

Monitoring Water Quality in River Bodies of Mining Communities in Ghana

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ABSTRACT

The Ghanaian mining industry has contributed greatly towards the socio-economic development of the country but its negative impacts, particularly on natural resources, raise a question about the net effect of mining on mining communities in Ghana. One major natural resource which is negatively affected by mining is water. The quantity and quality of water available in mining communities in Ghana is declining rapidly as mining activities increase. This is caused by the direct use of water from rivers by miners and also the discharge of mining waste into rivers from mines. This is depriving many communities of their source of clean drinking water. This study sought to investigate the effectiveness of government efforts to ensure the quality of water in these areas is maintained by using the MERI (monitoring, evaluation, reporting and improvement) approach as a framework. It was ascertained that attempts are made to address the monitoring, evaluation and reporting aspects but little improvement occurs. A number of solutions are recommended. These include establishing more stringent water quality monitoring programs, investigating waste disposal from production sites of mines and introducing progressive rehabilitation as opposed to post-mining rehabilitation. Additionally, adequately resourcing regulatory bodies and stricter sanctions for offenders is essential.

Key Words: monitoring, river bodies, mining communities, water quality

1. INTRODUCTION

The importance of mining in the history of Ghana's socio-economic development is considerable and well documented, with the country's former name, Gold Coast, reflecting the essence of the rich mineral resource, especially gold trade to the country by then (Agbesinyale, 2003; Akabzaa & Darimani, 2001; Akabzaa, 2000). Ghana is the second largest gold producer in Africa after South Africa, with gold exports accounting for about 40% of total export earnings (Tschakert & Singha, 2007). Even though other minerals such as diamond, bauxite and manganese are mined in Ghana, gold dominates the Ghanaian mining industry. Mining over the years has contributed immensely towards Gross Domestic Product (GDP) (Amponsah-Tawiah, 2011) and the socio-economic development of Ghana in terms of provision of employment and social infrastructure (Hilson, 2002). However, some studies have also reported the negative impacts of mining, especially on natural resources. The net effect of mining especially on mining communities in Ghana is therefore questionable.

One major natural resource affected by mining activities in Ghana is water in river bodies. Declining water quantity and quality in rivers of mining communities in Ghana has become a matter of great concern as mining activities keeps increasing (Donkor *et al.*, 2006). The direct use of river water by miners and or the discharge of mine waste into rivers (Oduro *et al.*, 2012; Tschakert & Singha, 2007; Donkor *et al.*, 2006) are depriving mining communities

access to clean portable water. Lack of access to clean water can affect Ghana's effort in attaining the Millennium Development Goals (MDGs) (Armah *et al.*, 2011).

Monitoring the activities of mining companies for compliance is very important in ensuring the sustainability of all the natural resources found in these communities. The Mining Act 703 has given regulatory powers to The Ghana Chamber of Mines, Forestry Department, Minerals Commission and the Environmental Protection Agency (EPA) to periodically monitor the activities of mining companies for compliance. Even though monitoring is been done by these regulatory bodies, the continual decreasing quality and quantity of water in rivers in mining communities shows flaws in the monitoring system.

The aim of this study therefore is to access the effectiveness of government efforts and other interest groups in ensuring good water quality in river bodies of mining communities in Ghana. This was done using the MERI (motoring, evaluation, reporting and improvement) approach as a framework. The MERI system has been used successfully in monitoring most land use systems in most developed countries. An example is 'Caring for our Country' program (May, 2010; Ross *et al.*, 2009) used in managing indigenous protected areas in Australia.

2. MONITORING PROGRAMS

Monitoring water quality in rivers of mining communities in Ghana is a very common practice and comes in many different forms by many interest groups. These groups can be categorised into academic and research institutions, community watch dog (pressure groups) like "Wassa Association of Communities Affected by Mining" (WACAM), Non-governmental organizations (NGOs) like ActionAid Ghana, government institutions, mining companies and individuals. Different groups monitor different indicators (whether slow or fast variables) depending on the objectives and aim of that group. Some measurable indicators being monitored by different groups include the presence of heavy metals like Mercury (Hg), Arsenic (As), cadmium (Cd), lead (Pb), zinc (Zn) and copper (Cu) in the water (Boamponsem *et al.*, 2010); and levels of nitrates, chemical oxygen demand (COD), sulphates, electrical conductivity (EC), and pH of water bodies (Armah *et al.*, 2012). Asamoah-Boateng, (2009) also looked at parameters like Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Turbidity, Total Hardness (TH) and Alkalinity of water bodies around Newmont Ghana concession areas. Most research on monitoring and evaluating quality of water in river bodies in mining communities in Ghana has been focused on the fast critical variables like Total Suspended Solids (TSS), colour and turbidity which are easily noticeable within a short span of time.

Although there are various efforts on monitoring from various interest groups to ensure sustainability and a friendly coexistence of the mining sector and its environment, some aspects of the mining activities are still difficult to monitor and control. Small-scale illegal mining has been difficult to monitor and the impact it has on the environment, especially rivers, is catastrophic.

Meanwhile the mining companies are been tasked by the 2006 Mining Act of Ghana, Act 703 section 63, to conduct a regular monitoring of its activities and report to the appropriate quarters on a monthly basis. The mining Act therefore takes cognisance of the MERI system for a healthy land use in Ghana.

3. EVALUATION PROGRAMS

The periodic evaluation or assessment of the activities of mining companies and its related impact on river bodies is the duty of Inspectorate Division of the Minerals Commission and the Environmental Protection Agency (EPA) although other governmental agencies do assist. The periodic assessment of the EPA on the impact and the appropriateness of the activities of mining companies on water qualities have been criticised by residents of most affected communities. The EPA, which is charged with testing and regulating local water safety levels is under-resourced and is ineffective according to the residents. They have accused the agency of relying on water samples provided by the mining companies for its water quality assessment analysis (ActionAid, 2006). Such an assessment by the EPA is likely to be erroneous as the mining companies may not present true samples to reflect the level of contamination they have cause to the environment. Higher levels of contaminations come with higher fines. Issues like this have created the impression in the minds of many Ghanaians that the impact of these regulatory bodies hasn't been felt and has led to a series of increasing incidence of polluted water bodies. An example is the Jimiso Dam near Obuasi in the Ashanti region as shown below (figure 1) where the activities of AngloGold Ashanti mining company have made the water in the dam unusable as levels of pollutants (particularly cyanide and Mercury) are beyond the safe limits (threshold) for both human and aquatic life.



Figure 1: The heavily polluted Jimiso dam near Obuasi in Ghana. (Source: ActionAid, 2006)

Meanwhile, evaluation of findings based on data collected in most cases has been a one-time activity which may be subject to change with change in activities of the mining companies. For a example, in 2006 an evaluation by ActionAid Ghana revealed the amount of pollutants in river bodies in Obuasi and its environs as a result of the activities of AngloGold Ashanti is about 38 times higher than the accepted legal levels (ActionAid, 2006). These findings from 2006 are likely to have changed by present times and a current monitoring and evaluation will be needed.

4. REPORTING PROGRAMS

Reporting of findings of monitored land use in Ghana has been poor. Although there has been some level of reporting in the form of publications of research findings in journals and

magazines and reporting through both the electronic and print media, there is more to be done as most of these reported figures in most cases do not represent the true picture or not enough representation of the monitored parameter.

Some key findings reported from research done in Ghana on water quality in mining communities in the past include Mercury (Hg), Arsenic (As), Lead (Pb) and Zinc (Zn) pollution. Adimado *et al.*, (2002) studied and reported on Mercury (Hg) concentrations in human blood, hair, nails, urine from inhabitants as well as fish from the Ankobra and Tano river basins in the south-western gold belt of Ghana. Also, Bannerman *et al.*, (2003) reported high levels of Mercury (Hg) and Arsenic (As) contamination in the Ankobra river basin passing through the gold mining areas. Bonzongo *et al.*, (2003) also examined and reported on the extent of Mercury contamination in water from artisanal gold mining and its impacts on Ghanaian watersheds. Armah *et al.*, (2010a) reported elevated heavy metal concentrations, especially Mercury (Hg), Lead (Pb), Arsenic (As), Copper (Cu) and Cadmium (Cd) which are above the Ghana Environmental Protection Agency (GEPA) and World Health Organisation (WHO) permissible levels in surface water samples in mining districts in Ghana.

However, there have been instances where reporting of information has been skewed depending on the interest of the monitoring body. A typical example is the case of AngloGold Ashanti, a mining firm operating in Ghana. According to ActionAid's research in 2006 AngloGold Ashanti (AGA) failed to report its activities accurately to shareholders and the general public. The report indicates that there were by then an on-going water contamination, environmental damage and toxic pollution of water in rivers and streams. Pollution levels were over 30 times above the maximum legal limits, with high levels of arsenic, iron, manganese and other heavy metals (ActionAid, 2006). This was not reported accurately by the mining firm's own monitoring and assessment put in place.

The Mining Act of Ghana Act 703 section 63 stipulates that:

“A holder of a license or lease under section 62 shall within the first week of each month furnish the Commission and the Geological Survey Department with a true report in writing of the prospecting and mining operations conducted by the holder in the immediately preceding month.....” Act 703 (2006).

This section of the mining Act gives an indication that mining companies are obliged to regularly report on self monitored activities but the inefficiencies in the other regulatory bodies to make sure mining companies are in compliance or reporting correctly is the problem. This has led to the increasing case of water pollution in the most mining communities depriving the local residents of their source of drinking water.

5. IMPROVEMENT PROGRAMS

The Improvement aspect of the MERI approach of water quality monitoring can be said to be the weakest link in the cycle although that should have been the strongest and most important. Short term solutions or improvement programs have been used by most mining companies in addressing the pollution they cause to the environment. Instead of making adjustment to their activities to minimise the incidence of water contamination, mining companies look for the easiest way of managing the consequences and not dealing with the problem from the source. In several mining communities in Ghana, groundwater has become the source of drinking water due to the high level of contamination of surface water by mining activities (Armah *et al.*, 2011). The mining companies in affected communities have over the years pursued improvement programs that provide groundwater-based supply systems in a form of hand-dug wells and boreholes to the affected communities (Obiri *et al.*, 2010).

The diagram below (figure 2) is an example of a borehole provided by a mining company to supply affected communities with drinking water as a short term improvement program after their own monitoring and assessment revealed the contamination caused to drinking water.



Figure 2: A bore hole for an affected community. Source: ActionAid, 2006

The majority of the bore holes supplied to the affected communities has also been polluted as a result of contaminated underground aquifers or water table (Armah *et al.*, 2012) and has been capped off completely. This has been affirmed by research findings that contamination of both surface and ground water bodies have particularly been experienced in gold mining communities in Ghana (Obiri 2007; Kuma *et al.*, 2004).

The Council for Scientific and Industrial Research (CSIR), a governmental agency in Ghana has done research that revealed that many mining communities in the Western Region are at risk of health-related issues from heavily polluted water bodies by small-scale mining activities in the region (Yeboah, 2013).

All the afore-mentions examples are evidence to show the inappropriateness of much mining activity and its impact on water quality yet there is no effective government political will to ensure better improvement programs to address the land use system in the mining sector. Mining companies are left on their own to do what will give the maximum return on their investment without caring for the environment. The mining sector reforms in Ghana favoured the mining companies (Akabzaa, 2009) in an attempt to woo private foreign investors which consequently yielded the needed result. Meanwhile little is done to the environment these mining companies destroy.

The Mining Act 703 only spells out how rehabilitation of mined concessions should be done after the exploration is completed. This means that if a mining company is still working on a concession of land, no matter how dangerous its activities may appear, it can still continue without bothering with any holistic improvement programs until exploration is complete. This has denied many mining communities access to clean drinking water.

6. DEFICIENCIES IN THE MERI APPROACH FOR THE GHANAIAN MINING INDUSTRY

The implementation of MERI to the activities of mining industry in an attempt to improve the water quality in mining communities has highlighted some deficiencies no matter the angle it is perceived.

The table below (table 1) shows comparisons of some parameters for measuring water quality by Armah *et al.*, (2010b). From the table parameters like Lead, Arsenic, Zinc and Mercury have higher permissible levels by Ghana EPA than that of World Health Organisation (WHO). This give an indication that the Ghana EPA is not keen on improving these parameters to meet the WHO levels but rather put them higher to cater for the wrong doing from the mining companies

Another deficiency was discovered by ActionAid, (2006) where the director in charge of mining at the EPA confirmed that mining companies provide water samples to the EPA for pollution analysis – a system which will not give the needed result. This has been a deficiency on the part of the regulatory body the EPA. The agency must have their own intelligence of cross checking the activities of mining companies whether it conforms to the law.

Table 1: Ghana EPA and WHO permissible of heavy metals concentrations. (Source: Armah *et al.*, 2010b)

Parameter	GEPA	WHO
Manganese (mg/l)	-	0.4
Lead (mg/l)	0.1	0.01
Copper (mg/l)	-	2
Arsenic (mg/l)	1	0.01
Zinc (mg/l)	10	3
Mercury (ppb)	0.2	0.01
Iron (mg/l)	-	0.3
Cadmium (mg/l)	-	0.003
pH	6.5 - 8.5	6.5 - 8.5
Turbidity (NTU)	-	-
Electrical Conductivity (μ S/cm)	5	5
Color	15	14
Total dissolved solids (mg/l)	1000	1000

A typical MERI analysis being used in monitoring in Ghana is shown below (figure 3). About 35% effort is being given to the monitoring, 30% to evaluate and interpreting the data or parameters gathered and about 20% effort is into reporting the evaluated information. A smaller percentage of effort (about 15%), goes into improving the situation. This is the most critical part and needs most attention.

Since the improvement aspect is not properly done, the problems caused by the activities of the mines will continue to increase despite having knowledge of the existence of the problems.

Some examples of such situations are found in all the research work done and published as academic articles in journals without having any positive impact on the situation on the ground.

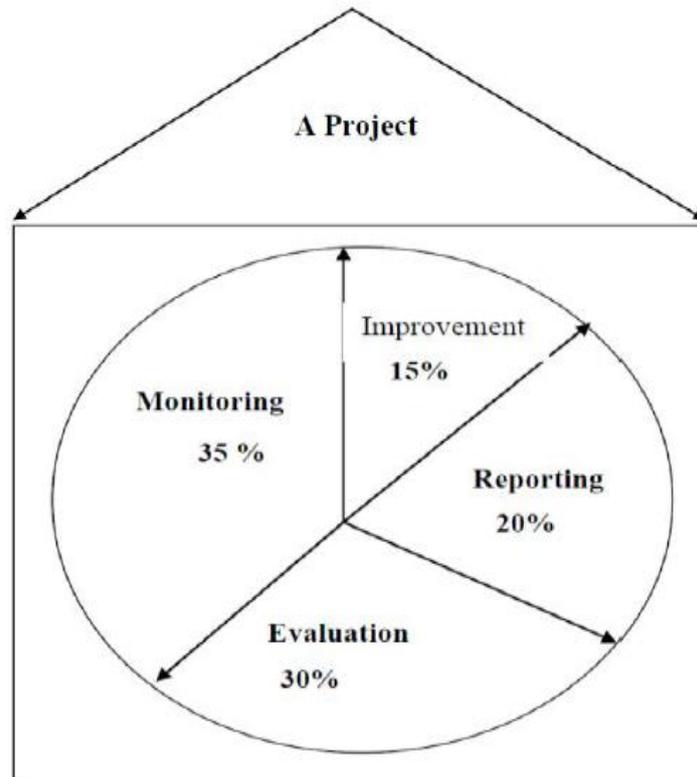


Figure 3: A typical project under MERI analysis in Ghana. (Source: Authors own estimation)

7. CONCLUSION

Inadequate monitoring of players in the Ghanaian mining industry for compliance will result in the destruction of many natural resources that support the mining communities. Adequately resourcing regulatory bodies to properly monitor these players is crucial if the mining industry must continue to contribute positively towards the socio-economic development of the country without having the negative impacts on the environment.

The following are some recommendations for the government of Ghana to follow in ensuring a sustainable mining industry:

1. To put in place a more stringent and stricter water quality monitoring and assessment through its regulatory bodies.

2. Waste disposal from production sites of mines should be properly investigated by the regulatory agencies (EPA, Ghana Water Commission) to ascertain true the levels of contaminants discharged into the environment.
3. Progressive rehabilitation, as opposed to post-mining rehabilitation should be used in preventing generation of sediment, which eventually pollutes river bodies.
4. Regulatory bodies must be adequately resourced to function effectively and efficiently in ensuring compliance by mining companies.
5. Stricter sanctions must be applied to those who do not comply with the mining regulations to serve as deterrent for other potential offenders.

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