Certificate of measurement

UKAS REFERENCE MATERIALS
4005

Hard Drinking Water – Anions

Certified Reference Material LGC6012

Certified Values

Constituent[1]	Number of laboratories	Units	Certified value[2]	Uncertainty[3]	Coverage factor, k[3]
Ammonium (NH_4)	17	mg/L	0.412	0.024	2.05
Chloride (Cl)	19	mg/L	246.5	5.8	2.04
Fluoride (F)	17	mg/L	1.36	0.11	2.07
Nitrate (NO_3)	18	mg/L	49.4	1.1	2.10
Sulfate (SO_4)	19	mg/L	246.9	8.8	2.05

Notes:

1. The constituents were certified using the results of an inter-laboratory comparison using different methods (see page 3). Robust estimates of location and dispersion were used as the values of the concentration determined by participant laboratories. Each data set was obtained in a different laboratory and/or using a different method of measurement.
2. The results are traceable to the SI through the physical and chemical standards used by the inter-laboratory study participant laboratories. The certified values are reported to the same number of decimal places as the uncertainties (which are reported to 2 significant figures).
3. The quoted uncertainty is the half-width of the expanded uncertainty interval, calculated using a coverage factor (k), which gives a level of confidence of approximately 95 %.

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Signed: _____
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for the Government Chemist

LGC

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Additional Information

The results of the inter-laboratory study provided a median pH of 8.0. The range of results reported was 7.4 to 8.2.

The results of the inter-laboratory study provided a median conductivity of 1580 µS/cm. The range of results reported was 1400 µS/cm to 1800 µS/cm.

The levels of calcium and magnesium were measured to calculate the hardness level of the material. The total hardness was calculated to be 265 mg/L expressed as $CaCO_3$, which equates to a hardness classification of 'Hard' [1].

The density of the material was measured in duplicate on three units, using an Anton Paar DMA 5000 five place density meter at (20.00 ± 0.01) °C. A mean value of 0.99814 g/cm^3 was obtained for the density.

The values quoted for pH, conductivity and density are not with LGC's scope of accreditation to ISO 17034.

Material Preparation

Hard drinking water was sourced from the Teddington (Greater London, UK) potable mains supply. The water was filtered through a set of 8 µm, 1.2 µm and 0.45 µm in-line filters and preserved with the addition of copper sulfate to a final concentration of 1 mg/L as copper.

High purity salt standards were used to spike the base material to reach the target levels, which reflect the regulatory limits in the European Drinking Water Directive [2] and the UK Water Supply (Water Quality) Regulations 2016 [3].

The material was bottled in 250 mL portions in tamper-evident screw cap amber glass bottles and stored at (5 ± 4) ºC.

Homogeneity Assessment

The homogeneity of the material was assessed for each of the parameters of interest. Analysis was carried out using methods accredited to ISO/IEC 17025.

The results showed the material was fit-for-purpose for a sample size of 5 mL for ammonium, chloride, nitrate and sulfate and for a sample size of 50 mL for fluoride.

Stability

The nature of the material is such that deterioration is not anticipated over its lifetime when stored under the recommended conditions. The material will be monitored at LGC, and customers will be notified of any changes in the certified values.

Certification

The material was certified using results from an inter-laboratory study organised by LGC.

Units of the candidate material were distributed to laboratories that had previously agreed to participate in an inter-laboratory study. Participant laboratories chose suitable methods with which they were familiar. The number of laboratories that used a particular method and submitted acceptable data is shown in Table 1.

The data from the inter-laboratory study were processed using a robust statistical approach after screening laboratories based on their performance in analysing a separate QC sample. The certified value for each constituent was assigned as the robust estimate of location of the accepted laboratory data. Uncertainties were based on the robust estimate of dispersion (taking into account the number of laboratories and corrected for the efficiency of the estimator) and combined with the uncertainties related to homogeneity and stability.

Table 1: Number of laboratories using each method.

	Constituent				
	Ammonium (NH_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Sulfate (SO_4)
Colorimetry	16	12	2	12	9
Ion Chromatography	1	6	9	6	6
Ion Selective Electrode	0	0	5	0	0
Titrimetry	0	1	1	0	0
Turbidimetry	0	0	0	0	1
ICP-MS	0	0	0	0	2
ICP-OES	0	0	0	0	1
Total	17	19	17	18	19

Participants

The following laboratories participated in the inter-laboratory study for this material:

Anglian Water Central Laboratory	UK
British Geological Survey	UK
Dwr Cymru Welsh Water	UK
Edinburgh Scientific Services (City of Edinburgh Council)	UK
Eurofins Chemtest	UK
Glasgow Scientific Services	UK
I2 Analytical Ltd	Poland
Instituto Nacional de Saúde Dr. Ricardo Jorge (INSA) - Lisbon	Portugal
Instituto Nacional de Saúde Dr. Ricardo Jorge (INSA) - Porto	Portugal
Intertek Caleb Brett	UK
Laboratorio Tecnológico del Uruguay	Uruguay
Northern Ireland Water	UK
Portsmouth Water	UK
Public Analysts Laboratory	Ireland
Severn Trent Water	UK
South East Water	UK
South West Water Ltd	UK
States Analysts' Laboratory - Guernsey	UK
Water Services Corporation Laboratory	Malta

Accreditation

Property values on this certificate are within LGC's scope of accreditation to ISO 17034 unless otherwise marked.

Intended Use

This reference material is primarily intended for use in the development, validation, or quality control of analytical methods for the determination of anions in hard drinking water. The material may also be applicable to other similar matrices where more closely matched reference materials are not available.

Instructions for Use

Before use, the material should be allowed to equilibrate to room temperature and thoroughly mixed by inversion. The recommended minimum amount of sample to be used is 5 mL for ammonium, chloride, nitrate and sulfate, and 50 mL for fluoride, based on the volume used for the homogeneity assessment.

After use, the bottle should be securely closed and returned to storage at (5 ± 4) °C. Any remaining sample should be used within one month from the date of opening, or discarded.

Storage

The material should be stored at (5 ± 4) °C in its original packaging.

Shelf Life

If stored unopened under the recommended conditions, the certified values will remain valid for 12 months from the date of shipment (see page 5 for shipment date).

Metrological Traceability

The results are considered traceable to the SI through the physical and chemical standards used by the participant laboratories.

References

[1] UK Drinking Water Inspectorate website: https://www.dwi.gov.uk/consumers/learn-more-about-your-water/water-hardness-hard-water/

[2] Drinking Water Directive. Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption.

[3] Statutory Instrument 2016 No. 614, Water, England and Wales, The Water Supply (Water Quality) Regulations 2016.

Unit Number	Date of Shipment

Legal Notice

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