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Safety and Health in Mining

Paola Parra O.[1], Marcos Quispe P.[2], Eyshller Caceres M.[3], Ivan Cahuaya C.[4], Crhistian Condori M.[5], Erick Gomez C.[6] and Edy Merma V.[7]
[1]Professor, National University of Moquegua, PERU
[2]National University of Moquegua, PERU
[3]National University of Moquegua, PERU
[4]National University of Moquegua, PERU
[5]National University of Moquegua, PERU
[6]National University of Moquegua, PERU
[7]National University of Moquegua, PERU

[1]Corresponding Author: parrao@unam.edu.pe

ABSTRACT

In the history of the mining sector, in its beginnings it faced very high levels of risks both safety and health.

The data are limited to serious accidents, and these are mainly associated with falls from land, transport and machinery.

Analysis of these data suggests that the leading causes of death tend to be the same as those of serious injuries, while disasters have a different profile. Over the past decade, mining disasters have been associated with explosions due to flammable gases, a fire on a conveyor belt, a flood of mud and water, and rock outbursts.

Mandatory compliance with a company's safety, health and environmental regulations is a minimum and can be significantly improved by adding a long-term management planning and implementation process with a deeper cultural shift towards continuous improvement in safety and quality. Note that the purpose of integrating health and safety into other management systems is the need for health and safety management to be central, rather than an organizational objective.

Keywords-- Occupational, Accidents, Asbestosis, Machinery, Safety, Health

I. INTRODUCTION

Occupational injuries and ill-health have huge social and economic implications for individuals, their families and their communities. They also have economic impacts in the form of direct and indirect costs for society as a whole. Total costs of occupational accidents and diseases have been estimated at between 1 and 3 percent of GDP in various countries[1,2]. Direct costs include compensation costs, costs associated with damage in the workplace and the costs of interruption of production. Indirect costs include the costs of livelihoods lost, income to dependents, and the cost associated with caregiving by families and the community. Poor communities tend to bear the brunt of externalized indirect costs, but today mining companies can also suffer loss of reputation and withdrawal of investment capital.(MA Hermanus, 2007)

The accident and ill-health record of the mining sector compares poorly to that of other economic sectors such as manufacturing, construction and rail, leading mining's reputation to the most hazardous industrial sector.(MA Hermanus, 2007)

When mining started on an industrial scale in the 1880s, miners faced very high levels of risk to both safety and health. Over the years the safety performance of mines improved, but not at the same rate as in other major mining countries such as Australia, Canada and the USA. It is difficult to compare health performance. In 1995, the Commission of Inquiry into Mine Safety and Health concluded, on the basis of a number of studies, that exposures to dust in mining had remained unchanged for 50 years. The commission attributed this to an absence of systemic approaches to controlling respiratory disease[7]. In recent years, changes in legislation, better appreciation of the relationship between silica exposure, TB and HIV / AIDS, and commitments made by industry stakeholders have resulted in fresh efforts to reduce health and safety risks. However, comprehensive initiatives to control health exposures are still new and in development. Since exposure data for airborne pollutants and noise indicate that risks to health are serious, they are likely to remain so until effective control strategies are implemented across the sector.(MA Hermanus, 2007)

II. THEORETICAL FRAMEWORK

2.1 National and International Background

The International Labor Organization (ILO) estimates the annual number of work-related fatalities that occur world-wide. Among the figures published by the ILO are estimates of the number of work-related fatalities in South Africa. According to the ILO 1 908 workers in total

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died in work-related accidents in 2001[10]. In the same year, 288 workers died in mine accidents[11]. Given that miners account for fewer than 500,000 workers (less than 4% of the total workforce) in the national workforce which is nearly 14 million strong, a disproportionate percentage of work-related fatalities (approximately 15%) are associated with mining. Table I sets out the numbers of fatalities and fatality rates per million hours worked in South African mines in the last four years[12]. In contrast to these relatively high rates, corresponding to the deaths of 12 miners[13]. Comparison of Australian and South African rates suggest that miners are 4–5 times more likely to lose their lives in mine accidents in South Africa than in Australia. A major difference between South Africa and other major mining countries is the depth of gold mines, the labor intensiveness of gold and platinum mining, and the large number of workers on a single mine (the last presents significant organizational and logistical challenges).(MA Hermanus, 2007)

In contrast, Australian mines are more mechanized and fewer people are directly exposed to mining hazards. The fatality rates of the South African coal sector are more comparable to the national rates of Australian mines, reflecting greater similarity in mining methods and conditions. It is estimated that the safety performance of the South African mining industry must improve by at least 20% per year to reach, by 2013, the average performance of Australia, US, and Canada (Ontario) [14]. In 2005 the best ever improvement in one year, 16%, was achieved[15].(MA Hermanus, 2007)

Figures 1 and 2 show how the safety performance of gold and coal sub-sectors of the South African mining industry changed over time[16]. For gold mining (Figure 1), the fatality rate declined sharply from 1904 to 1922. From then on until 1943, the rate of improvement slowed. From 1944 to the present day, improvements continued slowly and were punctuated by several reversals corresponding to years in which mine disasters occurred. The overall trend in injury rates (steep rise until 1943 and then a steep fall until 1988) cannot be easily explained, and suggests incompleteness in the data. (MA Hermanus, 2007)

The steep peaks that punctuate the downward trend in the fatality rates in Figure 2, for coal mines, clearly show the effect of mining disasters on fatality rates (sharp reversals in safety performance in years in which disasters occurred). The trend in the injury data suggests incompleteness, as is the case for the gold sector.(MA Hermanus, 2007)

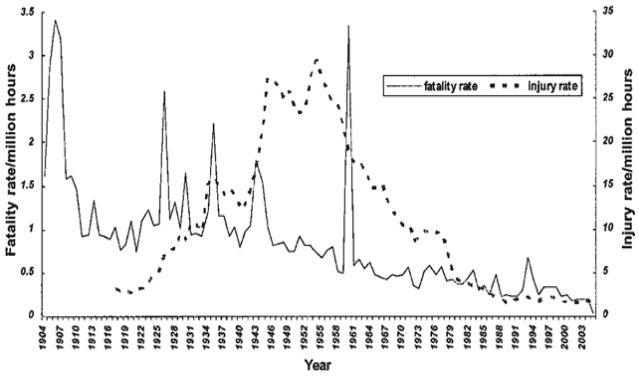

Figure 1: Fatality and injury rates in South African gold mines

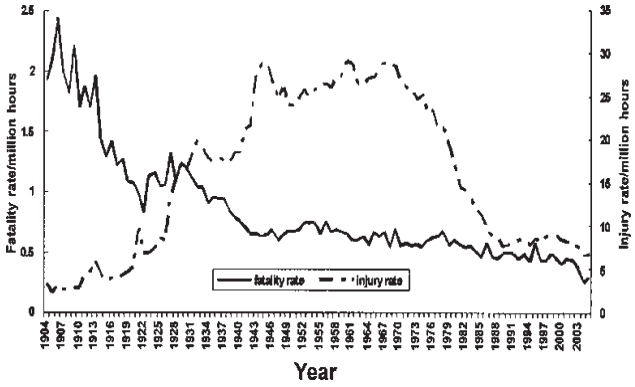

Figure 2: Fatality and injury rates in South African coal mines, 1904–2005

Table I: Annual number and rate of fatalities in mining2003–2006

Year	Number of fatalities	Fatality rate per million hours worked
2003	270	0.29
2004	246	0.25
2005	202	0.21
2006	191 (provisional)	0.19

Safety data published by the Department of Minerals and Energy (DME) only includes data on fatalities and injuries that result in workers being away from work for at least 14 consecutive days. In short, the data are restricted to serious accidents and these are mainly associated with falls of ground, transportation, and machinery, approximately 30%, 20% and 7% respectively in 2006[17]. Analysis of this data suggests that the major causes of fatalities tend to be the same as those for serious injuries, while disasters have a different profile. In the last decade, mining disasters were associated with explosions due to

flammable gases, a conveyor belt fire, an inundation of mud and water, and rock bursts. There is, however, another large category of accidents that is non-specific, entitled 'general', which confounds analysis of accident trends.(MA Hermanus, 2007)

2.2 Theoretical Bases

The ILO estimated that the total number of occupational disease-related deaths in South Africa was 8 229 in 2001. It is not clear how many of these deaths were associated with mining, although the available data suggest that the number would be significant and disproportional to the number of workers employed in mining and that there is a huge burden of occupational disease among former and current miners.(MA Hermanus, 2007)

In the period 1973 to 1993 (20 years) the Mineral Bureau for Occupational Disease certified 128 575 cases of occupational lung disease. The actual numbers of cases of disease is known to be higher, since black workers, who are more likely to have been exposed to high levels of respirable dust, were not entitled to benefit examinations in the past. Today, occupational disease is still unlikely to be diagnosed among former mineworkers served by resource strapped clinics in rural areas. Information available on exposure to airborne health hazards suggest that, depending on the commodity under consideration, between 9 and 50 percent of exposed workers, who account for about half of the workforce, are overexposed to airborne pollutants[23].(MA Hermanus, 2007)

Mansour Rahimi (1994)states that the integration of occupational health and safety management with total quality management (TQM) provides a company with significant cultural and practical principles, tools, and techniques to benefit both safety and quality. A company's mandatory compliance to safety, health and environmental regulations is a minimum and can be significantly enhanced by adding a long-range management planning and implementation process with deeper cultural change toward continuous improvement in safety and quality. Quinlan & Bohle (1991)point out that the purpose of integrating health and safety into other management systems is the need for health and safety management to be central, rather than an add on organization objective. The concepts and philosophy of total quality management have gained worldwide acceptance. Many studies have reported that TQM has helped many companies to increase their competitiveness, effectiveness and productivity(Kozak & Krafcisin, 1997). The philosophy has sparked an improvement in specific areas, such as customer relations and participation, process control and teamwork. Many authors(Weinstein, 1996; Wilkinson & Dale, 1998)also argue that TQM success can produce safety management success. Safety management can be combined with quality management to create a synergy.

III. METHODOLOGY

3.1 Research Design and Method

(a) Research Design:

In the research, the chosen design is descriptive and according to Hernández, Fernández, and Grajales, Carrasco (2006). The design lies in the realities of the event, it includes types of studies: surveys, cases, exploratory, table analysis, etc. Measure a set of subjects, facts or events, provide your description; to then elaborate the proposal to the interested quarry of the project in order to solve the problem found(T.,Grajales, 2006).

(b) Research Methods:

- The Analysis and Synthesis Method, which supposes a detailed and detailed study of the information that allows us to know the complexity of the subject in its most elementary aspects, at the same time the analytical method will allow us to distinguish foundations and principles of the safety culture. (T.,Grajales, 2006)
- The Descriptive Method, which implies knowing the most relevant characteristics and features of audit effectiveness in order to identify its particular notes, whose orientation is focused on answering the question How is it? A certain part of reality, which is the object of this study.(Tamayo, 2009)
- The Explanatory Method; whose orientation in addition to considering the answer to the How? It focuses on answering the question Why is reality like this? or What are the causes?, which has implied proposing explanatory hypotheses and implies proposing an explanatory research design, based on survey or stadistical tables .(T.,Grajales, 2006)

3.2 Population and Simple

This study seeks to examine the relationship and impact of occupational health and safety on employees' organizational commitment in the mining industry. The study explores occupational health and safety and the different dimensions of organizational commitment.

A cross-sectional survey design was used for this study. The respondents were selected based on simple random sampling. Out of 400 questionnaires administered, 370 were returned (77.3% male and 22.7% female) and used for the study. Correlation and multiple regression analysis were used to determine the relationship and impact between the variables.(Amponsah-Tawiah, 2016)

IV. RESULTS

4.1 Presentation and Analysis of the Results

Performance of mines improved, but not at the same rate as mining countries such as Australia, Canada and the USA. Given that the miners account for fewer than 4% of

thetotal workforce in South Africa, a disproportionately high percentage of occupational deaths, 15% of the estimated total for the country, are associated with mining. Globally, the sources of data on occupational disease are fragmented and incomplete, and exposure data is scarce and unpredictable.

Focusing on the safety and health framework for technologies in high-hazard mining domains. The outcomes should focus on both practical and academic dissemination. To maximize the practical benefits in industry that would result from developing and applying the approach (in terms of safer and healthier new mining technologies) dissemination should target three stakeholders: the designers and manufacturers who are creating such new technologies, the regulators who oversee mining or minerals processing, and the industry purchasing and deploying it (e.g., mine sites). Focusing on who makes the technology, who regulates its use.

V. CONCLUSIONS

It is very important that all companies at the national level have a security system of those that exist in the market since this system will allow us the guidelines, tools, and controls to carry out successful security management.

The process of change, in safety, have already defined stages to which it is necessary to carry out constant trainings to help raise awareness, raise awareness, and gradually raise the safety culture in workers in different areas and establish a habit.

The success of a safety system in a mining unit will depend mostly on the workers, it is achieved through trainings implemented to a safety system.

The area of greatest risk in a mine is exposure to suspended particles, the safety policy is the commitment that the company has to the workers.

All implementations have limitations. It is important the commitment of the staff within the company that is working.

Safety is not done by reaction, but rather by prevention.

RECOMMENDATIONS

It is very important that at the national level mining companies establish the safety policy, in turn it must contemplate the commitment of senior officials towards workers with reference to the work environment, personal protective equipment, housing and health.

At the level of mining companies, they must develop work procedures for each activity, due to specific dangers and risks.

It is very useful to create the proactive culture, tool to encourage spring and analysis of incidents.

Promote training and training with the sole purpose of improving performance in their areas of work, it is important to emphasize that the more knowledge they have will be safer and the importance within the work area.

Formalize, consolidate and improve existing programs, taking into account the progress made in the field of security.

Train and consider the worker as the most valuable element of the organization, guaranteeing work environments for personal protection.

Thesystematic procedure must be followed in such a way that it can be anticipated with a mind to eliminating human error and unsafe conditions when starting its work.

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