# Fapas® – Food Microbiology Proficiency Test Report 297

## May-June 2024

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Laboratory numbers are displayed in SecureWeb next to the download link for this report.

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## SUMMARY


1. The test materials for Fapas® – Food Microbiology proficiency test Distribution 297 were dispatched in May 2024. The test materials available in this Distribution were for the following proficiency tests:

| | |
|---|---|
| M297e05 | Enumeration of Enterobacteriaceae / Aerobic Plate Count (equivalent to 10 g Beef), |
| M297e06 | Enumeration of *Clostridium* spp. / *Clostridium perfringens* / Sulphite Reducing Clostridia (equivalent to 10 g Milk Powder), |
| M297e10 | Enumeration of *Escherichia coli* (equivalent to 10 g Beef), |
| M297e18 | Enumeration of Coliforms (equivalent to 10 g Beef), |
| M297d02 | Detection of *Listeria monocytogenes* / *Listeria* spp. (equivalent to 25 g Chicken, x2), |
| M297d071 | Detection of *Salmonella* spp. (equivalent to 25 g Salad, x2), |
| M297d072 | Detection of *Salmonella* spp. (equivalent to 25 g Animal Feed, x2), |
| M297d11 | Detection of *Escherichia coli* O157:H7 (equivalent to 25 g Beef, x2). |

2. An assigned value ($x_a$) was determined for each proficiency test in enumeration and in conjunction with the standard deviation for proficiency ($\sigma_p$) was used to calculate a z-score for each result. However, those for Sulphite Reducing Clostridia are given *for information only.*

3. Results and assessments for the proficiency tests in enumeration are summarised as follows:

| Proficiency test in enumeration | assigned value, $x_a$ $\log_{10}$cfu/g | number of scores, \|z\| ≤2 | total number of scores | % \|z\| ≤2 |
|---|---|---|---|---|
| Enterobacteriaceae in Beef | 4.18 | 24 | 25 | 96 |
| Aerobic Plate Count in Beef | 4.24 | 25 | 26 | 96 |
| *Clostridium perfringens* in Milk Powder | 2.97 | 22 | 23 | 96 |
| *Clostridium* spp. in Milk Powder | 2.74 | 6 | 7 | 86 |
| Sulphite Reducing Clostridia (SRC) in Milk Powder | *3.06* | *10* | 15 | *67* |
| *Escherichia coli* in Beef | 3.76 | 36 | 37 | 97 |
| Coliforms in Beef | 3.93 | 28 | 29 | 97 |

*italics indicate for information only*

4. Qualitative results for the proficiency tests in detection are assessed based on the presence or absence of the target organism in **both** of the test materials issued.

5. Results for the proficiency tests in detection are summarised as follows:

| Proficiency test in detection | intended result | number of satisfactory assessments | total number of assessments | satisfactory / agreement with intended result, % | false negatives, % | false positives, % |
|---|---|---|---|---|---|---|
| *Listeria monocytogenes* in Chicken | test material A detected<br>test material B not detected | 53 | 56 | 95 | 2 | 5 |
| *Listeria* spp. in Chicken | test material A detected<br>test material B not detected | 30 | 32 | 94 | 6 | 3 |
| *Salmonella* spp. in Salad | test material A detected<br>test material B not detected | 40 | 40 | 100 | 0 | 0 |
| *Salmonella* spp. in Animal Feed | test material A not detected<br>test material B detected | 44 | 44 | 100 | 0 | 0 |
| *Escherichia coli* O157:H7 in Beef | test material A not detected<br>test material B detected | 39 | 40 | 98 | 0 | 3 |

6. Quality control materials are available for purchase from fapas.com. On the home page, click on ‘Quality Control Materials’ then, under the heading ‘Analyte groups’, click on ‘Microbiology’.

FMOD11-MRP2 - M297d11 - Detection of *Escherichia coli* O157:H7 in Beef

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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® – Food Microbiology proficiency tests are available in our protocols [7, 8].

# 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].

Fapas® – Food Microbiology test materials include background flora to simulate real conditions. Information for these organisms is given in APPENDIX I.

The test materials were stored at +4°C ±2°C until dispatch.

## 2.2. Homogeneity and Validation

For each proficiency test in enumeration, 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.

For each proficiency test in detection, ten percent of the test materials were analysed to verify the presence/absence of the target organism. In addition, two of each of the test materials positive for the target organism were also analysed by the most probable number technique to verify the level of organisms present. The data obtained is given in APPENDIX II.

## 2.3. Dispatch

The start date was 13 May 2024. Test materials were sent to 252 participants.

## 2.4. Storage and Preparation Instructions

Instructions regarding sample storage and preparation were made available on the Fapas® website [9].

Participants are reminded that it is crucial to the outcome of the proficiency tests that the instructions for the preparation of the test materials are followed exactly.

# 3. RESULTS

The instructions for reporting results were as follows:

- Start the analysis between 13 May and 22 May 2024.
- The results for enumeration tests must be reported as cfu/g.

- The results for detection tests must be reported as detected/not detected in 25 g (in English).

Results were submitted by 242 participants (96%) before the closing date for this test, 3 June 2024.

Each participant was given a laboratory number, assigned in order of receipt of results. The reported results are given in Tables 1 to 8.

The methods used by each participant are summarised in APPENDIX III.

# 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, $\sigma_p$, to calculate a z-score [10] for each result. The procedure is detailed in the relevant protocols [7, 8].

Further background on the procedure followed can be found in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [11].

## 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:

i) exclusion, if present, of any non numerical results i.e. qualitative or semi-quantitative results or results reported as zero,

ii) a $\log_{10}$ transformation of submitted results to obtain a normal distribution,

iii) exclusion, if present, of any results that were approximately 10, 100 or 1000 × greater or smaller than the majority of submitted results (as these were considered to be reporting errors).

For Enterobacteriaceae, aerobic plate count, *E. coli*, coliforms, and *Clostridium perfringens* this procedure was straightforward, and the robust mean was chosen as the assigned value.

For *Clostridium* spp. and sulphite reducing clostridia 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. However, for sulphite reducing clostridia the assigned value is given *for information only* due to the high uncertainty.

The assigned values for all proficiency tests in enumeration, together with their uncertainties are shown in Table 9.

## 4.2. Standard Deviation for Proficiency, $\sigma_p$

The standard deviation for proficiency, $\sigma_p$, was set at a value that reflects fitness-for-purpose for the analyses in question. The appropriate members of the Fapas® Advisory Committee have agreed this value corresponds to 0.25 $\log_{10}$ cfu/g.

The values for $\sigma_p$ used to calculate z-scores from the reported results of this test are given in Table 9.

### 4.3. Individual z-Scores and Assessments

Participants' z-scores were calculated as:

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

where $x$ = the participant's reported result expressed as $\log_{10}$,
$x_a$ = the assigned value, see Table 9,
and $\sigma_p$ = the standard deviation for proficiency, see Table 9.

Participants' z-scores for all proficiency tests in enumeration are given in Tables 1 to 4 and shown as histograms in Figures 1 to 7. Those for sulphite reducing clostridia are given *for information only*. 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 9.

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 10.

Participants' results for the proficiency tests in detection are assessed based on the presence or absence of the target organism in **both** of the test materials issued. Assessments are given in Tables 5 to 8.

Intended results for these detection tests are shown in Table 11.

The number and percentage of satisfactory assessments are given in Table 12.

## 5. INTERPRETATION OF SCORES AND ASSESSMENTS

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 [11].

Results submitted by participants for detections tests are assessed as either satisfactory (S) or not satisfactory (NS) as compared to the intended result.

## 6. REFERENCES


1 Adobe Approved Trust List, https://helpx.adobe.com/acrobat/kb/approved-trust-list2.html#Whatisit accessed 23/02/2024.

2 GlobalSign AATL Document Signing FAQs, https://support.globalsign.com/aatl-document/aatl-document-signing-faqs accessed 23/02/2024.

3 ISO/IEC 17043:2010, Conformity assessment – General requirements for proficiency testing.

4 The ILAC Mutual Recognition Arrangement, https://ilac.org/ilac-mra-and-signatories/ accessed 23/02/2024.

5 Fera Science Ltd, Standards & Accreditations, https://www.fera.co.uk/about-us/standards-and-accreditation accessed 23/02/2024.

6 Lloyd's Register, Learn about ISO 9001 Quality Management Systems (QMS), https://www.lrqa.com/en-gb/iso-9001/?epslanguage=en-GB#accordion-whatarethebenefitsofiso9001certification accessed 23/02/2024.

7 Fapas®, 2023, Protocol for Proficiency Testing Schemes, Version 8, January 2023, Part 1 – Common Principles.

8 Fapas®, 2023, Protocol for Proficiency Testing Schemes, Version 6, January 2023, Part 3 – Fapas® Food Microbiology scheme (FEPAS).

9 Fapas® – Food Microbiology safety data sheet and preparation instructions, https://fapas.com/technical-documentation, accessed 23/02/2024.

10 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.

11 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 Enterobacteriaceae / Aerobic Plate Count in Beef

| laboratory number | analyte | | | | | |
|---|---|---|---|---|---|---|
| | Enterobacteriaceae assigned value: 4.18 $\log_{10}$ cfu/g | | | Aerobic Plate Count assigned value: 4.24 $\log_{10}$ cfu/g | | |
| | result | $\log_{10}$ | z-score | result | $\log_{10}$ | z-score |
| 001 | 1.4E+4 | 4.1 | -0.1 | 1.9E+4 | 4.3 | 0.1 |
| 012 | 1.2E+04 | 4.1 | -0.4 | 2.0E+04 | 4.3 | 0.2 |
| 019 | 19000 | 4.3 | 0.4 | 23000 | 4.4 | 0.5 |
| 029 | 23000 | 4.4 | 0.7 | 24000 | 4.4 | 0.6 |
| 073 | 13000 | 4.1 | -0.2 | 17000 | 4.2 | 0.0 |
| 080 | 1.0E+04 | 4.0 | -0.7 | 1.2E+04 | 4.1 | -0.6 |
| 096 | 24000 | 4.4 | 0.8 | | | |
| 109 | | | | 19000 | 4.3 | 0.1 |
| 113 | 27000 | 4.4 | 1.0 | 30000 | 4.5 | 0.9 |
| 116 | 1.5E+4 | 4.2 | 0.0 | 1.2E+4 | 4.1 | -0.6 |
| 122 | 1.4E+4 | 4.1 | -0.1 | 1.4E+4 | 4.1 | -0.4 |
| 124 | 1.2E+4 | 4.1 | -0.4 | 1.4E+4 | 4.1 | -0.4 |
| 125 | 1.9E+4 | 4.3 | 0.4 | 2.4E+4 | 4.4 | 0.6 |
| 133 | 1.8E+4 | 4.3 | 0.3 | 1.5E+4 | 4.2 | -0.3 |
| 148 | 1.8E+4 | 4.3 | 0.3 | 1.6E+4 | 4.2 | -0.1 |
| 154 | 7500 | 3.9 | -1.2 | | | |
| 170 | 1.7E+3 | 3.2 | **-3.8** | 2.6E+3 | 3.4 | **-3.3** |
| 173 | 16000 | 4.2 | 0.1 | 18000 | 4.3 | 0.1 |
| 176 | 8.0E+3 | 3.9 | -1.1 | 1.3E+4 | 4.1 | -0.5 |
| 180 | | | | 1.9E+4 * | 4.3 | 0.1 |
| 181 | 26000 | 4.4 | 1.0 | 21840 | 4.3 | 0.4 |
| 182 | 19000 | 4.3 | 0.4 | >5300 | | |
| 185 | 2.00E+4 | 4.3 | 0.5 | 2.83E+4 | 4.5 | 0.8 |
| 200 | 6.6E+3 * | 3.8 | -1.4 | 6.3E+3 * | 3.8 | -1.8 |
| 212 | | | | 2.2E+4 | 4.3 | 0.4 |
| 224 | | | | 1.35E+4 * | 4.1 | -0.4 |
| 228 | 17000 | 4.2 | 0.2 | 21500 | 4.3 | 0.4 |
| 239 | 1.6E+4 | 4.2 | 0.1 | 2.1E+4 | 4.3 | 0.3 |
| 240 | 14591 | 4.2 | 0.0 | 14296 | 4.2 | -0.3 |

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

## Table 2: Results and z-Scores for Enumeration of *Clostridium perfringens* / *Clostridium* spp. / Sulphite Reducing Clostridia (SRC) in Milk Powder

| laboratory number | analyte | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Clostridium perfringens* assigned value: 2.97 $\log_{10}$ cfu/g | | | *Clostridium* spp. assigned value: 2.74 $\log_{10}$ cfu/g | | | Sulphite Reducing Clostridia (SRC) assigned value: *3.06* $\log_{10}$ cfu/g | | |
| | result | $\log_{10}$ | z-score | result | $\log_{10}$ | z-score | result | $\log_{10}$ | z-score |
| 002 | 6E+2 | 2.8 | -0.8 | | | | | | |
| 005 | 1.2E+3 | 3.1 | 0.5 | | | | | | |
| 030 | | | | | | | 1.0E+3 | 3.0 | *-0.2* |
| 032 | 4.5E+2 | 2.7 | -1.3 | | | | | | |
| 047 | 450 | 2.7 | -1.3 | | | | | | |
| 055 | 7.5E+2 | 2.9 | -0.4 | | | | | | |
| 067 | 1.28E+3 | 3.1 | 0.6 | | | | | | |
| 076 | 530 | 2.7 | -1.0 | 530 | 2.7 | 0.0 | 530 | 2.7 | *-1.3* |
| 078 | 335 | 2.5 | -1.8 | 350 | 2.5 | -0.8 | 350 | 2.5 | *-2.1* |
| 088 | 1300 | 3.1 | 0.6 | | | | 2000 | 3.3 | *1.0* |
| 095 | 2.4E+3 | 3.4 | 1.7 | | | | | | |
| 148 | 4.8E+2 | 2.7 | -1.1 | | | | | | |
| 163 | 2.0E+3 | 3.3 | 1.3 | | | | | | |
| 166 | 2.5E+3 | 3.4 | 1.7 | | | | | | |
| 168 | | | | | | | 6000 | 3.8 | *2.9* |
| 183 | 9.4E+2 | 3.0 | 0.0 | 5.9E+2 | 2.8 | 0.1 | 9.4E+2 | 3.0 | *-0.3* |
| 184 | 2500 | 3.4 | 1.7 | | | | 4200 | 3.6 | *2.3* |
| 192 | 1.5E+3 | 3.2 | 0.8 | | | | | | |

z-scores outside |z| >2 are shown in **bold,** see Section 5
*italics indicate for information only*
* samples analysed outside of the required time frame

## Table 2 (continued): Results and z-Scores for Enumeration of Clostridium perfringens / Clostridium spp. / Sulphite Reducing Clostridia (SRC) in Milk Powder

| laboratory number | analyte | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Clostridium perfringens*<br>assigned value:<br>2.97 $\log_{10}$ cfu/g | | | *Clostridium* spp.<br>assigned value:<br>2.74 $\log_{10}$ cfu/g | | | Sulphite Reducing Clostridia (SRC)<br>assigned value:<br>*3.06* $\log_{10}$ cfu/g | | |
| | result | $\log_{10}$ | z-score | result | $\log_{10}$ | z-score | result | $\log_{10}$ | z-score |
| 193 | 9.0E+2 | 3.0 | 0.0 | 1.1E+3 | 3.0 | 1.2 | 1.1E+3 | 3.0 | *-0.1* |
| 196 | 300 * | 2.5 | -2.0 | | | | | | |
| 206 | 670 | 2.8 | -0.6 | | | | 700 | 2.8 | *-0.9* |
| 220 | 0 | | | 1.8E+2 | 2.3 | -1.9 | 1.0E+2 | 2.0 | *-4.2* |
| 225 | <1.0E+1 | | | 5.6E+2 | 2.7 | 0.0 | 5.6E+2 | 2.7 | *-1.2* |
| 228 | 1300 | 3.1 | 0.6 | | | | 1500 | 3.2 | *0.5* |
| 234 | 7.1E+2 | 2.9 | -0.5 | | | | 1.2E+3 | 3.1 | *0.1* |
| 236 | 8.0E+3 * | 3.9 | **3.7** | 8.0E+3 * | 3.9 | **4.7** | 8.0E+3 * | 3.9 | *3.4* |
| 238 | | | | | | | 2.10E+3 | 3.3 | *1.0* |
| 242 | 5.1E+2 | 2.7 | -1.0 | | | | | | |

z-scores outside |z| >2 are shown in **bold,** see Section 5
*italics indicate for information only*
* samples analysed outside of the required time frame

## Table 3: Results and z-Scores for Enumeration of *Escherichia coli* in Beef

| laboratory number | analyte | | | |
|---|---|---|---|---|
| | *Escherichia coli* assigned value: 3.76 $\log_{10}$ cfu/g | | | |
| | result | $\log_{10}$ | Most probable number technique used (yes/no) | z-score |
| 001 | 9.3E+3 | 4.0 | no | 0.8 |
| 012 | 7.8E+03 | 3.9 | No | 0.5 |
| 022 | 3600 | 3.6 | no | -0.8 |
| 033 | 8.45E+3 | 3.9 | No | 0.7 |
| 037 | 6000 | 3.8 | no | 0.1 |
| 038 | 1.4E+3 | 3.1 | no | **-2.5** |
| 039 | 4000 | 3.6 | No | -0.6 |
| 048 | 5.3E+3 | 3.7 | no | -0.1 |
| 054 | 1.0E+4 | 4.0 | no | 1.0 |
| 066 | 2.7E+3 | 3.4 | yes | -1.3 |
| 073 | 5200 | 3.7 | no | -0.2 |
| 105 | 2.9E+3 | 3.5 | NO | -1.2 |
| 114 | 4.5E+3 | 3.7 | NO | -0.4 |
| 115 | 5.8E+3 | 3.8 | no | 0.0 |
| 117 | 8.0E+3 | 3.9 | No | 0.6 |
| 123 | 3.1E+3 | 3.5 | yes(2.4E+3) | -1.1 |
| 126 | 9.54E+3 | 4.0 | no | 0.9 |
| 127 | 4.4E+3 | 3.6 | no | -0.5 |

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

## Table 3 (continued): Enumeration of *Escherichia coli* in Beef

| laboratory number | analyte | | | |
|---|---|---|---|---|
| | *Escherichia coli* assigned value: 3.76 $\log_{10}$ cfu/g | | | |
| | result | $\log_{10}$ | Most probable number technique used (yes/no) | z-score |
| 148 | 3.6E+3 | 3.6 | no | -0.8 |
| 161 | 2.4E+3 | 3.4 | no | -1.5 |
| 162 | 7.8E+3 | 3.9 | no | 0.5 |
| 164 | 4.5E+3 | 3.7 | NO | -0.4 |
| 173 | 7000 | 3.8 | no | 0.3 |
| 181 | 7575 | 3.9 | no | 0.5 |
| 185 | 9.56E+3 | 4.0 | NO | 0.9 |
| 207 | 6.5E+3 | 3.8 | no | 0.2 |
| 208 | 8900 | 3.9 | no | 0.8 |
| 211 | 3.4E+3 | 3.5 | no | -0.9 |
| 212 | 9.8E+3 | 4.0 | no | 0.9 |
| 213 | 3.6E+3 | 3.6 | no | -0.8 |
| 214 | 5.8E+3 | 3.8 | no | 0.0 |
| 215 | 73E+2 | 3.9 | No | 0.4 |
| 217 | 7900 | 3.9 | no | 0.6 |
| 222 | 7.7E+03 | 3.9 | YES | 0.5 |
| 232 | 7.4E+3 | 3.9 | No | 0.4 |
| 239 | 8.5E+3 | 3.9 | NO | 0.7 |
| 241 | 6650 * | 3.8 | no | 0.3 |

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

## Table 4: Results and z-Scores for Enumeration of Coliforms in Beef

| laboratory number | analyte | | | |
|---|---|---|---|---|
| | Coliforms assigned value: 3.93 $\log_{10}$ cfu/g | | | |
| | result | $\log_{10}$ | Most probable number technique used (yes/no) | z-score |
| 009 | 3.9E+03 | 3.6 | NO | -1.3 |
| 015 | 1.5E+4 | 4.2 | NO | 1.0 |
| 026 | 1.60E+4 | 4.2 | YES | 1.1 |
| 033 | 1.745E+4 | 4.2 | No | 1.3 |
| 052 | 1.3E+4 | 4.1 | NO | 0.7 |
| 065 | 9.3E+3 | 4.0 | NO | 0.2 |
| 066 | 6.1E+3 | 3.8 | yes | -0.6 |
| 084 | 2.0E+4 | 4.3 | no | 1.5 |
| 089 | 4.5E+3 | 3.7 | yes | -1.1 |
| 092 | 1.1E+4 | 4.0 | No | 0.5 |
| 108 | 1.1E+4 | 4.0 | yes | 0.5 |
| 109 | 1.4E+4 | 4.1 | 2024/05/23 | 0.9 |
| 114 | 6.5E+3 | 3.8 | NO | -0.5 |
| 123 | 6.7E+3 | 3.8 | yes(4.6E+3) | -0.4 |
| 129 | 4.6E+3 | 3.7 | yes | -1.1 |
| 131 | 2.8E+3 | 3.4 | no | -1.9 |
| 151 | 5600 | 3.7 | no | -0.7 |
| 154 | 6200 | 3.8 | no | -0.5 |
| 165 | 1.E+04 | 4.0 | yes | 0.3 |
| 167 | 1500 | 3.2 | NO | **-3.0** |
| 169 | 11000 | 4.0 | no | 0.5 |
| 179 | 1.3E+4 | 4.1 | no | 0.7 |
| 185 | 1.08E+4 | 4.0 | No | 0.4 |
| 188 | 2.4E+4 * | 4.4 | yes | 1.8 |
| 204 | 5.6E+3 | 3.7 | no | -0.7 |
| 212 | 1.2E+4 | 4.1 | NO | 0.6 |
| 222 | 9.9E+3 | 4.0 | YES | 0.3 |
| 223 | 5.59E+3 | 3.7 | no | -0.7 |
| 240 | 4600 | 3.7 | yes | -1.1 |

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

## Table 5: Results and Assessments for *Listeria monocytogenes* / *Listeria* spp. in Chicken

| laboratory number | analyte | | | | | |
|---|---|---|---|---|---|---|
| | *Listeria monocytogenes*<br>TMA consensus: 98% detected (positive)<br>(intended result: detected)<br>TMB consensus: 95% not detected (negative)<br>(intended result: not detected) | | | *Listeria* spp.<br>TMA consensus: 94% detected (positive)<br>(intended result: detected)<br>TMB consensus: 97% not detected (negative)<br>(intended result: not detected) | | |
| | result, TMA | result, TMB | assessment | result, TMA | result, TMB | assessment |
| 010 | detected | not detected | S | | | |
| 018 | detected | not detected | S | detected | not detected | S |
| 020 | detected | not detected | S | detected | not detected | S |
| 021 | detected | not detected | S | | | |
| 027 | detected | not detected | S | detected | not detected | S |
| 033 | detected | not detected | S | detected | not detected | S |
| 038 | detected | not detected | S | | | |
| 040 | detected | not detected | S | detected | not detected | S |
| 044 | detected | not detected | S | | | |
| 049 | detected | not detected | S | | | |
| 053 | detected | not detected | S | | | |
| 056 | detected | not detected | S | detected | not detected | S |
| 058 | detected | not detected | S | detected | not detected | S |
| 063 | detected | not detected | S | detected | not detected | S |
| 071 | detected | not detected | S | | | |
| 072 | detected | not detected | S | detected | not detected | S |
| 075 | detected | not detected | S | | | |
| 085 | detected | not detected | S | | | |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 5 (continued): Results and z-Scores for *Listeria monocytogenes* / *Listeria* spp. in Chicken

| laboratory number | analyte | | | | | |
|---|---|---|---|---|---|---|
| | *Listeria monocytogenes*<br>TMA consensus: 98% detected (positive)<br>(intended result: detected)<br>TMB consensus: 95% not detected (negative)<br>(intended result: not detected) | | | *Listeria* spp.<br>TMA consensus: 94% detected (positive)<br>(intended result: detected)<br>TMB consensus: 97% not detected (negative)<br>(intended result: not detected) | | |
| | result, TMA | result, TMB | assessment | result, TMA | result, TMB | assessment |
| 086 | detected | not detected | S | | | |
| 090 | detected | not detected | S | detected | not detected | S |
| 097 | detected * | not detected * | S | detected * | not detected * | S |
| 098 | detected | detected | NS | not detected | not detected | NS |
| 104 | detected * | not detected * | S | detected * | not detected * | S |
| 106 | detected | not detected | S | detected | not detected | S |
| 110 | detected | not detected | S | detected | not detected | S |
| 111 | detected | not detected | S | detected | not detected | S |
| 118 | detected | not detected | S | | | |
| 119 | detected | not detected | S | | | |
| 130 | detected | not detected | S | detected | not detected | S |
| 134 | detected | not detected | S | | | |
| 135 | detected | not detected | S | detected | not detected | S |
| 139 | detected | not detected | S | detected | not detected | S |
| 144 | detected | not detected | S | detected | not detected | S |
| 145 | detected | not detected | S | detected | not detected | S |
| 146 | detected | not detected | S | | | |
| 155 | detected | not detected | S | | | |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 5 (continued): Results and z-Scores for *Listeria monocytogenes* / *Listeria* spp. in Chicken

| laboratory number | analyte | | | | | |
|---|---|---|---|---|---|---|
| | *Listeria monocytogenes*<br>TMA consensus: 98% detected (positive)<br>(intended result: detected)<br>TMB consensus: 95% not detected (negative)<br>(intended result: not detected) | | | *Listeria* spp.<br>TMA consensus: 94% detected (positive)<br>(intended result: detected)<br>TMB consensus: 97% not detected (negative)<br>(intended result: not detected) | | |
| | result, TMA | result, TMB | assessment | result, TMA | result, TMB | assessment |
| 156 | detected | not detected | S | detected | not detected | S |
| 157 | detected | not detected | S | | | |
| 162 | detected | not detected | S | detected | not detected | S |
| 164 | detected | not detected | S | | | |
| 167 | detected | not detected | S | detected | not detected | S |
| 172 | not detected | detected | NS | not detected | detected | NS |
| 174 | detected | not detected | S | | | |
| 176 | detected | not detected | S | detected | not detected | S |
| 177 | detected | not detected | S | | | |
| 185 | detected | detected | NS | | | |
| 186 | detected | not detected | S | detected | not detected | S |
| 195 | detected | not detected | S | detected | not detected | S |
| 197 | detected | not detected | S | | | |
| 198 | detected | not detected | S | detected | not detected | S |
| 199 | detected | not detected | S | detected | not detected | S |
| 209 | detected | not detected | S | | | |
| 210 | detected | not detected | S | | | |
| 229 | detected * | not detected * | S | | | |
| 238 | detected | not detected | S | detected | not detected | S |
| 241 | detected * | not detected * | S | detected * | not detected * | S |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 6: Results and Assessments for *Salmonella* spp. in Salad

| laboratory number | analyte | | |
|---|---|---|---|
| | *Salmonella* spp.<br>TMA consensus: 100% detected (positive)<br>(intended result: detected)<br>TMB consensus: 100% not detected (negative)<br>(intended result: not detected) | | |
| | result, TMA | result, TMB | assessment |
| 005 | detected | not detected | S |
| 008 | detected | not detected | S |
| 011 | detected | not detected | S |
| 017 | detected | not detected | S |
| 034 | detected | not detected | S |
| 035 | detected | not detected | S |
| 043 | detected | not detected | S |
| 046 | detected | not detected | S |
| 051 | detected | not detected | S |
| 055 | detected | not detected | S |
| 057 | detected | not detected | S |
| 058 | detected | not detected | S |
| 059 | detected | not detected | S |
| 061 | detected | not detected | S |
| 062 | detected | not detected | S |
| 068 | detected | not detected | S |
| 071 | detected | not detected | S |
| 074 | detected | not detected | S |
| 077 | detected | not detected | S |
| 079 | detected | not detected | S |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 6 (continued): Results and z-Scores for *Salmonella* spp. in Salad

| laboratory number | analyte | | |
|---|---|---|---|
| | *Salmonella* spp.<br>TMA consensus: 100% detected (positive)<br>(intended result: detected)<br>TMB consensus: 100% not detected (negative)<br>(intended result: not detected) | | |
| | result, TMA | result, TMB | assessment |
| 082 | detected | not detected | S |
| 083 | detected | not detected | S |
| 087 | detected | not detected | S |
| 103 | detected | not detected | S |
| 119 | detected | not detected | S |
| 121 | detected | not detected | S |
| 132 | detected | not detected | S |
| 137 | detected | not detected | S |
| 139 | detected | not detected | S |
| 140 | detected | not detected | S |
| 141 | detected | not detected | S |
| 154 | detected | not detected | S |
| 159 | detected | not detected | S |
| 160 | detected | not detected | S |
| 167 | detected | not detected | S |
| 191 | detected * | not detected * | S |
| 195 | detected | not detected | S |
| 203 | detected | not detected | S |
| 219 | detected | not detected | S |
| 242 | detected | not detected | S |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 7: Results and Assessments for *Salmonella* spp. in Animal Feed

| laboratory number | analyte | | |
|---|---|---|---|
| | *Salmonella* spp.<br>TMA consensus: 100% not detected (negative)<br>(intended result: not detected)<br>TMB consensus: 100% detected (positive)<br>(intended result: detected) | | |
| | result, TMA | result, TMB | assessment |
| 003 | not detected | detected | S |
| 004 | not detected | detected | S |
| 007 | not detected | detected | S |
| 009 | not detected | detected | S |
| 014 | not detected | detected | S |
| 023 | not detected | detected | S |
| 031 | not detected | detected | S |
| 036 | not detected | detected | S |
| 045 | not detected | detected | S |
| 069 | not detected | detected | S |
| 080 | not detected | detected | S |
| 081 | not detected | detected | S |
| 091 | not detected | detected | S |
| 093 | not detected | detected | S |
| 099 | not detected | detected | S |
| 100 | not detected | detected | S |
| 102 | not detected * | detected * | S |
| 128 | not detected | detected | S |
| 136 | not detected * | detected * | S |
| 138 | not detected | detected | S |
| 142 | not detected | detected | S |
| 143 | not detected | detected | S |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 7 (continued): Results and z-Scores for Results and Assessments for *Salmonella* spp. in Animal Feed

| laboratory number | analyte | | |
|---|---|---|---|
| | *Salmonella* spp.<br>TMA consensus: 100% not detected (negative)<br>(intended result: not detected)<br>TMB consensus: 100% detected (positive)<br>(intended result: detected) | | |
| | result, TMA | result, TMB | assessment |
| 147 | not detected | detected | S |
| 150 | not detected | detected | S |
| 152 | not detected | detected | S |
| 154 | not detected | detected | S |
| 171 | not detected | detected | S |
| 175 | not detected | detected | S |
| 176 | not detected | detected | S |
| 178 | not detected | detected | S |
| 187 | not detected * | detected * | S |
| 189 | not detected * | detected * | S |
| 201 | not detected * | detected * | S |
| 204 | not detected * | detected * | S |
| 205 | not detected * | detected * | S |
| 215 | not detected | detected | S |
| 216 | not detected | detected | S |
| 218 | not detected | detected | S |
| 221 | not detected | detected | S |
| 226 | not detected | detected | S |
| 227 | not detected | detected | S |
| 230 | not detected | detected | S |
| 231 | not detected | detected | S |
| 237 | not detected | detected | S |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 8: Results and Assessments for *Escherichia coli* O157:H7 in Beef

| laboratory number | analyte | | |
|---|---|---|---|
| | *Escherichia coli* O157:H7<br>TMA consensus: 98% not detected (negative)<br>(intended result: not detected)<br>TMB consensus: 100% detected (positive)<br>(intended result: detected) | | |
| | result, TMA | result, TMB | assessment |
| 002 | not detected | detected | S |
| 006 | not detected | detected | S |
| 010 | not detected | detected | S |
| 013 | not detected | detected | S |
| 016 | not detected | detected | S |
| 024 | not detected | detected | S |
| 025 | not detected | detected | S |
| 028 | not detected | detected | S |
| 041 | not detected | detected | S |
| 042 | not detected | detected | S |
| 046 | not detected | detected | S |
| 050 | not detected | detected | S |
| 056 | not detected | detected | S |
| 060 | not detected | detected | S |
| 064 | not detected | detected | S |
| 070 | not detected | detected | S |
| 077 | not detected | detected | S |
| 094 | not detected | detected | S |
| 101 | not detected | detected | S |
| 106 | not detected | detected | S |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 8 (continued): Results and z-Scores for *Escherichia coli* O157:H7 in Beef

| laboratory number | analyte | | |
|---|---|---|---|
| | *Escherichia coli* O157:H7<br>TMA consensus: 98% not detected (negative)<br>(intended result: not detected)<br>TMB consensus: 100% detected (positive)<br>(intended result: detected) | | |
| | result, TMA | result, TMB | assessment |
| 107 | not detected | detected | S |
| 112 | not detected * | detected * | S |
| 120 | not detected | detected | S |
| 127 | not detected * | detected * | S |
| 130 | not detected | detected | S |
| 139 | not detected | detected | S |
| 141 | not detected | detected | S |
| 149 | not detected | detected | S |
| 153 | not detected | detected | S |
| 154 | not detected | detected | S |
| 158 | not detected | detected | S |
| 185 | not detected | detected | S |
| 190 | not detected | detected | S |
| 194 | not detected | detected | S |
| 195 | not detected | detected | S |
| 198 | not detected | detected | S |
| 202 | not detected | detected | S |
| 233 | not detected | detected | S |
| 234 | not detected | detected | S |
| 235 | detected | detected | NS |

S = satisfactory
NS = not satisfactory
* samples analysed outside of the required time frame

## Table 9: Assigned Values and Standard Deviations for Proficiency

| Proficiency test in enumeration | data points, *n* | assigned value, $x_a$ $\log_{10}$ cfu/g | uncertainty, *u* | standard deviation for proficiency, $\sigma_p$ | |
|---|---|---|---|---|---|
| Enterobacteriaceae in Beef | 25 | 4.18 | 0.04 | ffp | 0.250 |
| Aerobic Plate Count in Beef | 26 | 4.24 | 0.03 | ffp | 0.250 |
| *Clostridium perfringens* in Milk Powder | 23 | 2.97 | 0.07 | ffp | 0.250 |
| *Clostridium* spp. in Milk Powder | 6 | 2.74 | 0.07 | ffp | 0.250 |
| Sulphite Reducing Clostridia (SRC) in Milk Powder | 14 | *3.06* | *0.10* | ffp | *0.250* |
| *Escherichia coli* in Beef | 37 | 3.76 | 0.03 | ffp | 0.250 |
| Coliforms in Beef | 29 | 3.93 | 0.05 | ffp | 0.250 |

ffp = fitness-for-purpose criteria
*italics indicate for information only*

## Table 10: Number and Percentage of z-Scores where |z| ≤2

| Proficiency test in enumeration | number of scores where \|z\| ≤2 | total number of scores | % \|z\| ≤2 |
|---|---|---|---|
| Enterobacteriaceae in Beef | 24 | 25 | 96 |
| Aerobic Plate Count in Beef | 25 | 26 | 96 |
| *Clostridium perfringens* in Milk Powder | 22 | 23 | 96 |
| *Clostridium* spp. in Milk Powder | 6 | 7 | 86 |
| Sulphite Reducing Clostridia (SRC) in Milk Powder | *10* | 15 | *67* |
| *Escherichia coli* in Beef | 36 | 37 | 97 |
| Coliforms in Beef | 28 | 29 | 97 |

*italics indicate for information only*

## Table 11: Intended Results for Proficiency Tests in Detection

| Proficiency test in detection | test material A | test material B |
|---|---|---|
| *Listeria monocytogenes* in Chicken | detected | not detected |
| *Listeria* spp. in Chicken | detected | not detected |
| *Salmonella* spp. in Salad | detected | not detected |
| *Salmonella* spp. in Animal Feed | not detected | detected |
| *Escherichia coli* O157:H7 in Beef | not detected | detected |

## Table 12: Number and Percentage of Satisfactory Assessments and False Results for Proficiency Tests in Detection

| Proficiency test in detection | intended result | number of satisfactory assessments | total number of assessments | satisfactory / agreement with intended result, % | false negatives, % | false positives, % |
|---|---|---|---|---|---|---|
| *Listeria monocytogenes* in Chicken | test material A detected<br>test material B not detected | 53 | 56 | 95 | 2 | 5 |
| *Listeria* spp. in Chicken | test material A detected<br>test material B not detected | 30 | 32 | 94 | 6 | 3 |
| *Salmonella* spp. in Salad | test material A detected<br>test material B not detected | 40 | 40 | 100 | 0 | 0 |
| *Salmonella* spp. in Animal Feed | test material A not detected<br>test material B detected | 44 | 44 | 100 | 0 | 0 |
| *Escherichia coli* O157:H7 in Beef | test material A not detected<br>test material B detected | 39 | 40 | 98 | 0 | 3 |

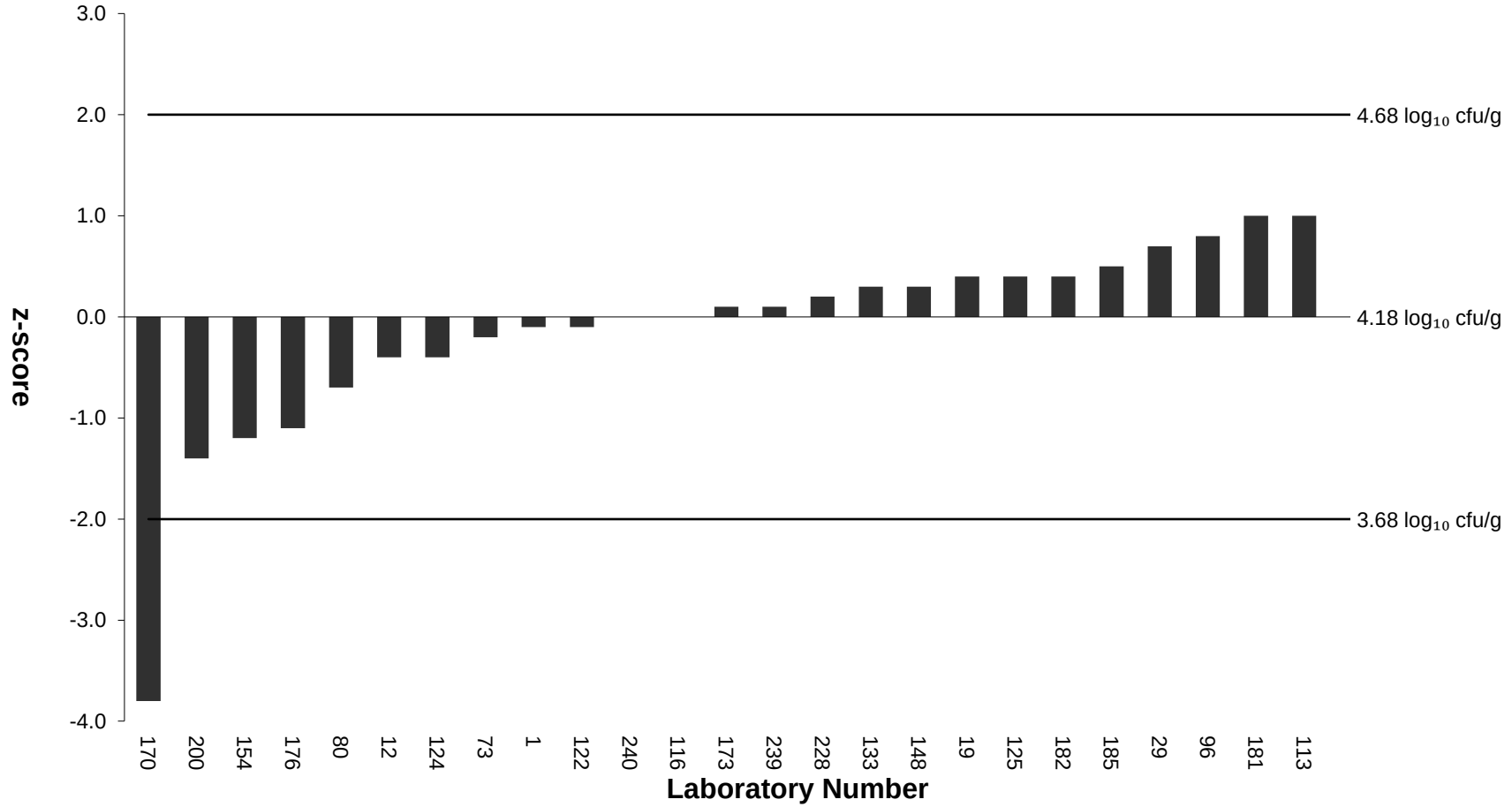


**Figure 1: z-Scores for Enumeration of Enterobacteriaceae in Beef**

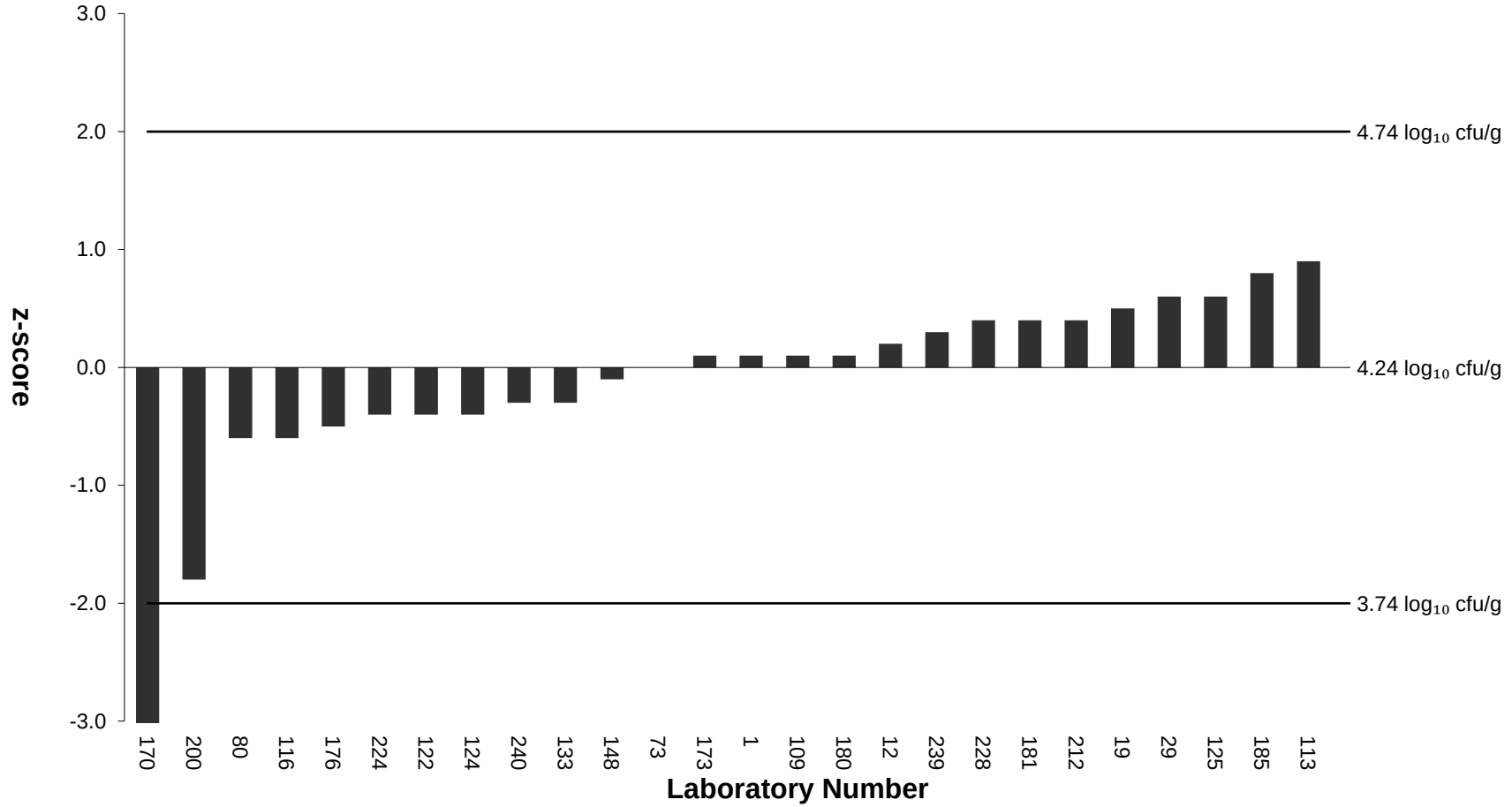


**Figure 2: z-Scores for Enumeration of Aerobic Plate Count in Beef**

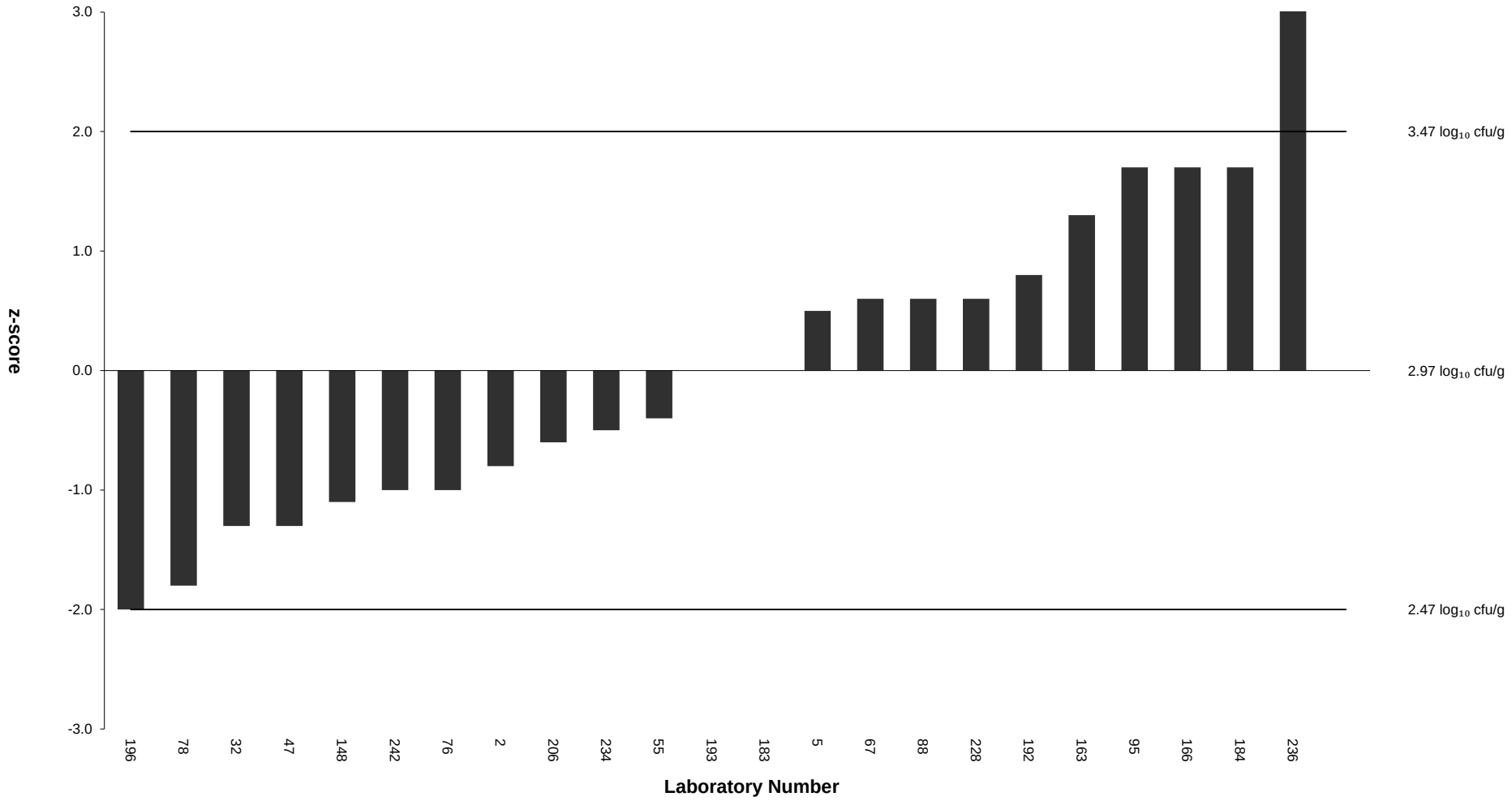


**Figure 3: z-Scores for Enumeration of *Clostridium perfringens* in Milk Powder**

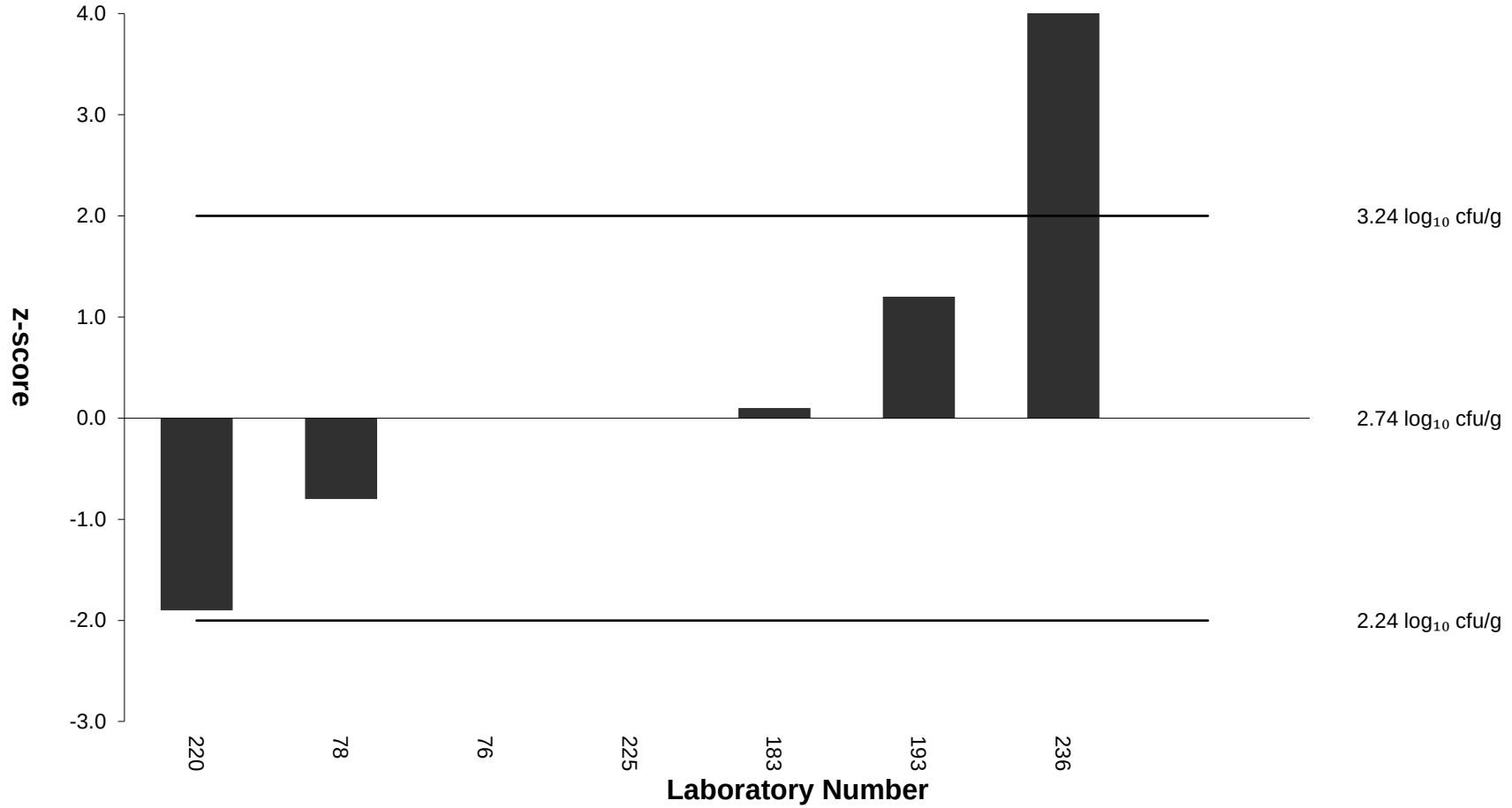


**Figure 4: z-Scores for Enumeration of *Clostridium* spp. in Milk Powder**

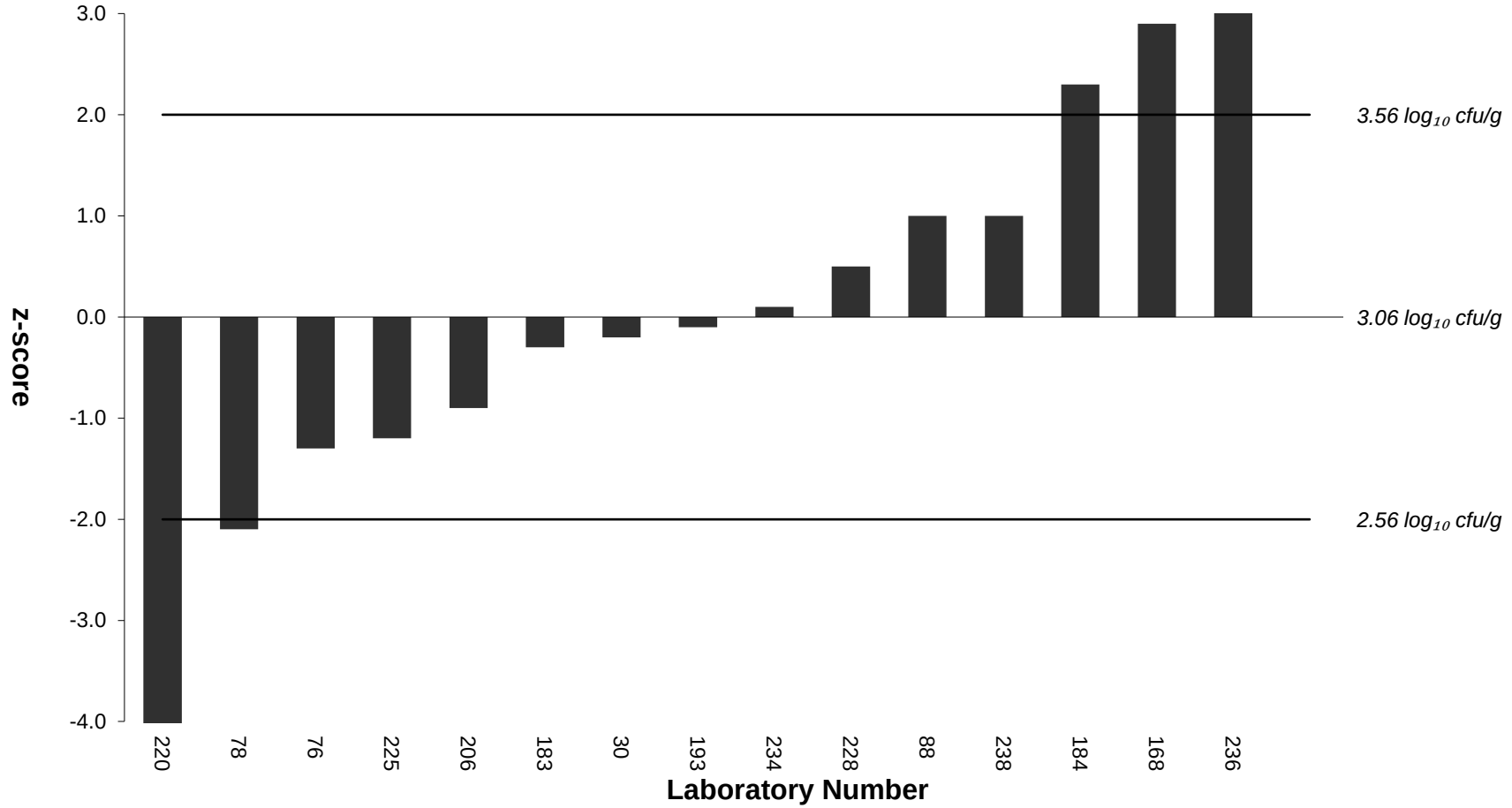


**Figure 5: z-Scores for Enumeration of Sulphite Reducing Clostridia (SRC) in Milk Powder**

*this histogram is given for information only*

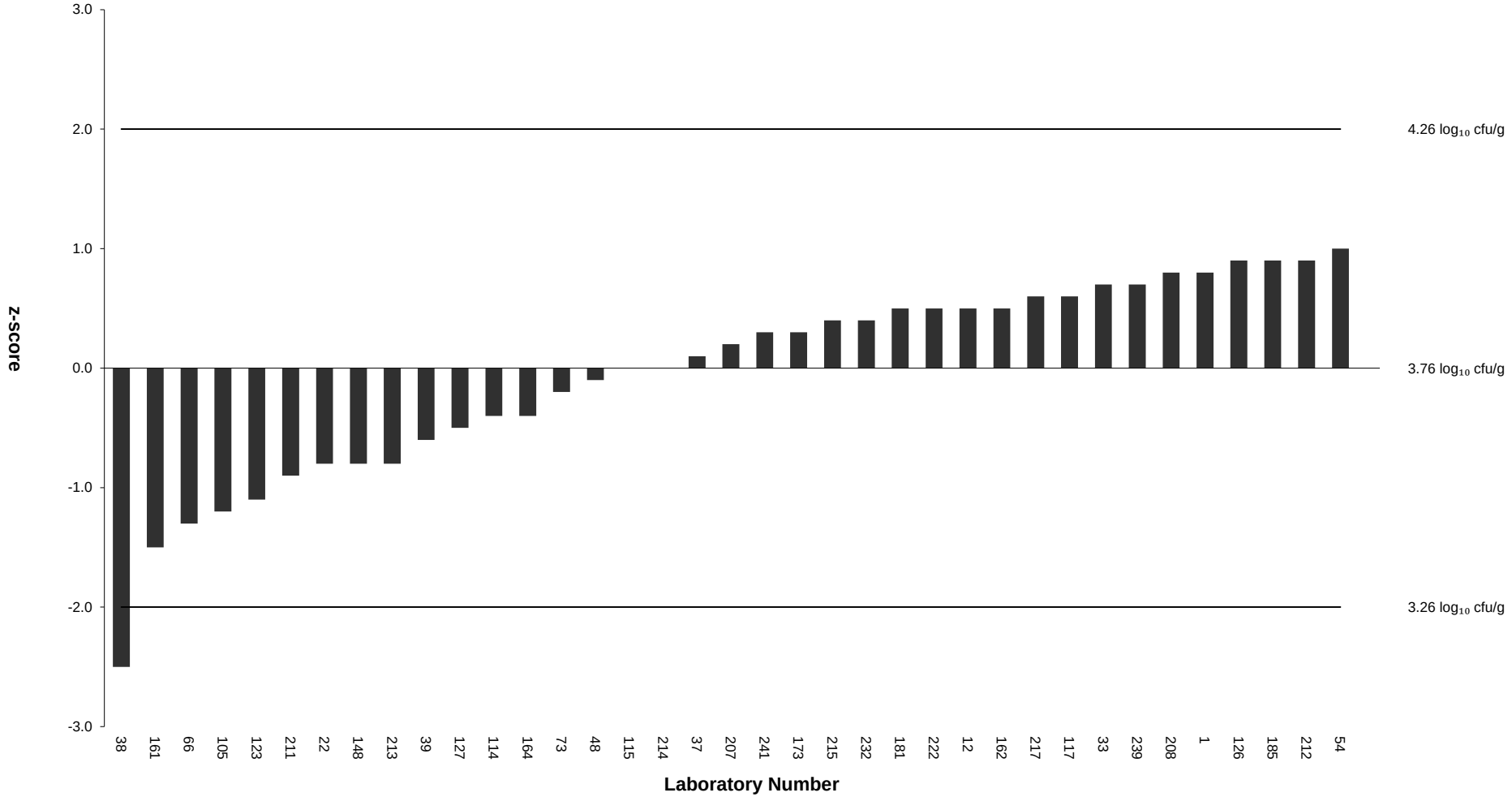


**Figure 6: z-Scores for Enumeration of *Escherichia coli* in Beef**

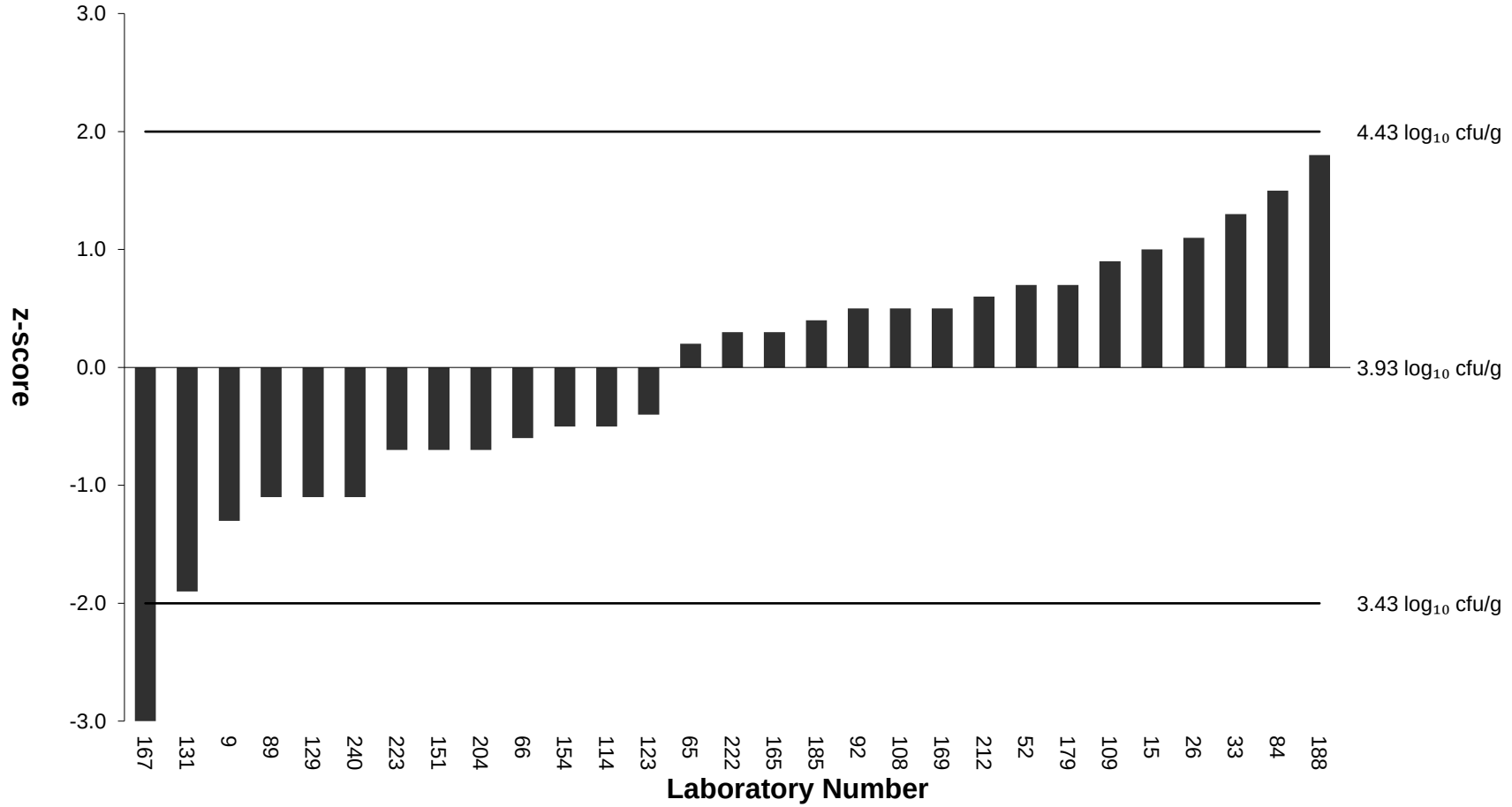


**Figure 7: z-Scores for Enumeration of Coliforms in Beef**

# APPENDIX I: Organisms present in Fapas® – Food Microbiology Test Materials

| proficiency test | matrix | target organism | background flora |
|---|---|---|---|
| enumeration of Enterobacteriaceae/APC | Beef | *Escherichia coli*<br>*Klebsiella pneumoniae*<br>*Bacillus cereus* | not applicable |
| enumeration of *Clostridium perfringens* / *Clostridium* spp. / Sulphite Reducing Clostridia (SRC) | Milk Powder | *Clostridium perfringens* | *Bacillus coagulans*<br>*Staphylococcus aureus*<br>*B. cereus* |
| enumeration of *Escherichia coli* | Beef | *Escherichia coli* | *B. cereus* |
| enumeration of Coliforms | Beef | *E. coli* | *B. cereus* |
| detection of *Listeria monocytogenes* / *Listeria* spp. test material A | Chicken | *Listeria monocytogenes* | *B. cereus*<br>*S. aureus*<br>*E. coli* |
| detection of *Listeria monocytogenes* / *Listeria* spp. test material B | Chicken | not applicable | *B. cereus*<br>*S. aureus*<br>*E. coli* |
| detection of *Salmonella* spp. test material A | Salad | *Salmonella* Cerro | *E. coli*<br>*S. aureus* |
| detection of *Salmonella* spp. test material B | Salad | not applicable | *E. coli*<br>*Citrobacter freundii*<br>*S. aureus* |
| detection of *Salmonella* spp. test material A | Animal Feed | not applicable | *L. plantarum*<br>*S. aureus*<br>*Enterococcus faecalis* |
| detection of *Salmonella* spp. test material B | Animal Feed | *S.* Cerro | *L. plantarum*<br>*S. aureus*<br>*E. faecalis* |
| detection of *Escherichia coli* O157:H7 test material A | Beef | not applicable | *E. coli*<br>*C. freundii*<br>*K. rhizophila* |
| detection of *Escherichia coli* O157:H7 test material B | Beef | *Escherichia coli* O157:H7 | *C. freundii*<br>*K. rhizophila* |

## APPENDIX II: Verification of Positive Qualitative Test Materials

| target organism | level of target organism, as assessed by the most probable number technique, MPN/g |
|---|---|
| *Listeria monocytogenes* in Chicken | 2.3 (0.76 to 7*) / 11 (3.8 to 30*) |
| *Salmonella* Cerro in Salad | not applicable § |
| *Salmonella* Cerro in Animal Feed | not applicable § |
| *Escherichia coli* O157:H7 in Beef | 17 (6.3 to 45*) / 23 (7.6 to 70*) |

*confidence limit at >95%

§ - Due to a technical issue the level of *Salmonella* Cerro in test materials M297d071 and M297d072 could not be provided.

# APPENDIX III: 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. Text that appears as unreadable symbols are derived from entries made using non-Western characters.

## Enumeration of Enterobacteriaceae in Beef

| Accredited Method Used | laboratory number |
|---|---|
| no | 073 116 170 181 |
| yes | 001 012 019 029 080 113 122 124 125 148 173 200 239 240 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 170 181 239 |
| yes | 001 012 019 029 073 080 113 116 122 124 125 148 173 200 240 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 001 012 019 073 113 125 148 170 240 |
| Butterfield's Phosphate Buffer | 029 |
| Maximum Recovery Diluent (MRD) | 080 116 173 200 |
| Peptone Water | 181 239 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 012 073 080 116 125 148 173 200 240 |
| Spread plate | 001 |
| Overlay | 148 |
| Petrifilm (3M) | 019 029 113 181 239 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.05 | 001 |
| 1.0 | 012 019 029 073 080 113 116 125 148 170 173 181 200 239 240 |

| Which Selective/Chromogenic Medium Used | laboratory number |
|---|---|
| Petrifilm (3M) Enterobacteriaceae | 019 029 113 181 239 |
| Violet Red Bile Dextrose Agar (VRBD) | 001 122 125 |
| Violet Red Bile Glucose Agar (VRBG) | 012 073 080 116 148 173 200 240 |
| CompactDry Enterobacteriaceae | 170 |
| Gassner-Agar | 124 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 30 | 001 |
| 35 | 170 |
| 37 | 012 019 029 073 080 113 116 125 148 173 181 200 239 240 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 24 | 001 012 019 029 073 080 113 116 125 148 170 173 181 200 239 240 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20E | 073 |
| Fermentation of Carbohydrates | 012 148 173 200 |
| Oxidase reaction | 001 080 125 148 170 173 200 240 |

## Aerobic Plate Count in Beef

| Accredited Method Used | laboratory number |
|---|---|
| no | 073 116 170 181 |
| yes | 001 012 019 029 080 109 113 122 124 125 148 173 180 200 212 224 239 240 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 170 181 239 |
| yes | 001 012 019 029 073 080 109 113 116 122 124 125 148 173 180 200 212 224 240 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 001 012 019 073 113 125 148 170 212 240 |
| Butterfield's Phosphate Buffer | 029 |
| Maximum Recovery Diluent (MRD) | 080 116 173 180 200 224 |
| Peptone Water | 181 239 |
| Aseptic saline | 109 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 012 073 080 109 116 125 148 173 180 200 224 240 |
| Spread plate | 001 |
| Petrifilm (3M) | 019 029 113 180 181 212 239 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.001 | 212 |
| 0.01 | 212 |
| 0.05 | 001 |
| 1.0 | 012 019 029 073 080 109 113 116 125 148 170 173 180 181 200 224 239 240 |

| Which Selective/Chromogenic Medium Used (APC) | laboratory number |
|---|---|
| Petrifilm (3M) Aerobic Plate Count | 019 029 113 180 181 212 239 |
| Plate Count Agar (PCA) | 001 012 073 080 109 125 148 173 180 200 224 240 |
| Tryptone Soy Agar (TSA) | 116 |
| Columbia Blood Agar (with Sheep Blood) | 122 124 |
| CompactDry Total Count (TC) | 170 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 30 | 001 012 073 080 116 148 173 181 200 224 239 |
| 35 | 019 029 113 125 170 180 212 240 |
| 37 | 109 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 24 | 019 180 |
| 48 | 029 073 109 113 116 125 170 181 212 240 |
| 72 | 001 012 080 148 173 200 224 239 |

## Enumeration of *Clostridium* spp. / *Clostridium perfringens* / Sulphite Reducing Clostridia in Milk Powder

| Accredited Method Used | laboratory number |
|---|---|
| no | 002 005 055 088 148 163 220 238 |
| yes | 030 032 076 078 095 166 168 192 193 196 206 225 234 236 242 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 002 163 166 |
| yes | 005 030 032 055 076 078 088 095 148 168 183 192 193 196 206 220 225 234 236 238 242 |

| Which International Standard? | laboratory number |
|---|---|
| Clostridium perfringens enumeration ISO 7937:2004 | 032 055 076 088 095 183 192 234 236 242 |
| Clostridium perfringens enumeration FDA/BAM Chapter 16 | 196 206 |
| EN ISO 15213-1:2023 | 220 |
| ISO 15213-1 | 030 206 |
| ISO 15213-1 : 2023 & ISO 15213-2 : 2023 | 078 |
| ISO 15213-1:2023; ISO 15213-2:2023 | 193 |
| ISO 15213-2:2023 | 076 |
| MFDS Notice (No.2024-20) Chapter 8. General Test Methods 4.14 Clostridium perfringens | 163 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 002 005 055 076 078 095 148 183 193 196 225 234 |
| Butterfield's Phosphate Buffer | 166 |
| Maximum Recovery Diluent (MRD) | 030 192 242 |
| Peptone Water | 032 088 168 206 220 |
| Ringer's Solution | 236 |
| 0.85 % Saline | 163 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 005 030 076 183 234 |
| Liver broth and fluid thioglycollate broth | 196 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| Liver broth | 196 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 005 030 032 076 078 095 148 163 166 168 183 192 193 206 234 |
| Spread plate | 002 055 |
| Overlay | 088 148 196 220 236 242 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.1 | 032 196 |
| 1.0 | 005 030 055 076 078 088 095 148 163 166 168 183 192 193 206 220 225 234 236 242 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| PCR | 078 166 196 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 35 | 002 005 166 196 206 |
| 37 | 030 032 055 076 078 088 095 148 163 168 183 192 193 220 225 234 236 238 242 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 18 | 055 076 078 095 148 192 |
| 24 | 002 005 032 088 163 166 193 196 206 236 242 |
| 48 | 030 078 168 183 193 220 225 234 236 238 |
| 72 | 220 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20A | 032 076 166 |
| Haemolysis | 234 |
| Indole production | 193 |
| Morphology | 242 |
| Motility | 242 |
| Nitrate/nitrite reduction | 192 196 |
| PCR | 078 |
| VITEK | 030 163 206 220 |

## Enumeration of *Clostridium perfringens*

| Which Selective/Chromogenic Medium Used (Clostridium perfringens) | laboratory number |
|---|---|
| Tryptose Sulphite Cycloserine Agar (TSC) | 005 032 055 076 078 088 095 183 192 193 196 234 236 242 |
| TSC agar egg yolk free | 078 148 163 166 206 |
| SPS agar | 220 |

## Enumeration of *Clostridium* spp.

| Which Selective/Chromogenic Medium Used | laboratory number |
|---|---|
| Sulfite Polymixin Sulphadiazine Agar (SPS) | 220 |
| TSC with egg and concentration of sulphite 0.5 g/L (ISO 15213-1:2023) | 076 |
| Sulfite Iron Tryptose Sulfite (TS) with concentration of sulphite 0.5 g/L (ISO 15213-1:2023) | 183 193 |
| Tryptose Cycloserine Agar | 236 |
| Iron Sulphite Agar (Modified) | 078 |

| Incubation Time (hours) | laboratory number |
|---|---|
| 24 | 236 |
| 48 | 078 183 193 220 |
| 18 | 076 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 37 | 076 078 183 193 220 236 |

| Have you performed heat treatment? | laboratory number |
|---|---|
| no | 076 078 183 193 |
| yes | 220 236 |

## Sulphite Reducing Clostridia (SRC)

| Which Selective/Chromogenic Medium Used | laboratory number |
|---|---|
| Sulfite Polymixin Sulphadiazine Agar (SPS) | 220 |
| Tryptose Sulphite Cycloserine Agar (TSC) with egg and concentration of sulphite 1g/L (ISO 15213:2003) | 088 |
| TSC with egg and concentration of sulphite 0.5 g/L (ISO 15213-1:2023) | 076 |
| Sulfite Iron Tryptose Sulfite (TS) with concentration of sulphite 0.5 g/L (ISO 15213-1:2023) | 030 193 234 238 |
| Tryptose Cycloserine Agar | 183 236 |
| Iron Sulphite Agar (Modified) | 078 206 |
| Iron sulfite agar | 168 |

| Incubation Time (hours) | laboratory number |
|---|---|
| 24 | 236 |
| 48 | 030 078 088 168 183 193 206 220 234 238 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 37 | 030 076 078 088 168 183 193 206 220 234 236 238 |

| Have you performed heat treatment? | laboratory number |
|---|---|
| no | 030 076 078 088 168 183 193 206 234 |
| yes | 220 236 |

# Enumeration of *Escherichia coli in Beef*

| Accredited Method Used | laboratory number |
|---|---|
| no | 012 073 181 208 241 |
| yes | 001 022 033 037 038 039 048 066 105 114 117 123 126 127 148 161 162 164 173 207 211 212 213 214 215 217 222 232 239 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 039 181 207 208 211 213 214 217 239 |
| yes | 001 012 022 033 037 038 048 066 073 105 114 117 123 126 127 148 161 162 164 173 212 215 222 232 241 |

| Which International Standard? | laboratory number |
|---|---|
| APC (pour plate) ISO 4833-1:2013 | 073 |
| Coliforms enumeration ISO 4832:2006 | 033 123 |
| Escherichia coli enumeration ISO 16649-1:2018 | 162 |
| Escherichia coli enumeration ISO 16649-2:2001 | 001 012 022 037 048 117 126 127 148 173 232 |
| Escherichia coli enumeration ISO 16649-3:2015 | 066 |
| Escherichia coli enumeration AOAC 991.14 | 105 161 |
| BAM Chapter 4: Enumeration of Escherichia coli and the Coliform Bacteria | 241 |
| KFDA Method | 208 |
| KOREA FOOD CODE | 217 |
| MOHWM0023.02 | 164 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 001 012 033 048 066 073 105 114 126 148 162 212 222 232 |
| Butterfield's Phosphate Buffer | 039 241 |
| Maximum Recovery Diluent (MRD) | 022 117 127 173 |
| Peptone Water | 123 161 181 239 |
| Phosphate Buffered Saline (PBS) | 207 208 211 213 214 215 |
| 0.85% NaCl Saline | 217 |
| Butterfield’s phosphate-buffered dilution water(BPBW) | 164 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 022 066 073 105 208 212 232 |
| Lauryl Sulphate Broth | 123 |
| Saline diluted | 162 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| Brilliant Green Bile Lactose Broth (BGLB) | 123 |
| EC Broth | 066 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 012 022 033 066 073 114 117 123 127 148 173 215 232 241 |
| Spread plate | 001 048 126 181 |
| Petrifilm (3M) | 039 105 161 162 207 208 211 212 213 214 217 222 239 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.01 | 212 |
| 0.1 | 001 048 126 |
| 1.0 | 012 022 033 039 066 073 105 114 117 123 127 148 161 162 164 173 207 208 211 213 214 215 217 222 232 239 241 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| Most Probable Number - Tube | 066 |
| Petrifilm (3M) | 123 161 162 181 208 212 215 239 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 35 | 039 066 105 123 161 162 164 207 208 211 212 213 214 215 217 222 241 |
| 37 | 012 033 073 181 |
| 42 | 239 |
| 44 | 001 022 048 114 117 126 127 148 173 232 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 24 | 001 012 022 033 039 048 114 117 126 127 148 173 215 222 232 239 241 |
| 48 | 066 073 105 123 161 162 164 181 207 208 211 212 213 214 217 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20E | 073 114 212 |
| beta-glucoronidase activity | 048 127 241 |
| IMViC test | 123 164 232 |
| Indole production | 048 |
| Morphology | 162 |
| VITEK | 033 048 066 |

| Which Selective/Chromogenic Medium Used | laboratory number |
|---|---|
| Petrifilm (3M) E.Coli | 123 181 207 208 211 212 215 217 222 239 |
| Tryptone Bile Glucuronide Agar (TBX) | 001 012 037 066 073 114 117 126 127 148 173 232 |
| Violet Red Bile Lactose Agar | 033 |

## Enumeration of Coliforms *in Beef*

| Accredited Method Used | laboratory number |
|---|---|
| no | 167 169 |
| yes | 009 015 026 033 052 065 066 089 092 108 109 114 123 129 131 151 165 179 188 204 212 222 240 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 089 109 129 167 169 188 |
| yes | 009 015 026 033 052 065 066 092 108 114 123 131 151 165 179 204 212 222 240 |

| Which International Standard? | laboratory number |
|---|---|
| APC (pour plate) ISO 4833-1:2013 | 204 |
| Bacillus cereus enumeration FDA/BAM Chapter 14 | 092 |
| Coliforms enumeration ISO 4832:2006 | 009 015 033 052 123 151 165 |
| Coliforms enumeration ISO 4831:2006 | 179 |
| Escherichia coli enumeration ISO 16649-3:2015 | 066 |
| BACTERIOLOGICAL ANALYTICAL MANUAL (BAM) ON LINE CHAPTER 4 OCTOBER 2020 | 240 |
| coliforms KFDA 8.4.7.2 | 108 |
| GB 4789.3-2010 | 167 |
| GB 4789.3-2016 | 109 |
| Nordval 020 - AOAC 050601 | 131 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 009 026 033 052 065 066 089 092 109 114 131 151 165 167 169 212 222 |
| Butterfield's Phosphate Buffer | 108 240 |
| Maximum Recovery Diluent (MRD) | 015 |
| Peptone Water | 123 188 |
| Phosphate Buffered Saline (PBS) | 129 |
| Ringer's Solution | 179 |
| 8.5% NaCl solution | 204 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 026 066 092 131 169 212 240 |
| Modified Lauryl Sulphate Tryptose Broth (mLST) | 123 129 |
| Lauryl Sulphate Broth | 026 188 |
| NONE | 109 |
| Saline peptone water | 009 |
| Violet Red Bile Agar | 167 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| Brilliant Green Bile Broth (BGBB) | 026 |
| Brilliant Green Bile Lactose Broth (BGLB) | 066 123 129 188 240 |
| NONE | 109 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 009 015 033 052 066 092 109 131 151 167 169 240 |
| Overlay | 114 |
| Petrifilm (3M) | 026 065 089 108 123 179 204 212 222 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.01 | 212 |
| 1.0 | 009 015 026 033 052 065 066 089 092 108 109 114 123 129 131 151 167 169 188 204 222 240 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| Most Probable Number - Tube | 026 066 |
| Petrifilm (3M) | 065 108 109 123 204 212 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 35 | 065 066 092 108 123 129 169 179 188 204 212 222 240 |
| 37 | 009 015 026 033 052 089 109 114 131 151 167 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 24 | 009 015 033 052 065 089 092 108 109 114 131 151 167 169 179 204 212 |
| 48 | 026 066 123 129 188 222 240 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20E | 123 212 |
| Fermentation of Carbohydrates | 015 052 109 114 |
| Motility | 179 |
| PCR | 151 |
| VITEK | 033 066 |

| Which Selective/Chromogenic Medium Used (Coliforms) | laboratory number |
|---|---|
| Brilliant Green Bile Broth (BGBB) | 009 |
| Brilliant Green Bile Lactose Broth (BGLB) | 066 109 123 129 |
| Petrifilm (3M) Colliforms | 026 065 108 204 212 |
| Violet Red Bile Agar (VRB) | 092 167 240 |
| Violet Red Bile Lactose Agar (VRBL) | 015 033 052 151 |
| Rapid Ecoli2 Agar | 131 |

## Detection of *Listeria monocytogenes*/*Listeria* spp. in Chicken

| Accredited Method Used | laboratory number |
|---|---|
| no | 027 072 097 098 111 134 167 172 238 241 |
| yes | 010 020 021 033 038 040 044 053 056 058 063 071 075 085 086 090 104 106 118 130 135 139 144 145 146 155 156 162 164 174 176 177 186 195 197 198 199 210 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 021 027 040 053 058 097 111 118 134 135 144 145 167 174 176 |
| yes | 010 018 020 033 038 044 056 063 071 072 075 085 086 090 098 104 106 130 139 146 155 156 162 164 172 177 186 195 197 198 199 210 238 241 |

| Which International Standard? | laboratory number |
|---|---|
| Clostridium perfringens enumeration FDA/BAM Chapter 16 | 021 |
| Listeria monocytogenes detection ISO 11290-1:2017 | 010 018 033 038 044 056 063 071 072 085 086 090 098 104 106 139 146 156 162 172 174 177 186 195 197 198 199 238 241 |
| 3M Molecular Detection Assay 2 - Listeria monocytogenes (AOAC 2016.08) | 155 |
| AOAC2016.08 | 164 |
| Compass Listeria Referance BKR 23/02-11-02 | 130 |
| GB 4789.30-2016 | 040 111 167 210 |
| GB 4789.30-2016 National food safety standards - Microbiological testing of food - Detection of Listeria monocytogenes | 174 |
| Health Canada Compendium of Analytical Methods | 075 |
| Método Vidas LMO xpress (LMX) | 134 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 010 020 027 044 053 063 075 086 104 111 139 162 167 172 174 176 210 |
| Half Fraser Broth | 056 058 071 085 097 130 156 177 186 195 198 241 |
| Phosphate Buffered Saline (PBS) | 040 |
| 3M Demi-Fraser Broth Base | 018 |
| Caldo LMX | 134 |
| Demi-Fraser Broth enrichment medium (includes ferric ammonium citrate) | 155 |
| Listeria broth | 098 |
| LMX | 072 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 097 |
| Fraser Broth | 058 071 130 177 186 195 241 |
| Half Fraser Broth | 020 021 033 044 053 056 085 086 090 146 156 172 174 198 |
| Listeria Enrichment Broth 1 (LEB) | 027 063 075 098 106 111 139 144 162 167 174 210 |
| Buffered listeria enrichment broth | 176 |
| Caldo LMX | 134 |
| Demi-Fraser Broth | 155 |
| LB1 | 040 |
| lpt broth | 104 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| Fraser Broth | 033 044 053 056 063 085 086 090 130 139 146 156 162 172 174 186 195 198 241 |
| Rappaport Vassiliadis Broth (RV) | 098 |
| Rappaport Vassiliadis Soya Peptone(RVS) | 071 |
| - | 134 |
| LB2 | 040 167 |
| Listeria Enrichment Broth 2 | 174 |
| Listeria Enrichment Broth 2 (LEB) | 111 210 |
| Morpholinepropanesulfonic acid-buffered Listeria enrichment broth (MOPS-BLEB) | 075 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 040 063 |
| Spread plate | 010 027 033 056 058 072 075 098 104 111 130 135 144 145 156 162 167 172 174 186 210 |
| Overlay | 021 071 086 241 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.001 | 072 |
| 0.01 | 027 033 063 111 135 144 145 146 167 198 210 241 |
| 0.05 | 104 |
| 0.1 | 010 021 040 056 058 071 075 086 090 098 139 156 162 172 174 186 |
| 0.5 | 097 |
| 1.0 | 020 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| MOLDI-TOF | 106 111 162 |
| PCR | 020 027 056 075 097 098 130 146 167 176 |
| Petrifilm (3M) | 172 |
| RapidChek | 058 063 |
| VIDAS (ELFA) | 010 040 071 072 086 090 210 |
| miniVIDAS (ELFA) | 053 085 104 134 156 174 177 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 30 | 020 027 040 056 075 090 111 130 135 144 145 162 174 176 195 198 210 241 |
| 35 | 021 063 086 097 098 106 139 |
| 37 | 010 018 033 044 053 058 071 072 085 104 134 146 155 156 164 167 172 186 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 24 | 010 018 020 027 040 044 053 058 063 072 085 097 098 130 134 135 144 145 155 156 164 167 174 198 210 241 |
| 36 | 104 111 |
| 48 | 021 027 033 056 071 075 086 090 106 139 146 162 172 174 176 186 195 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| Aesculin hydrolysis | 027 |
| API Listeria | 063 075 130 155 197 |
| CAMP test | 090 139 186 |
| Catalase reaction | 058 090 139 172 186 198 |
| Fermentation of Carbohydrates | 053 058 090 146 186 198 |
| Haemolysis | 027 058 090 139 146 172 186 198 |
| Morphology | 058 090 |
| Microscopy | 027 090 139 172 186 198 |
| Motility | 027 090 |
| Oxidase reaction | 139 |
| Serological agglutination test | 139 |
| PCR | 056 097 098 104 167 241 |
| VITEK | 010 027 033 040 044 071 085 086 111 156 162 174 176 177 195 210 |
| Voges-Proskauer (VP) reaction | 090 135 144 145 |

## Detection of *Listeria monocytogenes*

| Which Selective/Chromogenic Medium Used (Listeria) | laboratory number |
|---|---|
| Agar Listeria Ottavani Agosti (ALOA) | 044 053 071 085 086 090 106 130 134 155 174 186 197 198 210 241 |
| PALCAM Agar | 027 090 135 144 145 174 186 195 197 |
| Chromogenic Listeria Agar (Oxoid) | 021 063 111 135 167 |
| Ottavani Agosti Agar (OAA) | 010 130 177 |
| Oxford Agar | 044 075 086 130 198 |
| Modified Oxford Agar (MOX) | 033 139 176 |
| Brilliance Listeria Agar (OCLA) | 033 072 146 |
| Rapid L. mono | 020 058 075 104 |
| Chromogenic Listeria Agar (Land Bridge) | 174 |

| Which Selective/Chromogenic Medium Used (Listeria) | laboratory number |
|---|---|
| PALCAM Agar | 172 |

# Detection of *Salmonella* spp. in Salad

| Accredited Method Used | laboratory number |
|---|---|
| no | 005 011 061 087 167 203 219 |
| yes | 017 034 035 046 051 055 057 059 062 068 071 074 077 079 082 083 103 121 132 137 139 140 141 159 160 191 195 242 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 011 017 055 062 068 077 079 137 167 203 242 |
| yes | 005 034 035 046 051 057 059 061 071 074 082 083 087 103 121 132 139 140 141 160 191 195 219 |

| Which International Standard? | laboratory number |
|---|---|
| Salmonella spp. detection ISO 6579-1:2017 | 035 046 051 061 071 074 079 103 121 132 140 141 160 242 |
| Salmonella spp. detection FDA/BAM Chapter 5 | 083 195 203 219 |
| AOAC Official Method 2016.01 | 191 |
| GB 4789.4-2016 | 167 |
| Health Canada Compendium of Analytical Methods | 057 |
| SureTectTM Salmonella species PCR assay | 011 |
| VIDAS | 034 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 005 017 034 035 046 051 055 057 059 061 062 068 071 074 077 079 082 083 087 103 121 132 137 139 140 141 160 167 191 195 203 219 242 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 011 017 057 059 077 079 087 103 121 132 137 140 141 160 167 191 242 |
| Mueller Kauffman Tetrathionate Novobiocin Broth (MKKTn) | 035 046 051 061 074 082 |
| Rappaport Vassiliadis Broth (RV) | 062 068 195 203 |
| Rappaport Vassiliadis Soya Peptone(RVS) | 061 071 |
| Lactose Broth | 083 |
| Universal Pre-enrichment Broth | 219 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| Rappaport Vassiliadis Broth (RV) | 079 082 083 121 132 139 141 195 219 |
| Rappaport Vassiliadis Soya Peptone(RVS) | 035 046 051 057 074 103 160 167 242 |
| Tetrathionate Broth | 057 062 068 071 083 140 203 219 |
| Broth Rappaport Vassiliadis (RV), Müller-Kauffmann Tetrathionate-Novobiocine Broth (MKTTn) | 191 |
| Mueller Kauffmann Tetrathionate Broth | 242 |

| Plating Method Used | laboratory number |
|---|---|
| Spread plate | 011 017 035 055 057 062 068 074 077 079 082 083 103 121 132 137 140 141 160 167 195 203 242 |
| Overlay | 046 071 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.001 | 062 160 |
| 0.01 | 035 057 059 083 140 167 242 |
| 0.1 | 011 046 051 055 071 074 121 132 137 139 203 219 |
| 0.5 | 082 |
| 1.0 | 046 068 079 103 219 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| Immunofluorescence assay | 055 |
| Loop Mediated Isothermal Amplification (LAMP) | 005 057 191 |
| PCR | 011 059 068 077 079 082 087 103 132 141 167 203 242 |
| Petrifilm (3M) | 139 |
| VIDAS (ELFA) | 071 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 35 | 062 082 083 137 139 140 195 203 219 |
| 37 | 005 011 017 035 046 051 055 057 059 061 068 071 074 079 087 103 141 160 242 |
| 41.5 | 034 077 132 191 |
| 42 | 121 167 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 18 | 061 |
| 24 | 005 011 017 034 035 051 055 057 059 061 062 068 074 077 079 082 083 087 103 121 132 137 139 140 160 167 191 195 203 242 |
| 36 | 046 |
| 48 | 071 |
| 72 | 141 |
| 120 | 219 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20E | 035 055 141 219 242 |
| Indole production | 061 139 |
| Latex slide agglutination | 011 017 074 087 |
| Lysine Decarboxylase | 061 139 |
| Lysine Iron Agar | 057 |
| Oxidase reaction | 137 242 |
| Serological agglutination test | 057 061 242 |
| PCR | 051 059 077 132 167 |
| VITEK | 057 062 068 071 079 082 083 103 121 140 191 195 203 |
| Triple Sugar Iron Agar (TSI) | 046 057 061 139 160 242 |

| Which Selective/Chromogenic Medium Used | laboratory number |
|---|---|
| Bismuth Sulfite Agar (BSA) | 061 103 219 |
| Brilliant Green Agar (BGA) | 046 |
| Brilliance Salmonella Agar | 011 051 057 132 |
| Chromogenic Salmonella Agar (Oxoid) | 055 077 242 |
| Hektoen Agar | 219 |
| MacConkey Agar | 057 |
| Salmonella Chromogenic Medium | 059 167 |
| Xylose Lysine Desoxycholate Agar (XLD) | 035 046 051 059 061 062 071 074 079 082 087 103 121 137 139 140 141 160 195 203 219 |
| Hektoen Agar, Xylose-Lysine-Desoxycholate Agar (XLD), Bismuth Sulfite Agar (BSA) | 191 |
| Rapid Salmonella | 017 |

## Detection of *Salmonella* spp. in Animal Feed

| Accredited Method Used | laboratory number |
|---|---|
| no | 004 007 142 147 152 187 189 201 205 |
| yes | 003 009 014 023 031 036 069 081 091 093 099 100 102 128 136 143 171 175 176 178 204 215 226 237 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 004 007 023 091 152 176 178 187 205 226 |
| yes | 003 009 014 031 036 069 081 093 099 100 102 128 136 142 143 147 171 175 189 201 204 215 237 |

| Which International Standard? | laboratory number |
|---|---|
| Salmonella spp. detection ISO 6579-1:2017 | 003 009 014 031 036 069 081 099 100 142 143 147 175 189 201 204 237 |
| Salmonella spp. detection ISO 6579-3:2014 | 205 |
| Salmonella spp. detection FDA/BAM Chapter 5 | 215 |
| Biologia Molecular 3M | 187 |
| Certification AOAC 042001 Simultaneous Multiplex Real Time PCR (Simul q-PCR) Salmonella with GFP Assay (Applied Food ) | 102 |
| Salmonella spp. detection ISO 6579-1 (2020-08) | 128 |
| Salmonella spp. detection ISO 6579-1:2020 | 171 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 003 004 007 009 014 023 031 036 069 081 091 093 100 102 136 142 143 147 152 171 175 178 187 189 201 204 205 215 226 237 |
| Maximum Recovery Diluent (MRD) | 099 |
| Peptone Water | 128 |
| Lactose broth | 176 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 003 007 023 036 069 099 102 128 136 142 171 187 189 201 204 226 |
| Mueller Kauffman Tetrathionate Novobiocin Broth (MKKTn) | 009 014 031 081 093 143 147 |
| Rappaport Vassiliadis Broth (RV) | 176 178 205 |
| Modified Semi-Solid Rappaport Vassiliadis (MSRV) | 091 215 |
| Rappaport Vassiliadis Soya Peptone(RVS) | 093 147 175 237 |
| a second -line culture of bacteria : RV broth & TT broth | 178 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| Rappaport Vassiliadis Broth (RV) | 069 081 128 142 201 |
| Rappaport Vassiliadis Soya Peptone(RVS) | 009 014 031 036 093 099 143 189 204 237 |
| Selenite Cysteine Broth | 215 |
| Tetrathionate Broth | 189 |
| Kit Applied Food Simul q-PCR | 102 |
| Müller-Kauffmann-Tetrathionate-Novobiocin-Bouillon (MKttn) | 099 |
| segregated culture: XLD & BGSA Agar | 178 |
| XLD agar | 205 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 009 128 142 171 201 |
| Spread plate | 036 069 093 099 147 152 175 189 205 237 |
| Overlay | 091 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.01 | 091 152 189 237 |
| 0.05 | 036 102 |
| 0.1 | 009 069 128 142 147 171 176 201 |
| 0.5 | 007 136 147 |
| 1.0 | 031 143 |
| 0.2 microlitros | 187 |
| 25 g | 099 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| Loop Mediated Isothermal Amplification (LAMP) | 009 |
| MOLDI-TOF | 171 |
| PCR | 004 007 014 031 036 069 091 093 100 102 142 143 205 215 226 237 |
| VIDAS (ELFA) | 023 128 147 175 |
| miniVIDAS (ELFA) | 136 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 35 | 176 204 215 |
| 37 | 003 004 007 009 014 031 091 093 099 128 142 143 147 152 171 175 189 201 205 |
| 41.5 | 023 036 069 081 102 187 237 |
| 42 | 136 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 18 | 003 007 023 128 143 201 205 237 |
| 24 | 004 009 014 031 069 081 091 093 099 102 136 142 147 152 171 175 176 187 189 204 215 |
| 48 | 036 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20A | 152 |
| API 20E | 031 069 081 093 136 142 171 178 204 |
| API RapidID 20E | 023 |
| API 50 CH | 178 |
| Enterotube (BBL) | 175 |
| IMViC test | 189 |
| Indole production | 189 |
| Latex slide agglutination | 004 201 215 |
| Lysine Decarboxylase | 099 |
| Lysine Iron Agar | 189 |
| Motility | 189 |
| Nitrate/nitrite reduction | 189 |
| Oxidase reaction | 023 147 189 |
| Serological agglutination test | 023 147 189 |
| PCR | 003 007 014 036 091 102 128 143 205 226 |
| VITEK | 147 176 |
| Voges-Proskauer (VP) reaction | 189 |
| Triple Sugar Iron Agar (TSI) | 009 099 189 |

| Which Selective/Chromogenic Medium Used (Salmonella spp.) | laboratory number |
|---|---|
| Brilliant Green Agar (BGA) | 138 147 |
| Brilliance Salmonella Agar | 093 099 |
| Brilliant Green Phenol Red Lactose Sucrose Agar (BPLS) | 171 |
| Chromogenic Salmonella Agar (Oxoid) | 069 237 |
| Hektoen Agar | 093 |
| MacConkey Agar | 204 |
| Rambach Agar | 189 |
| Salmonella Chromogenic Medium | 036 091 175 |
| Xylose Lysine Desoxycholate Agar (XLD) | 009 014 031 081 093 099 100 128 136 138 142 143 147 150 171 176 178 189 205 215 |
| PCR | 004 |

## Detection of *Escherichia coli* O157:H7 in Beef

| Accredited Method Used | laboratory number |
|---|---|
| no | 002 016 050 060 112 141 190 |
| yes | 006 010 025 028 041 042 046 056 064 070 077 094 101 106 107 120 127 130 149 158 194 195 198 233 234 235 |

| Method Based on an International Standard | laboratory number |
|---|---|
| no | 002 042 077 120 149 233 |
| yes | 006 010 016 025 028 041 046 050 056 060 064 070 094 101 106 107 112 127 130 141 158 190 194 195 198 234 235 |

| Which International Standard? | laboratory number |
|---|---|
| APC AOAC 990.12 | 070 |
| Escherichia coli O157:H7 detection ISO 16654:2001 | 006 010 046 050 056 060 106 127 130 195 234 235 |
| Escherichia coli O157:H7 detection ISO/TS 13136:2012 (PCR) | 025 056 112 141 235 |
| 1.RapidChek® E. coli O157 (including H7) Lateral Flow Test Assay/ Certificate No.070801, 2019, RapidChek 2.Summary of Food Validated with RapidChek E. coli O157 | 198 |
| AFNOR BIO 12/25-05/09 | 190 |
| AFNOR No.: BRD 07/14-09/07 (RAPID' E. coli O157 : H7) | 064 |
| AOAC 996.09 | 101 |
| Detection of Escherichia coli O157:H7 by multiplex PCR. Journal of Clinical Microbiology 33(8):2188-2191 | 042 |
| MOHWM0017.03 | 094 |
| PCR BIORAD | 158 |
| USFDA BAM | 028 |

| Which Initial Suspension/Diluent Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 002 010 025 028 041 042 056 077 101 120 141 149 158 190 |
| Maximum Recovery Diluent (MRD) | 127 |
| Peptone Water | 016 |
| BAX MP media broth | 233 |
| mEHEC | 112 |
| Modified Tryptone Soya Broth (mTSB) | 064 |
| MTSB | 046 060 130 235 |
| RapidChek® E. coli O157 (Including H7) media | 198 |

| Which Primary Enrichment Medium Used | laboratory number |
|---|---|
| Buffered Peptone Water (BPW) | 010 016 028 041 042 056 158 194 |
| Enterobacteriaceae Enrichment broth (EE) | 002 120 |
| Tryptone Soya Broth | 050 106 127 |
| Brain heart infusion broth | 094 |
| mEC+n | 149 |
| mEHEC | 112 |
| Modified Trypticase Soy Broth + novobiocin with casamino acids | 101 |
| Modified Tryptone Soya Broth (mTSB) | 064 |
| MP media | 141 |
| MP Media (Broth) | 025 |
| mTSB | 060 |
| RapidChek® E. coli O157 (Including H7) media | 198 |
| Vancomycin-buffered peptone water | 190 |

| Which Secondary Enrichment Medium Used | laboratory number |
|---|---|
| CT – SMAC | 198 |
| mEHEC | 112 |
| Nil | 042 |
| No | 028 |
| RAPID' E. coli O157:H7 agar plate | 064 |
| Tryptone phosphate broth | 094 |

| Plating Method Used | laboratory number |
|---|---|
| Pour plate | 060 |
| Spread plate | 002 006 010 016 028 050 056 077 127 130 233 235 |
| Overlay | 046 064 101 |

| Inoculum Volume (ml) | laboratory number |
|---|---|
| 0.01 | 194 198 |
| 0.05 | 064 127 235 |
| 0.1 | 010 028 050 056 060 101 |
| 0.5 | 190 |
| 1.0 | 042 112 |
| >2.0 | 094 |
| 0.35 | 233 |

| Alternative/Rapid Method | laboratory number |
|---|---|
| MOLDI-TOF | 002 |
| PCR | 006 016 025 041 042 077 106 112 141 194 195 233 235 |
| VIDAS (ELFA) | 010 056 070 190 |

| Incubation Temperature (°C) | laboratory number |
|---|---|
| 35 | 002 094 101 106 195 |
| 37 | 006 028 041 042 046 050 064 120 127 149 235 |
| 41.5 | 010 025 056 060 070 077 112 130 141 190 194 198 233 |
| 42 | 016 |

| Time Incubated (hours) Approximately | laboratory number |
|---|---|
| 18 | 050 060 112 198 233 |
| 24 | 002 006 010 016 025 028 041 042 046 050 056 064 070 077 101 106 120 127 130 141 149 190 194 195 235 |

| Confirmation of Organism's Identity | laboratory number |
|---|---|
| API 20E | 101 190 |
| Indole production | 127 130 |
| Latex slide agglutination | 046 060 127 194 |
| Lysine Decarboxylase | 149 |
| Microscopy | 149 |
| Motility | 149 |
| Ornithine decarboxylase | 149 |
| Oxidase reaction | 130 149 |
| Serological agglutination test | 028 041 064 130 149 233 235 |
| PCR | 006 042 056 077 112 141 |
| VITEK | 010 050 056 094 106 120 195 |
| Triple Sugar Iron Agar (TSI) | 149 |

| Which Selective/Chromogenic Medium Used | laboratory number |
|---|---|
| Cefixine Tellurite Sorbitol MacConkey agar (CT-SMAC) | 046 077 101 120 127 130 190 194 195 198 233 234 |
| Chrom ID O157:H7 | 016 |
| CHROMAgar O157 | 028 130 |
| SMAC-BCIG | 010 041 106 127 |
| CT-SMAC (Oxoid) | 235 |
| MacConkey agar/L-EMB agar | 094 |
| RAPID' E. coli O157 : H7 agar plate (Biorad) | 064 |

# APPENDIX IV: 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® – Food Microbiology proficiency tests.

## 2. PROTOCOL

The Protocols [7, 8] set out how Fapas® – Food Microbiology is organised. Copies can be downloaded from our website.

## 3. CONTACT DETAILS

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

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