Amy Selvaraj (DELWP)

From: Andrew Helps [redacted]
Sent: Monday, 8 March 2021 12:10 PM
To: Amy Selvaraj (DELWP)
Subject: Fingerboards Human Health Risk Assessment Table 9.7 Page 82 - the need for a standardised toxicity standard
Attachments: HHRA Page 82.pdf; 22941-R01 Rev 1.pdf; ATSDR SPL data for KALBAR Relevent Metals.pdf

[redacted] [redacted]

EXTERNAL SENDER: Links and attachments may be unsafe.

Amy,

I have grave concerns with this document, it is deceptive and misleading.

I had a quick look at this document late last week and the cerebral alarm bells started to go off when I got to page 82 and looked at Table 9.7.

Table 9.7 claims to provide technical guidance on overburden leachate concentrations if and when the KALBAR mine starts operating.
This table is on page 82 of the so called Human Health Risk Assessment.

It would appear that the Consultants at Coffey do not understand that there is a few more than 14 metals in the KALBAR waste water.
Our testing produced data on 40 metals in the water for the same cost.

Clearly Coffee would have this data so why not publish it?

It is of great concern to me that the lab report that Coffey get from the lab is at ug/L level and then somebody then manually converts and retypes these results to mg/L to make the figures look smaller.

What concerned me was the comments below the table 9.7 that infer that this leachate water is basically safe to drink (by whom lower forms of algae?).

I suppose it will be some comfort to the local farmers that the mine water will quickly eliminate rabbits, Kangaroos, Wombats and mosquito's in the area.

Also of concern is that they have done the testing in mg/L when all the ICP-MS machines actually live and work in micrograms (ug/L).

So somebody in Coffey sits down and takes the Envirolab report and converts it by hand to mg/L!
Can you formally ask KALBAR to produce the original Envirolab report that underpins Table 9.7.

I am suggesting that you obtain this report as part of your Departments normal due diligence actions and then on-send it to me.

So Coffey publish a report with 14 metals in the water – this makes the assessment a lot easier and the resultant tables much smaller and client friendly.

Coffey seem to have some form of view that God made all these toxic elements to only be toxic to three decimal points at Mg/L level!
Even the poorer countries in Asia assess these risk according to the Hazard Index (Hi) where the default index is Zero and testing is at ug/L.

You calculate the index by Quantity of the Chemical/metal by the Theoretical daily dose (TDD) for a fit health 70kg male.
The TDD date is available from the American ATSDR and is regarded as best practice by almost every develop country except Australia.
The ATSDR TDD data for KALBAR Relevant metals is attached.

So our recent Water Analysis at Lindenow had one sample with total Chromium in the water at 48 ug/L
So you divide 48/0.20702 and you get a Hazard Index of 231 – a safe level would be 1.

Why is it the KALBAR Consultants Coffey have not put Hazard Index numbers in Table 9.7?
I think that you can figure that out without much effort.

Could you, as a matter of urgency, formally ask KALBAR to produce a version of table 9.7 that contains the full spectrum of 40 metals.

The Radionuclides (RADNUCS) section which starts on page 82 is at best deceptive and misleading and KALBAR need to get professional help to produce a document that articulates the true situation with RADNUCS.
I have run a couple of major radionuclide pollution incidents for Global NGO's over the last 40 years (I led the team that went into Chernobyl near Kiev in the USSR).

It is my professional opinion that the KALBAR reports on this subject are very poor.
This is a pity because the US EPA publishes a Rare Earth Element Review (EPA-600/R 572 dated December 2012) that could provide some good guidance.

I am advised by the Health Department that the public examination of the EES could be now be held in a public forum situation as has always happened in the past.

I would respectfully suggest that examination of KALBAR and their consultants in technical areas that could impact the Lindenow community should now be held in the Hall at Lindenow.
I look forward to receipt of an email with tentative dates for public examination of KALBARS witnesses at Lindenow Public Hall from IAC.

I look forward to your prompt response.

Kindest Regards

Andrew Helps
[redacted]
[redacted]
Mobile [redacted]
UNEP Global Mercury Partnership
Waste Management Partnership - designated expert
Mercury added products and alternatives – designated expert
Mercury Fate and Transport Group

Metals

Leachability results for fine tailings material was reported by EGi (2020) and have been adopted as the anticipated quality of fine tailings water. Fine tailings leachate water quality did not exceed drinking water health criteria. Leachable concentrations of aluminium (0.07 mg/L[1]) and iron (0.09 mg/L[1]), whilst not considered to pose a potential health risk, may create aesthetic issues (such as taste or colour) if present in drinking water.

The COPC measured in leachate are compared with Tier 1 screening criteria in Table 9.7.

Table 9.7 Tailings, heavy mineral concentrate and overburden leachate concentrations [mg/L]

Metal	Tier 1 screening criteria	Leachate concentration [mg/L]							
		Fine tailings		Sand tailings		Heavy mineral concentrate		Overburden gravelly clay	Overburden sandy clay
		Oct 2018	Nov 2018	Oct 2018	Nov 2018	Oct 2018	Nov 2018	Oct 2018	
Antimony	0.003	-	<0.001	-	<0.001	-	<0.001	-	-
Arsenic	0.01	0.007	0.009	0.002	0.005	0.003	0.004	0.006	0.003
Barium	2	-	0.005	-	0.003	-	0.003	-	-
Boron	4	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cadmium	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001
Chromium VI	0.05 (1)	-	<0.005	-	<0.005	-	0.034	-	-
Copper	2	0.001	0.002	<0.001	<0.001	<0.001	0.002	0.007	0.004
Lead	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.008	0.004
Manganese	0.5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.029	<0.005
Mercury	0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum	0.05	0.002	0.003	<0.001	<0.001	0.001	0.001	0.001	<0.001
Nickel	0.02	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.016	0.004
Selenium	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	3	0.001	0.002	<0.001	0.003	<0.001	0.002	0.029	0.015

[1] Based on hexavalent chromium.

Predicted concentrations of dissolved metals, based on measured concentrations in leachate associated with fine tailings, sand tailings, heavy mineral concentrate and overburden soils are all below the Tier 1 screening criteria for drinking water and recreational water. On this basis, leachate water is not considered to represent a risk to potable water supply via a groundwater infiltration pathway.

In addition to the potential release of metal contaminants, ore processing uses minimal amounts of additives (primarily flocculants). Seepage water quality is unlikely to be significantly different from natural groundwater recharge that would infiltrate through the unmined ore.

Radionuclides

The potential for significant migration of radionuclides from the rehabilitated tailings site into a groundwater aquifer that might be used for drinking, for stock use, or crop irrigation was evaluated qualitatively by SGS (2020). The potential for long-term impact on radioactivity levels in groundwater arising from mining, mineral processing and the disposal of tailings and other waste was found to be unlikely to change significantly from current conditions. The following assumptions were made in the assessment:

- Groundwater monitoring wells installed within the project area provided a very low yield and the minimal groundwater able to be extracted would not be sufficient for agriculture or any other use.

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CERTIFICATE OF ANALYSIS 22941

Client Details

Client	Andrew Helps
Attention	Andrew Helps
Address	VIC

Sample Details

Your Reference	**F01-11 Lindenow**
Number of Samples	2 Water, 3 Sand, 1 Sludge
Date samples received	14/10/2020
Date completed instructions received	14/10/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	16/10/2020
Date of Issue	20/10/2020
Reissue Details	This report supersedes 22941_R00 due to addition of Sulphur on all samples.

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Results Approved By
Chris De Luca, Operations Manager

Authorised By

Pamela Adams, Laboratory Manager

Acid Extractable metals in soil					
Our Reference		22941-2	22941-3	22941-5	22941-6
Your Reference	UNITS	L-26	L-27	L-29	L-30
Date Sampled		13/10/2020	13/10/2020	13/10/2020	13/10/2020
Type of sample		Sand	Sand	Sludge	Sand
Date digested	-	14/10/2020	14/10/2020	14/10/2020	14/10/2020
Date analysed	-	15/10/2020	15/10/2020	15/10/2020	15/10/2020
Silver	mg/kg	<1	<1	<1	<1
Aluminium	mg/kg	13,000	4,700	28,000	14,000
Antimony	mg/kg	<7	<7	<7	<7
Arsenic	mg/kg	5	<4	8	4
Boron	mg/kg	<3	<3	15	<3
Barium	mg/kg	18	15	58	22
Beryllium	mg/kg	<1	<1	<1	<1
Bismuth	mg/kg	<1	<1	<1	<1
Cadmium	mg/kg	<0.4	<0.4	<0.8	<0.4
Cobalt	mg/kg	2	1	8	3
Chromium	mg/kg	19	8	34	20
Copper	mg/kg	<1	<1	570	<1
Caesium*	mg/kg	<1	<1	<1	<1
Gallium	mg/kg	4	2	13	6
Gold*	mg/kg	<1	<1	<1	<1
Iron	mg/kg	30,000	12,000	37,000	26,000
Lanthanum*	mg/kg	16	9	27	15
Lead	mg/kg	10	4	29	11
Lithium	mg/kg	4	1	11	5
Manganese	mg/kg	33	10	190	31
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Molybdenum	mg/kg	<1	<1	<1	<1
Nickel	mg/kg	4	1	15	4
Selenium	mg/kg	<2	<2	<2	<2
Strontium	mg/kg	5	2	31	4
Sulphur	mg/kg	150	31	5,700	160
Tellurium	mg/kg	<1	<1	<1	<1
Thallium	mg/kg	<2	<2	<2	<2
Tin	mg/kg	<1	<1	2	<1
Titanium	mg/kg	7	9	61	6
Thorium	mg/kg	6	3	5	6
Uranium	mg/kg	<1	<1	2	1
Vanadium	mg/kg	50	28	62	54
Yttrium*	mg/kg	7.6	4.8	15	7.8

Acid Extractable metals in soil					
Our Reference		22941-2	22941-3	22941-5	22941-6
Your Reference	UNITS	L-26	L-27	L-29	L-30
Date Sampled		13/10/2020	13/10/2020	13/10/2020	13/10/2020
Type of sample		Sand	Sand	Sludge	Sand
Zinc	mg/kg	4	1	280	3

Moisture					
Our Reference		22941-2	22941-3	22941-5	22941-6
Your Reference	UNITS	L-26	L-27	L-29	L-30
Date Sampled		13/10/2020	13/10/2020	13/10/2020	13/10/2020
Type of sample		Sand	Sand	Sludge	Sand
Date prepared	-	14/10/2020	14/10/2020	14/10/2020	14/10/2020
Date analysed	-	15/10/2020	15/10/2020	15/10/2020	15/10/2020
Moisture	%	2.9	14	88	7.3

All metals in water - total			
Our Reference		22941-1	22941-4
Your Reference	UNITS	L-25	L-28
Date Sampled		13/10/2020	13/10/2020
Type of sample		Water	Water
Date prepared	-	14/10/2020	14/10/2020
Date analysed	-	14/10/2020	14/10/2020
Silver-Total	µg/L	<1	<1
Aluminium-Total	µg/L	12,000	43,000
Arsenic-Total	µg/L	3	4
Boron-Total	µg/L	30	60
Barium-Total	µg/L	37	150
Beryllium-Total	µg/L	<0.5	3
Bismuth-Total	µg/L	<1	<1
Cadmium-Total	µg/L	<0.2	<0.2
Cerium-Total*	µg/L	14	66
Cobalt-Total	µg/L	1	6
Chromium-Total	µg/L	11	48
Copper-Total	µg/L	<2	5
Caesium-Total*	µg/L	<1	2
Gallium-Total	µg/L	3	15
Mercury-Total	µg/L	<0.05	<0.05
Iron-Total	µg/L	8,100	30,000
Lanthanum-Total	µg/L	9	43
Lithium-Total	µg/L	3	15
Manganese-Total	µg/L	120	93
Molybdenum-Total	µg/L	<1	<1
Niobium-Total*	µg/L	2.7	2.4
Nickel-Total	µg/L	4	12
Lead-Total	µg/L	6	30
Rubidium-Total*	µg/L	8	31
Rhenium-Total*	µg/L	<1	<1
Antimony-Total	µg/L	<1	<1
Scandium-Total*	µg/L	<1	8
Selenium-Total	µg/L	<1	2
Tin-Total	µg/L	2	<1
Strontium-Total	µg/L	28	69
Tantalum-Total*	µg/L	<1	<1
Tellurium-Total*	µg/L	<0.5	<0.5
Thorium-Total	µg/L	1	5.0
Thallium-Total	µg/L	<1	<1

All metals in water - total			
Our Reference		22941-1	22941-4
Your Reference	UNITS	L-25	L-28
Date Sampled		13/10/2020	13/10/2020
Type of sample		Water	Water
Titanium-Total	µg/L	110	76
Uranium-Total	µg/L	0.6	3.5
Vanadium-Total	µg/L	13	53
Tungsten-Total	µg/L	<1	<1
Yttrium-Total*	µg/L	6.7	33
Zinc-Total	µg/L	9	25

Metals in Waters - Total			
Our Reference		22941-1	22941-4
Your Reference	UNITS	L-25	L-28
Date Sampled		13/10/2020	13/10/2020
Type of sample		Water	Water
Date prepared	-	20/10/2020	20/10/2020
Date analysed	-	20/10/2020	20/10/2020
Sulfur -Total	mg/L	2.0	3.6

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105 deg C for a minimum of 12 hours.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			14/10/2020	3	14/10/2020	14/10/2020		14/10/2020	[NT]
Date analysed	-			15/10/2020	3	15/10/2020	15/10/2020		15/10/2020	[NT]
Silver	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	98	[NT]
Aluminium	mg/kg	10	Metals-020 ICP-AES	<10	3	4700	3600	27	98	[NT]
Antimony	mg/kg	7	Metals-020 ICP-AES	<7	3	<7	<7	0	102	[NT]
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	3	<4	<4	0	108	[NT]
Boron	mg/kg	3	Metals-020 ICP-AES	<3	3	<3	<3	0	89	[NT]
Barium	mg/kg	1	Metals-020 ICP-AES	<1	3	15	11	31	104	[NT]
Beryllium	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	109	[NT]
Bismuth	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	91	[NT]
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	3	<0.4	<0.4	0	104	[NT]
Cobalt	mg/kg	1	Metals-020 ICP-AES	<1	3	1	1	0	103	[NT]
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	3	8	7	13	103	[NT]
Copper	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	101	[NT]
Caesium*	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	100	[NT]
Gallium	mg/kg	1	Metals-020 ICP-AES	<1	3	2	2	0	115	[NT]
Gold*	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	99	[NT]
Iron	mg/kg	10	Metals-020 ICP-AES	<10	3	12000	13000	8	99	[NT]
Lanthanum*	mg/kg	1	Metals-020 ICP-AES	<1	3	9	8	12	111	[NT]
Lead	mg/kg	1	Metals-020 ICP-AES	<1	3	4	4	0	98	[NT]
Lithium	mg/kg	1	Metals-020 ICP-AES	<1	3	1	1	0	90	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Manganese	mg/kg	1	Metals-020 ICP-AES	<1	3	10	12	18	105	[NT]
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	3	<0.1	<0.1	0	110	[NT]
Molybdenum	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	100	[NT]
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	3	1	1	0	99	[NT]
Selenium	mg/kg	2	Metals-020 ICP-AES	<2	3	<2	<2	0	100	[NT]
Strontium	mg/kg	1	Metals-020 ICP-AES	<1	3	2	2	0	107	[NT]
Sulphur	mg/kg	10	Metals-020 ICP-AES	<10	3	31	33	6	105	[NT]
Tellurium	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	98	[NT]
Thallium	mg/kg	2	Metals-020 ICP-AES	<2	3	<2	<2	0	97	[NT]
Tin	mg/kg	1	Metals-020 ICP-AES	<1	3	<1	<1	0	99	[NT]
Titanium	mg/kg	1	Metals-020 ICP-AES	<1	3	9	9	0	108	[NT]
Thorium	mg/kg	2	Metals-022 ICP-MS	<2	3	3	2	40	106	[NT]
Uranium	mg/kg	1	Metals-022 ICP-MS	<1	3	<1	<1	0	107	[NT]
Vanadium	mg/kg	1	Metals-020 ICP-AES	<1	3	28	31	10	102	[NT]
Yttrium*	mg/kg	1	Metals-020 ICP-AES	<1	3	4.8	4.5	6	98	[NT]
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	3	1	<1	0	102	[NT]

QUALITY CONTROL: All metals in water - total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			16/10/2020	[NT]	[NT]	[NT]	[NT]	16/10/2020	[NT]
Date analysed	-			16/10/2020	[NT]	[NT]	[NT]	[NT]	16/10/2020	[NT]
Silver-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Aluminium-Total	µg/L	10	Metals-022 ICP-MS	<10	[NT]	[NT]	[NT]	[NT]	106	[NT]
Arsenic-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Boron-Total	µg/L	20	Metals-022 ICP-MS	<20	[NT]	[NT]	[NT]	[NT]	107	[NT]
Barium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Beryllium-Total	µg/L	0.5	Metals-022 ICP-MS	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Bismuth-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	119	[NT]
Cadmium-Total	µg/L	0.1	Metals-022 ICP-MS	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Cerium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Cobalt-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chromium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Copper-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Caesium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Gallium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Mercury-Total	µg/L	0.05	Metals-021 CV-AAS	<0.05	[NT]	[NT]	[NT]	[NT]	85	[NT]
Iron-Total	µg/L	10	Metals-022 ICP-MS	<10	[NT]	[NT]	[NT]	[NT]	103	[NT]
Lanthanum-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lithium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Manganese-Total	µg/L	5	Metals-022 ICP-MS	<5	[NT]	[NT]	[NT]	[NT]	105	[NT]

QUALITY CONTROL: All metals in water - total					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Molybdenum-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Niobium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Nickel-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Lead-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Rubidium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Rhenium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Antimony-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Scandium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Selenium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Tin-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Strontium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Tantalum-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Tellurium-Total*	µg/L	0.5	Metals-022 ICP-MS	<0.5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Thorium-Total	µg/L	0.5	Metals-022 ICP-MS	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Thallium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Titanium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Uranium-Total	µg/L	0.5	Metals-022 ICP-MS	<0.5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Vanadium-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Tungsten-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Yttrium-Total*	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: All metals in water - total					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Zinc-Total	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]

QUALITY CONTROL: Metals in Waters - Total						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			20/10/2020	[NT]	[NT]	[NT]	[NT]	20/10/2020	[NT]
Date analysed	-			20/10/2020	[NT]	[NT]	[NT]	[NT]	20/10/2020	[NT]
Sulfur -Total	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	[NT]	[NT]	110	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

METALS: The PQL has been raised for Cadmium & Copper due to the sample matrix requiring dilution.

PQL has been raised for Cadmium due to the high moisture content in the sample, resulting in a high dilution factor.

Year	Rank	Substance Name	CAS Registry Number	Toxicity	Water GMMC (mg/L)	Soil GMMC (mg/kg)	Air GMMC (mg/m3)	Theoretical Daily Dose (TDD) (mg/day)
2019	1	ARSENIC	7440-38-2	1	0.06030	48.63636	0.00007	0.07113
2019	2	LEAD	7439-92-1	10	0.11817	884.79106	0.00243	0.33153
2019	3	MERCURY	7439-97-6	1	0.00350	2.71690	0.00314	0.05109
2019	7	CADMIUM	7440-43-9	10	0.03876	19.40584	0.00012	0.04444
2019	17	CHROMIUM, HEXAVALENT	18540-29-9	1	0.81491	46.31430	0.00000	0.82422
2019	35	CYANIDE	57-12-5	10	0.23628	27.02039	0.07093	1.30565
2019	52	COBALT	7440-48-4	10	0.06399	17.07890	0.00003	0.06780
2019	58	NICKEL	7440-02-0	100	0.30382	90.24526	0.00462	0.39114
2019	66	CHROMIUM(VI) TRIOXIDE	1333-82-0	1	0.15211	2.13689		0.15254
2019	69	METHANE	74-82-8	10	0.48000		529.80386	7947.53787
2019	75	ZINC	7440-66-6	1000	1.68153	1400.12252	0.00260	2.00056
2019	78	CHROMIUM	7440-47-3	5000	0.20702	198.07556	0.00059	0.25551
2019	95	RADIUM-226	13982-63-3	1				
2019	97	URANIUM	7440-61-1	1				
2019	101	RADIUM	7440-14-4	1				
2019	102	THORIUM	7440-29-1	1				
2019	106	RADON	10043-92-2	1				
2019	108	RADIUM-228	15262-20-1	1				
2019	109	THORIUM-230	14269-63-7	1				
2019	110	URANIUM-235	15117-96-1	1				
2019	111	THORIUM-228	14274-82-9	1				
2019	112	RADON-222	14859-67-7	1				
2019	113	URANIUM-234	13966-29-5	1				
2019	118	PLUTONIUM-239	15117-48-3	1				
2019	119	POLONIUM-210	13981-52-7	1				
2019	120	COPPER	7440-50-8	5000	0.37123	431.11606	0.00091	0.47117
2019	121	PLUTONIUM-238	13981-16-3	1				
2019	122	LEAD-210	14255-04-0	1				
2019	123	AMOSITE ASBESTOS	12172-73-5	1				
2019	123	PLUTONIUM	7440-07-5	1				
2019	123	STRONTIUM-90	10098-97-2	1				
2019	126	RADON-220	22481-48-7	1				
2019	136	BARIUM	7440-39-3	1000	0.51499	426.64488	0.00108	0.61652
2019	140	MANGANESE	7439-96-5	5000	1.36531	1219.24985	0.00102	1.62443
2019	147	SELENIUM	7782-49-2	100	0.03657	5.36217	0.00002	0.03795
2019	201	VANADIUM	7440-62-2	1000	0.10855	57.46577	0.00020	0.12304
2019	217	CESIUM-137	10045-97-3	10				
2019	217	Chromic Acid	7738-94-5	10				
2019	219	POTASSIUM-40	13966-00-2	10				
2019	225	THORIUM-227	15623-47-9	10				
2019	226	NITRATE	14797-55-8	1000	21.42883	103.78191	0.02715	21.85683
2019	227	ARSENIC ACID	7778-39-4	1				
2019	228	ARSENIC TRIOXIDE	1327-53-3	1				
2019	229	SILVER	7440-22-4	1000	0.02696	8.25419	0.00003	0.02901
2019	235	ARSINE	7784-42-1	1				
2019	239	MERCURIC CHLORIDE	7487-94-7	1				
2019	239	SODIUM ARSENITE	7784-46-5	1				
2019	239	URANIUM-233	13968-55-3	1				
2019	244	ANTIMONY	7440-36-0	5000	0.08579	75.25725	0.00012	0.10261
2019	279	THALLIUM	7440-28-0	1000	0.01358	6.04104	0.00007	0.01582
2019	311	TIN	7440-31-5	1000	0.07865	96.69555	0.00012	0.09981
2019	312	ANTHRACENE	120-12-7	5000	0.07213	19.11067	0.00002	0.07630
2019	313	TITANIUM	7440-32-6	1000	2.25872	58.79488	0.00008	2.27169
2019	334	MOLYBDENUM	7439-98-7	1000	0.22919	56.17243	0.00005	0.24120
2019	337	BORON	7440-42-8	5000	1.64915	181.03419		1.68535
2019	344	LITHIUM	7439-93-2	1000	0.38352	104.50714		0.40442
2019	351	CHROMIUM, TRIVALENT	16065-83-1	1000	0.10818	299.78167		0.16814
2019	356	CYANIDE, SODIUM	143-33-9	10				
2019	356	LEAD OXIDE	1317-36-8	10				
2019	375	ALUMINUM CHLORIDE	7446-70-0	10				
2019	375	ZINC OXIDE	1314-13-2	10				
2019	399	SULFIDE	18496-25-8	5000	3.09101	396.33319		3.17028
2019	439	SULFUR	7704-34-9	5000			0.00122	0.01829
2019	448	INDIUM	7440-74-6	1000			0.00002	0.00027
2019	453	LEAD-212	15092-94-1	100				
2019	470	TRITIUM	10028-17-8	1000				
2019	478	TUNGSTEN	7440-33-7	1000				
2019	479	GERMANIUM	7440-56-4	1000			0.00000	0.00002
2019	496	TELLURIUM	13494-80-9	1000			0.00003	0.00039
2019	500	COBALT-60	10198-40-0	100				
2019	570	CERIUM	7440-45-1	5000				
2019	573	NEODYMIUM	7440-00-8	5000				
2019	575	DYSPROSIUM	7429-91-6	5000				
2019	575	EUROPIUM	7440-53-1	5000				

Year	Rank	Substance Name	CAS Registry Number	Toxicity	Water GMMC (mg/L)	Soil GMMC (mg/kg)	Air GMMC (mg/m3)	Theoretical Daily Dose (TDD) (mg/day)
2019	575	PRASEODYMIUM	7440-10-0	5000				
2019	575	SAMARIUM	7440-19-9	5000				
2019	581	YTTERBIUM	7440-64-4	5000				
2019	583	GALLIUM	7440-55-3	5000			0.00001	0.00011
2019	584	SCANDIUM	7440-20-2	5000				
2019	585	INDAN	496-11-7	1000	0.00002	0.46900		0.00012
2019	612	ANTIMONY TRIOXIDE	1309-64-4	1000				
2019	711	CESIUM	7440-46-2	50000				
2019	711	IRON	7439-89-6	50000	11.29038	33072.13825	0.01626	18.14875
2019	711	LANTHANUM	7439-91-0	50000			0.00018	0.00268
2019	711	MAGNESIUM	7439-95-4	50000	33.33691	6317.86906	0.09072	35.96134
2019	711	NITROGEN	7727-37-9	50000	14.77943			14.77943
2019	711	NITROGEN OXIDE	10024-97-2	50000				
2019	711	POTASSIUM	7440-09-7	50000	13.30819	1379.44670	0.37635	19.22941
2019	711	RUBIDIUM	7440-17-7	50000			0.00001	0.00009
2019	711	SILICON	7440-21-3	50000	55.34264		0.32500	60.21764
2019	711	SODIUM	7440-23-5	50000	136.06748	819.01805	0.99375	151.13748
2019	711	SULFATE	14808-79-8	50000	737.54456	4588.94808	0.12563	740.34675
2019	711	YTTRIUM	7440-65-5	50000		0.10488	0.00001	0.00012
2019	711	ZIRCONIUM	7440-67-7	50000			0.00002	0.00032