**{NUTRIENTS TEMPLATE**

**NOTES: This is an excerpt from 2012 JOIS technical report. Please review all methods and add/change where appropriate. Please do not change the heading or text styles, or order within the report (to make it easier to incorporate later into the overall cruise report). Anything marked in RED needs to be updated with current information.}**

**Report by Linda White February 4, 2014**

* + 1. ***Nutrients***
       1. ***Sampling***

Water samples for nutrient determination were collected into new nutrient tubes after the tube and cap had been rinsed three times with the sample water. Samples were frozen at -20⁰C and analyzed in the lab at the Institute of Ocean Sciences by Linda White

***Analysis***

Nutrients (nitrate + nitrite, silicate and orthophosphate) were analyzed using a three channel Technicon Auto Analyzer, following the methods described by Barwell-Clarke and Whitney (1996). Reagents were prepared using 18 mega ohm-cm resistance Type I reagent grade water.

A 3.2% weight-to-volume solution of sodium chloride (Sigma) was prepared daily and used to rinse the system between samples and to prepare working standards. One cadmium column was used during analysis and, efficiency remained at 100%.

Chemwash solution was used to clean the system at the end of a day’s run followed by de-ionized water. Data were logged digitally using the Nutrient Acquisition Program (NAP), which also calculated all standards, reference materials and sample

values.

Colorimeters installed: Nitrate – SNPR0506, Silicate – CC#3, Phosphate – SNPR2164.

***Standard and blank preparation***

Primary Stock standards prepared at the Institute of Ocean Sciences, November 2013, Batch 2013-3, were calibrated against Wako Nitrate (20 μg atoms/L) and Wako Silicate (50 μg atoms/L); there is no calibration standard available for phosphate. A phosphate standard was compared with a same concentration from Water Properties Group.

Start-up solution was run before connecting the reagents and analyzing the initial standards and samples, and after the last set of reference materials Chemwash followed by deionized water were connected to clean the system at the end of the day.

All dry reagents used were pre-weighed May 2013 for the JOIS 2013-04 program.

A set of working standards (low, medium and high) were prepared from primary stock standard solutions, (phosphate, secondary), using freshly prepared 3.2% sodium chloride solution. The daily working standards were of the following concentrations: nitrate + nitrite 8.1, 16.1, 24.1µm/L; silicate 0, 16.2, 32.2, 48.4 µm/L; and phosphate 0, 0.81, 1.61, 2.41 µm/L.

Fresh standards were prepared daily along with silicate and phosphate ascorbic acid wetting agents. Concentrations of the standards were selected to bracket the expected nutrient levels in the samples. Wako reference material and Kanso reference materials were run at the beginning and middle of each day. Medium checks, Kanso Lot CA 2474, Lot 1475 and a medium drift cup (D5, D6) were run for each nutrient between standard curves. NAP calculates the samples using the previously run standard regression. A drift cup “D” that holds the same nutrient concentration as one of the previous standards was analyzed to correct for any changes occurring during the run.

NAP Method filename for standard concentrations used: Nitrate 2013-05, Silicate 2013-05 and Phosphate 2013-05.

Wako (20 µm/L nitrate and 50 µm/L silicate) and Reference Samples (RS) purchased from KANSO (CA series) were analyzed each day. Assigned values for KANSO were; nitrate + nitrite 20.05 µm/L, silicate 36.96 µm/L and phosphate 1.454 µm/L. There can be variability within each batch/bottle of reference material

The order of the sample analysis was from surface to depth. Duplicate samples were analyzed for each sample.

No salinities fell below 27o/oo therefore no turbidity tests were done for phosphate. Turbidity is analyzed through the phosphate channel without reagents being added to the sample.

When surface nitrate levels are slightly lower than the 3.2% sodium chloride solution baseline, profiles were adjusted by the negative amount to bring the surface value to zero, I.E. -0.1.

Second order polynomial equation was used to calculate data.

* + - 1. ***Problems and Solutions***

{ADD/REMOVE items from this list as appropriate}

***General Issues***

***Issues: Nutrient Acquisition Program NAP***

January 27, 2014, NAP – initially began logging peaks correctly then, flatlined midway through a peak indicating lack of signal recognition. Stopped the run and rebooted the computer, and started the run again – filename: 27.01.2014N3, ….Si3…..P3.

***1.1.1.3 Precision***

**Table ##. Water Sample Precision –Chauvenet test**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Chemistry Sample** | **Precision (*s*p)** | **Units**  mmol/m3 | **Number of Replicates (*n*)** | **Outliers removed** | **Minimum Range** | **Maximum Range** |
| Nitrate (frozen) | 0.122 |  | 194 | 4 | 0.00 | 17.49 |
| Silicate(frozen) | 0.204 |  | 196 | 2 | 0.44 | 46.55 |
| Phosphate (frozen) | 0.073 |  | 193 | 5 | 0.07 | 2.06 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**Table 9. Quality control and assurance for Frozen nutrient samples.**

The numbers include all data, outliers included.

|  |  |  |  |
| --- | --- | --- | --- |
| **Nutrient** | **Nitrate + Nitrite**  **(mmol/m3)** | **Silicate**  **(mmol/m3)** | **Phosphate**  **(mmol/m3)** |
| **Sample replicates: frozen** | 0.268 | 0.268 | 0.096 |
| *\*s*p |  |  |  |
| No. of duplicates | 195 | 195 | 192 |
| **Kanso CA reference sample**  **(**analyzed as unknown)  Average and std dev | 20.05  19.74 +/- 0.22 | 37.02  36.66 +/- 0.19 | 1.454  1.47 +/- 0.01 |
|  |  |  |  |
| No. of replicates | 27 | 27 | 28 |
| **Medium check standard**  (analyzed as unknown) | 16.1 | 32.2 | 1.61 |
| Calibrated value | 16.09+/-0.12 | 32.4+/-0.13 | 1.61+/-0.01 |
| Average and std dev  No. replicates | 27 | 27 | 27 |
|  |  |  |  |

Analyst comments

Samples were labelled clearly and filled to the appropriate level.