

# Proficiency Testing

## Food Microbiology

January 2015



*Edition*

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# *Proficiency Testing*

## **Microbiology – Food**

### January 2015



1457  
ISO/IEC 17043

#### **Quantitative analyses**

- Aerobic microorganisms, 30 °C
- Enterobacteriaceae
- Thermotolerant campylobacter
- *Listeria monocytogenes*

#### **Qualitative analyses**

- Thermotolerant campylobacter
- *Listeria monocytogenes*
- *Salmonella*
- *Escherichia coli* O157
- Pathogenic *Vibrio* spp.
- *Yersinia enterocolitica*

## **Abbreviations**

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### **Media**

ALOA	Agar Listeria Ottaviani & Agosti
APW 2%	Alcaline peptone water, 2 % NaCl
BriS	Brilliance Salmonella-agar
BPW	Buffered peptone water
CIN	Cefsulodin-irgasan-novobiocin-agar
CT-SMAC	Cefixime-tellurite-sorbitol-MacConkey-agar
LMBA	Listeria monocytogenes Blood-agar
MPCA	Milk Plate Count Agar
MRB	Modified Rappaport broth
mTSB	Modified Tryptone soya broth
PSB	Phosphate-sorbitol-broth
PCA	Plate Count Agar
RVS	Rappaport-Vassiliadis-soya peptone-broth
SPB	Salt-polymyxin-broth
TCBS	Thiosulfate citrate salt sucrose Agar
TSA	Tryptone-Soya-Agar
XLD	Xylose lysine deoxycholate agar
VRBG	Violet Red Bile Glucose agar

### **Organisations**

ISO	International Organization for Standardization
NMKL	Nordic Committee for Food Analyses
SLV/NFA	Livsmedelsverket/National Food Agency, Sweden

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# General information on results evaluation

## Statistical evaluation of the results

Highly deviating values that did not belong to a strictly normal distribution were identified as statistical outliers (Grubbs' test modified by Kelly (1)). In some cases, subjective adjustments were made to set limits, based on knowledge of the mixture's contents. Outliers and false results were not included in the calculations of means and standard deviations. Results reported as “>value” were excluded from the evaluation. Results reported as “<value” were interpreted as being zero (negative result). All reported results are presented in Annex 1.

According to EN ISO/IEC 17043, for which the proficiency testing programme organised by the National Food Agency is accredited since early 2012, it is mandatory for the participating laboratories to give method information for all analyses for which they report results. Method information is sometimes difficult to interpret, e.g. several laboratories choose a medium that differs from that in the reported standard methods. Therefore, in the following section, results have been grouped according to the method or the medium used to perform the analysis.

## Uncertainty of measurement for the assigned values

The uncertainty of measurement for an assigned value is calculated as the standard deviation divided by the square root of the number of correct results (“standard error”). The assigned value of evaluated parameters is the mean value of participants results.

## Tables and figures legend

### Tables

n	number of laboratory that performed the analysis
m	results mean value in $\log_{10}$ cfu/ml (false results and outliers excluded)
s	results standard deviation
F	number of false positive or false negative results
<	number of low outliers
>	number of high outliers
	global results for the analysis
	values discussed in the text

### Figures

Histograms of all analytical results obtained for each mixture are presented. The mean value of the analysis results is indicated in each histogram.

- values within the interval of acceptance (Annex 1)
- outliers
- false negative results
- \* values outside of the x-axis scale

# Results of the PT round January 15

## General outcome

Samples were sent to 163 laboratories, 34 in Sweden, 111 in other European countries, and 18 outside Europe. 158 laboratories reported results, 47 (30 %) provided at least one result that received an annotation. In the previous round (January 2014) with similar analyses, the proportion was 32 %.

Individual results for each analysis of the PT round are listed in annex 1 and are also available on the website after logging in: [www2.slv.se/absint](http://www2.slv.se/absint).

**Table 1** Microorganisms in each mixture and % of deviating results (F%: false positive or false negative, Out: outliers).

	Mixture A			Mixture B			Mixture C			
% participants with	0 annotation	1 annotation	2 annotations	>2 annotations	0 annotation	1 annotation	2 annotations	>2 annotations		
% participants with										
Organisms		<i>Staphylococcus saprophyticus</i> <i>Hafnia alvei</i> <i>Listeria seeligeri</i> <i>Listeria ivanovii</i> <i>Salmonella Enteritidis</i> <i>Vibrio cholera</i>			<i>Citrobacter freundii</i> <i>Listeria monocytogenes</i> <i>Vibrio parahaemolyticus</i> <i>Vibrio cholera</i>			<i>Micrococcus sp.</i> <i>Yersinia enterocolitica</i> <i>Campylobacter jejuni</i> <i>Salmonella Dublin</i> <i>Escherichia coli O157</i>		
Analysis	Target	F%	Out	Target	F%	Out	Target	F%	Out	
Aerob. microorg, 30 °C	<i>S. saprophyticus</i> <i>H. alvei</i>	0	3	<i>C. freundii</i>	0	4	<i>Micrococcus</i> <i>sp.</i>	0	11	
Enterobacteriaceae	<i>H. alvei</i>	1	5	<i>C. freundii</i>	2	3	<i>Y.</i> <i>enterocolitica</i>	21	0	
Thermo. camp.	Quant.	0	-	<i>C. freundii</i>	0	-	<i>C. jejuni</i>	18	0	
		0	-		0	-		0	-	
<i>L. mono-</i> <i>cytogenes</i>	Quant.	( <i>L. seeligeri</i> )	-	<i>L.</i> <i>monocytogenes</i>	6	2	<i>C. jejuni</i>	0	-	
	Qual.	( <i>L. ivanovii</i> )	-		0	-		0	-	
Salmonella	<i>S. Enteritidis</i>	2	-	( <i>C. freundii</i> )	2	-	<i>S. Dublin</i>	7	-	
<i>E. coli</i> O157	-	0	-	-	0	-	<i>E. coli</i> O157	4	-	
Path. <i>Vibrio</i> spp.	<i>V. cholera</i>	4	-	<i>V. para-</i> <i>haemolyticus</i>	17	-	-	9	-	
<i>Y. enterocolitica</i>	-	7	-	( <i>C. freundii</i> )	7	-	<i>Y.</i> <i>enterocolitica</i>	0	-	

- : no target organism or no value; (microorganism): false positive

## Aerobic microorganisms, 30 °C

### Mixture A

The colonies counted for this analysis were mainly from the strains of *Staphylococcus saprophyticus* and *Hafnia alvei* present at the highest concentration in mixture A.

### Mixture B

The colonies counted for this analysis were mainly from the strain of *Citrobacter freundii* present at the highest concentration in mixture B.

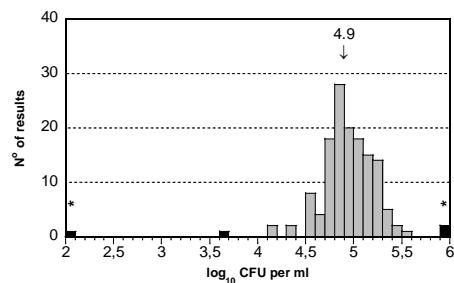
### Mixture C

The colonies counted for this analysis were mainly from the strain of *Micrococcus sp.* present at the highest concentration in mixture C.

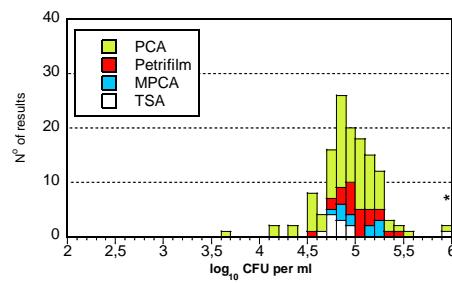
#### Results of aerobic microorganisms analysis

Medium	Mixture A					Mixture B					Mixture C				
	n	m	s	F	< >	n	m	s	F	< >	n	m	s	F	< >
Total	141	4.93	0.24	0	2 >	140	3.76	0.19	0	2 >	141	4.47	0.12	0	11 > 5
PCA	86	4.91	0.26	0	1 >	85	3.69	0.17	0	0 >	86	4.48	0.11	0	3 > 2
Petrifilm™ AC	24	5.01	0.20	0	0 >	24	3.92	0.14	1	0 >	24	4.39	0.13	0	4 > 0
MPCA	11	5.01	0.18	0	0 >	11	3.79	0.13	0	0 >	11	4.54	0.12	0	0 > 0
TSA	11	4.78	0.08	0	0 > 1	11	3.85	0.14	0	0 > 1	11	4.49	0.07	0	1 > 2

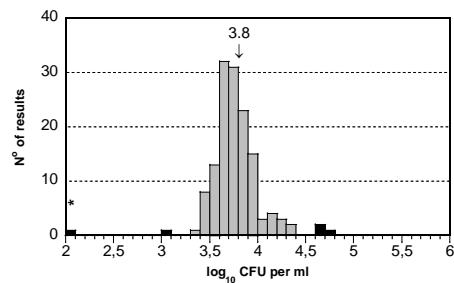
A



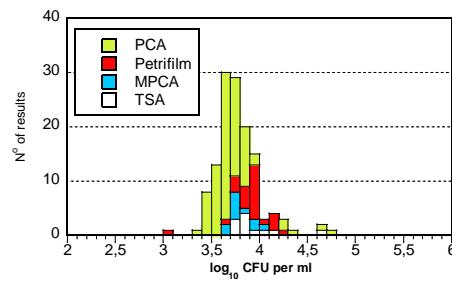
A



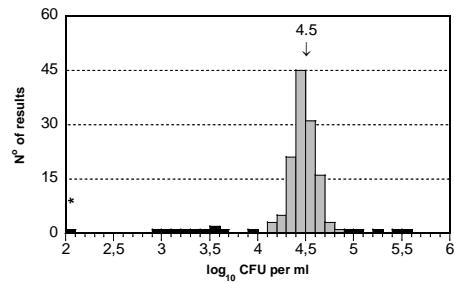
B



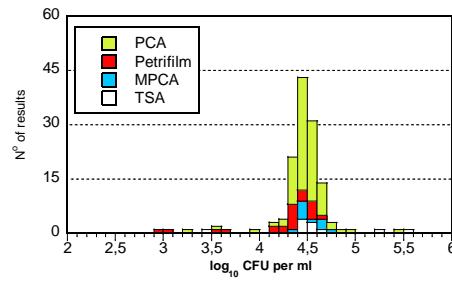
B



C



C



The results from mixture A are more spread (wider peak) than for mixture B and C. In mixture A counted colonies are from two different microorganisms while only from one in mixture B and C; a bigger variability in colonies appearance could lead to a higher variation in colonies enumeration. However this is not true for the results obtained with TSA: for mixture A results obtained by laboratories using this medium are less spread than the overall results (standard deviation 0.08 versus 0.24) and the average value is lower than the global average value (4.78 versus 4.93). This suggest that *S. saprophyticus* and *H. alvei* formed less colonies on TSA and that the reading of plates led somehow to more reproducible counts.

For mixture B, results obtained with the use of Petrifilm™ tend to be higher than the general results average. This suggests that the indicator dye present in Petrifilm™ could facilitate the enumeration of colonies of *C. freundii* and therefore lead to higher counts. Several laboratories reported low outliers for mixture C but these results could not be linked to a specific method and/or medium.

## Enterobacteriaceae

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### Mixture A

*Hafnia alvei* was the target-organism for this analysis.

### Mixture B

*Citrobacter freundii* was the target-organism for this analysis.

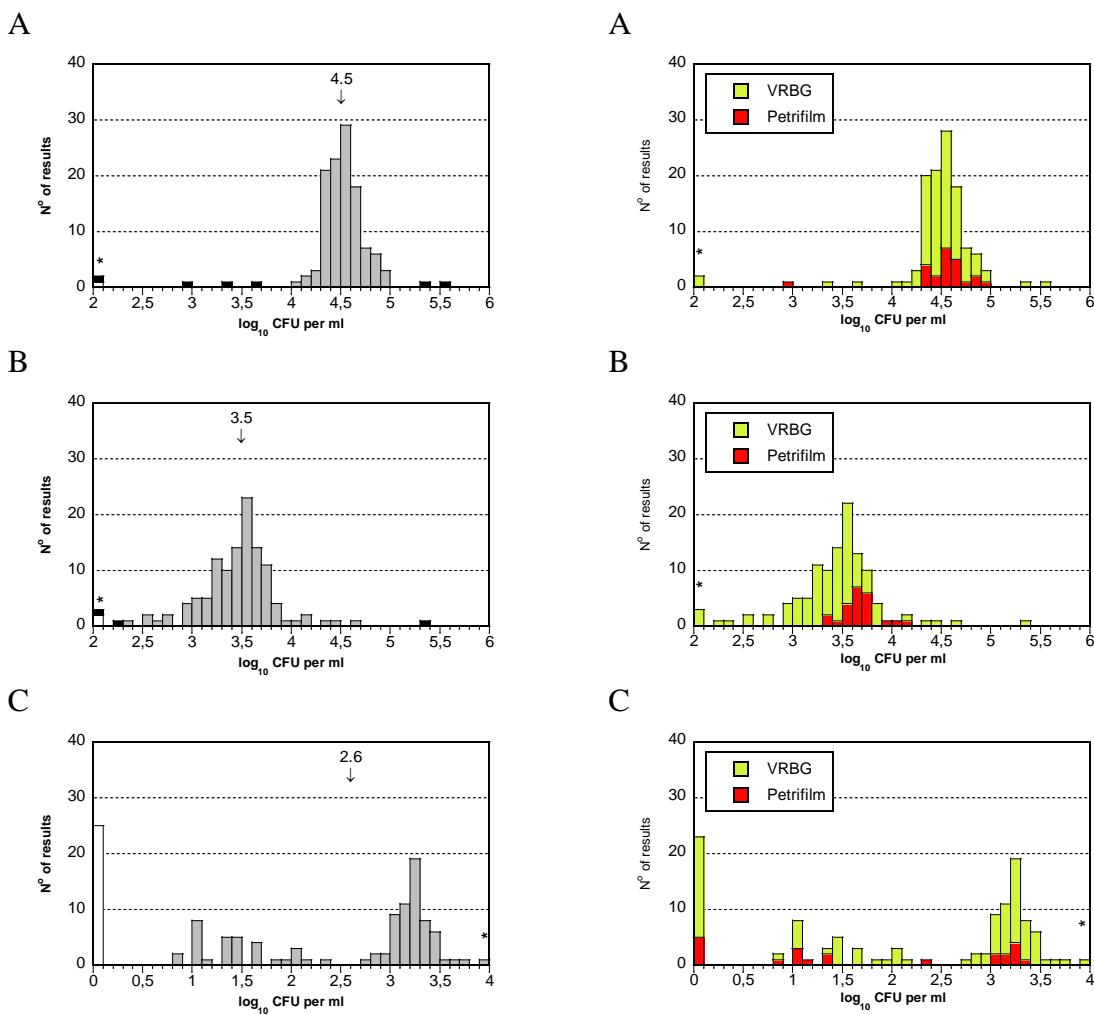
### Mixture C

21% of the laboratories reported a false negative result even though mixture C contained three Enterobacteriaceae strains, *Yersinia enterocolitica*, *Salmonella* Dublin and *E. coli* O157 at a concentration of 3.5, 1.1 and 1.2 log<sub>10</sub> cfu/ml, respectively. At NFA, *Y. enterolitica* formed typical but very small colonies on VRBG. Colonies of *Salmonella* and *E. coli* O157 could be counted only if performing the analysis from the undiluted sample or the highest recommended dilution (10<sup>-1</sup>); these colonies account for the reported results around 1.0 log<sub>10</sub> cfu/ml. The small size of *Y. enterocolitica* colonies and the low concentration of *S. Dublin* and *E. coli* O157 explain the high amount of false results as well as the very high dispersion of the results.

Considering the difficulty of the analysis, the results are not evaluated and therefore no z-scores are calculated. Moreover, these results are not taken into account in the tables under the box plots.

### Results of Enterobacteriaceae analysis

Medium	Mixture A					Mixture B					Mixture C							
	n	m	s	F	<	>	n	m	s	F	<	>	n	m	s	F	<	>
Total	120	4.52	0.17	1	4	2	120	3.46	0.36	2	2	1	119	2.62	0.93	25	0	0
VRBG	94	4.51	0.16	1	3	2	94	3.41	0.36	2	2	1	94	2.75	0.86	20	0	0
Petrifilm™ Ent.	23	4.58	0.16	0	1	0	23	3.67	0.19	0	0	0	22	2.27	1.02	5	0	0



Most of the laboratories used VRBG plate or Petrifilm<sup>TM</sup> for the analysis of Enterobacteriaceae which did not lead to significant results differences when analysing mixture A.

For mixture B, laboratories using Petrifilm<sup>TM</sup> reported values higher and less spread than those using VRBG. As for the analysis of aerobic microorganisms, it is possible that the indicator dye present in Petrifilm<sup>TM</sup> facilitated the reading of *C. freundii* colonies and therefore led to a higher and more reproducible count for mixture B.

For mixture C the report of false negative results and low values cannot be linked to a method and/or medium used.

## Thermotolerant campylobacter

### Mixture A

Mixture A did not contain any strain of thermotolerant campylobacter.

### Mixture B

There was no target-organism for this analysis in mixture B.

### Mixture C

Mixture C contained a strain of *Campylobacter jejuni* at a concentration of  $1.5 \log_{10}$  cfu/ml.

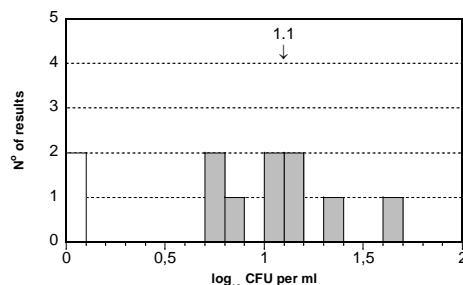
#### Results of thermotolerant campylobacter quantitative analysis

Method	Mixture A				Mixture B				Mixture C			
	n	m	s	F	<	>	n	m	s	F	<	>
Total	11	-	-	0	-	-	11	-	-	0	-	-
ISO 10272-2:2006	6	-	-	0	-	-	6	-	-	0	-	-
NMKL 119:2007	5	-	-	0	-	-	5	-	-	0	-	-

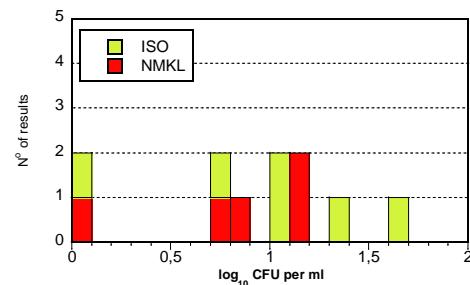
#### Results of thermotolerant campylobacter qualitative analysis

Method	Mixture A				Mixture B				Mixture C			
	n	m	s	F	<	>	n	m	s	F	<	>
Total	31	neg	-	0	-	-	31	neg	-	0	-	-
ISO 10272-1:2006	9	neg	-	0	-	-	9	neg	-	0	-	-
NMKL 119:2007	16	neg	-	0	-	-	16	neg	-	0	-	-

C



C



Few laboratories participate in the quantitative analysis of thermotolerant campylobacter, it is therefore quite difficult to draw any conclusion regarding the use of different methods.

### *Listeria monocytogenes*

#### Mixture A

A strain of *Listeria seeligeri* and *Listeria ivanovii* were included in mixture A. On ALOA medium, colonies of *L. ivanovii* can be misjudged as *L. monocytogenes*. On blood-based medium (LMBA), and medium revealing esculine hydrolysis (PALCAM and Oxford) both *L. seeligeri* and *L. ivanovii* form colonies similar to *L. monocytogenes*. However, in the confirmation steps, these strains can be differentiated: both *L. seeligeri* and *L. ivanovii* ferment xylose while *L. monocytogenes* does not.

#### Mixture B

Mixture B contained a strain of *L. monocytogenes* at a concentration of  $1.1 \log_{10}$  cfu/ml.

#### Mixture C

No target-organism was present in mixture C for this analysis.

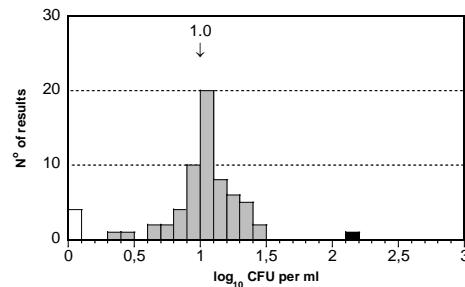
### Results of *L. monocytogenes* quantitative analysis

Method	Mixture A				Mixture B					Mixture C			
	n	m	s	F < >	n	m	s	F < >	n	m	s	F < >	
Total	66	-	-	4 < >	66	1.02	0.21	4 < >	66	-	-	0 < >	
ISO 11290-2:1998	30	-	-	1 < >	30	1.05	0.25	1 < >	30	-	-	0 < >	
NMKL 136:2010	14	-	-	1 < >	14	1.07	0.10	2 < >	14	-	-	0 < >	
Rapid L.m	15	-	-	2 < >	15	0.93	0.19	1 < >	15	-	-	0 < >	

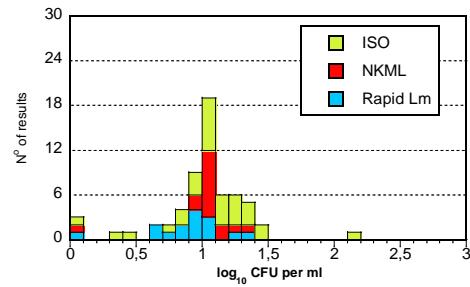
### Results of *L. monocytogenes* qualitative analysis

Method	Mixture A				Mixture B				Mixture C			
	n	m	s	F < >	n	m	s	F < >	n	m	s	F < >
Total	89	neg	-	6 < >	89	pos	-	0 < >	89	neg	-	0 < >
ISO 11290-1:1996	27	neg	-	2 < >	27	pos	-	0 < >	27	neg	-	0 < >
NMKL 136:2010	14	neg	-	1 < >	14	pos	-	0 < >	14	neg	-	0 < >
VIDAS	19	neg	-	0 < >	19	pos	-	0 < >	19	neg	-	0 < >
Rapid L.m	14	neg	-	2 < >	14	pos	-	0 < >	14	neg	-	0 < >
PCR	9	neg	-	0 < >	9	pos	-	0 < >	14	neg	-	0 < >

B



B



No correlation between method used and false results or outliers can be concluded.

### Salmonella

#### Mixture A

Mixture A contained a strain of *Salmonella* Enteritidis at a concentration of  $1.2 \log_{10}$  cfu/ml.

#### Mixture B

Even though mixture B did not contain any *Salmonella*, some false positive results were reported. *Citrobacter freundii* present in mixture B form atypical yellow colonies on XLD and brownish colonies on BriS agar that differentiate from black and violet colonies of *Salmonella* on the same media.

#### Mixture C

A strain of *Salmonella* Dublin was target-organism for this analysis. Under our quality control, after enrichment in BPW and RVS, this strain formed typical colonies on XLD medium but atypical white colonies on BriS chromogenic medium. Moreover, this strain is sensitive to temperature above 42°C and to high concentration of MgCl<sub>2</sub> in RVS medium (2). According to NMKL method this concentration should not be higher than 29 g/l. These characteristics might explain the report of 9 false negative results. The concentration of *S. Dublin* in mixture C was  $1.1 \log_{10}$  cfu/ml.

### *Results of Salmonella qualitative analysis*

Method	Mixture A					Mixture B					Mixture C				
	n	m	s	F	< >	n	m	s	F	< >	n	m	s	F	< >
Total	124	pos	-	2	- -	124	neg	-	2	- -	124	pos	-	9	- -
ISO 6579:2002	23	pos	-	1	- -	23	neg	-	0	- -	23	pos	-	1	- -
NMKL 71:1999	39	pos	-	0	- -	39	neg	-	0	- -	39	pos	-	4	- -
NMKL 187:2007	7	pos	-	0	- -	7	neg	-	0	- -	7	pos	-	0	- -
VIDAS	18	pos	-	0	- -	18	neg	-	0	- -	18	pos	-	1	- -
PCR	16	pos	-	0	- -	16	neg	-	0	- -	16	pos	-	0	- -

No correlation between the method used and false negative result can be concluded.

### *Escherichia coli O157*

#### **Mixture A**

Mixture A did not contain any *E. coli* O157 strain.

#### **Mixture B**

Mixture B did not contain any *E. coli* O157 strain.

#### **Mixture C**

Mixture C contained an *E. coli* O157 strain at a concentration of  $1.2 \log_{10}$  cfu/ml.

### *Results of E. coli O157 qualitative analysis*

Method	Mixture A					Mixture B					Mixture C				
	n	m	s	F	< >	n	m	s	F	< >	n	m	s	F	< >
Total	24	neg	-	0	- -	24	neg	-	0	- -	24	pos	-	1	- -
ISO 16654:2001	6	neg	-	0	- -	6	neg	-	0	- -	6	pos	-	0	- -
NMKL 164:2005	5	neg	-	0	- -	5	neg	-	0	- -	5	pos	-	0	- -

Almost all laboratories (79%) used mTSB or BPW for the enrichment step and CT-SMAC, alone or together with another medium, for the isolation step. In addition to the ISO and NMKL method, laboratories used PCR, immunological or “in house” methods.

It is important to note that methods for the analysis of *E. coli* are not suitable for the analysis of *E. coli* O157.

### *Pathogenic Vibrio spp.*

#### **Mixture A**

A strain of *Vibrio cholera* at a concentration of  $5.0 \log_{10}$  cfu/ml was target-organism for this analysis. At NFA, the strain formed typical yellow colonies on TCBS plate after enrichment in APW 2 % or SPB.

#### **Mixture B**

Mixture B contained a strain of *Vibrio cholera* and a strain of *Vibrio parahaemolyticus* at a concentration of 2.8 och 2.9  $\log_{10}$  cfu/ml, respectively. At NFA both strains formed typical colonies on TCBS after enrichment in APW 2% or SPB. Despite the presence of two target-organisms, 4 laboratories reported a false negative result.

### Mixture C

No target-organism was present in mixture C for this analysis.

#### *Results of pathogenic Vibrio spp. qualitative analysis*

Method	Mixture A					Mixture B					Mixture C				
	n	m	s	F	< >	n	m	s	F	< >	n	m	s	F	< >
Total	23	pos	-	1	- -	23	pos	-	4	- -	22	neg	-	2	- -
ISO/TS 21872-1:2007	11	pos	-	1	- -	11	pos	-	1	- -	11	neg	-	1	- -
NMKL 156:1997	10	pos	-	0	- -	10	pos	-	3	- -	9	neg	-	1	- -

The standard method ISO/TS 21872-1:2007 prescribes an enrichment in APW 2%, while the method NMKL 156:1997 recommends an enrichment in APW 2% for the isolation of *V. cholera* and an enrichment in SPB for the isolation of *V. parahaemolyticus*.

No correlation between false results and method or medium used could be seen.

### *Yersinia enterocolitica*

#### Mixture A

No target-organism was present in mixture A for this analysis.

#### Mixture B

There was no target-organism for this analysis in mixture B. Under our quality control, *C. freundii* formed pink colonies on CIN after incubation in PSB during 3 hours at room temperature and 3 weeks at 4°C. No growth was observed on CIN after incubation in MRB. Biochemical confirmation tests (API20E) differentiated colonies of *C. freundii* from *Y. enterocolitica*.

#### Mixture C

Mixture C contained a *Yersinia enterocolitica* strain which was also target-organism for the analysis of Enterobacteriaceae.

#### *Results of Y. enterocolitica qualitative analysis*

Method	Mixture A					Mixture B					Mixture C				
	n	m	s	F	< >	n	m	s	F	< >	n	m	s	F	< >
Total	14	neg	-	1	- -	14	neg	-	1	- -	14	pos	-	0	- -
ISO 10273:2003	7	neg	-	1	- -	7	neg	-	0	- -	7	pos	-	0	- -
NMKL 117:1996	4	neg	-	0	- -	4	neg	-	0	- -	4	pos	-	0	- -

## **Outcome of the results of individual laboratory - assessment**

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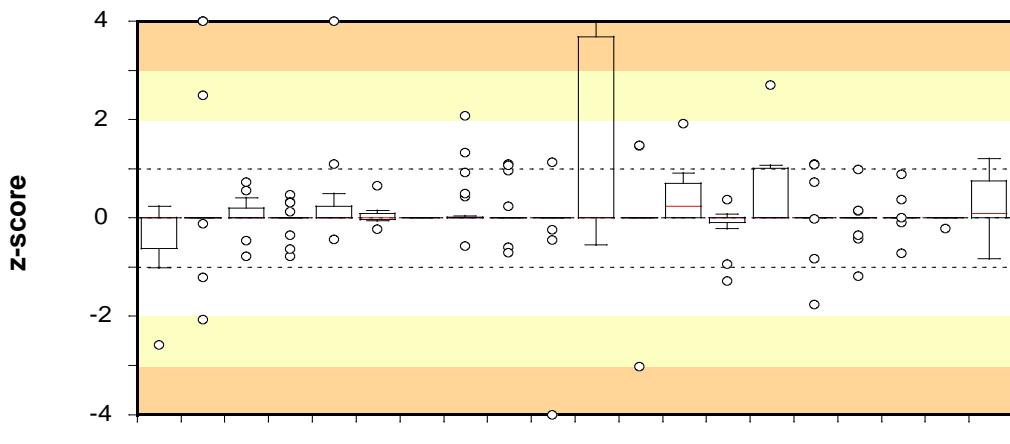
In order to allow comparison of the results from different analyses and mixtures, all the results of the analyses were transformed into standard values (z-scores). For quantitative analyses, a z-score is either positive or negative, depending on whether the individual result is higher or lower than the mean value calculated from all laboratory results for each analysis. For qualitative analyses, a z-score of zero is attributed for a correct answer. The z-scores obtained, which are listed in Annex 2, can be used as a tool by laboratories when following up on the results.

All the results from each laboratory – outliers included and false results excluded – were compiled into a box plot based on their z-scores. The smaller and more centred round zero the box of a laboratory is, the closer its results are to the general mean values calculated for all laboratory results.

The laboratories were not grouped or ranked based on their results. However, for each laboratory, the numbers of false results and outliers are presented below the box plots. These results are also highlighted in Annex 1, where all the reported results are listed, and the minimum and maximum accepted values for each analysis are stated. Information on the results processing and recommendations for follow-up work are given in the Scheme Protocol (3). Samples for follow-up can be ordered, free of charge via our website: [www.livsmedelsverket.se/en/PT-extra](http://www.livsmedelsverket.se/en/PT-extra)

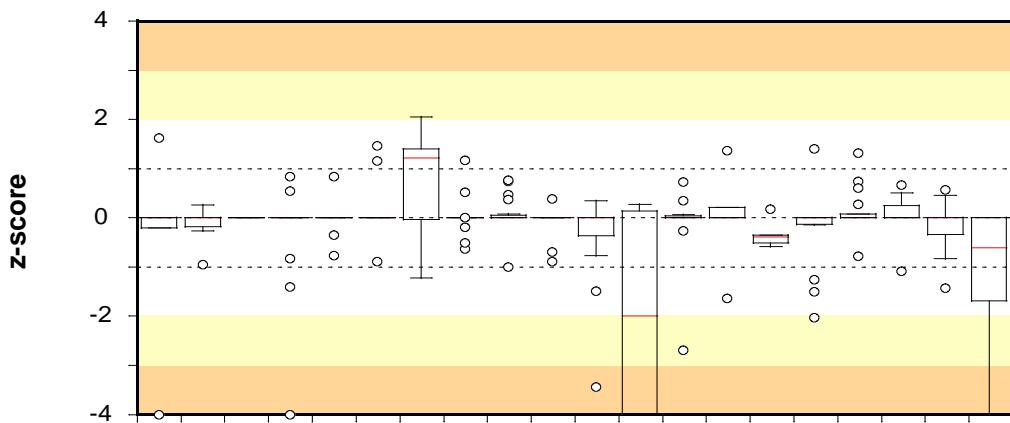
### **Box plots and numbers of deviating results for each laboratory**

- *The plots are based on the laboratory results from all analyses transformed into z-scores calculated according to the formula:  $z = (x-m)/s$ , where  $x$  is the result of the individual laboratory,  $m$  is the mean of the results of all participating laboratories, and  $s$  is the standard deviation.*
- *Correct results for quantitative analyses without target organism and for qualitative analyses generate a z-value of 0.*
- *The laboratory median value is illustrated by a horizontal red line in the box.*
- *The box includes 50 % of a laboratory's results (25 % of the results above the median and 25 % of the results below the median). The remaining 50 % are illustrated by lines and circles outside the box.*
- *Very deviating results are represented by circles and are calculated as follow: the lowest result in the box –  $1.5 \times (\text{the highest result in the box} - \text{the lowest result in the box})$  or the highest result in the box +  $1.5 \times (\text{the highest result in the box} - \text{the lowest result in the box})$ . z-scores higher than +4 and less than -4 are positioned at +4 and -4, respectively, in the plot.*
- *The background is divided by lines and shaded fields to indicate ranges in order to simplify location of laboratory results.*



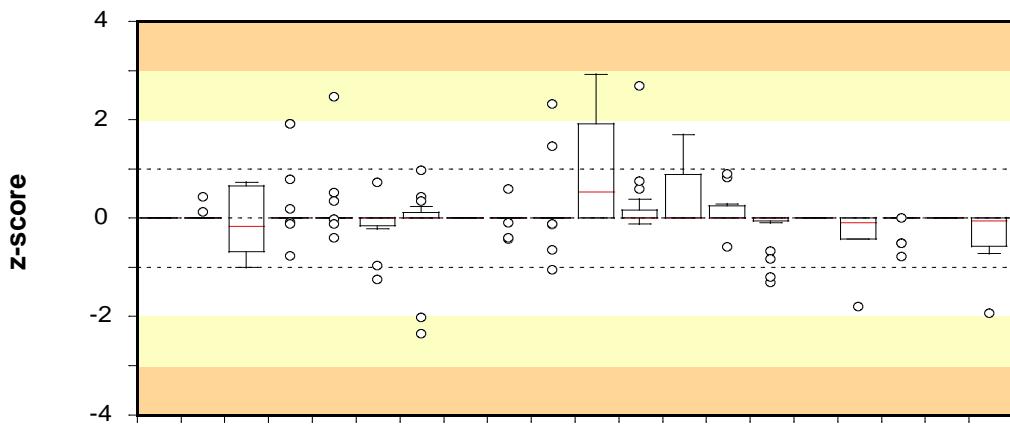
**Lab no** 1254 1290 1594 1970 2035 2050 2058 2072 2129 2151 2324 2386 2402 2637 2670 2704 2745 2764 2842 2920

No. of results	14	16	11	20	14	8	-	23	17	15	11	9	8	14	9	14	14	13	8
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
False negative	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
High outliers	-	2	-	-	1	-	-	-	-	-	3	-	-	-	-	-	-	-	-



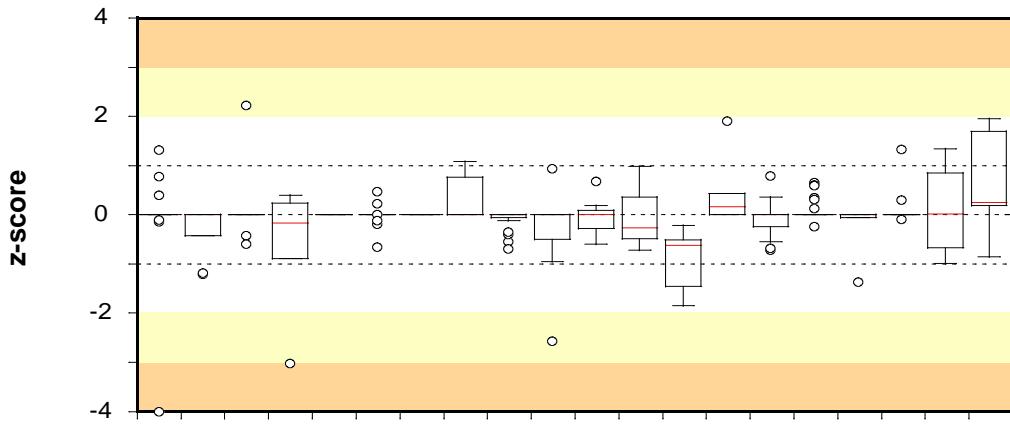
**Lab no** 3126 3159 3225 3305 3457 3533 3587 3595 3626 3825 3868 3878 3923 3925 4064 4100 4153 4171 4246 4288

No. of results	6	14	-	16	11	9	5	14	20	9	20	4	11	6	5	15	17	11	11	8
False positive	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	1	-	-	-	-	-	-	2	-	-	-	2	-	-	-	-
Low outliers	1	-	-	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



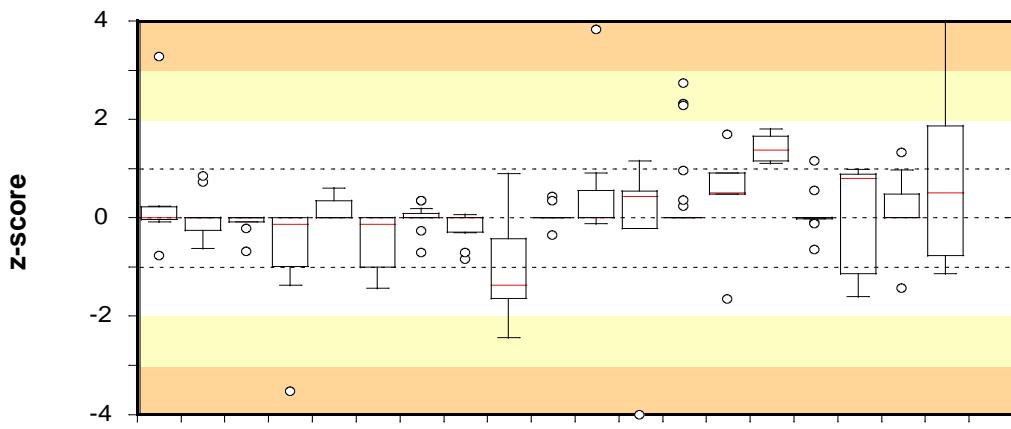
Lab no	4339	4352	4400	4562	4633	4635	4664	4683	4817	4840	4879	4889	4955	4980	5018	5028	5100	5120	5188	5197
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No. of results	-	19	5	29	14	11	16	-	24	17	10	17	14	14	19	3	6	16	3	8
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	1	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	1	-	-
Low outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



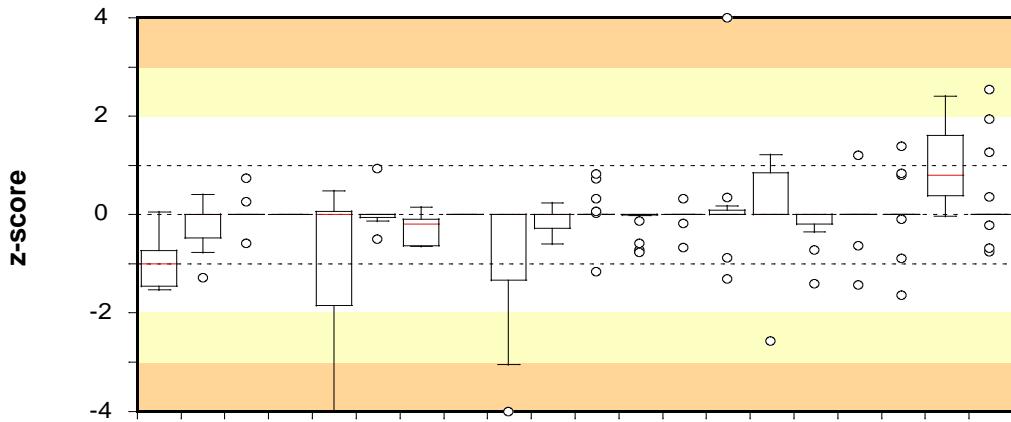
Lab no	5204	5220	5304	5329	5333	5352	5447	5545	5553	5615	5632	5701	5801	5808	5883	5950	5993	6109	6175	6224
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No. of results	17	9	9	5	6	14	3	6	19	11	8	3	5	6	14	28	5	9	4	5
False positive	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-
False negative	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1	-	-
Low outliers	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



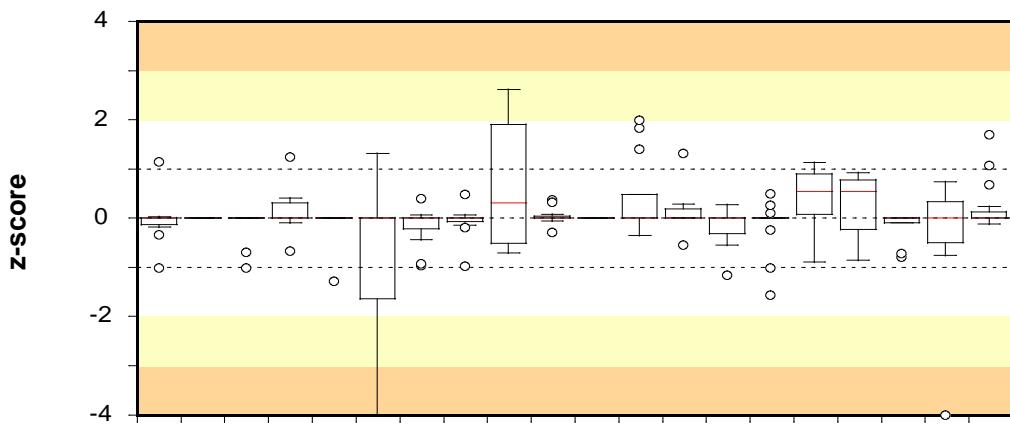
Lab no	6232	6253	6343	6352	6368	6443	6456	6594	6658	6686	6707	6762	6860	6971	7024	7096	7182	7191	7207	7232
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No. of results	8	11	9	8	17	7	11	11	5	9	14	5	28	5	5	14	5	7	5	3
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
False negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Low outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3

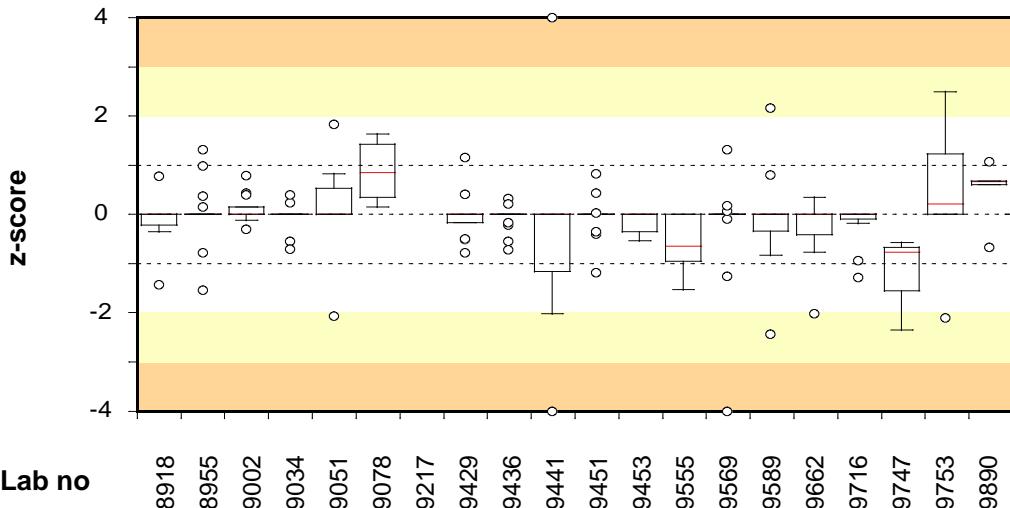


Lab no	7242	7248	7253	7302	7330	7334	7449	7564	7596	7627	7688	7706	7728	7750	7825	7876	7882	7930	7940	7946
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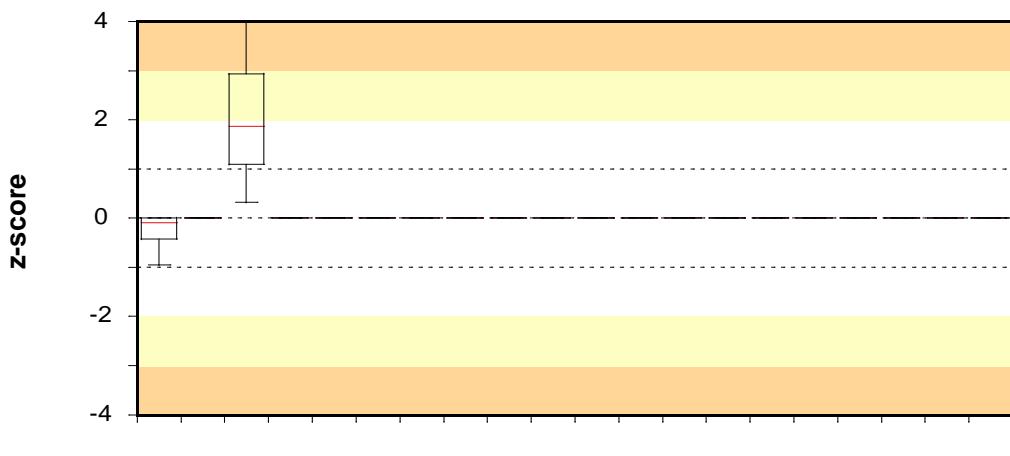
No. of results	5	17	14	9	8	8	5	-	16	8	23	23	12	11	11	14	9	14	3	27
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
False negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	
Low outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	



Lab no	7962	8042	8066	8068	8165	8260	8313	8333	8397	8435	8528	8529	8568	8626	8628	8657	8734	8742	8756	8766
No. of results	14	3	9	14	15	12	11	11	5	11	2	14	14	12	14	5	5	9	7	17
False positive	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	-	1	-
False negative	-	-	2	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Lab no	8918	8955	9002	9034	9051	9078	9217	9429	9436	9441	9451	9453	9555	9569	9589	9662	9716	9747	9753	9890
No. of results	9	26	14	14	8	5	5	14	17	12	13	11	8	17	14	14	12	3	8	5
False positive	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	5	-	-	1	-	-	1	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-



Lab no      9903      9923      9950

No. of results	10	-	3
False positive	1	-	-
False negative	-	-	-
Low outliers	-	-	-
High outliers	-	-	1

## Test material and quality control

### Test material

Each laboratory received three freeze-dried microbial mixtures designated A-C. The manufactured test material was freeze-dried in portions of 0.5 ml in vials, as described by Peterz and Steneryd (4). Before analysing the samples, the contents of each vial had to be dissolved in 254 ml of diluent. The organisms present in the mixtures are listed in Table 2.

**Table 2.** Microorganisms present in mixture A-C supplied to participants

Mixture <sup>1</sup>	Microorganism	Strain no.
A	<i>Staphylococcus saprophyticus</i>	SLV-013
	<i>Hafnia alvei</i>	SLV-015
	<i>Listeria seeligeri</i>	SLV-347
	<i>Listeria ivanovii</i>	SLV-348
	<i>Salmonella Enteritidis</i>	SLV-436
	<i>Vibrio cholera</i>	SLV-530
B	<i>Citrobacter freundii</i>	SLV-091
	<i>Listeria monocytogenes</i>	SLV-444
	<i>Vibrio parahaemolyticus</i>	SLV-529
	<i>Vibrio cholera</i>	SLV-530
C	<i>Micrococcus sp.</i>	SLV-055
	<i>Yersinia enterocolitica</i>	SLV-408
	<i>Campylobacter jejuni</i>	SLV-540
	<i>Salmonella Dublin</i>	SLV-242
	<i>Escherichia coli O157</i>	SLV-479

<sup>1</sup>The links between the mixtures and the randomised sample numbers are shown in annex 1

## Quality control of the mixtures

It is essential to have aliquots of homogeneous mixture and equal volume in all vials in order to allow comparison of all freeze-dried samples from one mixture. Quality control was performed in conjunction with manufacturing of the mixtures according to Scheme Protocol (3). The results are presented in Table 3. Homogeneity requires that the standard deviation and the difference between the highest and lowest value of results from 10 samples analysed do not exceed 0.15 log<sub>10</sub> units and 0.5 log<sub>10</sub> units, respectively.

**Table 3.** Concentration mean (*m*) and standard deviation (*s*) from analyses of 10 randomly selected vials per mixture, expressed in log<sub>10</sub> cfu (colony forming units) per ml of sample.

Analysis and method	A		B		C	
	<b>m</b>	<b>s</b>	<b>m</b>	<b>s</b>	<b>m</b>	<b>s</b>
Aerobic microorganisms 30 °C NMKL-method no. 86	5.17	0.04	3.83	0.06	4.48	0.05
Enterobacteriaceae NMKL-method no. 144	4.36	0.05	3.69	0.06	3.50	0.06
Thermotolerant campylobacter, quant. NMKL method no. 119	–	–	–	–	1.52	0.15
Thermotolerant campylobacter, qual. NMKL method no. 119	–	–	neg	–	pos	–
<i>Listeria monocytogenes</i> , quant. NMKL method no. 136	–	–	1.13	0.06	–	–
<i>Listeria monocytogenes</i> , qual. NMKL method no. 136	–	–	pos	–	neg	–
<i>Salmonella</i> NMKL method no. 71	1.22*	0.15*	neg	–	1.12*	0.04*
<i>Escherichia coli</i> O157 NMKL method no. 164	neg	–	neg	–	1.22**	0.03**
Pathogenic <i>Vibrio</i> spp. NMKL-method no. 156	5.01*	0.08*	2.95*	0.07*	2.84*	0.06*
<i>Yersinia enterocolitica</i> NMKL-method no. 117	neg	–	neg	–	3.50	0.06

– No target organism

\* Internal values based on the analyses results of parallel mixtures

\*\* Values based on the analyses results of the mototolerant coliform bacteria and *E. coli* (NMKL method no 125)

## References

1. Kelly, K. 1990. Outlier detection in collaborative studies. *J. Assoc. Off. Anal. Chem.* 73:58-64.
2. Peterz, Mats et al. 1989. The effect of incubation temperature and magnesium chloride concentration on growth of salmonella in home-made and in commercially available dehydrated Rappaport-Vassiliadis broths. *J. of Applied Bacteriology*. 523-528.
3. Anonymous, 2012. Protocol. Microbiology. Drinking Water & Food. The National Food Agency.
4. Peterz. M. Steneryd. A.C. 1993. Freeze-dried mixed cultures as reference samples in quantitative and qualitative microbiological examinations of food. *J. Appl. Bacteriol.* 74:143-148.

## Annex 1

### Results from the participating laboratories- January 2015

All results are expressed in  $\log_{10}$  cfu per ml sample.

Results reported as "<value" have been regarded as zero (negative).

Results regarded as "> value" are excluded in the calculations.

A dash in the table indicates that the analysis was not performed.

Outliers and false results are highlighted and summarized for each analysis at the end of the table.

Results from the analyses of enterobacteriaceae in mixture C are not included in the calculation of z-values (Annex 2) neither in the number of deviant results (Boxplot).

Lab no.	Provnr.	Aerobic microorganisms 30 °C			Enterobacteriaceae			Thermotolerant campylobacter			Listeria monocytogenes			Thermotolerant campylobacter			Listeria monocytogenes			Salmonella			Escherichia coli O157 (VT-neg)			Pathogenic Vibrio spp			Lab no.		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C			
1254	2 1 3	4,8	3,64	4,37	4,35	3,54	2,86	-	-	-	0	0,48	0	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	1254		
1290	2 3 1	6,28	3,53	4,77	5,51	2,72	3,06	-	-	-	<1	1	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	Neg	Pos	Neg	-	-	-	1290	
1594	1 2 3	5,11	3,67	4,52	4,61	3,18	<1	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	1594		
1970	3 2 1	5,05	3,61	4,51	4,54	3,23	1,48	0	0	1,15	0	0,95	0	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	1970			
2035	3 1 2	5,2	3,8	4,5	4,6	3,3	3,2	-	-	-	<1	2,1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	2035			
2050	2 3 1	4,92	3,76	4,55	4,48	3,51	3,35	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	2050			
2058	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2058				
2072	3 1 2	5,04	3,65	4,63	4,6	3,47	3,18	<1	<1	1,32	<1	1,46	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	Pos	Pos	Neg	-	-	2072		
2129	1 3 2	5,2	3,8	4,4	4,4	3,8	3,15	-	-	-	<1	1,25	<1	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	Pos	Pos	Neg	-	-	2129
2151	3 2 1	5,21	3,71	3,36	5,36	5,3	4,78	-	-	-	0	0,93	0	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	2151		
2324	2 1 3	4,8	4,38	5,4	5,33	5,3	4,78	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	2324			
2386	1 3 2	5,29	4,03	4,11	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	2386		
2402	2 3 1	5,4	3,85	4,5	4,67	3,54	1,18	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	2402			
2637	3 1 2	4,88	3,58	4,46	4,58	3	0,85	-	-	-	<1	1,04	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	2637		
2670	1 3 2	5,18	4,26	4,6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	Pos	Pos	Neg	-	-	2670
2704	2 1 3	5,11	3,96	4,26	4,7	3,45	3,1	-	-	-	<1	0,85	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	2704		
2745	2 3 1	4,83	3,78	4,49	4,32	3,81	3,45	-	-	-	0	0,95	0	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	2745		
2764	3 2 1	4,76	3,92	4,46	4,52	3,59	<1	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Pos	-	-	-	-	-	2764		
2842	3 1 2	-	-	-	-	-	-	<1	<1	1	-	-	-	Neg	Neg	Pos	-	-	-	Neg	Neg	Pos	Pos	Pos	Pos	Pos	Neg	Pos	2842		
2920	1 2 3	5,2	3,6	4,52	4,72	3,52	0	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	-	2920		
3126	3 1 2	5,33	3,72	2,95	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	-	3126		
3159	3 2 1	4,89	3,72	4,45	4,36	3,36	1	-	-	-	<1	1,08	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	3159		
3225	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3225				
3305	1 2 3	4,59	-	3,53	4,38	3,65	3,32	-	-	-	0	1,2	0	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	3305			
3457	3 1 2	-	-	-	4,39	3,33	3,22	-	-	-	2,96	1,2	<1	-	-	-	Pos	Pos	Neg	Pos	Neg	Neg	Neg	Pos	Pos	Neg	Neg	-	3457		
3533	3 1 2	5,29	3,59	4,61	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	3533			
3587	3 2 1	5,23	3,75	4,64	4,86	3,02	3,08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3587				
3595	3 1 2	4,78	3,72	4,41	4,52	3,64	3,36	-	-	-	<1	1,27	<1	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	-	-	-	-	-	3595		
3626	2 1 3	5,05	3,76	4,56	4,58	3,73	1,6	<1	<1	0,78	<1	1,04	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	3626			
3825	2 3 1	4,76	3,59	4,52	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	Pos	Pos	Neg	-	-	3825			
3868	2 1 3	4,57	3,73	4,38	4,42	3,58	3,34	0	0	0,85	0	0,3	0	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	3868			
3878	3 1 2	5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Neg	Neg	-	-	-	-	-	-	-	-	3878			
3923	3 2 1	5,11	3,82	4,48	4,07	3,36	1,34	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	Pos	Pos	Neg	-	-	3923			
3925	3 2 1	5,27	3,45	4,5	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	3925			
4064	2 3 1	4,84	3,69	4,41	4,42	3,52	3,25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4064				
4100	1 3 2	4,9	3,52	4,64	4,18	2,92	2,79	0	0	0	0	0	<1	1	<1	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	-	-	-	-	-	4100		
4153	1 3 2	5	3,77	4,56	4,62	3,18	<1	-	-	-	<1	1,3	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	4153			
4171	3 1 2	4,67	3,85	4,53	4,63	3,46	3,4	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	4171		
4246	3 1 2	4,77	3,84	4,3	4,38	3,66	3,19	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	-	-	-	-	-	4246		
4288	1 2 3	4,59	3,64	4,4	3,34	2,76	2	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	-	-	-	-	-	4288		
4339	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4339				
4352	1 2 3	-	-	-	4,54	3,61	1	-	-	-	<1	<1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	Pos	Neg	-	4352			
4400	3 1 2	4,69	3,89	4,39	4,49	3,69	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4400				
4562	3 2 1	5,4	3,79	4,38	4,65	3,43	1,48	<1	<1	1,6	<1	1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	Pos	Neg	-	4562			
4633	2 1 3	5,06	3,68	4,47	4,93	3,58	3,4	-	-	-	<1	1	<1	Neg	Pos	Neg	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	4633			
4635	3 1 2	4,7	3,89	4,46	4,31	3,38	1,4	-	-	-	-	-	-	Neg	Pos	Neg	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	4635			
4664	1 2 3	5,17	3,8	4,19	4,59	3,58	<2	-	-	-	<1	0,6	<1	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	4664	
4683	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4683				
4817	2 1 3	4,83	3,68	4,46	-	-	-	-	-	-	<1	1,15	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	Pos	Neg	-	4817			
4840	2 3 1	5,29	3,56	4,75	4,41	3,41	<1	-	-	-	<1	1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	4840			
48																															

Lab no.	Provnr.	Aerobic microorganisms 30 °C			Enterobacteriaceae			Thermotolerant campylobacter			Listeria monocytogenes			Thermotolerant campylobacter			Listeria monocytogenes			Salmonella			Escherichia coli O157 (VT-neg)			Pathogenic Vibrio spp			Lab no.
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
4955	3 1 2	5,28	3,92	4,62	4,8	3,76	3,3	-	-	-	<0	1,04	<0	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	4955
4980	2 3 1	4,94	3,91	4,58	4,56	3,56	3	-	-	-	<1	0,9	<1	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	4980
5018	3 2 1	4,91	3,63	4,47	4,3	3,03	2,08	-	-	-	<1	0,85	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	Neg	Pos	5018
5028	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Neg	5028	
5100	1 3 2	4,83	3,42	4,45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5100	
5120	3 2 1	4,81	3,61	4,41	4,52	3,46	2,92	-	-	-	<1	0	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	5120
5188	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Neg	Pos	-	-	-	-	-	-	-	-	-	5188
5197	1 3 2	4,83	3,62	4,24	4,5	3,46	<1	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	5197
5204	2 1 3	4,9	3,9	3,6	4,5	3,6	<1	-	-	-	<1	1,3	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	-	5204
5220	1 2 3	4,83	3,53	4,33	-	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	5220
5304	1 3 2	4,83	4,17	4,4	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	5304	
5329	3 1 2	5,03	3,59	4,5	4,49	2,38	3,08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5329	
5333	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	5333	
5352	3 2 1	4,93	3,63	4,45	4,56	3,62	3,08	-	-	-	<1	1	<1	Neg	Neg	Pos	-	-	-	-	-	-	-	-	-	-	-	5352	
5447	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	5447		
5545	1 3 2	-	-	-	4,7	3,73	3,59	-	-	-	-	-	-	-	-	-	Pos	Pos	Neg	Neg	Neg	Neg	-	-	-	-	-	5545	
5553	1 3 2	4,8	3,68	4,43	<1	3,21	3,15	-	-	-	<1	1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Neg	Pos	-	5553		
5615	1 2 3	4,92	3,93	4,36	4,36	2,54	<1	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	5615		
5632	1 3 2	5,1	3,68	4,4	4,55	3,4	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	5632	
5701	3 1 2	4,76	3,94	4,44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5701		
5801	2 3 1	4,58	3,64	4,41	4,21	3,38	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5801		
5883	3 1 2	4,76	3,71	4,39	4,65	3,26	2,13	-	-	-	0	1,1	0	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	5883		
5950	3 1 2	5,02	3,71	4,55	4,62	3,5	3,37	<1	<1	1,15	<1	1,15	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Neg	Pos	-	5950		
5993	3 2 1	-	-	-	4,51	2,97	0	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	-	5993	
6109	2 1 3	4,91	3,81	4,63	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	Neg	Neg	Pos	-	-	-	-	-	6109
6175	1 2 3	5,26	3,57	4,43	4,58	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6175		
6224	2 1 3	4,98	4,12	4,37	4,56	4,06	3,26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6224		
6232	1 2 3	4,99	3,8	4,38	4,51	4,62	1	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	6232	
6253	2 3 1	4,81	3,64	4,41	4,64	3,76	3,46	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	6253		
6343	3 1 2	4,88	3,74	4,39	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	6343		
6352	2 3 1	4,9	3,5	4,4	4,5	2,2	1	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	-	-	6352		
6368	1 2 3	5,05	3,84	4,54	4,62	3,58	3,42	-	-	-	<0	1,04	<0	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	6368		
6443	2 3 1	4,59	3,73	4,4	4,28	<1	3,29	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	6443		
6456	2 3 1	4,98	3,82	4,44	4,4	3,58	3,16	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	6456		
6594	3 1 2	4,73	3,7	4,48	4,4	3,36	3,11	-	-	-	-	-	-	-	-	Pos	Neg	Pos	Neg	Neg	Pos	-	-	-	-	-	6594		
6658	3 1 2	4,83	3,45	4,58	4,29	2,59	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6658		
6686	2 3 1	-	-	-	4,59	3,58	1,3	-	-	-	2,74	0,95	<1	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	6686		
6707	1 3 2	5,15	3,86	4,93	4,6	3,78	<1	-	-	0	1	0	-	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	6707		
6762	1 2 3	4,88	3,97	3,58	4,59	3,65	0,85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6762			
6860	2 3 1	5,5	3,8	4,8	4,9	3,8	3,7	<1	<1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	6860			
6971	3 2 1	4,53	3,85	4,53	4,8	3,78	3,18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6971			
7024	3 2 1	5,27	3,97	4,67	4,82	3,85	3,66	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7024		
7096	2 1 3	5,07	3,97	4,46	4,41	3,45	3,09	-	-	-	<1	1	<1	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7096		
7182	3 2 1	5,15	3,94	4,28	4,33	3,74	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7182			
7191	1 2 3	5,17	3,49	4,63	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Neg	Pos	Neg	Pos	-	-	-	-	-	7191	
7207	3 2 1	5,39	3,85	5,06	4,39	3,05	3,15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7207			
7232	1 2 3	6,16	4,63	5,57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7232		
7242	2 1 3	4,58	3,47	4,35	4,4	3,48	1	-	-	-	<1	1,11	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7242	
7248	2 1 3	4,62	3,66	4,4	4,39	3,29	1,85	-	-	-	<1	1,11	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7248	
7253	1 3 2	-	-	-	4,42	3,72	3,24	-	-	-	<1	1,08	<1	Neg	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7253	
7302	3 2 1	-	-	-	-	-	-	-	-	-	Neg	Neg	Pos	Neg	Pos	-	-	-	Pos	Neg	Pos	-	-	-	-	-	7302		
7330	3 2 1	4,15	3,78	4,53	3,65	3,29	3,24	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7330		
7334	3 1 2	4,9	3,66	4,58	-	-	-	-	-	-	Neg	Neg	Pos	Neg	Pos	-	-	Pos	Neg	Pos	Neg	Neg	Pos	-	-	7334			
7449	3 1 2	4,91	3,72	4,49	4,41	3,23	1,6	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Pos	-	-	-	-	-	7449		
7564	3 2 1	-	-	-	-	-																							

Lab no.	Provnr.	Aerobic microorganisms 30 °C			Enterobacteriaceae			Thermotolerant campylobacter			Listeria monocytogenes			Thermotolerant campylobacter			Listeria monocytogenes			Salmonella			Escherichia coli O157 (VT-neg)			Pathogenic Vibrio spp			Lab no.
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
7825	2 3 1	4,31	3,97	4,62	4,61	3,5	<1	-	-	-	<1	1,27	<1	-	-	-	Neg	Pos	Neg	-	-	-	-	-	-	-	-	-	7825
7876	2 1 3	4,59	3,72	4,45	4,49	3,2	3,21	-	-	-	<1	0,95	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	7876
7882	3 1 2	4,78	3,98	4,3	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	7882
7930	3 2 1	5,13	3,45	4,46	4,75	3,14	3,26	-	-	-	<1	1,2	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	7930
7940	3 1 2	5,13	3,75	4,76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7940		
7946	2 3 1	4,75	4,23	4,39	4,73	4,15	<1	<1	<1	1	<1	1,1	<1	Neg	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	Pos	Neg	Neg	Neg	7946		
7962	2 1 3	4,85	3,76	4,45	4,71	3,41	3,2	-	-	-	<1	0,81	<1	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	7962
8042	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	-	-	-	-	-	8042	
8066	3 1 2	-	-	-	4,35	3,21	0	-	-	-	0	0	0	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	-	-	-	-	-	8066
8068	2 1 3	4,91	3,63	4,62	4,57	3,58	1,48	-	-	-	0	1,11	0	-	-	-	Neg	Pos	Neg	Pos	-	-	-	-	-	-	-	-	8068
8165	2 3 1	-	-	-	-	-	-	<0,7	<0,7	0,7	-	-	-	Neg	Neg	Pos	-	-	Pos	Neg	Pos	Neg	Neg	Pos	-	-	-	8165	
8260	1 2 3	4,7	3,74	3,48	4,1	2,63	1,3	-	-	-	2,65	1,3	<1	Pos	Pos	Neg	Pos	Neg	Neg	Neg	Pos	Pos	Neg	Neg	Neg	Pos	8260		
8313	1 3 2	4,7	3,83	4,36	4,53	3,3	3,19	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8313		
8333	3 2 1	4,9	3,72	4,53	4,53	3,11	3,26	-	-	-	-	-	-	-	-	-	Pos	Neg	Pos	Neg	Neg	Pos	-	-	-	-	-	8333	
8397	1 2 3	5,01	4,11	4,41	4,4	4,39	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8397		
8435	3 1 2	5,03	3,77	4,51	4,47	3,44	3,26	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8435		
8528	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8528		
8529	3 2 1	5,38	3,78	4,64	4,85	3,63	1,6	-	-	-	<0	0,95	<0	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8529
8568	3 1 2	4,8	4	4,5	4,55	3,56	3,41	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8568		
8626	2 3 1	5	3,54	4,41	4,5	3,26	<1	-	-	-	<1	<1	<1	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8626		
8628	2 3 1	4,96	3,71	4,35	4,6	2,9	1,6	-	-	-	<0	1,08	<0	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8628		
8657	2 1 3	5,21	3,77	4,58	4,37	3,65	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8657		
8734	3 2 1	5,16	3,9	4,37	4,48	3,65	3,09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8734		
8742	3 1 2	4,74	3,62	4,46	-	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8742		
8756	1 2 3	4,75	3,88	3,1	4,48	3,72	1,3	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8756		
8766	1 3 2	5,1	3,8	4,6	4,8	3,5	3,2	-	-	-	0	1	0	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8766		
8918	1 3 2	4,88	3,9	4,3	-	-	-	-	-	-	0	0,95	0	-	-	Neg	Pos	Neg	-	-	-	-	-	-	-	-	-	8918	
8955	3 2 1	4,97	3,61	4,59	4,58	2,91	3,38	-	-	-	0	1,3	0	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	8955		
9002	1 2 3	5,04	3,7	4,49	4,65	3,6	3,23	-	-	-	0	1	0	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9002		
9034	1 2 3	4,8	3,8	4,5	4,4	3,6	3,3	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9034		
9051	2 1 3	5,38	3,37	4,57	4,56	3,46	3,24	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9051		
9078	2 3 1	5,14	4,02	4,49	4,79	3,58	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9078		
9217	2 3 1	1,71	1,4	1,06	1,36	1,97	1,93	-	-	-	<1	1,11	<1	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9217		
9429	2 3 1	4,81	3,61	4,61	4,49	3,28	3,11	-	-	-	<1	1,07	<1	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9429		
9436	2 1 3	4,88	3,62	4,51	4,49	3,26	2,9	-	-	-	<1	1,07	<1	Pos	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9436		
9441	3 2 1	3,65	4,61	4,23	4,32	3,05	<1	-	-	-	2,29	0,81	<1	Pos	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9441		
9451	2 1 3	4,94	3,68	4,57	4,32	3,61	3,2	-	-	-	<1	0,95	<1	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9451		
9453	3 1 2	4,87	3,67	4,46	4,43	3,3	1	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9453			
9555	2 1 3	4,73	3,47	4,41	4,34	3,18	3,08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9555		
9569	1 3 2	4,91	3,52	3,99	4,53	3,52	1	-	-	-	<1	1,3	<1	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9569		
9589	1 2 3	4,85	3,6	4,18	4,4	3,74	2,3	-	-	-	<1	1,48	<1	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9589		
9662	1 3 2	4,76	3,72	4,38	4,45	3,58	<1	-	-	-	<0	0,6	<0	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	-	-	9662		
9716	3 2 1	4,62	3,58	4,45	-	-	-	-	-	-	-	-	Neg	Pos	Neg	Pos	Neg	Neg	Neg	Pos	-	-	-	Pos	Pos	Neg	-	-	9716
9747	3 2 1	4,36	3,65	4,38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9747	
9753	2 1 3	5,04	4,22	4,22	4,69	3,97	3,04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9753	
9890	2 3 1	5,08	3,63	4,6	4,63	3,7	3,22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9890	
9903	3 2 1	4,83	3,69	4,45	4,36	3,2	2,85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9903	
9923	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9923	
9950	1 2 3	5,39	4,79	4,51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9950	

n = number of analyses performed

m = mean value

&lt; = low outlier

Min = lowest reported result

s = standard deviation

&gt; = high outlier

Max = highest reported result

F+ = false positive

&lt; OK = lowest accepted value

Median = median value

F- = false negative

&gt; OK = highest accepted value

## Annex 2. z-scores of all participants - January 2015

z-scores were calculated according the formula :  $z = (x-m)/s$ .

x: result of the individual laboratory, m: mean of the results of all participating laboratories , s: standard deviation of the results of all participating laboratories .

Correct negative results in quantitative analyses and correct results in qualitative analyses obtained a z-score of zero.

False results did not generate a z-score.

■  $2 < |z| \leq 3$ , ■  $|z| > 3$

Lab no.	sample	Aerobic microorganisms 30 °C			Enterobacteriaceae			Thermotolerant campylobacter			Listeria monocytogenes			Thermotolerant campylobacter			Listeria monocytogenes			Salmonella			Escherichia coli O157 (VT-neg)			Pathogenic Vibrio spp			Lab no.		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C			
1254	2 1 3	-0.549	-0.619	-0.848	-1.010	0.234					0	-2.582	0				0	0	0	0	0	0				0	0		1254		
1290	2 3 1	4.000	-1.208	2.489	4.000	-2.067					0	-0.115	0				0	0	0	0	0	0				0	0		1290		
1594	1 2 3	0.722	-0.458	0.404	0.549	-0.776																								1594	
1970	3 2 1	0.476	-0.779	0.320	0.129	-0.636		0	0	0.316	0	-0.352	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1970		
2035	3 1 2	1.091	0.239	0.237	0.489	-0.440					0	4.000	0				0	0	0	0	0	0									2035
2050	2 3 1	-0.057	0.025	0.654	-0.230	0.150																								2050	
2058	3 1 2																													2058	
2072	3 1 2	0.435	-0.565	1.321	0.489	0.038		0	0	0.919	0	2.068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2072		
2129	1 3 2	1.091	0.239	-0.597	-0.710	0.963					0	1.072	0				0	0	0	0	0	0				0	0	0	0	0	2129
2151	3 2 1	1.132	-0.243	-4.000							0	-0.447	0				0	0	0	0	0	0									2151
2324	2 1 3	-0.549	3.349	4.000	4.000	4.000																								2324	
2386	1 3 2	1.459	1.472	-3.017																										2386	
2402	2 3 1	1.910	0.507	0.237	0.909	0.234																								2402	
2637	3 1 2	-0.221	-0.940	-0.097	0.369	-1.281					0	0.075	0				0	0	0	0	0	0				0	0	0	0	0	2637
2670	1 3 2	1.009	2.706	1.071																										2670	
2704	2 1 3	0.722	1.097	-1.765	1.089	-0.019					0	-0.826	0				0	0	0	0	0	0				0	0	0	0	0	2704
2745	2 3 1	-0.426	0.132	0.153	-1.190	0.991					0	-0.352	0				0	0	0	0	0	0				0	0	0	0	0	2745
2764	3 2 1	-0.713	0.883	-0.097	0.009	0.374					0	0	-0.217				0	0	0	0	0	0				0	0	0	0	0	2764
2842	3 1 2																0	0	0	0	0	0				0	0	0	0	0	2842
2920	1 2 3	1.091	-0.833	0.404	1.209	0.178					0	0	0				0	0	0	0	0	0				0	0	0	0	0	2920
3126	3 1 2	1.623	-0.206	-4.000							0	0.265	0				0	0	0	0	0	0				0	0	0	0	0	3126
3159	3 2 1	-0.180	-0.190	-0.180	-0.950	-0.271					0	0.834	0				0	0	0	0	0	0				0	0	0	0	0	3159
3225	1 2 3										0	0.834	0				0	0	0	0	0	0				0	0	0	0	0	3225
3305	1 2 3	-1.409		-4.000	-0.830	0.543					0	0.834	0				0	0	0	0	0	0				0	0	0	0	0	3305
3457	3 1 2				-0.770	-0.355					0	0.834	0				0	0	0	0	0	0				0	0	0	0	0	3457
3533	3 1 2	1.459	-0.887	1.154							0	2.048	-1.225				0	0	0	0	0	0				0	0	0	0	0	3533
3587	3 2 1	1.213	-0.029	1.405							0	1.167	0				0	0	0	0	0	0				0	0	0	0	0	3587
3595	3 1 2	-0.631	-0.190	-0.514	0.009	0.514					0	0.075	0				0	0	0	0	0	0				0	0	0	0	0	3595
3626	2 1 3	0.476	0.025	0.737	0.369	0.767		0	0	-0.998	0	0	0			0	0	0	0	0	0				0	0	0	0	0	3626	
3825	2 3 1	-0.696	-0.887	0.379							0	0	-0.750			0	0	0	0	0	0				0	0	0	0	0	3825	
3868	2 1 3	-1.491	-0.136	-0.764	-0.590	0.346					0	-3.436	0				0	0	0	0	0	0				0	0	0	0	0	3868
3878	3 1 2	0.271	-4.000	-4.000							0	-2.689	-0.271				0	0	0	0	0	0				0	0	0	0	0	3878
3923	3 2 1	0.722	0.347	0.070							0						0	0	0	0	0	0				0	0	0	0	0	3923
3925	3 2 1	1.369	-1.637	0.212							0						0	0	0	0	0	0				0	0	0	0	0	3925
4064	2 3 1	-0.385	-0.350	-0.514	-0.590	0.178					0	-0.115	0				0	0	0	0	0	0				0	0	0	0	0	4064
4100	1 3 2	-0.139	-1.262	1.405	2.029	-1.506		0	0		0	1.309	0				0	0	0	0	0	0				0	0	0	0	0	4100
4153	1 3 2	0.271	0.079	0.737	0.609	-0.776					0	0	0			0	0	0	0	0	0				0	0	0	0	0	4153	
4171	3 1 2	-1.082	0.507	0.487	0.669	0.009					0	0	0			0	0	0	0	0	0				0	0	0	0	0	4171	
4246	3 1 2	-0.672	0.454	-1.432	-0.830	0.571					0	0	0			0	0	0	0	0	0				0	0	0	0	0	4246	
4288	1 2 3	-1.405	-0.602	-0.623	-4.000	-1.966					0						0	0	0	0	0	0				0	0	0	0	0	4288
4339	3 1 2										0						0	0	0	0	0	0				0	0	0	0	0	4339
4352	1 2 3										0						0	0	0	0	0	0				0	0	0	0	0	4352
4400	3 1 2	-1.000	0.722	-0.681	-0.171	0.655					0						0	0	0	0	0	0				0	0	0	0	0	4400
4562	3 2 1	1.910	0.186	-0.764	0.789	-0.075					0	-0.115	0				0	0	0	0	0	0				0	0	0	0	0	4562
4633	3 1 2	0.517	-0.404	-0.014	2.468	0.346					0	-0.115	0				0	0	0	0	0	0				0	0	0	0	0	4633
4635	3 1 2	-0.959	0.722	-0.097	-1.250	-0.215					0	-2.012	0				0	0	0	0	0	0				0	0	0	0	0	4635
4664	1 2 3	0.968	0.239	-2.349	0.429	0.346					0	0.597	0				0	0	0	0	0	0				0	0	0	0	0	4664
4683	1 2 3										0						0	0	0	0	0	0				0	0	0	0	0	4683
4817	2 1 3	-0.426	-0.404	-0.097							0						0	0	0	0	0	0				0	0	0	0	0	4817





## **Internal and external control for microbiological analyses of food and drinking water**

All analytical activities require work of a high standard that is accurately documented. For this purpose, most laboratories carry out some form of internal quality assurance, but their analytical work also has to be evaluated by an independent party. Such external quality control of laboratory competence is commonly required by accreditation bodies and can be done by taking part in proficiency testing (PT).

In a proficiency test, identical test material is analysed by a number of laboratories using their routine methods. The organiser evaluates the results and compiles them in a report.

### **The National Food Agency's PT program offers**

- External and independent evaluation of laboratories analytical competence.
- Improved knowledge of analytical methods with respect to various types of organisms.
- Expert support.
- Tool for inspections regarding accreditation.
- Free extra material for follow-up analyses.

For more information visit our website: [www2.slv.se/absint](http://www2.slv.se/absint)



1457  
ISO/IEC 17043

### **The National Food Agency's reference material**

As a complement to the proficiency testing, National Food Agency produces also reference material (RM) for internal quality control: a total of 8 RM for food and drinking water microbiological analyses, including pathogens, are available.

Information available on our website: [www.livsmedelsverket.se/en/RM-micro](http://www.livsmedelsverket.se/en/RM-micro)