Royal Commission on the Pike River Coal Mine Tragedy
Te Komihana a te Karauna mō te Parekura Ana Waro o te Awa o Pike

Chronology Five – Pike River Coal: Mine Development

Date	Topic	Doc ref
1946	First geological survey of the Pike River coalfield by H.W Wellman.	DAO.001.0003/11 47 MED0000010001/100
1972	Geological mapping and coal sampling undertaken by Magellan Minerals (NZ) Ltd.	DAO.001.0003/11 48
1982	Stratigraphy and sedimentology report of the Pike River coal field was completed by Jane Newman (University of Canterbury).	DAO.001.0003/11 50
1991	First drill hole into the Paparoa coal seam.	DAO.001.0003/11 51
Feb 1995	Pike River Coalfield marketing assessment completed by CMS Limited.	NZOG0067/11 3.9
Mar 1998	Minserv International Limited completes a pre-feasibility study for a hydro-monitor mine operation. It included an initial mine development plan. The study is based on information from Ian Brown and Associates, CMS studies, and a site visit on 13 Feb 1998. Key conclusions were that the coal seam was suitable for hydro-mining methods, a heavy duty roadheader was required for heading development, a main fan would be required to produce 50 m^3/s air, a complex gas monitoring system would not be necessary (low methane levels observed 3m^3/t), spontaneous combustion was unlikely to be a major hazard, workforce projected at 82 to 89 persons.	NZOG0067/11,12,13
1999	PRC initiated a drilling programme to provide additional data on seam structure and coal quality for a feasibility study.	DAO.001.0003 59
2000 - 2004	Access route selection and design of access road undertaken by URS New Zealand Ltd (URS).	RM.0002/3 3.1

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23 June 2000	AMC Resource Consultants Pty Ltd (AMC) final feasibility study (comprising 5 parts) completed for PRC (in return for equity). The study confirms the technical and financial viability of the mine. The study concluded: a) mining in area is feasible (and conditions in unstructured ground expected to be good); b) more design work required for detailed planning; c) local variations to mine plans were expected due to faults/variable seam grades; d) coal quality was good; e) mine developed using continuous miners or roadheader; f) hydraulic mining methods recommended to achieve extraction economically; g) projected internal rate of return of 29%; The study commented on: 1) Gas content: a) around 5m^3/t in Brunner seam, with highest value at 10m^3/t; b) risk of coal outburst should be examined; c) important to drain gas from coal before mining – reduces risk of coal outburst; 2) Ventilation: a) is to comprise a single main intake drift, with auxiliary ventilation to support the mining operation; b) extra demands on ventilation are anticipated as roadways extended; c) ventilation premised on 4m^3/t gas emission and 500 t/shift extraction rate; d) ventilation rate of 8.5m^3/s required to keep methane under 1.25%; e) moderate propensity for spontaneous combustion noted; f) mined out areas to be permanently sealed; g) management procedures for construction of ventilation structures will be implemented; h) ventilation requirements and equipment to be used for roadway, roadway development, coal extraction are described; 3) Fire: a) spontaneous combustion and fire management plan was designed; b) the plan should include a policy for ventilation and mining practice; c) all staff to be fully trained in the plan; Ventilation Officer required for remote tube bundle monitoring; d) plan included software for sampling gas trends and trigger levels; e) plan included detection and response to heating; fire detection monitoring to occur by 'normal inspection' method. The study also set out a safety management policy and developed a disaster management plan.	NZOG0067/13-22 DAO.001.0003 60
1 Feb 2001	AMC reports that PRC's mine design is conservative and ensures a high level of protection for surface features from subsidence.	NZOG0067/32 6.3 NZOG0012

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Mar 2002	Minarco Asia Pacific Pty (formerly AMC) reports on its review of West Coast mining experiences. It provides examples of surface features that have been successfully mined under without adverse or observable surface impact.	NZOG0067/33 6.9 NZOG0013
Mar 2002	Minarco updated the costs estimates in the final feasibility study. Changes to the mine plan included larger barrier pillars, reduced recoverable reserves (14.9Mt), improved mine layout efficiency and introduction of augering[1].	NZOG0067/33,34
Mar 2002	URS completed a risk assessment of the development of Pike River coalfield.	DAO.001.0003/13 64
2003	Dr Basil Beamish, University of Queensland, conducted spontaneous combustion tests and concluded that Pike River coal has low propensity for spontaneous combustion.	DAO.001.0003/14 70
Sept 2004	A report by R Cotton, geologist and T McMorran, an engineering geologist, identified that the most difficult part of the tunnelling operation would be the passing through and stabilisation of the area where the tunnel intersects with the Hawera Fault.	DAO.001.0003/13 67
2005	A report by Peter Gunn concluded that pit bottom development would involve some stone drilling.	DAO.001.0003/14 69
Apr 2005	URS commenced construction of the access road.	RM.0002/3 3.2
Apr- May 2005	PRC indicated that it intended to drill bore holes to define ventilation shaft inclination and pit bottom coal horizons.	MCD0001/6 13
Apr 2005	Tender documents were prepared for tunnel, ventilation shaft and pit bottom development by PRC and McCracken Consulting Ltd and invitations to tender extended to select contractors.	MCD0001/3 5

[1] Auger mining is usually associated with contour strip mining. With this method, the coal is removed by drilling auger holes from the last contour cut and extracting it in the same manner that shavings are produced by a carpenter's bit. Coal recovery rates approach 60 percent with this method.

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May 2005	Minarco completed project update report to enable PRC Board to make a development decision. The report concludes that: a) the mine layout is designed to meet a range of criteria including: integration with mine access, maximisation of coal recovery, maintenance of flexibility within a complex structural environment, optimisation of coal quality, optimisation of mined product, layout efficiency and adequate service provision; b) mining equipment selection in the feasibility study is state of the art with proven performance, and highly reliable; c) gas testing shows Brunner seam is around $5m^3/t$, ranging from 3-$8m^3/t$; d) proposed mining method is to develop the mine using a 2.2 km stone drive uphill at a 5 degree gradient e) proposed to develop the Mine 'up dip' using mechanical machinery (continuous miners and roadheaders); f) full extraction can best be economically achieved using hydraulic mining g) Fire management and Spontaneous Combustion Plan (required under DOC Access Agreement and Resource Consents) is designed to ensure the safety of all personnel.	NZOG0067/35-38 NZOG0020
12 May 2005	John St George of the University of Auckland reported on the pillar sizes to ensure pit bottom stability and general compliance with resource consents, and effects of Island Sandstone.	NZOG0067/41 6.28 NZOG0021 DAO.001.0003/14 74
22 June 2005	Strata Control Technology Operations Pty Ltd (SCT) reported on its review of the report by John St George. SCT recommended that a roof support design be developed based on an assessment of strata conditions. This would be refined through ongoing monitoring.	NZOG0067/43 6.37 NZOG0022
20 July 2005	Final Mine Plan and Financial Model Report (dated 14 July 2005) from Gordon Ward and Peter Whittall was presented to PRC Board (based on the Minarco report) to facilitate a financial investment decision. The PRC Board resolved to accept: a) the proposed mine plan and mine planning strategy; b) management strategies for the roading contract.	NZOG0067/39[2] 6.21-6.26 NZOG0023 NZOG0024 DAO.001.0003/27 156
20 Oct 2005	UniQuest Pty Ltd provided a report (prepared by Dr Basil Beamish) which reconfirms that PRC coal has low inherent propensity to spontaneously combust.	NZOG0067/45 6.41 NZOG0025

[2] See also DAO.012.03499

Date	Topic	Doc ref
Nov 2005	Contract formed between Ferguson Brothers and PRC for construction of the mine access road from the mine tunnel entrance to Big River (including bridges). Contractor established onsite.	NZOG0067/57 6.96
Nov 2005	A position paper was presented to Board on drilling the pit bottom area.	DAO.001.0003/14 75
16 Nov 2005	PRC Board noted a paper entitled 'Pit Bottom Drilling Position Paper' by Peter Gunn, and agreed to further drilling to determine the integrity of the Hawera fault region.	NZOG0067/46 NZOG0028
15 Dec 2005	Contract formed between PRC and McConnell Dowell for the construction of PRC Mine Tunnel and ventilation shaft.	RM.0002/4 4.4 RM.042.0003
16 Dec 2005	CRL Energy completed technical reports on gas drainage using simulation software (carried out over 1 year).	NZOG0067/45 6.42
Jan 2006	Golder Associates (NZ) Limited provided an independent assessment of in-situ coal resource and coal quality parameters. The report recommends additional drilling to increase confidence in analysis and modelling of coal deposits. It estimates measured coal with high level confidence at 11Mt, reasonable confidence at 25.6Mt, and low level at 19.1Mt (total = 55.7 Mt).	NZOG0067/47 NZOG0033
Jan 2006	PRC management and McConnell Dowell attended an independently facilitated technical risk assessment on the construction of the access tunnel.	DAO.001.0003/29 168
30 Mar 2006	Contract between URS and McConnell Dowell entered into for URS to provide consultancy services on design and construction of the mine and ventilation shaft. Services included designing tunnel portal, access rock mass along access tunnel, design the access tunnel rock support systems, design rock support and simple egress stairwell for the ventilation shaft, modelling the interaction of vertical and horizontal drives in the pit bottom and design support measures, and providing a liaison engineering geologist.	RM.0002 RM.010.00146
3 Apr 2006	Contract formed with SEIKO Mining and Construction for supply of steel for slurry pipeline and slurry pipeline couplings.	NZOG0067/58 6.101
May 2006	Tenders were issued for the supply of continuous miners and roadheaders.	DAO.001.0003/30 174
June 2006	Minarco produced a Ventilation and Gas design report for PRC.	DAO.001.0003/30 179
8 June 2006	PRC entered into a contract for construction of mine access road from Big River to Logburn Road with White Knight Joint Venture.	NZOG0067/59 6.101

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13 June 2006	A report prepared by Peter Whittall indicates that hydraulic mining is the preferred approach to coal recovery, with in seam directional drilling. Two sites for pit bottom were identified.	NZOG0067/49 6.55 NZOG0041
14 July 2006	An internal PRC report describes the strategy for establishing pit bottom and notes increased drilling required to verify the suitability of the pit bottom site. The report is provided to prospective lenders.	NZOG0067/49 6.57 NZOG0044
31 July 2006	Connections Assets Agreement with Westpower Limited for supply and construction of infrastructure and equipment required to supply electricity to mine site.	NZOG0067/59 6.101
Aug 2006	URS commenced construction supervision in relation to the stone drive.	RM.0002/6 4.17
Aug 2006	Work commenced on development of the portal area	MCD0001/12 43
Aug 2006	McConnell Dowell officially took possession of the portal and tunnel area.	DAO.001.0003/31 182
13 Sept 2006	Scheduling issues are identified around the option to locate the pit bottom in stone.	NZOG0067/50 6.59 NZOG0047
14 Sept 2006	Contract formed with Waratah Engineering Pty Ltd for supply of roadheader and continuous miners.	NZOG0067/59 6.101
21 Sept 2006	Tunnelling work commenced.	NZOG0067/58 6.99
22 Sept 2006	Contract for supply of flameproof electrical equipment with Ampcontrol International Pty Ltd.	NZOG0067/59 6.101
Oct 2006	Field work conducted on the potential site for the ventilation shaft.	DAO.001.0003/32 188
24 Nov 2006	Contract formed with Specialised Mining Vehicles Pty Ltd for the supply of flameproof Man Transporters and Loader.	NZOG0067/59 6.101
1 Dec 2006	Contract formed with Juganaut Industries Pty Ltd for supply of flameproof Load Haul dumpers.	NZOG0067/59 6.101
8 Dec 2006	Contract formed with Weir Minerals Australia Ltd for supply of the slurry, fluming water and makeup water pumps.	NZOG0067/59 6.101
15 Dec 2006	Contract formed for construction of amenities area buildings with Evan Jones Construction Ltd.	NZOG0067/60 6.101
15 Dec 2006	Contract formed with Anderson Industries Pty Ltd to supply Mine Grader.	NZOG0067/60 6.101
21 Dec 2006	Contract formed with Steel and Tube Holdings for Makeup Water Pipeline.	NZOG0067/60 6.101
Jan - Mar 2007	Flakt-Woods (Australia) selected for the supply of the mine's main ventilation fans.	DAO.001.0003/33 195

Date	Topic	Doc ref
Feb 2007	Facilitated risk assessment with PRC and Jim Rennie was undertaken to determine the viability of establishing the main ventilation fans underground. The risk assessment concluded that there were no legislative or technical barriers to locating the fans underground with engineering solutions available to resolve identified problems. The ventilation strategy further proposed a surface fan capable of delivering 90 cubic metres of air per second to provide continuity of ventilation in the event of main fan failure.	DAO.001.0003/32 194
7 Feb 2007	McConnell Dowell requested to review excavation options to sink the ventilation shaft, including top down excavation, raise bore and Alimak raise excavation.	MCD0001/22 87
12 Feb 2007	Contribution agreement signed with Grey District Council for PRC's contribution to upgrade of various roads.	NZOG0067/60 6.101
Mar 2007	Drilling commenced on the initial site proposed for the ventilation shaft.	DAO.001.0003/31 200
13 Apr 2007	Completion of a rolling series of independent technical due diligence reviews undertaken by Behre Dolbear Australia Pty Ltd (BDA) on 30 May 2006, 30 June 2006, 20 Sept 2006, 11 Oct 2006 and 13 Apr 2007). These assessed the feasibility of PRC's underground development proposal. The reports conclude that the proposed hydraulic mining method was technically feasible, and drilling (including in seam) and layout design was appropriate. BDA conclude that the PRC project is technically feasible and economically viable. It said there was a "limited potential risk of gas outbursts, particularly at greater depths".	NZOG0067/50 - 55 NZOG0043 NZOG0048 NZOG0050 NZOG0054 NZOG0067/53 6.78
25 June 2007	Contract formed with iPower Solutions Ltd for the supply of various pump and fan substations, variable speed drives and underground switchboard.	NZOG0067/60 6.102
28 June 2007	Contract formed with Brightwater PEAT Ltd for the design and construction of Coal Preparation Plant.	NZOG0067/60 6.102
16 July 2007	Power was connected to the Mine.	NZOG0067/60 6.102
13 Aug 2007	Report completed on poor quality rock for a shaft excavation.	RM.0002/12 8.3 RM.014.01364
27 Aug 2007	PRC requested McConnell Dowell to investigate alternative sites with PRC personnel and advise on constructability of ventilation shafts at various sites. PRC also providing drill hole data to inform best shaft site.	MCD0001/22 91
Sept 2007	PRC fixed the site for the ventilation shaft.	MCD0001/23 92

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Nov 2007	Board agreed to stop driving through the Hawera fault into the coal measures until all large stone excavations completed.	DAO.001.0003/35 220
16 Nov 2007	McConnell Dowell contract variation recorded the change to the shaft surface size.	MCD0001/23 93
Feb 2008	Construction commenced on the shaft top (included grouting).	MCD0001/23 93
Mar 2008	Ventilation workshop held with PRC, Jim Rennie and McConnell Dowell to ensure adequate ventilation of the multiple faces during excavation of the pit bottom in stone.	DAO.001.0003/36 227
7 Mar 2008	PRC instructed URS to carry out a geotechnical risk assessment of the stone drive to identify and quantify financial risks of instability in the stone drive under operating conditions.	RM.0002/8 5.1 RM.020.00005
25 Mar 2008	URS completed access tunnel risk assessment and concluded that the stone drive was most unlikely to suffer significant damage under operational conditions.	RM.0002/9 5.4 RM.020.00043
Oct 2008	McConnell Dowell and PRC prepared a risk assessment on methane levels (after pit bottom)	MCD0001/19 71
Nov 2008	Ventilation shaft top completed.	MCD0001/23 96
Nov 2008	"Permit to Mine" system introduced to integrate mine operations, planning, engineering and technical considerations for mining activities.	DAO.001.0003/40 254
Nov 2008	Ventilation Management Plan was completed and signed off.	DAO.001.0003/40 255
Dec 2008	Roadway drive to the ventilation shaft was completed.	DAO.001.0003/40 258
21 Dec 2008	Construction of 108m ventilation shaft started using the raise bore method.	RM.0002/14 8.13
9 Jan 2009	Ventilation shaft completed.	RM.0002/14 8.13
Feb 2009	Rate of shaft wall failure increased in the shaft. Concrete and aggregate used to fill and stabilise the void up to 67m depth.	DAO.001.0003/41 263, 265
2 Feb 2009	Additional support made to the shaft.	RM.0002/15 8.18
19 Feb 2009	A rock fall affected 30 metre zone near the bottom of the shaft.	RM.0002/15 8.20 RM.039.00091
18 Mar 2009	Risk assessment completed for McConnell Dowell regarding the risks in designing and positioning the Alimak raise.	RM.000215 8.22 RM.041.01970
April 2009	Excavation commenced on the 2.5 metre x 2.5 metre Alimak bypass.	RM0002/15 8.23 DAO 001.0003/41 265
19 Apr 2009	Shaft ventilation failure model completed.	RM.0002/15 8.22 RM.041.01970
June 2009	Alimak shaft work completed.	DAO.001.0003/41 271

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13 July 2009	Service agreement with McConnell Dowell to provide PRC with electricians/mechanical fitters and tunnel and stone drive excavation crews. Schedule 2 of this agreement enabled PRC to hire McConnell Dowell electrical cable to power the ventilation shaft and various other items of plant.	MCD0001/26 109 &112
1 Mar 2010	URS produced a geotechnical report - the Alimak Raise Rock Mass review – on the Alimak raise “as found” geology.	RM.0002/16 9.2 RM.016.00001
May 2010	Strata Engineering Australia recommended reduced roof support due to improved roof conditions.	DAO.001.0003/44 295
July 2010	“With the gas drainage line carrying its maximum 120 litres/second, additional gas was vented to the mine's return ventilation circuit. This was to maintain a target methane level of approximately 1 % with a maximum level of 1.25% allowed at the surface fan” “Gas levels in the return were maintained between 0.85% and 1.15%.”	DAO.001.0003/45 300
Aug 2010	Board was updated on planning work to establish a second ventilation shaft or a drift/s to the surface west of the existing workings.	DAO.001.0003/46 303
Aug 2010	John Rowlands (Dallas Mining - Australia) carried out ventilation modelling to improve ventilation efficiency.	DAO.001.0003/46 303
Sept 2010	Drive Mining (Australia) reviewed gas drainage monitoring and strategy and drainage infrastructure (May, July, Sept 2010).	DAO.001.0003/44 394
Sept 2010	Changes to the mine plan made to accommodate greater detailed knowledge of the seam obtained from inseam drilling.	DAO.001.0003/47 310
Sept 2010	Review of current and future ventilation requirements was undertaken by John Rowlands (Dallas Mining Services). This review considered a second intake airway.	DAO.001.0003/47 310
Oct 2010	“Board papers identified the preferred location for a second Egress drift which would also be a second intake airway, as well as an exhaust drift which would house the second main underground fan.”	DAO.001.0003/47 311

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Oct 2010	Main underground fan was completed and commissioning commenced. "The commissioning identified a problem with the variable speed drive and the main fan kept tripping off." "During this commissioning period, the mine was being ventilated by the surface fan with the main fan acting as a booster fan. The manufacturer upgraded/replaced the Rockwell variable speed drive which rectified the problem." "Consequently the main fan became the primary ventilation device and the surface fan reverted to its original design role of backup fan."	DAO.001.0003/47 312
Nov 2010	"A final test of the main fan at full load was undertaken by the manufacturer Flakt-Woods on 10 November 2010." "All close-out reports, operating, servicing, spare parts and handover documents were due for completion by the end of November 2010."	DAO.001.0003/47 315
Nov 2010	Louvres of surface fan were replaced.	DAO.001.0003/48 316
Nov 2010	Hydro monitor was commissioned.	DAO.001.0003/48 317
12 Nov 2010	Doug White requested McConnell Dowell to consider proposal for service agreement to be varied so that McConnell Dowell would supply only labour to PRC.	MCD0001/27 116
15 Nov 2010	McConnell Dowell started work on last large scale excavation area.	MCD0001
18 Nov 2010	McConnell Dowell received updated Mine Plan showing location and development of the main tunnel, pit bottom in stone and coal base of ventilation shaft, sump areas, and coal extraction arrears.	MCD0001/29 125
19 Nov 2010	First explosion in mine.	DAO.001.0003/48 319