

## METHOD STATEMENT

### Determinand:

Determination of Total and Dissolved (filtered) Aluminium, Manganese, Iron, Phosphorus, Boron, Calcium, Magnesium, Sulphate and Silica + Total Sodium and Total Potassium.

### Matrix:

Sample Types: Raw, Potable, Surface and Ground waters.

### Principle of Method:

This method uses the Perkin Elmer Optima 7300DV ICP-OES.

Samples are acidified and digested at elevated temperatures to ensure any particulate matter is brought into solution. The acidified samples are analysed on an ICP-OES instrument, where excitation of the sample within the 6,000°C plasma causes ionisation of atoms, which in turn causes the emission of electromagnetic radiation at specific wavelengths for each element. The intensity of the emission is measured and quantified by comparison against standards with known concentrations of elements. An internal standard solution is used to compensate the measurement for variances within the plasma on a sample-by-sample basis.

### Interferences:

Choice of analytical wavelength and placement of background correction points has been designed to eliminate possible interference from other elements within the sample.

This is further aided by the fact that the elements being measured are generally at significantly higher concentrations than any possible interfering species.

### Performance of the Method:

#### *Range of Application:*

Determinand	Calibration range
Fe	LOD - 5000 µg/l
Mn	LOD - 1000 µg/l
Al	LOD - 5000 µg/l
P	LOD - 5000 µg/l
B	LOD - 1000 µg/l
Ca	LOD - 250 mg/l
Mg	LOD - 50mg/l
Na	LOD - 200mg/l
K	LOD - 20 mg/l
SO <sub>4</sub>	LOD - 250 mg/l
Si	LOD - 20 mg/l

The analytical range may be extended by sample dilution. Samples with a concentration higher than that of the top standard should be diluted so that the final concentration of acid in the diluted solution should remain the same. This can be achieved by using the calibration blank solution or by using deionised (Milli-Q) water and concentrated nitric acid. The sample should then be reanalysed.

#### *Limit of Detection and Reporting limit*

Determinand	Units	Method LOD	Normal Reporting Limit
Al	µg/l	7.2160	7.22
Fe	µg/l	0.6984	0.70
Mn	µg/l	0.2184	0.22
P	µg/l	10.0562	10.1



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Determinand	Units	Method LOD	Normal Reporting Limit
Ca	mg/l	0.1519	0.16
Mg	mg/l	0.0369	0.04
Na	mg/l	0.7936	0.80
K	mg/l	0.1818	0.19
SO4	mg/l	0.3383	0.34
B	µg/l	2.6381	2.64
Si	mg/l	0.0153	0.02

## Recoveries of Compounds:

	Soft Water		Medium Water		Hard Water		Raw Surface	
	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD	% Rec	% RSD
Al	101.2	3.17	102.49	3.03	102.59	3.50	102.71	3.07
Fe	105.85	2.91	106.25	3.03	105.60	3.38	101.43	2.24
Mn	104.09	3.24	105.02	2.89	104.94	3.29	101.11	2.26
P	99.96	3.21	103.68	3.16	103.36	3.08	102.16	3.03
Ca	101.21	2.78	97.81	2.39	97.80	2.49	101.07	2.71
Mg	102.16	1.37	101.54	2.29	102.26	1.65	103.80	2.71
Na	101.62	2.26	100.71	1.94	101.27	2.16	101.74	2.19
K	105.05	0.79	105.68	2.60	103.53	1.29	104.69	1.63
SO4	101.60	1.47	99.38	1.78	98.82	1.62	101.34	1.60
B	104.46	1.77	103.65	2.47	103.69	2.24	100.72	2.21
Si	101.25	1.82	100.86	1.66	102.24	1.12	103.63	1.88

## References:

In house method based on SCA bluebook 163 Inductively Coupled Plasma Spectrometry 1 996 and DWI Guidance note Sample Preservation and Preparation for Metals Analysis of Drinking Water.

Perkin Elmer Optima 7100, 7200 and 7300 series Hardware Guide manual.

Water Quality-Sampling-Part 3: Guidance on the Preservation and Handling of Water Samples. BS EN ISO 5667-3-2003.

In-house Method WPC44- Metals Digestion Procedure

