


Contract labour and occupational health and safety in mining: A review of global evidence and learning from failure

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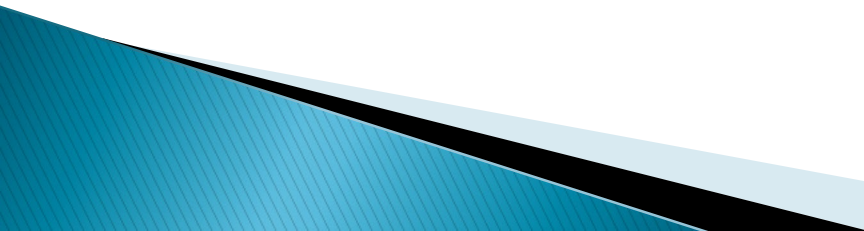
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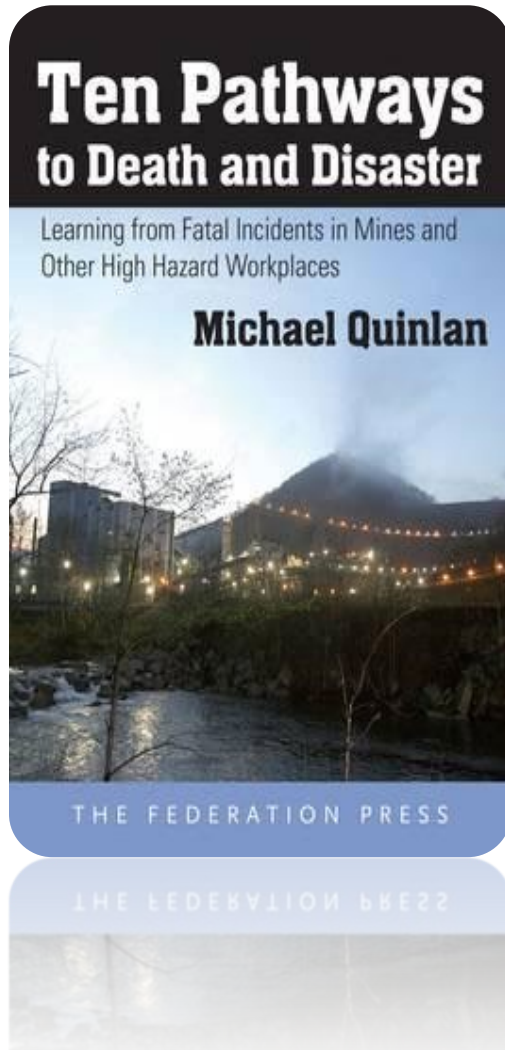
Putting contracting into context

- ▶ Contracting centuries old practice in mining (eg tribute/tut work in metal mining) and coal-hewers saw themselves as contractors to escape master and servant law (strong analogies between contracting and piecework)
- ▶ Subcontracting part of overlapping array of non-standard (ie direct full-time employees) work arrangements including temporary/casual employees, labour hire (agency work), part-time work, home-based/remote work, dependent self-employment
- ▶ Since mid-1970s use of non-standard work arrangements has grown globally & 'permanent' jobs became less secure due to repeated rounds of downsizing, restructuring, outsourcing & privatisation
- ▶ Contracting also grew in mining (in WA mining contract workers now outnumber employees, many doing same routine jobs alongside employees), taking number of forms including episodic (major overhaul, shutdowns), routine maintenance, specialist tasks (eg construction, surveying, pipe installation) and mining operations (specialist mining contractors). Contractors ranged from small to large firms and their workers could be self-employed, labour-hire/agency workers or employees (ongoing or temporary/casual). All these differences could affect OHS.
- ▶ Concerns re contractors and safety in mining not new (eg Western Australia, 1997 following cluster of fatalities)

Overall OHS effects of non-standard work arrangements: Evidence

- ▶ Now hundreds if not thousands of studies dealing with OHS effects of non-standard work (including contracting) globally and general findings clear
 - ▶ Persuasive evidence linking these work arrangements to higher incidence/rates of injury, poorer physical and mental health
 - ▶ Some evidence linking to suicide and drug use
 - ▶ Weakens regulatory protection, over-stretched inspectorates & less awareness or capacity to use law (reporting/assistance)
 - ▶ Less/ineffective cover by workers' compensation regimes
 - ▶ Flow on effects to health including healthcare access/screening, family health
 - ▶ These are generalised findings. There are exceptions but you should assume you are not exceptional unless you can demonstrate that
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Ten pattern causes



1. Design, engineering and maintenance flaws
2. Failure to heed clear warning signals (note similar findings re environmental disasters)
3. Flaws in risk assessment (hazard identification, likelihood/magnitude, controls/monitoring)
4. Flaws in management systems and changes to work organisation
5. Flaws in system auditing
6. Economic/production and rewards pressures compromising safety
7. Failures in regulatory oversight
8. Supervisor and worker expressed concerns prior to the incident
9. Poor management/worker communication/trust aka those controlling risk and those at risk
10. Flaws in emergency procedures, rescue and resources

Contracting, ten pathways and workplace disasters in other industries

Pattern-cause	ValuJet crash 1996 (110 dead)	AZF factory fire 2001 (31 dead 30 seriously injured)	Petrobras oil rig sinking 2001 (11 dead)	Texas City refinery fire 2005 (15 dead 180 injured)	Hangzhou subway collapse 2008 (17 dead)	Rana Plaza collapse 2013 (1134 dead 2500 injured)
Engineering, design & maintenance flaws	Yes, outsourcing of maintenance (led to later crashes too)	Yes chemical waste management	Yes, poor design location of safety material	Yes, second best technology used amongst other flaws	Yes, route revisions impacted on design integrity	Yes, building illegally extended
Warning signals ignored	Yes, two previous serious incidents	Yes history of downgrading conditions of waste storage	Yes, history of large spills from rig	Yes prior incidents	Yes, many similar incidents	Yes, signs of cracking & previous incidents
Risk-assessment flaws	Yes	Yes, not all risks assessed	Yes	Yes	Yes	Yes
OHSM management flaws	Yes, outsourcing maintenance	Yes especially multi-tiered subcontracting OHSMS didn't cover all hazards/communicate	Yes, downsizing, poor training & use of contractors*	Yes BP system flawed especially devolution and focus on personal safety	yes fragmented/ complex web of disarticulated contracts	Yes
System auditing failures	Yes	Yes	Probably but need more evidence	Yes	Yes	Yes
Economic/production pressures compromise	Yes, low-cost carrier cost-cutting	Yes, use of subcontractors	Yes, focus on cost-cutting & production	Yes	Yes, govt. cost cutting, subcontractors. Pressured & labourers working 16hours	Yes, global supply chain driver
Regulatory failure	Yes, FAA should have acted sooner	Yes, recommended ban multi-tier subcontracting didn't happen but new laws	Yes, government control/conflict	Yes	Yes, contractor offloaded responsibility & numerous violations	Yes, regulation symbolic and global supply chain pick for this
Supervisor and others concerned	Not investigated but probably no	Yes re lack of contractor training	Yes, union concerns prior	Not investigated but probably no	Not investigated but probably no	Yes
Poor worker management communication/trust	Non-union operator & workers' pay for training	Yes	Yes, union undermined by subcontractor use	Yes communication gap between subcontractors & other workers	Yes, reports ignored but clear no mechanisms for raising concerns	Yes, little if any union representation & workers threatened
Emergency & rescue system failures	No	Yes, significant impacts surrounding community law changes made	Yes	Yes	Yes problematic effectiveness examined in report	Yes

Risk factors associated with contracting

<i>Effort/Reward Pressures</i>	<i>Disorganization</i>	<i>Regulatory Failure</i>	<i>Spill-over Effects</i>
Insecure jobs (fear of losing job)	Short tenure, inexperience (note WA mining evidence)	Poor knowledge of legal rights, obligations	Extra tasks, workload shifting
Contingent, irregular payment	Poor induction, training & supervision	Limited access to OHS, workers comp rights	Eroded pay, security, entitlements
Long or irregular work hours	Ineffective procedures & communication	Fractured or disputed legal obligations	Eroded work quality, public health
Multiple jobs/ under-employment	Ineffective OHSMS / inability to organise	Non-compliance & regulator oversight (stretched resources)	Work-life conflict (eg FIFO)

Global Overview of the evidence

International research



Global evidence on contracting in mining and OHS: Sweden

- ▶ Study (Blank et al 1995) found apparent OHS improvement in the Swedish mining industry actually due to the growing contractor workforce not counted as mining employees. Further, contract workers experienced more frequent and severe injuries (see also Nygren et al 2017)
- ▶ Nygren (2018) PhD detailed case study based on extensive documentary analysis, interviews, multiple visits to a mine-site over 18 months (including attending and observing meetings and making field notes), industry level workshops, and 26 interviews with mine managers, safety and operations specialists, safety managers, supervisors and others working for the mine, its 10 contractors and a subsidiary
- ▶ Nygren found contractors undertook significant amount of work in mining and sustained more frequent and serious injuries (based on an analysis of Swedish injury statistics). Reasons for this, included disorganisation and blurred organisational boundaries
- ▶ “As for the relations between the mining company and the contractors, these were characterized by an asymmetry of power with a difference between being affiliated to the company or a contractor in terms of the status and rights each affiliation entailed. This ultimately had an impact on contractor managers’ and supervisors’ ability or willingness to communicate with the client on safety-related issues...An overall conclusion can be drawn that the dynamic, unfolding relations between the client and its contractors complicate the division of and adherence to legal responsibilities for safety management” (Nygren, 2018, v-vi)

Global evidence on contracting in mining and OHS: South Africa

- ▶ Study (Kenny & Bezuidenhout, 1999) argued renewed growth of subcontracting in mining operations and core activities in particular had serious implications for OHS standards and was liable to fracture relations amongst different groups of workers and consequently cause greater instability in the industry. Interviews referred to contractors being deployed in more dangerous tasks, a lack of mixing between contractors and employees, more problematic access to medical treatment, compensation or being dismissed when injured.
- ▶ Crush et al (2001) gold mining study documented subcontractor employees (labour hire) generally assigned to work in the most dangerous parts of the mines where regular miners (and union representatives) declined to work. Temporary employees often worked longer hours as management didn't monitor their shifts to same degree as full employees
- ▶ November 2010 report (Shaw Idea) on mine safety prepared for the South African Mine Health and Safety Council, based on extensive interviews and site visits confirmed contractor safety was a significant issue
- ▶ Another study (Stewart et al 2019) found "Precarious subcontracted work, illegal mining and the divisive scourge of inter-union rivalry are currently serious threats to life and limb that some mineworkers must face in addition to their harsh conditions of underground mining."
- ▶ Another study (Churchyard et al 2004) examined incidence of silicosis amongst Black contract goldminers, suggesting changes in job tenure and ageing workforce might have a role in changes. Study was worth raising in the context of the re-emergence of pneumoconiosis amongst coalminers and to indicate that differences in OHS indices between contract and employee workers might not be confined to injuries. The importance of recognising this reinforced by a more recent South African study (Ehrlich et al 2018) pointing to the greater problems of hazard exposure/disease surveillance associated with regard to a contractor workforce.

Global evidence on contracting in mining and OHS: United States of America

- ▶ Study (Karra, 2005) of fatal and non-fatal injury frequency rates amongst operator and contractor employees in US mines (coal and non-coal) between 1983 and 2003 using Mine Safety and Health Administration (MSHA) data. For fatal injuries Karra found that compared to the coal operator mean fatality rate the Coal Contractor rate was 129.54% higher and the Non-Coal Contractor rate was 234.81% higher.
- ▶ Pappas & Mark (2011) study noted doubling of contractors employed in underground coalmines in USA. Noting limitations in MSHA data which didn't assign contractor hours to the individual mining where they worked making it difficult to calculate injury frequency rates of contractors the National Institute for Occupational Safety and Health (NIOSH) did detailed examination of the MSHA database. The study compared overall contractor and operator trends 1983–2009 on employment, hours worked and injury rate, finding 'larger contractors tended to have higher injury rates than the smaller ones.' Study also examined role of contractors in safety records of 10 large underground coalmines in 1992–2007, finding contractor injury rates were significantly higher at most operations.
- ▶ Muzaffar et al (2013) used MSHA records (data on 157,410 miners employed by operators or contractors 1998–2007 noting shift to using contractors (grew by 41% while employees fell by 5%). Found univariate odds of fatal accidents versus non-fatal accidents amongst miners employed by contractors were 2.8 times higher than directly employed by mine. In multivariate model 'fatality was associated with contractor, less experience at the current mine, and occurrence at more than 8 hours into the workday.' Odds of fatal accidents were higher in underground operations for metalliferous mines but in coalmines higher in surface mines). Contractors had higher odds of fatal accidents in both coal and non-coal mines. They concluded that contractors had a higher proportion of fatal injuries and fatalities.

Global evidence on contracting in mining and OHS: USA continued

- ▶ Buessing & Boden (2016) compared injury rates for operator and contractor underground coalmines in state of Kentucky (1999–2013) found ‘contractor–operated mines with ‘15 or fewer full–time equivalent workers (FTEs) had a statistically significant 57% higher covariate–adjusted reported traumatic injury rate than similar mines without contract operators (to few large contractor operated mines to compare). Also found unionized mines had significantly lower traumatic injury rates than non–union mines, noting last unionised mine had just closed.
- ▶ Friedman et al (2019) used MSHA data (1983–2015) examined the effect of the shift to longer working hours (typically 10–12–hour shifts) in mining on injury. Study found long working hour injuries associated with a higher odds of death (Odds Ratio or OR=1.32) and single incidents resulting in two or more workers injured (OR=1.73). Specific risk factors associated with long hours identified included irregular shift starts, being newly employed (ie short job tenure), employment by a contractor, and mines with fewer than 100 employees. Overall, the results for metalliferous mines were worse than coalmining. Concluded ‘Long working hour injuries were associated with a lack of routine, being new at the mine and specific mining activities. An international shift towards using contract labour and extended workdays indicates that injuries during long working hours will likely continue to grow as a problem in the mining industry.’
- ▶ Amoako et al (2021) using MSHA data found contractors more susceptible to fatal injuries & permanent disability but less to lost–time injuries (reporting effect?)

Global evidence on contracting in mining and OHS: Australia and New Zealand

- ▶ *Digging Deeper* large study (Shaw Idea 2007) commissioned as follow up to NSW Mine Safety Review (2004–5) entailing visits to 53 coal and metalliferous mines sites, 583 people (workers, managers, contractors) were interviewed and 1667 people completed questionnaires examined key issues including contracting and production bonuses. Found both problematic re OHS including difficulty controlling contractor hour (especially those moving between sites despite swipe–cards) & FIFO/DIDO led to increase in consecutive shifts. Highlighting links between contracting, production pressures and disorganisation.
 - “What the bonus does do is get the blokes to hide injuries. They take a \$100 off you if you have an LTI.... If a contractor gets injured he gets put off. They hounded me about having time off. You feel like a victim. The intent of the bonus is for us to put pressure on blokes not to go off (coal, employee). “
 - The report also noted that contractors, direct–employees and managers had consistently referred to a belief amongst contractors and their employees (including labour hire workers) that reporting of LTIs would have negative consequences for their work, even where they were not formally part of the incentive or bonus scheme:
 - “We have a lot of contractors on site. They will not report near–misses for fear of loss of jobs (coal, employee). Contractors are under the pump. They are pressurised more (coal, employee). This is particularly for labour hire. You wouldn’t report, you feel pressured for your job. If you did report it, you’d be gone. And we don’t want to blow their bonus either (coal, labour hire employee).”
 - In particular, contractors reported that they are penalised by reduced payments or withdrawal of access to contracting work as a result of reporting incidents or injuries. We were consistently told by contractors that, as a result, they do not report such events, even when they occur. These views were expressed to us on site and in the consultations undertaken by the project with contracting companies. The consistency and strength of these reports demonstrates the impact that such views have on reporting behaviour.
- ▶ Bahn (2013) examined shift from contractor/staff mix to permanent employees in large WA metalliferous mine led to OHS improvements including significant drop in work–related injuries & clarity in supervisor roles. Key problem of mixed systems was ‘added complexity of managing multiple safety regimes and the lack of trust of the robustness of each system that create conflict.’ (ie disorganisation)

Global evidence on contracting in mining and OHS: Australia and New Zealand continued

- ▶ Lamare et al (2013) examined contract labour re Pike River mine disaster. 80 of 200 Pike River workforce contractors or their employees working in various capacities (maintenance, support and operational) and under arrangements already identified by this report. Complex subcontracting arrangements made these workers more insecure than direct-employees. Found: no effective contractor safety management system, no auditing of contractor safety performance and no supervision of contractors underground. Pike's safety management system required regular audits of contractor safety performance but no evidence either McConnell Dowell and VLI (two of the largest contractors) or any of the smaller contractors audited. As a result company missing vital information on its contractors and hazards that staff or equipment might introduce. Further, no formal system requiring supervisors to regularly check safety of contractors underground.' Workers also referred to disorganisation – Brenda Rackley, husband said mine was disorganised/chaotic, but must complete contract
- ▶ Western Australian Inquiry into FIFO (2015) found contracting represented major challenge to effective mental health/suicide prevention concluded 'The Committee does not accept that principal companies are unable to influence work conditions such as roster compressions or motelling procedures within their agreements with contractor companies' & 'Many smaller contracting companies told the Committee that they would prefer to offer their staff lower compression rosters (such as 2 weeks on, one week off, or eventime rosters), but that they are unable to do so due to the terms stipulated by the company that let the contract.' Note: Study of suicide rate amongst Australian male mineworkers (2001–19) found it was significant, higher than the comparator group (construction) and increasing over time (King et al 2023).
- ▶ Two large studies of mine safety reps (Qld study union funded) interviews, documents & observation the IOSH UK funded 5 country study (Australia included NSW & Qld) found contracting/labour hire undermined 'worker voice' and challenged HSR effectiveness (Walters et al 2016, 2018, 2019). Dave Walters will discuss this.
- ▶ Valluru et al (2020) examined 6 single subcontractor fatalities 2004–14 (DNRM Qld) found OSMS didn't cope with variability introduced by subcontractors; communication didn't flow to the subcontractor from the layers above them; & safety work viewed differently by subcontractor staff.

Global evidence on contracting in mining and OHS: Other studies

- ▶ Mabeti D (2020) A Systemic study of mining accident causality: An analysis of 100 accidents from a copper mining company in Zambia, M.Phil University of Cape Town
- ▶ Asane-Doku et al (2022) cross-sectional survey comparison of mental health amongst Australian coal miners & Ghana gold miners, greater use of contractors in Ghana linked to greater pressure/workload, lower reporting and less bargaining power.
- ▶ Wang et al (2022) overview of mine safety in China noted 'In 2019, almost all coal mine accidents rated serious and above involved illegal activities, such as cross-border mining, subcontracting production, unauthorized resumption of work during shutdown, and so on.'
- ▶ Brazilian study (Menezes-Junior et al, 2023) found outsourcing and shiftwork associated with higher risk of COVID-19 infection.
- ▶ Nyoni (2023) PhD University of Newcastle ethnographic study found contractor use associated with induction and organisational oversight problems ie disorganisation
- ▶ Arratia-Solar & Paredes (2023) study of copper prices & mine fatalities in Chile found rising price correlated to increase in fatalities as mines sought to boost production by operating more intensively, opening in-care operations etc but increase affected direct employees not contractors suggest former doing more hazardous tasks
- ▶ Stern & Benyarku (2023) survey of fatigue amongst 1113 goldminers Ghana (large operators) found fatigue significantly higher amongst contract miners than direct employees warranted serious concern given transition to contract mining in Ghana

Some illustrative incidents

Investigation findings

Mount Arthur Open Cut mine (2017)

Contractor management failure

- ▶ Tyre replacement contract worker severely burnt while refuelling a tyre handler at the heavy vehicle refuelling station using free flow adapter nozzle.
- ▶ Refuelling equipment not compatible with tyre handlers. Subcontractors used adapter that bypassed the automatic cut-off. Forces acting upon the adapter caused it to eject from the filling neck and diesel fuel entered engine bay and ignited on the hot engine surface.



Mount Arthur Open Cut mine (2017)

Contractor management failure



- ▶ Pathway 1: Inadequate engineering standards – no system to prevent access to the heavy vehicle refuelling station and subcontractors were not trained in its safe use.
- ▶ Pathway 3: Lack of task specific RA/risk not identified refuelling not considered high-risk by the service contractor
- ▶ Pathways 4 & 5: OHSMS feedback failures –Lack of clear communication to refuellers about their responsibility to refuel tyre handlers; Mine management unaware contractors using the heavy-vehicle refuelling station and non-approved adaptor or informal communication between service groups directing workers to the heavy-vehicle refuelling station; Audits failed to identify the non-approved adaptor; Contractor management –failed to provide subcontractor safe access to refuelling. Work demands and disorganization contributed to subcontractors using a non-approved adaptor.
- ▶ Pathway 6: Work pressure – tyre handler required refuelling to respond to an urgent service request. Workers had difficulty obtaining fuel from the refuelling service crew in a timely manner [refuelling crew suggested heavy vehicle station].
- ▶ Pathway 8: Prior concerns: Also present
- ▶ Actions after the incident: The contractor provided a dedicated refuelling cart for tyre handlers. A mining company audit identified non-approved adaptors in use at other mines ie unidentified systemic problem. Source: Jackson (2023)

Newlands coal prep plant (Qld) 30 August 2016

Contractor management failure

- ▶ Fatality – Hit by falling deck plate
- ▶ Pathway 1 Inadequate task planning/optimal engineering approach
- ▶ Pathway 3 Inadequate planning and risk assessment of task. Investigation found a number of risks in the task were foreseeable
- ▶ Pathway 4 Inadequate contractor management, poor work tasking planning, inadequate safe work statement, and supervision deficiencies
- ▶ Pathway 5 Glencore/UGL contract extension clause not exercised in 2016 so had expired and further a number of deficiencies in SOP etc. long standing so should have been picked up by effective auditing regime
- ▶ Pathway 9 Evidence of poor contractor–worker–management communication

Figure 8 – The recovered second bottom deck plate



Goonyella mine (Qld) 5 August 2017

Contractor management failure

- ▶ 1 fatality - Independent Mining Service employee hit by plate spring up during maintenance on bucket
- ▶ Pathway 1 Original manufacturer not consulted re maintenance on buckets & indentations in wear plates major reason for stored up tension
- ▶ Pathway 3 No formal risk assessment undertaken regarding modifications to bucket
- ▶ Pathway 4 Contrary to OHSMS contract worker didn't have relevant 'hot work' training and trade certificates and considerable confusion regarding supervision of task. Also clear deficiencies in contractor management
- ▶ Pathway 5 Auditing failed to pick lack of planning in maintenance, risk assessment procedures and supervision, a number of which were longstanding deficiencies



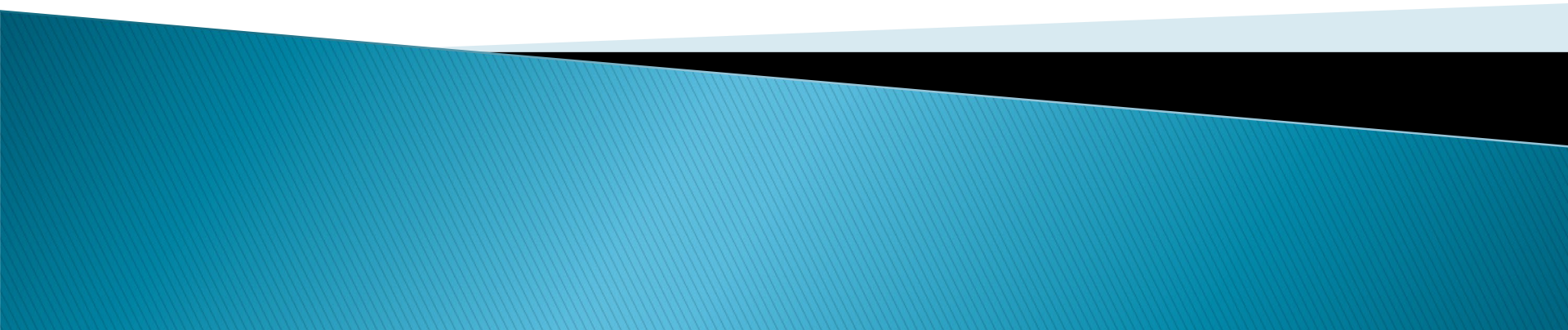
Near miss disaster: Grosvenor coalmine explosion May 2020



Path way	Description	Path way	Description
1	Methane drainage prior to incident inadequately monitored/managed (Board of Inquiry BOI). Source of ignition still being debated post BOI.	6	mining operations repeatedly conducted in a manner where gas emissions generated by rate of production in exceeded mine's gas drainage system capacity (BOI)
2	Pattern of gas exceedance for some time prior	7	Inspection regime tended to accept management reassurances/some disorganisation (visits/record coordination)
3	BOI found number of failures to risk asses gas exceedances as conditions changed	8	
4	OHSM regime weakened by extensive use of labour hire especially report back mechanism	9	Labour hire workforce afraid to report issues & union input marginalised (eg electronic exchange of inspection reports). Some issues raised ignored (note only 1 labour hire employee gave evidence to BOI)
5	BOI identified number of auditing failures & recommended improvements	10	rescue worked but serendipitous as anaesthetist visiting town on day able to stabilise miners so could be airlifted to hospital with burns unit

Addressing the problems

Some key learnings



Mitigating risks : Mining operations

- ▶ Contracting decisions need to be strategic & OHS informed
 - What activities can be contracted and what not (eg most operational routine tasks)
 - Cost-cutting is not a good driver (needs overall justification including quality, safety & control)
 - Significant disparities in pay of contractors and employees is recipe for poor OHS (morale, disorganisation, corner cutting & reporting – surveillance difficult where strong disincentives)
 - Need to factor in additional costs/control measures in decision
- ▶ Contractor management requirements
 - Comprehensive hazard identification, risk assessment
 - Extensive SOPs for all key activities – limit use of JSAs, when to stop/ask protocols
 - Rigorous monitoring/surveillance (challenge audits) and auditing
 - Multiple feedback/reporting loops including HSRs, unions (value criticism/involvement)
- ▶ Risk minimisation practices
 - Avoid subcontracting high risk activities unless compelling technical reasons (eg highly specialised maintenance)
 - Preferred subcontractor model/long term relations
 - Single OHMS on site with rare exceptions (eg major shutdown/overhaul by specialist contractor with better knowledge of hazards/risks entailed)
 - Industry-wide induction, skill-recognition protocols
 - Encourage personal relationships and informal reporting of problems
 - Forming networks including close links with unions, communities and other interests

Regulation & Policy remedies

- ▶ Some strengths in existing model OHS laws notably the general duty provisions (PCBU and worker (not employee) and focus on work and mining legislation contains contractor specific provisions. Closing the Loophole 'same work same pay' may also help re labour-hire disparities.
- ▶ But more specific regulatory requirements and targeted enforcement by adequately resourced inspectorate needed
- ▶ Regulator investigations need to specify contract status of those involved and indicate how mine operator and contractor fulfilled contractor safety management obligations
- ▶ Challenges include monitoring hazard exposures of contract workers
- ▶ Make Boards more accountable. Contracting OHS identified as omission in corporate annual reports (O'Neil et al 2016), source of bias in risk assessment (Hunt & Naweed, 2023)

Concluding observations

- ▶ Significant and long-term evidence contracting compromises OHS in mining (coal & metalliferous) both in Australia and globally. This evidence matches experience in other industries (beware of silos). There will always be exceptions and role for contracting but high probability growth of contracting will have detrimental effects
- ▶ Underlying factors economic/production pressures, disorganisation and regulatory failure (close alignment with PDR and 10 pathways models).
- ▶ Limiting risks require mandatory regulation as well as changes to organisational practices, engaged unions devoting resources to OHS (eg Qld MEU HSR training and mentoring), Boards/CEOs taking responsibility for human consequences of their activities.
- ▶ More research needed on contractors/labour hire OHS (including mental health and suicide) and FIFO, DIDO, hours/fatigue management and hazardous exposures (noise, dust, chemicals).

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