



Stantec on mining's quest for healthy closure

As the mining industry navigates an era of rapidly evolving technology and mounting environmental responsibilities, it faces a crossroads in its approach to mine closure

By Craig Guthrie

Above: An abandoned mining pit near Tsar Asen village, Bulgaria

The integration of digital solutions, such as Artificial Intelligence (AI) and other emerging technologies, has the potential to revolutionise the way miners track closure metrics, ensuring a more precise, efficient, and environmentally responsible process.

Openness to technology adoption could help streamline closure operations and address critical environmental and regulatory concerns. By harnessing the analytical power, miners can make data-driven decisions that optimise resource allocation, monitor environmental impacts, and implement more timely closure strategies.

However, beyond the realm of technology, an equally crucial aspect demands attention: community involvement from a project's inception.

Recognising the pivotal role of communities in the lifespan of a mine is imperative – and demand that miners include them in closure plans right from the outset.

Engaging local stakeholders ensures that their concerns, perspectives, and aspirations are woven into

the fabric of closure strategies. This proactive approach fosters goodwill and leads to more sustainable, community-centric solutions.

By synergising technology with community collaboration, miners can forge a path toward closure that harmonises economic prosperity, environmental stewardship, and societal well-being.

One company that's been at the forefront of leveraging technological capabilities to help miners navigate the intricate web of regulatory compliance, environmental stewardship, and community engagement is Stantec, specifically through its Nexus Flow platform.

Mining Magazine sat down with closure expert Phillip Crouse – who leads Stantec's Mine Closure, Reclamation, and Asset Transformation Technical Practice, to learn more about trends in the space.

Q **MM:** How did you first become involved in the mining closure field?

PC: I've been doing it now for 35 years. I kind of stumbled into it right out of school. Back in the 1980s,

towards the end of the uranium mining era in the US, the market took a nosedive.

This left a plethora of uranium mines in the Western United States that needed closure, and nobody really knew how to go about it. This situation ignited a spark in me. I had a background in soil mechanics and geoenvironmental work, and had spent some time in solid waste management. Essentially, if you needed to dig a hole and dispose of waste, that was my expertise. We're still working on those projects today, and they've provided us with a rich history of lessons learned.

There was a significant uranium belt in Western Colorado and other parts of the Western US. So, all these sites needed attention. Fast forward to today, and we're still engaged in those projects. It often takes a significant event like that to catalyse new technologies and approaches. I think now, with numerous mines reaching their end of life, and with instances of tailing dam failures at inactive mines, there's a renewed focus on closure. The cost factor is significant too. Many com-

"It often takes a significant event like that to catalyse new technologies"

panies acquire mines, inheriting the associated liabilities. Especially here in the US, and probably in Europe and the UK as well, they're accountable for these liabilities. They need to make sound financial decisions regarding how to mitigate them, and often find the long-term costs were underestimated. We've seen this with various portfolios, like those from acquisitions. These acquisitions brought with them waste facilities, and now they're embarking on a substantial decommissioning and closure effort, despite not having operated these facilities initially.

Q MM: Uranium disposal obviously requires careful handling. Has this influenced your approach to material disposal throughout your career, or does it vary based on the type of metal?

PC: Yes and No, there are several common principles that apply to each metal. The key distinction lies between non-metal and metal ores, which can result in notable differences in closure approaches. However, there are still overarching principles that apply to both. In the case of uranium, its unique aspect is its radioactive nature, which leads to the conversion of uranium into radon gas, a known carcinogen. In mines, we deal with various issues like airborne dust, water and soil impacts, and alterations to topography and the environment.

What sets uranium apart is mitigating the release of radon, a colourless gas, which is also naturally occurring. When building a house in certain areas, you must conduct a test to ensure radon isn't seeping into your home. If it is, there are ventilation systems in place. The good news is that radon eventually transforms into more stable isotopes after a couple of days. Therefore, it's essential to contain it within tailings or waste materials for a short period. This presents a unique challenge: how to apply an earthen cover over the tailings to shield them from erosion, and how to prevent the gas from migrating upward through the pore spaces and into the atmosphere.

Early on, the Nuclear Regulatory Commission in the US, which oversees uranium sites, provided grants to universities for research. A significant portion of the technology and methodologies for closure in this context emerged from these endeavours. The long-term aspect is worth noting, as radioactivity persists for tens of

thousands of years. Consequently, uranium closure designs have some of the lengthiest lifespans across industries, and this was one of the earliest considerations. Regulatory bodies for uranium in the US often stipulate that sites must be kept safe for tens of thousands of years. This raises the question: how do you design earthen structures or select materials with such longevity? Concrete doesn't endure for 10,000 years, and the durability of plastic liners beneath landfills over such timescales is uncertain. This has been a perennial challenge. Design approaches have evolved, emphasizing resilience rather than sheer size. Now, we also need to factor in climate change and other considerations, not just in closure, but across all infrastructure. Yes, dealing with uranium did lead to the development of tools still in use today, aiding in the design of long-lasting closure components with minimal maintenance requirements.

Q MM: When we delve into the myriad details of closure, there are numerous aspects to consider, from decommissioning substantial assets to dealing with smaller pieces of equipment, and everything in between. Moreover, unexpected developments may arise, such as a country introducing legislation regarding mine closure mid-process. Do we now rely on technology to oversee and coordinate all of this, or is the expertise of specialists still paramount?

PC: Stantec's Nexus Flow, tool serves precisely this purpose. It provides the mine a central platform for monitor-

ing and overseeing all aspects of closure, including financial, along with tracking evolving regulations and how they might impact a mine owner's closure portfolio, be it for a specific mine or the broader scope. Nexus Flow provides the platform for tracking and addressing community concerns throughout the mine life as well as ideas for post closure land use, while acknowledging that transformations occur in the life cycle of a mine, whether it's regulatory shifts, alterations in mine planning, or changes in ownership.

The true challenge lies in preserving knowledge. The best way to control closure costs and ensure success is by understanding the history of the mine, the land, and the surrounding community. Communities often evolve as a result of the presence of the mine, so it's natural that they'll transition once mining operations cease, perhaps into energy, agriculture, or recreational use. Nexus Flow captures this dynamic process for the mine and stakeholders to make critical decisions.

Communities are eager to explore the new asset left by the mine and find ways to make the most of it. The adage you may have heard before holds true: closure is not an event, it's a process. This process involves adapting to the changes that unfold over the life of the mine. By considering it as a process, the key lies in establishing closure principles from the outset, outlining the intended land use.

When regulations shift, ownership changes, or the mine plan itself undergoes alterations, the principles remain steadfast, while the specific details ▶

The Three Kids Mine in Nevada is an example of a challenging closure project



► may evolve. This underscores the significance of tools like Nexus Flow and the critical role of having a dedicated closure team integrated into your mine operations. They possess the expertise and knowledge to provide the necessary details while adhering to the defined roadmap to meet closure objectives. In a nut shell, Nexus Flow makes mine closure simpler.

Q MM: Regarding community engagement, it's heartening to note the shift from presenting communities with potentially polluted areas to providing something genuinely beneficial for them.

Based on your experience, are there recurring concerns that communities share, even across different countries and jurisdictions?

PC: Common threads invariably revolve around water and resources, with water being the predominant factor. Most mines are situated in elevated areas within a drainage basin, impacting a substantial surface area that serves as a natural resource for the community. Typically, water is the focal point, whether it's an issue of excess water like in tropical climates, water quality impacts, or diverting water that communities rely on for their livelihoods. Addressing water-related concerns is almost always a priority.

Another common consideration is physical stability. Communities often worry about potential risks

posed by large waste dumps, tailings dams, or water dams situated above them. Any substantial natural structure positioned above a community holds stored energy that, if released, could pose a threat. Hence, community safety is a paramount concern. Moreover, security is another universal theme. Communities want assurance that once the mining operation concludes and the company departs, what is left behind will remain safe for the community in the long run.

Q MM: Do you find that miners nowadays are more receptive to your advice, especially considering the potential risks and uncertainties surrounding how long closures might actually take?

PC: It depends on the maturity of both the mine and the miner themselves, as well as the location. In general, I would say yes. Mature mines and mine owners with a global presence recognize the need to leave a positive legacy for their communities, or they risk not obtaining permits for future operations. Even in countries with lax closure regulations, companies understand the importance of leaving a lasting impact on the community.

They can't simply cease operations without considering the aftermath. To answer your question, yes, there is indeed a growing receptiveness. We're noticing two significant

shifts. Firstly, at the outset of a new mine or expansion, owners are now asking about closure strategies and establishing closure teams early on. This is a relatively new development, as closure planning at the beginning was more about meeting a regulatory requirement ("check-the-box") then giving it thoughtful considerations. Secondly, there's a desire to give back to the community, whether through land use or repurposing infrastructure. Many mines are in remote areas, and repurposing existing structures benefits both the community and the mine itself, as it eliminates the need for demolition.

The term "transformation" is a recurring theme. After all closure is not the end, but a vital part of the mine's life cycle. So, while there is a growing consciousness about closure, there's still much work to be done. It should become second nature, akin to safety and sustainability, in our industry. Closure planning should be reflexive right from the very beginning. Currently, it tends to happen more towards the middle stages, and I'm observing a positive shift towards more planning and strategic thinking in the early stages.

However, we need to push for a jumpstart and ensure it happens right from the beginning. Financial institutions are also demanding more detailed closure plans, so while progress is being made, we're not quite there yet, in my opinion. ♥

"Addressing water-related concerns is almost always a priority"

Editorial

Editor Craig Guthrie
L: +44 20 8187 2304 **EXT** 2304
 craig.guthrie@aspermont.com
Deputy editor Georgia Williams
 georgia.williams@aspermont.com
Editorial enquiries +44 (0)20 8187 4003

Social
 @MiningMagazine
 miningmagazine.com

Subscriptions and circulation
 +44 (0)20 8187 4003 subscriptions@miningmagazine.com
 Aspermont Media, Ltd,
 21 Southampton Row,
 London, WC1B 5HA,
 United Kingdom

Executive
Managing director Alex Kent
Group content director Ana Gyorkos

Group chief operating officer Ajit Patel
Chief commercial officer Matt Smith

Advertising

Head office
 Aspermont Media, WeWork, 1 Poultry, London, EC2R 8EJ, UK
 +44 (0)20 8187 4003
Global Chief commercial officer Matt Smith
 +44 (0)20 8187 2310 matt.smith@aspermont.com
North America Sales account manager Chad Dorn
 8727 E. 35th Avenue, Denver, CO 80238, US
 +1 720 855 3996 cdorn@miningadvertising.com

Digital and creative
Group digital & creative director Abisola Obasanya
Print Management Print.management@aspermont.com

Group chief financial officer Nishil Khimasia

Annual 3-user subscription (Mining Journal print & digital)	
UK	£595
Europe	€685
US/rest of world	\$770
Australia	\$1,015

Mining Magazine, ISSN 0308 - 6631 (USPS 005-829) is published 10 times each year with combined issues in Jan/Feb and July/Aug by Aspermont Media, Wework, 1 Poultry, London, EC2R 8EJ, United Kingdom.

The US annual subscription price is US\$770. Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA.

Periodicals postage paid at Brooklyn, NY 11256

US Postmaster: Send address changes to Mining Magazine, World Container Inc., c/o BBT 150-15 183rd St, Jamaica, NY 11413-4037, USA.

Subscription records are maintained at at Aspermont Media, 21 Southampton Row, London, WC1B 5HA, United Kingdom.

Air Business Ltd is acting as our mailing agent.

Aspermont Media, publisher and owner of Mining Magazine (the publisher) and each of its directors, officers, employees, advisers and agents and related entities do not make any warranty whatsoever as to the accuracy or reliability of any information, estimates, opinions, conclusions or recommendations contained in this publication and, to the maximum extent permitted by law, the publisher disclaims all liability and responsibility for any direct or indirect loss or damage which may be suffered by any person or entity through relying on anything contained in, or omitted from, this publication whether as a result of negligence on the part of the publisher or not. Reliance should not be placed on the contents of this magazine in making a commercial or other decision and all persons are advised to seek independent professional advice in this regard.

 **Aspermont Media** Information for Industry © Aspermont Media 2023 ISSN 0308-6631 A member of BPA Worldwide