



Key Challenges for Achieving Mine Closure Excellence

KEYNOTE ADDRESS

By Les Sawatsky, M.Sc., P.Eng.
Mine Closure 2011 Conference Chair
September 19, 2011

Introduction

Ladies and Gentlemen, I am pleased to be chairing the 6th International Mine Closure Conference and am honoured to serve a very small part of a process, a process that began many years ago and has changed the way mining companies do business with sharply reduced environmental impacts. The process that has led to a well regulated industry and now regularly involves consultation and engagement of stakeholders and owners. I don't need to remind you of the failures and environmental disasters associated with mine closures in past generations.

Knowledgeable mine closure practitioners are aware of the many failures of previous generations in almost all countries of the world. I don't know about your experience but I would say that the mining industry has been and is being defined in part by failures of the past, long after root problems have been corrected. However, I believe that for much of the public, mining companies have taken on a new identity,

a new brand that includes safety, respect for the environment and respect for local communities. Of course the past offers a wonderful minefield of learning's, mistakes that we don't need to repeat if we are vigilant. The failures of the past must not be forgotten. Therefore, I asked Dr Andrew Robertson to speak about common mistakes, hoping that by hearing from Andy, we don't need learn from personal experience.

I believe that it is also appropriate to take a few moments to gloat a little, to list our recent accomplishments. If nothing else, listing the differences between mine developments of past generations with current practices, will help us explain why we will never need to wear blame for failures of the past. Here is a very short list. I'm sure that collectively, we would develop a much longer list:

- planning for closure is now done before mining commences;
- reclamations soils are salvaged before stripping mine overburden;
- the closure plan and land reclamation is implemented progressively;
- there are tough regulations governing erosion, sediment transport and water quality;
- the closure landforms must be designed for extreme events far beyond the 100 year flood;
- there are new technologies to deal with leaching, acid mine drainage, soft tailings and soil covers;
- local communities and land owners have legal rights
- mine operators cannot abandon the lease before it is certified by tough regulators

But (yes there is a 'but'), we do not yet live in a perfect world. There is more work to do. Fortunately, we have a wonderful opportunity to explore measures to improve the technologies and best management practices pertaining to mine closure at this conference. So I would like to offer the mining industry and mine closure practitioners several challenges to improve mine closure practices and thereby provide a legacy that we can all proudly claim as our own. My suggestions are based on my personal experience and those of some of the conference committee advisors and are not intended to be a comprehensive.

1. Improving Stakeholder Engagement and Collaboration with Local Communities

Stakeholder engagement in the mine closure planning process is an important focus of Mine Closure 2011, both in terms of papers presented and plenary sessions. It is widely recognised that local communities need to be heard and need to participate meaningfully in the process of mine closure planning. I know of some notable success stories; however, much more effort is required so that input by stakeholders involves much more than one person who is assigned the responsibility for stakeholder relations.

Let's take an example. You may be responsible for stakeholder relations but after taking your new assignment you discover that you stand alone in your interest in involving stakeholders, local community members and original land owners. At the same time, your colleague who is assigned the important role of managing reclamation may have no understanding or knowledge, perhaps even no interest in attending to stakeholder inputs or local community concerns. You can see that

responsibility for stakeholder and community inputs must be shared at all levels of the organization.

2. Supporting Effective Regulatory Systems

Without effective regulatory systems the lessons of the past and our current state-of-the-art technologies might not by themselves result in excellent mine closure and reclamation. I'm convinced that regulations are necessary even if it is simply to provide for a level playing field. Developing a suitable regulatory system with appropriate provisions is complicated and fortunately we do have excellently qualified people at this conference to address this issue.

Hugh Jones, a plenary speaker, will present his perspective based on a career devoted to regulating mines in Western Australia. Two other plenary speakers Gord Miller (Environmental Commissioner for Ontario) and Mark Wittrup (Assistant Deputy Minister, Environmental Protection and Audit of the Government of Saskatchewan) will refer to the mine closure regulatory systems in their provinces. Then on Wednesday, the panel discussion on oil sands mine closure and reclamation will include presentations by Richard Houlihan (Alberta's Energy Resources Reclamation Board - ERCB) and Shannon Flint (Director, Oil Sands and Clean Energy Policy Branch, of Alberta Environment). I am proud of the regulatory system governing mine closure here in Alberta and I was tempted to give you a brief overview, but I'll leave that to my friend and member of the Program Committee, Mr. Chris Powter who has a presentation on this topic at a the technical break out session.

I have a controversial challenge to regulators. You might consider providing a degree of freedom to mine operators so that they can

develop equivalent criteria and thresholds that assure compliance with agreed outcomes. Potentially, this might achieve the same goals more effectively, while respecting local site conditions and the unique technologies that may best fit the mine operation.

3. Build Self-Sustaining Landforms and Drainage Systems

I have spent most of my career in the mining business, much of it in some aspect of mine water management, tailings disposal and closure drainage. During my graduate studies at Colorado State University, focusing on river engineering, my advisor who happened to be one of the greatest river engineers in North America at the time, encouraged me to study under Dr. Stanley Schumm, a famous fluvial geomorphologist. It did not take me long to become a convert, applying the principals of geomorphology with near religious zeal. Later as I got involved in engineering mine closure systems, it became quite obvious to me that one might almost dispense with the great standard hydraulic textbooks of the day (Handbook of Hydraulics by Chow) and possibly even with hydraulic laboratories in favour of the greatest full scale hydraulic laboratory in the world, that is natural rivers and streams. I began to study natural drainage systems and natural landforms that were formed quite differently than our rigid straight line systems characterized by uniformity and designed to avoid change during a specified design event. Fortunately, I was contracted to do mine closure planning for Syncrude represented by Gord McKenna who will be introduced to you on Wednesday. With his geotechnical bent and my geomorphic conviction we advanced the technology. Gord eventually became a consultant and has spoken widely on this topic. During this past weekend, Anil Beersing of Golder

Associates presented a pre-conference workshop on this topic together with me and a few others at Golder.

I would like to emphasize the dramatic difference between structures that are designed by conventional standards and structures that are designed by the geomorphic approach. Conventional landforms and drainage systems are characterized by uniformity, smooth straight line continuous slopes, minimal micro relief, conventional design criteria where failure occurs if the design event is exceeded, and no accommodation for change. In sharp contrast, landforms that are designed by the geomorphic approach are characterized by considerable relief, well defined watersheds each with easily recognizable water courses set in incised swales, overland flow path lengths that do not violate thresholds that are evident in the local natural terrain, and watershed areas that do not exceed a geomorphic threshold defined by the slope of its watercourse. Drainage systems designed by the geomorphic approach are patterned after natural streams in the local area. Such drainage systems are able to evolve to suit changing environments. Erosion is accepted as a natural phenomenon with rates of erosion similar to those of the natural environment. As opposed to constructed canals and ditches, natural channel systems are complex and their replication demands a sound understanding of the principals of fluvial geomorphology.

I know that my geotechnical friends disagree with me; however, as a water management engineer with a strong appreciation for geomorphology, I can tell you that, unless the embankment is composed of pervious rock, placing benches in the profile of a waste dump or earth embankment is one of the worst violations of the

geomorphic approach. Such benches accumulate water and lead to concentration of surface overflows.

I am very pleased that TransAlta has arranged for you to view their reclaimed coal mines in Alberta by video on Wednesday at lunchtime. You will see that TransAlta's reclaimed landscape is almost indistinguishable from natural landscape. We learned from TransAlta. Anil Beersing and other colleagues at Golder have been applying the lessons learned to several of TransAlta's other mines in Washington State and Alberta and to oil sands mines in Alberta.

4. Build Maintenance Free Mine Closure Without Fluid Contained by Dam Embankments.

Having discussed the deficient practice of placing benches in the closure landforms, I would like to go out on another limb and challenge you on the concept of maintenance-free closure. This is even more controversial than the issue of benches on waste dumps in the mine closure landscape. In fact, use of 'perpetual maintenance' solutions with permanent fluid impoundments contained by dams in the mine closure landscape is *legal* in almost all countries of the world and almost all provinces of Canada. In fact my company regularly participates in such developments. Although I am in good company with Alberta Government policy and many mine closure specialists, I need to declare that this opinion is my own, not that of my Company. I respect the fact that there are two sides to this argument and that the pro-perpetual maintenance crowd can refer to continuing participation of local communities in a never-ending assignment, thereby providing economic benefit to the local economy.

The problem with perpetual maintenance schemes, particularly those with dams are as follows:

- Perpetual maintenance means forever. I'm comfortable with 30 years post mining monitoring and maintenance. I could even be persuaded that in some unique circumstances that 200 years of active work on the closed mine site might be acceptable. However, indefinite monitoring and maintenance and attending to vulnerable dam containments is like a large national debt; your children and their children will be attending to your legacy and the legacy with 1000's of other mine operators. That's not fair. There is something just terribly wrong about leaving future generations to attend to your failings.
- Secondly, if you target a maintenance-free condition, you will get a lot closer to this condition than if you target perpetual maintenance.
- Thirdly, targeting maintenance-free closure forces the mine operator to eliminate dams containing water or fluid tailings from the closure landscape. The issue of dams in perpetuity is controversial because many acid mine drainage solutions rely on submergence behind a dam, and because many fluid tailings ponds are very costly to dewater. There is no doubt that a perpetual maintenance scheme for mine closure is economically beneficial to the mine operator and perhaps local community, but I would equally suggest that the consequences of dams in the closure landscape are even more serious. I do believe that there are suitable compromises albeit at higher cost.
- Fourthly, maintenance-free closure with no dams in the closure landscape, reduces the long term liability and makes it easier to

transfer the mine lease to the next user, without continuing liability.

Alberta is a leader in this principle of maintenance free closure since it is one of the few regulatory jurisdictions that enforce this target. I understand that Western Australia equally insists on a maintenance-free mine closure. I would challenge you to eliminate dams from the mine closure landscape and target a maintenance-free condition for mine closure.

5. Integrate Mine Operations into Closure Planning

There is one message that I hear over and over from mining staff that are responsible for closure landforms and reclamation. They all agree that the best laid plans of closure planners are oft disregarded by mine operations staff. There are many reasons why dust collects on mine closure plans. The primary cause may be that the landform configuration required for closure cannot be easily constructed; mine operators claim that the closure plan is not practical. It is also possible that developing a configuration to suit the mine closure plan is slightly more costly than a conventional landform shape that minimizes effort or maximizes storage potential. The perceived problem with the configuration for closure may not be significant extra cost; the problem may simply be an operations team that is not convinced of the need for the unusual configuration required for closure, or the perception that closure aspects do not need to be constructed until closure, well in the future. An obvious solution is to involve the mine operations staff in the closure planning process.

It is not surprising that staff in charge of mine operation, are highly stressed and have workloads that prevent them from attending mine closure conferences or internal mine closure planning meetings. They have hourly obligations; their cell phone is glued to their ear. Their concentration span is no longer than 30 seconds. They can't be bothered to sit in a slow-moving meeting to discuss closure landform configurations. Clearly, involving mine operations staff is very difficult but there is no alternative.

6. Make Applied Research Available to the Public

Presenting the results of applied research is a very important element of this conference. It seems to me that each mine is obligated to assess the unique local physical setting and expected disturbances in their mine lease as a prerequisite to implementing a closure plan.

My challenge to mining companies is to make applied research available publically without restriction. When it comes to environmental research, there should be no constraint imposed by intellectual property. I'm no fan of hard copy research that ends up on a dusty bookshelf without public access through the internet. Ideally, the digital proceedings of this conference should be available to you and all mine closure specialists around the world. Unfortunately, the budget did not allow for this and a sponsorship opportunity for about \$20,000 remains open to any organization that would agree to such funding.

7. Declare Your Corporate Values

One of the plenary sessions later this morning is devoted to presentations by mining company executives who will describe their corporate values that govern their approach to mine closure excellence. The executives will include David Parker, Vice President - Sustainability at Teck, and Jean-Michel Gires, President and CEO of Total E&P Canada and Glen Scott VP Imperial. I see this session as a unique highlight of the conference because a company's actions are typically related to its values.

Among mining companies, corporate values properly promoted, are an excellent predictor of behaviour. I recently spoke to a mining executive who told me of his aspiration to reduce water imports to near zero. Having spent much of my career in water management, I would say that achieving such an aspiration will be difficult and costly and maybe impossible. This executive's goal is laudable but it did not come from government regulation. It came from his corporate value.

I hope that sharing of corporate values later this morning will inspire other companies to adopt a similar approach so that conformance to mine closure requirements in your world is not motivated by the threat of government sanction but by positive corporate values. I would challenge mining companies the world over to out-do each other in developing strong corporate values that result in minimum environmental impacts and returning mine disturbed land back to ecologically productive land use.

8. Base Your Mine Closure Plans on Proven Performance

In our fast paced society with rapidly changing technologies, there is a tendency to believe the result of models and bench scale tests. I would

challenge mine planners to develop a healthy level of scepticism so that firm conclusions are only drawn after full scale demonstration.

Models serve a wonderful purpose. But models by the most revered specialists have proven to be unreliable due to some parameter or boundary conditions that were not properly defined. I believe that a degree of scepticism is needed so that the results of new research are properly tested, proven progressively by bench scale testing, small scale pilot studies and full scale trials, before the results are incorporated into a closure plan and heralded as feasible.

I would challenge mining companies not to underestimate the risk that their mine closure facilities will not perform as expected. They must prove the effectiveness of their mine closure plans through pilot projects and full scale demonstrations early in the mine development.

9. Conclusions

I believe that this series of international mine closure conferences governed by ACG, is very important because these conferences speak to the heart of public concerns with mine developments. I believe that communities, environmentalists, and ordinary Canadians would be more willing to tolerate mine disturbances during mine operations if they understood that today's mining industry has a good track record in progressive reclamation and closing mines responsibly, complete with stable landforms, low rates of erosion comparable to the natural environment, suitable surface and ground water discharges, site-wide re-vegetation, development of suitable wildlife habitat and dewatered tailings ponds. Developing such conditions will be the measure of

success of this and other conferences like it. We recognize that this end-goal can only be achieved by appropriate consultation with stakeholders, engagement of owners including aboriginal owners, application of strong regulations and knowledge of applied research.

This conference is expected to achieve the goals of information sharing while connecting you with a host of like-minded miners, engineers, environmental scientists and reclamation practitioners. We trust that you will be inspired by the beauty of the towering mountains that overlook Lake Louise, find great value in the technical presentations, develop new insights and make many new friends.

Our goal for this conference is to assist in reducing the long term environmental footprint of mining, providing for self-sustaining mine closure landforms, maximizing ecological productivity following mine closure and developing beneficial post-mining land uses for stakeholders, local communities and aboriginal owners. I'm very pleased that this conference held at the historic Chateau Lake Louise will help make this vision to become a reality.

Thank you for your kind attention.