Life-of-Mine Conference 2018

Abstract Number: 48

Risk Management for Minesite Closure Planning and Execution – Start Now!

Lessons from the closure of the Leigh Creek Coalfield, South Australia

B Williams[1], A Querzoli[2]

1.
Program Director – Flinders Sites Closure, Flinders Power, Adelaide, S.A., 5063, brad.williams@flinderspower.com.au

2.
Deputy Director Mining Assessments, Mining Regulation Branch, South Australian Department for the Premier and Cabinet, Adelaide, S.A., 5001, andrew.querzoli@sa.gov.au

ABSTRACT

In late 2014 the Flinders Power Management Team was executing business improvement plans to ensure continued electricity generation until 2028 and beyond. Six months later, in June 2015, the Board announced the closure of the Flinders Power South Australian business, including the Leigh Creek Coal Mine, the Northern and Playford Power Stations located at Port Augusta and the 250km railway line. The announcement was preceded by a brief period of internal planning. A date was soon set for ceasing coal mining operations, being November 2015.

The mine is unique in many ways. Located approximately 550km north of Adelaide the site has over 100 years of history and was formerly operated by the South Australian Government. Privatisation in 2000 saw the mine continue operation under Perpetual Leases from the South Australian Government. The leases included exemptions from multiple sections of the Mining Act 1971, obliging primary regulation under the Mines and Works Inspection Act 1920. The coal, being a low rank sub-bituminous brown coal, is prone to self-heating and spontaneous combustion. The mine and company town Leigh Creek were the economic and cultural heartbeat of the community. Facilities at the mine were shared by the community and vice versa.

While many mines across Australia and the world enter periods of care and maintenance, few have been actively closed to the point of relinquishment (Bennett and Lacy, 2016). A swift decision to close, followed by a short mining operations shutdown period, presented significant technical and regulatory challenges for both the mine operator and for Regulators.

The subsequent joint risk mapping process employed by Flinders Power and South Australian Mining Regulators was a unique real-world example of collaborative mine closure planning and execution. Lessons

learnt are valuable for all mines, production facilities and for Regulators, even for those who may wrongly assume that closure is many years away.

SUMMATION

Key joint Industry/Regulator lessons learnt relate to the need and importance of:

1. Effective communication, consideration and understanding;
2. An Adaptive Mindset;
3. The Risk Management Process; and
4. Start Now!

EFFECTIVE COMMUNICATION, CONSIDERATION AND UNDERSTANDING

"*The best closure strategies and plans are dynamic and under constant scrutiny*" (Bennett and Lacy, 2016, p7)

The decision to close the Leigh Creek Mine came without a significant period of forewarning. The company assumed that the preceding Approved Development Program ('ADP') agreed some 17 years prior would form the basis for closure commitments and could be simply modified to meet current expectations. A six-month process to finalise the ADP with the South Australian Mining Regulator was thought an achievable aim (Figure 1). The majority of mines within South Australia are regulated under the Mining Act 1971 through a detailed Program for Environment Protection and Regulation ('PEPR') where the detailed closure plan and mine completion criteria are set prior to the commencement of mining operations. However, as the mine was a historic operation that was subject to its own specific legislative framework, a modern PEPR and closure framework did not apply.

Early meetings between the parties were challenging as there was a gap in the closure expectations. The company simply wanted to get on with the task at hand and had limited experience of the regulatory systems, culture, expectations and timeline. It also became clear that the provisions of the preceding 17 year old ADP were not sufficient to manage key closure risks.

A joint working party was formed between Flinders Power and Regulators and all agreed that the process called for a bespoke targeted risk management approach.

Progress was made only when:

- The needs and expectations of both parties were clearly understood;
- A source-pathway-receptor approach utilising a tailored risk matrix framework based on ISO31000 by geographic domain was agreed; and
- Key assumptions, including the closure objectives and final land use were articulated.

Effective closure planning requires the input of a multi-disciplinary team – it is not a sole person deliverable. Team members bring their own unique technical and non-technical skills to the table. All must remain:

- Risk-focussed. Planning time must be biased towards high inherent or residual risks;
- Pragmatic. Technical solutions must be designed to ensure they can be implemented practically by the site team. The input of site operational staff with their wealth of practical experience and site knowledge is essential. All parties, including advising consultants, must remain focussed on this.
- Outcome-focussed. Technical people must keep one eye on process and another eye on outcomes. Leaders need to act as clear compass points to direct their teams towards the most appropriate closure and rehabilitation outcomes within the agreed timeframe.

Due to the pressing risks onsite, particularly pertaining to spontaneous combustion activity, rehabilitation works were required immediately following cessation of mining operations. This necessitated works to be performed concurrent to the development of the revised ADP (Figure 1). Achieving synchronized planning and delivery required effective communication, understanding and consideration of the needs of both the company, the South Australian Government, the Regulators and stakeholders. Whilst not addressed in detail in this paper, stakeholder engagement with the community and landowners in relation to closure outcomes was undertaken and is also an integral process to ensure success.

AN ADAPTIVE MINDSET

If I had a dollar for each time someone mentioned….'this is new, we don't have a process for this…'

Snowden (2010) describes the difference between four different types of challenges, being:

- A simple challenge – where the relationship between cause and effect is obvious, requiring a best practice response (sense - categorize – respond);
- A complicated challenge – where there is a known answer however it requires some investigation or the application of expert knowledge (sense – analyze – respond);
- A complex challenge – where there is not currently a known answer and the relationship between cause and effect can only be perceived in retrospect. This is emergent practice (probe – sense – respond); and
- A chaotic challenge – where there is no relationship between cause and effect at a systems level, requiring novel practice (act – sense – respond).

Closure work requires all four types of response to the multiple challenges that arise.

Operational mines tend to work in the 'simple' or 'complicated' space. Site engineers, operators and maintainers are well versed in this space – 'give me a problem and I will find a solution'. Mining Regulators are no different – each challenge can usually be categorised within the regulatory framework with its accompanying statutory procedure. The South Australian regulatory framework is risk based and outcomes focussed which provided for a tailored approach.

Difficulties emerge because many of the closure challenges are in the 'complex' space – where both the answer to the challenge and the steps to achieve it are unknown at the outset and require an adaptive approach. The reduction in uncertainty for both parties is the king currency (Figure 2) and there may be a disconnect between views in relation to the uncertainty itself or how to address the uncertainty. This necessitates an adaptive and open mindset which when coupled with effective communication can ensure a successful outcome. Past custom and practice may not be well suited to a closure program. The closure working party benefitted from diversity and was better suited to those with an open mindset, who were willing to listen, challenge their underlying assumptions, build relationships and manage on the fly.

An example of adopting an adaptive approach and mindset relates to the strategies adopted to address uncertainty in relation to the potential risks from spontaneous combustion. Following a rigorous monitoring program, detailed test work and laboratory analysis, multiple strategies were considered for spontaneous combustion mitigation. By adopting a risk and evidence-based approach, a final landform design was chosen to ensure minimisation of air, water and oxygen ingress to potential high propensity spontaneous combustion sources. A field trial was also performed to validate and verify the scientific analysis and adopted strategies. A key lesson learnt was that the concept of an adaptive approach should start as early as possible in closure planning and progressive rehabilitation process.

THE RISK ASSESSMENT PROCESS

The risk assessment process for closure is also an adaptive challenge. A source-pathway-receptor approach utilising a tailored risk matrix framework based on ISO31000 was agreed.

While the company probably considered the process as simple – where cause and effect was seemingly obvious – in hindsight this perspective was very much from an operational 'known knowns' perspective. Closure prompts a different question – what are the 'unknown unknowns'? These risks are much more difficult to qualify, let alone quantify. Key lessons from the joint risk assessment process for Leigh Creek included:

- Closure outcomes/objectives with a clear end-state enabled a common rehabilitation planning platform.
- Independent objective science-based evidence informed the risk profile and risk mitigation/treatment. The data required in a closure context is quite different from data utilised to inform the operational risk profile of the mine.
- Risk treatment must focus on the key high residual risks (Figure 2). For Leigh Creek Coalfields this meant ensuring focus on (in risk order): 1. public safety, 2. spontaneous combustion, 3. surface water control, 4. Aboriginal heritage. Approximately 90% of the closure program works were focussed on these key areas of risk. This clear risk lens also provided an opportunity for distinct messaging for key stakeholders and the community.
- Completion criteria must provide a clear link to the key risks and outcomes, target effective treatment strategies and provide a measurement to demonstrate mitigation of those risks. Criteria must provide a clear path to relinquishment.

START NOW!

Resource companies are ever optimistic about their operational horizon. Improved planning or forewarning provides opportunity for a mine design that fully integrates closure planning at the earliest possible stage with a tangible reduction in closure cost.

The Leigh Creek example demonstrates that boards hold a fiduciary duty to take quick and decisive actions in the interest of the business. The operational consequences or the regulatory complexity required to enact those decisions can create a challenge.

The Leigh Creek example saw two major open voids that were progressively being filled as overburden dumps. Cessation of mining led to a significant rehabilitation challenge of 60m dump faces at angle of

repose and often heating/smoking/burning due to the entrainment of minor coal within the waste. Four rehabilitation designs were contemplated – all with significant OHS risk – before a final design was selected following extensive engagement with the Regulator. Around 1.1 million cubic metres has been reprofiled and 1.4 million cubic metres used as inert cover for these voids that otherwise would have been infilled in the following two years of the operational mine plan.

How suitable are your mining, rehabilitation and closure plans? The former 17-year-old Approved Mine Development Plan focussed all attention on visual amenity and virtually ignored the actual key risks at the mine. The 26GL Retention Dam, built in 1981 to prevent creek inflows to the mine, was scheduled to be breached to the enormous Upper Series mine void as a closure strategy. To waste this precious source of water in an arid climate, let alone destroy the amenity achieved by the dam, would have been a poor outcome for the community. A joint community/regulator/company approach saw the Retention Dam be retained in the final Mine Closure Plan, with a lower spillway to better cater for extreme events and a purpose-built overflow channel to divert episodic floodwaters to pastoralists further north. This change to closure strategy for the Retention Dam was arrived at through a risk-based approach and provided a better closure outcome for all stakeholders.

CONCLUSION

Salmon (2017, p22) states "*Each mine is unique…hence uncertainty in planning and implementing coal mine closure activities is inevitable*". While this was true in the instance of Leigh Creek Mine closure, the frustrations of uncertainty can be countered by an agreed risk management process where closure objectives and the behaviours of all parties are aligned.

Forewarning for closure is ideal but not always possible. The early identification of potential closure risks and the adoption and maintenance of a detailed closure plan ensures that should an unplanned mine shut down occur, the company, the Regulators and stakeholders are well prepared. The closure plan must ensure that there are studies and trials planned at appropriate times to address any uncertainty and verify that the risk treatments will be effective in the long term. While a scheduled six-month process morphed into a thirty-six-month process to achieve an Approved Development Program for closure, the resultant ADP sets a new benchmark for mine closure planning in South Australia. Start now – it's a complex process for both industry and Government.

ACKNOWLEDGEMENTS (USE ‘HEADING 1’ STYLE)

The authors would like to thank Mr Greg Marshall (Director Mining Regulation, SA Government), Mr Paul Jones (Manager Compliance and Quality – Leigh Creek Closure, Flinders Power) and Mr Ken Donaldson (Manager Technical Compliance – Leigh Creek Closure, Flinders Power) for their invaluable insights.

Flinders Power and the SA Government have provided permission for this article to be published.

REFERENCES

Bennett, K. and Lacy, H. (2016) *Mine Closure: Leading Practice Sustainable Development Program for the Mining Industry*. Australian Government Department of Industry, Innovation and Science.

Salmon, D. (2017) *Guidelines for Coal Mine Open Pit Final Void Closure and Relinquishment – Addressing Uncertainty in Coal Mine Environmental Planning*. ACARP Project 25030, published 01/06/2017.

Snowden, D. (2010) *The Cynefin Framework*, video, 2010, viewed 19 November 2017, https://www.youtube.com/watch?v=N7oz366X0-8

FIGURE CAPTIONS

FIG 1 – Leigh Creek Mine Closure Planning – Forecast vs Actual vs Operational

FIG 2 – Leigh Creek Mine Closure – Risk and Uncertainty Perception and Evidentiary Data

FIGURES

FIG 1 – Leigh Creek Mine Closure Planning – Forecast vs Actual vs Operational

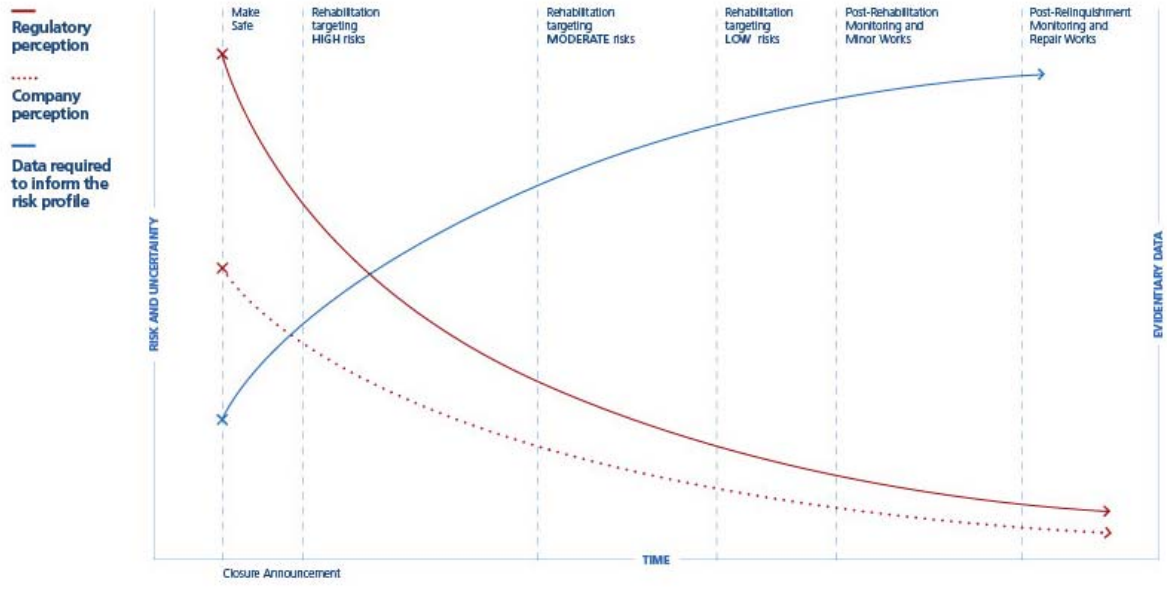

FIG 2 – Leigh Creek Mine Closure – Risk and Uncertainty Perception and Evidentiary Data