

Snapshot

V2

The Pike River underground coal mine lies high in the rugged Paparoa Range on the West Coast of the South Island. Access to the mine workings was through a single 2.3km stone drift, or tunnel, which ran upwards through complex geological faulting to intersect the Brunner coal seam.

On Friday 19 November 2010, at 3:45pm, the mine exploded. Twenty-nine men underground died immediately, or shortly afterwards, from the blast or from the toxic atmosphere. Two men in the stone drift, some distance from the mine workings, managed to escape.

Over the next nine days the mine exploded three more times before it was sealed. There is currently no access to the mine.

The commission is satisfied that the immediate cause of the first explosion was the ignition of a substantial volume of methane gas. The commission's report identifies a number of possible explanations for the source of that accumulation of methane, and the circumstances in which it was ignited.

Methane gas, which is found naturally in coal, is explosive when it comprises 5 to 15% in volume of air. In that range it is easily ignited. Methane control is therefore a crucial requirement in all underground coal mines. Control is maintained by effective ventilation, draining methane from the coal seam before mining if necessary, and by constant monitoring of the mine's atmosphere.

The mine was new and the owner, Pike River Coal Ltd (Pike), had not completed the systems and infrastructure necessary to safely produce coal. Its health and safety systems were inadequate. Pike's ventilation and methane drainage systems could not cope with everything the company was trying to do: driving roadways through coal, drilling ahead into the coal seam and extracting coal by hydro mining, a method known to produce large quantities of methane.

There were numerous warnings of a potential catastrophe at Pike River. One source of these was the reports made by the underground deputies and workers. For months they had reported incidents of excess methane (and many other health and safety problems). In the last 48 days before the explosion there were 21 reports of methane levels reaching explosive volumes, and 27 reports of lesser, but potentially dangerous, volumes. The reports of excess methane continued up to the very morning of the tragedy. The warnings were not heeded.

The drive for coal production before the mine was ready created the circumstances within which the tragedy occurred.

A drive for production is a normal feature of coal mining but Pike was in a particularly difficult situation. It had only one mine, which was its sole source of revenue. The company was continuing to borrow to keep operations going. Development of the mine had been difficult from the start and the company's original prediction that it would produce more than a million tonnes of coal a year by 2008 had proved illusory. The company had shipped only 42,000 tonnes of coal in total. It was having some success in extracting coal as it drove roadways but it was pinning its hopes on hydro mining as the main production method and revenue earner. Hydro mining started in September 2010 but was proving difficult to manage and output was poor.

It is the commission's view that even though the company was operating in a known high-hazard industry, the board of directors did not ensure that health and safety was being properly managed and the executive managers did not properly assess the health and safety risks that the workers were facing. In the drive towards coal production the directors and executive managers paid insufficient attention to health and safety and exposed the company's workers to unacceptable risks. Mining should have stopped until the risks could be properly managed.

The Department of Labour did not have the focus, capacity or strategies to ensure that Pike was meeting its legal responsibilities under health and safety laws. The department assumed that Pike was complying with the law, even though there was ample evidence to the contrary. The department should have prohibited Pike from operating the mine until its health and safety systems were adequate.

After the explosion a major search and rescue effort was launched. There was no predictable window of opportunity within which the Mines Rescue Service (MRS) could have safely entered the mine. Pike had no system for sampling the mine atmosphere after an explosion and without that information it was impossible to assess the risks of entry. The placement of the main fan underground and the damage caused to the back-up fan on the surface meant that the mine could not be reventilated quickly.

The New Zealand Police led the emergency response and made the major decisions in Wellington. There had been no combined testing of an emergency response of this nature involving Pike, mining specialists, the MRS, the police and emergency services.

For the first few days the families were given an over optimistic view of their men's chances of survival, but this was inadvertent. When the second explosion occurred five days later any remaining hope disappeared.

The new owner of the mine, Solid Energy New Zealand Ltd, has agreed that it will take all reasonable steps to recover the bodies provided this 'can be achieved safely, is technically feasible and is financially credible.' Any recovery will hinge on a resumption of commercial mining operations.

The mine is sealed and its atmosphere is inert. Solid Energy is ensuring the safety of the mine, including physical security, monitoring of the underground atmosphere, checking of seals and contingency planning.

New Zealand has a poor health and safety record compared with other advanced countries. The government has set up an independent ministerial task force to determine if New Zealand's health and safety system is fit for purpose. The task force will no doubt examine on a broader scale some of the matters that the commission has considered.

To reduce the risks of future tragedies, the commission makes 16 principal recommendations, set out at the end of this volume. Some recommendations have implications beyond the underground coal mining industry.

The commission recommends that there should be a new regulator with a sole focus on health and safety. The new regulator should be a Crown entity with an expert board accountable to the minister and working closely with the Ministry of Business, Innovation and Employment, employers and workers.

Based on the commission's inquiries, the Health and Safety in Employment Act 1992 is generally fit for purpose but many changes are required to update the mining regulations. The commission recommends that the changes be progressed by an expert mining task force separate from the ministerial task force. The Queensland and New South Wales regulations provide good precedents.

More worker participation in managing health and safety is needed and will require legislative change and guidance from the regulator.

Major improvements to emergency management are required. The first step should be a joint review by the organisations that responded at Pike River, then amendments to the co-ordinated incident management system and finally a programme of testing and simulation of emergencies to iron out any problems.

The statutory responsibilities of directors for health and safety should be reviewed to reflect their governance responsibilities, including their responsibility to hold management to account.

Leaving aside regulatory change, the commission recommends that directors should rigorously review their organisation's compliance with health and safety laws and assure themselves that risks are being properly managed. Managers should access the best practice guidance available on leading health and safety in the workplace.

The changes recommended by the commission rest firmly on the principle that health and safety in New Zealand can be improved only by the combined efforts of government, employers and workers.

What happened at Pike River

V2

The tragedy

On Friday 19 November 2010 at 3:45pm there was an underground explosion at the Pike River coal mine. Twenty-nine men lost their lives, and their bodies have not been recovered. Their names and details appear on pages 4-5.

Two men survived the explosion. They were in the stone access tunnel (drift), a distance from the pit bottom area where the main workplaces were located. Although initially overcome, Daniel Rockhouse rescued himself and his colleague Russell Smith.

The New Zealand Police led the emergency response that involved emergency services, and mines rescue crews from New Zealand, New South Wales and Queensland. Despite strenuous efforts by everyone involved, a lack of information concerning the conditions underground prevented a rescue attempt.

A second explosion on Wednesday 24 November extinguished any hope of the men's survival. The emergency focus changed to recovery of the bodies.

The commission

On 29 November 2010 the prime minister announced the government's intention to establish a royal commission. In December 2010 the commission's terms of reference and the appointment of three commissioners, the Hon. Graham Panckhurst, David Henry CNZM, and Stewart Bell PSM, the Commissioner of Mine Safety and Health for Queensland, were announced. The terms of reference are on pages 6-9. In broad terms the commission was required to report on:

- the cause of the explosions and the loss of life;
- why the tragedy at Pike River occurred;
- the effectiveness of the search, rescue and recovery operation;
- the adequacy of New Zealand mining law and practice and the effectiveness of its administration; and
- how New Zealand mining, and associated conservation and environmental, law and practice and its administration compares with that in other countries.

The commission was also asked to make recommendations about the prevention of mine disasters, the improvement of search, rescue and recovery operations, any necessary changes to mining law and practice and how to make the Pike River mine safe should it not be reopened.

The immediate cause

The immediate cause of the tragedy was a large methane explosion. Methane is found naturally in coal. It is released during mining and also accumulates in mined out areas. A group of mining experts assembled by the police and the Department of Labour (DOL) concluded that a substantial volume of methane fuelled the explosion. The area most likely to contain a large volume of methane was a void (goaf) formed during mining of the first coal extraction panel in the mine. A roof fall in the goaf could have expelled sufficient methane into the mine roadways to fuel a major explosion. It is also possible that methane which had accumulated in the working areas of the mine fuelled the explosion, or at least contributed to it.

Methane is explosive only when diluted to within the range of 5 to 15% in volume of air. Following a roof fall methane would be diluted as it was carried through the mine by the ventilation system. It is not possible to be definitive, but

potential ignition sources include arcing in the mine electrical system, a diesel engine overheating, contraband taken into the mine, electric motors in the non-restricted part of the mine and frictional sparking caused by work activities.

Effective methane management is essential in an underground coal mine. Undoubtedly there was a failure to control methane at Pike River on 19 November 2010.

The underlying causes

The commission has endeavoured to establish both the operational factors and the systemic reasons that contributed to the tragedy. The inquiry was not limited to events at the mine, but extended to the actions of the regulators and the effectiveness of mining regulation and practice in New Zealand.

Some major themes became evident in the course of the inquiry:

- This was a process safety accident, being an unintended escape of methane followed by an explosion in the mine. It occurred during a drive to achieve coal production in a mine with leadership, operational systems and cultural problems.
- Such problems coincided with inadequate oversight of the mine by a health and safety regulator that lacked focus, resourcing and inspection capacity.
- The legal framework for health and safety in underground mining is deficient.
- Those involved in the search and rescue were very committed, but the operation suffered from an absence of advance planning for a coal mine emergency and from a failure to properly implement the principles of the New Zealand co-ordinated incident management system (CIMS).
- The families of the 29 men received generous community support, but would have benefited from better communications during the search, rescue and recovery phases.

The New Zealand mining industry

Background

Coal has been mined in New Zealand since about 1850. It was initially mined almost exclusively underground, but open cast mining is now predominant, producing over 80% of total production. New Zealand mining conditions are typically complex and characterised by faulted and dipping coal seams. Comprehensive geological exploration is essential to define the coal reserve and facilitate the planning and development of a successful mine. Mining methods such as hydro mining, suited to the difficult conditions, are required.

The New Zealand coal mining industry is small. Annual production is about 5 million tonnes – approximately 2% of Australia's production. In 2010 fewer than 2000 people were working in 22 coal mines, only five of which were underground.

A failure to learn

New Zealand's health and safety record is inferior to that of other comparable countries. The rate of workplace fatalities is higher than in the United Kingdom, Australia and Canada, worse than the OECD average and has remained static in recent years.

New Zealand also has a history of underground coal mine tragedies including:

1879	Kaitangata mine	34 deaths
1896	Brunner mine	65 deaths
1914	Huntly, Ralph's colliery	43 deaths
1939	Huntly, Glen Afton No. 1 mine	11 deaths
1967	Strongman mine	19 deaths

Lessons from the past, learnt at the cost of lives, have not been retained.