



FINAL PROGRAM

July 13 -15, 2015

University of British Columbia
Vancouver, BC
Canada



2015 International Conference on Sustainable Development in the Minerals Industry

July 12-15, 2015

University of British Columbia, Vancouver BC

Accommodation

D6 Walter Gage Residence & West Coast Suites

Opening Reception

G3 Earth Sciences Building

Banquet Dinner

C3 Sage

Meeting Spaces

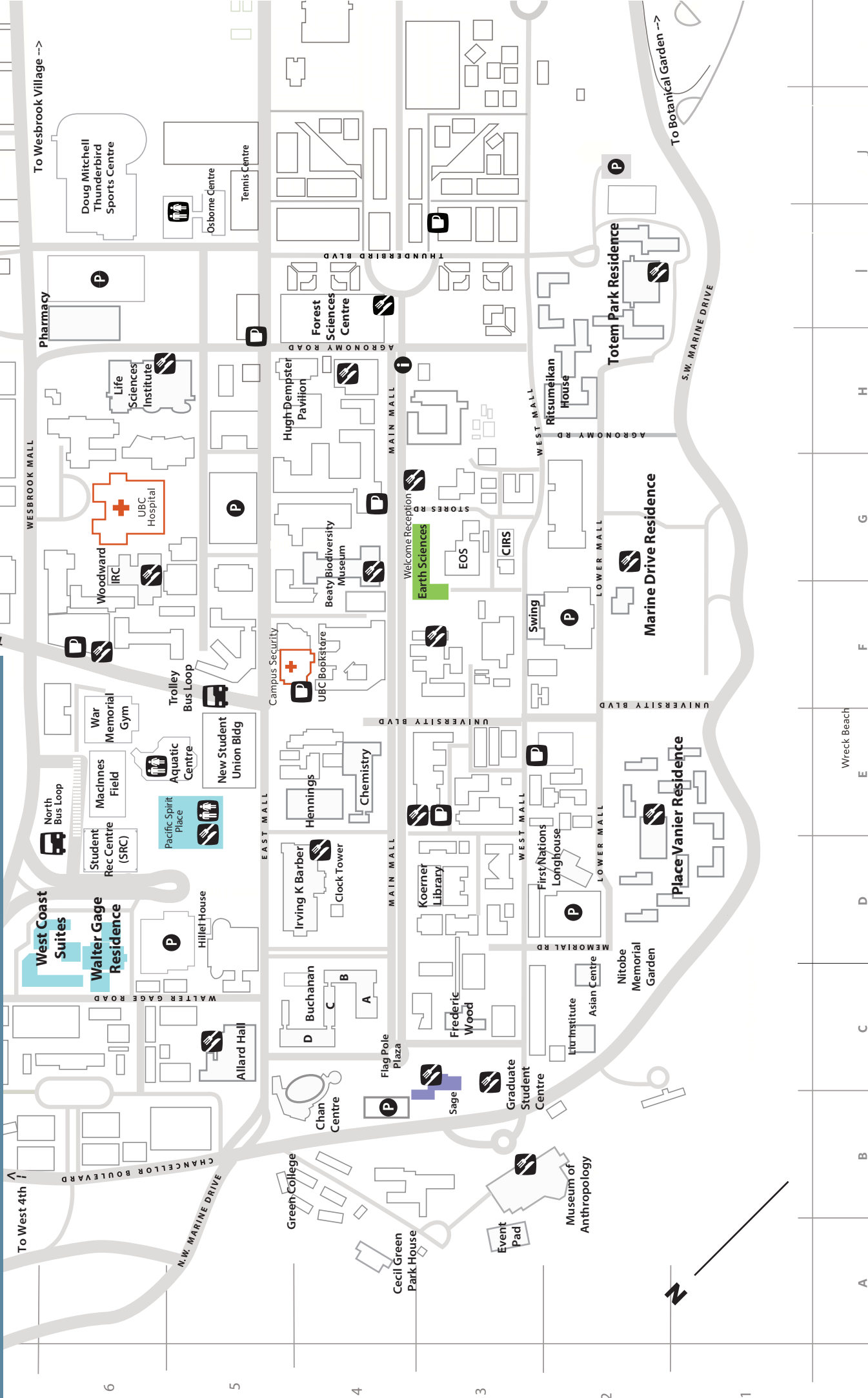
G3 Earth Sciences Building

P Parking

Public Washrooms

G6 **UBC Hospital**

F4/5 **UBC CAMPUS SECURITY**



Welcome from the Organizers

Since 2003 the SDIMI conference series has brought engineers, government officials, researchers, technical experts and non-governmental organizations together creating a community of mineral professionals who evaluate the challenges of creating and implementing practices in the mineral extraction industry that contributes to sustainable development.

The 7th SDIMI conference is being held at the University of British Columbia in Vancouver, British Columbia in July 2015. In keeping with the Milos Declaration tabled at the first SDIMI conference in 2003, this year's conference will focus on **integrating economics, community, environment and governance**.

The objective of SDIMI 2015 is to utilize the scientific, technical, educational and research potential of the mineral extraction community to contribute to a sustainable future.

We welcome all participants in SDIMI 2015 to the campus of the University of British Columbia for this conference. We have participation from 33 countries across the world. Participants include those who are taking part in the Summer Institute arranged by the Canadian International Resources and Development Institute (CIRDI). We also welcome undergraduate and graduate students from a number of international institutions.

The program includes keynote presentations, panel discussions and papers presented during plenary, as well as in parallel sessions. We thank all the authors for their hard work in preparing these papers. The papers that were submitted are available on a USB drive that is included in the conference bag. An important part of SDIMI 2015 is the revisit of the Milos Declaration (provided in this program booklet) and an activity to extend it during the conference, so you are also here to work!

Two social events will allow us all to meet new friends and to continue many discussions we might have had at one of the other conferences in this series along the way.

We had many supporters who gave freely of their time to help make SDIM 2015 possible. SDIMI is possible because many of us believe in the concept and the spirit of this meeting.

We hope that you will find the conference stimulating and that there will be many productive conversations about the presentations and panel discussions. We encourage everyone to actively engage in these conversations during the conference and to continue these discussions after returning home. We also hope that you will reflect on the topics that may be missing from the conversations.

Organizing Committee:

Dirk van Zyl, Chairman
Deborah Shields, Co-Chair
Zach Agioutantis, Co-Chair
Andre Xavier
Brandon Nichols

Useful Information

Registration Desk Location and Hours

- Sunday, July 12, 2015
 - 4:00 pm to 6:30pm in Fort Camp Lounge, Gage
- Monday, July 13, 2015
 - 7:30am-1:30pm in North lobby of EOS Lobby
- Tuesday, July 14, 2015
 - 8:00am-1:30pm in North lobby of EOS Lobby
- Wednesday, July 15, 2015
 - 8:00am-11am in North lobby of EOS Lobby

Social Functions

- Welcome Reception, Monday July 13, 2015
 - 6:00 to 7:30pm, EOS South Lobby
- Conference Dinner, Tuesday July 14, 2015
 - 6:30 to 9:00pm, Sage Bistro

Previous SDIMI Conferences

2003 – Milos, Greece
2005 – Aachen, Germany
2007 – Milos, Greece
2009 – Gold Coast, Queensland, Australia
2011 – Aachen, Germany
2013 – Milos, Greece

Walking time from Gage Residence to ESB is 12 to 15 minutes (easy walking)

The American Society of Mining and Reclamation

The Australasian Institute of Mining and Metallurgy

The Canadian Institute of Mining, Metallurgy and Petroleum

The European Federation of Geologists

The Iberoamerican Association of Mining Education
(The Asociación Iberoamericana de Enseñanza Superior de la Minería)

The Institute of Geologists of Ireland

The Peruvian Institute of Mining Engineers
(Peruvian El Instituto de Ingenieros de Minas del Peru)

The Society for Mining, Metallurgy and Exploration

The Society for Mining, Metallurgy, Resource and Environmental Technology
(Gesellschaft fuer Bergbau, Metallurgie, Rohstoff- und Umwelttechnik e.V.)

The Society of Mining Professors
(Societaet der Bergbaukunde)

The South African Institute of Mining and Metallurgy

The Spanish Association of Mining Engineers
(Consejo Superior de Colegios de Ingenieros de Minas)

The Milos statement was introduced on the occasion of the 14th Annual General Meeting of the Society of Mining Professors (Societaet der Bergbaukunde), May 19 to 21, 2003 and the First International Conference on Sustainable Development Indicators in the Minerals Industry, May 21-23, 2003, held in the Island of Milos, Greece.

Contact Information:
The Society for Mining, Metallurgy and Exploration, Inc.
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URL: <http://www.smenet.org>

Milos Statement

May 2003

Contribution of the Minerals Professional Community to Sustainable Development

Who we are: The minerals professional community comprises engineers, scientists, technical experts, and academics who work in, consult for, educate, study, or are in some other manner associated with the minerals industry.

Society's transition towards a sustainable future cannot be achieved without the application of the professional principles, scientific knowledge, technical skills, educational and research capabilities, and democratic processes practiced by our community. Our members share a mutual responsibility with all individuals to ensure that our actions meet the needs of today without compromising the ability of future generations to satisfy their own needs.

What we believe: We believe minerals are essential to meeting the needs of the present while contributing to a sustainable future.

The process of civilization is one of advancing intellectual, social, and cultural development for all of humankind. An important aspect of the history of civilization is the scientific discoveries and technological advancements that transform raw materials into resources, thus providing the means for increased human well-being. The benefits and services derived from minerals, metals, and fuels can contribute to the achievement of a sustainable future because the inherent characteristics of these resources make productivity and consumption gains possible.

Achieving a balance among economic prosperity, environmental health, and social equity will require significant changes in business strategies, operating technologies, personal behaviours, and public policies. Minerals professionals can engage with communities of interest in the process of improving quality of life by helping to balance the need for minerals, metals, and fuels against the need to protect the environment and society from unnecessary adverse impacts.

Our vision for the future: Our minerals community will contribute to a sustainable future through the use of our scientific, technical, educational, and research skills in minerals, metals, and fuels.

What needs to be done to achieve our vision:

Professional Responsibility:

- Employ science, engineering, and technology as resources to people, catalysts for learning, providers of increased quality of life, and protectors of the environment, human health, and safety.
- Encourage the development, transfer, and application of technologies that support sustainable actions throughout the product and mine life cycles.
- Give high priority to identifying solutions for pressing environmental and developmental challenges as related to sustainable development.
- Address social equity, poverty reduction, and other societal needs as issues that are integral to minerals and mining related endeavors.
- Participate in the global dialog on sustainable development.
- Engage in all stages of the decision-making process, not only in the project execution phase.

Education, Training, and Development:

- Attract the best people to the fields of mining and minerals by encouraging, facilitating, and rewarding excellence.
- Build up and maintain a critical mass of engineering, technical, scientific, and academic capacity through improved education and training.
- Promote the teaching of sustainability principles in all engineering programs at all academic levels.
- Support and commit funding to the infrastructure that enables nations to provide mineral education, professional training, information, and research.
- Prevent the loss of core competencies.
- Encourage a global exchange in academic training, as well as apprenticeship and internships programs.

Communication:

- Support professional growth and interaction through books, articles, symposia, short courses, and conferences on minerals and mining in sustainable development.
- Share and disseminate to the public sound information, knowledge, and technology, including information on every aspect of minerals and mining, through print, electronic, and other appropriate media.
- Disseminate technical information on sustainable development and the role of the minerals, metals, and fuels in sustainable development, including information on the role of minerals in maintaining a high quality of life.
- Promote the achievements and capabilities of mineral community professionals to managers and executives, policy makers, and the general public.

	Sustainable Development in the Minerals Industry	
	Monday - July 13th, 2015	
	Opening Session - ES1013	
	Session Chair - Zach Agioutantis	
8:30 - 08:45	Musqueam Elder Larry Grant	
08:45 - 09:00	Welcome and Introductions	
09:00 - 09:10	SDIMI Conference Series – Zach Agioutantis	
09:10 - 09:30	Milos +12 - Deborah Shields, Zach Agioutantis and Mike Karmis	
09:30 - 10:15	Keynote – Critical Raw Materials: the European perspective, Gian Andrea Blengini, European Commission, DG JRC, Ispra	
10:15 – 10:45	Break	
10:45 – 12:25	Session 1 - Rare Earths, ES1013	Session 2 - EU Session, ES1012
	Session Chair - Malcolm Scoble	Session Chair - Deborah Shields
	Overview on China's Rare Earth Industry Restructuring and Regulation Reform, L. Shen , Key Lab for Resources Use and Environmental Restoration (RUER), Institute of Geographic Sciences and Natural Resources Research (IGSNRR), Chinese Academy of Sciences (CAS), Beijing	INTRAW - Developing New Opportunities on the International Cooperation on Raw Materials , E. Hartai, Institute of Mineralogy and Geology, University of Miskolc, Miskolc-Egyetemváros, V. Correia, European Federation of Geologists, Brussels and Z. Agioutantis , Department of Mining Engineering, University of Kentucky, Lexington
	Building a New Assessment Tool for Potential Rare Earth Underground Mining Projects, G. Barakos , Helmholtz-Zentrum Dresden – Rossendorf, Helmholtz Institute Freiberg for Resource Technology, Freiberg, and H. Mischo, Institute for Mining and Special Civil Engineering, TU Bergakademie Freiberg, Freiberg	Integrating Economic Deep Mining with Community and Environment – Results of the I²Mine Project, H. Hejny , Mineral Industry Research Organisation – MIRO, Wellington House, Starley Way, Solihull
	Sustainable Sourcing of Rare Earth Elements, K. Long , U.S. Geological Survey, Tucson, AZ, USA	Life-Cycle Data Network: Contribution to an Improved Knowledge Base on Raw Materials and Critical Raw Materials, G.A. Blengini , M.S. Frazio, J. Dewulf, F. Mathieux and D. Pennington, European Commission, DG JRC, Ispra
	Rare Earth User Costs in China and Their Implications, B. Zhou, C. Chen, Z. Li, N. Hu, C. Li and Y. Zhao , Department of Mineral Resources Engineering, University of Science and Technology, Beijing	The Sustainable Development Strategy of the German Hard Coal Mining Industry, J. Kretschmann , TFH Georg Agricola zu Bochum, Bochum
	A New Tool for Geopolitical Assessment of REE Projects, S.N. Kamenopoulos , School of Mineral Resources Eng., Technical University of Crete, Greece, Z. Agioutantis , Dept. of Mining Eng., University of Kentucky, USA., K. Komnitsas & P. Partsinevelos , School of Mineral Resources Eng., Technical University of Crete, Greece	Minatura Project, H. Hejny , Mineral Industry Research Organisation – MIRO, Wellington House, Starley Way, Solihull
12:25 – 1:30	Lunch	
	Plenary Session - ES1013	
1:30 - 2:00	CSR - What is Next, Ian Thomson	
2:00 - 3:30	A Public Forum - Is Mining Broken: Social, Economic and Environmental Challenges and Engineering Solutions	
	The World Federation of Engineering Organizations (WFEO) Task Force on Mining and Sustainability is organizing this panel discussion on the contribution of engineering to sustainable mining practices. The focus will be on recent mining engineering advancements that support sustainability, the role that individual engineers play in promoting sustainable mining practices, and broader industry-wide initiatives in the area of mining and sustainable development. The goal of this interactive session is to examine some of the key social, economic and environmental challenges that the mining industry faces along with engineering solutions to address these challenges. The moderated panel will be comprised of mining professionals and experts who work in the area of sustainable development and who represent a range of sectors including industry, government and academia.	
	Panelists:	
	Jessica Kogel , GeoIntellus – moderator and WFEO TF chair	
	Darrel Danyluk , WFEO Vice President, Engineers Canada – introductory remarks from the WFEO	
	Dr. Priscilla Nelson , Chair of the Mining Engineering Department at Colorado School of Mines	
	Dr. Elaine Dorward-King , Executive Vice President Sustainability and External Relations at Newmont Mining Corporation	
	J. Steven Gardner , President, ESCI, LLC	
3:30 – 4:00	Dr. Jürgen Kretschmann , President, TFH Georg Agricola U of Applied Sciences	
	Bryan Cox , Vice President, Corporate Affairs, Mining Association of British Columbia	
4:00 – 5:40	Break	
	Session 3 - Governance and Community Aspects, ES1013	Session 4 - Leading Practices and SD, ES1012
	Session Chair - Michael Hitch	Session Chair - Nadja Kunz
	Corruption and the Extractive Industry Transparency Initiative, E. Papyrakis - International Institute of Social Studies (ISS), Erasmus University Rotterdam, and Emma Gilberthorpe - School of International Development, University of East Anglia, Norwich	A New Overview of Coal Mining in Antioquia from the Optic of Sustainable Development, O. Bustamante, K. Ocampo, R. Meneses , Instituto de Minerales CIMEX- Facultad de Minas, Universidad Nacional de Colombia, Medellín, Antioquia, J. Loaiza and G. Cano , Secretaría de Minas, Gobernación de Antioquia, Medellín, Antioquia

4:00 – 5:40	Work and Relationship Satisfaction in the Mining Industry , C.J. McShane and <u>K. Kanakis</u> , James Cook University, Townsville, Queensland	Development of Regional Systems of Innovation to Improve the Sustainability of Mining Industry , G.A. Aristizábal and O.J. Restepo, School of Mines, Universidad Nacional de Colombia, Medellín, Antioquia
	An investigation into the impact of the “Use-It-or-Lose-It” principles introduced in South Africa’s Mineral and Petroleum Resources Development Act of 2002, on the sustainability of mining in the platinum sector , <u>J. Scholtz</u> and P.M. Bredell, University of Pretoria, Pretoria, Gauteng	Research and Participatory Science in Achieving Sustainable Development in Mining and Energy Development Projects , J. R. Craynon and M. E. Karmis, Virginia Center for Coal and Energy Research
	Mitigating Boom and Bust: Creating a Sustainable Economy Independent of Extractive Industries in Rural Communities , R. Barickman & C. Lessard - Eagle Mine, Champion, and <u>S. McFaul</u> , SEF Canada Ltd., Vancouver	Can We Limit TDS Discharge from Appalachian Coal Surface Mines? <u>W.L. Daniels</u> , C.E. Zipper, W. Orndorff and D.K. Jonhson, Dept. of Crop & Soil Environmental Sciences, Virginia Tech, Blacksburg
	Strategies to Promote Women Participation in Mining , D. K. Tesh & H.K. <u>Musiyarira</u> , Department of Mining and Process Engineering, Polytechnic of Namibia, Windhoek, and G. Dzinomwa, Paasol Resources (Pvt) Ltd, Harare	Feasibility study for a Fairtrade Gold Centre of Excellence Programme , <u>R. Stocklin-Weinberg</u> and A. Stockwell, Miller-Preiswerk, Vancouver
6:00 – 7:30	Welcome Reception - ESB South Lobby	

Sustainable Development in the Minerals Industry		
Tuesday July 14th, 2015		
Morning Session - ES1013		
Session Chair - Deborah Shields		
08:30 - 08:45	Introduction and Welcoming	
08:45 - 09:30	Keynote - Jeffrey Davidson, Canada CSR Counsellor	
09:30 - 10:15	CIRDI and IM4DC - An Update on Two Federally Funded Resource Industry Centres Developing and empowering leaders and coalitions to achieve change in mining for development, M. Gondwe, IM4DC David Parker, CIRDI	
10:15 - 10:45	Break	
10:45 - 12:15	First Nations Panel Discussion, ES1013	
	Anne Marie Sam - Facilitator	
	Grand Chief Edward John (Akile Ch'oh) , Tl'azt'en Nation	
	Dave Porter , BC First Nations Energy and Mining Council	
	Dough White , Centre for Pre-Confederation Treaties and Reconciliation	
12:15 - 1:15	Lunch	
1:15 - 3:00	Social License Panel, ES1013	
	Jim Cooney introduced the term "social license" into the discussion of mining and sustainable development, when he made a presentation in March 1997 at a World Bank Conference on "Mining: the Next Twenty-Five Years". Since then the term has acquired broad use within the mining industry, government, academia, the consulting community, and non-governmental organizations. Not everyone agrees, however, on the meaning of "social license", or even on whether it is a useful concept. This panel will explore a range of perspectives on "social license" and its possible implications for exploration and mining projects.	
	Jim Cooney - Chair	
	Susan Joyce , On Common Ground Consultants, Inc.	
	Wayne Dunn , Professor of Practice in CSR, McGill University	
	Sheldon Tetreault , Guerin Tetreault & Associates	
	Joe Ringwald , President & CEO, Selwyn Resources	
3:00 - 3:30	Break	
3:30 - 5:30	Session 5 - Mining and Communities, ES1013	Session 6 - Mineral Education and SD, ES1012
	Session Chair - Rick Blake	Session Chair - John Craynon
	Biodiversity Management and Enhancement at the New Afton Mine , S. Davidson and <u>L. Holdstock</u> , New Afton Mine, Kamloops	Community Engagement as Means of Insuring Sustainability of Minerals Education , D. G. Dzinomwa, Paasol Resources (Pvt) Ltd, Harare, D.K. Tesh & <u>H.K. Musiyarira</u> , Department of Mining and Process Engineering, Polytechnic of Namibia, Windhoek
	Mine Closure Planning of the New Afton Mine with the Stk'emlupsemc te Secwepemc Nation , <u>B. Collins</u> , and D. van Zyl, Norman B Keevil Institute of Mining Engineering, University of British Columbia, Vancouver	Social Risk in the Extractives Sector - Do Miners Need New Skills to be Successful , <u>J. Fraser</u> and A. Xavier, Norman B Keevil Institute of Mining Engineering, University of British Columbia, Vancouver
	Fly in Fly Out and Family Life: Observations from An Australian Remote Mine Site , M. Pfaffl, C.J. McShane, <u>K. Kanakis</u> , James Cook University, Townsville	Educating Managers and Leaders for Sustainable and Socially Responsible Mining in Africa , <u>J. Broadhurst</u> , J-P. Franzidis, S.Harrison & H. von Blottnitz, Minerals to Metals Initiative, Department of Chemical Engineering, University of British Columbia, Vancouver
	Determination of Local Issues and Concerns Related to the Mines Operations in Northwest of the US , <u>A. Masaitis</u> , and G. Miller, University of Nevada, Reno	Embedding Sustainable Practices into a Mining Engineering Degree: A Ballarat Perspective , <u>M.A. Tuck</u> , Associate Professor of Mining Engineering, School of Engineering and Information Technology, Faculty of Science and Technology, Federation University Australia, Ballarat
	The Effective Roles of Company and Local Government on Facing Mine Closure: The Business Diversification and Regional Industrialization in the Joban Case of Japan , <u>N. Shamazaki</u> , Waseda University, Tokyo	EITI Sub-National Reporting: Comparative Perspectives of Mongolia , <u>B. Batdorj</u> , J. Brasnett, C. Costa, J. Fraser, J. Kwan, H. Li, B.M.N. Parizeau, D. Prasad, M. Ramirez, L. Ruan, C. Toepell, S. Zimmerling, J. Dierkes and D. van Zyl, UBC, Vancouver
	Sustainable Development and the Construction Phase: Digging Deep into the Risk of Contracts and Contractor Behaviour , <u>J. Shandro</u> , Monkey Forest Consulting Ltd. and Norman B. Keevil Institute of Mining Engineering, Vancouver, T. Kalinowsky, T. McLaughlin, and G. MacDonald, Monkey Forest Consulting Ltd.	An Innovative Solution to Enhancing the Mining Curriculum , S. Houlding, <u>M. Reinoso</u> , EduMine, Vancouver, and M. Scoble, Norman B Keevil Institute of Mining Engineering, University of British Columbia, Vancouver
6:30 - 9:00	Dinner - Sage Bistro	

	Sustainable Development in the Minerals Industry	
	Wednesday July 15th, 2015	
	Morning Session - ES1013	
	Session Chair - Glenn Gemerts	
08:45 - 09:00	Introduction and Welcoming	
09:00 – 10:00	SD in Mining Practice - David Parker, plus other Panelists, TBC	
10:00 - 10:15	Jessica Bratty, GEMM	
10:15 – 10:45	Break	
	Session Chair - José Lee	
10:45 - 11:15	Lana Eagle - The Importance of Early & Meaningful Aboriginal Engagement in BC's Mineral Exploration Sector	
11:15 - 11:45	Milos + 12 Discussion	
11:45 - 12:15	Terry Gray, WorldVision - Lessons Learned from Partnering with the Extractive Sector	
12:15 - 12:30	Invitation to Beijing 2017, Z. Li	
12:30 - 1:30	Lunch	
1:30 - 3:10	Session 7 - Water in Mining, ES1013	Session 8 - Mining and Communities, ES1012
	Session Chair - Bern Klein	Session Chair - Jennifer Broadhurst
	Sustainable Mine Water Management: A Case Study of Namibia's Uranium Industry , <u>H. Musiyarira</u> & D.K. Tesh - Department of Mining and Process Engineering, Polytechnic of Namibia, Windhoek, and G. Dzinomwa - Paasol Resources (Pvt) Ltd, Harare	The Need for Public Support for Mining Projects: Case Studies from Romania, Chile/Argentina, Kenya and India , <u>S.B. Bumtseren</u> , D.S. Stokes, A.K. Kuyuk, J.N. Nava and U.B. Baskurt, Norman B Keevil Institute of Mining Engineering, University of British Columbia, Vancouver
	Low-Tech, Low Cost Water Solutions: How to Reach the Last 10% who don't have Access to Clean Water? <u>B. Nichols</u> , UBC, K. Wagoner, R. Pillars, Potters for Peace and A. Xavier, UBC	Planning It Right: A Value-Focused approach to Responsible Mining and Indigenous Planning In Post Tsilhqot'in Decision British Columbia , <u>C. Carter</u> , SCARP – School of Community and Regional Planning, University of British Columbia, Vancouver and M. Scoble, Norman B Keevil Institute of Mining Engineering, University of British Columbia, Vancouver
	Catchment-Based Water Management in the Mining Industry: Challenges and Solutions , <u>N. Kunz</u> , Swiss Federal Institute for Aquatic Science and Technology (Eawag), Dübendorf	Reputation and Property Rights - the Mining Industry , <u>J. Tuck</u> , Federation University Australia, Ballarat, Victoria
	Panel: Bern Klein, Potters for Peace, Silvana Rosario Huanqui, TBC	Determining the Socio-Economic Factors Imperative to Enhancing the Participation of Women in the Extractive Resources Sector in Papua New Guinea , L. Bennett, Women in Mining, Papua New Guinea Chamber of Mines and Petroleum How to Select the Most Appropriate Indicators for Sustainable Mining - A Case Study of Sangan Iron Ore Mines (SIOM) in Iran , <u>J. Kretschmann</u> , TFH Georg Agricola zu Bochum, Bochum, and R. Amiri, Institute of Mining Engineering I, Faculty of Georesources and Materials Engineering, RWTH Aachen University, Aachen
2:50 - 3:20	Break	
3:20 - 5:00	Session 9 - Leading Practices and SD	Session 10 - Environmental, Social and Legal
	Session Chair - Janis Shandro	Session Chair - Muza Gondwe
	Substance Flow Analysis and Mineral Policy: The Case of Potash in Thailand , <u>K. Sakamornsnguan</u> , Institute of Mining Engineering I, RWTH Aachen University, Aachen, and J. Kretschmann, TFH Georg Agricola zu Bochum, Bochum	Development of a Mathematical Model for Particle-Droplet Interaction for Dust Control , <u>J.G. Swanson</u> and C. Negoita, Oregon Institute of Technology, Klamath Falls
	Assessment of Rehabilitation Completion Criteria for Mine Closure Evaluation , <u>M. Blommerde</u> , R. Taplin, and S. Raval, - The Australian Centre for Sustainable Mining Practices, School of Mining Engineering, University of New South Wales, Sydney	Environmental Impact Indicators and Mining Method , S. Murakami, T. Takasu, <u>A. Masuda</u> , The University of Tokyo, Bunkyo-ku, Tokyo, E. Yamasue, Kyoto University, Kyoto-shi, Kyoto, and T. Adachi, Akita University, Akita-shi, Akita
	The challenges of investing and strengthening relationships with Canada and Mongolia , B. Batdorj, M. Hitch and A. Xavier, Norman B Keevil Institute of Mining Engineering, University of British Columbia, Vancouver	Promoting Sustainable Artisanal Mining in Africa: The Case of Rwanda , Chilenye Nwapi, Canadian Institute of Resources Law, University of Calgary, Calgary
	Certification and Due Diligence in Mineral Supply Chains - Benefit or Burden , <u>P. Schütte</u> , Federal Institute for Geosciences and Natural Resources (BGR), Bujumbura, G. Franken, Federal Institute for Geosciences and Natural Resources (BGR), Hannover, and P. Mwambarangwe, Federal Institute for Geosciences and Natural Resources (BGR), Kigali	Land and Mineral Rights in Uganda: A Reform Agenda , <u>B. D. Binyina</u> , Africa Centre for Energy and Mineral Policy and N. Hasci, World Bank
5:10 - 5:40	Risk Management in the Extractive Sector , <u>K. Ramji</u> , Donovan & Company, Vancouver, BC, Canada	A Journey Toward Local Content Regulation For Better Extractive Industry Governance, Lessons Learned from Gumas District – Central Kalimantan, Indonesia , D. Anggraeni, Yayasan Tambuhak Sinta, Indonesia
	Plenary - Conference Closure, ES1013	

Monday – July 13, 2015

Session 1 – Rare Earths

Session Chair – Malcolm Scoble

10:45 am – 12:25 pm

Overview on China's Rare Earth Industry Restructuring and Regulation Reform

Lei Shen - Key Lab for Resources Use and Environmental Restoration (RUE), Institute of Geographic Sciences and Natural Resources Research (IGSNRR), Chinese Academy of Sciences (CAS), Beijing 100101, China

Rare element earths (REEs) have become critical to modern society for use in new technologies and green innovations. China continues to dominate the REE market whilst facing several international trade disputes and market fluctuations. Under the pressure of increasingly severe regulations and market challenges, the Chinese government has been carrying out a series of industry restructuring and regulations reform over recent years. This article aims to provide an overview on the rare earth industry adjustment in China, focusing on its current status of rare earths restructuring and consolidation of small-scale mines, historic policy evolution and present trend. It also points out some implications for small-scale REEs mining and insights on some changes in present mineral resource law revision in relevant to the rare earth industry sustainable development in China.

Building a New Assessment Tool for Potential Rare Earth Underground Mining Projects

George Barakos - Helmholtz-Zentrum Dresden – Rossendorf, Helmholtz Institute Freiberg for Resource Technology, Freiberg, Germany
Helmut Mischo- Institute for Mining and Special Civil Engineering, TU Bergakademie Freiberg, Freiberg, Germany

Once an ore body has been probed and outlined and initial resource indications deserve further attention, the evaluation stage has to begin to determine the potential exploitation. This analysis is a sophisticated process, let alone when it comes to underground mining projects and especially on rare earth deposits that are governed by notable boundary conditions. However, the significant numbers of the parameters to be considered and their complexity, as well as the solvency of the outcomes, often result in questioning the suitability of common evaluation methods. This has created a necessity for a new evaluation procedure that focuses on potential rare earth underground mining projects. This paper describes the construction development of an assessment tool that considers not only the mining method selection process but identifies social, economic and environmental impact factors and Rare Earth Element industry-specific criteria as well. Based on the philosophy of previous linguistic and numerical approaches, this combined tool is based on a step-by-step numerical analytical hierarchical process with weighted criteria. The purpose of building this tool is to adjust to the specifications of rare earth underground mining projects and to contribute into having accurate and secure conclusions for if and when investment decisions should be made and minimize the potential risks regarding the viability of any mining project.

Sustainable Sourcing of Rare Earth Elements

K.R. Long - U.S. Geological Survey, Tucson, AZ, USA

Sustainable sourcing of raw materials helps manufacturers to reduce their environmental footprint and market “greener” products. Rare earth elements (REE) are used in many ways to improve the environmental performance of products, yet over 90 percent of world production of REEs comes from China, where rare earth mining and mineral processing do not meet global standards for environmental protection, worker safety, and transparency. New sources of REEs outside of China are promising alternatives. This paper first reviews what is known about the environmental implications of REE production in China as a baseline. Two new REE mines and 36 feasibility-stage projects outside of China are then compared using multiple criteria for sustainability. Most of these projects are representatives of two deposit types, carbonatite-related and alkaline igneous rock-related, but there is considerable variation in geometallurgical, economic, process-input, and process-output indicators within each deposit type. Carbonatite-related projects are generally higher in grade, lower in radioactivity, and have smaller footprints. Alkaline igneous rock-related projects are coarser grained and have a more economically attractive distribution of REEs. All of these projects offer improvements in sustainability over Chinese sources.

Rare Earth User Costs in China and Their Implications

Baolu Zhou, Congcong Chen, Zhongxue Li^{}, Nailian Hu, Cuiping Li, Yiqing Zhao - Department of Mineral Resources Engineering, University of Science and Technology Beijing*

After three decades of expanding rare earth activities in China since the 1980s, rare earth extracting technologies and market has dramatically changed. For China, the previous policy priorities of economic boosting and GDP growth are yielding to those of resource preservation, health and environment protection, and sustainability as its rare earth resources are depleting and environmental problems are getting urgent. But its new quota-focused rare earth regulatory mechanisms have been accused of violating the international trade rules and the WTO ruling as such has brought those regulations to an impasse. To help understanding the issues of rare earths in China, this paper attempts to present a sustainability-oriented approach for rare earth regulations. It briefly discusses rare earth geography, production, health and environment impacts, and the Chinese policy problems, including taxation regimes. A user cost based methodology is presented to serve as a regulatory basis for rare earth industry. It has been shown that the current rare earth resource taxation rates in China are too low to compensate for the external costs caused by rare earth exploitation and there exists a large room for progressive adjustments or hybrid forms of rare earth royalties to achieve the Chinese policy goals.

A New Tool for the Geopolitical Assessment of REE Projects

S.N. Kamenopoulos - School of Mineral Resources Eng., Technical University of Crete, Greece

Z. Agioutantis - Dept. of Mining Eng., University of Kentucky, USA.

K. Komnitsas & P. Partsinevelos - School of Mineral Resources Eng., Technical University of Crete, Greece

Rare Earth Elements (REEs) are considered critical and/or strategic raw materials. Some of the REEs deposits are located in geographical areas that are either disputed or politically unstable. As the sustainability of REEs mining projects is sensitive to geopolitical risks, it is expected that in the future, decision makers at different levels of government and business, will need a decision support tool to assess the effect of the geopolitical factors in the sustainable development ranking of REE projects. This paper attempts to present a country risk assessment ranking, based on the geopolitical perspective, for areas that feature REE deposits. This information is provided in a user-friendly global map. The sustainable development indicators used and the evaluation procedure applied for this geopolitical ranking are based on a number of indicators such as political stability, number of historical conflicts, etc.

Monday – July 13, 2015

Session 2 – EU Session

Session Chair – Deborah Shields

10:45 am – 12:25 pm

INTRAW – Developing New Opportunities on the International Cooperation for Raw Materials

Éva Hartai - Institute of Mineralogy and Geology, University of Miskolc, H3515 Miskolc-Egyetemváros, Hungary

Vítor Correia - European Federation of Geologists, Rue Jenner 13, 1000 Brussels, Belgium

Zach Agioutantis - Department of Mining Engineering, University of Kentucky, 504 Rose Street, Lexington, Kentucky, 40506-0107, USA

A secure supply of mineral raw materials for European industry is absolutely necessary to ensure Europe's economic sustainability and to improve the quality of life of European citizens. In the last decade a structural change has taken place in the global mineral markets. With the integration of India, the People's Republic of China and other populous emerging countries like Brazil and Russia into the world economy, today more than half of the world's population claims an increasing share in raw materials. It is assumed that by 2030 the global need for raw materials will have doubled, which will result in a dramatic increase to the consumption of raw materials (OECD 2010). For this reason, safeguarding the domestic minerals supply will be challenging for the European Union and all other technologically advanced countries.

Integrating Economic Deep Mining with Community and Environment – Results of the I²Mine Project

Dr. Horst Hejny - Mineral Industry Research Organisation – MIRO, Wellington House, Starley Way, Solihull, B37 7HB, United Kingdom

Economy needs mineral raw materials in almost each sector of modern life. They can only be provided by mining activities. An increasing share of the total mining production will be by underground mining. The production of primary mineral raw materials in Europe will take place in ever greater depth in the future. Thus new production schemes are required considering both economic and sustainability issues. The I²Mine project marked the start of a series of development activities in this direction aiming at realizing the concept of an invisible, zero impact, deep mine. The concept of I²Mine was to develop innovative methods, technologies, machines and equipment necessary for the efficient exploitation of minerals and disposal of waste, all of which will be carried out underground. This will dramatically reduce the volume of surface transportation of both minerals and waste, minimizing above ground installations and reducing the environmental impact. New eco-efficient technologies will be applied in order to make the entire mining process more efficient and environmentally sound. The concept is for an integrated mine, with the majority of the installations underground, and only the final product will be transported above ground to be shipped to the customer. Production waste will be treated and stored underground and gaseous emissions will be managed underground as far as practical. I²Mine will also focus on ideas and concepts that increase energy efficiency and decrease waste. The core of the project was to develop breakthrough technologies for autonomous, highly selective, continuous mineral extraction processes and machinery based on new sensor technologies, face front separation as well as innovative concepts for mass flow management and transportation integrating state of the art technologies. The concept of an invisible, zero impact mine requires a refined process underground that selectively extracts the mineral thereby reducing waste. For this reason, improved extraction machines and near to face processing methods, including backfill procedures, need to be developed. These developments include rock mechanics and ground control solutions, incorporating health, safety and environmental issues accompanied by social dialogue activities. The presentation at conference time will show some selected results together with a sustainability assessment.

Life Cycle Data Network: Contribution to an Improved Knowledge-Base on Raw Materials and Critical Raw Materials

G.A. Blengini, L. Mancini, S. Fazio, J. Dewulf, F. Mathieux and D. Pennington - European Commission, DG JRC, Ispra, Italy

Life Cycle Assessment (LCA) was defined as the “best framework for assessing the potential environmental impacts of products” in the European Commission’s Integrated Product Policy Communication in 2003. Since then, the use of LCA and life cycle approaches have been developing in a wide range of European policies, and the related use has also significantly grown in business. Increasing the availability of quality-assured LCI data is the current challenge to ensure the development of LCA in various areas. In recent years, the Commission continued to develop lifecycle data, methods and studies in order to improve the knowledge base on (critical) raw materials. Life cycle datasets

outline the resources consumed, emissions, and social pressures associated with the supply chains of raw materials. They equally identify where raw materials are used in supply chains and how they are managed at the end-of-their life for products and services. The Life Cycle Data Network, officially launched in February 2014, is expected to host quality-assured life cycle data from European and non-European public and private organisations using a web IT infrastructure. This paper presents original solutions and recent achievements towards increased availability, quality and interoperability of Life Cycle Inventory data, developed through European Commission-led activities and based on wide stakeholder consultation and international dialogue.

The Sustainable Development Strategy of the German Hard Coal Mining Industry

Jürgen Kretschmann - President, TFH Georg Agricola University of Applied Science, Bochum, Germany

By the end of the 1950s, the German coal mining industry produced 150 million tons of hard coal per year in 170 collieries with 600,000 employees. At that time, 70% of the primary energy demand of the Federal Republic of Germany was covered by domestic coal. Since the advance of oil, later of natural gas, in the world energy market and with the growth of world coal trade, domestic coal stood under a long-term restructuring pressure. In 2007, a political understanding was arranged to phase out German coal mining, meanwhile concentrated under the umbrella of RAG Aktiengesellschaft, until the end of 2018 in a socially acceptable manner. This decision required a new strategy for the coal mining industry. Now German coal mining will be strictly finalized and will be prepared for the post-mining era. Within a sustainability strategy the long-term impacts of mining activities before and after the mine closures concerning the environmental, economic and social dimensions will be analyzed systematically and forward-looking. The regional and social responsibility of the coal industry during the closing process and for the post-mining era after 2018 will be emphasized. Additionally to the high technical standards the performance of German coal mining concerning occupational health and safety, environment protection, past mining and post-mining and the development of mine sites to create new jobs are significant from an international point of view and should attract worldwide attention. The traditionally constructive social partnership between employers, union and employees has enabled long-term stable change processes and avoided social frictions. The sustainability strategy of the German hard coal mining industry can be regarded as a role model for other mining countries and regions facing similar transition challenges.

MINATURA 2020 – Mineral Deposits of Public Importance

Horst Hejny Mineral Industry Research Organization – MIRO, Wellington House, Starley Way, Solihull

The exploitation of indigenous mineral deposits in Europe is essential if we are to ensure that the needs of European society can be satisfied in a sustainable manner. To achieve this objective, society needs to ensure that effective access is provided to enable the exploration and exploitation of such mineral deposits, without compromising the needs of current or future generations. Accordingly, the potential of exploitable mineral deposits (including abandoned and historic mining sites) needs to be evaluated specifically and in

relation to other land use and environmental objectives. The deliberation between mineral exploitation and other land uses objectives is a challenging arena, which requires informed evidence. In response to this challenge MINATURA2020 (Developing a concept for a European minerals deposit framework), a new EU project funded within the scope of the European Commission's Horizon 2020 Programme for Research & Innovation, was launched in February 2015. The overall objective of this three-year project is to develop a concept and methodology for the definition and subsequent protection of "Mineral Deposits of Public Importance" (MDoPI) in order to ensure their best use in the future with a view to being included in a harmonised European regulatory, guidance or policy framework. Providing a policy-planning framework that comprises the sustainability principle for mineral exploitation, as it exists for other resource/land use sectors, is thus the key driving force behind MINATURA2020. Led by MinPol, the Agency for International Minerals Policy (Austria), MINATURA2020 benefits from the extensive experience and strength of an international consortium of 24 partners from 16 EU member states (Austria, Belgium, Croatia, France, Hungary, Italy, Ireland, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom) and three non-member states (Bosnia and Herzegovina, Montenegro, Serbia). All project partners have a demonstrated record of accomplishment of projects at national, international and commercial levels and are active players in the international raw materials community. Particular emphasis will be given to the pan-European application and synergies of the project. The consortium aims therefore to include as many European countries as possible in its deliberations. In this sense, stakeholder workshops will be organised in many European countries in 2016 in order to collect broad input on the topic of Mineral Deposits of Public Importance.

Monday – July 13, 2015

Session 3 – Governance and Community Aspects

Session Chair – Michael Hitch

04:00 pm – 05:40 pm

Corruption and the Extractive Industries Transparency Initiative

*Elissaios Papyrakis - International Institute of Social Studies (ISS), Erasmus University Rotterdam
Emma Gilberthorpe - School of International Development, University of East Anglia, Norwich*

The Extractive Industries Transparency Initiative (EITI) has received much attention as a scheme that can help reduce corruption in mineral-rich developing economies. To our knowledge, this paper provides the first empirical attempt (using panel data) to explore how EITI membership links to changes in corruption levels. We also examine whether the different stages in EITI implementation (initial commitment, candidature, full compliance) influence the pace of changes in corruption. We find that EITI membership offers, on the whole, a shielding mechanism against the general tendency of mineral-rich countries to experience increases in corruption over time.

Work and Relationship Satisfaction in the Mining Industry

Dr Connor J. McShane, Katerina Kanakis - James Cook University, Townsville, Queensland, Australia

There has been an increase in concern from the public regarding the mental health and wellbeing of mine workers. This has been mainly due the incidence of suicide with the Fly-in, Fly-out (FIFO) mine worker population as well as the high turnover rate of employees. Investigating the stressors and buffers that influence mine worker job and relationship satisfaction with regards to differing work rosters will provide a better understanding of mine worker wellbeing. A total of 171 participants (81 male, 90 female) who were over 18 years of age and worked within the mining industry in Australia were recruited to participate within this study. Three distinct profiles were created indicating satisfaction levels for different work structures. Work factors were more likely to influence residential mine employee work satisfaction whilst social connectedness and support systems were important for long roster FIFO employee's work satisfaction. A work satisfaction profile could not be generated for the short roster FIFO employee but instead a balance between work and life was found to be important short roster FIFO employee relationship satisfaction. These findings have implications for workplaces in the management employee wellbeing as work rosters can be used to tailor support systems towards individual needs.

An investigation into the Impact of the “Use It or Lose It” Principles Introduced in South Africa’s Mineral and Petroleum Resources Development Act of 2002 (MPRDA), on the Sustainability of Mining in the Platinum Sector.

Johannes. Scholtz & Pierre. M. Bredell - University of Pretoria, Pretoria, Gauteng, South Africa

The platinum mining industry of South Africa is the largest in the world, producing approximately 73% of the world's annual supply and hosting 95% of the world's PGM reserves (US Geological Survey 2014). The industry has had a turbulent couple of years, highlighted by the Marikana disaster in 2012, and a grueling five-month strike in 2014, which left upwards of 1.33 million ounces of platinum underground. Despite the strike having stopped production country-wide for those five months in 2014, the platinum price hardly deviated. This price behavior can only be explained by the existence and use of significant stockpiles of PGMs. The Mineral and Petroleum Resources Development Act of 2002 (MPRDA), which came into effect in 2004, introduced the concept of “use it or lose it” to the mineral resources industry in South Africa. This paper aims to investigate the effect the “use it or lose it” legislation has had on the platinum industry in the ten years since its implementation.

Mitigating Boom and Bust: Creating a Sustainable Economy

R. Barickman & C. Lessard - Eagle Mine, Champion, Michigan, USA

S. McFaul - SEF Canada Ltd., Vancouver, British Columbia, Canada

In an attempt to break the boom and bust cycle historically associated with the mining industry, Eagle Mine, a subsidiary of Lundin Mining located in the Upper Peninsula of Michigan, is working with the community to bolster the local economy outside of extractive industries through programs like Accelerate UP. Accelerate UP is a nonprofit organization offering business coaching within Marquette County. A Facilitator and Community Resource Team work with entrepreneurs to create, expand, or maintain their business ventures independent of the mining industry. It focuses on assisting individuals who have energy, ideas, and motivation but who lack the skills necessary to transform their dreams into rewarding and satisfying enterprises. Accelerate UP works with community organizations by introducing clients to traditional economic development partners when they are ready and in need of those services. This case study analyzes the progress, successes, and challenges that Accelerate UP has encountered in its first two dynamic years of existence.

Strategies to Promote Women Participation in Mining

D. K. Tesh & H.K. Musiyarira - Department of Mining and Process Engineering, Polytechnic of Namibia,

G. Dzinomwa - Paasol Resources (Pvt) Ltd

The mining is known to be a sector which is traditionally male dominated. Opportunities for women involvement are very limited. Policies and various initiatives aimed at rectifying the gender imbalance within the mining sector have been set up in Namibia. Despite the good intentions of these policies, the missing link has been bridging the gap between the documented policies and the actual practice in addressing the imbalance. This study sought to investigate the strategies being utilised by all the stakeholders in the Namibian minerals industry in a bid to address the gender imbalance. The overall objective of the research was to explore mechanisms which could be used to bridge the policy and implementation divide and to encourage an enhanced participation of women in the Namibian mining industry. The methodology consisted of comprehensive literature review, field visit and statistical surveys. This research found that the engagement of all stakeholders from high schools, universities, government and mining companies was critical in mapping sustainable paths for women to choose and settle in the mining profession. The strategies employed by the Namibian minerals industry stakeholders involved engaging high school students and their teachers, bursaries awards for female students, promotions for women and assigning mentors to female graduates when they start their careers and employing female lecturers. One of the main recommendations was for primary and secondary schools and tertiary institutions to champion or make their own contribution in ensuring gender equity and equality in traditional male dominated fields of study.

Monday – July 13, 2015

Session 4 – Leading Practices and SD

Session Chair – Nadja Kunz

04:00 pm – 05:40 pm

A New Overview of Coal Mining in Antioquia from the Optic of Sustainable Development.

O. Bustamante, K. Ocampo & R. Meneses - Instituto de Minerales CIMEX- Facultad de Minas, Universidad Nacional de Colombia, Medellín, Antioquia, Colombia

J. Loaiza & G. Cano - Secretaría de Minas – Gobernación de Antioquia, Medellín, Antioquia, Colombia

The coal Basin of Sinifaná includes 5 towns in the southwest of Antioquia (Colombia); and it involves more than 20,000 inhabitant whose main source of direct and indirect employment is coal mining. In spite of providing the energy required by the industries with the subsequent generation of wealth for some companies, the region has not achieved desired levels of development, according to the importance of energy contribution it has made. Instead there is a risk of closing some mining operations, impacting heavily on employment, economic sustainability, and generates a big risk in the establishment of sustainable social welfare. On the other hand, a number of studies a priori and lacking scientific knowledge have generated confusion among coal mining practices in the region, rather than clarifying its complexity. It has added elements that have not allowed to establish a solution. In this sense, this article presents an overview within the framework of sustainable development of mining in this coalfield as a first approach, objecting theoretical aspects that have been raised traditionally by different actors, defining a new scenario of analysis, where the inappropriate mining practices and lack of technological development are the results of other stronger variables that control it.

Development of Regional Systems of Innovation to Improve the Sustainability of Mining Industry

G.A. Aristizábal Hernández & O.J. Restrepo Baena - School of Mines, Universidad Nacional de Colombia, Medellín, Antioquia, Colombia.

Mining as a source of raw material is essential to society; however it lacks of good reputation due to the generation of impacts that often obstruct the environmental license obtaining and community agreement. The viability of mining business is not only associated with economic profit but also with benefits to communities, local governments and environment. Furthermore, this viability is possible on the base of more sustainable practices use by implementing innovation process that drive new technologies and organizational frameworks, as well as better community and governance practices. Sustainable innovation in mining is a complex challenge due to the diversity of stakeholders around this activity. However, develop innovation capabilities to consolidate collaborative networks could build regional systems that allow facing this challenge. Nevertheless, there is a limited knowledge with regard to how regional systems of innovation could contribute to more sustainable mining industry. This work seeks to propose a model to articulate actors and dynamics of a specific territory with

important mining activity, contributing to generate collaborative innovations that promote a more sustainable mining. This effort is currently doing as a part of a doctoral research in the School of Mines at Universidad Nacional de Colombia in Medellin.

Research and Participatory Science in Achieving Sustainable Development in Mining and Energy Development Projects

John R. Craynon and Michael E. Karmis, Virginia Center for Coal and Energy Research

Mining and energy development projects have the potential for impacting the economic, social and environmental conditions in the communities and regions in which they occur. Research can help inform all stakeholders on the nature and extent of these impacts, methods for avoiding or mitigating negative impacts or enhancing positive impacts, assist in the development of governance structures, and serve as the basis for development and implementation of predictive and management tools. However, in order to be of most use, researchers must engage local communities and other stakeholders in the design and conduct of research. Recently, there has been a growing number of projects where participatory or citizen science has served as a component of research programs. This paper examines the success of stakeholder participation in research and the contributions of this research of maximizing the contribution of mining and energy development to sustainable development.

Can We Limit TDS Discharge from Appalachian Coal Surface Mines?

W. Lee Daniels, Carl E. Zipper, Zenah W. Orndorff and Daniel K. Johnson - Dept. of Crop & Soil Environmental Sciences, Virginia Tech

Appalachian USA surface coal mines face significant public and regulatory pressure to reduce total dissolved solids (TDS) in discharge waters, primarily due to effects on sensitive macroinvertebrates. Relatively low levels of TDS (300 to 500 $\mu\text{S cm}^{-1}$) have been proposed as regulatory benchmarks. We have focused on four primary research areas to develop new strategies/technologies for significantly reducing TDS release: (1) Rapid lab prediction of TDS release potentials of overburden; (2) Development of reliable field indicators to identify TDS risk; (3) Determination of the actual long-term pattern of TDS release; (4) verification of new spoil placement procedures to minimize TDS production. We correlated laboratory column leaching results for over 50 regional overburden materials with lab analyses (e.g. Total-S, saturated paste EC) and produced models that reliably predict ($p < 0.01$; $r^2 > 0.80$) peak TDS potential for most spoils. We confirmed that near-surface pre-weathered spoil materials are drastically lower in TDS risk than deeper strata and that color, hardness and occurrence above thin shale layers are important field indicators. Long-term discharge results from valley fills confirms that TDS elution peaks immediately following fill construction, but usually declines significantly, with many fills declining to $< 500 \mu\text{S cm}^{-1}$ after ~15-20 years.

Feasibility Study for a Fairtrade Gold Centre of Excellence Programme

R. Stocklin-Weinberg and A. Stockwell - Miller-Preiswerk Vancouver, BC, Canada

This paper is based on a study for the Fairtrade Foundation which makes recommendations to develop strategies to sustain the impact of the Fairtrade Gold pilot programme in East Africa and expand the reach of responsible mining practices, building a sustainable supply chain of gold from the region. One potential way of expanding the reach of the Fairtrade Gold pilot could be through a 'Centres of Excellence' programme. A Centre of Excellence could promote responsible mining in line with the Fairtrade Standard for Gold and Associated Precious Metals for Artisanal and Small-scale Mining, using certified artisanal mining organizations as beacons of best practice or 'Centres of Excellence' for the rest of the artisanal and small-scale gold mining sector. We assess the feasibility and potential impact of a Fairtrade Gold 'Centres of Excellence' programme in East Africa, including its potential structure, scope, operational management, funding and risks. We argue that a Centre of Excellence in artisanal mining is an ambitious programme for Fairtrade to design. It will be important Fairtrade to start small, temper user expectations and seek the guidance of a learning and training professional as well as a monitoring and evaluation expert.

Tuesday – July 14, 2015

Session 5 – Mining and Communities

Session Chair – Rick Blake

03:30 pm – 05:30 pm

Biodiversity Management and Enhancement at the New Afton Mine

Luke Holdstock and Scott Davidson – New Gold

New Gold's New Afton mine is located in the south-central Interior Plateau of British Columbia, Canada. It is a brownfield site located in the historical Afton Mine site 10Km west of the City of Kamloops and on the Traditional territory of the Secwepemc Nation. At New Afton, a Biodiversity Conservation Plan was prepared to comply with the Mining Association of Canada's Towards Sustainable Mining standards. This plan outlines projects, activities and partnerships with respect to managing biodiversity. The objectives of the Biodiversity Conservation Plan are to: increase the understanding of the existing level of biodiversity on the site; monitor changes in biodiversity and ecosystem functionality over the life of the project and beyond, to conserve and enhance biodiversity and to assist in the ongoing design of final closure plans for the site, which will implement traditional knowledge and align with the local First Nations' expectations. Understanding site biodiversity is crucial to being able to evaluate the success or limitations of: site environmental management plans, environmental performance, reclamation programs, ecosystems functionality and traditional uses of the site. This presentation will provide an overview of biodiversity management, enhancement and innovation at New Afton, providing examples of specific projects developed at site and

partnerships established with local and regional academic institutions and local First Nations.

Mine Closure Planning of the New Afton Mine with the Stk'emlupsemc te Secwepemc Nation

Benjamin C Collins, Dr. Dirk van Zyl - NBK Institute of Mining Engineering, University of British Columbia, Canada

The New Afton Mine site, located 10 km west of Kamloops, BC in the traditional territory of the Stk'emlupsemc te Secwepemc Nation, was operated by Teck from 1978 to 1991 and re-opened by New Gold Inc. in 2012 as an underground block cave mine. The goal of this study is to use Stk'emlupsemc te Secwepemc Aboriginal traditional knowledge and incorporate it into the reclamation and closure plan of the New Afton Mine. The New Afton Mine Permit M-229, issued by the B.C. provincial government, establishes the criteria for the site's reclamation planning, which includes a statement to require reclamation back to traditional aboriginal uses where appropriate. This study analyzes what considerations need to be taken into account when planning for traditional aboriginal uses post-closure. Along with analyzing pre-existing cultural heritage studies, interviews with knowledge keepers were conducted to understand the relationship between plant life, wild life, water sources and the Stk'emlupsemc te Secwepemc traditional use pattern in the area. Site visits to both the Stk'emlupsemc te Secwepemc Nation and New Afton Mine site have taken place during this study. Visits to the New Afton property focused on determining and understanding the different areas of reclamation planning and visits with the Stk'emlupsemc te Secwepemc members were aimed to engage, recognize and understand their objectives for the long term post-closure use of the mine site. With the findings from the site visits, this study will have the necessary information to ascertain how the objectives set out by the Stk'emlupsemc te Secwepemc Nation can be used to improve the closure plan. This study delivers an analysis into the closure and reclamation plans of the New Afton Mine property while considering traditional land usage and knowledge. The expertise of the Stk'emlupsemc te Secwepemc Nation will be used to understand the level of reclamation required to enable the site for its traditional uses. The long-term environmental risks associated with an open pit and block cave mine site will be determined and planned for during this study. Finally, a discussion on the long-term site uses have been undertaken to determine the best outcome for the brownfield property while taking into account all cultural, economic and socio-environmental needs.

Fly-in Fly-out and Family Life: Observations from an Australian Remote Mine Site

Magdalena Pfaffl, Dr Connor J. McShane, Katerina Kanakis - James Cook University, Townsville, Queensland, Australia

Working environments can be challenging at the best of times. Those work environments in more geographically remote locations present additional challenges to worker wellbeing. One of these challenges is that the worker is often separated from home and family for periods of time. This study sought to identify factors of living and working in a remote settlement that positively and negatively impacted mine workers. Participants were employees from an underground mine site in western Queensland that

uses an entirely FIFO workforce. The study involved a focus group and semi-structured individual interviews. There were a total of 16 participants (13 male, three female). Findings indicated that perceived control or accessibility, family separation and social capital were the most predominant reported influences on individual feelings of remoteness. Perceptions of control were altered by the availability of transport and telecommunication services at the mine site and if this availability was consistent with expectations of availability. These perceptions of control were often cited as important as they represented connection to family. Family separation and the associated guilt of working in an industry that induced this separation presented additional challenges to individual and family satisfaction. Separation and guilt were reported barriers to readjustment to family life. However these challenges within the work and home environment were more likely to be managed if individuals had supportive work and home environments as well as a perceived connectedness to work, community and place. Building workers' resilience within the FIFO context may be achieved with limited but targeted intervention efforts. Specifically, increasing the availability of services that increases perceived accessibility to family and personal life may increase worker perceived control within the workplace and cohesiveness within the family environment. These factors in turn may enhance job and life satisfaction, decreasing risk of poor mental health outcomes and creating stability within the organisational environment.

Determination of Local Issues and Concerns Related to the Mines Operations in Northwest of the US.

Alexandra Masaitis, Glenn C. Miller - University of Nevada, Reno, Nevada, USA

Conflicts between mining companies and communities are now prevalent in many countries of the world, both developed and developing. These conflicts have often resulted in delays of mine project development as well as adverse effects on the communities. Reduction of those conflicts has been shown to be best accomplished by good communication, transparency and a willingness of each of the parties to both understand the positions of other participants, but also a demonstrated willingness to compromise. One of the types of agreements that has shown success is termed a "Good Neighbor Agreement", or GNA. The objective of a GNA is to create an open dialog between the mining company and all interested parties who may have concerns regarding the social and/or environmental impacts from the mine, to minimize the possible conflicts and disagreements, and create and implement the appropriate negotiation tools. In this case, an agreement is negotiated where good communication and frequent meetings are utilized, and the resulting agreement has sufficient safeguards to encourage/ensure that all parties abide by the agreement through closure of the mine.

The Effective Roles of Company and Local Government on Facing Mine Closure: the Business Diversification and Regional Industrialization in the Joban Case of Japan

Naoko Shimazaki - Waseda University, Tokyo, Japan

The coal industry is a typical example of industrial restructuring in Japan. Its decline had a drastic socio-economic impact on miners and local communities. The aim of this paper is to explain how actively or passively coal mining companies and local governments

worked in avoiding and minimizing the impact. The framework for analysis used in this paper involves two elements which have important implications for coping with the closure of mines: (1) the type of the mining company, for example “*Zaibatsu*” conglomerates such as Mitsubishi, or those operated as a local industry rooted in the community; (2) the location of mine, that is whether it is an inland secluded area, or island, or urban area. In this paper, I will present Joban in Japan as a successful case. The Joban Colliery Co. Ltd. was a local rooted company in an urban area, Iwaki City. It closed down in 1971, resulting in the largest number of dismissed workers in Japan. Facing mine closure, and using two regional promotion measures of local government, both the Company’s diversification in the 1960s and regional industrialization played significant and effective roles.

Sustainable Development and the Construction Phase: Digging Deep into the Risk of Contracts and Contractor Behaviour

Janis Shandro, Monkey Forest Consulting Ltd./Research Fellow, Norman B. Keevil Institute of Mining Engineering

Trevor Kalinowsky, Tim McLaughlin, Gary MacDonald - Monkey Forest Consulting Ltd.

The construction phase of any large-scale extractive industry project marks a period of significant environmental and social change. Depending on the project, impacts and risks associated with labour and workforce, resource use and pollution, community health and safety, land acquisition and involuntary resettlement, biodiversity/natural resources, Indigenous Peoples, and cultural heritage may require management. While, the International Finance Corporations (IFC) Performance Standards (PS) for Environmental and Social Sustainability have been widely acknowledged to be the most rigorous and effective at managing risks associated with the above topics, it is the author’s experience that effective implementation of the standards hinges on contracts and contractor behavior. Guidance specific to construction phase engineering, procurement and construction (EPC) contracts and sub-contractor behavior is largely unavailable. This paper is based on professional experience in implementing and providing independent due diligence assessments for a multitude of large-scale extractive projects across the globe related to the IFC Performance Standards. It begins with an overview of the IFC PS’s with a focus on major risks associated with the construction phase and contractor behaviour. Common contractual relationships between owners, an EPC contractor and subcontractors are then reviewed through a risk lens. Evidence that points to the immediate need to consider EPC contracts as a fundamental base layer towards managing sustainability risks and impacts is provided through review of a recent case study of a complex \$9 billion extractive project that involved more than 30 subcontractors and a workforce of 30,000 under a high risk contract.

Tuesday – July 14, 2015

Session 6 – Mineral Education and SD

Session Chair – John Craynon

03:20 pm – 05:20 pm

Community Engagement as Means of Ensuring Sustainability of Minerals Education

G. Dzinomwa - Paasol Resources (Pvt) Ltd, Harare, Zimbabwe

D.K. Tesh & H.K. Musiyarira - Department of Mining and Process Engineering, Polytechnic of Namibia, Private Bag 13388, Windhoek, Namibia

Universities have always been under criticism for being 'ivory towers' focusing on teaching and learning and research with limited engagement with the communities in which they serve. Recently the focus has shifted to community engagement as being significant in provision of relevant tertiary education. For any country to develop technologically there must be a strong link between its industry, government and academic institutions. This study investigated how the Minerals Engineering Department at the Polytechnic of Namibia has been performing in moving from limited involvement to full community engagement. This paper reviewed the interventions made by the department to ensure the sustainability of its minerals education programmes through community engagement. The methodology consisted of an extensive literature and strategic goals review, identifying the gaps and mapping the goals and strategic actions to get to the desired state of community engagement. One key finding of this study was that for the department to remain relevant it has to find a mechanism of achieving national development needs through directing the teaching and research programmes at meeting the current and future needs of the country. The main outcome of this study was the creation of a model for engagement whose objective function is based on the triple helix approach which seeks to bring government, industry and universities together in seeking lasting solutions to the various problems plaguing their communities. The major strategies employed by the Department were offering training and consultancy services to industry, hosting symposiums and high school career fairs and helping government ministries to monitor abandoned mines among other strategies. This has the overall benefit of delivering well rounded graduates ready for the industry and has financial spin offs through industry chipping in to assist. This kind of approach brings the academic activities in close contact with the needs of their communities.

Social Risk in the Extractive Sector: Do Miners Need New Skills to Be Successful?

Jocelyn Fraser and André Xavier - Norman B. Keevil Institute of Mining Engineering, University of British Columbia.

The past five years has been a tumultuous time in the global mining sector. Declining commodity prices, revenues and profits; increasing capital costs and debt levels; and, the realities of mining lower grade deposits often in remote areas, has created risk for projects around the world. Traditional risk factors were exacerbated during this period by an increasing number of mining-community conflicts, and the need to earn the trust of

a growing number of stakeholders so that mining projects may be developed effectively. Research published in 2014 indicates that lack of social acceptance is now a leading – and costly – cause of delays for mining projects around the world (Davis & Franks, 2014). This suggests that building successful mining projects requires more than technical and financial expertise, it also requires specialized skills to work effectively with a myriad of different groups that have earned a legitimate right to have a voice in development that affects their communities. This paper presents the results of a media analysis examining incidents of company-community conflict in the global mining sector and reflects on the set of competences that can assist in preventing and addressing these conflicts.

Educating Managers and Leaders for Responsible Mining in Africa: A Post-Graduate Degree Programme

JL Broadhurst, J-P Franzidis, STL Harrison & H von Blottnitz - Minerals to Metals Initiative, Department of Chemical Engineering, University of Cape Town, Cape Town, South Africa

A sustained programme of research and human capacity development in the context of the extraction and processing of mineral resources in Africa is considered critical in ensuring that the mining sector continues to thrive and contribute to socio-economic development in a manner consistent with sustainability principles. To this end, the University of Cape Town, in collaboration with the University of Zambia and the United Nations University, has developed a new inter-institutional and trans-disciplinary Master of Philosophy degree programme specializing in Sustainable Mineral Resource Development that highlights the critical factors of sustainable development in the context of mining and minerals processing in Africa, and trains graduates to develop relevant knowledge at an advanced level through research. This innovative and progressive programme targets graduate professionals from across a spectrum of disciplines, including geologists, engineers, planners, strategists, lawyers, regulators, health professionals, safety specialists, environmental officers, economists and social scientists. This paper describes the programme design and outlines the four core course modules. Key learnings and outcomes experienced to date are highlighted.

Embedding Sustainable Practices into a Mining Engineering Degree: A Ballarat Perspective

M. A. Tuck - Associate Professor of Mining Engineering, School of Engineering and Information Technology, Faculty of Science and Technology, Federation University Australia, Ballarat, Vic, Australia.

Mining Engineering degrees have evolved over time to reflect the needs of the mining industry, educational requirements and the constantly evolving world in which mining operates. Whilst technical skills are still of prime importance to educating future generations of mining engineers there is a need to also embed other skills and knowledge into degree programs. This is in part influenced by engineering accrediting bodies such as Engineers Australia but also by wider community and industry needs. Sustainable development is an example of this and is an essential element to be taught to mining engineering students.

This paper outlines the development of the new Bachelor of Engineering (honours) Mining Engineering program at Federation University Australia to satisfy the needs of

embedding sustainable development and the principals of social licence to operate within a highly technical engineering degree. The current thinking of how this can be done is outlined and includes embedding sustainable development principles into technical subjects and other subjects within the degree program, ensuring that accreditation needs are still met. The design of the program also ensures that future changes can be embedded into the program readily.

EITI Sub-National Reporting: Comparative Perspectives of Mongolia

Bulgan Batdorj, Jonathan Brasnett, Carlos da Costa, Jocelyn Fraser, Justin Kwan, Harry (Yixiang) Li, Bérangère Maïa Nathasha Parizeau, Debbie Prasad, Mario Ramirez, Lotus Ruan, Christina Toepell, and Stephanie Zimmerling, Dirk van Zyl, Julian Dierkes

The Extractive Industries Transparency Initiative (EITI) is a global standard in resource-revenue transparency for oil, gas, and minerals. The “EITI Principles” were established at a conference in London, England, on June 17, 2003, and set out the underlying tenets of EITI, including sustainable economic growth. EITI is a method to improve governance accountability, fight corruption and address poverty, and the annual EITI report provides a tool for member countries to engage in political and public debate on resource-revenues expenditures. In 2011, EITI introduced sub-national reporting (SNR) for all member countries; however, there is currently no EITI sub-national reporting framework. This research seeks to understand the emerging country-specific SNR capacity, implementation strategies, challenges, and benefits, for thirteen EITI member states. This paper reviews sub-national reporting capacity, within the context of the politico-singularities for the following countries: Guatemala, Ghana, Indonesia, Kazakhstan, Kyrgyzstan, Mauritania, Democratic Republic of the Congo (DRC), Mongolia, Myanmar, Peru, Philippines, Republic of Congo, and Yemen. This research makes note of the structure of each country's political economy, as well as societal trends most conducive to the effective implementation of SNR. The research findings suggest that countries with stronger democratic institutions which uphold the rule of law, and those which are predominantly operating mining activities, are most likely to produce effective sub-national reporting initiatives. Based on the synthesis of the research and its conclusions, several policy recommendations will be made concerning EITI SNR communication strategies for Mongolia.

An Innovative Solution to Enhancing the Mining Curriculum

*Simon Houlding & Mariana Reinoso (EduMine)
Malcolm Scoble – Norman B. Keevil Institute of Mining Engineering - UBC*

There is a shortage of qualified, experienced faculty with which to build adequate curricula at mining schools around the world. One of the best ways to counter this is to involve industry specialists wherever possible. However, industry specialists tend to be in great demand and have limited availability. An effective solution is to get industry specialists to develop online, on-demand courses that can be taken by anyone in the global mining community at any time... i.e. to dramatically increase the teaching effectiveness of each specialist. There are four key requirements for ensuring that this is a viable, cost effective solution: (1) a sustainable business model based on royalties that makes it attractive for specialists to develop such courses; (2) a lightweight course

delivery platform that is effective in the remote areas with poor communications where mining tends to occur; (3) development of a critical mass of available courses on appropriate mining topics that allows both mining companies to supplement their training programs and mining schools to enhance their curricula; (4) accreditation and quality control of the courses. This paper presents the development of such a solution by EduMine (the professional development division of InfoMine Inc.) and the University of British Columbia.

Wednesday – July 15, 2015

Session 7 – Water in Mining

Session Chair – Bern Klein

01:30 pm – 03:10 pm

Sustainable Mine Water Management: A Case Study of Namibia's Uranium Industry

H. Musiyarira & D.K. Tesh - Department of Mining and Process Engineering, Polytechnic of Namibia

G. Dzinomwa - Paasol Resources (Pvt) Ltd, Harare, Zimbabwe

Namibia is the fourth largest producer of uranium in the world and all the uranium mines are in the Erongo region, which is one of the driest areas in the country. The mining industry depends and impacts on water resources, and extraction of uranium coupled with anticipated increase in water demand, has created significant stress on the water resource for the region. Sound water management is fundamental for mining operations to achieve environmental compliance. The current resource utilisation in most of the mining industry is not sustainable; a lot of water is taken from municipal water supplies at drinking level quality and is polluted through use and then discharged whereas some of these operations can utilise lower than the drinking quality. In this research, the uranium mining industry in Namibia was assessed for opportunities to reduce fresh water intake while minimising pollution, soil contamination and water costs. An extensive literature review, cleaner production assessment and benchmarking with best practices were carried out. This research shows that over a seven year period, freshwater consumption was reduced from 0.70 m³ to 0.32 m³ per ton of uranium ore milled resulting in substantive financial savings as well as the delay in water augmentation through seawater desalination. Typical pre-assessments indicated that a further water savings of 20% to 30% against the current levels could be realized through closing the loop as well as equipment and facilities modification. The strategies employed by the Namibian uranium companies involve engaging stakeholders and creating awareness, recycling and reuse and minimisation of water losses. However, one missing ingredient for water management has been the use of innovative technologies and a dedicated mine water management research centre within the country. Namibia's industrial leaders have increasingly recognized that reducing the water footprint of mining activities must be one of the key performance indicators for management.

Low-Tech, Low Cost Water Solutions: How to reach the last 10% who don't have access to clean water?

*Brandon Nichols, Andre Xavier - University of British Columbia
Kaira Wagoner, Robert Pillers - Potters for Peace*

Approximately 10% of the global population, 780 million, lack access to clean water resulting in over 3.4 million deaths from water related illness annually. Over 99% of these deaths occur in the developing countries, the majority resulting from diarrhea, the second largest cause of death of children under five. Providing clean drinking water to those without it in rural-undeveloped parts of the world is a social and technological challenge. Meeting these challenges requires a solution that is easy to use, affordable, constructed from local materials and creates positive economic outcomes from the diversification of the local economy and empowerment of its citizens. Ceramic Pot Water Filters (CPWF), a bucket shaped container constructed from clay and sawdust to create a porous filter capable of filtering particulate, bacteria and some viruses from water. To improve filters efficacy each CPWF is coated with colloidal silver, which adds an antimicrobial factor to the pot so it can remove 99.8% of bacteria, decreasing incidences of diarrhea by 50%. CPWF are currently manufactured in 50 factories in over 30 developing countries around the world. Invented in 1981 by Dr. Fernando Mazariegos, CPWF production techniques and technology has been promoted by international NGO Potters for Peace since 1998. Their entrepreneurial model departs from standard aid models, instead focusing on empowering local people with the education, technology and business partners they need to develop private and co-operative filter plants that supply the local community CPWF to be used in the home. Our paper will describe how CPWF work, present examples of successful CPWF operations that have successfully decreased water born diseases in developing areas and outline the social, technology and economic hurdles CPWF currently face. In addition, paper explore alternatives for collaboration where NGO, mining companies, academia and governments can come together to address the challenges of meeting global water needs while promoting local economic development.

Catchment-based water management in the mining industry: Challenges and solutions

*Nadja Kunz - Swiss Federal Institute for Aquatic Science and Technology (Eawag),
Überlandstrasse 133, CH-8600 Dübendorf, Switzerland*

The mining industry's aspirations towards a catchment-based water management approach has similarities with the concept of Integrated Water Resources Management (IWRM) which has been committed to by many governments around the world. However IWRM has proved challenging to implement in practice. This paper considers the question: *Which challenges are mining companies likely to face when implementing a catchment-based approach at a mine site level?* Drawing on lessons from the IWRM literature, it is argued that three coordination challenges must be overcome: fit, horizontal interplay, and vertical interplay. The problem of fit arises because the boundaries of mining leases do not align with water catchments, necessitating collaboration between companies to manage cumulative impacts. Problems of horizontal interplay arise because mining sites are typically one of several water users within a catchment, requiring that they liaise with diverse stakeholders to understand the

multiple values provided by water. Problems of vertical interplay arise across organizational levels and require alignment between corporate and site priorities. Drawing on examples from Australia, Mongolia and Germany, each coordination challenge is described, mechanisms for overcoming each challenge are discussed, and the paper concludes with future research directions.

Water Panel Discussion – Chair Bern Klein

Wednesday – July 15, 2015

Session 8 – Mining and Communities

Session Chair – Jennifer Broadhurst

01:30 pm – 03:10 pm

The Need for Public Support for Mining Projects: Case Studies from Romania, Chile/Argentina, Kenya and India

*Solongo Bumtseren, Debra Stokes, Ali Kuyuk, Javier Nava, Utku Baskurt – Norman B. Keevil
Institute of Mining Engineering – University of British Columbia*

Mining projects are being stopped worldwide by lack of public support. Although mining companies today accept the need to obtain a social license as well as a mining license, the issue of lack of public support still exists and some projects are delayed or stopped with significant money and time lost. This paper presents four case studies where projects were stopped, in Romania, Chile/Argentina, Kenya and India. A brief history of each case study is given along with the main concerns raised by the public. Through these case analyses, it is argued that if companies were to meet three conditions, obtaining a social license, contributing to sustainability and adhering to the FPIC principles, a trusting and respectful relationship can develop with local communities which can create shared value, allowing for Projects to move forward towards development.

Planning It Right: A Value-Focused approach to Responsible Mining and Indigenous Planning In Post Tsilhqot'in Decision British Columbia

*Christopher Carter - School of Community and Regional Planning – UBC
Malcolm Scoble - Norman B. Keevil Institute of Mining Engineering - UBC*

All 41 proposed and active mineral development projects in British Columbia today rest within the traditional territories of indigenous peoples. Today more than 1,200 modern Aboriginal communities are within 200km of producing mines, 70% of which remain in modern treaty negotiation. Meanwhile, Canadian Supreme Court cases such as *Tsilhqot'in v. British Columbia* (2014) extend rights, title and land management beyond areas of intensive use. This decision sets a precedent for mine development and land use decision-making. Informed by new legal terrain, the fields of mine planning, indigenous community planning and the decision sciences we 1.) Provide literature and legal analyses of the state of mineral development on indigenous lands today in British

Columbia today 2.) Evaluate and quantify the performance of one BC copper-gold mine development plans and policy using indigenous planning and ICMM principles and 3.) Offer actionable recommendations towards a strategic and value-focused approach to mine planning.

Reputation and Property Rights - the Mining Industry

J. Tuck - Federation University Australia, Ballarat, Victoria, Australia

This paper presents a property rights view of reputations based on a study of stakeholder reputations in the mining industry. This study reinforces the importance of the relationships between economics, community, environment and governance and identifies that stakeholder reputations are complimentary resources in the resource based view of the firm. In particular, the place based nature of community reputations and the nature of competitive activity in the mining industry, based on gaining and maintaining access to mineral resources – social license to operate – have implications for reputations as a strategic resource for the mining industry. Relatively good reputations with communities are not necessarily rare within the mining industry generally. However, reputations may not be transferable between communities. The irony is, as reputations are hard to imitate, mining companies may find it difficult to replicate in new communities – what makes them valuable may also be problematic. From a strategy perspective, the ability to create, appropriate and sustain value from resources in part depends upon the property rights held and how well they are protected. Thus, relatively good stakeholder reputations can be viewed as necessary both to obtain and protect the rights to mineral resources, to minimize constraints on property rights and reduce the costs of operation.

Determining the Socio-Economic Factors Imperative to Enhancing the Participation of Women in the Extractive Resources Sector in Papua New Guinea

Lesley Bennett - Women in Mining, Papua New Guinea Chamber of Mines and Petroleum

Much has been documented about the benefits of women's participation in development generally as well as specifically women in extractive resource communities in Papua New Guinea, however these studies have been conducted from an anthropological lens. My presentation will highlight the importance of identifying the socio-economic factors either as impediments or enabling the empowerment of women in this sector in the context of resource development in Papua New Guinea. During my eight years of intimate contact with women in this sector I have concluded that the lack of knowledge of factors such as the traditional leadership role that women play, religion, and in-migration have significant implications on the participation of women in extractive resource development. In Papua New Guinea all of the major mineral, oil and gas operations are situated in geographically remote locations. The majority of the population until very recently has had very little contact with the outside world, most are illiterate and have suffered from the lack of basic government services such as health and education. I will base my presentation on the need for a deeper contextual understanding of the social, cultural and economic dynamics affecting the participation of women in this sector in Papua New Guinea and recommendations to ensure that a more holistic approach is

considered when designing empowerment and capacity building programs for women in this sector in Papua New Guinea.

How To Select The Most Appropriate Indicators For Sustainable Mining – A Case Study Of Sangam Iron Ore Mines (SIOM) In Iran

Jürgen Kretschmann - President, TFH Georg Agricola zu Bochum, Bochum, Germany

Ravanbakhsh Amiri - PhD Student, Institute of Mining Engineering I, Faculty of Georesources and Materials Engineering, RWTH Aachen University, Aachen, Germany

The United Nations' Brundtland report provides a foundation for sustainable development but fails to explain how to implement it. As a consequence academics, politicians, and industrialists all around the world have developed numerous policy frameworks, strategies, management guidelines and indicator sets to operationalize what sustainable development really means in practice and how it can be measured. Indicators development can be a useful tool for decision-makers enabling country specific and regional analyses of the status and the progress towards sustainable development. However, due to innumerable indicator sets the question emerges how to select the most appropriate indicators for a mining project. Based on a case study of the Sangam Iron Ore Mines in Iran, the authors will describe a two stage process to select indicators. Firstly, the indicators are selected by the criteria long term measurability and relevance for the most important stakeholders of the mining project. Secondly, the evaluation is based on a Fuzzy Delphi Method (FDM) using questionnaires that are distributed among representatives of the different stakeholder groups. As a result, fifteen indicators with the highest priority for the stakeholders of this mining project could be determined and can be used to evaluate the sustainability of SIOM mining project.

Wednesday – July 15, 2015

Session 9 – Leading Practices in SD

Session Chair – Janis Shandro

03:30 pm – 05:30 pm

Substance Flow Analysis and Mineral Policy: The Case of Potash in Thailand

Kridtaya Sakamornsnguan - Institute of Mining Engineering I, RWTH Aachen University, Aachen, Germany

Jürgen Kretschmann - TFH Georg Agricola zu Bochum, Bochum, Germany

Mining is an economic activity linked to different parts of the economy. The development of mining projects can affect existing socio-economic activities and the environment in many ways. In Thailand, there have been efforts to develop potash mines in the Northeastern part of the country. Government plays an important role on balancing the positive and negative impacts, but current consideration focuses mainly on the project-level impacts. The lack of understanding of impacts at the macro-level, particularly the role of potassium in the economy, can prevent the government from implementing effective mineral policy. The use of Substance Flow Analysis (SFA) to quantify flows and stocks of potassium should be useful for identifying changes caused by mining projects and should be applicable to mineral resource management. This article aims to enhance

better understanding of potassium situation in Thailand and potential effects of new potash mining projects on long-term supply security. An SFA is conducted to analyze the current flows of potassium in Thailand. Then, changes in flows and stocks caused by investments in new potash mining projects are examined. Possible implication of this information on the mineral policy of Thailand is briefly mentioned.

Assessment of Rehabilitation Completion Criteria for Mine Closure Evaluation

Mascha Blommerde, Ros Taplin & Simitkumar Raval - The Australian Centre for Sustainable Mining Practices, School of Mining Engineering, University of New South Wales, Australia

In order to minimise the impact of mining on the natural environment, closure rehabilitation legislation and bonds systems have been put into place in most regulatory environments in developed countries. Success criteria (e.g. soil, water, flora and fauna) are established for mine closure plans and codes of practice for such regulations. Mining companies are required to abide by these criteria to have their bonds refunded and leases relinquished by government.

This paper looks into the closure criteria in New South Wales, Australia specifically, as well as comparing closure criteria with the other states and territories in Australia and leading practice in Canada, the United States and European Union. The research for the paper involves investigation of rehabilitation success criteria and the possible evaluation of mine closure success.

This study has highlighted the need for stronger guidance and key requirements for closure success. A stronger framework is therefore needed to quantify the different rehabilitation success criteria to be able to attain a well-documented evaluation of mine closure success. Robust quantification of the completion criteria, if verifiable, could assist mining companies as well as regulatory bodies to achieve best possible outcomes. Further research into key requirements of the closure criteria as well as a closure framework or tool is recommended.

The Challenges of Investing and Strengthening Relationships with Canada and Mongolia

*Bulgan Batdorj, Michael Hitch, Andre Xavier
Norman B. Keevil Institute of Mining Engineering, University of British Columbia*

Mongolia has been regarded as an emerging market, offering specific opportunities for Canadian mining and exploration companies to seek cooperation and prosperity. The Canadian government has included Mongolia in its 'Global Market's Action Plan 2013 and lists Mongolia as one of its 25 'development countries of focus'. Despite these official endorsements, Canadian businesses are failing to succeed due to unstable domestic policies and a growing sense of nationalism amongst its key policy makers. The Canadian approach to Corporate Social Responsibility (CSR) has historically not produced significant results and was largely based on philanthropic and short-term initiatives that are perceived by many Mongolians as a strategy to directly benefit Canada. This paper examines the existing paradox of investing and strengthening relations with Mongolia and mending the frail business environment that negatively affects Canadian mining and exploration enterprises.

Certification and Due Diligence in Mineral Supply Chains – Benefit or Burden?

Philip Schütte - Federal Institute for Geosciences and Natural Resources (BGR), Bujumbura, Burundi

Gudrun Franken - Federal Institute for Geosciences and Natural Resources (BGR), Hannover, Germany

Patricie Mwambarangwe - Federal Institute for Geosciences and Natural Resources (BGR), Kigali, Rwanda

Due diligence in mineral supply chains refers to the responsibility of companies to respect human rights and avoid contributing to conflict. International legal requirements for due diligence have been factored in by the industry to develop adapted sourcing concepts impacting on the supply chains of tin, tantalum and tungsten ore concentrates from the Great Lakes Region. In parallel, the region's governments have established a mandatory certification mechanism to facilitate due diligence compliance. In Rwanda, both industry- and government-led efforts over the last four years have resulted in significant progress in implementing due diligence concepts in the artisanal and small-scale mining sector. In this contribution, we are reviewing the implementation of these measures and discuss associated impact factors, challenges and constraints. We argue that more effective coordination and alignment between industry and government efforts is needed to improve implementation efficiency and influence relevant risk parameters. These aspects become particularly important when reflecting about the need to establish a regional level playing field for due diligence mineral sourcing.

Risk Management in the Extractive Sector

Karim Ramji - Donovan & Company, Vancouver, BC, Canada

The extractive sector is facing three growing risks from: (1) stakeholder activism, (2) resource nationalism, and (3) capital costs uncertainty. The project pipeline has been shut down because of these uncertainties. The spectrum of stakeholders has increased and their ability to thwart projects has grown in scope. There is a need to develop better stakeholder identification, management and engagement strategies so that the permitting hurdle does not become insurmountable. The surface risks are the single most critical factor in determining whether a viable geological ore body will reach production. Relationships with key stakeholders need to be transformed into Impact Benefit Agreements. New projects will need to have sustainable socio-economic benefits for local communities as mining makes a paradigm shift from an “extractive” industry to the “development” business. Investment Agreements and support from Export Credit Agencies will also become necessary to counter the risks of Resource Nationalism, especially in jurisdictions where the rule of law, an independent judiciary and political transparency are not firmly entrenched. The capital cost/time uncertainty can be addressed through more due diligence and ensuring that the surface platform has been secured. Large world-scale mines in challenging locations should be passed over in favor of smaller projects, with the possibility of incremental brownfield expansions.

Wednesday – July 15, 2015

Session 10 – Environmental, Social and Legal

Session Chair – Muza Gondwe

03:20 pm – 05:00 pm

Development of a Mathematical Model for Particle-Droplet Interaction for Dust Control

John-Glen Swanson - Oregon Institute of Technology, Klamath Falls, Oregon, USA

Cristina Negoita - Oregon Institute of Technology, Klamath Falls, Oregon, USA

Water spray systems are a common method used for dust control in mining. Often, the spray nozzle being used is either provided by the equipment manufacturer or chosen based upon previous experience. Unfortunately, this does not necessarily lead to the best possible dust control for a specific application. A detailed understanding of the relative sizes of the water droplets and dust particles as well as their relative speeds, concentrations and properties combined with the interaction environment provides the information needed to fully evaluate the quality of a dust control spray system. The development of a mathematical model that incorporates these criteria can provide the dust control engineer with a basis for evaluating the best nozzle to install for a specific application. On the basis of the Navier-Stokes Equations the flow around a water droplet will be modeled and modified to represent the two-phase fluid flow. Here the dynamics of the system are governed by the continuous phase of ventilation air containing dust particles and the relative velocity to the water droplets. Incorporating the momentum equations, the pathlines of the dust particles and collision with water droplets can be described. Finally, the capture efficiency of a specific nozzle can be determined from the model. Providing the engineer with simple spray nozzle selection criteria based upon known information would provide for a better use of resources and best possible dust control for the specific mining operation.

Environmental Impact Indicators and Mining Method

Shinsuke Murakami Taiga Takasu Akiyuki Masuda - The University of Tokyo, Bunkyo-ku, Tokyo, Japan

Eiji Yamasue - Kyoto University, Kyoto-shi, Kyoto, Japan

Tsuyoshi Adachi - Akita University, Akita-shi, Akita, Japan

Environmental impact of mining varies depending on its local environment, geology and mining methodology. Recent sustainable resource use/management discussion usually analyze macro environmental impact of mining industry as a whole and its trend, such as potentially increasing environmental impact because of decreasing grade. However, deeper pit therefore huge waste/ore ratio let some mines shift from open pit mining to large-scale underground mining such as block caving. Some of the environmental burdens, such as carbon dioxide emissions, land use change, may even decrease thanks to this shift. Then, in order to see what kind of indicator is useful to analyze the environmental impact for different mining methods, we estimate, land use change, carbon dioxide emission, TMR, Ecological Footprint (hereafter EF) for three copper mines, two are open pit mines while the other is an underground mine. In the estimation, we found out the conventional EF is not necessarily appropriate for analyzing the

individual mines. Most serious issue is the assumption on built-up land. The yield factor for Built-up land is assumed to be equal to that of cropland. However, in some mine locating in dessert area, the factor for cropland is obviously too huge. Also, these factors usually prepared country basis. Combining with TMR, which is weight therefore reflects not area but volume, EF has some potential to evaluate the difference of impact by mining methodology.

Promoting Sustainable Artisanal Mining in Africa: The Case of Rwanda

Chilenye Nwapi, Banting Postdoctoral Fellow - Canadian Institute of Resources Law - University of Calgary

Until recently, artisanal mining was isolated from the mainstream of economic development in Africa. In most countries, it was even illegal, which prevented it from becoming an accepted economic activity and from contributing to government revenue, despite its prevalence. Because most mining operations in Africa takes place at the artisanal level, the loss in government revenue is colossal. Lack of legal recognition forced artisanal miners to operate in clandestine fashion without any consideration of the socio-environmental impacts of their activities. Since the government did not recognize their activity, it could not require them to adopt environmentally sustainable methods of mining. This prompted calls for formalization of artisanal mining to give it legal recognition to enable governments regulate and monitor the activity through a licensing process that grants artisanal mining rights to persons who meet prescribed requirements. In 2014, the government of Rwanda responded to these calls by enacting *Law No 13/2014 of 20/05/2014 on Mining and Quarry Operations*, which came into force on 30 June 2014. This is the latest mining legislation in Africa. It redefines the relationship between miners (both artisanal and large scale) and the government and the people, with the ultimate goal of promoting investment in the mining sector and, consequently, increasing government revenue from mining. The purpose of this paper is to review the potential of this law to effectively promote the realization of sustainable artisanal mining in Rwanda. It identifies aspects of artisanal mining that the law deals with. While it argues that the law is a giant step in the evolution of artisanal mining in Rwanda, it offers a critique of the limitations of the law from a sustainable development perspective.

Land and Mineral Rights in Uganda: A Reform Agenda

*Bwesigye Don Binyina - Africa Centre for Energy and Mineral Policy
Naima Hasci - World Bank*

This Paper Originally prepared for presentation at the
“2015 WORLD BANK CONFERENCE ON LAND AND POVERTY”
The World Bank - Washington DC, March 23-27, 2015

This paper seeks to address competing land access rights between landowners and mineral rights holders in Uganda. It analyses the strength and weaknesses of the existing policy and regulatory frameworks, and highlights areas of divergence, and gaps. It raises policy questions and suggests policy options and regulatory reforms with the impetus to unlock the country's mineral economic potential and facilitate the co-

existence of the mining industry and human development, leading to shared prosperity and sustainable development. Recent increased inflow of Foreign Direct Investment from developed economies and the emerging Asian economies of China and India have exacerbated land grabbing and human displacements leading to massive violations of human rights. There are fears that proposed amendments to the constitution designed to grant government more powers to compulsorily acquire all mineral rich land without Free Prior and Informed Consent, prompt and adequate market value compensation will lead to more human right violations and culminate into “ a crowding out effect” against other sectors of economic importance, such as, the agricultural sector and the vibrant tourism industry leading to a resource curse. The paper suggests adoption of international best practices on exploration and mining on private and communally (Natively) owned land in Australia and Canada as a solution in defusing emerging tensions and conflicts between mining companies and landholders in Uganda. (Lenny Roth, 2012).

A Journey Toward Local Content Regulation for Better Extractive Industry Governance, Lessons Learned from Gumas District – Central Kalimantan, Indonesia

Dian Anggraeni - Project Coordinator, Yayasan Tambuhak Sinta

Since 1998, YTS has invested heavily in the development of the district of Gunung Mas (Gumas) in Central Kalimantan in Indonesia. Over the last eight years, the foundation has developed a model of CSR for the Kalimantan Gold Corporation, a junior mining exploration company listed on the Canadian exchange. YTS is dedicated to fostering sustainable development in Central Kalimantan through activities that harmonize the interests and well-being of civil society, businesses, government, and other key actors in the province. Governance Project of YTS was started with the aim of cognitive development of government staff and officials on good governance principles and technical skills to deliver those principles especially planning and budgeting. The objective is to make sure that the government has adequate capacity to formulate and implement local content regulation for better extractive industry governance in Gumas. In conducting this project, YTS found that economic considerations taken by the government should not focus solely on revenue generation but also include the assessment on how this business can provide employment, skills development and labor migration. Government has to be accountable in appraising the environmental impacts of mining and the consequences for sustainable regional development. The debate about CSR role for sustainable development emphasized that CSR has to be a complementary aspect within the government framework for sustainable development.

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