

## 2009-09 Nutrients duplicates - page 1

### Nitrate\_plus\_Nitrite:Bottle

#### Precision statement for replicate samples drawn from a single Niskin bottle:

The pooled standard deviation for Nitrate\_plus\_Nitrite:Bottle for the range 0.0 to 46.8  $\mu\text{mol/l}$  was 0.07,  $k = 28$  (0 outlier removed) where  $k$  is the number of pairs of duplicates.

The pooled standard deviation of pairs of samples ( $S_p$ ) was calculated by:

$$S_p = \text{SQRT}\{\text{sum}(d^2)/2k\}$$

where  $k$  is the number of pairs and  $d$  is the difference between pairs.

Accuracy of the stock standard batch was determined by using commercially available standards from WAKO Chemicals (Sagami Chemical Company of Japan).

The values were within 1.18 % of the 20  $\mu\text{mol/l}$  Nitrate Standard.

Accuracy was also determined by using commercially available standards from Kanso (Environmental Technos Co. Ltd, Japan). Kanso Lot AZ-1719.

When this standard was run as an unknown, nitrate values were within 0.47 %.

December 2008 Nitrate stock standard solutions were used for this cruise analyses.

#### Duplicate samples from a single Niskin bottle

Event Number	Sample Number	Station	Pressure dbar	Nitrate 1 $\mu\text{mol/l}$	Nitrate 2 $\mu\text{mol/l}$	Rejected yes / no	Comment
1	8	SI03	50.3	15.5	15.6		
3	21	P2	40.4	24.1	24.2		
7	49	P4	1.8	0.0	0.0		
7	46	P4	5.3	0.0	0.0		
7	45	P4	8.6	0.0	0.0		
7	42	P4	13.5	0.1	0.1		
7	41	P4	28.0	4.1	4.2		
10	52	P4	101.7	17.9	18.1		
11	80	P4	101.4	22.7	23.0		
20	139	P8	200.0	32.2	32.2		
25	162	P12	599.6	45.2	45.4		
31	181	P12	100.9	14.4	14.6		
39	248	P16	50.5	10.2	10.2		
40	274	P16	2.5	7.2	7.3		
40	271	P16	6.3	7.3	7.3		
40	268	P16	14.4	7.7	7.7		
40	266	P16	31.3	8.5	8.6		
40	263	P16	61.0	11.1	11.1		
43	281	P16	1500.2	46.8	46.7		
56	348	P20	76.2	14.3	14.3		
58	376	P20	400.0	42.9	43.0		
71	453	P26	75.5	14.0	14.0		
74	476	P26	2.8	9.9	9.9		
74	473	P26	4.4	10.0	10.0		
74	471	P26	8.4	10.1	10.1		
74	469	P26	27.5	10.4	10.4		
74	468	P26	46.2	12.0	12.0		
75	482	P26	75.3	13.4	13.5		

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### Phosphate:Bottle

#### Precision statement for replicate samples drawn from a single Niskin bottle:

The pooled standard deviation for Phosphate:Bottle for the range 0.36 to 3.19  $\mu\text{mol/l}$  was 0.005,  
 $k = 28$  (0 outlier removed) where  $k$  is the number of pairs of duplicates.

The pooled standard deviation of pairs of samples ( $S_p$ ) was calculated by:

$$S_p = \text{SQRT}\{\text{sum } (d^2)/2k\}$$

where  $k$  is the number of pairs and  $d$  is the difference between pairs.

Accuracy was determined by using commercially available standards from Kanto  
(Environmental Technos Co. Ltd, Japan). Kanto Lot AZ-1719.

When this standard was run as an unknown, phosphate values were within 0.87%.

April 2009 Phosphate stock standard solution was used for this cruise analyses.

#### Duplicate samples from a single Niskin bottle

Event Number	Sample Number	Station	Pressure dbar	Phosphate 1 $\mu\text{mol/l}$	Phosphate 2 $\mu\text{mol/l}$	Rejected yes / no	Comment
1	8	SI03	50.3	2.01	2.01		
3	21	P2	40.4	2.1	2.1		
7	49	P4	1.8	0.37	0.37		
7	46	P4	5.3	0.37	0.36		
7	45	P4	8.6	0.39	0.4		
7	42	P4	13.5	0.46	0.49		
7	41	P4	28.0	0.73	0.74		
10	52	P4	101.7	1.44	1.45		
11	80	P4	101.4	1.73	1.73		
20	139	P8	200.0	2.16	2.16		
25	162	P12	599.6	3.08	3.09		
31	181	P12	100.9	1.24	1.25		
39	248	P16	50.5	1.07	1.07		
40	274	P16	2.5	0.88	0.89		
40	271	P16	6.3	0.89	0.89		
40	268	P16	14.4	0.9	0.91		
40	266	P16	31.3	0.97	0.97		
40	263	P16	61.0	1.1	1.1		
43	281	P16	1500.2	3.19	3.19		
56	348	P20	76.2	1.28	1.28		
58	376	P20	400.0	2.98	2.98		
71	453	P26	75.5	1.32	1.32		
74	476	P26	2.8	1.04	1.04		
74	473	P26	4.4	1.04	1.04		
74	471	P26	8.4	1.05	1.04		
74	469	P26	27.5	1.08	1.08		
74	468	P26	46.2	1.19	1.19		
75	482	P26	75.3	1.29	1.3		

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### Silicate: Bottle

#### Precision statement for replicate samples drawn from a single Niskin bottle:

The pooled standard deviation for Silicate: Bottle for the range 2.1 to 171.2  $\mu\text{mol/l}$  was 0.07,  
 $k = 28$  (0 outliers removed) where  $k$  is the number of pairs of duplicates.

The pooled standard deviation of pairs of samples ( $S_p$ ) was calculated by:

$$S_p = \text{SQRT}\{\text{sum}(d^2)/2k\}$$

where  $k$  is the number of pairs and  $d$  is the difference between pairs.

Accuracy of the stock standard batch was determined by using commercially available standards from WAKO Chemicals (Sagami Chemical Company of Japan).

The values were within 0.67 % of the 100  $\mu\text{mol/l}$  Silicate Standard.

Accuracy was also determined by using commercially available standards from Kanto  
(Environmental Technos Co. Ltd, Japan). Kanto Lot AZ-1719.

When this standard was run as an unknown, silicate values were within 0.76%.

December 2008 Silicate stock standard solutions were used for this cruise analyses.

#### Duplicate samples from a single Niskin bottle

Event Number	Sample Number	Station	Pressure dbar	Silicate 1 $\mu\text{mol/l}$	Silicate 2 $\mu\text{mol/l}$	Rejected yes / no	Comment
1	8	SI03	50.3	26.8	26.7		
3	21	P2	40.4	35.9	35.8		
7	49	P4	1.8	2.3	2.3		
7	46	P4	5.3	2.2	2.3		
7	45	P4	8.6	2.2	2.2		
7	42	P4	13.5	2.2	2.1		
7	41	P4	28.0	6.9	7.0		
10	52	P4	101.7	20.7	20.7		
11	80	P4	101.4	27.1	27.2		
20	139	P8	200.0	47.6	47.7		
25	162	P12	599.6	107.5	107.5		
31	181	P12	100.9	17.1	17.1		
39	248	P16	50.5	13.5	13.5		
40	274	P16	2.5	11.8	11.9		
40	271	P16	6.3	11.9	11.9		
40	268	P16	14.4	11.8	11.8		
40	266	P16	31.3	12.9	12.8		
40	263	P16	61.0	14.4	14.4		
43	281	P16	1500.2	171.2	171.1		
56	348	P20	76.2	18.1	18.2		
58	376	P20	400.0	94.3	94.3		
71	453	P26	75.5	20.6	20.6		
74	476	P26	2.8	16.7	16.4		
74	473	P26	4.4	16.5	16.4		
74	471	P26	8.4	16.5	16.5		
74	469	P26	27.5	17.0	17.2		
74	468	P26	46.2	18.6	18.6		
75	482	P26	75.3	20.2	20.2		

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### Nitrate\_plus\_Nitrite:Bottle

#### Precision statement for samples drawn from duplicate Niskin bottles closed at same pressure:

The pooled standard deviation for Nitrate\_plus\_Nitrite:Bottle for the range 0.0 to 46.7  $\mu\text{mol/l}$  was 0.10,  $k = 12$  (0 outlier removed) where  $k$  is the number of pairs of duplicates.

The pooled standard deviation of pairs of samples ( $S_p$ ) was calculated by:

$$S_p = \text{SQRT}\{\text{sum}(d^2)/2k\}$$

where  $k$  is the number of pairs and  $d$  is the difference between pairs.

#### Duplicate Niskins at the same pressure

Event Number	Sample Number	Station	Nominal Pressure dbar	Nitrate 1 $\mu\text{mol/l}$	Nitrate 2 $\mu\text{mol/l}$	Rejected yes / no	Comment
3	14 / 15	P2	100	33.9	33.9		
3	17 / 18	P2	75	31.9	31.7		
3	19 / 20	P2	50	27.5	27.4		
3	23 / 24	P2	25	12.3	12.2		
3	27 / 28	P2	10	0.4	0.4		
3	29 / 30	P2	5	0.0	0.0		
11	68 / 69	P4	1250	46.7	46.3		
20	134 / 135	P8	600	45.8	45.7		
20	148 / 149	P8	5	4.1	4.1		
25	154 / 155	P12	3000	42.0	41.9		
43	276 / 277	P16	3500	40.9	40.8		
58	366 / 367	P20	3500	39.3	39.4		

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### Phosphate:Bottle

#### Precision statement for samples drawn from duplicate Niskin bottles closed at same pressure:

The pooled standard deviation for Phosphate:Bottle for the range 0.19 to 3.30  $\mu\text{mol/l}$  was 0.006,  
 $k = 12$  (0 outlier removed) where  $k$  is the number of pairs of duplicates.

The pooled standard deviation of pairs of samples ( $S_p$ ) was calculated by:

$$S_p = \text{SQRT}\{\text{sum}(d^2)/2k\}$$

where  $k$  is the number of pairs and  $d$  is the difference between pairs.

#### Duplicate Niskins at the same pressure

Event Number	Sample Number	Station	Nominal Pressure dbar	Phosphate 1 $\mu\text{mol/l}$	Phosphate 2 $\mu\text{mol/l}$	Rejected yes / no	Comment
3	14 / 15	P2	100	2.62	2.61		
3	17 / 18	P2	75	2.46	2.46		
3	19 / 20	P2	50	2.23	2.22		
3	23 / 24	P2	25	1.31	1.31		
3	27 / 28	P2	10	0.34	0.35		
3	29 / 30	P2	5	0.19	0.19		
11	68 / 69	P4	1250	3.30	3.28		
20	134 / 135	P8	600	3.17	3.16		
20	148 / 149	P8	5	0.70	0.70		
25	154 / 155	P12	3000	2.83	2.82		
43	276 / 277	P16	3500	2.75	2.74		
58	366 / 367	P20	3500	2.73	2.73		

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### Silicate:Bottle

#### Precision statement for samples drawn from duplicate Niskin bottles closed at same pressure:

The pooled standard deviation for Silicate:Bottle for the range 0.6 to 182.8  $\mu\text{mol/l}$  was 0.28,  
 $k = 12$  (0 outlier removed) where  $k$  is the number of pairs of duplicates.

The pooled standard deviation of pairs of samples ( $S_p$ ) was calculated by:

$$S_p = \text{SQRT}\{\text{sum}(d^2)/2k\}$$

where  $k$  is the number of pairs and  $d$  is the difference between pairs.

#### Duplicate Niskins at the same pressure

Event Number	Sample Number	Station	Nominal Pressure dbar	Silicate 1 $\mu\text{mol/l}$	Silicate 2 $\mu\text{mol/l}$	Rejected yes / no	Comment
3	14 / 15	P2	100	53.5	53.6		
3	17 / 18	P2	75	48.6	48.5		
3	19 / 20	P2	50	40.5	40.8		
3	23 / 24	P2	25	17.7	17.6		
3	27 / 28	P2	10	1.7	1.7		
3	29 / 30	P2	5	0.6	0.6		
11	68 / 69	P4	1250	144.3	143.2		
20	134 / 135	P8	600	103.9	104.1		
20	148 / 149	P8	5	8.2	8.2		
25	154 / 155	P12	3000	182.0	182.6		
43	276 / 277	P16	3500	182.4	182.8		
58	366 / 367	P20	3500	175.6	175.4		