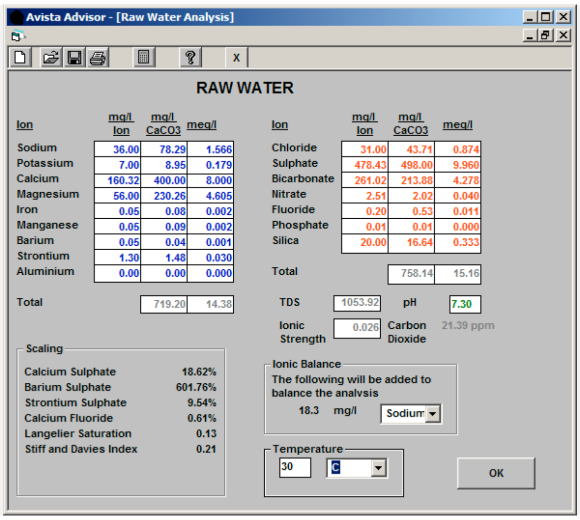
Water Sampling
For Antiscalant Projection

Introduction

This water sampling guide is provided to ensure that the best possible data is collected for antiscalant and membrane projection calculation purposes. This guide details the parameters to be measured for antiscalant projections and the level of accuracy required. In addition it gives generalised good practice procedures for sample collection.



RAW WATER

Ion	mg/l Ion	mg/l CaCO3	meq/l
Sodium	36.00	78.29	1.566
Potassium	7.00	8.95	0.179
Calcium	160.32	400.00	8.000
Magnesium	56.00	230.26	4.605
Iron	0.05	0.08	0.002
Manganese	0.05	0.09	0.002
Barium	0.05	0.04	0.001
Strontium	1.30	1.48	0.030
Aluminium	0.00	0.00	0.000
Total		719.20	14.38

Ion	mg/l Ion	mg/l CaCO3	meq/l
Chloride	31.00	43.71	0.874
Sulphate	478.43	498.00	9.960
Bicarbonate	261.02	213.88	4.278
Nitrate	2.51	2.02	0.040
Fluoride	0.20	0.53	0.011
Phosphate	0.01	0.01	0.000
Silica	20.00	16.64	0.333
Total		758.14	15.16

TDS 1053.92 pH 7.30

Ionic Strength 0.026 Carbon Dioxide 21.39 ppm

Scaling

Calcium Sulphate	18.62%
Barium Sulphate	601.76%
Strontium Sulphate	9.54%
Calcium Fluoride	0.61%
Langelier Saturation	0.13
Stiff and Davies Index	0.21

Ionic Balance

The following will be added to balance the analvsis

18.3 mg/l Sodium

Temperature

30 C

Figure 1: Raw Water analysis input screen from Avista Advisor, showing parameters which are to be entered.

Sampling Equipment

The following equipment is required for inorganic sampling:-

- 250ml or 1 litre new plastic bottle;
- preservation agent
- labels or tags
- sample seals if necessary;
- transporting container; and
- cooler or insulated box.
- pH meter
- Conductivity meter
- Thermometer
- Field log book

It is important that the correct sampling and analytical method is adopted for the water analysis results to best represent the nature of the water under examination. An incorrect water analysis result may lead to an inappropriate decision regarding any water treatment plant design. It should also be noted that degrees of error and accuracy are inherent in obtaining analysis results.

Sample Methods

Proper sampling and handling techniques and the use of a certified laboratory are required when determining water quality. Those responsible for collecting water samples must follow proper collection or record keeping methods or the sample results could be invalid. Sampling methods may vary for the different types of inorganic contsituents.

Taking Samples

Collection of inorganic samples is a relatively simple procedure. The equipment required is listed in the box above. Keep sample container closed until it is to be filled. Where appropriate open the test point and thoroughly flush the line for at least two to five minutes. Flushing for shorter periods may result in samples not representative of system water quality.

When ready to fill, remove the cap or stopper from the container. Do not contaminate the inner surface of the cap and neck of the bottle with your hands. Place the container directly below any sample point. Tilt the container so that the initial flow falls onto the interior side, preventing undue agitation of the sample and the release of dissolved gasses. (This is extremely important when measuring pH).

With the container in place at the sample point, gently increase flow to maintain a constant low-flo condition during sample collection. Adjust the flow of water so that water filling the container does not splash out any preservative. Fill the container to within 1 inch, (25mm), of the top or to the marked fill line. Replace cap immediately after the sample is taken.

To measure temperature and pH, fill the container to slightly overflowing. If using a hand held thermometer, insert it in the sample and record the reading when it stabilises. Remove the thermometer and immediately insert the pH electrode. If using a combined electrode, insert it into the sample container immediately after filling it and measure the sample temperature, change meter to read pH levels. Gently rotate the sample with the probe inside until the pH reading stabilises (this could take several minutes). When the reading is stable, record the measurement, rinse the electrode with de-ionised water, and return to its holding bottle. When the temperature and pH measurements are completed, seal the sample and place in a cool environment. Although small changes in the levels of conductivity, alkalinity, calcium, orthophosphate, and silica may occur between the time of sample collection and analysis in the lab, the error introduced by the delay should be negligible as long as sample procedures are followed.

When handling samples that have been exposed to waters that might contain waste water, it is always advisable to wear powderless plastic or rubber gloves.

Be sure to have a sample label for every container in order to prevent mistakes in identifying the sample.

Typical sample label information:

- sample number
- name of collector
- date and time of collection
- place of collection
- system name and identification
- -field data (temperature, pH, Conductivity, etc..)

All samples collected for a specific inorganic are designated a "sample set". When sampling for a specific inorganic, keep sample sets stored together in a protected area free from contamination.

Delivery to the Laboratory

Samples should be tightly sealed for transport. Mail or deliver the sample to the laboratory as soon as possible after collection. For inorganic chemicals the maximum elapsed time between collection and analysis may vary from a few hours to as much as 6 months, depending on the species and the preservation used. If delivery must be delayed, samples should be stored together at 4°C (38°F). Do not allow samples to become submerged in ice or melted ice water.

Sampling Summary

- Obtain correct equipment
- Complete sample labels and attach to sample bottles
- Open sample point and flush for 2-5 mins
- Fill container, without contaminating the inner surfaces
- Seal container to prevent tampering
- Store sample sets together under the proper temperature conditions
- Complete sample collection records
- Despatch to laboratory for analysis.

Labs must be approved and/or certified to perform analyses in compliance with

Regulations. Many participating labs have adopted uniform sampling procedures and have standardised analytical methodology, thus recognising the importance of proper sampling procedures, preservation of samples, and record keeping, as well as actual laboratory analysis.

Sample Analysis Requirements

The following components should be measured in feedwater to ensure a full assessment of the scaling and fouling potential can be made. The following table provides details of the minimum acceptable levels of measurement. If the requested measurement accuracy cannot be provided the level of antiscalant dose projected may be higher than required.

Depending on the source of the feedwater and the final use of the product water selected other parameters may be requested. For example: heavy metals or boron.

Parameters may be provided in any common Water Industry units but mg/l is preferred.

Parameter	Symbol	Measurement	Minimum Required Accuracy	Comment
Aluminum	Al	mg/litre	± 0.05	
Calcium	Ca	mg/litre	± 3	
Fluoride	F	mg/litre	± 0.1	
Magnesium	Mg	mg/litre	± 3	
Phosphate	PO_4	mg/litre	± 0.5	
Silica	SiO_2	mg/litre	± 1	Total silica should be measured
Strontium	Sr	Micro g/litre	± 50	
Barium	Ba	Micro g/litre	± 10	
Chloride	Cl	mg/litre	± 5	
Iron	Fe	Micro g/litre	± 50	Total iron and dissolved iron
Manganese	Mn	Micro g/litre	± 50	
Potassium	K	mg/litre	± 5	
Bicarbonate	HCO_3	mg/litre	± 3	
Sodium	Na	mg/litre	± 5	
Sulphate	SO_4	mg/litre	± 3	
Nitrate	NO_3	mg/litre	± 2	
Conductivity		Micro S/cm	± 10	Provided as a double check on analysis. TDS can be provided instead
pH			± 0.1	
Temperature		°C	± 1	Seasonal max/min

pH - The solubility of many salts can be related to a particular pH range.

Temperature - The solubility of many salts can be related to a particular temperature. Therefore the annual temperature range of the source water should be included.

Calcium, Magnesium, Strontium - These salts can be readily precipitated from water and high levels of hardness tend to promote the formation of scales.

Sodium, Potassium, Chloride – These salts are generally very soluble. Their concentration is required as they influence the ionic strength of the solution and hence the solubility of some scaling salts.

Barium - Barium is usually found at sub mg/l levels. Barium Sulphate however is very insoluble.

Iron, Manganese and Aluminium – Oxides of Iron or Manganese can cause membrane fouling. The solubility of Aluminium is pH critical. For all these foulants a knowledge of oxygen levels in the water and the pH are very informative.

Sulphate - Sulphates occur naturally in many waters and is considered one of the major anions. High Sulphate levels can cause localised corrosion of iron, steel and aluminium through the action of Sulphate Reducing Bacteria, (SRB).

Bicarbonate - Samples containing Bicarbonate alkalinity have a pH of 8.3 or less, usually less. In this case Bicarbonate alkalinity = total alkalinity. Carbon dioxide and the three forms of Alkalinity, Hydroxide, Carbonate, and Bicarbonate, are all part of one system that exists in equilibrium. A change in one component of the system will cause a shift in the equilibrium, altering the concentration of the respective ions and changing pH. The system stability is temperature dependant due to the Carbon Dioxide component. The equilibrium shift can produce Carbonate and/or Hydroxide scaling components.

Nitrate - Metal Nitrate salts are very soluble. Can be useful as an indicator of pollution.

Fluoride - Fluoride occurs naturally in some ground waters. It is often introduced into drinking water to improve dental care.

Phosphate - Phosphates are generally insoluble with the exceptions of Sodium, Potassium, and Ammonium. Phosphates are commonly added to waters to control corrosion and the formation of sediment deposits.

Silica - Silica is available in three forms in water, reactive, colloidal and suspended particles. The chemistry is further complicated by interaction with biological matter. Solubility is pH and Temperature dependant.

TDS - Total Dissolved Solids. Usually obtained by measuring Conductivity and applying a conversion factor. This method gives an approximation only with the applicable factor changing from site to site. TDS is the sum of all inorganic and organic material in a given volume of water. The lab method for TDS measurement is to heat a filtered water sample in a drying oven at 103°C until dry, then heat to 180°C to drive off water molecules trapped in crystallisation. The residue is then weighed. TDS will be measured as mg/l. Individual salt solubilities can be influenced by the overall TDS value.

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