Mr Steve O'Donoghue
Director Resource Assessments

By email: Stephen.ODonoghue@planning.nsw.gov.au

Monday, 12 December 2022

Dear Steve

Subject: Advice in relation to the Moolarben Coal Complex OC3 Extension Project, Predicted Greenhouse Gas Emissions

The DPE Science, Economics and Insights Net Zero Emissions Modelling team (NZEM) provide advice in relation to the Greenhouse Gas (GHG) emissions assessment for the Moolarben OC3 Extension Project (the Project). We have undertaken a high-level review of the key documents provided for our consideration in Appendix 1. A summary of our findings and recommendations follows.

Technical review of estimated greenhouse gas Scope 1, 2 and 3 emission calculations

The GHG assessment was prepared by Yancoal and Todoroski Air Sciences (final version 27 October 2022). This addressed the relevant emission sources and scopes. Emission estimates were consistent with contemporary practice and the emission factors in general appear to be adequate for the calculations. However, some recommended improvements are:

I. More detail is required on the diesel consumption associated with the Project. The use of a single activity factor for diesel consumption leads to discrepancies between reported values and those derived by NZEM. Having more detailed information on the sources of diesel consumption will better inform potential abatement measures.

II. The gas content of the seam should be provided as well as the methane and carbon dioxide contents of the gas. This data will provide further support for the small fugitive emissions factor reported to be approximately 0.001 t CO_2-e/t ROM.

III. The likely changes in the fugitive emission factor should be considered as the pit deepens over time. Will the pit continue to remain shallow in 2035?

IV. The Proponent should revise forecast scope 2 and 3 electricity emissions from 2025 to 2036 using e.g. DCCEEW's Australia's Emissions Projections 2021 forecasts. These forecasts take proper account of the expected decarbonisation of the NSW electricity grid.

V. More information is required on the specific areas of each type of vegetation to be cleared on an annual basis.

Consistency with NZEM modelling for Net Zero Stage 1: 2020-2030 Implementation Update

The currently approved Moolarben Open Cut mine operations are accounted for in NZEM's emissions projections. These have operations continuing to 2038. The current set of emissions projections was developed prior to the Project being granted State Significant Infrastructure status in 2022.

The Project falls within the approved life of the Moolarben Coal Complex which ends 31 December 2038.

Based on the GHG assessment, the annual average scope 1 and 2 emissions from the Project will increase NSW emissions by approximately 80,000 tonnes CO_2-e or 0.06% (based on the 2020 NSW emissions inventory). These additional emissions have not been factored into current projections.

All coal mine emissions forecasts have been developed using coal production forecasts provided by the Mining, Exploration and Geoscience (MEG) group in the Department of Regional NSW (DRNSW). NZEM's emissions forecasts will be updated upon receipt of approved Project run-of-mine (ROM) coal volume projections from MEG.

Review of the Proposed GHG Mitigation Measures

NZEM was requested to consider the measures to minimise the Scope 1 and 2 emissions from the Project and any additional measures that could be implemented to mitigate Scope 1 and 2 emissions to the greatest extent practicable over the life of the project. Our review is provided in Appendix 1.

The reduction measures described by the Proponent for reducing emissions from diesel-powered equipment (the largest source of scope 1 emissions for the Project) include:

- minimising haul distances
- maximising equipment utilisation
- regular equipment maintenance
- monitoring fuel consumption
- biodiesel use (under consideration).

NZEM agrees with the peer reviewer that the option for electrification of the mine fleet within the project lifetime is not likely feasible due to the lack of battery electric mobile equipment currently available at the required scale. However, there may be significant advancements in this technology over the next 5-10 years.

Therefore, the Proponent should commit to regular reviews of best practice technologies in relation to low emissions alternatives to diesel-powered equipment.

As discussed in the GHG assessment, the option for purchasing renewable electricity should be reviewed if the existing contractual arrangements allow.

Yours sincerely,

Matthew Riley

Director Climate and Atmospheric Science

Environment Energy and Science

Appendix 1 – Overview of Greenhouse Gas Assessment documents

The DPE Science, Economics and Insights Net Zero Emissions Modelling team (NZEM) in the Climate and Atmospheric Science Branch of the NSW Department of Planning and Environment has reviewed the following documents and the findings are presented below.

Greenhouse Gas assessment in Appendix J prepared by Yancoal with calculations performed by Todoroski Air Sciences in Attachment 1 – final version 27 October 2022[1]

The project concerns the Moolarben Coal Complex situated 40 km north of Mudgee in New South Wales (NSW). The mining operations at the Moolarben Coal Complex are currently approved until December 2038. The complex consists of four approved open cut mines (OC1 to OC4) and three approved underground mines. The combined production rate is 22 Mtpa of run-of-mine (ROM) coal.

Under the Safeguard Mechanism, the existing Moolarben Coal Complex has a current baseline of approximately 0.36 Mt CO_2-e for FY21 to FY23.

The Project seeks to extend open cut mining operations south of the approved OC3 open cut pit and develop four new open cut pits to the east and south-east of the approved OC3 area.

The extension would provide approximately 10 years of mining (2025-2034) yet fall within the approved life of the Moolarben Coal Complex which ends 31 December 2038.

The Project will extract up to a total of approximately 40 million tonnes (Mt) of additional ROM coal over the life of the Project or 9 Mtpa.

The greenhouse gas (GHG) assessment was prepared in accordance with Part 4 of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act).

The Secretary's Environmental Assessment Requirements (SEARs) in relation to the Project's greenhouse gas (GHG) emissions includes:

- an assessment of the likely GHG impacts
- an analysis of how the Project's GHG emissions would affect state and national GHG emission reduction targets
- a review of available best practice GHG emissions reduction measures for Scope 1 and 2 emissions
- details of proposed GHG emissions avoidance, mitigation and/or offset measures.
- an independent peer-review of the GHG emission estimates and emission reduction measures.

Scope of emissions

The GHG assessment covers scope 1 direct emissions from:

- fugitive methane emissions from coal mining
- combustion of fuels in stationary sources (e.g., generation of electricity)
- physical and/or chemical processing
- transportation of materials, products, waste and employees in mobile combustion sources

[1] https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-33083358%2120221104T091012.052%20GMT

It also covers Scope 2 emissions from the generation of purchased electricity consumed by the Project.

Scope 3 indirect emissions include:

- extraction, production and transport of diesel, oils and greases consumed at the Project
- purchased grid electricity used by the Project
- transportation of product coal to port and shipping to overseas consumers
- combustion of product coal by end users.

Activity Data

Table 2-1 in Attachment 1 of the GHG assessment gives the annual fuels, oils, greases, explosives and electricity requirements for the Project as a function of ROM coal production. Table 2-2 gives the quantities for each year covering 2025 to 2036 based on the anticipated volume of ROM coal. The years 2035-38 are considered the years for decommissioning, where diesel is consumed by plant and equipment for rehabilitation of the site.

A check was performed on the data in Table 2-2 covering years 2025-2036 using the factors in Table 2-1. Apart from diesel, the quantities were in reasonable agreement with those reported (apart from errors presumably due to round-off).

For diesel consumption, the consumption figures calculated by NZEM using 3,388 kL/Mtpa were between 4% and 24% lower than reported in Table 2-2. The Proponent should provide more details around the diesel consumption calculations given that it is the largest source of emissions for the Project.

The overall approach is reasonable but more information on e.g., the equipment and specific activities that consume the diesel would have been helpful. This would enable a more in-depth review of the abatement measures to be made.

Approximately 82 ha of land-clearing is required for the Project – the types of vegetation to be cleared was not specified.

GHG emission factors and calculations

Section 1.3 of the GHG assessment indicates that the key gases assessed were methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). The global warming potentials (GWPs) were consistent with those in the National Greenhouse Accounts Factors (NGAF) 2021.[2] The methane GWP is 28 and the nitrous oxide GWP is 265, consistent with the International Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).

Section 2.2 in Attachment 1 indicates the source of the emission factors. The scope 1 and 3 fuels, oils and greases emission factors in Table 2-3 were checked against NGAF 2021 and all were identical.

The explosives emission factors were identical to those in the 2004 AGO Factors and Methods workbook.

[2] Department of Industry, Science, Energy and Resources (DISER) (2021). National Greenhouse Accounts Factors. Australian National Greenhouse Accounts. August 2021.

The scope 2 and 3 electricity emission factors were also identical to those in NGAF 2021. As discussed in the Peer review report,[3] electricity consumption emissions were forecast using the current NSW grid emissions factor of 0.79 kg CO_2-e/kWh.

The Proponent should revise the forecast scope 2 and 3 electricity emissions from 2025 to 2036 using forecasts based on e.g. projections published by the Department of Climate Change, Energy, Environment and Water (DCCEEW).[4] Table 38 in ref. 4 gives the projected scope 2 electricity grid emission factor in 2035 as 0.02 kg CO_2-e/kWh. The scope 2 and 3 factor in 2030 (ref. 4, Table 39) is 0.02 kg CO_2-e/kWh.

The scope 3 emission factors for rail and ship transport of the product coal are as per the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015.[5] The GHG assessment states that the approximate rail distance is 560 km return and the shipping distance is 16,000 km return.

The scope 3 emission factor for combustion of product coal (assumed bituminous) was also identical to the factors in NGAF 2021.

The scope 1 emission factors for land clearing are consistent with those in the Greenhouse Gas Assessment Workbook for Road Projects.[6]

The scope 1 emission factor for fugitive emissions is a site-specific factor. The maximum fugitive emissions factor was 0.0009 t CO_2-e/t ROM based on gas sampling, coal quality and geological logging. The factor for the Moolarben Coal Complex, based on Method 2 under the NGER Act,[7] was 0.0012 t CO_2-e/t ROM. The latter value was adopted in the EIS providing more conservative figures for the fugitive emissions. However, the Proponent should use the pit-specific emission factor to provide more a more accurate assessment of fugitive emissions for the Project.

The Proponent should provide indicative values for the gas content of the seam and the methane and carbon dioxide content of the gas. This would provide more transparency in relation to the quoted fugitive emissions factor.

GHG emissions for the Project and Verification of Calculations

As discussed above, the emissions due to diesel consumption could not be verified due to discrepancies in the activity data. The Proponent should provide a more detailed calculation of diesel consumption (e.g. by specific equipment types) to allow verification and identification of the key diesel consuming activities to better inform abatement measures.

The land clearing emissions could not be verified – two emission factors are provided for clearance of forests and grassland but only a single figure for land clearing (82 hectares). The Proponent should specify the areas of each type of vegetation that are to be cleared annually.

A verification of the scope 3 emissions using the various emission factors shows a discrepancy of about 10-15% in the reported emissions. This may be due to round-off in the reported emission factors and/or ROM coal volumes.

The figures in Table 2-5 in Attachment 1 have been verified. That is, the annual average scope 1 and 2 emissions of 0.06 and 0.02 Mt CO_2-e and the total scope 1 and 2 emissions of 0.60 and 0.19

[3] https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-33083358%2120221104T091006.260%20GMT
[4] Australia's Emissions Projections 2022, Department of Climate Change, Energy, Environment and Water (DCCEEW), December 2022. https://www.dcceew.gov.au/sites/default/files/documents/australias-emissions-projections-2022.pdf
[5] https://www.dcceew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme/safeguard-mechanism
[6] https://roads-waterways.transport.nsw.gov.au/documents/about/environment/greenhouse-gas-assessment-workbook-road-projects.pdf
[7] National Greenhouse and Energy Reporting (Measurement) Determination 2008, Division 2.2.3.

Mt CO_2-e. However, the scope 2 emissions need to be reviewed in light of the declining NSW electricity grid GHG emissions intensity.

The Proponent claims that the estimated annual average and maximum annual Scope 1 greenhouse gas emissions of the Project combined with the emissions for the existing Moolarben Coal Complex would remain below the current Safeguard Mechanism baseline of 0.36 Mt CO_2-e. This is likely to be the case in NZEM's view.

The Proponent acknowledges that they would be required to purchase ACCUs, or fund other appropriate offsets, for any exceedance of the Safeguard Mechanism baseline emissions value.

GHG abatement measures

Section 4.2.2 of the main assessment report and Section 3 of Attachment 1 address GHG management. Fugitive emissions for the Project are "small due to the shallow open cut mining depth and low gas content of the target seam (particularly low methane content)."

The statement above may be true in the early years of the Project. But in the years beyond 2030, what depth will the open cut pit reach? Will the pit in these years remain shallow? As the pit expands towards the east and away from the basin margins could deeper seams with higher gas contents (and higher methane content) be accessed?

Were the gas properties of over- and underlying coal seams, and their subsequent contribution to fugitive emissions, considered particularly as mining deepens?

Is it possible that as the pit deepens the methane could be drained and used beneficially?

The most significant source of emissions for the Project is from diesel consumption. The reported mitigation measures include minimising haul distances, maximising equipment utilisation, regular equipment maintenance, and monitoring fuel consumption. The use of biodiesel is being considered.

As discussed in the Peer review report,[3] the option for electrification of the mine fleet within the project lifetime is not likely feasible due to the lack of battery electric mobile equipment currently available at the required scale. However, there may be significant advancements in this technology over the next 5-10 years.

Therefore, the Proponent should commit to regular reviews of best practice technologies in relation to low emissions alternatives to diesel-powered equipment.

As discussed above, more details are needed on the diesel consuming activities to allow better identification of mitigation opportunities.

As discussed in the GHG assessment, the option for purchasing renewable electricity should be reviewed if the existing contractual arrangements allow.