METHOD STATEMENT

Determinand:
Metals:-
(Aluminium, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Manganese, Molybdenum, Nickel, Selenium, Strontium, Tellurium, Thallium, Tin, Titanium, Uranium, Vanadium, Zinc, Phosphorus).

Matrix:
Treated sewage, Untreated sewage, Trade effluents, Surface waters, Groundwaters, Land leachates and preparedl leachates

Principle of Method:
Metals are determined by ICP-MS after heated dissolution in the presence of nitric acid. The digestion pre-treatment ensures that any suspended or colloidal forms are converted to soluble forms. Filtered (otherwise known as dissolved or soluble) metals may also be determined, by filtration through a 0.45µm membrane filter prior to analysis.

Sampling and Sample Preparation:
Samples undergo a hot nitric acid digest in accordance with Method WAS 011. The prepared samples are stored until required for analysis.
Samples are stable for times stated below, (In-House Data) from sampling.

Al	14 Days (In-House Data)
As	29 Days (In-House Data)
Ba	9 Days (In-House Data)
Be	17 Days (In-House Data)
B	7 Days (In-House Data)
Cd	17 Days (In-House Data)
Cr	17 Days (In-House Data)
Co	17 Days (In-House Data)
Cu	14 Days (In-House Data)
Fe	17 Days (In-House Data)
Pb	16 Days (In-House Data)
Mn	17 Days (In-House Data)
Mo	15 Days (In-House Data)
Ni	17 Days (In-House Data)
P	17 Days (In-House Data)
Sb	29 Days (In-House Data)
Se	29 Days (In-House Data)
Sr	17 Days (In-House Data)
Te	11 Days (In-House Data)
Tl	17 Days (In-House Data)
Sn	7 Days (In-House Data)
Ti	14 Days (In-House Data)
U	29 Days (In-House Data)
V	17 Days (In-House Data)
Zn	17 Days (In-House Data)

Interferences:
The interferences for a number of elements are well documented and understood. Within the limitations of the method, these interferences are adequately compensated for by careful choice of elemental isotopes and by using interference equations. Appendix IV has details of the interference equations used.
Additional isotopes for Cu, Zn, Fe, Sn, Se, Mo and Te have been included in the method in order to investigate suspected interference on individual samples.

Performance of Method:
Total Metals

Perkin Elmer Elan DRC ICPMS

Determinand	MCERTS Accreditation	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Aluminium	✓	15 - 1000	14.68	15
Antimony	✓	1.2 - 20	0.3617	1.2
Arsenic	✓	1.0 - 500	0.9512	1.0
Barium		2.8 - 1000	1.0823	2.8
Beryllium		0.1 - 100	0.0934	0.1
Boron		19 - 1000	8.2749	19
Cadmium	✓	0.07 - 100	0.0632	0.07
Chromium	✓	0.8- 100	0.4361	0.8
Cobalt	✓	1.6 - 100	0.4797	1.6
Copper	✓	1.9 - 100	1.8830	1.9
Iron	✓	120 - 10000	115.6165	120
Lead	✓	0.5 - 100	0.3373	0.5
Manganese		5.6 - 1000	5.594	5.6
Molybdenum		2 - 100	1.9959	2
Nickel	✓	1.7 - 100	1.6837	1.7
Phosphorus		26 - 1000	18.2665	26
Selenium		0.8 - 150	0.7121	0.8
Strontium		20 - 1000	19.0494	20
Tellurium		0.38 - 20	0.1242	0.38
Thallium		0.8 - 100	0.7554	0.8
Tin	✓	3.2 - 100	3.1194	3.4
Titanium		2.6 - 100	0.5476	2.6
Uranium		0.31 - 30	0.3056	0.31
Vanadium		0.9 - 100	0.3056	0.9
Zinc	✓	14 -1000	13.0881	14

Determinand	Low standard			High standard		
Elan	Conc. µg/ l	RSD %	Bias %	Conc. µg/ l	RSD %	Bias %
Aluminium	200	4.89	+5.33	800	5.24	-0.86
Antimony	4	5.07	+1.58	16	3.68	-1.15
Arsenic	100	3.14	+0.10	400	1.98	+0.59
Barium	200	8.99	+7.71	800	2.45	+4.99
Beryllium	20	8.44	+0.95	80	8.95	-4.61
Boron	200	9.93	+1.84	800	9.04	-0.72

Determinand	Low standard			High standard		
Elan	Conc. µg/ l	RSD %	Bias %	Conc. µg/ l	RSD %	Bias %
Cadmium	20	3.01	-1.24	80	2.57	-3.32
Chromium	20	4.16	+4.89	80	2.56	+4.67
Cobalt	20	3.64	-3.77	80	2.69	-3.45
Copper	20	5.24	-1.50	80	3.45	-6.81
Iron	2000	2.98	-0.86	8000	3.70	-1.62
Lead	20	3.97	-0.32	80	2.09	-3.82
Manganese	200	2.60	-2.51	800	1.71	-0.60
Molybdenum	20	6.06	+3.86	80	4.29	2.39
Nickel	20	3.82	+1.12	80	5.53	-0.04
Phosphorus	200	6.12	+5.65	800	4.53	2.89
Selenium	30	3.35	+0.33	120	3.10	-0.66
Strontium	200	7.83	+0.54	800	4.43	-3.06
Tellurium	4	3.49	+0.99	16	3.06	-5.04
Thallium	20	2.68	-0.97	80	2.18	-2.92
Tin	20	4.41	+2.76	80	2.12	+6.92
Titanium	20	4.06	+6.08	80	4.38	+1.52
Uranium	20	2.81	-0.11	80	4.02	+1.47
Vanadium	20	3.76	+0.12	80	2.70	+2.23
Zinc	200	1.52	+3.69	800	1.57	+1.71

Determinand	Spike Level	Treated Sewage (Finham)		Trade effluent (Trimpley)		Trade effluent (Walkers)		Untreated sewage (Finham/Alfreton*)	
Elan		RSD %	Rec. %	RSD %	Rec. %	RSD %	Rec. %	RSD %.	Rec. %
Aluminium	20%	5.16	102.14	4.69	103.05	-	-	5.43	99.84
	80%	5.07	95.84	5.66	101.66	5.10	97.10	4.87	96.77
Antimony	20%	3.94	97.24	3.12	99.75	4.77	99.38	3.32	96.21
	80%	4.51	98.98	4.20	98.15	4.92	97.05	3.28*	96.40*
Arsenic	20%	2.57	104.27	1.94	100.86	-	-	2.12	102.33
	80%	2.35	103.34	2.25	101.40	3.88	113.07	2.19	102.92
Barium	80%	4.48	105.32	-	-	4.69	107.54	2.63	106.42
Beryllium	80%	7.82	93.00	-	-	8.36	96.15	9.42	93.49
Boron	80%	6.98	97.12	-	-	6.63	100.34	6.84	101.94
Cadmium	20%	2.35	97.15	2.17	98.41	3.29	98.25	2.62	98.71
	80%	4.07	94.03	2.58	97.56	2.88	93.60	2.06	95.28
Chromium	20%	3.18	105.35	2.99	104.84	4.52	106.37	3.13	106.57
	80%	2.97	106.14	3.37	106.78	4.42	106.47	2.96	105.89
Cobalt	20%	3.28	98.48	2.93	97.88	2.74	99.74	3.14	99.73
	80%	2.95	97.52	2.93	101.28	3.95	101.23	2.58	101.29
Copper	20%	4.93	95.10	3.63	91.75	-	-	3.47*	91.51*
	80%	2.32	90.38	2.65	93.18	3.94	88.49	2.20*	93.26*
Iron	20%	4.18	99.86	3.61	100.8	-	-	4.42	102.03
	80%	2.91	98.54	3.48	102.140	3.25	94.74	3.48	98.87
Lead	20%	2.36	97.03	2.59	96.81	2.04	93.57	1.94	98.03
	80%	1.76	95.46	2.73	97.99	3.82	92.25	2.49	95.84
Manganese	20%	2.50	93.48	2.35	96.30	3.81	103.49	2.77*	93.34*

Determinand	Spike Level	Treated Sewage (Finham)		Trade effluent (Trimpley)		Trade effluent (Walkers)		Untreated sewage (Finham/Alfreton*)	
Elan		RSD %	Rec. %	RSD %	Rec. %	RSD %	Rec. %	RSD %.	Rec. %
	80%	2.10	96.30	2.08	96.74	2.66	99.80	2.03*	95.61*
Molybdenum	80%	3.80	103.08	-	-	5.19	101.81	3.62	102.69
Nickel	20%	3.72	98.95	3.54	102.54	4.23	99.37	3.59	102.78
	80%	3.56	98.37	3.16	103.97	3.90	99.11	4.53	98.75
Phosphorus	20%	4.82	105.47	4.46	98.56	-	-	4.95	107.15
	80%	4.47	103.87	4.34	98.35	4.05	103.02	4.91	101.27
Selenium	80%	2.98	98.63	-	-	4.64	104.31	1.82*	96.16*
Strontium	80%	3.29	94.61	-	-	3.39	97.54	3.17	96.15
Tellurium	80%	2.44	91.34	-	-	3.04	93.94	2.99	90.81
Thallium	80%	1.66	96.61	-	-	3.66	94.28	2.48	96.94
Tin	20%	3.14	104.6	4.34	101.93	-	-	5.73	95.78
	80%	2.14	105.29	3.10	105.99	-	-	3.01	102.03
Titanium	80%	5.00	100.20	3.43	104.14	9.15	84.82	7.05	94.26
Uranium	80%	4.66	102.62	3.19	101.48	7.58	82.89	3.74	103.45
Vanadium	80%	3.18	105.66	-	-	3.93	107.64	2.93	105.66
Zinc	20%	2.61	95.57	3.57	98.84	-	-	2.74*	93.50*
	80%	1.78	95.13	1.97	97.47	-	-	2.40*	93.87*

Determinand	Groundwater		Landfill leachate		Prepared leachate		Surface water	
Elan	RSD %	Rec. %	RSD %	Rec. %	RSD %.	Rec. %	RSD %.	Rec. %
Aluminium	4.54	97.60	6.27	95.46	5.12	99.01	4.19	98.05
Antimony	3.82	97.99	3.71	98.42	3.20	98.04	4.58	97.80
Arsenic	1.39	101.40	2.73	104.19	2.46	102.00	3.51	102.88
Barium	3.15	104.99	2.54	105.65	2.39	105.94	4.36	105.86
Beryllium	4.90	97.02	6.83	93.19	8.73	93.24	9.28	91.72
Boron	5.28	99.71	7.34	97.50	9.12	97.84	6.16	96.98
Cadmium	2.01	96.45	2.88	92.33	2.03	97.56	2.56	95.65
Chromium	1.62	105.82	3.12	105.95	2.66	105.92	2.83	105.46
Cobalt	1.68	96.78	3.52	95.97	2.65	97.98	3.46	97.26
Copper	1.60	90.65	2.26	92.67	8.76	95.21	7.73	92.34
Iron	3.04	98.97	4.13	98.77	3.57	99.20	4.31	98.99
Lead	1.63	96.54	2.12	95.13	2.31	97.47	2.96	96.02
Manganese	2.60	98.66	3.45	100.11	4.06	99.18	3.22	99.91
Molybdenum	4.17	102.75	4.44	102.55	3.27	102.25	5.40	102.20
Nickel	2.53	99.08	3.75	95.06	5.50	100.84	3.38	99.38
Phosphorus	6.44	101.91	6.68	98.98	5.49	102.11	5.37	101.12
Selenium	2.84	99.44	3.61	104.18	2.67	99.76	3.36	98.65
Strontium	5.08	96.69	3.04	97.57	4.00	97.73	3.72	95.93
Tellurium	2.28	91.35	2.44	93.78	1.36	94.37	2.59	92.78
Thallium	1.87	98.02	2.18	97.44	7.57	96.81	2.51	97.48
Tin	2.57	105.98	1.87	103.42	1.83	106.31	2.16	105.56
Titanium	4.13	100.74	3.73	97.46	6.81	101.10	4.04	101.79
Uranium	2.75	102.67	3.40	103.77	7.76	100.57	4.67	102.20
Vanadium	1.72	104.29	3.75	105.58	7.87	102.47	3.49	103.79
Zinc	1.42	96.16	3.48	90.48	2.00	99.82	1.70	97.02

Uncertainty of Measurement
Total Metals

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

Perkin Elmer Elan DRC ICPMS

Determinand (total)	Uncertainty of Measurement (%)
Aluminium	11.16
Arsenic	7.16
Boron	19.73
Barium	14.95
Beryllium	22.76
Cadmium	10.46
Cobalt	9.08
Chromium	14.37
Copper	17.73
Iron	9.89
Manganese	11.35
Molybdenum	9.62
Nickel	11.48
Phosphorus	11.26
Lead	9.88
Antimony	11.57
Selenium	7.72
Tin	12.44
Strontium	11.21
Tellurium	16.29
Titanium	17.83
Thallium	9.07
Uranium	10.19
Vanadium	12.16
Zinc	11.18

Filtered Metals

Perkin Elmer Elan DRC ICPMS

Determinand	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Aluminium	15 - 1000	11.1462	15
Antimony	1.2 - 20	0.4522	1.2
Arsenic	1.0 - 500	0.9513	1.0
Barium	2.8 - 1000	0.6621	2.8
Beryllium	0.1 - 100	0.0762	0.1
Boron	19 - 1000	18.4982	19
Cadmium	0.07 - 100	0.0179	0.07
Chromium	4.7 - 100	0.7934	4.7
Cobalt	1.6 - 100	0.0579	1.6
Copper	1.9 - 100	1.8125	1.9

Determinand	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Iron	120 - 10000	51.5151	120
Lead	0.5 - 100	0.4687	0.5
Nickel	1.7 - 100	1.5312	1.7
Phosphorus	26 - 1000	10.3066	26
Selenium	0.8 - 150	0.4602	0.8
Tellurium	0.38 - 20	0.3738	0.38
Uranium	0.31 – 30	0.2005	0.31
Vanadium	0.9 - 100	0.6333	0.9
Zinc	14 - 100	5.5766	14

Determinand	Ground water			Land Leachate		
Elan	Conc. µg/l	RSD %	Rec. %	Conc. µg/l	RSD %	Rec. %
Aluminium	12.80	2.70	97.57	3.85	3.84	94.81
Antimony	0.32	4.14	102.77	0.72	3.55	102.47
Arsenic	9.01	2.38	101.91	1.33	2.82	104.34
Barium	60.0	3.54	101.25	5.76	2.84	104.18
Beryllium	0.01	3.52	106.22	0.01	4.11	106.74
Boron	86.2	2.52	101.34	929	3.83	102.65
Cadmium	0.01	1.92	98.88	0.01	2.54	98.00
Chromium	0.26	2.42	103.24	0.72	2.70	101.7
Cobalt	0.07	2.44	99.79	2.86	3.27	98.77
Copper	1.04	2.26	93.22	7.87	3.13	90.23
Iron	25.5	2.50	100.18	509	3.22	98.76
Lead	<0.5	3.05	97.32	<0.5	2.45	96.73
Nickel	0.20	2.52	97.38	4.27	2.81	95.56
Phosphorus	0.65	2.08	101.01	<19	3.09	101.20
Selenium	0.33	2.47	100.87	3.14	3.04	106.39
Tellurium	0.12	2.27	96.45	0.13	2.97	101.33
Uranium	1.04	3.58	103.71	5.63	5.13	107.15
Vanadium	1.53	2.41	98.30	<0.9	2.99	98.65
Zinc	6.20	2.28	96.05	4.15	2.78	90.22

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	Uncertainty of Measurement (%)	
	Total Metals	Filtered Metals
Aluminium	11.16	11.22
Arsenic	7.16	8.17
Boron	19.73	9.44
Barium	14.95	8.25
Beryllium	22.76	15.41
Cadmium	10.46	5.29

Determinand	Uncertainty of Measurement (%)	
	Total Metals	Filtered Metals
Cobalt	9.08	5.62
Chromium	14.37	7.44
Copper	17.73	17.89
Iron	9.89	6.07
Manganese	11.35	-
Molybdenum	9.62	-
Nickel	11.48	9.00
Phosphorus	11.26	5.26
Lead	9.88	8.06
Antimony	11.57	8.10
Selenium	7.72	10.43
Tin	12.44	-
Strontium	11.21	-
Tellurium	16.29	-
Titanium	17.83	-
Thallium	9.07	7.21
Uranium	10.19	13.90
Vanadium	12.16	6.32
Zinc	11.18	16.08

Total Metals

Perkin Elmer NexION 300D ICP-MS

Determinand	MCERTS Accreditation	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Aluminium	Y	15 - 1000	14.5311	15
Antimony	Y	0.5 - 20	0.4370	1.2
Arsenic	Y	1.0 - 500	0.2955	1.0
Barium		2.8 - 1000	0.3504	2.8
Beryllium		0.1 - 100	0.0652	0.1
Boron		19 - 1000	5.3353	19
Cadmium	Y	0.07 - 100	0.0198	0.07
Chromium	Y	0.8- 100	0.1378	0.8
Cobalt	Y	1.6 - 100	0.1205	1.6
Copper	Y	1.9 - 100	1.2159	1.9
Iron	Y	120 - 10000	45.8063	120
Lead	Y	0.5 - 100	0.1208	0.5
Lithium		0.2 - 100	0.1029	0.2
Manganese		5.6 - 1000	0.3244	5.6
Molybdenum		2 - 100	0.3803	2
Nickel		1.7 - 100	0.6512	1.7
Phosphorus	Y	26 - 1000	21.9145	26
Selenium		0.8 - 150	0.4492	0.8
Strontium		20 - 1000	0.3454	20
Tellurium		0.38 - 20	0.0305	0.38

Determinand	MCERTS Accreditation	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Thallium		0.8 - 100	0.0513	0.8
Titanium		2.6 - 100	0.2013	2.6
Uranium		0.31 - 30	0.0388	0.31
Vanadium		0.9 - 100	0.1435	0.9
Zinc	Y	14 -1000	2.7773	14

Determinand	Low standard			High standard		
NexION	Conc. µg/ l	RSD %	Bias %	Conc. µg/ l	RSD %	Bias %
Aluminium	200	3.54	6.09	800	2.13	4.91
Antimony	4	7.37	5.93	16	5.64	-7.09
Arsenic	100	3.57	4.66	400	2.84	4.49
Barium	200	8.08	9.79	800	7.37	5.63
Beryllium	20	9.13	0.47	80	9.17	-0.82
Boron	200	6.00	5.03	800	5.51	6.15
Cadmium	20	3.87	3.85	80	2.83	4.09
Chromium	20	4.37	4.50	80	3.58	3.80
Cobalt	20	4.64	6.05	80	3.92	5.38
Copper	20	3.66	-0.04	80	2.86	0.19
Iron	2000	4.77	6.30	8000	3.57	5.72
Lead	20	4.10	9.43	80	2.84	5.29
Lithium	20	9.49	4.02	80	9.54	0.60
Manganese	200	9.37	-3.53	800	8.24	-3.94
Molybdenum	20	3.90	4.38	80	5.37	3.15
Nickel	20	9.14	-2.07	80	7.81	-1.88
Phosphorus	200	4.3	6.02	800	2.36	5.04
Selenium	30	6.70	1.32	120	5.67	0.47
Strontium	200	7.18	6.60	800	7.47	4.45
Tellurium	4	6.28	4.83	16	7.99	-3.04
Thallium	20	6.27	-2.35	80	5.95	8.79
Titanium	20	9.29	-0.18	80	9.64	-3.22
Uranium	20	6.57	9.78	80	5.24	1.61
Vanadium	20	9.09	-3.08	80	8.68	-3.36
Zinc	200	3.52	7.22	800	2.93	7.38

Determinand	Spike Level	Treated sewage (Finham)		Trade effluent (to controlled waters) (Trimpley)		Trade effluent (to sewer) (Walkers)		Untreated sewage (Finham)	
NexION		RSD %	Rec. %	RSD %	Rec. %	RSD %	Rec. %	RSD %.	Rec. %
Aluminium	80%	3.71	101.21	3.94	106.19	4.16	107.00	3.71	101.21
Antimony	80%	3.55	109.73	3.34	111.12	5.02	103.40	7.45	99.80
Arsenic	80%	3.09	109.26	2.59	109.68	4.34	108.29	3.09	109.26
Barium	80%	5.97	104.16	6.35	106.32	8.29	103.36	7.34	109.76
Beryllium	80%	9.98	100.93	9.10	98.96	9.23	102.31	9.40	101.94
Boron	80%	5.97	107.96	6.21	109.16	6.24	109.30	5.72	104.94
Cadmium	80%	3.38	103.60	3.01	106.47	4.61	103.48	3.18	103.69
Chromium	80%	3.67	105.48	4.16	105.84	4.76	105.23	4.34	105.89

Determinand	Spike Level	Treated sewage (Finham)		Trade effluent (to controlled waters) (Trimpley)		Trade effluent (to sewer) (Walkers)		Untreated sewage (Finham)	
Cobalt	80%	3.66	104.97	4.39	106.64	4.41	104.66	4.70	105.68
Copper	80%	3.43	92.90	4.13	97.27	3.98	94.46	3.72	95.73
Iron	80%	3.27	106.73	3.79	105.58	4.88	100.94	3.93	102.09
Lead	80%	3.45	99.18	3.38	104.87	4.98	95.83	3.44	98.48
Lithium	80%	8.97	98.05	9.09	99.45	6.87	94.47	8.03	99.02
Manganese	80%	9.74	97.12	9.96	97.22	7.29	99.58	7.36	97.96
Molybdenum	80%	3.89	111.66	3.78	106.48	5.46	102.56	5.84	106.94
Nickel	80%	7.56	96.64	8.81	94.06	7.74	96.96	6.12	96.64
Phosphorus	80%	4.03	109.44	3.58	109.84	3.83	103.10	2.59	103.37
Selenium	80%	6.78	101.93	6.39	99.71	7.60	107.43	4.29	102.65
Strontium	80%	9.20	104.57	9.09	105.34	6.31	109.51	6.98	108.09
Tellurium	80%	7.74	90.64	7.26	94.24	6.76	90.99	7.25	95.78
Thallium	80%	8.01	99.81	8.61	107.32	5.03	98.97	9.69	98.73
Titanium	80%	9.33	103.61	9.44	96.92	6.81	103.34	9.15	96.79
Uranium	80%	7.04	106.41	5.99	106.54	5.53	94.63	7.50	101.07
Vanadium	80%	9.20	104.36	9.70	98.23	6.97	106.43	7.78	103.47
Zinc	80%	3.49	102.93	3.25	107.90	3.54	104.63	3.49	101.91

Determinand	Ground water		Land leachate		Prepared leachate		Surface water	
NexION	RSD %	Rec. %	RSD %	Rec. %	RSD %.	Rec. %	RSD %.	Rec. %
Aluminium	7.60	102.24	8.83	93.86	9.02	98.48	9.73	101.83
Antimony	7.07	92.64	5.18	98.99	6.32	97.66	5.63	95.38
Arsenic	8.35	96.58	8.07	101.04	8.43	98.33	8.69	100.63
Barium	5.25	104.69	5.97	100.81	6.88	107.32	6.32	105.21
Beryllium	8.90	99.12	9.67	102.58	7.72	99.59	9.22	101.38
Boron	6.52	104.36	5.19	108.88	6.63	105.58	5.55	107.36
Cadmium	4.25	100.56	4.40	99.53	3.94	101.00	4.33	99.98
Chromium	6.65	99.04	8.60	100.04	7.61	99.74	9.36	99.11
Cobalt	5.97	96.44	7.63	96.79	6.87	98.56	7.94	96.42
Copper	5.99	91.35	7.70	96.22	6.07	90.79	6.24	94.37
Iron	8.19	99.37	7.65	97.15	6.98	98.06	7.84	97.06
Lead	4.98	98.64	4.49	91.94	5.80	101.85	5.56	93.11
Lithium	7.77	97.83	8.58	100.69	7.93	98.91	6.97	98.61
Manganese	7.44	96.71	9.87	93.89	7.79	97.52	9.69	95.82
Molybdenum	4.97	95.30	4.40	107.63	4.35	105.78	4.27	108.28
Nickel	5.83	94.37	8.07	94.18	6.98	98.08	8.63	94.06
Phosphorus	4.52	106.44	4.07	109.43	4.19	105.76	3.64	110.58
Selenium	5.73	95.24	6.35	101.06	5.29	101.47	105.46	102.67
Strontium	6.25	103.94	8.19	100.78	6.13	107.12	9.11	103.99
Tellurium	8.46	90.68	9.14	90.64	8.50	94.63	9.75	90.99
Thallium	5.94	106.20	8.16	99.35	4.09	109.11	9.67	101.38
Titanium	8.86	98.40	9.26	101.28	8.43	99.48	9.72	99.33
Uranium	5.18	104.51	5.27	102.07	5.72	104.30	6.09	103.43
Vanadium	6.78	99.58	8.78	103.29	7.44	98.67	9.18	100.55
Zinc	5.59	98.28	8.38	94.90	7.42	100.99	8.01	95.56

Uncertainty of Measurement

Perkin Elmer NexION 300D ICP-MS

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 (%)
Aluminium	15.88
Arsenic	19.59
Boron	17.40
Barium	20.69
Beryllium	21.96
Boron	17.59
Cadmium	11.05
Cobalt	13.17
Chromium	13.79
Copper	13.46
Iron	12.49
Manganese	22.11
Molybdenum	20.83
Nickel	19.21
Phosphorus	18.32
Lead	11.63
Lithium	18.37
Antimony	18.43
Selenium	16.69
Strontium	21.27
Tellurium	13.40
Titanium	22.87
Thallium	19.09
Uranium	16.33
Vanadium	21.11
Zinc	12.41

Determinand	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Aluminium	15 - 1000	6.2427	15
Antimony	1.2 - 20	0.1588	1.2
Arsenic	1.0 - 500	0.1531	1.0
Barium	2.8 - 1000	0.1187	2.8
Beryllium	0.1 - 100	0.0225	0.1
Boron	19 - 1000	2.5740	19
Cadmium	0.07 - 100	0.0094	0.07
Chromium	0.8 - 100	0.0326	0.8
Cobalt	1.6 - 100	0.0239	1.6
Copper	1.9 - 100	0.5029	1.9
Iron	120 - 10000	21.7249	120
Lead	0.5 - 100	0.0366	0.5
Nickel	1.7 - 100	0.1386	1.7
Lithium	0.2 -100	0.0275	0.2

Determinand	Range of Application (µg/ l)	LOD (µg/ l)	Routine Reporting Level (µg/ l)
Phosphorus	26 – 1000	23.2069	26
Selenium	0.8 - 150	0.0773	0.8
Tellurium	0.38 - 20	0.0438	0.38
Uranium	0.31 – 30	0.0792	0.31
Vanadium	0.9 - 100	0.0200	0.9
Zinc	14 - 1000	1.6319	14

Filtered Metals

Determinand	Ground water		Land leachate	
Elan	RSD %	Rec. %	RSD %	Rec. %
Aluminium	5.14	97.43	5.69	93.74
Antimony	2.8	99.61	1.90	103.01
Arsenic	3.37	97.71	4.91	98.95
Barium	3.47	99.97	2.58	101.44
Beryllium	4.84	99.61	4.61	99.33
Boron	5.15	100.37	4.78	100.56
Cadmium	2.09	100.18	1.59	101.68
Chromium	4.15	96.55	3.24	96.29
Cobalt	3.73	94.02	3.72	96.03
Copper	3.18	98.84	4.05	103.58
Iron	6.22	96.64	3.26	95.90
Lead	2.52	102.28	2.07	103.69
Lithium	4.84	97.43	4.62	97.70
Nickel	3.53	92.30	3.60	95.23
Phosphorus	4.22	101.02	4.50	100.48
Selenium	2.87	97.67	2.76	101.44
Tellurium	2.60	90.30	2.10	97.31
Uranium	2.92	104.52	2.81	103.57
Vanadium	4.03	99.48	2.87	99.24
Zinc	7.04	103.02	7.26	107.19

Uncertainty of Measurement

Determinand (Filtered)	Uncertainty of Measurement (%)
Aluminium	18.09
Arsenic	10.66
Boron	15.85
Barium	9.29
Beryllium	14.31
Cadmium	6.81
Cobalt	16.14
Chromium	11.83
Copper	12.35
Iron	13.47
Nickel	20.18
Phosphorus	18.86
Lead	9.48

Determinand (Filtered)	Uncertainty of Measurement (%)
Lithium	14.10
Antimony	6.82
Selenium	10.47
Tellurium	17.01
Uranium	11.72
Vanadium	10.14
Zinc	21.58

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