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The hazardous nature of small scale underground mining in Ghana

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ABSTRACT

Small scale mining continues to contribute significantly to the growth of Ghana's economy. However, the sector poses serious dangers to human health and the environment. Ground failures resulting from poorly supported stopes have led to injuries and fatalities in recent times. Dust and fumes from drilling and blasting of ore present health threats due to poor ventilation. Four prominent small scale underground mines were studied to identify the safety issues associated with small scale underground mining in Ghana. It is recognized that small scale underground mining in Ghana is inundated with unsafe acts and conditions including stope collapse, improper choice of working tools, absence of personal protective equipment and land degradation. Inadequate monitoring of the operations and lack of regulatory enforcement by the Minerals Commission of Ghana are major contributing factors to the environmental, safety and national security issues of the operations.

1. Introduction

Small scale mining (SSM) may refer to the mining of ore deposits by individuals or groups of persons with little technical know-how and characterized by minimal or no mechanization. Some countries define SSM operations based on output and human resources needed (Coakley, 1999). However, the definition of SSM in Ghana has been based on the amount of capital and human resources needed. The Minerals and Mining Act 2006 (Act 703) of Ghana defines small scale gold mining operation as the mining of gold by any effective and efficient method that does not involve substantial expenditure by an individual or group of persons not exceeding nine in number or by a co-operative society made up of 10 or more persons. Small scale mining is recognized as a major contributor to national income and a pillar for poverty reduction in developing countries (Hentschel, Hruschka, & Priester, 2003). Small scale mining of minerals such as gold and diamond has provided employment for thousands of Ghanaians, especially indigenes of SSM communities, and has made significant contributions to the foreign exchange earnings of the country. In 2014, the sector produced 1.49 million ounces of gold representing 34.3% of Ghana's total gold output (Ntibrey, 2016). The sector has also helped in stemming rural-urban migration, and provided raw

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materials for both foreign and local mineral industries. As a result SSM is recognized by government as a cornerstone of a multimillion dollar industrial sector, the products and sales from which are controlled. The government of Ghana under the auspices of a German Non-Governmental Organization (NGO), Gesellschaft Technishe Zusannebarbeit (GTZ), and the World Bank has undertaken a number of initiatives to formalize and regularize resident SSM operations (Hilson, 2001).

In Ghana, SSM has been carried out for hundreds of years. It is currently and widely operated in the country by both licensed operators and unlicensed miners popularly known as *galamsey* operators. According to the Ministry of Lands, Forestry and Mines of Ghana, the number of small scale miners increased rapidly by 941.73% from 1984 to 2004 following the promulgation of the Small Scale Gold Mining Law, PNDC Law 218 of 1989. The legalization was to revive the SSM sub-sector, facilitate supervision and minimize associated environmental hazards.

Although the efforts by government and the NGOs have noticeably improved the efficiency of operations, certain serious concerns continue to be largely ignored by the miners, the Minerals Commission and government, and have increasingly become unmanageable. Ground failures resulting from weak unsupported or poorly supported stopes have led to fatalities and various degrees of injury in recent times. Dust and fumes generated from chiseling, drilling, blasting, grinding and crushing of ore are potential health threats. Most of the stopes worked in by the miners are accessed by adits without adequate ventilation systems in place, leading to the accumulation of dust and fumes in the underground workings. Health hazards related to dust and fumes are well documented in the literature (Dockery et al., 1989; Bascom et al., 1996; Gielen, Van Der Zee, Van Wijnen, Van Steen, & Brunekreef, 1997; Pope, Hill, & Villegas, 1999; Yu, Sheppard, Lumley, Koenig, & Shapiro, 2000; Dockery, 2001; Gan, Man, Senthilselvan, & Sin, 2004; Gauderman et al., 2004; Jansen et al., 2005; Colucci, Veronesi, Roveda, Marangio, & Sansebastiano, 2005; Bansah & Amegbey, 2012). SSM activities can generate high levels of noise which can result in hearing impairment, as the use of hearing protection is largely ignored by the miners. Other problems related to noise include stress related illnesses, high blood pressure, speech impairment and lost productivity as described by many researchers (Pulles, Biesiot, & Stewart, 1990; Maschke, Harder, Hecht, & Balzer, 1998, Maschke, Harder, Ising, Hecht, & Thierfelder, 2002, Maschke, Ising, & Arndt, 1995; Ising & Kruppa, 2004).

Small scale mining operations endanger the environment by inducing land degradation and contaminating surface and groundwater resources. Wide open excavated areas are left unreclaimed while heavy metals, total suspended solids, dissolved solids, and other water contaminants are introduced into water bodies by mining and mineral extraction activities of the small scale miners. Mercury amalgamation technique, which is heavily relied on for gold extraction can pose serious health threats and is deleterious to a wide range of ecological entities (Harada, 1995).

Even though, SSM in Ghana is by law limited to only Ghanaians, the last decade has seen a large increase in involvement by foreign nationals, mostly Chinese miners and migrants from neighboring Togo, Burkina Faso and Ivory Coast and others from western and non-western cultures. The small scale mining activities of these foreign nationals have involved the destruction of cocoa farms, wide areas of land and protected forests, and reported as security threat to the people of Ghana (Al-Hassan & Amoako, 2014). In 2013, an inter-ministerial taskforce (drawn from the military, immigration and police) was set up by the president of Ghana to crackdown on these illegal miners. During that year, the Ghanaian authorities arrested and deported over 4500 illegal Chinese miners (The Guardian, 2013). The Chinese foreign minister visited Ghana in 2014, and pledged Beijing's support to help tackle the illegal small scale mining issue (Agence France-Presse, 2014). Although government's interventions have reduced the scale of illegal mining activities by foreign nationals, there are still some foreign nationals operating in remote mining areas (e.g. Manso Nkran) of the country.

The influx of migrant miners has led to a higher level of mechanization of the operations (use of excavators, trucks, dredging machines, crushers, etc.) and has increased the scale of mining. Consequently, this has increased the levels of land degradation, rechanneling of river/stream courses, and contamination of surface water bodies in terms of increased turbidity, total suspended solids (TSS), and total dissolved solids (TDS) to unacceptable levels. Bansah and Bekui (2015) report unacceptably high turbidity levels of water samples from the Bonsa River in the Western Region of Ghana, and attributed the levels to pronounced mining activities in and around the river. The colour of most streams in the vicinity of the operational areas can also be described as aesthetically objectionable.

It is publicly known that small scale miners in Ghana operate in unsafe conditions, and pose serious threats to other land users and the environment. However, very little research has been conducted to ascertain and address the safety and environmental issues related to small scale underground mining in Ghana. This paper therefore identifies the safety issues in small scale underground mines in Ghana and suggests methods to improve the safety of operations. Field visits were made to four different small scale underground mines; Dakete Mining Limited, Mohammed & Co. Small Scale Mining, Johnson Mining Company Limited, and Stejoan Mining Group, around Tarkwa in the Western Region of Ghana to assess the conditions of operations. Mine owners and mine operators were interviewed on site while the underground workings were accessed for relevant first hand information. Visits were also made to the office of the Minerals Commission, a regulatory body, to interact with personnel on their views on small scale underground mining in Ghana and the need for health and safety training for the mine operators to mitigate the dangers associated with SSM operations in Ghana.

2. Legal and regulatory framework of small scale mining

According to the World Bank, small scale mining is widespread in developing countries in Africa, Asia, Oceania, and Central and South America (World Bank, 2013). Small scale