17 December 2021

Department of Planning, Industry and Environment
Locked Bag 5022
PARRAMATTA NSW 2150
Via Email: Stephen.ODonoghue@planning.nsw.gov.au

Dear Steve,

RE: NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT – GREENHOUSE GAS INFORMATION

In reference to your email dated 14 December 2021 we understand that the Department of Planning, Industry and Environment (DPIE) has consulted with the Climate and Atmospheric Science team and have requests for information in relation to the Narrabri Underground Mine Stage 3 Extension Project (the Project). Narrabri Coal Operations Pty Ltd (NCOPL) is pleased to provide the responses below.

RFI 1 Fugitive emissions from "post mining activities" eg. emissions from coal stockpiles, were correctly applied for the Project as a "gassy" mine. The CAS team is seeking advice as to why it has not been applied to current operations and reporting for NGER. Can you clarify.

The National Greenhouse and Energy Reporting scheme (NGER) defines a gassy underground coal mine as 'an underground mine that has at least 0.1% methane in the mine's return ventilation'. To date the Narrabri Coal Project – Stage 2 has not exceeded 0.1% methane in its return ventilation and therefore it is not currently defined as a gassy mine for the purposes of NGER.

Over the life of the mine, the percentage of methane in the mines return ventilation has slowly increased and it is expected that it will exceed 0.1% in the future as part of the Project. During FY2021, the methane in the mine's return varied between 0.02 and 0.07%.

RFI 2 The Palaris reports provide some detail on Membrane Separation Technology as a potential option for abatement – is there information available on CAPEX/ OPEX related with this technology, similar to details provided on the RTO technology, even at a concept/ high level costings to provide a guide.

As described in Palaris (2021)[1], membrane separation technology could potentially be used to remove carbon dioxide from mine gas streams in order to improve methane composition and in-turn allow for additional flaring. A comprehensive study of several emissions reduction technologies is proposed to determine the best technical and commercially viable option for the Project.

Palaris (pers comms, 2021) has indicated that capital expenditure (CAPEX) would be estimated at $1 million (M) per unit and operating expenditure (OPEX) would be 20 - 30% more expensive to operate compared to flares. Additional costs are expected to be associated with maintenance, including servicing the compressor and cleaning the membranes. For comparison, and as noted in the Amendment Report, flaring infrastructure consisting of four mobile flares excluding the cost of the gas drainage units and piping has been costed at approximately $2M of CAPEX (approx. $500,000 per unit) and an OPEX of $0.3M per annum (or $5.6M over 12 years) (NCOPL pers comms, 2021). It should be noted that these cost assumptions are estimates only and as noted in the Palaris (2021)[1] report, additional comprehensive studies are required to determine the appropriateness and cost of the technology.

RFI 3 Can emissions post mine decommissioning be provided – based on NGER technical guidelines.

Attachment 1 provides a memorandum from Jacobs with an estimate of greenhouse gas emissions associated with the post-mine decommissioning phase.

[1] Palaris (2021) *Narrabri Underground Stage 3 Extension Project GHG Abatement Benchmarking.*

RFI 4 The Method 1 approach was applied to calculate emissions consistent with NGER Technical guidance – however CAS advises that global warming potentials from IPCC 4th Assessment Report were applied rather than 5th Assessment Report – can you provide clarification.

The Palaris (2020)[2] gas assessment used in Jacobs (2020)[3] (as part of the Project Environmental Impact Statement) provided the modelled CH_4 and CO_2 emissions. These data were used by Jacobs as the fugitive emission estimates in the overall site inventory, who modelled and reported CH_4 and CO_2 emissions on the assumption that the global warming potentials (GWPs) were 25 for CH_4 and 1 for CO_2. The IPCC 5th Assessment Report and NGA Factors 2020 (released in October 2020, subsequent to completion of Jacobs [2020]) provide updated GWPs; 28 for methane and 1 for carbon dioxide. In relation to the revised greenhouse gas emissions estimates in the Amendment Report, as described in Palaris (2021)[4], the GWP was maintained to be consistent with the EIS estimate (i.e. methane with a GWP of 25) to allow direct comparative analysis of the improved abatement delivered by the flaring proposed in the Amendment Report.

RFI 5 Can you compare/ benchmark the average electricity consumption at the site of 13.3 kWh/t ROM coal compared to current best practice for energy efficiency of underground mining operations in NSW -

Since the Amendment Report was lodged, NCOPL has commenced receiving carbon neutral energy for all its electricity supply, which is a scheme where eligible carbon offset units are purchased and retired to offset the emissions associated with the generation and delivery of electricity. For the period where this arrangement is in place, all Scope 2 emissions would be offset by these projects, which are certified by Climate Active.

We trust this meets your immediate requirements; please don't hesitate to contact me should you have any queries.

Yours sincerely,

David Ellwood
Director NCO Stage 3 Project

[2] Palaris (2020) *Gas Emissions Comparison – Narrabri South.*
[3] Jacobs (2020) *Narrabri Underground Mine Stage 3 Extension Project Air Quality and Greenhouse Gas Assessment.*
[4] Palaris (2021) *Narrabri Underground Mine Stage 3 Extension Project GHG Emission Forecast.*

ATTACHMENT 1

NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT
POST MINING AND DECOMMISSIONING GHG EMISSION ESTIMATE

Narrabri Coal Operations Pty Ltd ABN 15 129 850 139

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17 December 2021

Attention: David Ellwood
Narrabri Coal Operations Pty Limited

Project Name: Narrabri Underground Mine Stage 3 Extension Project
Project Number: IA217900

Dear David

Air Quality and Greenhouse Gas Assessment Information for the Department of Planning Industry and Environment

Thank you for the information from the Department of Planning, Industry and Environment (DPIE) seeking clarification on a number of matters related to greenhouse gas emissions.

Please see attached for information to assist with responses to Items 3 and 4 of the DPIE's request.

Yours sincerely

Shane Lakmaker
Principal (Air Quality)

Jacobs

17 December 2021

1. Emissions Post Mine Decommissioning

The DPIE asked the following question:

- *Can emissions post mine decommissioning be provided – based on NGER technical guidelines.*

Consistent with the methodology described by Jacobs (2020), emissions post mine decommissioning have been calculated in accordance with the principles of the Greenhouse Gas Protocol. This involved determining the sources of greenhouse gas emissions and reporting the calculated emissions as direct and indirect impacts of the Project. The greenhouse gas inventory for this assessment includes all significant sources associated with the Project (post mine decommissioning) and separated into Scopes 1, 2 and 3.

Table 1 shows the material emission sources and calculation methodologies. In relation to fugitive emissions, it should be noted that longwall blocks would be sealed after the last longwall block is finished, therefore, fugitive emissions would only occur mainly from first workings and goaves.

Table 1 Post mine decommissioning emission sources and calculation methodologies

Activity	Description	Scope(s)	Post mine decommissioning assumptions
Diesel usage	Combustion of diesel fuel from mobile and stationary plant and equipment.	1, 3	Final year operational usage (1,134 kL) assumed to continue for a further six years to allow for rehabilitation and earthworks (NCOPL). Emission factors from NGA Factors (DEE, 2019).
Fugitive	Fugitive emissions from the extraction of coal including gas venting and drainage.	1	Method 1 from Section 3.2.4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Measurement Determination)* relating to fugitive emissions from decommissioned underground mines. Final year fugitive emissions as per Palaris (2021).
Post-mining	Fugitive emissions from post mining activities such as transportation and stockpiling of coal from the release of residual gases not released during the mining process.	1	No coal production. Zero post mine decommissioning emissions.
Vegetation	Loss of carbon sink due to removal of vegetation.	1	Zero post mine decommissioning emissions.
Electricity	Electricity usage.	2, 3	Emission factors from NGA Factors (DISER, 2021).
Transport (rail)	Transport of product coal by rail to port.	3	No coal production. Zero post mine decommissioning emissions.
Transport (shipping)	Transport of product coal by ship to market.	3	No coal production. Zero post mine decommissioning emissions.
Energy production	Combustion of thermal coal in power generators by end users.	3	No coal production. Zero post mine decommissioning emissions.
Coking coal	Combustion of coking coal by end users.	3	No coal production. Zero post mine decommissioning emissions.

Table 2 provides a summary of the estimated greenhouse gas emissions up to 20 years post mine decommissioning.

Table 2 Summary of estimated greenhouse gas emissions post mine decommissioning

Year	ROM coal (t)	Emissions (Mt CO_2-e/y)		
		Scope 1	Scope 2	Scope 3
2045	0	0.305	0.038	0.004
2046	0	0.227	0.038	0.004
2047	0	0.177	0.038	0.004
2048	0	0.143	0.010	0.001
2049	0	0.118	0.010	0.001
2050	0	0.099	0.010	0.001
2051	0	0.080	-	-
2052	0	0.068	-	-
2053	0	0.059	-	-
2054	0	0.051	-	-
2055	0	0.045	-	-
2056	0	0.040	-	-
2057	0	0.035	-	-
2058	0	0.031	-	-
2059	0	0.028	-	-
2060	0	0.025	-	-
2061	0	0.022	-	-
2062	0	0.020	-	-
2063	0	0.018	-	-
2064	0	0.016	-	-

Appendix A provides more detailed breakdowns of the estimated emissions for each activity by mining year, as relevant to post mine decommissioning.

2. Global Warming Potentials

The DPIE asked the following question:

- *The Method 1 approach was applied to calculate emissions consistent with NGER Technical guidance – however CAS advises that global warming potentials from IPCC 4th Assessment Report were applied rather than 5th Assessment Report – can you provide clarification.*

Jacobs (2021) used the fugitive emission estimates from Palaris (2021) to develop the overall Project emission inventory. Palaris (2021) modelled the fugitive CH_4 and CO_2 emissions and reported these emissions on the assumption that the global warming potentials (GWP) were 25 for CH_4 and 1 for CO_2. As noted by the DPIE the IPCC 5th Assessment Report and NGA Factors (DISER, 2020 and subsequent versions) updated and now report the global warming potentials as 28 for CH_4 and 1 for CO_2. The update affects the fugitive emissions due to the conversion

from volumetric emission rates (litres per second) to mass emission rates (kg/s). Jacobs has estimated the change in emissions, over those previously reported, due to the GWP update to be an increase of approximately 9% on average during operational mining years.

3. References

DEE (2019) “National Greenhouse Accounts Factors”. Department of Environment and Energy, now Department of Industry, Science, Energy and Resources.

DISER (2020) “National Greenhouse Accounts Factors”. Department of Environment and Energy now Department of Industry, Science, Energy and Resources. October 2020.

DISER (2021) “National Greenhouse Accounts Factors”. Department of Environment and Energy now Department of Industry, Science, Energy and Resources. August 2021.

Jacobs (2020) “Narrabri Underground Mine Stage 3 Extension Project – Air Quality and Greenhouse Gas Assessment”. Final Report, dated 24 August 2020. Reference IA217900.

Jacobs (2021) “Air Quality and Greenhouse Gas Assessment Response to Submissions”. Letter dated 31 May 2021.

NGER (2020) “Estimating emissions and energy from coal mining guideline”. August 2020.

Palaris (2021) “Narrabri South Stage 3 Project GHG Emission Forecast”. Whitehaven Coal Limited. Dated May 2021. Document number WHC5824-06.

Appendix A Greenhouse Gas Emissions by Activity

Diesel Usage (Post Mine Decommissioning)

			Emission factor (kg CO2-e/kL)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kL)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2045	-	1,134	2709.72	0	138.96	3,074	-	158	3,231
2046	-	1,134	2709.72	0	138.96	3,074	-	158	3,231
2047	-	1,134	2709.72	0	138.96	3,074	-	158	3,231
2048	-	1,134	2709.72	0	138.96	3,074	-	158	3,231
2049	-	1,134	2709.72	0	138.96	3,074	-	158	3,231
2050	-	1,134	2709.72	0	138.96	3,074	-	158	3,231
2051	-	-	2709.72	0	138.96	-	-	-	-
2052	-	-	2709.72	0	138.96	-	-	-	-
2053	-	-	2709.72	0	138.96	-	-	-	-
2054	-	-	2709.72	0	138.96	-	-	-	-
2055	-	-	2709.72	0	138.96	-	-	-	-
2056	-	-	2709.72	0	138.96	-	-	-	-
2057	-	-	2709.72	0	138.96	-	-	-	-
2058	-	-	2709.72	0	138.96	-	-	-	-
2059	-	-	2709.72	0	138.96	-	-	-	-
2060	-	-	2709.72	0	138.96	-	-	-	-
2061	-	-	2709.72	0	138.96	-	-	-	-
2062	-	-	2709.72	0	138.96	-	-	-	-
2063	-	-	2709.72	0	138.96	-	-	-	-
2064	-	-	2709.72	0	138.96	-	-	-	-

Fugitive Emissions (Post Mine Decommissioning)

		Emissions (t CO2-e/year) - no abatement				Emissions (t CO2-e/year) - flaring pre drainage			
Year	ROM coal (t)	Scope 1	Scope 2	Scope 3	Total	Scope 1	Scope 2	Scope 3	Total
2045	-	301,445			301,445	301,445			301,445
2046	-	224,018			224,018	224,018			224,018
2047	-	174,301			174,301	174,301			174,301
2048	-	139,429			139,429	139,429			139,429
2049	-	114,491			114,491	114,491			114,491
2050	-	95,482			95,482	95,482			95,482
2051	-	80,272			80,272	80,272			80,272
2052	-	68,153			68,153	68,153			68,153
2053	-	58,804			58,804	58,804			58,804
2054	-	51,096			51,096	51,096			51,096
2055	-	44,660			44,660	44,660			44,660
2056	-	39,668			39,668	39,668			39,668
2057	-	35,041			35,041	35,041			35,041
2058	-	31,066			31,066	31,066			31,066
2059	-	27,626			27,626	27,626			27,626
2060	-	24,630			24,630	24,630			24,630
2061	-	22,184			22,184	22,184			22,184
2062	-	19,966			19,966	19,966			19,966
2063	-	18,000			18,000	18,000			18,000
2064	-	16,249			16,249	16,249			16,249

Electricity Consumption (Post Mine Decommissioning)

			Emission factor (kg CO2-e/kWh)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kWh)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2045	-	48,443,000	0	0.78	0.07	-	37,786	3,391	41,177
2046	-	48,443,000	0	0.78	0.07	-	37,786	3,391	41,177
2047	-	48,443,000	0	0.78	0.07	-	37,786	3,391	41,177
2048	-	12,614,000	0	0.78	0.07	-	9,839	883	10,722
2049	-	12,614,000	0	0.78	0.07	-	9,839	883	10,722
2050	-	12,614,000	0	0.78	0.07	-	9,839	883	10,722
2051	-	-	0	0.78	0.07	-	-	-	-
2052	-	-	0	0.78	0.07	-	-	-	-
2053	-	-	0	0.78	0.07	-	-	-	-
2054	-	-	0	0.78	0.07	-	-	-	-
2055	-	-	0	0.78	0.07	-	-	-	-
2056	-	-	0	0.78	0.07	-	-	-	-
2057	-	-	0	0.78	0.07	-	-	-	-
2058	-	-	0	0.78	0.07	-	-	-	-
2059	-	-	0	0.78	0.07	-	-	-	-
2060	-	-	0	0.78	0.07	-	-	-	-
2061	-	-	0	0.78	0.07	-	-	-	-
2062	-	-	0	0.78	0.07	-	-	-	-
2063	-	-	0	0.78	0.07	-	-	-	-
2064	-	-	0	0.78	0.07	-	-	-	-