

METHOD STATEMENT



Determinand:

Silver and Copper

Matrix:

Surface water, ground water, untreated sewage, treated sewage, trade effluent to sewer, trade to controlled water, Landfill leachate and process waters.

Principle of Method:

Metals are determined by ICP-OES after dissolution in the presence of nitric acid and hydrochloric acid. The pre-treatment ensures that any metals in suspended or colloidal forms are converted to soluble forms. An internal standard is used to compensate for interferences, such as those from matrices containing high levels of dissolved solids.

Sampling and Sample Preparation:

Samples are received in ALE204 bottles which contain a preservative to give 1% nitric acid when filled. The samples undergo a full bottle extraction before analysis.

Samples are stable for times stated below, (ISO 5667:2018) from sampling.

Ag	30 Days
Cu	180 Days

Interferences:

Spectral interference may occur from the presence of other elements. The spectral lines have been chosen so that overlap is minimal. Elements within standards have been chosen to minimise chemical interference. Internal standards are used to compensate for interference from plasma anomalies caused by high dissolved solids content.

Performance of Method:

Determinand	Range of application (mg/l)	LOD (mg/l)	Normal Reporting Level	
			(mg/l)	(µg/l)
Ag Silver	0.0013-0.500	0.001263	0.0013	1.3
Cu Copper	0.0021-10	0.002065	0.003	3

Determinand	Low Standard		High Standard	
	RSD %	Bias %	RSD %	Bias %
Silver	2.17	-0.58	1.56	-0.58
Copper	2.07	-0.87	1.73	-0.52

Determinand	Treated sewage		Untreated sewage		Trade to controlled		Trade to sewer	
	RSD %	REC %	RSD %	REC %	RSD %	REC %	RSD %	REC %
Silver	1.51	97.89	1.24	98.52	1.25	97.98	1.93	99.42
Copper	2.07	102.73	2.33	104.55	1.40	100.51	2.97	103.31

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Determinand	Clean process water		Dirty process water		Surface water		Ground water	
	RSD %	REC %	RSD %	REC %	RSD %	REC %	RSD %	REC %
Silver	2.07	96.57	3.22	97.36	2.55	98.07	2.23	97.95
Copper	1.72	101.21	2.62	103.07	2.02	100.88	1.89	100.96

Uncertainty of Measurement:

The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2, which gives a level of confidence of approximately 95%.

Determinand (Total)	Uncertainty of Measurement (%)
Silver	8.04
Copper	7.48

References:

Inductively Coupled Plasma Spectrometry 1996. HMSO, Methods for the Examination of Waters and Associated Materials ISBN 0117532444.

ISO 5667-3 2018 - Water quality Sampling Part 3: Preservation and handling of water samples.