Claire Bennett

In response to the Inquiry into current and potential impacts of gold, silver, lead and zinc mining on human health, land, air and water quality in New South Wales, 3rd October 2023. Please see response below regarding questions taken on notice.

Please note correction to my response and added information –

Page 5

These offset trees that they have planted—there are some bordering forests and other areas—they haven't even been looked after. They've planted them, ticked a box and put up a few good snaps. Before the IPC hearing we went out to have a look at these trees. A large majority of the plastic tree guards that they have planted these trees with are just floating all over the native vegetation around the area. I would, atan estimate, say that 70 per cent of the trees were dead.

Ms CATE FAEHRMANN: What's the area, specifically? Do you know the area or what the offset is

called? We can take that on notice.

CLAIRE BENNETT: No. I will take that on notice. There are a couple of offset areas. I can take that

on notice and I can get you that information from us.

The tress that I refer to are not offset trees as stated but trees that form a buffer on the boundary next to the Vittoria State Forrest. (photo attached) To expand on the offset and trees I would like to state the following.

1. Offset land has been offered to Goldfields Honey for beekeeping. This land is located some 30 minutes' drive which proves to be very impractical when bees are being bred and monitored.
2. The offset land is a property call AZIEL located between Blayney and Carcoar which was under stewardship, purchased by Regis Resources as offset land. This does not make sense as the land was already protected. Also, commercial activity cannot be done on offset land and as beekeeping is a commercial activity the offset land offered to Goldfield Honey Aust is useless.
3. Trees that will be destroyed by the mining footprint are endangered and many up to 150 years old. Regis Resources are planting offset trees on the land that they own surrounding the mine site, these trees will take 20 plus years to be of any use for queen bee breeding or honey production.

Page 6 response

The Hon. GREG DONNELLY: I am interested to see if the company is attempting to address both the smaller and larger issues. Have they said that they are going to provide you with which matters they are prepared to look at and address, or are you just getting bits and pieces from them?

CLAIRE BENNETT: I think that they are taking our concerns more seriously, and their attitude towards us—prior to the IPC they were quite cocky towards us and not friendly. Since the IPC they have been more friendly towards us and probably have made an attempt to take the time to really consider our concerns. There have been a few emails back and forth but, to date, we haven't really resolved any of the—

The Hon. GREG DONNELLY: Is there any process that you are aware of, post the IPC work, that you can link into, which can formalise these discussions to try to get some of your matters addressed? Has that been explained to you?

CLAIRE BENNETT: Not that I'm aware of, but I could take that on notice. That could be a question for my brother and mother to come back on.

In the final Development Consent from the Independent Planning Commission the commissioners have addressed agriculture, in its entirety, the apiary industry. Please see below. The acknowledgement is good but finding qualified and experienced experts will be the challenging especially now the beekeeping industry has the added stress of management of Varroa Mite.

Extracted from NSW Government – Department of Planning and Environment – McPhillamys Gold Project (SSD 9505)

AGRICULTURE

B104. The Applicant must prepare an Apiary Monitoring and Management Program, to the satisfaction of the Planning Secretary. This program must:

(a) Be prepared by suitably qualified and experienced expert/s approved by the Planning Secretary;
(b) Be prepared in consultation with DPI Agriculture and local apiary operators
(c) Include:
    (i) A research and monitoring program to assess heavy metal and other mining-related impacts on local apiary operations, including but not limited to:
        - The collection of baseline data;
        - Monitoring of sources that may contain contaminants that could affect bee heal and honey production, including dust and surface water bodies; and
        - The effectiveness of mitigation measures in place to minimise impacts on bee keeping operations;
    (ii) Performance criteria, including trigger levels for identifying and investigating any potentially adverse impacts on honey bee productivity associated with the mine site;
    (iii) A trigger action response plan to respond to exceedances of the performance criteria, and repair mitigate, and/or offset any adverse impacts on local honey bee productivity associated with the mine site; and
    (iv) A protocol to report on the measures, monitoring results and performance criteria identified above, in the Annual Review referred to in condition E8.

B105. The Applicant must not commence mining operations until the Apiary Monitoring and Management Program is approved by the Planning Secretary.

B106. The Applicant must implement the Apiary Monitoring and Management Program as approved by the Planning Secretary.

Page 7 response

The CHAIR: We are over time for this session. If I could leave you with one question on notice: Would you be willing to submit to us that study by Professor Taylor regarding the contamination?

CLAIRE BENNETT: Yes, there are two studies. There is a study that he has done for us that doesn't actually give too much evidence, but it's a baseline study. So when the mine starts, we can then do the same testing again and be like, "Here you go."

The CHAIR: I'm interested in that evidence regarding a different mine. I think you said it was a nickel mine. We'd love to read that.

CLAIRE BENNETT: Yes, I'll submit that. And you guys will email me the questions I've taken on notice, won't you?

See emailed attachments:

Goldfields Honey: Trace element analysis in honey bees, honey, soil, dust and water

Honorary Professor Mark Patrick Taylor

Macquarie University

My position:

“The truth is:
the natural world is changing. And we are totally dependent on that world. It provides our food, water and air. It is the most precious thing we have and we need to defend it.”

Sir David Attenborough, 28 October 2012

Environmental protection

- Prevent rather than rehabilitate.
- Make industry/community central to preventing harm.
- No safe levels.

Environmentally-sourced trace elements are remobilised in bees and honey

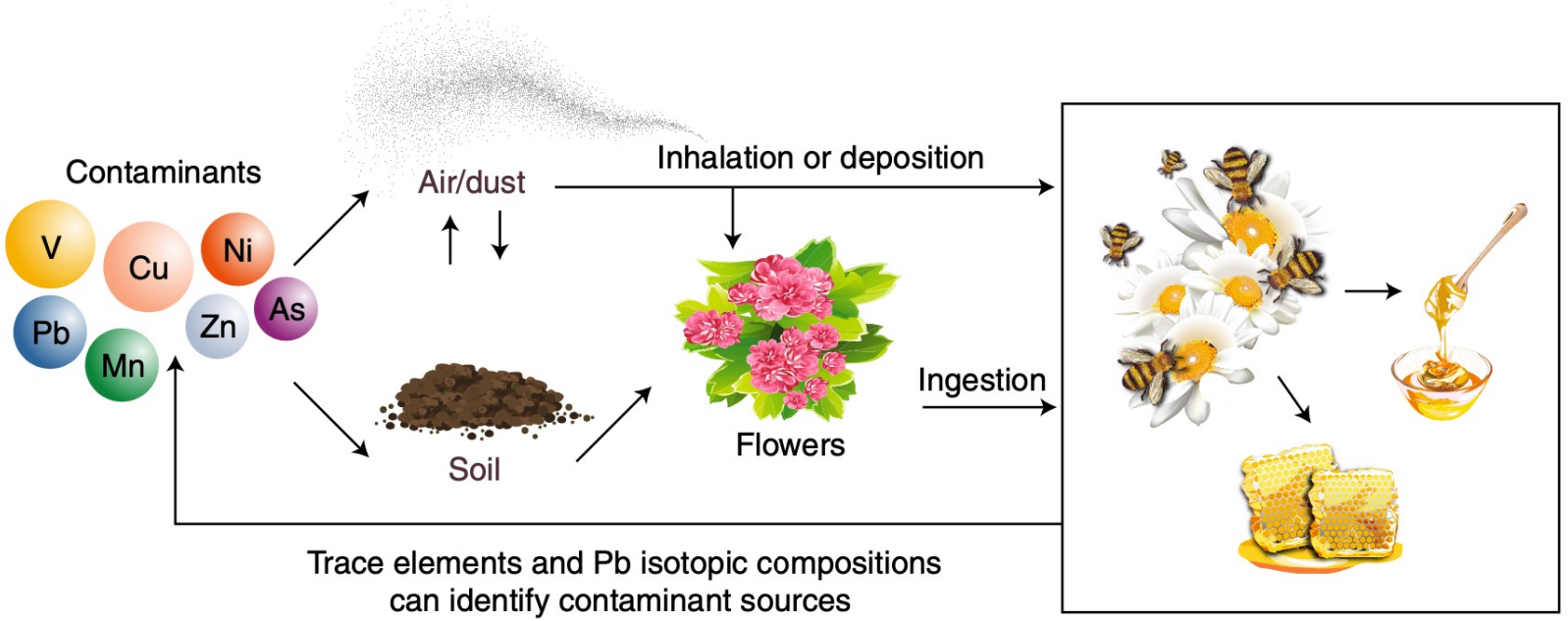
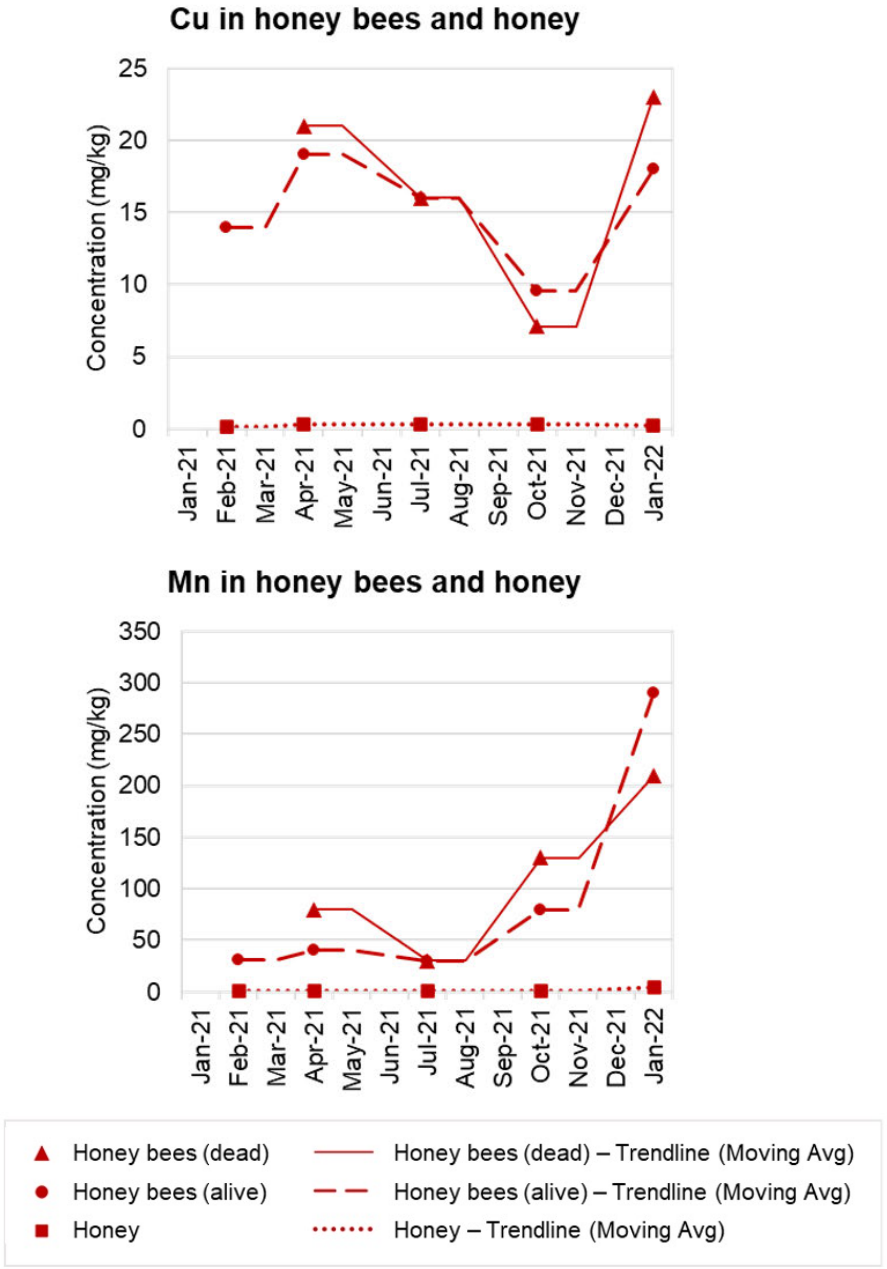


Fig. 1 | Honey bee exposures to trace element contaminants. Environmental sources of metal and metalloid contaminants held in air, dust and soils can be accumulated on and in honey bees, which then transfer these to their beehive products (wax and honey). Adapted from ref. [8], ACS.

Source: Taylor, M.P. 2019. Invited commentary. Bees as Biomarkers. Nature Sustainability, 2, 169-170. https://doi.org/10.1038/s41893-019-0247-9.

Key points from the baseline study

- Goldfields tank water is clean and no major concerns for:
  - bees
  - Honey.
- What does this matter?
- No mine site does not have off site pollution; values likely to change.



Baseline Goldfields data shows that bee display seasonal variations in trace elements

- Variations and exposure will be accentuated under dusty mine conditions

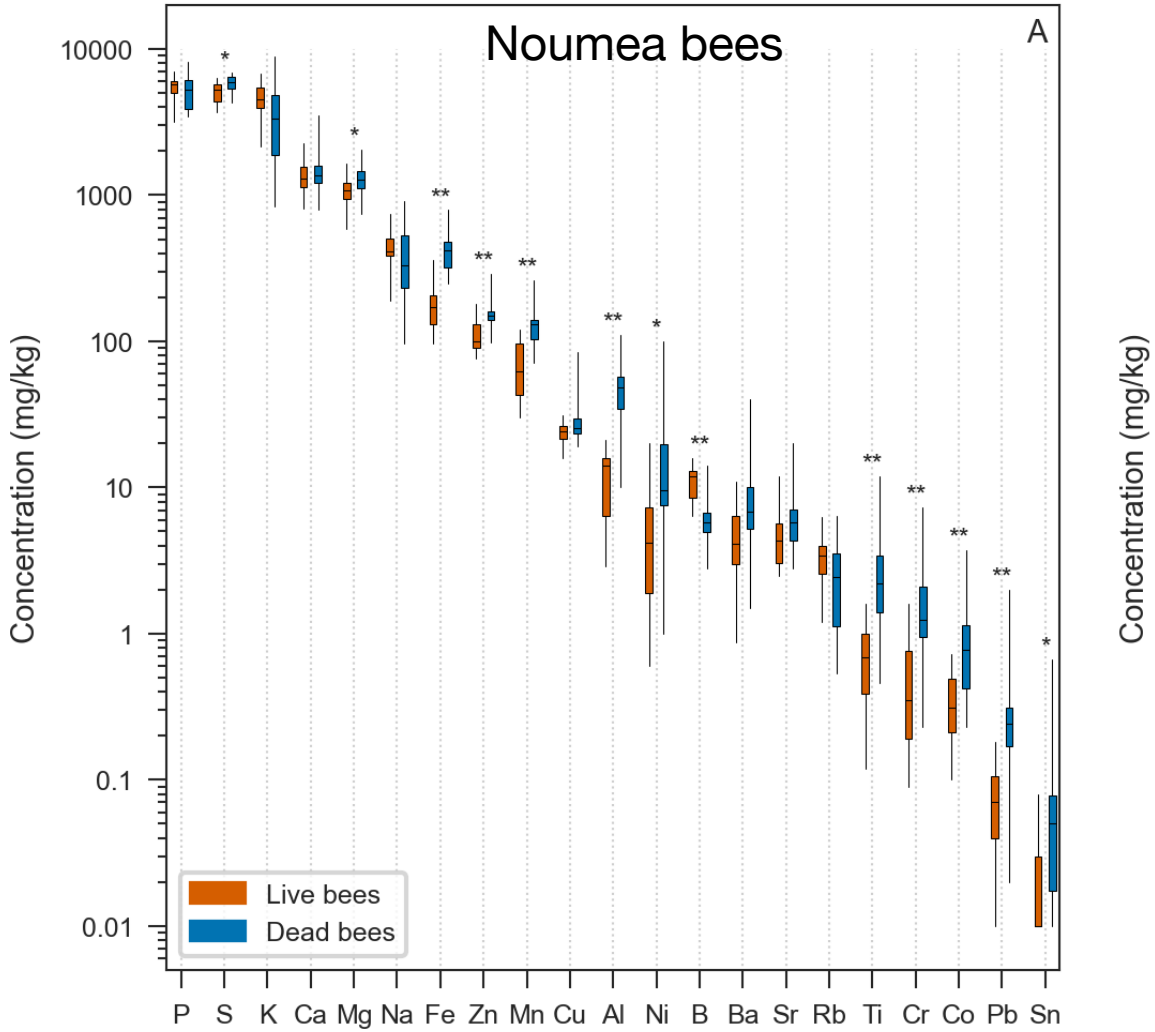
Source: Taylor M.P. and Fry K.F. 2022. Baseline environmental monitoring for Goldfields Honey. Trace element analysis in honey bees, honey, soil, dust and water. Macquarie University, NSW, Australia.

Figure 1. Time series display of honey bee (alive and dead) and honey trace element concentrations (mg/kg) measured over a 12-month period at Goldfields Honey.

Future dust control will be critical

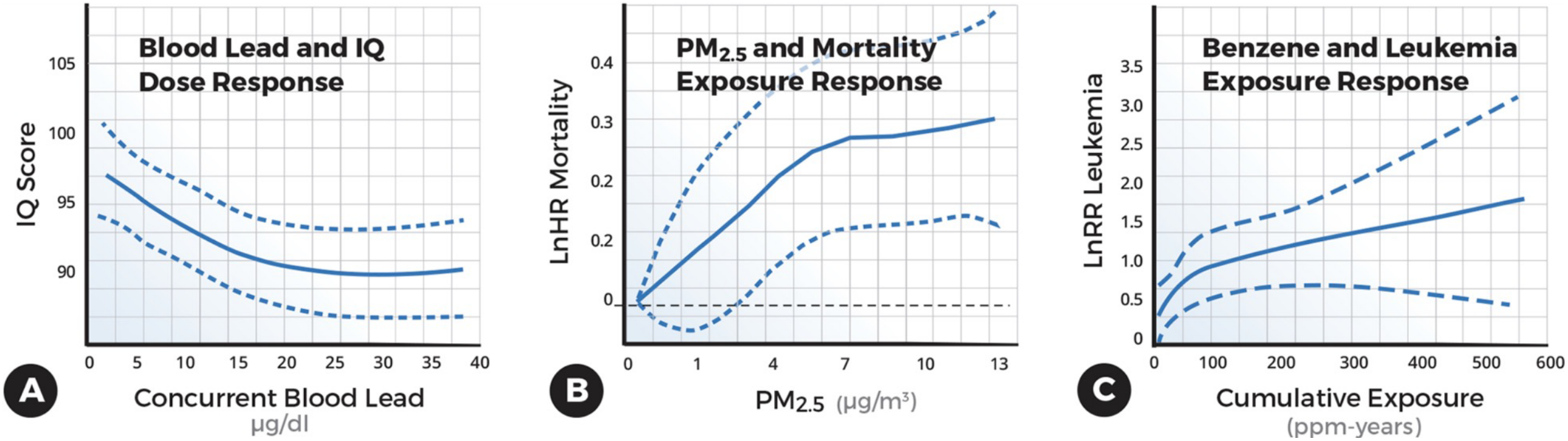
Dust will be a key because:

1. environment is dry;
2. dry/drying climate will exacerbate dust and increase challenge of keeping it under control;
3. bees are exposed from the environment as they age;
4. trace elements are toxic to bees and this impairs their foraging capacity;
5. for early all contaminants there is no safe level; just an acceptable threshold;
6. Exposure effects are proportionally greatest at the lowest exposure levels.

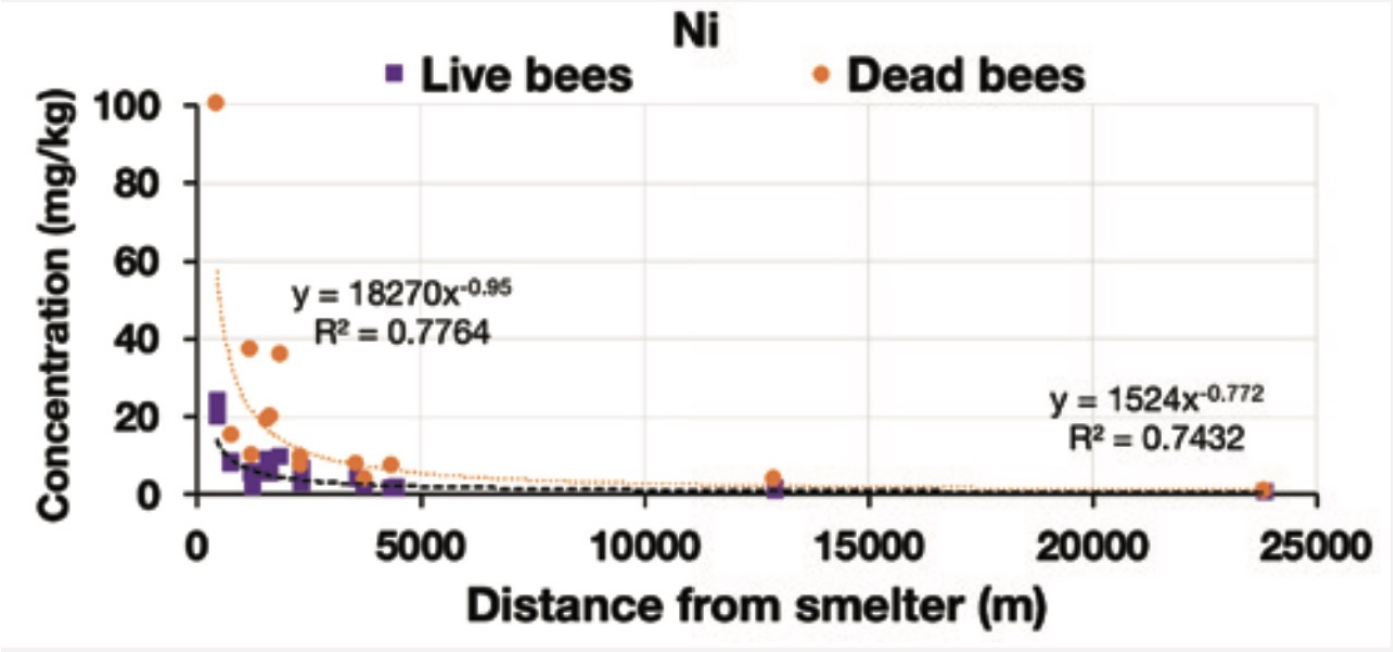


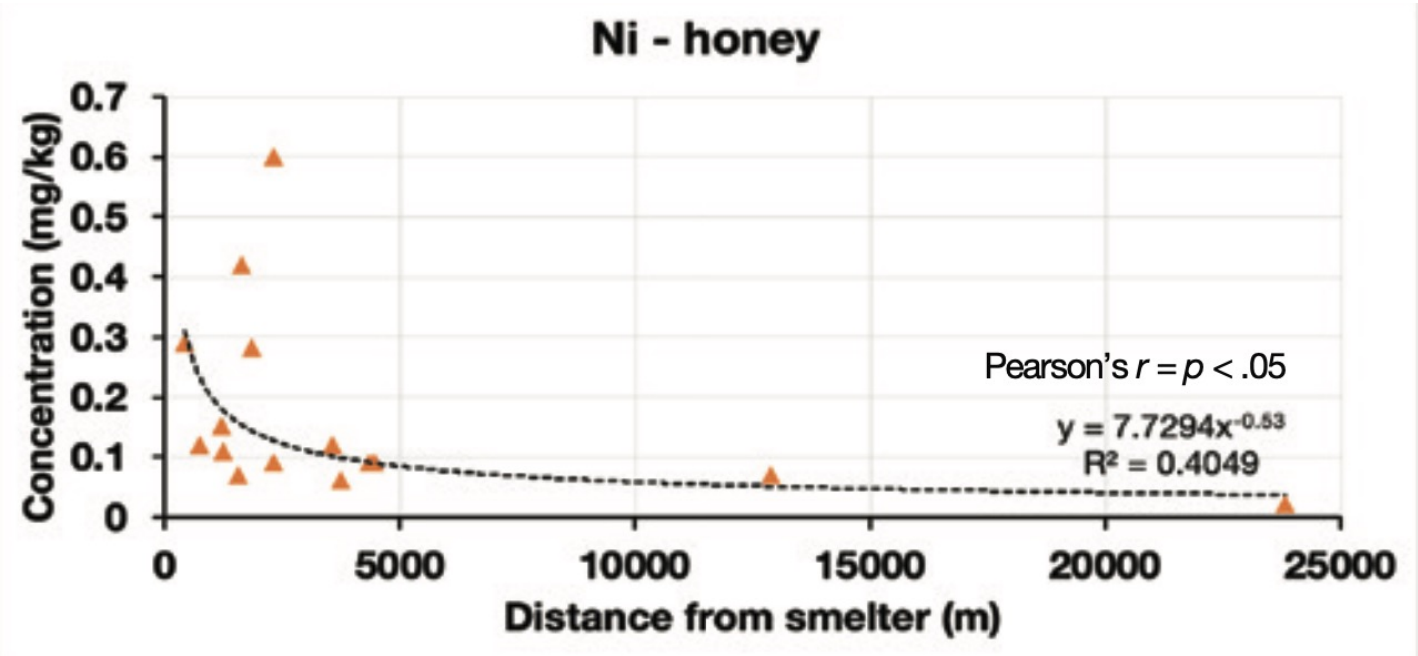
Why prevention?

Low-level toxicity of chemicals: No acceptable levels?



Source: Lanphear 2017, PLOS Biology.





Nickel in bees and honey – Noumea, New Caledonia

- Contamination in bees and honey unequivocally linked to the polluting nickel smelter source.

Source: Taylor, M.P., Isley, C., Fry, K., Gillings-Mclennan, M. 2019. Tracing anthropogenic trace element contamination of natural and human systems in the South Pacific using honey bees as a key biomarker. Poster presentation AGU Fall Meeting 9-13 December 2019, San Francisco. Available at: https://doi.org/10.1002/essoar.10501957.1.

Why do contaminants in bees matter?

- Accumulation of potential toxic trace elements shown to have adverse impacts on honey bee foraging (Monchanin et al. 2021; Søvik et al. 2015).
- Honey bees cannot sense harmful concentrations of trace elements in food sources (Monchanin et al. 2022).
- Our recent research from the nickel smelter city of Nouméa, New Caledonia showed that:
    - Trace element concentrations in soil were an order of magnitude (10 times) greater than trace elements in honey bees.
    - Honey bee trace elements were an additional order of magnitude (10 times) greater than trace elements found in the honey.
- The biggest potential impact from the proposal is on the bees and their foraging capacity, which in turn presents a risk of harm to Goldfields productivity and produce quality.

Sources: Monchanin, C., Drujont, E., Devaud, J.-M., Lihoreau, M. & Barron, A. B. 2021. Metal pollutants have additive negative effects on honey bee cognition. *Journal of Experimental Biology*. https://doi.org/10.1242/jeb.241869
Søvik, E., Perry, C. J., LaMora, A., Barron, A. B. & Ben-Shahar, Y. 2015. Negative impact of manganese on honeybee foraging. *Biology Letters,* **11,** 20140989. https://doi.org/10.1098/rsbl.2014.0989.

Unaddressed matters

- Can the operations guarantee there will be no off site impacts?
- No safe / acceptable level is established for bees (absence of evidence is not evidence of absence).
- Honey is a natural product and should be free of contamination – will that remain the case?
- The proposal has not quantified the short and long costs of distress and worry (mental health and wellbeing) on the impacted communities.

Tracing anthropogenic trace element contamination of natural and human systems in the South Pacific using honey bees as a key biomarker

Mark Patrick Taylor,[1] Cynthia Isley
Kara Fry, Max Mclennan-Gillings
Earth and Environmental Sciences, Faculty of Science and Engineering, Macquarie University, Sydney, NSW, 2159, Australia
[1] Contact: mark.taylor@mq.edu.au; +61 422 940 916

Overview

New Caledonia, located in the South Pacific (**Figure 1**), Ni deposits account for ~ 8.2% of the world's production of mined Ni, with a major Ni smelting facility (owned by SLN) located in the country's capital city of Nouméa (population 100,000). There has been virtually no research investigating the impact of anthropogenic trace element contamination of Noumea's natural and human environments. Nickel and Cr were contaminants of concern as they are associated with smelter operations.

Our study aimed to complete two primary tasks: (a) assess the impact of smelting emissions on top soils, deposited dusts, residential garden soils, indoor vacuum dusts benchmarked against natural rock and deep soil values; (b) assess whether the popular local practice of keeping honey bees and honey production were potential effective proxies for the measurement of environmental contamination (**Figure 2**).

Figure 1. New Caledonia, ~ 2000 km northwest of Sydney, Australia.

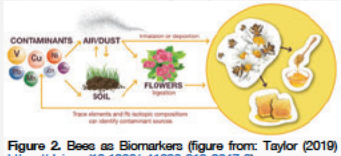


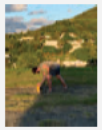
Figure 2. Bees as Biomarkers (figure from: Taylor (2019) https://doi.org/10.1038/s41893-019-0247-9)

Methods and approach

Sampling - was conducted mainly in July 2019 with pilot sampling in April 2019 and additional collection of dead honey bees in November 2019.

Rocks, soils, household vacuum dusts

Analytical techniques used to measure trace elements: Olympus Vanta portable XRF (pXRF) for *in situ* soil sampling (3 analyses per site; 92 sites = 276 analyses); ICPMS for Pb isotopes, CrVI in wipes and smelter slags. Vacuum dust samples were sieved to 250 µm before analysis.



Dust wipes

Surface dust collected from plastic bin surfaces (n=121) using a standard method (ASTM E-1728-03). Values transformed to µg/m². Wipes measured using pXRF (ppm) with values 'corrected' from a subset of 56 wipes analysed using ICPMS.

Wipes placed in mylar coin holder; pXRF analysed *4 / per wipe; mean value used.

Honey bees and honey

Dead bees were collected weekly and honey and live bees collected once during July 2019 from 15 hives across Noumea, including two control 'rural'/non-smelter impacted hives. Live bees were collected from inside the hives and dead bees collected outside the same hive. Samples were subject to trace element analysis using ICPMS.
NB – importing samples to Australia was costly and time consuming!

Dead bee collection

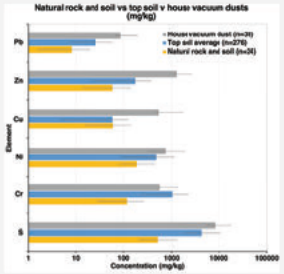
Honey samples

Live bee samples

Results – soils and dusts

City sampling

Sampling targeted an area ~ 4 km from the smelter. Dust trace metals (especially Cr and Ni) were generally more elevated close to the smelter and in the prevailing wind direction to the west/northwest.



Anthropogenic contamination

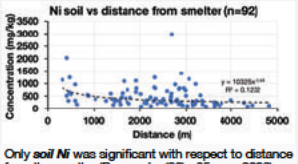
The data show that many trace elements are elevated vs natural background values, with concentrations increasing inside homes.

Scorrie (slag) from the smelter is found across the city: garden / school soils, road fill, grass verges, paths, public / sports areas.

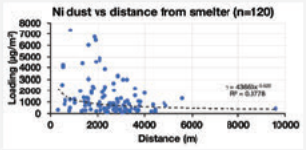
The slag contains ~ 2% Cr according to SLN information. Slag samples (n=4) were analysed for CrVI – returned maximum of 3.8 mg/kg; max dust wipe CrVI (n=10) was 20 µg/m². Total Ni in the slag ranged from 510-980 mg/kg; Pb < 1 mg/kg.

City wide data

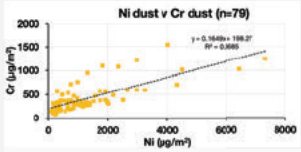
Spatial data were further explored for inter-relationships and relevance with respect to the smelter, the city's primary industry. Statistics calculated using https://www.socscistatistics.com.



Only ***soil Ni*** was significant with respect to distance from the smelter (Pearson's $r(92)=.35$, $p = .0006$).

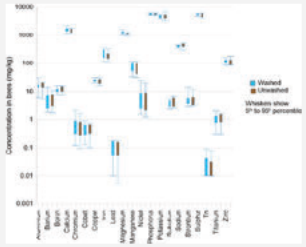


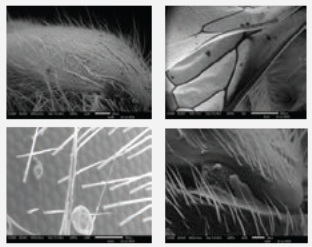
Only ***dust Ni*** was significant with respect to distance from the smelter (Pearson's $r(120)=.28$, $p = .002$).

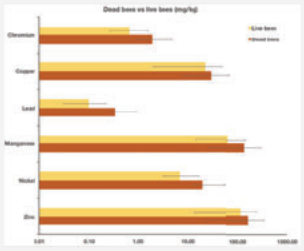


Ni and Cr is dust significantly associated (Pearson's $r(79)=.24 = p = .034$).

Results – bees and honey (1)







Contaminants on the bee or in the bee?

We wanted to know if the contamination was accumulating *on* or *in* the bees. To test this, where there were enough bees from hives we split the samples and used a standardised washing process with MilliQ on one half. The results show they were not significantly different (non-parametric significance test, $p > .05$. Therefore we concluded that the contaminants must be *in* the bee.

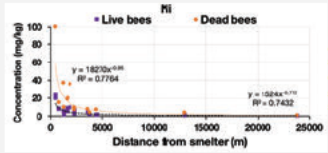
SEM image of a bee exterior

We used SEM image analysis at the University of New Caledonia to see if contaminated particles were present on the surface of an unwashed dead bee collected close to the smelter. We were unable able to identify any inorganic trace metal contaminants on the bee exterior. This work is progressing to examine the interior of the bees.

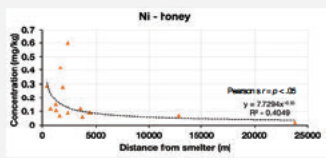
Do the bees accumulate metals with age?

We compared trace element concentrations in dead bees (life span 2-4 weeks when active) to lives bees from 14 different hives. Except for Cu, all trace elements were significantly greater in dead bee samples $p < 0.01$ (Wilcoxon Signed-Rank Test). This confirms previous research by Zhou, Taylor et al. (2018, *ES&T*, DOI: 10.1021/acs.est.7b04084) on Sydney bees but using a much larger dataset.

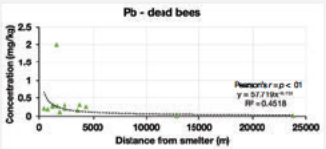
Results – bees and honey (2)



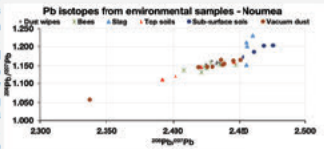
Live (n=15) and dead bees (n=14) Ni concentrations had the strongest association to distance from the smelter, indicating both sample types are useful biomarkers. Both Pearson's $r = p < 0.01$.



Honeys (n=15) had low trace metal concentrations: <0.05 mg/kg of Cr and <0.01 mg/kg of Pb. Ni in honey was present but at much lower levels than in dead bees (x̄ 134 times more) or live bees (x̄ 39 times more) (n=14).



The global anthropogenic contaminant Pb was present at low levels in dead bees. Concentrations declined with distance from the city area (n=14). Low concentrations in slag suggests Pb may have a different source e.g. former leaded gasoline emissions.



Lead isotopes were used to identify the likely source(s) of Pb in Noumea. Values for bees, dust wipes, top soils and vacuum dust overlapped and appear distinct to natural sub-soils and smelter slag.

Summary/conclusions

- There are clear anthropogenic trace element contaminant signatures associated with the smelter in Noumea.
- Levels of Ni and Cr are significantly elevated in soils and household dusts relative to Noumea's natural rock and soil values as well as those measured in nearby Australia, where Ni ore and processing is not dominant.
- Australian mean total Cr and Ni concentrations (> 15,000 samples) are 43 mg/kg and 13 mg/kg (data for Australian and New Caledonia available at: www.mainpveryironment.com).
- Contamination is accumulating in the bees but not on the bees, which appear to act as a filter preventing contamination of honey. The data shows that dead bees are significantly more contaminated than lives bees suggesting they accumulate contaminants as they age and spend more time foraging outside of the hive.
- Both live and dead bees appear more suitable for biomonitoring than honey. This is because trace element levels are higher in the bees than honey; they can be sampled more regularly and easily and are a more complete proxy for exposures in the environment over specific (and shorter) time periods.

Media activity associated with this research

- Australian Radio (Pacific region): https://www.abc.net.au/radio-australia/programs/pacificbeatnz/new-caledonia-bees/11378972
- New Caledonia Television (in French): https://la1ere.francetvinfo.fr/nouvelle-caledonie/abeilles-secret-a-lee-nos-meilleurs-indicateurs-pollution-atmospherique-733764.html

Acknowledgements: University of New Caledonia, Institute of Exact and Applied Sciences (Dr Peggy Gunkel-Grillon; Monika Le Mestre, Dr Aurelie Monnin); ADECAL, New Caledonia (Drs Margot Camion and Romain Gueyte; beekeepers in Noumea; National Measurement Institute, North Ryde, Sydney; Macquarie University for sabbatical funding.

Related research research on bees and honey as biomarkers

Smith, K.E. et al. 2019. Honey as a biomon tor for a changing world. *Nature Sustainabi lity*, 2, 223-232. https://doi.org/10.1038/s41893-019-0243-0
Taylor, M.P. 2019. Bees as Biomarkers. *Nature Sustainab lity*, 2, 169-170. https://doi.org/10.1038/s41893-019-0247-9
Zhou, X., Taylor, M.P., Davies, P.J. 2018. Tracing natural and industrial contamination and lead isotopic compositions in an Australian native bee species. *Environmental Pollution*, 242, 54-62.
Zhou, X., Taylor, M.P., et al. 2018. Identifying sources of environmental contamination in European honey bees (*Apis mellifera*) using trace elements and lead isotopic compositions. *Environmental Science & Technology*, 52 (3), 991–1001.