Australia Coal Sector Update to the 22nd Session of the Global Methane Initiative (GMI) Coal Subcommittee

Department of Industry and Science
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Geneva, Switzerland

Presented by Dr Hua Guo, Research Director
Coal Mining, Energy
Commonwealth Scientific and Industrial Research Organization (CSIRO)

Australian Government

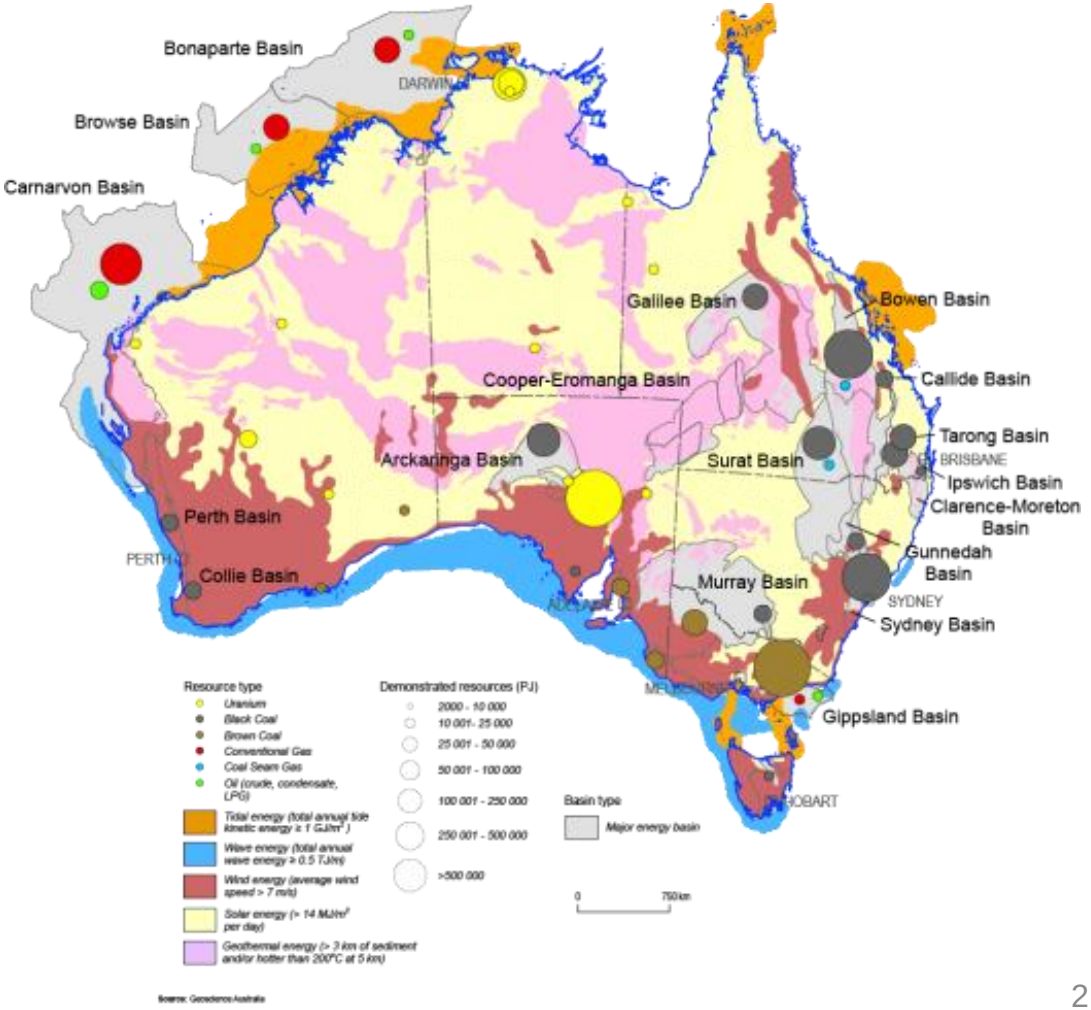
Global Methane Initiative

Australia Coal Sector Update

Coal is one of Australia's most significant energy resources

In 2014-15 Australia:

- Produced 442 million tonnes of coal:
- Exported 392 million tonnes of black coal worth around $38 billion or around 12% of Australia's total goods and services export income that financial year;
- Coal also met over 61% of our electricity generation.



CMM Project Outlook

- The Australian Government is committed to reducing greenhouse gas emissions to 5% below 2000 levels by 2020. Further, it proposes an additional response of reductions between 26–28% below 2005 levels by 2030

- Government's Direct Action Plan seeks to efficiently and effectively source emissions reductions through the $2.55 billion Emissions Reduction Fund https://www.environment.gov.au/climate-change/emissions-reduction-fund

- GMI Partner Country Action Plan and Coal Sector Action Plan in process of being updated

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Coal Methane Abatement Projects

The Coal Mining Abatement Technology Support Package (CMATSP) provides assistance to the coal industry to facilitate the commercialisation of fugitive methane abatement technologies

Six Projects - Funded by Government and Industry ($36.6 million government funds / ~$82 million total value)

Projects support the development and demonstration of technologies to safely reduce fugitive methane emissions from coal mines

Knowledge sharing through the GMI

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CMATSP Projects

	Aims	Total Funding ~$82M
Centennial Coal Company	**Safety Duct and Ventilation Air Methane-Regenerative Air Burner (VAM-RAB) Scale Up** To install a direct coupled regenerative thermal oxidiser (RTO) to a ventilation fan and to develop transparent methodology for future installations at Australian coal mines.	$30,923,000
University of Newcastle (UON)	**Chemical Looping VAM Abatement** To further development and pilot-scale demonstration of a novel ventilation air methane (VAM) abatement technology based on the chemical looping concept and is referred to as 'VAM chemical looping oxidiser (VAMCO)'.	$8,506,000
University of Newcastle (UON)	**VAM Abatement Safety** To determine the critical science and engineering issues that underpin the safe operation of VAM capture ducts, an integral component of large-scale VAM abatement systems to address fugitive emissions at Australian coal mines.	$26,931,212
Commonwealth Scientific Industrial Research Organisation (CSIRO)	**Novel VAM Technologies** To test and demonstrate three different prototype technologies designed to mitigate and utilise fugitive methane emissions from the ventilation air of coal mines.	$7,087,619
Bulga Underground Operations and Commonwealth Scientific Industrial Research Organisation (CSIRO)	**Methane Capture and Abatement Optimisation** To develop an advanced approach and technologies to optimise the design and operation of mine gas drainage and ventilation systems and improve the longwall post drainage efficiency.	$6,900,000
Commonwealth Scientific Industrial Research Organisation (CSIRO)	**Open Cut Emissions** To investigate the potential uses and likely uncertainties associated with inverse and traverse based atmospheric methods for estimating fugitive gas emissions in open cut coal mines, and design an appropriate monitoring network and modelling approach that would maximise the accuracy and precision of the results obtained from any subsequent field trial.	$1,477,042

Centennial VAM-RAB Scale Up Project Progress

- Stage 1 – Design assurance framework Complete
- Stage 2 – Detailed design Commenced, Due May 2016
- Stage 3 – Testing, modelling & final design Due August 2016
- Stage 4 – Construction Due June 2018
- Stage 5 – Monitoring and reporting Due November 2018

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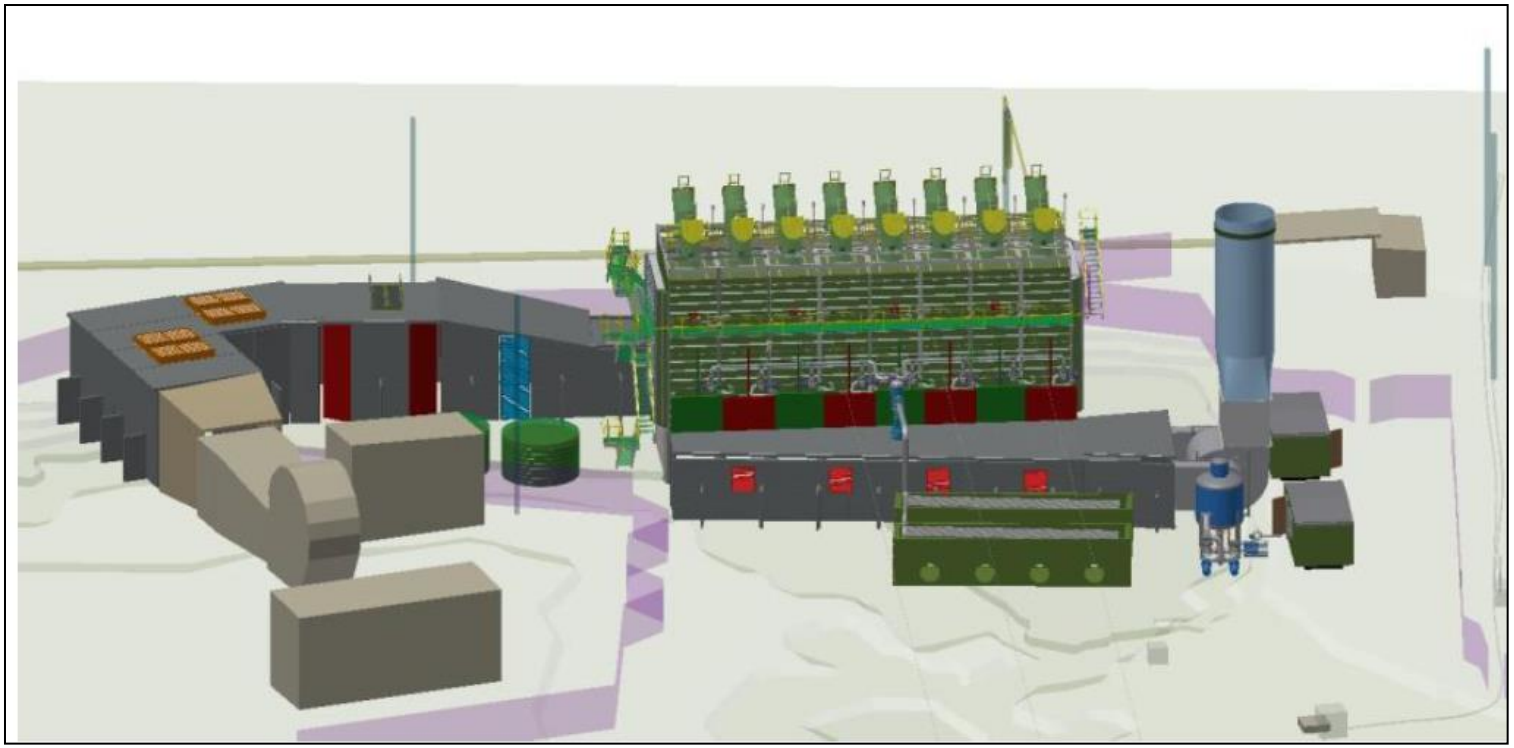
VAM-RAB Scale Up
(Early) Conceptual Design



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UON Chemical Looping VAM Abatement Project Progress

Year 1
- Bench scale studies
- Pilot scale studies

Year 2
- Design, fabrication and installation of a 1 m^3/s (VAM flow rate) prototype*

Current status

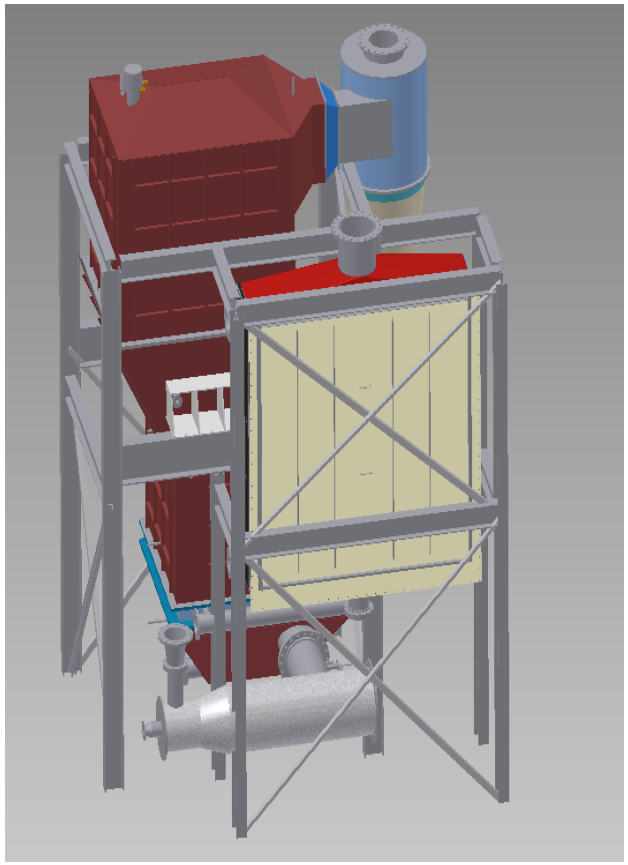
Year 3
- Scale-up and design of a 10 m^3/s demonstration unit
- Build 10 m^3/s unit

Year 4
- Field trials of the 10 m^3/s demonstration unit

***Construction and commissioning of the 1 m^3/s unit is currently underway.**

1 m^3/s VAMCO Prototype

Design of the Unit



1 m^3/s Unit under Construction

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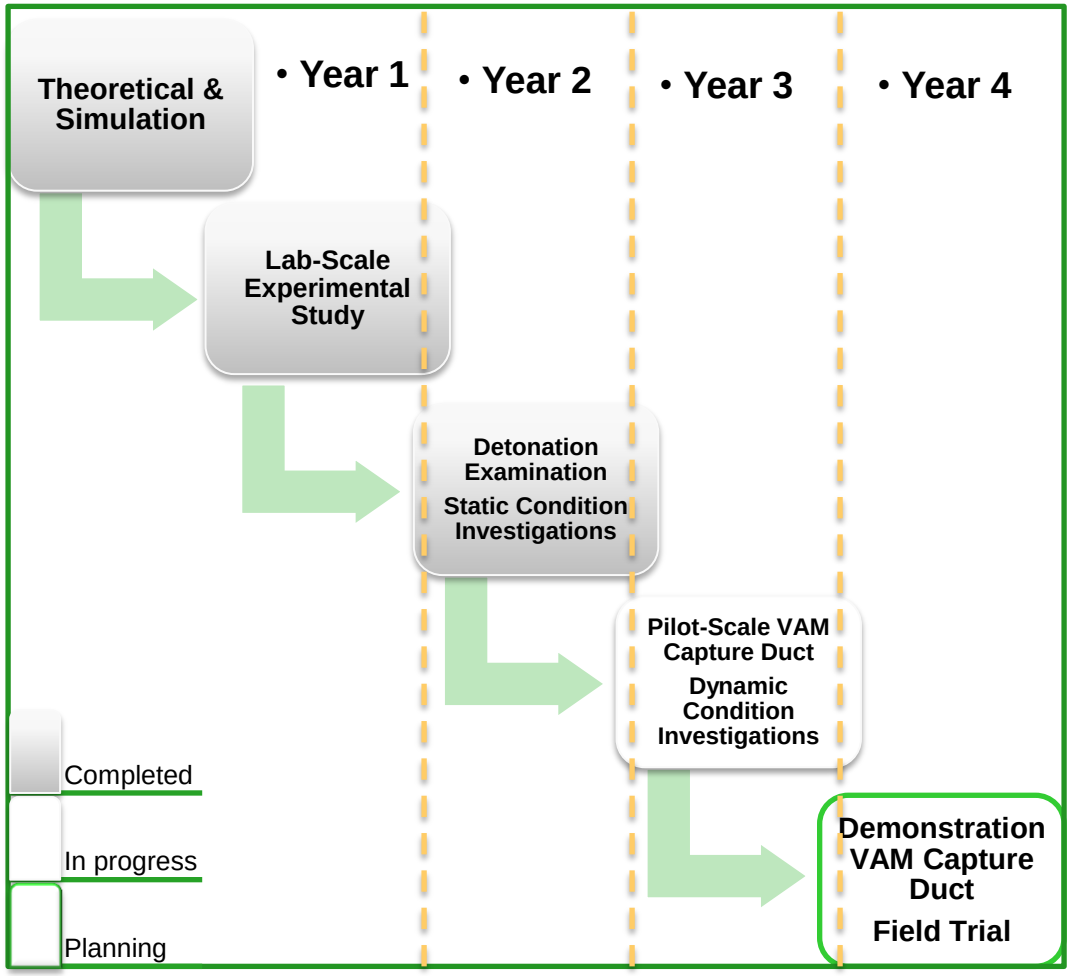
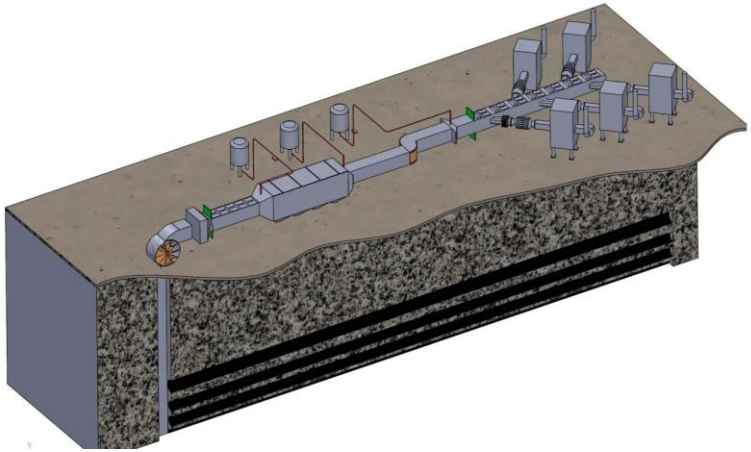
UON VAM Abatement Safety Project Progress





Large-Scale Demonstration Capture Duct

CSIRO Novel VAM Technologies Project Progress

With the support of our funding partners, in collaboration with Illawarra Coal, CSIRO is undertaking the field trials at West Cliff mine (a split stream of VA of 0.6 – 1 Nm^3/s) to test three different novel VAM prototype units (VAMCAT, VAMMIT, VAMCAP) first time under real-world conditions in Australia.

- Duration: 48 months from 1 July 2014
- Science: three patented VAM technologies
  - VAMCAT – novel catalytic gas turbine system operated with 0.8% CH_4 in air for power generation
  - VAMMIT – newly structured regenerative bed to destroy ≥0.3% CH_4 in air with lower energy consumption and no dust deposition issue
  - VAMCAP – novel carbon composite adsorbents and associated process for enriching VAM

VAMCAT unit

VAMMIT unit

VAMCAP unit

Glencore and CSIRO Methane Capture & Abatement Optimisation – Project Progress

Milestone 1 (3 mths)

Site characterisation

- Site characterisation of
  - Geology & hydrogeology
  - Strata properties
  - Gas reservoir parameters
  - Mining and drainage experience
- Project detailed planning and monitoring design

Milestone 2 (10 mths)

Monitoring and measurement

- Drilling
- Instrumentation installation
- Monitoring
- Measurements
- Tests
- Data analysis

Milestone 3 (10 mths)

Fundamental modelling study

- Coupled strata, gas and water responses to mining
- Goaf gas flow dynamics
- Gas drainage mechanisms
- Key factors affecting drainage performance

Milestone 4 (11 mths)

Approach development

- Identification of
  - gas emission sources
  - drainage targets
  - key factors
- Drainage approach development
- Site trial design

Milestone 5 (18 mths)

Site trial

- Site trial implementation
- Performance monitoring and tests

Milestone 6 (27 mths)

Approach refinement

- Site trial evaluation
- Integrated analysis of all project data
- Drainage design approach refinement

Milestone 7 (30 mths)

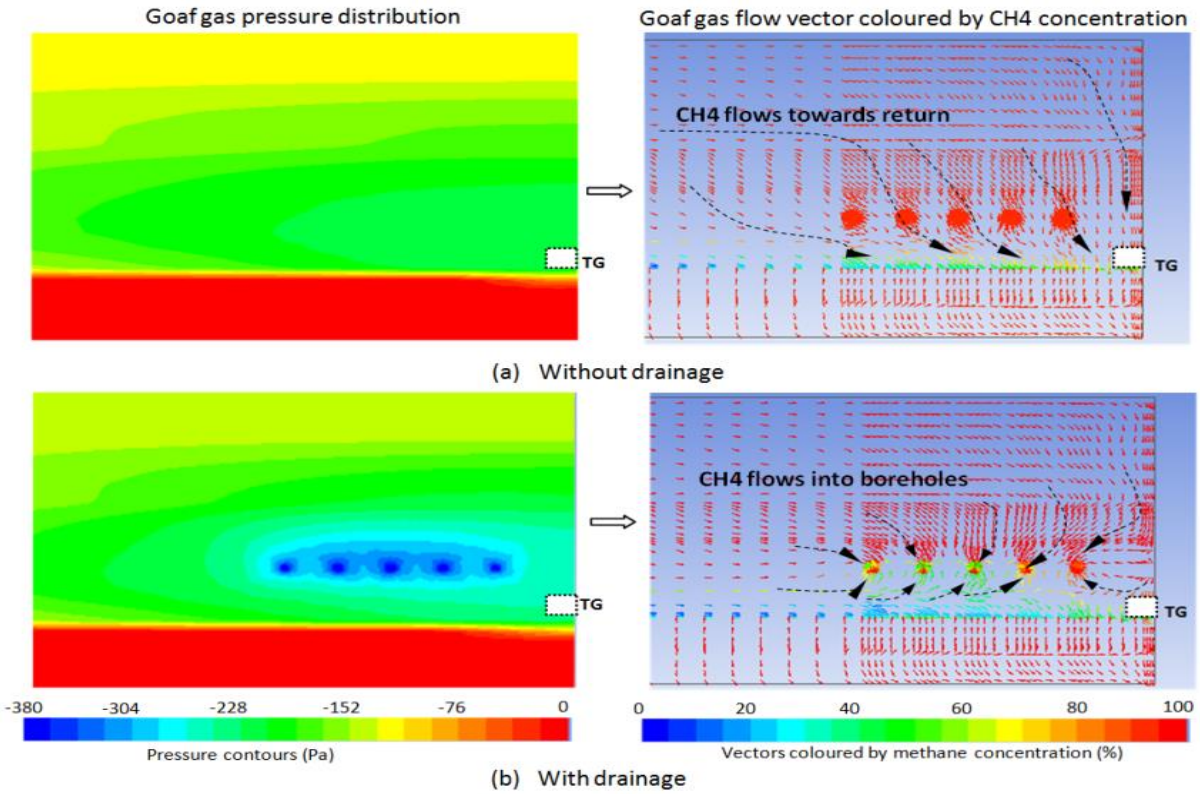
Summary and dissemination

- Preparation of project final report
- Knowledge sharing

Completed milestones

Ongoing milestones

Optimal Horizontal Post Capture Systems



Horizontal (lateral) gas drainage boreholes provide pressure sinks that control goaf gas flow directions

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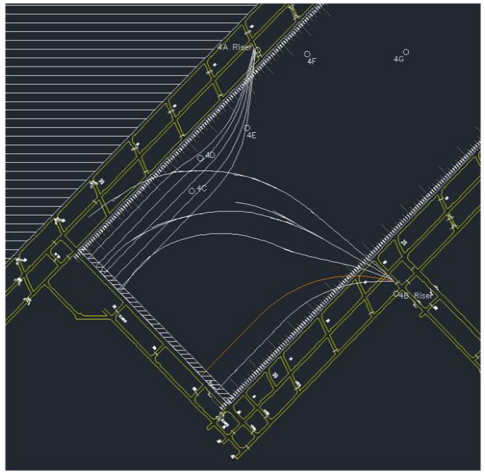
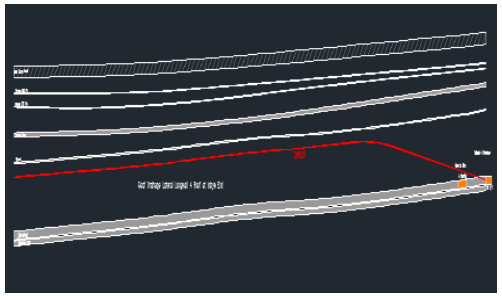
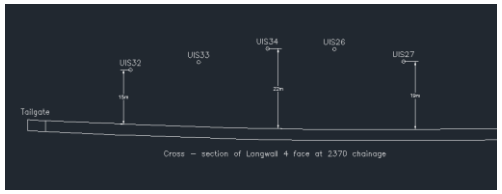
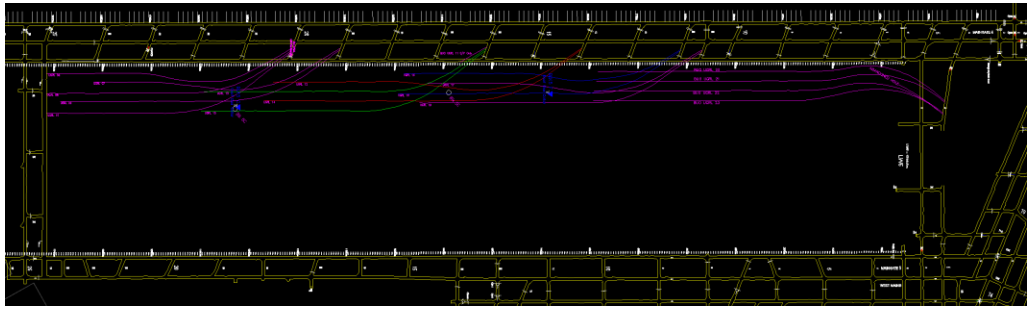
Design and Trial at LW4 Panel in 2014







- 5 roof holes and 5 floor holes were designed to replace surface goaf wells,
- the trial was at the first 500 m section of LW4 in 2014.



- Roof lateral drainage was successfully implemented for the full length of LW5 in 2015
- Both roof and floor drainage boreholes will be implemented at the next panel, LW7

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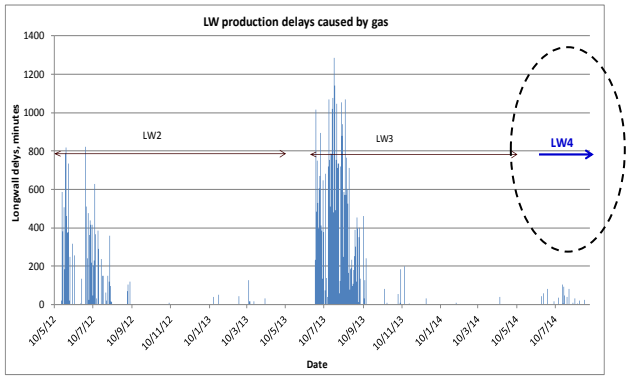
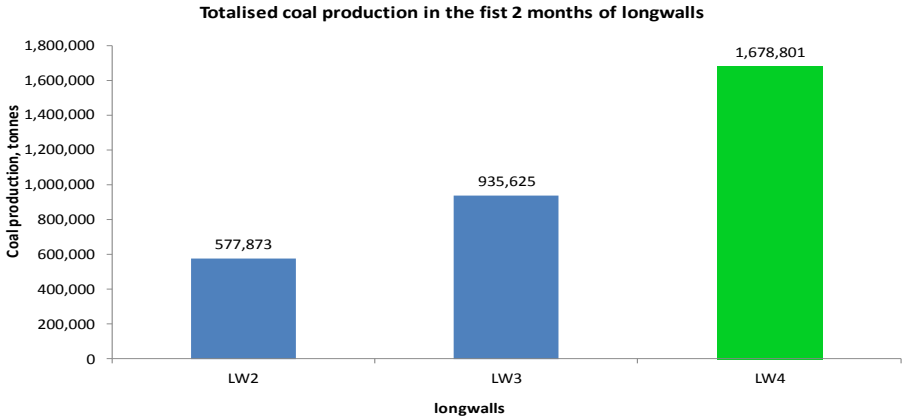
Project Outcomes to Date

- Improved gas capture efficiency
- Reduced gas related coal production delays and increased coal production
- Reduced fugitive emissions





LW	Retreat meter for comparison, m	Gas drainage method	Daily LW tones, t	Total gas emission, l/s	Drainage gas flow rate, l/s	Relative drainage gas, m3/t	Relative return gas, m3/t	Total relative gas emission, m3/t
LW3	35-223	Vertical	13,860	4004	1182	6.9	18.8	25.7
LW4, Trial	30-259	Lateral (roof +floor)	23,121	2869	1702	6.4	4.3	10.7
LW5	30-220	Lateral (floor only)	22,411	3171	1252	4.8	7.4	12.2

CSIRO Quantifying Open-Cut Emissions Project Progress

- Project aimed at developing new methods to measure fugitive emissions from open-cut coal mines
- Conducted in two stages

Stage 1 (June 2015 – June 2016)

- 12-month study to investigate practicality of atmospheric methods
- Assess methods
- Design for field trial (Stage 2)

Stage 2

- Subject to outcome of Stage1. Would involve long term (2-year) trial at a selected mine

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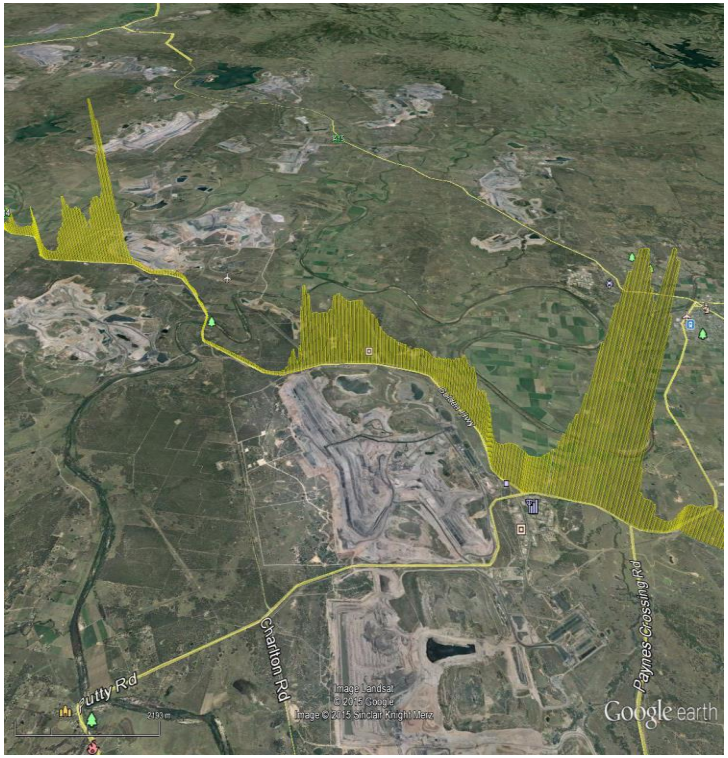
Quantifying Open-Cut Emissions



Atmospheric methods to measure fugitive emissions

Several approaches

- Ground level surveys – use local meteorological data and plume dispersion characteristics to estimate emission rate
- Tracer gas released in mine at known rate: ratio of tracer to methane concentration yields flux
- Inverse methods

Contact Information

Mr Josh Cosgrave

Manager

Low Emissions Section

Resources Division

Department of Industry and Science

Email: Josh.cosgrave@industry.gov.au

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