

**Research Paper on the Study on Silica Exposure of Workers in Surface and Underground
Mines in the Philippine Large-scale Mining Industry
2017**

ABSTRACT

Background

According to the data released by Philippine Statistics Authority, there were about 35,767 mining and quarrying workers in 2014. It is important to note that the annual years of healthy life lost per 100,000 people from silicosis in the Philippines has increased by 7.4% since 1990, an average of 0.3% a year (Silicosis in Philippines, 2013). These rising cases of silicosis is an emerging occupational illness, which needs an immediate attention to halt or minimize such cases. In this regard, baseline measurement is imperative to have a reference for appropriate action

This study is in response to the two (2) of the *8-Point Labor and Employment Agenda* of our present Administration, which are to ensure full respect of labor standards and, to bring more focus and accessibility in worker's protection.

Objective

The study aims to evaluate the concentration of respirable silica dust inhaled by mine workers. It is also set to determine the amount of silica dust in the ores being mined for determining the Threshold Limit Value. Thus, reviewing the prevailing Threshold Limit Value of Silica dust. Lastly, it will also determine the knowledge profiles of workers on silica and their working conditions.

Methodology

A survey tool was used as a guide for data collection on working conditions in the large-scale mines. A structured questionnaire was utilized to determine the demographic, knowledge profile of workers on silica and employers' compliance to regulations.

An exposure assessment to silica was carried to workers operating mechanized equipment and other mining activities in various mining sites in the Philippines. Filter samples were collected through personal sampling and analyzed by gravimetric analysis using Mettler Analytical Balance. Result of personal sampling was focused on respirable fraction. Threshold Limit Value was computed using the formula (TLV Respirable = $10 \text{ mg/m}^3 / (\% \text{SiO}_2 + 2)$). Likewise, ore samples were collected and analyzed using X-ray Fluorescence method.

Results

The average % SiO_2 for the surface mining industry is 26.07% with a range of 0.12% to 68.24% where limestone is the frequent commodity (16 out of 24 ore samples). From the 10 mining sites all over the country, the gathered range of TLV for respirable silica dust is from 0.17 mg/m^3 to 3.54 mg/m^3 . For total silica dust, the TLV ranges from 0.5 mg/m^3 to 7.84 mg/m^3 .

This study utilized t-test at 95% confidence interval to determine the conjecture about the computed TLV-TWA of respirable silica dust as compared to the 0.1 mg/m³ occupational exposure concentration standard of other countries like United Kingdom, Singapore, Malaysia, Brunei, and Mexico. Statistically, the DOLE, OSHS computed TLV-TWA of respirable silica dust is significantly higher as compared to 0.1 mg/m³. Thus, DOLE-OSHS computed TLV-TWA is **less protective** to worker's health as equated to other countries 0.1 mg/m³ occupational concentration exposure standard for respirable silica dust.

Among the 59 mine workers who had Silica Dust exposure assessment, the occupations such as drill assistants/helpers/spotters have the greatest concentration of respirable and total silica dust as high as 30.37 mg/m³ and 74.52 mg/m³, respectively. They were the ones who were rigorously exposed to different safety and health hazards such as clouds of dusts all throughout the mining operation. On the other hand, most of the heavy equipment operators like truck, digging equipment, drill rig machine and bulldozer operators have the lowest Silica dust exposure; as low as 0.11 mg/m³ for respirable dust and 0.24 mg/m³ for total dust. Generally, heavy equipment operator cabins were closed thereby preventing the entry of silica dust-laden air.

A total of 120 respondents were interviewed. It was found out that there was dust monitoring for some large-scale mining companies and being conducted quarterly; all workers have formal education and a few came from minahang bayan; most of the respondents have no information on Industrial Hygiene and without orientation on Silica. Also, it is imperative to note that most of the symptoms of Silicosis especially cough with or without sputum and fatigue have been the health concerns of the workers.

Recommendations

This study recommends to further investigate workers' exposure to silica and its health implication to cover silica – related tuberculosis. Based from the results of Silica dust exposure concentration and review of OSHS TLV, it is essential to develop Silica Dust Prevention Program to minimize the risk of one of the dust diseases – Silicosis. In addition, it is essential to amend the current OSHS TLV for Silica to protect the workers from dangers of such exposure. Also, another study can be conducted to determine the possibility of employing the Minahang Bayan workers in the large-scale mining company.