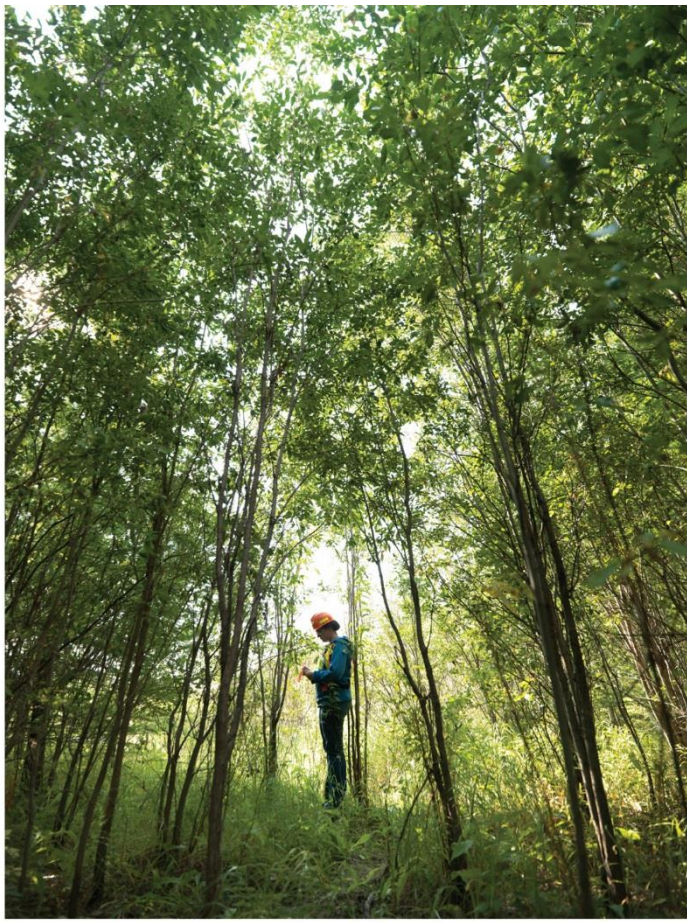

MINECLOSURE 2015

PROCEEDINGS OF THE 10TH INTERNATIONAL CONFERENCE ON MINE CLOSURE

June 1-3, 2015 | Vancouver | Canada

Editors Andy Fourie | Mark Tibbett | Les Sawatsky | Dirk van Zyl

Founded by

ACG AUSTRALIAN CENTRE FOR GEOMECHANICS

CSIRO | The University of Western Australia | Joint Venture

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InfoMine

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One of the greatest and continual challenges facing mining companies, regulators and local communities is how to effectively and sustainably close a mine with positive social, economic and environmental outcomes. The series of International Conferences on Mine Closure, founded by the Australian Centre for Geomechanics in 2006, provides an ongoing global forum for this universal issue. The event series allows for scientists, consultants, regulators, policy makers, company executives and environment managers to meet, share ideas, concerns and solutions to some of the most intractable problems in the primary sector.

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FOREWORD

This portfolio of conference proceedings presents peer-reviewed papers that were accepted for presentation at Mine Closure 2015, an international conference being held in Vancouver, BC on June 1 to 3 and organised by InfoMine. This conference marks the 10th international mine closure conference in a series that was initiated by the Australian Centre for Geomechanics (ACG) and the Centre for Land Rehabilitation in 2006 but, impressively, is also the 39th Annual BC Mine Reclamation Symposium. It is fitting that the 10th international conference is being held in British Columbia where the British Columbia Technical and Research Committee on Reclamation (BC TRCR) originated in the early 1970s in response to a demonstrated need in BC for greater government-industry communications in the area of environmental protection and reclamation associated with mining. For the second time, the BC TRCR will collaborate with the International Conference on Mine Closure. The previous collaboration was at Lake Louise, Alberta in 2011.

Like the preceding conferences, Mine Closure 2015 assembles mine closure practitioners, researchers, planners and operators and follows a successful tradition with presentations that cover state-of-the-art research findings, case histories of effective mine closure practices, recommended mine closure planning guidelines, analysis of effective regulatory systems and sharing of best practices. The initial enthusiasm for this type of international collaboration in 2006, stemming from regional initiatives like the BC TRCR, has matured as the mine closure community shares successes and failures, and as it identifies key challenges and even obstacles to sustainable mine closure. The conference series was envisaged to become a powerful force for improving mine closure and reclamation practices at mines all over the world. Ten years following the initial International Mine Closure Conference held in Perth Australia and 39 years after commencing BC TRCR, it appears that this vision is becoming a reality. The successes include widespread adoption of best practices related to mine closure, improved sustainability and reduced long term liability. But the mine closure storyline is not entirely good news as there are some pockets of resistance, disappointing compromises that may be related to economic conditions, inconsistent bonding mechanisms and inconsistent regulatory leadership in some countries. There is more work to be done and the proceedings of Mine Closure 2015 as reported herein, represent a significant contribution to assist in guiding that work.

With over 350 delegates, significant interest in conference presentations (over 200 abstracts submitted) and 90 papers accepted for publication, Mine Closure 2015 is expected to make a significant contribution to the mining industry by the dissemination of valuable lessons, networking amongst mine closure practitioners and “raising the bar” with a broad adoption of improved leading practices related to mine closure.

Like earlier mine closure conferences, Mine Closure 2015 has a broad reach based on the many countries from which the accepted papers originate. Over 40 of the accepted papers were submitted by international contributors (60% from Canada). This balance fulfils the vision of the conference organisers that Mine Closure 2015 would offer Canadian mine closure practitioners a forum for learning important research results from international guests and for sharing important findings and successes at mines in Canada. The overall goal is to build on available information and thereby improve mine closure and reclamation practices, reduce the environmental footprint and provide for a sustainable economy wherever mines exist.

The papers presented in these Mine Closure 2015 proceedings cover a broad array of topics pertaining to mine closure and reclamation. They were carefully selected to make an effective contribution to the sustainability of the mining industry, with many of the papers presenting the results of applied research into various aspects of mine closure and others describing successes and failures in the form of case histories. Some papers pertain to regulatory systems designed to achieve closure landscapes that will meet minimum requirements related to the environment, preservation of resources and development of stable landforms. Several papers address the need for stakeholder engagement to optimise return of the mine disturbed landscape for beneficial uses. Other papers address the difficult issue of integrating mine operations with mine planning.

Presenting the results of applied research into sustainable mine closure is a very important element of these proceedings. Each mine is obligated to assess the unique local physical setting and expected mine disturbances in developing a closure plan that meets the established goals.

Case histories presented in these proceedings provide valuable information to enable mining companies to replicate and even improve on successes at other mines. Case histories of failures will help readers avoid repeating the mistakes of others while successes will help readers emulate the beneficial practices of others.

Without effective regulatory systems the lessons of the past and the availability of state-of-the-art technologies might not by themselves result in excellent mine closure and reclamation. Several papers concern the development of appropriate regulatory systems to encourage and, if necessary, enforce mine closure planning and execution. These proceedings should encourage the desirable trend towards regulatory consistency across international boundaries.

Technical procedures and guidelines for effective mine reclamation are covered in many of the papers in these proceedings. These technical “guidance” papers will contribute to the development of a global “standard” that may define an improved state-of-practice in the future.

Perhaps the most effective factor in driving mine closure excellence is the motivation of senior mining company executives, a motivation that is rooted in corporate values related to community engagement, respect for aboriginal stakeholders, minimisation of the environmental footprint, long term sustainability and local economic benefits. Accordingly, several plenary sessions pertain to corporate social responsibility.

Stakeholder engagement in the mine closure planning process and the development of sustaining economic benefits to local land owners and aboriginal land owners are highly relevant topics of the Mine Closure 2015 conference, both in terms of papers presented, plenary sessions and panel discussions. Chief Clarence Louie of the Osoyoos Indian Band in British Columbia addresses this important topic. He encourages mining companies to build relationships and take advantage of valued input from local stakeholders and aboriginal landowners as a prerequisite to meaningful mine closure planning.

Finally, there is the difficult issue of integrating mine operations into closure planning. Mining staff who are responsible for developing the mine closure landforms and for reclaiming to mine disturbed land, commonly witness the fact that the work of mine closure planners is often disregarded in favour of more “practical” treatments. Mine operators complain that the

plan cannot be easily constructed, that it is not practical. The challenge is to involve the mine operators in the closure planning process. Several papers herein give some guidance on this issue.

We are pleased with the high quality of papers that were submitted and are printed in this volume. We congratulate the authors for their valued efforts and we encourage readers to take advantage of the results of these efforts as presented herein. Equally, we trust that all conference attendees and everyone who reads these papers, understand that conference presentations and associated papers are important steps towards a goal that will require many more. We must continue to challenge the state of global mine closure as we strive for community acceptance, environmental excellence and economic well-being. We need to understand that excellent mine closure is a prerequisite to maintaining social license for continued mine operations.

Les Sawatsky, P.Eng., M.Sc.
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The Organising Committee acknowledges with gratitude the authors' contributions of high quality, detailed and innovative papers. Their papers reflect ingenious and proactive solutions to challenging mine closures around the world.

We would also like to thank the technical reviewers, the employees of InfoMine and all those involved in the organisation of this conference and the preparation and production of these proceedings. The support of the committees is greatly appreciated. We especially wish to thank our chairman, Les Sawatsky, and his co-chair, Michael Davies.

The Organising Committee also wishes to thank all of our exhibitors, sponsors, institutional partners and media partners. These are all listed on the following pages.

Finally, we would like to thank all the delegates who attended the conference to exchange their valuable knowledge and expertise, thus contributing to the great success of the **10th International Conference on Mine Closure**.

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The data obtained from the matrices allows us to carry out a risk-weighted cost-benefit analysis of construction methods and to assess closure scenarios and the requirement for closure mitigation measures such as cover systems. For example, paddock dumping may be too costly for all materials, but a sulphur grade cut-off can be established such that the material with high acidity and/or temperature risks could be selectively managed in this manner.

Overall, material with higher sulphur content (greater than 3 wt% S) has fewer acceptable disposal options. This is because oxidation rates for higher-grade material are significantly higher than for lower-grade material, and so the level of risk is much greater for a given mass of sulphur. Therefore, identifying and characterising this material should be considered a high priority when planning and establishing appropriate management strategies.

The risk assessment involves several assumptions, so the analytical model has limitations; however, there are valuable conclusions regarding oxygen ingress, estimated internal gas compositions, potential spontaneous combustion and AMD. The assessment also identifies significant observations that relate directly to operational controls and waste placement planning. While a one-dimensional model cannot fully address the complexity of these multifaceted, time-dependant problems, this work shows developments toward a quantitative assessment of risk. Analytical modelling identifies a direct link between WRSF construction methods and the potential development of AMD risks and impacts, highlighting the importance of comprehensive material characterisation and WRMS for material placement. Investing in research and design prior to construction should make the target of designing WRSFs with reduced risks of AMD through to closure achievable.

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where the highest potential risks and costs are estimated, they've tended to focus on domains that show environmental issues during mine operations.

- Mining commenced almost 40 years ago with a remaining potential resource of another 40 years. Trying to develop mine closure criteria without pre-mining baseline date is challenging enough and requires a need to rely on benchmarking more than otherwise used for new projects)
- EMC has cooperated with QMC using a range of methods to assist management in the decision making process and to pioneer the integration of mine closure planning in Mongolia where mine closure regulations has yet to be fully developed. Methodologies and guidelines used in international standards are best suited for these particular conditions. The EMC mine closure plan has the potential to be used as a case study to help develope the Mongolian mine closure policy's and regulatory framework.
- The overlap in concept plans and renewed LOM planning gave us a fresh chance to review the correlation between the cost and the mine closure results to help resolve the many technical challenges.

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Managing the socio-economic impact of tin mining on Bangka Island, Indonesia – preparation for closure

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Abstract

Tin mines in the Bangka Belitung Islands have been exploited for about a hundred years. Following the issuance of a 1999 Ministry of Trade and Industry decree that tin is not an export item to be monitored and regulated, the Bangka regent issued a decree giving permission for the people to mine tin in 2001. Consequently, "unconventional mines" (tambang inkonvensional)*, the term used to describe local small-scale tin mines, have expanded significantly since 2000.*

Bangka Island has a surface of 11,900 km^2 and is mainly lowland below 50 m with some hills up to 700 m; climatic differences within the island are small. Its climate is hot and wet with an average annual rainfall of approximately 2,400 mm. Mining activities are spread across the island and run by one publicly listed tin mining company, dozens of private companies and thousands artisanal mining groups.

Tin mining activities increase the wealth of the people, but they decrease environmental stability. Offshore mining has reduced water quality as total soluble solids have increased and pH decreased; changes in the seabed have caused changes in benthic flora, fauna and plankton diversity and an increased mortality index of coral reefs and their associated fish. The number of fish caught in the offshore mining site has decreased. Inland mining activity has reduced soil fertility and flora and fauna diversity. Inland mining has reduced the number of individuals, species and plant families. In some areas, illegal mining causes floods in the rainy season and damages roads and bridges.

Socio-economic secondary data were collected from various sites on Bangka Island through a literature review. In addition to inadequate commitment and political will on the part of the local and national governments, a low level of law enforcement seems to be a dominant factor in the low environmental awareness. These findings may be used to accelerate the mine closure program started by the largest tin mining company. This paper illustrates some opportunities and alternatives.

1 Introduction

Bangka Belitung Islands produced approximately 106,000 t of tin in August 2013, representing more than one third of global tin supply (IDH, 2014). The majority is exported to Singapore, followed by Malaysia, Japan and the Netherlands. Tin mining is the most significant activity in the islands, taking place onshore and offshore, including in protected forests and marine ecosystems. There are between 15,000 and 50,000 artisanal mines and approximately 30 independent smelters (IDH, 2014).

Following the issuance of a 1999 Ministry of Trade and Industry decree (No. 146/MPP/Kep/4/Tahun 1999) that tin is not an export item to be monitored and regulated, the Bangka regent issued a decree (SK Bupati Bangka No. 6 Tahun 2001) giving permission for the people to mine tin in 2001. Previously, as a strategic or group "A" commodity, tin could be mined and marketed on by the public tin company. Consequently, "unconventional mines" (*tambang inkonvensional – TI*), the term used to describe artisanal and local small-scale tin mines, have expanded significantly since 2000. Tin mining has become a dominant economic driver in the islands, leaving pepper plantations behind (Zulkarnain et al., 2005).

There were 80 dredges and 3,600 floating tin mines off the shore of Bangka Island in 2013 (Bangka Pos, 2013). Tin production from artisanal mines contributes up to 80% of Indonesian tin exports, and tin mining activities

increase the wealth of the local people, but most of the activities neglect good mining practices, safety and land reclamation (ITRI, 2013). There were 80 mining-related casualties in 2012, and 22 in 2013 (Nurtjahya et al., 2014). Most accidents at inland mine sites are due to landslides, and non-standard diving devices are responsible for most deaths under water (Walhi – Friends of the Earth Indonesia, 2013).

The low level of law enforcement seems to be a dominant factor for low environmental awareness among people, operators and regulators. Without firm and consistent implementation of regulations, reclamation and revegetation measures and community development activities are meaningless and very inefficient. People's involvement and concerns are not genuine. It can be predicted that a mine closure program will fail, although a lot of money will be spent. Balancing internal and external pressures with socio-economic impacts would put law enforcement on the right track. The question then is how to manage these pressures to secure the mine closure process.

1.1 Site description

Bangka Island, with a population of 991,062, is located off the eastern coast of South Sumatra Island (BPS 2012). Bangka Island has a surface area of 11,900 km^2 and is mainly lowland below 50 m with some hills up to 700 m; climatic differences within the island are small. Its climate is hot and wet, belonging to the Af-type Köppen-Geiger climate classification (PT Timah Tbk., 1997), with an average temperature of 26.3°C, average humidity of 61.7% and average annual rainfall of approximately 2,400 mm.

The authors and their students gathered secondary data from sites in all four regencies in Bangka Island: Bangka, Central Bangka, West Bangka and South Bangka.

1.2 Soil degradation and inland biotas

Alluvial tin deposits – cassiterite (SnO_2) – were revealed after stripping the vegetation above the upper soil and removing the non-tin deposit overburden. Tin extraction is done by pouring a large volume of highly pressured water over the sediment, with the heavy tin ore separated from light material such as quartz by gravity in a series of jigs, shaking tables or traditional jigs (*sakan*). Non-tin sediment settles in a lower area with acidic pH that may go below 3.

Dredging is conducted to exploit tin deposits located offshore. Artisanal small-scale miners use small traditional gravel pumps to pump tin-ore deposits to floating dredge units (*TI apung*) or modified small fishing boats. Large dredging ships (*kapal keruk*) that can excavate tin ore at up to 70 m depth with bucket wheel dredging (BWD) and offshore suction boats (*kapal isap produksi*) are used to exploit the tin slurry and pump it to the concentrating plant. Gravity is used to separate the tin ore from other material. The alluvium is broken up by a high-pressure jet of water and suctioned to the concentrating plant above the water, changing the seabed and leaving high turbidity below the water surface.

Inland mining decreases soil properties, with soil texture changing from about 70% to 97% sand faction. The concentrations of phosphate, potassium and sodium in undisturbed land are higher than in disturbed areas, and are gradually decreasing as more tin-mined land is abandoned (Nurtjahya et al., 2009b). C-organics are less than 2%, and the cation-exchange capacity (CEC) of tin-mined lands is very low (0.4–3.9 units) (Nurtjahya et al., 2009b). The soil temperature may reach 45°C during the day (Nurtjahya et al., 2008c), and evaporation on sandy tailings may reach 4 L/m^2/day or double than of undisturbed soil (Nurtjahya, 2010). In mining activity, the water and the sediment from the washing process bring acidic material, which makes the catchment more acidic – with a pH below 3. Together with this material, lower pH negatively affects soil flora and fauna. The zero-year sandy tailings itself has pH of about 4.5–4.8. The pH is getting higher, up to 5.1 in an area with 38 years of natural regeneration. As a comparison, the pH of forest and abandoned farmland is around 4.5–4.7 (Nurtjahya et al., 2009b).

Mining activity changes the vegetation structure and composition. The vegetation structure after 38 years of natural succession on old tin-mined land was less than 2%, similar to that of a riparian forest on Bangka Island (Nurtjahya et al., 2009b). In the forest, there are 7,295 individuals per hectare of forest, belonging to 85 species and 44 families. An area with 38 years of natural succession on old tin-mined land has 2,180

individuals per hectare, belonging to 16 species and 13 families; and an area with seven years of natural succession on old tin-mined land has 890 individuals per hectare, belonging to six species and four families. After 38 years of natural succession on old tin-mined land, there is no record of poles (trees with diameter between 10 and 20 cm) or trees with a diameter of 20 cm or more. As a comparison, in an area of abandoned farmland, there are 7,175 individuals per hectare, belonging to 48 species and 47 families (Nurtjahya et al., 2009b). The number of arbuscular mycorrhizal fungi (AMF) spores increases with the abandonment of tin-mined land, and the number of phosphate solubilising bacteria (PSB) shows different readings with the period of abandonment (Nurtjahya et al. 2009b).

Land recovery and coral reef transplantation are costly. Excluding land function change from pepper plantation, the revenue from tin through land function change is lower than for non-mining land uses: protected forest, rubber plantation and beach (Nurtjahya et al., 2014). Cultivation on mined sites requires large input. The expenditure to convert one hectare of previously tin-mined site into rice field is estimated at Rp. 31 million, with the land preparation component representing the major portion (about 62%), and almost 50% of the costs are for physical and chemical soil property improvement (Nurtjahya et al., 2009a).

1.3 Water quality and off shore biotas

Offshore tin mining has reduced water quality. This is shown by a 40% total soluble solid (TSS) increase, a 75% sedimentation rate increase, a 25% water pH decrease (i.e. from 8.0 to 6.0, becoming more acidic) and a 50% dissolved oxygen (DO) increase (Nurtjahya et al., 2014). Wahyuni et al. (2013) reported that, owing to tin mining, the concentrations of lead (Pb) (0.223 ppm) and TSS in solution offshore at Batu Belubang (705 ppm) were above the ministerial regulations of (Kepmen LH No. 51 tahun 2004) 0.008 ppm and 400 ppm respectively, and it was normal to find cadmium (Cd) and zinc (Zn) in the water and Pb in sediment.

The increase of TSS affects the aquatic ecosystem, reducing oxygen supply (Mukhtasor, 2007) and changing photosynthetic processes in phytoplankton and aquatic plants. In another study, offshore mining was found to cause a 40% reduction of the number plankton species (Nurtjahya et al., 2008a). The number of species of seagrass in mined water was about 70% of the number in less mined water (Nurtjahya et al., 2008a). The dominant substrate in mined water was sand and rubble, in contrast to macroalga *Halimeda* sp. anemone in less mined water (Nurtjahya et al., 2008a). Seagrass specimens such as *Cymodocera rotundata*, *Cymodocea serrulata* and *Thallassia hemprichii* were reported in the water at Tukak Beach in South Bangka, whereas the majority of seagrass was dying in the water at Tanah Merah (Nurtjahya et al., 2014).

The Walhi – an environmental NGO – reported that tin mining was responsible for up to 90% of the damage to coral reefs and the reduction of coral reef–associated fish (Walhi, 2013). The number of coral reef–associated fish in mined water was 30% of that in less mined water (Nurtjahya et al. 2008b). Coral reef life coverage was less than 25% in mined water compared to more than 90% in less mined water (Nurtjahya et al., 2008a). However, the growth rate of the coral reef species *Acropora digitata* transplanted to Teluk Limau Beach, Bangka, was 2.2–2.4 mm/month (Sodikin, 2011).

Pratama (2014) reported that because of floating small-scale artisanal tin mining units (*TI apung*), the number of fish caught has decreased, causing some fishermen not to go fishing. In the past, when the condition of the coral reefs was much better, fishermen in one area could harvest up to five metric tonnes per day, fishing could be done 300 m to 1 km from the beach, whereas now the fishermen need to go 1.5–5 km with no guarantee of a good catch.

1.4 Tenurial claim

An agrarian problem has arisen since the start of mining, before the reclamation or revegetation of mined sites (FEM IPB, 2013). Two problems are identified: (1) the mobility of artisanal small-scale miners (TI and *tambang skala kecil*) in reclaimed sites cannot be controlled by the mining company, and (2) ownership claims related to and occupation of reclaimed sites. These problems may arise at any step of the reclamation process. During step 1, site determination, artisanal small-scale mining, or huts, or plantation crops suddenly exist in few days. During step 2, site preparation, artisanal small-scale mining and plantation claims arise.

During step 3, cover crop planting, artisanal small-scale mining, plantation claims and territorial claims arise. During step 4, revegetation, artisanal small-scale mining and territorial claims exist, and cover crops are tampered with. During step 5, maintenance, revegetation plants are stolen, cut or claimed, the area is re-mined or societal conflict exists (FEM IPB 2013).

As one mine site can be re-mined by different group of miners, soil quality decreases before reclamation (FEM IPB 2013). In the case of reclaimed and revegetated sites, illegal mining has destroyed the reclamation and revegetation process. Re-mining has financial consequences, as more input is needed for poorer soils. In many areas, the sites become an open access resource. In one location, the miners have land ownership issued by the local authority (FEM IPB 2013). From a survey conducted in 2012, only 23.6% of 2,111 hectares of potential reclamation area is eligible or free of claims by local people (FEM IPB, 2013).

2 Methodology

2.1 Data

Socio-economic secondary data were collected from various sites on Bangka Island through a literature review by the authors and some undergraduate students at Universitas Bangka Belitung. A descriptive qualitative method and purposive sampling were used, with 10-17 interviewees for each study. The interviewees are artisanal tin miners, artisanal tin mine owners, prominent local people, fishermen and former fishermen who has changed their profession to be floating TI tin miners.

2.2 Positive impacts

The positive impact of tin mining is economic (Juniarti, 2014; Indra, 2013; Romeo, 2011). The tin business brings in money in a short time; local people say the money earned from the tin business is "'hot money." Tin mining is considered the largest economic driver, making a significant contribution to the provincial economy. It is reported that about 10,000 artisanal small-scale miners support more than 50,000 people (ITRI, 2012). Artisanal small-scale mining contributes up to 80% of Indonesia's tin exports (ITRI, 2013).

The income percentage for tin miners compared to overall income per month of people in Lubuk Kelik, Bangka, is 93.4%; for ex-pepper farmers in Silip, Bangka, 95.1%; and for ex-rubber farmers in Bencah, Central Bangka, 89.1%. Pepper and rubber plantations contribute less than 2.3% each of overall monthly income of pepper farmers or rubber farmers (Nurtjahya et al., 2008b). The net monthly income of fishermen in Rebo and Bubus beaches, Bangka, is about one-third of the income of their colleagues working in tin mining (Nurtjahya et al., 2008a).

The majority of people in Bangka Belitung fall into wealthy categories as of 2011. The increase of income for the majority people is shown by the number of motorcycles and cars. From 1999 to 2011, motorcycle and car taxes increased 15-fold. The number of people who perform the hajj pilgrimage increased almost 10% from 2001 to 2012 (Erman, 2013).

2.3 Negative impacts

While tin mining increases income for miners or people active in mining, it also causes societal conflicts at mining sites. Most of the conflict in both inland and offshore mining is between locals and immigrants. Almost 60% of artisanal miners come from adjacent islands, such as mainland Sumatra and Java Island (Erman, 2013). Walhi – Friends of the Earth Indonesia (2013) reported 12 conflicts between local fishermen and miners between 2006 and 2011. Attitude changes and conflicts are reported in the hamlets and villages of the studied area (Table 1).

In terms of education, the drop-out rate from elementary to senior high school has increased. In 2011, the province of Bangka Belitung had the second-largest student drop-out rate in Indonesia because of children's involvement in mining or following their parents when they move to new mining sites (Erman, 2013.

In some areas, fishermen and farmers have changed their professions to become miners. Fishing boats are modified to become mobile floating dredges in Bangka (Nurtjahya et al., 2008a). Rubber plantations and pepper plantations have been mined in some areas in Central Bangka and South Bangka (Nurtjahya et al., 2008b).

Table 1 Attitude changes and conflicts because of artisanal tin mining in hamlets and villages

Aspect	Findings	References
Attitude changes	• Alcohol drinking, drunkenness, prostitution, gambling, drug use among male youth • Disobedience to parents • Consumerism • Neglecting prayer duties • Profession changes from fishermen to miners, from farmers to miners, from labourers to miners • Less collaboration among villagers	Iryanto (2014); Pratama (2014); Romeo (2011)
Conflicts	• Between café owners and local people, café owners and local women • Fighting over mining sites between different dredge-type miners, fishermen and artisanal miners, locals and immigrants • Between husbands and wives because of husbands buying the services of café hostesses • Between religious local culture and more secular immigrant culture • Over financial transparency between head of village and local people	Anggrewan (2012); Christina (2011); Juniarti (2014); Bangka Pos (2015)

Offshore mining affects the fish catch. Small pelagic and demersal fish production decreased at three offshore mined sites in three regencies over the period 2009–2010. At Batu Belubang Beach, Central Bangka, the total small pelagic fish production decreased more than 50% in the 2009–2010 period (Octarini, 2011). At Rebo beach, Bangka, small pelagic production decreased 10% and demersal fish catch decreased up to 48% in the period of 2007–2010 (Sucita, 2011). At Tanjung Ular beach, West Bangka, small pelagic production decreased 24% and demersal fish catch decreased up to 70% in the period of 1998–2008 (Bidayani, 2010). A river that receives tin sedimentation has 22 species and 10 families of fish, whereas a river free from tin mining has 36 species and 16 families of fish (Muslih et al., 2013).

The habitat changes have caused the benthic mollusc species *Laevistrombus canarium* L. (locally known as *siput gonggong*) of the family Strombidae to be replaced by the bivalve species *Anadara granosa* (Yulianda et al., 2009). The mollusc is the raw material of the most expensive seafood cracker in the province, up to Rp. 250,000 per kg or about US$ 25 per kg.

Flooding in many areas of the province is believed to be caused by tin mining. The original small stream channels have been changed by the mining activity. The changing channels cause flooding in many areas, and in one area flooding resulted in the loss of two lives in 2013.

2.4 Managing socio-economic impact

Socio-economic and cultural development is one of four mine closure programs stipulated by article 16 (2) d of the Ministry of Energy and Mineral Resources regulation for the Republic of Indonesia (Permen ESDM No. 7 Tahun, 2014). A number of social and economic indicators can be used in future surveys to measure the improvement as perceived by the local community.

Socio-economic impact must be managed to support the mine closure program in the province. To date, the only mining closure program is being conducted by the only publicly listed tin mining company. Socio-economic impact should be managed simultaneously by both internal and external stakeholders. Internal stakeholders implement the laws, socialise the laws to the people and work hand in hand to create alternative economic drivers after tin mining. External stakeholders such as the Tin Working Group (TWG) provide clarification of the tin supply chain to support the mining industry in becoming more sustainable. The IDH Tin Working Group works on mineral certification, although it started voluntarily. The local government may take the lead to educate and empower the local people by addressing the internal needs and external pressures in order to achieve sustainable development.

2.4.1 Internal needs

The broader group of stakeholders needs to consider the ecological cost of degraded mined soil for the sake of sustainable development in the province. Benefits should be passed on to future generations, not held by the current generation. Notably, more than 50% of mining money is sent outside of the province.

Regulators may play a role in enforcing good mining practices and issue rewards and punishments to miners as well as providing alternative non-tin economic drivers to the people. Law enforcement should be implemented fairly, and law the applied to everyone. Leadership, commitment and political will are required on the part of local and national legislators and executives. Every legislator and executive should have the same understanding of sustainable development. People should abide by the rule for the sake of their children and grandchildren. As the regulator, a Bangka Island regent invited a number of undergraduate students and skilled farmers from Java Island and the Sumatra mainland to change the mindset and educate local people about agriculture and livestock.

All mining laws (Peraturan Pemerintah Republik Indonesia Nomor 1 Tahun 2014, Undang-undang Nomor 4 Tahun 2009 tentang Pertambangan Mineral dan Batubara, dan PP Nomor 23 Tahun 2010 tentang Pelaksanaan Kegiatan Usaha Pertambangan Mineral dan Batubara, PP Nomor 24 Tahun 2012 tentang Perubahan Atas PP Nomor 23 Tahun 2010, PP Nomor 55 Tahun 2010 tentang Pembinaan dan Pengawasan Penyelenggaraan Usaha Pertambangan Mineral dan Batubara, PP Nomor 78 Tahun 2010 tentang Reklamasi dan Pasca Tambang) should be implemented. In many cases, especially in Bangka Belitung, the role of environmental NGOs is effectively to monitor the implementation of the law and trigger discussion among regulators and between regulators and legislators. Coverage in the local newspaper has given the local people more knowledge of the pros and cons of tin mining. One example is the issue of radioactivity in the mining industry. In the last two years, the international networking established by a local NGO has created pressure on local government to check on the implementation of the laws. Regardless how large the contribution, local and international NGOs invested in the International Tin Research Institute – ITRI Indonesia Tin Forum, an international seminar held in Pangkalpinang, Indonesia, in December 2013.

Academics should undertake research and development from a social approach to find economic ways of engaging in mine site reclamation and revegetation, find alternative economic drivers for the people and implementing the results of their research and patents. All of the work requires collaboration and integration from either regulators or business. In a previous study, the percentage of input to prepare mined land before it was ready to plant was almost 70%, or Rp. 22.8 million per hectare, with compost and mineral soils representing the two largest expenditures (Nurtjahya et al., 2009a). Corporate social responsibility (CSR) on the part of mining companies may support research, and at the same time create recognition of the companies themselves.

Operators, academics and regulators must find the best solution to implement the idea of people-based reclamation (FEM IPB, 2013) in practice. This is not an easy task. It is also about changing mindsets. However, involving students of all education levels may create positive results. Weekend camps and mandatory field involvement (*Kuliah Kerja Nyata*) for undergraduate students may be alternatives to educate people about sustainable development and sustainable mining.

Anyone can create environmental awareness. A university lecturer asked for support from the Pantai Rebo (Bangka Island) local authority and fishermen to conserve the offshore environment from inappropriate fishing and tin mining. Of 30 respondents, 64% agreed not to use bombs in their fishing, and 30% agreed not to mine in offshore water, while another 67% somewhat agreed (Umroh, 2015).

An effort should be made to change mindsets, although this requires a very long investment. Education is a potentially effective way to do this. Environmental awareness comes in many forms. Some local efforts includes the “Bina Cinta DAS” (loving watershed building) at the province’s Balai Pengelolaan Daerah Aliran Sungai (BPDAS) for junior high-school students; mangrove planting in Belinyu, Bangka, by multiple stakeholders, including scouts; and mangrove nursery building at Rebo Beach, Bangka, by university students as their social project. A legal draft of watershed management principles has been prepared by a multisectoral forum and is in the process of becoming law.

2.4.2 External pressures

The international community may play an important role from outside the country. In the last couple of years, local, national and international environmental organisations have increased their campaigns against exported tin ingots produced using poor mining practices (Nurtjahya et al., 2014). Some foreign coverage in newspapers and short films has strengthened the call for good mining practices. A large newspaper in Europe published a story stating that it is highly likely smartphones contain a few grams of illegal Bangkanese tin (Hodal, 2012). This pressure led to the December 2013 Indonesia Tin Forum international seminar in Pangkalpinang, which made more stakeholders aware of the issues. It was also attended by some overseas smartphone company representatives and local and international consultants.

The TWG, which facilitated the seminar, identified that many of the sustainability issues are derived from the local and national operating environment and are not directly intrinsic to the business and practices of mineral exploitation and trade (IDH, 2013). However, the impact of tin mining on the biota is reported to be a concern for smartphone companies (Nurtjahya et al., 2014).

Thanks to the emerging EU regulation on due diligence in mineral supply chains, including for tin, there is increasing pressure from national and international NGOs and consumers for producers to supply tin using standard practices. Responsibly produced raw materials are becoming more important for mineral importers. Bangka and Belitung Island tin production has been associated with sustainability challenges. These include critical issues such as mining in protected areas and critical marine ecosystems, the lack of adequate rehabilitation practices, inadequate occupational health and safety measures and illegal artisanal small-scale mining (BGR, 2015).

A government body in Germany is concerned about good mining products and supports mineral producers to improve their social and environmental performance (BGR, 2015). As an advisory institution to the German government and partner authorities in the mining sector in developing countries, BGR will develop a practical certification framework to allow semi-industrial operations linked to the artisanal sector in particular to prove socially and environmentally sound mineral production and encourage their integration into the formal business sector (BGR, 2015). The framework consists of five basic principles: (1) traceability, (2) fair working conditions, (3) security and human rights, (4) community development and (5) care for the environment. At the same time, the framework presents a business opportunity for producers to meet international supply chain due diligence expectations for traceability and transparency (BGR, 2015). Volunteer tin producers/smelters could be audited by independent auditors based on the agreed standards (BGR, 2015).

2.4.3 Managing internal needs and external pressures

In the last few months, economic growth has slowed. Since 2014, law enforcement related to the tin mining business has been enhanced. The province should reduce its dependence on tin mining as the first step towards sustainable development (Tan et al., 2014). The local government may play an important role as a "conductor" to manage both internal needs and external pressures to hasten the process of achieving good mining practices and sustainable development. As of 2015, the authority for issuing mining licences is the governor, not the local government.

The community representation group (LKMTL) withdrew from the Kelian mine closure process in 2003 owing to some unaccommodated requests from the local community (Nyompe, 2003). Workers and the community prefer to air their grievances directly with the company because of a lack of confidence in the local government (McGuire, 2003). The community tried various means to press the company to meet their demands, including sending their grievances in writing to relevant authorities, the legal aid office and the National Commission for Human Rights, and holding a series of demonstrations (Nyompe, 2003).

The local government must provide more accurate recommendations to the provincial government for issuing mining licences. The local and provincial governments together may ask for a higher percentage of royalties and taxes. Collaborating with other stakeholders such as academics and NGOs, the governments should enhance efforts to educate people, that is, build awareness of the environment for all ages. Finding alternative economic drivers is also encouraged. Bringing in skilled agriculture labourers and livestock from neighbouring islands would accelerate the transfer of technology and agricultural culture to the local people. Undergraduate students and lecturers from other islands may support mindset changing and transfer some agricultural knowledge to locals. Tourism investments should be supported, in line with the efforts by the local Belitung Island government. External influences should be considered motivation. Implementing legal and sustainable tin supply chains and all aspects of an international audit would increase operators' and local people's compliance with the regulation, and therefore support sustainable mining and sustainable development. Local and international environmental NGOs may become good partners in monitoring and evaluating. Their recommendations are needed.

The increase of environmental awareness to empower local people to do business in sectors other than mining; better cooperation between the local, provincial and central governments on royalties and taxes; and more contributions from other stakeholders may pave the way to mine closure. Local entrepreneurship is enhanced in the mine closure process (Permen ESDM No. 7 Tahun, 2014). The local government should increase the likelihood of establishing sustainable benefits for people beyond mine closure. The only mine closure program has just been started by a state mine company.

Managing internal needs, external pressures and socio-economic impacts will put law enforcement on the right track. Correct law enforcement would support and secure the development of socio-economic and cultural programs. Clearly, socio-economic and cultural development is just one of many mine closure attributes. Socio-economic and cultural programs, however, would significantly contribute to the success of mine closure programs in Bangka Belitung.

3 Conclusions

The local government may play an important role in managing internal needs and external pressures to hasten the process of implementing good mining practices and sustainable development. The local government together with the provincial government may ask for a higher percentage of royalties and taxes. Collaborating with other stakeholders, such as academics and NGOs, education – that is, building awareness environment – should be enhanced for all ages. Finding alternative economic drivers is also encouraged. Tourism investment should be supported. External influences should be considered as motivation. Implementing legal and sustainable tin supply chains and all aspects of international audit would increase operators' and local people's compliance with the regulations, and therefore support sustainable mining and sustainable development. Local and international environmental NGOs may become good partners for monitoring and evaluation.

The increase of environmental awareness; empowering local people to do business in sectors other than mining; better cooperation between local, provincial and central governments on royalties and taxes; and more contributions from other stakeholders may pave the way to mine closure.

Correct law enforcement would support and secure the development of socio-economic and cultural programs. The success of that development would provide strong a basis for the success of mine closure in the province.

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Chapter 13
Author Index

MINECLOSURE 2015

FOUNDED BY

ACG AUSTRALIAN CENTRE FOR GEOMECHANICS
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BCTRCR TECHNICAL AND RESEARCH COMMITTEE ON RECLAMATION

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NORMAN B. KEEVIL INSTITUTE OF MINING ENGINEERING
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COLLABORATING ORGANIZATION

University of Reading

JUNE 1-3, 2015 | VANCOUVER, CANADA
WWW.MINECLOSURE2015.COM

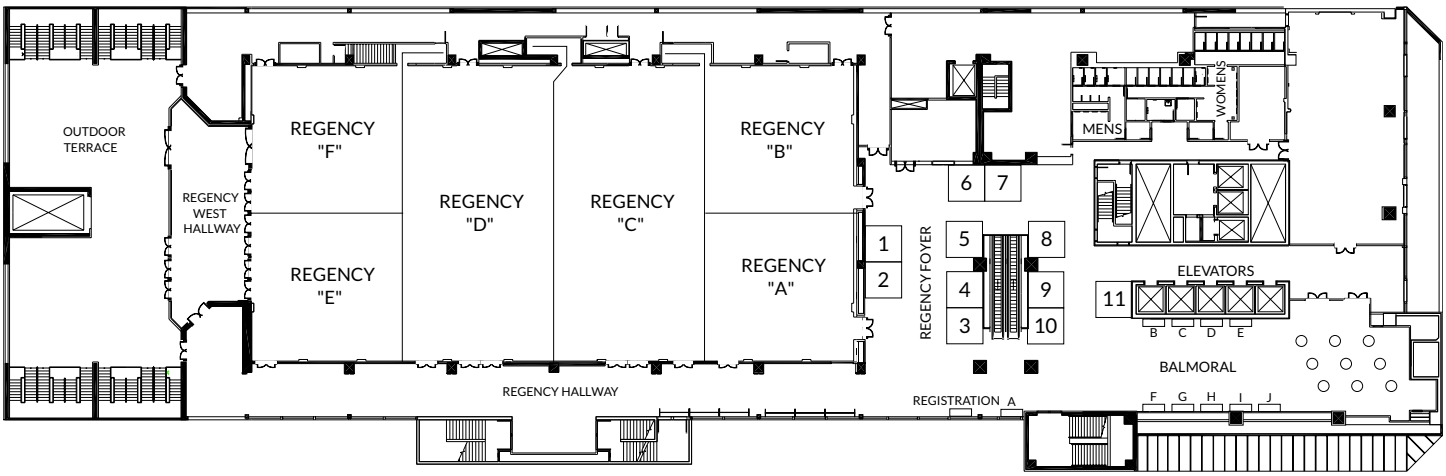
PROGRAM GUIDE

CONFERENCE FUNCTIONS AND LOCATIONS

All functions will be held on the 3rd floor of the Hyatt Regency Vancouver

Function	**Location**
Sessions	Regency C/D/E/F
Trade show	Regency Foyer/Balmoral
Reception and happy hour	Regency Foyer/Balmoral
Coffee breaks and lunches	Regency Foyer/Balmoral
Poster sessions	Regency Hallway
Speakers' breakfast	Regency A

3RD FLOOR



BOOTHS

01 SRK Consulting
02 Trace Associates
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06 O'Kane Consultants
07 Golder Associates
08 Envirotac
09 SoilVision
10 Quantum Murray
11 StormTec Filtration

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E Areva
F Robertson GeoConsultants
G Australian Centre for Geomechanics
H Premier Pacific Seeds
I Profile Products
J McCue Engineering

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WELCOME FROM THE ORGANIZERS

Dear Delegate,

It is our pleasure to welcome you to Vancouver to Mine Closure 2015! This event marks the 10th international mine closure conference in a very successful series. It was initiated by the Australian Centre for Geomechanics (ACG) in 2006 in Perth, but impressively, it is also the 39th Annual BC Mine Reclamation Symposium. It is fitting that this international mine closure conference is being held in the province of British Columbia, where the British Columbia Technical and Research Committee on Reclamation (BC TRCR) originated in the early 1970s in response to a clear need in BC for greater government-industry communications in the area of environmental protection and reclamation associated with mining. For the second time, the BC TRCR will collaborate with the International Conference on Mine Closure. The previous collaboration was at Lake Louise, Alberta, in 2011.

As with the preceding conferences, Mine Closure 2015 brings together closure practitioners, researchers, planners and operators. It continues a successful tradition with over one hundred presentations that cover state-of-the-art research findings, case histories of effective closure practices, recommended mine closure planning guidelines, analysis of effective regulatory systems, and sharing of leading practices. The initial enthusiasm for this type of international collaboration started about ten years ago, stemming from regional initiatives like the BC TRCR, and has now matured as the mine closure community shares successes and failures, and as it identifies key challenges and obstacles to sustainable mine closure. The conference series was envisaged to become a powerful force for improving mine closure and reclamation practices at mines all over the world. Ten years following the initial International Mine Closure Conference held in Perth Australia and 39 years after commencing BC TRCR, it appears that this vision is becoming a reality. The successes include widespread adoption of leading practices related to mine closure, improved sustainability, and reduced long-term liability.

However, the mine closure storyline is not entirely good news as there are some pockets of resistance, disappointing compromises that may be related to economic conditions, inconsistent and even punitive bonding mechanisms, and inconsistent regulatory leadership in some countries. There is more work to be done and the presentations and proceedings of Mine Closure 2015 represent a significant contribution to assist in guiding that work irrespective of jurisdiction.

With over 350 expected delegates, significant interest in conference presentations (201 abstracts submitted and over 90 papers accepted for publication), Mine Closure 2015 will make a significant contribution to the mining industry by sharing valuable lessons, facilitating networking among mine closure practitioners, and “raising the bar” by encouraging a broad adoption of improved leading practices related to mine closure.

Over the next three days you will be able to hear over one hundred carefully selected presentations, among them six stellar keynote addresses from Daryl Hockley of SRK Consulting; Mike Davies of Teck Resources Limited; Chief Clarence Louie of Osoyoos Indian Band; Rick Siwik of Siwik Consulting; Randy Knapp of SENES Consultants; and Harley Lacy of MWH Global. You will also have a unique opportunity to participate in a panel discussion on Successes and Challenges in Closure – Optimal Outcome for Communities that will take place on Tuesday afternoon.

Finally, we wish to express our sincere gratitude to all those who made this conference possible: to the authors for their invaluable contributions; to the reviewers for sharing their expertise and safeguarding the high quality of the presentations and proceedings; to the sponsors for their generous support; to InfoMine and its organizing partners for their superb organization; and to all of you, delegates, for your enthusiasm and interest in this conference series.

Have a great conference and enjoy your stay in beautiful Vancouver! We urge you to take full advantage of this opportunity to explore one of the most beautiful cities in the world.

Organizing Committee
Mine Closure 2015

ORGANIZERS

FOUNDING BODY

AUSTRALIAN CENTRE FOR GEOMECHANICS, AUSTRALIA

The Australian Centre for Geomechanics (ACG) was established in 1992 to promote research and education in the field of geomechanics for Australia's extractive resource industries. The aim is to ensure safer working environments for all resources (human and capital) and to add value to this most important of Australian industries.

The ultimate goal of the ACG is the effective application in industry of the principles and practices of geomechanics by personnel with a commensurate level of training. This is achieved via research, education and training. Quality research and the subsequent transfer of developed technology will ensure that industry is aware of the latest developments in geomechanics.

Please visit **www.acg.uwa.edu.au** for more information.

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InfoMine conferences provide an opportunity for specialists and technology users to exchange information, discuss the latest research and propose innovative solutions to technical challenges. Physical conferences include technical sessions, trade show and social functions, enabling personal exchanges in formal and informal settings.

ConferenceMine conferences are a very important medium for fostering discussion, developing technology, building relationships and gathering information.

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Tailings and Mine Waste 2011 Vancouver, Canada	**Mine Water Solutions in Extreme Environments** 2013 Lima, Peru; 2015 Vancouver, Canada
Paste and Thickened Tailings 2013 Belo Horizonte, Brazil; 2014 Vancouver, Canada	**Heap Leach Solutions** 2013 Vancouver, Canada; 2014 Lima, Peru; 2015 Reno, Nevada
Cold Covers Practice Seminar 2014 Whistler, Canada	**Mine Closure Solutions** 2014 Ouro Preto, Brazil
Geosynthetics Mining Solutions 2014 Vancouver, Canada	**Mine Closure** 2015 Vancouver, Canada

Please see **www.infomine.com/conferences** for a list of upcoming conferences.

ORGANIZATION SUPPORT

BRITISH COLUMBIA TECHNICAL AND RESEARCH COMMITTEE ON RECLAMATION (BC TRCR), CANADA

The British Columbia Technical and Research Committee on Reclamation (TRCR) originated in the early 1970's, in response to a demonstrated need in the province BC for greater government-industry communications in the area of environmental protection and reclamation associated with mining.

Membership is drawn from the corporate sector (several of the operating mines are represented); the Ministry of Energy and Mines (MEM); the Ministry of Environment (MOE); CanmetMINING; the Mining Association of British Columbia (MABC), the Mining Association of Canada, the Association of Mineral Exploration BC and British Columbia universities and colleges such as UBC and TRU. The Committee meets monthly to discuss matters of joint concern and interest, exchange experience, plan Symposium activities and prioritize research needs.

Please visit **www.trcr.bc.ca** for more information.

ORGANIZATION SUPPORT

NORMAN B. KEEVIL INSTITUTE OF MINING ENGINEERING, UNIVERSITY OF BRITISH COLUMBIA, CANADA

UBC's Department of Mining Engineering is known for being a small, close-knit family. The department is exemplified by the dedication of the faculty and staff who provide a dynamic, hands-on learning experience for both undergraduate and graduate students.

In addition to teaching, the faculty work with graduate students and staff to undertake research in all aspects of mining in order to study and improve the industry for future generations. Gifts from alumni, corporations, foundations, students, parents and other friends assist the Keevil Institute in conducting leading edge research, providing outstanding education and contributing to social and economic development.

Please visit **www.mining.ubc.ca** for more information.

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The University of Reading is ranked in the top 1% of universities in the world. It is a global university that enjoys a world-class reputation for teaching, research and enterprise. The University was established in 1892, received its Royal Charter in 1926, and has developed into a leading force in British and international higher education. The University delivers a world-class student experience, research-led teaching and the graduate employability record is excellent. The numbers of students going on to higher level study is well above the national average.

The University continues to evolve, reflecting an ever-changing world, which drives the development of the areas of research excellence and strength. They are leading the way in multidisciplinary work in biomedical and pharmaceutical sciences, housed in a new £17 million centre, for example. The University is committed to maintaining a supportive, challenging and high-quality experience for students and staff alike and to preserving the heritage and beauty of some of the most beautiful university campuses in the UK.

Please visit **www.reading.ac.uk** for more information.

DAY 02 - TUESDAY, JUNE 2

07:30-17:30	**Registration desk hours**	
10:00-19:00	**Trade show hours**	
07:30-08:30	**Speakers and session chairs' meeting (Tuesday sessions only)**	**Regency A**

Keynote Session 2 | Chair: Björn Weeks, Golder Associates Ltd., Canada — Regency D/E/F

09:00-09:45	**Theme keynote 2 | Making First Nations part of the mine operations and closure** Chief Clarence Louie, Osoyoos Indian Band, Canada
09:45-10:30	**Theme keynote 3 | Changing water treatment standards and the impact on mine closure** Randy Knapp, SENES Consultants, Canada
10:30-11:00	**Coffee break and poster session**

Plenary Session 2 | Chair: Björn Weeks, Golder Associates Ltd., Canada — Regency D/E/F

11:00-11:30	**Plenary presentation 4 | Now and then: Eight decades of lessons in closure planning – case studies from West Africa** Philipa Varris, Golden Star Resources Ltd., Ghana; Mark Thorpe, Torex Gold Resources Inc., Canada
11:30-12:00	**Plenary presentation 5 | Mine closure in Canada: A perspective on the past, present and future** Clem Pelletier, Erin Prelypchan and Kris Etches, Environmental Resources Management (ERM), Canada
12:00-12:30	**Plenary presentation 6 | Field study of biobased technologies for mine rehabilitation purposes** Claudia Ortiz, Marcela Wilkens, Daniel Barros and Jaime Pizarro, University of Santiago of Chile, Chile
12:30-13:30	**Lunch**

Parallel sessions

	Regency C	Regency D	Regency E/F
	Session 7 | First Nations and Communities Chair: Andre Xavier, University of British Columbia, Canada	**Session 8 | Vegetation** Chair: Mark Tibbett, University of Reading, UK	**Session 9 | Case Studies** Chair: Ben Chalmers, Mining Association of Canada
13:30-13:50	**Mine closure and First Nations – social licence strategies for effective community engagement** Ron Breadmore and George Lafferty, Aboriginal Affairs and Northern Development Canada, Canada	**Improving geotechnical stability of saturated mine tailings by dewatering with deep-rooted vegetation** Mark Dobrowolski, S. Rowlands and R. Hattingh, Iluka Resources Ltd., Australia	**Engineered flow-through closure of an acid pit lake, a case study** Clint McCullough, Golder Associates/Edith Cowan University, Australia; C. Harkin, Yancoal Premier Coal Ltd., Australia
13:50-14:10	**First Nations engagement in mine closure: Sä Dena Hes Mine decommissioning and reclamation** Chris Jeffrey, Environment & Infrastructure, Amec Foster Wheeler, Canada; Michelle Unger, Teck Resources Limited, Canada; John Pugh, Environment & Infrastructure, Amec Foster Wheeler, Canada	**A plant ecophysiological approach to assess the performance and potential success of mine revegetation** Stephen Ebbs, Lilyan Glaeser, Melissa House and Dale Vitt, Department of Plant Biology and Center for Ecology, Southern Illinois University, USA	**From tailings basin to aquatic ecosystem: The ecological recovery of two waterbodies in Kirkland Lake, Ontario** Andrea Chute, Klohn Crippen Berger, Canada; Natasha Dombrowski, Kirkland Lake Gold, Canada
14:10-14:30	**Making the most out of Zimbabwe's Marange diamonds: Leaving a lasting positive legacy for distressed communities** Tawanda Zvarivadza, University of the Witwatersrand, South Africa	**Selecting graminoids to increase substrate macroporosity for the revegetation of milled tailings of a gold mine** Marie Guittonny-Larchevêque, Research Institute in Mines and the Environment (RIME) – Université du Québec en Abitibi-Témiscamingue (UQAT), Canada	**Optimizing application rates of waste residuals in mine soil reclamation programs using response surface methodologies** Greg Piorkowski, Stantec Consulting Ltd., Canada; Gordon Price, Dalhousie University, Canada; N. Tashe, Stantec Consulting Ltd., Canada
14:30-14:50	**Best practices for wetland reclamation for Alberta oil sand mines** Théo Charette, CPP Environmental, Canada; Joshua Martin, Suncor Energy, Canada	**Achieving biodiversity conservation goals in mine development, operation and closure** Steven Hilts and Warn Franklin, Teck Coal Limited, Canada; Ted Gullison, Hardner & Gullison Associates, Canada	**The rehabilitation of the Bicapa – Tarnaveni waste storage facility** Matt Dey, C. Brough and Rob Bowell, SRK Consulting (UK) Ltd., UK; Duane Runciman and Victor Turea, SC Ecotech Wastes, Romania. Presented by Carl Williams, SRK Consulting (UK) Ltd., UK

14:50-15:00	**Break**

Parallel sessions

	Regency C	Regency D	Regency E/F
	Session 10 | First Nations and Communities Chair: Dennis Wilson, New Gold Inc., Canada	**Session 11 | Modelling** Chair: Andy Fourie, University of Western Australia	**Session 12 | Case Studies (Giant Mine)** Chair: Mike O'Kane, O'Kane Consultants Inc., Canada
15:00-15:20	**Social impacts of mine closure: engaging employees and host communities in planning for closure** Silvana Costa, New Gold Inc., Canada	**Developing a geo-environmental model for long-term post-mining monitoring: The former Salsigne Gold Mine area (France)** Fanny Le Loher and Francis Cottard, BRGM, France; Philippe Chartier, French Ministry of Environment / Languedoc-Roussillon Division, France	**Giant Mine remediation project** Craig Wells, Aboriginal Affairs and Northern Development Canada , Canada
15:20-15:40	**Challenges of integrating mine closure plans mid-way through the life of a mine in Mongolia** Dagva Myagmarsuren and Glen Ainsworth, QMC LLC, Mongolia; T. Davaatseren, K. Vladimir and O. Erdenetuya, Erdenet Mining Corporation, Mongolia	**Integrated surface water and groundwater modelling for oil sands reclamation** Ranjeet Nagare, WorleyParsons Canada Services Ltd., Canada; Young Jin Park, Aquanty Inc., Canada; Jalpa Pal, WorleyParsons Canada Services Ltd., Canada	**Innovative process for stabilizing the subsurface at the Giant Mine Site** Darren Kennard, Golder Associates Ltd., Canada; Chris MacInnis, Aboriginal Affairs and Northern Development Canada , Canada
15:40-16:00	**Managing the socio-economic impact of tin mining in Bangka Island, Indonesia – preparation for closure** Eddy Nurtjahya and F. Agustina Universitas Bangka Belitung Indonesia	**Use of contaminant dispersion modelling to guide close-out of the former Beaverlodge Lake Mine Site, Canada** Caroline Lucas and Bruce Halbert, ARCADIS Canada Inc., Canada; Michael Webster, Cameco Corporation, Canada	**Decontamination and deconstruction of the Giant Mine roaster complex: Risks, challenges, lessons learned and successes** Miguel Larivière, Aboriginal Affairs and Northern Development Canada, Canada; David Hango, Public Works and Government Services Canada , Canada; Cathy Corrigan, AECOM Canada Ltd., Canada
16:00-16:20	**Coffee break**		
16:20-18:00	**Panel Discussion | Successes and challenges in closure – optimal outcome for communities** — **Regency D/E/F** Facilitator: Michael Van Aandout, Stratos Inc., Canada Panelists: Larry Haber, Kimberley Citizen; Ben Chalmers, Mining Association of Canada, Towards Sustainable Mining; Harley Lacy, Closure Practitioner; Jeff Parshley, Developing Countries; David Parker, Industry Experience		
18:00-19:00	**Happy hour**		
19:00	**Close day 02**		

POSTER PRESENTATIONS

1 Support of solving the problems of abandoned mining areas in Germany by improvement of the university education

M. Hegemann, P. Goerke-Mallet and L. Henkel, Post-Mining Research Institute, University of Applied Sciences TFH Georg Agricola Bochum, Germany

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2 French post-mining management: Integrated institutional, legal and technical organization

A. Louis, Ministry of Ecology, Sustainable Development and Energy, France; R. Hadadou, GEODERIS, France; G. Vigneron, Mine Safety and Risk Prevention Department of French Geological Survey (BRGM), France

---

3 An example of integrated safety operation management in the Pontgibaud lead-silver former mine district (France)

P. Sabourault, French Geological Survey (BRGM), France; D. Niemiec, Ministry of Ecology, Sustainable Development and Energy, France; M. Dietz, A. Pidon and I. Girardeau, French Geological Survey (BRGM), France

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4 Soil bioengineering application in a reconstructed waterway on an Alberta oil sands overburden dump

P. Raymond, Terra Erosion Control Ltd., Canada

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5 Integrated surface/subsurface model supports proof-of-concept for co-disposal of ARD tailings and waste rock

S. Donald, R. McLaren, A. Puhalovich, J. Randall and B. Reiha, Golder Associates Ltd., Canada; E.A. Sudicky, Y-J. Park and S. Berg, Aquanty Inc., Canada

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6 Environmental DNA: A revolutionary sampling technique for aquatic ecological studies

C. Astley, Hemmera, Canada

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7 Bralorne-Takla mercury mine: A case study for collaborative remedial planning

T. McConkey, SNC Lavalin Inc., Canada; G. Stewart, Crown Contaminated Sites Program, BC Ministry of Forests, Lands and Natural Resource Operations, Canada; D. Radies, Takla Lake First Nation, Canada; B Power, Azimuth Consulting Group Partnership, Canada; T Gillett, SNC-Lavalin Inc., Canada

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8 Low-cost nursery inoculants for shrubs reduce reclamation costs, accelerate CO2 capture and derive nitrogen from thin air in Alberta

L. Garneau, C. Bissonnette, M-M. Corbeil, P-L. Mallet and J. Beaudin, Centre d'Étude et de Valorisation de la Diversité Microbienne, Faculté des Sciences, Université de Sherbrooke; Centre SÈVE, Canada; A. Quoreshi Symbiotech Research Inc., Canada; D. Khasa Centre d'Etude de la Forêt et Institut de Biologie Intégrative et des Systèmes, Université Laval, Canada; C.W. Greer Energy, Mining and Environment, Research Council Canada; S. Roy Centre d'Étude et de Valorisation de la Diversité Microbienne, Faculté des Sciences, Université de Sherbrooke; Centre SÈVE, Canada

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9 Mine reclamation: Developing soild guidelines for wildlife and livestock, First Nations/Canadian consumers of meat

Shannon M. Bard and Jennifer Trowell, Keystone Environmental Ltd., Canada

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10 Improving our understanding of reclaimed sites with remote sensing data

Mar Martínez de Saavedra Álvarez, Leslie Brown, Mike Henley, Eduardo Loos, Kaan Ersahin, and Gary Borstad, ASL Environmental Services Inc., Canada

---

11 Comparison of several biochemical reactors treating metal-rich mining-related effluents in terms of their metabolic potential

M. Rezadehbashi and S.A. Baldwin, Chemical and Biological Engineering, University of British Columbia, Canada

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HALAMAN PENGESAHAN LAPORAN PELAKSANAAN KEGIATAN SEMINAR LUAR NEGERI

1. Judul Paper : Managing the socio-economic impact of tin mining in Bangka Island, Indonesia – preparation for closure
2. Nomor Surat Persetujuan : 0830/E5.4/BSLN/2015 tanggal 14 April 2015
3. Pemrasaran

Nama	:	Dr. Eddy Nurtjahya, M.Sc.
NIDN	:	0203105901
Fakultas	:	Pertanian, Perikanan dan Biologi
Jabatan Fungsional	:	Lektor (300)
Universitas	:	Universitas Bangka Belitung
Bidang Keahlian	:	Reklamasi Lahan Pasca Tambang
Nama Seminar	:	The Tenth International Conference on Mine Conference
Tempat	:	Vancouver, Canada
Tanggal	:	1 – 3 Juni 2015

4. Pendanaan

Biaya yang dikeluarkan : Rp. **38.717.745,-**
(dana yang disetujui Dikti sebesar Rp. 30.000.000,-; karenanya kekurangan dana diajukan ke sumber lain)

Balunijuk, 15 Juni 2015

Pemrasaran,

Mengetahui:

Dekan Fakultas Pertanian, Perikanan dan Biologi

Kartika, M.Si.

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