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GENERAL NOTICE

NOTICE 1307 OF 1997

SAFETY IN MINES RESEARCH ADVISORY COMMITTEE (SIMRAC) CALL FOR RESEARCH PROJECT PROPOSALS

SUBMISSION FOR PROPOSAL FOR RESEARCH PROJECTS IN MINE HEALTH AND SAFETY ARE INVITED IN THE FIELDS AS STIPULATED BELOW OR IN ANY OTHER ADDITIONAL FIELDS INCLUDING FOR EXAMPLE, BUT NOT LIMITED TO TUBERCULOSIS, DUST AND RESPIRATORY DISEASES, NOISE AND HEAT STRESS

The committee would like to draw your attention to the following:

1. Copies of SIMRAC project reports to which reference is made under individual topics are available on request from the Department of Minerals and Energy.
2. Research agents should take into account that they may be called upon to write and present technical papers on each project.
3. Technology transfer is a specific output of all projects.
4. The committee is not obliged to accept any of the proposals and each proposal will be considered on its merits.

GOLD AND PLATINUM

DESCRIPTION OF SAFETY HEALTH RISK

Winder rope deterioration and failure.

TITLE OF RESEARCH TOPIC

Drum Winder Rope Deterioration Studies

PRIMARY OUTPUT(S) OF RESEARCH

Information on rope deterioration mechanisms and rate of damage accumulation. Calibration of the safety and adequacy of the proposed winder rope regulations and approved safety standards.

POTENTIAL IMPACT OF RESEARCH

Safer drum winder operations and optimum rope life utilisation. Improved winder rope regulations. Increased confidence in deeper single lift shaft projects.

SCOPE OF RESEARCH**Focus Areas:**

- 1 Monitor rope lives on the selected winders with verified operating conditions and maintenance procedure. Evaluate the rate of rope damage accumulation.
- 2 By analytical and experimental methods, determine the effect of surface deterioration, contact stresses and bending stresses on crack initiations in wire ropes. Correlate load variation and broken wire events.

DURATION: 12 months (24 man months)

POTENTIAL FOR APPLICATION:

Current and future drum winding and shaft sinking installations

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Communicate research results to mines

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Knowledge and experience of mine windings systems, and past research. In-depth knowledge of hoist rope construction. Access to a rope testing machine.

DESCRIPTION OF SAFETY HEALTH RISK

Winder rope deterioration and failure

TITLE OF RESEARCH TOPIC

Rope Condition Assessment and Discard Criteria.

PRIMARY OUTPUT(S) OF RESEARCH

Validation and development of winder rope discard practices for various rope constructions with emphasis on "non spin" ropes.

POTENTIAL IMPACT OF RESEARCH

Safer drum winder operations. Possible revisions to SABS 0293 : 1996 "Condition Assessment of Steel Wire rope on Mine Winders.

SCOPE OF RESEARCH**Focus Areas:**

- 1 Rope conditions assessment
- 2 Rope discard tests
- 3 Particular emphasis on non-spin ropes.

DURATION: 12 months (12 man months)

POTENTIAL FOR APPLICATION:

Current and future drum winding and shaft sinking.

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Communication of research results to mines

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Knowledge and experience of mine windings systems, rope condition assessment and past research on winder rope discard. Access to rope load test machines.

DESCRIPTION OF SAFETY HEALTH RISK

The ability to detect confidently defects in winding ropes of non spin construction particularly is limited. This rope type is the primary candidate for future deep level winding.

TITLE OF RESEARCH TOPIC

Magnetic Rope Testing Instrument Performance.

PRIMARY OUTPUT(S) OF RESEARCH

Evaluation of international and local magnetic rope testing instrument defect detection capabilities particularly in respect of non spin rope construction..

POTENTIAL IMPACT OF RESEARCH

- 1 Improved rope condition assessment - safer hoisting operations on all shafts.
- 2 Confirmation of rope condition assessment capabilities for deep winding ropes.

SCOPE OF RESEARCH**Focus Areas:**

- Defect detection tests on magnetic rope test instruments from Germany, Canada, Switzerland, Poland, USA, SA. The same set of used rope samples and special test ropes is to be used for all instrument tests.
- Test ropes of various constructions including non spin and full lock coil types.

DURATION: 12 months (24 man months)

POTENTIAL FOR APPLICATION:

- 1 All existing winding installations.
- 2 All future deep winding installations.

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Through normal SIMRAC representative system.

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Magnetic winding rope testing; rope construction knowledge. International rope testing knowledge and contacts.

DESCRIPTION OF SAFETY/HEALTH RISK

Ignitions and explosions of combustible strata gases emitted in gold and platinum mines

TITLE OF RESEARCH TOPIC

The occurrence, emission and ignition of combustible strata gases in Witwatersrand gold mines and Bushveld platinum mines, and means of ameliorating related ignition and explosion hazards

PRIMARY OUTPUT/S OF RESEARCH

Improved understanding of: the genesis of combustible strata gases; the geological factors affecting the potential composition and occurrence of such gases; and the measures that should be taken to reduce the risk of injury due to explosions of combustible strata gases

POTENTIAL IMPACT OF RESEARCH

Reduction in the risk of injury attributable to ignitions and explosions of combustible strata gases in mine workings.

SCOPE OF RESEARCH

Focus Areas:

1. Conduct international literature survey on the origin, composition, occurrence and emission of combustible strata gases with particular reference to hardrock mining
2. Review and summarise salient features of all reports of non-casualty flammable gas emissions submitted to the inspectorate in respect of Witwatersrand gold mines and Bushveld platinum mines in the last decade.
3. Review and summarise the technical evidence submitted to statutory inquiries held in connection with ignitions and explosions of combustible strata gases in SA hardrock mines.
4. By arrangement with the respective head offices and mine managements, interview mine ventilation practitioners with a view to obtaining additional technical documentation and anecdotal information on emissions of combustible strata gases.
5. Establish a listing of gold and platinum mines in which there are known to be active emissions of combustible strata gases, and negotiate with managements for access to sample such sources and nearby atmospheric environments.
6. Arrange for the detailed analysis by a reputable agency of the constituent gases in the samples referred to in paragraph 5, paying particular attention to the range of hydrocarbons present in the samples
7. Undertake and record a detailed examination of the geological environment associated with the samples referred to in paragraph 5, including details of any related groundwater.
8. Based on information collected in terms of the preceding paragraphs, analyse and comment on the origins, transportation and transformation processes that may be involved in connection with combustible strata gas emissions in gold and platinum mines, referring inter alia to possible regional and inter- and intra-mine variations.
9. Formulate guidelines for the safe exploitation of ground suspected to contain combustible strata gases.
10. Report on the suitability of current electronic flammable gas detectors when significant concentrations of flammable gases other than methane are present.
11. Submit a comprehensive report on the entire project, including, if considered necessary, recommendations for further research within the general scope of the proposal.

DURATION: 12 months (24 man months)

POTENTIAL FOR APPLICATION:

Mainly in the Free State, Klerksdorp and Far West Rand goldfields, with limited application in other goldfields and in the Bushveld platinum field

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

The guidelines referred to in item 9, and the report referred to in item 11, should be compiled and presented in a form that will facilitate the practical implementation of any beneficial research findings in the mining industry

SPECIAL SKILLS REQUIRED FOR PROJECT TEAM:

Expertise in geology, gas sampling and analysis, and electronics

Note: Parties intending to submit tenders are advised to make preliminary inquiries:

- (a) at the office of the Chief Inspector, Department of Minerals & Energy, regarding the nature and availability of the records referred to in Items 2 and 3
- (b) with senior officials in the Mining Industry regarding the feasibility of undertaking Items 4, 5 and 6.

The successful tenderer will be required to submit interim reports on each phase of the proposed project before proceeding to the next phase, ie on completion of Items 1 - 4, Items 5 - 7, Item 8, and Items 9 - 10.

DESCRIPTION OF SAFETY/HEALTH RISK

Heat stress and heat disorders

TITLE OF RESEARCH TOPIC

Revision of present guide for Heat Stress Management

PRIMARY OUTPUT/S OF RESEARCH

- 1 Revised heat stress management guide which addresses all issues identified as obstacles to the smooth and efficient running of heat stress management over the past five years.
- 2 A guide to mines for the development, revision and implementation of personal protection strategies designed to address heat as a health and safety hazard.
- 3 An assessment of the current status of heat tolerance in the South African mining industry.
- 4 A review of causal factors in the development of heat disorders.

POTENTIAL IMPACT OF RESEARCH

Improvement of worker safety and health through a more purpose-developed guide for work in hot environments, to assist mines in compiling Codes of Practice for heat stress management

SCOPE OF RESEARCH

Focus areas:

- 1 Procedures to be adopted to overcome logistical, infrastructural and other problems associated with present heat stress management guide.
- 2 The fate of individuals who repetitively fail heat tolerance screening.
- 3 Instrumentation (heat stress monitors/dosimeters) for assessing heat stress in workplaces.
- 4 The increasing mechanization in mining, and consequent requirements regarding clothing, must be taken into account.

DURATION: 6 months (12 man months)

POTENTIAL FOR APPLICATION:

Contribute to safe and healthy work practices

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Research reports, user guides, industry seminars.

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Expertise in heat physiology and human heat stress. Expertise and experience in the development of heat stress management programmes with specific reference to heat tolerance screening and heat acclimatisation procedures.

DESCRIPTION OF SAFETY / HEALTH RISK

Rockbursts and falls of ground

TITLE OF RESEARCH TOPIC

Modelling and quantification of complex seismic sources from waveforms

PRIMARY OUTPUT/S OF RESEARCH

Methodologies, procedures, algorithms and software for quantification of a seismic event in terms of distribution of inelastic deformation at its source to enable the integration into inelastic, nonlinear, time-dependent numerical models.

POTENTIAL IMPACT OF RESEARCH

- 1 New methods for forward modelling of complex seismic events in arbitrary 3D geological media
- 2 Inversion of seismic events not only for parameters currently used in routine seismic processing, but in addition for shape, orientation, duration, slip distribution along the source.

SCOPE OF RESEARCH

Focus Area:

Seismic source modelling and inversion of seismic waveforms recorded by receivers in near-, intermediate-, and far-field using fast, ray-theory based algorithms for wave propagation in complex 3D geological media:

- these algorithms, operating in time domain, allow a close match between observed and synthetic seismograms at a fraction of the computational cost usually required for this type of inversion by standard finite-difference and finite-elements numerical modelling procedures
- developed techniques will allow separate estimation of near-, intermediate-, and far-field contribution computation for any receiver location and for complex sources, which in itself may help to gain insight into the fine structure of complex sources and the wavefields recorded in near/intermediate/far field range of distances
- inversion may be done for rupture velocity distribution, slip distribution, rise time distribution along the source, as well as for the source orientation and shape. These parameters enable more realistic quantification of seismicity by parameters pertaining to changes in stress, strain rate, viscosity and diffusion of the deformation process in rock, thus facilitating the integration of results of seismic monitoring and numerical modelling

DURATION: 24 months (72 - 96 man months)

POTENTIAL FOR APPLICATION

All mines using seismic monitoring.

REQUIREMENTS FOR TECHNOLOGY TRANSFER

User-friendly and compatible software

DESCRIPTION OF SAFETY/HEALTH RISK

Rockfall and rockburst damage

TITLE OF RESEARCH TOPIC

Design of effective gully siding depths for intermediate and deep mines and improved methods for the cleaning of sidings.

PRIMARY OUTPUT/S OF RESEARCH

- 1 Consider the variables associated with tabular mining to establish relationship between siding depth and gully instability.
- 2 Methods for cleaning of sidings.

POTENTIAL IMPACT OF RESEARCH

- 1 Correct siding geometry for specific circumstances ensuring improved gully stability.
- 2 Improved mine layout.
- 3 Reduction in fall of ground and rockburst casualties.

SCOPE OF RESEARCH**Focus areas:**

- 1 Survey of current situation (literature review, including codes of practice, accident analysis and underground observations) to determine the severity of the problem and the relationship between depth and relative inclination of siding and gully stability.
- 2 Numerical modelling and back analysis to determine failure mechanisms and possible solutions.
- 3 Review of technology for cleaning sidings.

DURATION: 6 months (6 man months)

POTENTIAL FOR APPLICATION:

Improved layout applying to all gold and platinum mines.

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Transfer to mines through reports, visits to underground evaluation sites and workshops in various mining districts.

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Rock Engineering knowledge, numerical modelling skills, underground instrumentation experience

DESCRIPTION OF SAFETY/HEALTH RISK

Falls of ground and rockbursts

TITLE OF RESEARCH TOPIC

Proposed performance specifications for pack support types to cater for the variety of geotechnical conditions encountered

PRIMARY OUTPUT/S OF RESEARCH

- 1 Performance specifications for various geotechnical areas and applications.
- 2 A test methodology to apply to all types of packs used in the Mining Industry.

POTENTIAL IMPACT OF RESEARCH

An assurance that all pack support used underground is safe and effective where applied thus reducing falls of ground and damage caused by rockbursts.

SCOPE OF RESEARCH**Focus areas:**

- 1 Develop performance specifications for common pack support types used in the variety of geotechnical conditions in the Mining Industry
- 2 Draw up appropriate test methodology.

- 3 Review Stope Support Catalogue produced under GAP 032 and recommend any additional test work required

DURATION: 12 months (12 man months)

POTENTIAL FOR APPLICATION:

Apply to all new and currently used pack support types in gold and platinum mines to determine representative load/deformation characteristics to be used in support design.

DESCRIPTION OF SAFETY/HEALTH RISK

Lack of general hazard recognition in underground mining operations.

TITLE OF RESEARCH TOPIC

Acceptability and effectiveness of Virtual Reality Simulators as training tools

PRIMARY OUTPUT/S OF RESEARCH

Assessment of Virtual Reality as a training tool for underground mining operations

POTENTIAL IMPACT OF RESEARCH

Appreciation of the viability of VR as a training tool

SCOPE OF RESEARCH

Focus areas:

- Assessment of trainees' cognitive skills

DURATION: 6 months (6 man months)

POTENTIAL FOR APPLICATION:

All mine training centres

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Training and education

DESCRIPTION OF SAFETY/HEALTH RISK

Rockfalls and rockbursts

TITLE OF RESEARCH TOPIC

Rock mechanics aspects of the sequential grid mining method.

PRIMARY OUTPUT/S OF RESEARCH

An evaluation of the suitability of the mining method and potential impact of varying geotechnical parameters and a seismogenic environment, for:

- increasing depth
- weak footwall rock.

Indications of modifications required with depth and weak footwall rock:

- optimisation of pillars, can they be split
- optimisation of mining sequence.

POTENTIAL IMPACT OF RESEARCH

Evaluation of mining method and identification of potential need for more detailed research areas.

SCOPE OF RESEARCH**Focus areas:**

- 1 Pillars - evaluation of extent of fracturing, and load capacity.
- 2 Tunnels - evaluation of stability.
- 3 Stopping - evaluation of relative face condition and seismicity associated with extraction, comments and support suitability.

DURATION: 12 months (12 man months)

POTENTIAL FOR APPLICATION:

Possible substitute for longwalling, mining method for deep level, geologically complex, variable grade distribution ore bodies.

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Will require well trained mine rock engineers, personal contact, workshops.

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Deep understanding of pillars, mine sequencing, seismology and tunnel rock engineering.

DESCRIPTION OF SAFETY/HEALTH RISK

FOG/Rockburst

TITLE OF RESEARCH TOPIC

Evaluation and upgrading of records of stress measurement data in the mining industry.

PRIMARY OUTPUT/S OF RESEARCH

- 1 Collated and validated record of stress measurements made in the industry.

- 2 Evaluation of stress data with a view to providing recommendations for improving and sharing data and understanding of the virgin stress conditions and the influence of mining on stress levels.
- 3 Recommendations for the requirements for additional stress measurement data to be procured for improved understanding of stress conditions in all areas where mining is taking place.

POTENTIAL IMPACT OF RESEARCH

Improved data for the application of all numerical calculation of stress fields leading to more accurate assessment of conditions and hence improved measures for the amelioration of rock related hazards.

SCOPE OF RESEARCH

Focus areas:

- 1 Collection and collation of stress measurement records for all mines; stress measurement data base.
- 2 Assessment of validity and quality of stress measurement data.
- 3 Implementation and evaluation of stress measurement data in view of mining taking place at the time of measurement.
- 4 Identification of suitable plan for improving the quality and increasing the existing stress measurement database.

DURATION: 6 months (6 man months)

POTENTIAL FOR APPLICATION:

Direct application to providing important input data for most rock engineering assessment of conditions in mines.

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

- report
- stress measurement database

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Stress measurement experts.

DESCRIPTION OF SAFETY/HEALTH RISK

Stability and safety of shafts

TITLE OF RESEARCH TOPIC

Damage criteria for shaft support when early extraction of shaft reef is planned.

PRIMARY OUTPUT

Damage criteria which will ensure that shafts are adequately supported whilst being sunk so that their stability and safety is ensured when the reef is extracted around the shaft.

POTENTIAL IMPACT

Improved safety of shafts whilst extracting the shaft reef.

SCOPE OF RESEARCH

Currently uncertainty exists over type of support to install in a shaft if early extraction of the shaft reef is planned. Inadequate support will result in safety hazards in shafts. The strain and stress criteria which will result in damage to shaft linings and other support were derived from shafts which were surrounded by pillars of reef which are not appropriate. When extracting the reef at an early stage, the stress/strain relationships are different and the damage criteria may not be applicable. As a result the shafts may be inadequately supported.

The project should address the following aspects:

- Through a field survey, determine the experience with early extraction of shaft reef
- Determine stress and strain changes associated with early shaft reef extraction
- Determine the important rock mass parameters which affect the response of the excavation to stress and strain changes
- Evaluate shaft wall support response to the changes - including concrete linings, sprayed concrete and other support types
- Develop damage criteria which will allow rock engineers to predict potential damage to shaft support systems
- Present a design methodology to ensure stable shaft excavations
- Hold a number of workshops to communicate the findings of the research.

The project should be empirically based, so that theoretical model results may be used to design safe shaft support systems. The project should be limited to vertical shafts.

Focus areas:

- 1 Survey of damage in shafts where the shaft pillar has been extracted
- 2 Back analysis of stress/strain relationships and lining/support damage
- 3 Develop damage criteria
- 4 Technology transfer

Duration : 6 months (6 man months)

DESCRIPTION OF SAFETY/HEALTH RISK

Rockfalls

TITLE OF RESEARCH TOPIC

Accounting for variability in rock engineering design

PRIMARY OUTPUT

Methods to account for variability in rock properties and support properties to result in improved design.

POTENTIAL IMPACT OF RESEARCH

Improved safety through improved design of layouts and support

SCOPE OF RESEARCH

Rock is a highly variable material and this variability is not always accounted for in the design of excavations and their support. The use of arbitrary safety factors is not adequate in a scientifically based design. By applying reliability based design methods the variability can be accounted for. A design may then be assessed on its reliability and associated hazard.

This should be an initial project aimed at using established probability and reliability techniques in excavation and support design.

Focus areas:

- 1 Indicate benefits to be achieved by this approach
- 2 Describe further research requirements

Duration : 3 months (3 man months)

COAL MINES

DESCRIPTION OF SAFETY/HEALTH RISK

Flammable gas and coaldust explosions.

SUGGESTED TITLE OF RESEARCH TOPIC

To test dispersed stonedust barriers for effectiveness in bord and pillar workings.

PRIMARY OUTPUT/S OF RESEARCH

- 1 Validation of the effectiveness of the dispersed barriers in bord and pillar workings under different dynamic pressure regimes.
- 2 Evaluation of the requirements of the Guidelines for Codes of Practice for the Prevention of Coaldust Explosions

POTENTIAL IMPACT OF RESEARCH:

- Preventing a flammable gas and coal dust explosion to propagate throughout the workings of a colliery
- Improved safety to workers

SCOPE OF RESEARCH:

Focus areas:

- Testing of dispersed barrier to be done at Lake Lynn Facility
- All explosions to be directed to quantify the effect bord and pillar workings have on the effectiveness of the dispersed barrier to stop the propagation of a coal dust explosion
- Testing need to consider the effectiveness of the dispersed barrier when exposed to a low medium and high dynamic pressure wave
- Dispersed stonedust barriers utilized in bord and pillar workings

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Experience in the evaluation of the effectiveness of dispersed stonedust barriers

DURATION: 6 months (6 man months)

DESCRIPTION OF SAFETY/HEALTH RISK

Flammable gas and coaldust explosions in sealed-off bord and pillar workings.

TITLE OF RESEARCH TOPIC

The design, construction and testing of underground seals utilized to seal-off abandoned panels.

PRIMARY OUTPUT/S OF RESEARCH

- Provide design criteria to management for the construction of seals in abandoned areas, with respect to different seam heights (low, medium to high).
- Develop methods to construct seals for different seam heights, satisfying the requirements of the Guidelines for Codes of Practice for the Prevention of Coaldust Explosions
- Identify and develop methods to test seals to ensure compliance to the requirements of the Guidelines for Codes of Practice for the Prevention of Coaldust Explosions.

POTENTIAL IMPACT OF RESEARCH

Improved safety due to the containment of a flammable gas explosion within a sealed-off area

SCOPE OF RESEARCH:**Focus areas:**

- Investigate and document construction guidelines developed in Australia and the USA coal mining industries for sealed panels;
- Develop construction guidelines for seals capable to withstand a static pressure of 145 KPa in South African collieries for low, medium and high seams
- Construction guidelines considering S A mining practices and materials available
- Identify construction techniques and materials to enhance the effectiveness of constructing seals

DURATION: 12 months (12 man months)

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

- Experience of underground coal mining conditions
- Civil engineering design skills

DESCRIPTION OF SAFETY/HEALTH RISK

Poor roof conditions as a result of dykes.

TITLE OF RESEARCH TOPIC

Literature survey on the advanced detection of dykes in underground coal mine workings

PRIMARY OUTPUT/S OF RESEARCH

World-wide literature survey on technologies and procedures available to detect dykes.

POTENTIAL IMPACT OF RESEARCH

The collation of all available information on procedures and technologies to detect dykes.

SCOPE OF RESEARCH:**Focus areas:**

Extensive literature survey, nationally and internationally.

DURATION: 3 months (3 man months)

DESCRIPTION OF SAFETY/HEALTH RISK

Rock falls as a result of poorly installed roof support.

TITLE OF RESEARCH TOPIC

A simple and fit-for -purpose users' guide on the installation and examination of the quality of roof support.

PRIMARY OUTPUT/S OF RESEARCH

- A user's / training handbook to be used by operators and section supervisors for installing and checking the quality of roof support in South African coal mines.
- The Guide to be produced in a loose-leaf, wet-strength pocket sized format.

POTENTIAL IMPACT OF RESEARCH

Improved safety through improved support installation and assessment methods.

SCOPE OF RESEARCH:**Focus areas:**

- The project team should establish international and national methodologies currently in use in the coal mining industry to install and to assess the quality of roof support.
- The assessment methods should be condensed into a single manual which can be used as an industry guide.
- A 'Users' Guide' should be written for use by section supervisors.
- The Users' Guide should be a simple field guide and packaged in a plasticized, loose-leaf, wet-strength pocket sized format.

DURATION: 6 months (6 man months)

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Knowledge of rock engineering and roof bolt installation procedures over a wide spectrum of South African collieries. Good communications skills are essential

OTHER MINES

DESCRIPTION OF SAFETY/HEALTH RISK

Stope panel collapse and falls of ground in near surface and shallow mining operations

TITLE OF RESEARCH TOPIC

Investigation of factors governing the stability/instability of stope panels in order to define a suitable design methodology for near surface and shallow mining operations

PRIMARY OUTPUT

1. Report recommending design considerations for stable/shallow mining spans
2. Proposed design methodology for stable mining spans

POTENTIAL IMPACT

1. Reduction in fall of ground accidents
2. Engineering approach to panel design to comply with guidelines for the compilation of codes of practice

SCOPE OF RESEARCH

(Refer to current results of Project GAP 334)

1. Analysis of hangingwall collapse case histories
2. Review and assessment of current rock mass classification systems
3. Determine influence of parameters as identified under 1. and not captured in current classification systems
4. Define procedure for definition of geotechnical areas as defined under guidelines for code of practice
5. Determine influence/requirements of support systems
6. Determine procedure for design of stope panel spans
7. The work to include all underground mines classified as 'Other mines', and not only chrome mines.

DURATION: 12 months (12 man months)

POTENTIAL FOR APPLICATION:

Use by mine rock mechanics to comply to guidelines for codes of practice for the design of mine stope/pillar layouts and support systems based on engineering design process for both tabular and massive mining operations.

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

1. Design methodology and application case study
2. Mine workshops

SPECIAL SKILLS OF PROJECT TEAM:

Use of experienced industry practitioner
Broad-based rock engineering knowledge

DESCRIPTION OF SAFETY AND HEALTH RISK

Collapse of pillar workings in shallow mines to large changes in surface topography resulting from uncertainty of design load in these situations.

TITLE OF RESEARCH TOPIC

Influence of surface topography on the loading of pillar workings and mine structures in near surface and shallow mines.

PRIMARY OUTPUT

Report on guidelines for the design of pillars in areas of highly variable surface topography

POTENTIAL IMPACT

Prevent catastrophic failure of pillar supported mine workings or excavations by consideration of influence of changes in surface topography for shallow mines

SCOPE OF RESEARCH

1. Analysis of pillar failure case histories due to changes in surface topography
2. Assessment of extent of influence of surface topography
3. Develop guideline for mining practice.

POTENTIAL FOR APPLICATION:

- Use by mine engineer to design stable excavations and pillar systems
- Standard procedure for guidelines to compilation of codes of practice for rock engineering strategies for both massive and tabular mines situated in areas of steeply varying topography and for underground mines working below initial deep open pits

DURATION: 12 months (12 man months)

REQUIREMENTS FOR TECHNOLOGY TRANSFER

1. Report detailing guidelines and application
2. Mines / regional workshops

SPECIAL SKILLS OF PROJECT TEAM:

- Knowledge of design of pillar systems and general excavations;
- numerical modelling skills; and
- stress measurement skills.

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM

Remote control ergonomics and risk assessment

REQUIREMENTS FOR TECHNOLOGY TRANSFER

Cooperation with mobile equipment manufacturers

POTENTIAL FOR APPLICATION

Mobile machines, drilling rigs, scrapers, loading points

DURATION: 6 months (6 than months)

1. Current barriers for a driver using local control
2. Safety during loading and dumping operations
3. Risk assessment of a driver relocation
4. Recommendations for stand-off control application
5. Ergonomic requirements for portable controller

SCOPE OF RESEARCH

encourage its more wide spread use, which will in turn improve safety control application. The more effective design and application of stand-off devices will increase in mine safety by better understanding of human factors which impact on stand-off control application. A more effective design and application of stand-off devices will encourage its more wide spread use, which will in turn improve safety

POTENTIAL IMPACT OF RESEARCH

control application to improve safety use for both underground and surface mines. Recommendations on new areas of stand-off use for both underground and surface mines. Recommendations on new areas of stand-off use for both underground and surface mines. Recommendations on new areas of stand-off use for both underground and surface mines. Recommendations on new areas of stand-off use for both underground and surface mines.

PRIMARY OUTCOMES OF RESEARCH

mobile equipment and recommendations on stand-off control applications investigation of safety and health benefits and problems associated with stand-off controls for mobile equipment and recommendations on stand-off control applications

TITLE OF RESEARCH TOPIC

ergonomic design of portable controllers These include operator safety by another machine or assumes dangerous position, poor stand-off controls are often used where mobile equipment is used in potentially dangerous stations. Some problems have begun to occur through the use of these stand-off controls.

DESCRIPTION OF SAFETY AND HEALTH RISK

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DESCRIPTION OF SAFETY AND HEALTH RISK

Stand-off controls are often used where mobile equipment is used in potentially dangerous operations. Some problems have begun to occur through the use of these stand-off controls. These include: operator struck by another machine or assumes dangerous position, poor ergonomic design of portable controllers.

TITLE OF RESEARCH TOPIC

Investigation of safety and health benefits and problems associated with stand-off controls for mobile equipment and recommendations on stand-off control applications

PRIMARY OUTPUT/S OF RESEARCH

Comprehensive report on the existing stand-off control and the role of human factors on its safe use, for both underground and surface mines. Recommendations on new areas of stand-off control application to improve safety

POTENTIAL IMPACT OF RESEARCH

Increase in mine safety by better understanding of human factors which impact on stand-off control application. The more effective design and application of stand-off control devices will encourage its more wide spread use, which will in turn improve safety.

SCOPE OF RESEARCH

Focus Areas:

- 1 Current hazards for a driver using local control
- 2 Safety during loading and dumping operations
- 3 Risk assessment of a driver relocation
- 4 Recommendations on stand-off control application
- 5 Ergonomic requirements for portable controller.

DURATION: 6 months (6 man months)

POTENTIAL FOR APPLICATION

Mobile machines, drilling rigs, scrapers, loading points

REQUIREMENTS FOR TECHNOLOGY TRANSFER

Cooperation with mobile equipment manufacturers

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM

Remote control, ergonomics and risk assessment

DESCRIPTION OF SAFETY AND HEALTH RISK

Early knowledge of numbers of trapped miners, their location and rapid relief increase chances of survival after any event.

TITLE OF RESEARCH TOPIC

Develop a trapped miner location system and an adequate rescue strategy and associated technologies

PRIMARY OUTPUT/S OF RESEARCH

Develop and test a trapped miner location system with an operational range up to 30 m through solid or fragmented rock

POTENTIAL IMPACT OF RESEARCH

Improve mine safety by reducing rescue operation time through obtaining information on trapped miners' location and providing effective rescue technology. Reduce trapped miners' stress by audio/visual signal when locating.

SCOPE OF RESEARCH

Focus Areas: Rescue operations

DURATION: 6 months (6 man months)

POTENTIAL FOR APPLICATION

South African Mining Industry

REQUIREMENTS FOR TECHNOLOGY TRANSFER

Collaboration with manufacturers

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM

Knowledge of propagation of electromagnetic waves through rock, rock engineering and human behaviour under stress

DESCRIPTION OF SAFETY AND HEALTH RISK

Vibration-induced trauma and occupational disorders

TITLE OF RESEARCH TOPIC

The Measurement of vibration characteristics of mining equipment and impact-percussive machines and tools.

PRIMARY OUTPUT

The primary output of the research will be:

- Classification of equipment and tools (excluding transport systems) based on their type and levels of vibration.
- Measurement procedure for each category to ensure the correct measurement of the vibration.
- The domain in which the results are analyzed depend on the type of the vibration.
- Calculation of applicable indices found from standards and regulations, and national and international literature, to quantify whether the equipment falls within the comfort zone for usage by man. There are single value and narrow band indexes which are used on different types of machinery depending on the type of vibration.

POTENTIAL IMPACT

- The potential impact of the research:
- Quantify the harshness of different equipment and tools and suggest exposure times for man to them.
- Equipment that cause too high levels of vibration will be identified and can be redesigned and the cause of the vibration removed, or isolated to ensure a healthier and vibration friendlier piece of equipment.
- In cases where the vibration is essential for the proper operation of the equipment, like compactors, proper vibration control techniques can be applied to isolate the vibration from the user.

SCOPE OF RESEARCH

- Feedback is necessary to verify the application of the different characterization techniques used to quantify the effect of the measured vibration on man.
- The following order of activities is planned:
- List the typical equipment on which measurements should be done.
- Find, from international literature sources, results of previous vibration measurements to qualify the types of vibration on the equipment.
- Measure vibration on those equipment for which no information can be found from literature.
- Categorize the types of vibration. Random, shock, etc.
- Find the applicable indexes which must be calculated to quantify the effect of the different types of vibration on man.
- Set up measurement procedures to measure the vibrations for each category.
- Set up a questionnaire with the essential questions to find out how users experience the vibration of the equipment.
- Measure vibration on machines in the different categories and calculate the proper quantification indexes.
- Compare results against comments from users of equipment and standards.
- Make adjustments to the measurement procedure and index used for the specific vibration types if necessary.
- Compile a report giving the measurement procedure and analysis that must be performed on the results.

DURATION: 12 months (12 man months)

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Experience in vibration measurement and dynamics, with sound knowledge in the following fields:

NVH measurements and analysis for the motor industry and railway vehicles

Fault diagnoses on machinery

Noise and Vibration control.

Simulation of dynamic systems.

Present short courses in Vibration control and Vibration measurement and analysis for industry.

Electronics technician with experience in vibration measurement and the development of electronic circuits.

DESCRIPTION OF SAFETY AND HEALTH RISK

The transfer of safety and health technology and knowledge to end-users and implementers

TITLE OF RESEARCH TOPIC

An investigation into the problems associated with technology transfer and recommendations for the establishment of sustainable health and safety technology transfer programmes

PRIMARY OUTPUT/S OF RESEARCH

1. Principles, guidelines and recommendations for effective technology transfer techniques and methodologies
2. A technology transfer system which caters for the diversity of mining operations, activities and occupational levels in South Africa
3. Recommendations for the establishment of sustainable transfer mechanisms for current health and safety technologies
4. Recommendations for the appreciation and promotion of SIMRAC research programmes at end-user level.

POTENTIAL IMPACT OF RESEARCH

Enhancement of the understanding of health and safety knowledge and enablement of end-user implementation of health and safety practices

SCOPE OF RESEARCH

1. Conduct surveys to assess knowledge levels and understanding of health and safety issues of all stakeholder groups and end-users
2. Determine the technology transfer needs of all industry stakeholders to ensure focused analyses of needs

- 3 Assess, on a global scope, technology transfer techniques, methodologies, systems and practices in related industries
- 4 Formulate impact-based strategies and implementation plans to establish sustainable health and safety technology transfer mechanisms
- 5 Assess the degree of implementation of current health and safety implementation and compliance

DURATION: 12 months (36 man months)

POTENTIAL FOR APPLICATION:

The implementation of user-oriented, practical programmes will enable the transfer of health and safety technologies to all interested and affected parties

REQUIREMENTS FOR TECHNOLOGY TRANSFER

Reports, workshops, brochures and seminars

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

Expertise in and exposure to
Occupational health and safety
Training and development
Communication and promotional expertise

DESCRIPTION OF SAFETY AND HEALTH RISK

Lack of information on the prevalence of occupational diseases in the mining industry

TITLE OF RESEARCH TOPIC

The development of an occupational diseases database, to be managed by the Department Minerals and Energy, to record morbidity and mortality of occupational diseases in the South African mining industry.

PRIMARY OUTPUT/S OF RESEARCH

- 1 Develop a centralized medical diseases database system, to be managed by the Department Minerals and Energy
- 2 Develop and establish its format (also a hard-copy version), in collaboration with the Task Group on the S A Mines Reportable Accident Statistics System (SAMRASS) convened by the Department of Minerals and Energy
- 3 Develop and establish computerized software (usage: interrogatory data capture and retrieval system)
- 4 Develop a user manual and test its suitability.

POTENTIAL IMPACT OF RESEARCH

- 1 Correct medical surveillance programmes to be established.
- 2 The establishment of a quantified risk assessment and the prioritization of corrective actions and measures
- 3 The correct establishment and implementation of compensatory procedures
- 4 Correlating the database with corrective response.

SCOPE OF RESEARCH:

Focus areas:

- 1 All diseases in terms of the Occupational Diseases in Mines and Works Act, No. 78 of 1973 and the Compensation for Occupational Injuries and Diseases Act, No. 130 of 1993
- 2 South African focused, to include all variables, for example age, disease, type of occupation, exposure period, mineral type, etc.
- 3 Extent of morbidity, mortality and consequences
- 4 Extent of severity, and whether reportable but not compensationable
- 5 Pilot study to be undertaken, to test the system's suitability at a small and at a large mine.

NOTE: It is essential that the database has the potential of being expandable to include relevant information on occupational hygiene.

DURATION: 12 months (12 man months)

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

- A Report is required.
- It is essential that several one-day workshops are held with all the stakeholders in the mining industry.

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

- Experience in computer software programming and database administration
- It is essential that the research team include expertise in the field of occupational medicine in mines.

DESCRIPTION OF SAFETY AND HEALTH RISK

Tuberculosis

TITLE OF RESEARCH TOPIC

Assessment of current Tuberculosis case finding practices in the South African mining industry

PRIMARY OUTPUT/S OF RESEARCH

Recommendations on the best practices for case finding Tuberculosis in the South African mining industry.

POTENTIAL IMPACT OF RESEARCH

1. Develop a system to improve case finding techniques
2. Reduction of morbidity and mortality of Tuberculosis

SCOPE OF RESEARCH:**Focus areas:**

- Survey of all techniques and review of all case finding practices
- Investigate all mining components, i.e. geographical characteristics; types of minerals mined, etc;
- Establish a representative sample of known determinants that impact on the occurrence of tuberculosis, i.e. age, exposure, H.I.V.- positive, types of occupations, underground or surface work, etc.
- Recommendations on best practices in terms of mines, depths, procedures, etc.
- Establish prevalence.

DURATION: 12 months (24 man months)

REQUIREMENTS FOR TECHNOLOGY TRANSFER:

Mine-wide information workshops to all stakeholders; state and workers' unions

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

- Epidemiological, medical experience within mining environment;
- Researcher: capability and capacity of resources.

DESCRIPTION OF SAFETY AND HEALTH RISK

Reduction of noise induced hearing loss

TITLE OF RESEARCH TOPIC

An evaluation of hearing conservation programmes (HCP) in the SA mining industry to determine reasons for apparent failure to contribute to hearing conservation. Noise induced hearing loss will be used as an indicator of programme effectiveness

PRIMARY OUTPUT/S OF RESEARCH

- Provide a model for best practice for hearing conservation programmes
- Make recommendations by which to improve the training, the supply and issuing of protective equipment and measurements to ensure compliance

POTENTIAL IMPACT OF RESEARCH

- Reduction in noise induced deafness
- Better application of hearing conservation programmes.

SCOPE OF RESEARCH:**Focus areas:**

- Review the application of various conservation programmes
- Measure the above in terms of morbidity (deafness) rates
- Measure in terms of areas, types of mines and plants, occupations, training procedures, the supply of hearing protection devices, exposure periods, compliance with wearing hearing protective devices, assessment of amounts spent on mines for the supply of hearing protection devices, etc.

DURATION: 12 months (24 man months)

REQUIREMENTS FOR TECHNOLOGY TRANSFER

- Report with recommendations on training, to loss-control departments, employees and HPD suppliers

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

1. Hygienist
2. Epidemiologist
3. Mining experience
4. Medical input
5. Site visits

DESCRIPTION OF SAFETY AND HEALTH RISK

Tuberculosis

TITLE OF RESEARCH TOPIC

The determination of risk factors and their attributable risk influence in the incidence of Tuberculosis in the SA mining industry

PRIMARY OUTPUT/S OF RESEARCH

Risk factors will be identified and attributable risk measured

POTENTIAL IMPACT OF RESEARCH

Intervention strategies may be implemented which will contribute to Tuberculosis control programmes in the Mining Industry

SCOPE OF RESEARCH

Focus areas:

Proposed risk factors to be studied should include (amongst others):

1. Age
2. HIV status
3. Silica dust exposure/Silicosis
4. Occupation
5. Length of service
6. Alcohol consumption

DURATION: 24 months (24 man months)

POTENTIAL FOR APPLICATION:

Tuberculosis control programmes may be adjusted to obtain optimum TB control in the mining industry

SPECIAL SKILLS REQUIRED FROM PROJECT TEAM:

1. TB medical expertise
2. Database manager
Occupational hygienist

**To be handed in at Mineralia
cnr de Korte and De Beer Strs
BRAAMFONTEIN**

Tel: (012) 317-9137
Fax: (012) 317-9264

Closing date for proposals: 17 October 1997 at 15:00

To be handed in at Minerals
City de Korte
Pretoria

Application forms are obtainable from:

Mr D I Baker
DEPARTMENT OF MINERALS AND ENERGY
Private Bag X85
PRETORIA
0001Tel: (012) 317-9137
Fax: (012) 317-9264

CONTENTS

No.		Page No.	Gazette No.
GENERAL NOTICE			
Minerals and Energy, Department of			
<i>General Notice</i>			
1307	Safety in Mines Research Advisory Committee (SIMRAC): Call for research project proposals.....	1	18260
