Locked Bag 1797
Penrith NSW 2751 Australia
School of Science
12 February 2023

Dear Cadia Community Sustainability Network,

Here are latest results from a total of 13 water and 3 dust/sediment/water filter sludge samples. They are the result of commercial test results that were conducted in a commercial laboratory on samples that you (and many others) have collected. They are from samples collected November to December 2022. In my opinion, the results indicate contamination by metals in water and dust and are of considerable concern.

I have obtained permission to share results of other water and dust/sediment samples that were collected by others across your local community. Those results, overall, are more highly contaminated than the samples that you sent to me for analysis. I have added these results as an appendix to this report.

Table 1. Water sample metal results from samples collected by your group.

Location	Date Sampled	Arsenic	Copper	Lead	Nickel	Zinc
		µg/L	µg/L	µg/L	µg/L	µg/L
Aust. Drinking Water Guidelines		<10 H	<1000A/<2000H	<10 H	<20 H	<3000
Roadside off Panuara Rd	27/11/2022	1	42	<1	1	10
Mandurama	27/11/2022	<1	74	<1	<1	980
Cadia Rd Cadia	11/12/2022	<1	3	<1	<1	24
Four Mile Creek	11/12/2022	<1	510	<1	<1	2100
Four Mile Creek	11/12/2022	<1	120	2	<1	46
Milthorpe	11/12/2022	<1	350	22	95	1400
Forest Reefs	11/12/2022	<1	11	<1	<1	430
Forest Reefs	8/11/2022	<1	32	2	<1	190
Errowanbang area	8/11/2022	<1	2	<1	<1	100
Beneree	11/11/2022	<1	9	1	<1	52
Browns Creek	11/11/2022	<1	6	4	<1	890
Burnt Yards	8/12/2022	<1	40	4	<1	2400
Burnt Yards	8/12/2022	<1	36	4	<1	2400
ANZECC (95% Species in river)		<24	<1.4	<3.4	<11	<8
		Arsenic-Tota	Copper-Total	Lead-Total	Nickel-Tota	Zinc-Total
Tap water sample from Orange (Control	2	<1	2	<1	<1	110
Tap water sample from Orange (Control	2	<1	2	<1	<1	110

Many of the water samples contain lead. According to the USA EPA there is no safe concentration of lead in drinking water. The Australian Drinking Water Guidelines recommend that drinking water should contain less than 10 **µg/L of lead.** See Table 1. The lead concentrations of **22 µg/L** is of particular concern (see appendix for results of lead in other water samples from the area).

The Australian Drinking Water Guidelines recommend that drinking water should contain less than 20 µg/L of nickel. See Table 1. The nickel concentrations of **95 µg/L** is much higher than this guideline and is of particular concern. (see appendix for results of nickel in other water samples from the area).

Metal results from sediment / dust /water filters

The three sediment/dust samples that were opportunistically collected from surfaces, and from water filters and sediment collection plumbing fixtures (such as a water filter) from properties across the district had variable metal content. Of most concern was the elevated arsenic content (above ANZECC sediment guidelines) collected from creek rocks. The copper content in dust at Browns Creek was marginally less than the ANZECC (sediment) guideline for copper.

Date Sampled	Type of sample	Arsenic	Copper	Lead	Nickel	Zinc
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
8/12/2022	Sludge from filter	<4	10	<2	<1	140
4/12/2022	Sludge from creek rocks	58	47	8	12	46
11/12/2022	Dust (Browns Creek)	<4	59	<2	3	36
	ANZECC (Sediment)	20	65	50	21	200

Recommended action

For due diligence, I believe that these results need to be reported to NSW Health, NSW EPA and Council Environmental Health officers.

I have serious concerns that people in the surrounding area may be at risk from consuming tank water with elevated lead concentrations. This is a particular concern for the health and cognitive development for children. US EPA recommend zero lead in drinking water. Australia has more lenient drinking water guidelines for lead (<10 µg/L). Some water samples also exceeded drinking water guidelines for arsenic, nickel and zinc.

NSW Health / Council Environmental Health officers can organise testing of tank water samples and can also issue appropriate health warnings and treatment advice for people.

The Copper results are likely to not be of human health concern. But they are a major concern for the health of the environment, to natural ecosystems and also to agricultural enterprises.

The sediment/dust results suggest to me that some of the metals may be released as dust particles that are transported to roofs, land and waterways. To record such high copper concentrations in water from tanks, I consider it plausible that air-borne dust from the mine (or other sources) may be accumulating on roofs that are also used to collect house drinking water. It may also be possible that the source of the metals could be from other sources. A more detailed investigation should be able to determine their source.

NSW EPA should urgently conduct an investigation into the source of the metals. They hold a pollution licence that regulates the release of contaminants from the mine to the air and water. This licence for the Cadia mine (Environmental Protection Licence EPL 5590) appears

to have major shortcomings. I also recommend that the EPL 5590 will need to be reviewed, in light of the investigation.

Although EPL 5590 requires the mine to collect monitoring results on dust quantity, there are no requirements in EPL 5590 for the mine to measure the metal (or other contaminant) contents of dust samples that are collected. In contrast, the mine is required to measure the contaminant content of liquid discharges to waterways, with discharge restrictions through concentration limits for the metals/metaloids (arsenic, aluminium, copper, iron, lead, manganese and zinc). For example, if the mine releases water to the environment, it much have a copper content of less than 100 µg/L (EPL 5590). Seven of the 21 water samples (mostly from water tanks or house water supplies) had lead content higher than 100 µg/L (Table 1 and 2).

I am concerned that the current EPL 5590 fails to protect the environment in the local district from air borne metal emissions that are potentially being released from the mine operation. I suspect that the pollution pathway is associated with dust particles released from the mine. I also believe that it is plausible that this is contributing to atmospheric metal fall-out on local private properties, and this may also be adding to the accumulation of metals washed off roofs into water tanks that are used as household and rural water supplies.

Best wishes,

Dr Ian Wright,
Associate Professor, School of Science,
Western Sydney University

Friday 24 Feb 2023

Dear Cadia Community Sustainability Network,

Here is my short summary for NSW Health. I would only focus on the lead results, as they pose the most serious health hazard.

My summary:

The latest batch of water tests from the Cadia Valley included metal results for 38 water samples recently collected from household water tanks.

The laboratory tests were done by ALS and the results were provided in units 'mg/L'. For reference: 1 mg/L = 1000 µg/L). My analysis uses 'µg/L' as the Australian Drinking Water Guidelines for lead is less than 10 µg/L. This is equivalent to 0.01 mg/L.

The latest batch of water tests from the Cadia Valley included metal results for 38 water samples from household water tanks. Of these, 37 had results for five metals (total metal concentration) copper, lead, nickel and zinc. One sample was only tested for dissolved metals only. It did not have a detectable concentration of dissolved lead.

The results for total lead concentrations in the water samples are of substantial human health concern. Many water samples exceeded the Australian Drinking Water Guidelines (Health) for lead (<10 µg/L). The results were not uniformly hazardous. Of the 37 samples with total metal results, 10 did not have any detectable concentration of lead.

Of the other 27, they had lead concentrations that ranged from 2 to 841 µg/L. The largest lead result (841 µg/L = 0.841 mg/L) for the sample coded '41 ST 1' is more than 80 times the Australian Drinking Water Guideline (Health) for lead (<10 µg/L). The owners need to be informed of the results and recommended not to drink or cook with this water.

Of the 27 water samples with lead recorded at detectable concentrations, the mean concentration was 8.94 µg/L and the median concentration was 21 µg/L.

19 of the 37 (51.3%) water samples in this latest batch of water samples exceeded the Australian Drinking Water Guidelines (Health) for lead (<10 µg/L).

5 of the 37 (13.5%) of the water samples exceeded the lead guideline by more than 10 times. They ranged from 107 to 842 µg/L.

In my opinion the households with lead results above the guidelines should be alerted. I also strongly recommend that the resulted are promptly shared with Tim Brokenshire (NSW Health, Bathurst).

Ian

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23 March 2023

Dear Cadia Community Sustainability Network Inc.,

I have reviewed the results of all water tests from samples collected from water tanks in the Cadia area (In February and March 2023) by your group, using consistent sampling methods. This now represents a total 47 water samples collected from water tanks.

They are commercial test results that were conducted impartially by a NATA accredited laboratory. In my opinion, the results indicate that contamination of water tanks by metals, and lead in particular, is likely to be hazardous for people that consume water from the tanks.

Most of the water samples (83%) were found to contain lead. According to the USA EPA there is no safe concentration of lead in drinking water. The Australian Drinking Water Guidelines recommend that drinking water should contain less than **10µg/L of lead.**

Of the 47 water samples collected from water tanks, in February and March 2023 using comparable and consistent methods, 32 (68%) exceeded the Australian Drinking Water Guideline (Health) for lead (<10µg/L). Of greater concern is that 13 samples (27.6%) recorded lead concentrations that exceeded the lead guidelines by more than 10 times **(>100 µg/L of lead).**

The laboratory analysis of the water samples also recorded other metals at hazardous concentrations. For example, the most recent 20 samples that were collected and tested in March 2023, the following results were received.

The Australian Drinking Water Guidelines recommend that drinking water should contain less than 20 µg/L of nickel. 9 of 20 (45%) of the most recent batch of 20 water samples, collected in March 2023, exceeded the nickel guideline.

The Australian Drinking Water Guidelines recommend that drinking water should contain less than 10 µg/L of arsenic. 6 of 20 (30%) of the most recent batch of 20 water samples, collected in March 2023, exceeded the arsenic guideline.

The Australian Drinking Water Guidelines recommend that drinking water should contain less than 2 µg/L of cadmium. 4 of 20 (20%) of the most recent batch of 20 water samples, collected in March 2023, exceeded the cadmium guideline.

The Australian Drinking Water Guidelines recommend that drinking water should contain less than 3000µg/L of zinc. 10 of 20 (50%) of the most recent batch of 20 water samples, collected in March 2023, exceeded the zinc guideline.

I continue to have substantial concerns that people in the surrounding area may be at risk from consuming tank water with elevated metal concentrations, particularly for the metals lead, arsenic, nickel, cadmium and zinc.

Regards, Ian
Dr Ian Wright,
Associate Professor, School of Science,
Western Sydney University