

6 June 2023

NSW Department of Planning and Environment
4 Parramatta Square, 12 Darcy Street
PARRAMATTA NSW 2150

Attention: Stephen O'Donoghue
Mandana Mazaheri

Submitted via DPE Project Portal

Dear Mr O'Donoghue

Cadia Valley Operations (PA 06_0295) Request for Additional Information

I refer to your letter dated 11 April 2023, which seeks additional information. The information requested is shown in **bold** and is followed by Cadia Holdings Pty Limited (CHPL) response in normal type.

Department requires further investigation into methods to measure dust concentration more accurately in the ventilation shaft discharges.

CHPL engaged Ektimo to undertake an investigation into methods that would give a more accurate concentration of ventilation shaft discharges.

The current sampling location for VR8 is non-conforming in accordance with Australian Standard due to nearby in-stack upstream and downstream disturbances and the location of the sampling plane in relation to the downstream bend. This can cause turbulence across the sampling plane affecting the sampling, providing potentially inaccurate readings.

Ektimo has recommended improvements to the sampling test methodology which involves different sample capture techniques (duration and sample nozzle size) and a different sample collection location (i.e. at vent exit). The letter provided in **Appendix 1** details the proposed trial methodology.

CHPL proposes to implement the Ektimo recommendations in the following order of priority:

1. **Sampling Location:** Collection of a sample from the top of VR8 ventilation shaft discharge point (i.e. the top of the stack, minimum one location). CHPL observations show that a proportion of the dust is deposited within the ventilation infrastructure in a location downstream of the current sampling location. This deposited dust is therefore not emitted to the atmosphere. Sampling at the new location is expected to provide a more accurate measurement of the ventilation

shaft emissions. This measurement will be undertaken in parallel with sampling from the previous location. This will provide an opportunity for comparative / correlation analysis between the collected samples.

2. **Sample Nozzle Size:** The use of a larger nozzle diameter is expected to contribute to improving the certainty of testing.
3. **Test Quantity:** Three samples will be collected and compared to provide an understanding of test variability and uncertainty.
4. **Sample Duration:** Samples will be collected over a period of 12-24 hours (i.e. a material increase from the standard which is 175 minutes). This approach is expected to provide a more representative sample of the emissions from the ventilation shaft. Typically, CHPL produces approximately 100,000 tonnes of ore per day. The implementation of this recommendation will account for any changes in production (up or down) which may occur over smaller time periods within the sampling period and therefore unduly influence the sample result.

CHPL is not proposing to implement the modified high volume air sampler improvement (i.e. identified as improvement 3a in the Ektimo letter). It is noted that the implementation of this sampler type would involve a non-approved method and would require further research and development.

In conjunction with the above, CHPL notes that it has implemented the following investigations and mitigation measures to better understand its dust emissions and minimise its emissions respectively:

- **Additional dust monitoring locations:** Installation of nearfield, midfield and far field dust monitoring locations which are in addition to the approved locations. Analysis of this additional data will be used to identify correlations with CHPL dust emissions and quantify background dust levels. (N.B. Monitoring data from CHPL approved monitoring locations generally indicates compliance with the air quality criteria.)
- **Lead isotope testing:** Dust samples from the nearfield, midfield and far field monitoring locations have been subject to lead isotope fingerprint testing (i.e. the ANSTO report). CHPL has also undertaken lead isotope fingerprint testing of its ore to allow for a direct comparison of CHPL's contribution to the dust samples.
- **Hydro Mulching:** CHPL has installed hydro mulch over the Northern and Southern Tailings Storage Facilities (TSF), which can safely be accessed by hydro mulch machinery (i.e. nominally the areas of the TSF which are dry and are not subject to a wetting cycle associated with rainfall).
- **Crusting Agent Application via Aerial spraying:** In addition, and in support of the hydro mulching works, CHPL has applied a crusting agent to the wet suppression mitigation actions. The crusting agent acts as a binder and promote surface stabilisation by binding the particles on the surface together to prevent them lifting off as dust. This measure has been typically implemented via aerial

spraying in locations which cannot be accessed via hydro mulch machinery (i.e. nominally areas which are subject to a wet dry cycle).

- **Emission Filtration:** A trial filtration system has been fitted to a known source of dust for the VR8 system, one of the PC2 East Crusher ventilation ducts. Initial results have demonstrated the efficacy to the equipment.
- **Additional Emission Filtration:** Given the success of the trial filtration system, CHPL has committed to installing additional filtration units to other similar dust sources for the VR8 system (i.e. other crusher ventilation ducts).
- **Irrigation System:** CHPL has committed to installing an irrigation system over the tailings storage facilities. The planned schedule will see the majority of the northern TSF surface area under irrigation by December 2023.
- **Priority of TSF Embankment Works:** Returning the Southern TSF into operation is a key mitigation measure for the long-term management of dust emission. CHPL's focus is to remove potential delays and accelerate works which contribute to achieving this objective.

Department requires details on what and where crushing activities are being undertaken underground and how these are consistent with the approval and conditions of consent.

Compliance Assessment Against Primary Crusher Numbers

Ore is extracted from the drawpoints via a loader and transported to the underground primary crushing stations (i.e. jaw-gyratory crushers) before being transported to the surface via conveyor. Currently CHPL operates four underground crushing stations.

The *Cadia East Environmental Assessment, Modification 6 – Processing Rate Increase and Modification 14 - Increased Processing Rate*, includes numerous references to the underground primary crushing activities (See **Appendices 2 - 5**). Of note are:

- Page 2-19 which states:

“Key underground and surface mining infrastructure construction activities required for the Cadia East underground mine include:

- ...
- *installation of eight underground crushing stations;”*

- Page 2-12

“The key Project extensions to the approved Cadia Valley Operations would include:

- ...

- *development of underground crushing, handling and incline conveyor systems to transfer ore and waste rock mined from the Cadia East orebody to the Cadia Valley Operations ore processing facilities;*
- Page 2-31

“A schematic diagram showing the crushing stations and the other main underground ore handling system components is provided on Figure 2-9.”

CHPL currently operates four of the eight approved underground crushing stations (i.e. less than the approved number). CHPL’s underground crushing operations are therefore within the approved maximum as described in the *Cadia East Environmental Assessment* and as such are not inconsistent with the *Cadia East Environmental Assessment*.

CHPL’s operation of these four approved underground crushing stations is also not inconsistent with the Project Approval, as the Project Approval makes no specific reference to the number of underground crushing stations.

Compliance Assessment Against Primary Crusher Throughput

The four underground crushing stations currently operated by CHPL have a maximum throughput of approximately 2,500 – 2,600 tonnes per hour.

The approved increases in ore production rate from 27 to 35 million tonnes per calendar year associated with Modification 14 represents an increase of approximately 30% to the calendar year ore production rate approved as part of the *Cadia East Environmental Assessment*.

The original *Cadia East Environmental Assessment* noted that each crushing station would have a 1,000 tonnes per hour (tph) jaw crusher (See **Appendix 2**).

“At each ore crushing station, ore would be tipped by the LHDs through a static grizzly (stationary bar screen) equipped with a rock breaker (Figure 2-9) and would then pass into a 1,000 tonnes per hour (tph) jaw crusher (Figure 2-9).”

Given the increases to the calendar year ore production rate and upgrades to Cadia East mining and ore processing infrastructure, this corresponds to a jaw crusher rate of approximately 1,300 tph and a combined throughput of 10,400 tph.

CHPL currently operates four approved underground crushing stations, with a maximum throughput of approximately 2,500 – 2,600 tonnes per hour and a theoretical combine hourly throughput of 10,400 tonnes or 91.1 million tonnes per annum (i.e. approximately 2.6 times the approved calendar year ore production rate). Typically, CHPL crushes and transports to the surface approximately 100,000 tonnes of ore per day. This equates to a nominal crushing rate of approximately 1,000 tonnes per hour per crusher. CHPL’s combined

hourly throughput of the underground crushing stations is therefore not inconsistent with the *Modification 14 Environmental Assessment*.

As the Project Approval makes no specific reference to the underground primary crusher throughput, the operation of these four approved underground crushing stations with a combine hourly throughput of 10,400 tonnes is also not inconsistent with the Project Approval.

Project Approval Conditions

The Project Approval does not contain a condition which is specific to underground crushing operations with respect to the number or the hourly throughput. As such, compliance in relation to the Department questions is the administrative condition, specifically, Schedule 2, Condition 2 Terms of Approval (reproduced below for your convenience).

“TERMS OF APPROVAL

2. The Proponent shall carry out the project:

(a) generally in accordance with the EA;

(b) in accordance with the conditions of this approval; and

(c) in accordance with any written directions of the Secretary.

Note: The general layout of the project is shown in Appendix 2.”

As noted above, CHPL currently operates four underground crushing stations compared to the eight approved under the *Cadia East Environmental Assessment*. Therefore, CHPL underground crushing operations (number or the hourly throughput) are not inconsistent with the *Cadia East Environmental Assessment, Modification 14* or the Project Approval - Schedule 2, Condition 2 Terms of Approval.

Should you have any further queries regarding this matter, please do not hesitate to contact David Coe on 0413 171 330.

Yours sincerely,



Geoffrey Newcombe

Head of Strategy and Integrated Planning

Email: Geoffrey.Newcombe@newcrest.com.au

Appendix 1 Ektimo - Methodology advice for the sampling and analysis of particulate matter and metals emissions at VR 8

Newcrest Mining Limited
1460 Cadia Road
Orange NSW 2800

Attention: David Coe

Re: Methodology advice for the sampling and analysis of particulate matter and metals emissions at VR 8.

Current Sampling Methods at ground level:

Sampling is performed at a ground level location; sample points are designated per AS4323.1 (selection of sampling positions). Sampling is performed in accordance with AS4323.2 (determination of total particulate matter) and USEPA Method 29 (Metals emissions from stationary sources). 42 sample points are tested along 3 traverses, with 5-minutes designated per point (as per Australian Standard method requirements). Test duration is 210 min which results in a predicted sampling volume of 2.5-3.5 m³ (dry at standard temperature and pressure).

Note: sample points can be designated per USEPA Method 1 (sample and velocity traverses). This would require sampling via 40 points along 2 traverses with a minimum of 2-minute sampling points. USEPA method 1 is approved for usage in NSW.

Limitations with the current sampling regime:

1. Non-conformance of sampling plane. Sample plane conformance is “non-conforming” as per AS4323.1 (selection of sampling positions) due to in-stack obstructions and the location of the sampling plane in relation to the downstream bend. Note: sampling planes that do not conform with the requirements for “ideal” or “non-ideal” sampling planes shall be classified as “non-conforming” (this applies to VR 8). However, where conformance with the alternative procedure specified in Appendix C of AS4323.1 (i.e. USEPA 2F) can be demonstrated, the sampling plane shall be classified as “non-ideal”.

Note: Utilisation of USEPA 2F may be hindered by the presence of mud/dust within the sample plane, therefore, USEPA 2F shall only be used if the sampling plane is required to conform to the Australian Standard.

2. Bias high results for total particulate matter. High levels of particulate matter have been detected downstream of the ground-level sampling location (and upstream of the exit plane). Therefore, potential exists for particulate matter to pass through the ground-level sampling location without emitting to atmosphere, thereby causing in-stack measurements (at ground level) to be bias high when compared to concentrations of particulate matter emitted from the exit of the ducts.

Improvement: Perform testing from the duct exhaust of one (or all) of the duct outlets. These locations appear to be roughly 4000mm by 4000mm which would require 5 x 4-inch (BSP) test ports to be added to one side of one (or all 3) duct exhausts. Test points are estimated at 35 in total (per duct), which will equate to a test duration of 175 minutes as per Australian Standards (per duct). If one duct is tested rather than all 3 ducts, a representative duct shall be chosen to calculate emissions from all 3 exhaust ducts.

Note: Testing from the exit plane of the VR 8 ducts is a non-conforming test location due to the presence of nearby upstream and downstream disturbances. As noted above, Appendix C (alternative procedure for confirming sampling plane classification) of AS4323.1 could be utilised to classify the exit test location as non-ideal rather than non-conforming.

Note 2: Access to the exit of the sampling plane is not currently possible. Scaffolding will likely need to be constructed to make access safe to the exit of the vent/s. Further, Ektimo consultants will be required to wear Tyvek suits and a full-face respirator whilst working near the exit plane of the VR 8 ducts.

3. Particle distribution within VR 8 duct. Due to the presence of water and dust, the emitted particulate matter appears to behave as a mud like substance. Some of this matter is likely to clump together in a form which may be larger than our standard nozzle sizes (nozzles are generally 3-5mm in diameter at the VR 8 ground level test location). The uncertainty of standard test methods therefore increases, since the effectiveness of standard stack testing equipment (i.e. nozzles and pump rates) may not be appropriate to capture particulate matter with a significantly large diameter.

Improvement #1: Sample nozzle size. The sampling plane area at ground level is $\sim 27\text{m}^2$, whilst the combined sampling plane area of the 3 exhaust vents is $\sim 63\text{m}^2$. Therefore, the exit velocity is estimated at roughly half the velocity that is observed at ground level. Ektimo will therefore be able to use nozzles in the range of 6-8mm when performing testing at the duct exit/s. It is assumed that larger nozzles will be more suitable to handle larger diameter particulate matter. The theory applied here is that the nozzle diameter must be larger than the diameter of particulate matter during sampling. A larger nozzle size shall therefore decrease test uncertainty.

Improvement #2: Test quantity. The presence of mud in the emission of VR 8 increases test uncertainty when compared to standard emission testing test locations. Therefore, it is advised that the sample quantity shall be increased to a minimum of triplicate samples. Data can then be compared to gather an indication of test uncertainty.

Improvement #3: Sample volume/duration. Further to improvement #2, a further set of triplicate samples shall also be gathered over a greater test duration than the standard 175 minutes from exit plane samples. A sampling train shall be installed at a representative location (single point) and tested over 12-24 hours. The sampling train shall then be tested at a further 2 representative sampling points for 12-24-hour samples. Greater sample volumes via this test method have the intention of smoothing out the possible particulate fluctuations which may be present with the clumped/muddy particulate emission. Samples taken with increased sample volume over a 24-hour period will not be approved, however, the results shall be measured against standard 175-minute tests to reduce uncertainty.

Note: a 24-hour test will yield ~ 8 times the sample volume when compared to a 175-minute test (as per AS4323.2). Testing will be performed with a filter after test impingers to prevent filter blockages during the extended test run.

Improvement #3a: Sample volume/duration. If the above method improvements regarding sample volume/duration do not yield logical results, a non-approved method shall be utilised to increase sample volume at the outlet of the VR 8 duct/s. A high volume air sampling unit could be modified to run an appropriately sized nozzle diameter (20-40mm), with a modified probe which would be drawn through a condenser (to remove moisture). The sample gas will then pass through a weighed filter via an air-tight manifold. The intention of this sampling set-up is to maintain isokinetic rates (as performed with AS4323.2 and USEPA 29) whilst drawing much larger sample volumes than what is possible with standard stack testing methods. The nozzle diameter will also be significantly larger than what is achievable with standard stack testing methodology, as outlined above in “improvement #1”, increased nozzle diameter is suggested to increase the suitability of capturing clumped mud like particulate matter.

Note: Over a 24-hour test period, a high-volume air sampler will typically sample more than 1500 cubic metres (m³) of air whilst our standard test methods draw ~24m³ over this same period.

Note 2: A significant lead time would be required for research and develop this method (which is estimated at 3 months). Such a test method is non-approved for use in NSW and is not NATA accredited, this method should only be utilised if other test methods are not deemed effective.

Concluding remarks:

Ektimo advises sampling to be performed at the exit of at least one of the three VR 8 exhaust ducts. A minimum of 3 samples shall be taken as per AS4323.2/USEPA 29 from this test location. A further 3 samples shall be taken from representative single point locations over a 12–24-hour period to increase total sample volume. If these methods do not yield logical results, a non-approved method shall be utilised to decrease test uncertainty.

Appendix 2 Cadia East Environmental assessment

The following are extracts from the *Cadia East Environmental Assessment* which reference underground crushing activities.

Page 2-3

“Up to approximately 6 Mtpa of Ridgeway ore is processed in the high grade processing plant. Primary crushing is undertaken underground and secondary crushing on the surface.”

Page 2-12

“The key Project extensions to the approved Cadia Valley Operations would include:

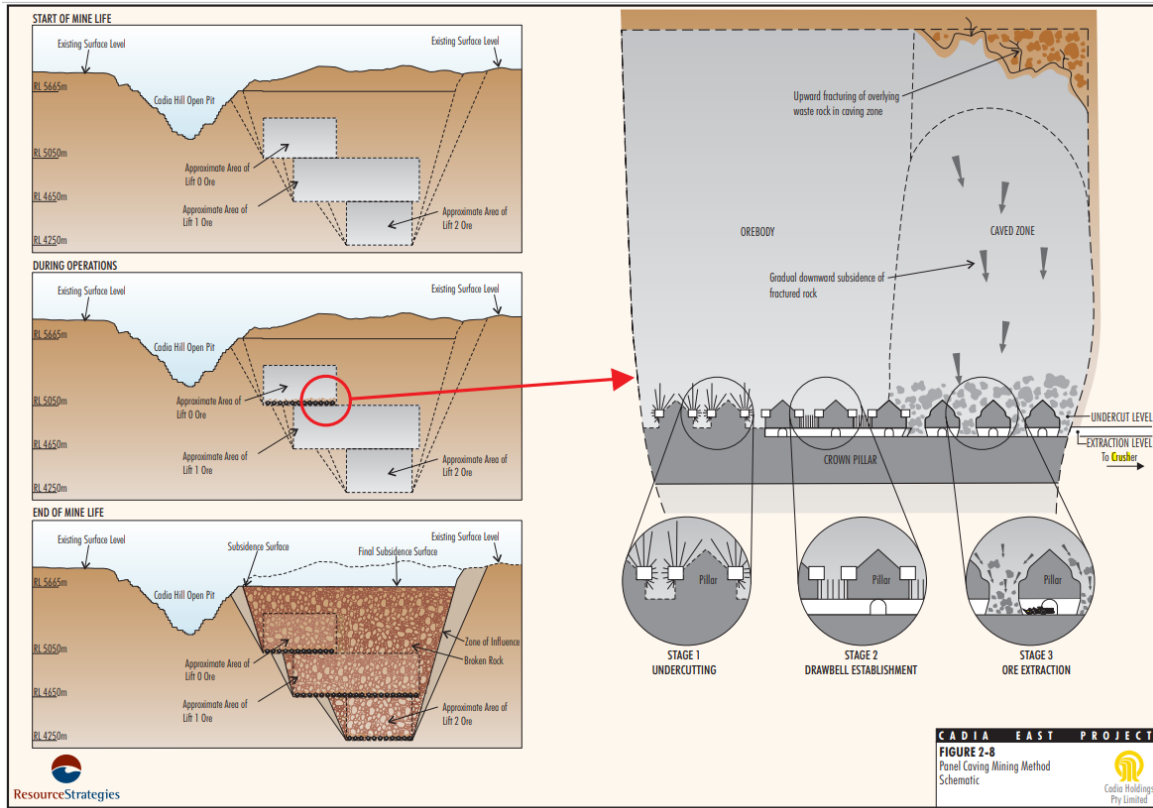
- ...
- *development of underground crushing, handling and incline conveyor systems to transfer ore and waste rock mined from the Cadia East orebody to the Cadia Valley Operations ore processing facilities;”*

Page 2-19

“Key underground and surface mining infrastructure construction activities required for the Cadia East underground mine include:

- ...
- *installation of eight underground crushing stations;”*

Figure 2-8



Page 2-30

“Mine development refers to works associated with the installation of underground mining infrastructure and tunnelling prior to full-scale mining of ore taking place. Mine development works would involve extending the two existing declines, access drives, installing ventilation raises, developing crushing stations, underground ore conveyors and other associated infrastructure.”

Page 2-31

“A schematic diagram showing the crushing stations and the other main underground ore handling system components is provided on Figure 2-9.

At each ore crushing station, ore would be tipped by the LHDs through a static grizzly (stationary bar screen) equipped with a rock breaker (Figure 2-9) and would then pass into a 1,000 tonnes per hour (tph) jaw crusher (Figure 2-9). The crushed material would then fall into a 250 t surge bin below the jaw crusher.

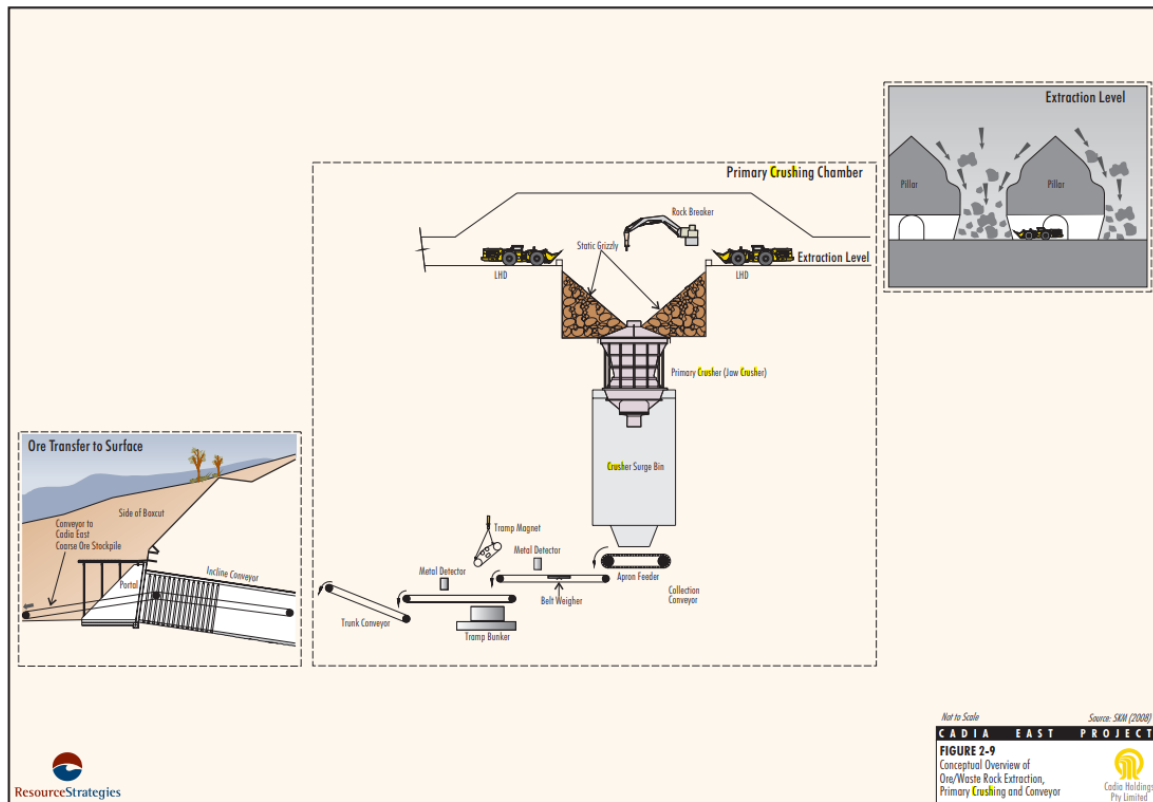
An apron feeder would be used to regulate the feed from the crushing station surge bin onto the collection conveyors (Figure 2-9). The collection conveyors would allow for the automated removal of tramp metals (e.g. drill steels, rock

bolts, etc.). Tramp metal removed would be directed by a chute to a tramp metal collection bin.”

“Ore conveyors would be used to transport ore from the underground primary crushing stations to the surface (Figure 2-9).”

“Waste would also be generated through the development of the primary crushing station chambers and other mine development works (e.g. production levels) during the mine life.”

Figure 2-9



“Cadia East ore would be primary crushed underground (Section 2.5.10 and Figure 2-9). Surface conveyors would transfer the primary crushed ore from the Cadia East incline conveyor to a new Cadia East coarse ore stockpile adjacent to the existing low grade coarse ore stockpile. The primary crushed ore would then be reclaimed, transported via conveyor to the secondary crusher (Figure 2-6) and crushed. The secondary crushed ore would then be transported via conveyor to either the new processing plant or the existing high or low grade processing plants.”

Page 2-55

“A number of substations would be installed for the Project including surface sites adjacent to the ventilation fans and surface conveyors, at the ore processing facilities, and underground substations for the crushing stations, loading conveyors, dewatering system, crib room/workshops and other mining purposes.”

Appendix 3 Modification 6 Processing Rate Increase (Appendix B Air Quality Assessment)

The following are extracts from *Modification 6 - Processing Rate Increase environmental assessment* which reference underground crushing activities.

Section 1.1 Overview of Modification

“The Modification includes:

- *an increase in the approved ore production and processing rate at the Cadia Valley Operations (CVO) from 27 million tonnes per annum (Mtpa) to 32 Mtpa;”*

Section 4.2 Modification Operations

“Estimates of the potential increase in dust emissions as a result of ongoing operations are presented based on the following assumptions:

- *An increase in ore production from 27 Mtpa to 32 Mtpa (~18.5% increase) would result in additional dust emissions associated with ore handling (i.e. conveyor transfer points, stockpiling, loading, crushing and screening).*
- ...

A summary of the estimated TSP emissions for ongoing operations is provided in Table 8 and is compared with the Year 17 emission inventory presented in the Cadia East AQIA (HAS, 2009).

...

Table 8: Calculated TSP emissions for the Modification Operational Stage		
Emissions source	Mod increase in emissions (kg/annum)	Year 17 emissions (kg/annum) as reported in the Cadia East AQIA
ORE HANDLING		
Loading coarse ore to stockpile	4,558	Not included
Primary and Secondary ore crushing	54,000	81,000
Loading crushed Ore to stockpile	4,558	24,613
Conveyor transfer points	2,735	7,384
Ore processing in mill	None	123,066
WASTE		
Loading waste to trucks	169	912
Hauling waste to emplacement area	3,438	17,778
Unloading waste at dump	169	912
Dozer on waste	3,751	20,257
WIND EROSION		
Ore stockpiles and exposed ground	No increase	13,332
TSF	No increase	1,669,887
Waste rock dumps	No increase	105,588
Wind erosion - all pits	No increase	399,954
Wind erosion - subsidence zone	No increase	333,295
MISCELLANEOUS		
General construction work	No increase	40,880
Ventilation Shaft	No increase	205,131
Grader	No increase	18,464
TOTAL	73,377	3,062,453
Percentage Increase	2.4%	

”

Section 4.5 Assessment of Potential Worst-case Daily Emissions

“The analysis presented in Section 4.2 and Section 4.4 is based on emission estimates derived from annual average throughput, for example a throughput of approximately 4 Mtpa for the secondary crushers. The maximum duty of the secondary crushers is 800 tonnes per hour (tph) and these crushers could theoretically operate at this maximum throughput in a 24-hour period. This is approximately double the processing rate allocated pro rata from the annual throughput of 4 Mtpa. This is considered to be highly conservative as it would represent the crushers operating at their maximum duty for a 24 hour period.”

Appendix 4 Modification 14 Increased Processing Rate

The following are extracts from *Modification 14 – Increased Processing Rate environmental assessment* which reference underground crushing activities.

Page ES-1

“The Processing Rate Modification (the Modification) proposes to increase the current ore processing rate from 32 million tonnes per annum (Mtpa) to 35 Mtpa, through the implementation of processing improvements and the upgrade of ore processing infrastructure. The main elements proposed for the Modification include the following (Figure ES-1):

- *an increase in the approved ore processing rate from 32 Mtpa to 35 Mtpa;*
- *upgrades to Cadia East mining and ore processing infrastructure to provide capacity to accommodate a mining, materials handling and processing rate of 35 Mtpa;*
- *...”*

Page 8 Table 1-1 Summary of Optimisation Works Implemented at CVO

Ore Processing Facility Upgrades – Component	Approved/Implemented
Concentrator 1	<p>Crushing capacity upgrades:</p> <ul style="list-style-type: none"> • Secondary crushing circuit expansion. • Additional ore screening capacity. • New conveyors and chutes. • New conveyor and bin transfer into Semi-Autogenous Grinding (SAG) mill feed conveyor. <p>Flotation capacity upgrades:</p> <ul style="list-style-type: none"> • New coarse ore flotation plant (Train 1/Train 2). • Additional transfer hoppers, pumping and pipework from within (and return to) the existing concentrator systems. • Modifications to existing flotation plants to increase processing capacity. • New cyclone tower with cyclone cluster. • New Jamieson cell. • New Vertimill re-grind mill. • Upgrades to tailings thickener.
Concentrator 2	<p>Crushing capacity upgrades:</p> <ul style="list-style-type: none"> • Larger motors and increase in speed on existing conveyors from the Coarse Ore Stockpile through to the SAG mill feed conveyor. • Replacement of the secondary and tertiary crushers and motors. <p>Regrind capacity upgrades:</p> <ul style="list-style-type: none"> • Additional pumping/pipework. <p>Flotation capacity upgrades:</p> <ul style="list-style-type: none"> • Replacement of cyclone cluster (10 cyclones to 12 cyclones). • Additional Jamieson cell. • New Vertimill re-grind mill. • Modifications to the existing tailings thickener and underflow pumps. • Additional transfer hoppers, pumps and pipework.
Cadia East Underground Materials Handling System	<p>Upgrades to:</p> <ul style="list-style-type: none"> • Cadia East underground crushing and conveying system capacity upgrade. • Additional new Panel Cave 2-3 materials crushing and conveying systems.

Source: After CHPL (2020).

Appendix 5 Modification 14 Air Quality and Greenhouse Gas Assessment (Appendix F)

The following are extracts from *Modification 14 Air Quality and Greenhouse Gas Assessment* which reference underground crushing activities.

Section 1.1 Modification description

“The main elements proposed for the Modification include the following:

- *an increase in the approved ore processing rate from 32Mtpa to 35Mtpa;*
- *upgrades to Cadia East mining and ore processing infrastructure to provide capacity to accommodate a mining, materials handling and processing rate of 35Mtpa;”*

5.4 Modelling scenarios

“The assessment considered a single scenario to represent the Modification which includes the increase in processing rate and the construction works on the NTSF and STSF.

For the increase in processing rate the dust generating activity was setup using a similar approach applied in the Air Quality Impact Assessment: Cadia East Project (Holmes Air Sciences, 2009). This approach was selected to provide a direct comparison with the existing approved operations. The assessed Year 17 in the Cadia East Project assessment most closely represents the current operations and is used as the basis for this assessment with the proposed increase in processing rate applied.”