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VALHALLA GREENHOUSE GAS ENVIRONMENTAL MANAGEMENT PLAN

EXTERNAL PEER REVIEW

Prepared for:

AES

Peer Review Completed: June 2024

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Acronyms

Acronym	Description
ACCU	Australian Carbon Credit Units
AES	Australasian Environmental Solutions
BNR	Bennett Resources
CO _{2e}	Carbon Dioxide Equivalent
EP	Exploration Permit
EPA	Environmental Protection Authorities
GHG	Greenhouse Gas
GHG EMP	Greenhouse Gas Environmental Management Plan
HFS	Hydraulic Fracture Stimulation
MMcf/d	million cubic feet per day
TJ/day	Terajoule per day

Addendum to Peer Review Report

10th June 2024

Following the submission of the Valhalla Greenhouse Gas Emissions Management Plan (GHG EMP) Peer Review Report Revision 0 to Australasian Environmental Solutions (AES), the peer review process identified several recommendations.

AES thoroughly examined these recommendations and has since issued Revision 4 of the GHG EMP, which addresses the original Peer Review recommendations.

A subsequent review of additional information has been performed on the GHG EMP, the findings of which are encapsulated in the following summary.

This addendum documents the iterative process of review and refinement undertaken to ensure the GHG EMP's alignment with best practices and regulatory standards.

Recommendations	GHG EMP Rev 4 Peer Review
Emission targets: Increase Valhalla GHG EMP interim target to 43% reduction of baseline by 2030 to align with Commonwealth targets rather than the historical 28%.	Emission targets throughout the GHG EMP have been updated from 28% to 43%.
Methane monitoring: Given the duration of this program and the number of wells proposed, the GHG EMP should consider utilising methane detection technologies to verify ambient-level methane across the project locations after the completion of the exploration and appraisal program.	Under Section 5 of the GHG EMP, Table 5-2 demonstrates a commitment to methane monitoring after the completion of the Proposal if methane levels are above the detection limit of 3.3 mg/m ³ .
Offset location and type: Provide further detail on the preferred location or types of offsets that will be utilised to satisfy any emission liabilities.	The GHG EMP has been updated to include Section 3.11, preferred offsets and availability. This section provides detail on: <ul style="list-style-type: none"> • Estimated volumes of offsets • Preferred type of offsets • High-level assessment of near-term offset volume forecasts.
Offset availability: The GHG EMP should include an assessment of offset availability relevant to the worst-case potential emission liabilities and forecast market availability out to 2030.	

Basis of Conclusion

The additional information in the updated Revision 4 of the Valhalla GHG EMP addresses the identified recommendations in the Valhalla GHG EMP Peer Review Report Revision 0.

1 Introduction

Australasian Environmental Solutions engaged Evolveable Consulting Pty Ltd to perform an independent peer review of the Bennett Resources (BNR) Valhalla Greenhouse Gas Environmental Management Plan (GHG EMP) per the Western Australian Environmental Protection Authorities (EPA) *Environmental Factor Guideline: Greenhouse Gas Emissions*.

1.1 Scope

The scope of the peer review is to:

- Review emission calculations.
- Assess the demonstration of best practices relevant to the project scope.
- Review industry benchmarks, and
- Review offset liabilities and plans to satisfy (integrity and availability).

1.1.1 Project context

The project under review involves an unconventional exploration and appraisal drilling program, coupled with Hydraulic Fracture Stimulation (HFS), within the confines of Petroleum Exploration Permit EP 371 in the Canning Basin, located in the Shire of Derby/West Kimberley, Western Australia.

The primary objective of this proposal is to assess the substantial tight gas reserves anticipated in the area. Should the exploration efforts yield a petroleum resource, testing to ascertain the quality and volume of gas within the well will be necessary. The outcomes of these tests are crucial as they will inform the company's decision-making process regarding the commercial viability of the reserves.

The project is time-bound, considering the exploration and appraisal activities. Each well represents a unique emissions event, distinct from those associated with continuous operations related to a production phase. This delineation and context are essential as they underpin the practicality of implementing best practice technologies throughout the exploration and appraisal program.

1.2 Documentation Reviewed

As part of this process, the following documentation was reviewed:

- Bennet Resources, Valhalla Gas Exploration and Appraisal Program Greenhouse Gas Environmental Management Plan, Rev 4, BNR_HSE_MP_014
- GHG EMP Supporting documentation:
 - Data and calculations – Valhalla GHG Estimates_Rev G
 - Valhalla Exploration Program GHG Management Report Rev0
 - Appendix H.1 – Valhalla Air Quality and GHG Monitoring Report

- Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia Final Report to the Western Australian Government September 2018
- Government of Western Australia, Position Paper, Monitoring, mitigation and offsetting of Greenhouse Gas Emissions for hydraulic fracturing proposals in Western Australia.
- Northern Territory government, Code of Practice: Onshore Petroleum Activities in the Northern Territory
- United States Natural Gas STAR Program
- International Petroleum Industry Environmental Conservation Association. (2014, February 1). Green completions.
- Government of Australia's 2008 National Greenhouse and Energy Reporting (Measurement) Determination
- American Petroleum Institute's 2009 Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry

2 Emission and Target Review

2.1 Emission Estimates

As part of this review, the emissions quantifications were reviewed to ensure alignment with the requirements of the EPA *Greenhouse Gas Emissions Factor guideline*.

Section 3.1 of the GHG EMP outlines the emissions estimates for the project. This review concentrates on the material emission sources, gas and condensate flaring, which account for over 90% of the total project emissions.

A review of both calculations and assumptions was performed.

2.1.1 Scope 1

The emissions data and associated assumptions that formed the basis of the GHG EMP are consistent with recognised industry best practices in emissions accounting. Scope 1 and 3 emissions have been quantified using primarily:

1. Government of Australia's 2008 National Greenhouse and Energy Reporting (Measurement) Determination
2. American Petroleum Institute's 2009 Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry

The duration of exploration and appraisal activities will vary well to well. The GHG EMP provides a 60-day and 90-day well range, which covers a minimum and maximum scenario to cover this uncertainty.

The project is split into two phases, with Phase One maximum emissions estimated to be < 200,000 tonnes CO_{2e} per year and Phase Two maximum emissions estimated to be < 600,000 tonnes CO_{2e} per year. The total emission estimated for the exploration and appraisal program is 1,603,293 tonnes of CO_{2e}.

The methodology applied aligns with that specified within the Western Australian Government Position Paper on monitoring, mitigation and offsetting of Greenhouse Gas Emissions for hydraulic fracturing proposals in Western Australia in the context of exploration and appraisal program; as such, it does not estimate emissions for potential future operations.

2.1.2 Scope 2

Section 3.1.2 of the GHG EMP specifies that the exploration and appraisal program will operate independently without importing power from external sources; as such, there are no Scope 2 emissions.

2.1.3 Scope 3

The base case for the GHG EMP is that there will be no Scope 3 emissions as all produced fluids will be combusted via the flare.

The GHG EMP presents an alternate option that the proponent is considering: selling condensate produced during the well testing program to external parties, thereby reducing Scope 1 emissions associated with the condensate portion (approximately 129,000 tonnes CO_{2e}). This is a common practice in other regions where supporting infrastructure is readily available near the exploration site location, and demand for the condensate product exists.

Scope 3 estimates for this scenario have been estimated utilising the Government of Australia's 2008 National Greenhouse and Energy Reporting (Measurement) Determination.

Although this alternate scenario would directly reduce Scope 1 emissions, the end use of the condensate product is likely the same. When this end use is combined with transportation of the condensate between the site location and third party, the net emissions of this alternate scenario will increase compared to the base case.

2.2 Emission Targets

Section 3.3 of the GHG EMP proposes emission reduction targets that align with the historical Australian Commonwealth emission target of 28% below 2005 levels by 2030. Given Australia's increased commitment in 2022 to achieve 43% below 2005 levels by 2030, it is recommended that BNR align their commitment to the Commonwealth Government at a minimum.

Recommendation: Increase Valhalla GHG EMP interim target to 43% reduction of baseline by 2030 to align with Commonwealth targets.

3 Best Practice Review

A desktop literature review was conducted to gain insight into the best practices within the onshore gas exploration and appraisal industry in Western Australia and nationally.

International guidance was leveraged to understand best practices relevant to exploration and appraisal well greenhouse gas measures.

A summary of key guidance documents reviewed to inform this peer review is provided in Table 1.

TABLE 1: LITERATURE REVIEW OF EMISSION MITIGATION STRATEGIES IN ONSHORE PETROLEUM OPERATIONS

Guidance Document	Summary
<p>Government of Western Australia: Monitoring, mitigation and offsetting of Greenhouse Gas Emissions for hydraulic fracturing proposals in Western Australia</p>	<p>This paper explains the State Government’s position regarding implementing the Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia’s (the Inquiry) recommendations for monitoring, mitigating, and offsetting greenhouse gas emissions from hydraulic fracturing proposals in Western Australia.</p> <p>Five key guiding principles are outlined, including the consideration of exploration activities.</p> <p>Since this paper was published, the Environmental Protection Authority has released further guidance on greenhouse gas emissions.</p>
<p>Independent Scientific Panel Inquiry into Hydraulic Fracture Stimulation in Western Australia Final Report to the Western Australian Government September 2018</p>	<p>Section 10.9 of the Inquiry Report discusses Green Completions, specifically Recommendation 12, which acknowledges that reduced (greens) emissions completions should be a requirement apart from the early exploratory phase of development.</p> <p>Section 10.10 states that GHG emissions from the exploration phase of unconventional gas exploration present a negligible environmental risk, even without reduced emission completions.</p>

<p>Northern Territory government, Code of Practice: Onshore Petroleum Activities in the Northern Territory.</p> <p>Link: Code of practice: Onshore petroleum activities in the Northern Territory</p>	<p>The Code of Practice for Onshore Petroleum Activities in the Northern Territory provides a framework for ensuring environmentally responsible petroleum operations within the region.</p>
<p>United States, Natural Gas STAR Program.</p> <p>Link: https://www.epa.gov/natural-gas-star-program/reduced-emission-well-completions-and-workovers</p>	<p>This initiative offers strategies for reduced emission well completions and workovers, aiming to minimise the environmental impact of natural gas operations.</p>
<p>IPIECA. (2014, February 1). Green completions.</p> <p>Link: https://www.ipieca.org/resources/energy-efficiency-solutions/units-and-plants-practices/green-completions-2014/</p>	<p>This resource offers insights into energy-efficient solutions for green completions in the oil and gas industry.</p>

The review of best practice guidance indicates substantial opportunities for emission reductions throughout the well development phase and subsequent production and operational stages. However, it is recognised that the emission reduction opportunities for exploration and appraisal are somewhat constrained due to various factors, including, but not limited to:

- Site location
- Lack of pre-existing infrastructure, such as gas transmission networks.
- The regional context of the operations.

3.1 Scope 1

Section 3.4.1 of the GHG EMP summarises potential emission reduction opportunities, which was informed by a detailed study, the Valhalla Gas Exploration Program GHG Management Report.

This report reviewed national and international sources for information on industry best practices. It considered each of the proposed emission reduction opportunities in the context of the Valhalla Exploration and Appraisal program, including site location constraints, regional context, and regulatory regime. In addition, it considered the findings of the Western Australian Hydraulic Fracking Inquiry Report.

A total of nine emission reduction opportunities are identified for the project. Of the nine, four have been selected to reduce Scope 1 emissions. These are:

- Well design – Horizontal vs Vertical

- Flaring versus venting
- Selection of efficient diesel generators
- Renewables (lighting towers)

Condensate capture for sale or other use has been identified as an opportunity under consideration; however, the lifecycle perspective has been considered and presented within the GHG EMP. Whilst this presents an opportunity to reduce Scope 1 emissions, it shifts the emissions to Scope 3 while adding further transportation emissions. Additional details on this are provided in Section 3.2.3.

Three emission reduction opportunities were identified but not progressed due to commercial or technical feasibility. These were:

- Renewables for power generation
- Compressed Natural Gas
- Micro Liquefied Natural Gas

Conclusion:

- The emission reduction opportunities proposed within the GHG EMP for exploration and appraisal activities align with national and international industry best practices when considering the project-specific context.

3.2 Scope 2

There are no Scope 2-related emissions on this project.

3.3 Scope 3

The project's base case scenario assumes no scope 3 emissions related to the consumption of gas and condensate, and test fluids will be flared onsite.

As detailed in Section 2.1.3 of this review, if the condensate portion of well test fluids is separated and captured, it could be utilised; however, considering the emissions related to the transport of these fluids combined with a similar end use, this would increase the project's net emissions.

3.4 Monitoring

A baseline GHG monitoring assessment was undertaken in 2021 to satisfy the requirements of the Monitoring, mitigation, and offsetting of GHG Emissions for hydraulic fracturing proposals in Western Australia. This evaluation included baseline methane measurements at three sites, with results below the detection threshold of 6.6 milligrams.

The GHG EMP Table 5-1 and Table 5-2 commit to monitoring the direct activity-related emissions but not ongoing monitoring of the broader ambient environment.

With technological advancements in methane detection in recent years, various cost-effective methods are now accessible for frequent monitoring of methane concentrations throughout the project area during operational activities.

The Code of Practice for Onshore Petroleum Activities in the Northern Territory outlines the routine periodic atmospheric monitoring programme requirements, including specific methane monitoring requirements prior to the exploration and production phases.

Recommendation: Given the duration of this program and the number of wells proposed, the GHG EMP should consider utilising methane detection technologies to verify ambient-level methane across the project locations after the completion of the exploration and appraisal program.

3.5 Industry Benchmarking

Section 3.2 of the GHG EMP provides a summary of industry benchmarking analysis. This section compares five analogous projects within Australia, evaluating them based on emissions intensity and total emissions per well.

For further context to support the peer review, international projects were reviewed by examining flow rate performance from comparable global developments to support the benchmarking context.

The benchmarking reveals that in emissions intensity—measured in tonnes of CO₂ equivalent (CO_{2e}) per well per day, Valhalla Phase 1 and Phase 2 exhibit the highest values among the projects evaluated. This higher intensity reflects the anticipated flow rates of the Valhalla project wells over a shorter duration (days) than other programs.

When analysed on a per-well basis, measured in total emissions per well, Valhalla Phase 1's potential maximum emission volumes align closely with those of the other projects. However, the emission volumes for Valhalla Phase 2 wells surpass the comparative projects for the minimum and maximum projected cases, attributed to the higher expected flow test rates due to reservoir properties.

Tamboran Resources has recently concluded an exploratory campaign in the Beetaloo Basin of the Northern Territory, identified as the Origin Energy Velkerri wells, as delineated in the GHG EMP. The appraisal of the SS-1H well yielded a flow rate of 2.9 million cubic feet per day (MMcf/d)¹, which, when normalised over a distance of 1,000 meters, equates to 5.8 MMcf/d. The original Origin Valkerri Greenhouse Gas Management Plan estimated a 2.5 TJ/day flow rate.

For the Valhalla wells, the proposed flow rates are estimated to be similar to the Tamboran Resources well in Phase 1 (5.9 MMcf/d) and approximately double in Phase 2 (10.7 MMcf/d).

¹ [ASX announcement: Tamboran Resources Corporation, April 2024](#)

This highlights the influence of expected well rates relative to emissions in exploration and appraisal activities.

As stated in Section 3.1 of this document, nine emissions reduction strategies have been evaluated, with several selected for implementation to reduce Scope 1 emissions.

4 Offset Integrity and Availability

In accordance with the EPA *Environmental Factor Guideline - Greenhouse Gas Emissions*, a review of the GHG EMP Offset commitments has been completed as part of this review.

Due to the project being exploration and appraisal, the volume of emissions will be proportional to the flaring durations required to gain sufficient data to understand the reservoir. The GHG EMP has set targets regarding emissions; if these are exceeded, this will trigger offset liabilities for the project.

A review of GHG emission calculations and targets estimates that the project's offset liabilities could be greater than 400,000 tonnes CO_{2e}.

The recommendation identified in Section 2.2 of this document regarding increasing the interim target to align with Australia's commitment may impact the number of offsets required for this proposal.

4.1 Offset Integrity

Section 3.9 of the GHGEMP has set the following offset integrity criteria.

- Australian Carbon Credit Units (ACCU) issued under the Commonwealth Carbon Credits (Carbon Farming Initiative) Act 2011
- eligible offsets under the standard Climate Active Carbon Neutral Standard for Organisations (Climate Active 2020), in addition to ACCUs, include:
 - verified emission reductions issued under the Gold Standard
 - verified carbon units issued under the Verified Carbon Standard
 - Certified emissions reductions are issued per the Kyoto Protocol rules from Clean Development Mechanism projects.
 - removal units issued by a Kyoto Protocol country on the basis of land use, land use change and forestry activities under Article 3.3 or Article 3.4 of the Kyoto Protocol.

No details on the preferred location or types of offsets are provided within the GHG EMP.

Recommendation: Provide further detail on the preferred locations or types of offsets that will be utilised to satisfy any emission liabilities.

4.2 Offset Availability

The GHG EMP does not estimate potential liabilities due to the uncertain nature of exploration and appraisal activities. However, based on a review of calculations, liabilities could be greater than 400,000 tonnes CO_{2e} in a worst-case emissions scenario for the project.

No assessment relevant to the availability of offsets has been completed within the GHG EMP; however, in Section 3.9 of the GHG EMP BNR commits that where and when required, they will acquire carbon offsets that meet the contemporary Australian acceptability standards (e.g., they should meet offset integrity principles and be based on transparent, enforceable, and accountable methods).

Based on a review of ACCU volumes estimated for 2024, sufficient offsets will likely be available in the near term. However, the process for assessing this availability is not evident within the GHG EMP.

Recommendation: The GHG EMP should include an assessment of offset availability relevant to the worst-case potential emission liabilities and forecast market availability out to 2030.

5 Summary

Basis of Conclusion

We believe the evidence we have obtained is sufficient and appropriate to provide a basis for the conclusion regarding:

- Emissions quantification: The methodology and assumptions utilised to estimate emissions align with good emissions accounting practices.
- Demonstration of best practice: The scope 1 emission reduction opportunities assessed within the GHG EMP for exploration and appraisal activities align with both national and international industry best practices relevant to the context of the project based on the literature review performed.
- Offset integrity: BNR have committed to reputable carbon offset integrity standards within the GHG EMP.

Recommendations:

- Emission targets: Increase Valhalla GHG EMP interim target to 43% reduction of baseline by 2030 to align with Commonwealth targets rather than the historical 28%.
- Methane monitoring: Given the duration of this program and the number of wells proposed, the GHG EMP should consider utilising methane detection technologies to verify ambient-level methane across the project locations after the completion of the exploration and appraisal program.
- Offset location and type: Provide further detail on the preferred location or types of offsets that will be utilised to satisfy any emission liabilities.
- Offset availability: The GHG EMP should include an assessment of offset availability relevant to the worst-case potential emission liabilities and forecast market availability out to 2030.

We have:

- Used our professional judgement to assess the GHG emission quantification methodology for the Project along with the proposed emission reduction opportunities.
- Considered credible external literature sources to inform our basis for best practice mining design and operations and
- Ensured that the review team possessed the appropriate knowledge, skills and professional competencies.

Use of this Peer Review Report

This report has been prepared for AES to provide a conclusion on demonstrating best practice, offset integrity, and availability, but it may not be suitable for any other purpose.

This Peer Review is based on our current understanding and knowledge, which may evolve, and we make no express or implied representations or warranties regarding the accuracy or completeness of the conclusions in this report. We disclaim any assumption of responsibility for any reliance on this report.

Statement of independence, impartiality and competence

Evolveable Consulting is an independent environmental engineering company specialising in decarbonisation, sustainability, and circular economy services.

No team member has a business relationship with BNR, beyond that required of this assignment. Evolveable Consulting conducted this review independently, and to our knowledge, there has been no conflict of interest.

The review team has extensive experience conducting assurance reviews of engineering designs, environmental information, systems, and processes.



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