

Gold Mining Industry Environmental Pollution Types and Effects

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INTRODUCTION

The gold mining industry has positive contribution economically due to government revenue and employment emanating from the industry. Beside these benefits, environmental pollution from the industry has remained a big challenge. There are three types of environmental pollution from the gold mining industry namely the mercury, cyanide and acid mine drainage (AMD) pollution. The mercury pollution comes from artisanal and small scale gold mining (ASGM) industry, which is mercury dependent and the largest source of mercury pollution on earth. Cyanide pollution comes from the large scale gold mining (LSGM) industry where it is used to extract gold. The method used in the extraction of gold in LSGM industry is that of using sodium cyanide solution to leach gold from the ore. The leaching process allows the mixing of the crushed ore with the cyanide salt in water. The cyanide binds to the gold ions which make them to be soluble in the solution and hence separating them from the rock. Zinc is then added to precipitate out the gold. The AMD pollution is caused by water flowing through the sulphide bearing materials forming solutions of net acidity. When mines are closed or abandoned mines, lead to contaminated ground water as well as surface water by AMD.

Mercury Dependant Gold Mining Industries and their Environmental Pollution Effects

Mercury is used in gold mining industry to recover minute pieces of gold mixed in soil, sediments and in crushed rocks. Mercury and gold combine together to form an amalgam which is an alloy combination of gold and mercury. Finally mercury is extracted using open flame to separate mercury from the gold by vaporization of the mercury. Mainly mercury is used by artisanal small scale miners and the industry is known as artisanal small scale gold mining (ASGM). The mining activities from this industry are vital to the small scale miners and to the government through employment earnings by the miners and through revenue collection by the government.

Despite of the fact that there are these benefits, there are also challenges associated with the mercury based gold mining due to the environmental pollution. The elemental mercury which is used to extract gold is released to the environment through vaporization. The health of the miners can become in danger by inhaling the mercury leading to neurological damage and other health

issues. Other health issues that have been associated to mercury pollution are problems with the kidneys, central nervous system together with cardiovascular system. Methyl mercury also known as organic mercury which is formed by mercury being converted to this compound by microbes is also poisonous to human health. This type of poisoning have been linked to eating sea food mainly fish through eating certain types of mercury containing fish. The routes of exposure of elemental mercury are through inhalation of mercury vapours and by slowly being absorbed through the skin if the elemental mercury comes in contact with the skin.

Large Scale Gold Mining (LSGM) Cyanide Environmental Pollution an Effects

Sodium cyanide solution is commonly used to leach gold particles from their ore by the LSGM companies. The cyanide dissolves the gold from the ore into solution as it goes through the crushed ore heap. Modern recovery methods that utilized cyanide solutions can recover nearly 100 % of the gold which make the recovery process been profitable to the mining companies. Although this gold extraction process is profitable, there also exists environmental pollution effects associated with this kind of gold extraction activities.

The effluents coming from these mining industries can find their way to the surrounding unpolluted water streams and pollute them. The result of this pollution could be devastating to wildlife, fish, invertebrate and human being. Fish and invertebrate are especially sensitive to cyanide pollution and can cause high mortality to these organisms at concentrations higher than 20 microgram/L [1]. Cyanide is deadly toxic to human even in small amount. Small dose of cyanide can result in rapid breathing restlessness, dizziness, weakness, headache, nausea, vomiting and increased heart rate. A prolonged exposure to a larger dose (1 part in 500) in an enclosed spaced could lead to convulsion, low blood pressure, loss of consciousness, lung injury and death 8-10 minutes [2].

Gold Mining Acid Mine Drainage (AMD) Environmental Pollution and Effect

AMD is produced when sulphide bearing material is exposed to oxygen and water. This forms acid solution which dissolves other heavy metals existing together with the gold. The leaching of these heavy metals into the environment can cause pollution of both

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ground water and surface water. AMD occurs in both open pit and underground mines that contain rocks with mineral sulphide where oxidation of the sulphide in the presence of water leads to the formation of acid mine drainage. This drainage pollutes water when merging with unpolluted streams. The water quality is mainly affected by the water running through the mine tailing, spillage from dams with acid mine drainage and from reprocessed tailings. The resulting chemicals are sulphuric acid for which its runoff dissolves other heavy metals such as copper, lead, mercury and iron into the ground water

AMD is characterized by low pH high salinity levels, elevated concentrations of sulphate, iron and manganese, raised levels of toxic metals such as cadmium, cobalt, copper, molybdenum, zinc and possibly radionuclides [3]. The method that has been used to reduce the effects of AMD is that of constructed wetlands. This method receives near neutral water after it has been neutralized by

using liming processes. Precipitation occurs as a result of oxidation of metal at this pH and complication, precipitating as carbonates and sulphides. The effluent from the wetlands at pH near neutral is buffered at 6.5 to 7.0 pH and discharged [4].

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