

Australian Coal Methane Abatement Projects Update GMI Coal Subcommittee 19th Session

3 June 2014
Australian Government



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Department of Industry



Projects at Australian coal mines

- Five projects to support the development and demonstration of technologies to safely reduce fugitive methane emissions from coal mines:
 1. VAM Safety Project - \$12.5 million government funding (total project value \$27 million)
 2. Chemical Looping VAM Abatement Project - \$2.7 million government funding (total project value \$8.5 million)
 3. Methane Capture & Abatement Optimisation Project - \$3 million government funding (total value \$6.9 million)
 4. Safety Duct and VAM-RAB Scale Up - \$13.4 million government funding (total project value \$31 million)
 5. Novel VAM Technologies - \$3.9 million government funding (total project value \$8.2 million)



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Ventilation Air Methane Safety Project

Project Key Objectives:

- 1. VAM characterisation and optimisation
- 2. Deeper understanding of ignition, fire and explosion fundamentals of VAM capture ducts
- 3. Examination of VAM abatement fundamentals and technology options
- 4. Assessment of prevention measures in VAM capture ducts
- 5. Assessment of mitigation measures in VAM capture ducts
- 6. Assessment of monitoring, detection and control systems
- 7. Large-scale demonstration of safety control measures
- 8. Establishment of scale-up rules
- 9. Development of a safety validation framework for VAM abatement installations
- 10. Dissemination of project findings and collaboration with stakeholders
- 11. Independent project reviews

VAM Safety Project Research Facilities

20 Litre Sphere Apparatus



Flammable range apparatus



Goldbert- Greenwald



Hot-surface ignition temperature of dust layers

Facilities Application

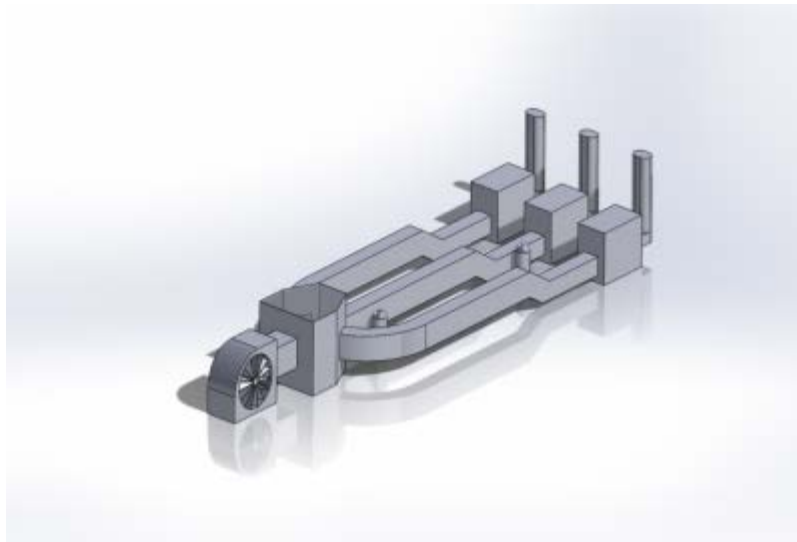
- Flammability/explosion limits of hydrocarbon and coal dust
- The minimum auto ignition temperature of coal dust clouds and coal dust layer.
- Coal dust cloud combustion phenomenon
- Minimum coal dust loading in dust cloud
- Thickness of coal dust layer for auto ignition
- Effect of chemical nature of the dust as well as its concentration, particle size, moisture, and surface area on the minimum auto ignition temperature



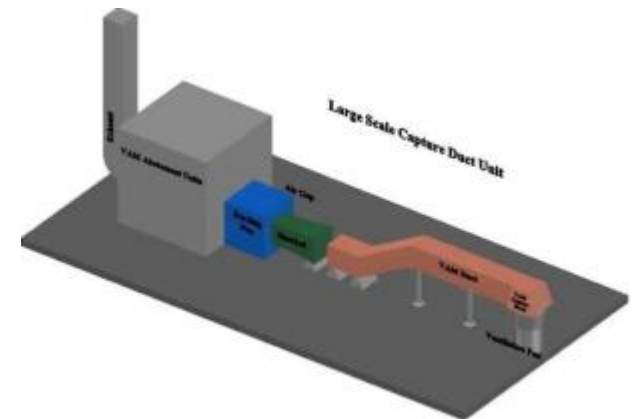
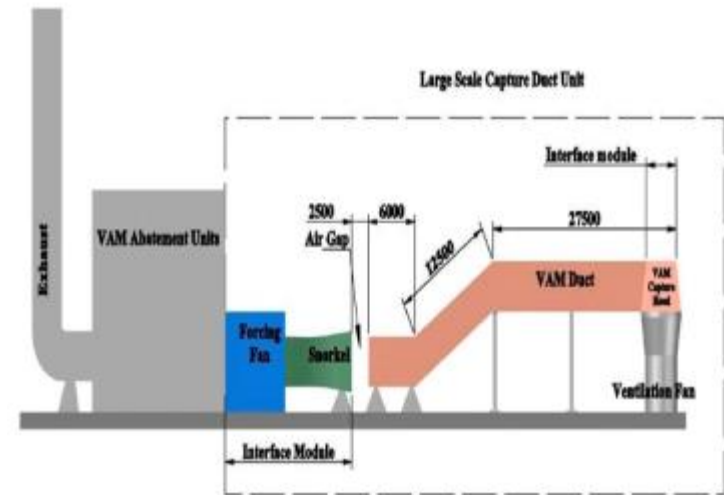
VAM Capture Duct

The smart capture duct will be studied, designed, built and tested in Phase 2 and 3 of the project.

- The pilot-scale capture duct (1-10 m³/s) smart capture duct will be designed and built at the UON.
- Then the 100 m³/s demonstration smart capture duct will be taken to BHPB Illawara for field try.



Modular VAM Capture Duct



Single capture duct

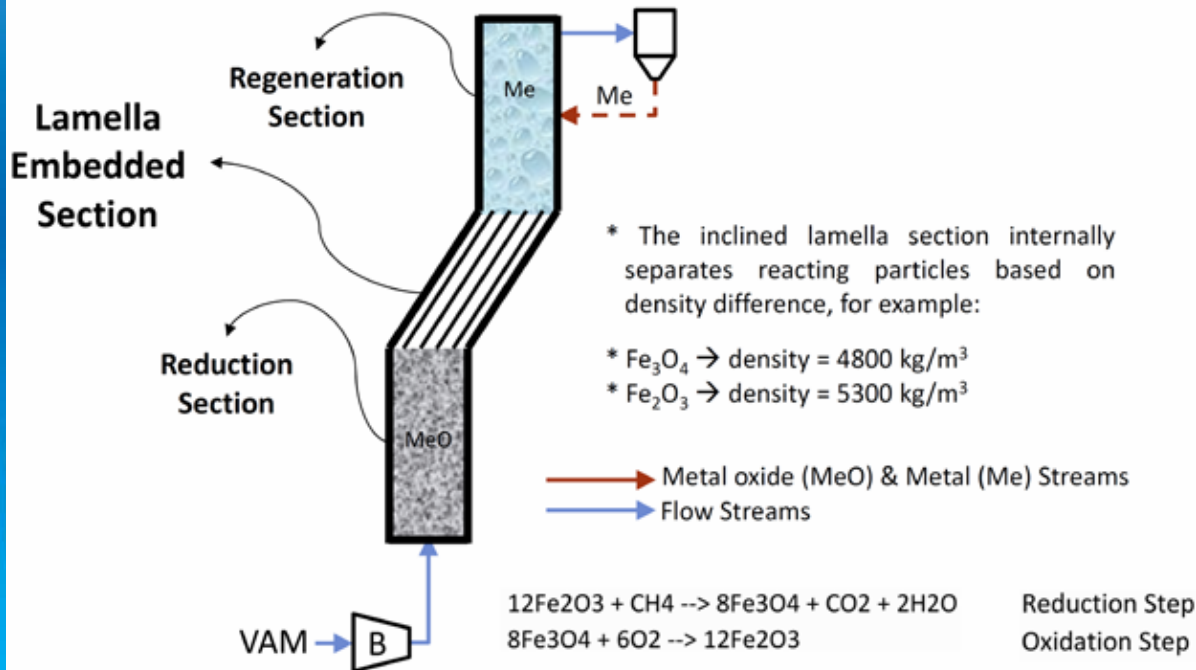
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Chemical Looping VAM Abatement Project

VAMCO Working Principle

The Lamella Embedded Reactor Concept

(Example of metal oxides systems are $\text{Fe}_2\text{O}_3/\text{Fe}_3\text{O}_4$ and CuO/Cu)



Schematic of a VAMCO unit working principle.

- Mitigates VAM flows with methane concentrations between 0.005% and 2.0%
- Project includes 1 m³/s VAMCO prototype and then a 10 m³/s pilot-scale demonstration unit

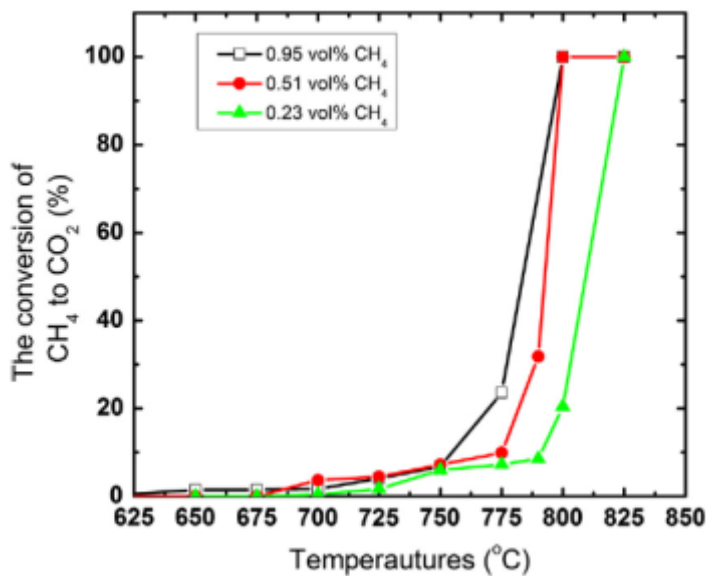
Chemical Looping Research Facilities

10 kW pilot-plant



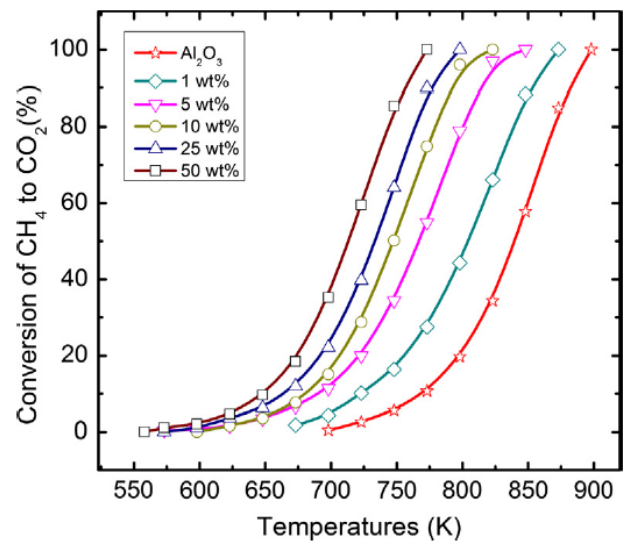
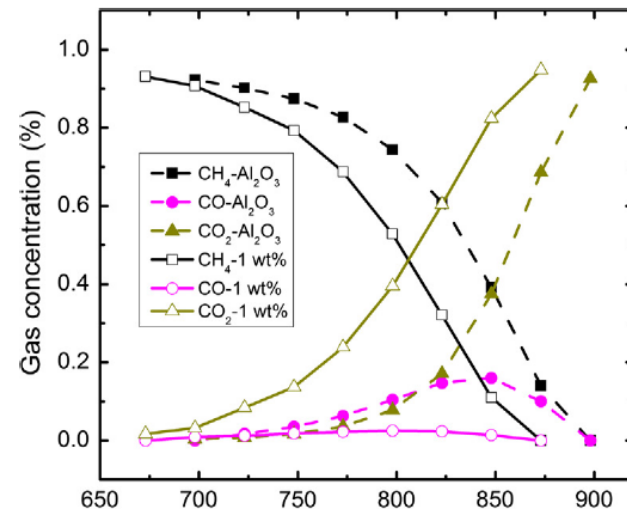
Experimental Results in Fixed-Bed Reactor

Thermal oxidation of VAM



VAM oxidation temperature can be dropped by 250-400 °C with VAMCO !!!

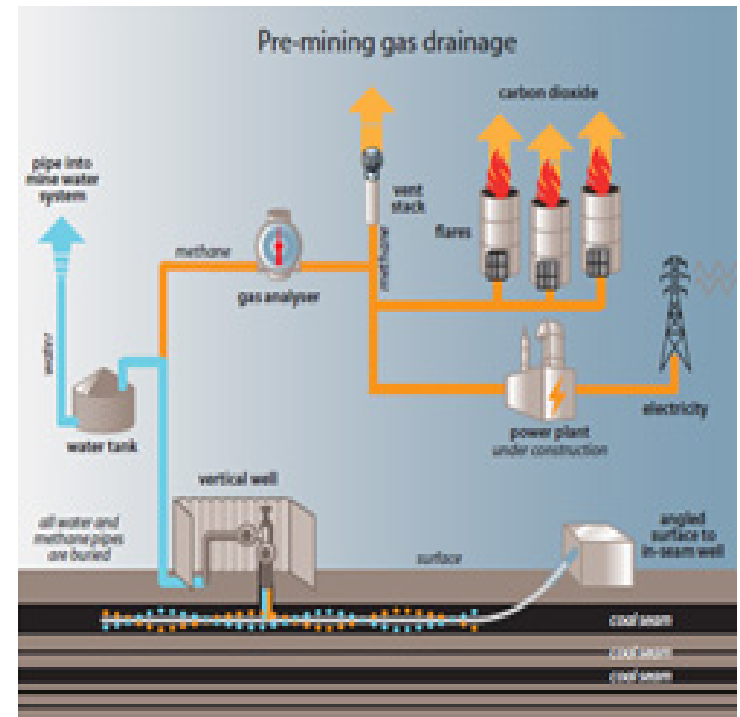
Fe₂O₃/Al₂O₃ experiments



Bulga Underground Operations

Methane Capture and Abatement Optimisation

- Increasing the longwall gas capture efficiency from 60% to 80%
- Result in a significant reduction of annual fugitive emissions by 0.3 Mt CO₂-e
- Best practice information to be shared with industry
- Surface and underground drilling program completed and instrumental installed, including extensometers, piezometers, stressmeters, goaf pressure gauges and sensors and tracer gas testing equipment



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