample 06 2525	Units	1	---	---	---
E. Coli - Sample 07 2525	Units	0	---	---	---
E. Coli - Sample 08 2525	Units	0	---	---	---
E. Coli - Sample 09 2525	Units	0	---	---	---
E. Coli - Sample 10 2525	Units	0	---	---	---

* If there are not enough data available to provide Study mean and Study Std. Dev, this is indicated by "---".

3 Data Availability

MIC001-PA WS-Microbiological PT - Presence/Absence LRAB9053

Analyte	Number of participating laboratories		Number of data points	
	in total	with quantitative data points only*	in total	quantitative only*
Coliforms, total - Sample 01 2500	39	39	75	75
Coliforms, total - Sample 02 2500	39	39	45	45
Coliforms, total - Sample 03 2500	39	39	45	45
Coliforms, total - Sample 04 2500	39	39	45	45
Coliforms, total - Sample 05 2500	39	39	45	45
Coliforms, total - Sample 06 2500	39	39	45	45
Coliforms, total - Sample 07 2500	39	39	45	45
Coliforms, total - Sample 08 2500	39	39	45	45
Coliforms, total - Sample 09 2500	39	39	45	45
Coliforms, total - Sample 10 2500	39	39	45	45
E. Coli - Sample 01 2525	38	38	63	63
E. Coli - Sample 02 2525	38	38	43	43
E. Coli - Sample 03 2525	38	38	43	43
E. Coli - Sample 04 2525	38	38	43	43
E. Coli - Sample 05 2525	38	38	43	43
E. Coli - Sample 06 2525	38	38	43	43
E. Coli - Sample 07 2525	38	38	43	43
E. Coli - Sample 08 2525	38	38	43	43
E. Coli - Sample 09 2525	38	38	43	43

* Only quantitative values are taken into account in the calculation of study mean and study std.dev. (i.e. without missing results, without less-than results, without larger-than results).

Analyte	Number of participating laboratories		Number of data points	
	in total	with quantitative data points only*	in total	quantitative only*
E. Coli - Sample 10 2525	38	38	43	43

* Only quantitative values are taken into account in the calculation of study mean and study std.dev. (i.e. without missing results, without less-than results, without larger-than results).

4 Results

4.1 MIC001-PA WS-Microbiological PT - Presence/Absence / LRAB9053

4.1.1 Coliforms, total - Sample 01

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	75 / 75
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.2 Coliforms, total - Sample 02

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.3 Coliforms, total - Sample 03

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.4 Coliforms, total - Sample 04

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.5 Coliforms, total - Sample 05

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.6 Coliforms, total - Sample 06

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.7 Coliforms, total - Sample 07

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.8 Coliforms, total - Sample 08

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.9 Coliforms, total - Sample 09

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.10 Coliforms, total - Sample 10

No. of participating laboratories (in total / with quant. data points only)	39 / 39
No. of data points (in total / quantitative)	45 / 45
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.11 E. Coli - Sample 01

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	63 / 63
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.12 E. Coli - Sample 02

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.13 E. Coli - Sample 03

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.14 E. Coli - Sample 04

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.15 E. Coli - Sample 05

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.16 E. Coli - Sample 06

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.17 E. Coli - Sample 07

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.18 E. Coli - Sample 08

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.19 E. Coli - Sample 09

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.1.20 E. Coli - Sample 10

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	43 / 43
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

5 Statistical Analysis

5.1 Definitions and Interpretation

Reported Value

The participant's result.

Assigned Value

Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose. See ISO/IEC 17043 for additional information. In general, the assigned value is the value used to assess proficiency and may or may not be the made to value (gravimetric value).

Acceptance Window

The range of values that constitute acceptable performance for a laboratory participating in this PT study.

z-score

A z-score shows how a single data point compares to normal data. A z-score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a z-score less than |2| is considered to be in control, a z-score between |2| and |3| is considered 'Questionable', but still within control and a z-score greater than |3| is considered not acceptable and the method is out of control. For WS studies, a z-score greater than |2| is not acceptable.

Calculated as $z = (\text{Reported Value} - \text{Assigned Value}) / \text{Proficiency Std. Dev.}$

A z-score cannot be provided

- (1) for presence/absence data,
- (2) for identification data and other categorical data,
- (3) where the analyte is not present in the sample,
- (4) for "less than" and "greater than" values,
- (5) NOEC analytes (in the framework of WETT analysis).

In cases (1) to (3) the participant's result is only evaluated by "acceptable" if it matches with the assigned value. Otherwise the result is indicated as "not acceptable". In case the analyte is not present in the sample and a PTRL is available, the participant's result is indicated as "acceptable" as long the result is less than the PTRL.

In case (4) the following evaluation rules will be applied:

- “less than” values:
 - PTRL available:
 - When the “less than” value is greater than the PTRL, then the result is indicated as “not acceptable”, otherwise as “acceptable”.
 - PTRL not available:
 - When the analyte is not present in the sample the result is always “acceptable”.
 - When the analyte is truly present in the sample, the result is only “acceptable” if the “less than” value is greater than the lower limit of the acceptance window.
- “greater than” values:
 - When the analyte is not present in the sample the result is always “not acceptable”.
 - When the analyte is truly present in the sample, the result is only “acceptable” if the “greater than” value is less than the upper limit of the acceptance window.

In case (5) the result is indicated as “acceptable” if it lies within the acceptance window, otherwise the result is indicated as “not acceptable”.

Proficiency Std. Dev.

Standard deviation calculated based on **Evaluation Criteria**.

PTRL

Proficiency Testing Reporting Limit

Study Mean

Statistical study mean calculated using a robust statistical model. Robust statistical techniques are used to minimize the influence extreme results can have on estimates of the mean and standard deviation. NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

Choice of statistical technique: In case of quantitative data points from at least 8 laboratories, Algorithm A (ISO 13528, Section C.3.1), and in case of quantitative data points of 4 to 7 laboratories, the Hampel estimator (ISO 13528, Section C.5.3) is applied. A study mean cannot be calculated in case there are quantitative data points from less than 4 laboratories available.

Study Std. Dev.

Standard deviation calculated from study data using robust statistics.

In case of quantitative data points from at least 8 laboratories, Algorithm A (ISO 13528, Section C.3.1), and in case of quantitative data points of 4 to 7 laboratories, the Q method (ISO 13528, Section C.5.2) is applied. A study standard deviation cannot be calculated in case there are quantitative data points from less than 4 laboratories available.

Gravimetric Value

The 'prepared to' value, determined by gravimetric means. The uncertainty associated with this value is the standard uncertainty and based on Sigma-Aldrich RTC's gravimetric tolerances.

5.2 Evaluation Criteria

1 - Regression Equation

Acceptance windows based on TNI adopted equation of proficiency value ± 3 proficiency standard deviations and check limits of proficiency value ± 2 proficiency standard deviations. Proficiency value and proficiency standard deviation are calculated from gravimetric variables a, b, c & d as proficiency value = $a * \text{gravimetric} + b$ and proficiency standard deviation = $c * \text{gravimetric} + d$.

2 - Study Robust Mean and c, d regression

Acceptance windows based on TNI adopted equation of proficiency value ± 3 proficiency standard deviations and check limits of proficiency value ± 2 proficiency standard deviations. Proficiency value and proficiency standard deviation calculated from robust study mean and variables c & d as proficiency value = robust mean and proficiency standard deviation = $c * \text{proficiency value} + d$.

3 - Fixed Limits

Acceptance windows based on span of gravimetric percentage from gravimetric as $\text{gravimetric} \pm \text{gravimetric} * \text{percentage}$.

4 - Adjustable Fixed Limits

Acceptance windows based on a span of gravimetric percentage from gravimetric as $\text{gravimetric} \pm \text{gravimetric} * \text{lowPercentage}$ where $\text{gravimetric} < \text{break}$ and $\text{gravimetric} \pm \text{gravimetric} * \text{highPercentage}$ where $\text{gravimetric} \geq \text{break}$.

5 - Study Statistics

Acceptance windows based on a number of standard deviations span from the study mean as $\text{study mean} \pm (\text{deviations} * \text{standard deviation})$.

6 - Log Transform Statistics

Acceptance windows based on lognormal distributed data. Acceptance windows = $\text{mean}(\text{lognormal}) \pm \text{span} * \text{standard deviation}(\text{lognormal})$.

7 - Regression Equation 2SD

Acceptance windows based on EPA equation of proficiency value ± 2 proficiency standard deviations. Proficiency value and proficiency standard deviation are calculated from gravimetric variables a, b, c & d as proficiency value = $a * \text{gravimetric} + b$ and proficiency standard deviation = $c * \text{gravimetric} + d$. Generally reserved for drinking water studies.

6 Notes on the Interpretation of the Results

z score Overview

The z-scores are presented as colored triangles. For each item, the z-scores of all analytes of the current and the previous (up to three) scheduled studies of this study type. The z-scores depend on the lot, analytical method used, and analyst (if given). A red cross is shown if no z-score is available.

For the assessment of participants by means of z-scores according to ISO/IEC 17043:2010 [2], the triangles were colored as follows:

$ z \leq 2$	green
$2 < z < 3$	yellow (WS studies, WETT samples: red)
$ z \geq 3$	red.

For $|z| \geq 3$, the corresponding triangles are displayed as -3 or 3. For $|z| > 2$, the value of the z score is displayed next to the triangle (yellow or red). A z-score = 0 is shown as a light blue vertical bar.

Interpretation of the z-scores' overview:

A z-score < 0 , i.e. the triangle points to the left, means that the measurement result is lower than the assigned value.

A z-score > 0 , i.e. the triangle points to the right, means that the measurement result is higher than the assigned value.

A z-score = 0, i.e. a light blue vertical bar is shown, means that the measurement result coincides with the assigned value.

Figures per Combination of Item, Lot and Analyte

The *diagram on the left* shows the participant results by means of blue diamonds.

The horizontal blue line indicates the assigned value.

Both the acceptance and the check limits for the participant results are calculated based on z-scores.

The acceptance limits are displayed as solid lines and correspond to z-scores of ± 3 . For WS studies and non-NOEC analytes (in the framework of WETT analysis), the acceptance limits correspond to a z-score ± 2 . For NOEC analytes (in the framework of WETT analysis), the acceptance limits correspond to ± 1 dilution.

The check limits are displayed as dashed lines and correspond to z-scores of ± 2 . They are only calculated if a rule is given by the evaluation criterion.

In case there are at least 8 laboratories with quantitative data points are available: The *diagram on the right* is a kernel density estimation of the distribution of the participant results. The measurement values are indicated as small circles. The kernel width is determined by the ISO 13528 formula from section 10.3.2 i) a).

7 Proficiency Test Item Preparation, Homogeneity and Stability Assessment

Sigma-Aldrich RTC uses proprietary and published methods for the manufacture, homogeneity and stability testing of proficiency test items. Sigma-Aldrich RTC's proficiency test materials meet the requirements of ISO Guide 34. For more information contact Sigma-Aldrich RTC. Additionally, Sigma-Aldrich RTC complies with the TNI Volume 3 'General Requirements for Environmental Proficiency Test Providers', EL-V3-2009, 2009 for all TNI Fields of Proficiency Testing analytes.

8 Metrological Traceability

All preparations are made using balances calibrated annually traceable to NIST standards. Where appropriate analytical measurements are traceable through an unbroken chain to NIST standards, or a Certified Reference Material manufactured under ISO Guide 34 in conjunction with ISO/IEC 17025.

9 Additional Information

Go to merck-pt.com for additional information on summary statistics for specific methods, advice on the interpretation of the statistical analysis and additional comments/recommendations. Sigma-Aldrich RTC recommends that you contact your accreditation body for specific instruction.

10 References

- [1] ISO 13528: Statistical methods for use in proficiency testing by interlaboratory comparison, August 2015
- [2] ISO/IEC 17025:2017: General requirements for the competence of testing and calibration laboratories
- [3] ISO/IEC 17043:2010: Conformity assessment - General requirements for proficiency testing, May 2010
- [4] S. Uhlig und P. Henschel (1997): Limits of tolerance and z-scores in ring tests. Fresenius' J. Anal. Chem., Vol. 358, pp. 761-766.

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