MINING INDUSTRY
OCCUPATIONAL
SAFETY & HEALTH

MINERALS COUNCIL
SOUTH AFRICA

GOOD LEDGING PRACTICE

FOR HARD ROCK NARROW TABULAR REEFS

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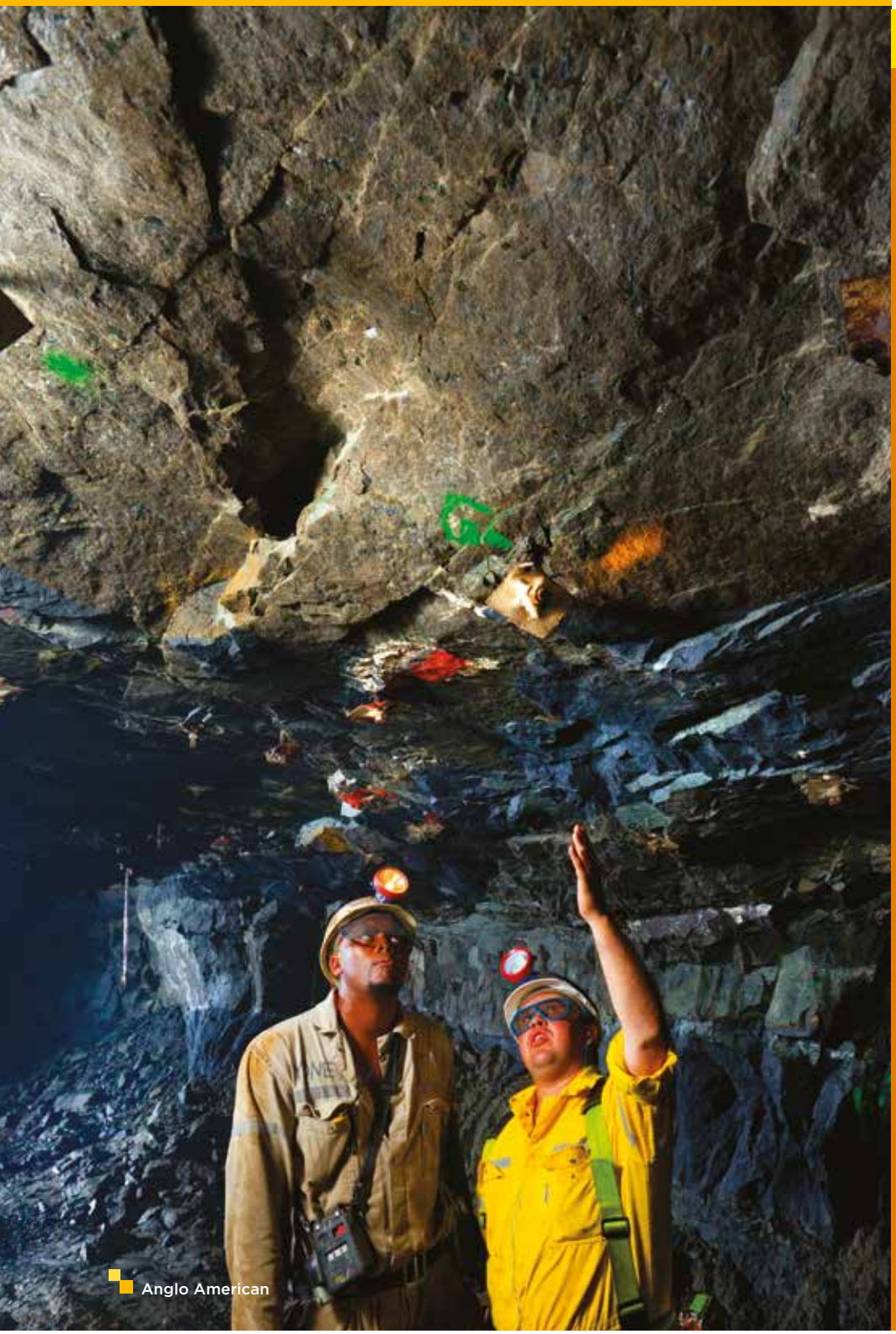
MINING INDUSTRY OCCUPATIONAL SAFETY & HEALTH



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INTRODUCTION

The purpose of this ledging practice guideline is two-fold:

1

It formalises the technical ledging practice.

2

It highlights the leadership practices to deal with people-related issues of ledging.

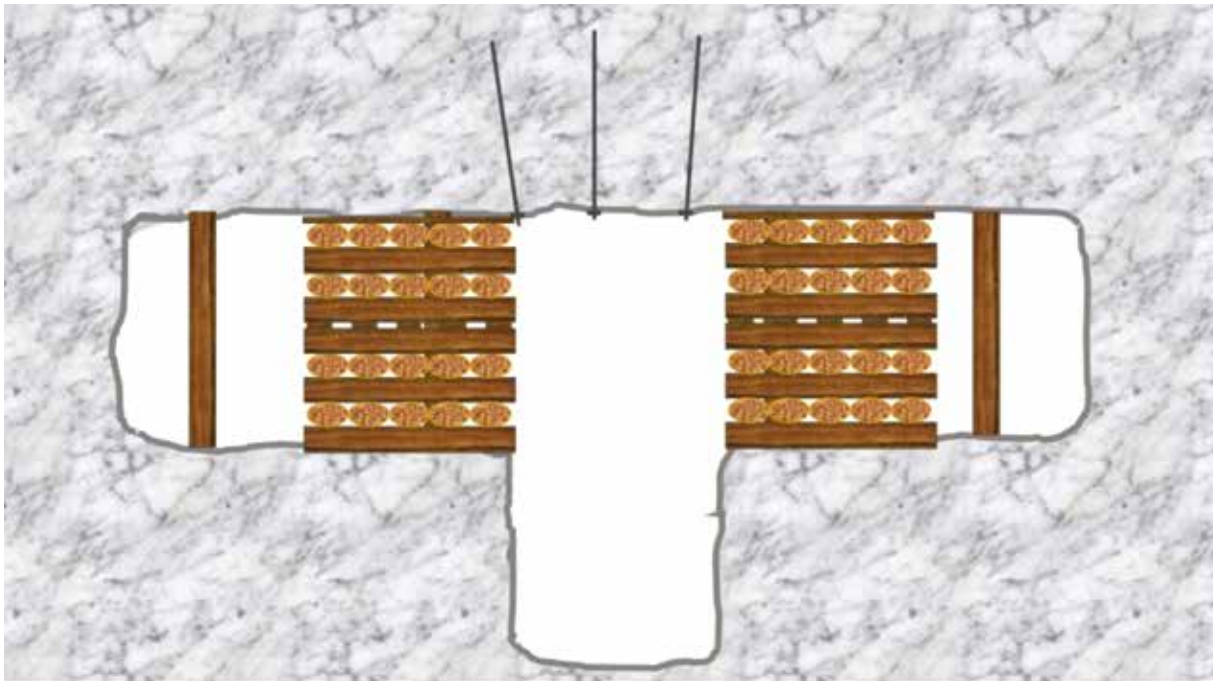
Historically the mining of hard rock narrow tabular reef bodies has been carried out by employing conventional stoping methodologies which rely on ledging as one of the initial operations.

The reef is accessed by way of shafts, inclined accesses or addits, and tunnels are then driven (mainly in the footwall) to access the reef.

From these tunnels a series of raises (or winzes) and ore passes are developed that allow for the "ledging phase" to follow.

Ledging is the process whereby the initial cut of the reef is undertaken from the raise in order to establish a robust centre gully, and to set up and equip the area for the stoping phase to follow.

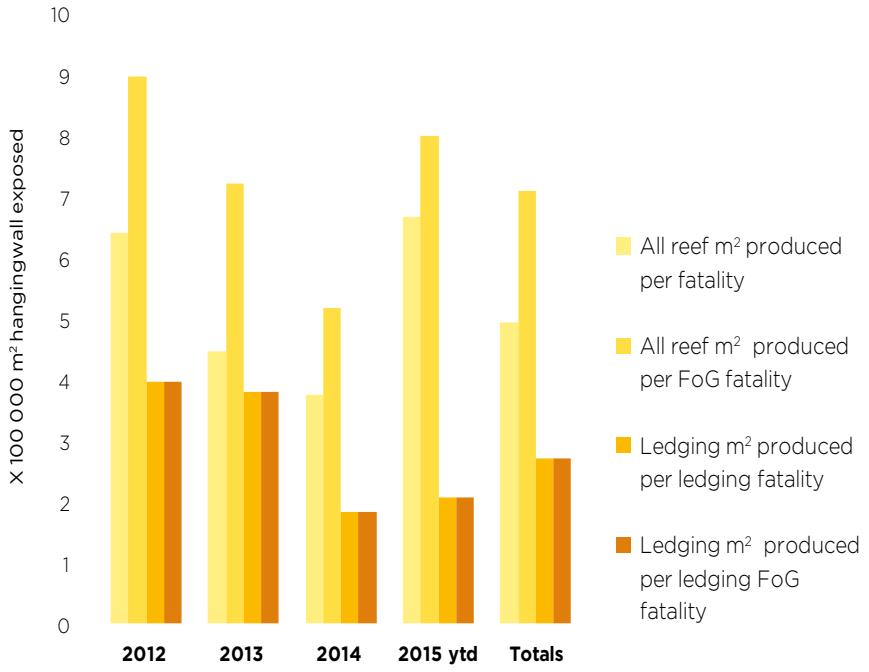
The management/leadership practices related to ledging are often not well structured and are poorly defined. This manifests itself in poor discipline and uncontrolled ledging conditions.



BACKGROUND AND METHODOLOGY

Mining experiences a number of unsafe incidents, fatalities and injuries. Ledging, which should be one of the safer processes in the mining cycle, has not escaped this pattern. While ledging forms a small percentage of a mine's production volume, the risk of fatalities is disproportionally high (see graph below).

m² OF HANGINGWALL EXPOSED PER FATALITY



The graph shows that the risk of a fatal accident occurring in a ledging excavation could be approximately twice that of a similar incident in a stoping excavation when compared to square metres of hangingwall exposed in each type of excavation. It also shows that all fatalities in ledging during this period were related to uncontrolled falls of ground FoG).

Brief from the Chief Executive Officer's (CEO's) Elimination of Fatalities Team

- CEOs were alerted to the fact that a number of fatalities have been experienced in ledging sections at some of their mines.
- The CEO's Elimination of Fatalities Team was initially established to eliminate all mine related fatalities.
- The MOSH Falls of Ground Leading Practice Adoption Team, from the Learning Hub in the Minerals Council South Africa, was requested to investigate the matter and ascertain whether there might be some leading practices within the industry that could assist in eliminating these unnecessary occurrences.
- A study was undertaken and the results are included in this guide.

Identifying the best ledging practice

The MOSH Falls of Ground Industry Leading Practice Adoption Team, as a first step, gathered statistics on ledging related injuries and fatalities from seven major mining companies that have ledging programmes. While not all companies keep injury statistics in a format that allows easy differentiation between stoping and ledging processes, the fatality statistics were readily identifiable. A time period of three and a half years was used in order to gain reasonably reliable fatality related statistics for ledging and stoping operations, and a common denominator of square metres of hangingwall exposed in both ledging and stoping operations was used as a measure to compare the occurrence of fatalities in each process.

Four areas were discussed:

1. The ratio of fatalities and injuries between stoping and ledging process at their operations (i.e. Does ledging really pose a risk?).
2. The differing causation parameters if any (i.e. What leads to the higher risk of injury or fatality in ledging?), the time delays between development and ledging, the time delays between ledging and stoping, and the effects of each (i.e. examining peculiar influences on ledging phases).
3. Their ledging standards, from initial planning to the commencement of stoping of those panels (i.e. Is the whole spectrum of risk exposure covered and is it possible to identify a leading practice?).
4. Any items that could be reported back to the CEOs (i.e. What should be done differently and recommendations to mitigate further ledging risks?).

Once this information was obtained, interviews were conducted with senior management at the operations, including participation by line managers and organised labour.

Information was collated and presented to the CEO's Elimination of Fatalities Team on the findings and the proposed way forward.

Pockets of excellence do exist in the industry and two mining companies were identified as having comprehensive ledging practices that could be documented and shared with the rest of industry as a guide to good ledging practice or to augment some of the effective practices already in use at other mines.

One issue that requires special attention is leadership behaviour related to ledging.

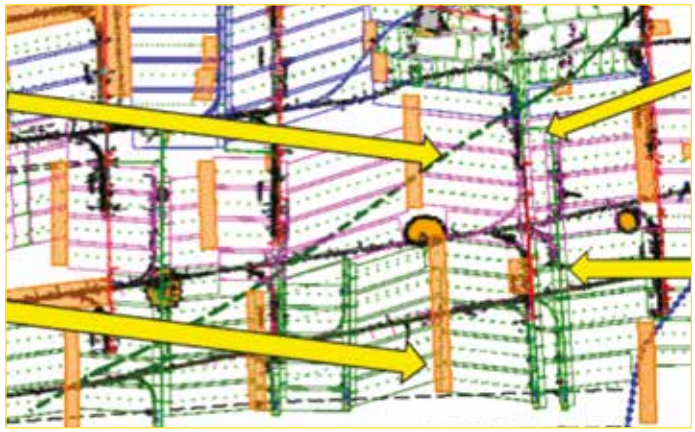
Leadership behaviour (what leaders must do) and behavioural communications (the communications of leaders to correct or reinforce behaviour of subordinates) are required to ensure that a leading practice becomes an "adopted" practice and not merely a "new process description".

INGREDIENTS OF GOOD LEDGING PRACTICE

- While there may be many forms of ledging (up-dip, down-dip, breast, checker-board, wide-raising or wide-winzing) it is not the intention of the guide to prescribe any format or standard to be applied at any specific mine site. It is intended to provide a set of principles, and especially leadership behaviour that will ensure a safe, sustainable and productive ledging process within the industry where ledging is practiced.

- General principles for good ledging practice:
  - Ledging is not a production phase. It is a set-up phase to ensure the safe, sustainable and productive extraction of ore from a stope which is to follow. This means that budgets, control measures, and efficiencies are different to that of the stoping phase.
  - Ledging does not start by taking the first reef cut from the raise, but with the planning process at a point preceding the cross-cut, boxhole(s), travelling ways and raise (or winze) or centre gully development.
  - Ledging is a specialist task and ideally requires dedicated ledging teams.

An intimate knowledge of all relevant geological factors and ground conditions is paramount in order to get the best layout for the mining of a block of ground, and even more so to be able to ledge in a manner that would best serve the life of the stope. To this end it is necessary to follow a drilling and mapping programme to establish discontinuities, accurate reef positions and cut-off points and fault losses (or gains) etc. Without this information, accurate layouts cannot be made.



Example of considerations required during the planning and mining layout phases

Ownership of the ledge and the associated behavioural requirements needs preferably to lie with the mining or production manager (3.1 management appointee) for the area, as he (or she) will co-ordinate the planning and execution of the mining process from the development phase through to the post ledging phase, at least.

An inter-departmental assessment of the whole process, from the development phase (generally the start of the development of the cross-cut) needs to be maintained and would include controls to the point of which no new step can be undertaken unless the quality assurance of the previous step has been evaluated and verified and signed off by the "owner" of that step. A permit to execute system should be applied throughout, where quality assurance and control will indicate progress or remedial process.

Master plans need to be developed and kept up to date especially for the raise, ledging stope and also the leadership behavioural aspects, and must be used to evaluate and measure compliance of the excavations to standard and the overall outcome, in such a manner that any significant deviations can be prevented before it is too late.

Clear role clarity for each role player in this programme is necessary and needs to be agreed in advance to establish the accountability of leaders at the different levels.

The table below indicates roles related to leadership activities of the role players.

Role player	Related leadership activity
Production/mining manager (3.1 appointee)	• High level project coordinator • Owner of the master ledging control plan • Reviewer of progress at all monthly planning sessions • Leader and coordinator of the initial on-site inspection and review of the holed raise
Section manager	• Owner of the master ledging schedule • Authorises permit to execute to begin ledging • Authorises payment of completed tasks • Provider of services and resources, including adequate budgets and skilled employee allocations • Continually evaluates compliance to rock engineering requirements against the master ledging plan
Section engineer	• Provides quality regional (macro) services and installations e.g. electrical equipment, compressed air and water pipes, box-front Installations, pumping installations, cooling equipment, backfill ranges and other control systems
SHEQ manager	• Provides SHE programmes and frameworks • Supplies adequate ventilation/refrigeration • Owner of the quality of the ledge

Mine overseer	• Signs off permit to execute to initiate an activity and signs off permit to execute only once satisfied with compliance and quality of outcome
	• Continually evaluates compliance to rock engineering requirements against the master ledging plan
	• Provider of logistics, local services and infrastructure pertaining to:
	  ◦ people
	  ◦ ventilation and associated controls
	  ◦ equipment and machinery
	  ◦ compressed air
	  ◦ water (service water, drinking water, pumped water and chilled water)
	  ◦ electricity
	  ◦ broken rock (and rolling stock)
	  ◦ construction of related localised infrastructure not covered by the engineer. (e.g. waiting places, footwall construction, backfill ranges, timber bays, explosives box storage facilities, installation of mono-winches, winch installations etc.)

Shift boss	• Overall health and safety compliance • Application and installation of all master and control paint lines • Oversees compliance to mine standards • Ensures timely supply and delivery of all required material • Oversees safe production activities for all ledging crew members during daily routines
Chief surveyor	• Supplies and updates the master ledging plan • Provides adequate, and timely, related survey services
Rock engineer	• Provides mining layout design and sequence of extraction • Provides the relevant information to the chief surveyor to be included on the master ledging plans • Continually evaluates compliance to rock engineering requirements against the master ledging plan • Provides support design and assesses quality of installation regularly • Provides regular inspection programmes to maintain good mining and support standards
Geologist	• Maps the reef and related geological features
Mine planner	• Creates and draws up schedules in conjunction with the section manager, section engineer, rock engineer and mine overseer

In addition:

- As a measure to ensure accountability for quality it is preferable for the same mine overseer to develop the infrastructure, ledge the raise and stope it afterwards.
- The evaluation and assessment of the raise, directly after holing, must be done with all the senior role players present:
  - mine/production manager to lead
  - mine planner to create schedules
  - section manager to ensure availability of sites and installations and completion of requisite installations and constructed infrastructure
  - section engineer to ascertain requirements for equipment and installations
  - mine overseer to check on hand-over from development to ledging section and construction requirements
  - surveyor to ensure excavation evaluation and line demarcation
  - geologist to map the reef and geological features
  - rock engineer to evaluate raise line and reef access support quality and to recommend additional support requirements if required
  - The use of a specialist ledger, a competent shift boss, with experience and a good knowledge of ledging, together with a dedicated ledging team is preferable to ensure a good ledging outcome. Drillers especially need to be skilled in the first few rounds to be blasted in the ledge. The success of this team lies in the fact that they understand that the quality of their work is not negotiable and that they do not condone any deviation from standard. It would be advantageous to conduct a careful selection process to obtain people who fit the required profile
- Payment for ledging crews should ideally be based on quality of installations and excavations, as required by the master ledging control plan, rather than that applied to normal mining and stoping. Consideration should be given to safe quality outcomes, as per the performance standards of the master ledging control plan, rather than quantity of output.
- Each ledging crew must be orientated in terms of their application and requirements prior to being deployed in a ledge (sequences, standards, principles, quality etc.).

Sibanye-Stillwater

"Clear role clarity for each role player is necessary and needs to be agreed in advance to establish the accountability of leaders at the different levels."

Anglo American

The ledging sequence

Once the raise is holed and stripped, a multi-disciplinary team will conduct an evaluation and assessment of the physical raise and infrastructure (recommendations, responsibilities and schedules to follow and to be included in the master plan and schedule).

- Ensure all footwall construction is complete (secondary support, waiting places, box-fronts, rails, drains, explosives box installations, cooling coil installations, timber bays, mono-winch installations, electrical boxes, cables, pipes, backfill ranges, pumps and sumps, illumination etc.)
- All boxholes/ore passes should be holed (preferably by drop raising) and adequately covered until they have proper grizzleys installed.
- Mining sequences should be determined from the assessment as described above and:
  - establish and confirm safe access to the raise by overstoping and supporting the reef access way/travelling way areas
  - install survey lines and master centre paint line
  - re-support and installation of additional support for the raise (as recommended by the rock engineer)
  - give attention to geological impacts, i.e. faults, dykes, shear zones etc.
  - install (surveyed) gulley positions and paint lines
  - establish tipping points and cleaning procedures as early as possible (slots for gullies, grizzleys and related support)
  - establish free breaking faces
  - first cut positions need to be determined carefully
  - consider installation of area support along the raise hangingwall
  - at least the first three blasts to be done with short rounds, aimed to protect the ledge (your mine standard should address this adequately)
  - install master pack paint lines
  - continue blasting with support installation to follow as soon as possible – only blast what you can clean and never hoard broken ore in the back areas
  - continue mining cycles up to ledging limit lines
  - sweep back areas

HOW TO SET UP A LEDGING TEAM

Ledging teams, which may include the shift boss, miner, team leader and various occupations within the mining crew (drillers, winch operators, water jet operators, mining assistants, miners' assistants, support crews etc.) should be selected from teams with good mining performance as well as good safety and health compliance records.

1 The ratio of fatalities and injuries between stoping and ledging process at their operations (i.e. Does ledging really pose a risk?).

2 Once the desired group of people has been assembled and their current understanding has been evaluated, they need to be trained, evaluated and found competent in terms of ledging standards, practices and related requirements.

3 An orientation of the ledging process must then be undertaken at their site of work. Processes need to be put in place to ensure understanding of and compliance to all required work standards, inclusive of what needs to be done when any deviations become apparent. (This should be carried out by the mine overseer, health and safety representative and organised labour representative, and if needed, section manager.)

4 Ledging teams should ideally be dedicated to ledging and should not, if possible, alternate between stoping and ledging phases.

REQUIRED LEADERSHIP BEHAVIOUR AND BEHAVIOURAL COMMUNICATIONS

The behaviour of leaders in any operation holds the key to the performance outcomes. What a leader does or does not do is observed by his followers and is reacted upon accordingly. These good or bad behaviours will establish the unwritten ground rules, those rules that govern the actual performance and value system of the group.

In ledging, certain behaviours become critical i.e. understanding your role in the practice, knowing what you are accountable for, and compliance to set standards. If the leadership does not take accountability, or is not insistent on critical compliance, the outcomes will be mediocre at the best.

During interviews with people of various occupations a number of problem areas were highlighted that need to be addressed through positive leadership behaviours. These include but are not limited to:

- Poor development of raises – offline development, over-breaking (both in width and height with resultant damage to hangingwall and especially sidewalls), off-reef development, developing over the reef and breaking the hangingwall and incorrect or insufficient support or incorrect installation of support elements
- Insufficient geological information leading to incorrect development at faults/dykes or wrong placement of boxholes/travelling ways etc
- Chaos in cross-cuts due to early ledging starts and cross-cut infrastructure and construction programmes not completed in time, or not established at all, prior to ledging
- Cutting of the ledge from the original raise is often incorrectly done due to poor drilling and poor blasting techniques, resulting in poor footwall conditions and poor support installation
- Congestion in the ledging areas, often due to a drive for production tons and cleaning facilities not established, results in too much broken rock in the areas where support should be installed and support is, therefore, not installed timeously, causing hangingwall deterioration and damage
- Absence of paint lines or correctly applied paint lines cause support not to be installed correctly or in good time and/or gullies to be broken away incorrectly or to be misaligned
- Incorrect sequence of ledging cuts create stress related problems, resulting in poor hangingwall conditions that can especially affect the life of the centre gully and the productivity of the stope
- Production pressures often override the quality requirements for the ledging process

"The behaviour of leaders holds the key to any performance outcomes."

LEADERSHIP REQUIREMENTS

The lack of proper planning, controls and leadership oversights are often the main contributors to the problems outlined above and need to be addressed through proper leadership behaviour plans and pertinent behavioural communications plans, as discussed in the following section.

The following set of behaviours (each operation should ideally develop its own set) should be displayed by the various levels of leadership (including supervisors) in the ledging programme:

Conduct evaluation and assessment of the raise – production manager

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Date and time of site visit confirmed • Raise is stripped and washed down, reef contacts and visible geological features demarcated • Availability of plans • Availability and presence of all role players (heads of department and organised labour included) • Standards book with relevant standards is present and available for consultation (development, equipping, ledging, stoping, engineering installations etc.)	• Production manager leads visit to site, with all heads of department and organised labour representation, present together, and walks through the top access, the whole raise and the bottom access and cross-cut • Each team member is encouraged to identify hazards/critical areas relating to the ledging and stoping process. These are recorded inclusive of possible solutions and action plans • Co-ordinates the drafting of the initial master plan and ensures that it forms the basis of all and any discussion relating to the ledging of this raise	• Master plan is drafted • All activities are recorded and scheduled • All role-players now have a fixed foundation to work from • Co-ordinated mining and construction schedule is drafted and implemented • Orientation of working crews can now commence • Control criteria can be developed and maintained • Permit to execute system is developed and implemented by the mine planner and scheduler	• Uncoordinated activities result in many delays and oversights and critical omissions become a reality

Manage process according to schedule – section manager and section engineer

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Master plan has been developed and is available • Activity schedules have been drafted and put in place • Teams have been trained and orientated with regard to the master plan and schedule	• Section manager and section engineer ensure that all activities are updated on a regular basis and that the relevant checks are made to ensure correctness • New permits to execute will only be issued and signed off after preceding work permits have been signed off by the mine overseer (or section engineer if required) conforming to the required standard • The master schedule and the master ledging plan is prepared for scrutiny at monthly planning sessions by the production manager	• Progress and process of work is controlled • Quality of work is managed • Resources are managed accordingly	• No schedule means no control

LEADERSHIP REQUIREMENTS continued

Managing of quality – production manager and section manager

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Suitably qualified mine overseer	• Appoint the mine overseer for a section to head up the development, including the ledging and stoping operations to follow	• Mine overseer will ensure quality development of quality infrastructure and raises for quality ledging and stoping to follow	• The person in charge of the ledging operation will not pay attention to quality but rather to quantity and this increases the chance of problems during stoping

Managing of quality – mine overseer and heads of department

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Performance standards for each task are drawn up and are readily available • Teams and all role-players are trained and know the standards • Payment schedules are drawn up and agreed to by all • Non-permitted work will not be paid	• Mine overseer (for mining related activities) and heads of department (for services sections) will evaluate compliance to performance standards for all activities and installations. Acceptable compliance is signed off, communicated to the section manager (or engineer) for updating the schedule and submitted for payment	• High degree of compliance • Quality installations • Motivated teams • Productive working environment	• Non-compliance

Material and equipment supply – shift boss and service providers

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Adequate budgets have been approved and relevant equipment has been sourced and is available • Material supply chain has been established and is operational	• Shift boss (for mining related supplies) and heads of service departments are responsible for ensuring an adequate and timeous supply of equipment and supplies as required at the ledging site	• Work can continue without interruptions • Work teams are motivated and enabled to comply	• Work cannot be completed on time • Work may be non-compliant and prone to failure • Unsafe conditions and activities may ensue • Undue work pressures result, behaviours become non-compliant and teams become de-motivated

Management of logistics and systems – mine overseer and heads of department

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Master plan and schedule is in place and activities identified • Equipment is available and serviceable • Labour and organisational structure is in place	• Mine overseer (in the case of mining activities) and heads of department will ensure timeous acquisition of equipment and the means to ensure delivery to and from the work place • Maintenance schedules will ensure on-going availability and serviceability of equipment and facilities	• Flow of workers, material, equipment, ventilation (and refrigeration), electricity, water, and broken rock are uninterrupted and unimpeded • Work place standards can easily be maintained • Motivated workers	• Work is impeded and work place becomes congested, unproductive and unsafe • Work standards deteriorate • Workers and crews become de-motivated • Project deliverables are compromised

Selection of team members – section manager

Pre-requisite	What the leader must do	Positive outcomes expected	Results of a negative outcome
• Role description and performance criteria for each job • Pre-determined selection criteria and screening processes • Adequate labour budget • Skills requirement analysis and profiles • Leadership assessments	• Section manager, together with the relevant human resources personnel, will evaluate and make available the individuals (from mine overseer level down), selected to form part of the ledging programme for that specific section	• Teams capable of performing to standard with high quality outcomes • Ledging areas with a good chance of ensuring productive stoping outcomes • Empowered and motivated ledging teams	• Poor application of skills • Sub-optimal work outcomes • Unsafe working conditions • De-motivated teams

Behavioural communications

The process of setting up the ledging practice and process, roles, accountabilities and behaviours of persons, will either ensure a good ledging outcome or a poor one. Incorrect understanding of the roles and accountabilities will lead to incorrect beliefs and will result in incorrect behaviours. The behaviour communication (what the leaders say or communicate) determines what the team believes and what they do. Managers, therefore, should confirm or deny through what they do and say the correct and incorrect beliefs respectively.

There are many factors that may influence behaviour and some of those beliefs that drive behaviours have been identified and are dealt with in this section:

Structuring the ledging roles and responsibilities

Common understanding (incorrect beliefs)	Reality	What is the correct message?	What happens if we do not comply with the correct message?	How must this message be conveyed?
• The ledging process can continue with the current stoping roles and responsibilities	• The ledging process requires specific roles and responsibilities to be clarified at each level in the process. This must be defined and accountabilities allocated • The persons accountable should be questioned at relevant stages	• The leading process will require clarity of roles first and each role player will be held accountable	• The control of the ledging process will be highly influenced by the lack of role clarification	• Development of a structure, with roles and responsibilities, must be given to role players in writing and scheduled feedback sessions held with each participant

Ledging is a set-up phase rather than a production phase

Common understanding (incorrect beliefs)	Reality	What is the correct message?	What happens if we do not comply with the correct message?	How must this message be conveyed?
• Ledging is a quick process • When people enter a ledging raise it is seen as an opportunity for quick production and easy money	• Ledging is a set-up phase for good stoping production to follow • It determines the quality of long-term, safe production • The easy gains for quick centares may result in the rest of the stoping being less productive, less safe and in many cases even unprofitable • The small initial spans lead people to think that they are safer than they really are • Quick, uncontrolled and unregulated production often results in failure, accidents and injuries • Ledging may have a higher potential for fatalities and injuries if not properly controlled	• Ledging determines stoping quality • A well-organised and well controlled ledging phase will guarantee that all reasonable measures are taken to ensure a stoping phase that will benefit all who participate • By ensuring that all equipment and installations are of good quality and function, and by ensuring a comprehensive plan and schedule is adhered to for the setting up of this ledge, the stoping programme will have a better chance for good safety and improved bonus pay-outs	• Create unsafe conditions • People will get into the raise, cut the ledge improperly resulting in poor ground conditions, poor pack support and a raise that will not be able to supply ore or safety • Quick blasting could choke up the area and support will not be installed in the correct places it is needed	• Managerial ownership of ledge before stoping • Discussion during planning sessions • Supervisory training sessions • Orientation of ledging crews prior to starting up a new ledge • Coaching during site visits and performance evaluations

Permit to execute process

Common understanding (incorrect beliefs)	Reality	What is the correct message?	What happens if we do not comply with the correct message?	How must this message be conveyed?
• A permit to execute is not important or required • We generally know our jobs and can continue with our work	• The permit will ensure success and accountability at the correct level • Knowing one's work is important, but not having a well thought through schedule and plan, and not controlling the compliance to a plan, can often result in some steps being omitted, others being done out of sequence or not done at all. This leads to disorganised working places and inefficient work outputs and may lead to accidents and unwanted incidents	• No permit – no work, as the correct level should be accountable • A permit to execute system ensures all work as scheduled and planned, performed to an acceptable standard and in sequence • It ensures we do the right things, at the right time and to correct specification • It brings a common understanding to what we are doing, why we are doing it and what the standard requirements are • Compliance to the system may lead to improved bonus payments	• No permit – no plan • All work becomes disorganised and may lead to misunderstandings • Work not included in the permit system may end up not being paid for • Some tasks, if not performed or not performed to standard, may result in injury or loss of life • Non-conformance may lead to lower bonus payments	• Leader taking ownership • Discussions during training programmes • Orientation meetings with ledging crews • Crew selection and appointment of crew members • Planning sessions • Performance evaluations • Waiting-place talks

Off-line development and over-break

Common understanding (incorrect beliefs)	Reality	What is the correct message?	What happens if we do not comply with the correct message?	How must this message be conveyed?
• It is permissable to develop off-line • A raise is intended to be developed as fast as possible for the ledging crews to come in and stoping to follow. Once the developer is out of the raise it becomes someone else's problem • Over-break and off-line development happens and cannot be helped	• On-line development is the only sustainable way • Raises are sometimes developed off-line and over-break does occur in some areas • This has a negative effect on the development, ledging and stoping processes to follow in that cleaning and support are a problem and generally the ledging cannot be done effectively or ensure a long life, safe access for the stope to follow. It costs time, money and may result in other losses	• There is only one correct way • A raise needs to be developed on-line at all times and within the dimensions as specified on the survey note, at all times • A raise with no over-break allows the ledge to be cut at the correct position and the ledging support (or master line) of packs to be installed correctly so that the integrity of the centre gully can be protected for the life of the stope	• Integrity of the work area is compromised • Hangingwall deterioration sets in, support cannot be installed to standard, cleaning becomes a problem, the raise eventually cannot be advanced as required, poor ledges result and thus the master lines of packs cannot be installed where required	• Identify immediately and rectify • All off-line or over-break incidents must be reported and developers must not be paid for non-standard work • Discussions and action to be taken at planning sessions and monthly production and performance reviews • Disciplinary action needs to be taken against the miner and the shift boss in charge as it is their duty to supervise operations on a daily basis

DEFINITIONS

Description of related terms and terminology used in this guide:

CEO	Chief executive officer
CEO's Elimination of Fatalities Task Team	Now referred to as the CEO Zero Harm Team
Ledge	The immediate area of a stope, on either side of a raise or gully, where special mining and support practices are used to ensure the long-term stability of the raise or gully, and to prepare for full-scale sustainable stoping
Ledging	The process of establishing the initial footwall ledge for a stope by taking the first cut of reef from the original raise and to create a suitably supported, robust and competent centre gully that can service the stope, in terms of access and supply, for the remainder of its life and includes the equipping phase necessary to set up a safe, sustainable and productive stoping phase
FoG	Fall(s) of ground, relating to uncontrolled falls of roof, hanging or side walls, either due to the influence of gravity or the effects of seismicity
Haulage	A tunnel driven on strike or dip (haulage refers to its function not its direction-hauling material) (generally in the footwall below the reef plane) to allow access to and facilitate the supply of services to a section or portion of the mine
Cross-cut	A tunnel driven horizontally but across the rock strata connecting the haulage to the stope/reef access ways and to supply access and services to the related mining processes to follow
Raise	A tunnel excavated on the plane of the reef, (generally on true dip) and being above the horizontal in the direction of development. May be referred to as a centre gully once developed
Winze	A tunnel excavated on the plane of the reef, (generally on true dip) and being below the horizontal in the direction of development. May be referred to as a centre gully once developed
Reef drive and/or diagonal raise	A tunnel excavated on the plane of the reef, and which is not classified as a raise or a winze
Travelling way	A tunnel that provides access to the reef horizon from the cross-cut or an access to raises or centre gullies on multiple stacked ore bodies. It may also be a designated and marked as an access-way on the reef plane
Boxhole	A tunnel excavated between the cross-cut or haulage to the reef, for the purpose of moving broken ore from the reef horizon to the footwall excavation below and generally excavated at an inclination of 55 degrees or more above the horizontal

DEFINITIONS continued

Ore pass	A boxhole that has been holed and equipped with a box-front at the discharge end (for the controlled extraction of broken ore) and a grizzley at the top end to regulate the size of objects allowed to enter
Ledger	The suitably qualified and competent miner who has been appointed to oversee the day to day activities in the ledging areas, as required by the regulations and the relative mine standards
Shift boss	The legally appointed and suitably qualified and competent person appointed, in terms of the regulations, to oversee especially the health and safety aspects in his areas of responsibility
Mine overseer	The suitably qualified and competent person appointed, in terms of the regulations and whose principal duties are to assist the manager in the direct control and oversight of mining operation under his control
Manager	The appointed person who is the holder of a mine manager's certificate of competency, valid for the class of mine where he/she is employed and who is responsible for the management, control and direction of activities in or at the mine or the portion of the mine ascribed to him in his appointment
Master ledging control plan	The management plan that controls and oversees the whole of the ledging process inclusive of master ledging survey plan and the master ledging schedule
Master ledging survey plan	The ledging survey plan that depicts the required mining layouts, mining geometries, mining limits and other excavations or installations. This plan is used as the blue print against which actual excavation and installation details are plotted and evaluated for compliance
Master ledging schedule	The activity schedule that contains the control mechanism for managing all the various activities and scheduled time plans for each activity to be completed, inclusive of responsibility and accountability requirements. This schedule will also be used to drive the permit to execute system against which all activities need to be signed off prior to authorising the next scheduled activity to take place. All activities and installations will have performance standards and required outcomes included for evaluation purposes
Permit to execute	An instruction to execute a specific task or activity, as per the time schedule and requirements of the master ledging schedule. It will only be issued once the preceding task or activity has been completed according to the required performance standard(s). Each permit will include its own set of performance standards and required behavioural requirements, and may only be signed off on completion of that specific task on conformance with the output criteria
Leadership behaviour	The things that leaders/supervisors do or do not do to get a specific and required positive outcome, inclusive of the work to be done at the different levels within the organisation
Behavioural communication	The things individuals or companies say or communicate to influence people to do the correct things voluntarily, every time and all of the time (even if not supervised)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