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**MINING COMMUNITIES PERCEPTION OF OPEN
PIT OPERATIONS: THE CASE OF THE PEOPLE OF
BRAHABEBOME**

BY

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SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD OF M.A.
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OF SOCIAL STUDIES, INSTITUTE OF STATISTICAL,
SOCIAL AND ECONOMIC RESEARCH, UNIVERSITY OF
GHANA.

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ACCEPTANCE

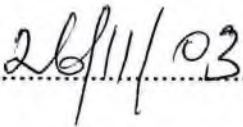
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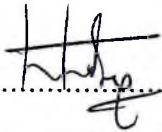
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DECLARATION

THIS PROJECT WORK WAS CONDUCTED BY ME AS PRESENTED, WITH THE SUPERVISION OF DR. ANTHONY TSEKPO OF THE INSTITUTE OF STATISTICAL, SOCIAL AND ECONOMIC RESEARCH (ISSER), UNIVERSITY OF GHANA.



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ACKNOWLEDGEMENT

TO GOD BE ALL THE GLORY AND HONOUR, FOR HIS CARE AND LOVE THROUGHOUT MY LIFE AND ESPECIALLY, THROUGHOUT THIS PROJECT PERIOD.

IN THE PREPARATION OF THIS WORK, A GREAT DEAL OF DEBT IS OWED MY SUPERVISOR, DR. ANTHONY TSEKPO, WHOSE SCRUPULOUS AND METICULOUS SUPERVISION COUPLED WITH HIS CONSTRUCTIVE AND MATURE CRITICISM HAVE GONE A LONG WAY TO PUT THIS WORK IN SHAPE. ONCE AGAIN I AM MOST GRATEFUL.

MY APPRECIATION ALSO GOES TO THE ENTIRE STAFF OF ISSER AND MY COLLEAGUES WHOSE ENCOURAGEMENT MOTIVATED ME TO CARRY ON IN DIFFICULT TIMES.

LASTLY MY APPRECIATION ALSO GOES TO MISS GRACE ASHIE AND MR. ENOCH DZIWORNU EDOKEY FOR TYPING THIS WORK.

DEDICATION

**THIS WORK IS DEDICATED TO THE LORD JESUS CHRIST WHO LOVED ME
SO MUCH TO DIE FOR ME ON THE CROSS.**



TABLE OF CONTENTS	PAGES
ACCEPTANCE.....	ii
DECLARATION.....	iii
ACKNOWLEDGEMENT.....	iv
DEDICATION.....	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES.....	x
ABSTRACT.....	xiii
 CHAPTER ONE	
INTRODUCTION AND BACKGROUND.....	1
1.1 INTRODUCTION.....	1
1.1 PROBLEM STATEMENT.....	3
1.2 OBJECTIVES OF THE STUDY.....	3
1.3 SCOPE OF STUDY.....	4
1.4 JUSTIFICATION OF THE STUDY.....	4
1.5 PURPOSE OF THE STUDY.....	4
1.6 HYPOTHESES.....	5
1.7.0 THEORIES.....	5
1.7.1 ECO-DEVELOPMENT.....	5
1.7.2 SUSTAINABLE DEVELOPMENT.....	6
1.8 APPROACH AND METHODOLOGY.....	7

1.9	LIMITATIONS.....	8
CHAPTER TWO.....		9
THE MINING INDUSTRY AND THE ENVIRONMENT.....		9
2.0	INTRODUCTION.....	9
2.1	MINING AND THE ENVIRONMENT.....	9
2.1.1	LAND, FOREST AND ECOSYSTEMS.....	9
2.1.2	WATER.....	10
2.1.3	MINE WASTES AND TAILINGS.....	10
2.1.4	AIR POLLUTION.....	11
2.1.5	NOISE AND LIGHT POLLUTION.....	11
2.2	BRIEF HISTORY OF GOLD MINING IN GHANA.....	11
2.3	DEVELOPMENTS IN THE MINING SECTOR OF GHANA.....	12
2.4	MINING AND THE NATIONAL ECONOMY.....	14
2.5	LARGE SCALE MINING COMPANIES IN GHANA.....	17
2.6	SMALL SCALE MINING IN GHANA.....	19
2.7	POLICY REFORMS AND ENVIRONMENTAL CONCERNS IN THE MINING INDUSTRY.....	20
2.8	SOME OBSERVATIONS ON THE EFFECT OF SURFACE MINING OPERATIONS ON THE ENVIRONMENT.....	22
CHAPTER THREE.....		24
DESCRIPTION OF THE STUDY AREA.....		24
1.3	INTRODUCTION.....	24
3.1	PHYSICAL CHARACTERISTICS.....	24

3.1.1	LOCATION AND SIZE.....	24
3.1.2	RELIEF AND DRAINAGE.....	24
3.1.3	CLIMATES.....	25
3.1.4	VEGETATION.....	25
3.1.5	GEOLOGY.....	25
3.1.6	SOILS.....	26
3.2	MINERALS.....	26
3.3	POPULATION.....	26
3.4	WATER AND SANITATION.....	26
CHAPTER FOUR.....		28
DATA ANALYSIS AND RESULTS.....		28
4.0	INTRODUCTION.....	28
4.1.1	DISTRIBUTION OF RESPONDENTS BY SEX.....	28
4.1.2	DISTRIBUTION OF RESPONDENTS BY OCCUPATION.....	29
4.1.3	DISTRIBUTION OF RESPONDENTS BY LENGTH OF STAY.....	30
4.1.4	PERCEPTION OF RESPONDENTS BY THEIR SURFACE MINING OPERATIONS.....	30
4.1.5	DISTRIBUTION OF RESPONDENTS BY CHANGES OBSERVED IN ENVIRONMENT DUE TO SURFACE MINING OPERATION.....	31

4.1.6	PERCEPTION OF RESPONDENTS OF THE EFFECT OF DUST FROM MINING OPERATIONS.....	33
4.1.7	RESPONDENTS 'PERCEPTION OF THE CONTRIBUTION SURFACE MINING OPERATION TO NOISE.....	34
4.1.8	RESPONDENTS PERCEPTION OF THE CONTRIBUTION OF SURFACE MINING OPERATION TO THE POLLUTION OF STREAMS AND OTHER WATER SOURCES.....	35
4.1.9	PERCEPTION OF RESPONDENTS' OF THE EFFECT OF SURFACE MINING.....	36
4.1.10	PERCEPTION OF RESPONDENTS OF THE EFFECT OF SURFACE MINING ON FARMING.....	38
4.1.11	PERCEPTION OF RESPONDENTS OF THE EFFECT OF SURFACE MINING OPERATIONS ON BUILDINGS.....	39
4.2.0	RESPONDENTS' ASSESSMENT OF SURFACE MINING OPREATIONS TO ENVIRONMENTAL AND HEALTH ISSUES.....	39
4.2.1	NOISE POLLUTION.....	39
4.2.2	AIR POLLUTION.....	40
4.2.3	REMOVAL OF VEGETATION AND FOREST COVER.....	40
4.2.4	DESTRUCTION OF FARM LANDS.....	40
4.2.5	REDUCTION OF BIRDS AND ANIMALS.....	41
4.2.6	CREATION OF SCENIC SCARS.....	41
4.2.7	INFLOW OF MIGRANT POPULATION.....	41

4.2.8	BUILDING OF HEALTH FACILITIES AND HEALTH PROBLEMS.....	42
4.2.9	POLLUTION OF STREAMS AND OTHER WATER BODIES.....	42
4.3	ANALYSIS OF QUESTIONNAIRE ADMINISTERED TO REGULATORY BODIES AND OTHER STAKEHOLDERS IN THE MINING SECTOR.....	42
4.3.1	REASONS FOR THE ADOPTION OF SURFACE MINING METHOD.....	43
4.3.2	REASONS OF BENEFIT DERIVED FROM SURFACE MINING.....	43
4.3.3	NEGATIVE ASPECTS OF SURFACE MINING OPERATIONS.....	44
4.3.4	WAYS OF MITIGATION NEGATIVE EFFECTS OF SURFACE MINING OPERATIONS	45
	CHAPTER FIVE.....	47
5.0	INTRODUCTION.....	47
5.1	OBSERVATIONS AND FINDINGS.....	47
5.2	RECOMMENDATIONS.....	49
5.4	CONCLUSION.....	51
	 BIBLIOGRAPHY.....	 52-55
	APPENDICES.....	56-60

LIST OF TABLES

TABLE	PAGE
1. GOLD OUTPUT IN MAJOR MINES: PRE-ERP (OZ).....	13
2. GOLD PRODUCTION AND REVENUE TRENDS.....	13
3. MINERAL PRODUCTION SALES VALUES FOR JANUARY – DECEMBER 2002 (CHAMBER MEMBERS ONLY).....	15
4. TOTAL INVESTMENT IN THE MINERALS SECTOR POST- ERP (EXCLUDING PROSPECTING COMPANIES).....	16
5. LARGE SCALE MINING COMPANIES OPERATING IN GHANA AND THE TECHNOLOGY ADOPTED IN MINING.....	18
6. DISTRIBUTION OF RESPONDENTS BY SEX.....	28
7. DISTRIBUTION OF RESPONDENTS BY OCCUPATION.....	29
8. DISTRIBUTION OF RESPONDENTS BY LENGTH OF STAY AT BRAHABEBOME.....	30
9. PERCEPTION OF RESPONDENTS ON WHAT THEY DISLIKE ABOUT SURFACE MINING OPERATIONS.....	31
10. PERCEPTION OF RESPONDENTS ON CHANGES THEY HAVE OBSERVED IN THEIR ENVIRONMENT DUE TO SURFACE MINING OPERATIONS.....	32
11. PERCEPTION OF RESPONDENTS ON SOURCE OF DUST FROM SURFACE MINING OPERATIONS.....	33
12. DISTRIBUTION OF RESPONDENTS ON SOURCE OF NOISE FROM SURFACE MINING OPERATIONS.....	34

13. PERCEPTION OF RESPONDENTS ON SURFACE MINING OPERATIONS AND POLLUTION OF STREAMS AND OTHER WATER BODIES.....	35
14. PERCEPTION OF RESPONDENTS ON SURFACE MINING AND FARMING ACTIVITIES.....	37
15. PERCEPTION OF RESPONDENTS ON THE EFFECT OF SURFACE MINING OPERATIONS ON BUILDINGS.....	38
16. PERCEPTION OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS ON FACTORS INFLUENCING OFFICIAL ENDORSEMENT OF SURFACE MINING.....	43
17. PERCEPTION OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS ON OTHER BENEFITS DERIVED FROM SURFACE MINING ACTIVITIES APART FROM EMPLOYMENT AND PAYMENT OF ROYALTIES.....	44
18. PERCEPTION OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS ON NEGATIVE ASPECT OF SURFACE MINING.....	45
19. PERCEPTION OF HEADS OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS ON WAYS OF MITIGATING THE NEGATIVE EFFECT OF SURFACE MINING OPERATIONS.....	46

ABSTRACT

Economic liberalisation in Ghana has made the hitherto unprofitable mining sector the most viable sector of the economy over the past decade. Cost effectiveness consideration and improved extraction technologies have combined to make open pit mining the preferred method of mining among the large number of mining companies operating in the country.

However, the open pit mining has some perceived environmental consequences. The subject matter of this dissertation is to find out the perception of people of Brahabehome of the effect of surface mining operations on the environment.

The study was carried out at Brahabehome a small community in the Wassa West District of the Western Region.

The objective of the study is to investigate the perception of the people on the effect of surface mining activities on the environment.

Primary data were as obtained by using simple random sampling to select 100 household heads and structured questionnaires administered to them. Again structured questionnaires were administered to regulatory institutions and other stakeholders as well as a non-governmental organisation.

The study sought to find out the perception of the community of the effect of surface mining operations on water, air, forest land and birds and animals. Simple percentages were used to analyse the field data.

It was found out from the study that 33% of respondents disliked surface mining activities because of the noise generated during operations; 31% of respondents disliked surface mining because of the perceived pollution of streams and other water sources. Also 29% of respondents mentioned dust generated during surface mining operations as their major dislike of surface mining operations and 5% of respondents the degradation of land.

From the study it was found out that majority of respondents 98% rated the contribution of surface mining activities to noise generation as very significant. Further, it was found from the study that 74% of respondents share the view that the contribution of surface mining to air pollution was very significant. Additionally, 94% of respondents rated the contribution of surface mining to the removal of vegetation and forest cover as very significant 96% of respondents rated the contribution of surface mining activities to the destruction of farmlands as very significant or above average.

Excavation due to surface mining is perceived to have badly denuded the land and with inhabitants limited as to the type crops to be cultivated very few, 4% of respondents are engaged in farming. It is recommended amongst others that excess land which is not needed for surface mining operations must be ceded to the community to enable them engage in farming and other related activities.

Further more, Government must provide the policy and legislative framework for a process by which the mining firms, Government, non-governmental Organisations (NGO's) and the community can communicate in a proactive and constructive way which will allow mining firms minimize the perceived negative effects on the local community.



CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.0 INTRODUCTION

Ghana has substantial mineral resources; the major minerals exploited being gold, diamond, manganese, bauxite, salt, sand and gravel (Mireku-Gyimah, 2001). There has been significant increase in mining activities in Ghana, since 1986, due to a number of steps taken by the government, notably the Economic Recovery Programme (ERP) and the Minerals and Mining Law of 1986 (Acquah, 1987).

Salami and Tsepko (2000), have observed that the liberalization in the mining sector in particular meant the introduction of private capital. Thus many new mining companies were established since the late 1980s with varied ownership structures. Notable among the new companies operating in the Wassa West District where this study was conducted are Teberebie Goldfields (Tarkwa) now defunct, Billiton Bogoso Gold Ltd. (Bogoso), Ghana Australian Goldfields Ltd. (Iduaprim), Bonte Gold Mines Ltd (Bonte), Prestea Sankofa Gold Ltd. (Prestea), Abosso Goldfields (Damang) and Gold Fields (Ghana) Ltd (Tarkwa).

The main minerals being mined by the companies listed above, is gold. Gold contributes more than 90% of the total value of minerals won in the country and has attracted the largest number of large and small-scale operators (Akabzaa and Darimani, 2001). Mining, looked at the economic viewpoint, is an activity considered

to be very desirable. It provides a potential source of varied opportunities for the development of settlements or towns, which are privileged to have mineral deposits. The mining industry contributes 40% of Ghana's gross foreign exchange earnings and directly employs about 18,000 people most of whom are Ghanaians (Anaman, 2001). It is also noteworthy that some mining companies provide infrastructural facilities such as schools, hospitals, roads and potable water in the localities that they are situated. Besides, the companies improve the professional and technical training skills of the people through training and employment.

There are two main types of mining in Ghana, namely underground (deep) and surface or opencast mining. In addition there is also artisanal or small-scale mining. The main negative impacts of mining include destruction of vegetation, land degradation, air pollution, noise generation and water pollution. Lately, underground mining has become unprofitable and mining companies are increasingly turning to open pit mining. The open pit mining has some environmental consequences and adversely affects the livelihood of people (ISSER, 2000).

According to Asante et al (2000), traditionally, the large companies like Ashanti Goldfields Company (AGC), Gold Fields (Ghana) Limited (GFL) have operated only underground mines. However, by the early 1990s, new medium-sized firms introduced state-of-the-art opencast mining technology. Although ecologically questionable, the cost-effectiveness of the technology is such that low-grade ore, which was unprofitable under the old technology, can now be economically mined. Salami and Tsekpo (2000) have also stated that the profit motivation that drives private investment compelled all new companies and the divested state gold mining

companies to opt for surface mining because many underground ore bodies are currently uneconomic to mine. In addition, however, there are technical reasons for adopting open cast method and according Mireku Gyimah (2001) near-surface deposits can be mined only by surface mining methods. Thus the positive impacts in the form of infrastructural facilities such as schools, clinics and employment notwithstanding, it is pertinent to note that mining and its related activities sometimes impose detrimental effects on Ghana's biophysical and socio-economic environment.

1.1 PROBLEM STATEMENT

With mining firms clearing large tracts of land which are required for surface mining operations affected communities tend to complain about such activities and their perceived effects on the environment. This is because mining communities have a perception of such mining activities on the environment, notably air, water and forestland, which they believe, is negative. Whether these perceptions are real or mere myths (non-existent) remains to be properly investigated. The study aims to unearth information about the perception of the members of the community of the perceived contribution of surface mining operations to the pollution of water, air, noise, destruction of forest land and effects of such activities on birds and animals.

1.2 OBJECTIVES OF THE STUDY

The objectives of the study are to:

- (i) Examine the perception of the people of the effect of surface mining operations on the environment.

- (ii) Provide recommendations that would achieve the aspirations of the local people and the objectives of mine operators in a sustainable manner to ensure that the present generation meets its needs without compromising that of future generations.

1.3 SCOPE OF STUDY

The study covers, a small community, Brahabebome in the Wassa West District of the Western Region. The study would review the general living conditions in Brahabebome and the people's perception with respect to the contribution of surface mining to environmental degradation.

1.4 JUSTIFICATION OF THE STUDY

Surface mining is a recent activity in Ghana's mining sector and not much is known about its full impact on the environment and society at large. There is therefore the need to study all aspects of surface mining operations. The perception of people of the effects of surface mining on the environment is one of the areas that need to be examined to provide a better understanding of surface mining operations. Such study will expose the facts and myths about surface mining operations among its critics and encourage self-examination by surface mining concerns.

1.5 PURPOSE OF THE STUDY

Information obtained from the study will help decision makers in the local and central government and mining firms make informed decisions on matters relating to people's perception on the effects of surface mining operations on the environment.

1.6 HYPOTHESIS

Perception of people o the effect of surface mining on the environment is negative.

1.7.0 Theories

Though there are a number of paradigms of environmental management in development such as Frontier Economics, Deep Ecology, Environmental Protection, Resources Management, Eco-Development and Sustainable Development, two main concepts appear to compete for the treatment of the subject of this study. These are Eco – Development and Sustainable Development. The latter though relatively new has a lot of theoretical appeal because it ensures that both present and future generations are catered for.

1.7.1 Eco-Development

Eco-Development involves a larger, more discontinuous shift in thinking and practice. It more explicitly sets out to restructure the relationship between society and nature into a “positive sum game” through sophisticated forms of symbiosis, compared to the back-to-nature “simple symbiosis” advocated by deep ecologists. It sees most development activity as a form of management of this relationship; environmental management, economic development, and socio-ecological development might virtually become semantic distinctions for the same subject: the integrated co-evolution of conscious civilization and nature. (Colby, 1989).

Eco-development is not just about the clean up of pollution or prevention of excessive resource depletion, or efficiency of resource use, though these are certainly allowed

and included, for practical reasons. Eco-Development includes and expands resource management. Its real goal is to remove the need for the polluter to pay by restructuring the economy according to ecological principles.

Ecological uncertainty needs to be incorporated into economic modeling and planning mechanisms; risk management (trying to figure out how much can be gotten away with) is not sufficient (Perrow, 1984). The polluter pays principle, widely regarded by economists as a major corrective mechanism, does not incorporate ecological uncertainty and social equity issues well at all. Eco-development therefore makes explicit social, ecological, and economic criteria for the development and use of technology.

1.7.2 Sustainable Development

Ecological innovation includes the development and implementation of new products (environmental technologies), new production processes, new resources, new markets and new systems (e.g. transportation of goods) and all of them integrate economy and ecology i.e. introduce ecological aspects in economic strategies. Ecological aspects derive from the concept of “sustainable development” (Welford, 1998).

Sustainable development is development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). This definition includes four principles of sustainability: future, inter generational justice, ecological efficiency and economic growth. The integration of economy and ecology through ecological innovations is understood as a contribution by companies towards sustainable development (Welford, 1998).

A permanent sustainable development has to keep the capital stock of natural resources to such an extent that the quality of life for future generations is guaranteed. Growth further exists as a dominant objective under sustainable conditions, however.

At the Rio Earth Summit in 1992, one hundred and seventy-nine States adopted a declaration committing themselves to making future development sustainable. Agenda 21 did not turn its back on growth, but strive to ensure that the price of growth did not become intolerable bill for future generations (DOE, 1994).

Most communities want to achieve higher standards of living, that is both now and future generations. Equally, they also seek to protect and enhance their environment. Sustainable development tries to reconcile these two objectives. The problems for implementing sustainable development arise when we attempt to balance social and economic progress with natural harmony.

1.8 APPROACH AND METHODOLOGY

Data for the study was obtained from two main sources:

- (a) Field Sources (Primary Data)
- (b) Documentary Sources (i.e. Secondary Data)

The 2002 Housing and Population Census provided and the sampling frame for the target population.

Using the simple random sampling approach the heads of household in particular were selected and interviewed. From a population of 645 males and 629 females it was decided to use a sample size of 100. This gave a sampling fraction of approximately 8% which gives an indication of a good representation.

In addition there was a higher sex ratio which also contributed to more male being interviewed.

The data collected was analysed using computer based Statistical Package for Social Sciences (S. P. S. S). Descriptive statistical techniques were also used to draw inferences.

Government officials of the Department of Town and Country Planning, the Geological Survey Department, the Mines Department, Environmental Health Department, Non-Governmental Organisation (NGOs), Small and Medium Scale Mining Department, Environmental Protection Agency (EPA), Precious Minerals Marketing Company, District Health Administration, the Department of Agricultural Extension, Commission for Human Rights and Administrative Justice, the Minerals Commission as well as the Member of Parliament and the District Assembly were also interviewed. Secondary data were obtained from books and periodicals.

1.10 LIMITATIONS OF THE STUDY

The use of structured questionnaire for the data collection intimidated some of the respondents who also complained of questionnaire fatigue, as they have had to respond to such questionnaires in the past, which according to some receive no further action.

CHAPTER TWO

THE MINING INDUSTRY AND THE ENVIRONMENT

2.0 INTRODUCTION

This Chapter will look at Mining and the Environment, Brief History of Gold Mining in Ghana, Developments in the Mining Sector of Ghana, Mining and the national economy, Large Scale Mining Companies in Ghana, Small Scale Mining in Ghana, Policy Reforms and Environmental Concerns in the Mining Industry and Peoples Perception of the Effect of Surface Mining Operations on the Environment.

2.1 MINING AND THE ENVIRONMENT

2.1.1 Land, Forest and Ecosystems

Mines can occupy and spoil large tracts of land. This is especially the case with open pit and strip mining, which, because of lower costs, is on the increase. According to Ferrari (2000), large scale mining and exploration for fossil fuels with their related roads and energy needs, represent the second largest threat to frontier forests globally, affecting nearly 40% of all frontier forests.

Mining disturbs the soil and bedrock, drainage patterns and long-term fertility. Trees are not only cleared to make way for mining operations. Forests are also cut down to provide energy for the mines. Access roads to mines and pipelines cut into forests. Dumping areas for the millions of tons of waste rock generated in a mining project are frequently identified in forested valleys. The rock wastes being dumped in the Ajikwa River in West Papua, Indonesia at a rate of 130,000 tons a day (currently more than 200,000 tons a day) have devastated 30 square kilometres of lowland rainforest.

Tailings ponds also take land and, in addition, contain concentrations of chemicals and heavy metal. Though increasing claims are made for reforestation after mining, there are often more words than trees. Many reforestation projects cover limited areas

and many of the trees planted do not thrive. The disturbance of original soil structures lead to stunted growth due to water and nutritional deficiencies, (Ferrari, 2000).

2.1.2 Water

Mining consumes massive amount of water during its various phases and can severely lower the water table, depriving plants and people of their water supply. (Ferrari, 2000).

Pollution of water sources with dangerous toxic discharge can also threaten health livelihood. Many mineral processing activities depend on the use of toxic materials including cyanide, concentrated acids and alkaline compounds.

According to Al-Hassan et al (1997) pollution of water by large-scale operation originates from dredging heap leaching, and washing and treatment of ore from the processing plants. In addition, toxic materials discharged from mines can enter the food chain and accumulate in the bodies of animals and people, causing a serious health threat.

2.1.3 Mine wastes and tailings

Huge amounts of ore are extracted in mining. Through the stages of mining, milling and processing massive amounts of waste rock and dust are generated. Extraction of one ton of gold can generate between one to three million tons of waste, depending on ore grade and extraction efficiency. “Contamination does not stop when a mine is closed. Long-term remediation efforts such as water quality treatment and tailings pond care to prevent spills and leakages need to be carried out. Sometimes companies cover these remediation costs, but in many cases mines are abandoned, leaving local communities and governments to deal with the ensuing health and safety issues”, (Ferrari, 2000).

2.1.4 Air pollution

The dust from mining could be serious health hazard and incidents of respiratory ailments are unnaturally high around mines. Plants and trees are also choked, damaged, or killed. Sulphur dioxide (responsible for acid rain) is generated by some processing operations while carbon dioxide and methane, two of the major green house gases responsible for climate change, are generated by burning fossil fuels.

Also grain mills are sometimes used in milling the ore. This causes very serious air pollution and poses potential health hazards to the communities (Al-Hassan et al, 1997).

2.1.5 Noise and light pollution

Many modern mines including open pit projects operate 24 hours per day. Equipment is loud and blasting frequent. These conditions can impose intolerable stress upon local people and forest animals and birds (Ferrari, 2000).

2.2 BRIEF HISTORY OF GOLD MINING IN GHANA

According to Acquah (1992), gold mining and processing in Ghana are centuries old. The modern form of mining and processing in the country commenced near the turn of the last century

Kesse (1985) states that gold is the only mineral, which the people of Ghana discovered and mined successfully with astonishing skill, long before the advent of the Whiteman to the West Coast of Africa. In the early years, gold nuggets were won from alluvial gravels along stream channels and river terraces. Mining was later extended to auriferous quartz veins (reefs), which carried the primary gold.

According to Barning (1988), a number of gold mining companies came to the Gold Coast between 1875 and 1880. The gold mining industry was restricted largely to the

Akan – speaking areas. Like iron, however, gold extraction was shrouded in secrecy and strict rules governed its operation. Gold was associated with magic.

Until 1875 when Western Europeans Companies began mining ventures, it was the African diggers that controlled mining in Ghana. With the coming of scientific gold mining methods in that year, African diggers with traditional mining techniques were displaced; a gold rush by about 400 European companies, with a total capital of \$40 million, began (Agbodeka, 1992).

2.3 DEVELOPMENTS IN THE MINING SECTOR OF GHANA

The mining sector has been dominated by the gold industry over the years. According to Asante et al (2000) the share of gold in total earnings from all minerals stood at almost 89% in 1980 and rose to 90% in 1994. The minerals sector has been a key beneficiary of the policy initiatives under the ERP. The major initiatives taken include:

- a. Removal of the minimum mineral duty which ranged between 5 and 10%; the minimum turnover tax of 2.5%; the 10% import duty, the foreign – exchange tax ranging from 35 to 75% and the gold export levy of ₵3.00 p/oz of gold after 100,000 oz;
- b. The 6% royalty charged on the gross values of minerals obtained was set to vary from a minimum of 3% to a maximum of 12%. There is also a flexible deferment clause which caters for exigencies faced by the companies;
- c. The corporate tax which ranged between 50 and 55% was reduced to a flat rate of 35%; and
- d. The import duty of 35% was replaced by an ‘Import Subsidy Scheme’, which exempted companies from payment of duties on plant and equipment, and from paying the selective Aliens Employment Tax.

However, there was a precipitous decline in output and foreign exchange earnings in all sub-sectors within the mining sector from the mid-1970’s to the early years of the ERP. Tables 1 and 2 show Gold Output in Major Mines: Pre-ERP and Gold Production and Revenue Trends.

TABLE 1: GOLD OUTPUT IN MAJOR MINES: PRE-ERP (oz)

MINE	1976	1977	1978	1979	1980	1981	1982	1983
AGC	361,512	265,684	237,935	232,156	232,036	252,408	268,040	243,194
TARKWA	58,319	56,271	52,931	39,210	43,120	*	*	*
PRESTEA	83,761	79,894	95,263	82,102	77,400	*	*	*
DUNKWA	9,587	64	1,272	4,147	5,394	*	*	*
KONOGO	3,199	4,282	998	61	400	*	*	*
SGMC	*	*	*	*	85,634	69,714	42,097	42,000
TOTAL	516,378	406,195	388,399	357,676	327,683	338,042	310137	285,291

Source: Asante et al (2000)

TABLE 2: GOLD PRODUCTION AND REVENUE TRENDS

YEAR	OUTPUT (oz)	OUTPUT GROWTH RATE	REVENUE (US\$'000)	REVENUE GROWTH RATE
1980	342,904.20		202,350	
1981	338,041.75	-1.42	166,980	-17.48
1982	337,754.14	-0.09	126,590	-24.19
1983	285,291.45	-15.33	104,690	-17.30
1984	282,298.75	-1.05	99,300	-5.15
1985	299,615.38	6.13	93,840	-5.50
1986	287,124.16	-4.17	107,134	14.17
1987	328,955.81	14.57	147,791	38.06
1988	373,936.53	13.67	157,427	6.43
1989	429,475.84	14.85	174,797	11.03
1990	541,408.33	26.06	205,786	17.73
1991	845,907.85	56.24	303,480	47.47
1992	998,194.50	18.00	346,220	14.08
1993	1,261,424.26	26.37	453,636	31.03
1994	1,423,600.00	12.86	519,800	14.59

Source: Asante et al (2000)

The decline in gold mining-which is by far the most important activity during this period was significant. While in the decade 1960-69 Ghana produced 8.0 mill.oz of gold, production fell to 5.97 mill.oz between 1970-79. By 1980-89 it had gone down to a disastrous 3.12 mill.oz. (Songsore et al, 1994).

According to a World Bank Report (1994), the reasons for the decline in minerals production include shortages of foreign exchange to maintain and rehabilitate the mines; lack of capital investment for exploration and development; poor management and lack of mining skills; infrastructure deterioration, particularly shortages of rail capacity for manganese and bauxite;

mining company financial problems due to the greatly overvalued currency and spiralling inflation; a declining grade of gold ore; illegal panning and smuggling of gold and diamonds.

The Bank's policy recommendation regarding the revamping of the gold mining industry, accordingly, included the need for a coordinated programme of rehabilitation and ore development, a satisfactory management autonomy, together with financial and technical assistance in order to reverse the downward production trend.

2.4 MINING AND THE NATIONAL ECONOMY

According to Adadey (1997), in spite of its well known mineral potential, the country did not record the opening of any new mines or the expansion of existing ones after the 1940s. While in 1936 there were 30 operating gold mines, by 1983 only four were left. The increased investment especially during the early eighties was a result of certain policy initiatives that were undertaken to revamp the mining sector, notably a new Minerals and Mining law (PNDCL 153) put in place in 1986. However over the years investment in the sector has dwindled. Investors no longer find our Mining code attractive as it has seen no revision unlike other African countries like Tanzania and

Mali. Secondly, falling gold prices on the international world market has further compounded the dwindling fortunes of the mining industry.

Total investment in the mineral sector between 1983 and the first half of 2001 stood at \$3,741,024,708 (Minerals Commission, 2002). Tables 3 and 4 shows Mineral Production Sales Values for January – December 2001 (Chamber Members Only) and Total Investment in the Minerals Sector, Post –ERP respectively.

TABLE 3: MINERAL PRODUCTION AND SALES VALUES FOR JANUARY – DECEMBER 2001 (CHAMBER MEMBERS ONLY)

MINERAL PRODUCTION AND SALES VALUES FOR JANUARY – DECEMBER 2001 (CHAMBER MEMBERS ONLY)				
COMPANIES	ORE PROCESSED		OUNCE PRODUCED	Dollars
	Metric tones	Cubic Metres		
AGC Group (Ghana)	–	–	998,150	271,167,687
Abosso Gold Fields Ltd	289697	–	302,868	81,963,022
Bogoso Gold Ltd	197,088	–	87,936	23,800,879
Bonte Gold Mines Ltd	–	1,906,465.00	65,289	17,663,409
Gold Fields (Gh) Ltd	14,528,344	–	527,030	143,341,668
Resolute Amansie Limited	1,711,141	–	110,808	29,761,571
Small – Scale Miners (PMMC)	–	–	46,502	12,640,000
Satellite Gold Fields Ltd	–	–	70,149	19,465,915
TOTALS	16,239,485.00	1,906,465.00	2,208,732	599,804,151

SOURCE: THE GHANA CHAMBER OF MINES 2000/2001 ANNUAL REPORT.

**TABLE 4: TOTAL INVESTMENT IN THE MINERALS SECTOR. POST – ERP
(US \$)**

INVESTMENT INFLOW INTO THE MINING SECTOR				
A. MINING COMPANIES				
	EQUITY	SNR. DEBT	SHAREHOLDER DEBT	TOTAL (US\$)
	US\$	US\$	US\$	
1983	6,000,000			6,000,000
1984		58,040,000		58,040,000
1985	93,800,000	81,220,000		175,020,000
1986				-
1987		1,000,000	5,900,000	6,900,000
1988				-
1989	6,060,370	197,247,051	1,929,772	205,237,193
Sub Total	106,860,370	342,407,051	1,929,772	451,197,193
1990	18,507,570	159,102,983	90,913,216	268,523,769
1991	9,901,991	18,314,418	59,020,000	87,236,409
1992	152,953,964	154,999,036	113,348,475	421,301,475
1993	1,060,000	5,696,770		6,756,770
1994	3,001,000		7,069,363	10,070,363
1995	7,321,591	2,436,116	14,209,049	23,966,756
1996	11,023,159		68,749,843	79,773,002
1997	19,933,825	60,836,328	137,462,682	218,232,835
1998	27,603,026	131,760,345	13,425,954	172,789,325
1999	35,323,351	41,193,606	77,313,609	153,830,566
2000	7,755,283	15,089,000	6,251,000	29,095,283
SUB TOTAL	294,384,760	589,428,602	587,763,192	1,471,576,554
B. PROSPECTING COMPANIES				
	OPERATING		CAPITAL EXPENDITURE	TOTAL (US\$)
		US\$	US\$	
1990		99,614,970	30,111,960	129,726,930
1991		133,179,889	58,904,228	192,084,117
1992		121,540,959	52,561,924	174,102,882
1993		228,359,656	28,775,994	257,135,650
1994		72,207,794	16,045,668	88,253,462
1995		46,829,122	94,164,469	140,993,591
1996		50,065,182	644,932,464	694,997,646
1997		33,508,994	288,522,984	322,031,979
1998		37,902,922	25,341,063	63,243,985
1999		14,663,760	9,528,510	24,192,270
2000		170,201,335	9,201,507	179,402,842
2001 (1 st Half)		1,738,247	1,534,953	3,282,200
SUB TOTAL		1,009,812,830	1,259,634,723	2,269,447,553
			US\$	3,741,024,108

SOURCE: Minerals Commission, (2002)

2.5 LARGE SCALE MINING COMPANIES IN GHANA

Ghana is well endowed with substantial mineral resources, the major ones being gold, diamonds, manganese and bauxite (Adadey, 1997).

The main gold mining and exploration companies are: Ashanti Gold Fields Corporation (AGC), Billiton - Bogosu Gold Ltd, Bonte Gold Mines Ltd, Gold Fields (Gh) Ltd, Resolute Amansie Ltd, Abosso Goldfields Limited (AGL), Goldfields (Ghana) Limited (GFL), Ghana Australian Goldfields (GAG), Bogoso Gold Limited (BGL), Satellite Goldfields (SGL) Limited and Barnex (Ghana) Limited, (Minerals Commission 2002).

Ashanti Goldfields Corporation (AGC) is by far the largest mining company in the country and has recently gone multinational with mines in Ghana, Zimbabwe, Malawi, Tanzania and Guinea.

Diamond is mined by the State-owned Ghana Consolidated Diamonds Limited (GCD). The only manganese mine is the Ghana Manganese Limited (GMC). The Ghana Bauxite Company Limited (GBC), a joint venture between the state and British Alcan Mine is located at Awaso.

The ownership structure of the mining industry is mixed, but foreign companies control an average of about 70% shares in these mines. The Ghana government has ten per cent free share in each mine with the option to acquire additional 20% at the ruling market price (Akabzaa et al, 2001). Table 5 shows a list of large-scale companies in the country and the technology adopted in mining.

TABLE 5: LARGE SCALE MINING COMPANIES OPERATING IN GHANA AND THE TECHNOLOGY ADOPTED IN MINING.

COMPANY	COMMODITY MINED	MINES	TYPE OF MINE
AGC	GOLD	OBUASI ANYAFURI BIBIANI IDUAPRIEM PRESTEA SANKOFA ASIKAM	UG & OP OP OP OP TAILINGS ALLUVIAL
GOLDFIELDS (GH) LIMITED	GOLD	TARKWA	OP
GAG	GOLD	IDUAPRIEM	OP
PRESTEA GOLD RESOURCES	GOLD	PRESTEA	UG
BILLINGTON BOGOSO	GOLD	BOGOSO	OP
BONTE GOLD MINES LIMITED	GOLD	AKROKERI	ALLUVIAL
DUNKWA CONTINENTAL GOLDFIELDS LIMITED	GOLD	DUNKWA-ON-OFFIN	ALLUVIAL
OBENEMASE GOLD MINES	GOLD	OBENEMASE	OP
AMANSIE RESOURCES	GOLD	-	OP
GHANA CONSOLIDATED DIAMONDS	GOLD	AKWATIA	ALLUVIAL
GHANA BAUXITE COMPANY	GOLD	AWASO	OP
GHANA MANGANESE COMPANY	GOLD	NSUTA	OP

SOURCE: MINERALS COMMISSION (2002)

UG - Underground

OP - Open Pit

In the area of exploration, there is active involvement of both foreign and local companies. About 164 local and foreign companies have been issued with exploration licenses mostly for gold (Minerals Commission, 2002).

2.6 SMALL SCALE MINING IN GHANA

According to Akabzaa (2000), small-scale mining has traditionally played an important role in the economy of Ghana. Mining by indigenous people goes back to the 4th century. They were the only miners of gold and diamond in the traditional economy until 1905 when the colonial authorities through legislation outlawed their operations.

Their operations however remained illegal until 1989, when the government legalized their operations. During the period that the sector was outlawed, the miners still carried out their operations illegally amidst harassment by the security agencies.

Criminalisation of the native gold industry since colonial period in order to prevent competition with foreign companies has inhibited over time the emergence in Ghana of genuine small entrepreneur class of Ghanaian gold producers who could easily have made to the economy the sort of contribution that their Brazilian counterparts have achieved in recent years (Songsore et al., 1994). Artisanal mining or what is called “galamsey” is popular in the Western and Ashanti regions of Ghana and people depend on it for their subsistence. Artisanal mining consists of panning the alluvial sands and gravel for gold (Salami and Tsekpo, 2000).

According to Salami and Tsekpo (2000) the degradation of the resource base and attempts to outlaw “galamsey” activities in the past have made this traditional productive activity poverty ridden and unsustainable.

In 1989, as part of the minerals sector restructuring, the small-scale mining sector was formalized through the enactment of PNDC Law 218, the Small Scale Gold Mining Law. Under this Law, the Small Scale Mining Project, a department of the Minerals Commission, is responsible for registering and supervising small-scale miners in the country.

According to Akabzaa (2000), the project has so far registered over 600 co-operative and individual small-scale producers. In addition the government has also established the Precious Minerals Marketing Corporation. This was the sole governmental agency for the purchase of the produce of small-scale miners. The government has since opened the marketing to private licensed buyers.

The small-scale mining sector as a whole is an important player in the country's mining sector. It is the largest producer of diamond and the fifth largest producer of gold (Akabzaa, 2000). However in spite of the economic benefits, their activities tend to impact negatively on the environment. Thus from the angle of environmental degradation and perhaps that of efficiency restrictions on "galamsey" is a desirable development. This is because even though their activities result in significant environmental degradation there is little chance of compelling them to rehabilitate lands that they have worked (Salami and Tsekpo, 2000).

2.7 Policy Reforms and Environmental Concerns in the Mining Industry

Until recently the country failed to take measure to observe one of the basic tenets for sustainable development, that is environment and development were inadvertently made exclusive of one another leading to environmental concerns being literally put into compartments (Acquah, 1992b)

According to Songsore et al (1994), in order to address this deficiency, the Government of Ghana saw the need to evolve a broad environmental policy. This culminated in the development of a comprehensive National Environmental Action Plan (EAP) by Ghana's Environmental Protection Council (EPC) now EPA, which until the creation of the Ministry of Environmental, Science and Technology, (MEST) was given the mandate to formulate and implement environmental policies.

The Mining Minerals Law of 1986 (PNDCL) represents the principal legislation providing a regulatory framework for mining in the country. Government is given a right of pre-emption over all minerals. A system of mineral rights is created in the form of a license or lease and no reconnaissance, prospecting or mining can be effected except on the basis of a mineral right (Larsey, 1997).

Since 1989, it has been the requirement in Ghana to subject all major development projects to the Environmental Impact Assessment (EIA) process, and mining projects which cover concession area of more than 25 acres is required to submit an EIA to Environmental Protection Agency (EPA), (Agra, 1997).

In view of the well-known impact of mining on the environment, a committee was set up specifically on the mining industry and hazardous chemicals. The committee noted the general inadequacy in existing legislation on the mining sector. The following proposals among others were, therefore, made to address these inadequacies

- (i) Predictive and mitigating plans ought to be submitted by new mining companies before actual mining commences. These include:
 - a. Environmental Baseline Statement (EBS);
 - b. Environmental Impact Assessment (EIA); and
 - c. Environmental Management Plans (EMPs).

- (ii) Old or existing mining companies should submit Environmental Management/Action Plan;

- (iii) Environmental standards and quality control polices must be clearly specified in the regulations coupled with sustained monitoring of pollutants in the environment for an effective law enforcement; and
- (iv) Appropriate institutional arrangements for the implementation of recommended policies (Acquah, 1992b)

Songsore et al (1994), have observed that the real test of environmental sustainability of mining operations goes beyond the preparation of Environment Action Plans (EAPs) to the need for effective implementation of existing regulations in addition to a legal commitment to undertake eventual restoration of degraded areas.

2.8 SOME OBSERVATIONS ON THE EFFECT OF SURFACE MINING OPERATIONS ON THE ENVIRONMENT

Surface mining operations can have a much broader impact on the environment than underground mines because of the large amounts of vegetation, soil and rock that must be removed to expose the mineral ore. The removal of the over burden physically alters the landscape and can disrupt ecosystem processes. Once removed, improperly contained or stabilized piles of stored waste rock are prone to erosion, threatening local soils and waterways.

According to Sraku-lartey (1994), underground mining does not seem to lead to significant destruction of the land and forests since much of the activities are carried out underground. Surface or opencast mining is perhaps the greatest agent leading to the destruction of the land. Large areas are stripped bare of all vegetation and deep excavations are also left in the ground.

According to Boateng (1997) the environmental impacts of surface mining are quite significant in comparison to other industries. At the exploration stage, forest and wildlife resources may be adversely affected by the field exploration works and water quality within the concession may also be impacted upon. Abandoned exploration

sites if not properly reclaimed can pose hazards to life and also give rise to other environmental problems.

Boateng (1997), further states that in the pre-production stage, the clearing of land for construction of mine infrastructure can give rise to increased soil erosion which in turn can lead to increased sediment loading in nearby water bodies. Dust generated from haul roads and other working areas can be a real nuisance.

Finally Boateng (1997) observes that at the production phase, waste dumps and ore stockpiles may cause dust emissions and can also lead to land sterilization. Leaching and percolation processes acting upon residuals contained in mine waste together with run-off from ore stockpiles and mill area can cause contamination of land and water bodies. Mine effluents if discharged untreated into water bodies can cause serious water pollution problems.

Tailings impoundments, solid waste dumps and surface installations often present serious visual intrusion. Some obnoxious substances such as arsenic trioxide and oxides of sulphur are sometimes generated from processing ores.

Again according to ISSER (2000), mining companies are increasingly turning to open pit mining. The open pit mining has some environmental consequences and adversely affects the livelihood of people. The removal of topsoil is depriving farmers their source of livelihood and accentuating poverty in the mining areas.

Finally the World Bank (1994) has also observed that open pit mines require substantial areas to be cleared of vegetation for the pit and waste dumps and topsoil needs to be stockpiled separately for use in subsequent restoration.

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.0 INTRODUCTION

This chapter will look at the Physical Characteristics, Minerals, Water and Sanitation and Population of the study area.

3.1 PHYSICAL CHARACTERISTICS

3.1.1 Location and Size

Brahabome is located in the Wassa West District in the Western region. It lies North – West of Tarkwa the District Capital and less than 1km from the main Takoradi – Kumasi rail terminal.

It shares boundaries on the North with Abontiakon, on the West Old Atuabo, in the South with The Western University College and the East by the main Takoradi – Kumasi rail terminal.

3.1.2 Relief and Drainage

Brahabeome is located, within the forest dissected plateau physiographic region. The forest-dissected plateau is underlain by pre-cambrian rocks of the Brimian and Tarkwain formations. It rises from about 220 metres to about 300 metres above sea level. The area is generally undulating with few scraps ranging between 150 metres to 300 metres above sea level. The area is drained by the Nsupa and Bediabewu streams.

3.1.3 Climate

Brahabehome is located within the South-Western Equatorial Zone marked by double maximum rainfall starting March and September, with a mean annual rainfall being 187.83cm. It has fairly uniform temperature ranging between 26⁰ C. (In August) and 30⁰C (in March). Relative humidity is generally high throughout the year between 70 – 80 percent in the dry season and 75 – 80 percent in the wet season. The fair temperature and rainfall enhance the cultivation of many food crops.

3.1.4 Vegetation

The vegetation of the area within which the study settlement is located falls within the forest belt of Ghana and consists of tropical rainforest characterized by rich undergrowth of climbers and shrubs of varying heights. However, there has been a rapid reduction in the density of tree population in areas affected by mining activities. Lack of protection especially from mining activities and lumbering is primarily responsible for the poor vegetation resources in the area. Where the area has been mined out the vegetation consists of ferns and other shrubs (Akabzaa and Darimani, 2001).

3.1.5 Geology

Brahabehome is underlain by two geological formations. These are the Birrimian and Tarkwaian rocks. The Birrimian rock so far has been, economically, the most important geological formation in Ghana since it contains all the minerals exported from the country.

3.1.6 Soils

Soils also form an important part of the physical environment and help greatly in the definition of the crops to be grown and the development of plant in an area. The soils found at Brahababome are forest oxysoils. These soils are developed over a wide range of highly weathered parent materials including Tarkwaian and Birimian rocks. They are porous, well drained and generally loamy and thus suitable for the cultivation of food and tree crops (such as cassava, maize, plantain, cocoa and oil palm).

3.2 Minerals

It has large deposits of gold, which is evidenced by the existence of the large-scale surface mining operations being undertaken and a number of small-scale miners usually referred to as galamsey operators.

3.3 Population

Brahabeome has a total population of 1274, comprising 645 males and 629 females (Ghana Statistical Service, Sekondi-Takoradi, 2002). Like most mining communities it has a dominant male population most of whom might have been attracted by the prospects of employment by the mining firms or to engage in small scale mining usually called “galamsey”. Although Wassa people are the natives of the area, the ethnic mix is highly varied due to the mining activities.

3.4 Water and Sanitation

The situation with water and sanitation in Brahababome like other communities needs some improvements. It has only one public place of convenience and four public

standpipes, which is not adequate for the needs of the community. As a result some residents rely on other sources of water notably surrounding streams.

It is perceived by the community that some of their streams are polluted and this together with other issues concerning their perception of surface mining is examined in detail in Chapter four.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

This chapter presents the analysis of the empirical data collected, starting with the responses to the structured questionnaires administered to individual respondents in the community as well as those administered to Regulatory Bodies, the Wassa West Association of Communities Affected by Mining (WACAM), a Non Governmental Organisation and other Government Institutions.

4.1.1 DISTRIBUTION OF RESPONDENTS BY SEX

A sample of 100 respondents made up of 55 males representing 55% of the respondents and 45 females representing 45% of the respondents were interviewed. The high sex ratio in favour of males underpins the population frame of the locality as there are more males than females. Table 6 shows the distribution of the respondents by sex.

Table 6: Distribution of Respondents by Sex.

Sex	Frequency	Percentage
Male	55	55
Female	45	45
Total	100	100

SOURCE: FIELD SURVEY, 2001

4.1.2 DISTRIBUTION OF RESPONDENTS BY OCCUPATION

The distribution of the respondents by occupation indicate that the community has varied occupation with only 4% engaged in farming. For a rural community farming should have been the major preoccupation. However this situation may be explained by the fact that very large tracts of land are required for mining purposes. Thus very little is available for farming purposes and hence the need to engage in other income earning activities. It may also be that the assertion that all lands have been taken over by mining activities may not be entirely true. It was gathered that some land is available but the inhabitants are precluded from growing tree crops such as cocoa and oil palm which they consider as cash crops and hence assets. Also due to the fact that they may have to travel farther to farm which they consider as a disincentive and hence general reluctance to farm. The 50% of respondents representing “others” includes those engaged in menial jobs, herbalists, a video operator and petty traders. Table 7 shows the distribution of the respondents by occupation.

Table 7: DISTRIBUTION OF RESPONDENTS BY OCCUPATION

OCCUPATION	FREQUENCY	PERCENTAGE
Farming	4	4
Non-farming/self employed artisans	28	28
Employed	10	10
Others	50	50
Unemployed	8	8
Total	100	100

SOURCE: FIELD SURVEY, 2001

4.1.3 DISTRIBUTION OF RESPONDENTS BY LENGTH OF STAY AT BRAHABEBOME

Majority of respondents representing 89% from the table have stayed for up to a period of 6 to 44 years. This is essential for a study of this nature, as it means respondents might have stayed long enough to give a fair assessment of events or changes they have observed over time. Table 8 shows the distribution of respondents by length of stay at Brahabehome.

Table 8: DISTRIBUTION OF RESPONDENTS BY LENGTH OF STAY AT BRAHABEBOME

LENGTH OF STAY (YEARS)	FREQUENCY	PERCENTAGE
UP TO 5	11	11
6-20 more than 5 years	89	89
TOTAL	100	100

SOURCE: FIELD SURVERY, 2001

4.1.4 DISTRIBUTION OF RESPONDENTS BY WHAT THEY DO NOT LIKE ABOUT SURFACE MINING OPERATIONS

Table 9 shows the distribution of respondents by their dislike about surface mining operations.

Table 9: Distribution of respondents by what they do not like about surface mining operations

DISLIKES	FREQUENCY	PERCENTAGE
Noise	33	33
Water pollution	31	31
Degradation of the land	5	5
Dust particles in the air	29	29
Shaking of building	1	1
Scent from chemicals	1	1
TOTAL	100	100

SOURCE: FIELD SURVEY 2001

About 33% of respondents mentioned the level of noise generated during mining operations as their major dislike of mining operations. Also 31% of respondents mentioned water pollution as their major dislike about mining operation. Another 5% of respondents mentioned the degradation of land. Further, 29% of respondents mentioned the presence of dust particles in the air and one respondent each mentioned the shaking of buildings, and scent from chemicals used during surface mining operations.

4.1.5 DISTRIBUTION OF RESPONDENTS BY CHANGES OBSERVED IN THE ENVIRONMENT DUE TO SURFACE MINING OPERATIONS.

Table 10 shows the distribution of respondents by changes observed in the environment due to surface mining operations. From the Table, 33% of respondents indicated reduction in forestland as the change they have observed most in the

environment. In a rural community where farming is supposed to be the most predominant economic activity this could have severe effects on the standard of living of the people. Again as most rural communities tend to rely on the forest for their fuel wood as well as other products such as herbs the reduction of such forests could have very telling effects on the community. It must be appreciated the trees also provide shade which is essential for the cultivation of crops like cocoa and oil palm.

Table 10: DISTRIBUTION OF RESPONDENTS BY CHANGES OBSERVED IN THE ENVIRONMENT DUE TO SURFACE MINING OPERATIONS

Changes observed	Frequency	Percentage
Reduction in forest land	33	33
Disappearance of animals and bird	12	12
Changed rainfall pattern	25	25
Changed land forms e.g. reduced mountains, gullies, stripped hills.	29	29
Reduction in soil fertility	1	1
TOTAL	100	100

SOURCE: FIELD SURVEY, 2001

Further, 12% of respondents indicated the disappearance of some animals and birds. Additionally 25% of respondents mentioned changed rainfall pattern. Another 29% of respondents mentioned changed landforms and one respondent mentioned reduction in soil fertility. This could be explained by the fact that very few people from the community are engaged in farming.

The reduction in birds and animals could also have effect on the dietary habits of the people, as they tend to rely on bush meat or the meat of such animals and birds to supplement their protein levels.

4.1.6 PERCEPTION OF RESPONDENTS ON SURFACE MINING ACTIVITIES ON DUST FROM MINING OPERATIONS

Table 11 shows the perception of respondents on surface mining activities and dust. All 100 respondents indicated that they experience dust from mining operations. A total 47% of respondents mentioned that the major source of dust they encounter is dust in the air. Another 44% of respondents indicated dust from surroundings and 9% dust on vegetation.

According to Akabzaa (2000), during the process of mining, blasting removes rocks. The blasting is accompanied by thundering noise and vibration of the ground. It produces a lot of dust thus increasing the particulate matter in both air and water.

Table 11. PERCEPTION OF RESPONDENTS ON SURFACE MINING ACTIVITIES AND DUST.

SOURCE OF DUST	FREQUENCY	PERCENTAGE
Dust in surrounding	44	44
Dust particles in the air	47	47
Dust on vegetation	9	9
TOTAL	100	100

SOURCE: FIELD SURVEY, 2001

4.1.7 PERCEPTION OF RESPONDENTS ON SURFACE MINING OPERATIONS AND NOISE.

All 100 respondents interviewed were of the view that they experience rather high noise from surface mining operations. This indicates that if the noise levels is not addressed it could serve as grounds for conflict between the mine operators on one hand and the community on the other.

This also confirms Akabzaa’s (2000) assertion that there is widespread and deafening noise from operations of all the surface mines in Brahabebome. Table 12, shows the distribution of respondents on source of noise from surface mining operations.

Table 12: DISTRIBUTION OF RESPONDENTS OF SOURCE OF NOISE FROM SURFACE MINING OPERATIONS

SOURCE OF NOISE	FREQUENCY	PERCENTAGE
Noise from machines	42	42
Noise from blasting	46	46
Noise from pay loaders excavators, tracks	12	12
TOTAL	100	100

SOURCE: FIELD WORK, 2001

From the Table12, 46% of respondents indicated that they experienced most noise from blasting. A further 42% of respondents mentioned noise from machines and 12% noise from pay loaders, excavators and trucks. According to Akabzaa (2000) a major complain of residents in the area within which the study was conducted relates to noise and vibration effects of blasts conducted at a number of open pits in the area within which the study area is located.

4.1.8 RESPONDENTS PERCEPTION OF THE CONTRIBUTION OF SURFACE MINING OPERATIONS TO THE POLLUTION OF STREAMS AND OTHER WATER SOURCES.

All 100 respondents were of the view that mining operations have affected streams and other water source in the community. Table 13, shows the distribution of the perception of respondents by ways surface mining operations have affected streams and other water sources.

TABLE 13: DISTRIBUTION OF RESPONDENTS BY THE CONTRIBUTION OF SURFACE MINING OPERATIONS TO THE POLLUTION OF STREAMS AND OTHER WATER SOURCES.

TYPE OF EFFECT	FREQUENCY	PERCENTAGE
Pollution of streams/water sources	59	59
Sedimentation of stream/rivers	35	35
Reduction in ground water	6	6
TOTAL	100	100

SOURCE: FIELD SURVEY, 2001

Water is regarded as “polluted” when it is changed in its quality or composition directly or indirectly as a result of man’s activity so that it becomes less suitable for drinking and may transmit certain diseases (Kumar, 1976). It must be pointed out that the inhabitants perceive any discharge of waste from the mine into any water system as pollution regardless of the technical definition of Kumar. Also as a non-technical investigator one could not discuss quality or composition directly but relied on

physical indicators like change in colour and sedimentation among others. From the table 59% of respondents were of the view that pollution of streams and water sources by surface mining operations has been the major way by which their stream has been affected. The community perceive the Bediabewu stream to have been badly polluted that they only use it for washing and bathing and drink only the Nsupa stream. This could be a major source of worry for the inhabitants especially coming off against recent claims of cyanide spillage into water bodies in certain communities.

Further, 35% of respondents were of the view that sedimentation due to surface mining operations has been the way their streams has been affected and 6% of respondents mentioned reduction in ground water.

Seepage of heavy metals into underground water is a potential hazard from the mining and other industrial establishments. Thus community water source like streams and rivers are polluted, (Medium District Development Plan, 2002-2004)

4.1.9 PERCEPTION OF RESPONDENTS OF THE EFFECT OF SURFACE MINING OPERATIONS ON FARMING

Nearly all respondents were of the perception that surface mining operations have affected farming activities. Table 14 shows some of the reasons respondents thought surface-mining operations has affected farming activities.

Table 14: RESPONDENTS PERCEPTION OF HOW SURFACE MINING OPERATIONS HAS AFFECTED FARMING ACTIVITIES

Activity	Frequency	Percentage
Land taken over by mining activities	57	57
Reduction in forest cover	10	10
Soil degradation	33	33
TOTAL	100	100

SOURCE: FIELD SURVEY, 2001

From the table 57% of respondents believe surface mining operations have affected farming activities by taken over farming lands. This perhaps confirms Akabzaa (2000) assertion that more than 70% of the land surface in the Tarkwa –Prestea – Bogosso – Abosso –Nsuta axis is under concession licenses to various mining companies operating in the area. Farming is not allowed in the concessions unless authorized by a company. Another 33% of respondents mentioned land degradation and 10% reduction in forest cover. Respondents maintained that certain crops like cocoa require shade from trees in their cultivation hence the absence of such forest cover has made it extremely difficulty to cultivate such crops. This confirms Akabzaa (2000) assertion that lands that were previously used for farming and those that could be so used have now been swallowed up by mining concessions. Consequently, food production has decreased considerably, creating the conditions for increased food prices.

4.1.10 PERCEPTION OF RESPONDENTS OF THE EFFECT OF SURFACE MINING OPERATIONS ON BUILDINGS

Blasting and movement of heavy machines due to surface mining operations has a major impact on buildings in so far as their functions are concerned. This can be felt in all the elements of the building namely the roof, foundation and walls. Blasting sends shock waves through the earth structure due to the nature of explosives used. This weakens the foundation and shakes the external walls of the buildings leaving cracks in them. According to Akabzaa (2000) the frequent blasting and the resulting ground vibration has caused cracks in many buildings in the area. Out of 100 respondents interviewed 69% indicated that they have had cracks in their walls as a result of the blasting carried out during surface mining operations; 23% indicated both that they have had cracks in their foundation and walls; 4% of respondents indicated that they have had cracks in walls and roofs and 2% of respondents mentioned that they have had cracks and problems with all elements that is roof, foundations and walls. This is shown on Table 15.

TABLE 15 DISTRIBUTION OF RESPONDENTS OF THE EFFECT OF SURFACE MINING OPERATIONS ON BUILDINGS

PART OF BUILDING AFFECTED	FREQUENCY	PERCENTAGE
Walls	69	69
Walls and Foundation	23	23
Walls and Roof	4	4
Roof	2	2
Roof, Walls and Foundation (All elements)	2	2
TOTAL	100	100

SOURCE: FIELD SURVEY, 2001

4.2.0 RESPONDENTS ASSESSMENT OF THE CONTRIBUTION OF SURFACE MINING OPERATIONS TO ENVIRONMENTAL AND HEALTH ISSUES

Respondents were asked for an assessment based on their perception of the activities of surface mining operations and its effect on the environment. Respondents were asked to rate on the scale of 1-5 the contribution or otherwise of the mining activities on the environment.

In the scheme, 1 represented minimum or no contribution; 2 represented below average contribution; 3 represented average contribution; 4 represented above average contributions; and 5 represented significant contribution and 6 represented the absence of any meaningful opinion on the particular issue.

4.2.1 NOISE POLLUTION

All the 100 respondents rated the contribution of surface mining operations to noise pollution. Majority of the respondents felt that the contribution of surface mining operations to noise pollution was maximum. The percentage of people who rated contribution of surface mining operation 4 (above average) or 5 (significant) stood at 98. Only two respondents rated the contribution of surface mining as 2 (average). The standard deviation was 0.48 and the mean 4.74.

4.2.2 AIR POLLUTION

The total number of respondents who expressed their view was 100. The mean rating was 3.91. Majority of respondents shared the view that the contribution of surface mining operations to air pollution was maximum or above average. There were however some variation in their opinion. A total of 74% of respondents share the view that the contribution of surface mining to air pollution was significant or above average while 26% of respondents thought that the contribution was average or below average. The standard deviation from the mean was 0.68.

4.2.3 REMOVAL OF VEGETATION AND FOREST COVER

The total number of respondents who expressed their view was 100. The mean rating was 3.44. Majority of them shared the view that the contribution of surface mining activities to the removal of vegetation and forest cover was significant. The standard deviation from the mean was 0.81. The percentage of people who rated the contribution of surface mining as significant or above average was 94% while 6% rated it as below average.

4.2.4 DESTRUCTION OF FARM LANDS

The total number of respondents who expressed their view was 100. The mean rating was 3.55. Majority of the respondents felt that the contribution of surface mining activities to the destruction of farmlands was significant or above average. A total number 96% rated contribution of surface mining operations to the destruction of

farmlands as significant or above average while 4% rated it below average. The standard deviation was 0.76.

4.2.5 REDUCTION OF BIRDS AND ANIMALS

100 respondents rated the contribution of surface mining activities to the reduction of birds and animals. Majority of the respondents felt that the contribution of surface mining activities to the reduction of birds and animals was below average. A total number of 60% rated the contribution of surface mining activities was below average whilst 40% rated it as significant or above average. The mean rating was 2.5 and the standard deviation was 0.83.

4.2.6 CREATION OF SCENIC SCARS

Scenic scars for the purpose of this study included stripped mountains, gullies, artificial ridges and any other activity carried out which has changed the beauty of the local scenery. The total number of respondents who expressed their view was 100. Majority of them shared the view that the contribution of surface mining operations to the creation of scenic scars was significant. A total number of 95% of respondents rated the contribution of surface mining operations as significant or above average while only one respondent rated it below average. The mean rating was 4.67 and the standard deviation 0.60.

4.2.7 INFLOW OF MIGRANT POPULATION

The total number of respondents who expressed their view was 100. Majority of them shared the view that the contribution of surface mining operations in this regard was below average or minimum. A total number of 46% of respondents rated the

contribution of surface mining in this regard as below average whilst 5% rated it as significant or above average. This means that people have not found it attractive to migrate to the study area as surface mining operations unlike the deep cast method usually employ less people. The mean rating was 2.60 and the standard deviation 0.62.

4.2.8 BUILDING OF HEALTH FACILITIES AND HEALTH PROBLEMS

Majority of them, indeed all the respondents shared the view that the contribution of surface mining operations to the provision of health facilities has been minimum. This may be attributed to the fact that there is no clinic in the community. The mean rating was 1.00 and the standard deviation 0.0.

4.2.9 POLLUTION OF STREAMS AND OTHER WATER BODIES

All 100 respondents expressed their views on the subject. Majority of the respondents felt that the contribution of surface mining operations was significant. A total number 82% rated the contribution of surface mining operations as maximum whilst 18% rated it as above average.

4.3 ANALYSIS OF QUESTIONNAIRE ADMINISTERED TO REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS IN THE MINING SECTOR.

Seven questionnaires were administered to the Environmental Protection Agency, the Wassa Association of Communities Affected by Mining (WACAM), the District Planning Office, the District Forestry Service, the District Town and Country Planning Department, the District Environmental Health Unit, the KNUST School of Mines and the Forest Services Division. These institutions were chosen because of

the major role they play in the mining community and also provide supplementary information to the research.

4.3.1 REASONS FOR THE ADOPTION OF SURFACE MINING METHOD

Majority of all the respondents were of the view that economic considerations influenced the official endorsement of surface mining. However others were of the view that it was due to political considerations whilst only one was of the view that it was due to modernisation.

Table 16 shows the perception of heads of regulatory institutions and other stakeholders on factors influencing the official endorsement of surface mining.

**Table16: PERCEPTION OF REGULATORY INSTITUTIONS AND OTHER
STAKEHOLDERS ON FACTORS INFLUENCING THE OFFICIAL
ENDORSEMENT OF SURFACE MINING.**

FACTOR	Frequency
Economic considerations	4
Political considerations	2
Modernisation	1
TOTAL	7

SOURCE: FIELD SURVEY, 2001

4.3.2 OTHER BENEFITS DERIVED FROM SURFACE MINING

According to the table two respondents of the regulatory institutions and other stakeholders see the provision of school buildings, water, electricity as the other benefits derived by Ghanaians from mining activities apart from the payment of

corporate taxes, royalties and dividends to government as well as providing employment. This is shown on Table 18.

TABLE 17: PERCEPTION OF HEADS OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS OF OTHER BENEFITS DERIVED BY GHANAIANS FROM SURFACE MINING ACTIVITIES.

BENEFITS	FREQUENCY
Provision of water	2
Provision of school building	2
Electricity	2
Non response	1
TOTAL	7

SOURCE: FIELD SURVEY 2001

4.3.3 NEGATIVE ASPECTS OF SURFACE MINING OPERATIONS

All the respondents indicated that there are negative aspects of surface mining. Majority of the respondents identified land degradation as the negative impact they have observed. Again majority of respondents identified water pollution and air pollution as the negative aspects of surface mining, whilst two respondents mentioned ground vibration and destruction of vegetation and the natural habitat of wildlife. This is shown on Table 18.

TABLE 18: DISTRIBUTION OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS ACCORDING TO THEIR PERCEPTION OF THE NEGATIVE ASPECTS OF MINING.

NEGATIVE ASPECTS	FREQUENCY
Land Degradation	2
Air Pollution	2
Water Pollution	1
Ground Vibration	1
Destruction of vegetation and natural habitat of wildlife	1
TOTAL	7

SOURCE: FIELD SURVEY, 2001

4.3.4 WAYS OF MITIGATING NEGATIVE EFFECT OF SURFACE MINING OPERATIONS.

Majority of respondents of the regulatory institutions and other stakeholders were of the view that the negative effects of surface mining could be reduced if reclamation is done correctly. Others however were of the view that by applying modern techniques to control blasting or clearing only lands that are required or by spraying water to minimize dust the negative effects could be reduced. This is shown on Table 19.

TABLE 19: DISTRIBUTION OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS BY WAYS OF MITIGATING NEGATIVE EFFECT OF SURFACE MINING OPERATIONS.

Ways of mitigating negative mining effects	Frequency
Reclamation done correctly	1
Clearing only required lands to avoid soil erosion.	1
Spraying water to minimize dust	1
Modern techniques in controlled blasting	1
Ensuring that mines comply with EIAs and EAPs	2
Resorting to underground mining	1
TOTAL	7

SOURCE: FIELD SURVEY, 2001

Some of the respondents were of the view that by ensuring that mines comply with their Environmental Impact Assessments (EIAs) or Environmental Action Plans (EAPs) or by resorting to underground mining the negative effects could be reduced. Other respondents were of the view that surface mining operations should be banned. Those who want it to be banned contend that the destruction left in its track far outweighs the economic gains derived there from. Whilst those who want it maintained contend that it is a major source of employment for the youth.

CHAPTER FIVE

FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.0 INTRODUCTION

This chapter looks at the findings or observations made. It also provides some useful recommendations and gives the overall conclusion. It also presents some useful recommendations and gives the overall conclusion.

5.1 OBSERVATIONS AND FINDINGS

1. It was observed from the analysis that few people (4%) are engaged in farming. For a fairly rural community, it is expected that farming should have been the predominant occupation. However as large tracks of land are required for mining operations little is available for farming purposes. Nearly all respondents (97%) were of the view that surface mining operations have affected farming activities.
2. It was observed that the noise derived from surface mining operations is perceived to be a major source of pollution. All 100 respondents were of the view that they experience rather high disturbing noise from such activities. A total number of (33%) of respondents mentioned noise pollution as their major discomfort about mining operations. According to the respondents the major source of noise is noise generated during blasting (46%), followed by the noise from machines (42%) and pay loaders, excavators and trucks (12%) respectively.

3. Another major perceived pollution is water pollution. All the 100 respondents mentioned water pollution as a major perceived effect of surface mining operations. A total number of (82%) respondents rated the contribution of surface mining as significant.
4. Excavation due to surface mining is perceived to have badly denuded the land in the study area thus increasing soil degradation, no wonder few people (4%) are engaged in farming.
5. The surface mining operations is perceived by the respondents to have accelerated deforestation as large tracks of land have to be cleared for such activities. This has also greatly affected flora and fauna as some animals and birds have been reduced or left the area for safer places. A total number (81%) respondents indicated reduction in forest as the major change they have observed with the inception of surface mining.
6. Public officials working with some of the Regulatory Institutions were of the view that economic consideration other than any other reason led to the adoption of surface mining as a mode of mining.
7. Also the surface mining operations are perceived by the inhabitants to have greatly affected buildings in the study area. Vibrations from blasting which shakes the foundation of buildings affect all the elements of buildings in the study area.

5.2 RECOMMENDATIONS

In the light of the afore-mentioned findings the following recommendations have been made:

- a. There is the need to mount educational programmes to educate the community to exercise restraint and allow the mining firms to exhaust their concessions. This may prevent perceived conflict situations. The mining firm however must be made to rehabilitate the lands they work on in accordance with the mining regulations.
- b. Streams perceived to be polluted which is used for domestic purposes by the inhabitants should be treated to make them safe for domestic purposes. There is also the need to sink additional boreholes at vantage points in the community to provide adequate potable water.
- c. In order to avoid the perceived destruction of fauna and flora, the rare and endangered species which are in the study area should be identified and protected and if possible transplanted. The local people should be assisted to undertake such an exercise in collaboration with the Forestry and Game and Wildlife Departments.
- d. The District Assembly should play a leading role in sensitising the community on the environmental consequences of surface mining. Particularly the Assembly should identify conflict points and devise immediate solutions to prevent any stand-offs between the community on one hand and the mining firms on the other.

The Assembly must also mount educational campaigns to create awareness about the need to protect the environment vis –a-vis the surface mining.

- e. Excess land not required for surface mining operations must be ceded or returned to the community to enable them engage in farming and other related activities.
- f. Furthermore, Government must provide the policy and legislative framework for a process by which the mining firms, Government, non governmental organisations (NGOs) and the communities can communicate in a pro-active and constructive way which will allow mining firms minimize the perceived negative impacts of mining on local communities.

5.4 CONCLUSION

Policy changes in the mining sector in Ghana have resulted in substantial investment in the gold sub-sector, culminating in increased mineral production. While the policy changes introduced generous incentives to investors, adequate measures have not been put in place to take into consideration the perception of local communities of the effect of such mining activities on the environment.

There is therefore the need to take steps to ensure that perception of communities about such activities are carefully taken into consideration when embarking on such projects.

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APPENDIX I

**“MINING COMMUNITIES’ PERCEPTION OF OPEN PIT
OPERATIONSS: THE CASE OF THE PEOPLE OF BRAHABEBOME”**

QUESTIONNAIRE

1. Sex of Respondent (a) Male [] (b) Female []
2. Occupation.....
3. How long have you stayed at Brahabebome?.....
4. What are the changes you have you observed in the environment since the introduction of surface mining?
 - i. Reduction in Forest Land []
 - ii. Disappearance of animals and birds []
 - iii. Altered rainfall pattern []
 - iv. Changed land forms (big gullies, stripped hills, reduced mountain size) []
 - v. Other (please specify).....
5. What are the things you do not like about the mining operations?
 - i. Noise []
 - ii. Water pollution []
 - iii. Degradation of the land []
 - iv. Dust particles []
 - v. Other (please specify).....
6. Do you experience dust from the mining operations?
Yes [] No []
7. If yes, how do you experience it?
 - i. Dust in surroundings []
 - ii. Dust particles in the air []
 - iii. Dust on vegetation []
 - iv. Other (please specify).....
8. Do you experience the noise? Yes [] No []
9. If yes, how do you experience it?
 - i. Noise from Machines []
 - ii. Noise from blasting []

- iii. Noise from pay loaders, excavators, truck []
- iv. Others (please specify).....

10. Is there any specific time or day that you experience those noises?
 Yes [] No []

11. If yes what are the times or days?.....

12. Do you think the mining operation has affected your streams or water sources?
 Yes [] No []

13. If yes, in what ways
- i. Pollution of streams/water sources []
 - ii. Sedimentation of streams/rivers []
 - iii. Reduction of ground water []
 - iv. Other (please specify).....

14. Has the mining activity affected your farming activities?
 Yes [] No []

15. If yes in what ways?
- i. Land taken over by the mining activity []
 - ii. Soil degradation []
 - iii. Reduction in forest cover []
 - iv. Other (please specify).....

16. Has the mining activities affected the structure of your building?
 Yes [] No []

17. If yes, which part has been affected?
- i. Foundation []
 - ii. Walls (cracks) []
 - iii. Roof []
 - iv. Other parts (specify).....

Respondent's Assessment of Surface Mining: please rate the role of Surface Mining as regards its contribution or otherwise on a five point scale.

- 1 - Minimum (no contribution)
- 2 - Below Average
- 3 - Average
- 4 - Above average
- 5 - Maximum (significant)
- 6 - No opinion

18. Noise pollution 1 2 3 4 5 6

19. Air Pollution (Emission of dust particles etc)	1	2	3	4	5	6
20. Destruction of vegetation and forest cover	1	2	3	4	5	6
21. Destruction of farmlands	1	2	3	4	5	6
22. Reduction in birds and animals	1	2	3	4	5	6
23. Creation of scenic scars	1	2	3	4	5	6
24. Inflow of migrant population	1	2	3	4	5	6
25. Building of health facilities	1	2	3	4	5	6
26. Pollution of streams and other water bodies	1	2	3	4	5	6

****Thank you very much****

APPENDIX II

QUESTIONNAIRE FOR HEADS OF REGULATORY INSTITUTIONS AND OTHER STAKEHOLDERS IN THE MINING SECTOR

1. Name of Institution.....
2. What specific role does your institution play in Ghana’s mining sector?
.....
3. What in your opinion influenced the official endorsement of surface mining:
 - (a) Economic considerations
 - (b) Political considerations
 - (c) Modernization
 - (d) Other (please specify).....
4. Apart from the payment of corporate taxes, royalties and dividends to government, as well as the provision of employment avenues to Ghanaians, do you know of any other benefits derived by Ghanaians from mining activities?
.....
.....
5. Are there any negative aspects of surface mining that you are aware of?
Yes [] No []
6. If yes, kindly specify
7. Is there a way by which such negative effects can be reduced or eliminated?
(please specify)
.....
.....
8. What in your view is public opinion about surface mining:
 - a) Negative
 - b) Positive

c) Neutral

9. If negative or positive, please state why you think it is so?.....

.....

10. If negative, kindly recommend ways by which the situation could be improved.

.....

.....

11. Should surface mining be banned outright, in Ghana?

(a) Yes [] No []

12. If yes, please give reasons:.....

.....

13. If surface mining is acceptable, do you think it should be carried out in forest reserves?

(a) Yes [] No []

14. If yes, please give reasons:.....

15. In your opinion, do you think it is possible for mining companies to reclaim mined out lands?

(a) Yes [] No. []

16. If yes, please give reasons:.....

17. Are there any additional information you may wish to provide the Researcher?

.....

****Thank you very much****