



CERTIFICATE OF PARTICIPATION

This certificate confirms that:

Public Health Bureau, Yunlin County

took part in:

LEAP MICRO Proficiency Test **DWM0345**

Start Date: 15/07/2020

Enterococci , Pseudomonas aeruginosa , Clostridium perfringens , Clostridium spp.
, Sulphite Reducing Clostridia (SRC) in Drinking Water

and were allocated laboratory number **30**.

The performance of the laboratory is shown in the relevant report, which is available
from the secure pages at fapas.com

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Fapas® – Water and Environmental Report DWM045

Drinking Water Microbiology

July-August 2020

PARTICIPANT LABORATORY NUMBER

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SUMMARY

1. The test materials for Fapas® – Drinking Water Microbiology proficiency test Distribution DWM045 were dispatched in July 2020. Three test materials were provided for nine examinations in this proficiency test:

Test Material A	DWM0145 Enumeration of Total Coliforms
Test Material A	DWM0145 Enumeration of <i>Escherichia coli</i>
Test Material B	DWM0245 Colony count after 3 days at 22°C
Test Material B	DWM0245 Colony count after 2 days at 37°C
Test Material C	DWM0345 Enumeration of enterococci
Test Material C	DWM0345 Enumeration of <i>Pseudomonas aeruginosa</i>
Test Material C	DWM0345 Enumeration of <i>Clostridium perfringens</i>
Test Material C	DWM0345 Enumeration of <i>Clostridium</i> spp.
Test Material C	DWM0345 Enumeration of Sulphite Reducing Clostridia (SRC)

2. An assigned value (x_a) was determined for each proficiency test in enumeration and in conjunction with the standard deviation for proficiency (σ_p) was used to calculate a z-score for each result. However, it was not possible to set and assigned value or issue z-scores for *Clostridium* spp. and Sulphite Reducing Clostridia (SRC), see Section 4.1.

3. Results for this proficiency test are summarised as follows:

Test Material A

Proficiency test in enumeration	assigned value, x_a SQRT cfu/100ml	number of scores, $ z \leq 2$	total number of scores	% $ z \leq 2$
Total Coliforms	4.79	21	22	95
<i>Escherichia coli</i>	4.41	21	22	95

Test Material B

Proficiency test in enumeration	assigned value, x_a SQRT cfu/ml	number of scores, $ z \leq 2$	total number of scores	% $ z \leq 2$
Colony Counts (22°C/3 days)	10.4	8	8	100
Colony Counts (37°C/2 days)	10.5	9	11	82

Test Material C

Proficiency test in enumeration	assigned value, x_a SQRT cfu/100ml	number of scores, $ z \leq 2$	total number of scores	% $ z \leq 2$
Enterococci	7.97	14	14	100
<i>Pseudomonas aeruginosa</i>	7.65	14	14	100
<i>Clostridium perfringens</i>	4.58	3	3	100
<i>Clostridium</i> spp.	not set	n/a	n/a	n/a
Sulphite Reducing Clostridia (SRC)	not set	n/a	n/a	n/a

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1. INTRODUCTION

1.1. Proficiency Testing

Proficiency testing aims to provide an independent assessment of the competence of participating laboratories. Together with the use of validated methods, proficiency testing is an essential element of laboratory quality assurance.

Further details of the Fapas[®] – Water and Environmental proficiency tests are available in our protocols [4, 5].

2. TEST MATERIAL

2.1. Preparation

Preparation of the samples for this proficiency test was sub-contracted to a laboratory meeting the quality requirements of the scheme's accreditation [3].

Each test material comprised of a small glass vial containing an inoculum pellet, sealed with a rubber bung and crimp-capped. The organisms present in the inoculum pellets were as follows:

- Test Material A *Escherichia coli* and *Klebsiella planticola*
- Test Material B *Enterococcus faecalis* and *Staphylococcus epidermidis*
- Test Material C *Enterococcus faecalis*, *Pseudomonas aeruginosa*,
Clostridium perfringens

The test materials were stored at $+4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ until dispatch.

2.2. Homogeneity

To test for homogeneity, randomly selected test materials were analysed in duplicate by a laboratory meeting the quality requirements of the scheme's accreditation [3].

These data showed sufficient homogeneity and were not included in the subsequent calculation of the assigned values.

2.3. Dispatch

The start date was 15 July 2020. Test materials were sent to 46 participants.

3. RESULTS

The instructions for reporting results were as follows:

- Start the analysis between 15 July and 24 July 2020.
- For proficiency tests DWM0145 (Test Material A), DWM0345 (Test Material C): Results for total coliforms, *Escherichia coli*, enterococci, *Clostridium perfringens*, *Clostridium* spp., sulphite reducing clostridia and *Pseudomonas aeruginosa* must be reported in cfu/100ml.
- For proficiency test DWM0245 (Test Material B): Results for colony counts must be reported in cfu/ml.

Results were submitted by 41 participants (89%) before the closing date for this test, 05 August 2020.

Each participant was given a laboratory number, assigned in order of receipt of results. The reported results concentrations are given in Tables 1 to 5.

Participants' comments are given in Table 6.

The analytical methods used by each participant are summarised in APPENDIX I.

4. STATISTICAL EVALUATION OF RESULTS

The results submitted by participants were statistically analysed in order to provide an assigned value for each proficiency test in enumeration. The assigned values were then used in combination with the standard deviation for proficiency, σ_p , to calculate a z-score [6] for each result. The procedure is detailed in the relevant protocols [4, 5].

Further background on the procedure followed can be found in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [7].

4.1. Calculation of the Assigned Value, x_a

The assigned value, x_a , for each test in enumeration was derived from the consensus of the results submitted by participants. The procedure used to derive this consensus involved a square root transformation of submitted results to obtain a normal distribution.

The following results were excluded from the calculation of the assigned value:

- i) non-numerical results i.e. qualitative or semi-quantitative results,
- ii) results reported as approximately 10, 100 or 1000 \times greater or smaller than the majority of submitted results (as these were considered to be reporting errors).

For the total coliforms and *Escherichia coli* examinations this procedure was straightforward and the robust mean was chosen as the assigned value.

For the colony count after 3 days at 22°C, colony count after 2 days at 37°C, enterococci, *P. aeruginosa*, *C. perfringens*, enumerations the median was chosen as the assigned value as this was considered the best measure of consensus due to the low number of data points.

No assigned value has been set for the test enumeration of Sulphite Reducing Clostridia (SRC) because only two results were submitted.

No assigned value has been set for the test enumeration of *Clostridium* spp. because only one result was submitted.

The assigned values for all proficiency tests, together with their uncertainties are shown in Table 7.

4.2. Standard Deviation for Proficiency, σ_p

A fixed standard deviation has been set at a value that reflects best practice for the analyses in question and the appropriate members of the Fapas® Advisory Committee have agreed these values.

The values for σ_p used to calculate z-scores from the reported results of this test are given in Table 7.

4.3. Individual z-Scores

Participants' z-scores were calculated as:

$$z = \frac{(x - x_a)}{\sigma_p}$$

where x = the square root of the participant's reported result,

x_a = the assigned value, see Table 7,

and σ_p = the standard deviation for proficiency, see Table 7.

Participants' z-scores for the proficiency tests in enumeration are given in Tables 1 to 5 and shown as histograms in Figures 1 to 7. It is possible for the z-scores published in this report to differ slightly from the z-score that can be calculated using the formula given above. These differences arise from the necessary rounding of the actual assigned values and standard deviations for proficiency prior to their publication in Table 7.

The number and percentage of z-scores in the range $-2 \leq z \leq 2$ for all proficiency tests in enumeration are given in Table 8.

5. INTERPRETATION OF SCORES

In normal circumstances, over time, about 95% of z-scores will lie in the range $-2 \leq z \leq 2$. Occasional scores in the range $2 < |z| < 3$ are to be expected, at a rate of 1 in 20. Whether or not such scores are of importance can only be decided by considering them in the context of the other scores obtained by that laboratory.

Scores where $|z| > 3$ are to be expected at a rate of about 1 in 300. Given this rarity, such z-scores very strongly indicate that the result is not fit-for-purpose and almost certainly requires investigation.

The consideration of a set or sequence of z-scores over time provides more useful information than a single z-score. Examples of suitable methods of comparison are provided in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [7].

6. REFERENCES

- 1 Adobe Approved Trust List,
<https://helpx.adobe.com/acrobat/kb/approved-trust-list2.html#Whatisit>
accessed 14/05/2020.
- 2 GlobalSign PDF Signing Tool, <https://www.globalsign.com/en/digital-signatures/>
accessed 14/05/2020.
- 3 ISO/IEC 17043:2010, Conformity assessment – General requirements for proficiency testing.
- 4 Fapas[®], 2017, Protocol for Proficiency Testing Schemes, Version 6, April 2017, Part 1 – Common Principles.
- 5 Fapas[®], 2017, Protocol for Proficiency Testing Schemes, Version 6, April 2017, Part 5 – Fapas[®] Water and Environmental scheme (LEAP).
- 6 AMC Tech Brief No. 74, z-Scores and other scores in chemical proficiency testing – their meanings, and some common misconceptions, *Anal. Methods*, 2016, **8**, 5553.
- 7 Thompson, M., Ellison, S.L.R. and Wood, R., 2006, The International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories, *Pure Appl. Chem.*, **78**, No. 1, 145–196.

Table 1: Results and z-Scores for Enumeration of Total Coliforms and *Escherichia coli*

laboratory number	organism							
	Total Coliforms assigned value: 4.79 SQRT cfu/100ml				<i>Escherichia coli</i> assigned value: 4.41 SQRT cfu/100ml			
	result cfu/100ml	SQRT cfu/100ml	method	z-score	result cfu/100ml	SQRT cfu/100ml	method	z-score
001	22	4.69	membrane filtration	-0.1	12	3.46	membrane filtration	-0.6
002	9	3.00	membrane filtration	-1.2	22	4.69	membrane filtration	0.2
003	15	3.87	MEMBRANE FILTRATION	-0.6	10	3.16	MEMBRANE FILTRATION	-0.8
007	40	6.32	MPN	1.0	31	5.57	MPN	0.8
008	14	3.74	membrane filtration	-0.7	6	2.45	membrane filtration	-1.3
010					17	4.12	Membrane filtration	-0.2
011	26	5.10	Membrane Filtration	0.2	23	4.80	Membrane Filtration	0.3
013	33	5.74	MPN	0.6				
014	5	2.24	filtrazione a membrana	-1.7	23	4.80	filtrazione a membrana	0.3
016	28	5.29	membrane filtration	0.3	22	4.69	membrane filtration	0.2
018	0 *	0	membrane filtration	-3.2	1 *	1.00	membrane filtration	-2.3
019					28	5.29	membrane filtration	0.6

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5

* samples analysed outside of the required time frame

samples received outside of the required time frame

Table 1 (continued): Results and z-Scores for Enumeration of Total Coliforms and *Escherichia coli*

laboratory number	organism							
	Total Coliforms assigned value: 4.79 SQRT cfu/100ml				<i>Escherichia coli</i> assigned value: 4.41 SQRT cfu/100ml			
	result cfu/100ml	SQRT cfu/100ml	method	z-score	result cfu/100ml	SQRT cfu/100ml	method	z-score
020	26.75 *	5.17	MPN	0.3	20.65 *	4.54	MPN	0.1
022	12	3.46	membrane filtration	-0.9	9	3.00	membrane filtration	-0.9
024	23	4.80	MPN/100ml	0.0	23	4.80	MPN/100ml	0.3
025	33	5.74	MPN	0.6	23	4.80	MPN	0.3
028	49	7.00	MPN	1.5	33	5.74	MPN	0.9
029	39 *	6.24	Membrae Filtration	1.0	33 *	5.74	Membrane Filtration	0.9
031	33 *	5.74	NMP	0.6	33 *	5.74	NMP	0.9
032	35 *	5.92	MPN	0.8	24 *	4.90	MPN	0.3
034	14.00	3.74	MPN	-0.7	13.60	3.69	MPN	-0.5
035	16	4.00	membrane filtration	-0.5				
038	20	4.47	membrane filtration	-0.2				
039	15	3.87	membrane filtration	-0.6	13	3.61	membrane filtration	-0.5
041	NIL #		MEMBRANE FILTRATION		3 #	1.73	MEMBRANE FILTRATION	-1.8

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5

* samples analysed outside of the required time frame

samples received outside of the required time frame

Table 2: Results and z-Scores for Colony Count after 3 days at 22°C and after 2 days at 37°C

laboratory number	organism					
	Colony Counts (22°C/3 days) assigned value: 10.4 SQRT cfu/ml			Colony Counts (37°C/2 days) assigned value: 10.5 SQRT cfu/ml		
	result cfu/ml	SQRT cfu/ml	z-score	result cfu/ml	SQRT cfu/ml	z-score
001	105	10.2	-0.1	135	11.6	0.9
006	110	10.5	0.1	110	10.5	0.0
011				93	9.64	-0.7
016	96	9.80	-0.5	110	10.5	0.0
017	118	10.9	0.4	134	11.6	0.9
026	106	10.3	-0.1	108	10.4	-0.1
027	110	10.5	0.1	110	10.5	0.0
029				1.1E+2 *	10.5	0.0
031	121 *	11.0	0.5	154 *	12.4	1.5
037	< 1 *			< 1 *		
040	67	8.19	-1.8	56	7.48	-2.4
041				195 #	14.0	2.8

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5

* samples analysed outside of the required time frame

samples received outside of the required time frame

Table 3: Results and z-Scores for Enumeration of Enterococci

laboratory number	organism			
	Enterococci			
	assigned value: 7.97 SQRT cfu/100ml			
	result cfu/100ml	SQRT cfu/100ml	method	z-score
001	50	7.07	membrane filtration	-0.7
004	45	6.71	Membrane filtration	-1.0
005				
007	50	7.07	MPN	-0.7
009	62	7.87	membrane filtration	-0.1
010	65	8.06	Membrane filtration	0.1
012	72	8.49	membrane filtration	0.4
015	71	8.43	Membrane Filtration	0.4
016				
018	73 *	8.54	membrane filtration	0.5
021				
022	69	8.31	membrane filtration	0.3
023				
030	66	8.12	membrane filtration	0.1
033	73	8.54	membrane filtration	0.5
035	62	7.87	membrane filtration	-0.1
036				
038	61	7.81	membrane filtration	-0.1
040	58	7.62	membrane filtration	-0.3

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5

* samples analysed outside of the required time frame

samples received outside of the required time frame

Table 4: Results and z-Scores for Enumeration of *Pseudomonas aeruginosa*

laboratory number	organism			
	<i>Pseudomonas aeruginosa</i> assigned value: 7.65 SQRT cfu/100ml			
	result cfu/100ml	SQRT cfu/100ml	method	z-score
001	70	8.37	MPN	0.5
004				
005	42	6.48	membrane filtration	-0.8
007	56	7.48	MPN	-0.1
009	58	7.62	membrane filtration	0.0
010				
012	64	8.00	membrane filtration	0.2
015				
016	36	6.00	membrane filtration	-1.1
018				
021				
022	62	7.87	membrane filtration	0.2
023	70	8.37	HGMF	0.5
030	54	7.35	membrane filtration	-0.2
033	81	9.00	membrane filtration	0.9
035	59	7.68	membrane filtration	0.0
036	51	7.14	membrane filtration	-0.3
038	52	7.21	membrane filtration	-0.3
040	64	8.00	membrane filtration	0.2

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5

* samples analysed outside of the required time frame

samples received outside of the required time frame

Table 5: Results and z-Scores for Enumeration of *Clostridium perfringens*, *Clostridium* spp. and Sulphite Reducing Clostridia

laboratory number	organism											
	<i>Clostridium perfringens</i> assigned value: 4.58 SQRT cfu/100ml				<i>Clostridium</i> spp. assigned value: not set				Sulphite Reducing Clostridia (SRC) assigned value: not set			
	result cfu/100ml	SQRT cfu/100ml	method	z-score	result cfu/100ml	SQRT cfu/100ml	method	z-score	result cfu/100ml	SQRT cfu/100ml	method	z-score
001	26	5.10	membrane filtration	0.3					17	4.12	membrane filtration	
004												
005												
007												
009	18	4.24	membrane filtration	-0.2	56	7.48	membrane filtration		32	5.66	membrane filtration	
010												
012												
015												
016												
018												

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5

samples analysed outside of the required time frame

samples received outside of the required time frame

Table 5 (continued): Results and z-Scores for Enumeration of *Clostridium perfringens*, *Clostridium* spp. and Sulphite Reducing Clostridia

laboratory number	organism											
	<i>Clostridium perfringens</i> assigned value: 4.58 SQRT cfu/100ml				<i>Clostridium</i> spp. assigned value: not set				Sulphite Reducing Clostridia (SRC) assigned value: not set			
	result cfu/100ml	SQRT cfu/100ml	method	z-score	result cfu/100ml	SQRT cfu/100ml	method	z-score	result cfu/100ml	SQRT cfu/100ml	method	z-score
021	21	4.58	Membrane filtration	0.0								
022												
023												
030												
033												
035												
036												
038												
040												

z-scores outside $|z| > 2$ are shown in **bold**, see Section 5
 samples analysed outside of the required time frame
 # samples received outside of the required time frame

Table 6: Participants' Comments

Test Material A

laboratory number	comments
008	Received on 22/7/2020 with an ambient temperature.
034	Reference: Standard Methods for the Examination of Water and Wastewater 23rd ed. -Total Colforms: 9221 B. Standard Total Coliform Fermentation Technique -Escherichia coli: 9221 F Escherichia coli Procedure Using Fluorogenic Substrate
041	The samples were received on 3rd August 2020, hence, analysis was not done between 15th July, 2020 & 24th July, 2020 as per the instructions.

comments are as submitted by participants but some may have been edited to maintain participant anonymity

Test Material B

laboratory number	comments
026	the sample was received in improper condition
041	The sample was received on 3rd August, 2020 and hence, analysis was not done between 15th July, 2020 and 24th August, 2020 as per the instructions.

comments are as submitted by participants but some may have been edited to maintain participant anonymity

Test Material C

laboratory number	comments
015	Test for Enterococci only.
023	Results are expressed as MPNGU
036	PT Sample received on 23rd July 2020.

comments are as submitted by participants but some may have been edited to maintain participant anonymity

Table 7: Assigned Values and Standard Deviations for Proficiency

Test Material A

Proficiency test in enumeration	data points, n	assigned value, x_a SQRT cfu/100ml	uncertainty, u	standard deviation for proficiency, σ_p	
Total Coliforms	21	4.79	0.28	ffp	1.50
<i>Escherichia coli</i>	21	4.41	0.25	ffp	1.50

ffp = fitness-for-purpose criteria

Test Material B

Proficiency test in enumeration	data points, n	assigned value, x_a SQRT cfu/ml	uncertainty, u	standard deviation for proficiency, σ_p	
Colony Counts (22°C/3 days)	8	10.4	0.2	ffp	1.25
Colony Counts (37°C/2 days)	11	10.5	0.4	ffp	1.25

ffp = fitness-for-purpose criteria

Test Material C

Proficiency test in enumeration	data points, n	assigned value, x_a SQRT cfu/100ml	uncertainty, u	standard deviation for proficiency, σ_p	
Enterococci	14	7.97	0.16	ffp	1.25
<i>Pseudomonas aeruginosa</i>	14	7.65	0.16	ffp	1.50
<i>Clostridium perfringens</i>	3	4.58	0.29	ffp	1.50

ffp = fitness-for-purpose criteria

Table 8: Number and Percentage of z-Scores where $|z| \leq 2$

Test Material A

Proficiency test in enumeration	number of scores where $ z \leq 2$	total number of scores	% $ z \leq 2$
Total Coliforms	21	22	95
<i>Escherichia coli</i>	21	22	95

Test Material B

Proficiency test in enumeration	number of scores where $ z \leq 2$	total number of scores	% $ z \leq 2$
Colony Counts (22°C/3 days)	8	8	100
Colony Counts (37°C/2 days)	9	11	82

Test Material C

Proficiency test in enumeration	number of scores where $ z \leq 2$	total number of scores	% $ z \leq 2$
Enterococci	14	14	100
<i>Pseudomonas aeruginosa</i>	14	14	100
<i>Clostridium perfringens</i>	3	3	100

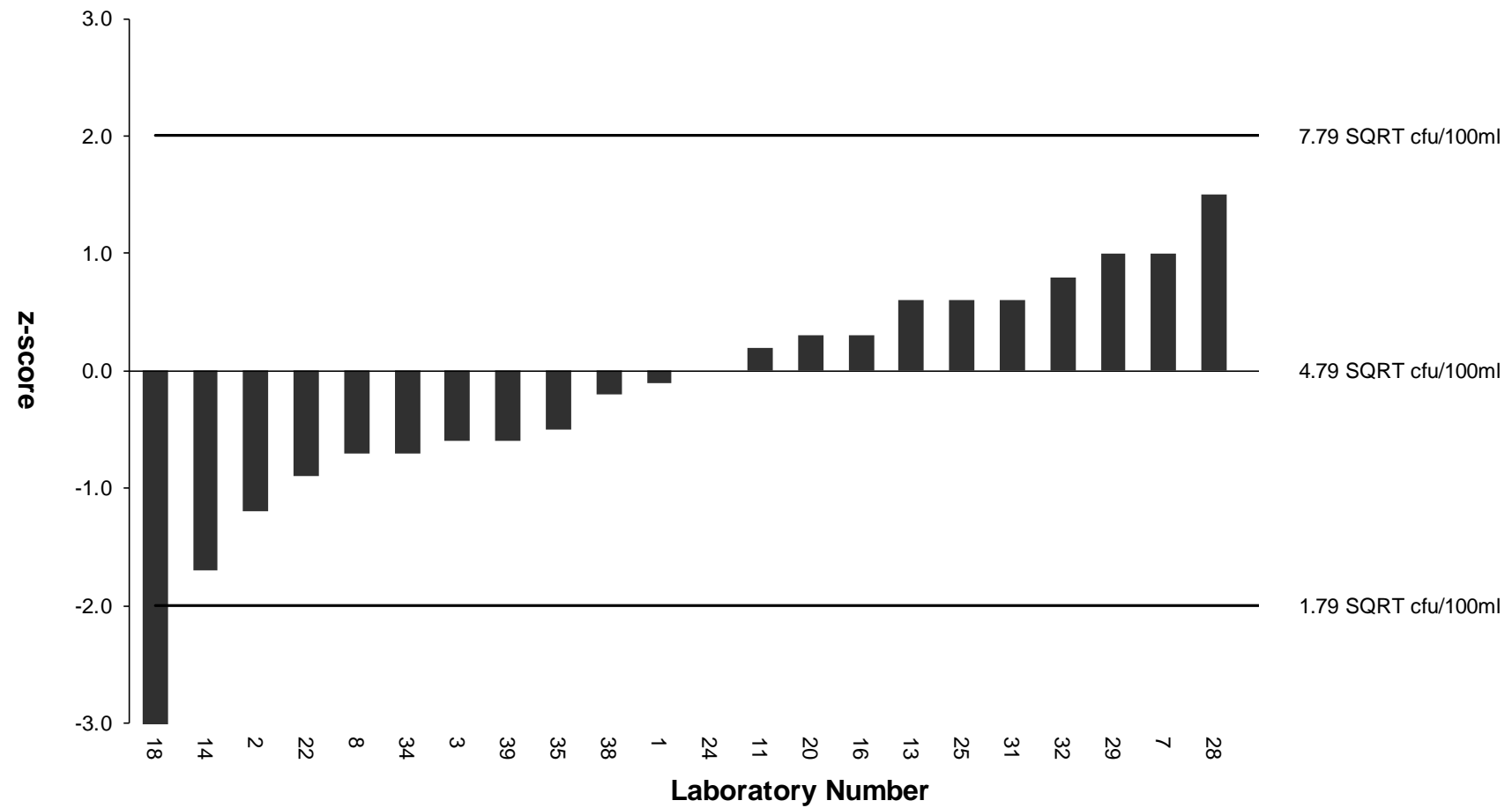


Figure 1: z-Scores for Enumeration of Total Coliforms

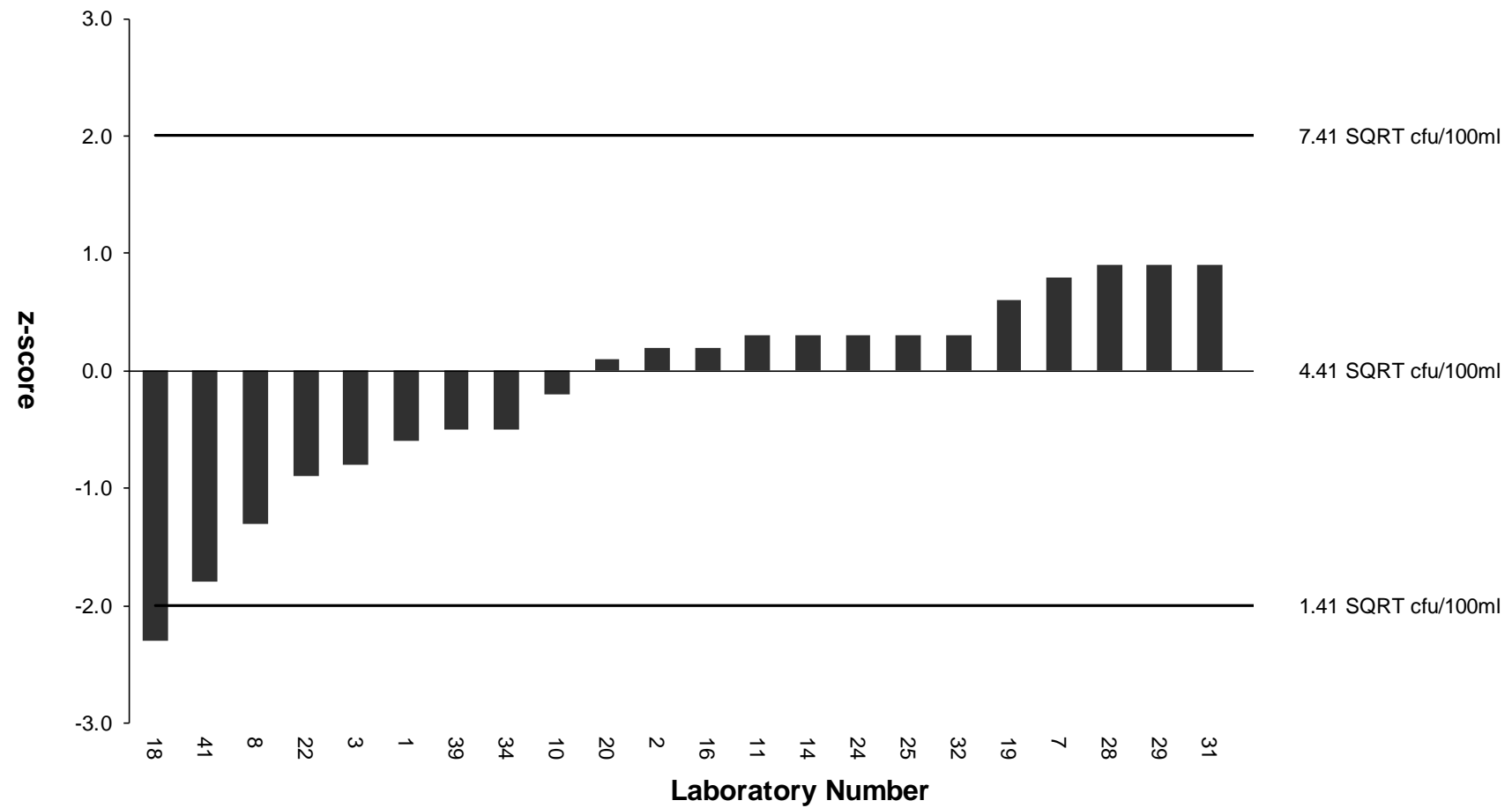


Figure 2: z-Scores for Enumeration of *Escherichia coli*

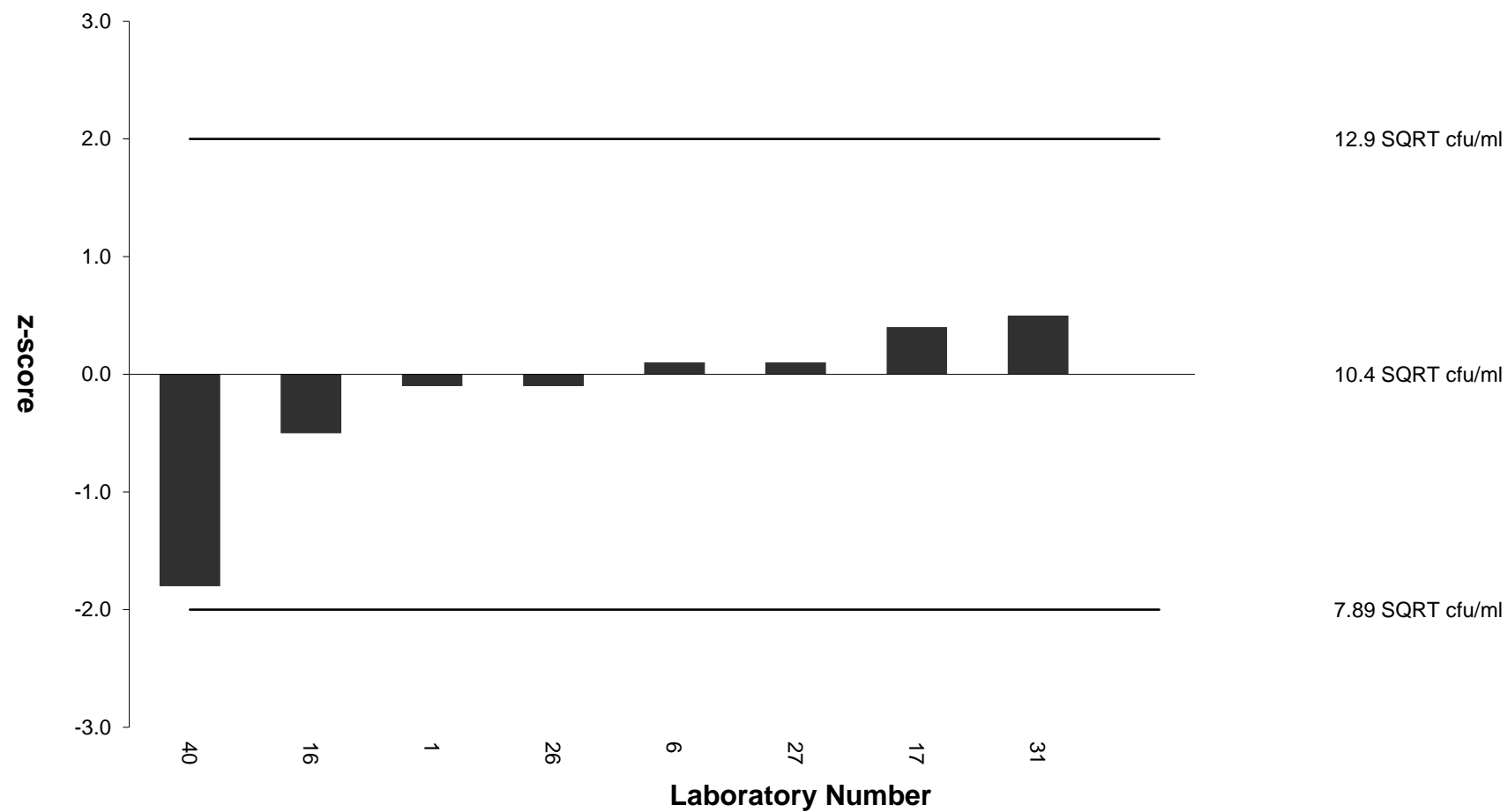


Figure 3: z-Scores for Enumeration for Colony Count after 3 days at 22°C

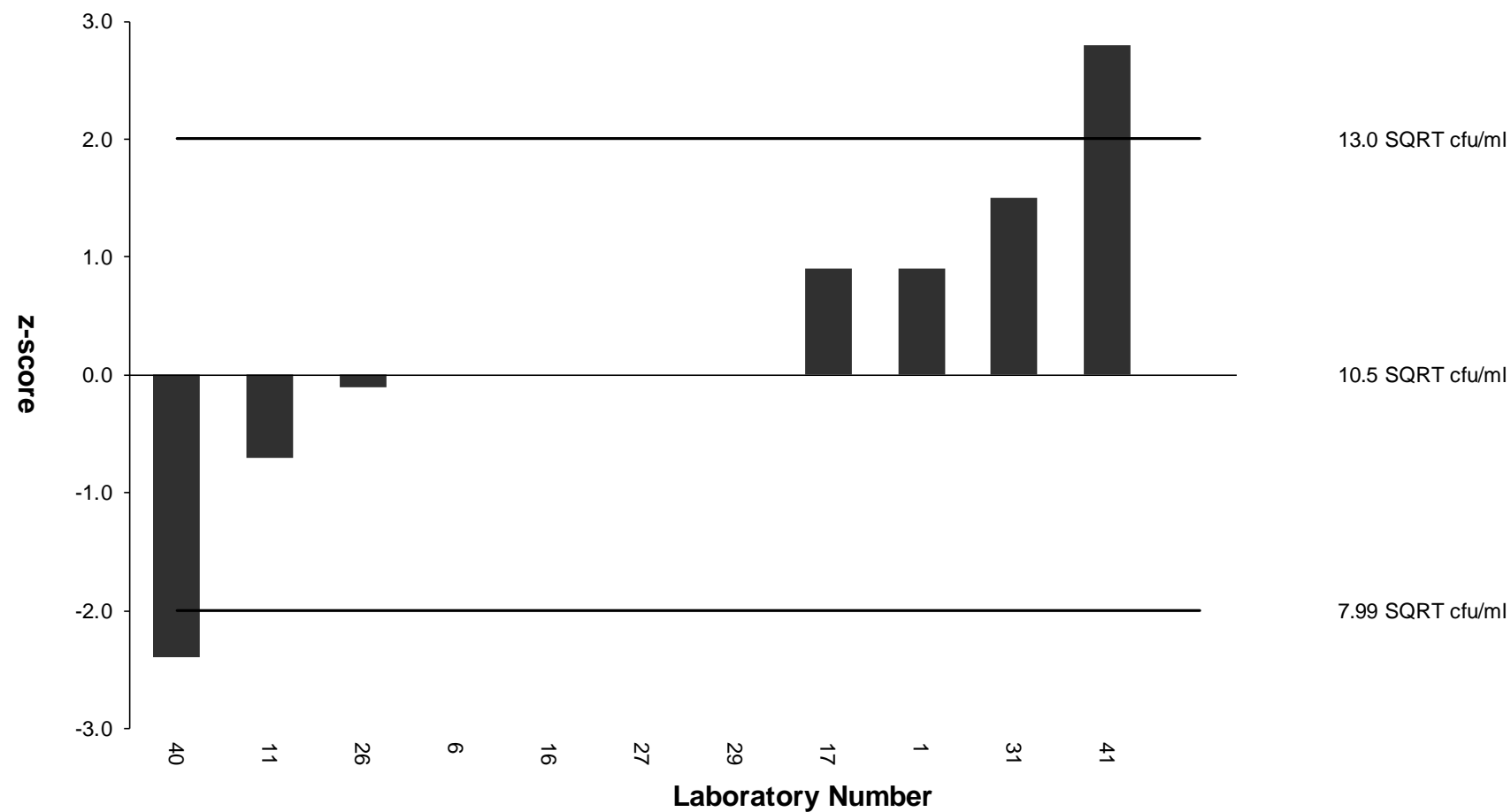


Figure 4: z-Scores for Enumeration for Colony Count after 2 days at 37°C

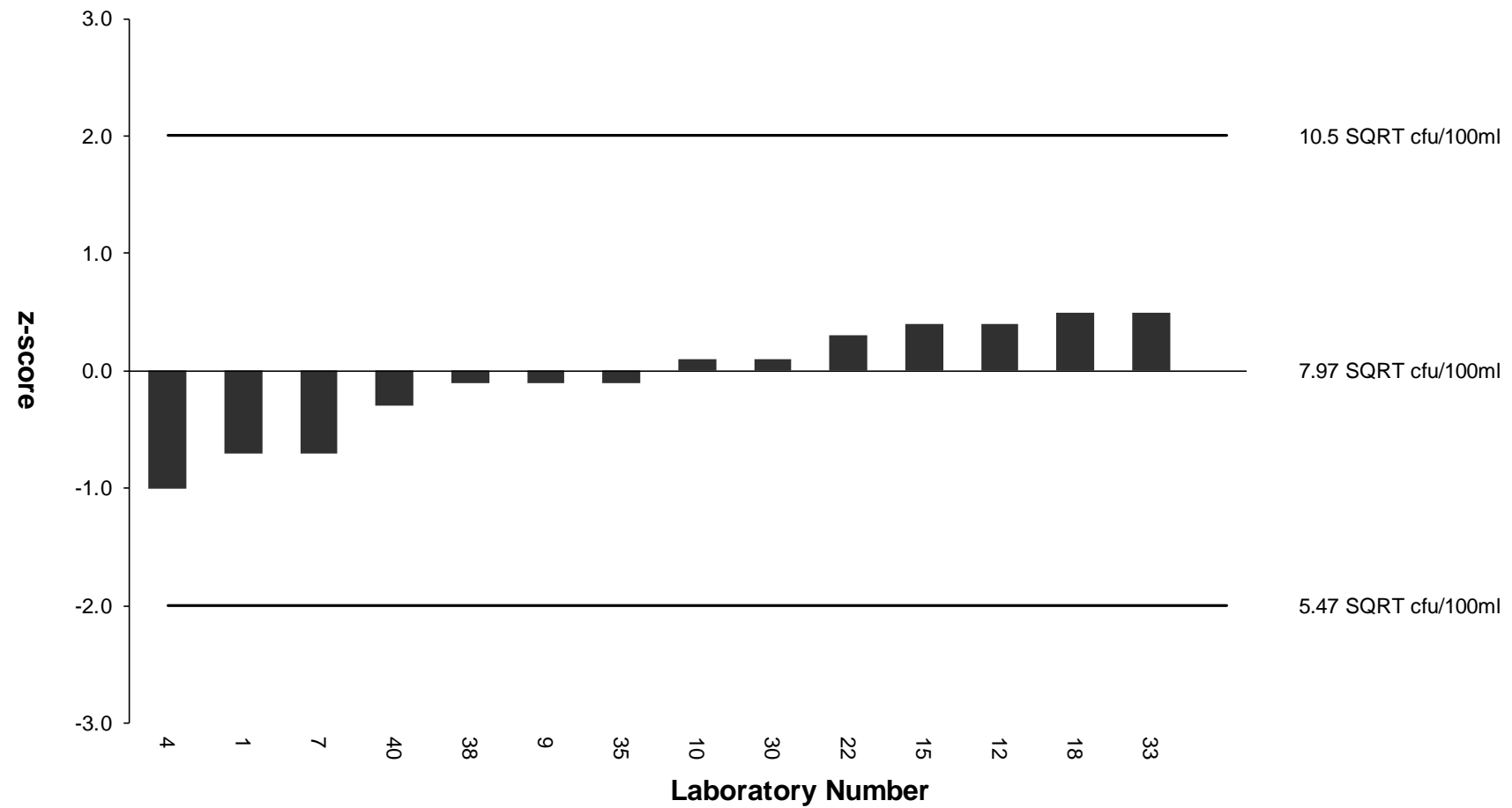


Figure 5: z-Scores for Enumeration of Enterococci

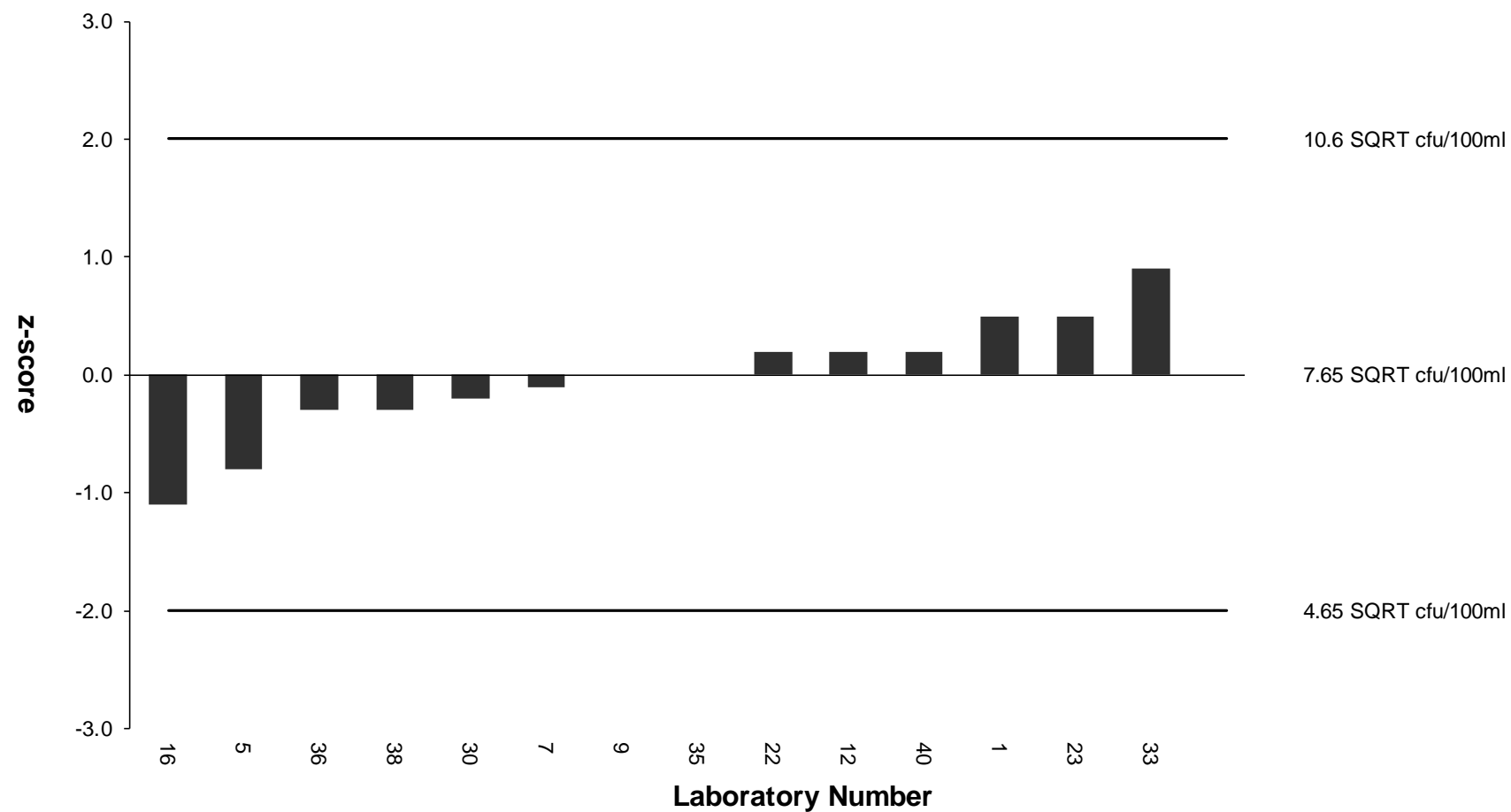


Figure 6: z-Scores for Enumeration of *Pseudomonas aeruginosa*

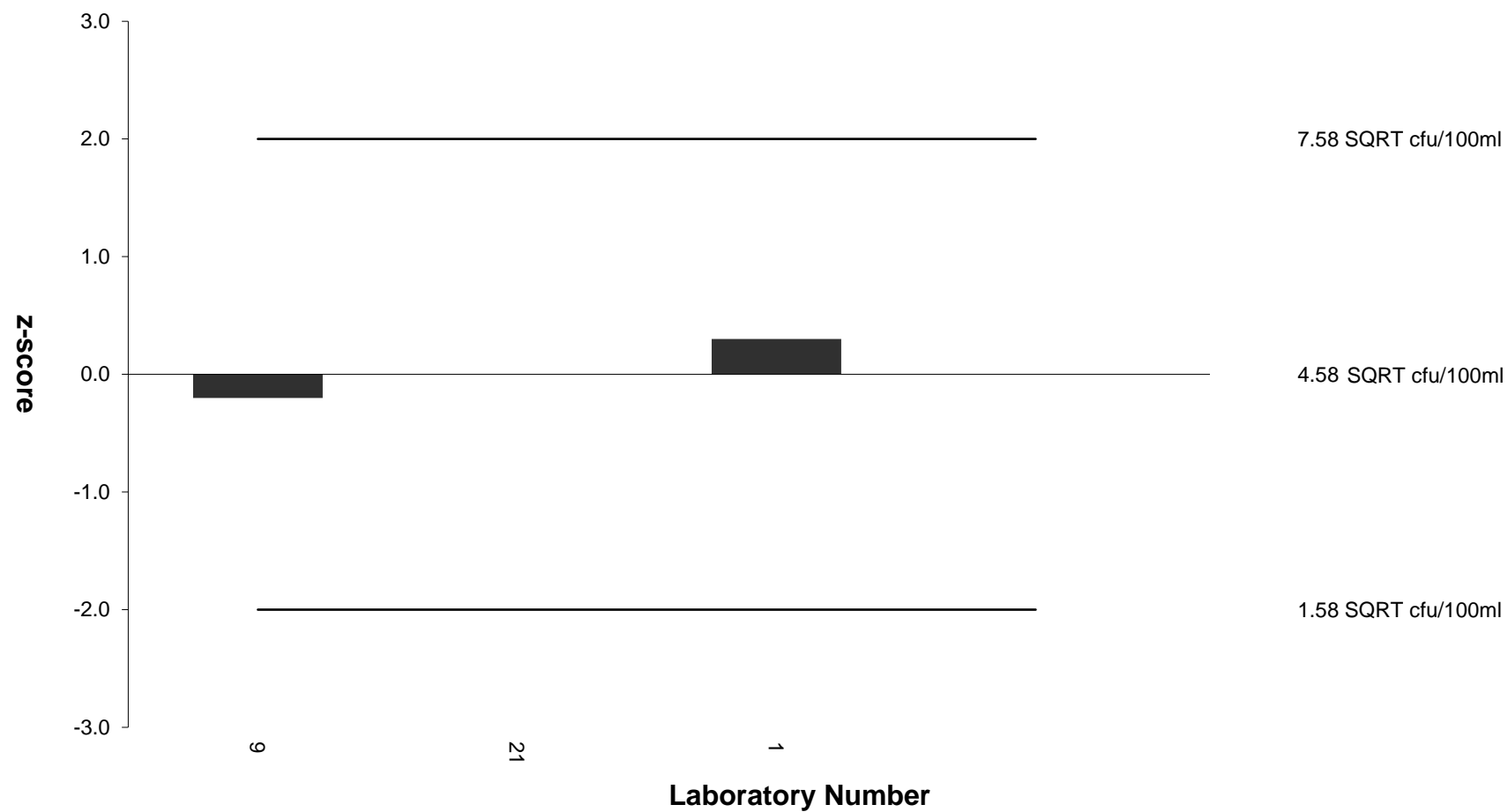


Figure 7: z-Scores for Enumeration of *Clostridium perfringens*

APPENDIX I: Analytical Methods Used by Participants

Methods are tabulated according to the information supplied by participants but some responses may have been combined or edited for clarity. In addition, responses not in English may have been omitted.

Total Coliforms

Accredited Method Used	laboratory number
no	020 029 031 034
yes	001 002 003 011 014 016 018 024 025 028 038 039 041

National or International Standard (ISO)	laboratory number
ISO 9308-1:2014 (membrane filtration)	002 018 041
ISO 9308-2:2012 (MPN - most probable number)	024
SCA MoDW (2009) - Part 4	001
APHA	016 025
APHA and Standard method	028
APHA-9222B	011
GB/T 5750.12-2006	039
HACH Membrane Filtration Method 8074	003
National Standard	038
SMWW.9223 ENZYME SUBSTRATE COLIFORM TEST	020
Standard methods for the examination of water and wastewater	031
Standard Methods for the Examination of Water and Wastewater 23rd ed	034
UNI EN ISO 9308-1:2017	014

If the method is not an ISO Standard, state laboratory number a reference for the method.

APHA 9222H	016
APHA and Standard method	028
b	014
GB/T 5750.12-2006	039
National Standard	038
Standard Methods for the Examination of Water and Wastewater 23rd ed. 9221 B. Standard Total Coliform Fermentation Technique	034
Standard Methods for the Examination of Water and Wastewater 23rd ed., 9221 B. Standard Total Coliform Fermentation Technique.	034

Method	laboratory number
membrane filtration	001 002 003 011 014 016 018 029 038 039 041
multiple tube (MPN - most probable number)	024 025 028 031 034

Media	laboratory number
Membrane Lactose Glucoronide Agar (MLGA)	001
Membrane Lauryl Sulphate Broth (MLSB)	028 031
Chromogenic Coliform Agar (CCA)	002 014 018
Endo Agar	041
Fuchsin Sodium Sulfite Agar	039
Lauryl Sulphate Tryptose Broth	024
Lauryl Tryptose Broth, Brilliant green lactose bile broth	034
LST	025
m-ColiBlue24	029
m-Endo agar	038
Millipore MCOLIBLUE	016
PourRite m-Endo Broth	003

Incubation Time (hours) / Incubation Temperature (°C)	laboratory number
4/30 then 14/37	025
4/30 then 14/44	001
24	020
24 hour/35 degree	003
24 hours/35	029
24/35	011
24/36	002
24/37	039
24/37	041
24/48 then 35°C	031
24hours/35 °c	016
30 / 36.8	014
48/35 then 48/35 (TC)	034
48hrs / 35'C ,	024

Confirmation of the identity of the colonies grown	laboratory number
no	016 020 028 029 034
yes	001 002 003 011 014 018 025 031 038 039 041

Number of colonies used for confirmation	laboratory number
-	028
10	001 038
15	039
2	003 041
6	011
9	002
all tubes positive	031

Confirmation Tests	laboratory number
Oxidase	001 002 014 024 041
Indole	001 024
beta-Galactosidase	011
Lactose fermentation	001 011 039
BGLB	038
Streaking on agar media (agar), observe gas formation in broth (broth)	003
VRBG	031

Confirmation (Selective Media)	laboratory number
Brilliant Green Bile Broth (BGBB)	011 024 028
Lactose Peptone Water	001 039
Bactident Oxidase	002
EC broth	025
MacConkey (Agar), BRILA (broth), BPLS (Broth), Lauryl Sulfate Broth (Broth)	003
N/A	038

Escherichia coli

Accredited Method Used	laboratory number
no	020 028 029 031 034
yes	001 002 003 010 011 014 018 019 024 025 039 041

National or International Standard (ISO)	laboratory number
ISO 9308-1:2014 (membrane filtration)	002 018 041
ISO 9308-2:2012 (MPN - most probable number)	024 025
SCA MoDW (2009) - Part 4	001 010
APHA-9221F	011
EPA 1603	019
GB/T 5750.12-2006	039
HACH Membrane Filtration Method 10029	003
Standard method	028
Standard Methods for the Examination of Water and Wastewater 23rd ed	034
UNI EN ISO 9308-1:2017	014

If the method is not an ISO Standard, state a reference for the method.

b	014
GB/T 5750.12-2006	039
Standard method	028
Standard Methods for the Examination of Water and Wastewater 23rd ed., 9221 F Escherichia coli Procedure Using Fluorogenic Substrate.	034
USEPA. 2004. Method 1603: Escherichia coli (E. coli) in Water by Membrane Filtration Using Modified membrane-Thermotolerant Escherichia coli Agar (Modified mTEC)	019

Method	laboratory number
membrane filtration	001 002 003 010 011 014 018 019 029 039 041
multiple tube (MPN - most probable number)	024 025 028 031 034
Colilert	020

Media	laboratory number
MacConkey Broth	020
Membrane Lactose Glucoronide Agar (MLGA)	001 010
Membrane Lauryl Sulphate Broth (MLSB)	028
Minerals Modified Glutamate Medium (MMGM)	025
Chromogenic Coliform Agar (CCA)	002 014
Endo Agar	041
Fuchsin Sodium Sulfite Agar	039
Lauryl Sulphate Tryptose Broth	024
Lauryl Tryptose Broth, EC-MUG medium	034
m-ColiBlue24	029
m-colibblue24 Broth	003
mTEC	019

Incubation Time (hours) / Incubation Temperature (°C)	laboratory number
4/30 then 14/37	014 025
4/30 then 14/44	001 010 018
2/35 then 22/44.5	019
24	020
24 hour / 35 degree	003
24 hours/35	029
24/35	011
24/36	002
24/37	039 041
48/35 then 24/44.5 (Ec)	034
48hrs / 35°C ,	024

Confirmation of the identity of the colonies grown	laboratory number
no	002 010 014 016 020 028 031 034
yes	001 003 011 019 025 039 041

Number of colonies used for confirmation	laboratory number
10	001
13	039
2	003 019 041
4	011
all tubes positive	031

Confirmation Tests	laboratory number
Oxidase	001 011 024 041
Indole	001 024
beta-Galactosidase	028
Lactose fermentation	001 018
API	019
NA-MUG	039
Streaking on agar media (Agar)	003

Confirmation (Selective Media)	laboratory number
TBX	025 028
EC with MUG Broth	011
Levine EMB agar (Merck)	003
NA-MUG	039
Nutrient agar	019
Tryptone Water	001 024

Colony Counts (22°C/3 days)

Accredited Method Used	laboratory number
no	026 031 037
yes	001 006 016 017 027 040

National or International Standard (ISO)	laboratory number
ISO 6222:1999	006 027
SCA MoDW (2012) - Part 7	001 026 040
AOAC 988.18	037
APHA 9215B	017
Millipore Filtration Method	016

If the method is not an ISO Standard, state laboratory number a reference for the method.

AOAC 988.18	037
Standard Methods for the Examination of Water and Wastewater. 22 nd edition. Part 9215D. Merck Millipore Membrane Filtration	016

Method	laboratory number
Pour plate	001 006 017 026 027 031 037 040
Membrane Filtration	016

Media	laboratory number
Plate Count Agar (PCA)	017 031 037
Yeast Extract Agar (YEA)	001 006 027 040
Millipore mTGE liquid medium	016
SPCA	026

Colony Counts (37°C/2 days)

Accredited Method Used	laboratory number
no	031 037 041
yes	001 006 011 016 017 026 027 029

National or International Standard (ISO)	laboratory number
ISO 6222:1999	006 027 041
SCA MoDW (2012) - Part 7	001 026
AOAC 988.18	037
APHA 9215B	017
APHA-9215D	011
Standard Methods for the Examination of Water and Wastewater. 22 nd edition. Part 9215D. Merck Millipore Membrane Filtration	016

If the method is not an ISO Standard, state a reference for the method.

AOAC 988.18	037
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Method	laboratory number
Spread plate	041
Pour plate	001 006 017 026 027 029 031 037
Membrane Filtration	011

Media	laboratory number
Plate Count Agar (PCA)	017 029 031 037
Yeast Extract Agar (YEA)	001 006 027
m HPC Agar	011
Millipore mTGE liquid medium	016
Tryptone Soya Agar	041

Enterococci

Accredited Method Used

laboratory number

no

009

yes

001 010 015 018 033 035 038 040

National or International Standard (ISO)

laboratory number

ISO 8199:2005

018 033

ISO 7899-2:2000

009 015

SCA MoDW (2012) - Part 5

001 010 040

National Standard

038

If the method is not an ISO Standard, state a reference for the method.

National Standard

038

Method

laboratory number

membrane filtration

001 009 010 015 018 033 035 038 040

Media

laboratory number

KF Streptococcus Agar

033 035 038

Slanetz and Bartley Agar

001 009 010 015 018 040

Incubation Time (hours) / Incubation Temperature (°C)

laboratory number

44/37

009 010

48/37

001 015 033 040

48/35

035 038

Confirmation of the identity of the colonies grown

laboratory number

yes

001 009 010 015 018 033 035 038 040

Number of colonies used for confirmation	laboratory number
10	001
3	038
3-5	033
62 cfu	009
71	010

Confirmation Tests	laboratory number
Aesculin hydrolysis by sub-culture	033
Aesculin hydrolysis by membrane transfer	009 010 018 040
Catalase reaction	001 033
Bile tolerance	001 033 035
Salt tolerance	033
Bile Esculin agar	038

Pseudomonas aeruginosa

Accredited Method Used	laboratory number
no	009
yes	001 016 023 033 035 036 038

National or International Standard (ISO)	laboratory number
ISO 16266:2006	009 036
ISO 8199:2005	033
SCA MoDW (2010) - Part 8	001
HCCAM MFLP61-B	023
Merck Millipore Membrane Filtration	016
National Standard	038

If the method is not an ISO Standard, state a reference for the method.

HCCAM MFLP61-B	023
Merck Millipore Membrane Filtration	016
National Standard	038

Method	laboratory number
membrane filtration	009 016 023 033 035 038
Pseudalert	001

Media	laboratory number
Pseudomonas Agar with CN supplement	009 023 033 036
Merck Millipore Pseudomonas Liquid Media (Ampoule 2mL)	016
MPAC agar	038

Incubation Time (hours) / Incubation Temperature (°C)	laboratory number
48/37	009 036
24/38	001
24/42	035
48h/35	023
72/30	016

Confirmation of the identity of the colonies grown	laboratory number
yes	009 016 023 033 035 036 038

Number of colonies used for confirmation	laboratory number
2	023
24	036
3	016 038
3-5	033
6	009

Confirmation Test	laboratory number
Casein hydrolysis	033
API 20 NE	009 016
Milk agar	038
Oxidase test, king's B test, acetamide broth test	036
Vitek GN	023

Clostridium perfringens

Accredited Method Used	laboratory number
no	001 009 021

National or International Standard (ISO)	laboratory number
ISO 14189:2013 (membrane filtration)	009
SCA MoDW (2010) - Part 6	001
Standard Methods for Examination of Waters and Associated Materials, The Microbiology of Drinking Water-EA, UK	021

Method	laboratory number
anaerobic jar	001 021
membrane filtration	009

Media	laboratory number
Tryptose Sulphite Cycloserine Agar (TSC) with egg	009
Tryptose Sulphite Cycloserine Agar (TSC) without egg	021

Incubation Time (hours) / Incubation Temperature (°C)	laboratory number
21/44	001 009 021

Confirmation of the identity of the colonies grown	laboratory number
yes	001 009 021

Number of colonies used for confirmation	laboratory number
10	001 021
2	009

Confirmation Test	laboratory number
Nitrate/nitrite reduction	021
Motility	021
Lactose fermentation	001 021
Gelatin liquifaction	021
acid phosphatase reaction	009

Method used for acid phosphatase	laboratory number
by dropping reagent on the colonies	009

***Clostridium* spp.**

Accredited Method Used	laboratory number
no	009

National or International Standard (ISO)	laboratory number
ISO 14189:2013 (membrane filtration)	009

Method	laboratory number
membrane filtration	009

Media	laboratory number
Tryptose Sulphite Cycloserine Agar (TSC) with egg	009

Incubation Time (hours)	laboratory number
48	009

Incubation Temperature (°C)	laboratory number
44	009

Sulphite Reducing Clostridia (SRC)

Accredited Method Used	laboratory number
no	001 009

National or International Standard (ISO)	laboratory number
ISO 6461-2:1986 (membrane filtration)	009
SCA Microbiology of Recreational & Environmental Waters (2015) part 6	001

Method	laboratory number
membrane filtration	001 009

Media	laboratory number
Tryptose Sulphite Cycloserine Agar (TSC) with egg	009
Tryptose Sulphite Cycloserine Agar (TSC) without egg	001

Incubation Time (hours)	laboratory number
24	001
48	009

Incubation Temperature (°C)	laboratory number
37	001 009

APPENDIX II: Fapas® SecureWeb, Protocol and Contact Details

1. Fapas® SECUREWEB

Access to the secure area of our website is only available to participants in our proficiency tests. Please contact us if you require a UserID and Password. Fapas® SecureWeb allows participants to:

- Obtain their laboratory numbers for the proficiency tests in which they have participated.
- View the results they submitted in past and current proficiency tests.
- Submit their results and methods for current tests.
- Review future tests they have ordered.
- Order proficiency tests, reference materials and quality control materials.
- Freely download copies of reports (PDF file), of proficiency tests in which they have participated.
- View charts of their z-scores obtained in previous Fapas® – Water Microbiology proficiency tests.

2. PROTOCOL

The Protocols [4, 5] set out how Fapas® – Water & Environmental is organised. Copies can be downloaded from our website.

3. CONTACT DETAILS

This report was prepared and authorised on behalf of Fapas® by Stilian Hristov (Round Coordinator). Participants with any comments or concerns about this proficiency test should contact:

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