Technical note 001 (Addendum to BDEC submission 554)

The Fingerboard's IAC Enquiry is aware that the Bendigo and District environment Council (BDEC Inc.) has long been interested in Domestic Water Tank contamination from mining in rural farming regions which **do not** have access to a reticulated water supply.

In BDEC Inc.'s Zoom Presentation before the Panel May 20, Dr Simon Perrin (myself) highlighted the issues of Lead and Antimomy contamination in Costerfield water tanks and Arsenic contamination in Woodvale water tanks both related to mining and failed regulation both before and after the recognition of that contamination. These are areas without access to a reticulated water supply.

In submission 554 on pages 20 & 21 the BDEC Inc's Submission. drew the Panel's attention to Plate 8 on Page 104 within EEES Document 38, Katestone, Appx009. Plate 8 described dust deposition rates by use of contours in Year 5 of the operation phase. The calculations on pages 20 & 21 estimated the amount of Uranium and Thorium entering a 30,000L domestic tank from a 200 m2 rooftop to be 5 mgs and 24mgs respectively over a 12 month period. Calculating backwards that gives a Uranium deposition rate of 0.06ugm/m2/day. Compare this to Tabled Document 501 (Technical Note 019)'s maximum Uranium deposition rate of 3.8ugms/m2/day.

This is 63 times BDEC's original determination.

It is also worth noting that Uranium and its daughter progeny are known to be largely water soluble as is Thorium's daughter progeny. I have deliberately excluded gaseous progeny from the ionising dose mentioned toward below.

3.8ugms/m2/day X 200 m2 (rooftop) X 365 days = 227,000 ugms. 227,000 (!) ugms into 30,000 litre tank gives a concentration of approx. 9.2ugms/L Uranium. Using a factor of 4 to estimate Thorium deposition, the Thorium concentration in the water tank will be close to 37 ugms/L.
Thorium itself is poorly absorbed but not necessarily its progeny.
After 2 years the concentration of Uranium in that tank will be approaching 18 ugms per Litre.

From page 1011 of the Australian Drinking Water Guidelines 2011, updated March 2021 "**The guideline value for uranium in drinking water of 0.015 mg/L was set from chemical toxicity data".** ie. radioactivity dose was ignored.

Accepting only water soluble progeny of Uranium and Thorium a 70 kg adult male consuming 3 litres a day will be receive <u>internally</u> 0.6 mSv per annum Thorium and Uranium in secular equilibrium with their progeny.

NB. 0.015mg/L = 15ugm/L

It should now be clear why BDEC requested full details of inputs used in TN019 calculations deriving Uranium deposition. The full derivation of all inputs were not forthcoming in the Proponent's subsequent response.

So this addendum is forwarded pending more accurate information from the Proponent. It is a complex situation and any further information supplied by the Proponent should receive independent verification sourced outside Victoria and with no connections to Mining Industry.

Having drawn the Proponents attention to this figure of 3.8 ugms/m2/day of Uranium deposition it was not retracted so must stand as a correct iteration.

I would now draw the Readers attention to the Australian Drinking Water Guidelines (ADWG). Quoting directly From page 1021 ADWG (Mar'21)

"where:
• ***0.1 mSv/year*** is the committed effective dose limit for an individual radionuclide. This is set at approximately a twentieth of the average background radiation dose from all sources (UNSCEAR 2000)
• 730 L/year is the estimated maximum amount of water consumed by an adult (2 L/day x 365 days).
• 4.5 x 10^{-5} mSv/Bq is the committed effective dose received per unit intake of uranium-238 activity (Bq) (International Commission on Radiological Protection -ICRP- 1996)."

ADWG'21 goes on:-

"iii) Comparing the chemical and radiological data:
A 238U activity concentration of 3.0 Bq/L is equivalent to a chemical concentration of natural uranium of 0.24 mg/L. (ie. 3.0 Bq/L = 240ugm/l) This is considerably greater than the guideline of 0.015 mg/L derived from the chemical toxicity data. The guideline value derived from chemical toxicity data is therefore also protective of radiological effects."……. End Quote.

Note **0.015 mg/L = 15ugms / L and is the ADWG standard to be met. After 2 years dust deposition 15 ugms/L is <u>most likely</u> to be exceeded in nearby tanks.** This exceedence does not include the synergistic effects of other toxic metals highlighted in Mr Helps Presentation.

This 15ugm /L is well above with the ATSDR <u>sub chronic</u> Tolerable Daily Intake (TDI) (otherwise known as Oral "TRVo") for Uranium. That value is 0.0002 **mg** / kg /day or **0.2 ugms /kg /day.**

A 2 litre water consumption per day with 15ugms/L Uranium would give a 70kg person a 30ugms per day intake or 0.4ugms /kg /day. Twice the ATSDR Minimum Risk Level. Once again Australian Regulator's standards fall short of world Best Practice. Nearby landowner water tanks are unlikely to even remain within the lower ADWG standards. Calculated using Kalbar's own data.

I would also note Tabled Document 501, Table 2 on page 8, misquotes this ATSDR figure by quoting the **Acute** Dose TDI of 0.002mg / kg / day or 2ugm / kg /day. A ten fold difference compared to the more appropriate Sub-chronic dose.

Maximum Uranium deposition is stated in Tabled Document 501 TN019 to .be 3.8 gums /m2 /day. This figure has embedded assumptions that underestimate dust and nuclide load.

There are multiple technical and calculation errors on Katestone estimations of dust emissions. Suggesting the 3.8 ugms /m2 /day figure is a significant underestimation of dust, Uranium and Thorium deposition. I shall list some of those deficiencies below;-

i) The Average Uranium concentration in overburden is 4.4 mg/kg (4.36 to be precise, Katestone p130 Appx009.).

ii) This is the average for each soil section (subsoil, sandy clay, sandy gravel, sand, upper sands). This "averaging" fails to consider the fact that Upper Sands will contribute ~ 40% by volume to the overburden.(14.7 m to 23.8 m or 9.1m of the 23metres of Overburden ~39.5%). If the WEIGHTED average of each. layer to the total overburden is considered the resulting Uranium concentration is 4.7 mg/kg….a 7% underestimate.

iii) By extrapolation this will raise the "maximum Uranium deposition rate to **4.2 ugm/m2/day**.

Additionally:-

iv) It is assumed there is NO dust contribution from **Fine tailings** with a Uranium content of 13mg/kg and Thorium content of 60mg/kg (see. Appx 002 pg 33, Table 7). Apparently, no dust from this source will occur because they will be constantly wetted as per level 1 dust suppression

v) This level of suppression requires 2 litres / m2 / hr. Others have calculated this alone will have an annual requirement of 3 GL just for water suppression of the exposed fine tailings in active mine voids.

vi) Table 15, page 41, EES Document 38, Katestone, Appx009, demonstrates **90%** of **<** PM10 arises from **wind erosion** during development phase. However there is **only one** mitigation technique available for wind erosion viz. water suppression(!) gain at 2L / m2 / hr. I believe this is an NPI recommendation for the coal (!) industry.

vii) It is also assumed there will be no dust from HMC loading (HMC contains Uranium at 250mg/kg and Thorium at 1600mg/kg - (ref. Mr. Morris 15/7/21 IAC hearing). There will be no HMC dust as it is all > 40um particles.(see. Table 18, page 45, EES Document 38, Katestone, Appx 009). However,that same Table 18 suggests 5.5.% of PM10 dust will arise from HMC during haulage.

viii) Thorium is consistently 4 times the Uranium concentration. in nearly all analytic samples presented. Whatever Uranium contamination is present on a weight basis, the Thorium contamination can safely be assumed to be at least four times that value by weight.

ix) Katestone have assumed, without clear explanation, that 50% of all dust, once mining has commenced, will arise from offsite sources effectively halving the concentrations of heavy metals and radionuclides. That dilution occurs because of what appears to be an estimate that "pre-mining" offsite dust sources will persist.

x) From Table 18, page 45, Document 38, Katestone, Appx009 one gleans that **37.5% of all ≤ PM10** dust arising from mine site will be from **overburden** and **5.5% of ≤ PM10** dust will arise from Ore and/or HMC which contain Uranium at 60 mg/kg and 250mg/kg respectively).

xi) Hence the maximum Uranium concentration by deposition at any Receptor may in actual fact be significantly above the stated level of 3.8ugms/kg/day as per Tabled Document 501(Technical Note 019)

xii) It seems highly unlikely that ALL the mitigating assumptions used in Katestone's dust estimations will be successfully applied at any one time.

xiii) Should any combination of mitigation failure occur then the above tank contamination estimates could readily exceed the ADWG levels for Uranium within one year. The Uranium in combination with its daughter progeny, plus Thorium with its progeny, could achieve one third of the annual background ionising dose by ingestion alone.

Having explained above why 3.8 ugm / m2 / day is likely a substantial underestimate of Uranium deposition. and how radionuclides in water tanks close to the mine site will likely exceed safety limits for adult males let alone Women and Children. BDEC submits this addendum in good faith using available data pending more accurate information on which to base a more complete response to a likely significant health impact of this mine.

Yours Sincerely,

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