20 ACARP 26 MATTERS

Open Cut Mine Gas Drainage for Methane Mitigation

Pre-drainage may help reduce fugitive methane emissions from selected open cut coal seams, but it is not a ready-to-use whole-of-mine solution. Feasibility is highly site-specific.

CORE POSITION

This study examined whether coal seam gas could be drained before open cut mining to reduce fugitive methane emissions. Pre-drainage is widely used in underground coal mining, but open cut mines present different challenges because they are commonly mining several seams, split seams, thin coal plies and carbonaceous interburden across a changing pit sequence.

The study considered representative coal settings in the Hunter Valley in New South Wales and the Moranbah Coal Measures in Central Queensland. It found that open cut pre-drainage is **conceptually plausible in favourable seams and mine areas**. However, it should be treated as a staged abatement opportunity, not as a method that can be applied generally across all open cut coal mines.

Why open cut pre-drainage is difficult

- Underground drainage usually targets one main mining seam; open cut mining can expose several seams and coal-bearing layers.
- A borehole in one seam will not usually drain other seams unless they are hydraulically connected.
- Thin, split, undulating or faulted seams can be difficult to drill and maintain in-seam.
- Drainage must fit with the mine schedule, because gas removal may require long lead times before mining reaches the area.
- Pre-drainage reduces gas content but does not remove all the gas. Some will remain in the coal seam and may still be released during mining.

The key issue is not simply whether methane can be drained, but how much can be removed before mining, how much will remain, and whether the reduction justifies the cost.

The main drainage method considered

- Surface-to-in-seam drainage, or SIS, was the main reference method considered.
- SIS uses drilling from the surface to place a long lateral borehole within a coal seam, with gas and water recovered through a production well.
- Conventional SIS is the most credible basis for further work because it is the most developed directional drainage method and has underground mining precedent.
- Reverse SIS may suit some seam geometries or surface constraints, but it is more constrained.
- Highwall-to-in-seam drainage may offer access advantages in some cases, but it places drilling and infrastructure close to active mining areas.

More information:
E: anne@acarp.com.au
P: 07 3225 3600

Feasibility depends on the seam and the mine plan

- The strongest cases are likely to involve seams that are thick enough to drill reliably, gas-rich, sufficiently permeable and continuous.
- Gas content and gas composition vary by seam, depth, geological history and local gas compartments.
- Permeability strongly controls how fast gas can flow, how long drainage takes and how much gas can be removed.
- A stable mine plan and enough lead time are critical because drainage must begin before mining reaches the target area.
- Multi-seam drainage may require several seam-specific targets, increasing cost and complexity.

Operational interaction matters

- Open cut pre-drainage requires surface infrastructure such as wellheads, gas lines, water management, metering, flares, power and access tracks.
- Infrastructure can affect haul roads, blasting, excavation, pit access and short-term planning flexibility.
- As mining advances, boreholes may need to be isolated, grouted, retired or removed to prevent air ingress and maintain safe mining conditions.
- Pump maintenance, water production, monitoring and verification are ongoing requirements.



A drainage design cannot be judged by the borehole alone. It has to be assessed as a **whole mining, infrastructure, safety and emissions-abatement system**.

Gas handling and methane abatement

- The main open cut objective is methane abatement, not gas production for its own sake.
- Flaring is likely to be the simplest gas handling pathway where gas is captured in suitable volumes and quality.
- Power generation or other use may recover more value, but depends on gas volume, composition, location and access to infrastructure.
- Gas sales alone are unlikely to justify many projects; the case depends on abatement value, avoided carbon-related costs and total system cost.

What the research does not yet show

- The study is conceptual and generic, not a site design for any particular mine.
- Indicative modelling illustrates sensitivities only; it does not prove field performance or economic viability.
- There is limited site-specific public data available, particularly for seam-by-seam gas content and permeability, hence why site-specific assessments by mines are prudent
- The study does not support immediate general deployment of open cut gas pre-drainage.



This work should be read as identifying **where feasibility may exist**, not as confirmation that pre-drainage will work at every open cut mine.

Future work

- Use a practical screening framework to identify seams and mine areas most likely to be suitable.
- Test site-specific gas content, permeability, gas composition, seam thickness, structure and continuity.
- Assess mine schedule, lead time, access, drainage infrastructure and interaction with active mining.
- Build a whole-of-system economic and abatement model before drawing conclusions.
- If results justify it, progress to a controlled mine-integrated pilot.

More information:
E: anne@acarp.com.au
P: 07 3225 3600

Conclusion

The research indicates that coal seam gas pre-drainage may be a practical methane mitigation pathway for selected open cut coal seams. The best prospects are likely to be seams that are gas-rich, permeable, thick enough to drill reliably and supported by sufficient lead time and a stable mine plan.

However, the method is not a simple transfer from underground mining. Open cut operations often involve multiple seams, changing mining fronts, and infrastructure constraints. A single drainage borehole will not normally drain a whole open cut sequence, and residual gas may remain after drainage.

Further site-specific investigation is required before the approach can be assessed as a practical emissions mitigation method at any mine.

Basis of preparation

This ACARP information summary draws on findings from ACARP project C36001 *Open Cut Mine Gas Drainage*. The study reviewed available technical literature and industry communications and used conceptual layouts, and indicative modelling to identify key feasibility conditions.

The findings are not site-specific and should be interpreted as identifying potential feasibility conditions, not as confirming mine-level gas recovery, regulatory performance or company-level greenhouse gas mitigation outcomes.

More information:
E: anne@acarp.com.au
P: 07 3225 3600