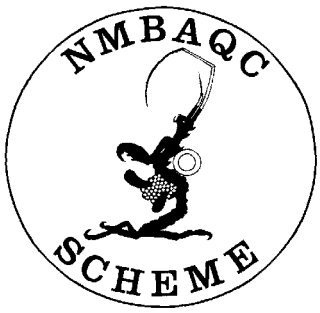

The National Marine Biological
Analytical Quality Control Scheme
www.nmbaqcs.org

Particle Size Results – PS40

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December 2011
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thomson unicomarine

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Table 1. Summary of the particle size information received from participating laboratories and replicate analysis laboratory for the fortieth particle size distribution - PS40.

Benchmark Data

Sample	Method	%Gravel	%Sand	%Silt	Median ϕ	Mean ϕ	Sediment Description (Post analysis)
PS40 60	L¹	0.00	15.80	84.20	6.531	6.358	Sandy Mud
PS40 61	L¹	0.00	14.55	85.45	6.566	6.422	Sandy Mud
PS40 62	L¹	0.00	13.96	86.04	6.566	6.432	Sandy Mud
PS40 63	L¹	0.00	13.23	86.77	6.604	6.478	Sandy Mud
PS40 64	L¹	0.00	12.72	87.28	6.608	6.493	Sandy Mud
PS40 65	L¹	0.00	14.18	85.82	6.555	6.418	Sandy Mud
PS40 66	L¹	0.00	12.73	87.27	6.637	6.514	Sandy Mud
PS40 67	L¹	0.00	15.73	84.27	6.503	6.353	Sandy Mud
PS40 68	L¹	0.00	13.31	86.69	6.590	6.468	Sandy Mud
PS40 69	L¹	0.00	9.82	90.18	6.736	6.620	Mud
TUM	L¹	**0.00**	**13.60**	**86.40**	**6.59**	**6.46**	**Sandy Mud**

Participant Data

Lab	Method	%Gravel	%Sand	%Silt	Sediment Description (Post analysis)
LB1801	L*	0.00	12.89	87.11	Silt
LB1802	L*	0.00	21.01	78.99	Sandy Mud
LB1803	L*	0.00	11.28	88.72	Slightly Sandy Mud
LB1804	L*	0.00	8.00	92.00	Mud
LB1806	L*	0.00	13.84	86.16	Sandy Silt
LB1809	L*	0.00	13.93	86.07	Sandy Mud
LB1811	L*	0.00	11.31	88.69	Sandy Mud
LB1814	WS/DS/L	0.00	9.62	90.38	Mud
LB1816	L*	0.00	12.90	87.10	Medium Silt
LB1818	L*	0.00	15.15	84.85	Muddy Sand
LB1830	L	0.00	13.68	86.32	Sandy Mud

Key to methods:

L¹ - Replicate analysis by Malvern MS2000+Hydro-G 0.02-2000µm; no blue laser (NMBAQC PSA SOP)

L - Laser analysis

WS - Wet Sieve

DS - Dry Sieve

'*' - NMBAQC PSA SOP

Figure 1. Particle size distribution curves resulting from analysis of ten replicate samples of sediment distributed as PS40 (Benchmark Data). All ten replicates analysed by Malvern Mastersizer 2000.

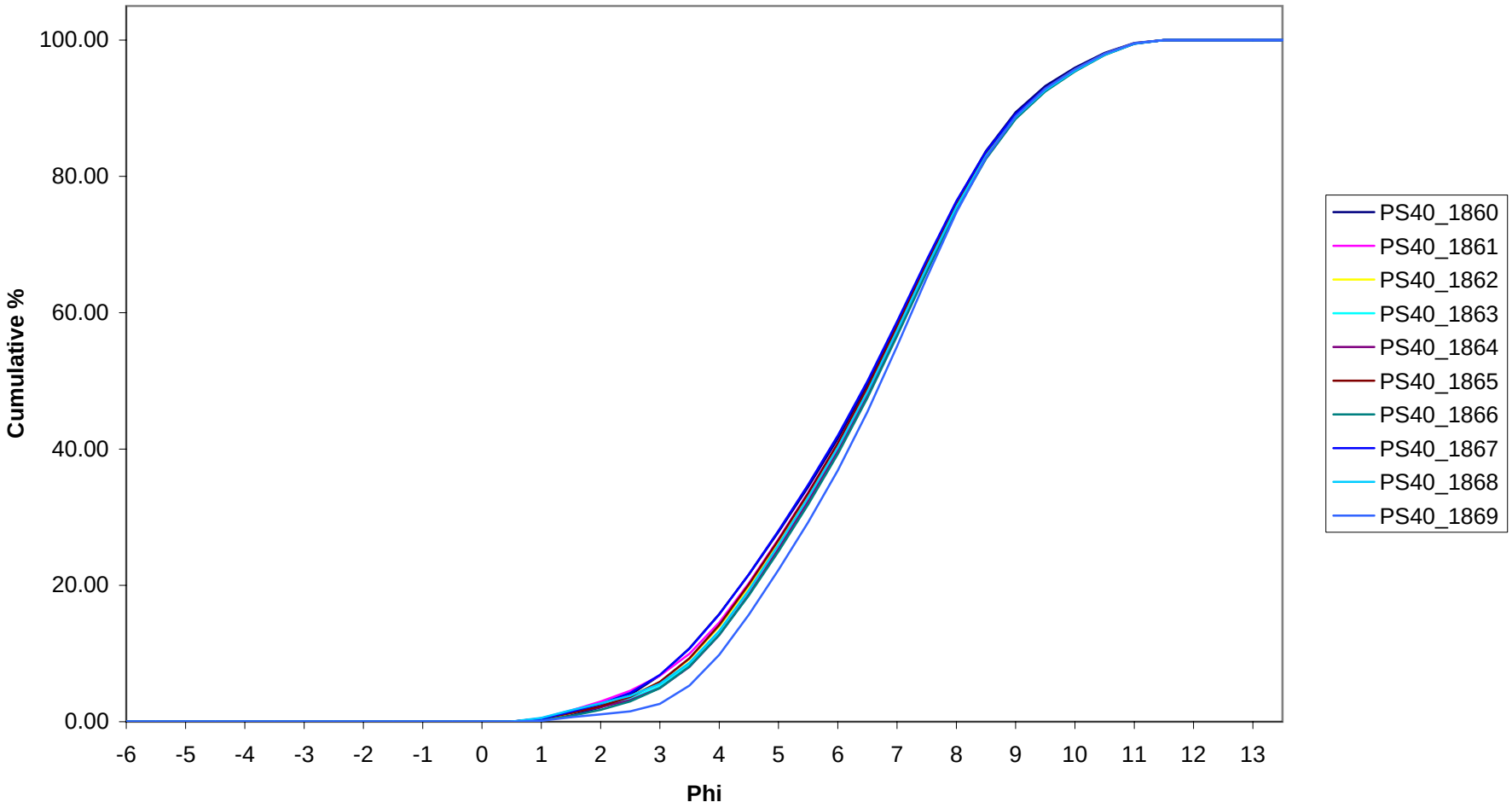


Figure 2. Particle size distribution curves from all participating laboratories for sediment samples distributed as PS40.

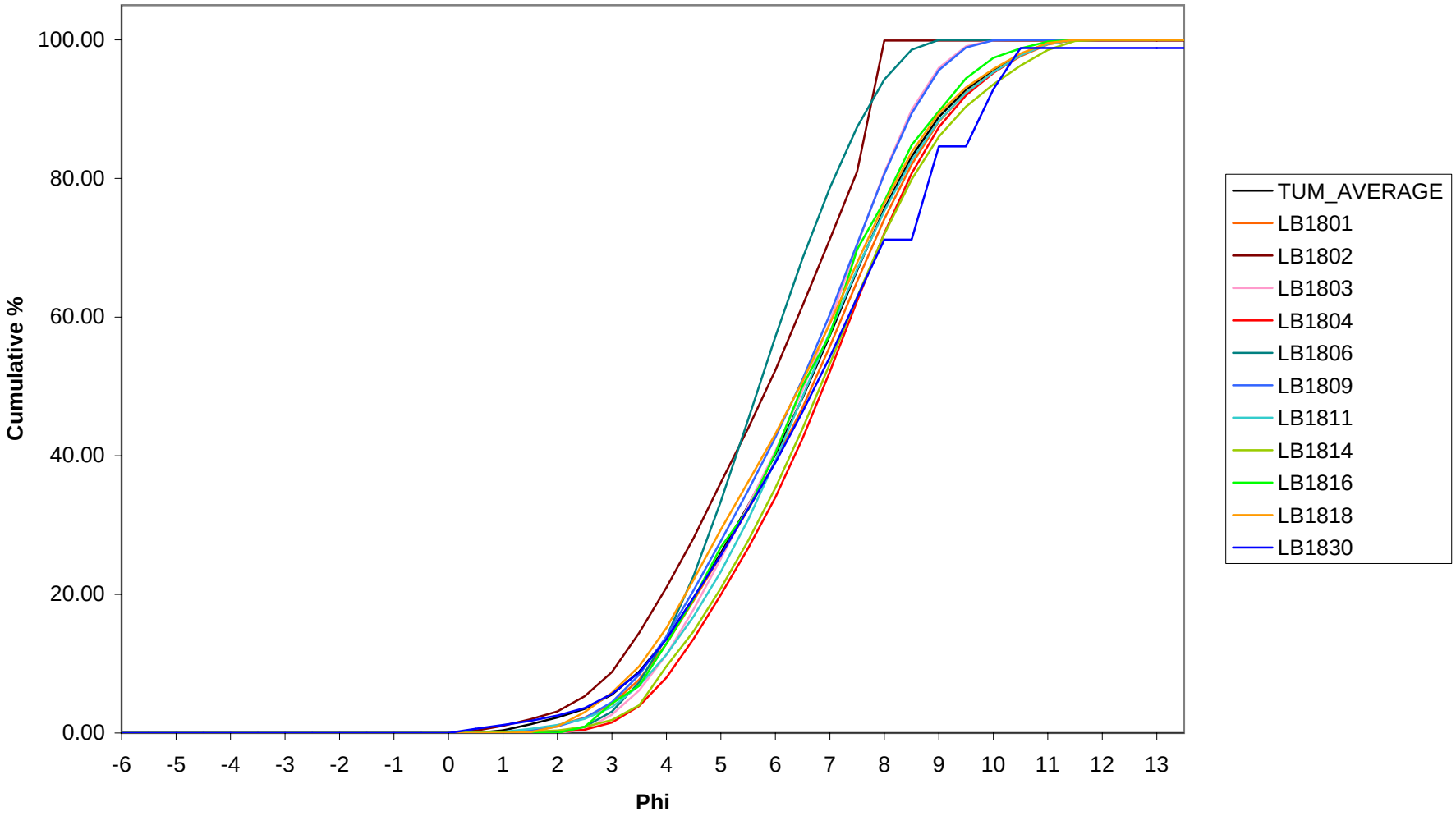


Figure 3. Particle size distribution curves from all participating laboratories following the NMBAQC PSA Standard Operating Procedure for sediment samples distributed as PS40.

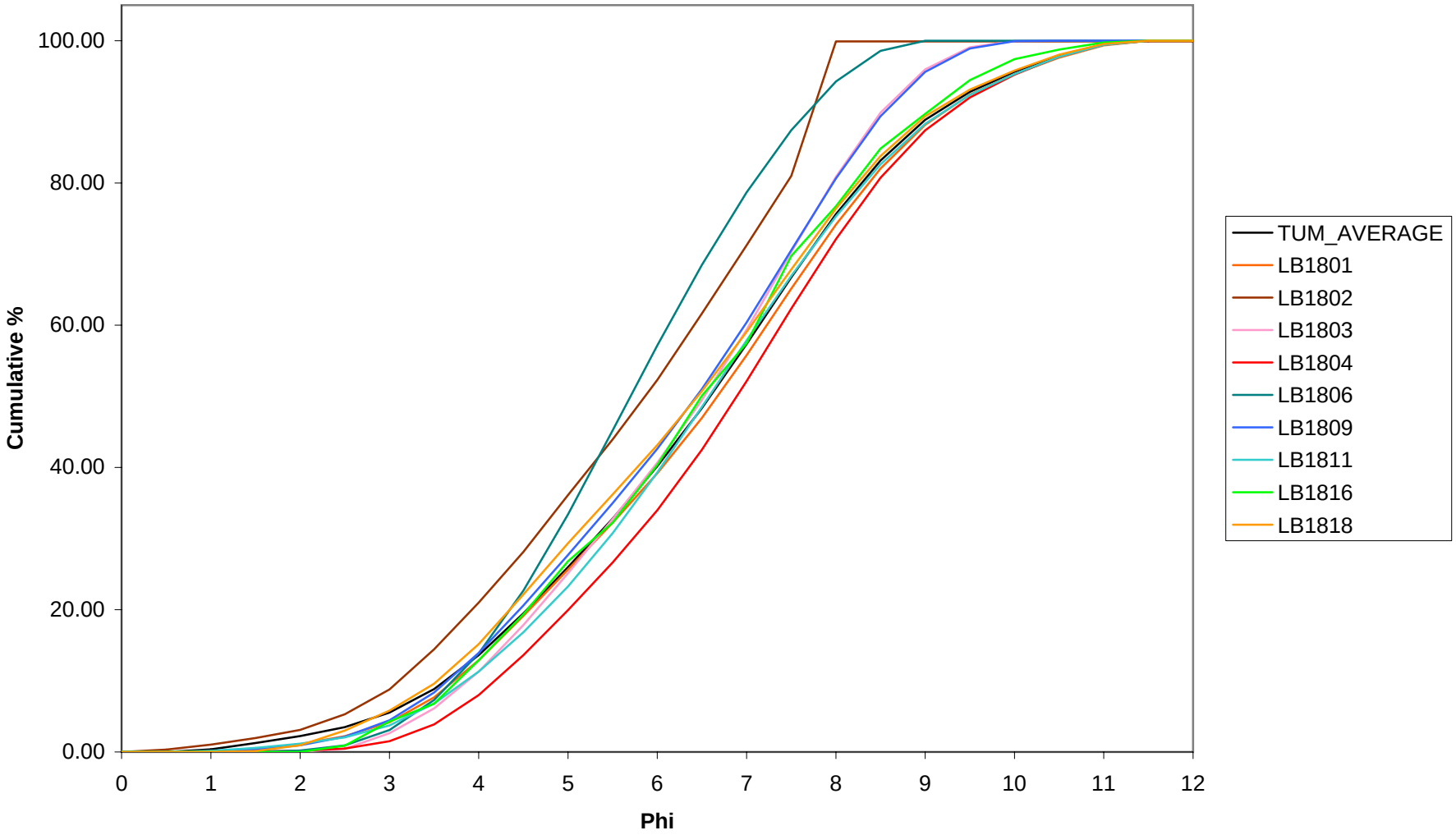


Table 2. Summary of z-scores for each phi-interval for all participating laboratories.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	-3.50 to -3.00	-3.00 to -2.50	-2.50 to -2.00	-2.00 to -1.50	-1.50 to -1.00	-1.00 to -0.50	-0.50 to 0.00	0.00 to 0.50	0.50 to 1.00	1.00 to 1.50	1.50 to 2.00	2.00 to 2.50	2.50 to 3.00	3.00 to 3.50
TUM AVERAGE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.39	0.84	1.72	1.21	0.35	-0.18	-0.11
LB1801	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.38	-0.36	0.06	0.47	0.10	-0.28	0.10
LB1802	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	2.21	1.85	1.61	1.92	1.70	2.34
LB1803	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	-0.68	-0.93	-1.21	-1.09	0.04	0.08
LB1804	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	-0.65	-0.75	-1.04	-1.26	-1.47	-1.11
LB1806	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	-0.68	-0.90	-0.80	-0.58	-0.02	0.86
LB1809	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	-0.49	-0.08	0.25	0.27	0.16	0.52
LB1811	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	0.02	0.31	0.18	-0.28	-0.63	-0.36
LB1814	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.37	-0.43	-0.61	-0.83	-0.93	-1.52	-1.37
LB1816	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	-0.68	-0.93	-1.29	-0.27	1.56	-0.96
LB1818	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	-0.68	-0.57	0.79	1.72	0.80	0.39
LB1830	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74	1.60	0.84	0.67	0.05	-0.16	-0.38

	3.50 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 to 5.50	5.50 to 6.00	6.00 to 6.50	6.50 to 7.00	7.00 to 7.50	7.50 to 8.00	8.00 to 8.50	8.50 to 9.00	9.00 to 9.50	9.50 to 10.00	10.00 to 10.50	10.50 to 11.00	11.00 to 11.50	11.50 to 12.00	12.00 to 12.50	12.50 to 13.00	13.00 to 13.50
TUM AVERAGE	-0.80	-0.54	-0.52	-0.32	-0.43	-0.51	-0.08	-0.34	-0.23	0.21	0.02	0.39	0.11	0.27	0.63	0.27	-0.30	0.00	0.00	0.00
LB1801	-0.22	-0.18	-0.49	-0.48	-0.73	-0.88	-0.29	-0.34	-0.20	0.34	0.15	0.57	0.15	0.28	0.78	0.67	-0.30	0.00	0.00	0.00
LB1802	1.54	0.74	0.66	0.32	0.30	0.56	0.62	0.02	2.97	-2.65	-1.77	-1.93	-1.18	-1.07	-1.19	-0.97	-0.30	0.00	0.00	0.00
LB1803	-0.29	0.14	0.11	0.19	-0.03	0.06	0.98	1.15	0.30	0.77	0.13	-0.10	-0.78	-1.04	-1.19	-0.97	-0.30	0.00	0.00	0.00
LB1804	-1.63	-0.82	-0.64	-0.42	-0.44	-0.20	0.69	0.43	0.05	0.62	0.31	0.79	0.30	0.41	0.74	0.40	-0.30	0.00	0.00	0.00
LB1806	1.50	2.48	2.82	2.90	2.88	2.39	1.35	-0.93	-0.88	-1.02	-1.32	-1.93	-1.18	-1.07	-1.19	-0.97	-0.30	0.00	0.00	0.00
LB1809	0.25	0.25	-0.04	-0.03	-0.22	-0.31	0.36	0.39	0.15	0.67	0.17	0.00	-0.71	-1.03	-1.19	-0.97	-0.30	0.00	0.00	0.00
LB1811	-1.13	-0.91	-0.57	0.11	0.43	0.44	0.33	-0.62	-0.40	0.13	0.01	0.46	0.17	0.35	0.72	0.47	-0.30	0.00	0.00	0.00
LB1814	0.33	-1.38	-0.76	-0.32	-0.24	-0.14	0.35	-0.13	-0.17	0.34	0.15	0.63	0.29	0.52	1.40	2.28	3.02			
LB1816	0.95	0.04	0.24	-1.24	0.13	0.92	-2.05	2.40	-0.85	0.43	-0.25	0.86	0.18	-0.27	-0.05	-0.36	-0.30	0.00	0.00	0.00
LB1818	0.23	0.58	0.04	-0.30	-0.74	-1.06	-0.88	-0.90	-0.34	0.16	-0.03	0.28	0.04	0.24	0.55	0.15	-0.30	0.00	0.00	0.00
LB1830	-0.73	-0.40	-0.84	-0.42	-0.92	-1.27	-1.39	-1.12	-0.40	-2.65	2.43	-1.93	2.61	2.40	-1.19	-0.97	-0.30	0.00	0.00	0.00

No data provided for these phi-intervals, zero entered to calculate z-score, data not used to calculate mean and stand deviation.
Combines data >11.5phi
Mean and standard deviation equal zero :. z-score uncalculatable

Calculations can be found in Appendix 2.

Table 3. Summary of z-scores for each phi interval for all participating laboratories; z-scores (mean and standard deviation) calculated using data from the laboratories following the NMBAQC PSA SOP only.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	-3.50 to -3.00	-3.00 to -2.50	-2.50 to -2.00	-2.00 to -1.50	-1.50 to -1.00	-1.00 to -0.50	-0.50 to 0.00	0.00 to 0.50	0.50 to 1.00	1.00 to 1.50	1.50 to 2.00	2.00 to 2.50	2.50 to 3.00	3.00 to 3.50
TUM AVERAGE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.28	1.00	1.66	1.14	0.25	-0.36	-0.29
LB1801	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.26	-0.26	0.08	0.43	0.01	-0.46	-0.08
LB1802	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.85	2.45	1.79	1.53	1.74	1.59	2.21
LB1803	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.60	-0.87	-1.18	-1.11	-0.14	-0.10
LB1804	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.56	-0.69	-1.01	-1.28	-1.69	-1.31
LB1806	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.60	-0.83	-0.78	-0.63	-0.19	0.70
LB1809	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.39	-0.06	0.23	0.17	-0.01	0.35
LB1811	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.14	0.32	0.15	-0.35	-0.83	-0.55
LB1814	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.23	-0.33	-0.56	-0.81	-0.96	-1.75	-1.57
LB1816	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.60	-0.87	-1.25	-0.33	1.44	-1.16
LB1818	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.60	-0.52	0.74	1.54	0.66	0.22
LB1830	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.32	1.80	0.82	0.62	-0.03	-0.34	-0.56

	3.50 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 to 5.50	5.50 to 6.00	6.00 to 6.50	6.50 to 7.00	7.00 to 7.50	7.50 to 8.00	8.00 to 8.50	8.50 to 9.00	9.00 to 9.50	9.50 to 10.00	10.00 to 10.50	10.50 to 11.00	11.00 to 11.50	11.50 to 12.00	12.00 to 12.50	12.50 to 13.00	13.00 to 13.50
TUM AVERAGE	-0.79	-0.74	-0.67	-0.36	-0.52	-0.65	-0.19	-0.45	-0.26	0.23	0.39	0.44	0.66	0.83	0.82	0.72	0.00	0.00	0.00	0.00
LB1801	-0.24	-0.37	-0.64	-0.51	-0.81	-1.01	-0.40	-0.45	-0.23	0.36	0.58	0.61	0.73	0.85	0.98	1.29	0.00	0.00	0.00	0.00
LB1802	1.40	0.58	0.49	0.23	0.18	0.41	0.52	-0.10	2.66	-2.50	-2.15	-1.81	-1.49	-1.14	-1.13	-1.07	0.00	0.00	0.00	0.00
LB1803	-0.30	-0.03	-0.05	0.11	-0.14	-0.08	0.89	0.99	0.22	0.77	0.55	-0.04	-0.81	-1.10	-1.13	-1.07	0.00	0.00	0.00	0.00
LB1804	-1.56	-1.02	-0.78	-0.45	-0.52	-0.34	0.59	0.29	-0.01	0.63	0.81	0.82	0.98	1.04	0.95	0.91	0.00	0.00	0.00	0.00
LB1806	1.36	2.35	2.60	2.60	2.63	2.23	1.26	-1.02	-0.86	-0.94	-1.52	-1.81	-1.49	-1.14	-1.13	-1.07	0.00	0.00	0.00	0.00
LB1809	0.19	0.08	-0.19	-0.10	-0.32	-0.45	0.26	0.26	0.09	0.67	0.61	0.06	-0.69	-1.09	-1.13	-1.07	0.00	0.00	0.00	0.00
LB1811	-1.09	-1.11	-0.72	0.04	0.30	0.30	0.23	-0.72	-0.42	0.15	0.38	0.51	0.77	0.95	0.92	1.01	0.00	0.00	0.00	0.00
LB1814	0.27	-1.59	-0.89	-0.36	-0.34	-0.28	0.25	-0.24	-0.21	0.36	0.59	0.67	0.96	1.19	1.65	3.62	"*"			
LB1816	0.85	-0.14	0.08	-1.20	0.01	0.78	-2.17	2.21	-0.83	0.44	0.01	0.89	0.78	0.03	0.09	-0.20	0.00	0.00	0.00	0.00
LB1818	0.18	0.41	-0.11	-0.34	-0.81	-1.19	-0.99	-1.00	-0.36	0.18	0.33	0.33	0.56	0.78	0.74	0.55	0.00	0.00	0.00	0.00
LB1830	-0.72	-0.59	-0.98	-0.45	-0.99	-1.40	-1.51	-1.21	-0.42	-2.50	3.83	-1.81	4.83	3.97	-1.13	-1.07	0.00	0.00	0.00	0.00

Mean and standard deviation equal zero :. z-score uncalculatable

Not following NMBAQC PSA SOP, data not used in mean and standard deviation calculations.

"*" z-score uncalculatable (Cannot divide by zero).

Calculations can be found in Appendix 3.

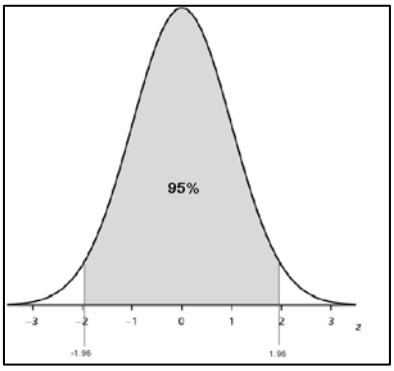
Standard Normal Distribution

$$z = \frac{x - \mu}{\sigma} \qquad X \sim N(\mu, \sigma^2)$$

Quartiles of X

$x = \sigma q_\alpha + \mu$ where, q_α is the $\alpha -$ quantile of Z

$q_{0.975} = 1.96 \quad q_{0.025} = -1.96$



Phi-interval	μ	σ	$q_{0.025}$	$q_{0.0975}$
-6.50 to -6.00; 63 mm	0.0000	0.0000	0.0000	0.0000
-6.00 to -5.50; 45 mm	0.0000	0.0000	0.0000	0.0000
-5.50 to -5.00; 31.5 mm	0.0000	0.0000	0.0000	0.0000
-5.00 to -4.50; 22.4 mm	0.0000	0.0000	0.0000	0.0000
-4.50 to -4.00; 16 mm	0.0000	0.0000	0.0000	0.0000
-4.00 to -3.50; 11.2 mm	0.0000	0.0000	0.0000	0.0000
-3.50 to -3.00; 8 mm	0.0000	0.0000	0.0000	0.0000
-3.00 to -2.50; 5.6 mm	0.0000	0.0000	0.0000	0.0000
-2.50 to -2.00; 4 mm	0.0000	0.0000	0.0000	0.0000
-2.00 to -1.50; 2.8 mm	0.0000	0.0000	0.0000	0.0000
-1.50 to -1.00; 2 mm	0.0000	0.0000	0.0000	0.0000
-1.00 to -0.50; 1.4 mm	0.0000	0.0000	0.0000	0.0000
-0.50 to 0.00; 1 mm	0.0000	0.0000	0.0000	0.0000
0.00 to 0.50; (707 μm)	0.0810	0.1923	-0.2959	0.4579
0.50 to 1.00; (500 μm)	0.1641	0.2397	-0.3057	0.6338
1.00 to 1.50; (353.6 μm)	0.3106	0.3322	-0.3405	0.9617
1.50 to 2.00; (250 μm)	0.5091	0.3932	-0.2616	1.2799
2.00 to 2.50; (176.8 μm)	1.0518	0.5934	-0.1112	2.2149
2.50 to 3.00; (125 μm)	2.1822	0.7733	0.6666	3.6978
3.00 to 3.50; (88.39 μm)	3.4194	0.9471	1.5630	5.2758
3.50 to 4.00; (62.5 μm)	5.3680	0.7719	3.8551	6.8810
4.00 to 4.50; (44.19 μm)	6.4171	0.9771	4.5019	8.3323
4.50 to 5.00; (31.25 μm)	7.1593	1.2692	4.6716	9.6470
5.00 to 5.50; (22.097 μm)	7.3397	1.5420	4.3175	10.3619
5.50 to 6.00; (15.625 μm)	7.9512	1.3845	5.2375	10.6649
6.00 to 6.50; (11.049 μm)	8.7218	1.0803	6.6044	10.8392
6.50 to 7.00; (7.813 μm)	9.0666	0.8338	7.4323	10.7009
7.00 to 7.50; (5.524 μm)	9.7311	1.0655	7.6427	11.8194
7.50 to 8.00; (3.906 μm)	9.6196	3.1272	3.4903	15.7490
8.00 to 8.50; (2.762 μm)	6.9783	2.6316	1.8203	12.1363
8.50 to 9.00; (1.953 μm)	5.6770	3.2136	-0.6217	11.9757
9.00 to 9.50; (1.381 μm)	3.2822	1.6975	-0.0449	6.6093
9.50 to 10.00; (0.977 μm)	2.5702	2.1700	-1.6830	6.8235
10.00 to 10.50; (0.691 μm)	1.8283	1.7165	-1.5360	5.1926
10.50 to 11.00; (0.488 μm)	1.0350	0.8691	-0.6684	2.7385
11.00 to 11.50; (0.345 μm)	0.3914	0.4036	-0.3996	1.1825
11.50 to 12.00; (0.244 μm)	0.0147	0.0487	-0.0807	0.1100

Table 4. Quartiles for each phi-interval based on mean and standard deviation calculations including all participating laboratories.

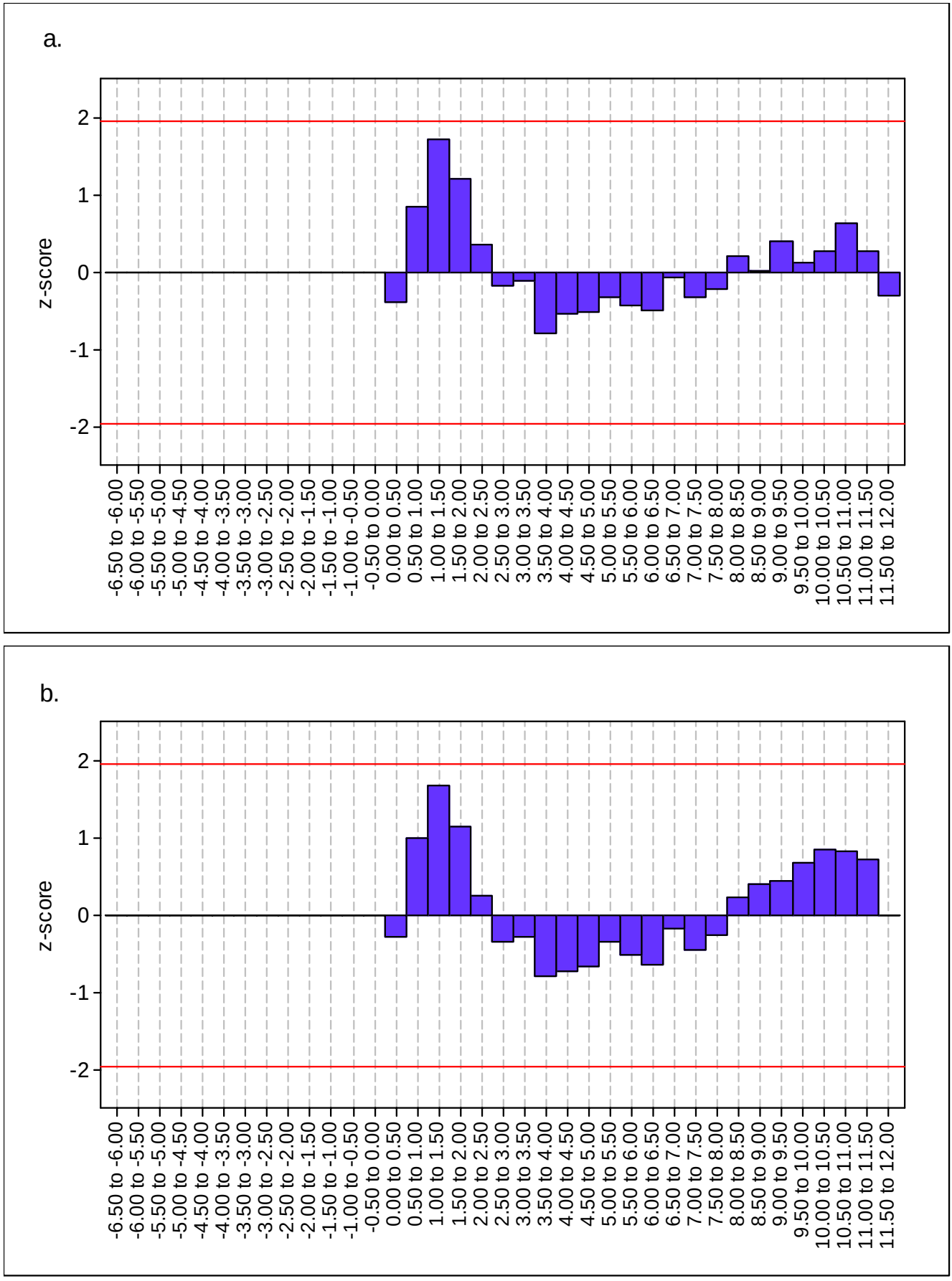


Figure 4. Summary of z-scores for the benchmark data (TUM AVERAGE); (a) when all laboratories are included in mean and standard deviation calculations and (b) when only those laboratories following the NMBAQC PSA SOP are included in mean and standard deviation calculations. Reference lines (red) are shown at the 95% level, z= ±1.96

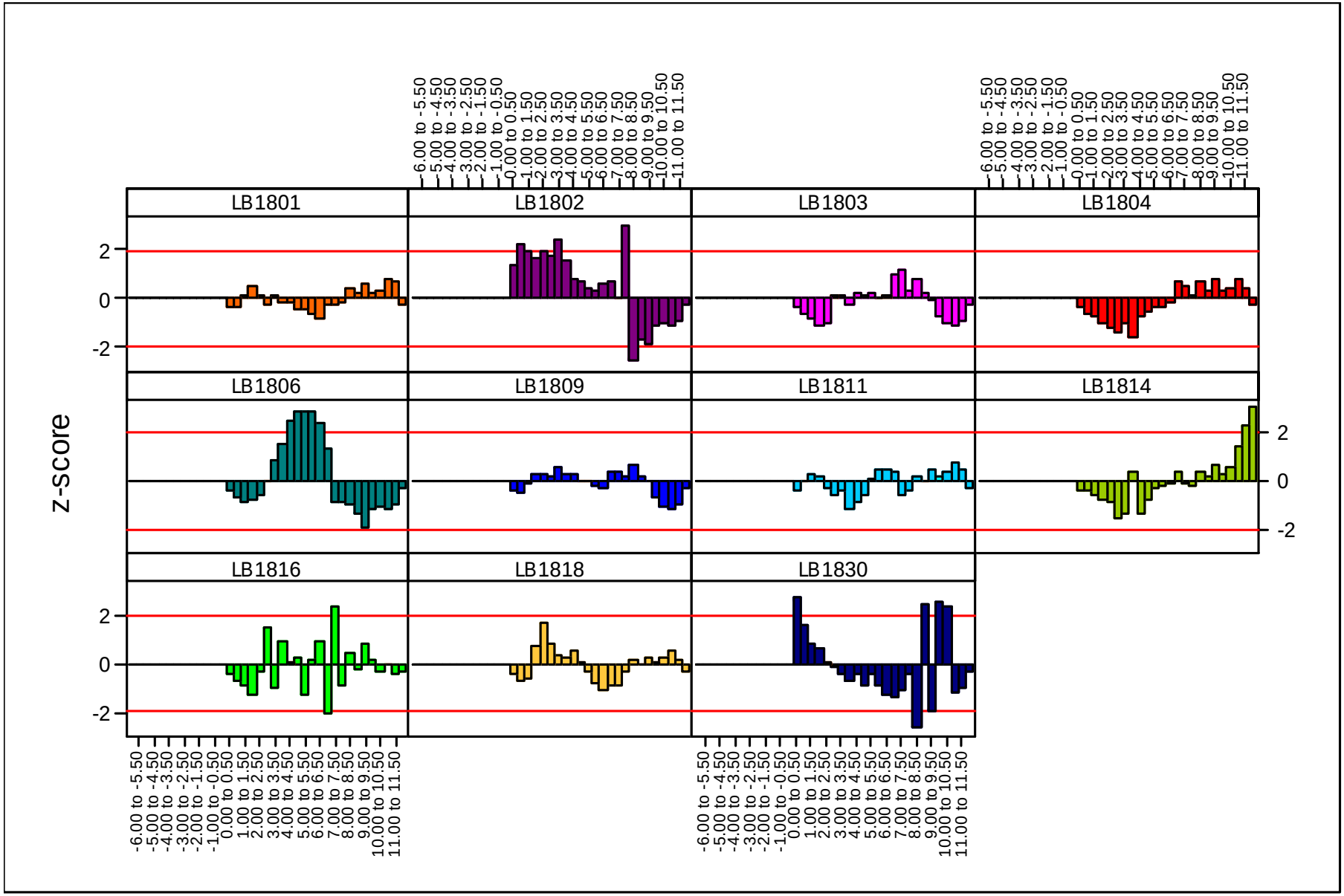


Figure 5. Summary of z-scores for participating laboratories when all laboratory data are included in mean and standard deviation calculations. Reference lines (red) are shown at the 95% level, z= ±1.96

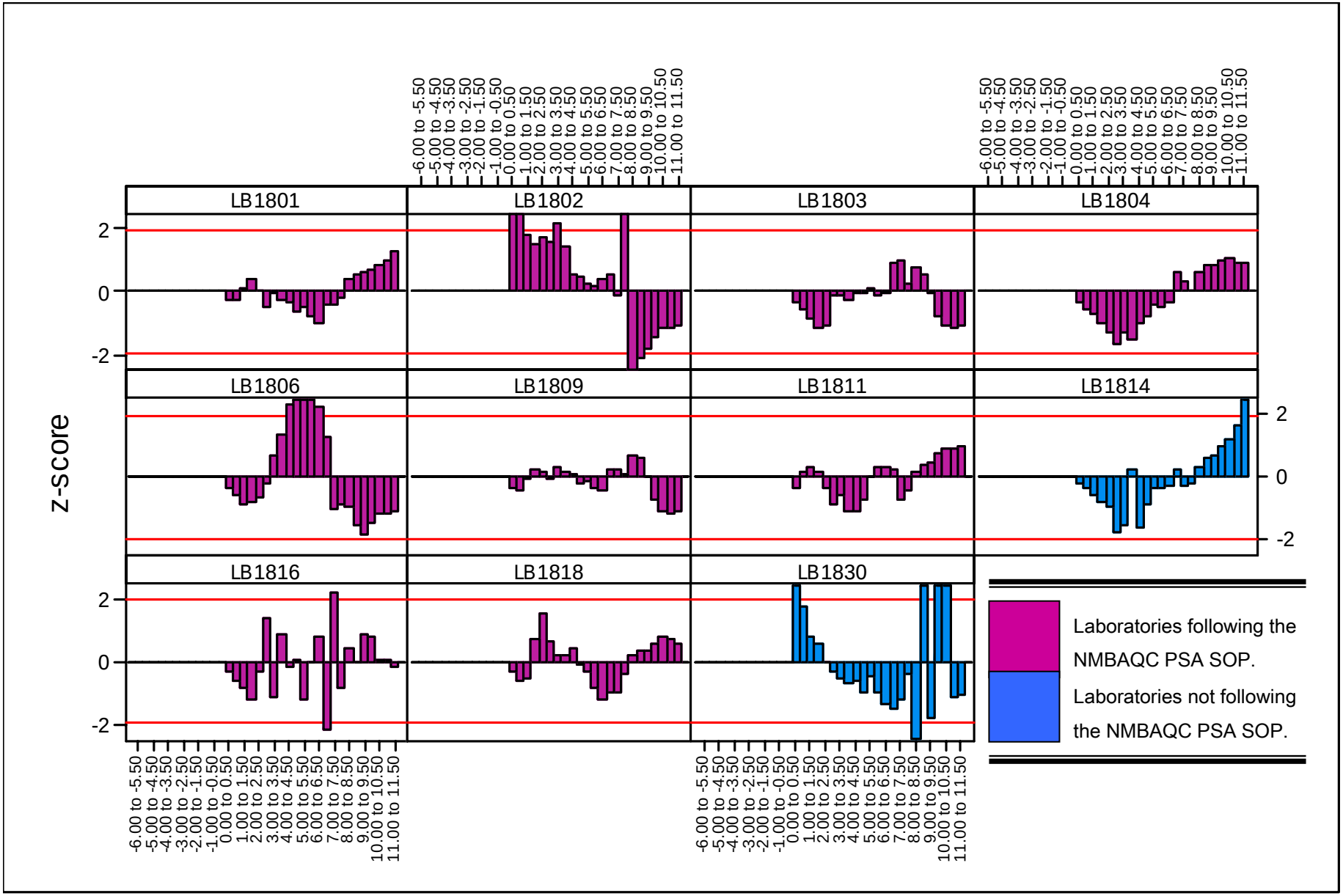


Figure 6. Summary of z-scores for participating laboratories when only those laboratories following the NMBAQC PSA SOP are included in mean and standard deviation calculations. Reference lines (red) are shown at the 95% level, z= ±1.96

Results of SIMPROF testing on PSA Ring test PS40 data

Data was entered into PRIMER v. 6.1.13 in half-phi intervals; missing data was entered as zero. The data did not need to be transformed as all data was on a similar percentage scale. A Euclidean distance matrix was created from the data; The Euclidean distance between two samples (labs) *j* and *k,* is defined algebraically as $d_{jk} = \sqrt{\sum_{i=1}^{p}(y_{ij} - y_{ik})^2}$. From this distance matrix cluster analysis was carried out including a SIMPROF test at a 5% significance level. The results are presented as a cluster dendrogram (Figures 7 and 10) and non-metric Multi-Dimensional Scaling (MDS) diagrams (Figures 8 and 9) below.

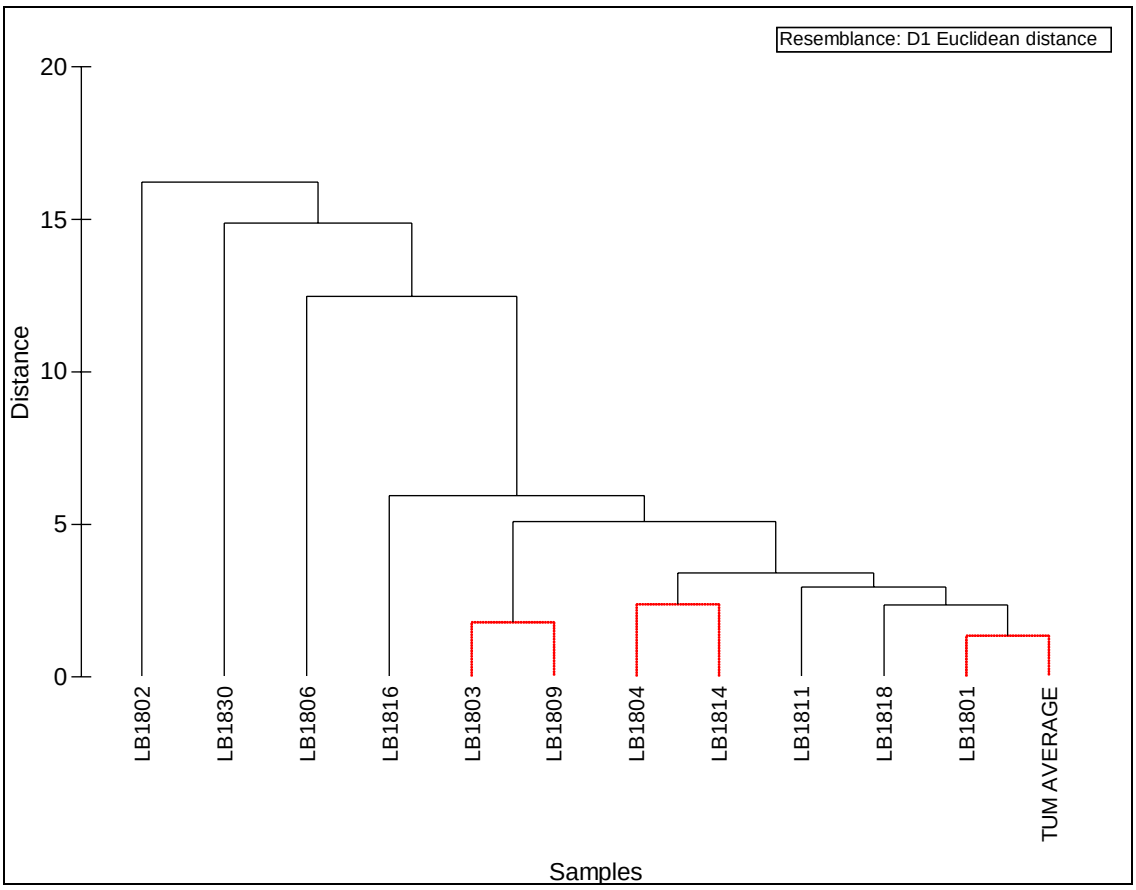


Figure 7.Cluster dendrogram of PS40 including all labs, with the benchmark replicates (TUM AVERAGE) averaged.

The red SIMPROF lines indicate samples that cannot be distinguished from each other at the 5% significance level. The dendrogram shows that LB1801 cannot be distinguished from the benchmark data. LB1803 and LB1809, LB1804 and LB1814 also cannot be distinguished from each other. The graph in Figure 2 shows that these pairs of labs follow very similar cumulative percentage curves. The dendrogram places LB1802, LB1830 and LB1806 far away from the other labs, the cumulative distribution curves in Figure 2 show these three labs produce different cumulative curves to the other laboratories.

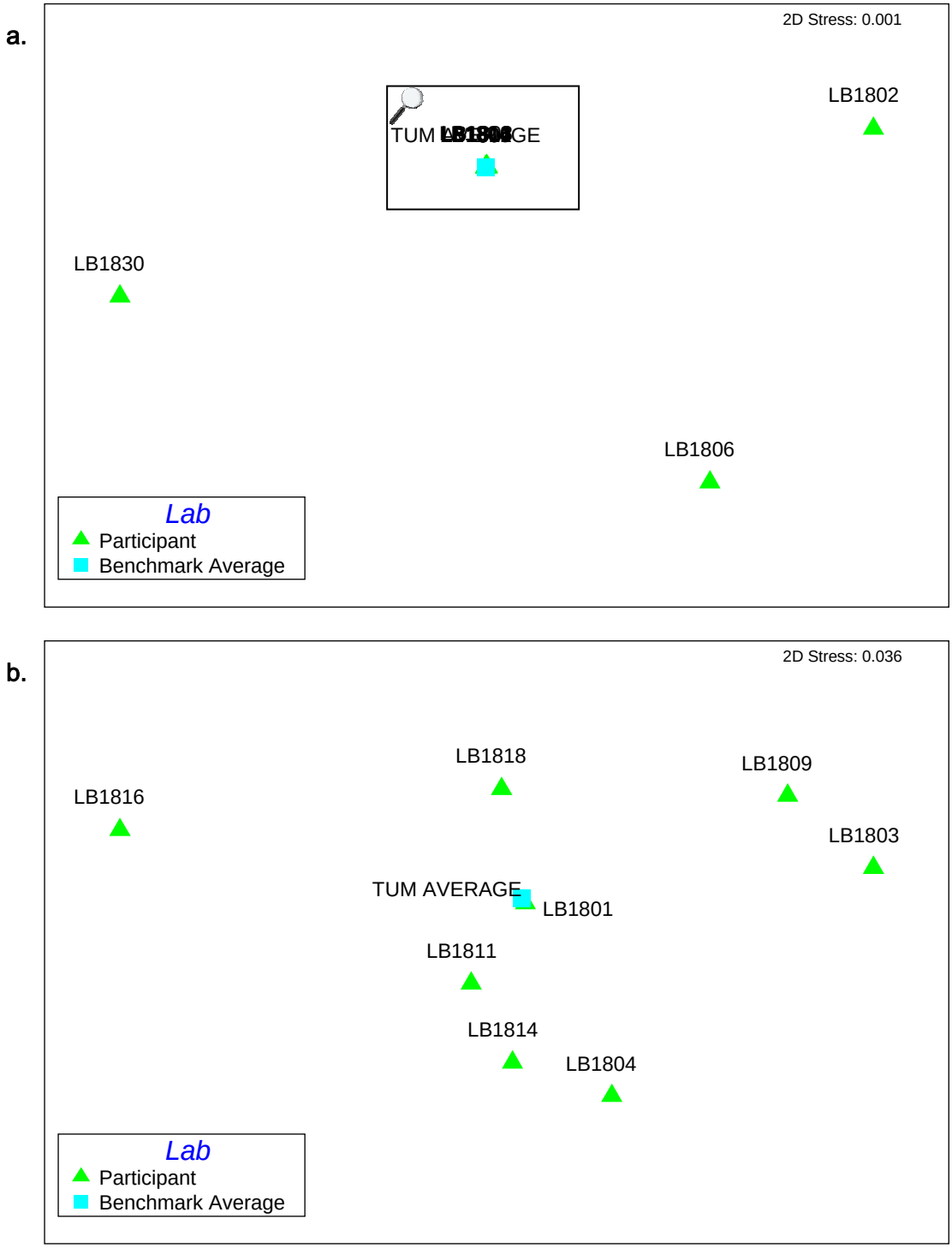


Figure 8. MDS plots of PS40 with the benchmark replicates (TUM AVERAGE) averaged; (a) including all labs and (b) sub-set of the data.

As with the dendrogram (Figure.7), the MDS plot in Figure.8a places LB1802, LB1806 and LB1830 away from the other labs and benchmark data, indicating that these labs are different from the others; this corresponds with cumulative distribution curves (Figure.2). The benchmark data and participant labs (LB1801, LB1803, LB1804, LB1809, LB1811, LB1814, LB1816 and LB1818) all cluster on top of each other, indicating that they are very similar; a subset of these data are shown in Figure.8b. The subset shows that the benchmark data and LB1801 are almost on top of each other indicating that they are very similar.

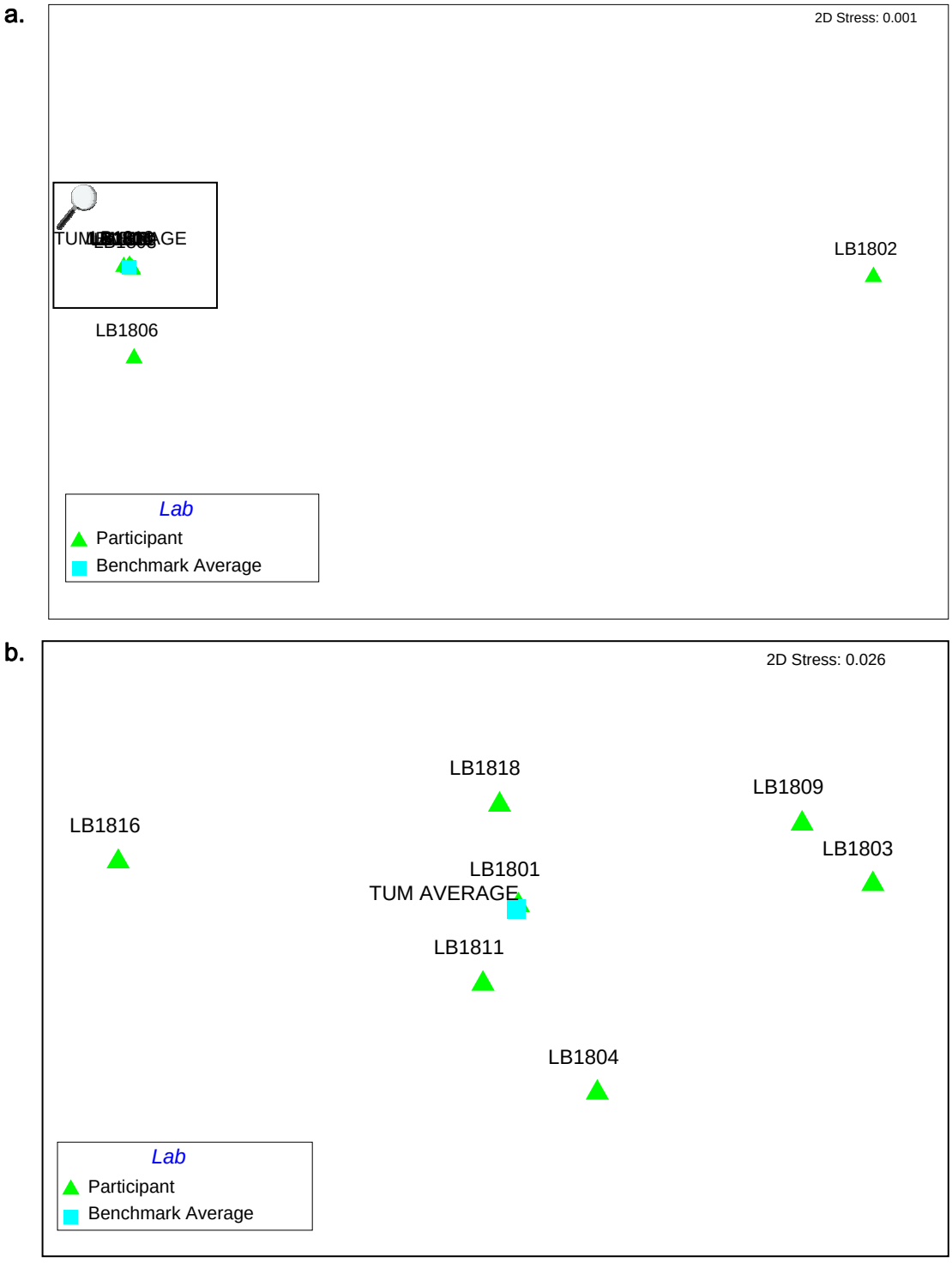


Figure 9. MDS plots of PS40, showing labs that follow the NMBAQC PSA SOP with the benchmark replicates (TUM AVERAGE) averaged (a) all labs and (b) a subset of data.

Figure.9 shows the MDS plots of the averaged benchmark data (TUM AVERAGE) with all the labs that have followed the NMBAQC PSA SOP (all laboratories except, LB1814 and LB1830). Figure.9a shows that all labs, except LB1802 and LB1806, cluster together with the benchmark data. LB1802 and LB1806 are the two laboratories whose cumulative distribution curves markedly differ from the other laboratories (Figure.3).

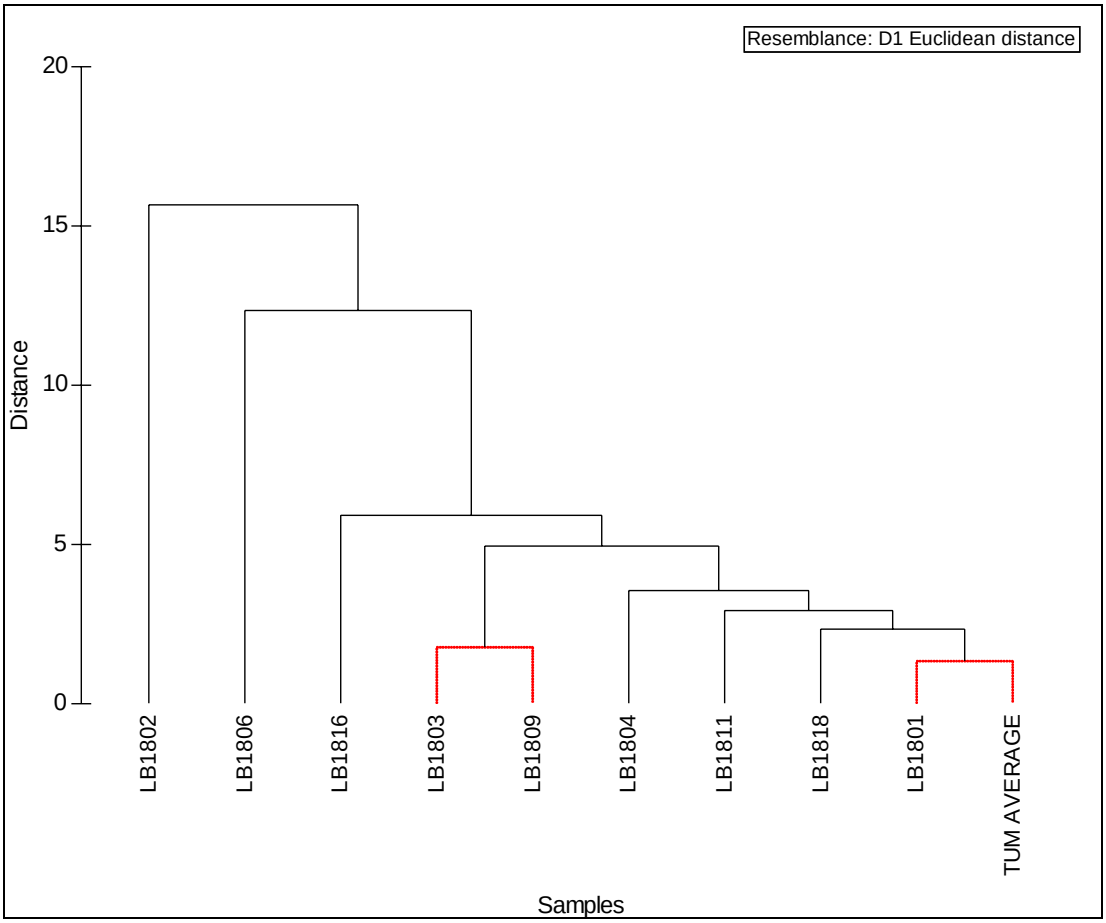


Figure 10. Dendrogram of PS40, showing labs that follow the NMBAQC PSA SOP with the benchmark replicates (TUM AVERAGE) averaged.

The dendrogram (Figure.10) is very similar to the dendrogram which includes all labs (Figure.7). LB1801 and the Benchmark Data, and LB1803 and LB1809 are still indistinguishable from each other at the 5% level.

Appendices

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1801**
Sample Code:	**PS401801**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0078
0.50 to 1.00; (500 µm)	0.0778
1.00 to 1.50; (353.6 µm)	0.3300
1.50 to 2.00; (250 µm)	0.6922
2.00 to 2.50; (176.8 µm)	1.1089
2.50 to 3.00; (125 µm)	1.9656
3.00 to 3.50; (88.39 µm)	3.5100
3.50 to 4.00; (62.5 µm)	5.1967
4.00 to 4.50; (44.19 µm)	6.2389
4.50 to 5.00; (31.25 µm)	6.5311
5.00 to 5.50; (22.097 µm)	6.5956
5.50 to 6.00; (15.625 µm)	6.9344
6.00 to 6.50; (11.049 µm)	7.7722
6.50 to 7.00; (7.813 µm)	8.8233
7.00 to 7.50; (5.524 µm)	9.3656
7.50 to 8.00; (3.906 µm)	9.0011
8.00 to 8.50; (2.762 µm)	7.8678
8.50 to 9.00; (1.953 µm)	6.1644
9.00 to 9.50; (1.381 µm)	4.2422
9.50 to 10.00; (0.977 µm)	2.8956
10.00 to 10.50; (0.691 µm)	2.3111
10.50 to 11.00; (0.488 µm)	1.7111
11.00 to 11.50; (0.345 µm)	0.6600
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1802**
Sample Code:	**PS401802**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.3412
0.50 to 1.00; (500 µm)	0.6948
1.00 to 1.50; (353.6 µm)	0.9262
1.50 to 2.00; (250 µm)	1.1442
2.00 to 2.50; (176.8 µm)	2.1927
2.50 to 3.00; (125 µm)	3.4971
3.00 to 3.50; (88.39 µm)	5.6399
3.50 to 4.00; (62.5 µm)	6.5588
4.00 to 4.50; (44.19 µm)	7.1413
4.50 to 5.00; (31.25 µm)	7.9951
5.00 to 5.50; (22.097 µm)	7.8341
5.50 to 6.00; (15.625 µm)	8.3682
6.00 to 6.50; (11.049 µm)	9.3232
6.50 to 7.00; (7.813 µm)	9.5860
7.00 to 7.50; (5.524 µm)	9.7552
7.50 to 8.00; (3.906 µm)	18.9115
8.00 to 8.50; (2.762 µm)	0.0000
8.50 to 9.00; (1.953 µm)	0.0000
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1803**
Sample Code:	**PS401803**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0313
2.00 to 2.50; (176.8 µm)	0.4043
2.50 to 3.00; (125 µm)	2.2100
3.00 to 3.50; (88.39 µm)	3.4920
3.50 to 4.00; (62.5 µm)	5.1470
4.00 to 4.50; (44.19 µm)	6.5587
4.50 to 5.00; (31.25 µm)	7.2940
5.00 to 5.50; (22.097 µm)	7.6310
5.50 to 6.00; (15.625 µm)	7.9137
6.00 to 6.50; (11.049 µm)	8.7914
6.50 to 7.00; (7.813 µm)	9.8857
7.00 to 7.50; (5.524 µm)	10.9560
7.50 to 8.00; (3.906 µm)	10.5524
8.00 to 8.50; (2.762 µm)	9.0077
8.50 to 9.00; (1.953 µm)	6.0857
9.00 to 9.50; (1.381 µm)	3.1077
9.50 to 10.00; (0.977 µm)	0.8863
10.00 to 10.50; (0.691 µm)	0.0450
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1804**
Sample Code:	**PS401804**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0089
1.00 to 1.50; (353.6 µm)	0.0622
1.50 to 2.00; (250 µm)	0.0989
2.00 to 2.50; (176.8 µm)	0.3022
2.50 to 3.00; (125 µm)	1.0478
3.00 to 3.50; (88.39 µm)	2.3656
3.50 to 4.00; (62.5 µm)	4.1100
4.00 to 4.50; (44.19 µm)	5.6111
4.50 to 5.00; (31.25 µm)	6.3478
5.00 to 5.50; (22.097 µm)	6.6989
5.50 to 6.00; (15.625 µm)	7.3489
6.00 to 6.50; (11.049 µm)	8.5011
6.50 to 7.00; (7.813 µm)	9.6400
7.00 to 7.50; (5.524 µm)	10.1867
7.50 to 8.00; (3.906 µm)	9.7767
8.00 to 8.50; (2.762 µm)	8.6178
8.50 to 9.00; (1.953 µm)	6.6667
9.00 to 9.50; (1.381 µm)	4.6189
9.50 to 10.00; (0.977 µm)	3.2144
10.00 to 10.50; (0.691 µm)	2.5400
10.50 to 11.00; (0.488 µm)	1.6811
11.00 to 11.50; (0.345 µm)	0.5544
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1806**
Sample Code:	**PS401806**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0122
1.50 to 2.00; (250 µm)	0.1956
2.00 to 2.50; (176.8 µm)	0.7078
2.50 to 3.00; (125 µm)	2.1678
3.00 to 3.50; (88.39 µm)	4.2356
3.50 to 4.00; (62.5 µm)	6.5256
4.00 to 4.50; (44.19 µm)	8.8356
4.50 to 5.00; (31.25 µm)	10.7400
5.00 to 5.50; (22.097 µm)	11.8189
5.50 to 6.00; (15.625 µm)	11.9389
6.00 to 6.50; (11.049 µm)	11.3000
6.50 to 7.00; (7.813 µm)	10.1944
7.00 to 7.50; (5.524 µm)	8.7411
7.50 to 8.00; (3.906 µm)	6.8533
8.00 to 8.50; (2.762 µm)	4.3022
8.50 to 9.00; (1.953 µm)	1.4322
9.00 to 9.50; (1.381 µm)	0.0000
9.50 to 10.00; (0.977 µm)	0.0000
10.00 to 10.50; (0.691 µm)	0.0000
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1809**
Sample Code:	**PS401809**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0463
1.00 to 1.50; (353.6 µm)	0.2835
1.50 to 2.00; (250 µm)	0.6088
2.00 to 2.50; (176.8 µm)	1.2116
2.50 to 3.00; (125 µm)	2.3033
3.00 to 3.50; (88.39 µm)	3.9142
3.50 to 4.00; (62.5 µm)	5.5599
4.00 to 4.50; (44.19 µm)	6.6650
4.50 to 5.00; (31.25 µm)	7.1113
5.00 to 5.50; (22.097 µm)	7.2906
5.50 to 6.00; (15.625 µm)	7.6525
6.00 to 6.50; (11.049 µm)	8.3893
6.50 to 7.00; (7.813 µm)	9.3675
7.00 to 7.50; (5.524 µm)	10.1444
7.50 to 8.00; (3.906 µm)	10.0885
8.00 to 8.50; (2.762 µm)	8.7463
8.50 to 9.00; (1.953 µm)	6.2307
9.00 to 9.50; (1.381 µm)	3.2863
9.50 to 10.00; (0.977 µm)	1.0361
10.00 to 10.50; (0.691 µm)	0.0638
10.50 to 11.00; (0.488 µm)	0.0000
11.00 to 11.50; (0.345 µm)	0.0000
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1811**
Sample Code:	**PS401811**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.1679
1.00 to 1.50; (353.6 µm)	0.4128
1.50 to 2.00; (250 µm)	0.5783
2.00 to 2.50; (176.8 µm)	0.8836
2.50 to 3.00; (125 µm)	1.6941
3.00 to 3.50; (88.39 µm)	3.0763
3.50 to 4.00; (62.5 µm)	4.4942
4.00 to 4.50; (44.19 µm)	5.5269
4.50 to 5.00; (31.25 µm)	6.4311
5.00 to 5.50; (22.097 µm)	7.5132
5.50 to 6.00; (15.625 µm)	8.5458
6.00 to 6.50; (11.049 µm)	9.2023
6.50 to 7.00; (7.813 µm)	9.3404
7.00 to 7.50; (5.524 µm)	9.0682
7.50 to 8.00; (3.906 µm)	8.3666
8.00 to 8.50; (2.762 µm)	7.3111
8.50 to 9.00; (1.953 µm)	5.7064
9.00 to 9.50; (1.381 µm)	4.0598
9.50 to 10.00; (0.977 µm)	2.9499
10.00 to 10.50; (0.691 µm)	2.4279
10.50 to 11.00; (0.488 µm)	1.6609
11.00 to 11.50; (0.345 µm)	0.5824
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1814**
Sample Code:	**PS401814**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0103
0.50 to 1.00; (500 µm)	0.0615
1.00 to 1.50; (353.6 µm)	0.1089
1.50 to 2.00; (250 µm)	0.1832
2.00 to 2.50; (176.8 µm)	0.5010
2.50 to 3.00; (125 µm)	1.0067
3.00 to 3.50; (88.39 µm)	2.1227
3.50 to 4.00; (62.5 µm)	5.6227
4.00 to 4.50; (44.19 µm)	5.0687
4.50 to 5.00; (31.25 µm)	6.1983
5.00 to 5.50; (22.097 µm)	6.8532
5.50 to 6.00; (15.625 µm)	7.6221
6.00 to 6.50; (11.049 µm)	8.5713
6.50 to 7.00; (7.813 µm)	9.3591
7.00 to 7.50; (5.524 µm)	9.5964
7.50 to 8.00; (3.906 µm)	9.0934
8.00 to 8.50; (2.762 µm)	7.8784
8.50 to 9.00; (1.953 µm)	6.1698
9.00 to 9.50; (1.381 µm)	4.3473
9.50 to 10.00; (0.977 µm)	3.1893
10.00 to 10.50; (0.691 µm)	2.7147
10.50 to 11.00; (0.488 µm)	2.2496
11.00 to 11.50; (0.345 µm)	1.3099
>11.50; (<0.345 µm)	0.1614

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1816**
Sample Code:	**PS401816**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0000
1.00 to 1.50; (353.6 µm)	0.0000
1.50 to 2.00; (250 µm)	0.0015
2.00 to 2.50; (176.8 µm)	0.8939
2.50 to 3.00; (125 µm)	3.3900
3.00 to 3.50; (88.39 µm)	2.5100
3.50 to 4.00; (62.5 µm)	6.1000
4.00 to 4.50; (44.19 µm)	6.4600
4.50 to 5.00; (31.25 µm)	7.4600
5.00 to 5.50; (22.097 µm)	5.4300
5.50 to 6.00; (15.625 µm)	8.1300
6.00 to 6.50; (11.049 µm)	9.7200
6.50 to 7.00; (7.813 µm)	7.3600
7.00 to 7.50; (5.524 µm)	12.2900
7.50 to 8.00; (3.906 µm)	6.9700
8.00 to 8.50; (2.762 µm)	8.1100
8.50 to 9.00; (1.953 µm)	4.8800
9.00 to 9.50; (1.381 µm)	4.7400
9.50 to 10.00; (0.977 µm)	2.9600
10.00 to 10.50; (0.691 µm)	1.3600
10.50 to 11.00; (0.488 µm)	0.9900
11.00 to 11.50; (0.345 µm)	0.2450
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1818**
Sample Code:	**PS401818**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.0000
0.50 to 1.00; (500 µm)	0.0001
1.00 to 1.50; (353.6 µm)	0.1209
1.50 to 2.00; (250 µm)	0.8193
2.00 to 2.50; (176.8 µm)	2.0728
2.50 to 3.00; (125 µm)	2.8029
3.00 to 3.50; (88.39 µm)	3.7896
3.50 to 4.00; (62.5 µm)	5.5489
4.00 to 4.50; (44.19 µm)	6.9841
4.50 to 5.00; (31.25 µm)	7.2149
5.00 to 5.50; (22.097 µm)	6.8746
5.50 to 6.00; (15.625 µm)	6.9278
6.00 to 6.50; (11.049 µm)	7.5750
6.50 to 7.00; (7.813 µm)	8.3349
7.00 to 7.50; (5.524 µm)	8.7683
7.50 to 8.00; (3.906 µm)	8.5578
8.00 to 8.50; (2.762 µm)	7.3957
8.50 to 9.00; (1.953 µm)	5.5896
9.00 to 9.50; (1.381 µm)	3.7526
9.50 to 10.00; (0.977 µm)	2.6668
10.00 to 10.50; (0.691 µm)	2.2363
10.50 to 11.00; (0.488 µm)	1.5144
11.00 to 11.50; (0.345 µm)	0.4533
11.50 to 12.00; (0.244 µm)	0.0000
12.00 to 12.50; (0.173 µm)	0.0000
12.50 to 13.00; (0.122 µm)	0.0000
13.00 to 13.50; (0.086 µm)	0.0000

Appendix 1.

Exercise Code:	**PS40**
LabCode:	**LB1830**
Sample Code:	**PS401830**

Phi interval (explicit) + sieve mesh (theoretical sieves shown in brackets)	**Volume/Weight (mark as "0" for not analysed or no material)**
-6.50 to -6.00; 63 mm	**0.0000**
-6.00 to -5.50; 45 mm	**0.0000**
-5.50 to -5.00; 31.5 mm	**0.0000**
-5.00 to -4.50; 22.4 mm	**0.0000**
-4.50 to -4.00; 16 mm	**0.0000**
-4.00 to -3.50; 11.2 mm	**0.0000**
-3.50 to -3.00; 8 mm	**0.0000**
-3.00 to -2.50; 5.6 mm	**0.0000**
-2.50 to -2.00; 4 mm	**0.0000**
-2.00 to -1.50; 2.8 mm	**0.0000**
-1.50 to -1.00; 2 mm	**0.0000**
-1.00 to -0.50; 1.4 mm	**0.0000**
-0.50 to 0.00; 1 mm	**0.0000**
0.00 to 0.50; (707 µm)	0.6073
0.50 to 1.00; (500 µm)	0.5466
1.00 to 1.50; (353.6 µm)	0.5893
1.50 to 2.00; (250 µm)	0.7724
2.00 to 2.50; (176.8 µm)	1.0837
2.50 to 3.00; (125 µm)	2.0571
3.00 to 3.50; (88.39 µm)	3.0614
3.50 to 4.00; (62.5 µm)	4.8039
4.00 to 4.50; (44.19 µm)	6.0290
4.50 to 5.00; (31.25 µm)	6.0917
5.00 to 5.50; (22.097 µm)	6.6923
5.50 to 6.00; (15.625 µm)	6.6747
6.00 to 6.50; (11.049 µm)	7.3454
6.50 to 7.00; (7.813 µm)	7.9073
7.00 to 7.50; (5.524 µm)	8.5363
7.50 to 8.00; (3.906 µm)	8.3669
8.00 to 8.50; (2.762 µm)	
8.50 to 9.00; (1.953 µm)	13.4729
9.00 to 9.50; (1.381 µm)	
9.50 to 10.00; (0.977 µm)	8.2389
10.00 to 10.50; (0.691 µm)	5.9442
10.50 to 11.00; (0.488 µm)	
11.00 to 11.50; (0.345 µm)	
11.50 to 12.00; (0.244 µm)	
12.00 to 12.50; (0.173 µm)	
12.50 to 13.00; (0.122 µm)	
13.00 to 13.50; (0.086 µm)	

Appendix 2. z-scores for all participating laboratories.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	-3.50 to -3.00	-3.00 to -2.50	-2.50 to -2.00	-2.00 to -1.50	-1.50 to -1.00	-1.00 to -0.50	-0.50 to 0.00	0.00 to 0.50	z-score
TUM AVERAGE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0057	-0.39
LB1801	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0078	-0.38
LB1802	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3412	1.35
LB1803	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1804	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1806	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1809	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1811	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1814	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0103	-0.37
LB1816	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1818	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.42
LB1830	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6073	2.74

μ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.081	
σ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.192	

z-scores all zero.

mean and standard deviation calculated using all data provided.

Appendix 2. z-scores for all participating laboratories.

	0.50 to 1.00	z-score	1.00 to 1.50	z-score	1.50 to 2.00	z-score	2.00 to 2.50	z-score	2.50 to 3.00	z-score	3.00 to 3.50	z-score	3.50 to 4.00	z-score	4.00 to 4.50	z-score	4.50 to 5.00	z-score
TUM AVERAGE	0.3650	0.84	0.8811	1.72	0.9836	1.21	1.2597	0.35	2.0436	-0.18	3.3159	-0.11	4.7485	-0.80	5.8860	-0.54	6.4963	-0.52
LB1801	0.0778	-0.36	0.3300	0.06	0.6922	0.47	1.1089	0.10	1.9656	-0.28	3.5100	0.10	5.1967	-0.22	6.2389	-0.18	6.5311	-0.49
LB1802	0.6948	2.21	0.9262	1.85	1.1442	1.61	2.1927	1.92	3.4971	1.70	5.6399	2.34	6.5588	1.54	7.1413	0.74	7.9951	0.66
LB1803	0.0000	-0.68	0.0000	-0.93	0.0313	-1.21	0.4043	-1.09	2.2100	0.04	3.4920	0.08	5.1470	-0.29	6.5587	0.14	7.2940	0.11
LB1804	0.0089	-0.65	0.0622	-0.75	0.0989	-1.04	0.3022	-1.26	1.0478	-1.47	2.3656	-1.11	4.1100	-1.63	5.6111	-0.82	6.3478	-0.64
LB1806	0.0000	-0.68	0.0122	-0.90	0.1956	-0.80	0.7078	-0.58	2.1678	-0.02	4.2356	0.86	6.5256	1.50	8.8356	2.48	10.7400	2.82
LB1809	0.0463	-0.49	0.2835	-0.08	0.6088	0.25	1.2116	0.27	2.3033	0.16	3.9142	0.52	5.5599	0.25	6.6650	0.25	7.1113	-0.04
LB1811	0.1679	0.02	0.4128	0.31	0.5783	0.18	0.8836	-0.28	1.6941	-0.63	3.0763	-0.36	4.4942	-1.13	5.5269	-0.91	6.4311	-0.57
LB1814	0.0615	-0.43	0.1089	-0.61	0.1832	-0.83	0.5010	-0.93	1.0067	-1.52	2.1227	-1.37	5.6227	0.33	5.0687	-1.38	6.1983	-0.76
LB1816	0.0000	-0.68	0.0000	-0.93	0.0015	-1.29	0.8939	-0.27	3.3900	1.56	2.5100	-0.96	6.1000	0.95	6.4600	0.04	7.4600	0.24
LB1818	0.0001	-0.68	0.1209	-0.57	0.8193	0.79	2.0728	1.72	2.8029	0.80	3.7896	0.39	5.5489	0.23	6.9841	0.58	7.2149	0.04
LB1830	0.5466	1.60	0.5893	0.84	0.7724	0.67	1.0837	0.05	2.0571	-0.16	3.0614	-0.38	4.8039	-0.73	6.0290	-0.40	6.0917	-0.84

μ	0.164		0.311		0.509		1.052		2.182		3.419		5.368		6.417		7.159	
σ	0.240		0.332		0.393		0.593		0.773		0.947		0.772		0.977		1.269	

mean and standard deviation calculated using all data provided.

Appendix 2. z-scores for all participating laboratories.

	5.00 to 5.50	z-score	5.50 to 6.00	z-score	6.00 to 6.50	z-score	6.50 to 7.00	z-score	7.00 to 7.50	z-score	7.50 to 8.00	z-score	8.00 to 8.50	z-score	8.50 to 9.00	z-score	9.00 to 9.50	z-score
TUM AVERAGE	6.8440	-0.32	7.3572	-0.43	8.1708	-0.51	9.0000	-0.08	9.3644	-0.34	8.8976	-0.23	7.5245	0.21	5.7257	0.02	3.9494	0.39
LB1801	6.5956	-0.48	6.9344	-0.73	7.7722	-0.88	8.8233	-0.29	9.3656	-0.34	9.0011	-0.20	7.8678	0.34	6.1644	0.15	4.2422	0.57
LB1802	7.8341	0.32	8.3682	0.30	9.3232	0.56	9.5860	0.62	9.7552	0.02	18.9115	2.97	0.0000	-2.65	0.0000	-1.77	0.0000	-1.93
LB1803	7.6310	0.19	7.9137	-0.03	8.7914	0.06	9.8857	0.98	10.9560	1.15	10.5524	0.30	9.0077	0.77	6.0857	0.13	3.1077	-0.10
LB1804	6.6989	-0.42	7.3489	-0.44	8.5011	-0.20	9.6400	0.69	10.1867	0.43	9.7767	0.05	8.6178	0.62	6.6667	0.31	4.6189	0.79
LB1806	11.8189	2.90	11.9389	2.88	11.3000	2.39	10.1944	1.35	8.7411	-0.93	6.8533	-0.88	4.3022	-1.02	1.4322	-1.32	0.0000	-1.93
LB1809	7.2906	-0.03	7.6525	-0.22	8.3893	-0.31	9.3675	0.36	10.1444	0.39	10.0885	0.15	8.7463	0.67	6.2307	0.17	3.2863	0.00
LB1811	7.5132	0.11	8.5458	0.43	9.2023	0.44	9.3404	0.33	9.0682	-0.62	8.3666	-0.40	7.3111	0.13	5.7064	0.01	4.0598	0.46
LB1814	6.8532	-0.32	7.6221	-0.24	8.5713	-0.14	9.3591	0.35	9.5964	-0.13	9.0934	-0.17	7.8784	0.34	6.1698	0.15	4.3473	0.63
LB1816	5.4300	-1.24	8.1300	0.13	9.7200	0.92	7.3600	-2.05	12.2900	2.40	6.9700	-0.85	8.1100	0.43	4.8800	-0.25	4.7400	0.86
LB1818	6.8746	-0.30	6.9278	-0.74	7.5750	-1.06	8.3349	-0.88	8.7683	-0.90	8.5578	-0.34	7.3957	0.16	5.5896	-0.03	3.7526	0.28
LB1830	6.6923	-0.42	6.6747	-0.92	7.3454	-1.27	7.9073	-1.39	8.5363	-1.12	8.3669	-0.40	0.0000	-2.65	13.4729	2.43	0.0000	-1.93
μ	7.340		7.951		8.722		9.067		9.731		9.620		6.978		5.677		3.282	
σ	1.542		1.385		1.080		0.834		1.065		3.127		2.632		3.214		1.698	

No data recorded. Zero entered to calculate z-score, value not used in μ and σ calculations.

mean and standard deviation calculated using all data provided.

Appendix 2. z-scores for all participating laboratories.

	9.50 to 10.00	z-score	10.00 to 10.50	z-score	10.50 to 11.00	z-score	11.00 to 11.50	z-score	11.50 to 12.00	z-score	12.00 to 12.50	12.50 to 13.00	13.00 to 13.50
TUM AVERAGE	2.8055	0.11	2.2965	0.27	1.5783	0.63	0.5007	0.27	0.0000	-0.30	0.0000	0.0000	0.0000
LB1801	2.8956	0.15	2.3111	0.28	1.7111	0.78	0.6600	0.67	0.0000	-0.30	0.0000	0.0000	0.0000
LB1802	0.0000	-1.18	0.0000	-1.07	0.0000	-1.19	0.0000	-0.97	0.0000	-0.30	0.0000	0.0000	0.0000
LB1803	0.8863	-0.78	0.0450	-1.04	0.0000	-1.19	0.0000	-0.97	0.0000	-0.30	0.0000	0.0000	0.0000
LB1804	3.2144	0.30	2.5400	0.41	1.6811	0.74	0.5544	0.40	0.0000	-0.30	0.0000	0.0000	0.0000
LB1806	0.0000	-1.18	0.0000	-1.07	0.0000	-1.19	0.0000	-0.97	0.0000	-0.30	0.0000	0.0000	0.0000
LB1809	1.0361	-0.71	0.0638	-1.03	0.0000	-1.19	0.0000	-0.97	0.0000	-0.30	0.0000	0.0000	0.0000
LB1811	2.9499	0.17	2.4279	0.35	1.6609	0.72	0.5824	0.47	0.0000	-0.30	0.0000	0.0000	0.0000
LB1814	3.1893	0.29	2.7147	0.52	2.2496	1.40	1.3099	2.28	0.1614	3.02			
LB1816	2.9600	0.18	1.3600	-0.27	0.9900	-0.05	0.2450	-0.36	0.0000	-0.30	0.0000	0.0000	0.0000
LB1818	2.6668	0.04	2.2363	0.24	1.5144	0.55	0.4533	0.15	0.0000	-0.30	0.0000	0.0000	0.0000
LB1830	8.2389	2.61	5.9442	2.40	0.0000	-1.19	0.0000	-0.97	0.0000	-0.30	0.0000	0.0000	0.0000
μ	2.570		1.828		1.035		0.391		0.015		0.000	0.000	0.000
σ	2.170		1.716		0.869		0.404		0.049		0.000	0.000	0.000

z-scores all zero.

No data recorded. Zero entered to calculate z-score, value not used in μ and σ calculations.

Combined data >11.5ϕ

mean and standard deviation calculated using all data provided.

Appendix 3. z-score calculations for all participating laboratories; z-score calculations based on mean and standard deviation of those labs following the NMBAQC PSA SOP only.

	-6.50 to -6.00	-6.00 to -5.50	-5.50 to -5.00	-5.00 to -4.50	-4.50 to -4.00	-4.00 to -3.50	-3.50 to -3.00	-3.00 to -2.50	-2.50 to -2.00	-2.00 to -1.50	-1.50 to -1.00	-1.00 to -0.50	-0.50 to 0.00
TUM AVERAGE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1801	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1802	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1803	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1804	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1806	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1809	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1811	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1814	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1816	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1818	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LB1830	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Mean	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S.D	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Mean and standard deviation equal zero :. z-score is uncalculatable (cannot divide by zero).

Laboratories not following the NMBAQC PSA SOP. Data excluded from mean and standard deviation calculations

Appendix 3. z-score calculations for all participating laboratories; z-score calculations based on mean and standard deviation of those labs following the NMBAQC PSA SOP only.

	0.00 to 0.50	z-score	0.50 to 1.00	z-score	1.00 to 1.50	z-score	1.50 to 2.00	z-score	2.00 to 2.50	z-score	2.50 to 3.00	z-score	3.00 to 3.50	z-score
TUM AVERAGE	0.0057	-0.28	0.3650	1.00	0.8811	1.66	0.9836	1.14	1.2597	0.25	2.0436	-0.36	3.3159	-0.29
LB1801	0.0078	-0.26	0.0778	-0.26	0.3300	0.08	0.6922	0.43	1.1089	0.01	1.9656	-0.46	3.5100	-0.08
LB1802	0.3412	2.85	0.6948	2.45	0.9262	1.79	1.1442	1.53	2.1927	1.74	3.4971	1.59	5.6399	2.21
LB1803	0.0000	-0.33	0.0000	-0.60	0.0000	-0.87	0.0313	-1.18	0.4043	-1.11	2.2100	-0.14	3.4920	-0.10
LB1804	0.0000	-0.33	0.0089	-0.56	0.0622	-0.69	0.0989	-1.01	0.3022	-1.28	1.0478	-1.69	2.3656	-1.31
LB1806	0.0000	-0.33	0.0000	-0.60	0.0122	-0.83	0.1956	-0.78	0.7078	-0.63	2.1678	-0.19	4.2356	0.70
LB1809	0.0000	-0.33	0.0463	-0.39	0.2835	-0.06	0.6088	0.23	1.2116	0.17	2.3033	-0.01	3.9142	0.35
LB1811	0.0000	-0.33	0.1679	0.14	0.4128	0.32	0.5783	0.15	0.8836	-0.35	1.6941	-0.83	3.0763	-0.55
LB1814	0.0103	-0.23	0.0615	-0.33	0.1089	-0.56	0.1832	-0.81	0.5010	-0.96	1.0067	-1.75	2.1227	-1.57
LB1816	0.0000	-0.33	0.0000	-0.60	0.0000	-0.87	0.0015	-1.25	0.8939	-0.33	3.3900	1.44	2.5100	-1.16
LB1818	0.0000	-0.33	0.0001	-0.60	0.1209	-0.52	0.8193	0.74	2.0728	1.54	2.8029	0.66	3.7896	0.22
LB1830	0.6073	5.32	0.5466	1.80	0.5893	0.82	0.7724	0.62	1.0837	-0.03	2.0571	-0.34	3.0614	-0.56

Mean	0.035		0.136		0.303		0.515		1.104		2.312		3.585	
S.D	0.107		0.228		0.349		0.412		0.627		0.746		0.930	

Mean and standard deviation equal zero :. z-score is uncalculatable (cannot divide by zero).

Laboratories not following the NMBAQC PSA SOP. Data excluded from mean and standard deviation calculations

Appendix 3. z-score calculations for all participating laboratories; z-score calculations based on mean and standard deviation of those labs following the NMBAQC PSA SOP only.

	3.50 to 4.00	z-score	4.00 to 4.50	z-score	4.50 to 5.00	z-score	5.00 to 5.50	z-score	5.50 to 6.00	z-score	6.00 to 6.50	z-score	6.50 to 7.00	z-score
TUM AVERAGE	4.7485	-0.79	5.8860	-0.74	6.4963	-0.67	6.8440	-0.36	7.3572	-0.52	8.1708	-0.65	9.0000	-0.19
LB1801	5.1967	-0.24	6.2389	-0.37	6.5311	-0.64	6.5956	-0.51	6.9344	-0.81	7.7722	-1.01	8.8233	-0.40
LB1802	6.5588	1.40	7.1413	0.58	7.9951	0.49	7.8341	0.23	8.3682	0.18	9.3232	0.41	9.5860	0.52
LB1803	5.1470	-0.30	6.5587	-0.03	7.2940	-0.05	7.6310	0.11	7.9137	-0.14	8.7914	-0.08	9.8857	0.89
LB1804	4.1100	-1.56	5.6111	-1.02	6.3478	-0.78	6.6989	-0.45	7.3489	-0.52	8.5011	-0.34	9.6400	0.59
LB1806	6.5256	1.36	8.8356	2.35	10.7400	2.60	11.8189	2.60	11.9389	2.63	11.3000	2.23	10.1944	1.26
LB1809	5.5599	0.19	6.6650	0.08	7.1113	-0.19	7.2906	-0.10	7.6525	-0.32	8.3893	-0.45	9.3675	0.26
LB1811	4.4942	-1.09	5.5269	-1.11	6.4311	-0.72	7.5132	0.04	8.5458	0.30	9.2023	0.30	9.3404	0.23
LB1814	5.6227	0.27	5.0687	-1.59	6.1983	-0.89	6.8532	-0.36	7.6221	-0.34	8.5713	-0.28	9.3591	0.25
LB1816	6.1000	0.85	6.4600	-0.14	7.4600	0.08	5.4300	-1.20	8.1300	0.01	9.7200	0.78	7.3600	-2.17
LB1818	5.5489	0.18	6.9841	0.41	7.2149	-0.11	6.8746	-0.34	6.9278	-0.81	7.5750	-1.19	8.3349	-0.99
LB1830	4.8039	-0.72	6.0290	-0.59	6.0917	-0.98	6.6923	-0.45	6.6747	-0.99	7.3454	-1.40	7.9073	-1.51

Mean	5.399		6.591		7.362		7.453		8.112		8.875		9.153	
S.D	0.827		0.956		1.302		1.679		1.456		1.090		0.826	

Mean and standard deviation equal zero :. z-score is uncalculatable (cannot divide by zero).

Laboratories not following the NMBAQC PSA SOP. Data excluded from mean and standard deviation calculations

Appendix 3. z-score calculations for all participating laboratories; z-score calculations based on mean and standard deviation of those labs following the NMBAQC PSA SOP only.

	7.00 to 7.50	z-score	7.50 to 8.00	z-score	8.00 to 8.50	z-score	8.50 to 9.00	z-score	9.00 to 9.50	z-score	9.50 to 10.00	z-score	10.00 to 10.50	z-score
TUM AVERAGE	9.3644	-0.45	8.8976	-0.26	7.5245	0.23	5.7257	0.39	3.9494	0.44	2.8055	0.66	2.2965	0.83
LB1801	9.3656	-0.45	9.0011	-0.23	7.8678	0.36	6.1644	0.58	4.2422	0.61	2.8956	0.73	2.3111	0.85
LB1802	9.7552	-0.10	18.9115	2.66	0.0000	-2.50	0.0000	-2.15	0.0000	-1.81	0.0000	-1.49	0.0000	-1.14
LB1803	10.9560	0.99	10.5524	0.22	9.0077	0.77	6.0857	0.55	3.1077	-0.04	0.8863	-0.81	0.0450	-1.10
LB1804	10.1867	0.29	9.7767	-0.01	8.6178	0.63	6.6667	0.81	4.6189	0.82	3.2144	0.98	2.5400	1.04
LB1806	8.7411	-1.02	6.8533	-0.86	4.3022	-0.94	1.4322	-1.52	0.0000	-1.81	0.0000	-1.49	0.0000	-1.14
LB1809	10.1444	0.26	10.0885	0.09	8.7463	0.67	6.2307	0.61	3.2863	0.06	1.0361	-0.69	0.0638	-1.09
LB1811	9.0682	-0.72	8.3666	-0.42	7.3111	0.15	5.7064	0.38	4.0598	0.51	2.9499	0.77	2.4279	0.95
LB1814	9.5964	-0.24	9.0934	-0.21	7.8784	0.36	6.1698	0.59	4.3473	0.67	3.1893	0.96	2.7147	1.19
LB1816	12.2900	2.21	6.9700	-0.83	8.1100	0.44	4.8800	0.01	4.7400	0.89	2.9600	0.78	1.3600	0.03
LB1818	8.7683	-1.00	8.5578	-0.36	7.3957	0.18	5.5896	0.33	3.7526	0.33	2.6668	0.56	2.2363	0.78
LB1830	8.5363	-1.21	8.3669	-0.42	0.0000	-2.50	13.4729	3.83	0.0000	-1.81	8.2389	4.83	5.9442	3.97

Mean	9.864		9.798		6.888		4.848		3.176		1.941		1.328	
S.D	1.099		3.422		2.756		2.254		1.750		1.305		1.163	

Mean and standard deviation equal zero :. z-score is uncalculatable (cannot divide by zero).

Laboratories not following the NMBAQC PSA SOP. Data excluded from mean and standard deviation calculations

Appendix 3. z-score calculations for all participating laboratories; z-score calculations based on mean and standard deviation of those labs following the NMBAQC PSA SOP only.

	10.50 to 11.00	z-score	11.00 to 11.50	z-score	11.50 to 12.00	z-score	12.00 to 12.50	12.50 to 13.00	13.00 to 13.50
TUM AVERAGE	1.5783	0.82	0.5007	0.72	0.0000		0.0000	0.0000	0.0000
LB1801	1.7111	0.98	0.6600	1.29	0.0000		0.0000	0.0000	0.0000
LB1802	0.0000	-1.13	0.0000	-1.07	0.0000		0.0000	0.0000	0.0000
LB1803	0.0000	-1.13	0.0000	-1.07	0.0000		0.0000	0.0000	0.0000
LB1804	1.6811	0.95	0.5544	0.91	0.0000		0.0000	0.0000	0.0000
LB1806	0.0000	-1.13	0.0000	-1.07	0.0000		0.0000	0.0000	0.0000
LB1809	0.0000	-1.13	0.0000	-1.07	0.0000		0.0000	0.0000	0.0000
LB1811	1.6609	0.92	0.5824	1.01	0.0000		0.0000	0.0000	0.0000
LB1814	2.2496	1.65	1.3099	3.62	0.1614	-			
LB1816	0.9900	0.09	0.2450	-0.20	0.0000		0.0000	0.0000	0.0000
LB1818	1.5144	0.74	0.4533	0.55	0.0000		0.0000	0.0000	0.0000
LB1830	0.0000	-1.13	0.0000	-1.07	0.0000		0.0000	0.0000	0.0000

Mean	0.914		0.300		0.000		0.000	0.000	0.000
S.D	0.812		0.279		0.000		0.000	0.000	0.000

Mean and standard deviation equal zero :. z-score is uncalculatable (cannot divide by zero).

Laboratories not following the NMBAQC PSA SOP. Data excluded from mean and standard deviation calculations