Supplementary Centrifuge Submission by Dr Joanna McCubbin 26 / 03 / 2021.

(Original Submission 752)

Key concerns:
How does the use of centrifuges

1. Alter dust
2. Alter water
3. Alter radiation partitioning between waste streams
4. Alter metal and other sand constituents in various streams -polyacrylamide, etc.
5. Alter electricity use and greenhouse gas emissions

1. DUST

Kalbar's data suggests that replacement of the tailings dam with centrifuges will increase the $PM_{2.5}$ significantly. These very fine particles, $PM_{2.5}$ are the most dangerous to human health because they get right down into the lungs and enter the blood stream. This mining process needs to protect its workers and local people, their stock and also local wildlife from this hazard.

2. WATER

The liquid stream leaving the centrifuge is recycled but may harbour a new range of contaminants. In extremely wet conditions such as do happen in this area, this may release these new elements to the environment, but I found it extremely difficult to figure out what went where. The scarcity of water which led to the change to centrifuges, suggests that every effort to recycle will be attempted, but will it also concentrate noxious elements, either in water or the "cake" streams over time? Insufficient data is provided!

3. RADIATION

Centrifuges add a new layer of potential radioactive contamination or waste. If the original plan is to keep the radioactive elements in the concentrate to be shipped out each day, then it is not clear how much remains in the waste stores to be sent through the centrifuges.

The nature of radioactive decay is that unstable (radioactive elements) emit electrons, protons and energy and decompose into lighter elements. As they decay they scatter electrons in all directions. This can dislodge nuclear particles and electrons from other elements rendering them radioactive, and so on. Hence, depending on the other constituents of the various streams of concentrate and waste, new radioactive elements may be formed. In essence you can't dilute radiation in the same way as you can dilute a stable measured quantity of an element, because it keeps changing (Shifting sands so to speak)!!

If there is more handling of different streams in centrifuging, then stacking and subsequently burying the resultant cake on a daily basis, we need to know how much more, or less, alpha and beta decay will present hazards to the workforce, and how much gamma radiation may be released which may travel further.

Is the waste technically TeNORM (Technologically enhanced Naturally Occurring Nuclear Material)? If so, ARPANSA stipulated that ESSO's NORM waste from oily sludges needed to be handled by solidifying with concrete, and burial in engineered pits, lined with specialised heavy duty plastic liners and with 1 m of clay below the waste and above the water table, and another 1 m of clay above the NORM waste. Scooping it into the pit and hoping for the best, hardly seems to measure up. This is important because sandy soils are porous and water can very easily infiltrate and carry contaminants to unacceptable places.

According to the Expert Witness statement by Mr Darren Billingsley regarding the need for placarding of transported HMC.

"Monazite is a rare earth mineral containing 5-7% thorium and can have an activity concentration of 200-300 Bq/g (RAR, Table 9). From a radiation protection perspective, it is the mineral of most interest in the mineral sands industry, capable of delivering the highest radiation dose if present in these concentrations. However, on the Fingerboards Project monazite it is not being separated from the HMC and will not be concentrated, with total activity concentrations remaining less than 10 Bq/g."

This makes no sense. If some other constituents are removed during processing, then the relative concentration of monazite must be increased. The actual dose of radiation from that aliquot of raw material, will be the same, however the volume of material will be less, allowing more of the HMC to be added to the load, increasing the overall content of monazite per load of the concentrate. If I am correct, they are being a little disingenuous.

4. SAND and MINERAL WASTE STREAMS

It is not clear from the information provided, how the use of centrifuges will alter the chemical and particle size of waste solids. It should be noted that East Gippsland suffered an East Coast Low this past week, with rainfall in excess of 100mm in some areas. If this fell on stockpiled centrifuge cake etc it is likely that significant loss of chemical and particulate material would occur. This could enter water for reuse, or dry into dust that spreads with the extraordinary winds experienced, before, during and after this recent weather event. Initially, for days and nights on end, from the east, the wind eventually turned to the NW and then the SW, having a drying effect on surfaces, and potentially spreading dusts of un-known but potentially toxic content.

East coast lows are generally also warm as well as wet which may provide the perfect environment for breakdown of polyacrylaminde to acrylamide which is a known human/animal toxin. The throw away line that polyacrylamide must be safe because it is used in drinking water, is breathtakingly negligent of the chemistry involved, and provides no attempt to assess health risk. It should be noted that many substances are beneficial in an appropriate dose and hazardous in different doses. For example, Iron tablets are commonly extremely beneficial medication in a person who is anaemic, but may produce seizures and death if accidentally consumed to excess, by a small child who thinks the lovely red tablets are lollies. Similarly, rotten-egg gas or Hydrogen sulphide is of nuisance value when you can smell it, but deadly when you can no longer smell it at higher concentrations in a confined space.

The absence of hard data provided, makes it impossible to tell what chemical or radioactive constituents may form part of the dust blown offsite.

5. GREENHOUSE GASES

The addition of centrifuges which spin large tonnages of wet residue will chew through an enormous amount of electricity compared to the non-centrifuge option. Clearly the maths needs to be re-done since the energy used will lead to a lot more fossil fuel burning, particularly if the centrifuges are used at night, when wind and solar are inactive.

Locals claim that even using the one Centrifuge employed by East Gippsland Water, places a strain on the grid leading to flickering lights or brief blackouts locally. This power is accessed by irrigators as well. It is evident that the grid already struggles to provide sufficient power, so significant provision will be needed by the energy provider to accommodate the needs of all local users who currently access their power at the same point where Kalbar would connect into the high voltage power line. It needs to be tested whether the grid can cope with the very high power drawn to power all the centrifuges.

It is disturbing that no clear data is provided about the likely huge increase in power required to utilise centrifuges. If this it provided from fossil fuelled electricity generation, it will mark a

significant escalation in Victoria's and Australia's greenhouse gas emissions, at a time when it is critically important that we all do our bit to limit use of our tiny, remaining greenhouse gas budget.

CONCLUSION

In summary, the addition of centrifuges may be a significant improvement but the lack of hard data, makes it almost impossible to judge this adequately. I believe all this material will need to be required to be produced by the time Kalbar is cross examined. If approved the centrifuge option will obviously be vastly more expensive, throwing into question the viability of the operation. The last thing we all need is a big hole in the ground and a company that walks away, leaving the taxpayer to pick up the pieces. In particular it is essential that local people and the Gippsland environment are not left with a festering and potentially toxic wound, leaking harm into the catchment.