

Subterranean Barriers and Their Role in Advancing NSW Greenhouse Gas Mitigation Goals

The New South Wales (NSW) 'Proposed Greenhouse Gas Mitigation Guide for NSW Coal Mines' emphasises the need for state-specific, accessible, and effective strategies to reduce emissions, particularly methane, from coal mining operations. Methane emissions from coal mines represent a significant portion of NSW's total greenhouse gas output, and underground mines are the largest contributors. The recently published guide outlines expectations for operators to incorporate mitigation measures into their Climate Change Mitigation and Adaptation Plans (CCMAPs), signaling future regulatory requirements and encouraging early adoption to leverage economic incentives such as carbon credits.

Technical Innovations Supporting NSW Objectives

A recent open access paper 'Improved Estimation Methods for Surface Coal Mine Methane Emissions for Reporting, Beneficial Use, and Emission Reduction Purposes and Relative to Australia's Safeguard Mechanisms' presents several technical innovations that align with NSW's mitigation goals (Alarcon Vigil et al., 2025). This study focuses on Australian coal mines, particularly in the Bowen Basin, which shares geological and operational similarities with NSW mines. It introduces numerical modelling and mine-specific gas reservoir models to replace outdated estimation methods (Method 1), offering more accurate, site-specific emissions outcomes than the current benchmark (Method 2). These models simulate methane emissions under various scenarios, including permeability variations, pre-drainage, and subterranean barrier implementation and include ongoing face drainage and down-dip gas influx not considered under Method 2.

Emissions Reduction Planning

The study evaluates six scenarios using numerical modeling, demonstrating that pre-drainage alone can reduce methane emissions by 38%, while combining pre-drainage with subterranean barriers achieves a 46% reduction. These findings provide actionable insights for coal mine operators in NSW to incorporate into their CCMAPs, directly supporting the guide's objective of informed and effective emissions planning. Further, this study emphasizes the importance of reducing fugitive emissions from mine faces, which are often underreported. Subterranean barriers are shown to significantly reduce post-mining emissions—by up to 71% in standard cases and 81% in high-permeability scenarios—making them a critical technology for achieving NSW's emissions targets.

Regulatory Alignment and Economic Incentives

The paper anticipates the transition from Method 1 to more rigorous estimation methods under Australia's Safeguard Mechanism, mirroring NSW's regulatory trajectory. It highlights the economic implications of exceeding emissions baselines and the benefits of early adoption of mitigation strategies. By implementing subterranean barriers and pre-drainage technologies ahead of regulatory mandates, operators can access Australian Carbon Credit

Units (ACCUs) and Safeguard Mechanism Credits (SMCs), enhancing financial viability and compliance.

Economic Benefits of Subterranean Barriers

Subterranean barriers not only reduce emissions but also offer economic benefits. They help mines stay below emissions baselines, avoiding penalties and enabling the accrual of carbon credits. The study demonstrates positive cash flow opportunities through flaring, gas sales, electricity generation, and diesel displacement. These benefits support the NSW guide's goal of encouraging early and economically viable mitigation actions.

Conclusion

The implementation of subterranean barriers, as detailed in the research by Alarcon Vigil et al. (2025), provides a robust, technically sound, and economically beneficial strategy for reducing methane emissions from coal mines. These innovations align closely with the NSW Greenhouse Gas Mitigation Guide's objectives, offering a pathway for coal mine operators to achieve compliance, reduce environmental impact, and enhance financial performance.

Reference

Alarcon Vigil, D., Johnson Jr, R. L., & Tauchnitz, J. (2025). Improved Estimation Methods for Surface Coal Mine Methane Emissions for Reporting, Beneficial Use, and Emission Reduction Purposes and Relative to Australia's Safeguard Mechanisms. *Journal of Environmental Management*, 48. <https://doi.org/10.1016/j.jenvman.2025.124366> (Open Access)