

Occupational Health Research Results: Coal mining operations and Generic work (SIMRAC 4 and 5 series) - Mary Ross

COL 515: Gravimetric monitoring of excessively high dust levels

The project evaluated gravimetric dust sampling to measure "engineering" or "area" respirable dust levels in coalmines.

This involved the investigation of respirable dust measuring instruments that could exclude large particle carry-over on to the filters at very high dust levels, to obtain an accurate and repeatable value for the dust levels to which continuous-mining machine operators are exposed.

A detailed analysis of studies conducted in South Africa and overseas, produced evidence that a cowl head attachment increases the accuracy of dust concentration measurements without increasing the bias of samples. Recommendations are that the CEN/ISO respirable curve with a d_{50} of 4 μ m should be introduced as the standard and that the sampling procedure changes from a 1.9 litres per minute rate to a 2.2 litres per minute for the existing cyclones.

The poor correlation between samples taken by mines and by an independent authority raises doubts about the validity of gravimetric dust monitoring and the rationale of current sampling practices.

It is suggested that extensive dust-training for legislators and mine environmental personnel plus awareness training for workers would make an important contribution towards combating dust in the industry.

GEN 408: Respiratory hazard risk assessment methods

The project was undertaken to assess and prioritise the health risks from exposure to each of the large number of toxins listed in guidelines in terms of the Occupational Diseases in Mines and Works Act No 78 of 1973 plus exposure to radon and radon daughter products.

This encompassed an initial assessment of sampling strategies, threshold limit values and reported exposure levels to determine the risk potential of each of the pollutants and a review of the health effects of the most important pollutants.

Assessment was oriented towards personal exposures experienced by South African miners, the TLVs or equivalent standards in countries with a good record of mining health and safety, identification of potential problems in different kinds of mining, informed judgement on risk of damage to health in those exposed, collation of information to quantify risks and prioritise pollutants and review data on incidence of disease.

The current TLVs and OELs in South African mines, were compared to those from the USA and UK plus other European countries. Differences in limits for respirable substances result from using the BMRC sampling convention rather than the ISO convention which samples a finer particle size.

The personal exposure data for two six-monthly cycles from mines were analysed. The highest dust concentrations were experienced in operations such as 'longwall mining in coal mines' and there was a tendency for very high concentrations within certain occupations, especially in coal and 'other' mines.

Exposure to high respirable dust concentrations, even in the absence of a high quartz concentration, was identified as a priority in coal mines.

An outline for training in the management of health risks was developed and recommendations made on relevant sampling strategy and data collection.

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CALENDAR OF EVENTS

MEETINGS*

SIMRAC: 31 Oct. 2000 (Strategic workshop)
28 Nov. 2000

SIMCOM: 12 Oct. 2000; 16 Nov. 2000

SIMGAP: 17 Oct. 2000; 9 Nov. 2000

SIMHEALTH: 20 Sep. 2000; 11 Oct. 2000;
15 Nov. 2000

SIMENG: 2 Nov. 2000

SIMROCK: 1 Nov. 2000

MANCOM: 3 Nov. 2000

* Subject to change

RESEARCH INPUT: 2001 PROGRAM

Research needs have been considered during July and August 2000 and SIMRAC research proposals will be invited per Government Gazette during September 2000

A site meeting will be held on 15 Sep. 2000 to discuss the Gazetted proposals

Should you require more information please contact the SIMRAC Research Manager, Paul van der Heever, at phone 27 11 358 9180 or by email at pvdheever@simpross.co.za

SIMRAC ANNUAL REVIEW 2000

The SIMRAC Annual Review will be held on 25 October 2000 at Mintek, Randburg. Registration information for the Symposium will be circulated during mid-September 2000.

An Annual SIMRAC Review Publication will be made available and will include technical papers on SIMRAC Research Projects, finalised as from January 2000 to April 2000.

For further information please contact Elsie Zinsser at 27 11 358 9188 or per email at ezinsser@simpross.co.za

Occupational Health Research Results: Coal mining operations and Generic work (SIMRAC 4 and 5 series) -continued

GEN 413: Investigation into and report on early warning and communication systems for irrespirable atmospheres in underground operations

The existing local and international early warning systems for irrespirable atmospheres were evaluated and the risks of the potentially hazardous underground atmosphere components were assessed. The two main problems were identified as a lack of selectivity in the detection of different flammable gas mixtures and the time interval required to warn those in danger. Global legislation was reviewed. Practical recommendations made are:

- to update South African regulations on central monitoring and alerting miners in danger and reduce the current permissible flammable gas concentration in mines with a mixture of butane and hydrogen
- to develop a new smart detector to measure separately the concentrations of each flammable gas in a mixture
- to improve communication systems and to develop a new personal alarm device to decrease alerting time and to allow location of those in danger.

GEN 505: The development of an occupational diseases database, to be managed by the Department of Minerals and Energy to record morbidity and mortality of occupational diseases in the South African mining industry

An occupational diseases database was designed, tested and developed for use by the Department of Minerals and Energy for research purposes to identify and classify problem areas in occupational disease management and prevention.

This included the programs required to use the data base, the layout of suitable data entry forms for the use of the mining industry to submit details of disease occurrences and a data format transferral of data electronically from mines with existing data-capture software. The system will be implemented in 2000 by the Department of Minerals and Energy.

GEN 509: Surveillance of respiratory disease across the mining industry using the autopsy (PATHAUT) database

Since 1975, findings from autopsies on deceased miners and ex-miners with details of mining sector and duration of service have been recorded in PATHAUT, a computerised database. The project was initiated to use the data for ongoing disease surveillance.

The computer software for annual surveillance reports was developed for autopsy data and was piloted using the 1997 autopsy data from 3208 autopsies.

The report shows the distribution of autopsies by mining sector (75% gold mining), the prevalence rate of silicosis (15%) and the prevalence rate of active pulmonary tuberculosis (14.5%).

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GEN 509 -continued

In addition, a detailed procedures manual was compiled to enable the staff at the National Centre for Occupational Health to produce reports on an annual basis and to enable interactive exchange of information with the mine medical services.

GEN 511: A success factor model to establish and manage a harmonious and motivating work environment conducive to a committed and empowered workforce, sustained health, safety and conformance

The project was aimed at enhancing pro-active safety management with regard to identifying, measuring and improving safety-related behaviours upstream - before accidents happen. It encompassed a literature study and an empirical survey of health and safety management practices in South African Mines.

The literature study verified the key success factors for most admired companies, including the pivotal role of human behaviour and the challenge to change the worker's poor perception of safety by transformation within the industry.

The survey indicated the achievements of the mining industry in maintaining and improving health and safety performances, seeking best practices and conformance with legislation. It also highlighted the need for management to involve the workforce meaningfully and on a sustained basis in job and safety-related matters and to accommodate workforce ideas.

The core model developed comprises a continuous improvement strategy with integrated organisational phases to facilitate and enhance safety commitment within a high involvement organisation.

GEN 521: To establish the presence of *M. tuberculosis* in the underground workplaces on the gold mines and by doing so develop strategies to reduce the prevalence of tuberculosis

South African gold miners probably have the highest incidence rates of tuberculosis (infection with *M. tuberculosis*) in the world and evidence points to 50% of cases being new infections acquired at the workplace.

This project sought to establish by environmental sampling of water, mud and air both underground and in crowded surface areas the transmission of *M. tuberculosis* in the gold mining industry.

Both standard methods and the most recent molecular techniques (polymerase chain reaction) failed to demonstrate *M. tuberculosis* in over 350 environmental samples. However, significant numbers of non-tuberculous mycobacteria (NTMs), which cause a notable proportion (12%) of mycobacterial pulmonary disease in miners, were isolated particularly from underground water and mud samples.

The study identified that effective chlorination of water could reduce this hazard from NTMs and that environmental prevention of *M. tuberculosis* transmission should be focussed on areas such as hospitals and clinics where infectious patients are likely to congregate.

The study highlights the importance of early detection and treatment of infectious miners in the prevention of transmission.

GEN 603: An ergonomics strategy for the South African Mining Industry

An extensive literature survey of global ergonomics strategies and approaches to implementation was conducted and the lack of a holistic ergonomics strategy world-wide in the mining industry was identified.

A formal strategy development process was used to draft an ergonomics strategy which was workshopped with a representative sample of the role players in the South African mining industry to refine the proposed strategy. The report outlines the activities required to implement the strategy for participatory ergonomics and highlights the need for a national macro-plan for implementation, management commitment, the use of existing health and safety structures, design guidelines and specifications for mining equipment and an educational programme.

A pilot study should be conducted to identify opportunities and problems in developing a mine-specific ergonomics programme.

For more information please contact Mary Ross per email mross@simpross.co.za

PROJECT LAUNCHES

Research results of the following Projects will be introduced to all SIMRAC stakeholders:

- Engineering:
GAP 635: Performance requirements for locomotive breaking systems

Contact Alec Gumbie agumbie@simpross.co.za for information on dates and venues

- Rock Engineering launches will be held on Projects
OTH 601: Prevention of mud rushes.
GAP 602: Stope gully support and sidings geometry at all depths and at varying dip.
GAP 607: Survey and assessment of support for non-standard stope areas in the mining industry.

Contact Duncan Adams dadams@simpross.co.za for the dates and the venues of the launches.

Reports available on SIMRAC Website after July 2000 www.simrac.co.za

HEALTH 610: Development of lung function reference tables suitable for use in the South African mining industry

Report on Existing Lung Function Reference Tables

Scope of Project

Search for published and unpublished lung function reference tables, discussions with stakeholders, review of scientific literature on generalisability of findings across heterogeneous groupings, identification and review of potentially applicable data bases and review of suitability for lung function reference tables for cross-sectional use. Analysis of potential for longitudinal "centile" charts and, if indicated, the identification of suitable population for further study

Progress/Significant Outcomes to date

- Identification and analysis of application of lung function reference tables and adjustment equations from local and foreign worker populations
- Identification of best prediction reference tables for black and white in-service workers
- Recommendations for further development of longitudinal monitoring and use of percentiles rather than percentage of normal predicted values for assessment of abnormal lung functions

Name of organisation: Department of Community Health, University of Cape Town

Name and title of researcher: Professors R.I. Ehrlich and J. Myers.

Please contact Mary Ross per email at mross@simpross.co.za for more information

SIMRAC Project HEALTH 619:

Clastogenic effects of continuous low levels of ionising radiation: Consequences for human health

Ionising radiation has the ability to introduce, amongst others, DNA damage; however the effects of continuous low exposures are not as clearly understood as those of exposure to high doses of short duration. Since bats exhibit similar DNA properties to humans, a population of bats residing in an abandoned radioactive monazite mine provided an ideal opportunity to investigate the clastogenic effects of radiation.

Bats were sampled from two areas of the mine, and a control group of bats were sampled from a cave where no radiation was detected. A number of different assay methods were used to evaluate different types of DNA damage, including the Micronuclei assay using binucleated bat lymphocytes to evaluate residual radiation effects; the rodent Micronuclei assay using bone marrow reticulocytes to evaluate chemical clastogenicity and the comet assay which allows evaluation of DNA damage at the level of the individual cell.

The methods all appeared to be sensitive to evaluate radiation-induced DNA damage in bats. The frequency of radiation-induced Micronuclei and the extent of DNA damage as demonstrated by the comet assay was found to be clearly dose dependent. It was concluded overall that the potential clastogenicity of the abandoned monazite mine means that additional precautions would need to be taken prior to the reopening of the mine to ensure the safety of the mineworkers.

Research Agency: Cape Technicon, School of Life Sciences

Contact Mary Ross at mross@simpross.co.za for more information

DEMONSTRATION

Interested persons are invited to a demonstration on projects GAP 642 (Design and development of self-thrusting blast hole drilling system) and GAP 638 (The identification, investigation and analysis of end-of wind protection devices for vertical and incline shafts)

Date: 19 September 2000

Time 9h00

Venue: University of Pretoria, Mechanical Engineering Building, Floor 9, Room 7

After the demonstration there will be a short presentation of GAP 702. The whole event should not take longer than 2 hours of your time. Please confirm your attendance to Cecile Gomes per email sgomes@simpross.co.za or per telephone at 011 358 9190 or fax 011 403 1821

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