Enhancing Landfill Gas Capture Through Temporary HDPE Surface Lining During the Interim Capping Phase

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WMRR WASTE MANAGEMENT & RESOURCE RECOVERY ASSOCIATION AUSTRALIA

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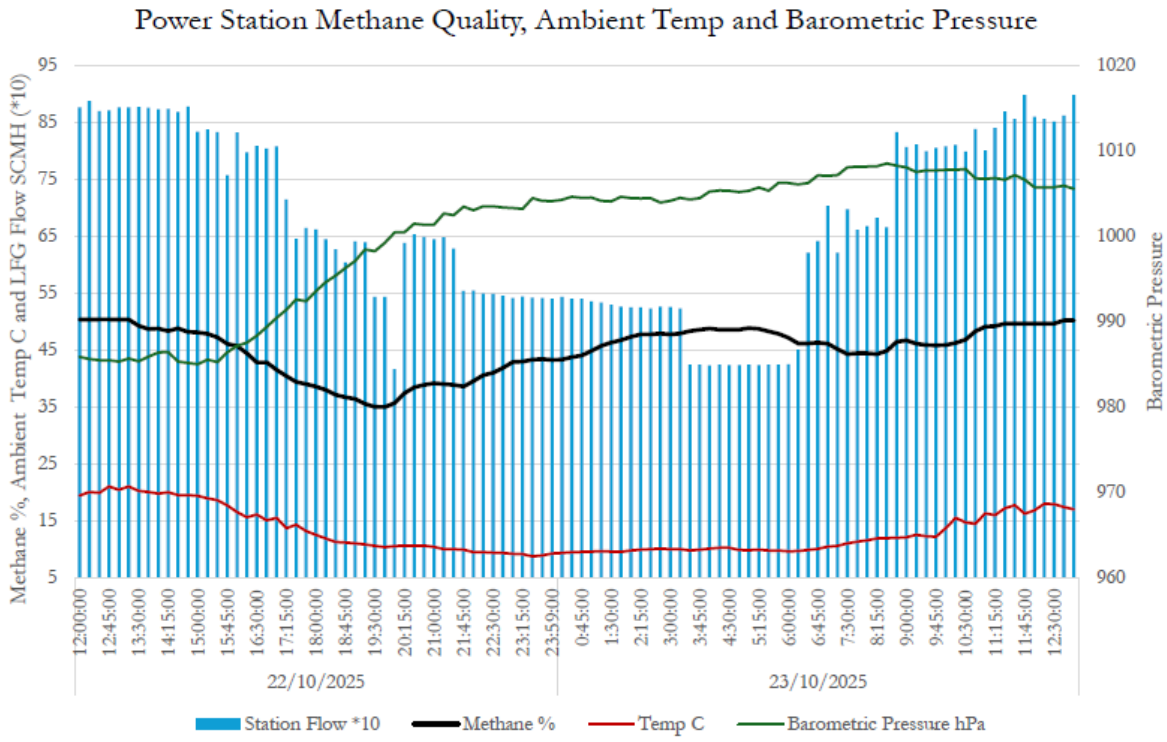
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An Introduction to MRL



The Industry Problem

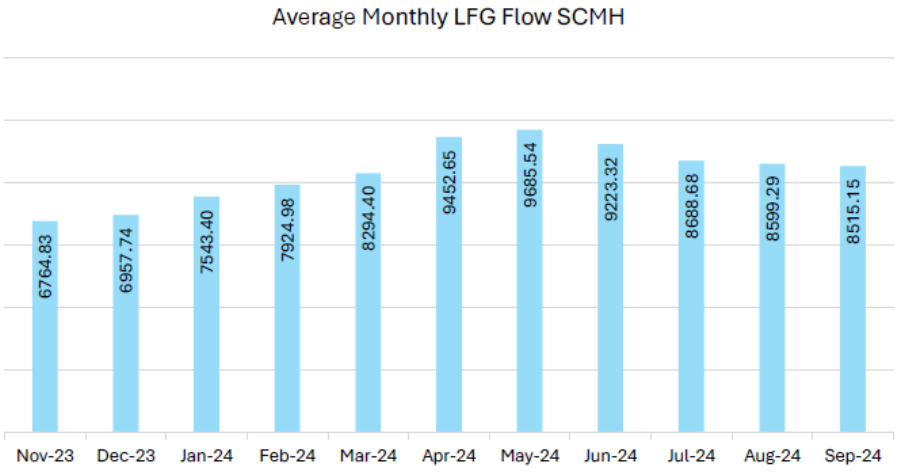
What happen last year?

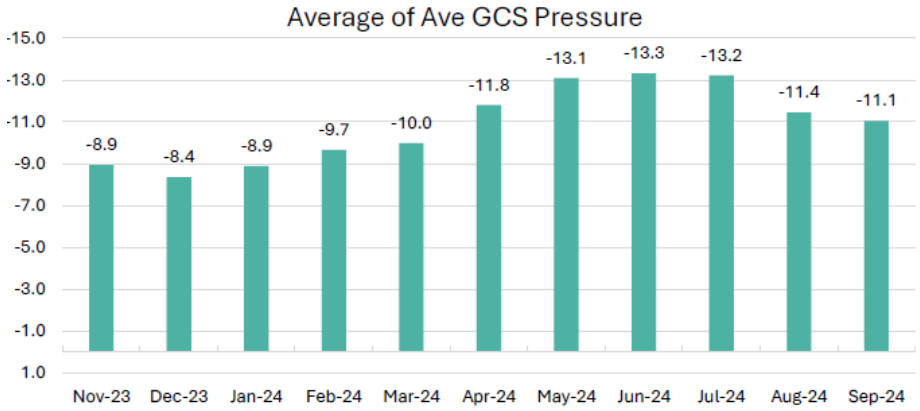


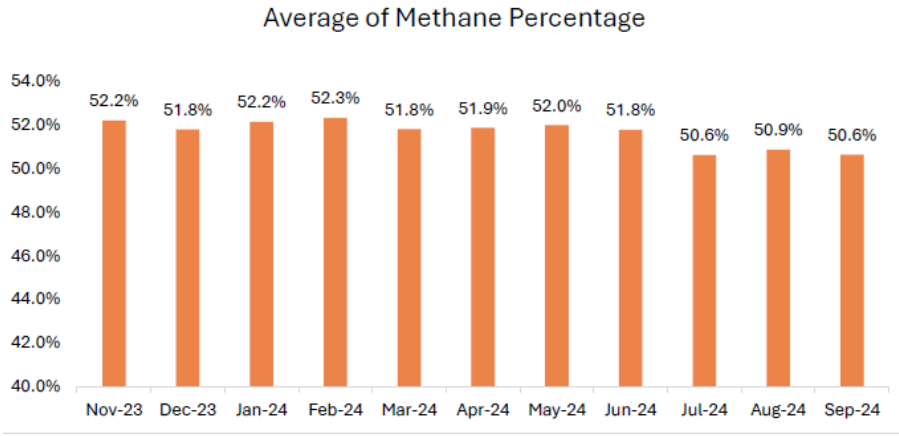
- Most Effected Area: Stage 4: 35% of CH_4
- Least Effected Area: Stage 2: 40% of CH_4

The Industry problem

More Investigation



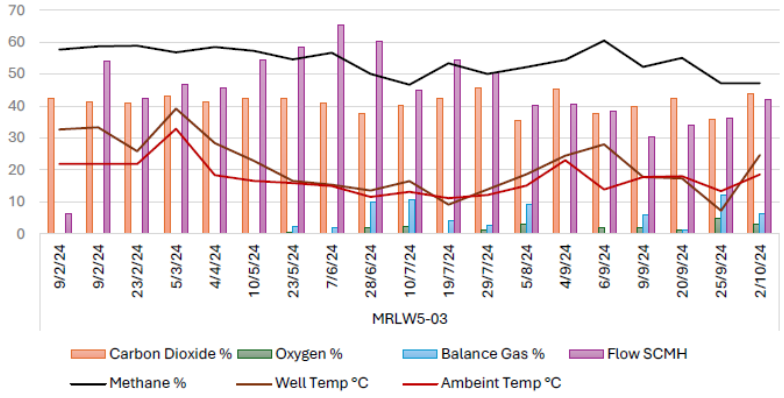


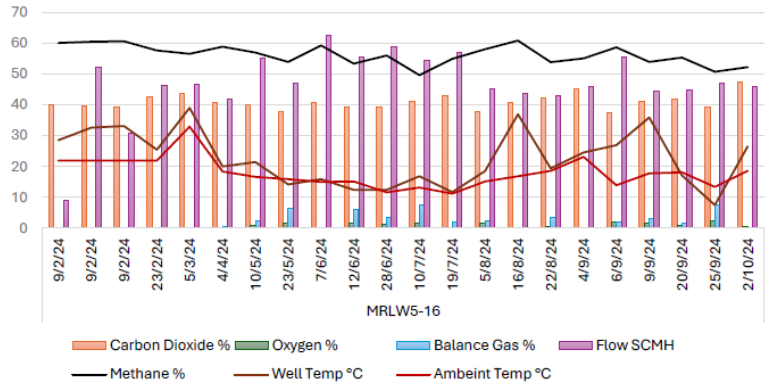


The Industry problem

More Investigation – Evidence of Atmospheric Influence

- 100 new LFG wells were commissioned between Dec 2023 and Apr 2024, driving a significant increase in gas extraction.
- LFG flow peaked shortly after commissioning as the system recovered accumulated reservoir gas within the waste mass.
- As reservoir gas declined, gas flow reduced and methane quality became increasingly sensitive to weather conditions.
- Several wells in Stage 4 showed oxygen intrusion, impacting gas quality and limiting sustainable extraction rates.
- Frequent balancing was required to maintain gas quality, highlighting the need to reduce atmospheric influence on the gas field.

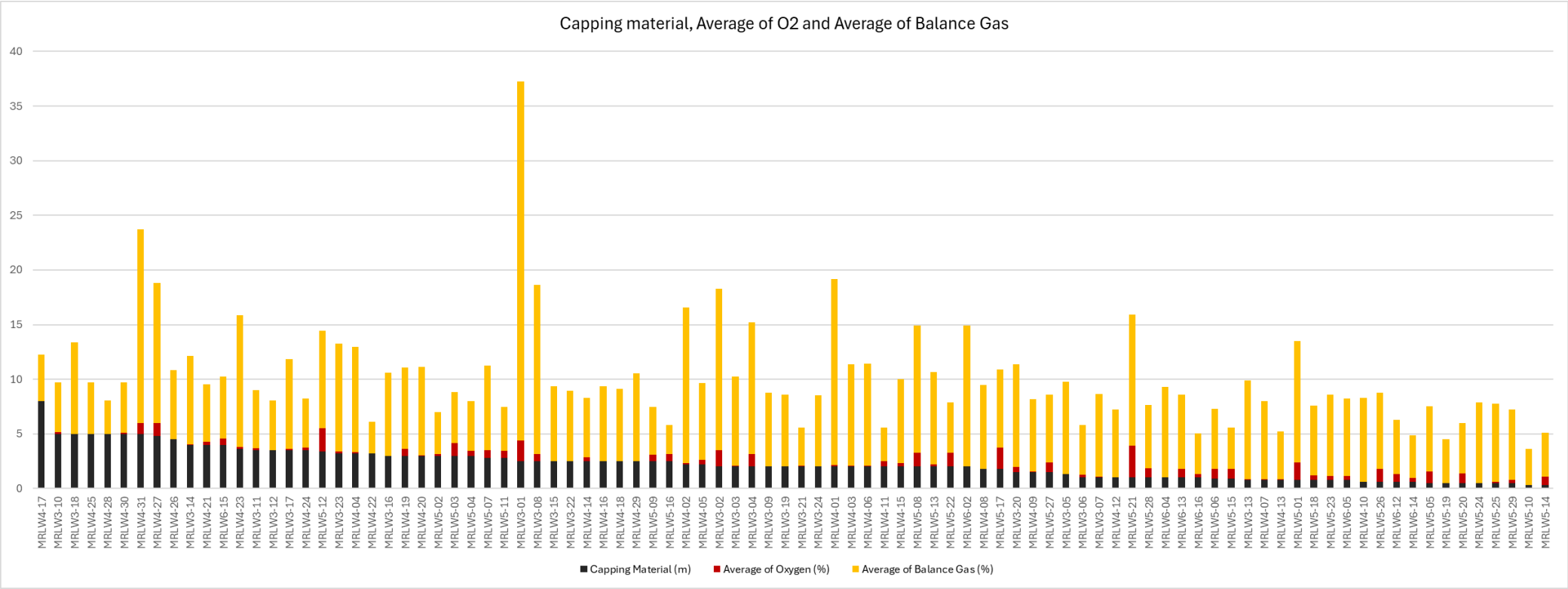




The Industry problem

Current Situation

- 75 of 99 wells showed temperature sensitivity
- Oxygen intrusion observed
- Weather impacts confirmed



Research Question

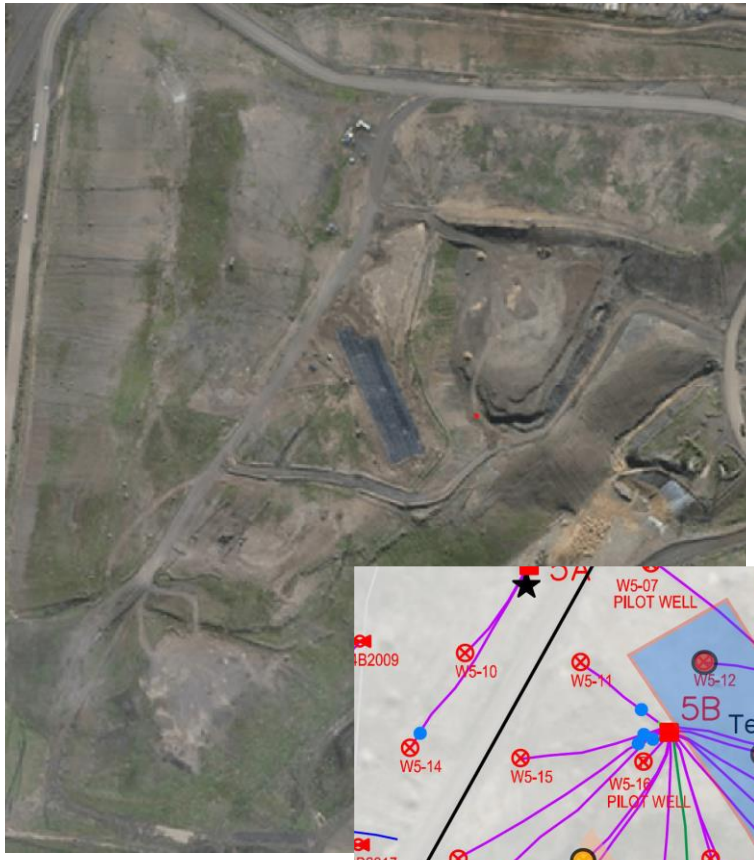
- Reduce air ingress!
- Improve methane quality !
- Increase sustainable extraction !
- Reduce weather sensitivity !

Can a temporary non-welded HDPE cover deliver similar benefits prior to final cap installation?



Trail Design

- Selecting 3 test wells
- Selecting 3 control wells
- Installation of 140*35m HDPE
- Monitoring of the wells
  - Scenario 1: Gas Quality Test (with the same flow)
  - Scenario 2: Flow Optimization
  - Scenario 3: Combined approach



Results

Scenario 1 - Gas Quality Test

- Flow rates were progressively increased from 0 to 60 SCMH in 10 SCMH daily increments, then reduced back to 0 SCMH using the same stepwise approach.
- This controlled testing methodology enabled a consistent comparison of gas quality across all wells.

	Before Liner Installation		After Liner Installation		Difference	
	Methane Avg %	Oxygen Avg %	Methane Avg %	Oxygen Avg %	Methane Change%	Oxygen Change %
Test Wells	49.9	1.5	52.1	1.7	2.2	0.2
MRLW5-12	50.2	0.5	50.1	1.7	-0.1	1.2
MRLW5-17	48.0	2.3	53.8	1.6	5.8	-0.7
MRLW5-22	51.5	1.8	52.4	1.9	0.9	0.1
Control Wells	47.8	1.1	37.0	2.7	-10.8	1.6
MRLW5-20	50.1	1.4	37.7	3.7	-12.4	2.3
MRLW5-25	48.7	0.0	43.3	0.1	-5.4	0.1
MRLW5-26	44.7	1.9	30.1	4.3	-14.6	2.4

Test Wells: CH_4 ↑ 2.2% | O_2 ↑ 0.2%

Control Wells: CH_4 ↓ 10.8% | O_2 ↑ 1.6%

Results

Scenario 2: Flow Optimization

- Well flows were balanced according to gas quality for both test and control wells.

	Average of Methane %	Average of Oxygen %	Average of Flow SCMH
Test Wells	56.4	0.9	38.0
MRLW5-12	60.7	0.2	40.2
MRLW5-17	52.4	1.3	36.6
MRLW5-22	56.3	1.2	37.2
Control Wells	47.4	1.6	23.5
MRLW5-20	48.3	2.2	23.7
MRLW5-25	51.3	0.0	29.0
MRLW5-26	42.6	2.7	17.9

Test Wells: 38.0 SCMH | 56.4% CH_4 | 0.9% O_2

Control Wells: 23.5 SCMH | 47.4% CH_4 | 1.6% O_2

Results

Scenario 3: Combined approach

- Combined results from the Gas Quality and Flow Optimisation trials were used to evaluate overall liner performance against the pre-liner baseline.

	Before Liner Installation		After Liner Installation		Difference	
	Methane Avg %	Oxygen Avg %	Methane Avg %	Oxygen Avg %	Methane Change%	Oxygen Change %
Test Wells	49.9	1.5	53.7	1.2	3.8	-0.3
MRLW5-12	50.2	0.5	57.1	0.4	6.9	-0.1
MRLW5-17	48.0	2.3	50.1	1.7	2.1	-0.6
MRLW5-22	51.5	1.8	53.8	1.6	2.4	-0.1
Control Wells	47.8	1.1	40.9	2.3	-6.9	1.2
MRLW5-20	50.1	1.4	41.7	3.1	-8.4	1.7
MRLW5-25	48.7	0.0	46.3	0.0	-2.4	0.0
MRLW5-26	44.7	1.9	34.8	3.7	-9.9	1.8

Test Wells: $CH_4 \uparrow$ 3.8% | $O_2 \downarrow$ 0.3%

Control Wells: $CH_4 \downarrow$ 6.9% | $O_2 \uparrow$ 1.2%

Conclusion

Temporary non-welded HDPE surface lining provides a practical interim gas management strategy that can improve methane recovery and reduce atmospheric influence before final cap installation.

- Temporary nonwelded HDPE surface capping improved landfill gas collection performance compared to adjacent control wells.
- Higher methane concentrations, lower oxygen levels, and increased sustainable extraction rates were achieved within the lined area.
- Gas quality in the lined wells was less sensitive to weather conditions, indicating reduced atmospheric influence.
- While the liner did not completely eliminate air ingress, it provided improved oxygen control and gas field stability.

Key Takeaway

Temporary non-welded HDPE covers can serve as an effective interim gas management strategy, improving methane recovery and gas collection efficiency during the period between waste placement and final cap installation.

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Thank you



Q & A

References

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