



The Use of External Inertisation in Australian Underground Coal Mines





Overview

External inertisation is a technique widely used in Australia

- Control heatings
- Remove explosive atmospheres
- Prevent spontaneous combustion



Techniques

- Vaporised liquid Nitrogen
- Vaporised liquid Carbon Dioxide
- Exhaust gas from Diesel Boiler
- Exhaust gas from Jet engine
- Dry ice
- Water
- Nitrogen separated from fresh air – membrane technology, pressure swing absorption



Selection

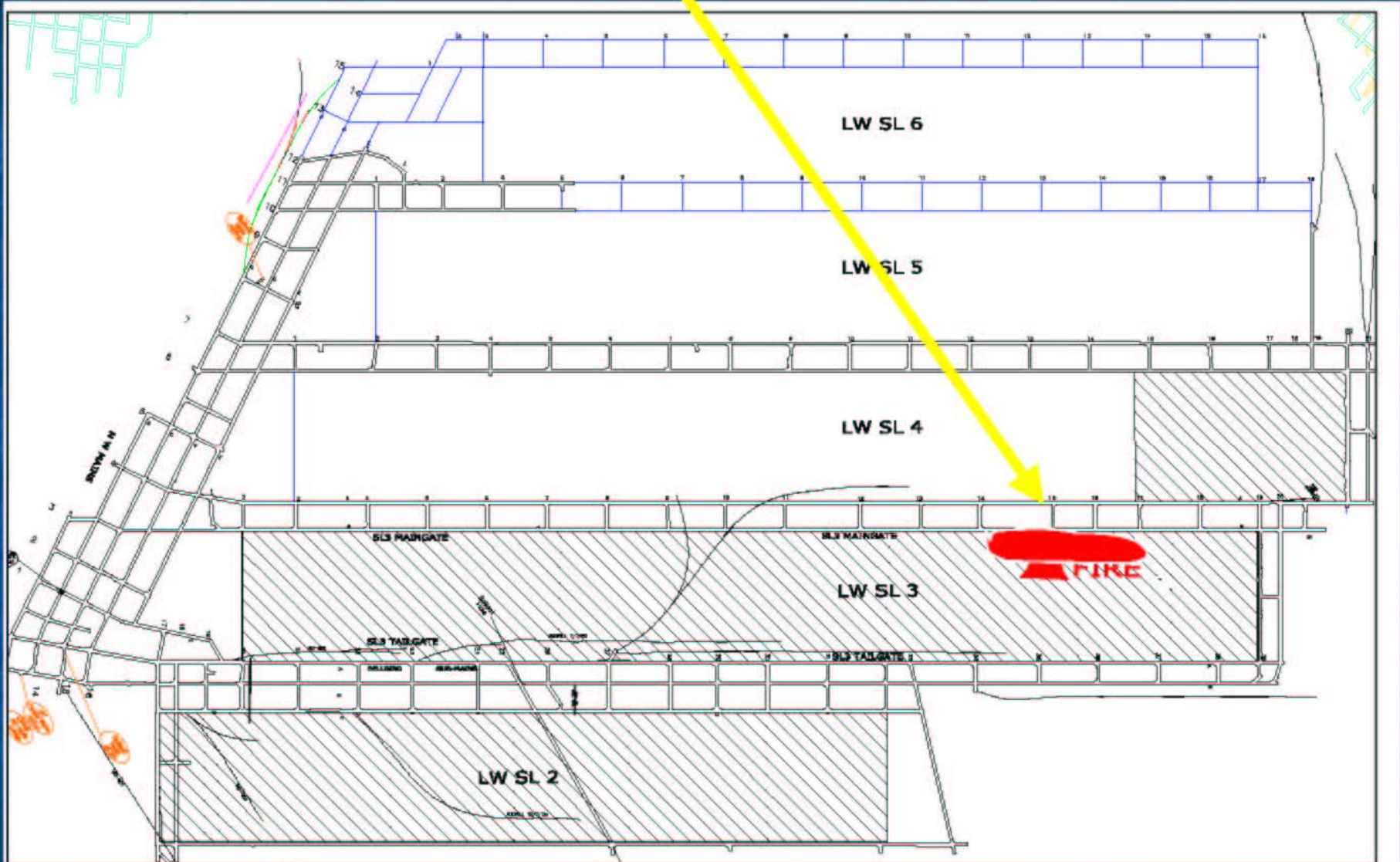
- Availability
- Capability
 - Urgency of need / sustained inertisation
 - Capacity – m^3/sec
 - Delivery/access to site – pipeline/compression
 - Supply arrangements
 - buoyancy effect
- Cost



History

- Vaporised Nitrogen first used in Australia in 1986 – Moura No. 4 Mine.
- Boiler exhaust gas first used in Australia in 1997
- Jet engine exhaust gas first used in Australia in 1997 trial – 1999 Blair Athol
- Water used in 2001 at United Colliery and Ulan in 1991
- Vaporised Carbon Dioxide used at Wallarah Colliery 2001
- Membrane separation Nitrogen first used 2004 Central Queensland

Where did the fire start?





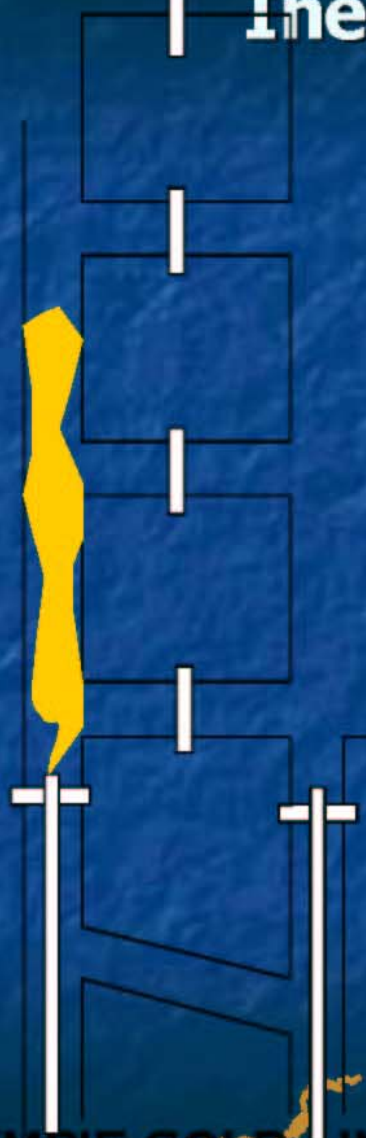
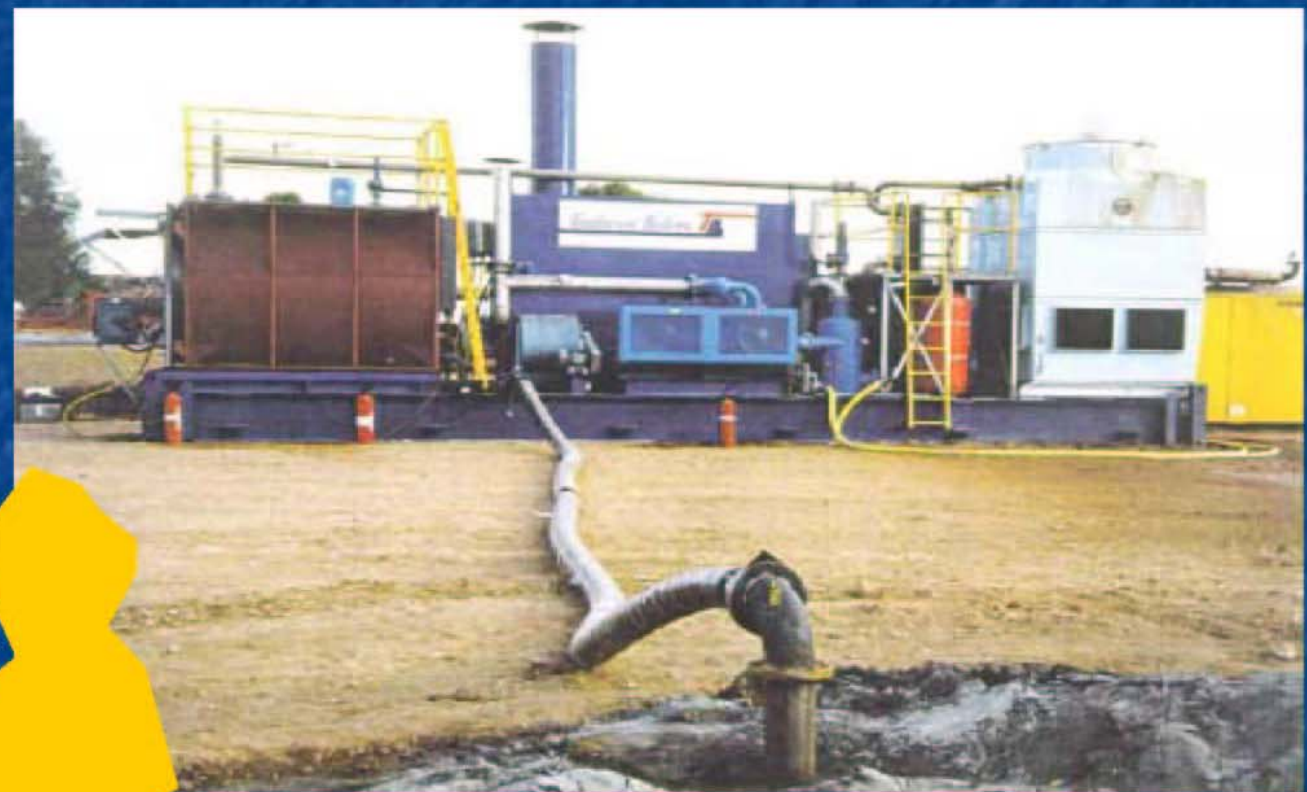
GAG Used 27-29 Dec 04



27/12/2003



Inertisation Using Tomlison Boiler

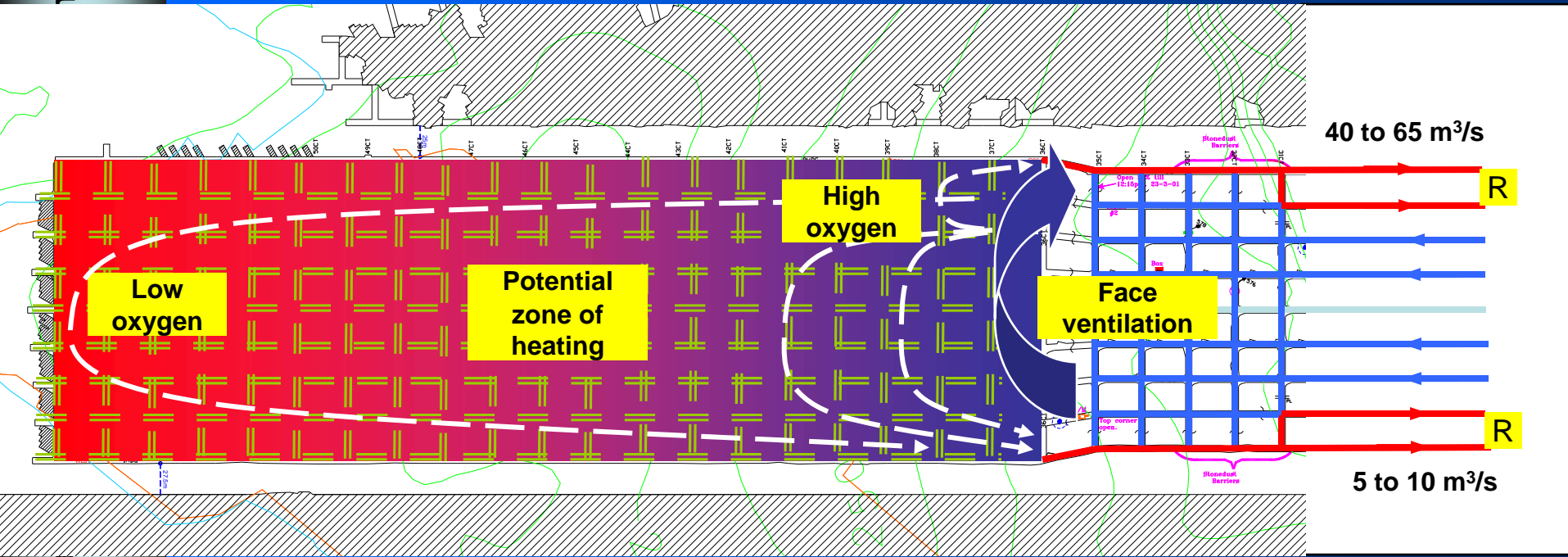


GYMPIE GOLD LIMITED



ntre

United Colliery 2001 415 Panel - Potential Migration Paths



Minera

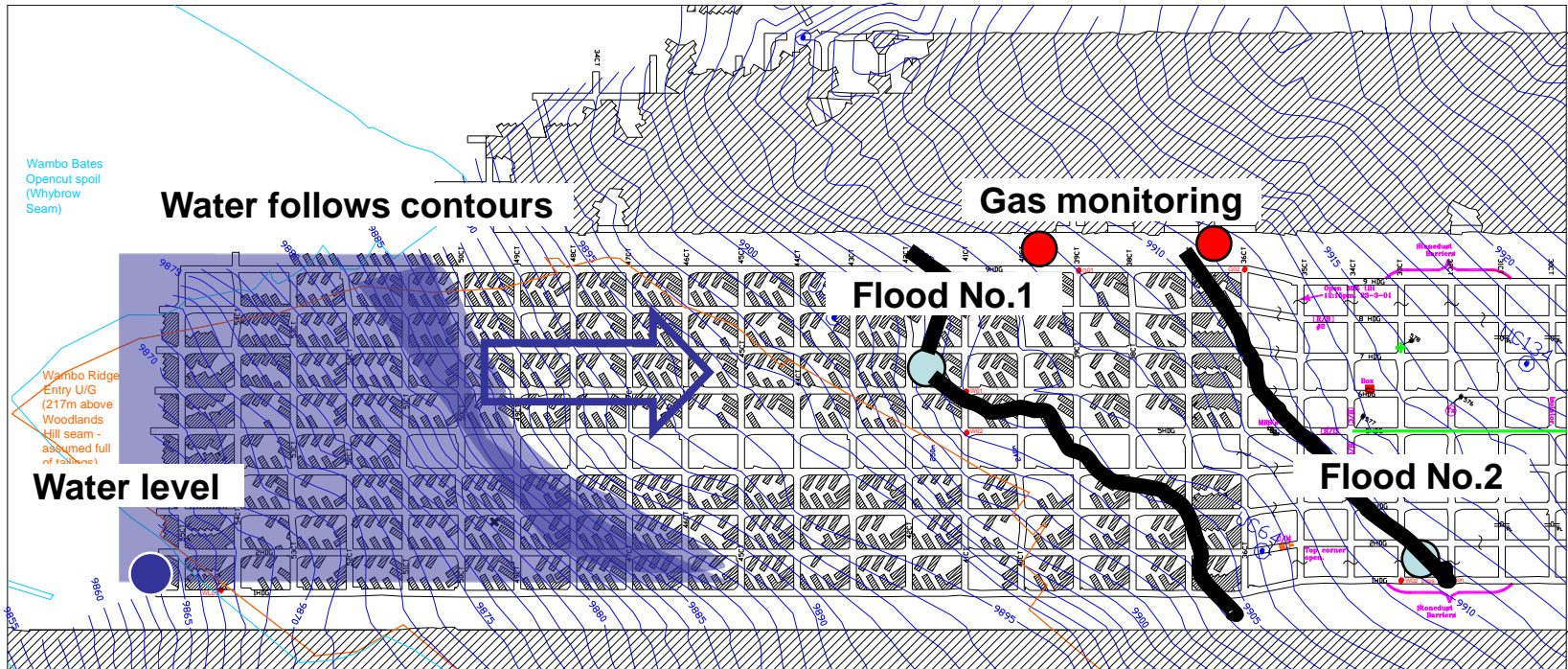
- Deep seated migration of oxygen possible due to reduced caving
- Changes direction with regulator settings
- Limited ingress of seam gas to displace oxygen



415 Panel - Gas Monitoring And Flooding



Mining Centre





Dartbrook

September 1999

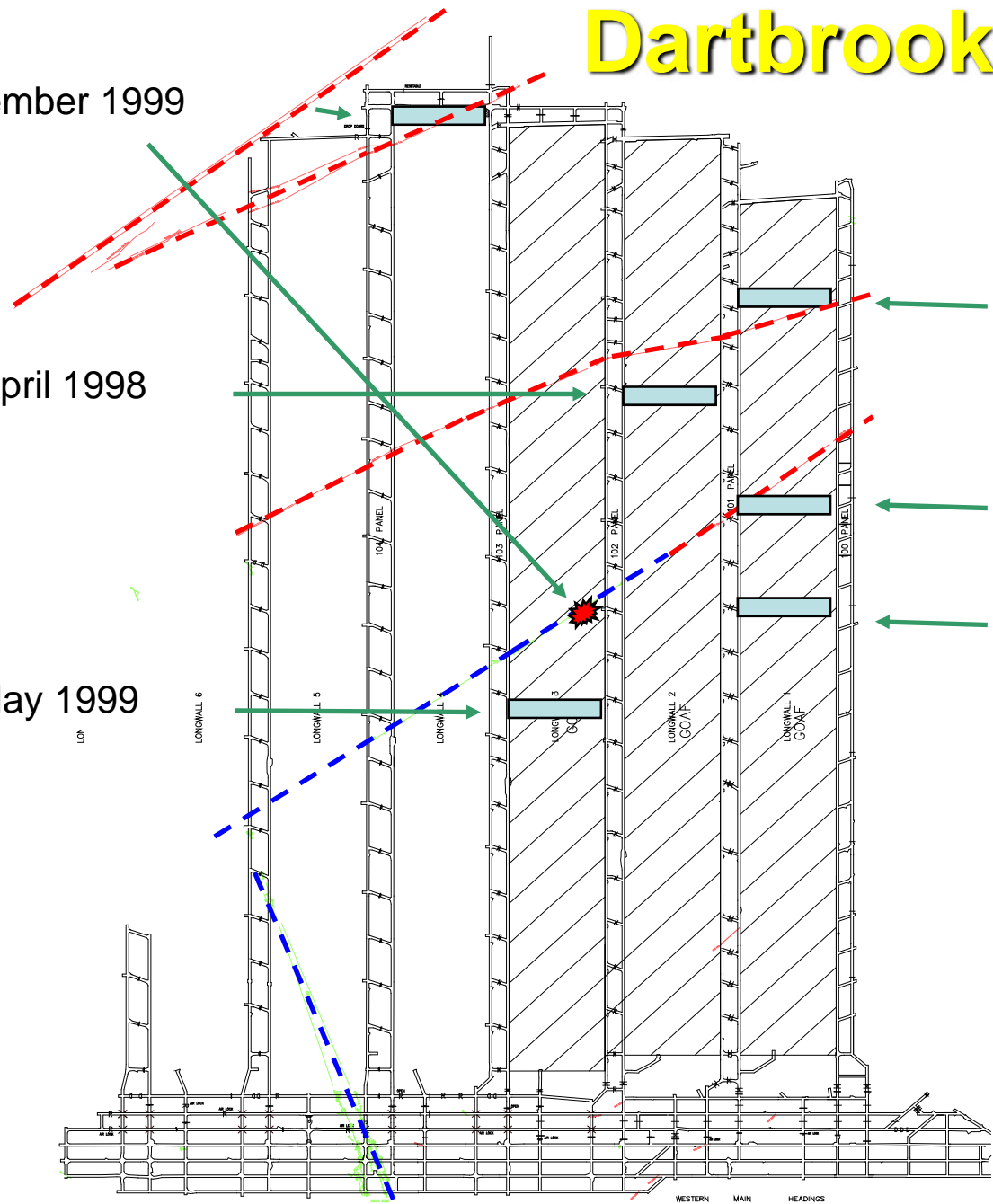
April 1998

May 1999

December 1996

April 1997

June 1997



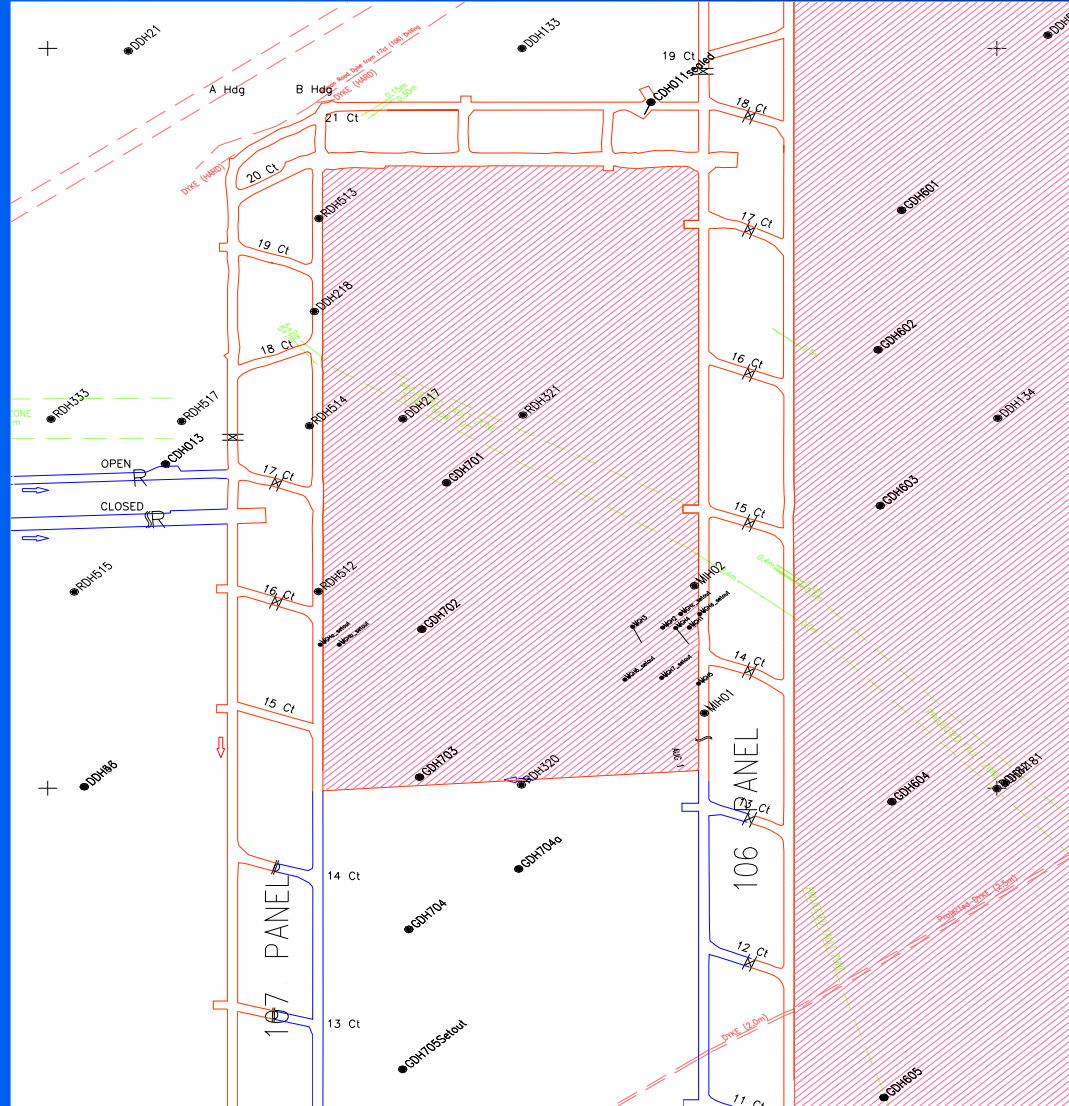


Nitrogen





2002 Event



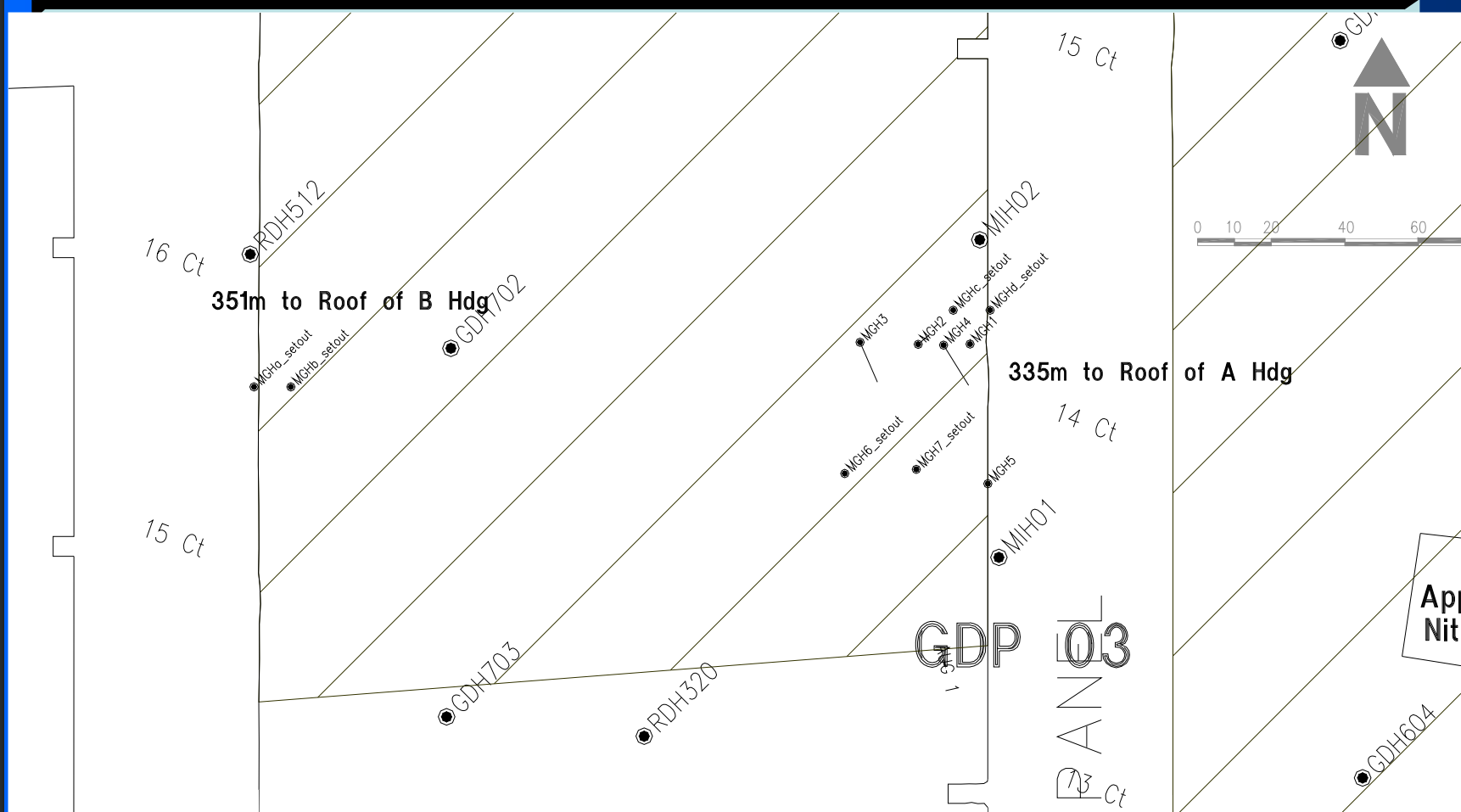


Fly ash





Boreholes





Diesel Boiler IGG

Minerals Industry Safety and Health Centre
The University of Queensland



29/05/2002



Newstan Coal Mine 10/2005

Minerals Industry Safety and Health Centre
The University of Queensland





Newstan Coal Mine 10/2005

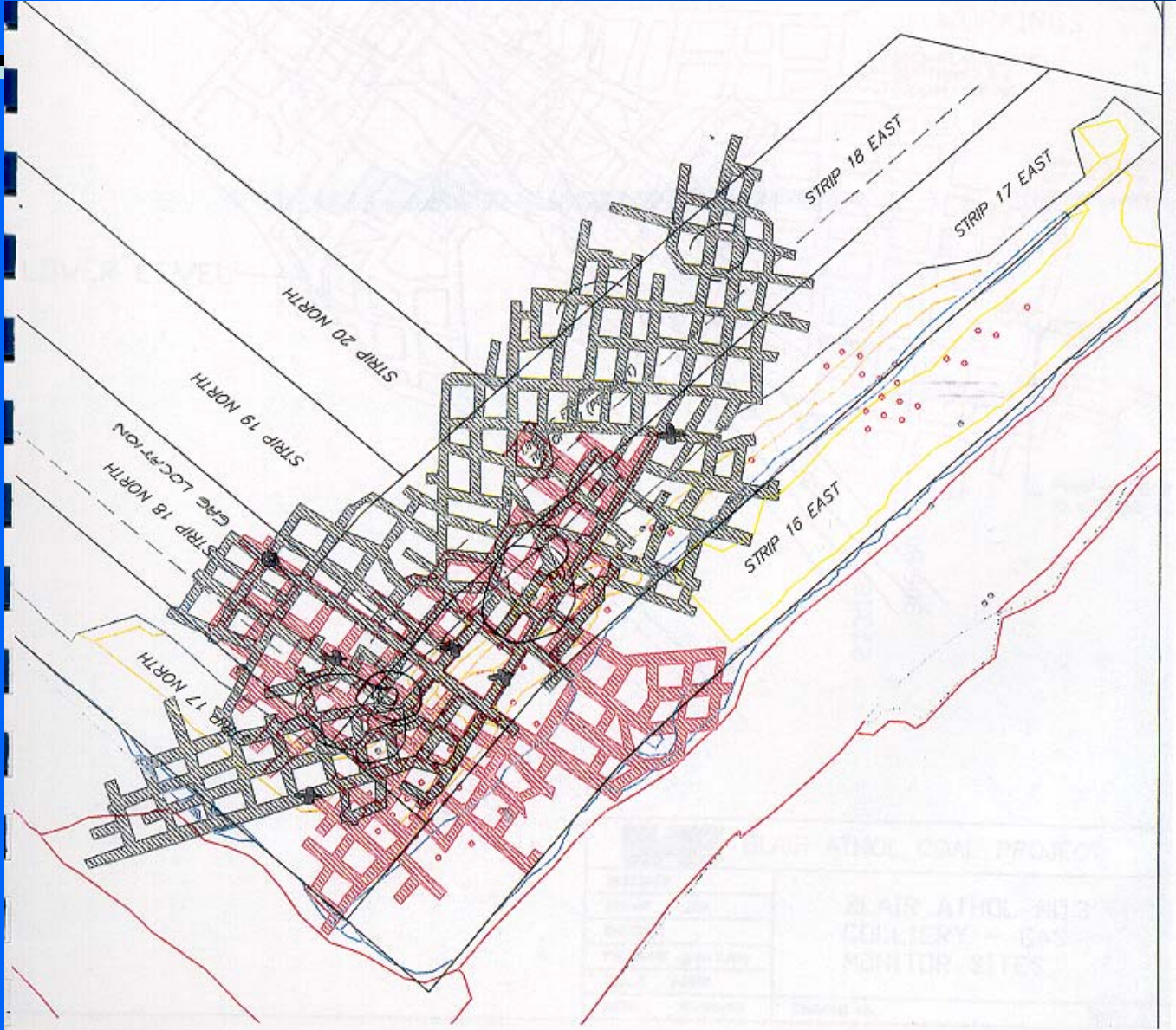
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Blair Athol Open Cut 1999 - 2000

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Definite signs of spontaneous combustion

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Exposed top of coal

Roadway roof completely burnt through and glowing strongly

Highwall



900m Gag Hole
used to flush out
combustible
gases.

Tomlinson Boiler
maintains inert
atmosphere in
long term.

Seal: Plugs of dirt

Plugs of dirt used
to seal upper and
lower workings.

Burning Material
Removed

No. 2 Seam Workings

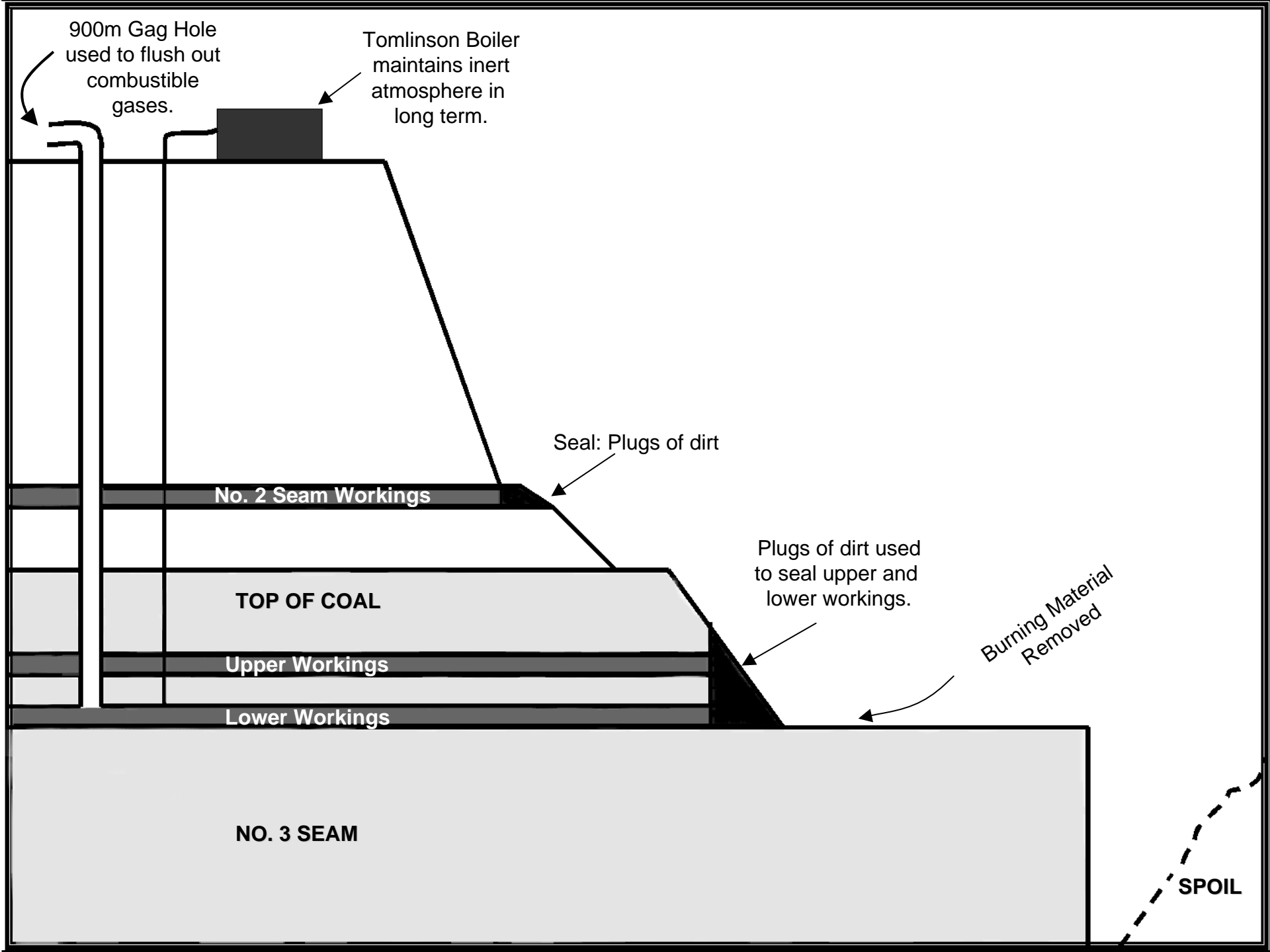
TOP OF COAL

Upper Workings

Lower Workings

NO. 3 SEAM

SPOIL





By-pass tube

Elbow into workings

Gag





Loveridge Mine USA 2003

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Wallarrah 2001 – use of CO2



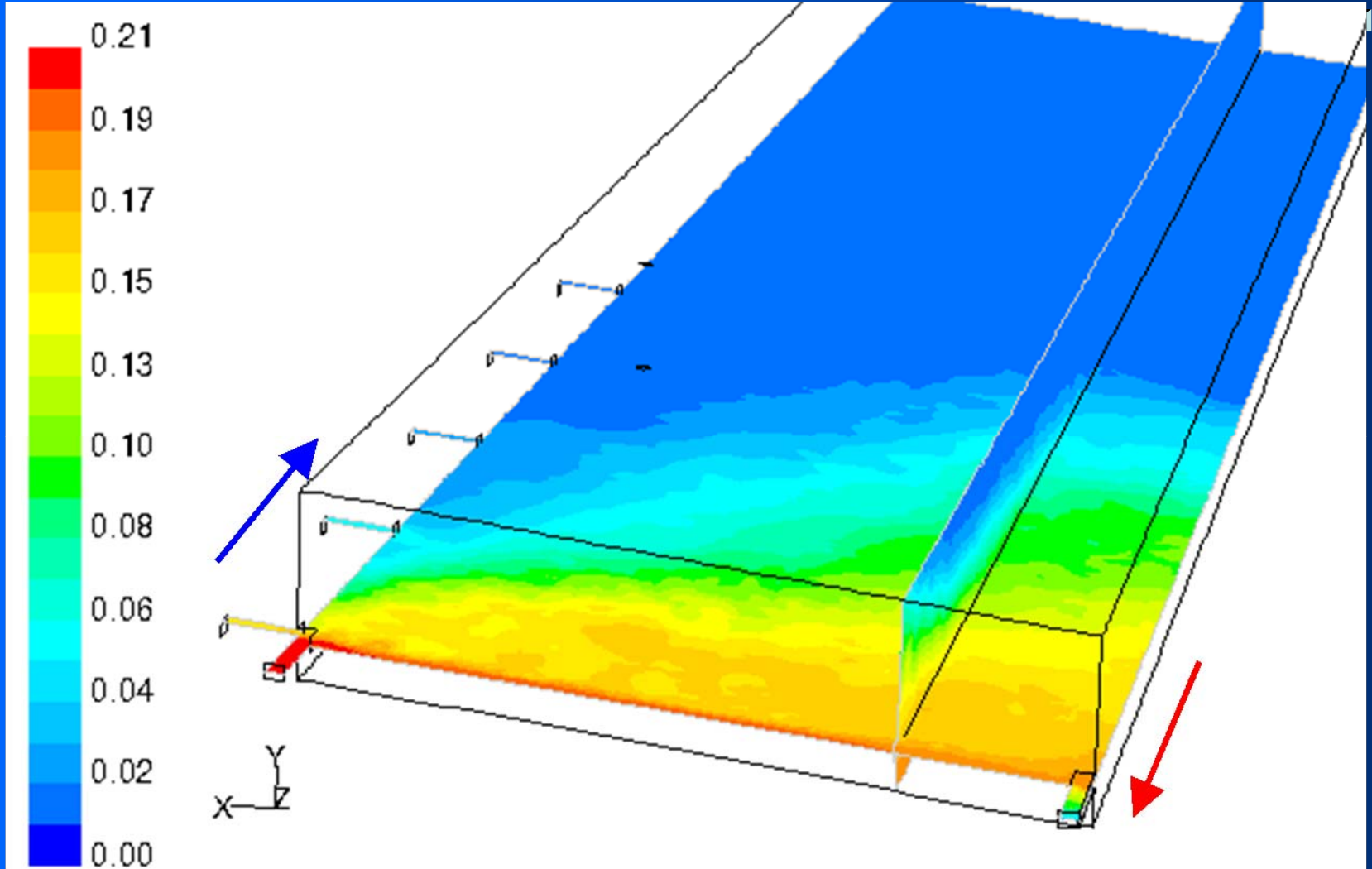


Preventative Inertisation

- Where there is no indication of an ignition source other gases can be used for inertisation
- Seam gas even including methane can be used to reduce the time it takes and area remains in the explosive zone. eg Central Colliery and Laleham No.1.
- Explosions cannot occur when the gas atmosphere is not explosive.

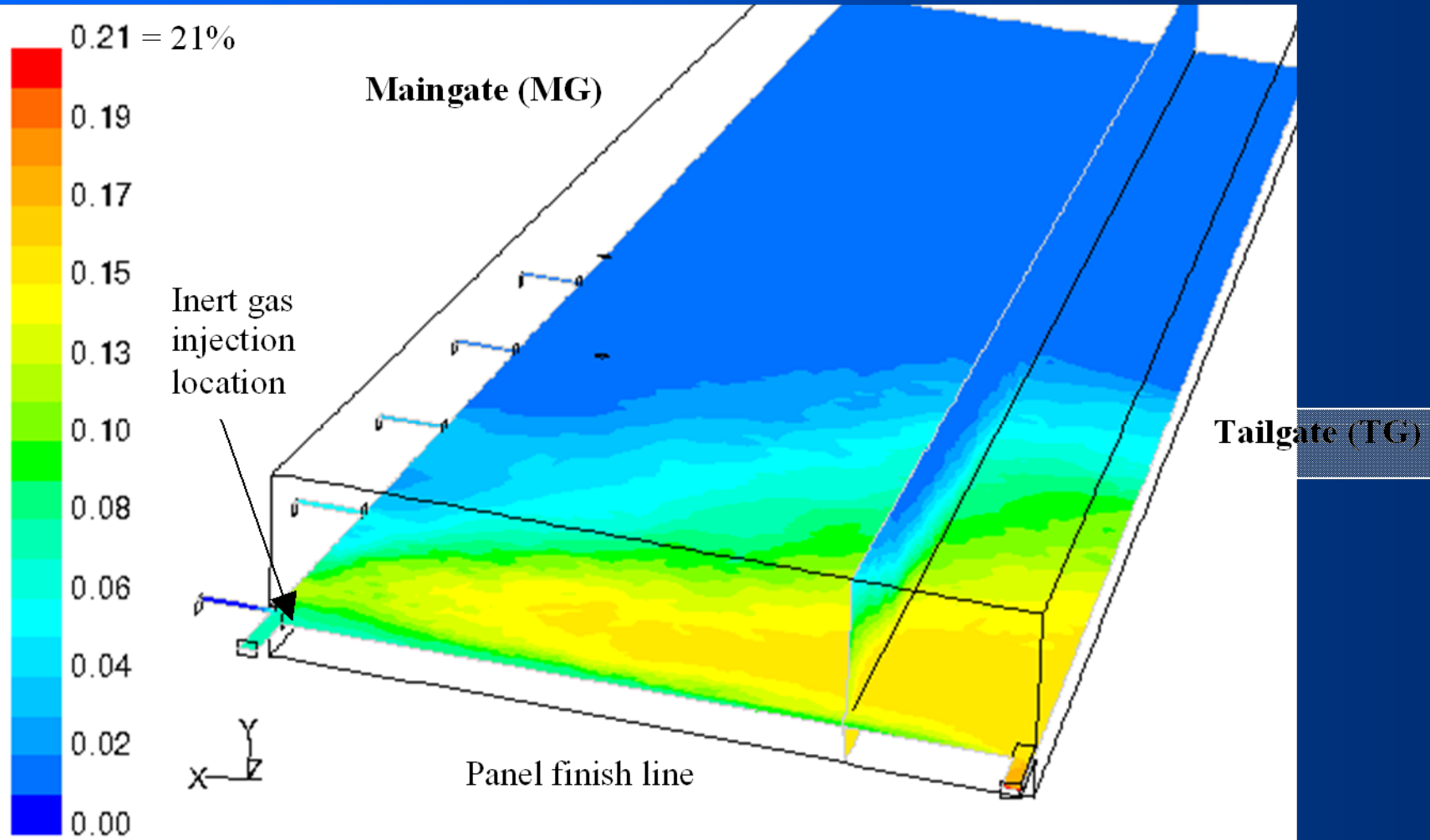


Just prior to sealing



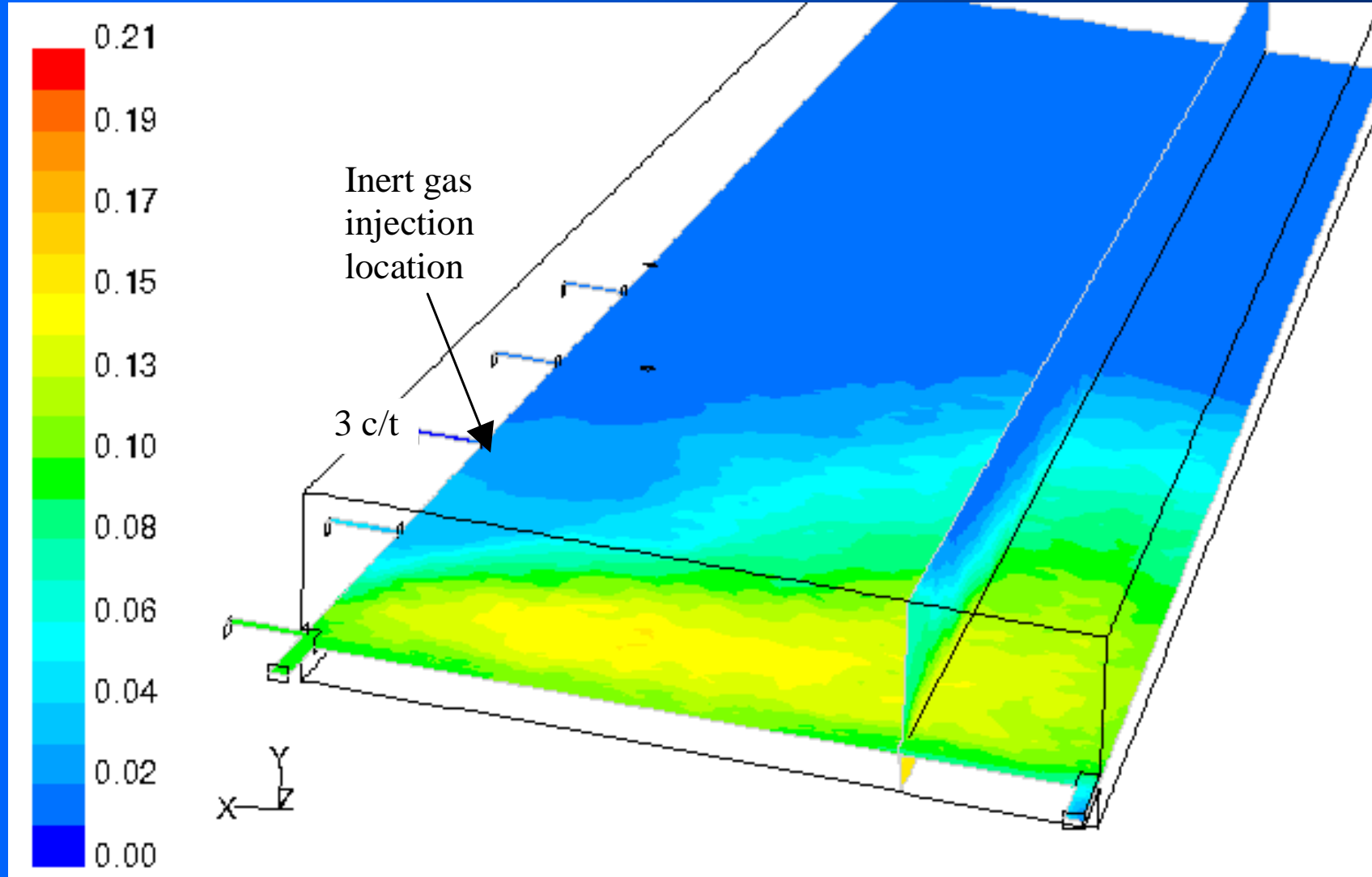


1 day after sealing





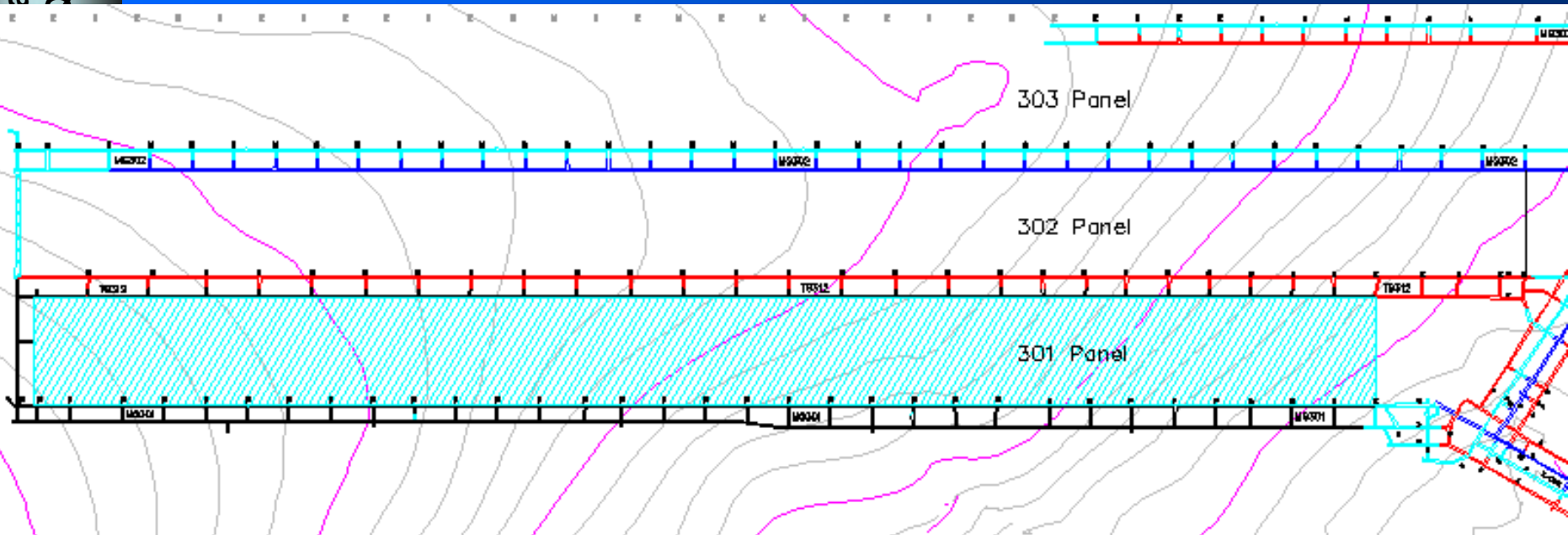
Improved inertisation





KESTREL 2005

- Proactive inertisation of sealed roadway to remove flammability risk





KESTREL JAN 2005

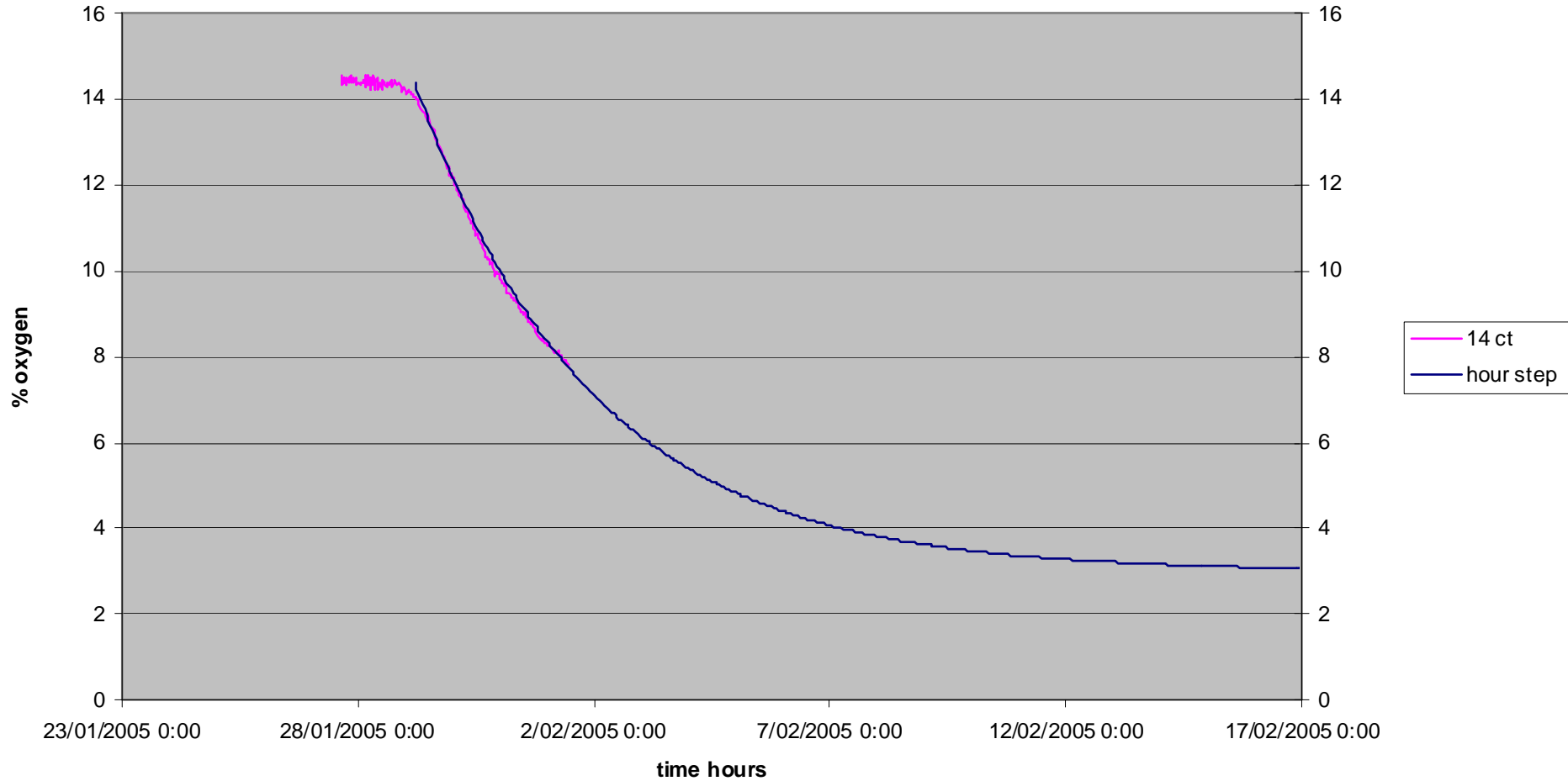
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Inertisation with mixing





- Thank You