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Health Risk Assessment of Inhalation Exposure to the Use of Chemical Hazards and Toxic Substances (CHTS) in the Mineral Ore Processing Industry

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Abstract. Chemical exposure known as chemical hazards and toxic substances (CHTS), which occur through inhalation, ingestion, and skin contact, causes serious illness, irritation, corrosion, injury, and even death. Therefore, this descriptive study aims to examine and analyze the health risk of mining workers exposed to CHTS through inhalation using the survey method. The Chemical Health Risk Assessment (CHRA) method issued by the Malaysian Department of Safety and Health in 2018 was used to assess the inhalation exposure rate. The analyzed chemicals were limited to reagents used in production with data collected through the semi-quantitative method. The results showed that the inhalation exposure risk level is categorized as moderate and capable of causing health defects related to acute toxicity, targeting specific reproductive organs. Furthermore, 5 out of 7 reagents were identified as having significant inhalation exposure risk, hence, controls related to Occupational health and Safety (OHS) in the mineral ore processing process must be increased.

Keywords: chemical hazards and toxic substances (CHTS), chemical health risk assessment (CHRA), inhalation exposure, risk assessment.

INTRODUCTION

One of the key factors used by companies to promote sustainable credentials and prevent work-related illnesses is through the fulfillment of Sustainable Development Goals (SDGs) (BOHS, 2022). In 2021/2022, over 1.8 million workers in the UK, suffered from various work-related illnesses with 72,000 new cases. Furthermore, 36.8 million days of work were lost due to these work-related illnesses with an estimated 13,000 deaths recorded each year due to major exposure to chemicals and dust (HSE, 2022). Many potential hazards pose a risk to workers' health, especially in the mining industry, such as exposure to chemicals through inhalation, absorption, and ingestion, which causes serious illnesses, irritation, injury, and even death (Utembe, et al., 2015; Othiri, et al., 2016). In 2008, a total of 2.02 million deaths related to work were recorded (ILO, 2011; Takala, et al., 2014). Global data released by ILO showed a 270 million (62.8%) and 160 million (37.2%) rise in work accidents and illnesses, culminating in 430 million per year. Furthermore, 2.78 million workers die yearly, with 40% of work accidents and illnesses usually among young people. The estimated economic loss of a country's GDP is 3.94 to 4%, while the associated medical costs in the United States are estimated at \$67 billion, with indirect costs of approximately \$183 billion (Hamäläinen, et al., 2017). In 2008, MSHA reported 151 cases of work-related illnesses in mines in America. These included 1 dermatitis case, 24 hearing impairment, 1 heart stroke, 60 cases of joint, tendon, inflammation, and muscle irritation, 40 cases of black lung disease (coal miner's pneumoconiosis), and 25 cases of other illnesses (Chen, et al., 2013). Another report from MSHA showed that 66 chemicals obtained by operators of refining plants, ore crushers, mechanics, utility and pump workers, truck machine operators, and electrical workers are responsible for 2,705 cases of injuries and illnesses (MSHA, 2008; Scott, et al., 2009).

Data on the number of workers who received benefits from the Work Accident Insurance program of the National Social Security Agency for Employment (known as BPJSSTK), showed that 210,789 people (4,007 fatal)