Mr David Ellwood
Director NCO Stage 3 Project

22/09/2021

Dear Mr Ellwood

Narrabri Underground Mine Stage 3 Extension Project (SSD-10269)
Request for Additional Information – GHGEs

I refer to the Department's ongoing assessment of the Narrabri Underground Mine Stage 3 Extension Project (SSD-10269). The Department has been considering the information provided in your company's Submissions Report and Amendment Report in respect of the Project. The Department has given particular consideration to the information provided in respect of greenhouse gas emissions (GHGEs), as set out in the following documents submitted with the Amendment Report:

- Greenhouse Gas Emission Forecast (GGEF);
- Amended Greenhouse Gas Calculations; and
- Abatement Technology Assessment.

Background

The Department notes the following from the above documents.

Over the life of the Project, total Scope 1 GHGEs are estimated to be in the order of 31.19 million tonnes carbon dioxide equivalent (Mt CO_2-e), averaging 1.36 Mt CO_2-e per financial year. The highest annual emissions occur during FY33-FY38 (varying from 1.67 to 1.94 Mt CO_2-e), which is when longwall extraction would be occurring in the part of the coal seam with the highest methane concentrations.

Predictions for the Project's fugitive emissions are roughly three times higher than historical levels at the mine, which have been around ~0.4-0.5 Mt CO_2-e per FY. Seam gas pressures in the Project area vary from 2.5 - 5 m^3/t. These levels are considerably lower than in the northern series of panels (~4.5 - 9 m^3/t). However, there is a substantial increase in the methane percentage in this seam gas (30-40% across the southern and western parts of the Project area, compared with 5-25% in the northern series), which has a major effect on overall GHGEs in terms of CO_2-e.

Because of this increasing methane component, the Project's Scope 1 GHGEs would be greatly dominated by fugitive emissions from coal extraction, including gas venting and gas drainage. About 85.7% of the Project's Scope 1 predicted unabated emissions would be from this source.

In respect of identifying the technical opportunities and limits for flaring, the GGEF considered four separate sources of mine gas contributing to the overall total of 26.9 Mt CO2-e, being:

- pre-mining drainage of the coal seam (2.3%) prior to longwall extraction and/or roadway development using the UIS and/or SIS methods;
- un-managed drainage from the ribs of gateroads (ie first workings) during longwall development (30%);
- un-managed drainage during longwall extraction (53.9%); and
- post-mining goaf gas drainage (13.8%).

The GGEF took the position that no flaring of the three major sources of methane emissions was technically possible, because each of these sources is greatly diluted by mine ventilation air (MVA). In the case of un-managed drainage from the ribs of gateroads and during longwall extraction, all methane simply joins the MVA and is evacuated from the mine through the ventilation shafts. In the case of the post-mining goaf gas drainage, the methane percentage is higher, but the mine gas is still diluted by MVA which is introduced to the goaf behind the longwall equipment. This introduces oxygen to the gas mixture in the goaf.

The Department notes carefully that methane is explosive in the presence of significant quantities of oxygen. Under NSW mine safety legislation, the methane percentage in MVA must be kept "as low as reasonably practicable" and "not greater than 2% by volume". Any area of the mine where methane exceeds 1.25% by volume must be managed as a "hazardous zone". Any exceedance of the 2% limit is a "high potential incident".

The Department accepts that combustion of methane contained in the goaf gas drainage presents significant technical challenges, due to the potential for unplanned combustion or explosion.

For these reasons, the GGEF only assessed potential flaring of pre-mining drainage gas, which contributes 2.3% of the overall GHGEs attributable to fugitive emissions. The GGEF also reported that, within the Australian coal mining industry, it is "uncommon" for mines to flare mine gas when methane contents are <30%, primarily because of the inability to maintain a stable atmosphere at the flare head due to fluctuating gas flows and gas composition. Methane concentrations are predicted to exceed 30% in only about one third of the Project area. The GGEF was also based on the view that pre-mining gas drainage could only be successfully undertaken to the same final gas pressure levels as are currently obtained in the northern series (ie 3.5 m^3/t).

In summary, the GGEF considered that only 2.3% of the seam gas in the Project area was technically *amenable* to flaring, and that less than one third of this gas (0.7%) was technically *achievable* to flaring. On this basis, the GGEF calculated that just 0.2 Mt of the 26.9 Mt CO_2-e resulting from fugitive emissions (ie 0.7%) could be mitigated through flaring of mine gases.

In comparison, the applicants for both the Tahmoor South Coal Project (SSD-8445) and the Dendrobium Extension Project (SSD-8194) made commitments to flare post-mining goaf gas drainage, in addition to flaring pre-mining drainage gas. Further, the anticipated reductions in fugitive GHGEs through flaring of mine gases for each of these proposals was in the order of 28%.

The Department notes that the mine gases in each of these two latter mines are very rich in methane and very low in CO_2 and accepts that flaring such gas (including in respect of goaf gas) is a very much simpler and safer prospect.

Nonetheless, the Department considers that the apparently very limited opportunity to flare mine gases in the Project area is a matter which warrants more detailed consideration.

The Department also notes your company's commitments in the Amendment Report to prepare, fund and implement a Research Program into improving abatement of the Project's Scope 1 GHGEs by:

- enriching methane content in gas streams to be burnt by flares (ie by concentrating methane in waste streams, probably via stripping other gases, principally oxygen and/or nitrogen);
- flaring or power generation of gas with low methane content (<30% methane);
- using the methane content within mine ventilation air (known as 'VAM') at relatively low methane contents (0.2% to 0.5% methane);
- capturing carbon dioxide for beneficial re-use or sequestration; and
- other potential abatement options that may be identified.

The Department recognises and supports the extensive scope of this commitment. Nonetheless, it considers that the first two identified approaches are likely to offer the most straightforward and achievable means of reducing Project emissions.

Request

The Department requests that you provide the following additional information:

- are there any underground coal mines in Australia where pre-mining gas drainage containing <30% methane is flared? If so, please report on the technologies and practices in place at these mines;
- are there any underground coal mines in Australia where goaf gas drainage containing a) <20% and b) <15% methane is flared? If so, please report on the technologies and practices in place at these mines;
- does the introduction of mine ventilation air to goaf gases at the longwall face present a risk of underground explosion in any part of the Project area? Does this risk exist regardless of whether drained goaf gas is flared? If so, please report on these risks (including the affected part/s of the Project area) and how they would be managed to the satisfaction of the NSW Resources Regulator;
- what technologies might be applied either a) now or b) at some future part of the Project life in order to increase the amount of seam gas that can be effectively pre-drained (ie residual gas content <3.5 m3/t). Please report in detail on these technologies, including whether NCOPL considers that they would be likely to require an amendment to the development application (or modification to any development consent) in order to be implemented;
- what technologies might be applied either a) now or b) at some future part of the Project life in order to safely flare drained goaf gas. Please report in detail on these technologies, including whether NCOPL considers that they would be likely to require an amendment to the development application (or modification to any development consent) in order to be implemented; and
- are there any underground coal mines in Australia where the relatively low methane content (0.2% to 0.5%) within mine ventilation air (VAM) is combusted? If so, please report on which mines; whether these are pilot, demonstration or large-scale operations; what proportion of their VAM is combusted; the capex and opex costs of operation and the resultant GHGE mitigation.

If you have any questions, please contact Philip Nevill on 8275 1036 or philip.nevill@planning.nsw.gov.au.

Yours sincerely,

Stephen O'Donoghue
Director
Resource Assessments