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A framework of toolbox for managing risks in the minerals sector

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Introduction - positive spillover

- The document of The Future We Want, resulting from UNCSD/Rio+20 states
- > minerals & metals make a major contribution to world economy & modern societies
- > mining industries are important to all countries with mineral resources, in particular developing countries
- to offer opportunity to catalyze broadbased economic development, reduce poverty & assist in meeting development goals such as UNMDG

Introduction - negative externalities

 Nature of MD is such that adverse impacts on mines & local communities are inevitable
 Mine hazards such as ground collapses & roof falls, U/G explosions & outbursts, fires, floods & land slides often occur with tremendous harms to property & personnel

Mineral extraction also involves largescale & long-lasting alterations of the environment, leading to various forms of biological degradation, pollution, damage and human health & safety hazards around mining communities

Introduction - interwoven impacts



Introduction - risks & sustainability

Faced to OSH, E, E & socio-political, the question is not only sustainability but also responsibility & capacity

- by promoting app of RAM²T in MS
- thru strict professional & EE principles with respect for S/C values of countries where MMP occurs
- > to mitigate W/P, S&E risks associated with MMD & conserve biodiversity & ecosystems
- WFEO & SME SD&M TF RAM²T group proposed a toolbox or KW approach for SMEs to build capacity in managing risks as associated with MMS

Problem & approach - total view



Problem & approach - delineation

Goal: aligned w/TF, KWORAMT is to help raise U/S & E&T app to increase MMS contributions to ES&E wellbeing & SD & that of mining communities Objective: aligned w/TF Theme 5, KWORAMT is to aim at promoting app RAM²T in MMS & SMEs Context: KWORAMT users are SMEs & contexts such as E/S situations & S/H values are adapted to region by region levels Knowledge sources: KWoRAMT sources include all in 3 sectors from SME TF experts & Internet such as codes, standards, guidelines & best practices

Problem & approach - process

Development cycle: three KWoRAMT stages

- > design for conceptual/model
- > implementation for illustrative prototype
 on Internet
- > advancement for intelligence with KB & KD
- SME TF work product: conceptual framework done & illustrative prototype anticipated as final work product/outcome of TF Theme 5
- <u>USTB research</u>: intelligent KWoRAMT as medium-term or long-term efforts at USTB

Model framework - total view



Architecture: knowledge base/warehouse, B/S based platform, web oriented interfaces, ...

- Functions: navigation w/links, tools w/annotations, best practices w/cases, searching w/learning, guidance for users/stakeholders, ...
- Components: risks w/LC, hazards/risks sources, impacts/consequences/severity, likelihood, capacity or vulnerability, pathways, receptors, ...

Model framework - risk elements

Risks: risks of OSH, ME & CE throughout MLC from prospecting, exploration, development, & exploitation to post-mining closure Hazards: OSH, roof falls, outbursts, fires, floods, blasts/explosions, ground subsidence/collapse, disposals, toxic/chemical emissions to air, water & soil, ecological/aquifer/vegetation losses <u>Impacts/consequences</u>: OSH, pollution, land/biodiversity damage, community interactions, economic effects, project profitability, resource efficiencies & other stakeholder needs

Model framework - risk elements

Vulnerability: hazards interacts with vulnerability or capacity & dynamically evolves from dormant thru armed with potential harm to active accident Pathways & receptors: in terms of HHRAP by US EPA, vulnerability links hazards onto receptors such as firms, employees, community & national level thru > pathways such as energy releases, physical forces, air, waters, soil & biota in E or at W/P, families, schools, hospitals & transport in C, & profitability, jobs, financial services & insurances in E

Model framework - risk elements

<u>Techniques</u>: ISO 31010 risk management involves communication & consultation, context establishment, assessment (identification, analysis & evaluation), treatment & mitigation, & monitoring & review

 pros & cons or strengths & weaknesses for various techniques annotated for guidance & mitigation strategies developed to enhance opportunities & reduce threats of SMEs
 <u>Best practices</u>: cases & best practices including experiences & lessons w/ problems, solutions & recommendations on solutions

exemplified



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Introduction

05511 Prospecting viewdofened eugly nopentol Mine Closure

An Intro to KWoRAMTs

KWORAMIS is proposed to help small and medium sized enterprises (SMEs) in the mining and minerals sector build their capacity for risk analysis, mitigation and management (RAM) and gain their credibility and social license to operate while simultaneously strengthening their skills and confidence in their ability to apply the risk management techniques and methodologies.

KWDBANITS is proposed to include risk management resources such as standards, guidelines, code of conducts, reports, academic papers, and internet websites. Key elements of the KWoRAMTs are focused on the critical, analytical, and in-depth comments and annotations such as pros or cons, strengths or weaknesses, and opportunities or threats of risk management issues, problems and techniques for various risk aspects and phases such as risk communication and consultation; risk context establishment; risk identification, analysis and evaluation; risk treatment and mitigation; and risk monitoring and review. Typical cases including experiences and lessons with the major problem, its solution, and annotations about how the solution was derived will also be exemplified.

In the end, the KWoRAMTs is designed by a team of students directed by Professor Zhongxue Li and other faculty members at the Department of Mineral Resources Engineering, University of Science and Technology Beijing (USTB), China.

Contends in KWoRAMTs

Risks in mine lifecycle

A risk is an effect of uncertainty state on objectives or a deviation from the expectations, and it is often expressed or characterized by a combination of the consequences of an event (including changes in states or circumstances) and the associated likelihood of its occurrence. Risks to be taken into consideration are those effects on mine occupational safety and health, mine property and performance, and community environment of mining engineering processes throughout the mine life cycle from prospecting, exploration, mine development, and exploitation to mine closure.

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Exploitation

Linit O Ruppedson Wine Development

Blasting Accidents

When underground or opencast blasting, the warning is not strict, the people into the blasting area, or blasting personnel illegal operation caused by the injury of personnel. The blasting damage including early burst, delayed explosion, blasting and misfire accident caused by the earthquake, the air shock wave, flying rocks in blasting, blasting fume poisoning hazards.



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Guidance

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Group Discussion	Firms
Scenario Analysis	Employees
Risk-Killer	Natural Community
Spread from the system	सुद्राद्य स्मान्तेम् गृत गृता गृत भूति स
Surface Collapse	Surface Mine
Tailings Pond	Underground Mine

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Remarks & acknowledgements

Presented - is KWORAMT, a multi-SH oriented & B/S web based model framework of mine risk toolbox or KW for mitigating & managing MLC risks & building SMEs capacity > to fulfill task of WFEO-SME SD&M TF Theme 5 & as M-L term research efforts at USTB Wanted - are critical comments, instrumental suggestions & further collaboration for realization Acknowledgements - are sincerely given to WFEO-SME TF leadership for initiative & to Theme 5 members & all TF members for previous inputs



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And thanks to you all For attention or organizing SDIMI

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