AGENDA

Anti-trust Policy and Code of Conduct Reminder

Safety Share

GMG Working Groups - Structure and Processes Review

Underground Mining Working Group Overview

GMG Projects – Structure and Processes Review

Project Updates

• Time Usage Model for Underground Mining
• Rethinking Mine Design
• Underground Mining Communications Infrastructure
ANTITRUST COMPLIANCE

**DO’s**

- Prepare and circulate written agendas for all GMG Annual, Board, and committee meetings, and any other meetings that may entail roundtable discussions among competitors. Conduct all such meetings pursuant to the previously prepared written agendas, and prepare clear, concise, accurate, and unambiguous written minutes of each such meeting.

- Avoid all loose, facetious, or careless remarks, especially those in writing, that could be misconstrued as posing antitrust problems if read out of context.

- Review all matters of potential antitrust sensitivity with the GMG CEO or other designated staff person. Such matters would include, for example, any proposed discussion of prices, limitation or allocation of production, division or allocation of markets or customers, and boycotts or refusals to deal with prospective customers. When in doubt or when otherwise appropriate, GMG staff will review such matters with legal counsel.

**DO NOT’s**

- Engage in any discussions with or among any competitors, regarding prices, costs, sales, margins, plans, schedules, bids, transportation rates, terms of sale, or any marketing or competitive information that could affect pricing.

- Engage in any discussions with or among competitors which relate to customers, sales territories, production, capacity, amount of reserves, output, or any other information relating to production or output.

- Exchange or discuss any other confidential statistical or financial information of any company.

- Discuss the advantages, desirability, or possibility of eliminating or impairing any competition, whether existing or potential, foreign or domestic.

- Assume that foreign sales or production are not subject to your country’s antitrust laws.

- Guess. When in doubt, get help-consult with GMG staff / representative and legal counsel.
BE FRIENDLY AND PATIENT

BE WELCOMING

BE RESPECTFUL

BE CONSIDERATE

WHEN WE DISAGREE, TRY TO UNDERSTAND WHY

A SIMPLE APOLOGY CAN GO A LONG WAY

BE CAREFUL IN THE WORDS THAT YOU CHOOSE

MODERATE YOUR EXPECTATIONS

DO NOT INSULT OR PUT DOWN OTHER COMMUNITY MEMBERS (INDIVIDUALS AND COMPANIES)
Safety share
Common language and processes and good operational practices

Data integration, interoperability and management

Enabling innovation and technology advancement

Decarbonization and ESG

Safety, culture and skills

WHO WE ARE

We are a global, multi-stakeholder network of “doers” in the mining industry who openly discuss challenges and opportunities and collaborate on solutions and the materials to support their implementation.

We achieve this by collecting industry knowledge and making it available in a structured way.

PURPOSE

Working together to be a catalyst for the operationalization of innovation in the global mining industry to improve the safety, sustainability and productivity of our mines.

VALUES

Inclusivity
Collaboration
Encouragement

Accessibility
Integrity

CRITICAL FOCUSES

GMG
Working Groups
Communities of interest focused on mining industry topics or fields, formed based on what the industry identifies as priority areas. The Working Groups launch and oversee projects.

Working Group Steering Committees
Steer a working group, launching projects that will result in valuable and relevant guidance documents.

Who can join? Leaders at GMG member companies

Project Steering Committees
Govern a project, ensuring the timely delivery of a high quality, relevant guideline, white paper, etc.

Who can join? Subject matter experts at GMG member companies

Projects
Focused efforts that produce tangible guidance for the benefit of the global mining community.

Who can join? Subject matter experts
GMG’s Working Groups represent major fields related to the mining industry aimed at addressing the industry’s most pressing issues and challenges.

The purpose of Working Groups is to create communities of interest based on industry need for collaboration to advance innovation, provide guidance, and share best practices.
This working group aims to identify and address common underground mining sector challenges and opportunities while considering the adaptability of the mine infrastructure and new and legacy technologies.

The group is a community of operators, suppliers, subject-matter experts, leaders from inside and outside the industry, and others with experience and interests related to underground mining.
UNDERGROUND MINING
FOCUS AREAS

➢ Implementation of innovative technology
➢ Operational effectiveness/excellence
➢ People, skills, and capabilities
**Underground Mine Communications Infrastructure Guidelines Suite:**

- Part I: Positioning and Needs Analysis, February 2017
- Part II: Scenarios and Applications, April 2017
- Part III: General Guidelines, March 2019

**Guideline for Implementing Short Interval Control in Underground Mining Operations,**
June 2019

**Recommended Practices for Battery Electric Vehicles in Underground**
* Mining – Version 3,
June 2022

*This guideline is now a collaboration with the Electric Mine Working Group*
PROJECT LIFECYCLE

PRE-LAUNCH
- Project steering committee guides development of the volunteer structure to enable content generation
- Phase completed when a complete rough draft is signed off by the Project committee
- Stakeholders: Ongoing verification of required expertise

LAUNCH
- Edited document to working group for final review
- Comments sent to the Project steering committee if revisions are needed
- Potential second working group review
- Stakeholders: Verification of required expertise for review

GUIDELINE DEFINITION
- Develop guideline framework
- Project steering committee revision and approval of framework
- Stakeholders: Ensure adequate input and agreement

CONTENT GENERATION
- Project steering committee guides development of the volunteer structure to enable content generation
- Phase completed when a complete rough draft is signed off by the Project committee
- Stakeholders: Ongoing verification of required expertise

TECHNICAL EDITING, LAYOUT, FINAL REVIEW
- Working group members vote on whether to publish the guideline
- GMG Executive Council has the final vote and ensures guideline adheres to GMG core principles
- Stakeholders: Ensure sufficient stakeholder representation in vote

VOTE & PUBLICATION
- Project steering committee guides creation of post-publication plan for GMG to carry out
- Dissemination of guideline throughout companies and industry
- Use and impact tracking to help determine if a new version is required
- Stakeholders: 1. Industry awareness to promote use and ensure value; 2. feedback loop

INDUSTRY EDUCATION & FEEDBACK
- Clear problem statement and industry demand
- No competing efforts
- Stakeholders: Identify and consult
THE DEFINITION PHASE OF GUIDELINE DEVELOPMENT

Workflow for the Guideline Definition phase

Identify the key focus areas (topics and potentially sub-topics) to be included in the guideline

- Draft the table of contents with clear priorities for each section
- Identify expertise and participation requirements for different sections

Project Steering Committee Approval

➢ This phase is an important step of the project lifecycle. A framework that has been well thought through will minimize the inefficient need to reorganize content at later stages in the process.

➢ Content development strategies are also often identified as the framework is pulled together.

➢ The outcome of this phase is an approved framework/table of contents with clear priorities for each section.
The objective of this project is to publish a time usage model for underground mining, covering recommendations for the consistent classification of common underground mining operational activities into standard time categories.

Potential considerations for the guideline include:

- Recommendations for the consistent classification of common underground mining operational activities, statuses, and events into standard time categories
- Alignment with the GMG surface mining time usage model, which is a visual representation of the recommended classification framework identified above
- Recommended definitions for common industry operational KPIs
This project aims to adapt the equipment time usage model for surface mining into the underground taking into account:

- benchmarking and specific processes in the underground environment.
- Short Interval Control
- Various mining methods such as stoping and block caving
- Planning
- Processing facilities
- Backfill
- Automated vs not automated

This project might expand beyond the equipment time usage model to develop a common model of the entire cycle to optimize planning and create a common ground.
GET INVOLVED

- Key drivers of this project include the need to improve:
  - Performance statistics and measurements
  - Knowledge of efficiencies and data of different machines (e.g., machine selection)
  - Understanding of equipment needs underground
  - Schedule management (understanding of activities, events, and delays underground)
  - OEM understanding of miner needs

- Content Considerations:
  - Requirements to understand machine usage
  - Understanding the stope cycle using machine data
  - Using the stope as a resource
  - Looking at the full stope cycle in order to make the entire mine more efficient

Upcoming Workshop
- July 19
RETHINKING MINE DESIGN FOR UNDERGROUND MINING

Existing mines have been designed based on technology that has not fundamentally changed in years. With new technologies emerging to enable mining at greater depth and increase safety and productivity, the design of the mine has to be reconsidered for integration and optimization of these new technologies.

This white paper will:
• provide an understanding of common considerations and new approaches to mine design in UG mining to enable the implementation of emerging technologies
• develop a framework of requirements and aspects that enable mine designers
  • define a baseline of where things stand, how things work and what is needed to be able to do things differently
• describe strategies and tools for risk management
TOPICS

Content will include:
• Defining the audience and roles – for different people in mine to understand what redesigning a mine will take through all lenses
• Creating a framework with the roles and what guidance is required
• Outline de-risking roadmaps
• List the possible risks and tie it to the business case
• Education on the toolsets to enable change (including processes and technology)
• Support from Executives

Publication target date: Q1 2024
THE CONTENT GENERATION PHASE OF GUIDELINE DEVELOPMENT

There are a number of content development approaches and coordination of work for the different stages of content generation. Below are some examples, but each project should develop its own approach as part of the project planning stage. All approaches however should always be collaborative and flexible so as not to become restrictive to volunteers.

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<th>Content Generation Phase</th>
<th>Description</th>
<th>Approaches</th>
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| Early content generation | Volunteers draft the content of the different sections of the publication | • In-person and virtual workshops  
• Sub-group volunteers work asynchronously with check-in meetings to update on progress and assess next steps  
• Sub-group volunteers meet to generate content together |
| Draft review             | Project Steering Committee will review the existing content and advise on how to complete the draft | • Project Steering Committee meetings to review |
| Late content generation  | This may require input from specific stakeholders, refinement or further development of certain sections, the adding of missing sections or the moving of certain content or suggestions to a “parking lot” for future editions. | • Peer review workshops (virtual or in-person)  
• Sub-group revisions – can be done either independently or in sub-group meetings  
• Volunteers work directly with GMG’s technical editors to revise content |
| Final project review     | Workshops to refine the content and identify if further work is needed before the Project Steering Committee signs off on the initial draft and sends the draft for the Working Group review. At this point the content generation phase is complete. | • Workshops – virtual and in-person |
This project addresses how new and existing communications infrastructure can be adapted and considered in UG mines.

A three-part suite originally published between 2017 - 2019. With new technologies now available, it was determined that a significant revision was required. The 3 guidelines are:

- Part I: Positioning and Needs Analysis
- Part II: Scenarios and Applications
- Part III: General Guidelines
POSITIONING AND NEEDS ANALYSIS

A mine communications maturity lifecycle diagram including what technology is used during what phase of the mine’s life, from exploration through to environmental restoration, covering the following:

- Positioning and radio communications
- Networking UG (wired and wireless)
- Personnel required during each phase

SCENARIOS AND APPLICATIONS

Various UG mine communication infrastructure scenarios and the associated problem statements, objectives, technologies used, and deliverables including:

- Operations between shifts
- Accelerate post-blast re-entry
- Monitoring and dispatching system
- Auto drilling support
- Autonomous mining activities
- UG environment monitoring and analysis
- Post-accident communications
- UG mapping and sampling

GENERAL GUIDANCE

Planning and design recommendations for underground communications development, some of the best practices used within mining environments, and where to find more information regarding digital communications, standards, and frameworks, including:

- Types of mining
- UG mining methods
- Ideal network topology models for UG mines
- Choosing IP infrastructure
- Different tracking technologies
- Network selection and design
- Seven-layer model for networking

Upcoming Workshops:

➢ June 28
➢ July 11
DIFFERENTIATING LIFECYCLE FACTORS

Depending on the lifecycle and current stage of the operation, some mines will have an easier time adapting to changing technology than other mines. Depending on the stage of operation, there are differences when considering what communication infrastructure is needed. For example:

- Requires more effort to retrofit
- Downtime considerations (the need to halt an operation can be a roadblock to implement)
- Training requirements and new skills sets needed
- Bandwidth requirement assessments and understanding the possibilities needed to fit the system

A digital road map to determine needs
- Rapid technology evolution (i.e. LTE today but 5G exists)
- Data requirements
The original guideline was published when LTE was just emerging for mining and was therefore not well covered.

Discussions on:
- What are the differentiating factors between LTE and other networks?
- How does monitoring, infrastructure, amount of fibre requirements, skills, and change management impact the choice of network?

Simplicity is a key factor for LTE but there is more analysis required when comparing LTE with other networks because there are still diagnostics required. For example, an LTE system with a good diagnostic platform is critical.

With LTE, a need for personnel devices impacts:
- SIM card management assuming everyone on the site has a device
- Device charging management to ensure devices are ready
GET INVOLVED

1. Validate and update technology references
2. Content on the technology itself and on the implementation and applications of the technology
3. Life cycle considerations

Timeline: Draft completion by December 2023

Upcoming Workshops:
- June 28
- July 11
THANK YOU