Fingerboards EES Hearing 7 June 2021

Submitter 423 – Nick Barton

My background: I worked for 33 years for the Victorian Department of Agriculture or one of its many aliases, most of that time as a scientist. I have considerable laboratory and research experience, having authored over 30 publications in peer reviewed journals or scientific conferences. However, my expertise is in animal sciences, not mining. I hold a Master's Degree in Agricultural Science. I am currently farming on the Mitchell River at Hillside, downstream of the proposed mine

I have not had the luxury of being able to listen to all presentations at the IAC hearings, so if I raise points which have already been dealt with I apologise in advance.

Let us look at the proponent.

Kalbar Operations Pty Ltd has spent $11.7 million during the 2019 and 2020 financial years, with almost no source of revenue. (ASIC document 7EBC03377) Its survival is totally dependent on the continued financial backing of overseas shareholder Appian Capital. Hence attention grabbing statements such as "*the Glenaladale deposit is one of the largest mineral sands deposits in the world, with a JORC (Joint Ore Reserves Committee) resource of 2.7 billion tonnes of heavy mineral*". (https://gateway.icn.org.au/project/3944/kalbar-fingerboards-mineral-sands-project) are intended to keep shareholders optimistic

This sounds impressive but is largely irrelevant to the Kalbar proposal which is to extract 170 million tonnes of ore to produce around 8 million tonnes of heavy mineral concentrate (HMC) over 15 years.

Similarly, Kalbar have made statements such as

"*EBITDA (Earnings Before Interest, Tax, Depreciation and Amortization) of A$1.5 billion over the LOM (Life of Mine).*"

"*IRR (Internal Rate of Return) of 80%*"

"*Average Revenue to Cash Cost Ratio (R:C)of >2*"

"*Pay back on the development capital of $106M of only 1.5 years*"

Admittedly, these projections do come with a multitude of disclaimers many of which are likely to prove to be correct.

Kalbar, who purchased the lease from Rio Tinto in 2013 claimed that Rio had overlooked the high-grade shallow mineralization on which Kalbar are focussing. They also claimed that Rio's focus was primarily TiO_2, not zircon.

https://www.businesses.com.au/Analysts-Presentation-May-2017-for-website.pdf

This latter statement is demonstrably untrue.

Rio Tinto Exploration (RTX), the original tenement holder over the Glenaladale Mineral deposit decided to divest the project on the basis that it was unlikely to meet the minimum criteria for a Rio Tinto mining project (Bishop 2013). Oresome Australia Ptd Ltd, a wholly owned subsidiary of Metallica Minerals Ltd entered into a "*Right to Explore and Option to Purchase Agreement*" with RTX in August 2011. After a Scoping Study Report prepared on their behalf by RJ Robbins and Associates they also decided not to proceed with the purchase of the rights to the tenement.

Key findings from Robbins were that:

The mine would cost $271 million to establish (2012 costs) (compared with Kalbar's estimate of $106M)

It would cost $80 million per year to operate exclusive of royalties and taxes

It would require 4.6GL, and potentially up to 6.2GL per year to operate. This did not include water for dust suppression.

Although they would still be saleable, chromium and magnesium content would downgrade most titanium products, causing price reductions in the vicinity of 30%

Uranium and thorium content would cause the downgrade of zircon produced, potentially by up to 20%. (It is instructive that Professor Mudd, Prehearing document 84, demonstrated that the uranium levels in the fingerboards ore were of similar magnitude to that of commercial uranium mines)

Although Kalbar's analyses have confirmed the presence of chromium, uranium and thorium they have not attempted to refute the statement that their presence could lead to downgrading of the product.

Unlike other significant zircon resources in Victoria in areas such as the WIM Avonbank resource near Horsham (WIM Resources 2020) (http://www.wimresource.com.au/irm/content/overview.aspx?RID=311&RedirectCount=1), where the topography is flat and overburden shallow the Glenaladale resource is situated on a plateau, intersected with deep gullies and overlying numerous shallow and deeper groundwater systems, with a considerable depth of overburden. It overlooks the Lindenow flats, one of Victoria's premier vegetable growing areas. It is only 300 m from the Heritage Mitchell River, the largest unrestricted river in Victoria, the health of which is vital to the Ramsar Listed Gippsland Lakes. The climate is characterised both by extended dry periods and irregular very heavy rainfall events. This will necessitate complex engineering to attempt to prevent contaminated water, sediment or dust leaving the site, and poses a risk of contaminated water reaching the underlying groundwater. It is an unsuitable location for a large open cut mine.

The current situation is that we have viable farms on and around the site of the proposed mine, and a growing horticultural industry on the Lindenow flats and surrounds. Properties are locally owned. The horticultural industry in particular is a major industry, providing food and revenue to the state and elsewhere, produce for downstream processing, and significant local and downstream employment. There is a large seasonal workforce, which despite the contention of the expert for the proponent that they do not count as employees, are happy to receive their wages.

If the presence of the mine places this at risk the mine would be of detriment, rather than an asset to the state.

On an ethical basis, if the mine did in fact turn out to be profitable, most of the profits would accrue to shareholders living well away from the mine site, and in many cases overseas. All detrimental effects of the mine would be borne by those locals living in the vicinity. Drew, J Dollery, BE and Blackwell, BD (2021). A square deal? Mining costs, mining royalties and local government in New South Wales, Australia: *Resources Policy (in press)* demonstrated that whereas revenue from mining accrues to the states, local communities are often left to bear the costs, particularly where rehabilitation is neglected.

This extremely sensitive location means that if the mine is to proceed, authorities would have to have the highest confidence in the competence of the proponent to safely manage a multitude of challenges which have the potential to lead to disaster for the surrounding farms, the environment and the State if things go wrong.

Unfortunately, the EES process to date has given the opposite impression. Timelines given in the May 2017 presentation mentioned above forecast that mining would start in the third quarter of 2019, whereas the EES itself was nowhere near complete at that time. Despite the time taken to prepare the EES it was soon shown to be flawed, and multiple changes have been made “on the fly”, with little evidence that these will be practical. Obviously, the main change is the introduction of centrifuges in place of the tailings storage facility (TSF) which will be discussed later.

It is also concerning that multiple drafts of submissions prepared for the EES were reviewed by, and revised by Kalbar. For example Appendix A006, prepared by Coffee, went through 8 drafts, almost all reviewed by Kalbar, before being accepted. It is possible that not all points required for the EES were covered in early drafts, but it is also possible that risk assessments in the impact assessment (A006 table 8.9) were higher that Kalbar was comfortable with and had to be reduced. Without access to the early drafts the IAC will be unable to decide.

A bulk 10t sample of ore, stated to represent the first 7 years of mine life was collected from a 9t composite sample from 27 bore holes drilled in 2017 plus 1t from aircore drilling in 2016. It is not stated how these cores were mixed, or how the separation into fine tailings, (<38μm) coarse sand tailings and HMC was achieved. The EES work plan process flow diagram (Fig 5.1) shows spiral gravity separation of the heavy minerals from the coarse sand. It is assumed that this method of separation informed the EES analyses.

Despite the EES showing spirals, the Kalbar Directors' Report for the financial year ending 30/6/2019 (ASIC document No. 7EAQ64645) reported that the FLSmidth Reflux Classifier (RC) had been tested several times. "*Recent RC test work has demonstrated that higher recoveries at product specification can be achieved using a much simpler circuit requiring screening of the ore, a single stage of RC separation and screening of the final product.*

A 20t sample processed with the RC300 test unit at CSIRO Minerals in Brisbane, recently achieved very high recoveries of zircon and rare earths (>96%) and produced a high grade HMC of commercial grade which has now been shipped to China for DFS test work at Changsa Research Insitute (sic)of Mining and Metallurgy Co Ltd (("CRIIM")"

This report raises a number of questions.

If the RC was preferred over spirals by 2019 why were spirals still shown in the figure 5.1 of the EES work plan published in 2020? The corresponding figure in PD 197a shows a reflux classifier.

Why was no mention made of the results of CRIIM tests on this sample in either the EES or the 2020 Financial Report? (ASIC document 7EBC03377)? Were the results unlikely to impress the company's financial backers? This is a question the IAC should be asked to resolve.

Dust mitigation measures suggested by Welchman (PD 84) require the cessation of activities at times, followed by increased activity at others. This will require Kalbar to purchase additional machinery. And Kalbar's initial cost estimate makes no provision for a rehabilitation bond.

The complex engineering of water management dams has almost certainly been underestimated.

Hence the costs will be far higher than estimated.

On the revenue side, apart from their assumption that contaminates will not downgrade their products, Kalbar have assumed they will be able to work 24 hours per day, 365 days per year. They have apparently ignored the findings by GHD, (Preliminary Starter Pit Preliminary Geotechnical Investigation, EES Appendix A004.

"….soils of the haunted hills formation encountered on site were found to be dispersive"

"Construction with dispersive soils may present probable challenges"

"Dispersive soils can be difficult to compact as they lose strength rapidly at or above optimum moisture content"

"Dispersive soils are sensitive to water and highly erodible when exposed. Stormwater runoff from stockpiles and site is likely to have high turbidity. Discharges from temporary retention or settlement ponds are likely to have high suspended solids"

"If stormwater ponds and then infiltrates into exposed dispersive soils then tunnel erosion may be an issue, particularly if soils are poorly compacted"

"….the Coongulmerang Formation (mineral deposit) whose silty nature makes it particularly vulnerable to loss of strength on saturation. …saturation of the material by surface water including rainfall, drainage, perched water tables and such can make earthworks operation particularly difficult"

This also suggests that mining may have to cease during wet conditions, as equipment attempting to work on the mine floor could become bogged. Trafficking In such conditions would destroy the mine underfloor drains. Advancing the mine may also become impossible as working wet overburden becomes impracticable.

Thus the 24 hours/365 days per year looks ever more fanciful, and production targets are unlikely to be realised.

GHD (in 2015) "*suggested that a trial pit be excavated into this material to gauge performance of various plant and assist with planning of the mining operation*". Kalbar did not adopt this suggestion.

GHD also recommended that "*Earthworks be carried out in the dry months*"

This conflicts with the advice of Welchman (PD 84) to limit operations during dry conditions because of potential dust emissions.

Kalbar inadvertently gave a demonstration of the pitfalls of attempting to work on (undisturbed) wetted dispersive soils as illustrated by the photo below.

Scene at a farm on the site of the proposed fingerboards mine, 26 October 2020

Kalbar have claimed that their freshwater and process water dams will be sealed with clay. There will also be 19 temporary water management dams but it is unclear whether these are to be lined or will merely rely on compaction of the subsoil. (EMM 2020a, Appendix 006, Appendix A, Table 4.2). Some are to contain run-off from undisturbed ground, whilst others will contain water which has been in contact with ore or processed water. They have been designed to contain a maximum of 95mm run-off when empty. Kalbar have allowed for the possibility of up to 240 mm falling during an 'east coast low', (p3-25) so these dams will be unable to contain a rainfall event of anything near this magnitude. Up to 12 dams, with a capacity of 1440 ML will be operational at the peak activity of the mine (*Appendix 1 Kalbar Dams Capacity*,). They will rely on spillways to safely release water if capacity is exceeded (EMM 2020a p29) and have conceded that overtopping is possible, and that mine contact water may be released to the environment. The risk of dam failure in dams constructed for a limited life, height to spillway up to 24m, and embankment length up to 830m is also a possibility which cannot be discounted. It is conceded that these dams will leak. EMM (2020a)'s water balance model, (Appendix A006, Appendix A, Figures 8.1 to 8.3 and Figures C1 to C6) allows for up to 14 ML/year of seepage from mine contact water dams and 23 ML/year from undisturbed water dams. Should any of this leaking water find its way into the dispersive sodic clay subsoil the potential for dispersion and tunnelling is very high. A failure of one or more of these dams would lead to a sudden release of potentially contaminated water and sediment into a sensitive environment.

Centrifuges

The replacement of the tailings storage facility with centrifuges is conceded to raise the costs of the project. It is extremely improbable that 6 operating centrifuges will be sufficient to process the fine tailings. Figures provided by Kalbar to a supporter of MFG showed the percentage of particles below 38 microns in the 10 tonne bulk sample, taken to represent the first 7 years of mine life, was 28.24%, or 423tph at an ore processing rate of 1500tph. Technical Note 1 (PD 43) states that centrifuges would have a throughput rate of around 55 t/hr solids. So 8 operating centrifuges would be required for 423tph of fines. Ausenco (Submission 716 centrifuges) believed that centrifuges would be limited by water volume – at the 23% dilution for flocculants to work 423 tph would require 1418 m3 of water, requiring 18 centrifuges. Technical note 20 (Hearing document 327) priced 8 centrifuges at $30.2M, so 18 would cost $68M, a very significant rise on the original $106M establishment cost estimate. If Kalbar are correct in their estimate of fines of 21% this can only mean that the hydrocyclones do not remove all fine particles, so some must remain in the coarse tailings or HMC. This has implications for dust from these deposits.

The EES work plan had fine tailings going immediately to the TSF, while coarse tailings were placed in Perry Gully for the first four months, until space was available on the mine floor. There has been no indication of where the first four months of fine tailings are to be placed. However, if it is the Perry Gully that will lead to a substantial increase in materials deposited therein. Kalbar have given no indication of the capacity of the Perry Gully TSF – either as originally intended (with coarse tailings and overburden) or with the additional burden of fine tailings.

Wet Concentrator Plant

Apart from the reflux classifier and the centrifuges another difference between the original and modified work plans is in the screens of the WCP (figures 5.1). The original plan showed particles greater than 5mm and 2.5mm being screened and stacked, although their ultimate destination was not stated.

The modified plan shows an initial oversize 850µm screen, followed, after the primary cyclone by a 500µm. By way of comparison, flywire mesh has apertures around 1400µm and fine fuel mesh, designed to prevent water passing through with fuel, 350µm. Such screens may be feasible in a laboratory situation but one could imagine the immediate collapse of such screens when impacted by 150t of slurried solids per hour.

The modified work diagram Figure 5.1 (PD 197a) has the screened material going directly to the end product without further intervention. This diagram is hard to follow, as the figures in boxes, purported to show the proportion of solids and the cubic metres of water at each step of the process are sometimes inverted. None-the-less it appears that rather than the 4.7% HMC predicted, around double this amount will be shipped. This of course will double the shipping costs and increase the costs to the end processor, as further separation will be required. It will dilute the concentration of their valuable heavy minerals but also reduce the intensity, although not the total amount of radiation from their end product.

This modified work plan is flawed in other ways. 27% of the ore (405 t/hr) is shown leaving the cyclones for the thickener, together with 4228 m3 of water. This is 8.7 % w/w

Nalco (Appendix C, Prehearing document 130) undertook settling rate trials in the laboratory using a range of flocculants. They determined that Nalco 83384 was the most economical of the anionic polyacrylamide flocculants tried, giving a settling rate of 10m/hr at 130 g/t under ideal calm conditions. They added the proviso that it was very important to dilute the slurry as thickener feed to less than 3% w/w. It is clear that at 8.7% w/w the flocculent will be ineffective in removing the fines from the supernatant. Thus the thickener will not work as predicted. Almost 3 times the volume of water will be required.

Nalco had provided a conceptual thickener design in this document. They had feed solids entering at 8.1%. However, they added diluting water with the flocculant to the thickener to bring the solids to 3.6%. There is no such provision for additional water in the work plan.

All fines (27%, 405 tph) are shown leaving the thickener with 766 m3 water per hour, (35% w/w) bound for the centrifuges. Again, 35% solids are too thick for flocculants to work. Alfa Laval (Appendix B, Prehearing Document 130) confirmed that a 25% suspension (w:w) of slimes, with 340g/tonne solids of flocculant added, could be successfully concentrated to 70% solids in a bench top centrifuge. The addition of flocculant was essential for separation. An additional 450 m3 of water would need to be added to the fines slurry to dilute to 25%. This is not shown in the work plan.

The fines, at 70% solids, exit the centrifuge for rehabilitation. Inexplicably, 6% (90 tonnes) suddenly disappears.

This is in the revised work plan. Given that there still appear to be significant shortcomings one cannot have much confidence that further revisions will not be required before a practical plan is devised.

Flocculants

Flocculant use will be considerable. At 130g/t in the thickener and 370 g/t in the centrifuge (TN14, PD194, P3) this works out 500 g/t. At 55c for 130 g (Nalco 2013 price for their WATERSHED flocculant (PD 130 Appendix C,p10) this is $2.11 per tonne of ore for flocculant.

Technical note 20 (Hearing document 327) has budgeted 27c/tonne of ore for flocculant. It is unclear whether they are expecting an 87% discount in the price of their flocculant or whether they have miscalculated. The project will require 3.85

tonnes per day for 321 tonnes slimes/hr, (around 21% fines). This is 1400 tonnes per year which at the Nalco price comes to $6 million per year. Around $4.4 million is ascribed to flocculant used solely for the centrifuges.

It is also proposed to use additional flocculant for dust suppression on bare areas and coagulants and flocculants in the DAF. Other compounds are touted to reduce dust on roads. Chemicals will be a major budget item.

TN 14 (PD 194) states (correctly) that 370g flocculant/tonne x 321 tonnes solids per hour through the centrifuges comes to 118 kg/hour flocculant used. It follows that as the centrifuges will be running continuously this is 2.83 t flocculant /day or nearly 88 t over a 31 day month. Adding the 130 g/t needed for the thickener brings it to nearly 120 t/month for slimes processing. Bulk density of Nalco Optimer 83384 (PD 194 Appendix 2) is .72, which comes to 165 cu m/month.

TN14 (p3) states that a 50 cu m silo will hold enough flocculant for a month. This is clearly incorrect. At the rate proposed it wouldn't last 10 days.

(TN14, Appendix 3 is even worse. It is stated that 5 bags of flocculant would be enough for 10 days. This calculation appears to be based on flocculant for the thickener only. Bulka bags normally hold 1 tonne to allow handling by normal forklifts (this would be about 1.4 cu m). Counting flocculant for the centrifuges as well as the thickener, five bags would last just 31 hours. One can have very little confidence in documents which contain such glaring errors.

The potential biological hazard from the use of flocculant is completely glossed over. Nalco Optimer 83384, the preferred option, is a high molecular weight anionic polyacrylamide (PAM) which is considered non-toxic when intact. Anionic PAM compounds work by aggregating small solid particles into larger flocs which then readily come out of suspension. Hence size of the PAM molecule is important. Degradation of these molecules is incompletely understood, however "*it is well known that PAM can undergo degradation by a variety of mechanisms, significantly increasing its mobility and potentially leading to the release of acrylamide monomer, a known toxin and potential carcinogen"* (Xiong et al 2018, p3). PAM can degrade in the presence of iron and oxygen. The presence of nanoparticles caused a further reduction. (Xiong et al 2018 p4).

Iron, oxygen and TiO2 are present in abundance in the slimes slurry, raising the possibility that the flocculant could break down in the thickener, losing effectiveness and allowing a build-up of particulate matter in the recycled water.

Worse, mobile fragments of PAM, and acrylamide monomer could leach from the slime cake stockpiles during rain, or leach from the tailings placed in the mine void, and hence enter the ground or surface water.

These potential outcomes have not been considered by the proponent.

Water

I spent considerable time discussing water in my submission 423, in which I pointed out that 12 GL per year had been modelled to enter the TSF with the fine tailings, and that any under-estimate of the water recovered would result in a dramatic increase in the water requirement for the mine. This proved to be prophetic, as Kalbar subsequently realised that predicted recoveries would not be achieved, and hence introduced the concept of centrifuges.

Professor Webb (PD 190) theorised that the presence of spring fed dams may be explained by ancient dunal sands over part of the project area. GDH (Appendix A004) confirmed this in two of their drill holes. It may be possible that this also feeds the chain of ponds. However, it is certain that if the mine proceeds, destruction of these dams, and a significant portion of the catchment of the chain of ponds will ensue.

However, there have been numerous expert reports on water and I will add nothing further.

Dust

The contention that dust emissions from the mine site will be low is critical to Kalbar's radiation, health and horticultural impact reports.

However, there are strong grounds for believing that the figures provided by Katestone (Appendix A009, and Prehearing Document 84) are deeply flawed.

Katestone calculated emission factors for PM2.5, PM10 and Total Suspended Solids (TSP) for scraper on topsoil, bulldozing, grading and wheel generated dust, none of which took any account of wind speed. They used equations including wind speeds averaged over periods of 1 hour in equations derived from coal mining to determine emission factors from material handling and from stockpiles. Katestone have not explained how equations derived from coal mining are relevant to the situation at the fingerboards. They were criticized for this by ERM in the EES Peer Review.

Figures supplied to a supporter of MFG by Kalbar and incorporated into Table 4 of the Landloch report (Appendix A001) indicated that subsoil (0.2 -0.5m) contained 50% particles below 20µm, sandy clay (0.5 – 3.4m) 53%; much less in the sandy gravel to 8.6m, then 20% in the sands and 16% in the upper sands (14.7-23.8m). Their 10 t bulk ore sample contained 26.33% particles below 20µm and 1.91% between 20 and 38µm. (This makes 28.24% of their ore sample fine tailings, well in excess of that modelled when determining the numbers of centrifuges required) This table is appended as Appendix 2.

Such high proportions of potential dust size particles throughout the overburden casts severe doubt on the validity of using coal based emission factors when considering overburden removal. Emissions factors may well be significantly underestimated during dry conditions.

It is assumed that these emission factors were used in the AERMOD model which apparently uses meteorological data to predict the dispersion of particles – Katestone do not appear to have provided an intelligible guide to the factors considered by this model.

The results from this modelling appear surprising and counterintuitive.

This model apparently gave the highest concentration of particulates (PM10, PM2.5 at night under still conditions, which influenced the dust mitigation measures recommended by Katestone in PD84, Appendix C. (Cessation and then working at an increased speed during the day, which would obviously increase the requirement for machinery)

I am aware that spraying agricultural chemicals with fine droplets under still conditions is prohibited because the particles are not dispersed, and may drift as a cloud under light wind conditions to neighbouring properties where they may cause damage. I am far from convinced that these are the conditions operational in a sand mine. Humidity is higher at night, so I would have thought dust to be less of a problem.

I have assumed that wind speeds would be a major factor driving dispersion. The meteorological equipment installed at the fingerboards measures average wind speeds over 1 hourly intervals, whereas BoM data records instantaneous wind speeds and direction at specific times, together with the maximum wind speed and direction each day. This may at least partially explain the apparently lower wind speeds recorded at the fingerboards compared with the nearest BoM Stations.

Bureau of Meteorology (BoM) look to mention raised dust in forecasts when it has been dry for a lengthy period and they expect average winds of around 35+km/hr (which would generally mean wind gusts of around 55+ km/hr. (Steven McGibbony, Severe Weather Manager, BoM, email dated 2 October 2019). This is actually a higher average wind speed threshold than that recommended for the fingerboards of 25 km/hr (Welchman, January 2021, Draft Air Quality Management Plan, Appendix C, Prehearing Document 84).

It would appear from experience that it is these higher wind gusts which are instrumental in mobilising dust, including particles well in excess of 20μm. Anybody who has been on a sandy beach on a day of high winds will attest to this.

The potential for large bare areas to generate dust is well recognised. Agriculture Victoria (2018) promotes the use of stock containment areas to, among other purposes, “*reduce soil erosion or damage to paddocks during a drought or dry conditions”*

https://agriculture.vic.gov.au/_data/assets/pdf_file/0008/537578/Stock-containment-areas.pdf

Cropping paddocks are likewise prone to wind erosion.

Analysis of wind speeds recorded by the BoM at Bairnsdale for the 12 months from 1st October 2018 to 30th September 2019 revealed 66 days (roughly 1 day in 6) when maximum wind gusts exceeded the 55 km/hr threshold at which dust may be raised. (Appendix 3) Similar figures were derived from Mt Moornapa (approximately 15 km WNW of the fingerboards) by Dr S Perrin (submission 554) who found 65 days over a 12 month period when maximum wind gusts exceeded 50 km/hr. (Appendix 4) On 10 of the days at Bairnsdale peak wind gusts exceeded 75 km/hr (Appendix 3). Typically, the direction of the peak gusts was south-westerly, which would propel dust raised in the direction of the vegetable areas of the Lindenow flats. Although it cannot be concluded that the winds at Glenaladale are identical to those at Mt Moornapa or Bairnsdale airport, these strong winds are usually associated with cold fronts which have a widespread impact. This does cast doubt on the velocity of the winds recorded by Katestone. The mine site is elevated, and in the absence of screening the mine area will be subjected to strong winds.

It would appear that more realistic results may be obtained from the model if actual, rather than average wind speeds were used.

A third point of contention is that Katestone do not appear to consider that mine floor to be a potential source of particulate emissions. Tables for evaporation from East Sale are appended. (Appendices 5, 6, 7 and 8) These are consistent with the figures provided in the EES. These show that evaporation was consistently higher that rainfall in the summer months. There was an average of 5.6 days per year on which evaporation exceeded 10mm/day. Under such conditions the mine floor (and surrounds) would rapidly dry out, providing an additional source of dust with potentially high levels of contaminants.

Katestone (PD 84) still consider that the mitigation factors described in Appendix A009 of the EES will be required, together with additional measures described in Appendix C, PD 84.

It was immediately obvious that there would be insufficient water or equipment for the dust mitigation measures advocated in table 17, EES Appendix 9 to be effective.

These included the continuous use of water while scrapers are operating, the watering of transport routes, the necessity to keep dozer travel routes and materials moist, and the application of water and/ or suppressants during haulage and grading.

On p3-31 of the main report it is stated that “water trucks will routinely spray water onto exposed areas, roads and within the mine void to suppress fugitive dust created by mobile plant and equipment movements. An estimated 400 megalitres (ML) of water per year will be used for dust suppression.”

In the EES, EEM (2020a) Appendix 006, Appendix A p47, in their modelling of water requirements for the project, calculated that around 375ML/year is required solely for watering the haul roads. This leaves 25ML/year for water for dust suppression in all other situations. In the Main Report, Table 3.1 “Estimate of area of disturbance in project area at any point of time” gives 35 ha in the topsoil, strip, 23 ha in the overburden strip, 18 ha in the ore and mine void floor, 19 ha for tailing cells construction in the mine void and another 40 ha for topsoil and overburden placement. There are also large areas in the TSF and topsoil stockpiles.

Reading on, on page P 3-18, bottom paragraph we find that: “The selected mining layout is a series of cells approximately 300m wide by 1000 m long. The mine is expected to have two active mining voids of less than 60 ha each at any one time, with an area of 10 ha within each void being used for tailings”. This indicates that in fact the area of the mine floor will be in the vicinity of 120 ha

EEM (2020a) p47 allowed 3 mm/day in excess of evaporation for the fact that water output cannot be so precise as to exactly match evaporation. Including this factor, on days of evaporation ranging from 5-10 mm, 1ML would cover from 12.5 to 7.7 ha. If this was sprayed over just the 60 ha of active exposed mine floor, the 25ML would last between 3 and 5 days. Kalbar are proposing to purchase 2 water trucks to suppress dust both on haul roads and disturbed areas. These are to be either 45000L or 75000L capacity. These would require 22 or 13 trips respectively to put out 1ML, with associated filling and spraying times. It is obviously completely absurd to suggest that they could be used for widespread dust mitigation. It therefore follows that the dust mitigation factors essential to Katestone’s conclusions that dust emissions will be acceptable cannot be met.

Since the EES was published many of these fallacies have been recognised. The proposal for the TSF has been abandoned, and haul roads may be paved or treated with dust suppressants. Stockpiles may be treated with dust suppressants while vegetation is establishing. The use of scrapers has been discarded in favour of truck and shovel. Obviously these methods will reduce the need for water, although some will be needed to mix with suppressants and water trucks will be required to spread this.

Suppressants cannot be used where active work on shifting topsoil, stripping overburden, dumping in the mine void, levelling, and all other earthmoving activities are in progress. As mentioned above, there will be insufficient water trucks or water to suppress dust in hot windy conditions. Conversely, in wet conditions, operations on disturbed, dispersible soils may become impossible.

Additional dust avoidance measures advocated in Appendix C, PD 84 include adjusting mining activities in response to forecast weather conditions, and slowing or ceasing activities if real-time monitoring indicates allowable emission standards are being breached, a little like tying the bag after the cat has jumped out. Triggers creating concern (Table 8) are: measured or forecast winds > 25km/hr, or: forecast of light winds (< 2m/s) for more than 18 hours over the next 24 hours. Incidentally, an interesting inconsistency of units in the same table.

Should these standards be adhered to there would probably be a lot of down time on the site, making achievement of production forecasts problematical.

Dust exceedances during mining are extremely common e.g. Moranbah, Queensland (ABC 2019) (https://www.abc.net.au/news/2019-08-26/elevated-dust-levels) and Newman, Western Australia where emissions exceeded allowable levels on 45 occasions during a 12 month period.(ABC 2020) (https://www.abc.net.au/news/2020-10-12/dust-levels-bhp-newman-iron-ore-mine-exceed-licence-limit/12732272). This has not resulted in cessation of mining activities.

Similarly, if the Fingerboard Mine is approved, and dust emissions exceed predictions, the community will be forced to endure the consequences. The ore and tailings have elevated concentrations of a number of toxic or radioactive metals including vanadium, thorium and uranium compared with existing topsoils.

References

RJ Robbins and Associates, pp 44-45 in Bishop, SR (2013) Geological Survey of Victoria Report No 29569.

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