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Darren Wong
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21 April 2021

Dear Darren

Subject: Fingerboards Mineral Sands Project Inquiry and Advisory Committee (IAC) Supplementary submission of East Gippsland Shire Council (Submitter 716 – Supplementary Submission – Centrifuges)

Ausenco Review of Centrifuges for Tailings Dewatering, 29 March 2021

At the request of Planology, Acting for the East Gippsland Shire Council, Ausenco prepared a review of centrifuges for tailings dewatering, submitted to Planology on 29 March 2021 (Ausenco Review).

The purpose of this letter is to clarify that:

1) Planology's cover letter prefacing the submission of the Ausenco Review to the IAC (Submitter 716), dated 30 March 2021 does not accurately represent the findings and contents of the Ausenco Review by concluding that further work, as recommended by Ausenco to validate technical risks, denotes a material deficiency in the scope of the project.

2) Some of the recommendations for further work outlined in the Ausenco Review of 29 March 2021 have been addressed in workplans and updated submissions that are relevant but were not assessed in the review dated 29 March 2021. In particular, there are nine relevant documents (listed subsequently) including the updated draft work plan, updated risk management plans and technical notes that affect the findings in the Ausenco Review, particularly with regard to further work.

This letter clarifies Ausenco's technical position as described in the Ausenco Review of 29 March 2021 and appends an addendum to reflect additional reviewed documents.

Planology Cover Letter

In Planology's cover letter to the IAC, dated 30 March 2021 (Submitter 716), Planology stated that "The Ausenco Review identifies respects in which information provided by the Proponent in relation to the use of centrifuges as a component part of the Project is materially deficient". And "In that context, the deficiencies identified in the Ausenco Review in respect of the centrifuge proposal independently and together mean that:

a) it is not possible for parties to understand or interrogate precisely what the Project will comprise and entail

b) it is not possible for the IAC to:

i) consider or report on the environmental effects of the project, or their significance and acceptability;

ii) identify any measures which may be necessary, or which could be effective, to avoid, mitigate or manage environmental effects of the Project, including any necessary modifications to the Project;

c) ultimately, it is not possible for the Minister (or other decision makers) to assess the environmental effects of the Project."

With respect to Ausenco's technical position on these matters, the Ausenco review highlighted that there are some technical risks that require further work to validate, summarised as follows:

a) The centrifuge sizing, performance and materials characterisation should be validated/confirmed:

i) supported by additional centrifuge testwork (considering variability)

ii) confirming ultrafines recirculation within the process

b) The design for co-storage of fine and coarse material should be confirmed

c) The water balance based on the above should be confirmed

Ausenco did not conclude that;

- The project scope as outlined is materially deficient
- managing technical risks (as a usual part of any project development) will result in a material change to the project or change the environmental effects from that which has been outlined

In the interests of a fair technical representation of the review, Ausenco requests that the cover letter be amended.

Amended Ausenco Review

The following information was not included in the Ausenco Review but directly impacts the findings and recommended further work:

- Kalbar – Technical Note 02 (TN 002) – Expert recommendation (Part 2.1, Questions 1 and 2) – RFI Response, 8 February 2021, Doc Ref 109
- Kalbar – Updated Project Description (Chapter 3 of the EES) – Tracked Changes (Direction 59), 8 February 2021, Doc Ref 122
- Supplementary Expert Witness Statement – Jarrah Muller – Water balance (Direction 59), 8 February 2021, Doc Ref 132
- Kalbar – Technical Note 13 (TN 013) – Additional expert recommendations (Part 2.1, Question 2) – RFI Response, 12 March 2021, Doc Ref 192
- Kalbar – Technical Note 14 (TN 014) – Exhibit 1 – Additional centrifuge test work – 2nd RFI Response (Direction 29), 12 March 2021, Doc Ref 195
- Kalbar – Amended Draft Work Plan – use of centrifuges and removal of Tailing Storage Facility (Fingerboards Rev4 D) – Clean version, 12 March 2021, Doc Ref 197a.
- Kalbar – Updated Risk management plan (Rev4 – 24 02 2021) (updated Appendix B to revised Draft Work Plan), 12 March 2021, Doc Ref 198
- Kalbar – Updated Risk treatment plan Water Quality and Hydrology (RevC) – 12 03 2021, 12 March 2021, Roc Ref 202

- Kalbar – updated Draft mine Rehabilitation Plan – 24 March 2021 (appendix C to revised draft Work Plan), 25 March 2021, Doc Ref 215

Together these documents present:

- strategies, a work plan, risk assessment and future documents (i.e. fine cake dumping operational procedure) for co-storage of fines, coarse and overburden
- a strategy and risk assessment to address water mounding through tailings monitoring and surveillance
- an updated site wide water balance including centrifuges, and confirmation that the site water balance and water management regime including groundwater and surface water quality is currently underway to support centrifuging of fine tailings.
- confirmation that runoff from stockpiles will be captured and managed, and addressed during detailed design

In addition to the above documents, Ausenco benchmarked data from six similar centrifuges from operation or large scale piloting in coal, mature fine tailings, borax, nickel/cobalt residue, red mud (alumina) and gold-silver tailings applications.

The amended review is attached for Planology's review. We request that, subject to council's views, this amended review be submitted to the IAC.

Yours sincerely,

[redacted]

Matt Pyle

Director Technical Solutions

Ausenco

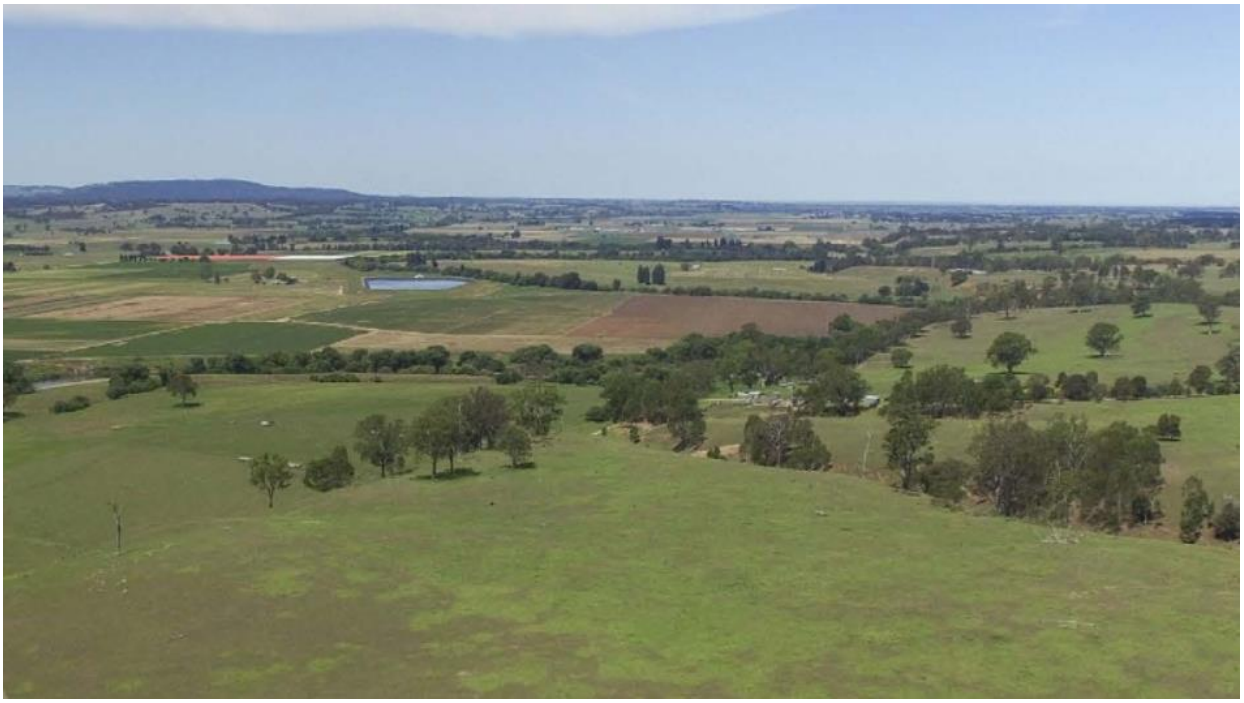
CRM2100459-RPT-0001
Revision Number C

East Gippsland Shire Council Fingerboards Project

Review of Centrifuges for Tailings Dewatering - Amended

April 2021

April 21, 2021



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Revision Status

Revision	Date	Description	Author		Approver	
			Name	**Position Title**	**Name**	**Position Title**
A	28 March 2021	Initial Draft for Planology Comment	Matt Pyle	Director Technical Solutions	Matt Pyle	Director Technical Solutions
B	29 March 2021	Issued for Use	Greg Lane	Chief Technical Officer	Matt Pyle	Director Technical Solutions
C	21 April 2021	Addendum	Matt Pyle	Director Technical Solutions	Matt Pyle	Director Technical Solutions

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1 Introduction

1.1 Context

Ausenco has been engaged by the East Gippsland Shire Council to review documents related to the application of centrifuges to dewater fine tailings for the Fingerboards Minerals Sands Project ("Project").

The objective of the review was to:

- Assess the technical suitability of centrifuges to dewater fine tailings for the Project
- Identify key gaps in data and approach
- Assess risks and opportunities
- Recommend the next steps and/or further focus areas

This report presents the findings of the review based on Ausenco's judgement and experience to support the Inquiry and Advisory Committee (IAC) in their review of the Project.

This addendum presents changes to the document from reviewing additional more recent documentation, including the updated draft work plan, updated risk management plans and technical notes that affect the findings in the Ausenco Review.

1.2 Ausenco's Background

Ausenco's technical solutions group is focussed on the design and application of tailings dewatering solutions and interfacing with tailings storage facilities within minerals processing projects. Our focus is predominantly on base metal projects (i.e. copper, gold, lead, zinc) and precious metals (gold, silver) but we also develop mineral sands projects. In particular, the Alfa Laval P3 series of centrifuges has been a specific technology of interest for our technical solutions group due to design developments of the units arising from the application into oil sands and the consequent potential for improved dewatering performance in minerals applications compared to other technologies and centrifuges available on the market.

In this amended review, Ausenco has supplemented the commentary based on an assessment of six similar centrifuges in operating and large demonstration duties in other industries.

1.3 Supplied Information

The review is based on the following documents:

a) Document Ref. 0: Letter from White & Case to Mr Wimbush, 18 January 2021, Fingerboards Mineral Sands Project – Public Hearing

b) Document Ref. 43: Fingerboards Mineral Sands Project Inquiry and Advisory Committee Technical note, 18 January 2021.

c) Alfa Laval Australia Pty Ltd, *Laboratory Spin Test Report – Mineral Sands Slimes Tailings Dewatering test for Decanter Centrifuge*, Rev A, 8 October 2018.

d) Alfa Laval Australia Pty Ltd, *Slimes sample Y1Q2 Fingerboards Laboratory Spin Test Report – Mineral Sands Slimes Tailings Dewatering test for Decanter Centrifuge*, Rev A, 2 February 2021

e) Kalbar – Technical Note 02 (TN 002) – Expert recommendation (Part 2.1, Questions 1 and 2) – RFI Response, 8 February 2021, Doc Ref 109

f) Kalbar – Updated Project Description (Chapter 3 of the EES) – Tracked Changes (Direction 59), 8 February 2021, Doc Ref 122

g) Supplementary Expert Witness Statement – Jarrah Muller – Water balance (Direction 59), 8 February 2021, Doc Ref 132

h) Kalbar – Technical Note 13 (TN 013) – Additional expert recommendations (Part 2.1, Question 2) – RFI Response, 12 March 2021, Doc Ref 192

i) Kalbar – Amended Draft Work Plan – use of centrifuges and removal of Tailing Storage Facility (Fingerboards Rev4 D) – Clean version, 12 March 2021, Doc Ref 197a.

j) Kalbar – Updated Risk management plan (Rev4 – 24 02 2021) (updated Appendix B to revised Draft Work Plan), 12 March 2021, Doc Ref 198

k) Kalbar – Updated Risk treatment plan Water Quality and Hydrology (RevC) – 12 03 2021, 12 March 2021, Roc Ref 202

l) Kalbar – updated Draft mine Rehabilitation Plan – 24 March 2021 (appendix C to revised draft Work Plan), 25 March 2021, Doc Ref 215

2 Summary

The key comments from the review are as follows:

Centrifuge

- The Alfa Laval P3 centrifuges are a promising technology that have the potential to increase water recovery, reduce footprint and increase the speed of rehabilitation for the Project. For these reasons they are worthy of consideration.
- The technical risk related to the sizing and application of centrifuges in this duty is managed as follows:
    - The application of solid bowl centrifuges into the minerals processing industry is relatively recent. However, there are operations treating similar and more difficult tailings materials in other industries.
    - The sizing of the centrifuges is based on a solids mass loading rate of 55 t/h/unit, which is reasonable based on the tailings characterisation when compared to other benchmarked sites from Ausenco's database. For the material considered at a solids loading rate of 55 t/h/unit, volumetric loading is not expected to be an issue.
    - Scale-up from laboratory scale spin testing to full size throughput is indicative of potential dewatering performance. Further work at larger scales is expected to demonstrate the equipment selection and performance.
    - The work to date on six variability samples indicates that centrifuges are capable of producing a damp product at the design rates that is expected to be handleable.
    - The planned updates to water balance modelling as well as pond design and centrifuge operating strategies are reasonable approaches to address potential issues with low recovery of ultrafines in the centrifuges if it occurs.
    - Centrifuge operability issues can include excessive vibration, high wear, damage due to tramp material or other issues that impact the performance of the units but can be managed by engineered feed preparation to the units.

Fines Handling

- The handling of the centrifuged product is described in the updated draft workplan:
    - The centrifuged product will be paddock dumped with the overburden to ensure the fines cake and overburden is evenly distributed to avoid localised areas of high fines content, which could cause perching of groundwater after closure.
    - Liquefaction of the material during rehandling and trucking may occur from time to time, however this can be managed by adjusting the centrifuge operating parameters.
    - The impact on groundwaters is managed as outlined in Section 8.5.2 of the workplan and the Water Risk Treatment Plan (Attachment C of Risk Management Plan).

Water Consumption

- The overall project water consumption is dependant on the sitewide water balance, including the design and operation of all related equipment and water management structures. This has been updated in the Addendum to Expert Witness Statement of Jarrah Muller, February 2021, EMM.

Tailings Management Structures

- Tailings storage stockpiles are described in the workplan and their water management plans and risk assessments are described in the reviewed documents. Ultrafine management is proposed to be assessed using updated water balance modelling.

Centrifuge Relocation

- There is an opportunity to convey tailings to intermediate transfer points which may also provide for reduced haul fleet emissions and dust generation.

3 Further Work

Further work should consider:

- Validating the centrifuge sizing with the vendor, based on the latest available test work (2 February 2021).
- Validating the assumptions around centrifuge performance and centrifuged material properties by conducting a sufficiently large-scale centrifuge trial treating similar and variable material. In particular, the relationships between feed density, flocculant and coagulant consumption, bowl speed, throughput, fines capture and product moisture can be examined.
- Conducting a testing program to confirm the materials handling, truckability, geotechnical and hydrogeological (permeability) characteristics of the centrifuged product.
- Updating the water balance (as planned) to validate the centrifuge fines recovery and management strategies.

4 Review of Letter from White & Case to Mr Wimbush, 18 January 2021

Table 4-1 presents commentary on the statements outlined in the White & Case letter, 18 January 2021.

Table 4-1 Commentary on White & Case letter, 18 January 2021

Statement	Review comments
The technical note indicates that there would be clear advantages for the Project if centrifuges are included.	The use of centrifuges in minerals processing and sand applications is limited. However the technology is likely to provide for several advantages compared to conventional wet storage of fines and scrolling. Ausenco's database of similar applications and recent (February 2021) testwork on six samples indicates that the material is amenable to dewatering by centrifuges.
1. Centrifuges would provide certainty about water recovery from the fine tailings that is independent of climatic and soil conditions.	The water balance has been updated by Kalbar to include centrifuges, and consider seasonal impacts on water supply and storage. There will be variable water recovered subject to the following factors: a) the variable size distribution of the feed material, and the attrition and breakage of particles during the beneficiation process and efficiency of separation of coarse and fines b) the centrifuge discharge moisture and water losses to fine tailings, as a function of clay size distribution and speciation of clays and other minerals, the flocculant addition and centrifuge operating conditions (i.e. throughput, bowl speed, differential scroll speed, etc.). c) management of contact and non-contact water sources, including catchment areas, diversion structures, and variable moisture contents of dewatered fines and coarse sand.

Statement	Review comments
2. There is no need to construct the temporary tailings storage facility (TSF) or the in-pit fines TSFs if centrifuges are used, as they create a dry cake from fine tailings.	The centrifuge product will be discharged in a state that is close to fully saturated (most of the void volume between the solid particles will be filled by water). The centrifuge product may seep water after centrifuging and after placement. The amount of water that seeps from the centrifuged tailings is related to the flocculant addition, compaction of the cake under its own weight (self-consolidation) as well as compaction equipment (which may be required to improve trafficability, increase rainfall runoff and reduce rainfall erosion). The centrifuge product has been described as a 'damp' cake in recent descriptions by Kalbar.
3. Centrifuges allow the continuous backfilling of the mined voids without the need to rip and remove the in-pit fine TSFs before the commencement of rehabilitation operations, which means that the disturbed mining area is smaller, and rehabilitation can occur sooner after the completion of mining in any particular area.	In principle Ausenco agrees with this comment. Required interim fine tailings storage is proposed in a stockpile with managed drainage.
4. The continuous mining and backfilling operating significantly reduces overburden haul distance, which in turn reduces noise and dust generation.	It is probable that haul distance could be reduced. However, relocation of the centrifuge facilities is likely to incur high costs as well as interruption to operations. Use of modular systems may moderate the costs, downtime and duplication implications. Conveying to intermediate trucking points may present an opportunity for the project.
5. Any risk of seepage from fine tailings is removed as this material is fully dewatered to a state that will only retain capillary moisture that cannot seep to the environment."	The centrifuged tailings will not be fully dewatered, and will contain up to ~35% w/w solids (35 percent of the total mass of water and solids will be water). This water may seep from the centrifuged product with vibration (i.e. material handling and placement) and under compaction (under self-weight, or via compaction equipment). Seepage from the fine tailings, if it occurs, will be into the coarse sand layer and management strategies have bene presented by Kalbar.

5 Review of Technical Note, 18 January 2021

Table 5-1 presents commentary on the statements outlined in the Technical Note – Implementation of centrifuges for water recovery, 18 January 2021.

Table 5-1 Commentary on Technical note, 18 January 2021

Statement	Review comments
Section 1 – Introduction to Mineral Sand Tailings	
By mass, the fine tailings represent approximately 21% of the ore and the coarse sand approximately 74%. The remaining fraction is the HMC product.	The relative proportions of coarse, fines and HMC product will vary during the life of the mine, as the mine treats material with different size distributions and mineralogical proportions. The production samples provide an indication of the changes in size distribution that are expected over the life of the project.
From the thickener underflow, the fine tailings are still a fluid slurry at approximately 30 – 35% solids content, as seen in Figure 1.	The basis for the solids content is most likely reported on a % w/w solids basis (weight of solids divided by total weight of solids + water), but should be clarified and aligned in subsequent project documentation, as geotechnical engineers typically report using a different convention (mass of water divided by the mass of solids).
Section 2 – Water Recovery from Tailings	
General	The comments in this section represent a reasonable summary of the likely water recovery from tailings.
Section 3 – Footprint Considerations	
General	The comments in this section represent a reasonable summary of the footprint considerations.
Section 4 – EES Tailings Method – Fine Tailings Disposal Dams	
General	The comments in this section represent a reasonable summary of the likely process.

Statement	Review comments
Section 5 – Alternative Option – Centrifuge Tailings	
Although the proposed TSFs can comply with relevant standards, the GSTM requires consideration of alternatives that minimize the volume of tailings and water placed in external tailings facilities.	In principle, including centrifuges in the project has the potential to minimise the volume of tailings and water placed in external tailings facilities. An updated water balance has been provided by Kalbar reflecting the impact of centrifuges on the project.
It is expected that, in the case of this project, the need for TSFs can be avoided altogether by the use of solid bowl centrifuges…	With the inclusion of centrifuges in the project, it is possible that ultrafines may need to be managed. Kalbar have outlined water balance modelling to understand and address suspended solids in the process water. Mining voids are proposed to be generated through the use of managed stockpiles.
…which would produce dry cake from fine tailings.	The term “dry stack” has become a commonly used industry descriptor for projects that are moving away from conventional “wet” tailings deposition to dryer forms of storage. However, the term incorrectly implies that the material is “dry”. The centrifuged material will have a moisture up to ~35% w/w which means there will be a large amount of water in the centrifuged material. In practical terms a large proportion of this water will be chemically bound to the clays, as well as being retained within fine capillaries so the material may appear dry once discharged from the centrifuge. Nevertheless, some water may be released through vibration (shearing) and compression during rehandling, trucking, placing and compaction of the tailings. This has been considered in the deposition plan and drainage designs. At an Argentinian operation, the centrifuged tailings produced at a similar moisture content of ~35% w/w (albeit with a different mineralogical composition) tends to flow downhill by gravity, behaving like a very viscous fluid, akin to a lava flow. It should be noted this is a deliberate operating strategy used to help deposit the tailings across variable topography at this site and dryer moistures could be achieved if required. In recent communication Kalbar have described the material as a ‘damp’ cake which is appropriate.

Statement	Review comments
The centrifuge dewaters the cake to the absolute point of practical dewatering…	Filters typically remove a larger amount of interstitial water than centrifuges and achieve lower moistures than centrifuges, particularly if operated at high pressures and/or with membrane squeezing and/or air blow steps. Additionally, dewatering technologies (centrifuges included) can be configured to operate at higher throughputs and wetter product moistures (within limits). Therefore, centrifuges do not (and may not always) dewater the cake to the absolute point of practical dewatering. However, this is not a problem.
…and any remnant water will remain entrained due to the capillary action between the water and solid particles. This means that any water that remains in the cake will not drain freely from the material, even when it is deposited back into the void with overburden.	Centrifuge products approach saturation (all void spaces filled by water) and are generally thixotropic and compressible. Therefore, in the same way that a sponge can entrain water due to capillary action, once vibrated (by material handling or trucking) or once compressed/squeezed (by placing and covering with material, or consolidating under self-weight) the centrifuged material can become fully saturated and seep water back into surrounding soils. The “floccs” that form through the addition of flocculant prior to the centrifuging process can also degrade with shearing, placement and compaction, and time, increasing the amount of released water. It is important to note that saturated materials typically exhibit poor geotechnical strength and trafficability.
The risk of groundwater mounding from seepage is removed as the ability of water to seep from the fines into the underlying soil, at a rate greater than the vertical permeability of the underlying soil, is eliminated.	The risk of groundwater mounding may be reduced but is not removed and therefore is proposed to be actively managed through dewatering bores.

Statement	Review comments
After being processed through the centrifuge, two products are produced. Firstly, a clear overflow water (called the centrate) containing very little suspended solids, and secondly a readily transportable solid cake.	The spin tests conducted to date do provide an indication of the material that can be produced by centrifuging and the six production samples indicate that the material is amenable to centrifuging, and the centrates contain a low amount of suspended solids. Scale-up and operational factors include: • Machine design and hydrodynamics • Flocculant addition, mixing and residence time • Operating g-force, and machine limitations due to scrolling speeds, material clumping, vibration, or other factors
Solid bowl centrifuge units are a proven technology and their application in tailings dewatering is not new, with multiple units being used globally in coal, tar sands, bauxite, iron ore, borax, gold, nickel tail dewatering applications.	Solid bowl centrifuges are not a new technology. Technology developments in recent years have improved the viability of these units due to lower flocculant consumption, reduced power, higher g-forces, improved hydrodynamics and reduced moistures. The advent of the technology into tailings dewatering duties is relatively recent and the market share of centrifuges in tailings dewatering projects is relatively small. Although these centrifuges are not proven in this duty, a review of six other similar centrifuges in other applications supports their suitability for this duty. A recent coal project has had commissioning and ramp-up challenges due to a combination of factors related to the project, duty and material characteristics. Ausenco expects that these technical challenges would be easily resolved for this project through appropriate project development, scale-up/demonstration and engineering processes.
Centrifuges have previously been evaluated and successfully trialled, but not used, in mineral sands applications.	Ausenco is not aware of the specific trials of centrifuges in mineral sands duties, nor the specific reasons for not implementing them on the project where the trial occurred.

Statement	Review comments
One of the main advantages of the centrifuge is that it provides certain and maximum water recovery within a controlled mechanical process, which is not affected by weather, evaporation rates or tailings deposition methods.	The spin testing provides an indication of the moistures that can be achieved from centrifuges at full scale. The performance will be subject to the machine configuration, material types and throughputs. Water recovery is a function of the sitewide water balance which includes climatic factors and has been evaluated as part of updated water balance modelling.
Also, because the product is a truckable solid cake, the need to store and dry the fines tails slurry in TSF dams is no longer necessary and the cake can immediately used for backfilling of the pit.	The material appears to be truckable based on the spin testing. It is possible that the centrifuge product may be sloppy from time to time in which case some dessication (drying) prior to rehandling, trucking and placement on the stockpiles can be employed. Potential seepage from the stockpile is captured. Some minor seepage from the fines into the sand may occur and is managed. Trucking of centrifuged material will result in vibration and potentially release water from the coarse capillaries, however, can be managed based on reviewing the centrifuge operating parameters. A long-term strategy for managing “dirty” decant water and removal of ultrafine particles from recirculating loads is planned to be developed based on updated water balance modelling.
The centrifuge cake will be transported during dayshift from the centrifuge facility to the active backfill area in the void, where it will be placed as backfill with the overburden. The benefit of this is that it ensures an even dispersal of the fines throughput the backfill profile, rather than concentrating the fines in in-pit TSF cells. In total, the fines cake will represent only 7% - 8% of the total overburden backfill volume and stability of the backfill is not compromised.	The updated project documentation including draft work plan outlines an approach to blend and deposit coarse, fine and overburden material within specified zones of the pit. There is another operation that Ausenco is aware of that deposits centrifuge product with overburden in a similar ratio (1:10).
Avoidance of the need for TSFs would also reduce dust and noise generation by the proposed mining activities as it would reduce the active mining footprint and facilitate closer and more rapid backfilling and rehabilitation of mining voids.	In principle these comments are correct.
Section 6 – Centrifuge Plant Technical Details	

Statement	Review comments
As the project entails two mining unit plants (MUP) in two separate areas, two centrifuge plants would also be required. Each plant would contain three operating units and one standby unit, with a throughput rate of ~55 tons solids per hour per unit and would be enclosed in a building that is approximately 23.5 m long, 13.5 m wide and 11.5 m high at the crest of the roof.	The proposed sizing for centrifuges is based on a solids capacity of 55 t/h/machine. Based on benchmarking six other similar large-scale centrifuges this solids capacity is expected to be reasonable. Further work is required to clarify the limiting criteria for sizing of the centrifuges and the implications in terms of flocculant consumption, fines capture and moisture with changing throughput.
The proposed building layout for each plant entails the four centrifuge units on the cladded top floor, a cake discharge conveyor below them, and an external cake stacking conveyor. The centrifuge plant would operate 24 hours a day, producing a fines cake which is discharged onto a stockpile. The trucking of the cake to the mine void, where backfilling is occurring, would take place during the day shift. During evening and night periods, the cake will accumulate on the stockpile for loading and haul to pit during the following dayshift. Ancillary equipment around the plant will be a flocculant mixing tank, electrical switchroom, transformer enclosure and a bypass sump.	In addition to the scope mentioned, the centrifuge building will likely require slurry storage tanks for flocculant addition, water services (tanks and pumps), a hardstand for the radial stacker and stockpile and drainage infrastructure and sumps/pumps to capture seepage from the stockpile. Slurry and water return pipelines and fire water services (tanks, pipes and pumps) may also be required. These elements would typically be detailed as part of detailed design of the project.
The centrifuge plants would be located in close proximity to the mining area in order to reduce the overland haul distance of the centrifuge cake back to the mining void, and thereby minimise noise and dust generation. Based on the preliminary mine planning, it is anticipated that each centrifuge plant would be relocated to a new position every four to five years. The plant has been designed to be modular so that it can be dismantled and trucked to a new location, when required. The plant positions have been selected such that the average one-way haul distance from the plant to the mine void is an average of 750 m for all locations.	It may be preferable to convey centrifuged material to intermediate locations rather than relocating plant and equipment. The additional conveying could lead to reduced trucking distances with a reduction in dust and haul fleet emissions.
Section 7 – Water Recovery Comparison	

Statement	Review comments
The centrifuges enable a significant increase in fine tailings dewatering to be achieved, as it employs the use of a flocculant and increased centrifugal forces to dewater the material to a degree that cannot be achieved in a conventional TSF.	It is important to make the distinction that the centrifuge will dewater the material rapidly to a high solids content (circa 65% w/w) and recover that water immediately to the process. The TSF may achieve higher solids contents after scrolling and desiccation. However, much of this water will be recovered slowly, lost to evaporation and not returned to the process.
Based on centrifuge testwork results, the water recovery estimate shows that the 3 GL per annum water requirement remains achievable, with ~2.9 GL per annum required for a process plant operating at the maximum 1,500 tpa processing rate.	The water balance has not been evaluated as part of this review. However, an updated water balance reflecting centrifuges has been provided.
Section 8 – Noise Comparison	
General	The noise impact has not been evaluated as part of this review.
Section 9 – Air Quality Comparison	
General	The air quality impact has not been evaluated as part of this review.
Section 10 – Rehabilitation of Mining Areas	
General	The rehabilitation impact has not been evaluated as part of this review.
Section 11 – Centrifuge Costs	
Compared to the EES scenario, the centrifuge costs require increased upfront capital expenditure. The centrifuge cost is partially offset by the removal of the TSF construction, but not withstanding this offset, the additional investment is significant.	In principle these comments are correct.
Compared to the EES, the direct tailings operating cost of the centrifuge is slightly greater but this is largely offset by the improved operational efficiency of the mining operations, the removal of TSF operating costs and the accelerated rehabilitation of disturbed mining land.	In principle these comments are correct.

Statement	Review comments
Section 12 – Advantages of Centrifuge Fine Tailings	
General	The advantages are repeated in the letter from White & Case to Mr Wimbush. Therefore, the comments outlined in Section 4 apply here.