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for Environmental Water Quality

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Analytical Methods for Environmental Water Quality

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Analytical Methods for Environmental Water Quality

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Introduction

The international water community continues to highlight good water quality as vital for securing the future of human and aquatic ecosystem health. The Millennium Development Goals on water and sanitation are not limited to water scarcity and access. Water quality is an important determinant of availability because water which is not fit for use is in effect unavailable. It is clear, as with any goal, that decision-makers require scientifically sound information with which to base their policies and priorities. There is a need for reliable, current data and information about water resources at the global level for the water and sanitation targets to be measured. The UNEP GEMS/Water Programme implements quality assurance activities as part of its mandate.

The UNEP GEMS/Water Programme is a multi-faceted water science centre oriented towards building knowledge on inland quality issues worldwide. The twin goals of the Programme are to improve water quality monitoring and assessment capacity in participating countries, and to determine the state and trends of regional and global water quality.

Quality assurance (QA) activities are essential to ensuring the reliability of water quality measurements. The trend through the broader analytical community is to strengthen laboratory QA from simple internal quality control measures, to laboratory accreditation to international standards such as ISO/IEC 17025. The use of documented analytical methods is also integral to the generation of reliable water quality data. A lack of such documentation can lead to the production, merging and comparison of water quality data generated by different procedures for the same parameter.

The purpose of this book is to provide a compilation of methodologies that are currently in use, or have been used, in laboratories that provide water quality data and information to the GEMS/Water global database, GEMStat. Part A provides an overview of nearly 800 analytical methods codes for over 100 parameters. Each entry includes the GEMS/Water method code, the parameter name, a brief method description, method name, measurement units, the number of decimal places reported in GEMStat, and where available, a method detection limit, the name of the requesting agency, and a literature reference. The specific methodologies provided for each parameter are not designed to replace or revise methodological protocols that are being used in laboratories.

Ms. Yvonne D. Stokker led the development of this publication, with the assistance of Kelly Hodgson. Contributions and reviews by others are acknowledged and appreciated. The target audience includes water quality laboratories, UNEP and its partner agencies, and especially users of GEMStat data. Readers are invited to submit new method descriptions, using the submission form at the end of Part A, and comments, suggestions and updates to Ms. Yvonne Stokker (yvonne.stokker@ec.gc.ca).

PART A: Key to GEMS/Water Analytical Methods Codes

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------------------------|-------|----------|
| 00120 | <p>SUM OF CATIONS</p> <p>Calculated</p> <p>The sum of the cations can be calculated, in milli-equivalents per litre, by the following formula:</p> $SC = *Ca + *Mg + *Na + *K + b Sr + b NH_4-N$ <p>* ionic forms obligatory for the calculation of ionic balance; b ions used only if in sufficient concentration to significantly modify the ionic balance.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1978. Reference: UNEP GEMS/Water 1992.</p> | SUM OF CATIONS | meq/L | 3 |
| 00125 | <p>SUM OF ANIONS</p> <p>Calculated</p> <p>The sum of the anions can be calculated, in milli-equivalents per litre, by the following formula:</p> $SA = *SO_4 + *Cl + a *CO_3 + a *HCO_3 + *NO_3-N + b NO_2-N + b PO_4-P$ <p>* ionic forms obligatory for the calculation of ionic balance; a can be replaced by Total Alkalinity, in meq/L, (where alk meq/L = alk mg/L CaCO₃/50); b ions used only if in sufficient concentration to significantly modify the ionic balance.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1978. Reference: UNEP GEMS/Water 1992.</p> | SUM OF ANIONS | meq/L | 3 |
| 00130 | <p>SUM OF CATIONS + ANIONS</p> <p>Calculated</p> <p>The sum of the cations and anions can be calculated, in milli-equivalents per litre, by the following formula:</p> $S(C+A) = Ca + Mg + Na + K + b Sr + NH_4-N + SO_4 + Cl + CO_3 + HCO_3 + NO_3-N + b NO_2-N + b PO_4-P$ <p>b ions used only if in sufficient concentration to significantly modify the ionic balance.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1997. Reference: UNEP GEMS/Water 1992.</p> | SUM OF CATIONS + ANIONS | meq/L | 3 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------------------|----------|----------|
| 00190 | <p>SAMPLING METHOD, INTEGRATED SAMPLE – (<i>Code is for internal use only</i>)</p> <p>Vertical (V), Horizontal (H), Time (T)</p> <p>Parameter code used for GEMS/Water projects to indicate sampling method. (Integrated sample code is for internal use only):</p> <p>1 - Vertical Integration (V) 2 - Horizontal Integration (H) 3 - Time Integration (T) 4 - Flow Integration</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1978. Reference: UNEP GEMS/Water 1992.</p> | INTEGRATED SAMPLE | Code | 0 |
| 01000 | <p>HYDROGEN SULPHIDE</p> <p>A tablet of Alka-seltzer is added to a sample aliquot; the shaken aliquot evolves gas and reacts with a lead acetate indicator paper in the cap. The black colour of lead sulphide is compared to standard and blank solutions to determine the concentration of hydrogen sulphide.</p> <p>Requesting Agency: Saskatchewan Environment, Canada, 1977. Reference: APHA 1975.</p> | H ₂ S | mg/L | 2 |
| 01001 | <p>HYDROGEN SULPHIDE</p> <p>Iodometric Method with Pretreatment</p> <p>Pretreatment Put 1mL zinc acetate solution and 0.5 mL of 6N NaOH into a 500mL glass bottle. Fill with sample and add 0.5 mL of 6N NaOH solution. Mix solution together and add enough NaOH to reach a pH above 9. Let precipitate rest for 30 min. Collect precipitate on glass fibre filter and continue with titration.</p> <p>Titration Measure from a buret into a 500mL flask an amount of iodine solution estimated to be an excess amount over the amount of sulphide present. Add distilled water if necessary to bring volume to 20mL. Add 2mL 6N HCl. Pipet 200mL sample into flask. If iodine colour disappears add more iodine until colour remains. Back titrate with Na₂S₂O₃ solution adding a few drops of starch solution as endpoint is approached and continuing until blue colour disappears. If the sulphide was precipitated with zinc and ZnS filtered out, return filter with precipitate to original bottle and add about 100mL water. Add iodine solution and HCl and titrate as per instructions above.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: APHA 2012, methods SM-4500 S₂ C and F</p> | H ₂ S | mg/L | 3 |
| 02003 | <p>ABSORPTION at 340 nm</p> <p>Spectrophotometric Absorbance Reading</p> <p>A sample is passed through a 0.45 µm membrane filter paper, then its absorbance is measured spectrometrically, at 340 nm in a 40 mm cell and the result is multiplied by 1000.</p> <p>Requesting Agency: NIWA, New Zealand, 2000. Reference: Davies-Colley and Vant 1987.</p> | A340 | Abs*1000 | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------|----------|----------|
| 02004 | <p>ABSORPTION at 440 nm</p> <p>Spectrophotometric Absorbance Reading</p> <p>A sample is passed through a 0.45 µm membrane filter paper, then its absorbance is measured spectrometrically, at 440 nm, in a 40 mm cell and the result is multiplied by 1000.</p> <p>Requesting Agency: NIWA, New Zealand, 2000. Reference: Davies-Colley and Vant 1987.</p> | A440 | Abs*1000 | 1 |
| 02005 | <p>ABSORPTION at 740 nm</p> <p>Spectrophotometric Absorbance Reading</p> <p>A sample is passed through a 0.45 µm membrane filter paper, then its absorbance is measured spectrometrically, at 740 nm, in a 40 mm cell, and the result is multiplied by 1000.</p> <p>Requesting Agency: NIWA, New Zealand, 2000. Reference: Davies-Colley and Vant 1987.</p> | A740 | Abs*1000 | 1 |
| 02006 | <p>ABSORPTION COEFFICIENT at 340 nm</p> <p>Calculated from 440 nm and 740 nm Absorbances</p> <p>The “apparent” absorbance, measured at 740 nm, is principally caused by light scattering and particulates absorbance. The absorption coefficient (G_{340}) corrects for this interference.</p> <p>Apparent $Abs_{740} = Abs_{740} \times 740/340 = Abs_{740} \times 2.176471$</p> <p>Error! Bookmark not defined. $G_{340} = (\ln 10) \times \text{Corrected Abs/cuvette path length (m)}$</p> <p>$G_{340} = 2.303 (Abs_{340} - \text{App. } Abs_{740})/\text{cuvette path length (m)}$</p> <p>Requesting Agency: NIWA, New Zealand, 2000. Reference: Davies-Colley and Vant 1987.</p> | G340 | M | 1 |
| 02007 | <p>ABSORPTION CO-EFFICIENT at 440 nm</p> <p>Calculated from 340nm and 740 nm Absorbances</p> <p>The “apparent” absorbance, measured at 740 nm, is principally caused by light scattering and particulates absorbance. The absorption coefficient (G_{340}) corrects for this interference.</p> <p>Apparent $Abs_{740} = Abs_{740} \times 740/440 = Abs_{740} \times 1.681818$</p> <p>Error! Bookmark not defined. $G_{440} = (\ln 10) \times \text{Corrected Abs/cuvette path length (m)}$</p> <p>$G_{340} = 2.303 (Abs_{440} - \text{App. } Abs_{740})/\text{cuvette path length (m)}$</p> <p>Requesting Agency: NIWA, New Zealand, 2000. Reference: Davies-Colley and Vant 1987.</p> | G440 | M | 1 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------|------------|----------|
| 02011 | <p>COLOUR APPARENT</p> <p>Visual Comparison</p> <p>The colour of a shaken sample is determined by visual comparison to known concentration of coloured solutions sealed in glass disks (Hellige Aqua Tester) or by visual comparison with platinum-cobalt standards (chloroplatinate ions). Apparent colour includes colour due to suspended matter (true colour is the colour of the water where turbidity has been removed by centrifuge).</p> <p>The method detection limit is 5 Pt-Co units.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | COLOUR APPARENT | Rel. Units | 1 |
| 02021 | <p>COLOUR TRUE</p> <p>Visual Comparison – centrifuged</p> <p>True colour refers to the colour of water from which the suspended material has been removed. Apparent colour refers to the colour of water that includes both the colour due to materials in solution and that due to turbidity.</p> <p>This method measures colour that results from natural occurring substances. The colour in the water sample is determined by visual comparison with known concentrations of coloured standard solutions. The unit of colour in the platinum-cobalt method is defined as being that produced by one milligram of platinum in the form of the chloroplatinate ion. The stock solution prepared at 500 colour units is composed of potassium chloroplatinate (K_2PtCl_6), and cobaltous chloride ($CoCl_2 \cdot 6H_2O$) in 10% hydrochloric acid. The solution is diluted in 50 mL Nessler tubes to form a series of standard colour solutions in the range expected for naturally occurring surface waters. For apparent colour, the whole water sample is shaken, poured in a Nessler tube and the tube then placed alongside the standards. Visual comparison and matching is conducted by looking vertically downward through the tubes, which have been placed over a lighted white surface, such that, light is reflected upward through the columns of liquid. For true colour, the turbidity is removed by filtration through 0.45 μm membrane filter paper and the filtrate analyzed.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 24.</p> | COLOUR TRUE | Rel. Units | 1 |
| 02022 | <p>COLOUR REAL</p> <p>Photometric – Spectral Absorption Coefficient (Real)</p> <p>Requesting Agency: Guatemala INSIVUMEH, 2013 Reference: Merck Methods of Analysis.</p> | COLOUR REAL | m-1 | 1 |
| 02023 | <p>COLOUR HAZEN</p> <p>Photometric – Platinum Cobalt (Hazen)</p> <p>Requesting Agency: Guatemala INSIVUMEH, 2013 Reference: Merck Methods of Analysis</p> | COLOUR HAZEN | m-1 | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------|-------|----------|
| 02040 | <p>ELECTRICAL CONDUCTANCE</p> <p>Electrometer @ 20°C</p> <p>Specific Conductance of a solution is the ability of the solution to carry electric current and has some relationship to the Total Ionic Concentration of the solution. The sample temperature is brought to 20°C and the aliquot is measured electrometrically.</p> <p>Requesting Agency: European Environment Agency, 1998. Reference: n/a.</p> | ELEC. COND. | µS/cm | 0 |
| 02041 | <p>ELECTRICAL CONDUCTANCE</p> <p>Conductivity Meter @ 25°C</p> <p>Conductivity of a solution is the ability of the solution to carry electric current and has some relationship to the Total Ionic Concentration of the solution. The specific conductance is measured by a conductivity meter with Pt electrodes and is equilibrated to 25°C before the sample measurement is made. The conductivity meter is calibrated on a per use basis.</p> <p><i>Note: This parameter was formerly measured in µmho/cm. As a result of the change to the metric system, the unit now is µS/cm (microsiemens/cm).</i> 1 umho/cm = 1 µS/cm = 0.1 mS/m</p> <p>The method detection limit is 2 µS/cm. (= 0.2 mS/m)</p> <p>Requesting Agency 1: NIES, Japan, 1998. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 1999. Requesting Agency 3: Russia GHI, 2003. Requesting Agency 4: CEA Laboratory, Sri Lanka 2004. Reference 1: JSA 1998, method 13. Reference 2: APHA 2012, SM 2510 B. Reference 3: Semyonov 1977. Reference 4: ISO 7888 – Determination of electrical conductivity.</p> | ELEC. COND. | µS/cm | 0 |
| 02042 | <p>ELECTRICAL CONDUCTIVITY</p> <p>Conductivity Meter - Field measurement</p> <p>Specific conductance is measured <i>in situ</i> with a battery operated Conductivity-Temperature Meter, employing nickel electrodes in the four-electrode configuration with integral temperature sensor- compensator and internal calibration standards. The accuracy is ±2.5%.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 2007. Requesting Agency 2: Zimbabwe, 2009 Reference: Environment Canada 2007, ENVIRODAT code 33.</p> | ELEC. COND. | µS/cm | 0 |
| 02043 | <p>ELECTRICAL CONDUCTIVITY</p> <p>Conductivity Meter – Field measurement</p> <p>Requesting Agency: Lake Kariba Research Station, Zimbabwe 2009 Reference:</p> | ELEC. COND. | µS/cm | 0 |
| 02047 | <p>ELECTRICAL CONDUCTIVITY</p> <p>Calculated</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 2355.</p> | ELEC. COND. | µS/cm | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------|-------|----------|
| 02049 | <p>ELECTRICAL CONDUCTANCE</p> <p>Radiometer CDM 83</p> <p>Specific Conductance of a solution is the ability of the solution to carry electric current and has some relationship to the Total Ionic Concentration of the solution. The specific conductance is measured, using a radiometer CDM 83, automatic ranging conductivity meter and a radiometer type CDC 334 jacketed platinum electrode. A one-gallon water bath, with a HAAKE Model E52 temperature controller/circulation pump (or equivalent), accurately maintains the temperature bath at 25°C (± 0.1°C) and continually circulates water through the cell jacket. The sample aliquot is drawn into the conductivity cell via a vacuum and specific conductivity is read directly from the meter after a fifteen second temperature stabilization period. The radiometer is calibrated on a per use basis.</p> <p>The method detection limit is 0.2 µS/cm. 1 umho/cm = 1 µsie/cm. 1 µS/cm</p> <p>Requesting Agency 1: Alberta Environment, Canada, March 1984. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1995. Reference 2: JSA 1998, method 13.</p> | ELEC. COND. | µS/cm | 0 |
| 02050 | <p>TOTAL DISSOLVED SOLIDS</p> <p>Calibrated Conductivity Meter at 25°C</p> <p>The Total Dissolved Solids (TDS) is measured through a calibrated conductivity meter (Orion 105 or 115, or equivalent) and corrected to 25°C, where the values are compared to the Critical Table Values, with a relative standard deviation (RSD) of 0.87% and an accuracy of ± 0.5%. The resolution is 3 significant digits or 1 mg/L and the range varies between 0 and 19900 mg/L.</p> <p>Requesting Agency: Middle East Technical University, Turkey, 2003. Reference: Orion Research Inc. 1996.</p> | TDS | mg/L | 0 |
| 02051 | <p>ELECTRICAL CONDUCTIVITY</p> <p>Conductivity Meter – Ambient Temperature</p> <p>Specific conductance is measured by a conductivity meter with Pt electrodes at the sample temperature (uncorrected).</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 37.</p> | ELEC. COND. | µS/cm | 0 |
| 02052 | <p>TOTAL DISSOLVED SALTS</p> <p>Total Dissolved Salts – calculated</p> <p>Dissolved Major Salts (DMS) refers to a calculation result for Total Dissolved Solids (TDS). TDS is defined as the sum of a number of fundamental variables, all with concentrations in mg/L. The concentrations of orthophosphate (PO₄), nitrate-nitrite (NO₃+NO₂), ammonium (NH₄) and alkalinity are converted before calculation of TDS. The TDS value for PO₄ is derived from the molar ratio of PO₄ to P; the TDS values of NO₃ and NH₄ are derived from the molar ratios of NO₃ to N and NH₄ to N. The TDS value for alkalinity is derived from the ratio of the molar mass of HCO₃⁻ divided by CaCO₃ equivalent mass.</p> <p>Requesting Agency: South Africa, 2005 Reference: n/a</p> | TDS | mg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------|-------|----------|
| 02053 | <p>SPECIFIC ELECTRICAL CONDUCTANCE (<i>in situ</i>)</p> <p>Field conductivity sensor</p> <p>In situ measurement generally is preferred for determining the conductivity of surface water; downhole or flowthrough-chamber measurements are preferred for ground water</p> <p>Requesting Agency: USGS 2009 Reference 1: USGS 1998, method 6.3 Specific Electrical Conductance Reference 2: USGS PCode-95 MCode-SC001</p> | ELEC. COND. | μS/cm | 0 |
| 02055 | <p>SALINITY</p> <p>TDS-Salinity-Conductivity Meter at 25°C</p> <p>Specific Conductance of a solution is the ability of the solution to carry electric current and has some relationship to the Total Ionic Concentration of the solution. The salinity is measured through a calibrated TDS-salinity-conductivity meter (Orion 105 or 115, or equivalent) and corrected to 25°C, where the salinity is compared to a salinity table with a precision of 0.5% and reported in parts per thousand (ppt).</p> <p>The range is 0 to 80.0 ppt with a resolution of 0.1 ppt. The salinity-conductivity meter is calibrated on a per use basis.</p> <p>Requesting Agency: Middle East Technical University, Turkey, 2003. Reference: Orion Research Inc., 1996.</p> | SALINITY | ppt | 0 |
| 02061 | <p>TEMPERATURE</p> <p>Mercury Thermometer</p> <p>Both atmospheric and water temperature are measured upon sample collection. The atmospheric temperature is measured in a well-ventilated area and in the shade, at 1.2 to 1.5 m above the ground, using a 50°C calibrated (liquid in glass) thermometer.</p> <p>The water temperature is measured by immersing a calibrated thermometer into the water or by measuring the temperature immediately after collection using a calibrated thermometer.</p> <p>The Hg-filled thermometer has a precision of ± 0.1°C.</p> <p>Requesting Agency: NIES, Japan, 1998. Requesting Agency 2: CEA Laboratory, Sri Lanka 2004. Reference 1: JSA 1998, method 7.2. Reference 2: APHA 1998, SM 2550 B. Reference 3: Semyonov 1977.</p> | TEMP | °C | 1 |
| 02062 | <p>TEMPERATURE</p> <p>Battery Thermometer</p> <p>Water Temperature is measured with a battery-operated YSI thermistor (or equivalent) calibrated against a certified thermometer. Resolution is 0.1°C and accuracy is ±0.2°C.</p> <p>The method range is -10 °C to +90 °C.</p> <p>Requesting Agency: DFO-FWI, Canada, 1978. Reference: YSI Environmental. http://www.ysi.com/index.php</p> | TEMP | °C | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|-------|----------|
| 02063 | <p>TEMPERATURE</p> <p>Digital Thermometer</p> <p>Ambient temperature is measured with a calibrated digital thermometer in the shade, free from the influences of direct or reflected solar radiation. To reduce the error due to evaporative cooling, a dry thermometer should be used. Water temperature is measured by immersing a calibrated digital thermometer into the water sample immediately after collection.</p> <p>Method precision is ± 0.1 °C.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2003. Reference: APHA 1998, SM-2550.</p> | TEMP | °C | 1 |
| 02065 | <p>TEMPERATURE</p> <p>Conductivity-Temperature Meter (battery)</p> <p>Water temperature is measured with a battery-operated conductivity-temperature meter calibrated by switching to an internal standard. The accuracy is ± 0.5 °C.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 42.</p> | TEMP | °C | 1 |
| 02066 | <p>TEMPERATURE</p> <p>Electronic Bathythermograph</p> <p>The electronic bathythermograph provides a direct instantaneous readout and graphical record of temperatures versus depth.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 104.</p> | TEMP | °C | 1 |
| 02067 | <p>TEMPERATURE</p> <p>Oceanographic Reversing Thermometer</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference 1: Environment Canada 2007, Great Lakes STAR code 100. Reference 2: Williams 1971.</p> | TEMP | °C | 1 |
| 02068 | <p>TEMPERATURE</p> <p>Infrared (non-contact)</p> <p>Air temperature, in addition to water temperature, should be measured and recorded whenever water-quality samples are collected. Water temperature must always be measured <i>in situ</i> and in a manner that ensures that the measurement accurately represents the intended sample conditions. Before measuring air or water temperature, inspect the liquid-in-glass thermometer to be certain that the liquid column has not separated. Inspect the glass bulb to be sure it is clean. Inspect the protective case to be sure it is free of sand and debris. Check that batteries are fully charged for thermistor thermometers or temperature sensors incorporated into other field meters.</p> <p>Requesting Agency: USGS 2009 Reference: USGS 1998, section 6.1 Temperature; USGS Pcode-10 MCode-THM03</p> | TEMP | °C | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|-------|----------|
| 02069 | <p>TEMPERATURE</p> <p>pH meter (<i>in situ</i>)</p> <p>Potentiometric or Electrochemical field measurement.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference:</p> | TEMP | °C | 1 |
| 02070 | <p>CLARITY</p> <p>Horizontal Black Disc</p> <p>The black disk is expected to be particularly important in waters where depths are too shallow for deployment of Secchi disk. A disk of 20 mm is used for depth of less than 0.4 m of clarity, a 60 mm disk is used for depth between 0.4 to 1.5 m and a disk of 200 mm is used for depth greater than 1.5 m. The disk is placed vertically in the water (often held in position by water current) and moved away from a mirror, placed at 45 degrees in an open-ended tube; measure the length when the disk disappears; pull the disk back toward the mirror and measure the distance when the disk re-appears. Average these distances to calculate the clarity.</p> <p>The method detection limit is variable, depending on the depth of the waters.</p> <p>Requesting Agency: NIWA, New Zealand, 2010. Reference: n/a.</p> | CLARITY | m | 1 |
| 02071 | <p>TURBIDITY</p> <p>Visual</p> <p>Turbidity measurements are based on the light path through a suspension causing the image of the flame of a standard candle to disappear, meaning to become undistinguishable against the general background.</p> <p>The method detection limit is 25 Jackson Turbidity Units (JTU).</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1975.</p> | TURBIDITY | JTU | 1 |
| 02073 | <p>TURBIDITY</p> <p>Photometry</p> <p>A light beam is passed through the shaken sample. The light, scattered at 90 degrees to the beam-axis, is measured by photocells. The calibration of the instrument is made using a standard suspension of Formazin (the reaction product of an aqueous solutions of hydrazine sulphate (N₂H₄.H₂SO₄) and hexamethylenetetramine solutions). Standardisation of the instrument utilises a polyacrylic plastic rod containing special turbidity material.</p> <p>The method detection limit is 0.02 Jackson Turbidity Units (JTU).</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 2130 B</p> | TURBIDITY | JTU | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|-------|----------|
| 02074 | <p>TURBIDITY</p> <p>Nephelometric - Hach</p> <p>In a Hach turbidimeter, a strong light beam is sent upwards through a transparent tube containing a shaken sample. The light, reflected at 90 degrees to the axis, is captured by photocells and their electrical response is proportional to the sample turbidity. The instrument is calibrated using a standard solution of Formazin. Standardization of the instrument uses a polyacrylic plastic rod, containing a special turbidity material, supplied with the instrument.</p> <p>The method detection limit is 0.02 NTU.</p> <p>Requesting Agency 1: Saskatchewan Environment, Canada, 1977. Requesting Agency 2: CEA laboratory, Sri Lanka 2004. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference: APHA 2012, SM 2130 B.</p> | TURBIDITY | NTU | 1 |
| 02076 | <p>TRANSPARENCY</p> <p>30 cm Secchi Disc</p> <p>The depth at which a 30 cm diameter disc, painted in black and white quadrants, is no longer visible in a body of water. The procedure is to record the point of disappearance as the disk is lowered, allow it to drop a little farther, and then determine the point of re-emergence as the disk is raised. The mean of the two readings is taken as the turbidity light penetration.</p> <p>In turbid waters, the precision is 1 cm and in clear waters 10 cm.</p> <p>Requesting Agency 1: Environment Canada, Ontario Region, 2007. Requesting Agency 2: NIES, Japan 2013 Reference 1: Environment Canada 2007, Great Lakes STAR code 030. Reference 2: JWVA 2001, method VI-1 5</p> | TRANS | m | 3 |
| 02081 | <p>TURBIDITY</p> <p>Nephelometric method – HACH Ratio Turbidimeter</p> <p>Turbidity in water is caused by suspended or colloidal matter and consequently, light passing through matter is scattered. This characteristic of water that causes light scattering is referred to as turbidity. In the nephelometric method light scattered at 90 degrees to the incident light is measured. The whole water sample is shaken and poured into transparent cell or tube, which are allowed to sit for sufficient time to allow any air bubbles formed to escape before being placed in the nephelometer. A strong light beam is sent through the sample and the suspended particles reflect the light. The light which is reflected at 90 degrees to the axis is received by photo cells and their electrical response is proportional to the amount received and hence to the sample turbidity. Calibration of the instrument is made using a standard suspension of formazin- the reaction product of aqueous solutions of hydrazine sulphate and hexamethylenetetramine. The value is reported in units of NTU (nephelometric turbidity units).</p> <p>Ratiometric Method: The turbidity meter utilized has additional detectors that measures forward scattered light and light transmitted through the sample. Using a ratio of the light received by the different detectors to compute the turbidity value the variability of the turbidity reading can be reduced.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 54.</p> | TURBIDITY | NTU | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------|------------|----------|
| 02082 | <p>TURBIDITY</p> <p>Wagtech turbidimeter</p> <p>Turbidimeter calibration: The manufacturer's operating instructions should be followed. Measure standards on the turbidimeter covering the range of interest. Turbidities less than 40 units: Shake the sample to thoroughly mix in the turbidimeter tube. Read the turbidity directly from the instrument scale or from the appropriate calibration curve. Turbidities exceeding 40 units: Dilute the sample with one or more volumes of turbidity-free water until the turbidity falls below 40 units. The turbidity of the original sample is then computed from the turbidity of the diluted sample and the dilution factor.</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: US-EPA method 180.1</p> | TURBIDITY | NTU | 1 |
| 02083 | <p>TRANSPARENCY</p> <p>5 digit recorded value</p> <p>Per cent transmission of light at a specific recorded depth using specified path lengths and filters. Profiles are taken from surface to bottom. A reading of 100% would be obtained in hypothetical non-attenuating water.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 124.</p> | TRANS | per cent | 1 |
| 02084 | <p>TURBIDITY</p> <p><i>In situ</i> sensor (YSI sonde)</p> <p>Calibrate the instrument before leaving for the field. At the field site, verify that the instrument has retained its calibration within 5%. For dynamic measurements, immerse the sonde or single turbidity sensor in the water body. <u>NOTE</u>: USGS reports units as FNU (=NTU)</p> <p>Requesting Agency: USGS 2009 Reference: USGS 1998, section 6.7 Turbidity; Pcode-63680 Mcode-TS085, TS087</p> | TURBIDITY | FNU or NTU | 1 |
| 03001 | <p>LITHIUM – TOTAL</p> <p>Atomic Absorption Spectrometry - Direct Aspiration</p> <p>A sample is preserved in the field with mineral acid. The shaken sample aliquot is digested with nitric acid and aspirated in an air-acetylene oxidizing flame. The absorbance is measured spectrometrically at 670.8 mμ and is compared to identically-prepared Li standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 3111 B.</p> | Li TOTAL | mg Li/L | 1 |
| 03009 | <p>LITHIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel digestion and pre-concentration. ICP 1502 (<i>See Appendix 3</i>).</p> <p>Digestion with HNO₃/HCl. Preconcentration by evaporation (factor 5 to 10).</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1502.</p> | Li TOTAL | mg/L Li | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 03011 | <p>LITHIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Li TOTAL | mg/L Li | 1 |
| 03091 | <p>LITHIUM – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Li TOTAL | mg/L Li | 1 |
| 03092 | <p>LITHIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1298</p> | Li TOTAL | mg/L Li | 1 |
| 03101 | <p>LITHIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry - Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 670.8 mµ, and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 3500-Li B</p> | Li DISS | mg/L Li | 1 |
| 04009 | <p>BERYLLIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>).</p> <p>Digestion with HNO₃/HCl. Preconcentration by evaporation (factor 5 to 10).</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1502.</p> | Be TOTAL | mg Be/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 04011 | <p>BERYLLIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with aqua regia (HNO₃/HCl ratio v/v: 1to 3), Residue taken up with deionized water to one-fifth original volume. Digest filtered through 0.4 um membrane.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Be TOTAL | mg Be/L | 1 |
| 04091 | <p>BERYLLIUM – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Be TOTAL | mg Be/L | 1 |
| 04092 | <p>BERYLLIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1290.</p> | Be TOTAL | mg Be/L | 3 |
| 05001 | <p>BORON - TOTAL</p> <p>Atomic Absorption Spectrometry – Graphite furnace</p> <p>A sample is preserved in the field, in a plastic container, with mineral acid. The shaken sample aliquot is digested with nitric acid and the absorbance is measured, spectrometrically by Graphite Furnace, at 249.7 nm, and compared to identically-prepared boron standard solutions</p> <p>The method detection limit is 0.15 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: Perkin-Elmer Corp. 1982.</p> | B TOTAL | mg/L B | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|--------|----------|
| 05002 | <p>BORON – TOTAL</p> <p>Colourimetry</p> <p>A sample is preserved in the field in a plastic container. When a shaken sample aliquot, containing boron, is acidified and evaporated in the presence of curcumin, a red coloured product (rosocyanine) is formed. The rosocyanine is taken up in ethyl alcohol and the absorbance is measured spectrometrically at 540 nm, with a minimum light path of 1 cm, and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: nitrate > 10 mg/L and hardness > 100 gm/L.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1979. Reference 2: JWWA 2001. VI-3 4.4 Reference 3: APHA 2012, SM 4500-B B</p> | B TOTAL | mg/L B | 1 |
| 05009 | <p>BORON – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>).</p> <p>A sample is preserved in the field, in a plastic container, with nitric acid. The shaken sample aliquot is digested with nitric acid and HCl (aqua regia), concentrated appropriately and aspirated from an autosampler. The emission is measured at 249.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.0005 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 47.3. Reference 3: Japan MHLW 2003, Notification No. 261Appendix No.5 Reference 4: Environment Canada 2007, PYR code 1502. Reference 5: APHA 2012. SM 3120 B</p> | B TOTAL | mg/L B | 1 |
| 05011 | <p>BORON - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>A sample is preserved in the field, in a plastic container, with dilute mineral acid. The shaken sample aliquot is digested with aqua regia and evaporated to near dryness. The residue is dissolved in concentrated HCl and diluted to one-fifth of the aliquot volume. The digested sample aliquot is aspirated and the emission is measured at 249.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.0005 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 47.3. Reference 3: Environment Canada 2007, PYR code 2634. Reference 4: APHA SM 3120 B</p> | B TOTAL | mg/L B | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|--------|----------|
| 05031 | <p>BORON – TOTAL</p> <p>Colorimetry by Wagtech photometer</p> <p>In the Wagtech Boron method, two test tablets are used to provide the necessary buffer and indicator reagents. A sequestering agent is incorporated to eliminate any interference from cations. The test is carried out by adding one of each tablet to a sample of the water. Stand for exactly 20 minutes to allow full colour development. Take photometer reading in usual manner. For optimum results this test should be carried out at a temperature of 20°C ± 2°C.</p> <p>Testing range for boron is 0-2.5 mg/L.</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Wagtech on-line methodologies.</p> | B TOTAL | mg/L B | 1 |
| 05090 | <p>BORON – TOTAL</p> <p>Inductively Coupled Plasma, Mass Spectrometry (ICP-MS)</p> <p>A sample is preserved in the field, in a plastic container, with dilute mineral acid. The shaken sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector, compared to identically-prepared standard and blank solutions and the resulting information processed by a computer database system.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998 Reference 1: JWWA 2001, method VI-3 4.3. Reference 2: Japan MoE 1971, Notification No.59-NO.7 Reference 3: Japan MHLW 2003, Notification No.261 Appendix 7.</p> | B TOTAL | mg/L B | 1 |
| 05091 | <p>BORON – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | B TOTAL | mg/L B | 1 |
| 05092 | <p>BORON – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency 1: Japan, 2007 Requesting Agency 2: Environment Canada, Ontario Region, 2007. Reference 1: Japan 261-NO.6 Reference 2: Environment Canada 2007, Great Lakes STAR code 1288.</p> | B TOTAL | mg/L B | 1 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------|--------|----------|
| 05101 | <p>BORON - DISSOLVED</p> <p>Potentiometric Mannitol</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container. If PO₄ concentration exceeds 10 mg/L, the filtrate is precipitated with Pb(NO₃)₂. The excess Pb is removed by precipitation with NaHCO₃; the HCO₃ is then removed by acidification with H₂SO₄. If hardness exceeds 100 mg/L of CaCO₃ the sample is passed through a strongly acidic cation exchange resin. The final sample aliquot is titrated, with a pH meter, to a pH of 7.00 with NaOH, using mannitol as indicator. The concentration of boron is proportional to the amount of NaOH needed and is compared to identically prepared standard and blank (to compensate for any CO₂ error) solutions.</p> <p>Interference: Ge and tetravalent V also interfere. The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1971.</p> | B DISS | mg/L B | 1 |
| 05102 | <p>BORON - DISSOLVED</p> <p>Curcumin Method</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container. A red coloured solution (rosocyanine) is obtained when the sample aliquot, containing boron, is acidified and evaporated in the presence of curcumin (turmeric yellow; 1,7-bis(4-hydroxymethoxy-phenyl)-1,6-heptadiene-3,5-dione), mixed and diluted with ethanol. The diluted sample is read at 540 mµ within one hour after sample has been dried and compared to identically-prepared standard and blank solutions.</p> <p>Interference: NO₃ ion greater than 20 mg/L NO₃. The method detection limit is 0.06 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | B DISS | mg/L B | 1 |
| 05105 | <p>BORON - DISSOLVED</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container. The sample aliquot is mixed with a solution of carminic acid and phenol in concentrated H₂SO₄. The absorbance of the resulting colour is measured spectrometrically at 600 mµ, and compared to identically-prepared standard and blank solutions.</p> <p>Interference: a phenol concentration of 0.05% in the carminic acid solution will suppress the nitrate interference up to 40 mg/L of nitrogen. The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1971.</p> | B DISS | mg/L B | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------|--------|----------|
| 05107 | <p>BORON - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectroscopy (ICP-OES) ICP 1516 (See Appendix 3).</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container with dilute mineral acid. The sample aliquot is aspirated and the emission is measured at the wavelength of 249.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 47.3.</p> | B DISS | mg/L B | 1 |
| 05109 | <p>BORON - DISSOLVED</p> <p>Inductively Coupled Argon Plasma by Optical Emission Spectrometry (ICP-OES) ICP 1502 (See Appendix 3)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container with dilute mineral acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 249.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 47.3.</p> | B DISS | mg/L B | 1 |
| 05111 | <p>BORON - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectroscopy (ICP-OES) ICP 1516 (See Appendix 3)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container with dilute mineral acid. The sample aliquot is aspirated and the emission is measured at 249.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 47.3.</p> | B DISS | mg/L B | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------|--------|----------|
| 05190 | <p>BORON - DISSOLVED</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a plastic container with dilute mineral acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer and compared to identically-prepared standard and blank solutions. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: Japanese Waterworks Analytical Method (2001) VI-3 4.3. Reference 2: Japan 261-NO.6</p> | B DISS | mg/L B | 1 |
| 06001 | <p>CARBON - TOTAL ORGANIC</p> <p>Infrared Analysis (Single Channel)</p> <p>A small volume of blended sample is acidified with HCl, aerated with air or Nitrogen, and passed into a combustion tube, at 950°C, containing pumice stone impregnated with cobalt oxide. The carbonaceous material in the sample is oxidized, yielding carbon dioxide and steam. The resulting CO₂ is measured by an IR analyzer and compared to identically-prepared Organic Carbon standard and blank solutions to give Total Organic Carbon (TOC).</p> <p>Infrared Analysis (Dual Channel)</p> <p>A small volume of a blended sample is injected into a combustion tube, at 950°C, containing pumice stone impregnated with cobalt oxide. The carbonaceous material in the sample is oxidized, yielding carbon dioxide and steam. The resulting CO₂ is measured by an IR analyzer and compared to identically-prepared organic Carbon standard and blank solutions to give total C.</p> <p>An identical volume of sample is injected into a combustion tube, at 150°C containing 85% H₃PO₄ on quartz chips. The airflow carries out the resulting sample which is condensed and the inorganic carbon, as CO₂, is measured by an IR analyzer, and compared to identically-prepared inorganic carbon standard and blank solutions. The total organic carbon is calculated by difference.</p> <p>Interference: Large particles may not be injected.</p> <p>The method detection limit is 0.5 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 22.1 (dual channel) Reference 3: JSA 1998, method 22.2 (single channel) Reference 4: JSA 1998, methods JIS K 0102 22.2 and JIS K 0805.</p> | TOC | mg/L C | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|--------|----------|
| 06012 | <p>CARBON - TOTAL ORGANIC</p> <p>Infrared Analysis – Automated</p> <p>Total carbon is analyzed by injecting a blended whole water sample onto a platinum catalyst packed combustion tube kept at 680°C. The CO₂ formed, which is proportional to the total carbon in the sample, is measured on a non-dispersive infrared detector. Total inorganic carbon is then analyzed by injecting an identical blended whole water sample into an inorganic reaction vessel containing 25% phosphoric acid. The CO₂ formed represents the total inorganic carbon in the sample and is determined by a non-dispersive infrared detector. Calculation of the total organic carbon is obtained by subtracting the total inorganic carbon from the total carbon.</p> <p>Calculation: TOC (06012) = TC (06016) – TIC (06060)</p> <p>Requesting Agency 1: Environment Canada, Pacific & Yukon Region, 2007. Requesting Agency 2: NIES, Japan 2013. Reference 1: Environment Canada, PYR code 2695. Reference 2: Japan JIS K 0102 22.1</p> | TOC | mg/L C | 1 |
| 06015 | <p>CARBON - TOTAL ORGANIC</p> <p>CALCULATION</p> <p>TOC = DOC + POC</p> <p>Requesting Agency: Japan, 2013 Reference: n/a</p> | TOC | mg C/L | 1 |
| 06016 | <p>TOTAL CARBON</p> <p>Infrared analysis – automated</p> <p>Total carbon is analyzed by injecting a blended whole water sample onto a platinum catalyst packed combustion tube kept at 680°C. The CO₂ formed, which is proportional to the total carbon in the sample is measured on a non-dispersive infrared detector.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2695.</p> | TC | mg/L C | 1 |
| 06051 | <p>CARBON - TOTAL INORGANIC</p> <p>Infrared Analysis – Combustion Tube</p> <p>A small volume of the blended sample is injected into a combustion tube at 950°C containing pumice stone impregnated with cobalt oxide. The resulting CO₂ is measured by an IR analyzer and compared with standard organic C solutions to give total C. An identical volume is injected into a combustion tube at 150°C containing 85% H₃PO₄ on quartz chips. The resulting CO₂ is measured by an IR analyzer, and compared with standard inorganic C solutions to give the total inorganic C.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 95.</p> | TIC | mg/L C | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------|--------|----------|
| 06060 | <p>CARBON - TOTAL INORGANIC</p> <p>Infrared Analysis – Automated</p> <p>The sample is injected into an inorganic reaction vessel containing 25% phosphoric acid. The oxidized inorganic carbon is measured on the calibrated non-dispersive infrared detector.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2695.</p> | TIC | mg/L C | 1 |
| 06076 | <p>ORGANIC CARBON - PARTICULATE</p> <p>CHN Analyzer</p> <p>A sample aliquot is washed with 0.3% sulphuric acid [Japan uses 4mol/L HCl] to remove all inorganic carbons. The aliquot is then weighed and ignited in a combustion tube, containing MnO₂ catalyst, at 850°C [Japan uses 900-950 °C]. The resulting CO₂ is measured by thermal conductivity and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 µg/g.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 1976. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JGS 2001, method 0231-2000 4.2.</p> | ORG. C PART | µg/g | 3 |
| 06077 | <p>ORGANIC CARBON - PARTICULATE</p> <p>Flame Ionization</p> <p>A sample aliquot is acidified prior to the analysis to remove the inorganic carbon and a volume of blended sample is injected into a platinum boat containing manganese oxide. After sample vaporization the boat is advanced to pyrolysis zone at 850°C. Volatile organic compounds pass over a hydrogen-enriched nickel catalyst at 350°C and are reduced to CH₄ which is measured by a flame ionization detector and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: Alberta Environment, Canada, 1978. Reference: Alberta Environment 1978.</p> | ORG. C PART | µg/g | 3 |
| 06081 | <p>ORGANIC CARBON – PARTICULATE</p> <p>Thermal Conductivity</p> <p>Particulates were collected by filtering a sample through pre-treated GF/C glass fibre filters. The analysis was conducted with a Hewlett-Packard model 185 CHN analyzer with a strip chart recorder and surface peak area integrator.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2011 Reference: Environment Canada, Great Lakes STAR code 227.</p> | ORG. C PART | mg C/L | 3 |
| 06082 | <p>ORGANIC CARBON – PARTICULATE</p> <p>Thermal Conductivity (Integrated Sample)</p> <p>From integrated samples, particulates were collected by filtering a sample through pre-treated GF/C glass fibre filters and the analysis was conducted with a Hewlett-Packard model 185 CHN analyzer with a strip chart recorder and surface peak area integrator.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2011. Reference: Environment Canada 2007, Great Lakes STAR code 225.</p> | ORG C PART | mg C/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------|-------|----------|
| 06083 | <p>ORGANIC CARBON - PARTICULATE</p> <p>CHN Analyzer</p> <p>A sample aliquot is washed with 4mol/L HCl to remove all inorganic carbons. The aliquot is then weighed and ignited in a combustion tube, containing MnO₂ catalyst, at 900-950 °C. The resulting CO₂ is measured by thermal conductivity and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 2010. Reference: Japanese Geotechnical Society Standard 0231-2000 4.2.</p> | ORG. C PART | mg/L | 3 |
| 06084 | <p>ORGANIC CARBON - PARTICULATE</p> <p>Difference calculation</p> <p>POC = TOC (code 06001) – DOC (code 06101)</p> <p>The method detection limit is 0.5 mg/L</p> <p>Requesting Agency: Japan 2013 Reference : n/a</p> | ORG. C PART | mg/L | 1 |
| 06101 | <p>ORGANIC CARBON - DISSOLVED</p> <p>Calculation, Infrared Analysis</p> <p>DOC = DC - DIC</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. A small volume is injected into a combustion tube at 950°C containing Cobalt oxide on asbestos. The resulting CO₂ is measured by an IR analyzer and compared with organic carbon standard and blank solutions to give the total dissolved C (DC). An identical volume is injected into a combustion tube at 150°C containing 85% H₃PO₄ on quartz chips. The resulting CO₂ (DIC) is measured by an IR analyzer and compared to identically-prepared inorganic carbon standard and blank. The dissolved organic C (DOC) is calculated by difference.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method JIS K 0102 22.1</p> | DOC | mg/L | 1 |
| 06104 | <p>ORGANIC CARBON – DISSOLVED</p> <p>Infrared Analysis</p> <p>A Beckman 915 Total Organic Carbon (TOC) analyzer.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 226.</p> | DOC | mg/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|-------|----------|
| 06107 | <p>ORGANIC CARBON – DISSOLVED</p> <p>Colourimetry with UV oxidation</p> <p>The sample stream is segmented with CO₂-free air, acidified, heated and sparged with nitrogen gas to remove the inorganic carbon. After re-sampling and air segmentation, persulphate and mercury(II) nitrate solutions are added and the mixed liquid stream is pumped through a quartz coil where it is exposed to a low intensity ultraviolet light, used as a source of energy. This process oxidizes the dissolved organic carbon to CO₂ which by means of a gas permeable silicon membrane is dissolved in a weakly buffered thymol blue indicator solution. The colour change of the acid-base indicator is measured at 590 nm and is proportional to the concentration of dissolved organic carbon in a water sample.</p> <p>Optimum range = 1.3 to 20.0 mg C/L.</p> <p>Requesting Agency: South Africa, 2005 Reference: Gravelet-Blondin et al, 1980.</p> | DOC | mg/L | 1 |
| 06112 | <p>ORGANIC CARBON – DISSOLVED</p> <p>Infrared Analysis – Automated</p> <p>Total dissolved carbon is analyzed by injecting a filtered whole water sample onto a platinum catalyst packed combustion tube kept at 680°C. The CO₂ formed, which is proportional to the total dissolved carbon in the sample, is measured on a non-dispersive infrared detector. Dissolved inorganic carbon is then analyzed by injecting an identical filtered whole water sample into an inorganic reaction vessel containing 25% phosphoric acid. The CO₂ formed represents the dissolved inorganic carbon in the sample and is determined by a non-dispersive infrared detector. Calculation of the dissolved organic carbon is obtained by subtracting the dissolved inorganic carbon from the total dissolved carbon.</p> <p>Calculated: DOC (06112) = DC (06116) – DIC (06160)</p> <p>Requesting Agency 1: Environment Canada, Pacific & Yukon Region, 2007. Requesting Agency 2: Argentina (Pilcomayo), Dec 2011 Reference 1: Environment Canada, PYR code 2695. Reference 2: APHA 2012, SM 5310 B</p> | DOC | mg/L | 1 |
| 06113 | <p>ORGANIC CARBON – DISSOLVED</p> <p>Infrared analysis – Burning Oxidation</p> <p>Inject a small amount of filtered sample into a high-temperature measuring tube for total carbon together with carbon dioxide-free air or oxygen. The organic carbon (organic matter) and inorganic carbon (mostly carbonate) in the sample convert to carbon dioxide which is measured in a non-dispersive infrared gas analyzer to find the Total Carbon (TC). Inject a separate sample into a measuring tube for inorganic carbon, which has been kept at a temperature that is low enough not to decompose the organic matter. Measure the carbon dioxide to find the Total Inorganic Carbon (TIC). Subtract TIC from TC to get Total Organic Carbon (TOC).</p> <p>Requesting Agency: Japan 2013 Reference 1: JSA 1998, method JIS K 0102 22.1 Reference 2: Japan MHLW 2003, Notification No. 261-No.30</p> | DOC | mg/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|-------|----------|
| 06116 | <p>DISSOLVED CARBON (DC)</p> <p>(Infrared Analysis – Automated)</p> <p>Total dissolved carbon is analyzed by injecting a filtered whole water sample onto a platinum catalyst packed combustion tube kept at 680°C. The CO₂ formed, which is proportional to the total dissolved carbon in the sample, is measured on a non-dispersive infrared detector.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2695</p> | DC | mg/L | 1 |
| 06151 | <p>INORGANIC CARBON – DISSOLVED</p> <p>Infrared Analysis – Combustion Tube (Dual Channel Method)</p> <p>The whole water sample is filtered through a 0.45 µm membrane filter. A small volume is injected into a combustion tube at 150°C containing 85% H₃PO₄ on quartz chips. The resulting CO₂ is measured by an IR analyzer, and compared with inorganic carbon standards. Interference: large particles may not be injected.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 95.</p> | DIC | mg/L | 1 |
| 06152 | <p>INORGANIC CARBON – DISSOLVED</p> <p>Infrared Analysis – Automated</p> <p>The sample is filtered through a 0.45 µm membrane filter. In an automated system, the shaken sample is acidified to convert inorganic carbon to CO₂ which is stripped from solution. The remaining liquid phase is passed through a UV coil to oxidize organic carbon compounds. The resulting CO₂ is measured by an infrared (IR) analyzer and compared with standard organic carbon solutions.</p> <p>Detection limit is 0.1 mg/L</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2004. Reference 1: Goulden and Brooksbank, 1975. Reference 2: Environment Canada 1995, ENVIRODAT code 99.</p> | DIC | mg/L | 1 |
| 06154 | <p>INORGANIC CARBON – DISSOLVED</p> <p>Colourimetry</p> <p>If turbid, the sample is filtered through a 0.45µm membrane filter. In an automated system the sample is sparged with nitrogen gas or aerated in an acid medium to remove inorganic carbon and the remaining organic carbon compounds are converted to CO₂ gas in an in-line acid-persulfate-UV digester. After dialysis the CO₂ concentration is determined colourimetrically by measuring the loss of colour in a borate buffered alkaline phenolphthalein solution.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference 1: Crowther and Evans 1980. Reference 2: Environment Canada 1995, ENVIRODAT code 119.</p> | DIC | mg/L | 1 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------------|---------------------------|----------|
| 06156 | <p>INORGANIC CARBON – DISSOLVED</p> <p>Infrared Analysis</p> <p>A whole water sample is filtered through a 0.45 um membrane filter. An aliquot of the filtrate is pumped into a reaction vessel where it is mixed with 2.4% sulphuric acid (H₂SO₄) and heated up to 95⁰C to convert and relaes the dissolved inorganic carbon as CO₂. The CO₂ is purged by an inert gas stream and is determined by a non-dispersive infrared detector.</p> <p>Requesting Agency – Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 2658.</p> | DIC | mg/L | 1 |
| 06160 | <p>INORGANIC CARBON – DISSOLVED</p> <p>Infrared Analysis – Automated</p> <p>The filtered water sample is injected into an inorganic reaction vessel containing 25% phosphoric acid. The oxidized inorganic carbon is measured on the calibrated non-dispersive infrared detector.</p> <p>Requesting Agency – Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 2695</p> | DIC | mg/L | 1 |
| 06201 | <p>BICARBONATE</p> <p>Calculated</p> <p>If PA = 0 then HCO₃= 1.219*TA If PA ≤ TA/2 then HCO₃= 1.219*(TA-2*PA) If PA > TA/2 then HCO₃= 0 If TA < PA then no calculations If TA = PA and Not = 0 then no calculations.</p> <p>PA = phenolphthalein alkalinity TA = total alkalinity</p> <p>The method detection limit is 0.5 mg/L. Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1967.</p> | BICARBON- ATE | mg HCO ₃ /L | 0 |
| 06301 | <p>CARBONATE</p> <p>Calculated</p> <p>If PA=0 then CO₃= 0 If PA ≤ TA/2 then CO₃= 1.2*PA If PA> TA/2 then CO₃= 1.2*(TA-PA) If TA<PA then no calculations If TA=PA and Not = 0 then no calculations</p> <p>PA = phenolphthalein alkalinity TA = total alkalinity</p> <p>The method detection limit is 0.5 mg/L. Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1967.</p> | CARBONAT E | mg CO ₃ /L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------------|-------|----------|
| 06402 | <p>CO₂ – DISSOLVED</p> <p>Titration</p> <p>Carbon dioxide, dissolved in water, is measured by titrating a sample aliquot with a solution of NaOH/NaHCO₃ to a pH of 8.3 using a phenolphthalein indicator until a pink colour persists for 30 seconds in the sample aliquot (potentiometric method can also be used).</p> <p>It is advisable to analyse the sample in the field; if not, then preserve the sample at lower temperature than collected, and analyse within 24 hours.</p> <p>Interference: Anions and cations that quantitatively disturb the equilibrium of carbon dioxide-carbonate. Al, Cr, Cu, Fe are some of the metals with salts that provide bias high analytical results; amines, ammonia, borate, nitrite, phosphate, silicate and sulphide also provide positive results. Mineral acids and salts of strong acids and base should be absent. This method is not applicable in samples containing mine wastes. High total dissolved solids may introduce negative results.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1978. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1975. Reference 2: JSA 1998, method 25.1.</p> | CO ₂ DISS | mg/L | 0 |
| 06521 | <p>OIL AND GREASE</p> <p>Petroleum Ether Extraction</p> <p>A sample is acidified with H₂SO₄ and extracted twice with petroleum ether, (if the ether layer is turbid, extracted 3 times); the combined extracts are filtered. The ether is partially distilled, then evaporated at 70°C in a tared flask. The flask is cooled and dried in a desiccator, then weighed.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1971.</p> | OIL AND GREASE | mg/L | 0 |
| 06531 | <p>PHENOLS</p> <p>Colourimetry – Steam Distillation</p> <p>If turbid, sample is passed through a glass fibre mat. CuSO₄ and H₃PO₄ are added to the sample. (If sea water, sample is diluted to avoid Br interference). A small aliquot is steam distilled into alkaline solution (pH=10, NH₄OH/NH₄Cl buffer) containing 4-aminoanti-pyrine (4-amino-1, 5-dimethyl-2-phenyl-3-pyrazolene) and ammonia (NH₄). The resulting colour is measured spectrometrically on a Technicon Autoanalyzer unit at 505 mu and compared with identically treated standard phenol solutions. Interferences: Br, S compounds, steam distillable aldehydes. For phenol: the coloured antipyrine dye is extracted into chloroform. Absorbance of the chloroform extract is measured at 590nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 154</p> | PHENOLS | mg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------------|-------|----------|
| 06532 | <p>PHENOLS</p> <p>Colourimetry</p> <p>If turbid, a sample is passed through a GF/C glass-fibre filter then preserved with CuSO₄ and H₃PO₄ in the field. The phenolic materials (for sea water: the aliquot is diluted to avoid Br contamination) are steam-distilled on a Technicon automated system (or equivalent) under acidic conditions. The distillate is then mixed with an alkaline buffer solution (NH₄OH/NH₄Cl) to a pH of 10 (±0.2), reacted with 4-aminoantipyrine (4-amino-1, 5-dimethyl-2- phenyl-3- pyrazolene) (4-amino-1,2-dihydro-1,5-dimethyl-2-phenyl-3H-pyrazole-3-one) and the resulting colour is measured spectrometrically at 505-510nm and compared with identically-prepared phenol standard and blank solutions.</p> <p>Interferences: Br, S compounds and steam distillable aldehydes. The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 28.1.</p> | PHENOLS | mg/L | 3 |
| 06533 | <p>PHENOLS</p> <p>Colourimetry</p> <p>Phenol and phenol derivatives are reacted with a thiazole derivative producing a reddish violet azo dye that is determined photometrically.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference: Merck method 1.14551.001</p> | PHENOLS | mg/L | 3 |
| 06561 | <p>LIGNOSULPHONATES</p> <p>Colourimetry</p> <p>If turbid, sample is passed through a 0.45 µ membrane filter. Acetic acid, NaNO₂ and NH₄OH are added to a sample aliquot. After 15 minutes, the resulting colour is measured spectrophotometrically at 440 mu and compared with a standard sodium lignosulphonate (no exact formula) solution.</p> <p>Requesting Agency – Environment Canada, Atlantic Region, 2007. Reference 1: Jayne and Pohl, 1967. Reference 2: Environment Canada 1995, ENVIRODAT code 166.</p> | LIGNOSULPHONATES | mg/L | 0 |
| 06570 | <p>HYDROCARBONS - TOTAL</p> <p>IR Intensity Spectroscopy</p> <p>An acidified sample is extracted in freon and silica gel; the silica gel selectively removes the fatty acids and the materials not eliminated by silica gel are considered hydrocarbons. Infrared detection permits measurements of many relatively volatile hydrocarbons. The samples are compared to identically-prepared standard and blank solutions.</p> <p>Interference: any compounds, other than hydrocarbons and fatty matter, recovered by this method will interfere. The method detection limit is 500 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1998.</p> | HYDROCARBONS - TOTAL | µg/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-------------|---------|----------|
| 06581 | <p>HUMIC ACID</p> <p>UV Spectrophotometric</p> <p>If turbid, sample is passed through a 0.45 µ membrane filter. The pH of the filtrate is adjusted to 6.0. An aliquot of the filtrate is then excited at 270 mu and the fluorescent emission measured spectrofluorimetrically at 452 mu, and compared with those of standard purified humic acid solutions. (It can also be measured at 250 mu). Interference: water background fluorescence.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 175.</p> | HUMIC ACID | mg/L | 1 |
| 06582 | <p>HUMIC ACID</p> <p>UV Spectrofluorimetry</p> <p>If turbid, sample is passed through a 0.45 µ membrane filter. The pH of the filtrate is adjusted to 6.0. An aliquot of the filtrate is then excited at 270 mu and the fluorescent emission measured spectrofluorimetrically at 452 mu, and compared with those of standard purified humic acid solutions. (It can also be measured at 250 mu). Interference: water background fluorescence.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 175.</p> | HUMIC ACID | mg/L | 1 |
| 06606 | <p>CYANIDE</p> <p>Colourimetry</p> <p>If turbid, a sample aliquot is decanted. On an autoanalyzer, the sample is acidified with phosphoric and hypophosphorous acid solution and irradiated with UV light to convert the complex cyanides to hydrocyanic acid, HCN. After irradiation, the sample is buffered at pH 5.2 with a potassium dihydrogen phosphate and disodium hydrogen phosphate solution and the HCN is distilled out of the phosphoric acids solution. It is then converted to cyanogen chloride, CNCl, by reaction with Chloradine-T. The CNCl is finally mixed with a mixture a Pyridine-Barbituric reagent and forms a blue dye. The intensity of the colour produced is measured spectrometrically at 580 nm, and compared to identically-prepared KCN standard and blank solutions. The chemistry is linear over the range 0.5 - 50 µg/L and the sampling rate is 30/hour.</p> <p>Interference: Sulphides interfere and should be removed prior to analysis.</p> <p>Requesting Agency 1: Environment Canada, Pacific Region, 1976. Requesting Agency 2: Argentina (Pilcomayo) 2011 Reference 1: Technicon Industrial Systems (date unknown), Method No. 315-74W. Reference 2: APHA 2012, SM 4500-CN C & E</p> | CN | mg/L CN | 3 |
| 06609 | <p>CYANIDE</p> <p>Colourimetric (released)</p> <p>Cyanide ions react with a chlorinating agent to produce cyanogen chloride, which is then reacted with 1,3-dimethyl-barbituric acid producing a violet dye (König reaction pyridine-free). This is measured photometrically.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference 1: Merck method 1.114561.001 Reference 2: ISO method EN ISO 14403.</p> | CN RELEASED | mg/L CN | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 06610 | <p>CYANIDE</p> <p>Colourimetric (total)</p> <p>Cyanide ions react with a chlorinating agent to produce cyanogen chloride, which is then reacted with 1,3-dimethyl-barbituric acid producing a violet dye (König reaction pyridine-free). This is measured photometrically.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference 1: Merck method 1.114561.001 Reference 2: ISO 1996, method EN ISO 14403.</p> | CN TOTAL | mg/L CN | 3 |
| 06701 | <p>CHLOROPHYLL α</p> <p>Atomic Absorption Spectrometry (AAS)</p> <p>The photosynthetic pigments are extracted from the algae, which have been entrapped on a glass microfibre filter, using boiling 90% (v/v) ethanol. The concentrations of chlorophyll A and phaeopigments are determined by measuring the absorbance, before and after acidification of the extract, at 665.5 nm and 750 nm against a 90% (v/v) ethanol blank. The resulting absorbance measurements are then applied to a standard equation.</p> <p>Interferences: Extracts must be centrifuged prior to spectrophotometry, as suspended particles interfere with absorbance measurements. Overestimation of phytoplankton chlorophyll will occur if large populations of photosynthetic bacteria are present.</p> <p>Requesting Agency: South Africa, 2007. Reference: Hussaing 1973.</p> | CHLOR A | mg/L | 4 |
| 06702 | <p>CHLOROPHYLL α</p> <p>Colorimetry</p> <p>Filter 50 to 1000 mL of a thoroughly mixed water sample through a 0.45 μ membrane filter until just a few millilitres of sample remains. Add 1 to 2 mL saturated Mg CO₃ solution and complete the filtration. Place the filter in a 15-mL screw-cap centrifuge tube, and add 10 mL of 90% acetone (v/v). Shake vigorously and incubate in the dark at 4°C for 24 hours. Add 90% acetone (v/v) to make a total volume of 12 mL. Shake the sample, then centrifuge at 4000 rpm for 20 minutes to obtain a clear supernatant. Top up to 12 mL with 90% acetone (v/v). Decant the supernatant into a 5 cm path-length cell of a spectrophotometer. Measure the absorbance at wavelengths 750nm, 663nm, 645nm, and 630nm, after using 90% acetone (v/v) to set zero for each wavelength. Correct for turbidity by subtracting the absorbance reading at 750nm from the other 3 readings. The original sample size should be selected so as to give an absorbance at 663nm of 0.1 to 0.7 (ideally 0.3).</p> $\text{Chlorophyll } \alpha \text{ (}\mu\text{g/L)} = \frac{[11.64(A_{663}) - 2.16(A_{645}) + 0.10(A_{630})] \times \text{Vol}_{\text{extract}} \text{ (mL)}}{\text{Vol}_{\text{sample}} \text{ (L)} \times \text{light path (cm)}}$ <p>where A is the corrected absorbance at a particular wavelength.</p> <p>Requesting Agency: PUB, Singapore, 2009 Reference: Jones and Lee 1982.</p> | CHLOR A | mg/L | 4 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|--------|----------|
| 06711 | <p>CHLOROPHYLL α</p> <p>Colorimetry (SCOR – UNESCO)</p> <p>The volume of a water sample is measured and noted in the field; 0.1 to 1.0 mL of magnesium carbonate suspension is added and the sample is immediately filtered through GF/C glass-fibre filter. The filter is kept in the dark and frozen at -20°C until analysis. The pigments are extracted in an acetone-water mixture (9:1 V/V), centrifuged and the concentrations are calculated from the optical densities measured at 663, 645 and 630 mμ.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: Japanese Waterworks Analytical Method (2001) VI-4 27.</p> | CHLOR A | mg/L | 4 |
| 07001 | <p>TOTAL KJELDAHL NITROGEN (TKN)</p> <p>Kjeldahl Method – Neutralization titration</p> <p>A sample is preserved in the field at 4°C. TKN includes all forms of nitrogen, except the nitrate and nitrite compounds. The sum of the free ammonia and organic nitrogen compounds are converted to ammonium bisulphate as follows: the shaken sample aliquot is digested in a solution of concentrated H_2SO_4 with HgSO_4 or CuSO_4 (as a catalyst) and K_2SO_4 to form NH_4HSO_4. The ammonia is then distilled from an alkaline medium, absorbed in boric acid, determined by titration with standardized sulphuric acid, using the “N point” indicator and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, methods 44.1 and 44.3. Reference 3: APHA 2012, SM 4500-NOrg.</p> | TKN | mg/L N | 1 |
| 07004 | <p>TOTAL KJELDAHL NITROGEN (TKN)</p> <p>Colourimetry</p> <p>A sample is collected in the field and preserved with sulphuric acid at 4°C. The sum of the free ammonia and organic nitrogen compounds are converted to ammonium bisulphate under the following conditions: the shaken sample aliquot of known volume is digested, at 300°C, with HClO_4 and H_2SO_4 solutions [or H_2SO_4 and CuSO_4] to convert the organic nitrogen to $(\text{NH}_4)\text{HSO}_4$. The total ammonia-nitrogen is determined colourimetrically, at 660 nm, by the reaction of ammonia with salicylate and dichloro-isocyanurate solutions, in the presence of sodium nitroprusside, to form an indophenol blue complex; the colour intensity is measured at 660 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.03 mg/L.</p> <p>Requesting Agency: DFE-NB, Canada, November 1973. Reference: Technicon Industrial Systems (date unknown), Method No. 170-72W.</p> | TKN | mg/L N | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 07005 | <p>TOTAL KJELDAHL NITROGEN (TKN)</p> <p>Colourimetry (automated)</p> <p>In the Kjeldahl method, the organic compounds are digested with concentrated sulphuric acid, which convert organic nitrogen into ammonium sulphate. Inorganic nitrogen compounds, which include amongst others, nitrate and nitrite are not reduced. For most surface waters, it is accepted that the method determines the sum of the ammonium originally present and the organic nitrogen. The digestion is accelerated in two ways, by the addition of mercury(II) as a catalyst and potassium sulphate to raise the boiling point of the digestion mixture. After digestion of the sample, the ammonium ions are determined using the indophenol-blue method. Measurements are done colorimetrically at 630 nm.</p> <p>Optimum concentration range is 0.30 to 4.0 mg N/L.</p> <p>Requesting Agency: South Africa 2005. Reference: Van Vliet 1974.</p> | TKN | mg/L N | 1 |
| 07012 | <p>NITROGEN TOTAL KJELDAHL</p> <p>Electrodes – gas</p> <p>The shaken sample is digested with concentrated H₂SO₄ and K₂SO₄ to yield NH₄HSO₄. The solution is then made alkaline with NaOH and ammonia is determined by Orion gas sensing electrode – model 95-10. (NOTE: If free ammonia was done on a preserved sample and TKN was done, then subtracting ammonia-N from TKN would give Total Organic Nitrogen).</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 227</p> | N KJEL | mg /L N | 1 |
| 07014 | <p>TOTAL KJELDAHL NITROGEN (TKN) - DISSOLVED</p> <p>Colourimetry (automated)</p> <p>Samples are filtered then continuously digested at 300°C with H₂SO₄ and H₂O₂. The organic nitrogen (converted to ammonium sulphate) is then analyzed using sodium salicylate, dichloroisocyanurate and sodium nitroprusside. The resulting blue colour is measured at 660 nm. The range is 10-500 ug N/L.</p> <p>The detection limit is 10 ug N/L</p> <p>Requesting Agency: Environment Canada, 1992. Reference: Environment Canada 1988.</p> | TKN DISS | mg/L N | 2 |
| 07021 | <p>NITROGEN TOTAL KJELDAHL</p> <p>Colourimetry - Autoanalyzer</p> <p>Water samples are digested with H₂SO₄, K₂SO₄ and HgO catalyst in a block digester during a two stage heating cycle (200°C and 360°C). Organic nitrogen is converted to ammonia which is determined by automated colourimetry of the Berthelot reaction at 660 nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 235.</p> | TKN | mg /L N | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------------------------|---------|----------|
| 07023 | <p>NITROGEN TOTAL -KJELDAHL</p> <p>Calculation</p> <p>$NKCT = NTOT \text{ (code 07609) } - NO_3 - NO_2$</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: Israel Mekorot 2012</p> | TKN | mg /L N | 1 |
| 07052 | <p>NITROGEN DISSOLVED - KJELDAHL</p> <p>Calculation</p> <p>$NKCF = NTOF \text{ (code 07653) } - NO_3 - NO_2$</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: Israel Mekorot 2012</p> | TKN | mg /L N | 1 |
| 07105 | <p>NITROGEN, NITRATE + NITRITE</p> <p>Colourimetry with cadmium reduction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is passed through a coil, filled with cadmium filings, to reduce the nitrates to nitrites. The resulting nitrites, plus the original nitrites, are then reacted with sulphanilamide to form a diazo compound. This compound is then reacted with N-(1-naphthyl) ethylenediamine dihydrochloride to form an azo dye. The azo dye colour intensity, proportional to the nitrate + nitrite concentration, is determined colourimetrically at 520 nm [Japan uses 540 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 43.2.3. Reference 3: ISO 1996, method 13395.</p> | NO ₃ NO ₂ | mg/L N | 2 |
| 07106 | <p>NITROGEN, NITRATE + NITRITE</p> <p>Colourimetry (Cadmium reduction)</p> <p>If turbid, the sample is passed through a 0.45µ membrane filter. An aliquot of the sample is mixed with a disodium EDTA; disodium dihydrogen ethylenediamine tetraacetate (EDTA) solution and passed through a column of Cd filings into a sulphanilamide solution to form an azo dye. The intensity of the dye is measured spectrophotometrically at 550 mu, and compared with those of standard NO₃ and NO₂ ion solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 239</p> | NO ₃ NO ₂ | mg /L N | 3 |
| 07108 | <p>NITROGEN, NITRATE + NITRITE</p> <p>Colourimetry (Zinc reduction)</p> <p>The sample after filtration through a 0.45µ membrane filter is reduced by Zn. The resulting nitrite is determined with sulphanilamide and N-1-Naphthylethylenediamine dihydrochloride..</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 242.</p> | NO ₃ NO ₂ | mg /L N | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------------------------|---------|----------|
| 07109 | <p>NITROGEN, NITRATE + NITRITE</p> <p>Colourimetry (Hydrazine Sulphate)</p> <p>The sample, after filtration through a 0.45µ membrane filter is reduced by hydrazine sulphate containing a copper catalyst. The resulting nitrite is determined with sulphanilamide and N-1-Naphthylethylenediamine dihydrochloride.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 243.</p> | NO ₃ NO ₂ | mg /L N | 3 |
| 07110 | <p>NITROGEN, NITRATE + NITRITE</p> <p>Colourimetry (Copper/Cadmium)</p> <p>A whole water sample is filtered through a 0.45 um membrane filter paper and the filtrate analyzed by a continuous segmented flow analyzer (CFA). In the analyzer, nitrate is reduced to nitrite at pH 5.5, using an on-line copper-cadmium reduction column. Metals, such as copper and iron, if present in the sample above several mg/L, may lower reduction efficiency. This interference may be removed by complexing metals with EDTA. The resulting nitrites, plus free nitrites already present, react under acidic conditions with sulphanilamide (NH₂C₆H₄SO₂NH₂) to form a diazo compound which is then coupled with N-(naphthyl)-ethylenediamine dihydrochloride (C₁₂H₁₆C₁₂N₂) to form a reddish-purple azo dye. The absorption of radiation by the dye is proportional to the dissolved nitrate-nitrite concentration in the sample and is determined by the CFA photometer at 520 nm wavelength.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 239.</p> | NO ₃ NO ₂ | mg /L N | 2 |
| 07112 | <p>NITROGEN, NITRATE + NITRITE</p> <p>Colourimetry (Unfiltered)</p> <p>An aliquot of the sample is mixed with a disodium EDTA; disodium dihydrogen ethylenediamine tetraacetate (EDTA) solution and passed through a column of Cd filings into a sulphanilamide solution to form an azo dye. The intensity of the dye is measured spectrophotometrically at 550 mu, and compared with those of standard NO₃ and NO₂ ion solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 239.</p> | NO ₃ NO ₂ | mg /L N | 3 |
| 07207 | <p>NITRITE, DISSOLVED</p> <p>Colourimetry (sulphanilamide)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is reacted with sulphanilamide to form a diazo compound. This compound is then reacted with N-(1-naphthyl) ethylenediamine dihydrochloride to form an azo dye. The azo dye intensity, proportional to the nitrite concentration, is determined colourimetrically at 520 nm [Japan @ 540 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSUVIMEH, Guatemala, 2012. Requesting Agency 4: South Africa (autoanalyzer), 2005. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 43.1.1. Reference 3: APHA 2012, SM 4500-NO₂⁻ B Reference 4: Merck method 14776.</p> | NO ₂ -N DISS | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------------------|--------|----------|
| 07208 | <p>NITRITE</p> <p>Ultraviolet Visible Spectrophotometer (UV-VIS)</p> <p>Requesting Agency: Bangladesh CFP, 2012</p> <p>Reference:</p> | NO ₂ -N | mg/L N | 2 |
| 07209 | <p>NITRITE</p> <p>Ion Chromatography (with suppressed conductivity detection)</p> <p>A whole water sample is filtered through a 0.45 um membrane filter. The analysis is conducted by ion chromatography and determined in conjunction with other anions. An ion exchange process separates the ions of interest based on the affinity for the exchange sites of the resin bed. The sample is then pumped through the suppressor which reduces the background conductivity of the eluent to a negligible level by converting the anions in the sample to their respective acid forms (HF, HCl, HNO₃, and H₂SO₄). The concentrations of these separated anions are determined by measuring their respective conductivities using a conductivity detector. Anions are identified by their retention times compared to known calibration standards.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007.</p> <p>Reference: Environment Canada 2007, PYR code 617.</p> | NO ₂ -N | mg/L N | 2 |
| 07210 | <p>NITRITE - DISSOLVED</p> <p>Colourimetric method (with Cleve's acid)</p> <p>A sample is filtered in the lab through filter paper. Add sulphanilic and Cleve's (1-naphthylamine-7-sulphonic acid) acids to an aliquot of the filtrate, let stand in the dark for 30 minutes. After colour development, the solutions are determined, at 522 nm, on a calibrated spectrometer and compared to identically-prepared standard nitrite solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 1979.</p> <p>Reference: Holden 1971.</p> | NO ₂ -N | mg/L N | 3 |
| 07211 | <p>NITRITE</p> <p>FIA Method</p> <p>Setup manifold. Follow methods supplied by column and instrument manufacturer or laboratory's standard operating procedure for this method.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012</p> <p>Reference: APHA 2012, SM-4500 NO₃ I</p> | NO ₂ -N | mg/L N | 3 |
| 07231 | <p>NITRITE</p> <p>Colourimetry by Wagtech Photometer)</p> <p>Nitrites in acid solution react with sulphanilic acid. The resulting diazo compound couples with N-(1-naphthyl)-ethylene diamine to form a reddish dye. Fill a round test tube with sample to the 10 ml mark. Add one Nitricol tablet, crush and mix to dissolve. Stand for 10 minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0-0.5 mg/L N (0-1.6 mg/L NO₂)</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007</p> <p>Reference: Palintest Test Instructions NITRITE (NITRICOL)</p> | NO ₂ -N | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------------------------|--------|----------|
| 07300 | <p>NITROGEN (NO₃-N + NO₂-N)</p> <p>Automated Hydrazine Reduction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is reacted with an alkaline hydrazine sulphate solution, containing a copper catalyst, to reduce the nitrates to nitrites. The resulting nitrites, plus the original nitrites, are reacted with sulphanilamide to form a diazo compound. This compound is then reacted with N-(1-naphthyl) ethylenediamine dihydrochloride to form an azo dye. The azo dye colour intensity, proportional to the nitrate + nitrite concentration, is determined colourimetrically at 520 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.014 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIWA, New Zealand, 2010. Reference 1: Environment Canada 1994.</p> | NO ₃ NO ₂ | mg/L N | 3 |
| 07302 | <p>NITROGEN (NO₃-N + NO₂-N)</p> <p>Calculation</p> <p>The Determination of Nitrogen content is calculated by the summation of Nitrate (07321) and Nitrite (07210) analytical results, analysed separately.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2001. Reference: n/a.</p> | NO ₃ NO ₂ | mg/L N | 2 |
| 07303 | <p>NITROGEN (NO₃-N + NO₂-N)</p> <p>Calculation</p> <p>The Determination of Nitrogen content is calculated by the summation of Nitrate (07320) and Nitrite (07210) analytical results, analysed separately.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2000. Reference: n/a.</p> | NO ₃ NO ₂ | mg/L N | 1 |
| 07304 | <p>NITROGEN (NO₃-N + NO₂-N)</p> <p>Colourimetric</p> <p>A sample is preserved in the field with 1 mL of H₂SO₄ and stored at 4°C. The nitrate content in the sample aliquot is reduced to nitrite in the presence of zinc dust in alkaline medium. The resulting nitrites, plus the original nitrites, are reacted with sulfanilamide and with alpha naphthylamide to form a highly coloured azo dye. The azo dye colour intensity, proportional to the nitrate plus nitrite concentration, is determined colourimetrically at 530 nm and compared to identically prepared standard ad blank solutions.</p> <p>The method detection limit is 0.010 mg/L.</p> <p>Requesting Agency: EBY ARGENTINA, 2005 Reference:</p> | NO ₃ NO ₂ | mg/L N | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------------------|--------|----------|
| 07306 | <p>NITRATE</p> <p>Colourimetry – Brucine-sulphanilic Method</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is mixed with a brucine-sulphanilic reagent, in the presence of nitrate, to produce a yellow colour, measured spectrometrically at 410 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: all strong oxidising and reducing agents interfere (addition of orthotolidine against oxidising agents is an option); the addition of sodium arsenite eliminates the residual chlorine interference; high concentrations of organic matters (in wastewater) usually interfere.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>NOTE: This method is recommended for concentrations between 0.1 and 2 mg NO₃-N per litre due to poor sensitivity in the low range and anomalies above this range.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 1979. Requesting Agency 3: NIES, Japan, 1998. Reference: JSA 1998, method 43.2.4.</p> | NO ₃ -N | mg/L N | 2 |
| 07308 | <p>NITRATE SCREENING METHOD</p> <p>Spectrophotometric – UV screening method</p> <p>Requesting Agency: Argentina CFP (IHLLA), 2012 Reference: APHA 2012, SM 4500-NO3 B</p> | NO ₃ -N | mg/L N | 2 |
| 07309 | <p>NITRATE</p> <p>Chromotropic Acid</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is treated with sulphite (to eliminate interference against chlorine and oxidizing agents), urea (to convert nitrite to nitrogen gas) and antimony (to mask the chloride interference up to 4000 mg/L) reagent solutions. Swirl between each addition. After four minutes, the aliquot is then mixed with Chromotropic acid reagent and sulphuric acid. After 45 minutes, the absorbance is read at 410 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interference: chloroferrate complex discharged by addition of antimony; barium, lead, strontium, iodide, iodate, selenite and selenate precipitate with this system. The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency: International Joint Commission, 1987. Reference: APHA 2012, SM 4500 P E.</p> | NO ₃ -N | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------------------|--------|----------|
| 07313 | <p>NITRATE</p> <p>Calculation</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. Nitrates, from the sample aliquot, are reduced through a cadmium column to nitrites. The resulting nitrites, plus the original nitrites, are then reacted with sulphanilamide to form a diazo compound. This compound is then reacted with N-(1-naphthyl) ethylenediamine dihydrochloride to form an azo dye. The azo dye colour intensity, proportional to the nitrate + nitrite concentration, is determined colourimetrically at 520 nm [Japan method is at 540 nm] and compared to identically-prepared standard and blank solutions. The nitrate concentration is obtained by subtracting the original nitrite concentration, determined from a duplicate sample that has not been passed through the cadmium column.</p> <p>NO_3 (code 07313) = $[\text{NO}_3 + \text{NO}_2]$ (code 07105) – NO_2 (code 07207)</p> <p>The method detection limit is 0.005 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Russia GHI, 2003. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 43.2.3. Reference 3: APHA 1998, SM 4500-NO_3^- E Reference 4: Semyonov 1977. Reference 5: Hydrometeoizdat 1999.</p> | $\text{NO}_3\text{-N}$ | mg/L N | 2 |
| 07314 | <p>NITRATE</p> <p>Devarda's Alloy Method</p> <p>This method is recommended for samples of concentration greater than 2 mg/L. A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The nitrate and nitrite compounds are reduced to ammonia under hot alkaline conditions with a reducing agent (Devarda's alloy is composed of 50% Cu, 45% Al and 5% Zn). The distillation is carried out on a Kjeldahl distillation apparatus. The ammonia formed is distilled and trapped in a boric acid solution. The ammonia is then determined by nesslerization (colourimetry) or acidimetry (titration).</p> <p>Interference: Nitrite should be analysed separately and ammonia removed from the solution; the method is not recommended in the presence of amino and albuminoid nitrogen.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 1975.</p> | $\text{NO}_3\text{-N}$ | mg/L N | 2 |
| 07315 | <p>NITRATE</p> <p>Ion Chromatography (with suppressed conductivity detection)</p> <p>A whole water sample is filtered through a 0.45 µm membrane filter. The analysis of NO_3 on an aliquot of the filtrate is conducted by ion chromatography and determined in conjunction with other anions. The ions of interest are separated based on the affinity for the exchange sites of the resin bed. The sample is then pumped through the suppressor which reduces the background conductivity of the eluent to a negligible level by converting the anions in the sample to their respective acid forms (HF, HCl, HNO_3, and H_2SO_4). The concentrations of these separated anions are determined by measuring their respective conductivities using a conductivity detector. Anions are identified by their retention times compared to known standards</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 267.</p> | $\text{NO}_3\text{-N}$ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------------------------|--------|----------|
| 07316 | <p>NITRATE + NITRITE</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field and preserved at 4°C. The sample aliquot is injected into an eluent stream, pumped through two columns (separator and suppressor columns) packed with low capacity anion exchange resin in the form of $\text{CO}_3^-/\text{HCO}_3^-$. The nitrate is separated, based on its affinity for the exchange sites of the resin bed. The suppressor column reduces the background conductivity of the eluent and the concentration of nitrate is measured using a conductivity detector. The anion is identified by its retention time and its concentration by its peak height or area and compared to identically-prepared standard and blank solutions. Sample concentrations exceeding the linear range are diluted and re-run.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1994. Reference 2: JSA 1998, method 43.2.5.</p> | NO_3NO_2 | mg/L N | 2 |
| 07317 | <p>NITRATE</p> <p>Colourimetric – reaction with Nitrospectral</p> <p>Nitrate ions react with a derivative of nitrobenzoic acid in a solution of concentrated sulphuric acid to produce a red dye that is measured photometrically.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference: Merck method 14773.</p> | $\text{NO}_3\text{-N}$ | mg/L N | 2 |
| 07320 | <p>NITRATE</p> <p>Ion Specific Electrode and Nitrate Combination Electrode</p> <p>An ion-specific electrode meter with a nitrate combination electrode is calibrated with buffers of standard nitrate solutions. The nitrate concentration of the solution is measured directly by immersing the nitrate combination electrode, stirring constantly until a steady reading is obtained.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2000. Reference: APHA 1998, 4500 NO_3^- D Nitrate Electrode Method.</p> | $\text{NO}_3\text{-N}$ | mg/L N | 1 |
| 07321 | <p>NITRATE</p> <p>Ion Chromatography</p> <p>A sample is filtered through a 0.45 μm membrane filter paper. The sample is then injected into a flowing stream carbonate eluent. The sample is pumped through an ion exchange column, then a suppressor device, and into a conductivity detector. An ion chromatogram of response (conductivity) vs. time is generated. Nitrate ions are identified based on their retention times compared to known standards. Quantitation is accomplished by measuring the area and comparing it to a calibration curve generated from known standards.</p> <p>The method detection limit is 0.01 mg N/L.</p> <p>Requesting Agency 1: Water Supplies Department, Hong Kong SAR, 2001. Requesting Agency 2: CEA Laboratory, Sri Lanka, 2004. Reference 1: US-EPA 1999. Reference 2: APHA 1998, SM 4110 B.</p> | $\text{NO}_3\text{-N}$ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------------------------|--------|----------|
| 07322 | <p>NITRATE</p> <p>Potentiometry with Nitrate Selective Electrode</p> <p>A sample is filtered through a 0.45 µm membrane or dense paper filter. A buffer solution with pH 2.2 (H₃PO₄ + KOH) and a solution of 0.01mol/L Ag₂SO₄ is added to the sample aliquot. The potential of the nitrate-selective electrode relative to a saturated Ag/AgCl electrode is measured and compared to identically-prepared standard and blank solutions. Organic substances sorbed on the electrode membrane surface may cause interferences.</p> <p>The method detection limit is 0.2 mg/L, upper limit is 20 mg/L.</p> <p>Requesting Agency: GHI, Russia, 2003. Reference: Hydrochemical Institute 1985.</p> | NO ₃ -N | mg/L N | 1 |
| 07323 | <p>NITRATE</p> <p>Flow Injection Analysis (FIA)</p> <p>Setup manifold. Follow methods supplied by column and instrument manufacturer or laboratory's standard operating procedure for this method.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: APHA 2012, SM 4500-NO₃ I</p> | NO ₃ -N | mg/L N | 3 |
| 07331 | <p>NITRATE</p> <p>Colourimetry by Wagtech photometer</p> <p>In the Palintest Nitratest method, nitrate is first reduced to nitrite, and the resulting nitrite is then determined by a diazonium reaction to form a reddish dye. Fill the Nitratest Tube with sample to the 20 ml mark. Add one level spoonful of Nitratest Powder and one Nitratest tablet. Do not crush the tablet. Replace screw cap and shake tube well for one minute. Allow tube to stand for about one minute then gently invert three or four times to aid flocculation. Allow tube to stand for two minutes or longer to ensure complete settlement. Remove screw cap and wipe around the top of the tube with a clean tissue. Carefully decant the clear solution into a round test tube, filling to the 10 ml mark. Add one Nitricol tablet, crush and mix to dissolve. Stand for 10 minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0-1 mg/L N, 0-20 mg/L N</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions NITRATE (NITRATEST)</p> | NO ₃ -N | mg/L N | 2 |
| 07332 | <p>NITRATE + NITRITE</p> <p>Calculation</p> <p>NO₃NO₂ (code 07332) = NO₃ (code 07306) + NO₂ (code 07207)</p> <p>Requesting Agency: Japan, 2010 Reference: n/a</p> | NO ₃ NO ₂ | mg/L N | 2 |
| 07333 | <p>NITRATE + NITRITE</p> <p>Calculation</p> <p>NO₃NO₂ (code 07333) = NO₃ (code 07323) + NO₂ (code 07207)</p> <p>Requesting Agency: Japan, 2012 Reference: JSA 1998, method JIS K 0102</p> | NO ₃ NO ₂ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------------------------|--------|----------|
| 07335 | <p>NITRATE + NITRITE</p> <p>Calculation</p> <p>NO_3NO_2 (code 07335) = NO_3 (code 07313) + NO_2 (code 07207)</p> <p>Requesting Agency: Japan 2008. Reference: n/a</p> | NO_3NO_2 | mg/L N | 2 |
| 07337 | <p>NITRATE + NITRITE</p> <p>Calculation</p> <p>NO_3NO_2 (code 07337) = NO_3 (code 07316) + NO_2 (code 07207)</p> <p>Requesting Agency: Japan, 2012 Reference: JSA 1998, JIS K 0102</p> | NO_3NO_2 | mg/L N | 2 |
| 07338 | <p>NITRATE + NITRITE</p> <p>Calculation</p> <p>NO_3NO_2 (code 07338) = NO_3 (code 07316) + NO_2 (code 07208)</p> <p>Requesting Agency: Japan, 2012 Reference: JSA 1998, JIS K 0102</p> | NO_3NO_2 | mg/L N | 2 |
| 07339 | <p>NITRATE + NITRITE</p> <p>Ion Chromatography</p> <p>Requesting Agency: Japan, 2012 Reference: Japan MHLW 2003, Notification No.261-No.13</p> | NO_3NO_2 | mg/L N | 2 |
| 07401 | <p>NITROGEN ORGANIC DISSOLVED</p> <p>Kjeldahl With Removal of NH_3</p> <p>A sample is collected in the field and preserved at 4°C. The shaken sample aliquot is neutralized, if necessary, to pH=7. A phosphate buffer solution (pH=7.4) is added. If Ca ion exceeds 250 mg/L, more buffer solution is added, and the solution is titrated to pH=7.4. Approximately one third of the sample is distilled to remove free NH_3. The residual solution is digested with concentrated H_2SO_4, in the presence of HgSO_4 (as a catalyst) and K_2SO_4 to give NH_4HSO_4. The solution is made alkaline and the NH_3 is distilled and collected in a H_3BO_3 solution. The distillate is then titrated with 0.02N H_2SO_4, using an 'N Point' indicator and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | ORG. NIT.- DISS | mg/L | 1 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------------------|--------|----------|
| 07403 | <p>NITROGEN ORGANIC DISSOLVED</p> <p>Difference Calculation</p> <p>Organic Nitrogen = Total Kjeldahl Nitrogen - Total Ammonia The analytical results are expressed as mg/L N.</p> <p>The method detection limit is 0.5 mg/L. Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference: JSA 1998, method 44.</p> | ORG. NIT. DISS | mg/L N | 1 |
| 07404 | <p>NITROGEN ORGANIC DISSOLVED</p> <p>Calculated</p> <p>Total Organic N = Total N – dissolved NH₃ – dissolved (NO₂ & NO₃)</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 271.</p> | ORG. NIT. DISS | mg/L N | 2 |
| 07405 | <p>NITROGEN ORGANIC DISSOLVED</p> <p>Calculated</p> <p>DON = TON – (NO₃ + NO₂) – NH₃</p> <p>Requesting Agency: Japan, 2013 Reference: n/a</p> | ORG. NIT. DISS | mg/L N | 2 |
| 07505 | <p>NITROGEN TOTAL AMMONIA</p> <p>Colourimetry (Unfiltered) – Berthelot method</p> <p>The shaken sample is digested with concentrated H₂SO₄, in the presence of K₂S₂O₈ or disodium EDTA, or dipotassium EDTA. The resultant NH₃ is then determined colourimetrically on an autoanalyzer with alkaline phenol, potassium sodium tartrate and sodium hypochlorite (Berthelot method). The resulting colour is measured at 630 nm. For total ammonia do not do a digestion.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 219.</p> | NH ₄ -N | mg/L N | 3 |
| 07506 | <p>AMMONIA</p> <p>Ion Selective Electrode</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is adjusted to pH 12 or greater using a 10 molar solution of NaOH. An identically-prepared series of NH₄Cl standard and blank solutions are prepared and used to calibrate the ion specific electrode meter. The ammonia concentration of the sample is read directly and corrected to 25°C.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency 1: Environment Canada, Prairies Region, 1975. Requesting Agency 2: Japan 2008 Reference 1: Orion Research Inc. (date unknown), Form D595-10/1711. Reference 2: Potable Water Test Method(2001)-210.5 + JISK0102 42.4</p> | NH ₃ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------------------|---------|----------|
| 07507 | <p>NITROGEN TOTAL AMMONIA</p> <p>Colourimetry (Salicylate method)</p> <p>The sample is filtered through a membrane filter if suspended particles exist. The sample is reacted with salicylate and hypochlorite in the presence of sodium nitroprusside to form a blue compound. Hypochlorite is generated in situ by the alkaline hydrolysis of sodium dichloroisocyanurate. The blue compound is measured spectrometrically at 655 nm and compared with a series of standard solutions and a blank treated in the same way.</p> <p>The method detection limit is 0.02 mg N/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2003. Reference: ISO 1984, ISO 7150-1.</p> | NH ₄ -N | mg N/L | 2 |
| 07531 | <p>NITROGEN TOTAL AMMONIA</p> <p>Colourimetry by Wagtech photometer (Nessler-based method)</p> <p>The Palintest Tubetests Ammonia/50N (Nessler) test is based on the Nessler method. Nessler's reagent (potassium tetraiodomercurate (II)) reacts rapidly with ammonia under alkaline conditions to form an orange-brown product. Remove the cap of the Tubetests Ammonia/50N (Nessler) Tube and add 1.0 ml of sample using a pipettor or Pasteur pipette. Cap tube and invert three times to mix. Add 0.5 ml of Tubetests Ammonia (Nessler) Reagent. Replace cap and invert several times to mix. Stand for one minute to allow colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0-50 mg/L N</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions AMMONIA/50N (NESSLER)</p> | NH ₄ -N | mg/L N | 2 |
| 07532 | <p>AMMONIA</p> <p>Ultraviolet Visible Spectrophotometer</p> <p>Requesting Agency: Bangladesh CFP, 2012 Reference:</p> | NH ₃ | mg N /L | 2 |
| 07550 | <p>NITROGEN TOTAL AMMONIA</p> <p>Nesslerization and distillation</p> <p>An aliquot of the sample is distilled in a mixture of Magnesium Carbonate and boiling stones. The distillate is reacted with a Nessler's reagent and left standing for 10 minutes for colour development. The ammonia concentration is determined by comparing the colour of the aliquot to a set of coloured discs.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 1979. Reference: The Institution of Water Engineers 1960.</p> | NH ₄ -N | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------------|--------|----------|
| 07551 | <p>AMMONIA</p> <p>Direct Nesslerization, visual comparison</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is dechlorinated with ZnSO₄, the pH is adjusted to 10.5 with NaOH to precipitate Ca, Mg, Fe and sulfides. EDTA is also added (or Rochelle salt) to remove the Ca, Mg or other ions producing turbidity before adding the Nessler reagent. Add Nessler reagent and mix the sample by inverting the Nessler tube. Visually compare the colour intensity of the sample aliquot against identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 2004 Reference 1: Alekin et al 1973. Reference 2: Hydrometeoizdat 1999.</p> | NH ₃ | mg/L N | 2 |
| 07552 | <p>AMMONIA</p> <p>Colourimetry (O-Tolidine)</p> <p>If turbid, the sample is decanted. A simple aliquot is mixed with an alkaline sodium hexametaphosphate (Na₂O:P₂O₅ 1:1 w/w) solution, and dialyzed through a membrane into a phosphate buffer solution (pH=7.5) to remove interfering ions. The dialyzed solution is mixed with a NaOCl solution. After the NH₃ is chlorinated, the solution is mixed with a solution of oxalic and monochloroacetic acids to remove excess OCl⁻ ion. This solution is then mixed with an o-tolidine (3,3-dimethyl-4,4'-diaminodiphenyl dihydrochloride) solution. The resulting colour is measured spectrophotometrically at 420 mu and compared with those of standard NH₃ solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 284</p> | NH ₃ | mg/L N | 2 |
| 07553 | <p>AMMONIA</p> <p>Distillation and Titration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. If necessary, the sample aliquot is neutralized to pH=7. A phosphate buffer (pH=7.4) solution is added. If Calcium ion exceeds 250 mg/L, more buffer solution is added and the solution is titrated to pH=7.4. The sample aliquot is partly distilled and the distillate is collected in a H₃BO₃ solution and then titrated with 0.02N H₂SO₄, using the 'N Point' indicator.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency 1: Central Pollution Control Board, India, 2003. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 42.1 and 42.3. Reference 3: APHA 2012, SM 4500-NH₃ C</p> | NH ₃ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------------|--------|----------|
| 07554 | <p>AMMONIA</p> <p>Distillation + Nesslerization</p> <p>A sample is filtered through a 0.45µ membrane filter or dense paper filter in the field and preserved at 4°C. An alkaline potassium permanganate solution is added to the sample aliquot and is partly distilled in a boric acid solution, followed by Nesslerization. Visual Comparison with identically-prepared standard (or permanent standards) and blank solutions determines the concentration of the sample. Alternatively (Russia method), a buffer solution of pH 7.4-7.6 (potassium dihydrophosphate + potassium hydrophosphate in deionized water) is added to the sample aliquot and it is distilled in a sulphuric acid solution, followed by Nesslerization and colourimetry.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 1979. Requesting Agency 3: GHI, Russia 2003. Reference 1: APHA 1975. Reference 2: Lourye, 1973. Reference 3: Hydrometeoizdat 1999.</p> | NH ₃ | mg/L N | 2 |
| 07555 | <p>AMMONIA</p> <p>Colourimetry – Alkaline phenol method (Alpha-Naphthol)</p> <p>A sample is filtered in the field through a 0.45 µ membrane filter and preserved at 4°C. The sample aliquot is mixed with an alkaline phenol solution, followed by sodium hypochlorite and potassium sodium tartrate. The indophenol blue complex produced is read at 630 nm and is compared to the identically-prepared ammonia standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L. Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency 1: Environment Canada, Ontario Region, 1973. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Water Supplies Department, Hong Kong SAR, 2003. Reference 1: Environment Canada, Great Lakes STAR code 270. Reference 2: JSA 1998, method 42.2.</p> | NH ₃ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------|--------|----------|
| 07556 | <p>AMMONIA, DISSOLVED</p> <p>Colourimetry (Indophenol Blue)</p> <p>A sample is filtered in the field and preserved at 4°C. The sample aliquot is treated with an Alkaline phenol solution, followed by a hypochlorite solution as an oxidizing agent, and sodium nitroprusside solution (Na₂Fe(CN)₅NO.2H₂O) as a catalyst. The sample aliquot is mixed and allowed to stand at room temperature for 1 hour. Alternatively (Russia method), the filtered sample is treated with a buffer solution of pH 10.4-10.6 (sodium citrate, boric acid and sodium hydroxide in ammonia-free water), phenol and sodium nitroprusside solution, followed by hypochlorite solution. This sample aliquot is mixed and allowed to stand for 6 hours. In both procedures, the absorbance is read at 630 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: Environment Canada, Pacific Region, 1974. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: South Africa (by autoanalyzer) Reference 1: APHA 1971. SM 4500-NH₃ F Reference 2: JSA 1998, method 42.2. Reference 3: Hydrochemical Institute 1987. Reference 4: Hydrometeoizdat 1999.</p> | NH ₃ | mg/L N | 2 |
| 07557 | <p>AMMONIA, DISSOLVED</p> <p>Automated Indophenol Blue Method</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is treated with an alkaline phenol solution, followed by a hypochlorite solution as an oxidizing agent, and sodium nitroprusside solution (Na₂Fe(CN)₅NO.2H₂O) as a catalyst; the sample aliquot is mixed and allowed to stand at room temperature for 1 hour. The absorbance is then read at 640 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: Environment Canada, Pacific Region, 1974. Reference 1: Environment Canada 1979. Reference 2: APHA SM 4500-NH₃ G</p> | NH ₃ | mg/L N | 2 |
| 07558 | <p>AMMONIA</p> <p>1-naphthol Method</p> <p>Requesting Agency: Japan 2012 Reference: JWWA 2001.</p> | NH ₃ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------------|--------|----------|
| 07563 | <p>TOTAL AMMONIA AS NITROGEN</p> <p>Colourimetry (Indophenol Blue) - automated</p> <p>Ammonium reacts in a mildly alkaline medium with hypochlorite to form monochloramine, which forms indophenol-blue in the presence of phenol, catalytic quantities of nitroprusside and an excess of hypochlorite. Monochloramine formation requires a pH between 8 and 11,5. At higher pH values, incomplete oxidation of ammonium to nitrite occurs. Precipitates of calcium and magnesium hydroxide are formed at pH values higher than 9,6 and a complexing agent (citrate) is added to prevent precipitation. The complex is read colourimetrically at 630 nm.</p> <p>Interferences: Mercury chloride, used as a preservative, gives a negative interference by complexing with the ammonia. This can be overcome by adding the same quantity of Hg(II) to the standard used for the calibration curves and the samples.</p> <p>Optimum concentration range: 0.03 to 2.00 mg ammonium/L.</p> <p>Requesting Agency: South Africa, 2005. Reference:</p> | NH ₄ -N | mg/L N | 2 |
| 07564 | <p>AMMONIA DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C The sample aliquot is injected into an eluent stream and pumped through two columns (separator and suppressor columns) before being detected by conductivity, identified by its retention time and peak height or area and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1978. Requesting Agency 2: NIES, Japan, 1998. Reference: JSA 1998, method 42.5.</p> | NH ₃ DISS | mg/L N | 1 |
| 07565 | <p>TOTAL AMMONIA AS NITROGEN</p> <p>Flow Injection Analysis (FIA)</p> <p>Setup manifold. Follow methods supplied by column and instrument manufacturer or laboratory's standard operating procedure for this method.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: APHA 2012, SM 4500-NH₃ H</p> | NH ₄ -N | mg/L N | 2 |
| 07570 | <p>AMMONIA - FREE</p> <p>Calculated Free ammonia</p> <p>Ammonia (free) is calculated from Total ammonia (NH₄⁺), temperature, and pH as follows: $\text{NH}_3 = \text{NH}_4^+ / [1.0 + 10 * (10.055 - (0.0324 * \text{temp}) - \text{pH})]$</p> <p>Requesting Agency: UK Environment Agency, United Kingdom, 2005. Reference: (none provided)</p> | NH ₃ | mg/L N | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|--------|----------|
| 07601 | <p>NITROGEN TOTAL</p> <p>Colourimetry</p> <p>A sample is preserved in the field at 4°C. On an autoanalyzer, a shaken sample aliquot is aerated, acidified and irradiated in a quartz coil by a UV lamp. The sample is made alkaline and the irradiated process repeated. This solution is mixed with an EDTA (disodium dihydrogen ethylenediamine tetraacetate) solution and the nitrates are reduced to nitrites through a column of Cadmium fillings. A sulphanilamide solution, followed by an N-1-Naphthylethylenediamine dihydrochloride solution, is added to the sample to form an azo dye. The intensity of the dye is measure spectrometrically at 550mμ, and compared to identically-prepared NO₃ standard and blank solutions.</p> <p>Interference: Turbidity. The method detection limit is 0.025 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | N TOTAL | mg/L N | 2 |
| 07606 | <p>TOTAL NITROGEN</p> <p>Alkaline Persulphate Digestion</p> <p>A sample is preserved in the field at 4°C. The Nitrogen of the sample aliquot is oxidised to nitrate in an alkaline persulphate solution. The nitrate is then reduced to nitrite in an alkaline hydrazine sulphate solution, containing copper as a catalyst. The resulting nitrites, under acidic conditions, react with sulphanilamine to form a diazo compound and couple with naphthylethylenediamine to form an azo dye. The colour intensity is proportional to the nitrogen concentration, measured spectrometrically at 520nm and compared to identically-prepared standard and blank solutions.</p> <p>Interference: sample with colour absorbing in the same range. If suspected, analyse a sample blank, omitting the naphthylethylenediamine reagent. Also, samples with certain metal concentrations greater than 35 mg/L (i.e.: Hg II, Cu II, iron and manganese). These samples are diluted before digestion.</p> <p>The method detection limit is 0.014 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1994.</p> | N TOTAL | mg/L N | 2 |
| 07607 | <p>TOTAL NITROGEN</p> <p>Alkaline persulphate digestion</p> <p>Requesting Agency: South Africa, 2008. Reference: APHA 2012, SM 4500 N-org D (automated).</p> | N TOTAL | mg N/L | 2 |
| 07608 | <p>TOTAL NITROGEN</p> <p>Persulphate method with Cadmium reduction</p> <p>As per code 07607 (above) with persulphate digestion, but using Cd reduction prior to analysis.</p> <p>Requesting Agency: Lake Kariba Research Station, Zimbabwe CFP, 2009 Reference: [modified from APHA 2012, SM 4500-N C].</p> | N TOTAL | mg N/L | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------------------|--------|----------|
| 07609 | <p>TOTAL NITROGEN</p> <p>Persulphate method with NAS reagent</p> <p>Prepare NO_3^- calibration standards in the range of 0 to 2.9 mg NO_3^--N/L. Prepare glutamic acid digestion check standard of 2.9mg N/L. Samples preserved with acid cannot be analyzed by this method. To a culture tube, add 10.0mL sample or standard or a portion diluted to 10.0mL. Add 5.0mL digestion reagent. Mix by inverting twice and heat for 30 min in an autoclave or pressure cooker at 100 to 110°C. Slowly cool to room temperature. Add 1.0mL borate buffer solution. Mix by inverting at least twice. Carry a reagent blank through all the steps and apply necessary corrections to the results. Determine nitrate by Cd reduction.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: APHA 2012, SM 4500-N C</p> | N TOTAL | mg N/L | 2 |
| 07610 | <p>TOTAL NITROGEN</p> <p>UV absorption spectroscopy</p> <p>An alkaline potassium peroxodisulfate solution is added to the water sample which is then heated at about 120°C to convert nitrogen compounds to nitrate ion and to decompose organic matter at the same time. After reducing the pH to 2 or 3, the absorbance of the nitrate ion is measured at 220 nm wavelength. This method is suitable for samples with low amounts of decomposable organic matter, and very low concentrations of interferences such as bromide ion or chromium.</p> <p>Requesting Agency: Japan, 2013 Reference: JSA 1998, method JIS K 0102 45.2</p> | N TOTAL | mg N/L | 2 |
| 07651 | <p>NITROGEN DISSOLVED</p> <p>UV Digestion + Colourimetry</p> <p>The sample is filtered through a 0.45µ filter. An aerated aliquot of the shaken sample is acidified and then irradiated in a quartz coil by a UV lamp. The sample is made alkaline and the irradiation process repeated. This solution is mixed with disodium EDTA (disodium dihydrogen ethylenediamine tetraacetate) solution and passed through a column of Cadmium filings. First a sulphanilamide solution is added, then an N-1-naphthylethylene-diamine dihydrochloride solution is added to the sample to form an azo dye. The intensity of the dye is measured spectrophotometrically at 550mu, and compared with those of standard. NO_3^- ion solutions. Interference may be caused by turbidity.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 300.</p> | N DISS | mg/L N | 2 |
| 07653 | <p>TOTAL DISSOLVED NITROGEN</p> <p>Persulfate Method</p> <p>Prepare NO_3^- calibration standards in the range of 0 to 2.9 mg NO_3^--N/L. Prepare glutamic acid digestion check standard of 2.9mg N/L. Samples preserved with acid cannot be analyzed by this method. To a culture tube, add 10.0mL sample or standard or a portion diluted to 10.0mL. Add 5.0mL digestion reagent. Mix by inverting twice and heat for 30 min in an autoclave or pressure cooker at 100 to 110°C. Slowly cool to room temperature. Add 1.0mL borate buffer solution. Mix by inverting at least twice. Carry a reagent blank through all the steps and apply necessary corrections to the results. Determine nitrate by Cd reduction.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference: APHA 2012, SM-4500 N C</p> | TOTAL NIT. DISS | mg/L N | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------|--------|----------|
| 07902 | <p>ORGANIC NITROGEN - PARTICULATE</p> <p>Thermal conductivity (CHN Analyzer)</p> <p>A sample is passed through a pre-ignited Whatman GF/C filter. The residue is washed with diluted H₂SO₄ (0.3%) to remove inorganic ions. The filter containing the residue is dried and inserted into a combustion tube at 950°C. The resulting N₂ is measured by thermal conductivity, and compared with identically-prepared standard and blank solutions. A Hewlett-Packard 185 CHN Analyzer (or equivalent) is used.</p> <p>Requesting Agency 1: Environment Canada, Ontario Region, 2007. Requesting Agency 2: NIES, Japan, 2013 Requesting Agency 3: Pakistan. Requesting Agency 4: Japan 2004. Reference: Environment Canada 2007, Great Lakes STAR code 268</p> | N PART | mg/L | 3 |
| 07907 | <p>NITROGEN – PARTICULATE</p> <p>Thermal Conductivity (Integrated Sample)</p> <p>From integrated samples, particulates were collected by filtering through pre-treated GF/C glass fibre filters. The analysis is conducted with a Hewlett-Packard Model 185 CHN analyzer, or equivalent with a strip chart recorder and surface peak area integrator/</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 267.</p> | N PART | mg/L N | 3 |
| 07912 | <p>ORGANIC NITROGEN - PARTICULATE</p> <p>Thermal Conductivity (CHN Analyzer)</p> <p>NOTE: This is the same procedure as GEMStat code 07902 but the data are reported in units of ug/g particulate material.</p> | ORG N PART | ug/g | 3 |
| 08001 | <p>PERCENT DISSOLVED OXYGEN SATURATION</p> <p>Calculated or Nomogram</p> <p>Calculated from dissolved oxygen (DO) concentration at the temperature and depth of sampling obtained from the “solubility of oxygen table”, where:</p> $S' = S \times \frac{P - p}{760 - p}$ <p>S' (mg/L) = solubility under any barometric pressure; S (mg/L) = solubility at 760 mm Hg; P = barometric pressure (mm Hg); p = pressure of saturated water vapour at water temperature, at 760 mm Hg; If elevations are less than 1000 metres and temperatures below 25°C, p can be ignored; therefore:</p> $S' = S \times \frac{P}{760}$ <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1975.</p> | % DO SAT | % | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------------|---------------------|----------|
| 08005 | <p>PERCENT DISSOLVED OXYGEN SATURATION</p> <p>Electrometric, (YSI Oxygen Meter)</p> <p>The YSI oxygen meter contains oxygen-sensitive membrane electrodes of two solid metal electrodes in contact with supporting electrolyte separated from the test solution by a selective membrane. The diffusion current is linearly proportional to the concentration of molecular oxygen and is converted to concentration units (mg/L) through a calibration procedure or reported as %DO saturation.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 2012, SM 4500-O G.</p> | % DO SAT | % | 0 |
| 08006 | <p>PERCENT DISSOLVED OXYGEN SATURATION</p> <p>Winkler and Alsterberg</p> <p>The original Winkler method has been modified since oxidizing agents give a positive interference, reducing agents a negative interference, and organic compounds a varied interference.</p> <p>Requesting Agency: Algeria, 2006 Reference: Wilson 1970.</p> | % DO SAT | % | 0 |
| 08101 | <p>DISSOLVED OXYGEN</p> <p>Winkler Method</p> <p>A sample is collected and analysed in the field or preserved at 4°C and analysed as soon as possible. A sample aliquot is treated with manganous sulphate (MnSO₄) and a strong alkaline iodide reagent (NaN₃, NaI and NaOH). The manganous hydroxide formed reacts with the dissolved oxygen to form a brown precipitate (MnO(OH)₂ (a KF solution is added if ferrous ions are present). Upon acidification, in the presence of iodide, the iodine liberated is equivalent to the dissolved oxygen originally present in the sample. The iodide is titrated with a standardized sodium thiosulphate solution (Na₂S₂O₃), starch is used as an indicator.</p> <p>Interferences: ferrous ion at 1 mg/L (if KF is added the interference level for ferrous ion is 100-200 mg/L), SO₃ ion, S₂O₃ ion, polythionate ions, free Cl₂, OCl ion, oxidizing and reducing agents, and turbidity. The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: CEA Laboratory, Sri Lanka 2004. Reference 1: APHA 1998, SM 4500-O B or C (azide modification) Reference 2: JSA 1998, method 32.1. Reference 3: ISO 1996, method ISO 5813.</p> | DISS O ₂ | mg/L O ₂ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------------|---------------------|----------|
| 08102 | <p>DISSOLVED OXYGEN</p> <p>Electrometric, (Oxygen Meter, membrane electrode)</p> <p>Measurements are made in the field using a calibrated dissolved oxygen meter. The electronic cell, containing a gold cathode and a silver anode, is covered with an Oxygen permeable membrane to prevent interferences. Upon entering the cell, the Oxygen is reduced and the current is directly proportional to the oxygen concentration at a specific temperature. The DO ranges are usually automatically temperature corrected (between -5°C and $+40^{\circ}\text{C}$), as are the solubility and permeability of the probe, while salinity usually needs manual compensation. Regular calibration against the Winkler Titration Method is recommended or by exactly following the manufacturer's procedure. (DO meter is calibrated in air saturated with moisture and the reading is taken when steady condition is obtained).</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: Water Supplies Department, Hong Kong SAR, 2000. Requesting Agency 2: UNITED KINGDOM , 2005. Reference 1: APHA 2012, 4500-0 G Membrane Electrode Method. Reference 2: ISO 1996, method ISO 5814.</p> | DISS O ₂ | mg/L O ₂ | 1 |
| 08107 | <p>DISSOLVED OXYGEN</p> <p>Calculated from % Sat., H₂O temperature, and pressure at site.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: n/a.</p> | DISS O ₂ | mg/L O ₂ | 1 |
| 08108 | <p>DISSOLVED OXYGEN</p> <p>Miller Method (modified procedure)</p> <p>Requesting Agency: Japan 2012 Reference: JSA 1998, method JIS K 0102</p> | DISS O ₂ | mg/L O ₂ | 1 |
| 08109 | <p>DISSOLVED OXYGEN</p> <p>Oxygen meter</p> <p>Requesting Agency 1: Japan 2012 Requesting Agency 2: INSIVUMEH, Guatemala, 2012. Reference: JWVA 2001.</p> | DISS O ₂ | mg/L O ₂ | 1 |
| 08110 | <p>DISSOLVED OXYGEN</p> <p>Diaphragm electrode method</p> <p>Requesting Agency: Japan 2012 Reference: JSA 1998, method JIS K 0102</p> | DISS O ₂ | mg/L O ₂ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|---------------------|----------|
| 08201 | <p>BIOCHEMICAL OXYGEN DEMAND</p> <p>Five-Day Dilution Method, Winkler Titration</p> <p>Biochemical Oxygen Demand is defined as the quantity of oxygen necessary for biological and chemical oxidation of water-borne substances under conditions of the test. A sample is preserved in the field at 4°C and the analysis started within 4 hours. A sample is incubated at 20°C under proper conditions. Comparison of the dissolved oxygen content at the beginning and the end of the incubation period is the measure of the Biochemical Oxygen Demand. The procedure depends on the nature of the sample. After aeration of the samples to bring the dissolved oxygen content to saturation, one of the following three variations can be used, depending on the type of samples to be analysed:</p> <p>A – The direct method: If the BOD does not exceed 7 mg/L, the BOD is determined directly by measuring the dissolved content of the water sample before and after a five days incubation period at 20°C.</p> <p>B – Unseeded dilution method: With waters having BOD values greater than 7 mg/L, appropriate sample aliquots are diluted using dilution water, saturated with oxygen, and the oxygen content is determined before and after the incubation period. A minimum of three dilutions per sample, with a final content between 40% and 70% of the original oxygen concentration, will give best results.</p> <p>C – Seeded dilution method: It is extremely important that the conditions be appropriate for the living organisms to function unhindered during the incubation period. Toxic substances should be absent, and necessary nutrients, such as nitrogen and phosphorus, should be present. It is important that a mixed group of organisms (called “seed”) be present during the test. The dilution water is seeded with the proper kind and number of organisms and saturated with oxygen (overnight) before the BOD test.</p> <p>Siphon the diluted sample to fill three BOD bottles; one for incubation (five days), one for the determination of the dissolved oxygen content (measured and record as “initial DO”), and the other for the determination of the immediate dissolved oxygen demand (IDOD), after a 15 minutes incubation period (to eliminate the oxygen demand from sulphide, sulphite and/or ferrous ions). A minimum of three dilutions per sample, with a final content between 40% and 70% of the original oxygen concentration, will give best results.</p> <p>DO Winkler method: A sample is treated with manganous sulphate (MnSO₄) and a strong alkaline iodide reagent (NaN₃, NaI and NaOH). The manganous hydroxide reacts with the dissolved oxygen to form a brown precipitate (MnO(OH)₂). Let stand for one hour. Upon acidification, with concentrated H₂SO₄, in the presence of iodide, the iodine liberated is equivalent to the dissolved oxygen originally present in the sample. The iodide is titrated with a standardized sodium thiosulphate (Na₂S₂O₃), using starch as an indicator.</p> <p>Interference: Many synthetic organic components from industrial wastewaters are not biodegradable without adding seeding water. Sample containing residual Cl₂, that is acidic or alkaline, must be neutralized to pH=7 and titrated with Na₂S₂O₃ solution. The IDOD is determined to eliminate the oxygen demand of sulphide, sulphite and/or ferrous ions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>NOTE: India uses 27° and 3 days because of geoclimatic conditions.</p> <p>Requesting Agency 1: DFE-NB, Canada, March 1974. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: CEA Laboratory, Sri Lanka 2004. Reference 1: Environment Canada 1974. Reference 2: APHA 1998, SM 5210 B. Reference 3: JSA 1998, method 21.</p> | BOD | mg/L O ₂ | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------|----------------------|----------|
| 08202 | <p>BIOCHEMICAL OXYGEN DEMAND (BOD)</p> <p>Five days incubation at 20°C, Dissolved Oxygen Meter</p> <p>BOD is a measure of the oxygen demand produce by carbonaceous and nitrogenous materials in a sample. It is measured by determining the decrease of oxygen content, using a dissolved oxygen meter, after incubation at 20°C for five days. A sample is preserved in the field at 4°C and the analysis started within four hours. The sample aliquot is incubated, at 20°C for five days under proper conditions. The procedure depends on the nature of the sample. After aeration of the samples to bring the dissolved oxygen content to saturation, one of the following three variations can be used, depending on the type of samples to be analysed:</p> <p>1 – The direct method: If the BOD does not exceed 7 mg/L, then the BOD is determined directly by measuring the dissolved oxygen content of the water, before and after a five days incubation period at 20°C.</p> <p>2 – Unseeded dilution method: For waters having BOD values greater than 7 mg/L: appropriate sample aliquots are diluted using dilution water, saturated with oxygen, and the oxygen content is determined before and after the incubation period. A minimum of three dilutions per sample, with a final content between 40% and 70% of the original oxygen concentration, will give best results.</p> <p>3 – Seeded dilution method: It is extremely important that the conditions be appropriate for the living organisms to function unhindered during the incubation period. Toxic substances should be absent, and necessary nutrients, such as nitrogen and phosphorus, should be present. It is important that a mixed group of organisms (called “seed”) should be present during the test. The dilution water is seeded with the proper kind and number of organisms and saturated with oxygen (overnight) before the BOD test.</p> <p>Siphon the diluted sample to fill three BOD bottles; one for incubation (five days), one for the determination of the dissolved oxygen content (measured and record as “initial DO”) and the other for the determination of the immediate dissolved oxygen demand (IDOD), after a 15 minutes incubation period. A minimum of three dilutions per sample, with a final content between 40% and 70% of the original oxygen concentration, will give best results.</p> <p>Use a calibrated oxygen meter to measure the oxygen concentrations before and after incubation.</p> <p>Interference: Many synthetic organic components from industrial wastewaters are not biodegradable without adding seeding water due to the toxic effect or the absence or deficiency of appropriate microorganisms. Sample containing residual Cl₂, that is acidic or alkaline, must be neutralized to pH=7, and sometimes titrated with a Na₂S₂O₃ solution to liberate the chloride from solution. A sample, containing sulphide, sulphite and/or ferrous ions, creates an immediate demand, corrected by the IDOD.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency: Environment Canada, 1978. Reference 1: APHA 1975, 422F and 507. Reference 2: APHA 2012, SM 5210 B</p> | BOD | mg/L O ₂ | 0 |
| 08203 | <p>CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND</p> <p>Five Day Incubation at 20°C with Allylthiourea (ATU)</p> <p>Dilute the sample, as needed before incubation, adding nutrients such as nitrogen, phosphorus and trace metals. Buffer the solution to ensure that the sample remains in a pH range suitable for bacterial growth (usually pH 6.5 to 7.5). Incubate at 20°C for five days. Results are reported as carbonaceous biochemical oxygen demand (CBOD₅) when inhibiting the nitrogenous oxygen demand. When nitrification is not inhibited, results are reported as BOD₅.</p> <p>Requesting Agency: European Environment Agency, 1998. Reference 1: EN-1899-1, 1998 Reference 2: APHA 16th edition, SM 507.</p> | CBOD | mg O ₂ /L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------|---------------------|----------|
| 08301 | <p>CHEMICAL OXYGEN DEMAND</p> <p>K₂Cr₂O₇ digestion, open reflux, titration</p> <p>Most organic compounds are oxidised by potassium dichromate under acid condition. A sample is preserved in the field at 4°C. The sample aliquot is refluxed for two hours in concentrated H₂SO₄ with a known amount of K₂Cr₂O₇, containing sulphamic acid against the interference of nitrites, HgSO₄ against the interferences of chlorides, and Ag₂SO₄, as a catalyst for organic compounds. The sample is cooled and the excess dichromate is titrated with standardised ferrous ammonium sulphate (Fe(NH₄)₂(SO₄)₂), using ferroin (a complex of ferrous ion and 1,10-phenanthroline) as an indicator. The amount of oxidizable organic matter is proportional to the dichromate consumed. A reagent blank is identically analysed. The concentration of COD is calculated from the difference between sample and blank aliquots.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: Saskatchewan Environment, Canada, 1977. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 20. Reference 3: APHA 2012, SM 5220 B Reference 4: ISO 1996, method 6060</p> | COD | mg/L O ₂ | 0 |
| 08304 | <p>CHEMICAL OXYGEN DEMAND</p> <p>Colorimetric (closed reflux)</p> <p>Sample, blanks, and standards in sealed tubes are heated in an oven or block digester in the presence of potassium dichromate at 150°C. Sulfuric acid oxidizes the water samples, while chloride is masked with mercury sulphate. After two hours, the tubes are removed from the oven or digester, cooled, and measured spectrophotometrically at either 420 nm or 600 nm. The colorimetric determination may also be performed manually.</p> <p>Requesting Agency 1: CEA Laboratory, Sri Lanka, 2005. Requesting Agency 2: United Kingdom, 2005. Requesting Agency 3: USGS Reference 1: APHA 2012, SM 5220 D. Reference 2: EPA 410.4 Reference 3: ISO 1996, method 15705.</p> | COD | mg/L O ₂ | 0 |
| 08305 | <p>TOTAL CHEMICAL OXYGEN DEMAND (COD)</p> <p>KMnO₄ Digestion Method</p> <p>A sample is preserved in the field at 4°C. An acidified sample aliquot is digested with potassium permanganate in a boiling water bath for 30 minutes where reducing substances are oxidized along with part of the carbonaceous material. The remaining permanganate is reacted with a volume of sodium oxalate solution, equivalent to the permanganate originally added. Keeping the solution between 60-80°C [Japan maintains solution at 50-60°C], the excess oxalate is back-titrated with the permanganate solution. The permanganate required in this back-titration is equivalent to the KMnO₄ chemical oxygen demand. A reagent blank is identically treated. The Total COD is calculated from the difference between sample and blank aliquots.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 17.</p> | COD | mg/L O ₂ | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------------------|----------|
| 08401 | <p>PERMANGANATE VALUE</p> <p>KMnO₄ Method, oxygen consumed</p> <p>A sample is tightly capped and preserved in the field at 4°C. The sample aliquot is acidified with diluted H₂SO₄ (25%) and KMnO₄ solution is added. The solution is then digested 20-30 minutes on a boiling water bath, and immediately cooled. An oxalic acid solution equivalent to the original KMnO₄ solution is added to the mixture at 70°C. The excess oxalic acid is back-titrated with standard KMnO₄ solution at 60°C. A reagent blank is identically treated. The consumed O₂ is calculated by difference between sample and blank aliquots.</p> <p>Swedish method: A solution of potassium iodide is added. The released iodine is titrated in the same manner as the Winkler method for dissolved oxygen.</p> <p>Interferences: Cl ion concentration in excess of 1000 mg/L. The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 3: Sweden, 2003. Reference 1: Environment Canada, 1974. Reference 2: Swedish standard.</p> | PERM V | mg/L O ₂ | 0 |
| 08402 | <p>PERMANGANATE VALUE</p> <p>KMnO₄ Method, four-hour digestion</p> <p>A sample is tightly capped and preserved in the field at 4°C. A sample aliquot is acidified with diluted H₂SO₄ (25%) and KMnO₄ solution is added. The solution is then digested four hours on a boiling water bath. An oxalic acid solution equivalent to the original KMnO₄ solution is added to the mixture at 70°C. The excess oxalic acid is back-titrated with standard KMnO₄ solution at 60°C. A reagent blank is identically treated. The consumed O₂ is found by difference between sample and blank aliquots.</p> <p>Interferences: Cl ion concentration in excess of 1000 mg/L. The method detection limit is 0.1 mg/L</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: Environment Canada 1974.</p> | PERM V | mg/L O ₂ | 0 |
| 09031 | <p>FLOURIDE TOTAL</p> <p>Colourimetry by Wagtech photometer</p> <p>Zirconyl Chloride and Eriochrome Cyanine R are reacted in acid solution to form a red coloured complex. This colour is destroyed by fluoride ions to give the pale yellow colour of the Eriochrome Cyanine. Fill test tube with sample to the 10 ml mark. Add one Fluoride No.1 tablet, crush and mix to dissolve. Add one Fluoride No.2 tablet, crush and mix to dissolve. Stand for five minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0-1.5 mg/L</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions FLUORIDE</p> | F TOTAL | mg F/L | 1 |
| 09103 | <p>FLUORIDE DISSOLVED</p> <p>Colourimetric detection with SPADNS on an autoanalyzer</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 354.</p> | F DISS | mg/L F | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------|--------|----------|
| 09104 | <p>FLUORIDE - DISSOLVED</p> <p>Colourimetry with SPADNS Distillation</p> <p>To a round bottom flask, add sample aliquot, concentrated H₂SO₄, glass beads and Ag₂SO₄ (at a rate of 5 mg/mg Cl if concentration is greater than 7000 mg/L) and attach flask to distillation unit. Heat until the temperature of the flask content reaches exactly 180°C. Do not heat over 180°C to prevent SO₄ carry-over.</p> <p>Analysis: The SPADNS colourimetric method is based on the reaction between fluoride and zirconium ions; this reaction is greatly influenced by the acidity (as the reaction can be almost instantaneous). Mix SPADNS and zirconyl-acid reagent to the sample and read the absorbance at 570nm; compare to identically-prepared standard and blank solutions. If the sample concentration exceeds the highest standard, then dilute and re-analyse the sample.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Caution: In seawater, there may be significant interference from Mg or pH.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985.</p> <p>Reference: APHA 1975, SM 4500 F D</p> | F DISS | mg/L F | 1 |
| 09105 | <p>FLUORIDE - DISSOLVED</p> <p>Specific Ion Electrode (Fluoride probe meter)</p> <p>A sample is preserved in the field at 4°C. A sample aliquot is mixed with a Total Ionic Strength Adjustment Buffer (TISAB) solution and compared to identically-prepared standard and blank solutions, using a calibrated specific ion meter. The F ion concentration of the sample is read directly and corrected to 25°C.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985.</p> <p>Requesting Agency 2: NIES, Japan, 1998.</p> <p>Reference 1: Environment Canada 1974.</p> <p>Reference 2: JSA 1998, method 34.2.</p> <p>Reference 3: APHA 2012 SM 4500-F C</p> | F DISS | mg/L F | 1 |
| 09106 | <p>FLUORIDE - DISSOLVED</p> <p>Electrode Potential Method Hydrogen meter with fluoride probe</p> <p>A sample is preserved in the field at 4°C. A sample aliquot is mixed with a Total Ionic Strength Adjustment Buffer solution (TISAB). The electrode potential of the solution is measured on a pH meter expanded MV scale and compared to identically-prepared fluoride F standard and blank solutions, and corrected to 25°C.</p> <p>Alternatively, a fluoride-specific electrode, consisting of a single lanthanum fluoride crystal, can be used in the same manner, as long as the pH is greater than 5 to prevent the formation of the molecular hydrogen fluoride. The complexing agent cyclohexylene-diamine-tetraacetic acid is provided as a CDTA buffer solution.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985.</p> <p>Requesting Agency 2: South Africa, 2005. (automated method)</p> <p>Reference 1: Environment Canada 1974.</p> <p>Reference 2: APHA 2012, SM 4500 F C</p> | F DISS | mg/L F | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------|--------|----------|
| 09107 | <p>FLUORIDE - DISSOLVED</p> <p>Potentiometric Specific Ion</p> <p>A sample is preserved in the field at 4°C. Fluoride is determined potentiometrically in a flow-through system using a specific ion combination electrode and a digital millivolt meter. A strip chart recorder and a printer provide continuous monitoring of the electrode output and automatic printout of the potential at optimum peak heights.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 1979. Reference: Environment Canada 1979.</p> | F DISS | mg/L F | 1 |
| 09110 | <p>FLUORIDE - DISSOLVED</p> <p>Photometric (Alizarin Complex / Complexone method)</p> <p>The photometric method is based on the colourimetric reaction between fluoride and lanthanum-alizarin reagent. The sample aliquot is buffered to pH of 4.5 and the lanthanum-alizarin reagent is added to form a stable complex with fluoride (residual chlorine is removed by acetic acid addition). The photometer provides a light path of at least 1 cm and the optical density is read at 620-622 nm. Read 30-60 minutes after the addition and mixing of reagents and compare to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.1 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Greenhalgh and Riley 1961. Reference 2: JSA 1998, method 34.1. Reference 3: APHA 2012, SM 4500-F E Reference 4: Merck method 14557.</p> | F DISS | mg/L F | 1 |
| 09116 | <p>FLUORIDE - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is injected into an eluent stream, pumped through two columns (separator and suppressor columns) packed with low capacity anion exchange resin in the form of CO³⁻/HCO³⁻. The fluoride is separated, based on its affinity for the exchange sites of the resin bed. The suppressor column reduces the background conductivity of the eluent and the concentration of fluoride is measured using a conductivity detector. The anion is identified by its retention time, peak height or area and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Note: this method is not recommended for unknown matrices as positive or negative bias has been noticed; it is difficult to quantify F at low concentrations and also, the organic acids (formic, carbonic, etc.) elute close to F and therefore interfere.</p> <p>Requesting Agency 1: NIES, Japan, 1998. Requesting Agency 2: Sri Lanka 2005 Reference 1: APHA 1995. SM 4500-F F Reference 2: Japanese Waterworks Analytical Method (2001) VI-2 3.2</p> | F DISS | mg/L F | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------|---------------------------|----------|
| 09209 | <p>FLUORIDE - DISSOLVED</p> <p>Ion Chromatography (with suppressed conductivity detection)</p> <p>A whole water sample is filtered through a 0.45 um membrane filter. The analysis of fluoride on an aliquot of the filtrate is conducted by ion chromatography and determined in conjunction with other anions. The ions of interest are separated based on the affinity for the exchange sites of the resin bed. The sample is then pumped through the suppressor which reduces the background conductivity of the eluent to a negligible level by converting the anions in the sample to their respective acid forms (HF, HCl, HNO₃, and H₂SO₄). The concentrations of these separated anions are determined by measuring their respective conductivities using a conductivity detector. Anions are identified by their retention times compared to known standards</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 267.</p> | F DISS | mg/L F | 1 |
| 10101 | <p>ALKALINITY TOTAL</p> <p>Potentiometric Titration</p> <p>Alkalinity is defined as the quantitative capacity of a sample to neutralise a strong acid to a selected pH. A sample is preserved in the field at 4°C. If turbid, the sample is allowed to settle. A known volume of the sample aliquot is titrated with a standardized solution of H₂SO₄ (or HCl), to pH=4.5 then to pH=4.2 [Sweden titrates to pH 5.4], using an automatic titrator and a pH meter calibrated for 25°C. The total alkalinity is found from both titration volumes. A two endpoint technique is employed to determine the actual inflection point.</p> <p>The method detection limit is 0.5 mg/L of CaCO₃.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Sweden, 2003. Reference 1: Environment Canada 1974. Reference 2: Japanese Waterworks Analytical Method (2001) VI-1 14.2.1 Reference 3: ISO 1996, method ISO 9963-2.</p> | ALK TOTAL | mg/L CaCO ₃ | 2 |
| 10102 | <p>ALKALINITY TOTAL</p> <p>Colourimetric Titration</p> <p>A sample is preserved in the field at 4°C. If turbid, the sample is allowed to settle. A known volume of the sample aliquot is titrated with standardized H₂SO₄ or HCl to the methyl purple end point of pH=4.8 -5.4 calibrated for 25°C. Methyl purple indicator is used with a blue water-soluble dye to sharpen the end point. An indicator blank is also titrated. Alternatively, one can use methyl red indicator to a pH 4.8 end point [Japan method], or methyl red to a pH 5.4 end point [Russian method], or bromophenol blue measured colourimetrically at 600 nm [South Africa].</p> <p>The method detection limit is 0.5 mg/L of CaCO₃.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Water Supplies Department, Hong Kong SAR, 1986. Requesting Agency 4: GHI, Russia, 2004. Requesting Agency 5: South Africa, 2005. Reference 1: ASTM 1971. Reference 2: JWWA 2001, method VI-1 14.2.1 Reference 3: JSA 1998, method JIS K 0101 13.1 and method JIS K 0102 16.1. Reference 4: Semyonov 1977. Reference 5: Hydrometeoizdat 1999.</p> | ALK TOTAL | mg/L CaCO ₃ | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------|---------------------------|----------|
| 10103 | <p>ALKALINITY TOTAL</p> <p>Titration method</p> <p>A known volume of sample aliquot is titrated with standardized HCl to the end point colour change from blue to steel grey with a pH 4.5 indicator.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2000. Reference: APHA 2012, SM 2320 B. Titration Method.</p> | ALK TOTAL | mg/L CaCO ₃ | 0 |
| 10109 | <p>ALKALINITY TOTAL</p> <p>Potentiometric Titration</p> <p>If turbid, the sample is allowed to settle. An aliquot of the sample is then titrated with standard H₂SO₄ or HCL to pH 4.5 using an automatic titration system and a pH meter.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 1988, NAQUADAT code 10109.</p> | ALK TOTAL | mg/L CaCO ₃ | 2 |
| 10110 | <p>ALKALINITY TOTAL (CaCO₃)</p> <p>Potentiometric Titration (Gran Inflection Point)</p> <p>The Gran Function employs an algorithm to determine inflection points from titration curves that are not well defined. The titration curves of low ionic strength soft waters and precipitation samples fall into this category. Total alkalinity of these samples is determined by titration with sulphuric acid employing an automatic titrator which makes incremental addition of titrant and plots a titration curve of pH against volume of titrant.</p> <p>Add 0.25mL 1 N KCl to 100mL of sample, then titrate to pH 3.7 with 0.001N HCl. To use the Gran function, small increments of acid are added beyond the expected inflection point. Record both the incremental volumes added, and the corresponding pH. The volume corrected H⁺ concentration is plotted against the volume of added acid. The alkalinity is determined from extrapolation of the linear portion of the curve on the abscissa. Total alkalinity is given by the equation F*X, where X= ml of acid needed to titrate to the inflection point and F is a factor derived from standardization of the acid. The factor F incorporates the concentration of the acid used in the titration, the volume of sample analyzed, and the conversion of the units to mg/L CaCO₃. The results of this titration, which is suitable only for very "soft" waters, may be either positive or negative.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference 1: Environment Canada 1995, ENVIRODAT code 372. Reference 2: Gran, 1952.</p> | ALK TOTAL | mg/L CaCO ₃ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|--------------------------|----------|
| 10111 | <p>ALKALINITY TOTAL</p> <p>Titroprocessor</p> <p>The total alkalinity is a measure of all hydroxides, carbonates and bicarbonates present in the water sample. Total alkalinity is determined in a whole water sample by potentiometric titration of a sample aliquot with a standard solution of sulphuric acid. This method employs an automated titrator which makes incremental additions of titrant to the sample and plots a titration curve. The titration curve is a plot of pH vs volume of titrant added. The endpoint of the titration is determined by analysis of the titration curve using a first derivative function to find the inflection point (curve changes from concave to convex or vice versa). The inflection point represents the stoichiometric equivalence point for the neutralization of the carbonates and other bases present. The total alkalinity is given by the equation $F \cdot X$, where X = ml of acid needed to titrate to the inflection point and F is a factor derived from standardization of the acid. The factor F, incorporates the concentration of the acid used in the titration, the volume of sample analyzed and the conversion of the units to mg/L CaCO_3.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007 Reference: Environment Canada, PYR code 373.</p> | ALK TOTAL | mg/L CaCO_3 | 2 |
| 10113 | <p>ALKALINITY TOTAL</p> <p>Infrared detection (autoanalyzer)</p> <p>A filtered sample is mixed with HCl, then oxygen. The resulting CO_2 is separated from the liquid phase and determined by in infrared detector.</p> <p>The detection limit is 2 mg/L.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference 1: Environment Canada 2007, Great Lakes STAR code 223. Reference 2: Goulden 1976.</p> | ALK TOTAL | mg/L CaCO_3 | 2 |
| 10120 | <p>ALKALINITY TOTAL</p> <p>Visual titration</p> <p>Alkalinity is defined as the quantitative capacity of a sample to neutralise a strong acid to a selected pH.</p> <p>A sample is preserved in the field at 4°C. If turbid, the sample is allowed to settle. A sample aliquot is titrated at 25°C, with standard H_2SO_4 using the mixed bromocresol green-methyl red indicator, and the colour response is indicated as follows: above pH 5.2, greenish blue; pH 5.0, light blue with lavender grey; pH 4.8, light-grey with bluish colour; and pH 4.6, light pink. [Japan uses methyl red to pH 4.8.]The colour changes can be verified against a calibrated pH meter under the conditions of titration. An indicator blank is also titrated. The results are expressed as milliequivalents CaCO_3 per litre.</p> <p>NOTE: 1 meq CaCO_3/L = 50 mg CaCO_3/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 1979. Requesting Agency 3: NIES, Japan, 1998. Reference 1: APHA 1975. Reference 2: JWWA 2001, method VI-1 14.2.1</p> | ALK TOTAL | meq/L CaCO_3 | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|----------------------------|----------|
| 10121 | <p>ALKALINITY TOTAL</p> <p>Electrometric Titration</p> <p>Alkalinity is defined as the quantitative capacity of a sample to neutralise a strong acid to a selected pH.</p> <p>Select sample aliquot size (adjust to room temperature: 25°C) and normality of titrant. Add standard acid in increments of 0.5 mL or less, mix thoroughly; as the end point approaches, make smaller additions of acid and be sure the pH has reached equilibrium before adding more titrant. Titrate to pH of 3.7. Construct a titration curve by plotting the observed pH against the cumulative millilitres of titrant used. A smooth curve showing one or more inflections should be obtained (an erratic curve may indicate that equilibrium was not reached between successive additions). Results expressed as milliequivalent per litre of CaCO₃.</p> <p>The method detection limit is 0.5 meq/L of CaCO₃.</p> <p>NOTE: 1 meq CaCO₃/L = 50 mg CaCO₃/L</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 1975.</p> | ALK TOTAL | meq/L CaCO ₃ | 2 |
| 10123 | <p>ALKALINITY TOTAL</p> <p>Electrometric Titration</p> <p>Alkalinity is defined as the quantitative capacity of a sample to neutralise a strong acid to a selected pH at 25°C.</p> <p>Total alkalinity is determined, under a nitrogen atmosphere, by electronic titration of a sample aliquot with a standard strong acid, using a microprocessor-controlled dynamic mode of titration (titroprocessor METROHM-EP or equivalent). The increments are added so that the change of potential (mV/pH) between data points is equal. Successive increments are then added to give small volume addition in the region of the end point. At the end of the titration to an interpolated end point pH, a report containing the calculated data for end point volume, end point pH and alkalinity concentration is automatically printed.</p> <p>Interference: Dissolved gases such as carbon dioxide, hydrogen sulphide or ammonia. The results expressed as mg/L of CaCO₃.</p> <p>The method detection limit is 0.30 mg/L of CaCO₃.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1998. Requesting Agency 2: EEA 1998 Reference: Environment Canada 1994.</p> | ALK TOTAL | mg CaCO ₃ /L | 2 |
| 10151 | <p>ALKALINITY, PHENOLPHTHALEIN</p> <p>Potentiometric Titration</p> <p>A sample is preserved in the field at 4°C. If turbid, the sample is allowed to settle. A known volume of sample aliquot is titrated with standard H₂SO₄ [Japan uses HCl] to pH of 8.3, at 25°C, using an automatic titration system and a pH meter (free residual chlorine is removed with sodium thiosulphate).</p> <p>Interference: Turbidity, dissolved gases such as carbon dioxide, hydrogen sulphite and ammonia. The detection limit is 0.1 mg/L of CaCO₃.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985 Requesting Agency 2: Japan, 2013 . Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method JIS K 0102 15.2</p> | ALK-PHEN | mg/L CaCO ₃ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|------------------------|----------|
| 10201 | <p>ACIDITY TOTAL</p> <p>M Titration (pH=4.5)</p> <p>If turbid, the sample is passed through a 0.45µ membrane filter. A filtrate aliquot is titrated to pH=4.5 with standard NaOH. A pH meter is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 381.</p> | TOTAL ACIDITY | mg/L CaCO ₃ | 1 |
| 10251 | <p>ACIDITY TOTAL</p> <p>Manual Titration (pH=5.6)</p> <p>The sample is titrated to a pH of 4.0 and air is then bubbled through to remove CO₂ formed from CO₃ and HCO₃ on acidification. Alkaline titration is carried out to pH 5.6, the expected pH of distilled water in equilibrium with atmospheric CO₂. A negative result is measure of alkalinity.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 382.</p> | TOTAL ACIDITY | mg/L CaCO ₃ | 1 |
| 10252 | <p>ACIDITY TOTAL</p> <p>Titroprocessor</p> <p>Acidity is defined as the quantitative capacity of a water sample to neutralise a strong base to a selected pH. A sample is preserved in the field at 4°C. Total acidity is determined, at room temperature, under nitrogen atmosphere, by electronic titration of a sample aliquot, using a standard alkaline solution (e.g.: 0.01 N NaOH) to the designated end points of pH 4.5 and 8.3. The inflection point is determined automatically. Interference: dissolved gases such as carbon dioxide, hydrogen sulphide or ammonia; complexes from mine drainage samples.</p> <p>The method detection limit is 0.1 mg/L of CaCO₃.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 1981. Reference: Environment Canada 1979.</p> | TOTAL ACIDITY | mg/L CaCO ₃ | 2 |
| 10300 | <p>pH</p> <p>Colourimetric Method</p> <p>The pH is measured by adding an universal indicator such as [phenolphthalein / methyl red / thymol blue] or [bromothymol blue / crezol red / thymol blue] or using a pH "non bleeding" strip, wait for colour development and compare the colour of the reaction to the coloured chart of the appropriate indicator used. Interference: colour, turbidity, salinity, colloidal matter and various oxidants and reductants can interfere with the indicator.</p> <p>The precision is within 0.2 pH units.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Snell and Snell 1967. Reference 2: JWWA 2001, method VI-1 9.3</p> | pH | pH units | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-------------|----------|----------|
| 10301 | <p>pH</p> <p>pH Meter (Electrometry with automatic temperature compensation)</p> <p>The pH meter, with a glass combination electrode and automatic temperature compensation probe, is calibrated with three buffers at pH 4.0, 7.0, and 10.0. The pH and temperature values of the sample aliquot are recorded upon reading.</p> <p>The precision is within 0.1 pH units.</p> <p>Requesting Agency 1: Water Supplies Department, Hong Kong SAR, 2000. Requesting Agency 2: CEA Laboratory, Sri Lanka, 2004. Requesting Agency 3: JAPAN, 2005 Reference 1: APHA 2012, SM 4500-H⁺ B Electrometric Method. Reference 2: JSA 1998, method 12.1.</p> | pH | pH units | 1 |
| 10302 | <p>pH</p> <p>pH Meter (Electrometric) at 25°C</p> <p>The temperature of a sample is stabilised at 25°C. A calibrated glass electrode in combination with a reference potential, provided by a saturated calomel (Hg₂Cl₂) electrode, is used for pH determination. The sample aliquot is read at 25°C.</p> <p>The precision is within 0.1 pH units.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: JAPAN, 2005 Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 12.1. Reference 3: ISO 1996, method ISO 10527 Determination of pH.</p> | pH | pH units | 1 |
| 10306 | <p>pH, <i>in situ</i></p> <p>ph Meter, (field measurement)</p> <p>Requesting Agency: Lake Kariba Research Station, Zimbabwe CFP, 2009. Reference:</p> | pH | pH units | 1 |
| 10401 | <p>TOTAL SUSPENDED SOLIDS, 105°C</p> <p>Gravimetric method (105°C)</p> <p>If oil and grease are present, the sample is blended. If large particles, either floating or submerged, are present, they are excluded from the sample. The sample aliquot is passed through a pre-ignited and pre-weighed Whatman GF/C filter. The filter containing the residue is placed in a porcelain dish, oven-dried at 105°C for 2.5 hours, cooled 15 minutes in a desiccator, and weighed to a constant weight. Suspended solids are also known as non-filterable residue.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 14.2. Reference 3: APHA 2012, SM 2540 D Reference 4: JSA 1998, method JIS K 0102 14.1</p> | TSS - 105°C | mg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------------|-------|----------|
| 10402 | <p>SUSPENDED SOLIDS 103-105°C</p> <p>Gravimetric (103-105°C) (Weighed Gooch Crucible with Asbestos)</p> <p>Sample is passed through a weighed Gooch crucible with an asbestos mat. The crucible with its contents is dried in an oven at 103-105°C. The increase in weight over that of the Gooch crucible and asbestos mat represents the non-filterable residue (suspended matter).</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 397.</p> | TSS - 105°C | mg/L | 0 |
| 10408 | <p>TOTAL SUSPENDED SOLIDS, 180°C</p> <p>Gravimetric method (180°C)</p> <p>If oil and grease are present, the sample is blended. If large particles, either floating or submerged, are present, they are excluded from the sample. A sample aliquot is passed through a pre-ignited Whatman GF/C filter. The filter containing the residue is placed in a porcelain dish, oven-dried at 180°C for 2.5 hours, cooled 15 minutes in a desiccator and weighed to a constant weight.</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 1975.</p> | TSS - 180°C | mg/L | 0 |
| 10451 | <p>FILTERABLE RESIDUE</p> <p>Gravimetric Method at 105°C (Whatman GF/C)</p> <p>If oil and grease are present, the sample is blended. A sample aliquot is passed through a Whatman GF/C filter or through a 0.45µ membrane filter. The filtrate is evaporated to dryness in a pre-ignited platinum dish. The dish containing the residue is oven-dried overnight at 105°C, cooled 15 minutes in a desiccator, and weighed to constant weight.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 404.</p> | TDS - 105°C | mg/L | 0 |
| 10452 | <p>FILTERABLE RESIDUE, 105°C</p> <p>Gravimetric method (105°C)</p> <p>If oil and grease are present the sample is blended. A sample aliquot is passed through a Whatman GF/C filter. The filtrate is evaporated to dryness in a pre-weighed ignited dish. The dish containing the residue is oven-dried overnight at 103-105°C, cooled for 15 minutes in a desiccator, and weighed to constant weight.</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency: DFE-NB, Canada, 1974. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 2540 D</p> | TDS - 105°C | mg/L | 0 |
| 10454 | <p>TOTAL DISSOLVED SOLIDS</p> <p>Gravimetric (70-80 °C)</p> <p>Filtrate is dried at 70-80 degrees C.</p> <p>Requesting Agency: Resource Quality Services, DWAF, South Africa, 2008. Reference:</p> | TDS - 75°C | mg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------------|-------|----------|
| 10455 | <p>RESIDUE TOTAL – DISSOLVED</p> <p>Gravimetric Method</p> <p>Pipet a volume of filtered sample containing 10 to 200mg dissolved solids into a tared platinum dish. Evaporate the sample jus to dryness on a steam bath then dry in an oven at 180°C for 2.0 hours. Cool in a desiccator and immediately weigh. Record to nearest 0.1 mg.</p> <p>Requesting Agency: USGS, United States, 2009 Reference 1: USGS PCode-70300 MCode-ROE10 Reference 2: USGS TWRI 5-A1/1989, p 437 Reference 3: APHA 2012, SM 2540 C</p> | TDS - 180°C | mg/L | 0 |
| 10471 | <p>RESIDUE TOTAL</p> <p>Gravimetric</p> <p>The shaken sample is evaporated in a weighed platinum dish or crucible, and oven dried at 103-105°C to a constant weight.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 407.</p> | RESIDUE TOTAL | mg/L | 0 |
| 10473 | <p>RESIDUE TOTAL, 105°C</p> <p>Gravimetric Micro-Method (105°C)</p> <p>A small sample volume (< 1.0 mL) is homogenized and an aliquot placed in a pre-weighed 12 mm aluminium pan. The sample is evaporated to dryness at 105°C in approximately 15 minutes and then weighed to a constant weight. Total residue is also known as Total Solids.</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency: Alberta Environment, Canada, 1979. Reference 1: Carter, Houston and Logsdon 1976. Reference 2: APHA 2012, SM 2540 B</p> | RESIDUE TOTAL - 105°C | mg/L | 0 |
| 10480 | <p>TOTAL SOLIDS, SUM OF CONSTITUENTS</p> <p>Gravimetric @ 170-180 °C</p> $\text{mg total solids/L} = \frac{(A - B) \times 1000}{\text{sample volume mL}}$ <p>where: A= Weight of dried residue + dish, mg. B= Weight of dish, mg.</p> <p>Requesting Agency: USGS 2009 Reference 1: APHA 2012 SM 2540B Reference 2: USGS PCode 70301 MCode-CAL09</p> | RESIDUE - SUM | mg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------|-------|----------|
| 10501 | <p>FIXED SUSPENDED SOLIDS</p> <p>Gravimetric method @ 550 °C</p> <p>If oil and grease are present, the sample is blended. If large particles, either floating or submerged, are present, they are excluded from the sample. A sample aliquot is passed through a pre-ignited Whatman GF/C filter. The filter containing the residue is placed in a porcelain dish, ignited in a muffle furnace at 550°C for 30 minutes, cooled in a desiccator, and weighed to constant weight.</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Algeria, 2006. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 2540 E</p> | FIX SUSP SOLIDS | mg/L | 0 |
| 10502 | <p>FIXED SUSPENDED SOLIDS</p> <p>Gravimetric at 550°C (Weighed Gooch Crucible with Asbestos Mat)</p> <p>Fixed Suspended Solids are defined as the residue remaining when the filter with its residue retained after completion of the test for non-filterable residue, is subjected to heat for a fixed period of time in a furnace held at 550°C. This test is conducted by taking the asbestos filter mat containing the residue for the total suspended solids (non-filterable residue) and placing it in a muffle furnace set at 550°C for 30 minutes. The filter is then cooled in a desiccator and the filter reweighed to constant weight. The increase in weight over that of the empty filter represents the fixed suspended solids.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 412.</p> | FIX. SUSP SOL | mg/L | 0 |
| 10504 | <p>FIXED SUSPENDED SOLIDS</p> <p>Gravimetric at 600°C (Weighed Gooch Crucible with Asbestos Mat)</p> <p>Fixed Suspended Solids are defined as the residue remaining when the filter with its residue retained after completion of the test for non-filterable residue, is subjected to heat for a fixed period of time in a furnace held at 600°C. This test is conducted by taking the asbestos filter mat containing the residue for the total suspended solids (non-filterable residue) and placing it in a muffle furnace set at 600°C for 20 minutes. The filter is then cooled in a desiccator and the filter reweighed to constant weight. The increase in weight over that of the empty filter represents the fixed suspended solids.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 413.</p> | FIX. SUSP SOL | mg/L | 0 |
| 10511 | <p>VOLATILE SUSPENDED SOLIDS</p> <p>Gravimetric method, calculated</p> <p>It is defined as the weight loss on ignition of non-filterable residue. Calculate the difference between non-filterable residue (parameter code 10401) and fixed non-filterable residue (parameter code 10501).</p> <p>The method detection limit is 10 mg/L</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | VOL SUSP SOLIDS | mg/L | 0 |

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| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------------|-------|----------|
| 10521 | <p>RESIDUE VOLATILE TOTAL</p> <p>Calculated</p> <p>It is defined as the weight loss on ignition of total residue. Calculate the difference between total residue (parameter codes 10401+10452) and fixed total residue (parameter code 10571).</p> <p>The method detection limit is 10 mg/L</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | RESIDUE - VOL | mg/L | 0 |
| 10531 | <p>VOLATILE DISSOLVED SOLIDS</p> <p>Gravimetric method</p> <p>It is defined as the weight loss on ignition in a muffle furnace of the dried residue of filterable solids.</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency: Environment Canada, 1979. Reference: UNEP GEMS/Water Programme 1992.</p> | VOL DISS SOLIDS | mg/L | 0 |
| 10551 | <p>FIXED FILTERABLE RESIDUE</p> <p>Gravimetric method, calculated</p> <p>If oil and grease are present, the sample is blended. The sample aliquot is passed through a pre-ignited Whatman GF/C filter. The filtrate is evaporated in a pre-ignited dish, dried at 105°C and weighed to constant weight. The dish is then ignited in a muffle furnace at 550°C for one hour, cooled in a desiccator, and weighed to constant weight. The difference in weight is the fixed filterable residue.</p> <p>Fixed filterable residue = Dissolved Solids @ 105 °C – Dissolved Solids @ 550 °C</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | RESIDUE - FIXED | mg/L | 0 |
| 10571 | <p>RESIDUE FIXED TOTAL</p> <p>Gravimetric @ 550 °C</p> <p>The dish or crucible with retained residue from the total residue is ignited at 550°C for 30 minutes in a furnace. Increase in weight over that of the ignited empty dish or crucible represents fixed total residue.</p> <p>The method detection limit is 10 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | RESIDUE-FIXED TOTAL | mg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------|------------------------|----------|
| 10602 | <p>HARDNESS TOTAL</p> <p>Calculation</p> <p>Total Hardness as mg CaCO₃/L = 2.497 * Ca [mg/L] + 4.117 * Mg [mg/L]</p> <p>Requesting Agency 1: Environment Canada, Pacific & Yukon Region, 2007. Requesting Agency 2: Panama Canal Authority, Panama, 2009. Requesting Agency 3: South Africa, 2005. Reference 1: Environment Canada, PYR code 423. Reference 2: APHA 2012, SM 2340B</p> | HARDNESS TOTAL | mg/L CaCO ₃ | 1 |
| 10603 | <p>HARDNESS TOTAL</p> <p>EDTA Titration</p> <p>If turbid, the sample aliquot is filtered through a 0.45 µm membrane filter. The titration method depends on the ability of the ethylenediamine tetraacetic acid (EDTA) and its sodium salts to form stable unionized complexes with calcium and magnesium ions. Before titration, a buffer solution (NH₄Cl, NH₄OH, and Mg salt of EDTA) is added to a sample aliquot to adjust the pH to 10.0 ± 0.1, followed by an indicator (Eriochrome Black T to form a pink complex, or Calmagite to form a wine-red colour). (<i>See Appendix 6.</i>) The sample aliquot is then titrated against EDTA which forms stable complexes with calcium and magnesium ions in the sample. At the end point, when all the calcium or magnesium ions have complexed with the titrant, the solution turns blue.</p> <p>Hardness as mg CaCO₃/L = $\frac{B \times N \times 1000}{\text{mL of sample}}$</p> <p>B = mL EDTA used in titration N = mg CaCO₃, equivalent to 1.00 mL</p> <p>Interference: Total heavy metal ion concentration of 0.5 mg/L.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 2001. Reference 1: Environment Canada 1974. Reference 2: APHA 1998, SM-2340 C</p> | HARDNESS TOTAL | mg/L CaCO ₃ | 1 |
| 10607 | <p>CALCIUM HARDNESS</p> <p>EDTA Titration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. Adjust the pH of the sample aliquot between 12 and 13 with 1N NaOH solution (to precipitate the magnesium), add the Eriochrome Black T indicator (<i>See Appendix 6</i>) and immediately titrate with the standard EDTA solution while continually stirring; the dye turns from red to its blue colour when the calcium has been removed.</p> <p>mg/L as CaCO₃ = (A x B x 1000) / mL of sample</p> <p>A = mL of titrant B = mg CaCO₃ equivalent to 1.00 mL of EDTA</p> <p>Interferences: Heavy metal concentrations in excess of 0.5 mg/L. The method detection limit is 1.0 mg/L.</p> <p>Requesting Agency: DFE-NB, Canada, November 1974. Reference: APHA 1971.</p> | Ca HARDNESS | mg/L CaCO ₃ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------------|------------------------------|----------|
| 10608 | <p>TOTAL HARDNESS</p> <p>Calculation Hardness (mg/L as CaCO₃) = \sum (Ca + Mg + Ba + Sr) me/L *50.05</p> <p>Hardness, mg equivalent CaCO₃/L=2.497[Ca,mg/L] + 4.118 [Mg, mg/L]</p> <p>Requesting Agency: USGS 2009 Reference 1: USGS PCode-900 MCode-Cal07 Reference 2: APHA 2012 SM 2340B</p> | HARDNESS TOTAL | mg/L as CaCO ₃ | 1 |
| 10609 | <p>TOTAL HARDNESS</p> <p>Volumetric titration with titration pipette</p> <p>The test measures the content of salts of the alkaline earth metals calcium, magnesium, strontium and barium in groundwater and surface water, drinking water, mineral water and boiler water.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference: Merck method 108047.</p> | HARDNESS TOTAL | mg/L as CaCO ₃ | 1 |
| 10631 | <p>TOTAL HARDNESS</p> <p>Colourimetry (Wagtech photometer)</p> <p>Under the controlled conditions of the test, calcium and magnesium ions react with Hardicol indicator to produce a purple coloration. Filter sample if necessary to obtain a clear solution. Fill test tube with sample to the 10 ml mark. Add one Hardicol No.1 tablet, crush and mix to dissolve. Add one Hardicol No.2 tablet, crush and mix to dissolve. Ensure all particles are completely dissolved. Stand for two minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 500 mg/l CaCO₃ Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions HARDNESS (HARDICOL)</p> | HARDNESS TOTAL | mg/L as CaCO ₃ | 1 |
| 10632 | <p>CALCIUM HARDNESS</p> <p>Colourimetry by Wagtech photometer</p> <p>The Palintest Calcium Hardness test is based on the Calcicol indicator reagent method. Calcium ions react specifically with Calcicol indicator in alkaline solution to give an orange coloration. Filter sample if necessary to obtain a clear solution. Fill the test tube with sample to the 10 ml mark. Add one Calcicol No.1 tablet, crush and mix to dissolve. Add one Calcicol No.2 tablet, crush and mix to dissolve. Stand for two minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 500 mg/l CaCO₃ Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions CALCIUM HARDNESS (CALCICOL)</p> | Ca HARDNESS | mg/L CaCO ₃ | 1 |
| 10650 | <p>HARDNESS, NON-CARBONATE</p> <p>Calculation</p> <p>Hardness, non-carbonate (mg/L as CaCO₃) = Hardness (me/L) - Alkalinity (me/L) *50.05</p> <p>Requesting Agency: USGS 2009 Reference 1: USGS 2005, USGS PCode-95902 Mcode-TT038 Reference 2: APHA 2012, SM 2340 B</p> | HARDNESS NON-CARB | mg/L as CaCO ₃ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 10702 | <p>ANIONIC TENSIDES (Surfactants)</p> <p>Colorimetric - Methylene Blue Active Substances (MBAS)</p> <p>A sample aliquot is made alkaline (phenolphthalein as indicator), extracted with chloroform and methylene blue solutions. The colour intensity, proportional to the concentration of surfactants in the extract, is measured spectrometrically at 652 nm and compared to identically-prepared standard solutions.</p> <p>The detection limit is 10 ng LAS (Linear Alkylate Sulphonate or 2 ug/L MBAS)</p> <p>N.B.: If the concentration is low (i.e.: less than 500 µg/L), this method suffices as there is no surfactant problem in the water supply. If the concentration is higher, it is important to distinguish between interferences and real surfactants: make an infrared determination or purify the LAS and measure colourimetrically.</p> <p>Interference: Organic sulphates, sulphonates, carboxylates, phosphates and phenols complex with methylene blue and inorganic cyanates, chlorides, nitrates and thiocyanates are among the positive interferences. Numerous materials present in wastewater, industrial waste and sludge lead to incorrect results. This method is applied successfully in measuring surfactants in drinking water supplies. Compare sample aliquots to identically-prepared LAS standard solutions.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: APHA 2012, SM 5540 C. Reference 2: JSA 1998, method 30.1.1.</p> | TENS AN | mg/L | 1 |
| 11001 | <p>SODIUM - TOTAL</p> <p>Atomic Absorption Spectroscopy (AAS)</p> <p>The sample is collected and preserved in a polyethylene bottle at 4°C. A shaken sample aliquot is mixed with a lanthanum solution, as an internal standard, and the absorbance is measured spectrometrically at 589 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Perkin-Elmer Corp. 1973. Reference 2: JSA 1998, method 48.2. Reference 3: APHA SM 3111 B.</p> | Na TOTAL | mg/L Na | 0 |
| 11002 | <p>SODIUM - TOTAL</p> <p>Flame Photometry</p> <p>The sample is collected and preserved in a polyethylene bottle at 4°C. A sample aliquot is mixed with lithium nitrate and passed into the burner of a flame photometer equipped with filters to isolate the spectral lines of sodium. The intensity of light produced is proportional to the concentration of sodium in the sample and compared to identically-prepared standard and blank solutions, using a propane and air flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 48.1. Reference 3: APHA 2012, SM 3500-Na</p> | Na TOTAL | mg/L Na | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 11005 | <p>SODIUM – TOTAL</p> <p>Inductively-Coupled Plasma Emission Spectroscopy (ICP-AES)</p> <p>The whole water sample is preserved with 0.2% HNO₃ and digested with HNO₃ / HCl. The digest is analyzed by ICP-AES.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 440.</p> | Na TOTAL | mg/L Na | 1 |
| 11011 | <p>SODIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Na TOTAL | mg/L Na | 1 |
| 11032 | <p>SODIUM - TOTAL</p> <p>Calculated (Wagtech Photometer)</p> <p>Sodium concentration is calculated through a null ionic balance: $Na = \sum \text{anions} - (Ca + Mg + K + \text{metals})$</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Wagtech Manual</p> | Na TOTAL | mg/L Na | 1 |
| 11101 | <p>SODIUM – DISSOLVED</p> <p>Flame Photometry (Direct Intensity measurement)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. The sample is then aspirated in a flame photometer and the direct intensity of the light emission of the analyte is measured.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 59.</p> | Na DISS | mg/L Na | 1 |
| 11102 | <p>SODIUM - DISSOLVED</p> <p>Atomic Absorption Spectroscopy (AAS) – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a polyethylene bottle at 4°C. The sample aliquot is mixed with a lanthanum solution, as an internal standard, and the absorbance is measured spectrometrically at 589 nm, using an air-acetylene oxidizing flame. The absorbance produced is proportional to the concentration of sodium in the sample and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.1 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Perkin-Elmer Corp. 1973. Reference 2: JSA 1998, method 48.2.</p> | Na DISS | mg/L Na | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 11103 | <p>SODIUM - DISSOLVED</p> <p>Flame Emission Spectroscopy</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a polyethylene bottle at 4°C. The sample aliquot is mixed with a 1% LiNO₃/H₂SO₄ solution and aspirated in a flame photometer. The light emission is measured at 589 nm and compared with that of internal Li standard at 671nm. Alternatively, the emission is compared to identically-prepared Na standard and blank solutions, using a propane and air flame. Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency 1: Environment Canada, Pacific Region, 1973. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: Semyonov 1977. Reference 3: JSA 1998, method 48.1.</p> | Na DISS | mg/L Na | 0 |
| 11104 | <p>SODIUM – DISSOLVED</p> <p>Flame Photometry (Internal STD)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. A sample aliquot is then mixed with a LiNO₃, 1% v/v H₂SO₄ solution. This solution is then aspirated in a flame photometer and the direct intensity of the light emission of the analyte is measured.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 445.</p> | Na DISS | mg/L Na | 1 |
| 11105 | <p>SODIUM - DISSOLVED</p> <p>Atomic Absorption Spectroscopy (AAS) - Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a polyethylene bottle at 4°C. The absorption is measured at 295 nm and compared with those of standard NaCl solutions. An air-acetylene flame is used.</p> <p>The method detection limit is 0.1 mg/L</p> <p>Requesting Agency 1: DFO-FWI, Canada, 1978. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Perkin-Elmer Corp. 1973. Reference 2: JSA 1998, method 48.2.</p> | Na DISS | mg/L Na | 0 |
| 11107 | <p>SODIUM – DISSOLVED</p> <p>Flame Photometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. A sample aliquot is then mixed with a LiNO₃, 1% v/v H₂SO₄ solution. This solution is then aspirated in a flame photometer. The direct intensity of the light emission of the analyte is measured and corrected for transport variability by comparison with the known concentration of the internal Lithium standard. A propane and air, or a natural gas-oxygen flame is used..</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 445.</p> | Na DISS | mg/L Na | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 11111 | <p>SODIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>).</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved in a polyethylene bottle with dilute mineral acid. The sample aliquot is aspirated and the emission is measured at 589 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.03 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JWVA 2001, method VI-3 5.4.</p> | Na DISS | mg/L Na | 0 |
| 11112 | <p>SODIUM - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm filter and preserved in a polyethylene bottle at 4 °C. A sample aliquot is injected into an eluent stream, pumped through two columns (separator and suppressor columns) before being detected by a conductivity meter. The sample concentration is compared to the peak height or area and retention time of identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 1988. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Cheam and Chau 1987. Reference 2: JSA 1998, method 48.3.</p> | Na DISS | mg/L Na | 0 |
| 11115 | <p>SODIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a polyethylene bottle with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 589.0 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JWVA 2001, method VI-3 5.4.</p> | Na DISS | mg/L Na | 0 |
| 11116 | <p>SODIUM DISSOLVED</p> <p>Atomic Absorption Spectrometry (AAS) – Emission</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved in a polyethylene bottle at 4°C. The sample aliquot is mixed with a lanthanum solution. The emission is measured spectrometrically at 589 nm and compared to identically-prepared Na standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L</p> <p>Requesting Agency: NIWA, New Zealand, 2010. Reference: New Zealand DSIR 1971 and 1972, CD 2151.</p> | Na DISS | mg/L Na | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|----------------|----------|
| 11190 | <p>SODIUM DISSOLVED</p> <p>Inductively Coupled Plasma - Mass Spectrometry ICP-MS</p> <p>A water sample is filtered through a glass fiber filter (GF/F) heat-treated at 400°C in advance, and used as a test solution. Concentrations of the target substances (Na) in the sample are adjusted with purified water to fall within the range (0.0006-0.06mg/L). A total of 1 part of nitric acid (i.e. including that added at the time of the sample collection) are added per 100 parts of the sample, and the sample is then gently heated until the solution volume becomes less than 90% of the original volume. After cooling, 1 part of internal standard mixture is added to 10 parts of the sample. Additionally, purified water is added to bring the solution up to a known volume, and this is used as the test solution. The test solution is introduced into an ICP-MS and the ion intensities at the mass numbers of metals of interest as well as the internal standard substance are measured. A series of standard solutions are prepared and handled in exactly the same way as the test solution in order to prepare calibration curves based on the relationships between metal concentration and ion intensity ratio for each metal.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference: Japan MHLW 2003, Notification No. 261-No.6</p> | Na DISS | mg/L Na | 0 |
| 11201 | <p>SODIUM ADSORPTION RATIO (SAR):</p> <p>Difference Calculation</p> <p>Excess Sodium in irrigation water, relative to calcium and magnesium or to total salt content, can affect soil structure, soil aeration, flow rate, permeability, infiltration, etc. The ratio can be calculated as follows:</p> <p>Method 1:</p> $\text{SAR} = \frac{\text{Na}^+}{\sqrt{\frac{\text{Ca}^{2+} + \text{Mg}^{2+}}{2}}}$ <p>Method 2:</p> $\text{SAR} = 1.41 * 0.04350 * \text{Na} / \text{SQRT}(A)$ <p>where $A = 0.01988 * \text{TH}$, if Total Hardness (TH) is present or $A = 0.04990 * \text{Ca} + 0.08226 * \text{Mg}$, if TH is not present.</p> <p>If Na is not present, or A cannot be calculated because of lack of sufficient parameters, SAR is not calculated.</p> <p>Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: South Africa 2005. Reference 1: UNEP GEMS/Water Programme 1992. Reference 2: Environment Canada 1988.</p> | SAR | Relative Units | 3 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 12002 | <p>MAGNESIUM - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is collected and preserved in the field at 4°C. The shaken sample aliquot is mixed with a LaCl₃ solution and aspirated in an air-acetylene reducing flame. The absorbance is measured spectrometrically at 285.2 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 51.2. Reference 3: APHA 2012, SM 3111 B.</p> | Mg TOTAL | mg/L Mg | 0 |
| 12003 | <p>MAGNESIUM - TOTAL</p> <p>EDTA Titration</p> <p>A sample is preserved in the field at 4°C. The pH of the sample aliquot is adjusted to 10.0 ± 0.1 with a buffer (NH₄Cl, NH₄OH and Mg EDTA salt) solution; an indicator, Eriochrome Black T, is added and the aliquot then is slowly titrated with EDTA within five minutes to avoid precipitation. The colour changed from a wine red to a blue colour (a fluorescent light is highly recommended to see the complete disappearance of the red).</p> <p>Interference: Ca ion concentration of 1 mg/L, total heavy metal ion concentrations of 0.5 mg/L.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 51.1.</p> | Mg TOTAL | mg/L Mg | 0 |
| 12005 | <p>MAGNESIUM - TOTAL</p> <p>ICP-AES</p> <p>After preparing samples and obtaining the correct operating conditions. Calibrate the instrument and analyze the samples. Analysis is done by running a calibration blank and then the actual sample. Rise for at least 60 seconds with dilute acid between samples and blanks. Analyze instrument check standard once per 10 samples. Suggested wavelength for Mg is 257.61nm</p> <p>Requesting Agency 1: Canada Requesting Agency 2: Belgium, 2008 Reference 1: ISO 1996, method ISO 11885. Reference 2: APHA 2012, SM 3120 B.</p> | Mg TOTAL | mg/L Mg | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 12011 | <p>MAGNESIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Samples are preserved with 2mL concentrated HNO₃ per litre. A sample aliquot is digested with HNO₃ and evaporated to near dryness. The residue is taken up in HCl and again digested to near dryness. The residue is dissolved in one-tenth of the aliquot volume of deionised water. The emission is measured spectrophotometrically at 279.6 nm and compared with standard solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 2634.</p> | Mg TOTAL | mg/L Mg | 2 |
| 12031 | <p>MAGNESIUM - TOTAL</p> <p>Colourimetry by Wagtech photometer</p> <p>The Palintest Magnecol test is based on a simple colorimetric procedure. Magnesium reacts with an organic reagent to produce an orange coloured complex. Using the measuring syringe take a 1 ml sample of the water under test. Transfer to the round test tube and make up to the 10 ml mark with deionized water. Add one Magnecol tablet, crush and mix to dissolve. Stand for five minutes to allow full colour development and the slight turbidity to clear. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 500 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions MAGNESIUM (MAGNECOL)</p> | Mg TOTAL | mg/L Mg | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 12101 | <p>MAGNESIUM - DISSOLVED</p> <p>Calculated</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The magnesium concentration in the sample aliquot is calculated from the values of the Total Hardness (determined by EDTA titration) and Calcium Dissolved.</p> <p>Total Hardness (TH), parameter code = 10603: The pH of a sample aliquot is adjusted to 10.0 ± 0.1 with a NaOH solution; an indicator (Eriochrome Black T) is added and the aliquot is slowly titrated with EDTA to remove the calcium and magnesium from the complex dye. The colour changes from a wine red to a blue colour (a fluorescent light is highly recommended to see the complete disappearance of the red). (See Appendix 6). TH (as CaCO₃) = A x B x 1000/mL sample</p> <p>Calcium: The pH of a sample aliquot is adjusted between 12 and 13 with a NaOH solution to precipitate the magnesium; the indicator (Eriochrome Blue Black R or Murexide) is added and reacts only with calcium if the sample is immediately but slowly titrated with EDTA.</p> <p>mg/L Ca (as CaCO₃) = A x B x 1000/mL sample</p> <p>where A = mL of titration B = mg CaCO₃ equivalent to 1.00 mL of EDTA titrant</p> <p>METHOD 1: mg/L Mg = TH (mg/L CaCO₃) – Ca hardness (mg/L CaCO₃) x 0.244.</p> <p>Interference: suspended and colloidal organic matter and high metal concentrations (Cu > 2 mg/L, Fe > 29 mg/L, Mn > 10 mg/L, Zn > 5 mg/L, Pb > 5 mg/L, Al > 5 mg/L, etc). The sample should be diluted to minimise contaminations. The method detection limit is 1.0 mg/L.</p> <p>METHOD 2: Mg = (TH*0.01998 - Ca*0.0499)*12.16</p> <p>Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: GHI, Russian Federation 2004. Reference 1: APHA 2012, SM 3500-Mg E Reference 2: Environment Canada 1988. Reference 3: Semyonov 1977.</p> | Mg DISS | mg/L Mg | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 12102 | <p>MAGNESIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is mixed with a LaCl₃ solution and aspirated in an air-acetylene reducing flame. The absorbance is measured spectrometrically at 285.2 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: Environment Canada 1979. Reference 2: JSA 1998, method 51.2.</p> | Mg DISS | mg/L Mg | 0 |
| 12103 | <p>MAGNESIUM - DISSOLVED</p> <p>EDTA Titration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The pH of the sample aliquot is adjusted to 10.0 ± 0.1 with a buffer (NH₄Cl, NH₄OH and Mg EDTA salt) solution; an indicator (Eriochrome Black T) is added and the aliquot then is slowly titrated with EDTA within five minutes to avoid precipitation. The colour changed from a wine red to a blue colour (a fluorescent light is highly recommended to see the complete disappearance of the red).</p> <p>Interference: Ca ion concentration of 1 mg/L, total heavy metal ion concentrations of 0.5 mg/L. The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 51.2..</p> | Mg DISS | mg/L Mg | 0 |
| 12104 | <p>MAGNESIUM – DISSOLVED</p> <p>AutoAnalyzer</p> <p>Mg is precipitated in alkaline solution and magnesium blue dye absorbed in the presence of a wetting agent and suspended material.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 466.</p> | Mg DISS | mg/L Mg | 1 |
| 12106 | <p>MAGNESIUM – DISSOLVED</p> <p>AAS – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. There is no digestion and the water sample is analyzed by direct aspiration atomic absorption spectrometry (AAS) using a reducing flame. The wavelength used for magnesium analysis is 285.2 nm.</p> <p>Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 459.</p> | Mg DISS | mg/L Mg | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 12107 | <p>MAGNESIUM – DISSOLVED</p> <p>AAS – Automated</p> <p>The sample is digested with HNO₃. A sample aliquot is mixed with a standard LaCl₃ solution. The solution is aspirated. The absorption at the 285.2 is measured spectrometrically and compared with those of a reagent blank and standard Mg solution. An acetylene-air reducing flame is used. The autoanalysis unit consisting of an automated sampler, manifold and transmission delay line are incorporated so that the sample is diluted. The magnitude of the dilution is proportioned to the diameter of the auxiliary pump line.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 469.</p> | Mg DISS | mg/L Mg | 2 |
| 12109 | <p>MAGNESIUM - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is injected into an eluent stream, pumped through two columns (separator and suppressor columns) before being detected by a conductivity meter. The sample concentration is compared to the peak height or area and retention time of identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.05 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Cheam and Chau 1987. Reference 2: JWWA 2001, method VI-3 6.5.</p> | Mg DISS | mg/L Mg | 0 |
| 12111 | <p>MAGNESIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>).</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with dilute mineral acid. The sample aliquot is aspirated and the emission is measured at 279.5 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Belgium, 2005. Reference 1: Alberta Environment 1979. Reference 2: Japanese Waterworks Analytical Method (2001) VI-3 6.3. Reference 3: ISO 1996, method ISO 11885.</p> | Mg DISS | mg/L Mg | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|------------|----------|
| 12115 | <p>MAGNESIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>).</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is digested with nitric acid or aqua regia, concentrated appropriately and aspirated from an autosampler. The emission is measured at 279.5 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.0003 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Belgium, 2005. Reference 1: Alberta Environment 1981. Reference 2: Japanese Waterworks Analytical Method (2001) VI-3 6.3. Reference 3: ISO 1996, method ISO 11885. Reference 4: APHA 2012, SM-3120 B</p> | Mg DISS | mg/L Mg | 0 |
| 12190 | <p>MAGNESIUM DISSOLVED</p> <p>Inductively Coupled Plasma - Mass Spectrometry ICP-MS</p> <p>A water sample is filtered through a glass fiber filter (GF/F) heat-treated at 400°C in advance, and used as a test solution. Concentrations of the target substances (Mg) in the sample are adjusted with purified water to fall within the range (0.0006-0.06mg/L). A total of 1 part of nitric acid (i.e. including that added at the time of the sample collection) are added per 100 parts of the sample, and the sample is then gently heated until the solution volume becomes less than 90% of the original volume. After cooling, 1 part of internal standard mixture is added to 10 parts of the sample. Additionally, purified water is added to bring the solution up to a known volume, and this is used as the test solution. The test solution is introduced into an ICP-MS and the ion intensities at the mass numbers (Mg: 24) of metals of interest as well as the internal standard substance are measured. A series of standard solutions are prepared and handled in exactly the same way as the test solution in order to prepare calibration curves based on the relationships between metal concentration and ion intensity ratio for each metal.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference: Japan MHLW 2003, Notification No. 261-No.6</p> | Mg DISS | mg Mg/L | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|--------------|----------|
| 13001 | <p>ALUMINUM TOTAL</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with diluted mineral acid. A hydroxylamine hydrochloride (NH₂OH.HCl) solution, containing BeSO₄ (to minimize the interference of fluoride), is added to two aliquots: one is the test aliquot and the other is the colour correction aliquot. A solution, containing ferron and orthophenanthroline (9,10-phenanthroline) (to minimize the interference of iron), is added to one of the sample aliquots. Sodium acetate solution is added to both sample aliquots. The absorbance of the aliquot, containing ferron/orthophenanthroline, is measured spectrometrically at 520 nm, and compared to identically-prepared Al standard and blank solutions. A colour correction is made, using the aliquot without ferron and orthophenanthroline. The Al concentration measured is corrected for Fe, Mn and F ions, by the following equation:</p> <p>mg/L Al = A - B - C + D where, A = apparent mg/L Al B = (0.12 x mg/L Fe) C = 0.04 x mg/L Mn D = (0.05 x mg/L F)</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Al TOTAL | mg/L Al | 3 |
| 13002 | <p>ALUMINUM - TOTAL</p> <p>Atomic Absorption Spectrometry - Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with nitric acid and aspirated in a N₂O-C₂H₂ reducing flame. The absorbance is measured spectrometrically at 309.3 nm. The sample is compared to identically-prepared Al standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 58.2. Reference 3: APHA 2012, method SM 3111</p> | Al TOTAL | mg/L Al | 3 |
| 13003 | <p>ALUMINUM - TOTAL</p> <p>AAS - Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with nitric acid. The aliquot is buffered to a pH between 7.5 and 8.5 and oxine reagent is added. The solution is extracted on a mechanical shaker and the solvent layer is aspirated and the absorbance is measured spectrometrically at 309.3 nm and compared to identically-prepared standard and blank solutions, using a N₂O-C₂H₂ reducing flame.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Al TOTAL | mg Al/L - | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 13005 | <p>ALUMINUM - TOTAL</p> <p>Colourimetry</p> <p>Colorimetric analysis of the coloured solution resulting from coloured lacquer and aluminum chromazurol S buffer with acetates.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference: Merck method 1.14825.0001</p> | Al TOTAL | mg Al/L | 3 |
| 13009 | <p>ALUMINUM - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (See Appendix 3).</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with concentrated nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 309.3 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.0004 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1984. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 58.4. Reference 3: APHA 2012, SM 3120 B.</p> | Al TOTAL | mg Al/L | 3 |
| 13011 | <p>ALUMINUM - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (See Appendix 3).</p> <p>A sample is preserved in the field with diluted mineral acid. The sample aliquot is digested with aqua regia and evaporated to near dryness. The wet residue is dissolved in concentrated HCl and diluted appropriately. The digested sample aliquot is aspirated and the emission is measured spectrometrically at 309.3 nm and compared to identically-prepared Al standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 58.4.</p> | Al TOTAL | mg Al/L | 3 |
| 13031 | <p>ALUMINUM - TOTAL</p> <p>Colourimetry by Wagtech photometer</p> <p>Aluminum reacts with Eriochrome Cyanine R indicator in slightly acid solution to produce a pink-red coloured complex. Fill test tube with sample to the 10 ml mark. Add one Aluminum No.1 tablet, crush and mix to dissolve. Add one Aluminum No.2 tablet, crush and mix gently to dissolve. Avoid vigorous agitation. Stand for five minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 0.5 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions ALUMINUM</p> | Al TOTAL | mg Al/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 13090 | <p>ALUMINUM - TOTAL</p> <p>Inductively Coupled Plasma by Mass Spectrometry (ICP – MS)</p> <p>A sample is preserved in the field with diluted mineral acid. The sample aliquot is digested in mineral acids and introduced in an argon stream high temperature and radio frequency plasma through a pneumatic pump. The energy from the plasma is transferred to the sample and causes desolvation, atomisation and ionization. The ions generated are extracted from the plasma, through a vacuum interface, and separated on the basis of their mass to charge ratio in the mass spectrometer, the ions are counted by an electron multiplier detector, the data are processed by a computer data handling system and compared to identically-prepared standard and blank solutions.</p> <p>Interference: Isobaric elemental interferences are calculated automatically by the data system; the abundance sensitivity should be corrected through adjustment of the spectrometer resolution; physical interferences are usually corrected by ensuring the water sample does not contain more than 0.5% dissolved solids; ionization interferences are corrected by the addition of internal standards and sufficient wash time should minimise memory interferences.</p> <p>The method detection limit is 0.4 ug/L.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference: JWVA 2001, method VI-3 7.4.</p> | Al TOTAL | mg/L Al | 3 |
| 13091 | <p>ALUMINUM - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Al TOTAL | mg/L Al | 3 |
| 13092 | <p>ALUMINUM - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1286.</p> | Al TOTAL | mg/L Al | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|------------|----------|
| 13101 | <p>ALUMINUM - DISSOLVED</p> <p>Colourimetry (Ferron)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with diluted mineral acid. A hydroxylamine hydrochloride (NH₂OH.HCl) solution, containing BeSO₄ (to minimize the interference of fluoride), is added to two aliquots: one is the test aliquot and the other is the colour correction aliquot. A solution, containing ferron and orthophenanthroline (9, 10-phenanthroline) (to minimize the interference of iron), is added to one of the sample aliquots. Sodium acetate solution is added to both sample aliquots. The absorbance of the aliquot, containing ferron and orthophenanthroline, is measured spectrometrically at 520 nm, and compared to identically-prepared Al standard and blank solutions. A colour correction is made, using the aliquot without ferron and orthophenanthroline. The Al concentration measured is corrected for Fe, Mn and F ions, by the following equation: $\text{mg/L Al} = A - B - C + D$ where, A = apparent mg/L Al B = (0.12 x mg/L Fe) C = 0.04 x mg/L Mn) D = (0.05 x mg/L F)</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Al DISS | mg/L Al | 3 |
| 13102 | <p>ALUMINUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with diluted mineral acid. The sample aliquot is aspirated and the absorbance measured spectrometrically at 309.3 nm [ref.1] or 324.7 nm [ref.2], and compared with to identically-prepared Al standard and blank solutions, using a N₂O-C₂H₂ (nitrous oxide – acetylene fuel) reducing flame.</p> <p>The method detection limit is 0.10 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Argentina EBY, 2005. Requesting Agency 3: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: EPA 1986, method 7020. Reference 3: JSA 1998, method JIS K 0102 58.2.</p> | Al DISS | mg/L Al | 3 |
| 13103 | <p>ALUMINUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry - Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with diluted mineral acid. An 8-hydroxy-quinoline and a buffer solution (pH=8) are added to the sample aliquot to adjust the pH between 7.5 and 8.5. This solution is extracted twice with CHCl₃. The extractions are combined and the solvent layer is aspirated and the absorbance is measured spectrometrically at 309.3 nm and compared to identically-prepared standard and blank solutions, using a N₂O-C₂H₂ reducing flame.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Al DISS | mg/L Al | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|------------|----------|
| 13104 | <p>ALUMINUM - DISSOLVED</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with diluted mineral acid. The 50 ml sample aliquot is mixed with ascorbic acid and AluVer® powder pillows. Bleaching powder is added to the equally-split sample aliquot and the bleached and unbleached aliquots are measured colourimetrically at 522 nm and the absorbance is compared to identically-prepared standard and blank solutions, in the range is from 0.02 to 0.75 mg/L.</p> <p>Interference: Fluoride is a major interference. The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: Environment Canada, 1982. Reference: n/a.</p> | Al DISS | mg/L Al | 2 |
| 13109 | <p>ALUMINUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (See Appendix 3)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 309.3 nm and compared to identically-prepared Al standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 58.4.</p> | Al DISS | mg/L Al | 3 |
| 13111 | <p>ALUMINUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES)3: ICP 1516 (See Appendix 3)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with dilute mineral acid. The sample aliquot is aspirated and the emission is measured at 309.3 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 58.4.</p> | Al DISS | mg/L Al | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------|---------|----------|
| 13190 | <p>ALUMINUM - DISSOLVED</p> <p>Inductively Coupled Plasma - Mass Spectrometry (ICP – MS)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with dilute mineral acid. The sample aliquot is introduced in an argon stream high temperature and radio frequency plasma through a pneumatic pump. The energy from the plasma is transferred to the sample and causes desolvation, atomisation and ionization. The ions generated are extracted from the plasma, through a vacuum interface, and separated on the basis of their mass to charge ratio in the mass spectrometer, the ions are counted by an electron multiplier detector, the data are processed by a computer data handling system and compared to identically-prepared standard and blank solutions.</p> <p>Interference: Isobaric elemental interferences are calculated automatically by the data system; the abundance sensitivity should be corrected through adjustment of the spectrometer resolution; physical interferences are usually corrected by ensuring the water sample does not contain more than 0.5% dissolved solids; ionization interferences are corrected by the addition of internal standards and sufficient wash time should minimise memory interferences.</p> <p>The method detection limit is 0.4 ug/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: JWWA 2001, method VI-3 7.4 Reference 2: Japan MHLW 2003, Notification 261-NO.6</p> | Al DISS | mg/L Al | 3 |
| 13301 | <p>ALUMINIUM – EXTRACTABLE</p> <p>Colourimetry (Ferron)</p> <p>If turbid, the sample is passed through a 0.45 u membrane filter. A hydroxylamine hydrochloride (NH₂OH.HCl) solution, containing BeSO₄ (to minimize the interference of fluoride), is added to two aliquots: one is the test aliquot and the other is the colour correction aliquot. A solution, containing ferron and orthophenanthroline (9, 10-phenanthroline) (to minimize the interference of iron), is added to one of the sample aliquots. Sodium acetate solution is added to both sample aliquots. The absorbance of the aliquot, containing ferron and orthophenanthroline, is measured spectrometrically at 520 nm, and compared to identically-prepared Al standard and blank solutions. A colour correction is made, using the aliquot without ferron and orthophenanthroline. The Al concentration measured is corrected for Fe, Mn and F ions, by the following equation:</p> $\text{mg/L Al} = A - B - C + D \quad \text{where,}$ <p style="margin-left: 40px;">A = apparent mg/L Al B = (0.12 x mg/L Fe) C = 0.04 x mg/L Mn D = (0.05 x mg/L F)</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 488.</p> | Al EXTRBLE | mg/L Al | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------|---------|----------|
| 13302 | <p>ALUMINIUM – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>The sample is acidified with diluted mineral acid (0.2% HNO₃), shaken, and left overnight. The solution is then aspirated; the absorbance is measured spectrophotometrically at 309.3 nm, and compared with those of standard Al solutions. A N₂O-C₂H₂ reducing flame is used.</p> <p>The detection limit is 0.10 mg/L.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 499.</p> | Al EXTRBLE | mg/L Al | 2 |
| 13305 | <p>ALUMINIUM – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>If turbid the sample is passed through a 0.45µ membrane filter. The sample is acidified with dilute mineral acid, shaken and left overnight. The pH of the filtrate is adjusted to 8.00 with buffer solution, 8-Hydroxyquinoline is added, followed by extraction with methyl isobutyl ketone (MIBK). The absorbance of the extract is measured at 309.6 nm and compared with those of standard Al solution. An N₂O-C₂H₂ reducing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 493.</p> | Al EXTRBLE | mg/L Al | 3 |
| 13309 | <p>ALUMINIUM – EXTRACTABLE</p> <p>Flameless Atomic Absorption Spectrometry (AAS – Graphite Furnace)</p> <p>The sample is collected in a clean, linear polyethylene bottle, acidified with 2 mL/L high purity HNO₃ and stored. No further sample treatment is employed prior to analysis by heated graphite furnace and background correction.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 504.</p> | Al EXTRBLE | mg/L Al | 4 |
| 13901 | <p>ALUMINUM - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry (AAS – Graphite Furnace)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with mineral acid. The sample aliquot is usually heated in three stages in a graphite furnace or an electrically heated atomiser where: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the aluminum to be determined. The absorbance of the resultant ground state atoms is measured at 309.3 nm and is compared to identically-prepared Al standard and blank solutions.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method JIS K 0102 58.3.</p> | Al DISS | mg/L Al | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|--------------------------|----------|
| 13911 | <p>ALUMINUM – TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with mineral acid. The sample aliquot is digested in nitric acid or aqua regia. The aliquot is then heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the aluminum to be determined. The absorbance of the resultant ground state atoms is measured at 309.3 nm and is compared to identically-prepared Al standard and blank solutions.</p> <p>The method detection limit is 0.02 mg/L</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 58.3.</p> | Al TOTAL | mg/L Al | 3 |
| 14009 | <p>SILICA – REACTIVE</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested with concentrated nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 288.1 nm [Japan measures at 251.6nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JWWA 2001, method VI-2 15.3.</p> | SI REAC | mgSiO ₂ /L | 2 |
| 14031 | <p>SILICA – REACTIVE</p> <p>Colourimetry by Wagtech photometer</p> <p>Sodium molybdate reacts with silica under acid conditions to produce molybdosilicic acid. Fill the test tube with sample to the 10 ml mark. Add one Silica No 1 tablet, crush and mix to dissolve. Add one Silica No 2 tablet, crush and mix to dissolve. Stand for 10 minutes to allow full colour development. Add one Silica PR tablet, crush and mix to dissolve. Stand for two minutes. (This stage may be omitted if the sample is known to be completely free of phosphate and chlorine). Take photometer reading in usual manner.</p> <p>Testing range is 0 – 150 mg/l SiO₂</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions SILICA HR</p> | SI REAC | mg/L SiO ₂ | 2 |
| 14090 | <p>SILICA – REACTIVE</p> <p>ICP-MS</p> <p>Requesting Agency: Japan 2013 Reference: Japan MHLW 2003, Notification No.261-NO.6</p> | SI REAC | mgSiO ₂ /L | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|--------------------------|----------|
| 14101 | <p>SILICA - REACTIVE</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with diluted mineral acid. NaHCO₃(S) is added to the sample aliquot, heated for one hour at 100°C and cooled. Slowly add H₂SO₄ and dilute to volume. Add 50% HCl and (NH₄)₆Mo₇O₂₄ solutions and shake. Oxalic acid solution (to destroy the molybdophosphoric acid and decrease tannin interference) is added, followed by a 1-amino-2-naphthol-4-sulphonic acid solution (as a reducing agent), containing Na₂SO₃ and NaHSO₃. The resulting heteropoly blue colour is measured, at least two minutes after (but before 15 minutes) adding the oxalic acid, spectrometrically at 815 nm (or 650 nm) and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: High Fe concentrations, colour, sulphide ion, and tannin (the method lessens tannin interference).</p> <p>The method detection limit is 0.01 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: GHI, Russian federation 2004. Reference 1: APHA 1971. Reference 2: JSA 1998, method 44.1.2. Reference 3: Semyonov 1977 Reference 4: Hydrometeoizdat 1999.</p> | SI REAC | mg/L SiO ₂ | 2 |
| 14102 | <p>SILICA – REACTIVE</p> <p>Colourimetry (Heteropoly Blue)</p> <p>If turbid, the sample is passed through a 0.45µ membrane filter. If the sample is seawater, all standard SiO₂ solutions are prepared with synthetic sea water instead of distilled water. A filtrate aliquot is mixed with a solution of (NH₄)₆Mo₇O₂₄ in diluted H₂SO₄. This mixture is then mixed with oxalic acid solution, followed by a 1-amino-2-naphthol-4-sulphonic acid solution, containing Na₂SO₃ and NaHSO₃. The resulting heteropoly blue colour is measured spectrophotometrically at 660 mu and compared with identically prepared standard SiO₂ solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 512</p> | Si REAC. | mg/L SiO ₂ | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|--------------------------|----------|
| 14104 | <p>SILICA – REACTIVE</p> <p>Molybdosilicate method</p> <p>The sample is filtered in the field through a 0.45µm membrane filter and preserved at 4 °C. To a 50.0mL sample add in rapid succession 1.0mL + 1 HCl and 2.0mL ammonium molybdate reagent. Mix and stand for 5-10 min. Add 2.0mL oxalic acid solution (to destroy the molybdophosphoric acid but not the molybdosilica acid) and mix thoroughly. Read colour visually or photometrically at 410 nm after 2 min but before 15 min, recording the time from the addition of oxalic acid. The intensity of this colour is proportional to the concentration of “molybdate-reactive silica”.</p> <p>The method detection limit is 0.2 mg SiO₂/L.</p> <p>To detect the presence of the molybdate-unreactive silica, digest sample with NaHCO₃ before colour development. Prepare a clear sample by filtration if necessary. Place 50.0mL in a 100mL platinum dish. Add 200mg silica-free NaHCO₃ and digest on a steam bath for 1 hour. Cool and add slowly, with stirring, 2.4mL 1N H₂SO₄. Immediately transfer quantitatively to a 50mL Nessler tube and make up to the mark with water. If NaHCO₃ pretreatment is used, add to the standards (approximately 45mL total volume) 200mg NaHCO₃ and 2.4mL 1N H₂SO₄, to compensate both for the slight amount of silica introduced by the reagents and for the effect of the salt on colour intensity. Dilute to 50.0mL. Prepare a special blank for every sample that needs such correction. Carry two identical portions of each such sample through the procedure, including NaHCO₃ treatment if this is used. To one portion add all reagents. To the other portion add HCL and oxalic acid but no molybdate. Adjust photometer to zero absorbance with the blank containing no molybdate before reading absorbance of molybdate-treated sample. Prepare a calibration curve from a series of approximately six standards to cover the optimum ranges. Set photometer to zero absorbance with water and read all standards, including a reagent blank, against water. Make a set of permanent artificial colour standards, using K₂CrO₄ and borax solutions. Mix liquid volumes and place them in 50mL Nessler tubes. Verify correctness of these permanent artificial standards by comparing them visually against standards prepared by analyzing portions of the standard silica solutions.</p> <p>Requesting Agency 1: EBY, ARGENTINA, 2005. Requesting Agency 2: Israel Mekorot 2012 Reference: APHA 2012, SM 4500-SiO₂ C.</p> | SI REAC | mg/L SiO ₂ | 2 |
| 14105 | <p>SILICA – REACTIVE DISSOLVED</p> <p>Colourimetry (filtered)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. If the sample is seawater all SiO₂ standard solutions are prepared with synthetic seawater. A sample aliquot is mixed with a solution of ammonium molybdate (NH₄)₆Mo₇O₂₄ in diluted H₂SO₄. The sample is then mixed with an oxalic acid solution, to destroy the interfering molybdophosphoric acid, and an ascorbic acid solution to form a heteropoly blue complex. The colour is measured at 660 nm and compared to identically-prepared SiO₂ standard and blank solutions.</p> <p>The method detection limit is 0.2 mg/L.</p> <p>Requesting Agency 1: Environment Canada, Pacific Region, 1973. Requesting Agency 2: South Africa, 2005 Reference: Environment Canada 1995, ENVIRODAT code 2329.</p> | SI REAC | mg/L SiO ₂ | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|--------------------------|----------|
| 14106 | <p>SILICA – REACTIVE TOTAL</p> <p>Colourimetry (Heteropoly Blue, unfiltered)</p> <p>If the sample is sea water, all standard SiO₂ solutions are prepared with synthetic sea water. An unfiltered aliquot is mixed with solution of (NH₄)₆Mo₇O₂₄ in diluted H₂SO₄. The sample is then successively mixed with oxalic and ascorbic acid solutions. The resulting heteropoly blue colour is measured spectrophotometrically at 660 mu and compared with those of identically prepared standard SiO₂ solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 2328.</p> | Si REAC. | mg/L SiO ₂ | 3 |
| 14108 | <p>SILICA – REACTIVE</p> <p>Colourimetric – sulphuric acid</p> <p>Reaction with sulphuric acid solution to form a yellow heteropoly ion complex with silicate and molybdate.</p> <p>Requesting Agency: INSIVUMEH, Guatemala 2013 Reference 1: APHA 2012, SM 4500-SiO₂ E Reference 2: Merck method 14794.</p> | Si REAC | mg/L SiO ₂ | 2 |
| 14109 | <p>SILICA – DISSOLVED</p> <p>Molybdenum yellow- absorption spectrometry</p> <p>A sample is filtered in the field through a 0.2 um membrane filter and diluted with mineral acid. To a 50mL aliquot of sample, add 1 mL 50% HCl plus 20 mL (NH₄)₆Mo₇O₂₄ and shake well. Let stand for 5 minutes at 20-25°C, then add 2mL H₂SO₄. Within 2-15 minutes, measure the absorbance of the test solution at 410 nm.</p> <p>Requesting Agency: Japan 2013 Reference: JWVA 2001, VI-2 15.2</p> | Si DISS | mg/L SiO ₂ | 2 |
| 14111 | <p>SILICA - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with dilute mineral acid. The sample aliquot is aspirated and the emission is measured at 288.1 nm [Japan measures at 251.6 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: Japan 2005 Reference 1: Alberta Environment 1979. Reference 2: JWVA 2001, method VI-2 15.3.</p> | SI DISS | mg/L SiO ₂ | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------|-----------------------|----------|
| 15011 | <p>PHOSPHORUS – TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES)</p> <p>Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by photosensitive devices. The wavelength to monitor phosphorus (P) is 214.914 nm.</p> <p>The method detection limit is 16 µg/L.</p> <p>Requesting Agency: PUB Singapore 2009 Reference 1: EPA method SW-846, method 6010c Reference 2: APHA 2012, method 3120 B</p> | P TOTAL | mg P/L | 3 |
| 15019 | <p>PHOSPHORUS – TOTAL</p> <p>Emission Spectrometry - direct aspiration</p> <p>An acidified portion of the sample is directly aspirated from an auto-sampler into a high temperature argon plasma torch to conduct multi-element determinations by ICP-AES. The wavelength to measure phosphorus is 214.914 nm.</p> <p>The method detection limit is 16 µg/L.</p> <p>Requesting Agency 1: Singapore, 2009. Requesting Agency 2: Belgium 2005. Reference 1: APHA 2012, SM 3120 B. Reference 2: US-EPA method 6010C.</p> | P TOTAL | mg P/L | 3 |
| 15031 | <p>REACTIVE ORTHOPHOSPHATE</p> <p>Colourimetry by Wagtech photometer</p> <p><u>High Range</u> – (Testing range of 0 – 100 mg/l): The Palintest Phosphate HR test is based on the vanadomolybdate method. The distinct advantage of the Palintest method is that all reagents required are provided in the form of a test tablet. Fill test tube with sample to the 10 ml mark. If the samples contain silica (>20 mg/l SiO₂), add one Phosphate SR tablet, crush and mix to dissolve. Add one Phosphate HR tablet, crush and mix to dissolve. Stand for 10 minutes to allow full colour development. Take photometer reading in usual manner.</p> <p><u>Low Range</u> – (Testing range is 0 – 4.0 mg/l PO₄ and 0 – 1.3 mg/l P): In the Palintest Phosphate LR method, the phosphate reacts under acid conditions with ammonium molybdate to form phosphomolybdic acid. This compound is reduced by ascorbic acid to form the intensely coloured ‘molybdenum blue’ complex. Fill test tube with sample to the 10 ml mark. Add one Phosphate No 1 LR tablet, crush and mix to dissolve. Add one Phosphate No 2 LR tablet, crush and mix to dissolve. Stand for 10 minutes to allow full colour development. Take photometer reading in usual manner.</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions PHOSPHATE HR & LR</p> | PO4-P REACT | mg PO ₄ /L | 3 |
| 15090 | <p>PHOSPHORUS – TOTAL</p> <p>ICP MS</p> <p>Prepare sample in clean environment and follow manufacturer’s standard operating procedure for initialization, mass calibration, gas flow optimization, and other instrument operating conditions. Apply the analytical run sequence.</p> <p>Requesting Agency: Belgium (Walloon Region), 2005. Reference: APHA 2012, SM 3125 B.</p> | P Total | mg P/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------------|----------------------|----------|
| 15103 | <p>PHOSPHORUS - DISSOLVED</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with 0.2% H₂SO₄. The sample aliquot is autoclaved with K₂S₂O₈ and H₂SO₄ for 30 minutes at 121°C. The sample is then mixed with ammonium molybdate, ascorbic acid and antimonyl tartrate to form a molybdenum blue complex measured at 880 nm and compared to identically-prepared standard phosphorus and blank solutions.</p> <p>The method detection limit is 0.003 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1974. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 46.3.1.</p> | P DISS | mg/L P | 3 |
| 15204 | <p>PHOSPHORUS – TOTAL</p> <p>Ion Chromatography</p> <p>Requesting Agency: CEA Laboratory, Sri Lanka, 2004. Reference: APHA 1998, SM 4110 B</p> | P Total | mg P/L | 3 |
| 15205 | <p>ORTHOPHOSPHATE – TOTAL</p> <p>Colourimetry</p> <p>A sample is collected and preserved at 4°C (if not analysed immediately). The shaken sample aliquot is mixed with ammonium molybdate to form the heteropoly molybdophosphoric acid and is reduced with stannous chloride, in an aqueous sulphuric acid medium, at 30°C, to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 660 nm [Japan uses 700nm] [APHA uses 650 nm] and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: Hg, at concentration of 1 mg/L, (sample should not be preserved with mercuric chloride) and As also interfere with stannous chloride.</p> <p>The method detection limit is 0.0001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 1985. Requesting Agency 3: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 4500-P D Reference 3: JSA 1998, method 46.1.2.</p> | P ORTHO TOTAL | mg P/L | 3 |
| 15253 | <p>ORTHOPHOSPHATE – DISSOLVED</p> <p>Colourimetry with ascorbic acid</p> <p><i>NOTE: This code is reported as phosphate, otherwise method is like 15256.</i></p> <p>Pipet 50.0mL sample into a test tube or 125mL Erlenmeyer flask. Add 0.05mL phenolphthalein indicator. If a red colour develops add 5N H₂SO₄ solution dropwise to discharge the colour. Add 8.0mL combined reagent and mix thoroughly. After 10 min but no more than 30 min, measure absorbance of each sample at 660 nm, using reagent blank as the reference solution.</p> <p>Requesting Agency: Resource Quality Services, DWAF, South Africa, 2008. Reference: APHA 2012, SM 4500-P E.</p> | P ORTHO DISS | mg/L PO ₄ | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------------------|----------------------|----------|
| 15254 | <p>ORTHOPHOSPHATE SOLUBLE REACTIVE</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C (if not analysed immediately). The sample aliquot is mixed with ammonium molybdate to form the heteropoly molybdophosphoric acid and is reduced with stannous chloride, in an aqueous sulphuric acid medium, at 30°C, to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 660 nm [Japan uses 700nm], and compared to identically-prepared PO₄ standard and blank solutions.</p> <p>Interferences: Hg, at concentration of 1 mg/L, and As also interfere with the stannous chloride reagent.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 46.1.2.</p> | PO ₄ -P SOL | mg/L PO ₄ | 3 |
| 15255 | <p>ORTHOPHOSPHATE – DISSOLVED</p> <p>Colourimetry (stannous chloride method)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C (if not analysed immediately). The sample aliquot is mixed with ammonium molybdate to form the heteropoly molybdophosphoric acid and reduced with stannous chloride, in an aqueous sulphuric acid medium, at 30°C, to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 660 nm [Japan uses 700nm] and compared to identically-prepared PO₄ standard and blank solutions.</p> <p>Interferences: Hg, at concentration at 1 mg/L, and As interfere with the reduction reaction of stannous chloride. The method detection limit is 0.0002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 1979. Requesting Agency 3: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 46.1.2. Reference 3: ISO 1996, method EN 1189.</p> | P ORTHO DISS | mg/L P | 3 |
| 15256 | <p>ORTHOPHOSPHATE – DISSOLVED</p> <p>Molybdenum Blue - Ascorbic Acid Reduction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C (if not analysed immediately). The sample aliquot is mixed with ammonium molybdate, antimonyl tartrate and ascorbic acid solutions to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 880 nm and compared to identically-prepared PO₄ standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | P ORTHO DISS | mg/L P | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------------|----------------------|----------|
| 15257 | <p>ORTHOPHOSPHATE – DISSOLVED</p> <p>Colourimetry (Stannous Chloride)</p> <p>If the sample is sea water, all standard SiO₂ solutions are prepared with synthetic sea water. An unfiltered aliquot is mixed with solution of (NH₄)₆Mo₇O₂₄ in diluted H₂SO₄. The sample is then successively mixed with oxalic and ascorbic acid solutions. The resulting heteropoly blue colour is measured spectrophotometrically at 660 nm and compared with those of identically prepared standard SiO₂ solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 2328 = Silica</p> | P ORTHO DISS | mg/L PO ₄ | 3 |
| 15313 | <p>PHOSPHORUS - TOTAL INORGANIC</p> <p>Colourimetry</p> <p>A sample is preserved in the field with 0.2% H₂SO₄. The shaken sample aliquot is autoclaved with H₂SO₄ for 30 minutes at 121°C. If turbid, the aliquot is filtered on a 0.45 µm membrane filter. The aliquot is then mixed with ammonium molybdate to form the heteropoly molybdophosphoric acid and is reduced with stannous chloride, in an aqueous sulphuric acid medium, at 30°C, to form a molybdenum blue complex. The resulting molybdenum blue complex is measured spectrometrically at 660 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: Hg concentration at 1 mg/L and As. The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | P INORG AH TOTAL | mg/L P | 3 |
| 15314 | <p>PHOSPHORUS – TOTAL REACTIVE & ACID-HYDROLYZABLE</p> <p>Colourimetry</p> <p>A sample aliquot is digested by boiling gently with dilute H₂SO₄/HNO₃ solution for at least 90 minutes, and then mixed with ammonium molybdate, antimonyl tartrate and ascorbic acid solution to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 880 nm and compared to identically-prepared phosphorus standard and blank solutions. For highly coloured or turbid samples, the blank is prepared by adding all reagents except ascorbic acid and antimonyl tartrate to a duplicate sample aliquot.</p> <p>The method detection limit is 0.004 mg P/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 2004. Reference: APHA 1998, 4500-P B & E.</p> | P TOTAL React. | mg P/L | 3 |
| 15315 | <p>PHOSPHORUS - DISSOLVED REACTIVE & ACID-HYDROLYZABLE</p> <p>Colourimetry</p> <p>A sample aliquot is filtered through a 0.45 µm membrane filter. The filtrate is digested by boiling gently with dilute H₂SO₄/HNO₃ solution for at least 90 minutes, and then mixed with ammonium molybdate, antimonyl tartrate and ascorbic acid solution to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 880 nm and compared to identically-prepared phosphorus standard and blank solutions. For highly coloured or turbid samples, the blank is prepared by adding all reagents except ascorbic acid and antimonyl tartrate to a duplicate sample aliquot.</p> <p>The method detection limit is 0.004 mg P/L.</p> <p>Requesting Agency: Water Supplies Department, Hong Kong SAR, 1999. Reference: APHA 1998, 4500-P B & E.</p> | P DISS React. | mg P/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------------|----------------------|----------|
| 15363 | <p>PHOSPHATE – INORGANIC DISSOLVED</p> <p>Colourimetry (Stannous chloride)</p> <p>The sample is passed through a 0.45µ membrane filter. H₂SO₄ solution is added to a filtrate aliquot, which is then autoclaved 30 min at 121°C. The aliquot is mixed with a premixed solution of (NH₄)₆Mo₇O₂₄ and SnCl₂. The resulting molybdenum blue colour is measured spectrophotometrically at 60 mu, and compared with those of identically prepared standard phosphate ion solutions and reagent blanks.</p> <p>Interferences: Hg concentration of 1mg/L, and arsenic.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 558.</p> | P INORG. DISS | mg/L P | 3 |
| 15364 | <p>PHOSPHATE – INORGANIC DISSOLVED</p> <p>Automated Colourimetry (Aminonaphtholsulphonic Acid)</p> <p>The sample is passed through a 0.45µ membrane filter. In an autoanalyzer, the filtrate is mixed with ammonium molybdate and aminonaphtholsulphonic acid after passing through a heating bath with H₂SO₄ at 90°C.</p> <p>The detection limited is 2 µg/L.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 561.</p> | P INORG. DISS | mg/L P | 3 |
| 15365 | <p>PHOSPHATE – INORGANIC DISSOLVED</p> <p>Colourimetry (Ascorbic Acid)</p> <p>A turbid sample is decanted. Colourimetry proceeds on an autoanalyzer with ammonium molybdate and aminonaphtholsulphonic acid after passing through heating bath with H₂SO₄ at 90°C shaken sample.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 555.</p> | P INORG. DISS | mg/L P | 3 |
| 15403 | <p>PHOSPHATE - TOTAL</p> <p>Colourimetry (stannous chloride method)</p> <p>A sample is preserved in the field with 0.2% H₂SO₄. The shaken sample aliquot is autoclaved with K₂S₂O₈ and H₂SO₄ for 30 minutes at 121°C. If turbid, the aliquot is filtered through 0.45 µm membrane filter. The sample is then mixed with ammonium molybdate to form the heteropoly molybdophosphoric acid and is reduced with stannous chloride, in an aqueous sulphuric acid medium, at 30°C, to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 660 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: Hg concentration of 1 mg/L and As. The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Hong Kong, 2005. Reference: Environment Canada 1974.</p> | PO ₄ TOTAL | mg/L PO ₄ | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|--------|----------|
| 15405 | <p>PHOSPHORUS - TOTAL</p> <p>Colourimetry (stannous chloride method)</p> <p>A sample is preserved in the field with 0.2% H₂SO₄. The shaken sample aliquot is boiled with K₂S₂O₈ and H₂SO₄ for 90 minutes, maintaining the volume of the aliquot. The sample is then mixed with ammonium molybdate to form the heteropoly molybdophosphoric acid. This is reduced with stannous chloride, in an aqueous sulphuric acid medium to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 660 nm and compared to identically-prepared standard and reagent blank solutions.</p> <p>Interferences: Hg concentration of 1 mg/L and As. The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Hong Kong, 2005. Reference 1: Environment Canada 1974. Reference 2: ISO 1996, method EN 1189 Determination of phosphorus – ammonium molybdate method.</p> | P TOTAL | mg/L P | 3 |
| 15406 | <p>PHOSPHORUS TOTAL</p> <p>Colourimetry - Acid Persulphate Digestion, Ascorbic Acid method</p> <p>A sample is preserved in the field with 0.2% H₂SO₄. The shaken sample aliquot is autoclaved with K₂S₂O₈ and H₂SO₄ for 30 minutes at 121°C. If turbid, the aliquot is filtered through 0.45 µm membrane filter. The sample aliquot is mixed with ammonium molybdate, antimonyl tartrate [or antimony potassium tartrate per South Africa method] and ascorbic acid solutions to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 660 nm and compared to identically-prepared standard and blank solutions</p> <p>Interference: High iron concentrations. Also mercury chloride used as preservative interferes when the chloride levels of the sample are low (<50 mg/L). This can be overcome by spiking the samples with sodium chloride.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Mekorot National Water Company, Israel, 2012. Requesting Agency 3: South Africa, 2005. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 4500-P B and E</p> | P TOTAL | mg/L P | 3 |
| 15408 | <p>PHOSPHORUS - TOTAL</p> <p>Colourimetry</p> <p>The sample is preserved in the field with 0.2% H₂SO₄. The shaken sample aliquot is autoclaved with K₂S₂O₈ and H₂SO₄ for 30 minutes at 121°C. If turbid, the aliquot is filtered through 0.45 µm membrane filter. The sample aliquot is mixed with ammonium molybdate, antimonyl tartrate and ascorbic acid solutions to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 880 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Saskatchewan Environment, Canada, 1977. Requesting Agency 2: Belgium 2004 Reference 1: Environment Canada 1974. Reference 2: APHA 2012, method SM 4500-P F.</p> | P TOTAL | mg/L P | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|--------|----------|
| 15412 | <p>PHOSPHORUS - TOTAL</p> <p>Colourimetry (Digestion)</p> <p>H₂SO₄ and K₂S₂O₈ solutions are added to an aliquot of the shaken sample which is autoclaved 30 minutes at 121°C, then mixed with a premixed solution of (NH₄)₆Mo₇O₂₄, and SnCl₂ at 30°C. The resulting molybdenum blue colour is measured spectrophotometrically at 660 nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 563.</p> | P TOTAL | mg/L P | 3 |
| 15413 | <p>PHOSPHORUS - TOTAL</p> <p>Colourimetry (AutoAnalyzer)</p> <p>H₂SO₄ and K₂S₂O₈ solutions are added to an aliquot of a shaken sample, which is then boiled 90 min., the volume of the aliquot being maintained. Then, if turbid, the aliquot is passed through a 0.45µ membrane filter. The filtrate is mixed with premixed solution of (NH₄)₆Mo₇O₂₄ and SnCl₂. The resulting molybdenum blue colour is measured spectrophotometrically at 660 mu and compared with those of identically prepared standard phosphate ion solutions and reagent blanks.</p> <p>Interferences: Hg concentration of 1mg/L, and arsenic.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 566.</p> | P TOTAL | mg/L P | 4 |
| 15414 | <p>PHOSPHORUS - TOTAL</p> <p>Colourimetry (ANSA Reagent)</p> <p>A shaken sample is analyzed directly on a colourimetric autoanalyzer with ammonium molybdate and aminonaphtholsulphonic acid (ANSA reagent) after 30 min in an autoclave with H₂SO₄ and K₂S₂O₈.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 575.</p> | P TOTAL | mg/L P | 3 |
| 15416 | <p>PHOSPHORUS – DISSOLVED</p> <p>Colourimetry - Acid Persulphate Digestion</p> <p>Acid persulphate digestion followed by automated colorimetric molybdate stannous chloride method.</p> <p>To convert data from PO₄ to P, use the following conversion formula: $P \text{ (mg/L)} = 0.326 * PO_4 \text{ (mg/L)}$</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference 1: Environment Canada 2007, Great Lakes STAR code 264. Reference 2: Philbert and Traversy 1973.</p> | P DISS | mg/L P | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|--------|----------|
| 15417 | <p>PHOSPHORUS DISSOLVED</p> <p>Colourimetry (Ascorbic acid)</p> <p>A sample is filtered in the field through a pre-cleaned 0.80 µm glass fibre filter and preserved with 0.2% H₂SO₄ (or CHCl₃ at 4°C). The sample aliquot is digested with H₂SO₄ and (NH₄)₂S₂O₈ or K₂S₂O₈ solutions, and mixed with ammonium molybdate, antimonyl tartrate and ascorbic acid solutions to form a molybdenum blue complex. The resulting blue colour is measured spectrometrically at 880 nm (or 670 nm if a filter photometer is used) and compared to identically-prepared phosphorus standard and blank solutions.</p> <p>The method detection limit is 0.01 mg P/L.</p> <p>Requesting Agency 1: International Joint Commission, 1987 Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 2003 Requesting Agency 3: NIES, Japan, 1998. Reference 1: APHA 2012, SM 4500-P B and E. Reference 2: JSA 1998, method 46.3.1. Reference 3: Semyonov 1977. Reference 4: Hydrometeoizdat 1999.</p> | P DISS | mg P/L | 3 |
| 15423 | <p>TOTAL PHOSPHORUS</p> <p>Perchloric acid digestion</p> <p>Requesting Agency: Resource Quality Services, DWAF, South Africa, 2008. Reference:</p> | P TOTAL | mg/L P | 3 |
| 15424 | <p>TOTAL PHOSPHORUS</p> <p>Continuous Flow Stream Analysis with Potassium peroxodisulfate decomposition</p> <p>A sample is filtered and used as a test solution. 10 mL of potassium peroxodisulfate solution is added to a 50mL sample. The container holding the sample is stoppered, shaken to mix, and placed in a high pressure steam sterilizer to decompose the sample by heating for 30 min at 120°C and a pressure of 0.12 MPa. After cooling, 25 mL of the supernatant of the sample solution is used as the test solution. 2 mL of a color reagent is added, and the solution is then shaken and left to stand at 20–40°C for 15 min. The absorbance at wavelength 880 nm is measured by a photoelectric spectrophotometer and compared to a series of phosphorus standard solutions, which are prepared by sequentially diluting a concentrated standard solution.</p> <p>Requesting Agency: Japan, 2013 Reference: JWVA 2001, VI-2 9.3</p> | P TOTAL | mg/L P | 3 |
| 15463 | <p>PHOSPHORUS - DISSOLVED PHOSPHATE</p> <p>Colourimetry (AutoAnalyzer)</p> <p>Colourimetry on an autoanalyzer with ammonium molybdate and SnCl₂.</p> <p>The sample is passed through a 0.45µ membrane filter. H₂SO₄ and K₂S₂O₈ solutions are added to an aliquot of the shaken sample which is autoclaved 30 min. at 121°C. The sample is then mixed with a solution of (NH₄)₆Mo₇O₂₄ and SnCl₂, at 30°C. The resulting molybdenum blue colour is measured spectrophotometrically at 660 nm and compared with those of identically prepared standard phosphate ion solutions and reagent blanks. Interferences: Hg concentration at 1 mg/L, arsenic.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 564.</p> | P DISS | mg/L P | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|--------|----------|
| 15701 | <p>PHOSPHORUS – DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.2 µm membrane filter. The sample aliquot is injected into an eluent stream, pumped through a separator column packed with anion exchange resin in the form of $\text{CO}_3^{2-}/\text{HCO}_3^-$. The nitrate is separated, based on its affinity for the exchange sites of the resin bed. A suppressor reduces the background conductivity of the eluent and the concentration of nitrate is measured using a conductivity detector. The anion is identified by its retention time and its concentration by its peak height or area and compared to identically-prepared standard and blank solutions. Sample concentrations exceeding the linear range are diluted and re-run.</p> <p>Requesting Agency: ORE-HYBAM (CFP), 2006. Reference: Pfaf 1993, (EPA method 300).</p> | P DISS | mg P/L | 3 |
| 15901 | <p>PHOSPHORUS - PARTICULATE</p> <p>Difference calculation</p> <p>The difference between total phosphorus (method code 15406) and dissolved phosphorus (method code 15103), filtered through a 0.45 µm membrane filter, is used to report the particulate phosphorus concentration in a water sample.</p> <p>$PP = TP - DP$</p> <p>PP = Particulate Phosphorus TP = Total Phosphorus DP = Dissolved Phosphorus</p> <p>The method detection limit is 0.003 mg/L.</p> <p>Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: n/a.</p> | P PART | mg P/L | 3 |
| 15902 | <p>PHOSPHORUS TOTAL PARTICULATE</p> <p>Difference calculation</p> <p>The difference between the total phosphorus (method code 15408) and dissolved phosphorus (method code 15417) is used to report the phosphorus particulate concentration in a water sample.</p> <p>$PP = TP - DP$</p> <p>PP = Particulate Phosphorus TP = Total Phosphorus DP = Dissolved Phosphorus</p> <p>Caution: These calculated results are computed from measured analytical values according to the formula indicated. The computations may be in error if the parameters used in the calculation are subsequently edited or changed.</p> <p>Requesting Agency: Alberta Environment, Canada, 1980. Reference: n/a</p> | P TOTAL PART. | mg P/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------------|----------------------|----------|
| 15903 | <p>PHOSPHORUS TOTAL PARTICULATE</p> <p>Acid-Extraction Colourimetry</p> <p>A sample is filtered through a glass fibre filter paper. The filter paper is ignited at low temperature and then acid extracted to dissolve the particulates. The extract is reacted with ammonium molybdate and ascorbic acid to form a molybdenum blue complex, measured colourimetrically at 660 nm and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: Environment Canada, FWI/ELA Field Laboratory, 1984. Reference: Environment Canada 1994.</p> | P TOTAL PART. | µg/g | 3 |
| 15904 | <p>PHOSPHORUS TOTAL PARTICULATE</p> <p>Colourimetry</p> <p>A water sample is filtered through a glass fibre filter (GF/F) heat-treated at 400°C in advance. K₂S₂O₈ solution is added to the suspended matter and the solution autoclaved for 30min at 121°C. To make a molybdenum blue complex, ammonium molybdate, antimonyl tartrate, and ascorbic acid are added to the digested sample. The resulting blue colour is measured spectrometrically at 880nm, and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002mg/L.</p> <p>Requesting Agency: NIES, Japan, 2013 Reference 1: JSA 1998, method JIS K0102 46.3.1 Reference 2: JWVA 2001 method VI-2 9.2.1</p> | P TOTAL PART. | mg/L | 3 |
| 16031 | <p>SULPHATE</p> <p>Colourimetry by Wagtech photometer</p> <p>The Palintest Sulphate test is based on a single tablet reagent containing barium chloride in a slightly acidic formulation. Barium salts react with sulphates to form insoluble barium sulphate. Fill test tube with sample to the 10 ml mark. Add one Sulphate Turb tablet, crush and mix to dissolve. A cloudy solution indicates the presence of sulphate. Stand for five minutes then mix again to ensure uniformity. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 200 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions SULPHATE</p> | SO ₄ | mg/L SO ₄ | 0 |
| 16301 | <p>SULPHATE</p> <p>Gravimetric Method</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sulphate in the sample aliquot is precipitated in an HCl medium as barium sulphate by the addition of barium chloride. After a period of digestion, near the boiling point, the precipitate is filtered, washed, ignited, and weighed as BaSO₄.</p> <p>The method detection limit is 1.0 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1975.</p> | SO ₄ DISS | mg/L SO ₄ | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------------|----------------------|----------|
| 16302 | <p>SULPHATE - DISSOLVED</p> <p>Turbidimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sulphate in a sample aliquot is precipitated in a hydrochloric acid medium with barium chloride, in the presence of ethanol and glycerine (or ethylene glycol). The absorbance of the barium sulphate suspension is measured by a photometer at 315 nm and the sulphate concentration is compared to a calibration curve from identically-prepared standard and blank solutions.</p> <p>Interference: Colour and/or suspended matter in large amounts, silica at concentrations greater than 200 mg/L will interfere. Organic matter may also interfere.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: GHI, Russian Federation, 2004. Reference 1: APHA 2012, SM 4500-SO₄²⁻ E. Reference 2: Japanese Waterworks Analytical Method (2001) VI-2 7.3 Reference 3: Semyonov 1977. Reference 4: Hydrometeoizdat 1999.</p> | SULPHATE - DISS | mg/L SO ₄ | 1 |
| 16303 | <p>SULPHATE - DISSOLVED</p> <p>Titration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C.</p> <p><u>Method A.</u> The sample aliquot is passed through a strongly acidic cation exchange resin. Thorin (<i>See Appendix 6</i>), used as an indicator, and 95% ethanol is added to the eluent. The pH of the eluent is adjusted between 3.8 and 4.0 with 1% NH₄OH and 1% HCl solution and titrated with a barium chloride solution until the sample turns just pink.</p> <p><u>Method B.</u> The sample aliquot is mixed with 5-10g of strongly acidic cation exchange resin for 10 min. 10 mL of the solution is mixed with 15 ml of 95% ethanol. Orphanilic K [2-(2-sulphophenylazo)-7-(2-carboxyphenylazo)-1,8-dihydroxynaphthalene-3,6-disulphonic acid trisodium salt] is used as an indicator. The pH of the sample is adjusted between 3.8 and 4.0 with NaOH or HCl solution and titrated with a barium chloride solution, until the sample turns dark blue-violet into light blue-green.</p> <p>Method C. The sample aliquot is mixed with 5-10 g of strongly acidic cation exchange resin for 10 min. Then 10 ml of this sample is mixed with 15 ml of 95% ethanol or acetone. Dithizone is used as an indicator and titration is with a lead nitrate solution until the sample turns dark blue-green into red-violet.</p> <p>In each method, the test aliquot results are compared against identically-prepared standard and blank solutions.</p> <p>Interference: Chloride ion concentration of 1000 mg/L or more. The method detection limit is 1.0 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: GHI, Russian Federation, 2004. Reference 1: Environment Canada 1974. Reference 2: Semyonov 1977. Reference 3: Hydrometeoizdat 1999.</p> | SULPHATE - DISS | mg/L SO ₄ | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------|----------------------|----------|
| 16304 | <p>SULPHATE - DISSOLVED</p> <p>Autoanalyzer</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sulphate in the sample aliquot is precipitated in a hydrochloric acid medium with barium chloride. The transmittance of the barium sulphate suspension is measured spectrometrically at 420 nm [Japan measures at 430 nm] and the sulphate concentration is compared against identically-prepared standard and blank solutions.</p> <p>Interference: Colour and/or suspended matter in large amounts, silica in concentration greater than 500 mg/L will interfere. Organic matter may also interfere.</p> <p>The method detection limit is 5 mg/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1975. Reference 2: JWWA 2001, method VI-2 7.3</p> | SULPHATE - DISS | mg/L SO ₄ | 0 |
| 16306 | <p>SULPHATE - DISSOLVED</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. SO₄ ions from the sample aliquot are reacted with an equimolar solution of BaCl₂ and methylthymol blue at pH 2.3 - 3.0 producing barium sulphate. The pH is raised to 12.5 - 13.0 and the excess Ba ions in solution complex with the methylthymol blue to produce a blue colour, leaving a grey uncomplexed methylthymol blue in solution. The absorbance of the excess methylthymol blue, equivalent to the concentration of sulphate removed, is measured at 460 nm and compared to identically-prepared standard and blank solutions. (See Appendix 6).</p> <p>The method detection limit is 0.2 mg/L.</p> <p>Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, NWRI, 1974. Reference: Environment Canada 1979.</p> | SULPHATE - DISS | mg/L SO ₄ | 0 |
| 16307 | <p>SULPHATE</p> <p>Colourimetry (Unfiltered)</p> <p>The sulphate ion is reacted with an equimolar solution of BaCl₂ and methylthymol blue at pH 2.3-3.0 to produce barium sulphate. The pH is raised to 12.5-13 where excess Ba reacts with the methylthymol blue. The absorbance of uncomplexed methylthymol blue (which is proportional to the amount of sulphate removed as barium sulphate at low pH) is measured at 460 nm.</p> <p>Note: in the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 2007, ENVIRODAT code 615.</p> | SULPHATE | mg/L SO ₄ | 1 |
| 16308 | <p>SULPHATE</p> <p>Ultraviolet - Visible Spectrophotometry</p> <p>Requesting Agency: Bangladesh CFP, 2012 Reference:</p> | SULPHATE | mg/L SO ₄ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--|---------------------------------------|----------|
| 16309 | <p>SULPHATE - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is injected into a flowing carbonate eluent stream, passed through separator and suppressor columns packed with low capacity anion exchange resin. The sulphate is separated, based on its affinity for the exchange sites, and the background conductivity of the eluent is reduced to a negligible level by being converted to its acid form. An ion chromatogram of response (conductivity) against retention time is generated. Sulphate is identified by its retention time compared to known standards and quantitation is accomplished by comparison against a calibration curve generated from known standards.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1980. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 2001. Requesting Agency 3: NIES, Japan, 1998. Requesting Agency 4: Sri Lanka 2005 Reference 1: Environment Canada 1994. Reference 2: US-EPA 1999. Reference 3: JSA 1998, method 41.3.</p> | SULPHATE - DISS | mg/L SO ₄ | 0 |
| 16502 | <p>THIOSULPHATE – TOTAL</p> <p>Titration</p> <p>The thiosulfate anion is oxidized to tetrathionate in weakly acid iodine solution: $2\text{S}_2\text{O}_3^{-2} + \text{I}_2 = \text{S}_4\text{O}_6^{-2} + 2\text{I}^-$ Then the thiosulfate anion is titrated with 0.01N iodine solution using thyodene or British drug house indicator (catalogue No. 20054).</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 621.</p> | S ₂ O ₃ TOTAL | mg/L S ₂ O ₃ | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 17031 | <p>CHLORIDE – TOTAL</p> <p>Colourimetry by Wagtech photometer)</p> <p>The Palintest Chloridol test is based on a tablet reagent system containing silver nitrate. Chlorides react with the silver nitrate to produce insoluble silver chloride. Select sample volume for testing as follows:</p> <p>(a) For Testing Boiler Condensate and Softened Waters (Range 0 - 50 mg/l Cl), fill test tube with sample to the 10 ml mark.</p> <p>(b) For Testing Natural Waters, Swimming Pools and Boiler Waters (Range 0 - 500 mg/l Cl), use the the measuring syringe to take 1 ml of sample. Transfer to the test tube and make-up to the 10 ml mark with deionised water.</p> <p>(c) For Testing Salt Chlorinator Treated Swimming Pools (Range 0 - 10,000 mg/l NaCl), use the measuring syringe to take 0.5 ml of sample. Transfer to the sample container (PT 510) then make-up to the 100 ml mark with deionised water. Cap tube and mix. Fill test tube to the 10 ml mark with solution from the sample container.</p> <p>(d) For Testing Sea Water and Brackish Waters (Range 0 - 50,000 mg/l NaCl), use the measuring syringe to take 0.1 ml of sample. Transfer to the sample container (PT 510) then make-up to the 100 ml mark with deionised water. Cap tube and mix. Fill test tube to the 10 ml mark with solution from the sample container.</p> <p>Add one Acidifying CD tablet, crush and mix to dissolve. Add one Chloridol tablet, allow the tablet to disintegrate for two minutes then crush any remaining particles and mix. A cloudy solution indicates the presence of chloride. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 50 mg/l Cl and 0 – 50,000 mg/l NaCl</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions CHLORIDE (CHLORIDOL)</p> | Cl TOTAL | mg Cl/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 17201 | <p>CHLORIDE - DISSOLVED</p> <p>Titration (Mercuric Nitrate)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. If the total alkalinity of the sample aliquot is < 150 mg/L, add a diphenylcarbazone acidifier indicator (<i>see Appendix 6</i>) and 10 mg of sodium bicarbonate to bring the pH to 2.5 ± 0.1 (error of about 1% per 0.1 pH unit change) and titrate with a standardized mercuric nitrate solution to a blue colour end-point. The measurements are then compared to identically-prepared standard and blank solutions.</p> <p>In the Russian methods, the filtered sample aliquot, containing no more than 0.8 mg of chlorides, is evaporated to dryness on a water bath. The precipitate is dissolved in 0.5 ml of a nitric acid solution, and 2 ml of ethanol is added. A mixed indicator (diphenylcarbazone + bromphenol blue) is added, the pH is adjusted to 2.5 ± 0.1 using NaOH or HNO₃ solutions. Titration is with a standardized mercuric nitrate solution up to colour turning from yellow into violet.</p> <p>For high chloride concentrations, dilute the sample aliquot (use no more than 5 mL of titrant), add 0.5 mL of mixed indicator (<i>See Appendix 6</i>) and agitate (the colour should be purple). Add 0.1 N nitric acid drop-wise until colour turns to yellow and titrate with standardized mercuric nitrate to the first permanent dark purple colour. The measurements are then compared to identically-prepared standard and blank solutions.</p> <p>Interference: Bromide and iodide are also titrated with mercuric chloride; chromate, ferric and sulphite ions interfere if the concentrations are greater than 10 mg/L. The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: GHI, Russian Federation, 2004. Reference 1: APHA 1975, SM 4500-Cl⁻ C Reference 2: Semyonov 1977. Reference 3: Hydrometeoizdat 1999.</p> | Cl DISS | mg/L Cl | 0 |
| 17202 | <p>CHLORIDE – DISSOLVED</p> <p>Potentiometric (Silver nitrate)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. Neutralise the sample aliquot with nitric acid and add 2.0 mL in excess. Measure, by potentiometric titration, using a silver nitrate solution with a calibrated glass and silver-silver chloride electrode system. An electronic voltmeter detects the change in potential between the electrodes. The end point of the titration is when the instrument reads the greatest change in voltage for a small and consistent addition of silver nitrate (if the exact end point cannot be determined, plot the differential titration curve to inspect the data: plot the change in instrument reading for equal increments against the volume of silver nitrate added).</p> <p>Interference: Bromide and iodide are titrated as chloride; ferricyanide causes high results and needs to be removed; chromate and dichromate should be reduced to chromic state; iron interferes if present in concentration greater than chloride. The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 2012, SM 4500-Cl⁻ D</p> | Cl DISS | mg/L Cl | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 17203 | <p>CHLORIDE - DISSOLVED</p> <p>Colourimetry (Thiocyanate method)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The method is based on the displacement of thiocyanate ion (SCN) from mercuric thiocyanate (III) by chloride ion and the subsequent reaction of the liberated thiocyanate with ferric ion, from an acidified (nitric acid) ferric ammonium sulphate solution, forming a coloured complex with ferric thiocyanate. This colour is proportional to the original chloride concentration and is measured spectrometrically at 480-490 nm. The sample is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: United Kingdom, 2005. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 4500-Cl E Reference 3: Merck method 14897.</p> | Cl DISS | mg/L Cl | 0 |
| 17204 | <p>CHLORIDE - DISSOLVED</p> <p>Argentometric Titration (Silver Nitrate)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. If a sample aliquot is highly coloured, add Al(OH)₃ suspension, mix, let settle and filter; if sulphide, sulphite or thiosulphate is present, add H₂O₂ and stir for one minute. The pH of the sample should be between 7 and 10 (if not, adjust with diluted sulphuric acid, sodium hydroxide, or sodium carbonate). Titrate with a standardized silver nitrate solution, using potassium chromate (<i>See Appendix 6</i>) as an indicator, to a pinkish yellow end point and compare to identically-prepared standard and blank solutions.</p> <p>Interference: Bromide, cyanide and iodide interfere as equivalent chloride concentrations. Soluble reactive phosphorus in excess of 25 mg/L precipitates as silver phosphate. Iron greater than 10 mg/L masks the end point.</p> <p>Calculation: $\text{mg Cl/L} = \frac{(A - B) \times N \times 35.450}{\text{mL sample}}$</p> <p>A = mL of titrant for sample B = mL of titrant for blank N = normality of silver nitrate (mg/L NaCl = mg/L Cl x 1.65).</p> <p>The method detection limit is 5 mg Cl/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: Water Supplies Department, Hong Kong SAR, 2001. Requesting Agency 3: NIES, Japan, 1998. Requesting Agency 4: CEA Laboratory, Sri Lanka 2010. Reference 1: APHA 1998, 4500-Cl B. Argentometric Method. Reference 2: Japan MHLW 2003 Notification No.261 Appendix 31. Reference 3: JWVA 2001, method VI-2 4.3.</p> | Cl DISS | mg Cl/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 17205 | <p>CHLORIDE - DISSOLVED</p> <p>Specific Ion Electrode</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is mixed with an ionic strength adjustor and read on a calibrated specific ion meter. The sample aliquot is consistently and slowly stirred and the Cl ion concentration is read at the same temperature as the standard solutions (a difference of 1°C will result in a 2% error) and compared to identically-prepared standard and blank solutions (the electrode should be calibrated hourly to ensure reproducibility).</p> <p>Interference: Temperature differences between sample aliquot and standard solutions must be carefully controlled.</p> <p>A surface layer of silver may be formed by reducing salts when the electrode needs to be polished. Mercury must be absent, and complexing chloride agents reduce the chloride concentration, as only free ions are measured. The method detection limit is 1.0 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Man/Tech Associates Co Ltd. 1998.</p> | Cl DISS | mg/L Cl | 0 |
| 17206 | <p>CHLORIDE – DISSOLVED</p> <p>Colourimetry (Autoanalyzer)</p> <p>The whole water sample is passed through a 0.45µ membrane filter. An aliquot of the filtrate is mixed with a solution containing mercuric thiocyanate [Hg(SCN)₂] and ferric nitrate [Fe(NO₃)₃]. The chloride ion (Cl⁻) in the sample reacts with mercuric thiocyanate resulting in the formation of the soluble mercuric chloride (HgCl₂) and the displacement of the thiocyanate ion (SCN⁻). A subsequent reaction of the liberated thiocyanate ion with ferric ion (Fe³⁺) forms the coloured complex ferric thiocyanate (Fe(SCN)²⁺). The absorbance of light by the complex is measured spectrophotometrically at 480 nm wavelength and represents the concentration of chloride in the sample. Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 630.</p> | Cl DISS | mg/L Cl | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 17207 | <p>CHLORIDE DISSOLVED</p> <p>Ion Exchange</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is split in two fractions, each being passed through an ion exchange column. In Column 1, a strong acid cation resin exchanges the sample aliquot cations for H ions. The H ion concentration in the effluent is equivalent to Cl + SO₄ ion concentrations and is measured by conductivity. Column 2 contains a two-step resin bed. In the first stage, the sample aliquot cations are exchanged for Ag ions to precipitate the Cl ions as AgCl. In the second stage, the Ag ions are exchanged for H ions. The resulting effluent is identical to that of Column 1 except that HCl has been removed. Thus the H ions concentration, measured by conductivity, in the effluent from Column 2 is equivalent to SO₄ ions concentration. The difference in H ion concentration is calculated by subtracting Column 2 from Column 1 and is equivalent to Cl ion concentration. The conductance measurements are compared to identically-prepared standard and blank solutions.</p> <p>Interference: Corrections must be made when NO₃, PO₄ and F⁻ ions are present in significant amounts. At 10 mg/L Cl ions level the standard deviation was 0.15 mg/L. The method detection limit is 1.0 mg/L</p> <p>Requesting Agency: DFO-FWI, Canada, 1978. Reference: n/a.</p> | Cl DISS | mg/L Cl | 0 |
| 17208 | <p>CHLORIDE – TOTAL</p> <p>Colourimetry (Unfiltered)</p> <p>An aliquot of the whole water sample is mixed with a solution containing mercuric thiocyanate [Hg(SCN)₂] and ferric nitrate [Fe(NO₃)₃]. The chloride ion (Cl⁻) in the sample reacts with mercuric thiocyanate resulting in the formation of the soluble mercuric chloride (HgCl₂) and the displacement of the thiocyanate ion (SCN⁻). A subsequent reaction of the liberated thiocyanate ion with ferric ion (Fe³⁺) forms the coloured complex ferric thiocyanate (Fe(SCN)²⁺). The absorbance of light by the complex is measured spectrophotometrically at 480 nm wavelength and represents the concentration of chloride in the sample. Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 630.</p> | Cl TOTAL | mg/L Cl | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 17209 | <p>CHLORIDE - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is injected into an eluent stream, passed through separator and suppressor columns packed with low capacity anion exchange resin. The chloride is separated, based on its affinity for the exchange sites, and the background conductivity of the eluent is reduced to a negligible level by being converted to its acid form. The concentration is measured by conductivity and identified by its retention time. The sample is compared to identically-prepared standard and blank solutions.</p> <p>Interferences from ions with similar retention time and large concentration of an adjacent anion are usually removed by dilution; particulate matter can clog the separator column, causing sluggish instrument performance. The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: CEA Laboratory, Sri Lanka 2004. Reference 1: Environment Canada, 1994 Reference 2: JSA 1998, method 35.3. Reference 3: Japan MHLW 2003, Notification No.261 Appendix 13 Reference 4: APHA1998, SM 4110 B.</p> | Cl DISS | mg/L Cl | 0 |
| 17211 | <p>CHLORIDE - TOTAL</p> <p>Colourimetry (Thiocyanate method)</p> <p>A sample is preserved at 4°C. The method is based on the displacement of thiocyanate ion (SCN) from mercuric thiocyanate (III) by chloride ion and the subsequent reaction of the liberated thiocyanate with ferric ion, from an acidified (nitric acid) ferric ammonium sulphate solution, forming a coloured complex with ferric thiocyanate. This colour is proportional to the original chloride concentration and is measured spectrometrically at 480-490 nm. The sample is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency: Belgium, 2005. Reference: APHA 2012, SM 4500-Cl⁻ E.</p> | Cl TOTAL | mg/L Cl | 0 |
| 17805 | <p>PENTACHLOROPHENOL</p> <p>Gas chromatography – electron capture detection (GC-ECD)</p> <p>After preparing the chromatograph by packing the column, proper thermal and pesticide conditioning, developing a proper injection technique, and running the calibration procedure. Collect and extract the sample then inject 3-4 µL of extract solution into a packed column or 1 µL on a fused silica capillary column. Proceed with magnesia-silica gel cleanup and determine extraction efficiency.</p> <p>Requesting Agency: Belgium (Flemish Region), 2005. Reference: APHA 2012, SM 6630 B.</p> | PCP | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------------------|-------|----------|
| 17860 | <p>ORGANOCHLORINE COMPOUNDS TOTAL</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to each retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.01 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, November 1984. Reference: Chau 1972.</p> | ORGANO CL CMPDS | µg/L | 3 |
| 18000 | <p>p,p'-DDT</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1984. Reference 1: Chau 1972. Reference 2: APHA 2012 SM 6630 B</p> | P,P-DDT | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|-------|----------|
| 18002 | <p>DDT - TOTAL</p> <p>Gas Chromatography (dual GC-ECD)</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivitization techniques, thin layer chromatograpgy (TLC), or mass spectrometry (MS).</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency: International Joint Commission (Canada –US), 1987. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | DDT TOTAL | µg/L | 3 |
| 18005 | <p>o,p'-DDT</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency: Environment Canada, 1978. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | O,P-DDT | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|-------|----------|
| 18010 | <p>p,p'-DDD</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>Alternate name: p,p'-TDE</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1984. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | P,P-DDD | µg/L | 3 |
| 18015 | <p>o,p'-DDD</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>Alternative name: o,p'- TDE</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency: Environment Canada, 1978. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | O,P-DDD | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------------|-------|----------|
| 18020 | <p>p,p'-DDE</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency: Environment Canada, 1978. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | P,P-DDE | µg/L | 3 |
| 18025 | <p>o,p'-DDE</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or 2-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | O,P-DDE | µg/L | 3 |
| 18030 | <p>p,p'-METHOXYCHLOR</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference 1: Environment Canada 1995, ENVIRODAT code 718. Reference 2: APHA 2012, SM 6630 B</p> | P,P-METHOXYCHLOR | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------------|-------|----------|
| 18040 | <p>HEPTACHLOR</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference 1: Environment Canada 1995, ENVIRODAT code 718. Reference 2: APHA 2012, SM 6630 B</p> | HEPTACHLOR | µg/L | 3 |
| 18045 | <p>HEPTACHLOR EPOXIDE</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference 1: Environment Canada 1995, ENVIRODAT code 718. Reference 2: APHA 2012, SM 6630 B</p> | HEPTACHLOR EPOXIDE | µg/L | 3 |
| 18050 | <p>ENDOSULPHAN - ALPHA</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 2007. Requesting Agency 2: India, 2008 Reference 1: Environment Canada 1995, ENVIRODAT code 718. Reference 2: APHA 2012, SM 6630 B</p> | ENDOSULPHAN - ALPHA | µg/L | 3 |
| 18055 | <p>ENDOSULPHAN - BETA</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 2007. Requesting Agency 2: India, 2008 Reference 1: Environment Canada 1995, ENVIRODAT code 718. Reference 2: APHA 2012, SM 6630 B</p> | ENDOSULPHAN - BETA | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------------------------|-------|----------|
| 18060 | <p>CHLORDANE – ALPHA (CIS)</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 718.</p> | CHLORDAN E - BETA | µg/L | 3 |
| 18065 | <p>CHLORDANE – Gamma (trans)</p> <p>Gas Chromatography (GC-ECD)</p> <p>A 1 litre sample is extracted by benzene or hexane, and the extract dried, concentrated and cleaned up on a Florisil column for the preliminary separation. The eluates are concentrated, and injected into a gas chromatograph using electron capture detection. The pesticide is confirmed qualitatively by thin layer chromatography (TLC) and measured quantitatively by comparing the non-solvent areas of the chromatogram to those of standard solutions of the purified pesticide.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 718.</p> | CHLORDAN E – GAMMA (TRANS) | µg/L | 3 |
| 18070 | <p>LINDANE (γ – BHC, gamma-BHC)</p> <p>Gas Chromatography with Electron Capture Detection (GC-ECD)</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual-column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency 1: Environment Canada, 1978. Requesting Agency 2: Belgium (Flemish Region), 2005. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | LINDANE | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|-----------|----------|
| 18073 | <p>DELTA-BHC (δ-BHC)</p> <p>Gas Chromatography</p> <p>After preparing the chromatograph by packing the column, proper thermal and pesticide conditioning, developing a proper injection technique, and running the calibration procedure. Collect and extract the sample then inject 3-4 μL of extract solution into a packed column or 1 μL on a fused silica capillary column. Proceed with magnesia-silica gel cleanup and determine extraction efficiency.</p> <p>Requesting Agency: Belgium (Flemish Region), 2005. Reference: APHA 2012, SM 6630 B.</p> | DELTA-BHC | μ g/L | 3 |
| 18075 | <p>ALPHA-BHC</p> <p>Gas Chromatography</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or 2-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required. The method detection limit is 0.001 μg/L.</p> <p>Requesting Agency: Environment Canada, NWRI, 1978. Reference 1: Environment Canada 1974. Reference 2: APHA 2012, SM 6630 B</p> | ALPHA-BHC | μ g/L | 3 |
| 18078 | <p>BETA-BHC (β-BHC)</p> <p>Gas Chromatography</p> <p>Collect and extract the sample then inject 3-4 μL of extract solution into a packed column or 1 μL on a fused silica capillary column. Proceed with magnesia-silica gel cleanup and determine extraction efficiency.</p> <p>Requesting Agency: Belgium (Flemish Region), 2006. Reference: APHA 2012, SM 6630 B.</p> | BETA-BHC | μ g/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------|-------|----------|
| 18125 | <p>MIREX</p> <p>Gas Chromatography (GC-ECD)</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 1980. Requesting Agency 2: IJC PLUARG, 1987. Reference 1: Environment Canada 1974. Reference 2: APHA 2005, SM 6630 B</p> | MIREX | µg/L | 3 |
| 18130 | <p>ALDRIN</p> <p>Gas Chromatography (GC-ECD)</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency 1: Environment Canada, 1978. Requesting Agency 2: Belgium 2005. Reference 1: Environment Canada 1974. Reference 2: APHA 2005, SM 6630 B.</p> | ALDRIN | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|-------|----------|
| 18140 | <p>ENDRIN</p> <p>Gas Chromatography (GC-ECD)</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.001 µg/L.</p> <p>Requesting Agency 1: Environment Canada, 1978. Requesting Agency 2: Belgium 2005. Reference 1: Environment Canada 1974. Reference 2: APHA 2005, SM 6630 B.</p> | ENDRIN | µg/L | 3 |
| 18150 | <p>DIELDRIN</p> <p>Gas Chromatography (GC-ECD)</p> <p>A sample is extracted three times in benzene or hexane. Add saturated sodium sulphate, methanol, iso-propanol or two-octanol to break down the emulsions. Add iso-octane and concentrate the combined extract, using a rotary evaporator flask. The extract is loaded on a Florisil® column and four separate fractions are eluted using hexane, 6% ethyl ether in petroleum ether, 15% ethyl ether in petroleum ether, then 50% ethyl ether in petroleum ether or chloroform. Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, TLC, or Mass Spectrometry.</p> <p>Interference: Other pesticide residues and their degradation products or metabolites and organic compounds, other than OCs and PCBs, may interfere. As many of these compounds cannot be separated, confirmation is required.</p> <p>The method detection limit is 0.005 µg/L.</p> <p>Requesting Agency 1: Environment Canada, 1978. Requesting Agency 2: Belgium 2005. Reference 1: Environment Canada 1974. Reference 2: APHA 2005, SM 6630 B.</p> | DIELDRIN | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|-------|----------|
| 18165 | <p>PCBs</p> <p>Gas Chromatography (GC-ECD) with benzene extraction</p> <p>A sample aliquot is extracted three times with benzene. The extract is loaded on a Florisil® column and eluted using 15% dichloromethane in hexane. Concentrate in a rotary flask, transfer to graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area. A gas chromatograph equipped with a mass selective detector (GC/MSD) is used for confirmation.</p> <p>Interference: All solvents are checked for background interference. The method detection limit is 0.1 µg/L.</p> <p>Requesting Agency: Environment Canada, NWRI, 1985. Reference: Environment Canada 1979.</p> | PCBs | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------|-------|----------|
| 18166 | <p>PCBs</p> <p>Gas Chromatography with hexane extraction</p> <p>A sample is transferred to a separatory funnel, hexane is added, and after shaking for approximately 10 min, left to stand. The aqueous layer is removed, the same procedure is repeated with this aqueous layer, and the hexane layer is transferred to separatory funnel. Next, the hexane layer is dehydrated by passing through sodium sulfate (anhydrous), and then the sample is concentrated with a concentrator. A solution of potassium hydroxide in ethanol is added, and a reflux condenser is attached and heated for approximately 1 h in a boiling water bath to break down interfering substances. The apparatus is then left to stand and cool to approximately 50°C. Hexane is added, the solution is shaken, and left to stand and cool to room temperature. The solution is transferred to a separatory funnel, purified water and a mixture of hexane and ethanol are added and after shaking, the mixture is left to stand. The water layer is removed and after carrying out extraction in the same manner, the hexane layer is transferred to. Additionally, the hexane layer is washed by adding water and vigorously shaking. This washing procedure is repeated three times. The washed hexane layer is dehydrated with sodium sulfate (anhydrous), and then concentrated with a concentrator. The concentrated solution is gently transferred to a chromatography column packed with silica gel or Florisil and sodium sulfate (anhydrous). A separatory funnel containing hexane is fitted to the top of the chromatography tube, and hexane is poured from the separatory funnel. The flow rate of the discharge of eluent from the column is set at 1 drop per second, and a portion of the discharged eluent is collected in a container such that all PCBs, but no chlorinated organic compounds other than PCBs and DDE are collected. This portion of collected eluent is concentrated to 5 mL or less with a concentrator, and hexane is added to bring the volume up to 5 mL. The PCB standard solution is injected into a gas chromatograph using a micro syringe, and peak numbers are assigned to the peaks in the obtained chromatogram. Next, the peak height (mm) of each peak is read, and K value of each peak is calculated from the following equation using the recorded height (H1) together with the CB0 (%) value corresponding to the peak number of each peak obtained from the attached table.</p> $K = CB0(\%) / H1$ <p>Similarly, the concentrate of the treated sample obtained through the steps above is injected into the gas chromatograph, and the same peak numbers are assigned to the peaks in the sample chromatogram as the corresponding peak numbers of the peaks in the PCB standard chromatogram determined from their peak positions. Next, the peak height (mm) of each peak is read, and the CB2 (%) value is obtained based on the following equation with the recorded height (H2) and the K value corresponding to the relevant peak number.</p> $CB2(\%) = K \times H2$ <p>From the above results, the sample PCB concentration (mg/L) is calculated using the following equation.</p> $PCB \text{ concentration (mg/L)} = \text{Concentration of PCB standard solution (mg/L)} \times \frac{\text{volume of PCB standard solution injected (\mu L)}}{\text{volume of sample solution injected (\mu L)}} \times \frac{\sum CB2(\%)}{\sum CB0(\%)} \times \frac{\text{volume of sample solution (mL)}}{\text{volume of sample used (mL)}}$ <p>Requesting Agency: NIES, Japan 2013 Reference 1: Japan MoE 1971, Notification No. 59 Table No.3 Reference 2: JWVA 2001, method VI-4 22.2</p> | PCBs | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|-------|----------|
| 18414 | <p>ATRAZINE - TOTAL</p> <p>Solid Phase Extraction (SPE)-Derivatization - Gas Chromatography (SPE-GC-MS)</p> <p>The water sample is collected in a clean, dry glass bottle and stored in a cool dark location until analysis. If chlorine is present, add 0.01-0.02g of sodium ascorbate per 1mg of residual chlorine. A solid phase column of styrene divinylbenzene copolymer or packed with silica gel chemically bonded octadecyl groups is washed sequentially with 5mL each of dichloromethane, methanol and purified water. Purified water is added to the test sample to adjust the concentrations of the target substances to fall within the prescribed concentration ranges (0.1-10 µg/L). The sample solution is passed through the solid-phase column at a flow rate of 10-20mL/min, and dried by flushing with nitrogen gas or air for 30min or more. Next, 3mL of dichloromethane is gently flowed through the solid-phase column in the direction opposite to the direction of regular water flow and the extract collected in a test tube. The extract is concentrated by blowing N₂ gas until the final extract volume is less than 0.8mL. After adding 0.2mL internal standard, dichloromethane is added to bring the total volume to 1mL. This extract analyzed by GC-MS, by comparing to blanks and standard solutions that have undergone the same sample treatment.</p> <p>The method detection limit is 0.1 µg/L.</p> <p>Requesting Agency: NIES, Japan 2013. Reference: Japan MHLW 2003, Notification No. 261:4-15.</p> | ATRAZINE | µg/L | 1 |
| 18415 | <p>ATRAZINE - TOTAL</p> <p>Gas Chromatography with Nitrogen-Phosphorus Detector (GC-NPD)</p> <p>A sample aliquot is extracted with dichloromethane three times. The extract is loaded on a Florisil® column and two separate fractions are eluted using 15% dichloromethane in hexane for fraction A and 2% methanol in dichloromethane for fraction B (which contains the atrazine). Concentrate in a rotary flask, transfer to a graduated centrifuge tube. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. The sample extract is then injected into a dual column GC/NPD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. A gas chromatograph equipped with a mass selective detector (GC/MSD) is used if confirmation is required.</p> <p>Interference: Some organic compounds may co-extract with atrazine but most interferences are eliminated by Florisil® clean up. All solvents are checked for background interference.</p> <p>The method detection limit is 0.1 µg/L.</p> <p>Requesting Agency: Environment Canada, NWRI, 1985. Reference: Environment Canada 1979.</p> | ATRAZINE | µg/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|-----------|----------|
| 18444 | <p>ALDICARB</p> <p>High Performance Liquid Chromatography (HPLC – UV and Fluorescent Detectors)</p> <p>A water sample is extracted with dichloromethane under different pH conditions. The extract is concentrated and subjected to adsorption chromatography on alumina and/or size exclusion chromatography on μ styragel to remove interfering substances. The eluents are evaporated to dryness and dissolved in 45:55 methanol/water solution and analysed, using reverse phase HPLC with UV and fluorescent detectors, at a flow rate of 2 mL/min in the mobile phase. Some carbamate pesticides elute very closely during HPLC separation; therefore, the identification is done through adsorption and fluorescence response ratios or by extracting the sample under acidic (pH 2) and neutral conditions. Quantify by monitoring the UV adsorption at 205 nm as well as the fluorescence at 313 nm or 390 nm, using an excitation wavelength of 254 nm, and compared to multi-point calibration standards and blank solutions.</p> <p>Interference: Many high molecular weight compounds (lipids, humic/fulvic acids, phenols, amines, PAHs, etc) can co-extract and interfere. The clean-up procedures using solvent partitioning, gel permeation chromatography or micro-alumina column chromatography will remove most interferences. UV light and hydrolysis under certain strong acidic or alkaline conditions can also interfere.</p> <p>The method detection limit is 0.09 μg/L.</p> <p>Requesting Agency: Environment Canada, 1982. Reference: Afghan and Ryan 1982.</p> | ALDICARB | μ g/L | 2 |
| 18503 | <p>2,4-D</p> <p>Gas Chromatography (GC-ECD)</p> <p>A water sample is collected and acidified at a pH \leq 1.0 with 50% sulphuric acid. The sample is extracted with dichloromethane and evaporated. The residue is dissolved and esterified with $\text{BCl}_3/2$-chloroethanol to pentafluoro-benzyl esters. Add benzene and potassium bicarbonate (2%), shake and dry the benzene extract with anhydrous sodium. Add iso-octane as a keeper and concentrate under a gentle stream of nitrogen at 40°C. Load to a silica gel column and elute with 25% benzene in hexane to remove the excess reagent and contaminants from the extract: discard this product. Elute fraction A with benzene and fraction B with 10% diethyl ether in benzene (with a benzene wash between the two fractions to remove extraneous interfering peaks). Quantify the 2,4-D (fraction A) by GC-ECD, according to its retention time and peak height/area, using multi-point calibration curve.</p> <p>Interference: Some non-target compounds may co-extract but most interferences are removed through silica gel chromatography.</p> <p>The method detection limit is 0.03 μg/L.</p> <p>Requesting Agency: Environment Canada, NWRI, 1985. Reference 1: Environment Canada 1979. Reference 2: APHA 2012, SM 6630B.</p> | 2,4-D | μ g/L | 2 |
| 18504 | <p>2,4-D</p> <p>Gas Chromatography-Mass Spectrometry (GC/MS)</p> <p>Requesting Agency: NIES, Japan, 2004. Reference: Japan MHLW 2003, Notification No. 261-No.16</p> | 2,4-D | μ g/L | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------|-------|----------|
| 18505 | <p>2,4-D</p> <p>Solid Phase Extraction (SPE)-Derivatization- Gas Chromatography (GC-MS)</p> <p>The water sample is collected in a clean, dry glass bottle and stored in a cool dark location until analysis. If chlorine is present, add 0.01-0.02g of sodium ascorbate per 1mg of residual chlorine. A solid phase column of styrene divinylbenzene copolymer or packed with silica gel chemically bonded octadecyl groups is washed sequentially with 5mL each of dichloromethane, methanol and purified water. The pH of the test sample is adjusted to 3.5 using hydrochloric acid, and purified water is added to adjust the concentrations of the target substances to fall within the prescribed concentration ranges (0.02-1µg/L). The sample solution is passed through the solid-phase column at a flow rate of 10-20mL/min, and dried by flushing with nitrogen gas or air for 30min or more. Next, 3mL of dichloromethane is gently flowed through the solid-phase column in the direction opposite to the direction of regular water flow and the extract collected in a test tube. The extract is concentrated by blowing N₂ gas until the final extract volume is 0.5mL. After adding 0.5mL diazomethane, the extract is left to stand for 10min. This extract is again concentrated to 0.5mL with N₂ gas, and 0.5mL internal standard solution is added. Dichloromethane is added to bring up the total volume of the sample to 1mL. Analysis is by GC-MS, by comparing to blanks and standard solutions that have undergone derivatization to methyl esters in the same manner.</p> <p>The method detection limit is 0.01 ug/L.</p> <p>Requesting Agency: NIES, Japan, 2013. Reference: Japan MHLW 2003, Notification No. 261:4-15.</p> | 2,4-D | µg/L | 2 |
| 18506 | <p>2,4-D</p> <p>Solid Phase Extraction (SPE)-Liquid Chromatography-fluorescence (HPLC)</p> <p>The water sample is collected in a clean, dry polytetrafluoroethylene bottle and stored in a cool dark location until analysis. If chlorine is present, add 0.01-0.02g of sodium ascorbate per 1mg of residual chlorine. A solid phase column of styrene divinylbenzene copolymer or packed with silica gel chemically bonded octadecyl groups is washed sequentially with 5mL each of methanol and purified water. The test sample is diluted with purified water to adjust the concentrations of the target substances to fall within the prescribed concentration ranges (5-500 µg/L). The sample solution is passed through the solid-phase column at a flow rate of 10-20mL/min, and dried by flushing with nitrogen gas or air for 30min or more. Next, 3mL of a mixed solution of ammonia and methanol (2:80:18 mixture of ammonia water [25%v/v] : methanol : purified water) is gently flowed through the solid-phase column and dried again with N₂ gas. Next 3 mL of 2% acetic acid in methanol is passed through the column and the extract collected in a test tube. A solution of 17:5 sodium perchlorate solution/acetonitrile is added to bring the final extract volume to 1.0mL. [Prepare sodium perchlorate solution by mixing 14.1g sodium perchlorate + 400 mL sodium hydroxide + 1.8 mL lactic acid and dilute with purified water to 1L.] Analyze by HPLC-fluorescence and compare to standard solutions that have been prepared in the same manner as the samples.</p> <p>The method detection limit is 1 ug/L.</p> <p>Requesting Agency: NIES, Japan, 2013. Reference: Japan MHLW 2003, Notification No. 261:4-15.</p> | 2,4-D | µg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------------------|--------|----------|
| 18803 | <p>p,p'-DDD OLEFIN</p> <p>Gas Chromatography (GC-ECD)</p> <p>The sample is passed through a XAD-2 resin and eluted with diethyl ether, followed by concentration. The extract is concentrated with iso-octane under a stream of nitrogen at 40°C, then cleaned and separated into three fractions, using iso-octane, 20% benzene in iso-octane and benzene, in a high pressure liquid chromatograph (HPLC). The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, thin layer chromatography (TLC), or mass spectrometry.</p> <p>Interference: Large amounts of particulate interfere with the flow in the resin column; high salt contents reduce the effectiveness of the column, so does a water sample with pH outside 5 to 8. Sulphur must be removed with mercury prior to LC cleanup.</p> <p>The method detection limit is 1.0 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: Environment Canada 1979.</p> | P,P-DDD OLEFIN | µg/L | 3 |
| 18814 | <p>BHC</p> <p>Gas Chromatography</p> <p>The sample is passed through a XAD-2 resin and eluted with diethyl ether, followed by concentration. The extract is concentrated with iso-octane under a stream of nitrogen at 40°C, then cleaned and separated into three fractions, using iso-octane, 20% benzene in iso-octane and benzene, in a high pressure liquid chromatograph (HPLC). The sample extract is then injected into a dual column GC/ECD and quantified, according to its retention time and peak height/area, using a multi-point calibration curve. Confirmation is achieved by chemical derivation techniques, thin layer chromatography (TLC), or mass spectrometry.</p> <p>Interference: Large amounts of particulate interfere with the flow in the resin column; high salt contents reduce the effectiveness of the column, so does a water sample with pH outside 5 to 8. Sulphur must be removed with mercury prior to LC cleanup.</p> <p>The method detection limit is 1.0 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: Environment Canada 1979.</p> | BHC | µg/L | 3 |
| 19001 | <p>POTASSIUM - TOTAL</p> <p>Atomic Absorption Spectrometry – direct aspiration</p> <p>A sample is preserved in the field at 4°C. The sample aliquot, mixed with an alkaline salt to overcome the ionization effect, is aspirated through a burner head, measured spectrometrically at a wavelength of 766.5 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Perkin-Elmer Corp. 1973. Reference 2: JSA 1998, method 49.2. Reference 3: APHA 2012, SM 3111 B.</p> | K TOTAL | mg/L K | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|--------|----------|
| 19002 | <p>POTASSIUM - TOTAL</p> <p>Flame Photometry</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is mixed with a lithium nitrate solution [Japan does not use any ISTD] as an internal standard, and is passed through the burner of a flame photometer equipped with interference filters isolating the spectral lines of potassium. The intensity of light produced is proportional to the amount of potassium present in the sample and is compared to identically-prepared standard and blank solutions, using a propane and oxygen flame.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 49.1.</p> | K TOTAL | mg/L K | 1 |
| 19005 | <p>POTASSIUM TOTAL</p> <p>ICP-AES</p> <p>After preparing samples and obtaining the correct operating conditions. Calibrate the instrument and analyze the samples. Analysis is done by running a calibration blank and then the actual sample. Rinse for at least 60 seconds with dilute acid between samples and blanks. Analyze instrument check standard once per 10 samples. Suggested wavelength for K is 766.49nm</p> <p>Requesting Agency 1: Belgium, 2008. Requesting Agency 2: Japan 2004 Reference 1: ISO 1996, method ISO 11885. Reference 2: APHA 2012, SM 3120 B.</p> | K TOTAL | mg/L K | 1 |
| 19011 | <p>POTASSIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Samples are preserved with 2 mL HNO₃ per litre. Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1 to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis. The emission is measured spectrophotometrically at 766.5 nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 2634.</p> | K TOTAL | mg/L K | 1 |
| 19031 | <p>POTASSIUM – TOTAL</p> <p>Colourimetry (Wagtech photometer)</p> <p>The Palintest Potassium test is based on a single tablet reagent containing sodium tetraphenylboron. Potassium salts react with sodium tetraphenylboron to form an insoluble white complex. Fill test tube with sample to the 10 ml mark. Add one Potassium K tablet, crush and mix to dissolve. A cloudy solution indicates the presence of potassium. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 12.0 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions POTASSIUM</p> | K TOTAL | mg/L K | 1 |

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| Code | Method Description | Name | Units | Decimals |
|-------|--|--------|--------|----------|
| 19101 | <p>POTASSIUM – DISSOLVED</p> <p>Flame Photometry (Direct Intensity measurement)</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1048.</p> | K DISS | mg/L K | 1 |
| 19102 | <p>POTASSIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry (AAS)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot, mixed with an alkaline salt to overcome the ionization effect, is aspirated through a burner head, measured spectrometrically at a wavelength of 766.5 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Perkin-Elmer Corp. 1973. Reference 2: JSA 1998, method 49.2.</p> | K DISS | mg/L K | 1 |
| 19103 | <p>POTASSIUM - DISSOLVED</p> <p>Flame Emission Spectroscopy</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C in a polyethylene bottle. The sample aliquot is mixed with a lithium nitrate solution as an internal standard and aspirated into a flame photometer at the wavelength of 768 nm and compared to the internal standard at 671 nm and compared to identically-prepared standard and blank solutions, using a propane and air flame. Alternatively, the sample aliquot is mixed with a buffer solution (2.5 g CsCl and 125 g Al(NO₃)₃ · 9H₂O in 500 ml distilled water) and aspirated in a flame photometer. The light emission is measured at 768 nm, using a propane and air flame and compared to identically prepared K⁺ standard and blank solutions.</p> <p>Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1973. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: GHI, Russian Federation, 2004. Reference 1: Environment Canada 1974. Reference 2: Environment Canada 1979. Reference 3: JSA 1998, method 49.1. Reference 4: Semyonov 1977.</p> | K DISS | mg/L K | 1 |
| 19104 | <p>POTASSIUM – DISSOLVED</p> <p>Flame Emission Spectrophotometer (ICP-AES)</p> <p>The sample is passed through a 0.45µm membrane filter and preserved with 2 mL HNO₃ per litre. Following open-vessel digestion with HNO₃/HCl, the digest emission is measured spectrophotometrically at 766.5 nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 440.</p> | K DISS | mg/L K | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------|--------|----------|
| 19105 | <p>POTASSIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The absorption of the sample aliquot is measured at 766.5 nm and compared to identically-prepared standard and blank solutions, using an air-C₂H₂ flame.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency 1: DFO-FWI, Canada, 1978. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Perkin-Elmer Corp., 1973. Reference 2: JSA 1998, method 49.2.</p> | K DISS | mg/L K | 1 |
| 19107 | <p>POTASSIUM – DISSOLVED</p> <p>Flame Photometry</p> <p>The sample is passed through a 0.45µ membrane filter. A sample aliquot is then mixed with a LiNO₃, 1% v/v H₂SO₄ solution. This solution is aspirated in a flame photometer. The light emission is measured and the intensity corrected for transport variability by comparison with that of internal Li standard at 671 nm using a propane and air or a natural gas-O₂ flame K ion emission is measured at 768 nm.</p> <p>Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 445.</p> | K DISS | mg/L K | 1 |
| 19111 | <p>POTASSIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>).</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is aspirated and the emission is measured at 766.5 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.3 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Belgium, 2005. Reference 1: Alberta Environment 1979. Reference 2: Japanese Waterworks Analytical Method (2001) VI-3 8.3 Reference 3: ISO 1996, method ISO 11885.</p> | K DISS | mg/L K | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 19112 | <p>POTASSIUM - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is injected into an eluent stream, passed through separator and suppressor columns packed with low capacity cation exchange. The potassium is separated, based on its affinity for the exchange sites, and the background conductivity of the eluent is reduced to a negligible amount. The concentration is measured by conductivity and identified by its retention time. The sample aliquot is compared to identically-prepared standard and blank solutions.</p> <p>Interference of ions with similar retention time and large concentration of an adjacent cation can interfere. Dilution of sample usually removes these interferences. Particulate matter can clog the separator column, causing sluggish instrument performance.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Cheam and Chau 1987. Reference 2: JSA 1998, method 49.3.</p> | K DISS | mg/L K | 1 |
| 19115 | <p>POTASSIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter, preserved with nitric acid and stored at 4°C. The sample aliquot is digested with nitric acid or aqua regia, concentrated appropriately and aspirated from an autosampler. The emission is measured at 766.5 nm and compared to identically-prepared standard and blank solutions. The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Belgium, 2005. Reference 1: Alberta Environment 1981. Reference 2: Japanese Waterworks Analytical Method (2001) VI-3 8.3. Reference 3: ISO 1996, method ISO 11885.</p> | K DISS | mg/L K | 1 |
| 19190 | <p>POTASSIUM - DISSOLVED</p> <p>Inductively Coupled Plasma ICP-MS</p> <p>Requesting Agency: Japan 2013 Reference: Japan MHLW 2003, Notification No.261-NO.6</p> | K DISS | mg/L K | 1 |
| 20003 | <p>CALCIUM - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field at 4°C. A LaCl₃ solution is added to the sample aliquot, mixed and aspirated. The absorbance is measured spectrometrically at 422.7 nm, and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 50.2. Reference 3: APHA 2012, SM 3111 B.</p> | Ca TOTAL | mg/L Ca | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 20005 | <p>CALCIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel digestion and pre-concentration. ICP 1502 (<i>See Appendix 3</i>).</p> <p>The whole water sample is preserved with 2 mL HNO₃ per litre. Following open-vessel digestion with HNO₃/HCl, the digest emission is measured spectrophotometrically at 317.9 nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 440.</p> | Ca TOTAL | mg/L Ca | 3 |
| 20011 | <p>CALCIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Samples are preserved with 2 mL HNO₃ per litre. Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1 to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 µm membrane before analysis. The emission is measured spectrophotometrically at 317.9 nm.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 2634.</p> | Ca TOTAL | mg/L Ca | 1 |
| 20032 | <p>CALCIUM – TOTAL</p> <p>Calculated</p> $\text{Ca} = \frac{\{\text{hardness} - \text{Mg} * (\text{M.CaCO}_3 / \text{M.Mg})\}}{(\text{M.CaCO}_3 / \text{M.Ca})}$ <p>Requesting Agency: DACAAR, Afghanistan 2007 Reference: Wagtech on-line methodologies.</p> | Ca TOTAL | mg/L Ca | 1 |
| 20101 | <p>CALCIUM - DISSOLVED</p> <p>EDTA Titration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The pH of the sample aliquot is adjusted between 12 and 13 with a 1 N or 2 N NaOH solution to precipitate the magnesium in its hydroxide form. Add Calver II (<i>See Appendix 6</i>) indicator and titrate the aliquot with a standardised EDTA (disodium dihydrogen ethylenediamine tetraacetate) solution. The colour changes from pink to purple when the calcium is removed. Alternatively, when using the HSNN indicator (Japanese method), the colour changes from magenta to blue, and when using a Murexide indicator, the colour changes from pink to purple when the calcium is removed. The samples are compared to identically-prepared standard and blank solutions.</p> <p>Interferences: Total heavy metal ion concentration of 0.5 mg/L.</p> <p>The method detection limit is 0.5 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: GHI, Russian Federation, 2004. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 50.1. Reference 3: Semyonov 1977 Reference 4: Hydrometeoizdat 1999. Reference 5: APHA 2012, SM 3500-Ca B.</p> | Ca DISS | mg/L Ca | 3 |

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| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 20102 | <p>CALCIUM – DISSOLVED</p> <p>Titration</p> <p>Titration with ethylenediaminetetraacetic acid (EDTA) and Eriochrome blue Se, as indicator.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1069.</p> | Ca DISS | mg/L Ca | 1 |
| 20103 | <p>CALCIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. A LaCl₃ solution is added to the sample aliquot, mixed and aspirated. The absorbance is measured spectrometrically at 422.7 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene reducing flame.</p> <p>The method detection limit is 0.05 mg/L. Note: With precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 50.2.</p> | Ca DISS | mg/L Ca | 3 |
| 20105 | <p>CALCIUM - DISSOLVED</p> <p>Flame Emission</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is aspirated in a flame and the emission is measured at 422.6 nm and compared to identically-prepared standard and blank solutions, using nitrous oxide-acetylene flame.</p> <p>The method detection limit is 0.07 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: Perkin-Elmer Corp. 1971.</p> | Ca DISS | mg Ca/L | 3 |
| 20108 | <p>CALCIUM – DISSOLVED</p> <p>Atomic Absorption Spectrometry (AAS)</p> <p>If turbid, the sample is passed through a 0.45µ membrane filter. CaCO₃ solution is added to a filtrate aliquot, which is then aspirated. The absorbance is measured spectrophotometrically at 422.7 nm, and compared with those of standard Ca solutions and a reagent blank.</p> <p>Note: In the case of precipitation samples, a decanted aliquot of the unshaken, unfiltered sample is normally taken for analysis.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1070.</p> | Ca DISS | mg/L Ca | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------------------------|----------|
| 20109 | <p>CALCIUM - DISSOLVED</p> <p>Ion Chromatography</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter [Japan filters through 0.2 µm filter] and preserved at 4°C. The sample aliquot is injected into an eluent stream, passed through separator and suppressor columns packed with low capacity cation exchange. The calcium is separated, based on its affinity for the exchange sites, and the background conductivity of the eluent is reduced negligibly. The concentration is measured by conductivity and identified by its retention time. The sample is compared to identically-prepared standard and blank solutions.</p> <p>Ions with similar retention time and large concentration of adjacent cations can interfere. Dilution of sample usually removes these interferences. Particulate matter can clog the separator column, causing sluggish instrument performance.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Cheam and Chau 1987. Reference 2: Japanese Waterworks Analytical Method (2001) VI-3 9.5. Reference 3: Japan MHLW 2003 Notification No. 261-No.20 Reference 4: JWWA 2001, method VI-3 9.5</p> | Ca DISS | mg/L CaCO ₃ | 3 |
| 20110 | <p>CALCIUM – DISSOLVED</p> <p>Atomic Absorption Spectroscopy (AAS)</p> <p>The sample is passed through a 0.45µ membrane filter. The sample is digested with HNO₃. A sample aliquot is mixed with a standard LaCl₃ solution. The solution is aspirated. The absorption at the 422.7 nm wavelength is measured spectrometrically and compared with those of a reagent blank and standard solution. An acetylene-air reducing flame is used. The autoanalysis unit consisting of an automated sampler, manifold and transmission delay line are incorporated so that the sample is diluted. The magnitude of the dilution is proportioned to the diameter of the auxiliary pump line.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 469.</p> | Ca DISS | mg/L Ca | 2 |
| 20111 | <p>CALCIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (See Appendix 3)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is aspirated and the emission is measured at 317.9 nm [Japan measures at 393.4 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.006 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JWWA 2001, method VI-3 9.3.</p> | Ca DISS | mg/L Ca | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 20115 | <p>CALCIUM -DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is aspirated from an autosampler. The emission is measured at 317.9 nm [Japan measures at 393.4 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JWVA 2001, method VI-3 9.3.</p> | Ca DISS | mg/L Ca | 3 |
| 20190 | <p>CALCIUM DISSOLVED</p> <p>Inductively Coupled Plasma - Mass Spectrometry ICP-MS</p> <p>A water sample is filtered through a glass fiber filter (GF/F) heat-treated at 400°C in advance, and used as a test solution. Concentrations of the target substances (Ca) in the sample are adjusted with purified water to fall within the range (0.0006-0.06mg/L). A total of 1 part of nitric acid (i.e. including that added at the time of the sample collection) are added per 100 parts of the sample, and the sample is then gently heated until the solution volume becomes less than 90% of the original volume. After cooling, 1 part of internal standard mixture is added to 10 parts of the sample. Additionally, purified water is added to bring the solution up to a known volume, and this is used as the test solution. The test solution is introduced into an ICP-MS and the ion intensities at the mass numbers of metals of interest as well as the internal standard substance are measured. A series of standard solutions are prepared and handled in exactly the same way as the test solution in order to prepare calibration curves based on the relationships between metal concentration and ion intensity ratio for each metal.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference: Japan MHLW 2003, Notification No. 261-No.6</p> | Ca DISS | mg/L Ca | 3 |
| 23009 | <p>VANADIUM – TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 231.6 nm [Japan uses 238.204nm] and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region Reference: Environment Canada PYR code 2634</p> | V TOTAL | mg V/L | 3 |
| 23011 | <p>VANADIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | V TOTAL | mg V/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 23091 | <p>VANADIUM – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | V TOTAL | mg V/L | 3 |
| 23092 | <p>VANADIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1308.</p> | V TOTAL | mg V/L | 3 |
| 24002 | <p>CHROMIUM - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. Digest the sample aliquot with nitric acid at pH of 1.6 (usual pH if sample is preserved with 0.2% nitric acid), then add bromine water to the sample and warm on a water bath until the colour disappears. [Japan adds HNO₃ or HCl and boils] The sample aliquot is aspirated and the absorbance is measured at a wavelength of 358.0 nm and compared to identically-prepared chromium standard and blank solutions, using a C₂H₂-air reducing flame.</p> <p>The method detection limit is 0.010 ug/L</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference: JSA 1998, method 65.4.2.</p> | Cr TOTAL | mg/L Cr | 3 |
| 24004 | <p>CHROMIUM – TOTAL</p> <p>Flameless Atomic Absorption Spectroscopy (GFAAS)</p> <p>Use graphite furnace AAS at wavelength 357.9 nm to measure chromium.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 481.</p> | Cr TOTAL | mg/L Cr | 2 |
| 24006 | <p>CHROMIUM – TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 357.9 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference : APHA 2012, SM 3111 B.</p> | Cr TOTAL | mg/L Cr | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 24009 | <p>CHROMIUM - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with concentrated nitric acid or aqua regia, concentrated appropriately and aspirated from an autosampler. The emission is measured at 267.7 nm [Japan uses 206 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Alberta Environment 1981. Reference 2: Japanese Industrial Standards Committee 1998.</p> | Cr TOTAL | mg/L Cr | 3 |
| 24011 | <p>CHROMIUM - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with diluted mineral acid. The sample aliquot is digested with aqua regia and evaporated to near dryness. The wet residue is diluted with concentrated HCl to one-fifth of the aliquot original volume. The emission is measured spectrometrically at 267.7 nm [Japan uses 206 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 65.1.4.</p> | Cr TOTAL | mg/L Cr | 3 |
| 24031 | <p>CHROMIUM - HEXAVALENT</p> <p>Colourimetry by Wagtech photometer)</p> <p>In the Palintest Chromicol method, hexavalent chromium salts in acidic conditions react with diphenylcarbazide to give a purple coloured complex. This provides a measure of the hexavalent chromium (Cr-VI) present in the sample. Fill round test tube to the 10 ml mark. Add one Chromicol No.1 tablet, crush and mix to dissolve. Add one Chromicol No.2 tablet, crush and mix to dissolve. Stand for 10 minutes without disturbing the solution to allow full colour development and to enable any undissolved particles to settle. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 1.0 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions CHROMIUM (CHROMICOL)</p> | Cr VI | mg/L Cr | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 24052 | <p>CHROMIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with 0.2% nitric acid. To the sample aliquot, add bromine water and warm on a water bath until the colour disappears. [Japan adds HNO₃ or HCl and boils] The absorbance is then measured spectrometrically at 358.0 nm and the concentration is compared to identically-prepared standard and blank solutions, using air-acetylene oxidising flame.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 65.1.2.</p> | Cr DISS | mg/L Cr | 3 |
| 24090 | <p>CHROMIUM - TOTAL</p> <p>ICP-MS</p> <p>The sample is preserved in the field with nitric acid. The sample is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.02 ug/L</p> <p>Requesting Agency 1: NIES, Japan, 1998. Requesting Agency 2: JAPAN 2012 Reference 1: APHA 2012. Reference 2: Japanese Waterworks Analytical Method (2001) VI-3 11.5. Reference 3: JSA 1998, JIS K 0102 method 65.1.5</p> | Cr TOTAL | mg/L Cr | 3 |
| 24091 | <p>CHROMIUM - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Cr TOTAL | mg/L Cr | 3 |
| 24092 | <p>CHROMIUM - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1293.</p> | Cr TOTAL | mg/L Cr | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 24101 | <p>CHROMIUM - HEXAVALENT</p> <p>Colourimetry</p> <p>A sample is preserved in the field with mineral acid. The sample aliquot is mixed with diphenylcarbazide in an acid solution. A red-violet colour is produced. (The reaction is very sensitive as the absorbancy index per gram of chromium is approximately 40,000 at 540 nm). The absorbance is measured and compared to identically-prepared standard and blank solutions, ensuring the blank is subtracted, at a wavelength of 540 nm.</p> <p>Note: If the solution is turbid, take an absorbance reading before adding the diphenylcarbazide reagent and correct the absorbance reading of the final coloured solution.</p> <p>Interferences: Hexavalent molybdenum and mercury salts will form a colour with the reagent but the intensities are much lower than chromium at the specified pH (concentration of molybdenum and mercury up to 200 mg/L can be tolerated); vanadium interferes if the concentration is 10 times greater than chromium. The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998 Reference 1: APHA 1975. SM 3500-Cr E Reference 2: JSA 1998, method 65.2.1.</p> | Cr VI | mg/L Cr | 3 |
| 24109 | <p>CHROMIUM HEXAVALENT</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES)</p> <p>Requesting Agency: Japan, 2013 Reference: JSA 1998, method JIS K 0102 65.2.4</p> | Cr VI | mg/L Cr | 3 |
| 24111 | <p>CHROMIUM – DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at 267.7 nm [Japan uses 206 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method JIS K 0102 65.1.4.</p> | Cr DISS | mg/L Cr | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------|---------|----------|
| 24190 | <p>CHROMIUM - DISSOLVED</p> <p>ICP – MS</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.2 ug/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 11.5.</p> | Cr DISS | mg/L Cr | 3 |
| 24202 | <p>CHROMIUM - SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A measured sample volume is passed through a 0.45 µm membrane filter. The filter, containing the residue, is digested with nitric acid at a pH of 1.6. The solution is aspirated and the absorbance is measured spectrometrically at 358.0 nm and compared to identically-prepared standard and blank solutions, using a C₂H₂-air reducing flame.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference 1: Environment Canada 1974. Reference 2: APHA SM 3111 A</p> | Cr PARTICULATE | µg/g | 3 |
| 24303 | <p>CHROMIUM – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid, shaken, and left overnight. The pH of the solution is adjusted to 1.6. Br₂ water is added, and the solution warmed until the Br₂ colour vanishes. The pH of the solution is then adjusted to 3.5 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added, and the complex extracted with methyl isobutyl ketone (MIBK). The solvent layer is directly aspirated into the AAS. The absorbance is measured spectrophotometrically at 358.0 nm and compared with those of identically prepared standard Cr₂O₇ ion solutions using an acetylene-air reducing flame.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1114.</p> | Cr EXTRBLE | mg/L Cr | 4 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 24901 | <p>CHROMIUM – DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry (GFAAS)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages in a graphite furnace or an electrically heated atomiser in which: the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the chromium to be determined. The absorbance of the resultant ground state atoms is measured at 357.9 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Requesting Agency 2: CEA Laboratory, Sri Lanka 2004. Reference 1: JSA 1998, method 65.1.3. Reference 2: APHA 1998, SM 3113 B.</p> | Cr DISS | mg/L Cr | 3 |
| 24911 | <p>CHROMIUM - TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested in nitric acid or aqua regia. The aliquot is then heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the chromium to be determined. The absorbance of the resultant ground state atoms is measured at 357.9 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 65.1.3.</p> | Cr TOTAL | mg/L Cr | 3 |
| 25001 | <p>MANGANESE – TOTAL</p> <p>Colourimetry</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or sulphuric acid and oxidized with sodium bismuthate or potassium periodate. The colour is read on a spectrometer 20 (or equivalent) and compared with identically-prepared standard and blank solutions.</p> <p>The method detection limit is 1 mg/L.</p> <p>Requesting Agency 1: Saskatchewan Environment, Canada, 1977. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Park 1935. Reference 2: JSA 1998, method 56.1.</p> | Mn TOTAL | mg/L Mn | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 25004 | <p>MANGANESE - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with nitric acid. The solution is aspirated and the absorbance is measured spectrometrically at 279.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998 Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 56.2. Reference 3: APHA 2012, SM 3111 B.</p> | Mn TOTAL | mg/L Mn | 2 |
| 25005 | <p>MANGANESE - TOTAL</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with nitric acid. The pH of the digest is adjusted between 10 and 11 with an ammonium hydroxide solution, mixed with an ammonium pyrrolidine dithiocarbamate (APDC) solution then extracted with a methyl isobutyl ketone (MIBK) solution containing 8-hydroxyquinoline. [The Japanese method adjusts pH to 4.5-5.0 and extracts with 4-methyl-2-pentanone]. The solvent layer is aspirated at the wavelength of 279.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 56.2</p> | Mn TOTAL | mg/L Mn | 2 |
| 25009 | <p>MANGANESE - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with concentrated nitric acid or aqua regia, concentrated appropriately and aspirated from an autosampler. The emission is measured at 257.6 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, 1984. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 56.4.</p> | Mn TOTAL | mg/L Mn | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 25011 | <p>MANGANESE - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (See Appendix 3)</p> <p>A sample is preserved in the field with dilute mineral acid. The sample aliquot is digested with aqua regia and evaporated to near dryness. The wet residue is diluted in concentrated HCl to one-fifth of the aliquot original volume. The emission is measured at 257.6 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998 Requesting Agency 3: Environment Canada, Pacific & Yukon Region Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 56.4. Reference 3: Environment Canada 2007, PYR code 2634</p> | Mn TOTAL | mg/LMn | 2 |
| 25031 | <p>MANGANESE – TOTAL</p> <p>Colourimetry by Wagtech Photometer</p> <p>Requesting Agency: DACAAR, Afghanistan 2007 Reference: Wagtech on-line methods.</p> | Mn TOTAL | mg/L Mn | 2 |
| 25090 | <p>MANGANESE - TOTAL</p> <p>ICP - MS</p> <p>A sample is preserved in the field with mineral acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.5 ug/L.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference 1: APHA 1998. Reference 2: JSA 1998, method 56.5.</p> | Mn TOTAL | mg/L Mn | 2 |
| 25091 | <p>MANGANESE – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Mn TOTAL | mg/L Mn | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 25092 | <p>MANGANESE – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1299.</p> | Mn TOTAL | mg/L Mn | 2 |
| 25101 | <p>MANGANESE - DISSOLVED</p> <p>Colorimetry - Visual Spot Test with Tetrabase</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with mineral acid. The sample aliquot is mixed with an NH₄OH solution, a KIO₄ solution, and a buffer (pH = 4.75) solution. A Tetrabase (tetramethyldiaminodiphenylmethane) solution is finally added and mixed. The resulting colour is immediately visually compared to those of simultaneously and identically-prepared MnO₄ standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Mn DISS | mg/L Mn | 2 |
| 25104 | <p>MANGANESE - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 279.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 56.2.</p> | Mn DISS | mg/L Mn | 2 |
| 25105 | <p>MANGANESE - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The pH of the digest is adjusted between 10 and 11 with an ammonium hydroxide solution, mixed with an ammonium pyrrolidine dithiocarbamate (APDC) solution then extracted with a methyl isobutyl ketone (MIBK) solution containing 8-hydroxyquinoline. [The Japanese method adjuststhe pH to 4.5 to 5.0 and extracts with 4-methyl-2-pentanone.] The solvent is aspirated at the wavelength of 279.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidising flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/ Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998 Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 56.2</p> | Mn DISS | mg/LMn | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 25109 | <p>MANGANESE – DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm filter paper and preserved with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 257.6 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 56.4.</p> | Mn DISS | mg/L Mn | 2 |
| 25111 | <p>MANGANESE - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at 257.6 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 56.4.</p> | MN DISS | mg/L Mn | 2 |
| 25190 | <p>MANGANESE - DISSOLVED</p> <p>ICP - MS</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.5 ug/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 56.5.</p> | Mn DISS | mg/L Mn | 2 |
| 25204 | <p>MANGANESE - SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>The sample is passed through a 0.45 µm membrane filter. The filter, containing the residue, is digested with nitric acid. The resulting solution is then aspirated and the absorbance is measured spectrometrically at 279.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Mn PART | µg/g | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|---------|----------|
| 25304 | <p>MANGANESE – EXTRACTABLE</p> <p>Atomic Absorption Spectroscopy (AAS)</p> <p>The sample is acidified with diluted mineral acid (usually 0.2% HNO₃), shaken, and left overnight. The sample is then aspirated. The absorbance is measured spectrophotometrically at 279.8 nm and compared with those of standard Mn²⁺ (Manganous) ion solutions. An acetylene-air oxidizing flame is used. The detection limit is 10µg/L.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1172.</p> | Mn EXTRBLE | µg/L Mn | 2 |
| 25305 | <p>MANGANESE – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The sample is preserved with HNO₃. The sample is acidified with dilute mineral acid, shaken and left overnight. The pH of the sample is then adjusted to 10-11 with a NH₃ solution. This solution is extracted with methyl isobutyl ketone containing 8-hydroxyquinoline, and the solvent layer aspirated. The absorbance is measured spectrophotometrically at 279.8 nm, and compared with those of identically prepared standard. Mn²⁺ ion solutions and a reagent blank. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1149.</p> | Mn EXTRBLE | µg/L Mn | 3 |
| 25901 | <p>MANGANESE - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages, in a graphite furnace or an electrically heated atomiser in which: in the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the manganese to be determined. The absorbance of the resultant ground state atoms is measured at 279.5 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 1 ug/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 56.3.</p> | Mn DISS | mg/L Mn | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 25911 | <p>MANGANESE - TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia. The aliquot is then heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: in the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the manganese to be determined. The absorbance of the resultant ground state atoms is measured at 279.5 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 1 ug/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: JSA 1998, method 56.3. Reference 2: Japanese method 261-NO.3 Reference 3: kousei-bettenn4-18 NO.1</p> | Mn TOTAL | mg/L Mn | 2 |
| 25913 | <p>MANGANESE - DISSOLVED</p> <p>Flame Atomic Absorption Spectrometry</p> <p>After filtering the water sample, inject into an acetylene-air flame to measure the absorbance of manganese at 279.5 nm wavelength.</p> <p>Requesting Agency: Japan 2013 Reference: JSA 1998, method JIS K 0102 56.2</p> | Mn DISS | mg/L Mn | 2 |
| 26002 | <p>IRON - TOTAL</p> <p>Colourimetry with TPTZ</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with nitric acid, mixed with HCl, followed by hydroxylamine hydrochloride (NH₂OH.HCl) solution (reducing ferric to ferrous ions). This solution is mixed with TPTZ (2,4,6-tripyridyl-s-triazine) solution and buffered at pH 4.75. The absorbance of the resulting violet colour is measured spectrometrically at 588 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interference: Precipitable organic compounds. The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Fe TOTAL | mg/L Fe | 2 |
| 26003 | <p>IRON – TOTAL</p> <p>Phenanthroline spectrometry</p> <p>The method detection limit is 0.020 mg/L</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 57.1.</p> | Fe TOTAL | mg/L Fe | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 26004 | <p>IRON - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid, diluted appropriately, then aspirated and the absorbance is measured spectrometrically at 248.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 57.2. Reference 3: APHA 2012, SM 3111 B</p> | Fe TOTAL | mg/L Fe | 2 |
| 26005 | <p>IRON -TOTAL</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is buffered to 4.75. Ammonium pyrrolidine dithiocarbamate (APDC) solution is mixed to the digest then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 248.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Fe TOTAL | mg/L Fe | 2 |
| 26009 | <p>IRON - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately and aspirated from an autosampler. The emission is measured at 259.9 nm [Japan uses 238.204nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 57.4.</p> | Fe TOTAL | mg/L Fe | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 26011 | <p>IRON - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with dilute mineral acid. The sample aliquot is digested in aqua regia solution and evaporated to near dryness. The wet residue is diluted with concentrated HCl to one-fifth of the aliquot's original volume. The emission is measured at 259.9 nm [Japan uses 238.204nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 57.4. Reference 3: Environment Canada, PYR code 2634</p> | Fe TOTAL | mg/L Fe | 2 |
| 26031 | <p>IRON - TOTAL</p> <p>Colourimetry by Wagtech Photometer</p> <p><u>Low range</u> (Testing range is 0 – 1.0 mg/l): The Palintest Iron LR test is based on a single tablet reagent containing 3-(2-Pyridyl)-5, 6-bis(4-phenyl-sulphonic acid)-1, 2, 4-triazine (PPST) formulated with a decomplexing/reducing agent in an acid buffer. Fill the test tube with sample to the 10 ml mark. Add one Iron LR tablet, crush and mix to dissolve. Stand for one minute to allow full colour development. Take photometer reading in usual manner.</p> <p><u>High Range</u> (Testing range is 0 – 10 mg/l): The Palintest Iron HR test is based on a single tablet reagent containing an alkaline thioglycollate. The test is carried out simply by adding a tablet to a sample of the water under test. The thioglycollate reduces ferric iron to ferrous iron and this, together with any ferrous iron already present in the sample, reacts to give a pink coloration. Fill test tube with sample to the 10 ml mark. Add one Iron HR tablet, crush and mix to dissolve. Stand for one minute to allow full colour development. Take photometer reading in usual manner.</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions IRON LR and IRON HR</p> | Fe TOTAL | mg/L Fe | 2 |
| 26090 | <p>IRON - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.007 mg/L.</p> <p>Requesting Agency: NIES, Japan, 2004. Reference: APHA 1998.</p> | Fe TOTAL | mg/L Fe | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 26091 | <p>IRON - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Fe TOTAL | mg/L Fe | 2 |
| 26092 | <p>IRON - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1295.</p> | Fe TOTAL | mg/L Fe | 1 |
| 26102 | <p>IRON - DISSOLVED</p> <p>Colourimetry with TPTZ</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is mixed with HCl solution, followed by hydroxylamine hydrochloride (NH₂OH.HCl) solution (reducing ferric to ferrous ions). This solution is mixed with TPTZ (2,4,6-tripyridyl-s-triazine) solution, then buffered at 4.75. The resulting violet colour is spectrometrically measured at 588 nm and compared to identically-prepared standard and blank solutions. Alternatively (Russian methods), the sample aliquot with HCl and hydroxylamine hydrochloride is boiled for 15-20 minutes, then cooled and neutralized with ammonia solution. A buffer solution with pH 3 and 1,10-phenanthroline solution are added. The resulting pink colour is spectrometrically measured at 510 nm and compared to identically prepared standard and blank solutions.</p> <p>Interference: Precipitable organic compounds, or high concentrations of copper, nickel, and/or cobalt. The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: GHI, Russian Federation, 2004. Reference 1: Environment Canada 1974. Reference 2: Semyonov 1977. Reference 3: Hydrometeoizdat 1999.</p> | Fe DISS | mg/L Fe | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 26103 | <p>IRON – DISSOLVED</p> <p>Phenanthroline/Bathophenanthroline Method</p> <p>Immediately after collection filter sample through a 0.45µm membrane filter into a vacuum flask containing 1mL concentrated HCL/100mL sample. Analyze filtrate for total dissolved iron. Prepare a series of standards by pipetting calculated volumes of standard iron solutions to measure 1-10µg portions into 125mL Erlenmeyer flasks and diluting to 50mL by adding measured volumes of water. Add 2mL concentrated HCl and 1mL NH₂OH·HCl solution. For visual comparison, prepare a set of at least 10 standards, ranging from 1-100µg Fe in the final 100mL volume. Compare colours in 100mL tall-form Nessler tubes.</p> <p>Requesting Agency: Mekorot National Water Company, Israel, 2012 Reference 1: APHA 2012, SM 3500-Fe B (Phenanthroline Method) Reference 2: Israel Mekorot 2012 (Bathophenanthroline Method)</p> | Fe DISS | mg/L | 3 |
| 26104 | <p>IRON - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 248.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: GHI, Russian Federation, 2004. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 57.2. Reference 3: Hydrochemical Institute 1986 (GFAAS and flame AAS)</p> | Fe DISS | mg/L Fe | 3 |
| 26105 | <p>IRON - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is buffered at pH of 4.75. Ammonium pyrrolidine dithiocarbamate (APDC) solution is mixed to the aliquot then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 248.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Fe DISS | mg/L Fe | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 26109 | <p>IRON - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately, and aspirated from an autosampler. The emission is measured at 259.9 nm [Japan uses 238.204nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 57.4.</p> | Fe DISS | mg/L Fe | 2 |
| 26111 | <p>IRON - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at 259.9 nm [Japan uses 238.204nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 57.4.</p> | Fe DISS | mg/L Fe | 2 |
| 26190 | <p>IRON - DISSOLVED</p> <p>ICP – MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard solutions.</p> <p>The method detection limit is 0.007 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: APHA 1998. SM 3210 B.</p> | Fe DISS | mg/L Fe | 2 |
| 26204 | <p>IRON - SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. The filter, containing the residue, is digested in nitric acid. The resulting solution is then aspirated and the absorbance is measured spectrometrically at 248.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Fe PART | µg/g | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------|---------|----------|
| 26302 | <p>IRON – EXTRACTABLE</p> <p>Colourimetry (TPTZ)</p> <p>The sample is digested with HNO₃. A sample aliquot is mixed with HCl followed by hydroxylamine hydrochloride (NH₂OH–HCl) solution. This is mixed with TPTZ (2,4,6-tripyridyl-S-triazine) solution, then with buffer (pH=4.75) solution. The absorbance of the TPTZ complex is spectrophotometrically measured at 588 nm, and compared with those of identically prepared standard Fe²⁺ solutions. Interference possible from precipitable organic compounds.</p> <p>Dissolved: If turbid, the sample is passed through a 0.45µ membrane filter.</p> <p>Suspended: The sample is acidified with dilute mineral acid, shaken and left overnight.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1180.</p> | Fe EXTRBLE | mg/L Fe | 3 |
| 26304 | <p>IRON – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight and analyzed by direct aspiration AAS. The absorbance is measured spectrophotometrically at wavelength 248.3 nm, and compared with those of standard solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 479.</p> | Fe EXTRBLE | mg/L Fe | 2 |
| 26305 | <p>IRON – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 248.3 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Fe EXTRBLE | mg/L Fe | 3 |
| 26901 | <p>IRON – DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages, in a graphite furnace or an electrically heated atomiser where: in the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the iron to be determined. The absorbance of the resultant ground state atoms is measured at 248.3 nm by Flameless Atomic Absorption and is compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 57.3.</p> | Fe DISS | mg/L | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 27009 | <p>COLBALT - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 228.6 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 60.3.</p> | Co TOTAL | mg/L Co | 3 |
| 27011 | <p>COLBALT – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Co TOTAL | mg/L Co | 3 |
| 27091 | <p>COLBALT – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Co TOTAL | mg/L Co | 3 |
| 27092 | <p>COLBALT – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1292.</p> | Co TOTAL | mg/L Co | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|---------|----------|
| 27302 | <p>COBALT – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 240.7 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Co EXTRBLE | mg/L Co | 3 |
| 28001 | <p>NICKEL – TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 232.0 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 59.2. Reference 3: APHA SM 3111 B</p> | Ni TOTAL | mg/L Ni | 3 |
| 28002 | <p>NICKEL - TOTAL</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. A sample aliquot is digested in nitric acid. The digest is buffered to 4.75. [Japan buffers to pH 3.5-4.0]. Ammonium pyrrolidine dithiocarbamate (APDC) solution is mixed to the digest then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 232.0 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 59.2.</p> | Ni TOTAL | mg/L Ni | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 28009 | <p>NICKEL - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (See Appendix 3)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 231.6 nm [Japan uses 238.204nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 59.3.</p> | Ni TOTAL | mg/L Ni | 3 |
| 28011 | <p>NICKEL - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (See Appendix 3)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in an aqua regia solution and evaporated to near dryness. The wet residue is diluted with concentrated HCl and diluted to one-fifth of the aliquot's original volume. The emission is measured spectrometrically at 231.6 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 59.3.</p> | Ni TOTAL | mg/L Ni | 3 |
| 28090 | <p>NICKEL - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard solutions.</p> <p>The method detection limit is 0.02 µg/L.</p> <p>Requesting Agency 1: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 14.5.</p> | Ni TOTAL | mg/L Ni | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 28091 | <p>NICKEL - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Ni TOTAL | mg/L Ni | 3 |
| 28092 | <p>NICKEL - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency 1: Environment Canada, Ontario Region, 2007. Requesting Agency: NIES, Japan, 2014 Reference 1: Environment Canada 2007, Great Lakes STAR code 1301. Reference 2: Japan Environment Agency, Notification 121, no. 4.</p> | Ni TOTAL | mg/L Ni | 2 |
| 28101 | <p>NICKEL -DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The acidified aliquot is aspirated and the absorbance is measured spectrometrically at 232.0 nm and compared with identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 59.2. Reference 3: APHA 2012, SM 4500-O C.</p> | Ni DISS | mg/L Ni | 3 |
| 28102 | <p>NICKEL – DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is buffered to 4.75. [Japan buffers to pH 3.5-4.0]. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 232.0 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 59.2.</p> | Ni DISS | mg/L Ni | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 28109 | <p>NICKEL - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (See Appendix 3)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately, and aspirated from an autosampler. The emission is measured at 231.6 nm [Japan uses 221.647 nm] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 59.3.</p> | Ni DISS | mg/L Ni | 3 |
| 28111 | <p>NICKEL - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (See Appendix 3)</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. A sample aliquot is aspirated and the emission is measured at 231.6 nm and compared with identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: Alberta Environment, Canada, 1979. Reference: Alberta Environment 1979.</p> | Ni DISS | mg/L Ni | 3 |
| 28190 | <p>NICKEL - DISSOLVED</p> <p>ICP – MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.02 µg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 14.5.</p> | Ni DISS | mg/L Ni | 3 |
| 28192 | <p>NICKEL – DISSOLVED</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are filtered, preserved with 2% nitric acid, and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: NIES, Japan 2013 Reference: Japan Environment Agency, Notification 121, no. 4.</p> | Ni DISS | mg/L Ni | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------|---------|----------|
| 28301 | <p>NICKEL – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight and analyzed by direct aspiration AAS. The absorbance is measured spectrophotometrically at wavelength 232.0 nm, and compared with those of standard solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 479.</p> | Ni EXTRBLE | mg/L Ni | 2 |
| 28302 | <p>NICKEL – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 232.0 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Ni EXTRBLE | mg/L Ni | 3 |
| 28901 | <p>NICKEL - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: at the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilising other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the nickel to be determined. The absorbance of the resultant ground state atoms is measured at 232.0 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1995. SM 3113 A Reference 2: JWWA 2001, method VI-3 14.2.</p> | Ni DISS | mg/L Ni | 3 |
| 28911 | <p>NICKEL - TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia. The aliquot is then heated, usually in three stages in a graphite furnace or an electrically heated atomiser in which: in the first stage, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilising other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the nickel to be determined. The absorbance of the resultant ground state atoms is measured at 232.0 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1995. SM 3113 A Reference 2: JWWA 2001, method VI-3 14.2.</p> | Ni TOTAL | mg/L Ni | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 29001 | <p>COPPER - TOTAL</p> <p>Colourimetry – Bathocuproine method</p> <p>A sample is preserved in the field with nitric acid. To the sample aliquot, blank and standard solutions, add HCl, hydroxylamine hydrochloride, sodium citrate and bathocuproine disulphonate (2,9-dimethyl-4,7-diphenyl-1,10-phenanthrolinedisulphonic acid, disodium salt). An orange complex develops; the solution is then passed through a cell, and the absorbance is measured at 484 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.020 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 2012, method SM 3500-Cu C</p> | Cu TOTAL | mg/L Cu | 3 |
| 29005 | <p>COPPER - TOTAL</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The pH of the digest is adjusted to 4.75 [Japan buffers to pH 3.5-4.0], with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the digest and then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 324.7 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 52.2.</p> | Cu TOTAL | mg/L Cu | 3 |
| 29006 | <p>COPPER - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 324.7 nm and compared to identically-prepared standard and blank solutions, using an air-propane or air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 52.2. Reference 3: APHA SM 3111 A.</p> | Cu TOTAL | mg/L Cu | 3 |
| 29008 | <p>COPPER - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 324.7 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference: APHA 2012, SM 3111 B.</p> | Cu TOTAL | mg/L Cu | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 29009 | <p>COPPER - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (See Appendix 3)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured spectrometrically at 324.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 52.4.</p> | Cu TOTAL | mg/L Cu | 3 |
| 29011 | <p>COPPER - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (See Appendix 3)</p> <p>A sample is preserved in the field with diluted mineral acid. The sample aliquot is digested in an aqua regia solution and evaporated to near dryness. The wet residue is diluted with concentrated HCl to one-fifth of the aliquot's original volume. The emission is measured spectrometrically at 324.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 52.4. Reference 3: Environment Canada 2007, PYR code 2634</p> | Cu TOTAL | mg/L Cu | 3 |
| 29031 | <p>COPPER – TOTAL</p> <p>Colourimetry by Wagtech photometer</p> <p>In the Palintest Coppercol method, copper salts are reduced to the cuprous form and then reacted with a 2,2 Biquinoline-4,4-dicarboxylic salt to form a purple coloured complex. Fill test tube with sample to the 10 ml mark. Add one Coppercol No 1 tablet, crush and mix to dissolve. Take photometer reading in usual manner</p> <p>Testing range is 0 – 5.0 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions COPPER (COPPERCOL)</p> | Cu TOTAL | mg/L Cu | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 29090 | <p>COPPER - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: NIES, Japan, 1998. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 52.5.</p> | Cu TOTAL | mg/L Cu | 3 |
| 29091 | <p>COPPER - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Cu TOTAL | mg/L Cu | 3 |
| 29092 | <p>COPPER - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1294.</p> | Cu TOTAL | mg/L Cu | 2 |
| 29101 | <p>COPPER - DISSOLVED</p> <p>Colourimetry – DDTC method</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is extracted in a 20% solution of acetylacetone in chloroform to remove the iron interference. Discard the organic phase. The pH of the aqueous phase is adjusted to 10 with an ammonium hydroxide solution. Precipitate all copper by drop-wise addition of sodium diethyldithiocarbamate (DDTC) and extract with three portions of 5:2 mixture of chloroform and acetone. Dilute the combined extracts with chloroform, mix and measure the wavelength in a one cm cell or longer at 440 nm against a blank (the colour is stable for two hours). Compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: Chalmers and Dick 1965.</p> | Cu DISS | mg/L Cu | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 29105 | <p>COPPER - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The pH of the sample aliquot is adjusted to 4.75 [Japan buffers to pH 3.5-4.0]. with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 324.7 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 52.2.</p> | Cu DISS | mg/L Cu | 3 |
| 29106 | <p>COPPER - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 324.7 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 52.2.</p> | Cu DISS | mg/L Cu | 3 |
| 29109 | <p>COPPER – DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 324.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 52.4.</p> | Cu DISS | mg/L Cu | 3 |
| 29111 | <p>COPPER - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm filter paper and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at 324.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 52.4.</p> | Cu DISS | mg/L Cu | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|---------|----------|
| 29190 | <p>COPPER - DISSOLVED</p> <p>ICP - MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. A sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 52.5.</p> | Cu DISS | mg/L Cu | 3 |
| 29206 | <p>COPPER - SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µ membrane filter. The filter, containing the residue, is digested in nitric acid. The resulting solution is then aspirated and the absorbance is measured spectrometrically at 324.7 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Cu PART | µg/g | 3 |
| 29305 | <p>COPPER – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 324.7 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Cu EXTRBLE | mg/L Cu | 3 |
| 29306 | <p>COPPER – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight and analyzed by direct aspiration AAS. The absorbance is measured spectrophotometrically at wavelength 324.7 nm, and compared with those of standard solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 479.</p> | Cu EXTRBLE | mg/L Cu | 2 |
| 29309 | <p>COPPER – EXTRACTABLE</p> <p>Flameless Atomic Absorption Spectroscopy (GFAAS)</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. An aliquot is analyzed by graphite furnace AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 504.</p> | Cu EXTRBLE | mg/L Cu | 4 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 29901 | <p>COPPER - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages in a graphite furnace or an electrically heated atomiser in which: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the copper to be determined. The absorbance of the resultant ground state atoms is measured at 324.7 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 52.3.</p> | Cu DISS | mg/L Cu | 3 |
| 29911 | <p>COPPER – TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>The sample is preserved in the field with nitric acid. A sample aliquot is digested in nitric acid or aqua regia. The digest is then heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the copper to be determined. The absorbance of the resultant ground state atoms is measured at 324.7 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 52.3.</p> | Cu TOTAL | mg/L Cu | 3 |
| 30001 | <p>ZINC - Total</p> <p>Colourimetry – Dithizone method</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is evaporated to dryness to remove the excess acid and brought back to volume. The aliquot is then reacted with diphenylthiocarbazone (dithizone) to produce a coloured complex. The complex is extracted with an organic solvent (carbon tetrachloride) and most interferences are overcome by adjusting the pH between 4.0 and 5.5 and adding sufficient sodium thiosulphate (which tends to slow the coloured reaction). The sample, and the standard and blank solutions must be identically-prepared and the pH kept constant. The absorbance is read at 535 nm in a path light of 2 cm or longer.</p> <p>Interferences: Many metals could interfere with this reaction without the complexation by sodium thiosulphate and pH adjustment. This reaction is extremely sensitive and the glassware used should be dedicated to zinc analysis only. Dithizone and dithizonates decompose in strong light: perform analysis in subdued lighting</p> <p>The method detection limit is 0.001 mg/L</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 1995, SM 3500-Zn D. (NOTE: this method only in 1995 edition)</p> | Zn TOTAL | mg/L Zn | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 30002 | <p>ZINC - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 213.9 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: INSIVUMEH, Guatemala, 2013 Reference: APHA 2012, SM 3111 B.</p> | Zn TOTAL | mg/L Zn | 3 |
| 30004 | <p>ZINC - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 213.8 nm and compared to identically-prepared standard and blank solutions, using an air-propane or air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Argentina EBY, April 2005. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 53.1. Reference 3: EPA method 7950. Reference 4: APHA 2012, SM 3111 A</p> | Zn TOTAL | mg/L Zn | 3 |
| 30005 | <p>ZINC - TOTAL</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The pH of the digest is adjusted to 4.75 [Japan buffers to pH 3.5-4.0]. with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the digest then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 213.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 53.1.</p> | Zn TOTAL | mg/L Zn | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 30009 | <p>ZINC - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 213.8 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 53.3.</p> | Zn TOTAL | mg/L Zn | 3 |
| 30011 | <p>ZINC - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with diluted mineral acid. The sample aliquot is digested in aqua regia and evaporated to near dryness. The wet residue is diluted with concentrated HCl to one-fifth of the aliquot's original volume. The emission is measured spectrometrically at 213.8 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 53.3. Reference 3: Environment Canada 2007, PYR code 2634.</p> | Zn TOTAL | mg/L Zn | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 30031 | <p>ZINC – TOTAL</p> <p>Colourimetry – Wagtech photometer</p> <p>In the Palintest Tubetests Zinc/7/35 test, the sample is first digested in a sulphuric acid/nitric acid mixture in order to solubilise particulate matter, break down complexes and remove colour. The acid digest mixture is provided pre-dispensed into special digestion tubes for ease of use and maximum safety. Following the digestion stage, the sample is neutralised and then complexed with thiocyanate ions to form zinc thiocyanate. This is then reacted with brilliant green indicator under acidic conditions to give a green coloration. The indicator itself is yellow so over the range of zinc levels under test a distinctive range of colours from pale yellow to dark green is produced.</p> <ol style="list-style-type: none"> 1. Turn on Tubetest heater to 105°C 2. Prepare sample tube with digest reagent 3. Place tube in heater for 60 min. and let cool for 10 min. 4. Add 5mL of Zinctube Neut Reagent 5. Fill tube to 10ml with deionised water 6. Add crushed Zinc IR tablet 7. Add 2 level scoops of Zinctube powder using size 4 dosing scoop. Let stand for 2 min. 8. Make indicator by adding Zinctube indicator tablet to 10mL deionised water. Crush the tablet and mix thoroughly to dissolve. 9. Add 1mL of indicator solution to sample tube. 10. After 10 min. zero the photometer and take a reading. <p>Testing range is 0 – 7 mg/l, 0-35 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions TUBETESTS ZINC/7/35</p> | Zn TOTAL | mg/L Zn | 3 |
| 30090 | <p>ZINC - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.04 µg/L.</p> <p>Requesting Agency 1: NIES, Japan, 1998. Requesting Agency 2: Environment Canada, Atlantic Region, 2007. Reference 1: APHA 1998. Reference 2: JSA 1998, method 53.4. Reference 3: Environment Canada 1995, ENVIRODAT code 64.</p> | Zn TOTAL | mg/L Zn | 3 |

UNEP GEMS/Water Programme

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 30091 | <p>ZINC – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Zn TOTAL | mg/L Zn | 3 |
| 30092 | <p>ZINC – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1309.</p> | Zn TOTAL | mg/L Zn | 2 |
| 30101 | <p>ZINC - DISSOLVED</p> <p>Colourimetry – Zincon method</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with HCl or mineral acid. Before sample treatment, adjust to pH 7 with 1N NaOH or 1N HCl. To a series of sample aliquots, standards, blanks and QC solutions, add, in sequence and mix after each addition, sodium ascorbate, KCN, buffer and zincon (2-carboxy-2'-hydroxy-5'-sulphoformazyl benzene) solutions. Add a chloral hydrate solution [or cyclohexanone per APHA method] and time for exactly five minutes [or 1 minute in APHA method]; measure the absorbance at 620 nm and compare to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 2005, SM 3500-Zn B. (<u>NOTE</u>: <i>this was SM 3500-Zn F in APHA 1995</i>).</p> | Zn DISS | mg/L Zn | 3 |
| 30104 | <p>ZINC – DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 213.8 nm and compared to identically-prepared standard and blank solutions, using an air-propane or air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Argentina EBY, 2005. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 53.1. Reference 3: EPA 1986, method 7950.</p> | Zn DISS | mg/L Zn | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 30105 | <p>ZINC- DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The pH of the sample aliquot is adjusted to 4.75 [Japan buffers to pH 3.5-4.0]. with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added, mixed, then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 213.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 53.1.</p> | Zn DISS | mg/L Zn | 3 |
| 30109 | <p>ZINC - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 213.8 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 53.3.</p> | Zn DISS | mg/L Zn | 3 |
| 30111 | <p>ZINC - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at 213.8 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 53.3.</p> | Zn DISS | mg/L Zn | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|---------|----------|
| 30190 | <p>ZINC - DISSOLVED</p> <p>ICP – MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 53.4.</p> | Zn DISS | mg/L Zn | 3 |
| 30204 | <p>ZINC SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered through a 0.45 µm membrane filter. The filter, containing the residue, is digested in nitric acid. The resulting solution is then aspirated and the absorbance is measured spectrometrically at 213.8 nm and compared to identically-prepared standard and blank solutions, using an air-propane oxidizing flame.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Zn PART | µg/g | 3 |
| 30304 | <p>ZINC – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight and analyzed by direct aspiration AAS. The absorbance is measured spectrophotometrically at wavelength 213.8 nm, and compared with those of standard solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 479.</p> | Zn EXTRBLE | mg/L Zn | 2 |
| 30305 | <p>ZINC – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 213.8 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Zn EXTRBLE | mg/L Zn | 3 |
| 30309 | <p>ZINC – EXTRACTABLE</p> <p>Flameless Atomic Absorption Spectroscopy (GFAAS)</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. An aliquot is analyzed by graphite furnace AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 504.</p> | Zn EXTRBLE | mg/L Zn | 4 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 30511 | <p>ZINC - DISSOLVED</p> <p>Anodic Stripping Voltammetry</p> <p>A sample is filtered through a 0.45 µm membrane or dense paper filter and preserved with nitric acid to pH <3. Zinc concentration in the sample aliquot is evaluated by preliminary accumulation (electrolysis) of zinc at a working electrode at a potential of -1.4 V and its subsequent electrodisolution at a potential of -0.9 V. Maximum current of dissolution, proportional to zinc concentration in the sample, is recorded. The working electrode is amalgamated silver wire and the reference electrode is saturated Ag/AgCl electrode. A calculation of zinc concentration in the sample is made according to the method of standard addition.</p> <p>Interference of organic substances is eliminated by UV-radiation of the sample in the presence of formic acid. When large amounts of organic substances are present, the sample is first mineralized by evaporating with nitric and hydrochloric acids.</p> <p>The method detection limit is 0.0005 mg/L, upper limit is 1 mg/L.</p> <p>Requested Agency: GHI, Russia, 2003. Reference: Hydrochemical Institute 1996.</p> | Zn DISS | mg/L Zn | 4 |
| 30901 | <p>ZINC - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages in a graphite furnace or an electrically heated atomiser in which: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the zinc to be determined. The absorbance of the resultant ground state atoms is measured at 213.8 nm and is compared with those of identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1995. Reference 2: JSA 1998, method 53.2.</p> | Zn DISS | mg/L Zn | 3 |
| 30911 | <p>ZINC – TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>The sample is preserved in the field with nitric acid. A sample aliquot is digested in nitric acid or aqua regia. The sample aliquot is heated, usually in three stages in a graphite furnace or an electrically heated atomiser in which: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the zinc to be determined. The absorbance of the resultant ground state atoms is measured at 213.8 nm and is compared with those of identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1995. Reference 2: JSA 1998, method 53.2.</p> | Zn TOTAL | mg/L Zn | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 31092 | <p>GALLIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1296.</p> | Ga Total | mg Ga/L | 3 |
| 33003 | <p>ARSENIC - TOTAL</p> <p>Colourimetry</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is digested in nitric acid. Add consecutively HCl, KI and SnCl₂ solutions (swirl between each addition) to the sample aliquot and allow one hour for reduction. The inorganic arsenic is reduced (gaseous arsine) by zinc in an acid medium. The arsine is then passed through a scrubber containing glass wool impregnated with lead acetate to remove sulphide and finally through an absorber tube containing Silver Diethyl Dithiocarbamate in pyridine. The arsenic reacts with the silver salt and forms a red colour, measured spectrometrically at 540 nm [Japan measures at 510 nm] and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: Sb and other heavy metal ions at high concentrations.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 61.1.</p> | As TOTAL | mg/L As | 3 |
| 33006 | <p>ARSENIC – TOTAL</p> <p>Colourimetry (Acidification)</p> <p>The sample is digested with HNO₃. HCl, KI, and SnCl₂ solutions are added in turn to an aliquot of the sample solution. After 1 hour, Zn metal is added. The arsine evolved is passed through a lead acetate scrubber and absorbed in a silver diethyl-dithiocarbamate solution in pyridine. The resulting colour is measured spectrophotometrically at 540 nm, and compared with those of identically prepared standard arsenic solutions.</p> <p>Interferences: Sb and other heavy metal ions at high concentrations.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1362.</p> | As TOTAL | mg/L As | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 33007 | <p>ARSENIC – TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is digested and oxidised with an acidic potassium persulphate solution, then all forms of arsenic are reduced to arsenite (As³⁺) with HCl. [Japan uses sulphuric acid, nitric acid and potassium permanganate as reagent]. Hydrides of arsenic are formed in an acidic sodium borohydride solution. The arsine vapours are separated from the solution by heating, usually in three stages in a graphite furnace or an electrically heated atomiser in which: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; and finally, the third stage applies a high current which heats the tube to incandescence and atomises the arsenic to be determined. The absorbance of the resultant ground state atoms is measured at 193.7 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 61.2.</p> | As TOTAL | mg/L As | 3 |
| 33008 | <p>ARSENIC - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES).</p> <p>A sample is preserved in the field at 4°C. From the sample aliquot, all organoarsenides are decomposed with acidic persulphate. After reduction to arsenite with HCl, the metal is converted to its hydride form with sodium borohydride in an automated system and passed through an argon plasma torch where it is decomposed to its arsenic atoms, measured by emission spectrometry at 193.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 61.3.</p> | As TOTAL | mg/L As | 3 |
| 33009 | <p>ARSENIC - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with nitric acid and H₂O₂ to oxidise all organoarsenides, then passed through a tube furnace at 850°C, using a 1000 ppm nickel nitrate solution as a matrix modifier, and the arsenic atoms are measured spectrometrically at 193.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Government of Québec at Longueuil, Canada, 1982. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JWWA 2001, method VI-3 17.4.</p> | As TOTAL | mg/L As | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 33011 | <p>ARSENIC – TOTAL</p> <p>Flameless Atomic Absorption Spectrometry – Hydride</p> <p>A sample is preserved in the field at 4°C. The sample aliquot and standard solutions are digested with H₂SO₄, HNO₃, and HClO₄. Arsenic is reduced to arsine with acidic NaBH₄ solution and is then sparged into a heated quartz combustion tube, decomposing the hydride to form arsenic atoms. The absorbance is measured spectrometrically at 193.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: Alberta Environment, Canada, 1985. Reference: Alberta Environment 1979.</p> | As TOTAL | mg/L As | 3 |
| 33012 | <p>ARSENIC - TOTAL</p> <p>Atomic Absorption Spectrometry – Gaseous Hydride</p> <p>Samples are digested with a nitric/sulphuric acid procedure. The arsenic in the digestate is then reduced to the trivalent form with tin chloride. The trivalent arsenic is then converted to a volatile hydride using hydrogen produced from a zinc/HCl reaction. The volatile hydride is swept into an argon hydrogen flame located in the optical path of an atomic absorption spectrometer. The resulting absorption of the lamp radiation at 193.7 nm wavelength is proportional to the arsenic concentration.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency: EBY, ARGENTINA, 2005 Reference: EPA 1986, method 7061.</p> | As TOTAL | mg/L As | 2 |
| 33013 | <p>ARSENIC – TOTAL</p> <p>Wagtech Arsenator (based on Gutzeit method)</p> <p>The Arsenator system is based on the Gutzeit method in which arsine gas is generated, then reacted with mercuric bromide (HgBr₂). It features a portable digital photometer capable of giving accurate digital readings within an arsenic concentration range of 2-100 ppb. A tri-filter arsenic trap removes excess arsine gas as well as any hydrogen sulphide which may be given off as a by-product of the reaction.</p> <p>Applicable range is 2 ug/L to 100 ug/L.</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Wag-WE10500 Arsenator Operation Manual 2006</p> | As TOTAL | mg/L As | 3 |
| 33014 | <p>ARSENIC – TOTAL</p> <p>ICP-AES – Hydride Generation</p> <p>Aliquots of a whole water sample and standards are digested with acidic persulphate to decompose organoarsenides and organoselenides. Alternatively (Japanese method), the organoarsenides are decomposed with heat using nitric acid, sulphuric acid, and potassium permanganate. After reduction to arsenite and selenite with HCl (and potassium iodide in the Japanese method), the metals are converted to their respective hydrides with sodium borohydride in an automated system and passed to an argon plasma torch where they are decomposed and measured by atomic emission spectrometry.</p> <p>Requesting Agency 1: Environment Canada, Pacific & Yukon Region, 2007. Requesting Agency 2: NIES Japan, 2014. Reference 1: Environment Canada, PYR code 2640. Reference 2: Japan MHLW 2003. Notification no. 261, Appendix no.11</p> | As TOTAL | mg/L As | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 33090 | <p>ARSENIC - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with mineral acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 17.5.</p> | As TOTAL | mg/L As | 3 |
| 33091 | <p>ARSENIC – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | As TOTAL | mg/L As | 3 |
| 33092 | <p>ARSENIC - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1287.</p> | As TOTAL | mg/L As | 2 |
| 33103 | <p>ARSENIC - DISSOLVED</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. Add consecutively HCl, KI and SnCl₂ solutions (swirl between each addition) to the sample aliquot and allow one hour for reduction. The inorganic arsenic is reduced (gaseous arsine) by zinc in an acid medium. The arsine is then passed through a scrubber containing glass wool impregnated with lead acetate to remove sulphide and finally through an absorber tube containing Silver Diethyl Dithiocarbamate in pyridine. The arsenic reacts with the silver salt and forms a red colour, measured spectrometrically at 540 nm [Japan uses 510 nm] and compared to identically-prepared standard and blank solutions.</p> <p>Interferences: Sb and other heavy metal ions at high concentrations. The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 61.1.</p> | As DISS | mg/L As | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 33104 | <p>ARSENIC - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is digested with sulphuric acid, nitric acid and potassium permanganate until a white fume of sulphuric acid is generated. Dissolve the residue with HCl and transfer into reactor vessel generator. Add KI, SnCl₂ and ferric solutions (10 mg/L Fe), mix and let stand 15 minutes. Connect generator to Atomic Absorption Analyser, replace air with argon, quickly add one gram of zinc powder. Pass arsenic hydride into hydrogen-argon flame and the absorbance of the resultant ground state atoms is measured at 193.7 nm and is compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 61.2.</p> | As DISS | mg/L As | 3 |
| 33108 | <p>ARSENIC - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES).</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. All organoarsenides, from the sample aliquot, are decomposed with acidic persulphate. After reduction to arsenite with HCl, the metal is converted to its hydride form with sodium borohydride in an automated system and passed through an argon plasma torch where it is decomposed to its arsenic atoms, measured by emission spectrometry at 193.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1983. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 61.3.</p> | As DISS | mg/L As | 3 |
| 33111 | <p>ARSENIC - DISSOLVED</p> <p>ICP 1516</p> <p>Requesting Agency: Belgium, 2013 Reference:</p> | As DISS | mg/L As | 3 |
| 33114 | <p>ARSENIC - DISSOLVED</p> <p>ICP-AES – Hydride Generation</p> <p>Filtration: 0.45 um membrane filter. The filtrate and standards are digested with acidic persulphate to decompose organoarsenides and organoselenides. After reduction to arsenite and selenite with HCl, the metals are converted to their respective hydrides with sodium borohydride in an automated system and passed to an argon plasma torch where they are decomposed and measured by atomic emission spectrometry.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2641.</p> | As DISS | mg/L As | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------------------|---------|----------|
| 33190 | <p>ARSENIC - DISSOLVED</p> <p>ICP- MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 17.5.</p> | As DISS | mg/L As | 3 |
| 33191 | <p>ARSENIC - DISSOLVED</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - A filtered water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | As DISS | mg/L As | 3 |
| 33202 | <p>ARSENIC SUSPENDED</p> <p>Flameless Atomic Absorption Spectrometry – Acid Digestion</p> <p>A sample is preserved in the field. Arsenic is extracted from the soil or sediment aliquot by digestion with HNO₃, HClO₄, KMnO₄, K₂S₂O₈ and HF to its inorganic forms. Following the oxidation and complete solubilization, an automated system is used to determine arsenic. After reduction to arsenite with HCl, the metal is converted to its hydride form with sodium borohydride in an automated system and passed through an argon plasma torch where it is decomposed to its arsenic atoms, measured by emission spectrometry at 193.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: Environment Canada, NWRI, 1979. Reference: Agemian and Bedek 1980.</p> | As PARTICU- LATE | µg/g | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 34002 | <p>SELENIUM - TOTAL</p> <p>Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is oxidized, in acidic persulphate, to Selenate (Se^{-6}O_4)⁻², reduced to selenite (Se^{-4}O_3)⁻² in HCl, then converted to its hydride form (hydrogen selenide: H_2Se) with sodium borohydride in an acid medium. The sample is aspirated into the flame and the selenium absorbance is measured spectrometrically at 196.0 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interference: Chromium, cobalt, copper, mercury, molybdenum, nickel, platinum and silver may interfere in large concentration.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 67.2.</p> | Se TOTAL | mg/L Se | 3 |
| 34007 | <p>SELENIUM - TOTAL</p> <p>Flameless Atomic Absorption Spectrometry – Hydride</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is digested and oxidised with acidic potassium persulphate, then concentrated HCl reduces all forms of selenium to selenite. [Japan uses sulphuric acid and nitric acid for digestion]. The hydride is formed by the action of NaBH_4 in acidic solution then sparged into a quartz tube cell and decomposes at 800°C to form selenium atoms. The absorbance is measured spectrometrically at 196.1 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 67.2.</p> | Se TOTAL | mg/L Se | 3 |
| 34008 | <p>SELENIUM - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES).</p> <p>A sample is preserved in the field at 4°C. All organoselenides, from the sample aliquot, are oxidised in acidic persulphate. After reduction to selenite with HCl, the metal is converted to its hydride with sodium borohydride on an automated system and passed through an argon plasma torch where it is decomposed to its selenium atoms, measured by emission spectrometry at 196.0 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.03 µg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Goulden, Anthony and Austen 1981. Reference 2: JSA 1998, method 67.3.</p> | Se TOTAL | mg/ Se | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 34014 | <p>SELENIUM - TOTAL</p> <p>ICP-AES – Hydride Generation</p> <p>Aliquots of a whole water sample and standards are digested with acidic persulphate to decompose organoarsenides and organoselenides. Alternatively (Japanese method), the water sample is heat-digested with 1 mL of 50% sulphuric acid and 2 mL nitric acid. When cooled, 8 mL each of water, HCl, and 1 mol/L potassium bromide are added and again heated for up to one hour at 50 °C. After reduction to arsenite and selenite with HCl, the metals are converted to their respective hydrides with sodium borohydride (or 10g/L sodium tetrahydroborate) in an automated system and passed to an argon plasma torch where they are decomposed and measured by atomic emission spectrometry at 196.026 nm wavelength..</p> <p>Requesting Agency 1: Environment Canada, Pacific & Yukon Region, 2007. Requesting Agency 2: NIES Japan, 2014. Reference 1: Environment Canada, PYR code 2640. Reference 2: Japan MHLW 2003. Notification no. 261, Appendix no. 9.</p> | Se TOTAL | mg/L Se | 3 |
| 34090 | <p>SELENIUM - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field at 4°C. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 18.5.</p> | Se TOTAL | mg/L Se | 3 |
| 34091 | <p>SELENIUM - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Se TOTAL | mg/L Se | 3 |
| 34092 | <p>SELENIUM - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1311.</p> | Se TOTAL | mg/L Se | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 34102 | <p>SELENIUM - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is digested with 2% potassium persulphate (oxidising the organoselenides to selenates) and concentrated HCl (reducing selenates to selenites). [Japan uses sulphuric acid and nitric acid to digest sample]. In an automated system, the selenium is mixed with a potassium iodide-stannous chloride mixture and an aluminum slurry in sulphuric acid to form hydrogen selenide (H₂Se). [Japan uses sodium tetrahydroborate solution to form hydrogen selenide]. This is then separated from solution, passed into a quartz tube atomiser, decomposed to its selenium atoms, measured spectrometrically at 196.1 nm and is compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 67.2.</p> | Se DISS | mg/L Se | 3 |
| 34108 | <p>SELENIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES).</p> <p>A sample is filtered in the field and preserved at 4°C. All organoselenides, from a sample aliquot, are decomposed with acidic persulphate. After reduction to selenite with HCl, the metal is converted to its hydride with sodium borohydride on an automated system and passed through an argon plasma torch where it is decomposed to its selenium atoms, measured by emission spectrometry at 196.0 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.03 µg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1983. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1982. Reference 2: JSA 1998, method 67.3.</p> | Se DISS | mg/L Se | 3 |
| 34114 | <p>SELENIUM – DISSOLVED</p> <p>ICP-AES – Hydride Generation</p> <p>Aliquots of a filtered whole water sample and standards are digested with acidic persulphate to decompose organoarsenides and organoselenides. Alternatively (Japanese method), the water sample is heat-digested with 1 mL of 50% sulphuric acid and 2 mL nitric acid. When cooled, 8 mL each of water, HCl, and 1 mol/L potassium bromide are added and again heated for up to one hour at 50 °C. After reduction to arsenite and selenite with HCl, the metals are converted to their respective hydrides with sodium borohydride (or 10g/L sodium tetrahydroborate) in an automated system and passed to an argon plasma torch where they are decomposed and measured by atomic emission spectrometry at 196.026 nm wavelength.</p> <p>Requesting Agency 1: Environment Canada, Pacific & Yukon Region, 2007. Requesting Agency 2: NIES Japan, 2014. Reference 1: Environment Canada, PYR code 2641. Reference 2: Japan MHLW 2003. Notification no. 261, Appendix no. 9.</p> | Se DISS | mg/L Se | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 34190 | <p>SELENIUM - DISSOLVED</p> <p>ICP – MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved at 4°C. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JWWA 2001, method VI-3 18.5.</p> | Se DISS | mg/L Se | 3 |
| 34191 | <p>SELENIUM - DISSOLVED</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Se DISS | mg/L Se | 3 |
| 35031 | <p>BROMINE – TOTAL</p> <p>Colourimetry by Wagtech photometer</p> <p>Bromine reacts with diethyl-p-phenylene diamine (DPD) in buffered solution to produce a pink coloration. The intensity of the colour is proportional to the total bromine concentration and is measured using a Palintest Photometer. Rinse test tube with sample leaving two to three drops of sample in the tube. Add one DPD No 1 tablet, crush tablet and then fill the test tube with sample to the 10 ml mark. Take photometer reading in usual manner.</p> <p>Testing range is 0 – 10.0 mg/l</p> <p>Requesting Agency: DACAAR, Afghanistan, 2007 Reference: Palintest Test Instructions BROMINE</p> | Br Total | mg Br/L | 1 |
| 35209 | <p>BROMIDE – DISSOLVED</p> <p>Ion Chromatography (with suppressed conductivity detection)</p> <p>A whole water sample is filtered through a 0.45 µm membrane filter. The analysis is conducted by ion chromatography and determined in conjunction with other anions. An ion exchange process separates the ions of interest based on the affinity for the exchange sites of the resin bed. The sample is then pumped through the suppressor which reduces the background conductivity of the eluent to a negligible level by converting the anions in the sample to their respective acid forms. The concentrations of these separated anions are determined by measuring their respective conductivities using a conductivity detector. Anions are identified by their retention times compared to known calibration standards.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 617.</p> | Br DISS | mg Br/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-------------------|---------------|----------|
| 36001 | <p>COLIFORMS - TOTAL</p> <p>Multiple Test Tube</p> <p>Minor variations in analytical techniques can cause change in results; therefore microbiological methods and sterilising procedures must be standardized to obtain uniform results from different laboratories. The results are an estimate of the mean density of coliforms in the sample and are reported as most probable number (MPN). Unless a large portion of fermentation tubes are used, the precision is low.</p> <p>Presumptive Phase: Use sufficient medium (lauryl tryptose broth) in fermentation tubes, incubate at 20°C overnight before use and discard tubes with growth or bubbles. Arrange fermentation tubes in rows of five or ten in test tube rack. For potable water, use five 20mL portions, ten 10mL portions tubes or a single 100mL portion. For non-potable water, use five tubes per dilution (10, 1.0, 0.1 mL, etc). Shake sample well, inoculate and mix test tubes in the medium by gentle agitation. Incubate inoculated tubes or bottles at 35°C ± 0.5°C. [Japan uses 36°C ± 1°C.] After 24 hours, swirl each container and check for growth, gas or acidic reaction (producing a shade of yellow colour) and document. If absent, re-incubate for another 24 hours. The absence of acidic reaction or gas formation constitutes a negative test.</p> <p>Confirmed Phase: Submit all presumptive tubes with growth, gas or acidic reaction. Transfer culture to the fermentation tube (containing brilliant green lactose bile broth) or insert a sterile applicator into the culture, quickly remove and insert to the bottom of fermentation tube containing the broth. Remove and discard applicator. Repeat for all positive presumptive tubes. Incubate at 35°C ± 0.5°C. [Japan uses 36°C ± 1°C.] Formation of gas at any time within 48 hours ± 3 hours constitutes a positive confirmed phase.</p> <p>Alternative Procedure (for polluted waters): If all presumptive tubes are positive in two or more consecutive dilutions within 24 hours, only submit, to the confirmed phase, all tubes with the highest dilution (also submit all positive tubes produced after 48 hours). Calculate the MPN value from the number of positive brilliant green lactose bile tubes.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1995, SM 9221 B Reference 2: JWWA 2001, method VIII 2.1.2.</p> | COLIFORM TOTAL | MPN/100 mL | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------|------------|----------|
| 36002 | <p>COLIFORMS - TOTAL</p> <p>Membrane Filtration (MF)</p> <p>Minor variations in analytical techniques can cause change in results; therefore microbiological methods and sterilising procedures must be standardized to obtain uniform results from different laboratories. The Membrane Filter technique is usually more rapid and more reproducible than the multiple-tube technique in monitoring drinking water and a variety of natural waters. MF has limitations: i.e.: testing samples with high turbidity or large background (non-coliforms) bacteria.</p> <p>Apply sufficient medium (lauryl tryptose broth) in fermentation tubes, incubate at 20°C overnight before use and discard tubes with growth or bubbles. The coliform group is defined as all bacteria that produce a red colony with a metallic (golden) sheen within 24 hours at 35°C on an Endo-type medium containing lactose (production of aldehydes). The medium is stable for a maximum of three weeks and the broth for four days at 4°C.</p> <p>Filter 100 to 1000 mL of water, place filter paper on saturated lactose pad for two hours at 35°C, remove from incubator and transfer to M-endo medium pad, incubate for 20 to 22 hours [Japan uses 23 ± 1 hours] at 35°C ± 0.5°C, [Japan uses 36°C ± 1°C.] then count the colonies on membrane filters using a 10 to 15 times magnifying binocular wide field dissecting microscope or equivalent, with a cool white fluorescent light source directed to provide maximum viewing of the sheen.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1995, SM 9222 B and D. Reference 2: JWWA 2001, method VIII 2.1.4..</p> | COLIFORM TOTAL | MPN/100 mL | 0 |
| 36004 | <p>COLIFORMS - TOTAL</p> <p>Enzyme Substrate Specific Reaction</p> <p>After 100 mL of a sample is added to one of the following media (a MMO-MUG culture medium, an ONPG-MUG culture medium with added IPTG, an XGal-MUG culture medium, or an XGal-MUG culture medium with added pyruvic acid), 5 tubes of the medium and test sample are mixed. Then, the sample is incubated for 24 hours. After incubation, the sample is irradiated with ultraviolet light with a wavelength of 366 nm from a UV lamp to verify the presence of fluorescence. The sample is judged positive if the fluorescence of the culture medium is stronger than a colorimetric solution of appropriate medium and negative if the fluorescence is weaker. It is sought the most probable number corresponding to the dilution of the test water.</p> <p>Requesting Agency: NIES. Japan 2013 Reference: JWWA 2001, method VIII 2.1.3.</p> | COLIFORM TOTAL | MPN/100 mL | 0 |
| 36006 | <p>COLIFORMS - TOTAL</p> <p>WTW Potatest based on membrane filtration.</p> <p>Requesting Agency: DACAAR, Afghanistan 2007 Reference:</p> | COLIFORM TOTAL | MPN/100 mL | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------|------------|----------|
| 36007 | <p>COLIFORMS – TOTAL</p> <p>Colilert Quanti-Tray</p> <p>The nature of the Colilert test, which is simply a Most Probable Number (MPN) test, is that 100 ml of sample (mixed with growth media) is poured and sealed into a plastic tray that has 49 "large" wells and 48 "small" wells. After 24 hours incubation at 35 °C the number of wells (large and small) showing "positive" signs of coliform growth (due to presence of enzyme beta-galactosidase) are counted and those numbers then referred to an MPN table. The maximum MPN number that can be achieved without dilution of the sample is 2419.17 i.e. 49 large wells and 47 small wells reading positive. If all wells are positive (49 large and 48 small) then the test has gone over range and a result of >2419.2 is reported, unless the sample was prior diluted.</p> <p>Requesting Agency 1: NIWA, New Zealand, 2007 Requesting Agency 2: Japan, 2007 Requesting Agency 3: Environment Canada, Atlantic Region, 2007. Reference 1: Environment Canada 1995, ENVIRODAT code 2566. Reference 2: APHA 2005, SM 9223 B</p> | COLIFORM TOTAL | MPN/100 mL | 0 |
| 36011 | <p>THERMOTOLERANT (FAECAL) COLIFORM BACTERIA</p> <p>Multiple Test Tube:</p> <p>Elevated temperature distinguishes faecal coliforms from total coliforms. Minor variations in analytical techniques can cause change in analytical results; therefore microbiological methods and sterilising procedures must be standardized to obtain uniform results from different laboratories.</p> <p>Use sufficient EC medium in fermentation tubes and incubate at 20°C overnight before use; discard tubes with growth or bubbles. Arrange fermentation tubes in rows of five or ten each in test tube rack. For potable water, use five 20 mL portions, ten 10 mL portions tubes or a single 100 mL portion. For non-potable water, use five tubes per dilution (10, 1.0, 0.1 mL, etc). Shake sample well, inoculate and mix test tubes in the medium by gentle agitation. Incubate inoculated tubes or bottles at 44.5°C ± 0.2°C. Gas production with growth in an EC broth culture tube within 24 hours ± 2 hours or less is considered positive faecal coliform reaction. If absent, re-incubate for another 24 hours. The absence of acidic reaction or gas formation constitutes a negative test. Gently shake or rotate the tubes/bottles to re-suspend the organisms. With a sterile loop, transfer one or more loopfuls of culture to the fermentation tube containing brilliant green lactose bile broth (or insert a sterile applicator into the culture, quickly remove and insert to the bottom of fermentation tube containing the broth. Remove and discard applicator). Repeat for all positive presumptive tubes. Incubate at 44.5°C ± 0.2°C. Formation of gas at any time within 48 hours ± 3 hours constitutes a positive confirmed phase. Failure to produce gas (with little or no growth) constitutes a negative reaction. Calculate from the number of positive EC broth tubes.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: APHA 1995, SM 9221 G.</p> | FAEC COL | MPN/100 mL | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|------------|----------|
| 36012 | <p>THERMOTOLERANT (FAECAL) COLIFORM BACTERIA</p> <p>Membrane Filtration</p> <p>Survival and growth at elevated temperature distinguishes faecal coliforms from total coliforms. Minor variations in analytical techniques can cause change in analytical results; therefore microbiological methods and sterilizing procedures must be standardized to obtain uniform results from different laboratories.</p> <p>Method 1: Filter a volume of sample (to yield counts of 20 to 80 faecal coliform colonies), rinse with sterile water between filtration; analyse a blank membrane filter and a duplicate sample after every 10 samples. Place a sterile absorbing pad in each culture dish and saturate with M-FC medium. Place the prepared filter on medium pad, insert in waterproof container and incubate by placing in a plastic bag and immerse in a water bath at $44.5^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$ for 24 hours. Colonies produced by faecal coliform bacteria on M-FC medium are various shades of blue (non-faecal coliform colonies are grey to cream coloured.). Count colonies on membrane filters using a 10 to 15 times magnifying binocular wide field microscope, with a cool white fluorescent light. Count coliforms based on 100 mL of sample.</p> <p>Method 2: A measured volume of water sample is filtered through a sterile cellulose ester membrane where the pore size is small enough to retain the organisms to be enumerated. The membrane is placed on an absorbent pad saturated with membrane lauryl sulphate broth (containing lactose and phenol red as indicator of acidity) and incubated 4 hours at 30°C then 14 hours at 44°C. The colonies of organism with characteristic colour and morphology are counted with subsequent confirmation of the ability to produce acid and gas from the lactose broth and indole formation from tryptophan broth. The results are expressed in number of colony forming units (cfu) per 100 mL of sample.</p> <p>Requesting Agency 1: Water Supplies Department, Hong Kong SAR, 1998. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Department of Environment (UK) 1982. Reference 2: Japanese Waterworks Analytical Method (2001) VIII-2.3.2. Reference 3: APHA 2005, SM-9222 I.</p> | FAEC COL | MPN/100 mL | 0 |
| 36016 | <p>THERMOTOLERANT (FAECAL) COLIFORM BACTERIA</p> <p>WTW Potatest, based on membrane filtration.</p> <p>Requesting Agency: DACAAR, Afghanistan 2007 Reference:</p> | FAEC COL | MPN/100 mL | 0 |
| 36017 | <p><i>Escherichia coli</i></p> <p>Colilert Quanti-Tray</p> <p>After 24 hours incubation at 35°C, the presence of <i>E.coli</i> are identified from their enzyme beta-glucuronidase. Measure the presence of its fluorescent enzymatic decomposition product at 366 nm wavelength.</p> <p>Requesting Agency 1: New Zealand, 2007 Requesting Agency 2: NIES Japan, 2007 Reference: APHA 2005, SM 9223 B</p> | <i>E.coli</i> | MPN/100 mL | 0 |
| 36018 | <p>THERMOTOLERANT (FAECAL) COLIFORM BACTERIA</p> <p>Membrane Filtration</p> <p>Requesting Agency: Reference:</p> | FAEC. COL. | No./100 mL | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------|------------|----------|
| 36020 | <p><i>Escherichia coli</i></p> <p>Enzyme Specific Substrate Culture (Qualitative test)</p> <p>After 100 mL of a sample is added to one of the following media (a MMO-MUG culture medium, an ONPG-MUG culture medium with added IPTG, an XGal-MUG culture medium, or an XGal-MUG culture medium with added pyruvic acid), the test container is immediately sealed and shaken in order to dissolve and mix the culture medium. Then, the sample is incubated for 24 hours. After incubation, the sample is irradiated with ultraviolet light with a wavelength of 366 nm from a UV lamp to verify the presence of fluorescence. The sample is judged positive if the fluorescence of the culture medium is stronger than a colorimetric solution of appropriate medium, and negative if the fluorescence is weaker.</p> <p>Requesting Agency: NIES Japan 2013 Reference: Japan MHLW 2003, Notification No. 261 Appendix 3</p> | <i>E coli</i> | MPN/100 mL | 0 |
| 36101 | <p>FAECAL STREPTOCOCCI</p> <p>Multiple Tube Fermentation</p> <p>Minor variations in analytical techniques can cause change in results; therefore microbiological methods and sterilising procedures must be standardized to obtain uniform results from different laboratories.</p> <p>Inoculate a series of tubes in azide dextrose broth, using appropriate volumes of sample. Use portions of 10mL or less; double the strength of broth usage for 10 mL inocula. Incubate inoculated tubes at 35°C ± 0.5°C. [Japan uses 36°C ± 1°C.] Examine each tube for turbidity after 24 hours; if no definite turbidity, incubate for a total of 48 hours. All turbid broth tubes are subject to a confirmation test: streak a portion of growth from dextrose broth tubes on PSE (Pfizer Selective Enterococcus) agar. Incubate the inverted dish at 35°C ± 0.5°C for 24 hours ± 2 hours. Brownish-black colonies with brown halos confirm the presence of faecal streptococci. Estimate its densities from the number of positive tubes in each dilution series that are positive on PSE agar. Compute the combination of positives and document as the most probable number (MPN).</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1995, SM 9230 B. Reference 2: Sewage Works in Japan 1997, Book3, Chapter 3, Section 7, 5-1)-2.</p> | FAEC STREP | MPN/100 mL | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------------|------------|----------|
| 36102 | <p>FAECAL STREPTOCOCCI</p> <p>Membrane Filtration</p> <p>Minor variations in analytical techniques can cause change in results; therefore microbiological methods and sterilising procedures must be standardized to obtain uniform results from different laboratories.</p> <p>Select appropriate sample volumes and filter through a 0.45 µm, gridded, sterile membrane filter to give 20 to 80 colonies on the membrane surface. Transfer filter to an agar medium Petri dish, invert culture plates and incubate at 41°C ± 0.5°C for 48 hours. [Japan uses 36°C ± 1°C.] Carefully transfer filter to EIA medium (stable for 30 days if kept in the dark between 2°C to 10°C) and incubate at 41°C ± 0.5°C for 20 minutes. Count the colonies (per 100 mL) using a fluorescent lamp and magnifying lens.</p> <p>Growth of catalase-negative, gram-positive cocci on bile esculin agar and at 45°C, in brain-heart infusion broth, verifies that the colony is of the faecal streptococcus group (growth at 45°C and in 6.5% NaCl broth indicates that the colony belongs to the Enterococcus group).</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1995, SM 9230 C. Reference 2: Sewage Works in Japan 1997, Book3, Chapter3, Section7, 5-1)-3, 5-2.</p> | FAEC STREP | MPN/100 mL | 0 |
| 36220 | <p>SALMONELLA</p> <p>Concentration by filtration</p> <p>The sample is filtered (on membrane or appropriate filter) and inoculated into a pre-enrichment medium. After enrichment, the sample is transferred into an isolating gelose for identification.</p> <p>Requesting Agency: European Environmental Agency (EEA), 2000. Reference: EEA 2000.</p> | SALMONELLA | No./L | 0 |
| 36301 | <p>PHYTOPLANKTON COUNT</p> <p>Total Number Phytoplankton Cells Observed (Lackey method):</p> <p>With a calibrated dropper, a known volume of aliquot is put on a cover glass. Agitate the aliquot to evenly distribute the organisms, carefully cover with a square cover glass and count. Record the number. Similarly, count another drop (several drops should be counted, on a large and uniform sample, to improve the precision). Calculate the total number per drop as follows:</p> $\text{Total number / drop} = \frac{\text{Area of cover glass}}{\text{Area of 1 transect}} \times \text{Individual counts / transect}$ <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1980. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Vollenweider, Talling and Westlake 1974. Reference 2: JWWA 2001, method X-1.</p> | PHYTO COUNT | No/drop | 0 |

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| Code | Method Description | Name | Units | Decimals |
|-------|---|-------------|-------------------|----------|
| 36302 | <p>PHYTOPLANKTON BIOMASS</p> <p>Microscopic count</p> <p>Using a calibrated microscope, equipped with an eyepiece, identify and count the number of individual species of phytoplankton in multiple cells of a known volume of sample. The sample is weighed on a wet or dry basis and the number of cells are multiplied or divided by the dilution or concentration factor of the sample.</p> <p>N.B.: The number and variety of species available can serve as an indicator of water quality and identify trends in water degradation.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 1975.</p> | PHYTO BIO | mg/m ³ | 1 |
| 36304 | <p>PHYTOPLANKTON COUNT</p> <p>Total Number Phytoplankton Cells Observed (Kolkwitz Chamber and Utermöhl's method)</p> <p>Pour a known volume of sample into a sedimentation chamber. After suitable sedimentation time, transversely remove the chamber and counting of sediment collected at the bottom plate is done visually.</p> <p>Enumeration may be done in two steps. First, the bottom area is scanned under a low magnifying microscope to count the large forms, generally in small numbers. Then the nanoplankton individuals of two crossed diameter transects are enumerated using high power magnification. The total number of cells is calculated by multiplying the number of individuals counted in the transects by the ratio of the whole chamber area. 100 mL is usually the maximum volume needed.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1981. Reference: Vollenweider, Talling and Westlake 1974.</p> | PHYTO COUNT | No/mL | 0 |
| 37092 | <p>RUBIDIUM TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1303.</p> | Rb TOTAL | mg Rb/L | 2 |
| 38009 | <p>STRONTIUM TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel digestion and pre-concentration. ICP 1502 (<i>See Appendix 3</i>).</p> <p>Digestion with HNO₃/HCl. Preconcentration by evaporation (factor 5 to 10).</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1502.</p> | Sr TOTAL | mg Sr/L | 3 |
| 38011 | <p>STRONTIUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Sr TOTAL | mg Sr/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 38091 | <p>STRONTIUM – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Sr TOTAL | mg Sr/L | 3 |
| 38092 | <p>STRONTIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1305.</p> | Sr TOTAL | mg Sr/L | 2 |
| 42009 | <p>MOLYBDENUM - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel digestion and pre-concentration. ICP 1502 (<i>See Appendix 3</i>).</p> <p>Digestion with HNO₃/HCl. Preconcentration by evaporation (factor 5 to 10).</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1502.</p> | Mo TOTAL | mg Mo/L | 3 |
| 42011 | <p>MOLYBDENUM – TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Mo TOTAL | mg Mo/L | 3 |
| 42091 | <p>MOLYBDENUM – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Mo TOTAL | mg Mo/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------|---------|----------|
| 42092 | <p>MOLYBDENUM - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1300.</p> | Mo TOTAL | mg Mo/L | 2 |
| 42302 | <p>MOLYBDENUM – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 1.6. Br₂ water is added, and the aliquot warmed until the bromine colour almost vanishes. A solution of benzoin alpha-oxime in ethanol is added, and then the aliquot is extracted with n-butyl acetate. The solvent layer is aspirated. The absorbance is measured spectrophotometrically at 313.5 nm, and compared with those of identically prepared standard Mo₇O₂₄ ion solutions. A N₂O-C₂H₂ reducing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region Reference: Environment Canada 1995, ENVIRODAT CODE 1457.</p> | Mo EXTRBLE | mg/L Mo | 4 |
| 47009 | <p>SILVER - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel digestion and pre-concentration. ICP 1502 (<i>See Appendix 3</i>).</p> <p>Digestion with HNO₃/HCl. Preconcentration by evaporation (factor 5 to 10).</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1502.</p> | Ag TOTAL | mg Ag/L | 3 |
| 47011 | <p>SILVER - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Ag TOTAL | mg Ag/L | 3 |
| 47091 | <p>SILVER - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Ag TOTAL | mg Ag/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|---------|----------|
| 47092 | <p>SILVER - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1285.</p> | Ag TOTAL | mg Ag/L | 2 |
| 47101 | <p>SILVER DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with EDTA. The sample aliquot is acidified with nitric acid, aspirated and the absorbance is measured spectrometrically at 328.1 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.010 mg/L.</p> <p>Requesting Agency: Instituto Nacional del Agua, Argentina, 2005. Reference: Environment Canada 1974.</p> | Ag DISS | mg/L | 2 |
| 47302 | <p>SILVER EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample, preserved with EDTA, is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to between 3.5 and 6.5. The aliquot is extracted with ethyl propionate containing diphenylthiocarbazone. The solvent layer is homogenized with acetone and analyzed spectrophotometrically at a wavelength of 328.1 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1482.</p> | Ag EXTRBLE | mg/L | 3 |
| 48001 | <p>CADMIUM - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested with nitric acid. The digest is aspirated into the flame and the absorbance is measured spectrometrically at 228.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.002 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 55.1. Reference 3: APHA 2012, SM 3111 B</p> | Cd TOTAL | mg/L Cd | 3 |

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| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 48002 | <p>CADMIUM - TOTAL</p> <p>Atomic Absorption Spectrometry - Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested in nitric acid. The pH of the digest is adjusted to 4.75 with a buffer solution. [Japan uses pH 3.5 – 4.0.] Ammonium 1-pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot and then extracted with a methyl isobutyl ketone (MIBK). The solvent layer is aspirated at the wavelength of 228.8 nm and compared with identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 55.1.</p> | Cd TOTAL | mg/L Cd | 3 |
| 48009 | <p>CADMIUM - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately and aspirated from an autosampler. The emission is measured at 228.8 nm [Japan measures at 214.438 nm.] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 55.3.</p> | Cd TOTAL | mg/L Cd | 3 |
| 48011 | <p>CADMIUM - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested in aqua regia and evaporated to near dryness. The wet residue diluted with concentrated HCl to one-fifth of the aliquot's original volume. The emission is measured spectrometrically at 228.8 nm [Japan measures at 214.438 nm.] and compared with identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 55.3. Reference 3: Environment Canada 2007, PYR code 2634</p> | Cd TOTAL | mg/L Cd | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 48090 | <p>CADMIUM - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.5 ug/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 55.4.</p> | Cd TOTAL | mg/L Cd | 3 4? |
| 48091 | <p>CADMIUM - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Cd TOTAL | mg/L Cd | 3 |
| 48092 | <p>CADMIUM - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Requesting Agency 2: Japan 2004 Reference: Environment Canada 2007, Great Lakes STAR code 1291. Reference 2: Ministry of Health Labour and Welfare Notification # 261 Table # 6</p> | Cd TOTAL | mg/L Cd | 3 |
| 48101 | <p>CADMIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 228.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 55.1.</p> | Cd DISS | mg/L Cd | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 48102 | <p>CADMIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The pH of the sample aliquot is adjusted to 4.75 with a buffer solution. [Japan uses pH 3.5 – 4.0.] Ammonium 1-pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot and then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 228.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 55.1.</p> | Cd DISS | mg/L Cd | 3 |
| 48109 | <p>CADMIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured at 228.8 nm [Japan measures at 214.438 nm.] and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 55.3.</p> | Cd DISS | mg/L Cd | 3 |
| 48111 | <p>CADMIUM - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at 228.8 nm [Japan measures at 214.438 nm.] and compared with identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 55.3.</p> | Cd DISS | mg/L Cd | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------------|---------|----------|
| 48190 | <p>CADMIUM – DISSOLVED</p> <p>ICP - MS</p> <p>The sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. A sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.5 µg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 55.4.</p> | Cd DISS | mg/L Cd | 4 |
| 48201 | <p>CADMIUM SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A measured sample volume is passed through a 0.45 µm membrane filter. The filter, containing the residue, is digested in nitric acid. The resulting solution is then aspirated and the absorbance is measured spectrometrically at 228.8 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Cd PARTICULA TE | µg/g | 3 |
| 48301 | <p>CADMIUM – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight and analyzed by direct aspiration AAS. The absorbance is measured spectrophotometrically at wavelength 228.8 nm, and compared with those of standard solutions.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 479.</p> | Cd EXTRBLE | mg/L Cd | 3 |
| 48302 | <p>CADMIUM – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 228.8 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Cd EXTRBLE | mg/L Cd | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------------|---------|----------|
| 48309 | <p>CADMIUM – EXTRACTABLE</p> <p>Flameless Atomic Absorption Spectroscopy (GFAAS)</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. An aliquot is analyzed by graphite furnace AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 504.</p> | Cd EXTRBLE | mg/L Cd | 4 |
| 48901 | <p>CADMIUM - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. Add palladium nitrate to the sample aliquot, as a matrix modifier, and heat, usually in three stages, in a graphite furnace or an electrically heated atomiser where: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the cadmium to be determined. The absorbance of the resultant ground state atoms is measured at 228.8 nm and is compared with those of identically-prepared standard and solutions.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 55.2.</p> | Cd DISS | mg/L Cd | 3 |
| 48911 | <p>CADMIUM – TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested in nitric acid or aqua regia. The aliquot is then heated, usually in three stages, in a graphite furnace or an electrically heated atomiser in which: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the cadmium to be determined. The absorbance of the resultant ground state atoms is measured at 228.8 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.0001 mg/L</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: JSA 1998, method 55.2. Reference 2: APHA 2012, SM 3113 A</p> | Cd TOTAL | mg/L Cd | 3 |
| 50091 | <p>TIN – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Sn TOTAL | mg Sn/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------|---------|----------|
| 51091 | <p>ANTIMONY – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Sb TOTAL | mg Sb/L | 3 |
| 51092 | <p>ANTIMONY – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1304.</p> | Sb TOTAL | mg Sb/L | 3 |
| 51101 | <p>ANTIMONY - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the absorbance is measured spectrometrically at 217.6 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidising flame.</p> <p>The method detection limit is 0.2 mg/L.</p> <p>Requesting Agency: Instituto Nacional del Agua, Argentina, 2005. Reference: Environment Canada 1974.</p> | Sb DISS | mg/L | 1 |
| 51302 | <p>ANTIMONY – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 217.6 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Sb EXTRBLE | mg/L Sb | 3 |

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| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 56001 | <p>BARIUM - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested in nitric acid. A NaCl solution is added to the digest (to overcome the ionization interference) and then aspirated into the flame. The absorbance is then measured spectrometrically at 553.6 nm and compared to identically-prepared standard and blank solutions, using a nitrous oxide-acetylene reducing flame.</p> <p>The method detection limit is 0.03 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974. Reference 2: APHA 2012, SM 3111 A</p> | Ba TOTAL | mg/L Ba | 1 |
| 56002 | <p>BARIUM - TOTAL</p> <p>Atomic Emission Spectrometry - Flame Emission</p> <p>The sample is preserved in the field with nitric acid. A shaken sample aliquot is digested in nitric acid. The aliquot is aspirated into the flame and the emission is measured spectrometrically at 553.6 nm and compared to identically-prepared standard and blank solutions, using a nitrous oxide-acetylene flame.</p> <p>The method detection limit is 0.02 mg/L.</p> <p>Requesting Agency: Environment Canada, 1974. Reference: Perkin-Elmer Corp. 1973.</p> | Ba TOTAL | mg/L Ba | 1 |
| 56009 | <p>BARIUM - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel digestion and pre-concentration. ICP 1502</p> <p>Digestion with HNO₃/HCl. Preconcentration by evaporation (factor 5 to 10).</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1502.</p> | Ba TOTAL | mg/L Ba | 1 |
| 56011 | <p>BARIUM - TOTAL</p> <p>Inductively Coupled Plasma, by Optical Emission Spectrometry (ICP-OES) with open vessel rigorous digestion to near dryness. ICP 1503 (<i>See Appendix 3</i>).</p> <p>Preconcentration by evaporation to near dryness with HNO₃ or aqua regia (HNO₃/HCl ratio v/v: 1to 3). Residue is taken up with HCl, and digested to near dryness, then brought to one-fifth or one-tenth original volume with deionized water. Digest is filtered through 0.4 um membrane before analysis.</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 2634.</p> | Ba TOTAL | mg/L Ba | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 56091 | <p>BARIUM - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Ba TOTAL | mg/L Ba | 1 |
| 56092 | <p>BARIUM - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1289.</p> | Ba TOTAL | mg/L Ba | 2 |
| 56101 | <p>BARIUM - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. A NaCl solution is added to the acidified sample aliquot (to overcome the ionization interference) and then aspirated into the flame. The absorbance is then measured spectrometrically at 553.6 nm and compared to identically-prepared standard and blank solutions, using a nitrous oxide-acetylene reducing flame.</p> <p>The method detection limit is 0.1 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Ba DISS | mg/L Ba | 1 |
| 56190 | <p>BARIUM – DISSOLVED</p> <p>Inductively Coupled Plasma by Mass Spectrometry (ICP – MS).</p> <p>A sample is filtered in the field through a 0.2 µm membrane filter and preserved with nitric acid. Using a peristaltic pump, the sample aliquot is introduced to an argon stream high temperature and radio frequency plasma in which the sample undergoes desolvation, atomization and ionization. The ions generated are separated on the basis of their mass to charge ratio in the mass spectrometer, counted by an electron multiplier detector and compared to identically-prepared standard and blank solutions.</p> <p>Interference: Isobaric elemental interferences are calculated automatically by the data system; the abundance sensitivity should be corrected through adjustment of the spectrometer resolution; physical interferences are usually corrected by ensuring the water sample does not contain more than 0.5% dissolved solids; ionization interferences are corrected by the addition of internal standards and sufficient wash-time should minimise memory interferences.</p> <p>The method detection limit is 0.05 µg/L</p> <p>Requesting Agency: ORE-HYBAM, 2006. Reference: Yeghichyan et al, 2001.</p> | Ba DISS | mg/L Ba | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------|---------|----------|
| 56301 | <p>BARIUM – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>Preservation with 0.2% HNO₃. The whole water sample is acidified with dilute mineral acid (usually, the preservative), shaken, left to stand overnight and analyzed by direct AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 387.</p> | Ba EXTRBLE | mg/L Ba | 2 |
| 56302 | <p>BARIUM – EXTRACTABLE</p> <p>Flame Emission</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. NaCl solution is added to this solution, which is then aspirated. The absorbance is measured spectrophotometrically at 553.1 nm, and compared with those of standard Ba solutions, containing NaCl. A N₂O-C₂H₂ reducing agent is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1575.</p> | Ba EXTRBLE | mg/L Ba | 2 |
| 57092 | <p>LANTHANUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1297.</p> | La TOTAL | mg La/L | 3 |
| 80011 | <p>MERCURY - TOTAL</p> <p>Semi-Automated and Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with potassium dichromate and sulphuric acid (or nitric acid). The shaken sample aliquot is digested with sulphuric acid, potassium permanganate and potassium persulphate. The mercury compounds are reduced with stannous sulphate, in a hydroxylamine sulphate-sodium chloride solution, to elemental mercury, then sparged from the solution with a stream of air and the absorption is measured spectrometrically, using a mercury lamp, at 253.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.05 µg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 66.1.1.</p> | Hg TOTAL | µg/L Hg | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 80012 | <p>MERCURY - TOTAL</p> <p>Cold Vapour Atomic Absorption Spectroscopy – CVAAS</p> <p>To an appropriate amount of sample (the mass of mercury in the aliquot should be less than 0.002 mg), add sulfuric acid and nitric acid and shake well. Next, potassium permanganate solution (5% w/v) is added and the sample is shaken, and left to stand for approximately 15 min. If the red color of the permanganate ion disappears, add small quantities of potassium permanganate solution (5% w/v) step-by-step until the red color is retained for 15 min. Then, add potassium peroxodisulfate solution (5% w/v) or ammonium peroxodisulfate solution (5% w/v), and heat to approximately 95°C in a water bath for 2 hours. Cool the solution to room temperature, add hydroxyl ammonium chloride solution (10% w/v) and shake to reduce the excess potassium permanganate. After adding purified water to make up the solution, immediately add 10 mL of tin (II) chloride solution and swiftly introduce the mercury vapor into the absorption cell of the atomic absorption spectrometer. The peak height of absorbance at 253.7 nm wavelength is recorded and compared to standard solutions prepared in the same manner as the sample.</p> <p>Requesting Agency 1: Belgium 2005 Requesting Agency 2: Japan 2013 Reference 1: ISO 1996, ISO method 5666/3 Reference 2: Japan MHLW 2003, Notification No.261, Appendix 7. Reference 3: Japan MoE 1971, Notification No. 59, No.1.</p> | Hg TOTAL | µg/L Hg | 3 |
| 80016 | <p>MERCURY - TOTAL</p> <p>Cold Br Wet Oxidation P AAS</p> <p>The sample is preserved in the field with potassium dichromate and either sulphuric or nitric acid. The shaken sample aliquot and its particulates are digested with sulphuric acid, potassium dichromate and ultra violet (UV) photo-oxidation. The mercury compounds are reduced with stannous sulphate in a hydroxylamine sulphate-sodium chloride solution to elemental mercury, then sparged from the solution with a stream of air and the absorption is measured spectrometrically, using a mercury lamp, at 253.7 nm and compared to identically-prepared standard and blank solutions. The method is applicable to surface, ground and saline waters.</p> <p>The method detection limit is 0.02 µg/L.</p> <p>Requesting Agency 1: Environment Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1979. Reference 2: JSA 1998, method 66.1.1.</p> | Hg TOTAL | µg/L Hg | 3 |
| 80090 | <p>MERCURY – TOTAL</p> <p>ICP – MS</p> <p>Prepare sample in clean environment and follow manufacturer’s standard operating procedure for initialization, mass calibration, gas flow optimization, and other instrument operating conditions. Apply the analytical run sequence.</p> <p>Requesting Agency: Belgium (Walloon Region), 2005. Reference: APHA 2012, SM3125 B.</p> | Hg TOTAL | µg/L Hg | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------------------|---------|----------|
| 80111 | <p>MERCURY - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with potassium dichromate and sulphuric acid. [Japan method uses nitric acid.] The sample aliquot is digested with sulphuric acid, potassium permanganate and potassium persulphate. The mercury compounds are reduced with stannous sulphate in a hydroxylamine sulphate-sodium chloride solution to elemental mercury, then sparged from the solution with a stream of air and the absorption is measured spectrometrically using a mercury lamp at 253.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.05 µg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 66.1.1.</p> | Hg DISS | µg/L Hg | 3 |
| 80201 | <p>MERCURY SUSPENDED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved. The filter, containing the residue, is digested in nitric, sulphuric and hydrochloric acids and potassium permanganate and persulphate solutions. The mercury compounds are reduced with stannous sulphate in a hydroxylamine sulphate-sodium chloride solution to elemental mercury, then sparged from the solution with a stream of air and the absorption is measured spectrometrically, using a mercury lamp, at 253.7 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.05 µg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Hg PARTICU- LATE | µg/g | 3 |
| 81091 | <p>THALLIUM – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Tl TOTAL | mg Tl/L | 3 |
| 81092 | <p>THALLIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1306.</p> | Tl TOTAL | mg Tl/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------|---------|----------|
| 82001 | <p>LEAD - TOTAL</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The digest is aspirated and the absorbance is measured spectrometrically at 283.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: INSIVUMEH, Guatemala, 2012. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 54.1. Reference 3: APHA 2012, SM 3111 B.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82002 | <p>LEAD - TOTAL</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid. The pH of the digest is adjusted to 4.75 with a buffer solution. [Japan uses pH 3.5 – 4.0.] Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the digest and then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated at the wavelength of 283.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 54.1.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82009 | <p>LEAD - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (See Appendix 3)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia, concentrated appropriately, and aspirated from an autosampler. The emission is measured at 220.3 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1981. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 54.3.</p> | Pb TOTAL | mg/L Pb | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 82011 | <p>LEAD - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1503 (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with aqua regia and evaporated to near dryness. The wet residue is diluted with concentrated HCl to one-fifth of the aliquot's original volume. The sample aliquot is aspirated and the emission is measured at 220.3 nm and compared with identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Environment Canada, Pacific & Yukon Region, 2007. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 54.3. Reference 3: Environment Canada 2007, PYR code 2634.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82090 | <p>LEAD - TOTAL</p> <p>ICP – MS</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 µg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 54.4.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82091 | <p>LEAD - TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82092 | <p>LEAD - TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1302.</p> | Pb TOTAL | mg/L Pb | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|---------|----------|
| 82101 | <p>LEAD – DISSOLVED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into the flame and the absorbance is measured spectrometrically at 283.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.05 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 54.1.</p> | Pb DISS | mg/L Pb | 3 |
| 82102 | <p>LEAD - DISSOLVED</p> <p>Colourimetry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric or hydrochloric acid. Interfering metals are removed by preliminary extraction at a pH of 2 to 3. Add a tartrate solution to prevent formation of hydroxide before bringing the pH of the solution to between 8 and 9 with an ammonium hydroxide/sodium cyanide solution. Lead is extracted with a diluted solution of dithizone in carbon tetrachloride (pink colour); the excess dithizone masks the colour (intense green colour) and this excess is removed from the carbon tetrachloride layer by the alkaline cyanide solution, leaving lead dithizonate in the organic layer. This solution is diluted and the colour is measured spectrometrically at 520 nm and compared to identically-prepared standard and blank solutions.</p> <p>Interference: Bismuth, stannous tin and thallium interfere in the extraction of lead in cyanide medium. The sample is fumed with perchloric and nitric acids to remove the organic compounds and then reduced with hydrazine acetate to lower the oxidation state of elements (tin and iron) and compounds capable of oxidizing dithizone.</p> <p>Method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1980. Reference: APHA 1975.</p> | Pb DISS | mg/L Pb | 3 |
| 82103 | <p>LEAD - DISSOLVED</p> <p>Atomic Absorption Spectrometry – Solvent Extraction</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The pH of the sample aliquot is adjusted to 4.75 with a buffer solution. [Japan uses pH 3.5 – 4.0.] Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the digest then extracted with a methyl isobutyl ketone (MIBK) solution. The solvent layer is aspirated, measured spectrometrically at the wavelength of 283.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Environment Canada 1974. Reference 2: JSA 1998, method 54.1.</p> | Pb DISS | mg/L Pb | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|---------|----------|
| 82106 | <p>LEAD – DISSOLVED</p> <p>Emission Spectroscopy using Arc Excitation</p> <p>A sample is filtered through a 0.45 µm membrane or dense paper filter and preserved with hydrochloric acid to pH <2. A sample aliquot is boiled with ammonium persulfate for decomposition of complexes with organic ligands. Then the sample is neutralized, acetate buffer solution with a pH 5 is added, and the metals (including lead) are extracted with chloroform in the form of complexes with 8-hydroxyquinoline and diethyl dithiocarbamate. The extract is evaporated to 0.5 mL, mixed with 80 mg of a spectroscopic basis (<i>see Appendix 5</i>) and calcined for 20 minutes at 350°C. The calcined sample is placed in a crater of the graphite electrode and the emission of metal atoms, excited by the action of arc discharge, is recorded. The intensity of lead emission at 283,3 nm relative to an internal standard (Sr) is compared to identically prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L, upper limit is 0.16 mg/L.</p> <p>Requesting Agency: GHI, Russia, 2003 Reference: Hydrochemical Institute 1977.</p> | Pb DISS | mg/L Pb | 3 |
| 82109 | <p>LEAD - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1502 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is concentrated appropriately and aspirated from an autosampler. The emission is measured spectrometrically at 220.3 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: Environment Canada, NWRI, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1981. Reference 2: JSA 1998, method 54.3.</p> | Pb DISS | mg/L Pb | 3 |
| 82111 | <p>LEAD - DISSOLVED</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP 1516 (<i>See Appendix 3</i>)</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured spectrometrically at 220.3 nm and compared with identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 mg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1979. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 54.3.</p> | Pb DISS | mg/L Pb | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------------------|---------|----------|
| 82190 | <p>LEAD - DISSOLVED</p> <p>ICP - MS</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated into an argon-based, high temperature radio frequency plasma. The sample is dissolved, atomised and ionised. These ions are extracted from the plasma through a vacuum interface and separated on the basis of their mass to charge ratio by a mass spectrometer. The ions are counted by an electron multiplier detector and the resulting information processed by a computer database system and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.01 µg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference 1: APHA 1998. Reference 2: JSA 1998, method 54.4.</p> | Pb DISS | mg/L Pb | 3 |
| 82201 | <p>LEAD - SUSPENDED</p> <p>Atomic Absorption Spectrometry – Direct Aspiration</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter. The filter, containing the residue, is digested with nitric acid. The resulting solution is then aspirated and the absorbance is measured spectrometrically at 283.3 nm and compared to identically-prepared standard and blank solutions, using an air-acetylene oxidizing flame.</p> <p>Requesting Agency: UNEP GEMS/Water Programme, 1985. Reference: Environment Canada 1974.</p> | Pb PARTICULA TE | µg/g | 3 |
| 82301 | <p>LEAD – EXTRACTABLE</p> <p>AAS – Direct Aspiration</p> <p>Preservation with 0.2% HNO₃. The whole water sample is acidified with dilute mineral acid (usually, the preservative), shaken, left to stand overnight and analyzed by direct AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 679.</p> | Pb EXTRBLE | mg/L Pb | 3 |
| 82302 | <p>LEAD – EXTRACTABLE</p> <p>AAS – Solvent Extraction</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. The pH of an aliquot of this solution is adjusted to 4.75 with a buffer solution. Ammonium pyrrolidine dithiocarbamate (APDC) solution is added to the aliquot, which is then extracted with methyl isobutyl ketone (MIBK). The absorbance is measured spectrophotometrically at a wavelength of 283.3 nm and compared with those of identically prepared standards. An acetylene-air oxidizing flame is used.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1183.</p> | Pb EXTRBLE | mg/L Pb | 3 |
| 82303 | <p>LEAD – EXTRACTABLE</p> <p>Colourimetry (Dithizone)</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 1641.</p> | Pb EXTRBLE | mg/L Pb | 2 |

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| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------|---------|----------|
| 82305 | <p>LEAD – EXTRACTABLE</p> <p>Flameless Atomic Absorption Spectroscopy (GFAAS) - (Massman)</p> <p>The whole water sample is acidified with dilute mineral acid (0.2% HNO₃), shaken, left to stand overnight. An aliquot is analyzed by graphite furnace AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 481.</p> | Pb EXTRBLE | mg/L Pb | 3 |
| 82309 | <p>LEAD – EXTRACTABLE</p> <p>AAS – Graphite Furnace</p> <p>The sample is collected in a clean, linear polyethylene bottle, acidified with 2 mL/L high purity HNO₃ and stored. No further sample treatment is employed prior to analysis by graphite furnace AAS.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 504.</p> | Pb EXTRBLE | mg/L Pb | 4 |
| 82360 | <p>LEAD - TOTAL</p> <p>Inductively Coupled Plasma by Optical Emission Spectrometry (ICP-OES): ICP – AES (<i>See Appendix 3</i>)</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested with aqua regia, evaporated to dryness, dissolved in HCL, concentrated appropriately, and aspirated from an autosampler. [Japan evaporates to near dryness and the wet residue is diluted with concentrated HCl and diluted to one-fifth of the aliquot's original volume.] The emission is measured at 220.3 nm and compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.001 mg/L.</p> <p>Requesting Agency 1: UNEP GEMS/Water Programme, 1985. Requesting Agency 2: NIES, Japan, 1998. Reference 1: Alberta Environment 1979. Reference 2: JSA 1998, method 54.3.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82511 | <p>LEAD - DISSOLVED</p> <p>Anodic Stripping Voltammetry</p> <p>A sample is filtered through a 0.45 µm membrane or dense paper filter and preserved with nitric acid to pH <3. Lead concentration in the sample aliquot is evaluated by preliminary accumulation (electrolysis) of lead at a working electrode with a potential of -1.2 V and its subsequent electrodisolution at a potential of -0.4 V. Maximum current of dissolution, proportional to lead concentration in the sample, is recorded. The working electrode is amalgamated silver wire, and the reference electrode is saturated Ag/AgCl electrode. A calculation of lead concentration in the sample is made according to the method of standard addition.</p> <p>Interference of organic substances is eliminated by UV-radiation of the sample in the presence of formic acid. When large amounts of organic substances are present, the sample is first mineralized by evaporating with nitric and hydrochloric acids.</p> <p>The method detection limit is 0.0002 mg/L, upper limit is 1 mg/L.</p> <p>Requesting Agency: GHI, Russia, 2003 Reference: Hydrochemical Institute 1996</p> | Pb DISS | mg/L Pb | 4 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------|---------|----------|
| 82901 | <p>LEAD - DISSOLVED</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilizes other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomizes the lead to be determined. The absorbance of the resultant ground state atoms is measured spectrometrically at 283.3 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Requesting Agency 2: CEA Laboratory, Sri Lanka, 2004. Reference 1: JSA 1998, method 54.2. Reference 2: APHA 1998, SM 3113 B.</p> | Pb DISS | mg/L Pb | 3 |
| 82911 | <p>LEAD - TOTAL</p> <p>Flameless Atomic Absorption Spectrometry</p> <p>A sample is preserved in the field with nitric acid. The sample aliquot is digested in nitric acid or aqua regia. The aliquot is then heated, usually in three stages in a graphite furnace or an electrically heated atomiser where: first, a low current is applied to dry the sample; the second stage chars the sample by destroying the organic matter and volatilises other matrix compounds; finally, the third stage applies a high current which heats the tube to incandescence and atomises the lead to be determined. The absorbance of the resultant ground state atoms is measured at 283.3 nm and is compared to identically-prepared standard and blank solutions.</p> <p>The method detection limit is 0.005 mg/L.</p> <p>Requesting Agency: NIES, Japan, 1998. Reference: JSA 1998, method 54.2.</p> | Pb TOTAL | mg/L Pb | 3 |
| 82913 | <p>LEAD – DISSOLVED</p> <p>Flame atomic absorption spectroscopy</p> <p>After filtering the water sample, spray into an acetylene-air flame and measure the absorption of lead at 283.3 nm wavelength.</p> <p>Requesting Agency: Japan 2014 Reference: JSA 1998, method JIS K 0102 54.1</p> | Pb DISS | mg/L Pb | 3 |
| 83091 | <p>BISMUTH – TOTAL</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is collected, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested “in-bottle” in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1919.</p> | Bi TOTAL | mg Bi/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|--------------|---------|----------|
| 83092 | <p>BISMUTH – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1310.</p> | Bi TOTAL | mg Bi/L | 3 |
| 83191 | <p>BISMUTH – DISSOLVED</p> <p>Inductively Coupled Plasma - Sector Field Mass Spectrometry (ICP-SFMS)</p> <p>Closed Vessel Digestion - The whole water sample is filtered through a 0.45 um membrane filter, preserved with 2% H₂NO₃, and stored in a HDPE or Teflon bottle. The sample is digested "in-bottle" in a convection oven at 60°C for 16 hours. The sample is cooled and introduced to an inductively coupled argon plasma-sector field mass spectrometer (ICP-SFMS) by pneumatic nebulization. Each respective element is measured at a specific mass to charge ratio, m/z value expressed in amu (atomic mass units), and at a specified instrument resolution. LR: Low Resolution ≈ 300, MR: Mid Resolution ≈ 4000 and HR : High Resolution ≈ 10000</p> <p>Requesting Agency: Environment Canada, Pacific & Yukon Region, 2007. Reference: Environment Canada 2007, PYR code 1920.</p> | Bi TOTAL | mg Bi/L | 3 |
| 92092 | <p>URANIUM – TOTAL</p> <p>Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)</p> <p>Water samples are preserved at 2% nitric acid and digested overnight at 60°C in a closed vessel. The resulting solution is analyzed by ICP-MS.</p> <p>Requesting Agency: Environment Canada, Ontario Region, 2007. Reference: Environment Canada 2007, Great Lakes STAR code 1307.</p> | U TOTAL | mg U/L | 4 |
| 95000 | <p>BENZOIC ACID</p> <p>Gas Chromatography</p> <p>A 1 L water sample is spiked with deuterated surrogate standards and serially extracted with methylene chloride, first at a pH greater than 11 for the phenol fraction and secondly at a pH less than 2 for the benzoic fraction, in a separatory funnel. The methylene chloride extract is taken to dryness, and re-constituted to a volume of 100 µl with methylene chloride, and spiked with deuterated internal standards. The acidic solution is analysed using a capillary column and mass spectrometry detection. Screening is performed using the relative retention time and relative abundance of two or more characteristic ions. Full identification of organic compounds screened and their quantification are performed using full reference spectra, multi internal standards and extracted areas of characteristic ions. Non-target compounds are tentatively identified using mass spectral libraries, approximate concentration ranges are based on relative total ion counts.</p> <p>The method detection limit is 2.0 µg/L.</p> <p>Requesting Agency: Alberta Environment, Canada, 1978. Reference: n/a.</p> | BENZOIC ACID | µg/L | 0 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------|-------|----------|
| 95011 | <p>PHENOLS</p> <p>GC – MS</p> <p>A 1 L water sample is spiked with deuterated surrogate standards and serially extracted with methylene chloride, first at a pH greater than 11 for the phenol fraction and secondly at a pH less than 2 for the benzoic fraction, in a separatory funnel. The methylene chloride extract is taken to dryness, and re-constituted to a volume of 100 µl with methylene chloride, and spiked with deuterated internal standards. The alkaline solution is analysed using a capillary column and mass spectrometry detection. Screening is performed using the relative retention time and relative abundance of two or more characteristic ions. The full identification of organic compounds screened and their quantification are performed using the full reference spectra, multi internal standards and extracted areas of characteristic ions. Non-target compounds are tentatively identified using mass spectral libraries, approximate concentration ranges are based on relative total ion counts.</p> <p>The method detection limit is 1.0 µg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1978. Requesting Agency 2: NIES, Japan, 1998. Reference: JWVA 2001, method VI-4 10.3.</p> | PHENOLS | µg/L | 1 |
| 95012 | <p>PHENOLS</p> <p>GC-MS</p> <p>A 50mL water sample is placed in a 100 mL separatory funnel with 10 µL surrogate solution and 1.5 g sodium chloride. It is adjusted to pH 3 with hydrochloric acid, and extracted three times with dichloromethane (10 mL + 5 mL + 5 mL). The extract is concentrated to about 3 mL by blowing down with nitrogen. After passing through approximately 1 g anhydrous sodium sulfate, it is concentrated further to 1 mL with nitrogen. After adding 10 µL internal standard solution, the extract is analyzed by gas chromatography-mass spectrometry in selective ion detection mode, monitoring quantitative ions 99, quantification ions 94 phenol, confirmation ions 65, phenol-d5, quantification ions 164 acenaphthene-d10.</p> <p>Requesting Agency: Japan 2014 Reference: Japan MoE 2003. Notification No. 031105001, No.1.</p> | PHENOLS | µg/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|---------|-------|----------|
| 95013 | <p>PHENOLS</p> <p>Solid Phase Extraction - Gas Chromatography-Mass Spectrometry (SPME-GC-MS)</p> <p>A dry glass bottle is completely filled with the water sample. If the test cannot be carried out promptly, the pH of the sample is adjusted to approximately 4 by adding 1 g of copper sulfate (pentahydrate) and dropwise phosphoric acid (1 part of phosphoric acid diluted into 9 parts of purified water) to every 1 L of the sample, and then stored in a cool dark location. Additionally, if chlorine is present, 0.01–0.02 g of sodium ascorbate is added per 1 mg of residual chlorine.</p> <p>10 mL each of ethyl acetate, methyl alcohol and purified water are sequentially poured into a solid-phase column. The pH of the test sample is adjusted to 2 using hydrochloric acid, and purified water is added to adjust the concentrations of the target substances to fall within the prescribed concentration ranges. The sample solution is passed through the solid-phase column at a flow rate of 10–20 mL/min. Then, after 10 mL of purified water has flowed through, the solid-phase column is dried by flushing for at least 30 minutes with nitrogen or air that does not contain any of the substances to be measured. Next, 5 mL of ethyl acetate is gently flowed through the solid-phase column in the direction opposite to the direction of regular water flow and collected in a test tube. To this test tube, ethyl acetate is added to bring the total volume up to 5 mL, and anhydrous sodium sulfate is added to thoroughly dehydrate the solution. Nitrogen gas is gently blown on a 4-mL aliquot of this solution until it is concentrated to 0.8 mL. After adding 100 µL of N,O-bis(trimethylsilyl)trifluoroacetamide, the solution is left to stand for at least one hour. Then, 20 µL of internal standard solution is added, and ethyl acetate is added to bring up the total volume of the sample solution to 1 mL. This is used as the test solution. An aliquot of test solution is analyzed by a gas chromatograph-mass spectrometer, and the ratio of fragment ion peak height or peak area of each of the phenolic compounds listed below to that of acenaphthene-d10 are calculated. A series of standard solutions containing the phenolic compounds are prepared and analyzed in the same manner as for the sample. The ratios of analyte to internal standard peak heights or areas are calculated for each standard solution, and calibration curves are prepared based on the relationships between these ratios and the concentration of each phenolic compound. The concentration of each phenolic compound is converted to an equivalent phenol concentration and the sum of the concentrations is used to represent the total concentration of phenolic compounds.</p> <p>Requesting Agency: Japan 2014 Reference: Japan MHLW 2003, Notification No. 261 Appendix 39.</p> | PHENOLS | µg/L | 1 |
| 95014 | <p>PHENOLS</p> <p>4-aminoantipyrene absorptiometry (Colorimetry)</p> <p>Pre-treat the water sample by distillation. In a 500 mL flask, add several drops of methyl orange solution to a 250 mL water sample. Add 10% phosphoric acid until the solution changes its colour to indicate a pH of about 4, then add 2.5 mL of copper (II) sulphate. After distillation, adjust to pH 10 with ammonium chloride-ammonia buffer solution. Add 4-aminoantipyrene solution and potassium hexacyanoferrate (III). Measure the absorbance of the red antipyrene solution generated, and compare to similarly treated standard phenol solutions.</p> <p>Requesting Agency: Japan 2014. Reference: JSA 1998, JIS K 0102, method 28.1.2</p> | PHENOLS | µg/L | 1 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-------------------|-------|----------|
| 95100 | <p>BENZENE</p> <p>Purge-and-Trap Gas Chromatography/Mass Spectrometry: (P&T GC-MS)</p> <p>A surface water sample (150 ml) is spiked with deuterated surrogate standards and internal standards, purged with helium, and the released volatiles are adsorbed onto a Tenax GC trap. This is followed by thermal desorption and analysis using a 25 meter DB-5 capillary column with mass spectrometry detection. Screening is performed using the relative retention time and relative abundance of two or more characteristic ions. Full identification of organic compounds screened and their quantification are performed using full reference spectra, multi internal standards and extracted areas of characteristic ions. Non-target compounds are tentatively identified using mass spectral libraries. Approximate concentration ranges are based on relative total ion counts.</p> <p>The method detection limit is 0.1 µg/L.</p> <p>Requesting Agency 1: Alberta Environment, Canada, 1978. Requesting Agency 2: NIES, Japan, 1998. Reference: JSA 1998, method 5.1.</p> | BENZENE | µg/L | 1 |
| 95101 | <p>CHLOROBENZENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N^o3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | CHLOROBE NZENE | µg/L | 3 |
| 95102 | <p>1,2 DICHLOROBENZENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N^o3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | 1,2-DCB | µg/L | 3 |
| 95103 | <p>1,4-DICHLOROBENZENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N^o3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | 1,4-DCB | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------|-------|----------|
| 95200 | <p>BENZENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | BENZENE | µg/L | 3 |
| 95201 | <p>TOLUENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | TOLUENE | µg/L | 3 |
| 95202 | <p>ETHYLBENZENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | ET- BENZENE | µg/L | 3 |
| 95203 | <p>O-XYLENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | O-XYLENE | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------|-------|----------|
| 95204 | <p>M-XYLENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | M-XYLENE | µg/L | 3 |
| 95205 | <p>P-XYLENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | P-XYLENE | µg/L | 3 |
| 95206 | <p>M+P-XYLENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | M+P-XYLENE | µg/L | 3 |
| 95207 | <p>SUM OF XYLENES</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | ΣXYLENES | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------------------|-------|----------|
| 95220 | <p>STYRENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | STYRENE | µg/L | 3 |
| 95221 | <p>1,2-DICHLOROETHANE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | 1,2-DICHLOROETHANE | µg/L | 3 |
| 95222 | <p>1,2-DICHLOROETHENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | 1,2-DICHLOROETHENE | µg/L | 3 |
| 95223 | <p>CARBON TETRACHLORIDE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | C-CL4 | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|------------|-------|----------|
| 95224 | <p>TRICHLOROETHENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | CL3-ETHENE | µg/L | 3 |
| 95225 | <p>TETRACHLOROETHENE</p> <p>Purge-and-Trap Gas chromatography – Flame Ionization (P&T GC-FID)</p> <p>Purge-and-trap gas chromatography using a capillary column and flame ionization detection. A 5.0 mL water sample is purged with nitrogen and released volatiles are adsorbed onto a Tenax N°3 GC trap. Analytes are thermally desorbed onto a PE-502.2 capillary column into a flame ionization detector. Identification and quantification are performed according to retention times and peak area using a multi-point calibration curve. Confirmation is achieved using a second capillary column, such as PE-5 or PE-1301.</p> <p>Requesting Agency: INA Argentina, 2013 Reference: APHA 2012, SM 6200 C.</p> | CL4-ETHENE | µg/L | 3 |
| 95400 | <p>BENZENE</p> <p>Head space GC/MS</p> <p>A sample and sodium chloride are placed in a vial so that a head space remains in the vial, and equilibrium between gaseous and liquid phases is achieved at a set temperature. An aliquot of the gas phase is introduced into a gas chromatograph-mass spectrometer. The selective ion monitoring (SIM) method or an equivalent method is used for detection, and a chromatogram of each selective ion is obtained to calculate the concentration of the volatile organic compound.</p> <p>Requesting Agency: NIES Japan, 2007. Reference 1: JSA 1998, method JIS K 0125 5.2. Reference 2: Japan MHLW 2003, Notification No. 261, No.15.</p> | BENZENE | µg/L | 1 |
| 95401 | <p>POLYAROMATIC HYDROCARBONS (PAHs) TOTAL</p> <p>Gas Chromatography – Flame Ionization (FID) and Mass Spectrometry (GC/MS)</p> <p>The measured sample is vigorously extracted three times with benzene or hexane, dried with pre-washed sodium sulphate, and reduced to 10 mL. Direct analysis for PAH is completed by capillary GC-FID and GC-MS and compared to calibration standards and blank solutions.</p> <p>The method detection limit is 0.02 µg/L.</p> <p>Requesting Agency 1: Environment Canada, March 1980. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: Belgium 2011 Reference 1: Borneff and Kunte 1969. Reference 2: JWWA 2001, method VI-4 16.2.</p> | PAH | µg/L | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|--------------|-------|----------|
| 95402 | <p>POLYAROMATIC HYDROCARBONS (PAHs) TOTAL</p> <p>High Performance Liquid Chromatography – Fluorescence (HPLC-FI)</p> <p>Requesting Agency 1: NIES, Japan, 2004. Requesting Agency 2: Belgium 2011 Reference 1: see Japan method books</p> | PAH | µg/L | 2 |
| 95403 | <p>POLYAROMATIC HYDROCARBONS (PAHs) TOTAL</p> <p>Fluorescence Spectrophotometry (HPLC-FI + GC-FID confirmation)</p> <p>A sample is acidified in the field. The concentration of Aromatic Hydrocarbons, associated with oils, is measured directly on a known volume of water sample, by fluorescence spectrometry, using methyl-naphthalene as a standard. The confirmation is completed by extraction with hexane. This extract is fractionated on an alumina column and analysed by temperature programmed GLC using a flame ionization detector (FID). The samples are compared to calibration standards and blank solutions.</p> <p>The method detection limit is 1.0 µg/L.</p> <p>Requesting Agency: Environment Canada, Prairie and Northern Region, 1974. Reference:</p> | PAH | µg/L | 3 |
| 95404 | <p>POLYAROMATIC HYDROCARBONS TOTAL</p> <p>HPLC- Fluorescence - UV Spectrophotometry</p> <p>After the addition of methyl chrysene as internal standard, the sample is extracted with dichloromethane. After the addition of a solvent keeper (acetonitrile and acetic acid) the extract is concentrated to 1 ml and analysed by HPLC and fluorescence - / UV spectrometry. LOQ ranges from 2 and 30 ng/L (depending on the compound) for surface water, and between 6 and 80 ng/L for wastewater. For wastewater, a sample clean-up is required (GPC: gel permeation chromatography).</p> <p>Requesting Agency: Belgium, 2009 Reference: APHA 2012, SM 6440 B.</p> | PAH | µg/L | 3 |
| 95414 | <p>ACENAPHTHENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | ACENAPHTHENE | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|----------------|-------|----------|
| 95415 | <p>ACENAPHTHYLENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | ACENAPHTHYLENE | µg/L | 3 |
| 95416 | <p>ANTHRACENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | ANTHRACENE | µg/L | 3 |
| 95417 | <p>BENZO(A)ANTHRACENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | B(A)A | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-----------|-------|----------|
| 95418 | <p>BENZO(K)FLUORANTHENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | B(K)F | µg/L | 3 |
| 95419 | <p>BENZO(G,H,I)PERYLENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | B(G,H,I)P | µg/L | 3 |
| 95420 | <p>BENZO(A)PYRENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | B(A)P | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|------------------|-------|----------|
| 95421 | <p>CHRYSENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | CHRYSENE | µg/L | 3 |
| 95422 | <p>DIBENZO(A,H)ANTHRACENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | D(A,H)A | µg/L | 3 |
| 95423 | <p>FLUORANTHENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | FLUORANT HENE | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|-----------------|-------|----------|
| 95424 | <p>FLUORENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | FLUORENE | µg/L | 3 |
| 95425 | <p>INDENO(1,2,3-CD)PYRENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | I(1,2,3-CD)P | µg/L | 3 |
| 95426 | <p>NAPHTHALENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | NAPHTHAL ENE | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|----------------------|-------|----------|
| 95428 | <p>PHENANTHRENE</p> <p>HPLC-Fluorescence – UV Spectrometry</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | PHENANTHRENE | µg/L | 3 |
| 95429 | <p>PYRENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | PYRENE | µg/L | 3 |
| 95431 | <p>BENZO(B)FLUORANTHENE</p> <p>HPLC Fluorescence – UV Spectrometry</p> <p>Mark the water meniscus on the side of the sample bottle for later determination of volume. Pour entire sample into a 2-L separatory funnel and extract. Separation and clean-up is by means of a silica-gel column. Add 4mL acetonitrile and concentrate the extract in a 95-100°C water bath using a micro-Snyder column. Rinse column with 0.2 mL acetonitrile. Adjust final extract volume to 1.0mL. After the operating conditions are met, proceed with calibration and sample analysis. If the internal standard calibration procedure is being used, add internal standard to sample extract and mix thoroughly. Immediately inject 5 to 25µL sample extract or standard into HPLC using a high pressure syringe or constant-volume sample injection loop. Record volume injected to nearest 0.1 µL and resulting peak size in area or peak height units. Re-equilibrate HPLC column at initial gradient conditions for at least 10 minutes between injections. Identify compounds in sample by comparing peak retention times with peaks of standard chromatograms.</p> <p>Requesting Agency: Belgium, 2011 Reference: APHA 2012, SM 6440 B.</p> | BENZO(B)FLUORANTHENE | µg/L | 3 |

| Code | Method Description | Name | Units | Decimals |
|-------|--|-------------------|------------------------|----------|
| 97060 | <p>TEMPERATURE – AIR</p> <p>Air temperature is measured with a calibrated thermometer with a scale marked for every 0.1°C, and reported in degrees Celsius.</p> <p>The method precision is within 0.1°C</p> <p>Requesting Agency 1: Saskatchewan Environment, Canada, 1977. Requesting Agency 2: NIES, Japan, 1998. Reference 1: APHA 1975. Reference 2: JSA 1998, method 7.1.</p> | TEMP-AIR | °C | 1 |
| 97061 | <p>TEMPERATURE – AIR</p> <p>Thermistor</p> <p>Measurement device should be routinely checked against a precision thermometer certified by the National Bureau of Standards.</p> <p>Requesting Agency: USGS, 2009 Reference 1: USGS Pcode-20 Mcode-THM04 Reference 2: US-EPA, method EPA 170.1</p> | TEMP-AIR | °C | 1 |
| 97160 | <p>INSTANTANEOUS DISCHARGE</p> <p>Gauge Height</p> <p>The Instantaneous Discharge is measured at or near the sampling site in cubic metre per second.</p> <p>The method detection limit is $\pm 1 \text{ m}^3/\text{s}$.</p> <p>Requesting Agency 1: Environment Canada, Atlantic Region, 1979. Requesting Agency 2: NIES, Japan, 1998. Requesting Agency 3: GHI, Russian Federation, 2004. Reference 1: JSA 1998, method 8. Reference 2: Hydrometeoizdat 1978.</p> | INST DISCHG | m^3/s | 1 |
| 97161 | <p>INSTANTANEOUS DISCHARGE</p> <p>The instantaneous discharge is measured in cubic feet per second.</p> <p>Requesting Agency: USGS 2009 Reference: USGS P.Code-00061</p> | INST DISCHG | ft^3/s | 0 |
| 97163 | <p>DISCHARGE – DAILY MEAN</p> <p>Gauge Height</p> <p>Requesting Agency: Japan, 2010 Reference:</p> | DISCHG DAILY MEAN | m^3/s | 1 |
| 97167 | <p>DISCHARGE – DAILY MEAN</p> <p>Calculated</p> <p>Daily discharge measurement at sampling site in cubic meters per second. From 1980 onwards, this is the main parameter extracted from the Water Survey of Canada tapes.</p> <p>Requesting Agency: Environment Canada, Atlantic Region, 2007. Reference: Environment Canada 1995, ENVIRODAT code 2198.</p> | DISCHG DAILY MEAN | m^3/s | 2 |

| Code | Method Description | Name | Units | Decimals |
|-------|---|---------------------|-----------------------|----------|
| 97184 | <p>DISCHARGE MONTHLY MEAN</p> <p>Calculated</p> <p>The monthly mean discharge is calculated in cubic metres per second.</p> <p>The method precision is $\pm 1 \text{ m}^3/\text{s}$.</p> <p>Requesting Agency: n/a. Reference: n/a.</p> | DISCH. MON. MEAN | m^3/s | 0 |
| 97320 | <p>CLOUD COVER</p> <p>Estimated Percent</p> <p>The units of measurement are by fractional cover (by type) and estimated in percentage. The hourly means are calculated, from stations equipped with short-wave radiometers, 10-daily for satellite products. The special resolution is 10 to 50 km. The measurement methods are:</p> <p>Tiers 1-2: kilometres (sky cameras) Tier 3: ocular estimates Tier 5: spectral radiance</p> <p>The method precision is $\pm 10\%$ absolute.</p> <p>Requesting Agency: Saskatchewan Environment, Canada, 1977. Reference: n/a.</p> | CLOUD COVER | % | 0 |

PART B: Appendices to GEMStat Analytical Methods Dictionary

Appendix 1. Method Codes in Alphabetical Order

NOTE: The first two digits of the GEMStat method codes are the atomic number for that element.

| Code | Alpha Description | Units | Analytical Method |
|-------|---------------------------------------|--------------------------|---------------------------------------|
| 95102 | 1,2-Dichlorobenzene | µg/L | P&T GC-FID |
| 95221 | 1,2-Dichloroethane | µg/L | P&T GC-FID |
| 95222 | 1,2-Dichloroethene | µg/L | P&T GC-FID |
| 95103 | 1,4-Dichlorobenzene | µg/L | P&T GC-FID |
| 18504 | 2,4-D | µg/L | GC-MS |
| 18506 | 2,4-D | µg/L | SPE-HPLC |
| 18503 | 2,4-D | µg/L | Electron Capture - GLC |
| 18505 | 2,4-D | µg/L | SPE-GC-MS |
| 02003 | Absorbance at 340 nm | ABS*1000 | Spectrophotometric Absorbance Reading |
| 02004 | Absorbance at 440 nm | ABS*1000 | Spectrophotometric Absorbance Reading |
| 02005 | Absorbance at 740 nm | ABS*1000 | Spectrophotometric Absorbance Reading |
| 02006 | Absorbance Co-efficient at 340nm | M | Calculated Values Absorbances |
| 02007 | Absorbance Co-efficient at 440nm | M | Calculated Values Absorbances |
| 95414 | Acenaphthene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95415 | Acenaphthylene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 10201 | Acidity | mg CaCO ₃ /L | Potentiometric Titration (pH=4.5) |
| 10251 | Acidity | mg CaCO ₃ /L | Potentiometric Titration (pH=8.3) |
| 10252 | Acidity | mg CaCO ₃ /L | Titroprocessor |
| 18444 | Aldicarb | µg/L | High Pressure Liquid Chromatography |
| 18130 | Aldrin | µg/L | Gas Chromatography |
| 10151 | Alkalinity Phenolphthalein | mg CaCO ₃ /L | Potentiometric Titration |
| 10101 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Potentiometric Titration |
| 10102 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Colourimetric Titration |
| 10103 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Titration Method |
| 10109 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Potentiometric Titration |
| 10110 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Titration (Gran) |
| 10111 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Titroprocessor |
| 10113 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Infrared Detection |
| 10120 | Alkalinity Total (CaCO ₃) | meq CaCO ₃ /L | Visual Titration |
| 10121 | Alkalinity Total (CaCO ₃) | meq CaCO ₃ /L | Electrometric Titration |
| 10123 | Alkalinity Total (CaCO ₃) | mg CaCO ₃ /L | Electrometric Titration |
| 13101 | Aluminum - Dissolved | mg Al/L | Colourimetry |
| 13102 | Aluminum - Dissolved | mg Al/L | AAS - Direct Aspiration |
| 13103 | Aluminum - Dissolved | mg Al/L | AAS - Solvent Extraction |
| 13104 | Aluminum - Dissolved | mg Al/L | Colourimetry |
| 13109 | Aluminum - Dissolved | mg Al/L | ICP 1502 |
| 13111 | Aluminum - Dissolved | mg Al/L | ICP 1516 |
| 13190 | Aluminum - Dissolved | mg Al/L | ICP MS |
| 13901 | Aluminum - Dissolved | mg Al/L | AAS - Flameless |
| 13301 | Aluminum - Extractable | mg Al/L | Colourimetry (ferron) |
| 13302 | Aluminum - Extractable | mg Al/L | AAS - Direct Aspiration |
| 13305 | Aluminum - Extractable | mg Al/L | AAS - Solvent Extraction |
| 13309 | Aluminum - Extractable | mg Al/L | AAS - Graphite Furnace |

| Code | Alpha Description | Units | Analytical Method |
|-------|------------------------|---------|---------------------------------------|
| 13001 | Aluminum - Total | mg Al/L | Colourimetry |
| 13002 | Aluminum - Total | mg Al/L | AAS - Direct Aspiration |
| 13003 | Aluminum - Total | mg Al/L | AAS - Solvent Extraction |
| 13005 | Aluminum - Total | mg Al/L | Colourimetric |
| 13009 | Aluminum - Total | mg Al/L | ICP 1502 |
| 13011 | Aluminum - Total | mg Al/L | ICP 1503 |
| 13031 | Aluminum - Total | mg Al/L | Colourimetry (Photometer - Wagtech) |
| 13090 | Aluminum - Total | mg Al/L | ICP MS |
| 13091 | Aluminum - Total | mg Al/L | ICP SFMS |
| 13092 | Aluminum - Total | mg Al/L | ICP MS |
| 13911 | Aluminum - Total | mg Al/L | AAS - Flameless |
| 07532 | Ammonia | mg N/L | Ultraviolet Visible Spectrophotometer |
| 07551 | Ammonia | mg N/L | Direct Nesslerization |
| 07552 | Ammonia | mg N/L | Colourimetry (O-Tolidine) |
| 07553 | Ammonia | mg N/L | Distillation and Titration |
| 07554 | Ammonia | mg N/L | Distillation + Nesslerization |
| 07555 | Ammonia | mg N/L | Colourimetry (Alpha-Naphtol) |
| 07556 | Ammonia | mg N/L | Colourimetry (Indophenol Blue) |
| 07557 | Ammonia | mg N/L | Indophenol Blue Method (Automated) |
| 07558 | Ammonia | mg N/L | 1-naphthol Method |
| 07570 | Ammonia | mg N/L | Calculated (Ammonia-Free) |
| 07564 | Ammonia Dissolved | mg N/L | Ion Chromatography |
| 10702 | Anionic Tensides MBAS | mg/L | Methylene Blue Active Substances |
| 95416 | Anthracene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 51101 | Antimony - Dissolved | mg Sb/L | AAS - Direct Aspiration |
| 51302 | Antimony - Extractable | mg Sb/L | AAS - Solvent Extraction |
| 51091 | Antimony - Total | mg Sb/L | ICP SFMS |
| 51092 | Antimony - Total | mg Sb/L | ICP MS |
| 33103 | Arsenic - Dissolved | mg As/L | Colourimetry |
| 33104 | Arsenic - Dissolved | mg As/L | AAS - Flameless |
| 33108 | Arsenic - Dissolved | mg As/L | ICP OES |
| 33111 | Arsenic - Dissolved | mg As/L | ICP 1516 |
| 33114 | Arsenic - Dissolved | mg As/L | ICP - Hydride |
| 33190 | Arsenic - Dissolved | mg As/L | ICP MS |
| 33191 | Arsenic - Dissolved | mg As/L | ICP SFMS |
| 33202 | Arsenic - Suspended | µg/g | AAS-Acid Digestion (Flameless) |
| 33003 | Arsenic - Total | mg As/L | Colourimetry |
| 33006 | Arsenic - Total | mg As/L | Colourimetry (Acidification) |
| 33007 | Arsenic - Total | mg As/L | AAS - Flameless |
| 33008 | Arsenic - Total | mg As/L | ICP - Emission Spectroscopy |
| 33009 | Arsenic - Total | mg As/L | ICP 1502 |
| 33011 | Arsenic - Total | mg As/L | AAS - Hydride |
| 33012 | Arsenic - Total | mg As/L | AAS - Gaseous Hydride |
| 33013 | Arsenic - Total | mg As/L | Arsenator - Wagtech |
| 33014 | Arsenic - Total | mg As/L | ICP - Hydride |
| 33090 | Arsenic - Total | mg As/L | ICP MS |

| Code | Alpha Description | Units | Analytical Method |
|-------|---------------------------|------------------------|--|
| 33091 | Arsenic - Total | mg As/L | ICP SFMS |
| 33092 | Arsenic - Total | mg As/L | ICP MS |
| 18415 | Atrazine - Total | µg/L | GC-Nitrogen-Phosphorus Detector |
| 56101 | Barium - Dissolved | mg Ba/L | AAS - Direct Aspiration |
| 56190 | Barium - Dissolved | mg Ba/L | ICP MS |
| 56301 | Barium - Extractable | mg Ba/L | AAS - Direct Aspiration |
| 56302 | Barium - Extractable | mg Ba/L | Flame Emission |
| 56001 | Barium - Total | mg Ba/L | AAS - Direct Aspiration |
| 56002 | Barium - Total | mg Ba/L | Flame Emission |
| 56009 | Barium - Total | mg Ba/L | ICP 1502 |
| 56011 | Barium - Total | mg Ba/L | ICP 1503 |
| 56091 | Barium - Total | mg Ba/L | ICP SFMS |
| 56092 | Barium - Total | mg Ba/L | ICP MS |
| 95100 | Benzene | µg/L | GC - MS |
| 95200 | Benzene | µg/L | P&T GC-FID |
| 95400 | Benzene | µg/L | GC-MS - Headspace |
| 95417 | Benzo(a)anthracene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95420 | Benzo(a)pyrene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95431 | Benzo(b)fluoranthene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95419 | Benzo(g,h,i)perylene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95418 | Benzo(k)fluoranthene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95000 | Benzoic Acid | µg/L | Gas Chromatography |
| 04009 | Beryllium - Total | mg Be/L | ICP 1502 |
| 04011 | Beryllium - Total | mg Be/L | ICP 1503 |
| 04091 | Beryllium - Total | mg Be/L | ICP SFMS |
| 04092 | Beryllium - Total | mg Be/L | ICP MS |
| 18814 | BHC | µg/L | Gas Chromatography |
| 18075 | BHC - Alpha | µg/L | Gas Chromatography |
| 18078 | BHC - Beta | µg/L | Gas Chromatography |
| 18073 | BHC - Delta | µg/L | Gas Chromatography |
| 18070 | BHC - Gamma (Lindane) | µg/L | Gas Liquid Chromatography (ECD) |
| 06201 | Bicarbonate | mg HCO ₃ /L | Calculated |
| 08201 | Biochemical Oxygen Demand | mg O ₂ /L | 5-Day Dilution, Winkler Method |
| 08202 | Biochemical Oxygen Demand | mg O ₂ /L | 5 Day Incubation, Dissolved Oxygen Meter |
| 08203 | Biochemical Oxygen Demand | mg O ₂ /L | 5 Day Incubation with Allyl ThioUrea |
| 83191 | Bismuth - Dissolved | mg Bi/L | ICP SFMS |
| 83091 | Bismuth - Total | mg Bi/L | ICP SFMS |
| 83092 | Bismuth - Total | mg Bi/L | ICP MS |
| 05101 | Boron - Dissolved | mg B/L | Potentiometric - Mannitol |
| 05102 | Boron - Dissolved | mg B/L | Curcumin |
| 05105 | Boron - Dissolved | mg B/L | Colourimetry |
| 05107 | Boron - Dissolved | mg B/L | ICP 1516 |
| 05109 | Boron - Dissolved | mg B/L | ICP 1502 |
| 05111 | Boron - Dissolved | µg B/L | ICP 1516 |
| 05190 | Boron - Dissolved | mg B/L | ICP MS |
| 05001 | Boron - Total | mg B/L | AAS - Graphite Furnace |

| Code | Alpha Description | Units | Analytical Method |
|-------|------------------------------|-----------------------|--------------------------------------|
| 05002 | Boron - Total | mg B/L | Colourimetry |
| 05009 | Boron - Total | mg B/L | ICP 1502 |
| 05011 | Boron - Total | mg B/L | ICP 1503 |
| 05031 | Boron - Total | mg B/L | Colourimetry (Photometer - Wagtech) |
| 05090 | Boron - Total | mg B/L | ICP MS |
| 05091 | Boron - Total | mg B/L | ICP SFMS |
| 05092 | Boron - Total | mg B/L | ICP MS |
| 35209 | Bromide - Dissolved | mg Br/L | Ion Chromatography |
| 35031 | Bromine - Total | mg Br ₂ /L | Colourimetry (Photometer - Wagtech) |
| 48101 | Cadmium - Dissolved | mg Cd/L | AAS - Direct Aspiration |
| 48102 | Cadmium - Dissolved | mg Cd/L | AAS - Solvent Extraction |
| 48109 | Cadmium - Dissolved | mg Cd/L | ICP 1502 |
| 48111 | Cadmium - Dissolved | mg Cd/L | ICP 1516 |
| 48190 | Cadmium - Dissolved | mg Cd/L | ICP MS |
| 48901 | Cadmium - Dissolved | mg Cd/L | AAS - Flameless |
| 48301 | Cadmium - Extractable | mg Cd/L | AAS - Direct Aspiration |
| 48302 | Cadmium - Extractable | mg Cd/L | AAS - Solvent Extraction |
| 48309 | Cadmium - Extractable | mg Cd/L | AAS - Graphite Furnace |
| 48201 | Cadmium - Suspended | µg/g | AAS - Direct Aspiration |
| 48001 | Cadmium - Total | mg Cd/L | AAS - Direct Aspiration |
| 48002 | Cadmium - Total | mg Cd/L | AAS - Solvent Extraction |
| 48009 | Cadmium - Total | mg Cd/L | ICP 1502 |
| 48011 | Cadmium - Total | mg Cd/L | ICP 1503 |
| 48090 | Cadmium - Total | mg Cd/L | ICP MS |
| 48091 | Cadmium - Total | mg Cd/L | ICP SFMS |
| 48092 | Cadmium - Total | mg Cd/L | ICP MS |
| 48911 | Cadmium - Total | mg Cd/L | AAS - Flameless |
| 20101 | Calcium - Dissolved | mg Ca/L | EDTA Titration |
| 20102 | Calcium - Dissolved | mg Ca/L | Titration |
| 20103 | Calcium - Dissolved | mg Ca/L | Atomic Absorption Spectrometry (AAS) |
| 20105 | Calcium - Dissolved | mg Ca/L | Flame Emission |
| 20108 | Calcium - Dissolved | mg Ca/L | AAS (unfiltered) |
| 20109 | Calcium - Dissolved | mg Ca/L | Ion Chromatography |
| 20110 | Calcium - Dissolved | mg Ca/L | AAS |
| 20111 | Calcium - Dissolved | mg Ca/L | ICP 1516 |
| 20115 | Calcium - Dissolved | mg Ca/L | ICP 1502 |
| 20190 | Calcium - Dissolved | mg Ca/L | ICP MS |
| 20003 | Calcium - Total | mg Ca/L | Atomic Absorption Spectrometry (AAS) |
| 20005 | Calcium - Total | mg Ca/L | ICP 1502 |
| 20011 | Calcium - Total | mg Ca/L | ICP 1503 |
| 20032 | Calcium - Total | mg Ca/L | Calculated |
| 06152 | Carbon - Dissolved Inorganic | mg C/L | Infrared Analysis - Autoanalyzer |
| 06154 | Carbon - Dissolved Inorganic | mg C/L | Colourimetric |
| 06156 | Carbon - Dissolved Inorganic | mg C/L | Infrared Analysis |
| 06160 | Carbon - Dissolved Inorganic | mg C/L | Infrared Analysis - Automated |
| 06151 | Carbon - Dissolved Inorganic | mg C/L | Infrared Analysis - Combustion Tube |

| Code | Alpha Description | Units | Analytical Method |
|-------|------------------------------|-----------------------|---|
| 06101 | Carbon - Dissolved Organic | mg C/L | Infrared Analysis |
| 06104 | Carbon - Dissolved Organic | mg C/L | Infrared Analysis |
| 06107 | Carbon - Dissolved Organic | mg C/L | Colourimetry |
| 06112 | Carbon - Dissolved Organic | mg C/L | Infrared Analysis - Automated |
| 06113 | Carbon - Dissolved Organic | mg C/L | Infrared Analysis - Burning Oxidation |
| 06116 | Carbon - Dissolved Organic | mg C/L | Infrared Analysis - Automated |
| 06076 | Carbon - Particulate Organic | µg C/g | CHN Analyzer |
| 06077 | Carbon - Particulate Organic | µg C/g | Flame Ionization |
| 06081 | Carbon - Particulate Organic | mg C/L | Thermal Conductivity |
| 06082 | Carbon - Particulate Organic | mg C/L | Thermal Conductivity (Integrated Sample) |
| 06083 | Carbon - Particulate Organic | mg C/L | CHN Analyzer |
| 06084 | Carbon - Particulate Organic | mg C/L | Difference Calculation |
| 95223 | Carbon Tetrachloride | µg/L | P&T GC-FID |
| 06016 | Carbon -Total | mg C/L | Infrared Analysis - Automated |
| 06051 | Carbon -Total Inorganic | mg C/L | Infrared Analysis - Combustion Tube |
| 06060 | Carbon -Total Inorganic | mg C/L | Infrared Analysis - Automated |
| 06001 | Carbon -Total Organic | mg C/L | Infrared Analysis - Dual Channel |
| 06012 | Carbon -Total Organic | mg C/L | Infrared Analysis - Automated |
| 06015 | Carbon -Total Organic | mg C/L | Calculated |
| 06301 | Carbonate | mg CO ₃ /L | Calculated |
| 08301 | Chemical Oxygen Demand | mg O ₂ /L | K ₂ Cr ₂ O ₇ Digestion |
| 08304 | Chemical Oxygen Demand | mg O ₂ /L | Colourimetric - Closed Reflux |
| 08305 | Chemical Oxygen Demand Total | mg O ₂ /L | KMnO ₄ Method |
| 18060 | Chlordane - Alpha (cis) | µg/L | Gas Chromatography |
| 18065 | Chlordane - Gamma (trans) | µg/L | Gas Chromatography |
| 17201 | Chloride - Dissolved | mg Cl/L | Mercuric Nitrate Titration |
| 17202 | Chloride - Dissolved | mg Cl/L | Silver Nitrate Potentiometric |
| 17203 | Chloride - Dissolved | mg Cl/L | Colourimetry |
| 17204 | Chloride - Dissolved | mg Cl/L | Silver Nitrate Titration |
| 17205 | Chloride - Dissolved | mg Cl/L | Specific Ion Electrode |
| 17206 | Chloride - Dissolved | mg Cl/L | Colourimetry (AutoAnalyzer) |
| 17207 | Chloride - Dissolved | mg Cl/L | Ion Exchange |
| 17208 | Chloride - Dissolved | mg Cl/L | Colourimetry (Unfiltered) |
| 17209 | Chloride - Dissolved | mg Cl/L | Ion Chromatography |
| 17211 | Chloride - Dissolved | mg Cl/L | Colourimetry (Thiocyanate Method) |
| 17031 | Chloride - Total | mg Cl/L | Colourimetry (Photometer - Wagtech) |
| 95101 | Chlorobenzene | µg/L | P&T GC-FID |
| 06701 | Chlorophyll A | mg/L | Atomic Absorption Spectrometry (AAS) |
| 06702 | Chlorophyll A | mg/L | Colourimetry |
| 06711 | Chlorophyll A | mg/L | Colourimetry |
| 24006 | Chromium - Total | mg Cr/L | AAS - Direct Air-Acetylene Flame |
| 24052 | Chromium - Dissolved | mg Cr/L | AAS |
| 24111 | Chromium - Dissolved | mg Cr/L | ICP 1516 |
| 24190 | Chromium - Dissolved | mg Cr/L | ICP MS |
| 24901 | Chromium - Dissolved | mg Cr/L | AAS - Flameless |
| 24303 | Chromium - Extractable | mg Cr/L | AAS-Solvent Extraction |

| Code | Alpha Description | Units | Analytical Method |
|-------|-----------------------|------------|---|
| 24031 | Chromium - Hexavalent | mg Cr/L | Colourimetry (Photometer - Wagtech) |
| 24101 | Chromium - Hexavalent | mg Cr/L | Colourimetry |
| 24109 | Chromium - Hexavalent | mg Cr/L | ICP-OES |
| 24202 | Chromium - Suspended | µg/g | AAS - Direct Aspiration |
| 24002 | Chromium - Total | mg Cr/L | AAS - Direct Aspiration |
| 24004 | Chromium - Total | mg Cr/L | AAS |
| 24009 | Chromium - Total | mg Cr/L | ICP 1502 |
| 24011 | Chromium - Total | mg Cr/L | ICP 1503 |
| 24090 | Chromium - Total | mg Cr/L | ICP MS |
| 24091 | Chromium - Total | mg Cr/L | ICP SFMS |
| 24092 | Chromium - Total | mg Cr/L | ICP MS |
| 24911 | Chromium - Total | mg Cr/L | AAS - Flameless |
| 95421 | Chrysene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 02070 | Clarity | m | Horizontal Black Disc |
| 06402 | CO2 - Dissolved | mg/L | Titration |
| 27302 | Cobalt - Extractable | mg Co/L | AAS - Solvent Extraction |
| 27009 | Cobalt - Total | mg Co/L | ICP 1502 |
| 27011 | Cobalt - Total | mg Co/L | ICP 1503 |
| 27091 | Cobalt - Total | mg Co/L | ICP SFMS |
| 27092 | Cobalt - Total | mg Co/L | ICP MS |
| 36001 | Coliform - Total | No./100ml | Multiple Test Tube |
| 36002 | Coliform - Total | No./100ml | Membrane Filtration |
| 36004 | Coliform - Total | No./100 ml | Enzyme Substrate Specific Reaction |
| 36006 | Coliform - Total | No./100ml | Potatest - WTW |
| 36007 | Coliform - Total | No./100ml | Colilert Quanti-Tray |
| 02021 | Colour | Rel. Units | Visual Comparison - Centrifuged |
| 02011 | Colour | Rel. Units | Visual Comparison |
| 02022 | Colour | m-1 | Photometric - Spectral Absorption Coefficient(Real) |
| 02023 | Colour | m-1 | Photometric - Platinum Cobalt(Hazen) |
| 29101 | Copper - Dissolved | mg Cu/L | Colourimetry |
| 29105 | Copper - Dissolved | mg Cu/L | AAS - Solvent Extraction |
| 29106 | Copper - Dissolved | mg Cu/L | AAS - Direct Aspiration |
| 29109 | Copper - Dissolved | mg Cu/L | ICP 1502 |
| 29111 | Copper - Dissolved | mg Cu/L | ICP 1516 |
| 29190 | Copper - Dissolved | mg Cu/L | ICP MS |
| 29901 | Copper - Dissolved | mg Cu/L | AAS - Flameless |
| 29305 | Copper - Extractable | mg Cu/L | AAS - Solvent Extraction |
| 29306 | Copper - Extractable | mg Cu/L | AAS - Direct Aspiration |
| 29309 | Copper - Extractable | mg Cu/L | AAS - Graphite Furnace |
| 29206 | Copper - Suspended | µg/g | AAS - Direct Aspiration |
| 29001 | Copper - Total | mg Cu/L | Colourimetry |
| 29005 | Copper - Total | mg Cu/L | AAS - Solvent Extraction |
| 29006 | Copper - Total | mg Cu/L | AAS - Direct Aspiration |
| 29008 | Copper - Total | mg Cu/L | AAS - Direct Air-Acetylene Flame |
| 29009 | Copper - Total | mg Cu/L | ICP 1502 |
| 29011 | Copper - Total | mg Cu/L | ICP 1503 |

| Code | Alpha Description | Units | Analytical Method |
|-------|--------------------------|----------------------|--|
| 29031 | Copper - Total | mg Cu/L | Colourimetry (Photometer - Wagtech) |
| 29090 | Copper - Total | mg Cu/L | ICP MS |
| 29091 | Copper - Total | mg Cu/L | ICP SFMS |
| 29092 | Copper - Total | mg Cu/L | ICP MS |
| 29911 | Copper - Total | mg Cu/L | AAS - Flameless |
| 06606 | Cyanide | mg CN/L | Colourimetry |
| 06610 | Cyanide | mg CN/L | Colourimetric (Total) |
| 06609 | Cyanide | mg CN/L | Colourimetric (released) |
| 18002 | DDT - Total | µg/L | Gas Chromatography |
| 95422 | Dibenzo(a,h)anthracene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 18150 | Dieldrin | µg/L | Gas Chromatography |
| 97163 | Discharge - Daily Mean | m ³ /s | Gauge Height |
| 97167 | Discharge - Daily Mean | m ³ /s | Calculated |
| 97184 | Discharge - Monthly Mean | m ³ /s | Calculated |
| 08101 | Dissolved Oxygen | mg O ₂ /L | Winkler Method |
| 08102 | Dissolved Oxygen | mg O ₂ /L | Oxygen Meter |
| 08107 | Dissolved Oxygen | mg O ₂ /L | Calculated from % Saturation |
| 08108 | Dissolved Oxygen | mg O ₂ /L | Miller Method (modified procedure) |
| 08109 | Dissolved Oxygen | mg O ₂ /L | Oxygen Meter |
| 08110 | Dissolved Oxygen | mg O ₂ /L | Diaphragm Electrode Method |
| 02040 | Electrical Conductance | µS/cm | Electrometer @ 20°C |
| 02041 | Electrical Conductance | µS/cm | Conductivity Meter @ 25°C |
| 02042 | Electrical Conductance | µS/cm | Conductivity-Temperature Meter |
| 02043 | Electrical Conductance | µS/cm | Conductivity Meter - Field |
| 02049 | Electrical Conductance | µS/cm | Radiometer CDM 83 |
| 02051 | Electrical Conductance | µS/cm | Conductivity Meter (Ambient Temperature) |
| 02053 | Electrical Conductance | µS/cm | Specific Conductance Sensor |
| 02047 | Electrical Conductance | µS/cm | Calculated (Theoretical) |
| 18050 | Endosulphan - Alpha | µg/lL | Gas Chromatography |
| 18055 | Endosulphan - Beta | µg/L | Gas Chromatography |
| 18140 | Endrin | µg/L | Gas Chromatography |
| 36017 | Escherichia Coli | No./100ml | Colilert Quanti-Tray |
| 36020 | Escherichia Coli | No./100 ml | Specific Enzyme Substrate Culture Medium |
| 95202 | Ethylbenzene | µg/L | P&T GC-FID |
| 36011 | Faecal Coliform Bacteria | No./100ml | Multiple Test Tube |
| 36012 | Faecal Coliform Bacteria | No./100ml | Membrane Filtration |
| 36016 | Faecal Coliform Bacteria | No./100ml | Potatest - WTW |
| 36018 | Faecal Coliform Bacteria | No./100ml | Membrane Filtration |
| 36101 | Faecal Streptococci | No./100ml | Multiple Tube Fermentation |
| 36102 | Faecal Streptococci | No./100ml | Membrane Filtration |
| 10501 | Fixed Suspended Solids | mg/L | Gravimetric Method |
| 10502 | Fixed Suspended Solids | mg/L | Weighed Gooch Crucible (with Asbestos) |
| 10504 | Fixed Suspended Solids | mg/L | Weighed |
| 95423 | Fluoranthene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 95424 | Fluorene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 09103 | Fluoride - Dissolved | mg F/L | Colourimetry |

| Code | Alpha Description | Units | Analytical Method |
|-------|--|------------|---|
| 09104 | Fluoride - Dissolved | mg F/L | Colourimetry - with SPADNS Distillation |
| 09105 | Fluoride - Dissolved | mg F/L | Specific Ion Electrode |
| 09106 | Fluoride - Dissolved | mg F/L | Electrode Potential Method |
| 09107 | Fluoride - Dissolved | mg F/L | Potentiometric Specific Ion |
| 09110 | Fluoride - Dissolved | mg F/L | Photometric (La-Alizarin Complex) |
| 09116 | Fluoride - Dissolved | mg F/L | Ion Chromatography |
| 09209 | Fluoride - Dissolved | mg F/L | Ion Chromatography |
| 09031 | Fluoride - Total | mg F/L | Colourimetry (Photometer - Wagtech) |
| 31092 | Gallium - Total | mg Ga/L | ICP MS |
| 10607 | Hardness - Calcium | mg CaCO3/L | EDTA Titration |
| 10632 | Hardness - Calcium | mg CaCO3/L | Colourimetry (Photometer - Wagtech) |
| 10650 | Hardness - NonCarbonate | mg CaCO3/L | Calculated |
| 10602 | Hardness - Total | mg CaCO3/L | Calculated |
| 10603 | Hardness - Total | mg CaCO3/L | EDTA Titration |
| 10608 | Hardness - Total | mg CaCO3/L | Calculated |
| 10609 | Hardness - Total | mg CaCO3/L | Volumetric - titration |
| 10631 | Hardness - Total | mg CaCO3/L | Colourimetry (Photometer - Wagtech) |
| 18040 | Heptachlor | µg/L | Gas Chromotography |
| 18045 | Heptachlor Epoxide | µg/L | Gas Chromotography |
| 06581 | Humic Acid | mg/L | UV Spectrophotometric |
| 06582 | Humic Acid | mg/L | UV Spectrofluorimetry |
| 06570 | Hydrocarbons Total | µg/L | IR Intensity Spectroscopy |
| 01000 | Hydrogen Sulphide | mg/L | |
| 01001 | Hydrogen Sulphide | mg/L | Iodometric Method with Pretreatment |
| 95425 | Indeno(1,2,3-cd)pyrene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 97160 | Instantaneous Discharge | m3/s | Gauge Height |
| 97161 | Instantaneous Discharge | ft3/s | Gauge Height |
| 00190 | Integrated Sample - Code for internal use only | | Vertical (V), Horizontal (H), Time (T) |
| 26102 | Iron - Dissolved | mg Fe/L | Colourimetry |
| 26103 | Iron - Dissolved | mg Fe/L | Bathophenanthroline |
| 26104 | Iron - Dissolved | mg Fe/L | AAS - Direct Aspiration |
| 26105 | Iron - Dissolved | mg Fe/L | AAS - Solvent Extraction |
| 26109 | Iron - Dissolved | mg Fe/L | ICP 1502 |
| 26111 | Iron - Dissolved | mg Fe/L | ICP 1516 |
| 26190 | Iron - Dissolved | mg Fe/L | ICP MS |
| 26901 | Iron - Dissolved | mg Fe/L | AAS - Flameless |
| 26302 | Iron - Extractable | mg Fe/L | Colourimetry (TPTZ) |
| 26304 | Iron - Extractable | mg Fe/L | AAS - Direct Aspiration |
| 26305 | Iron - Extractable | mg Fe/L | AAS - Solvent Extraction |
| 26204 | Iron - Suspended | µg/g | AAS - Direct Aspiration |
| 26002 | Iron - Total | mg Fe/L | Colourimetry |
| 26003 | Iron - Total | mg Fe/L | Phenanthroline Spectrometry |
| 26004 | Iron - Total | mg Fe/L | AAS - Direct Aspiration |
| 26005 | Iron - Total | mg Fe/L | AAS - Solvent Extraction |
| 26009 | Iron - Total | mg Fe/L | ICP 1502 |
| 26011 | Iron - Total | mg Fe/L | ICP 1503 |

| Code | Alpha Description | Units | Analytical Method |
|-------|-----------------------|---------|--|
| 26031 | Iron - Total | mg Fe/L | Colourimetry (Photometer - Wagtech) |
| 26090 | Iron - Total | mg Fe/L | ICP MS |
| 26091 | Iron - Total | mg Fe/L | ICP SFMS |
| 26092 | Iron - Total | mg Fe/L | ICP MS |
| 57092 | Lanthanum - Total | mg La/L | ICP MS |
| 82101 | Lead - Dissolved | mg Pb/L | AAS - Direct Aspiration |
| 82102 | Lead - Dissolved | mg Pb/L | Colourimetry |
| 82103 | Lead - Dissolved | mg Pb/L | AAS - Solvent Extraction |
| 82106 | Lead - Dissolved | mg Pb/L | Emission Spectroscopy - Arc Excitation |
| 82109 | Lead - Dissolved | mg Pb/L | ICP 1502 |
| 82111 | Lead - Dissolved | mg Pb/L | ICP 1516 |
| 82190 | Lead - Dissolved | mg Pb/L | ICP MS |
| 82511 | Lead - Dissolved | mg Pb/L | Stripping Voltammetry |
| 82901 | Lead - Dissolved | mg Pb/L | AAS - Flameless |
| 82913 | Lead - Dissolved | mg Pb/L | AAS - Flame |
| 82301 | Lead - Extractable | mg Pb/L | AAS - Direct Aspiration |
| 82302 | Lead - Extractable | mg Pb/L | AAS - Solvent Extraction |
| 82303 | Lead - Extractable | mg Pb/L | Colourimetry (Dithizone) |
| 82305 | Lead - Extractable | mg Pb/L | AAS - Graphite Furnace (Massman) |
| 82309 | Lead - Extractable | mg Pb/L | AAS - Graphite Furnace |
| 82201 | Lead - Suspended | µg/g | AAS - Direct Aspiration |
| 82001 | Lead - Total | mg Pb/L | AAS - Direct Aspiration |
| 82002 | Lead - Total | mg Pb/L | AAS - Solvent Extraction |
| 82009 | Lead - Total | mg Pb/L | ICP 1502 |
| 82011 | Lead - Total | mg Pb/L | ICP 1503 |
| 82090 | Lead - Total | mg Pb/L | ICP MS |
| 82091 | Lead - Total | mg Pb/L | ICP SFMS |
| 82092 | Lead - Total | mg Pb/L | ICP MS |
| 82360 | Lead - Total | mg Pb/L | ICP AES |
| 82911 | Lead - Total | mg Pb/L | AAS - Flameless |
| 06561 | Lignosulphonates | mg/L | Colourimetry |
| 03101 | Lithium - Dissolved | mg Li/L | AAS - Direct Aspiration |
| 03001 | Lithium - Total | mg Li/L | AAS - Direct Aspiration |
| 03009 | Lithium - Total | mg Li/L | ICP 1502 |
| 03011 | Lithium - Total | mg Li/L | ICP 1503 |
| 03091 | Lithium - Total | mg Li/L | ICP SFMS |
| 03092 | Lithium - Total | mg Li/L | ICP MS |
| 12101 | Magnesium - Dissolved | mg Mg/L | Calculated |
| 12102 | Magnesium - Dissolved | mg Mg/L | AAS - Direct Aspiration |
| 12103 | Magnesium - Dissolved | mg Mg/L | EDTA Titration |
| 12104 | Magnesium - Dissolved | mg Mg/L | AutoAnalyzer |
| 12106 | Magnesium - Dissolved | mg Mg/L | AAS - Direct Aspiration |
| 12107 | Magnesium - Dissolved | mg Mg/L | AAS - Automated |
| 12109 | Magnesium - Dissolved | mg Mg/L | Ion Chromatography |
| 12111 | Magnesium - Dissolved | mg Mg/L | ICP 1516 |
| 12115 | Magnesium - Dissolved | mg Mg/L | ICP 1502 |

| Code | Alpha Description | Units | Analytical Method |
|-------|--------------------------|---------|-------------------------------------|
| 12190 | Magnesium - Dissolved | mg Mg/L | ICP MS |
| 12002 | Magnesium - Total | mg Mg/L | AAS - Direct Aspiration |
| 12003 | Magnesium - Total | mg Mg/L | EDTA Titration |
| 12005 | Magnesium - Total | mg Mg/L | ICP AES |
| 12011 | Magnesium - Total | mg Mg/L | ICP 1503 |
| 12031 | Magnesium - Total | mg Mg/L | Colourimetry (Photometer - Wagtech) |
| 25101 | Manganese - Dissolved | mg Mn/L | Colourimetry |
| 25104 | Manganese - Dissolved | mg Mn/L | AAS - Direct Aspiration |
| 25105 | Manganese - Dissolved | mg Mn/L | AAS - Solvent Extraction |
| 25109 | Manganese - Dissolved | mg Mn/L | ICP 1502 |
| 25111 | Manganese - Dissolved | mg Mn/L | ICP 1516 |
| 25190 | Manganese - Dissolved | mg Mn/L | ICP MS |
| 25901 | Manganese - Dissolved | mg Mn/L | AAS - Flameless |
| 25913 | Manganese - Dissolved | mg Mn/L | AAS - Flame |
| 25304 | Manganese - Extractable | mg Mn/L | Colourimetric (periodate) |
| 25305 | Manganese - Extractable | mg Mn/L | AAS - Solvent Extraction |
| 25204 | Manganese - Suspended | µg/g | AAS - Direct Aspiration |
| 25001 | Manganese - Total | mg Mn/L | Colourimetry |
| 25004 | Manganese - Total | mg Mn/L | AAS - Direct Aspiration |
| 25005 | Manganese - Total | mg Mn/L | AAS - Solvent Extraction |
| 25009 | Manganese - Total | mg Mn/L | ICP 1502 |
| 25011 | Manganese - Total | mg Mn/L | ICP 1503 |
| 25031 | Manganese - Total | mg Mn/L | Colourimetry (Photometer - Wagtech) |
| 25090 | Manganese - Total | mg Mn/L | ICP MS |
| 25091 | Manganese - Total | mg Mn/L | ICP SFMS |
| 25092 | Manganese - Total | mg Mn/L | ICP MS |
| 25911 | Manganese - Total | mg Mn/L | AAS - Flameless |
| 80111 | Mercury - Dissolved | µg Hg/L | AAS - Flameless |
| 80201 | Mercury - Suspended | µg/g | AAS - Flameless |
| 80011 | Mercury - Total | µg Hg/L | AAS - Flameless |
| 80012 | Mercury - Total | mg Hg/L | Reduction Vaporized - AAS |
| 80016 | Mercury - Total | µg Hg/L | Cold Br Wet Oxidation P AAS |
| 80090 | Mercury - Total | µg Hg/L | ICP MS |
| 18125 | Mirex | µg/L | Gas Chromatography |
| 42092 | Molybdenum - Total | mg Mo/L | ICP MS |
| 42302 | Molybdenum - Extractable | mg Mo/L | AAS - Solvent Extraction |
| 42009 | Molybdenum - Total | mg Mo/L | ICP 1502 |
| 42011 | Molybdenum - Total | mg Mo/L | ICP 1503 |
| 42091 | Molybdenum - Total | mg Mo/L | ICP SFMS |
| 95206 | M-P-Xylene | µg/L | P&T GC-FID |
| 95204 | M-Xylene | µg/L | P&T GC-FID |
| 95426 | Naphthalene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 28101 | Nickel - Dissolved | mg Ni/L | AAS - Direct Aspiration |
| 28102 | Nickel - Dissolved | mg Ni/L | AAS - Solvent Extraction |
| 28109 | Nickel - Dissolved | mg Ni/L | ICP 1502 |
| 28111 | Nickel - Dissolved | mg Ni/L | ICP 1516 |

| Code | Alpha Description | Units | Analytical Method |
|-------|--------------------------------|---------|---|
| 28190 | Nickel - Dissolved | mg Ni/L | ICP MS |
| 28192 | Nickel - Dissolved | mg Ni/L | ICP-MS |
| 28901 | Nickel - Dissolved | mg Ni/L | AAS - Flameless |
| 28301 | Nickel - Extractable | mg Ni/L | AAS - Direct Aspiration |
| 28302 | Nickel - Extractable | mg Ni/L | AAS - Solvent Extraction |
| 28001 | Nickel - Total | mg Ni/L | AAS - Direct Aspiration |
| 28002 | Nickel - Total | mg Ni/L | AAS - Solvent Extraction |
| 28009 | Nickel - Total | mg Ni/L | ICP 1502 |
| 28011 | Nickel - Total | mg Ni/L | ICP 1503 |
| 28090 | Nickel - Total | mg Ni/L | ICP MS |
| 28091 | Nickel - Total | mg Ni/L | ICP SFMS |
| 28092 | Nickel - Total | mg Ni/L | ICP MS |
| 28911 | Nickel - Total | mg Ni/L | AAS - Flameless |
| 07300 | Nitrate | mg N/L | Automated Hydrazine Reduction |
| 07306 | Nitrate | mg N/L | Brucine Sulphanilic |
| 07308 | Nitrate | mg N/L | Spectrophotometric - Ultraviolet Screening Method |
| 07309 | Nitrate | mg N/L | Chromotropic Acid |
| 07313 | Nitrate | mg N/L | Cadmium Reduction |
| 07314 | Nitrate | mg N/L | Devarda's Alloy |
| 07315 | Nitrate | mg N/L | Ion Chromatography |
| 07317 | Nitrate | mg N/L | Colourimetric - Reaction with Nitrospectral |
| 07320 | Nitrate | mg N/L | Ion Specific Electrode |
| 07321 | Nitrate | mg N/L | Ion Chromatography |
| 07322 | Nitrate | mg N/L | Potentiometry - Nitrate Selective Electrode |
| 07323 | Nitrate | mg N/L | Flow Injection Analysis |
| 07331 | Nitrate | mg N/L | Colourimetry (Photometer - Wagtech) |
| 07207 | Nitrite | mg N/L | Colourimetry (Sulfanilamide) |
| 07208 | Nitrite | mg N/L | Ultraviolet Visible Spectrophotometer |
| 07209 | Nitrite | mg N/L | Ion Chromatography |
| 07210 | Nitrite | mg N/L | Colourimetric (Cleve's Acid) |
| 07211 | Nitrite | mg N/L | Flow Injection Analysis |
| 07231 | Nitrite | mg N/L | Colourimetry (Photometer - Wagtech) |
| 07907 | Nitrogen - Particulate | mg N/L | Thermal Conductivity (Integrated Sample) |
| 07651 | Nitrogen Dissolved | mg N/L | UV Digestion + Colourimetry |
| 07902 | Nitrogen Organic - Particulate | mg N/L | Thermal Conductivity |
| 07912 | Nitrogen Organic - Particulate | µg N/g | CHN Analyzer |
| 07401 | Nitrogen Organic Dissolved | mg N/L | Kjeldahl with Removal of NH ₃ |
| 07403 | Nitrogen Organic Dissolved | mg N/L | Difference Calculation |
| 07404 | Nitrogen Organic Dissolved | mg N/L | Calculated |
| 07405 | Nitrogen Organic Dissolved | mg N/L | Calculated |
| 07601 | Nitrogen Total | mg N/L | Colourimetry |
| 07606 | Nitrogen Total | mg N/L | Alkaline Persulphate Digestion |
| 07607 | Nitrogen Total | mg N/L | Alkaline Persulphate Digestion - Automated |
| 07608 | Nitrogen Total | mg N/L | Potassium Persulphate Digestion |
| 07609 | Nitrogen Total | mg N/L | Persulphate with NAS reagents |
| 07610 | Nitrogen Total | mg N/L | UV Absorption Spectroscopy |

| Code | Alpha Description | Units | Analytical Method |
|-------|-------------------------------------|----------|--|
| 07653 | Nitrogen Total Dissolved | mg N/L | Persulphate with NAS reagents |
| 07001 | Nitrogen Total Kjeldahl | mg N/L | Kjeldahl Method |
| 07004 | Nitrogen Total Kjeldahl | mg N/L | Colourimetry |
| 07005 | Nitrogen Total Kjeldahl | mg N/L | Colourimetry |
| 07012 | Nitrogen Total Kjeldahl | mg N/L | Electrodes - gas |
| 07021 | Nitrogen Total Kjeldahl | mg N/L | Colourimetry - AutoAnalyzer |
| 07023 | Nitrogen Total Kjeldahl | mg N/L | Calculated |
| 07052 | Nitrogen Total Kjeldahl | mg N/L | Calculated |
| 07014 | Nitrogen Total Kjeldahl - Dissolved | mg N/L | Colourimetry |
| 07105 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetry |
| 07106 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetry (Cadmium) |
| 07108 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetry (Zinc Reduction) |
| 07109 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetry (Hydrazine SO4) |
| 07110 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetry (Copper/Cadmium) |
| 07112 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetry (Unfiltered) |
| 07302 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07321 + 07210) |
| 07303 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07320 + 07210) |
| 07304 | Nitrogen, Nitrate + Nitrite | mg N/L | Colourimetric |
| 07316 | Nitrogen, Nitrate + Nitrite | mg N/L | Ion Chromatography |
| 07332 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07306 + 07207) |
| 07333 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07323 + 07207) |
| 07335 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07313 + 07207) |
| 07337 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07316 + 07207) |
| 07338 | Nitrogen, Nitrate + Nitrite | mg N/L | Calculated (07316 + 07208) |
| 07339 | Nitrogen, Nitrate + Nitrite | mg N/L | Ion Chromatography (anion) |
| 18015 | O,P-DDD | µg/L | Gas Chromatography |
| 18025 | O,P-DDE | µg/L | Gas Chromatography |
| 18005 | O,P-DDT | µg/L | Gas Chromatography |
| 06521 | Oil and Grease | mg/L | Petroleum Ether Extraction |
| 17860 | Organochlorine Compounds Total | µg/L | Gas Chromatography |
| 15253 | Orthophosphate - Dissolved | mg PO4/L | Colourimetry |
| 15255 | Orthophosphate - Dissolved | mg P/L | Colourimetry |
| 15256 | Orthophosphate - Dissolved | mg P/L | Molbdenum Blue-Ascorbic Acid Reduction |
| 15257 | Orthophosphate - Dissolved | mg P/L | Colourimetry (Stannous Chloride) |
| 15031 | Orthophosphate - Reactive | mg PO4/L | Colourimetry (Photometer - Wagtech) |
| 15254 | Orthophosphate - Soluble Reactive | mg PO4/L | Colourimetry |
| 15205 | Orthophosphate - Total | mg P/L | Colourimetry |
| 95203 | O-Xylene | µg/L | P&T GC-FID |
| 18010 | P,P-DDD | µg/L | Gas Chromatography |
| 18803 | P,P-DDD Olefin | µg/L | Gas Chromatography |
| 18020 | P,P-DDE | µg/L | Gas Chromatography |
| 18000 | P,P-DDT | µg/L | Gas Chromatography |
| 18030 | P,P-Methoxy Chlor | µg/L | Gas Chromatography |
| 18165 | PCBs | µg/L | Gas Liquid Chromatography |
| 18166 | PCBs | µg/L | Gas Chromatography - Hexane Extraction |
| 18414 | PCBs | µg/L | SPE-GC-MS |

| Code | Alpha Description | Units | Analytical Method |
|-------|-------------------------------------|-----------------------|---|
| 17805 | Pentachlorophenol | µg/L | Gas Chromatography |
| 97320 | Percent Cloud Cover | % | Estimated Percent |
| 08001 | Percent Dissolved Oxygen Saturation | % | Calculation or Nomogram |
| 08005 | Percent Dissolved Oxygen Saturation | % | Meter (YSI) |
| 08006 | Percent Dissolved Oxygen Saturation | % | Winkler and Alsterberg |
| 08401 | Permanganate Value | mg O ₂ /L | KMnO ₄ Method |
| 08402 | Permanganate Value | mg O ₂ /L | KMnO ₄ Method - 4 Hour Digestion |
| 10306 | pH | pH Units | pH Meter - Field |
| 10300 | pH | pH UNITS | Colourimetric Method |
| 10301 | pH | pH UNITS | pH Meter (Electrometry) |
| 10302 | pH | pH UNITS | pH Meter (Electrometric) at 25°C |
| 95428 | Phenanthrene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 06531 | Phenols | mg/L | Colourimetry- Steam Distillation |
| 06532 | Phenols | mg/L | Colourimetry |
| 06533 | Phenols | mg/L | Colourimetric |
| 95011 | Phenols | µg/L | GC - MS |
| 95012 | Phenols | µg/L | GC-MS |
| 95013 | Phenols | µg/L | GC-MS Solid Phase Extraction |
| 95014 | Phenols | µg/L | 4 Aminoantipyrine Absorption Spectrometry |
| 15701 | Phosphate - Dissolved | mg P/L | Ion Chromatography |
| 15363 | Phosphate - Inorganic Dissolved | mg P/L | Colourimetry (SnCl ₂) |
| 15364 | Phosphate - Inorganic Dissolved | mg P/L | Colourimetry (Aminonaphtholsulphonic Acid) |
| 15365 | Phosphate - Inorganic Dissolved | mg P/L | Colourimetry (Ascorbic Acid) |
| 15403 | Phosphate - Total | mg PO ₄ /L | Colourimetry |
| 15408 | Phosphate - Total | mg P/L | Colourimetry |
| 15313 | Phosphate - Total Inorganic | mg P/L | Colourimetry |
| 15103 | Phosphorus - Dissolved | mg P/L | Colourimetry |
| 15901 | Phosphorus - Particulate | mg P/L | Difference Calculation |
| 15011 | Phosphorus - Total | mg P/L | ICP-OES |
| 15019 | Phosphorus - Total | mg P/L | Emission Spectrometry - Direct Aspiration |
| 15090 | Phosphorus - Total | mg P/L | ICP MS |
| 15204 | Phosphorus - Total | mg P/L | Ion Chromatography |
| 15405 | Phosphorus - Total | mg P/L | Colourimetry |
| 15406 | Phosphorus - Total | mg P/L | Acid Persulphate Digestion |
| 15412 | Phosphorus - Total | mg P/L | Colourimetry (Digestion) |
| 15413 | Phosphorus - Total | mg P/L | Colourimetry (AutoAnalyzer) |
| 15414 | Phosphorus - Total | mg P/L | Colourimetry (ANSA Reagent) |
| 15423 | Phosphorus - Total | mg P/L | Perchloric Acid Digestion |
| 15416 | Phosphorus - Total Dissolved | mg P/L | Acid Persulphate Digestion |
| 15417 | Phosphorus - Total Dissolved | mg P/L | Colourimetry |
| 15424 | Phosphorus - Total Dissolved | mg P/L | Continuous Flow Stream Analysis |
| 15902 | Phosphorus - Total Particulate | µg/g | Difference Calculation |
| 15903 | Phosphorus - Total Particulate | µg/g | Acid Extraction Colourimetry |
| 15904 | Phosphorus - Total Particulate | mg/L | Colourimetry |
| 15463 | Phosphorus Dissolved Phosphate | mg P/L | Colourimetry (AutoAnalyzer) |

| Code | Alpha Description | Units | Analytical Method |
|-------|---|---------|--|
| 15315 | Phosphorus Total Dissolved Reactive & Acid Hydrolyzable | mg P/L | Spectrophotometry - Reactive & Colourimetry |
| 15314 | Phosphorus Total Reactive & Acid Hydrolyzable | mg P/L | Spectrophotometry - Reactive & Colourimetry |
| 36302 | Phytoplankton Biomass | mg/m3 | Microscopic Count |
| 36301 | Phytoplankton Count | No./L | Total Number Observed (Zackey Method) |
| 36304 | Phytoplankton Count | No./ml | Total Number Observed (Kolkwitz chamber & Uternohl's Method) |
| 95401 | Polyaromatic Hydrocarbons | µg/L | Gas Chromatography (FID and GC-MS) |
| 95402 | Polyaromatic Hydrocarbons | µg/L | HPLC-Fluorometry |
| 95403 | Polyaromatic Hydrocarbons | µg/L | Fluorescence Spectrophotometry |
| 95404 | Polyaromatic Hydrocarbons | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 19101 | Potassium - Dissolved | mg K/L | FLame Photometry (Direct Intensity) |
| 19102 | Potassium - Dissolved | mg K/L | Atomic Absorption Spectrometry (AAS) |
| 19103 | Potassium - Dissolved | mg K/L | Flame Photometry |
| 19104 | Potassium - Dissolved | mg K/L | Flame Emission Spectrophotometer |
| 19105 | Potassium - Dissolved | mg K/L | AAS - Direct Aspiration |
| 19107 | Potassium - Dissolved | mg K/L | Flame Photometry (unfiltered) |
| 19111 | Potassium - Dissolved | mg K/L | ICP 1516 |
| 19112 | Potassium - Dissolved | mg K/L | Ion Chromatography |
| 19115 | Potassium - Dissolved | mg K/L | ICP 1502 |
| 19190 | Potassium - Dissolved | mg K/L | ICP - MS |
| 19001 | Potassium - Total | mg K/L | Atomic Absorption Spectrometry (AAS) |
| 19002 | Potassium - Total | mg K/L | Flame Photometry |
| 19005 | Potassium - Total | mg K/L | ICP AES |
| 19011 | Potassium - Total | mg K/L | ICP1503 |
| 19031 | Potassium - Total | mg K/L | Colourimetry (Photometer - Wagtech) |
| 95205 | P-Xylene | µg/L | P&T GC-FID |
| 95429 | Pyrene | µg/L | HPLC-Fluorescence - UV Spectrometry |
| 10551 | Residue - Fixed | mg/L | Gravimetric Method |
| 10571 | Residue - Fixed Total | mg/L | Gravimetric Method - Ignited at 550°C. |
| 10451 | Residue Filterable | mg/L | Gravimetric Method (Whatman GF/C) |
| 10452 | Residue Filterable | mg/L | Gravimetric Method (0.45 U Filter) |
| 10480 | Residue Sum | mg/L | Calculated |
| 10471 | Residue Total | mg/L | Gravimetric Method |
| 10473 | Residue Total | mg/L | Gravimetric (Micro) Method |
| 10455 | Residue Total - Dissolved | mg/L | Gravimetric Method |
| 10521 | Residue Volatile - Total | mg/L | Calculated |
| 37092 | Rubidium - Total | mg Rb/L | ICP MS |
| 02055 | Salinity | ppt | TDS-Salinity-Conductivity Meter - 25°C |
| 36220 | Salmonella | No./L | Concentration by Filtration |
| 34102 | Selenium - Dissolved | mg Se/L | AAS - Flameless |
| 34108 | Selenium - Dissolved | mg Se/L | ICP OES |
| 34114 | Selenium - Dissolved | mg Se/L | ICP - Hydride |
| 34190 | Selenium - Dissolved | mg Se/L | ICP MS |
| 34191 | Selenium - Dissolved | mg Se/L | ICP SFMS |
| 34002 | Selenium - Total | mg Se/L | Atomic Absorption Spectrometry (AAS) |

| Code | Alpha Description | Units | Analytical Method |
|-------|-------------------------|------------------------|---|
| 34007 | Selenium - Total | mg Se/L | AAS - Hydride (Flameless) |
| 34008 | Selenium - Total | mg Se/L | ICP OES |
| 34014 | Selenium - Total | mg Se/L | ICP - Hydride |
| 34090 | Selenium - Total | mg Se/L | ICP MS |
| 34091 | Selenium - Total | mg Se/L | ICP SFMS |
| 34092 | Selenium - Total | mg Se/L | ICP MS |
| 14106 | Silica - Reactive | mg SiO ₂ /L | Colourimetry (Heteropoly Blue unfiltered) |
| 14111 | Silica - Dissolved | mg SiO ₂ /L | ICP 1516 |
| 14009 | Silica - Reactive | mg SiO ₂ /L | ICP 1502 |
| 14031 | Silica - Reactive | mg SiO ₂ /L | Colourimetry (Photometer - Wagtech) |
| 14090 | Silica - Reactive | mg SiO ₂ /L | ICP-MS |
| 14101 | Silica - Reactive | mg SiO ₂ /L | Colourimetry |
| 14102 | Silica - Reactive | mg SiO ₂ /L | Colourimetry (Heteropoly Blue) |
| 14104 | Silica - Reactive | mg SiO ₂ /L | Molybdosilicate Method |
| 14105 | Silica - Reactive | mg SiO ₂ /L | Colourimetry |
| 14108 | Silica - Reactive | mg SiO ₂ /L | Colourimetric - Sulfuric Acid |
| 14109 | Silica - Reactive | mg SiO ₂ /L | Colourimetry (Molybdenum Yellow) |
| 47101 | Silver - Dissolved | mg Ag/L | AAS - Direct Aspiration |
| 47302 | Silver - Extractable | mg Ag/L | AAS - Solvent Extraction |
| 47009 | Silver - Total | mg Ag/L | ICP 1502 |
| 47011 | Silver - Total | mg Ag/L | ICP 1503 |
| 47091 | Silver - Total | mg Ag/L | ICP SFMS |
| 47092 | Silver - Total | mg Ag/L | ICP MS |
| 11201 | Sodium Adsorption Ratio | REL.UNIT | Difference Calculation |
| 11101 | Sodium - Dissolved | mg Na/L | Flame Photometry (Direct Intensity) |
| 11102 | Sodium - Dissolved | mg Na/L | AAS - Direct Aspiration |
| 11103 | Sodium - Dissolved | mg Na/L | Flame Photometry |
| 11104 | Sodium - Dissolved | mg Na/L | Flame Photometry (internal Std) |
| 11105 | Sodium - Dissolved | mg Na/L | AAS - Direct Aspiration |
| 11107 | Sodium - Dissolved | mg Na/L | Flame Photometry (no filtration) |
| 11111 | Sodium - Dissolved | mg Na/L | ICP 1516 |
| 11112 | Sodium - Dissolved | mg Na/L | Ion Chromatography |
| 11115 | Sodium - Dissolved | mg Na/L | ICP 1502 |
| 11116 | Sodium - Dissolved | mg Na/L | AAS - Emission |
| 11190 | Sodium - Dissolved | mg Na/L | ICP MS |
| 11001 | Sodium - Total | mg Na/L | Atomic Absorption Spectroscopy (AAS) |
| 11002 | Sodium - Total | mg Na/L | Flame Photometry |
| 11005 | Sodium - Total | mg Na/L | ICP - emission Spectroscopy |
| 11011 | Sodium - Total | mg Na/L | ICP1503 |
| 11032 | Sodium - Total | mg Na/L | Calculated |
| 38009 | Strontium - Total | mg Sr/L | ICP 1502 |
| 38011 | Strontium - Total | mg Sr/L | ICP 1503 |
| 38091 | Strontium - Total | mg Sr/L | ICP SFMS |
| 38092 | Strontium - Total | mg Sr/L | ICP MS |
| 95220 | Styrene | µg/L | P&T GC-FID |
| 16031 | Sulphate | mg SO ₄ /L | Colourimetry (Photometer - Wagtech) |

| Code | Alpha Description | Units | Analytical Method |
|-------|----------------------------|-------------------------------------|--|
| 16301 | Sulphate | mg SO ₄ /L | Gravimetric Method |
| 16307 | Sulphate | mg SO ₄ /L | Colourimetry (Unfiltered) |
| 16308 | Sulphate | mg SO ₄ /L | Ultraviolet Visible Spectrophotometer |
| 16302 | Sulphate - Dissolved | mg SO ₄ /L | Turbidimetric Method |
| 16303 | Sulphate - Dissolved | mg SO ₄ /L | Titration |
| 16304 | Sulphate - Dissolved | mg SO ₄ /L | Autoanalyzer |
| 16306 | Sulphate - Dissolved | mg SO ₄ /L | Colourimetry |
| 16309 | Sulphate - Dissolved | mg SO ₄ /L | Ion Chromatography |
| 00125 | Sum of Anions | meq/L | Calculated |
| 00120 | Sum of Cations | meq/L | Calculated |
| 00130 | Sum of Cations + Anions | meq/L | Calculated |
| 95207 | Sum of Xylenes | µg/L | P&T GC-FID |
| 10402 | Suspended Solids 103-105°C | mg/L | Weighed Gooch Crucible (with Asbestos) |
| 10401 | Suspended Solids 105°C | mg/L | Gravimetric Method |
| 10408 | Suspended Solids 180°C | mg/L | Gravimetric Method |
| 02061 | Temperature | °C | Mercury Thermometer |
| 02062 | Temperature | °C | Battery Thermometer |
| 02063 | Temperature | °C | Digital Thermometer |
| 02065 | Temperature | °C | Conductivity-Temperature Meter (battery) |
| 02066 | Temperature | °C | Electronic Bathythermograph |
| 02067 | Temperature | °C | Oceanographic Reversing Thermometer |
| 02068 | Temperature | °C | Non-Contact IR |
| 02069 | Temperature | °C | pH Meter (Potentiometric or Electrochemical) |
| 97060 | Temperature - Air | °C | °C |
| 97061 | Temperature - Air | °C | Thermistor |
| 95225 | Tetrachloroethene | µg/L | P&T GC-FID |
| 81091 | Thallium - Total | mg Tl/L | ICP SFMS |
| 81092 | Thallium - Total | mg Tl/L | ICP MS |
| 16502 | Thiosulphate - Total | mg S ₂ O ₃ /L | Titration |
| 50091 | Tin - Total | mg Sn/L | ICP SFMS |
| 95201 | Toluene | µg/L | P&T GC-FID |
| 07505 | Total Ammonia as Nitrogen | mg N/L | Colourimetry (Unfiltered) |
| 07506 | Total Ammonia as Nitrogen | mg N/L | Ion Selective Electrode |
| 07507 | Total Ammonia as Nitrogen | mg N/L | Colourimetric (Salicylate Method) |
| 07531 | Total Ammonia as Nitrogen | mg N/L | Colourimetry (Photometer - Wagtech) |
| 07550 | Total Ammonia as Nitrogen | mg N/L | Nesslerization |
| 07563 | Total Ammonia as Nitrogen | mg N/L | Colourimetry (Indophenol Blue) |
| 07565 | Total Ammonia as Nitrogen | mg N/L | Flow Injection Analysis |
| 02052 | Total Dissolved Salts | mg/L | Calculated |
| 02050 | Total Dissolved Solids | mg/L | Calibrated Conductivity Meter - 25°C |
| 10454 | Total Dissolved Solids | mg/L | Gravimetric Method (70-80°) |
| 02076 | Transparency | m | 30 cm Secchi Disc |
| 02083 | Transparency | PERCENT | 5 Digit Recorded Value |
| 95224 | Trichloroethene | µg/L | P&T GC-FID |
| 02071 | Turbidity | JTU | Visual |
| 02073 | Turbidity | JTU | Photometry |

| Code | Alpha Description | Units | Analytical Method |
|-------|---------------------------|---------|--|
| 02074 | Turbidity | NTU | Nephelometric Hach |
| 02081 | Turbidity | NTU | Nephelometry - Hach Ratio Turbidimeter |
| 02082 | Turbidity | NTU | Turbidimeter - WTW |
| 02084 | Turbidity | FNU | Sensor-YSI Environmental |
| 92092 | Uranium - Total | mg U/L | ICP MS |
| 23009 | Vanadium - Total | mg V/L | ICP 1502 |
| 23011 | Vanadium - Total | mg V/L | ICP 1503 |
| 23091 | Vanadium - Total | mg V/L | ICP SFMS |
| 23092 | Vanadium - Total | mg V/L | ICP MS |
| 10531 | Volatile Dissolved Solids | mg/L | Gravimetric Method |
| 10511 | Volatile Suspended Solids | mg/L | Gravimetric Method |
| 30101 | Zinc - Dissolved | mg Zn/L | Colourimetry |
| 30104 | Zinc - Dissolved | mg Zn/L | AAS - Direct Aspiration |
| 30105 | Zinc - Dissolved | mg Zn/L | AAS - Solvent Extraction |
| 30109 | Zinc - Dissolved | mg Zn/L | ICP 1502 |
| 30111 | Zinc - Dissolved | mg Zn/L | ICP 1516 |
| 30190 | Zinc - Dissolved | mg Zn/L | ICP MS |
| 30511 | Zinc - Dissolved | mg Zn/L | Stripping Voltammetry |
| 30901 | Zinc - Dissolved | mg Zn/L | AAS - Flameless |
| 30304 | Zinc - Extractable | mg Zn/L | AAS - Direct Aspiration |
| 30305 | Zinc - Extractable | mg Zn/L | AAS - Solvent Extraction |
| 30309 | Zinc - Extractable | mg Zn/L | AAS - Graphite Furnace |
| 30204 | Zinc - Suspended | µg/g | AAS - Direct Aspiration |
| 30001 | Zinc - Total | mg Zn/L | Colourimetry |
| 30002 | Zinc - Total | mg Zn/L | AAS - Direct Air-Acetylene Flame |
| 30004 | Zinc - Total | mg Zn/L | AAS - Direct Aspiration |
| 30005 | Zinc - Total | mg Zn/L | AAS - Solvent Extraction |
| 30009 | Zinc - Total | mg Zn/L | ICP 1502 |
| 30011 | Zinc - Total | mg Zn/L | ICP 1503 |
| 30031 | Zinc - Total | mg Zn/L | Colourimetry (Photometer - Wagtech) |
| 30090 | Zinc - Total | mg Zn/L | ICP MS |
| 30091 | Zinc - Total | mg Zn/L | ICP SFMS |
| 30092 | Zinc - Total | mg Zn/L | ICP MS |
| 30911 | Zinc - Total | mg Zn/L | AAS - Flameless |

Appendix 2. Identification of Institution acronyms for data providers

| | |
|------------|---|
| ACP | Panama Canal Authority (Panama) |
| ATL | Atlantic Region (Environment Canada) |
| CEA | Central Environment Agency (Sri Lanka) |
| CFP | <i>Collaborating Focal Point</i> |
| CPCB | Central Pollution Control Board (India) |
| DACAAR | Danish Committee for Aid to Afghan Refugees (Afghanistan) |
| DFE-NB | Department of Fisheries & Environment, New Brunswick (Canada) |
| DFO-FWI | Department of Fisheries & Oceans, Freshwater Institute (Canada) |
| DWAF | Department of Water Affairs & Forestry (South Africa) |
| EBY | Entidad Binacional Yacyretá (Argentina - Paraguay) |
| EC | Environment Canada |
| EEA | European Environment Agency |
| GEMS/Water | Global Environment Monitoring System, Freshwater Programme |
| GHI | Hydrochemical Institute (Russian Federation) |
| IHLLA | Large Plains Hydrology Institute (Argentina) |
| IJC | International Joint Commission (Canada - USA) |
| INA | National Institute for Water (Argentina) |
| INSIVUMEH | National Inst. for Seismology, Volcanology, Meteorology & Hydrology (Guatemala) |
| ISO | <i>International Organization for Standardization</i> |
| MRC | Mekong River Commission (Cambodia, Lao PDR, Thailand, Vietnam) |
| NFP | <i>National Focal Point</i> |
| NIES | National Institute of Environmental Studies (Japan) |
| NIVA | Norwegian Institute for Water Research (Norway) |
| NIWA | National Institute of Water & Atmospheric Research (New Zealand) |
| ORE-HYBAM | The Environmental Research Observatory HYBAM (France, a CFP) |
| PUB | Public Utilities Board (Singapore) |
| PYR | Pacific & Yukon Region (Environment Canada) |
| UNEP | <i>United Nations Environment Programme</i> |
| USGS | United States Geological Survey (USA) |
| WSD | Water Supplies Department (Hong Kong SAR, now a China CFP) |

Appendix 3. Definitions and Digestion Procedures for Metals Analysis by ICP

NOTE 1: *Inductively Coupled Plasma (ICP) replaces the term Inductively Coupled Argon Plasma (ICAP).*

NOTE 2: *ICP-OES (Optical Emission Spectrometry) is equivalent to ICP-AES (Atomic Emission Spectroscopy).*

Total metals

The sample is preserved in the field with nitric acid; and a shaken aliquot is rigorously digested before analysis.

e.g. **ICP 1503** (total metals, digested to dryness and concentrated in HCl)

A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested with aqua regia and evaporated to near dryness. The residue is dissolved in concentrated HCl and diluted to one-fifth of the aliquot original volume. The digested sample is aspirated and the emission is measured at the appropriate wavelength and compared to identically-prepared standard and blank solutions.

Dissolved metals

An unacidified sample is filtered in the field through a 0.45 µm membrane filter and then preserved with nitric acid. An aliquot is analysed in the laboratory without digestion.

e.g. **ICP 1516** (direct aspiration for dissolved metals)

A sample is filtered in the field through a 0.45 µm membrane filter and preserved with nitric acid. The sample aliquot is aspirated and the emission is measured at the appropriate wavelength and compared to identically-prepared standard and blank solutions.

Acid-Extractable/ Recoverable metals

An unfiltered sample is preserved in the field with nitric acid. An aliquot undergoes mild digestion with hot dilute mineral acid, then is concentrated appropriately [e.g. by Ultra Sonic Nebuliser (USN)].

e.g. **ICP 1502** (recoverable metals, digested and concentrated)

A sample is preserved in the field with nitric acid. The shaken sample aliquot is digested with nitric acid or aqua regia, concentrated appropriately (e.g. from 100 mL to 20 mL, or by Ultra Sonic Nebuliser [USN]), and aspirated from an autosampler. The emission is measured at the appropriate wavelength and compared to identically-prepared standard and blank solutions.

NOTE 3: Unless conditions are rigidly controlled, extractable results will be meaningless and imprecise. Final concentrations can be close to total metal concentrations or measured concentrations may even be higher than total value due to greater uncertainty, especially if the analytical results are in the region of the method detection limits.

Appendix 4. Guide to Method Code Assignments for ICP Analyses

GEMStat method codes consist of 5 digits.

- The first two digits of the GEMStat method codes are the atomic number for the element.
- For ICP analyses, the last 3 digits have been grouped as follows:

| TOTAL | Unfiltered samples | | DISSOLVED | Filtered through a 0.45 µm membrane filter | |
|-------|--|----------|-----------|--|----------|
| xx009 | ICP 1502 digestion | ICP-OES | xx109 | ICP 1502 | ICP-OES |
| xx011 | ICP 1503, digest to dryness | ICP-OES | xx111 | ICP 1516, no digestion | ICP-OES |
| xx014 | total As, Se, Sb | ICP-OES | xx114 | dissolved As, Se, Sb | ICP-OES |
| | | | xx115 | ICP 1502 for Na, K, Ca, Mg | ICP-OES |
| xx019 | ICP 1520, direct aspiration | ICP-OES | | | |
| xx090 | direct aspiration | ICP-MS | xx190 | direct aspiration | ICP-MS |
| xx091 | digest but not to dryness | ICP-SFMS | xx191 | digestion | ICP-SFMS |
| xx092 | closed vessel digestion at 60°C overnight with 2% HNO ₃ | ICP-MS | xx192 | closed vessel digestion at 60°C overnight with 2% HNO ₃ | ICP-MS |

Appendix 5. Reagent Nomenclature and Preparation

EDTA [ethylenediamine tetraacetic acid] (for analysis of hardness, magnesium; **Method Codes: 07551, 07601, 10603, 10607, 12003, 12101, 12103, 20101, 47101**)

Preparation of Standard 0.1M EDTA Solution: Dry about 4 g. of purified dihydrate $\text{Na}_2\text{H}_2\text{Y}\cdot 2\text{H}_2\text{O}$ (F.Wt. 372.24) at 80°C for 1 hour to remove superficial moisture. Cool to room temperature in a desiccator. Weigh (to the nearest milligram) about 3.8 g into a 1L volumetric flask. Use a powder funnel to ensure quantitative transfer, rinse the funnel well with water before removing it from the flask. Add 600 to 800mL of water and swirl periodically. Dissolution may take 15 minutes or longer. When the entire solid has dissolved, dilute to the mark with water and mix well. Note: in calculating molarity of the solution, correct the weight of the salt for the 0.3% moisture it ordinarily retains after drying at 80°C.

<http://www.sjsu.edu/faculty/chem55/app2edta.htm>

Hahn's Oxine reagent **Method Codes: 13003**

An alcoholic solution of 8-hydroxyquinoline used in the determination of zinc, aluminum, magnesium, and other minerals. <http://www.medilexicon.com/medicaldictionary.php?t=76302>

Dissolve 1.0 g of oxine (8-hydroxyquinoline) in 200 mL of methyl isobutyl ketone (MIBK).

LAS (Linear Alkylate Sulphonate) for analysis of anionic tensile surfactants, **Method Code: 10702**

Linear alkylbenzene sulfonate (LAS) is the world's largest-volume synthetic surfactant and is widely used in household detergents as well as in numerous industrial applications. It was developed as a biodegradable replacement for nonlinear (i.e., branched) alkylbenzene sulfonate (BAS) and has largely replaced BAS in household detergents throughout the world. <http://www.ihs.com/products/chemical/planning/ceh/linear-alkylate.aspx>

MBAS (Methylene Blue Active Substances) for analysis of surfactants anionic tensides **Method Codes: 10702**

Murexide (calcium hardness) **Method Code: 12101**

Dissolve 150 g of ammonium purpurate (murexide) into 100 g of ethylene glycol.

Murexide ($\text{NH}_4\text{C}_8\text{H}_4\text{N}_5\text{O}_6$, or $\text{C}_8\text{H}_5\text{N}_5\text{O}_6\cdot\text{NH}_3$), is used as a dye in tissue staining procedures, an indicator in complexometric titrations, and a metallochromic chelator of such free metal ions as calcium, zinc, and nickel.

<http://chemicaland21.com/specialtychem/nd/MUREXIDE.htm>

Nessler Reagent (ammonia)

Add 100g HgI_2 + 70g KI to water, then slowly add solution to a cooled solution of 160 g NaOH in 500 mL water. Dilute to one litre.

SPADNS **Method Codes: 09104**

Dissolve 958 mg SPADNS, sodium 2-(parasulphophenylazo)-1,8-dihydroxy-3,6-naphthalene disulphonate, also called 4,5-dihydroxy-3-(parasulphophenylazo)-2,7-naphthalenedisulphonic acid trisodium salt, in distilled water and dilute to 500 mL. This solution is stable indefinitely if protected from direct sunlight.

Spectroscopic Basis **Method Codes: 82106**

Mix 10 g graphite, 5 g K_2SO_4 , 0.071 g $\text{Ce}(\text{SO}_4)_2$, 0.072 g $\text{Sr}(\text{NO}_3)_2$ and 2-3 drops glycerine. Grind thoroughly in an agate mortar until a homogeneous mass is obtained. The mixture is then calcined for 30 minutes at 350°C.

Szechrome NAS Reagent (specific for nitrate or nitrite ions)

Mix equal volumes of analytical grade concentrated phosphoric acid (85-86%) and concentrated sulphuric acid (95-97%). Let stand one week in a closed flask to allow nitrate content to diminish. Dissolve 5g NAS in 1L of the $\text{HPO}_3/\text{H}_2\text{SO}_4$ acid. Shake until the reagent is solubilized. It is ready for use when the liberated gas is absorbed and the liquid clears.

TISAB (Total Ionic Strength Adjustment Buffer) for fluoride analysis by ISE in the presence of Ca, Mg, Cl, etc. **Method Codes: 09105, 09106**

To approximately 500 mL distilled water, add 57 mL glacial acetic acid (CH_3COOH), 58 g sodium chloride (NaCl), and 4.0 g 1,2-cyclohexylenediaminetetraacetic acid (CDTA). Stir to dissolve. Slowly add 5 M sodium hydroxide (NaOH) (about 125 mL) until the solution has a pH of 5.3 to 5.5. Dilute with distilled water to 1 litre in a volumetric flask.

<http://www.sigmaldrich.com/catalog/product/FLUKA/89465?lang=en®ion=CA>

Appendix 6. Indicators and their Preparation

4-aminoantipyrene [Method code 95014]

Dissolve 2.0 g of 4-aminoantipyrene (4-amino-1,5-dimethyl-2-phenyl-3H-pyrazole-3-one) in 100 mL water, as needed.

Calmagite [Method Code: 10603]

Used as an indicator in the titration of calcium or magnesium with EDTA.

<http://www.sigmaaldrich.com/catalog/product/aldrich/c204?lang=en®ion=CA>

CalVer II[®] (calcium analysis) [Method Code: 20101]

For determination of calcium hardness by EDTA titration methods. Active ingredient: Hydroxy Naphthol Blue.

<http://www.hach.com/calver-2-calcium-indicator-113-g/product?id=7640191003>

Curcumin [Method Codes: 05002, 05102]

Dissolve 40 mg of finely ground curcumin and 5.0 g of oxalic acid in 80 mL of 95% ethyl alcohol. Add 4.2 mL of concentrated HCl and make up to 100 mL with ethyl alcohol. This reagent is stable for several days if stored in a refrigerator. Curcumin reacts with boric acid forming a red coloured compound, known as rosocyanine.

http://www.sigmaaldrich.com/catalog/product/sigma/c7727?lang=en®ion=CA&cm_sp=Customer_Favorites--Detail_Page--Text-C7727

Diphenylcarbazone-acidifier (chloride analysis) [Method Code: 17201]

Dissolve 250 mg s-diphenylcarbazone, 4.0 mL concentrated nitric acid and 30 mg of xylene cyanol FF in 100 mL 95% ethyl alcohol or iso-propanol. Store in dark bottle and refrigerate.

N.B.: For highly alkaline or acid waters, adjust pH to 8 before adding the indicator.

Eriochrome Black T (calcium analysis) [Method Codes: 10603, 10607, 12003, 12101, 12103]

Sodium salt of 1-(1-hydroxy-2-naphthylazo)-5-nitro-2-naphthol-4-sulfonic. Dissolve 0.5 g dye in 100 g triethanolamine or ethylene glycol monomethyl ether. Add 2 drops per 50 mL solution to be titrated. Adjust volume if necessary. If the end point colour change of this indicator is not clear and sharp, it usually means that an appropriate complexing agent is required. If NaCN inhibitor does not sharpen the end point, the indicator probably is at fault. Stable for one year.

Eriochrome cyanine R dye [Method codes: 09031, 13031]

Dissolve 300 mg of the dye in 50 mL of distilled water, adjust pH to 2.9 with 50% acetic acid (approximately 2 mL is required) and dilute to 100 mL.

Ferroun / phenanthroline (aluminum analysis) [Method Code: 13001, 13101]

Phenanthroline {7-iodo-8-hydroxyquinoline-5-sulphonic acid, C₁₂H₈N₂} forms strong complexes with most metal ions. Ferroun complex [Fe(phen)₃]²⁺ is used for the photometric determination of Fe(II). It is used as a redox indicator with standard potential +1.06 V. The reduced ferrous form has a deep red colour and the oxidised form is light-blue.

Methylthymol Blue (sulphate analysis) [Method Code: 16306]

Dissolve 0.1286 g of methylthymol blue, 3'3''-Bis-({N,N-bis(carboxymethyl)-amino}-methyl) thymolsulphonephthalein trisodium salt in 25 mL of barium chloride (1.526 BaCl₂·2H₂O in 1L of distilled water) solution. Add 4.0 mL of 1 N HCl, 71 mL of distilled water, 0.5 mL Brij-35 solution and dilute to 500 mL with ethanol. Prepare fresh daily and store in a brown bottle.

Mixed indicator (chloride analysis) [Method code 17201]

Dissolve 5 g of diphenylcarbazone powder and 0.5 g bromphenol blue powder in 750 mL of 95% ethyl or isopropyl alcohol and dilute to 1L with the alcohol.

Murexide [Method code: 12101]

Dissolve 150 g of ammonium purpurate (murexide) into 100 g of ethylene glycol.

Potassium chromate (chloride analysis) [Method Code: 17204]

Dissolve 50 g of K_2CrO_4 in distilled water. Add silver nitrate solution until a red precipitate is formed. Let stand for 12 hours, filter and dilute to 1L with distilled water.

Potassium hexacyanoferrate (III) solution [Method code 95014]

Take one large crystal of potassium hexacyanoferrate (III), weigh 9 g, wash its surface with a little water, then dissolve in 100 mL of water. Filter if necessary and prepare fresh every week. Do not use if the colour has turned dark red.

Thorin (sulphate analysis) [Method Code: 16303]

Dissolve 0.2 g of thorin (2(2'-Hydroxy-3,6-disulpho-1-Naphthylazo) benzene arsonic Acid) in 100 mL of distilled water.

Appendix 7. Procedure for Requesting New Method Codes and for Submitting Data

Since 1978 the GEMS/Water Programme has been the primary source for water quality monitoring data worldwide. Its on-line database GEMStat (www.gemstat.org) houses nearly 4.6 million data representing surface and ground water quality data from a network of more than 4,000 stations. Countries and collaborating (non-governmental) agencies participate in GEMS/Water on a voluntary basis by providing data from existing national, regional or trans-boundary water quality monitoring programs and from international or university-based projects.

Each data point that is added to GEMStat must have an associated sampling date, sampling location (station) and an analytical method code. The GEMS/Water website provides links to guidance documents and forms that will assist data providers in submitting all required information to the Programme.

<http://www.unep.org/gemswater/GlobalNetwork/tabid/78238/Default.aspx>

The Excel file "**GEMS Op Guide Station Submission Form**" from the above link, is used to describe the location information required for each monitoring station registered in GEMStat. It is only necessary to submit this information once for each station. All subsequent data submissions will be linked to the relevant station information in GEMStat by means of the station number.

The Excel file "**GEMS Op Guide Data Submission Form**" contains general information about data formatting and a template for data submissions in electronic form. The *Parameter Classification* tab provides a list of all variables that are currently recorded in the GEMStat's Analytical Methods Dictionary (this document) and database. Another tab "*Request for New Parameter Code*" is used to document analytical methods that are not currently registered in GEMStat and request their inclusion. The information requested includes:

- Title of Method
- Method Description
- Units for data reporting
- Equipment
- Method detection limit
- Requesting Agency
- Literature Reference

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