The following submission is in regard to the Hume Coal Environmental Impact Statement and the Berrima Rail Project and in particular, the assessment of nitrogen oxide gaseous emissions modeling data, predictions and proposed monitoring and abatement proposals.

ITEM 1

The first item in this assessment comes from the following four statements from the EIS:

> ***"The introduction of additional Hume Coal train movements and associated increase in annual air pollutant emissions will increase ground level concentrations slightly; however, the increase in emissions will not result in exceedance of any applicable air quality criteria at any receptor location."***
>
> Hume Coal Project EIS - Appendix D - Berrima Rail Project - Part 1 of 5, Executive summary, Page ES6, Section ES3.2 Air quality and Greenhouse gas:

This prediction of future emissions is based on emissions modeling that is dependant upon, amongst other variables, locomotive emissions data which is confirmed by Hume coal as follows:

> ***"Primary inputs to the model were ...The emissions profiles of locomotives proposed to be used."***
>
> (Hume Coal Project EIS - Appendix D - Berrima Rail Project - Part 2 of 5 Volume 3A Section 8.2.2)

The type of locomotive proposed to be used is stated by Hume Coal is as follows:

> ***"Hume Coal trains will have two locomotives- indicatively of C44ACi class or newer if available at the time of purchase"***
>
> (Hume Coal Project EIS - Appendix D - Berrima Rail Project - Part 2 of 5 Volume 3A Section 8.2.5)

The emissions modeling for Hume Coal's C44ACi locomotive is being based upon US-EPA Tier 1+ emission factors as quoted:

> ***"Locomotive emissions were estimated based on US-EPA uncontrolled emission factors for the existing Berrima Branch Line, and US-EPA Tier 1+ emission factors for the Hume Coal trains"***
>
> (Hume Coal Project EIS - Appendix D - Berrima Rail Project - Part 2 of 5 Volume 3A Section 8.2.5)

The combined statements above show that emissions modeling is dependant upon the locomotives to comply to Tier1+ emissions (i.e.: NOx emissions above 6.64 and below 8.98 g/kW.hr). But the C44ACi locomotive does not comply to Tier1+ requirements. The C44ACi locomotive is classified as pre Tier 0 with Tier 0 being the limit of the GE 7FDL engine.

The C44ACi locomotive, supplied by United Group Limited, and manufactured using the 7FDL engine is supplied by GE in the United States. A Data sheet for the locomotive is attached to this submission or can be viewed via the following link. http://www.ugllimited.com/c44aci-locomotive
GE also sell the similar AC44i locomotive to the South American market as uncontrolled emissions vehicles (Pre Tier 0) . This class of locomotive is in stark contrast to other available classes of GE locomotives such as the Powerhaul series, Evolution series and the Next fuel series that are compliant to Tier 2, 3 and Tier 4 emissions requirements.

A summary of NOx emissions for various Tier standards is given below with uncontrolled and Tier 1+ emissions highlighted.

NOx emissions for Line Haul locomotives (g/kW.hr)

Uncontrolled	**17.53**
Tier 0	11.53
Tier 0+	9.66
Tier 1	8.98
Tier 1+	**8.98**
Tier 2	6.64
Tier 3	6.64
Tier 4	1.34

Nowhere in the locomotive supplier's website or data sheet is compliance to Tier 1+ emissions requirements indicated. Phone correspondence in early June 2017 to UGL has confirmed that this locomotive does not comply to any US EPA emissions requirements because there are no requirements for emissions from locomotives in NSW and most locomotives in NSW are classified as uncontrolled emissions locomotives. UGL further stated that there were no emissions upgrades currently available or scheduled for this locomotive. Furthermore, emissions testing of the C44ACi locomotive for the NSW EPA have confirmed it does not comply with US EPA Tier 1+ emissions requirement and NOx emissions were much higher at 16.55 and 12.1 g/kW.hr. (See attached documents)

The EIS emissions modeling should be based upon worst possible emissions which is not the case. It should also be noted that the locomotive exhaust emissions will increase with the age of the locomotive.

The last EIS statement above also refers to uncontrolled emissions of existing locomotives that use the Berrima branch line. This implies the authors were aware of the differences between uncontrolled and Tier 1+ emissions standards and have knowingly used higher standards for Hume Coal locomotives. Since the EIS NOx modeling depends upon these emission values its results are under stated and incorrect.

Could Hume Coal please provide evidence as to why they have knowingly applied Tier 1+ standards for NOx modeling and if they cannot provide this, to make a correction to the modeling inputs that reflect the change from Tier 1+ to uncontrolled emissions? The results of the corrected modeling and any exceedances should also be provided.

ITEM 2

The EIS states the yearly maximum of 1 hr averaged NO2 concentration for the Bargo air quality monitoring station was 94 ug/m3. (Hume Coal Project EIS, Appendix D, Berrima rail Project, Part 2 of 5, Section 8.3 Existing Environment, Table 8.4)
The EIS NO2 concentration modeling predicts a maximum NO2 concentration as 68.8 ug/m3. (Hume Coal Project EIS, Appendix D, Berrima rail Project, Part 2 of 5, Section 8.5, Operational impact assessment, Table 8.6)
The predicted maximum NO2 concentration (68.8) seems to be below the average Bargo background NO2 concentration of (94).

Could Hume coal please explain why the predicted value (being the sum of background and existing cumulative emissions from neighboring emissions sources) is below the background concentration? If a correction to modeling is required could Hume Coal please provide the results of the corrected modeling and any exceedances?

ITEM 3

With regard to NO2 concentration modeling results for all receptors, the maximum concentration of NO2 is stated as 201 ug/m3 compared to the maximum of 246 ug/m3 or 82% of the maximum allowable concentration. There is no estimation of errors in the modeling prediction. Hume Coal seems to be aware of a potential variance as they make numerous claims on the conservative nature of the modeling as quoted:

> ***"The predicted concentrations are below applicable air quality impact assessment criteria noting that the methodology for deriving NO2 concentrations from NOx concentrations is highly conservative"***
>
> Hume Coal EIS Main Report Part 7 of 8, page 334, 12.4.2 Gaseous pollutants

The EIS uses an ozone limiting method to model atmospheric NO2 concentrations. The following is an explanation of this methodology:

> ***"In other words, the NO_2 levels will vary with time and space away from the emissions source(s) depending on the composition and state of the receiving atmosphere, and it is very difficult to precisely model this situation. An accurate model that might represent these complex reactions would be unlikely to be practical to use for routine regulatory assessment purposes, and a simplified model becomes necessary.***
>
> ***Thus in any practical model that is suitable for routine use for NO_2 assessments, it is important that the model operates with a degree of conservatism (overestimation) in order to reasonably take into account the inherent inaccuracy that arises due to model simplifications."***
>
> ASSESSMENT METHODOLOGY FOR NITROGEN DIOXIDE AS AN AIR POLLUTANT, NSW Environment Protection Authority, Todoroski Air Sciences (TAS), 2015.

In summary, the ozone limiting methodology used in the EIS modeling is highly inaccurate and conservative estimates are essential because of this inaccuracy, but no accuracy of the NO2 concentration modeling is indicated in the EIS.

Furthermore, the ozone limiting methodology used in the EIS is not the most conservative approach for modeling. Assuming 100% conversion of NO to NO2 is the most conservative of NSW EPA recognized methods. The ozone limiting method neglects the oxidation of NO to NO2 by oxidants other than ozone and ignores the photodissociation of NO2. Furthermore, a significant variable that increases NO2 concentrations is low temperatures. The southern highlands with low yearly average temperatures would significantly raise the proportion of NO2 relative to NO.

The above claim by Hume coal seems to be misleading as to it's highly conservative approach.

Could Hume coal please provide data to indicate the accuracy of predicted maximum concentrations of NO2 and corresponding maximum NO2 concentrations at each receptor with this error? Also could Hume Coal please further explain the "highly conservative" methodology quoted?

ITEM 4

The EIS claims the Bargo air quality measurements are not representative since it is in the Sydney basin.

> ***"Finally, the use of NO2 and O3 air quality monitoring data from the NSW OEH Bargo air quality monitoring station, located in the southwest of the Sydney basin, is considered conservative for representing ambient concentrations at the project."***
>
> Hume Coal Project EIS Appendix K Air Quality and Greenhouse Gas Assessment, Section 8.5 Pg 71.

There is no NOx measuring data within the project area, so the comparison claim above has no data to support it.

Furthermore, Wikipedia's definition of the Sydney basin is as follows:

> ***"The Sydney Basin consists of Permian and Triassic sedimentary rocks. It is named for the city of Sydney which is centred within it and stretches from Newcastle in the north to Batemans Bay in the south, and west to the Great Dividing Range."***
>
> https://en.wikipedia.org/wiki/Sydney_Basin

Durras Lake on the NSW south coast, 270 km from Sydney, is also in the Sydney basin. Claiming that the measurement location being atop of a geological feature has no connection to air quality.

Bargo at 300 m elevation and 100 km from the Sydney CBD, is in the Macarthur region in a rural setting and would seem to be a good approximation of air quality to that of the Moss Vale area. With significantly less development in the Bargo area compared to the project area, one could argue that background air quality in Bargo is better. Air quality data for the Bargo measuring station shows lower NO2 and higher ozone than measuring stations within the Sydney metropolitan area which is typical for a rural location. Bargo is located in the Wollondilly local government area and part of the Greater Sydney metropollitan area but not the Sydney Metropollitan area or the Sydney air shed. The Wingecarribee local government area where the project is proposed is located next to the Wollondilly Shire.

Paradoxically, the EIS claims Bargo monitoring data is in good agreement with Hume TEOM1.
Hume Coal Project Main Report Part 7 of 8, 12.2.3 Baseline air quality environment, section iv,PM10, pg 323
Could Hume Coal please support the claim of the conservative nature of the Bargo air quality monitoring station?

ITEM 5

Hume coal again state the apparent conservative nature of NO2 modeling results.

"It is reiterated that the methodology for deriving NO2 concentrations from predicted NOx concentrations is highly conservative on the following basis (as per Section 8.5):
- 1-hour average concentrations predicted based on the peak hourly rail movements occurring continuously throughout the 12 month dispersion modeling period:"

(Hume Coal Project EIS Appendix K Air Quality and Greenhouse Gas Assessment, Section 9.2)

The above 1 hourly average concentration would not be affected if assumed to have continuously occurred during the 12 month period. However this value could be affected if the other emissions sources, background and peak rail movements coincided within the same 1 hour period, which is the purpose of the modeling, therefore is not conservative but necessary.

Can Hume Coal please explain why the above claim is conservative as opposed to necessary?

ITEM 6

> ***"As described in Chapter 2, leading practice measures have been incorporated into the design of the project, including measures specifically related to avoiding, minimizing and/or mitigating potential air quality impacts including: … Procurement of the latest generation rail locomotives and wagons"***
>
> Hume Coal Project Main Report Part 7 of 8, Section 12 Air quality, Section 12.1 introduction, Page 315.

This locomotive has improved traction control compared to older locomotives leading to better operational efficiency but with regard to exhaust emissions, which is in the context of this claim, this locomotive emits the same exhaust emissions as locomotives decades older in technology. In fact, the older EMD powered 81 and 90 Class locomotives with EMD exhaust emissions upgrade kits have better emissions (Tier 0+) than the C44ACi locomotive.

(DIESEL LOCOMOTIVE Emissions Upgrade Kit Demonstration Project. Prepared for NSW EPA, ABMARC, 2015)

The only information with regard to wagons is that they are covered. No other wagon information in the EIS is available. See also: Hume coal project EIS Main Report Part 2 of 8, page 17, Section 2.3.4. Covering of rail wagons. Hume coal project EIS Main Report Part 3 of 8, page 31, 2.9 Coal transport.

> ***"Hume Coal will use the latest generation rail locomotives and wagons. They use less fuel and generate fewer emissions than older locomotives commonly used in Australia, which will improve air quality and greenhouse gas emissions. The locomotives will have isolated engine and operator cab mountings to reduce vibration and noise generation."***
>
> Hume coal project EIS Main Report Part 2 of 8, page 17, Section 2.3.5. Advanced High Performance locomotives.

Again, Hume Coal are not using the latest generation rail locomotives as claimed. These generate more emissions than older locomotives such as the upgraded EMD locomotives and current locomotives to Tier 2 standard such as in the Pilbara with GE evolution locomotives used by Rio Tinto, BHP Billiton and Fortescue Metal Group to name a few. Claiming less vibration and noise generation is false as the noise and vibration is not reduced at its source. The engine and cab mountings merely mitigate the generated noise from reaching the train driver inside the cab, but this claim seems to imply the locomotive will be quieter to the local environment, which is not the case.

Can Hume Coal please substantiate the above 2 claims?

ITEM 7

Mitigation measures are also claimed by using new rolling stock to minimise diesel combustion.

> ***"The following management practices will be implemented to minimise emissions from the combustion of diesel:***
>
> - ***new rolling stock and locomotives will be used minimise emissions from diesel combustion:"***
>
> Hume Coal Project EIS Main Report Part 7 of 8, page 339, 12.6.2 diesel combustion engines.

In light of the preceding discussions, can Hume Coal please substantiate the above claim?

ITEM 8

With regard to on site air quality monitoring during construction and operation phases, there are no measures indicated to measure NO2 concentrations and verify modeling accuracy even though other pollutants are already being monitored.

Hume Coal Project EIS Main Report Part 7 of 8, page 339, 12.6.3 Air quality monitoring

Can Hume Coal please explain why NO2 / NOx monitoring is not planned, particularly when modeling data is known to be inaccurate and final modeling NO concentrations are close to the 246ug/m3 limit?

ITEM 9

The EIS claims the C44ACi locomotive with the latest technology with regard to emissions is chosen as a mitigation measure. (Hume Coal Project EIS Main Report Part 7 of 8, 13.4 Management and Mitigation. Pg 348) As highlighted previously, the C44ACi locomotive produces the highest exhaust emissions of any available locomotive.

Can Hume Coal please substantiate this claim?

ITEM 10

Hume Coal EIS Project Appendix K Air quality and greenhouse gas assessment, Appendix 2: Neighboring emission source emission calculations and impacts: pg 2-5, Table A2-2 Annual Berrima Branch Line emissions-current and future.

Existing NOx emissions from rail movements along the Berrima branch line are stated as 56 tonnes p.a. from existing movements and 81 tonnes NOx p.a. or a 144 % increase in emissions for future movements. With the current emissions sources, the receptors 26, 27, 28 and 29 next to the Berrima branch line have a

maximum NO2 concentration over 1 hour of 112.2, 94.6, 140.1, and 120.8 ug/m3. (Table A2.3). These receptors are understandably sensitive to locomotive emissions which are reflected in their high NO2 concentrations relative to other receptors located further away from the Berrima branch line.

Future rail movements will result in a 144% increase in NOx emissions but the modeling predicts a miniscule 0.04% increase to 112.2, 94.6, 140.1, 120.9 ug/m3 for the same receptors (Table A4-6).

Can Hume Coal please explain why only a 0.04% increase in NO2 concentrations is predicted for the noted receptors in light of a 144% increase in NOx emissions from locomotive movements? Additionally, can Hume Coal please explain the effect of using unrestricted emissions factors for Hume Coal locomotives on the NO2 concentrations at the noted receptors.

ITEM 11

Hume coal Project EIS Main Report Part 2 of 8, Page 27, 2.5.3 Gas drainage.
EIS claims gas levels will be extremely low. In light of recent attempts to extract coal seam gas in the same region, this hardly seems to be the case? As a result of high gas concentrations how would this impact on air quality?

Summary

The optimistic opinion of the authors is constantly repeated throughout the EIS which questions the scientific rigor of the authors. This casts doubt regarding modeling data and any study that required input of data by the Authors. Additionally, nowhere in the EIS is there data validating the accuracy of dispersion model predictions.

An EIS is intended to be a scientific document that demonstrates proper scientific procedure, rigor and logic. It has degraded into a private company marketing document with financially driven, skewed opinions drawing to foregone conclusions with disregard for the above rigor and logic. This document undermines the credibility of the scientific community by claiming to be an EIS or scientific document.

I hope that this review of the nitrogen oxides emissions has shown that the Authors of this EIS under the brief supplied by Hume Coal have understated the emission and exposure of persons to pollutants in the proposal. Furthermore the Authors and Hume coal have down played the already high NO2 emissions with numerous unfounded arguments to mislead readers into assuming that actual NO2 emissions could possibly be lower.

> ***"All applicable standards and criteria specified by relevant regulators will be satisfied meaning no impacts will occur that are at unacceptable levels. The net overall outcome of***

environmental, economic and social impacts is positive and therefore it is considered the project is orderly development and will be in the public interest."

Hume Coal Project EIS - Appendix D - Berrima Rail Project - Part 1 of 5, Executive summary, section ES4 Justification and conclusion:

In light of the dangerously optimistic modeling of NO2 concentrations and lack of a NO2 monitoring plan with a real potential to endanger the health of the public, I recommend that the above quoted recommendation be retracted. Hume Coal and EMM consulting have through this EIS, demonstrated that this development is a risk to public health and cannot proceed in its current state. This submission focuses only on EIS NOx gaseous emissions where numerous misleading claims and inaccurate data are commonplace. Due to time constraints one would prefer to review the entire EIS to examine how far this professional misconduct has spread. One would imagine that the Hume Coals and EMM consulting's opinions projected in this part of the EIS is representative of the rest of the EIS which puts into doubt any of its recommendations.