PROFICIENCY TESTING

Evaluation Report

Scheduled Study	**WS19-2**
Study Type	WSCHEM_MICRO
Open Date	2019-03-27
Close Date	2019-05-10
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Laboratory	Energy Laboratories-Gillette Julie Weisz 400 West Boxelder Rd. Gillette WY 82718 US
Account Number	49978849
US EPA Lab Code	WY00006

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Provider of the proficiency test

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Authorized release of the report

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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

Marcie Tidd
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Denver CO 80202-1129 US

Summary Results for WS19-2
MIC002-2EA Standard Plate Count - WS
LRAC1816

Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
SimPlate® (2000) 60032602				
Microbiology				
Heterotrophic Plate Count, MPN[1,2] 2555 Analyst: JW Analysis Date: 2019-04-01	120 MPN	123 MPN *Evaluation Criteria – 6** *Parameters*: span:2*	65.6 - 231 MPN	**-0.1** Acceptable
Group Analysis Summary	Acceptable: 1/1		**Score: 100% - Acceptable**	

* Study mean from the latest scheduled study within this scheme. If no study mean is available, this is indicated by "---".

** Due to the size of this data set and lack of verified gravimetric value, this evaluation is provided for informational purposes only.

[1] NELAC Compliant, covered by Sigma-Aldrich RTC's ANAB Proficiency Testing Provider accreditation, Cert. AP-1469

[2] ISO 17043 Accredited, covered by Sigma-Aldrich RTC's ANAB Proficiency Testing Provider accreditation, Cert AP-1469

Summary Results for WS19-2
MIC001-PA WS-Microbiological PT - Presence/Absence
LRAC1823

Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
SM 9223 B (Colisure®) 22nd ED 20231612				
Microbiology				
Coliforms, total - Sample 01[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
Coliforms, total - Sample 02[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
Coliforms, total - Sample 03[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
Coliforms, total - Sample 04[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
Coliforms, total - Sample 05[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
Coliforms, total - Sample 06[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
Coliforms, total - Sample 07[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
Coliforms, total - Sample 08[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
Coliforms, total - Sample 09[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable

* Study mean from the latest scheduled study within this scheme. If no study mean is available, this is indicated by "---".
** Due to the size of this data set and lack of verified gravimetric value, this evaluation is provided for informational purposes only.
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Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
Coliforms, total - Sample 10[1,2] 2500 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
E. Coli - Sample 01[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
E. Coli - Sample 02[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
E. Coli - Sample 03[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
E. Coli - Sample 04[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
E. Coli - Sample 05[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
E. Coli - Sample 06[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
E. Coli - Sample 07[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
E. Coli - Sample 08[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable
E. Coli - Sample 09[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	0 Units	0 Units *Evaluation Criteria – 7* *Parameters*: a:1, b:0, c:0, d:0*	0 - 0 Units	Acceptable

* Study mean from the latest scheduled study within this scheme. If no study mean is available, this is indicated by "---".

** Due to the size of this data set and lack of verified gravimetric value, this evaluation is provided for informational purposes only.

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Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
E. Coli - Sample 10[1,2] 2525 Analyst: JW Analysis Date: 2019-04-02	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*	1 - 1 Units	Acceptable
Group Analysis Summary	Acceptable: 20/20		**Score: 100% - Acceptable**	

* Study mean from the latest scheduled study within this scheme. If no study mean is available, this is indicated by "---".

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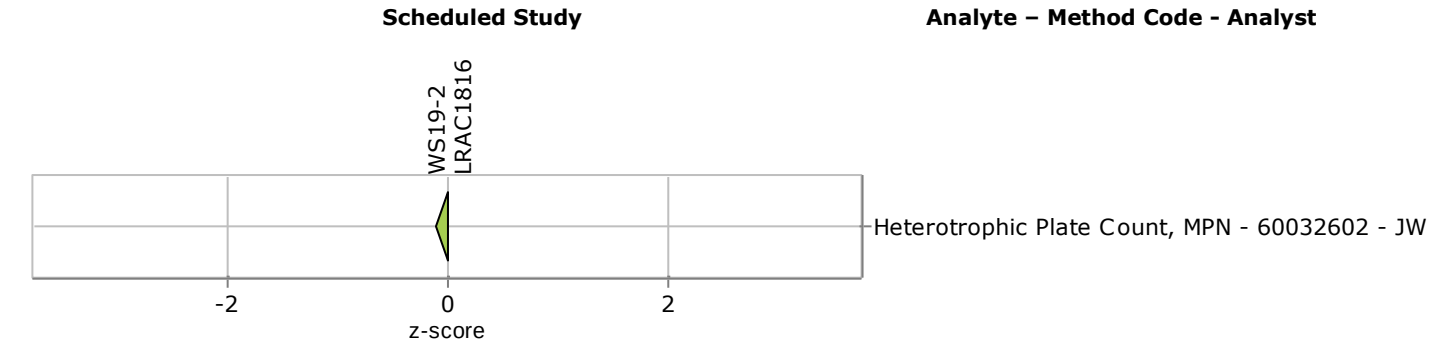
Graphical z-score Overview for WS19-2
MIC002-2EA Standard Plate Count - WS

z-score Overview* for WS19-2 and the Previous three Scheduled Studies of this Study Type



* Evaluation parameters used for the statistical analysis; explanation at the end of report

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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

MIC002-2EA Standard Plate Count - WS LRAC1816

Analyte	Unit	Gravimetric Value	PTRL	Study Mean*	Study Std. Dev.*
Heterotrophic Plate Count, MPN 2555	MPN	171 ± 30.0	---	123	38.7

MIC001-PA WS-Microbiological PT - Presence/Absence LRAC1823

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

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

Analyte	Unit	Gravimetric Value	PTRL	Study Mean*	Study Std. Dev.*
E. Coli - Sample 07 2525	Units	1	---	---	---
E. Coli - Sample 08 2525	Units	0	---	---	---
E. Coli - Sample 09 2525	Units	0	---	---	---
E. Coli - Sample 10 2525	Units	1	---	---	---

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

3 Data Availability

MIC002-2EA Standard Plate Count - WS
LRAC1816

Analyte	Number of participating laboratories		Number of data points	
	in total	with quantitative data points only*	in total	quantitative only*
Heterotrophic Plate Count, MPN 2555	14	14	14	14

MIC001-PA WS-Microbiological PT - Presence/Absence
LRAC1823

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	38	38	54	54
Coliforms, total - Sample 02 2500	38	38	54	54
Coliforms, total - Sample 03 2500	38	38	54	54
Coliforms, total - Sample 04 2500	38	38	54	54
Coliforms, total - Sample 05 2500	38	38	54	54
Coliforms, total - Sample 06 2500	38	38	54	54
Coliforms, total - Sample 07 2500	38	38	54	54
Coliforms, total - Sample 08 2500	38	38	54	54
Coliforms, total - Sample 09 2500	38	38	54	54
Coliforms, total - Sample 10 2500	38	38	54	54
E. Coli - Sample 01 2525	38	38	51	51
E. Coli - Sample 02 2525	38	38	51	51
E. Coli - Sample 03 2525	38	38	51	51
E. Coli - Sample 04 2525	38	38	51	51

* 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 05 2525	38	38	51	51
E. Coli - Sample 06 2525	38	38	51	51
E. Coli - Sample 07 2525	38	38	51	51
E. Coli - Sample 08 2525	38	38	51	51
E. Coli - Sample 09 2525	38	38	51	51
E. Coli - Sample 10 2525	38	38	51	51

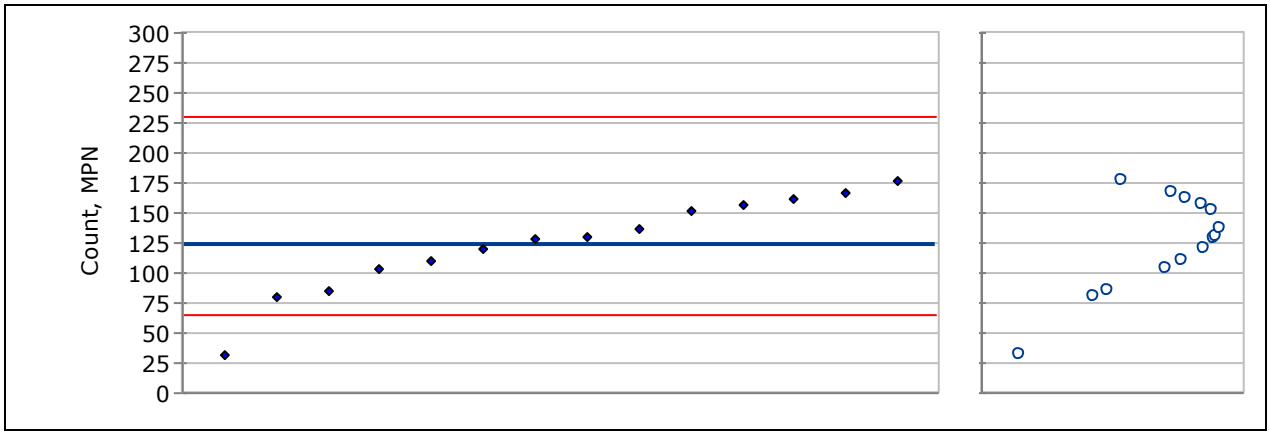
* Only quantitative values are taken into account in the calculation of study mean and study std.dev. (i.e. without missing results, without less-than results, without larger-than results).

4 Results

4.1 MIC002-2EA Standard Plate Count - WS / LRAC1816

4.1.1 Heterotrophic Plate Count, MPN

No. of participating laboratories (in total / with quant. data points only)	14 / 14
No. of data points (in total / quantitative)	14 / 14
Assigned value	123 MPN
Proficiency std. dev.	38.7 MPN
Acceptance window	65.6 - 231 MPN



4.2 MIC001-PA WS-Microbiological PT - Presence/Absence / LRAC1823

4.2.1 Coliforms, total - Sample 01

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.2 Coliforms, total - Sample 02

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.3 Coliforms, total - Sample 03

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.4 Coliforms, total - Sample 04

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.5 Coliforms, total - Sample 05

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.6 Coliforms, total - Sample 06

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.7 Coliforms, total - Sample 07

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.8 Coliforms, total - Sample 08

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.9 Coliforms, total - Sample 09

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.10 Coliforms, total - Sample 10

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	54 / 54
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.11 E. Coli - Sample 01

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.12 E. Coli - Sample 02

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.13 E. Coli - Sample 03

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.14 E. Coli - Sample 04

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.15 E. Coli - Sample 05

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.16 E. Coli - Sample 06

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.17 E. Coli - Sample 07

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	1 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.18 E. Coli - Sample 08

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.19 E. Coli - Sample 09

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	0 Units
Proficiency std. dev.	0 Units
Acceptance window	--- Units

4.2.20 E. Coli - Sample 10

No. of participating laboratories (in total / with quant. data points only)	38 / 38
No. of data points (in total / quantitative)	51 / 51
Assigned value	1 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 and 'Acceptable'; a z-score between |2| and |3| is considered 'Questionable', but still within control and 'Acceptable' 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 = (Reported Value - Assigned Value) / Proficiency Std. Dev.

A z-score cannot be provided

(1) for presence/absence data,
(2) for identification data and other categorial 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:
  - 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.

Analytical Value

The measured value, determined after preparation. The uncertainty associated to this value is the standard uncertainty and based on the measurement process.

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 * gravimetric + b and proficiency standard deviation = c * 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 *proficiency value + d.

3 - Fixed Limits

Acceptance windows based on span of gravimetric percentage from gravimetric as gravimetric +/- gravimetric * percentage.

4 - Adjustable Fixed Limits

Acceptance windows based on a span of gravimetric percentage from gravimetric as gravimetric +/- gravimetric * lowPercentage where gravimetric < break and gravimetric +/- gravimetric * highPercentage where gravimetric >= break.

5 - Study Statistics

Acceptance windows based on a number of standard deviations span from the study mean as study mean +/- (deviations * standard deviation).

6 - Log Transform Statistics

Acceptance windows based on lognormal distributed data. Acceptance windows = mean(lognormal) +/- span * standard deviation(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 * gravimetric + b and proficiency standard deviation = c * gravimetric + d. Generally reserved for drinking water studies.

8 - Study Median and Dilution Levels

Acceptance windows based on study median ± 1 dilution. If the median falls between two test dilutions, then the assigned value is set at the higher value, and the lower acceptance limit is the second test dilution below the median, and the upper acceptance limit is the second test dilution above the median. Generally reserved for NOEC analytes (in the framework of WETT analysis).

9 - Fixed Limits based on Analytical Value

Acceptance windows based on span of analytical value from measurements.

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:

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

For $\lvert z \rvert \geq 3$, the corresponding triangles are displayed as -3 or 3. For $\lvert z \rvert > 2$, 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.

<u>In case there are at least 8 laboratories with quantitative data points are available:</u> 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 17034. 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 17034 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.

[5] ISO 17034:2016: General requirements for the competence of reference material producers.

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Lit. No. MS_BR1761EN
2018 - 10431
06/2018

PROFICIENCY TESTING

Evaluation Report

Quick Turn	**QT-0024476**
Study Type	WSCHEM_MICRO
Open Date	2019-01-08
Close Date	2019-01-22
Report Generated	2019-01-24
Laboratory	Energy Laboratories-Gillette Julie Weisz 400 West Boxelder Rd. Gillette WY 82718 US
Account Number	49978849
US EPA Lab Code	WY00006

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Statistical analysis and reporting

QuoData GmbH Quality & Statistics!

Release of the report

Mark Pooler
(QA manager)

Sign:

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Sigma-Aldrich RTC, Inc. is accredited by ANAB to perform PT programs for the scope of accreditation under ANAB Certificate # AP-1469.

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

Marcie Tidd
1595 Wynkoop Street
Denver CO 80202-1129 US

1 Laboratory Performance Evaluation Summary

Summary Results for QT-0024476
MIC001-PA WS-Microbiological PT - Presence/Absence
LRAB9662

Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
SM 9223 B (Colilert®-18) 22nd ED 20214419				
Microbiology				
Coliforms, total - Sample 01[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 02[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 03[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 04[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 05[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 06[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 07[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 08[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
Coliforms, total - Sample 09[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable

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

[1] NELAC Compliant, covered by Sigma-Aldrich RTC's ANAB Proficiency Testing Provider accreditation, Cert. AP-1469

[2] ISO 17043 Accredited, covered by Sigma-Aldrich RTC's ANAB Proficiency Testing Provider accreditation, Cert AP-1469

Analyte	Reported Value	Assigned Value	Acceptance Window	z-score*
Coliforms, total - Sample 10[1,2] 2500 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 01[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 02[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 03[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 04[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 05[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 06[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 07[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 08[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 09[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	1 Units	1 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		Acceptable
E. Coli - Sample 10[1,2] 2525 Analyst: TA Analysis Date: 2019-01-21	0 Units	0 Units *Evaluation Criteria – 7** *Parameters*: a:1, b:0, c:0, d:0*		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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2 Sample Information

MIC001-PA WS-Microbiological PT - Presence/Absence
LRAB9662

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

* Study mean and Study Std. Dev. from the latest scheduled study within this scheme. If not available, this is indicated by "---".

3 Statistical Analysis

3.1 Definitions and Interpretation

Reported Value

The laboratory 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 this QT.

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 unacceptable.

Calculated as z = (Reported Value - Assigned Value) / Proficiency Std. Dev.

Proficiency Std. Dev.

Standard deviation calculated based on Evaluation Criteria.

Study Mean

Statistical study mean calculated using a robust statistical model (Algorithm A). Robust statistical techniques to minimize the influence that 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.

Study Std. Dev.

Standard deviation calculated from study data using robust statistics.

Gravimetric Value

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

3.2 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 * gravimetric + b and proficiency standard deviation = c * 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 *proficiency value + d.

3 - Fixed Limits

Acceptance windows based on span of gravimetric percentage from gravimetric as gravimetric +/- gravimetric * percentage.

4 - Adjustable Fixed Limits

Acceptance windows based on a span of gravimetric percentage from gravimetric as gravimetric +/- gravimetric * lowPercentage where gravimetric < break and gravimetric +/- gravimetric * highPercentage where gravimetric >= break.

5 - Study Statistics

Acceptance windows based on a number of standard deviations span from the study mean as study mean +/- (deviations * standard deviation).

6 - Log Transform Statistics

Acceptance windows based on lognormal distributed data. Acceptance windows = mean(lognormal) +/- span * standard deviation(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 * gravimetric + b and proficiency standard deviation = c * gravimetric + d. Generally reserved for drinking water studies.

4 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.

5 Metrological Traceability

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6 Additional Information

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[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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