



NordVal International Certificate

Issued for:	CompactDry TC Method for the Enumeration of Total Count
NordVal No:	033
First approval date:	01 December 2008
Renewal date:	29 November 2023
Valid until:	01 December 2025

CompactDry TC

Manufactured and supplied by:

Shimadzu Diagnostics Corporation,
20th Floor Ueno Frontier Tower,
3-24-6 Ueno, Taito-ku, Tokyo,
110-8736 JAPAN

The principle of this method is based on enumeration on a rehydratable media plate.

The performance of this method has been compared to the reference method ISO 4833-1:2013: "Microbiology of foods and animal feeding stuffs. Horizontal method for the enumeration of microorganisms. Colony count techniques at 30°C".

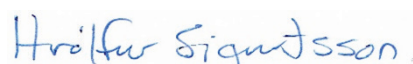
The validation studies have been conducted by Campden BRI, UK, according to ISO 16140-2:2016 and NordVal International Protocol 1.

NordVal International concludes that CompactDry TC provides equivalent results to ISO 4833-1:2013 for a broad range of foods feed and primary production samples.

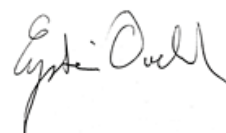
The production of CompactDry TC is certified according to ISO 9001 and ISO 13485.

Date: 29 November 2023

Yours sincerely,

A handwritten signature in blue ink that reads 'Hrölfur Sigurðsson'.

Hrölfur Sigurðsson
Chair of NordVal International

A handwritten signature in black ink that reads 'Eystein Oveland'.

Eystein Oveland
NMKL Executive Director



PRINCIPLE OF THE METHOD

CompactDry TC is a ready-to-use dry chromogenic plate for enumeration of total count. An aliquot of 1 ml of an appropriate dilution is plated onto CompactDry TC plate. The incubation conditions tested in the study were $30 \pm 1^\circ\text{C}$ for $48 \pm 3\text{h}$.

FIELD OF APPLICATION

The method has been tested on enumeration of total viable organisms in a broad range of foods, pet food and primary production samples. Lowest levels tested for the categories can be found in **Table 2**.

HISTORY

In 2007, the method was validated according to the ISO 16140:2003.

June 2016, a new edition of ISO 16140 for validation of alternative methods was published, which included new validation design and statistical evaluation of the results. NordVal International had a transition period of two years for additional studies required according to the new protocol.

In 2019, a new comparison study is performed according to ISO 16140-2 and NordVal protocol 1. The study includes more samples and the additional categories feed and primary production samples. The results of the interlaboratory study conducted in November 2007 were recalculated in 2019.

METHOD COMPARISON STUDY

Compliance between CompactDry TC method and the reference method

The comparison study was carried out by Campden BRI in 2007 on cooked chicken, frozen fish, lettuce, milk powder and raw beef. Five levels of contamination were used for each food matrix. For all foods, except milk powder, naturally contaminated samples were tested. Five replicates were analysed at each level.

For all matrices, there were no statistical difference between the results obtained after 48 h and 72 h, hence the results in this certificate are reproduced for the shortest incubation time only.

In the renewal and extension study of 2019, the comparison study was carried out on five food categories, one petfood and one primary production sample each with three types. In the accuracy profile, new matrices were tested; dessert powder, chilled tuna steak, spinach, chicken breast fillets, pork liver pate, dog pate, cat pate, wash water and cooling water. Artificially contaminated samples were used. Results were obtained after $72 \pm 3\text{ h}$ for the reference method and $48 \pm 3\text{ h}$ for the CompactDry TC.

Relative Trueness

The relative trueness is illustrated by the use of a Bland-Altman plot, i.e. the difference (bias) between paired samples analysed with the reference method and the alternative method respectively, plotted against the mean values obtained by the reference method. In the plot, Upper and Lower limits are included as the bias ± 2 times the standard deviation of the bias. **Table 1** shows the different categories, types and items tested. The Bland-Altman Plot in **Figure 1**, illustrates the difference obtained in the enumeration of total viable organisms in foods by the alternative and the reference method, respectively.

Table 1. Categories and types tested

Category	Types	No. of samples
Dairy products (combined category; raw milk and heat processed)	Dry	5
	Pasteurised dairy products	5
	Pasteurised milk	6
Fishery products (combined category: raw, RTE, RTRH, RTC)	Raw	5
	RTE fish	5
	Acidified and marinated	5
Produce and fruits (combined category fresh and processed)	Cut RTE	5
	Heat processed	5
	Vegetable and fruit juices	5
Raw and RTC meat and poultry (combined category)	Cuts unprocessed	5
	Mince unprocessed	5
	RTC	5
RTE and RTRH meat and poultry (combined category)	RTE cooked	5
	Fermented or dried	5
	Cured smoked	5
Pet food and animal feed	Dry Food	5
	Wet food (raw and canned)	5
	Animal feeds (poultry and fish)	5
Primary production samples (food or feed production)	Surfaces (wipes, swabs)	5
	Process water	5
	Dusts	5

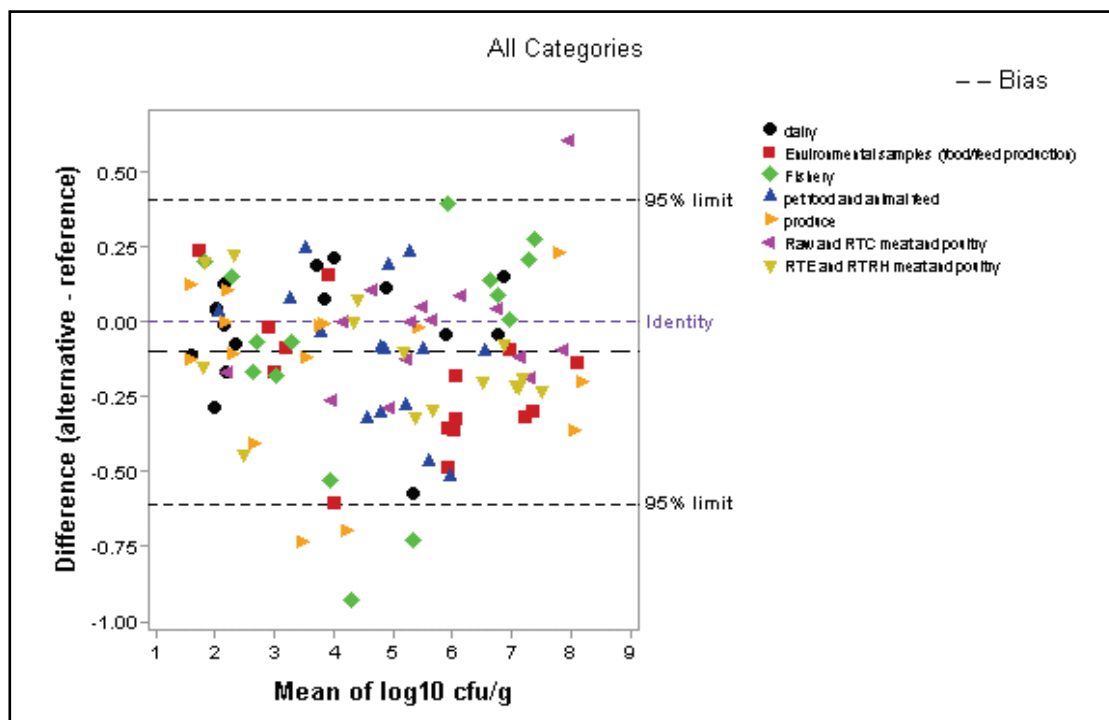


Figure 1. Bland-Altman Plot of the food categories tested

It is expected that no more than 1 in 20 data values will lie outside the 95% confidence levels (upper limit and lower limits). In this, study 5 data points of 106 in total were outside the accepted limits. Four with a negative bias. The points were from 3 different categories and different food types. The Bland-Altman plot shows that there is a small negative bias the bias-line is below zero. The results obtained are in accordance with the expectations.

Accuracy Profile

The accuracy profile study is a comparative study between the results obtained by the reference method and the results of the alternative method.

The tested categories, types, items and inoculated strains are provided in the **Table 2**.

Table 2. Categories, types and food items

Category	Types	Strain	Item	Level
Dairy products (combined category; raw milk and heat processed)	Dry dairy products	<i>E.faecalis</i> NCIMB 1993	Milk powder	10 ² cfu /g
				10 ³ cfu/g
				10 ⁵ cfu /g
		<i>Bacillus cereus</i> CRA 1724 Dried milk	Dessert powder	10 ² cfu /g
				10 ³ cfu/g
				10 ⁴ cfu/g
Fishery products Combined category: raw, RTE, RTRH, RTC	RTC	natural	Frozen white fish	10 ³ cfu /g
				10 ⁴ cfu/g
				10 ⁶ cfu /g
		<i>Pseudomonas fragi</i> CRA7222 spoiled fish	Chilled tuna steak	10 ² cfu /g
				10 ³ cfu/g
				10 ⁵ cfu/g
Produce and fruits (combined category fresh and processed)	Cut ready to eat	natural	Lettuce	10 ² cfu /g
				10 ³ cfu/g
				10 ⁵ -cfu/g
		<i>E.coli</i> CRA3379 Spinach	Spinach	10 ² cfu/g
				10 ³ cfu/g
				10 ⁴ cfu/g
Raw and RTC meat and poultry (Combined category)	Fresh meats	natural	Raw ground beef	10 ³ cfu/g
				10 ⁶ cfu/g
				10 ⁷ cfu /g
		<i>Citrobacter freundii</i> CRA403 chicken	Chicken breast fillets	10 ³ cfu/g
				10 ⁵ cfu/g
				10 ⁶ cfu/g
RTE and RTRH meat and poultry (Combined category)	Cooked products	natural	Cooked chicken	10 ³ cfu/g
				10 ⁵ cfu/g
				10 ⁶ cfu/g
		<i>Hafnia alvei</i> CRA7417 (from pate)	Pork liver pate	10 ² cfu/g
				10 ³ cfu/g
				10 ⁵ cfu/g

Category	Types	Strain	Item	Level
Pet food and animal feed	Wet food (cooked)	<i>Staph aureus</i> CRA 1246 (from pork sausage)	Dog pate	10 ² cfu/g
				10 ³ cfu/g
				10 ⁵ cfu/g
			Cat pate	10 ² cfu/g
				10 ³ cfu/g
				10 ⁴ cfu/g
Primary production samples	Process water	<i>Pseudomonas fluorescens</i> CRA 7774 (from wash house)	Wash water	10 ² cfu/g
				10 ³ cfu/g
				10 ⁵ cfu/g
			Cooling water	10 ² cfu/g
				10 ³ cfu/g
				10 ⁵ cfu/g

The samples in the renewal study was bulk inoculated and five replicate test portions examined from the bulk sample. Data from the original study, marked with darker background, contained naturally present organisms, except for except for milk powder.

The statistical results and the accuracy profiles are provided in the **Figures 2 to 8**.

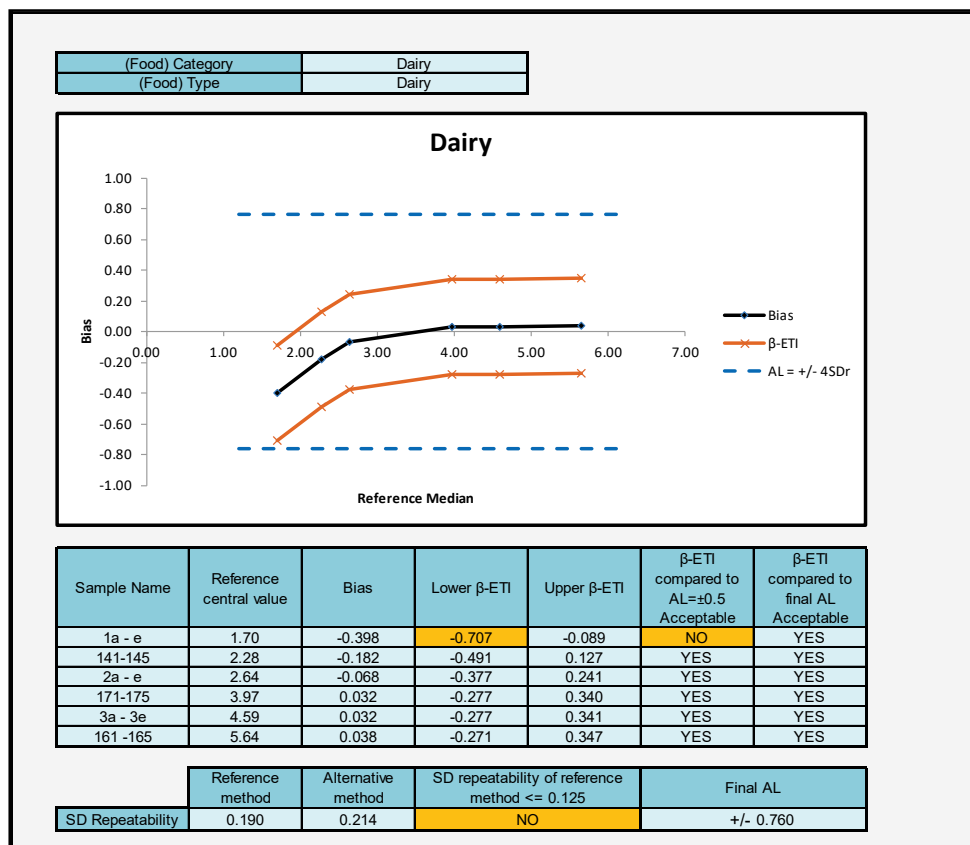


Figure 2. Dairy products

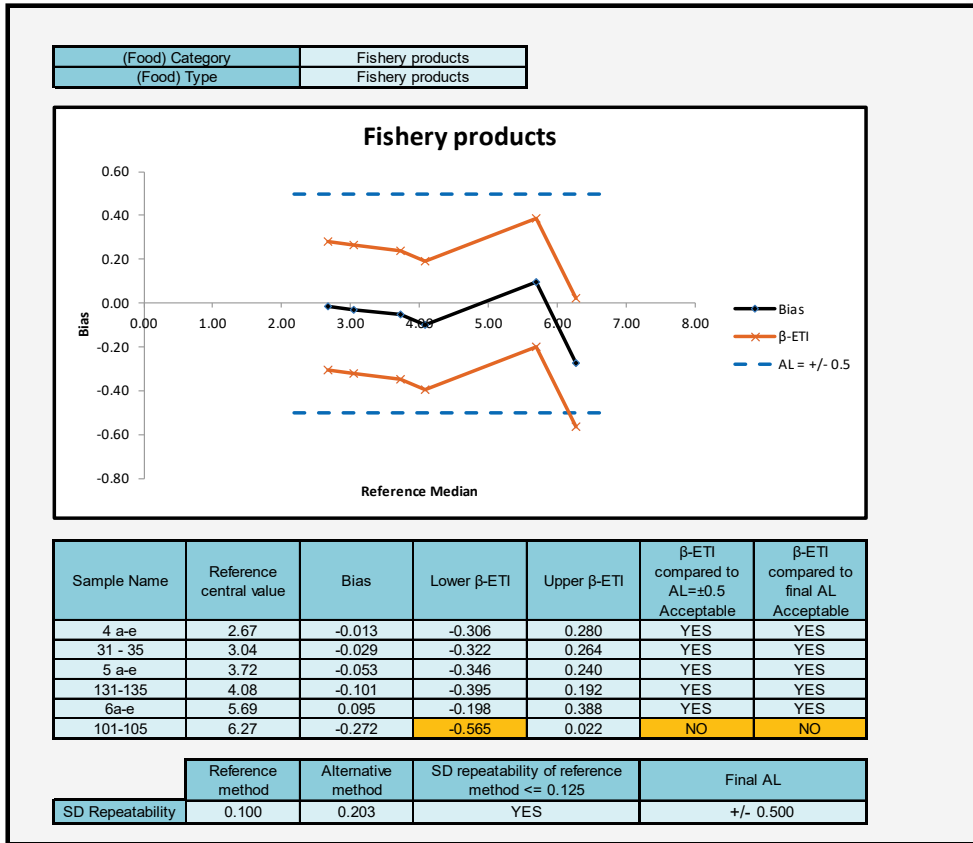


Figure 3. Fishery products

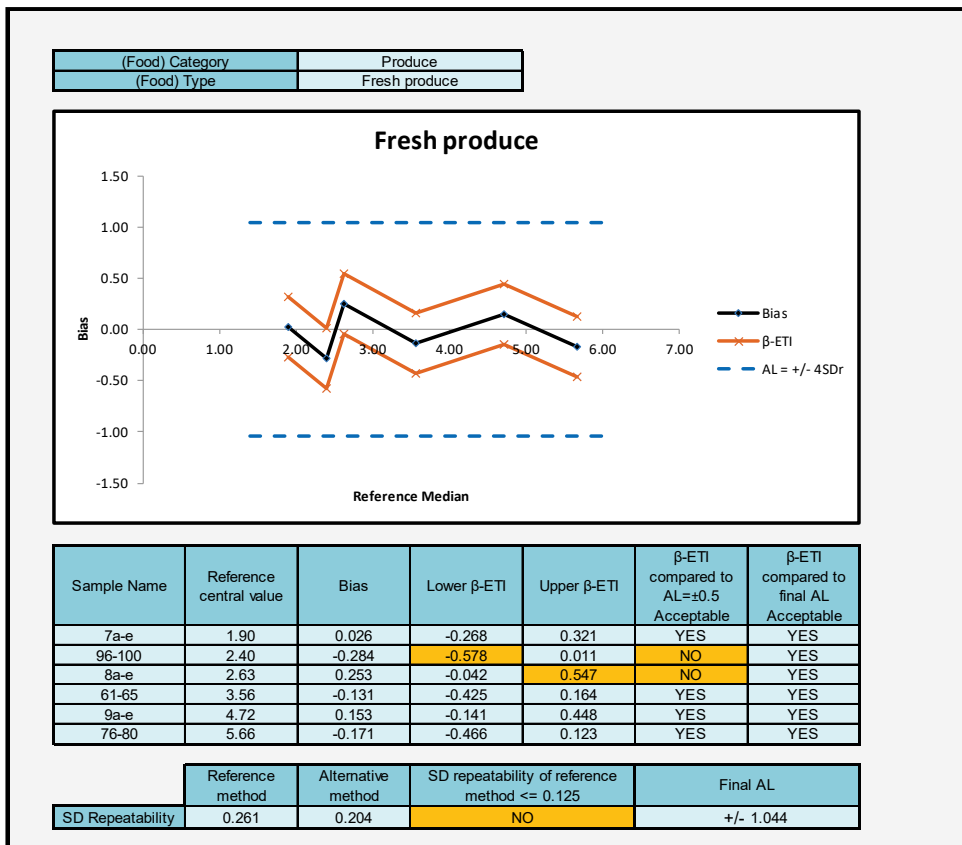


Figure 4. Fresh produce

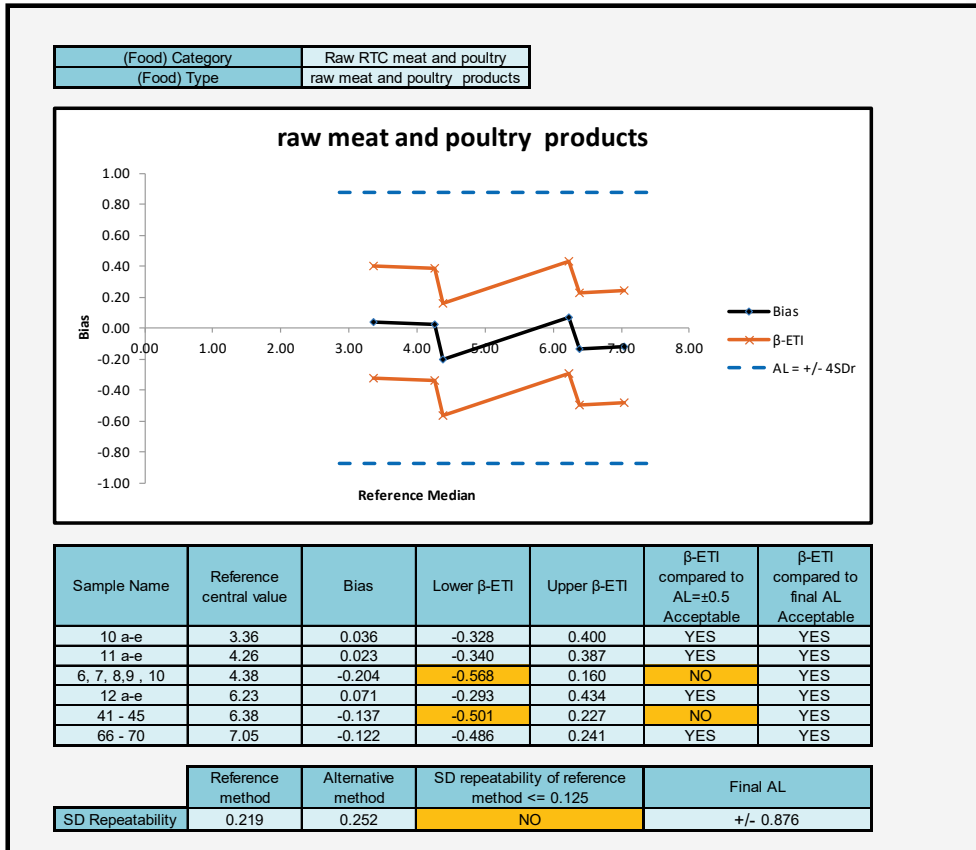


Figure 5. Raw and RTC meat and poultry products

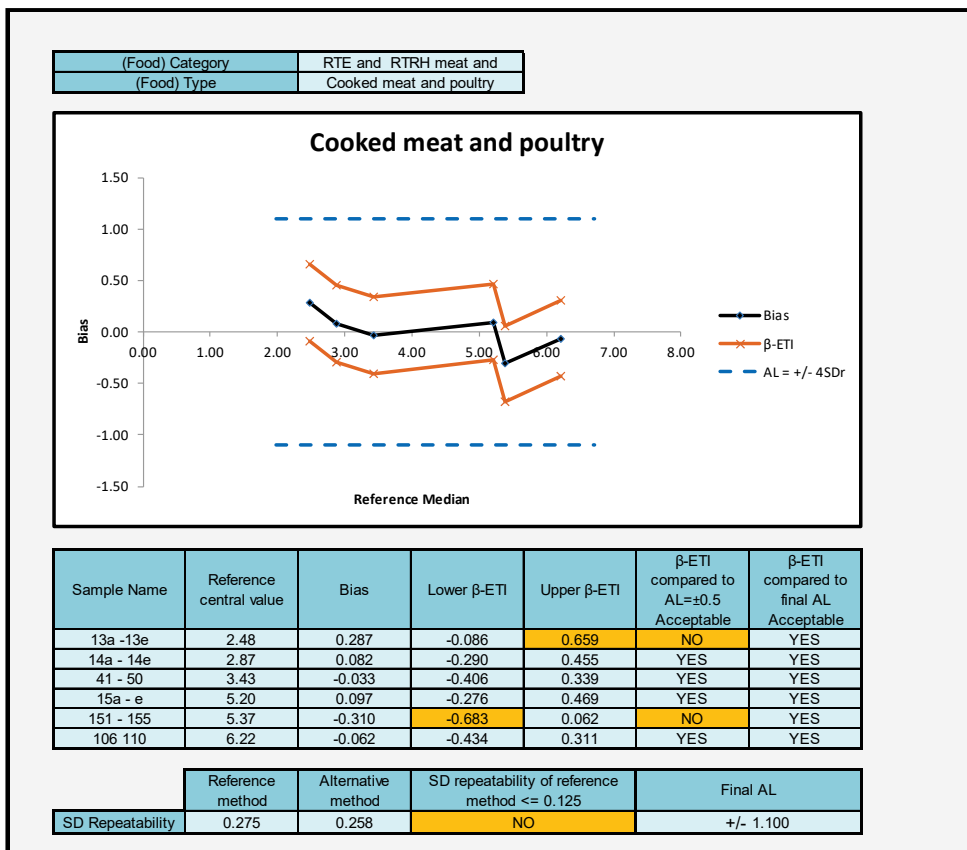


Figure 6. RTE and RTRH meat and poultry products

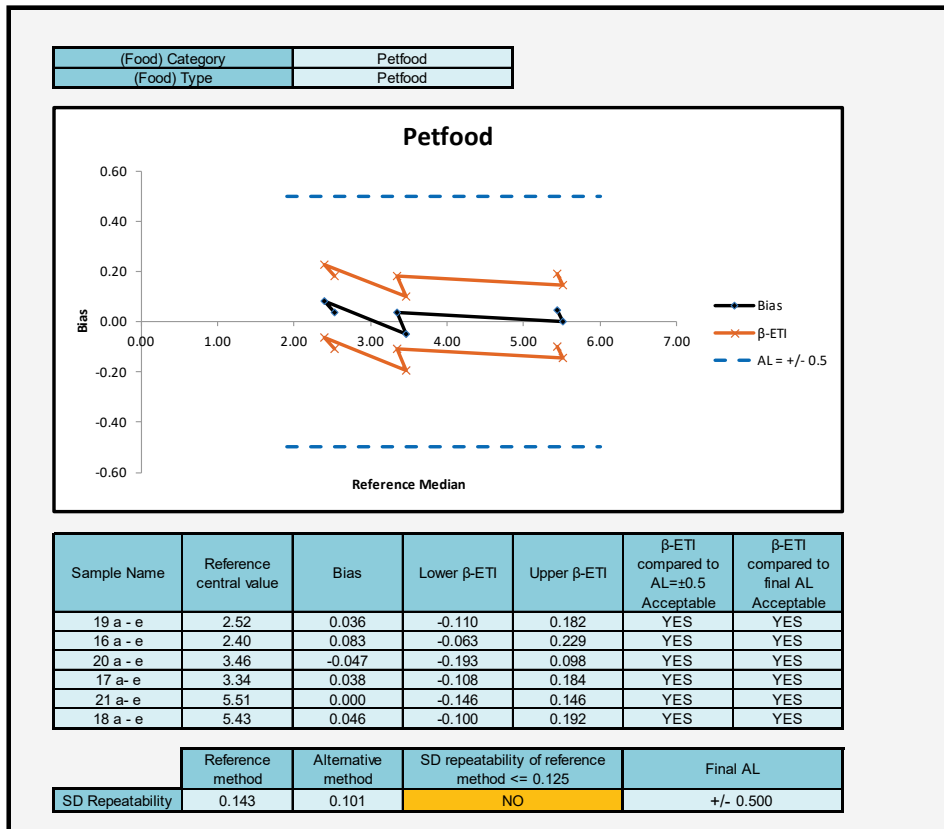


Figure 7. Pet food and animal feed products

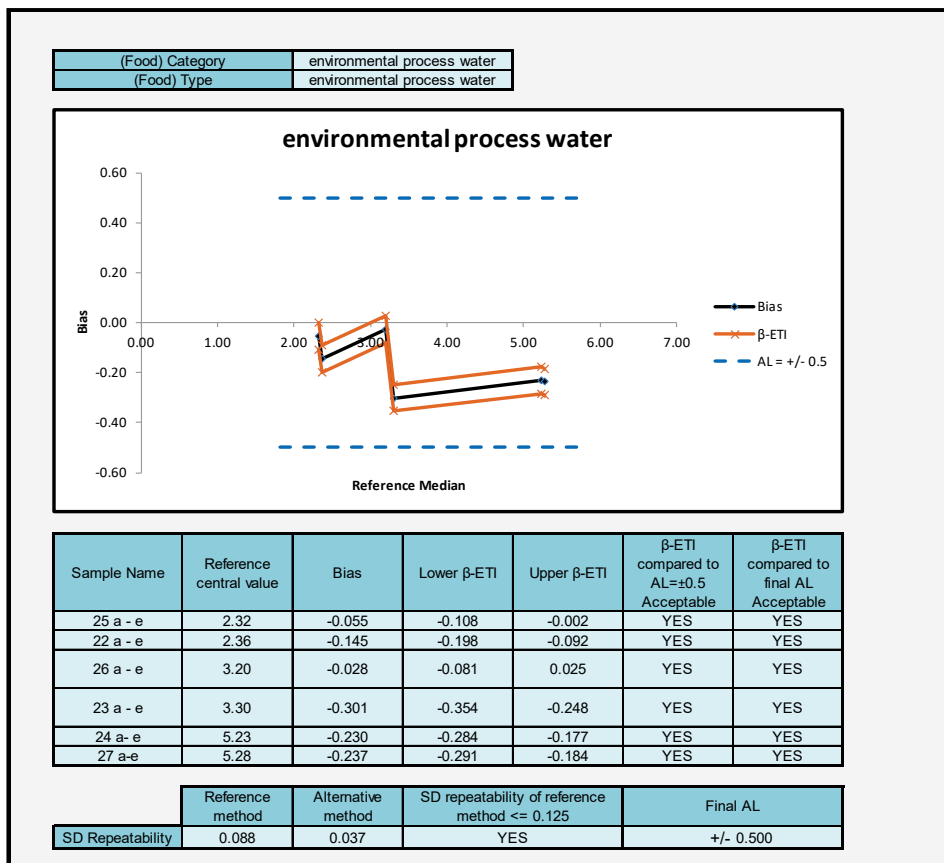


Figure 8. Primary production samples



If any of the upper or lower limits exceeded the 0.5log Acceptance Limits (AL) and the standard deviation of the reference method was $>0.125 \log \text{ cfu/g}$, a new AL can be calculated as $4 \times \text{SD}$. This was done for the four categories: Dairy products ($\text{AL} \pm 0.76 \log \text{ cfu/g}$), Fresh produce ($\text{AL} \pm 1.04 \log \text{ cfu/g}$), Raw and RTC meat and poultry products ($\text{AL} \pm 0.88 \log \text{ cfu/g}$) and RTE and RTRH meat and poultry products ($\text{AL} \pm 1.1 \text{ cfu/g}$).

For one category, Fishery Products, a new AL could not be calculated as the SD was below $0.125 \log \text{ cfu/g}$ but it should be noted that one item (high level for white fish) was just outside the $\text{AL} \pm 0.50 \log \text{ cfu/g}$.

Thus, the accuracy of the alternative method met the AL of $0.50 \log \text{ cfu/g}$ or the re-calculated AL, except for one fishery product.

Conclusion of the method comparison study

The results of the method comparison study showed that the CompactDry TC provide equivalent results to the reference method ISO 4833:2003. The lowest validated level with satisfactory precision varies from 2 - 3 $\log \text{ cfu/g}$ depending on the matrix.

INTERLABORATORY STUDY

Thirteen laboratories analysed samples of pasteurised milk artificially contaminated with defined numbers of *E. coli*. The laboratories performed the analyses according to ISO 4833 after 72 h and CompactDry TC after 48 h. The results are given in **Table 3** and the accuracy profile is shown in **Figure 9**.

Table 6. Results ($\log \text{ cfu/g}$) of the interlaboratory study

Levels	Alternative method			Reference method		
	Low	Medium	High	Low	Medium	High
Target value	2.70	3.84	4.85			
Number of participants	12	12	12	12	12	12
Average for alternative method	2.28	3.70	4.77	2.70	3.84	4.85
Repeatability standard deviation (sr)	0.08	0.04	0.06	0.05	0.04	0.05
Between-labs standard deviation (sL)	0.00	0.15	0.16	0.08	0.08	0.10
Reproducibility standard deviation (sR)	0.08	0.16	0.17	0.10	0.09	0.10
Bias	0.08	-0.14	-0.08			
Relative Lower TI limit (beta = 80%)	-0.02	-0.36	-0.33			
Relative Upper TI limit (beta = 80%)	0.18	0.08	0.16			
Lower Acceptability Limit	-0.5	-0.5	-0.5			
Upper Acceptability Limit	0.5	0.5	0.5			

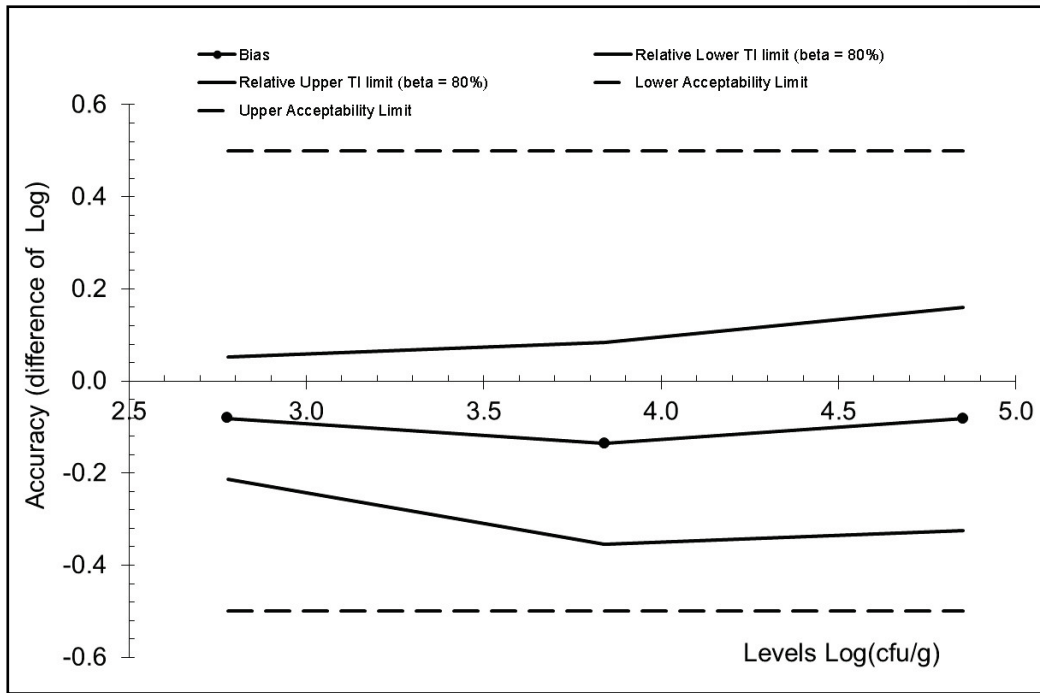


Figure 9. The Accuracy Profile for the interlaboratory study, ILS

CONCLUSION

According to the comparison and the interlaboratory study no substantial differences were found between the CompactDry TC method and the reference method (ISO 4833-1:2013) for the enumeration of total viable microorganisms at 30°C.