**UNIVERSITY OF NAIROBI**

 

**SCHOOL OF ENGINEERING**

**DEPARTMENT OF ENVIRONMENTAL AND BIOSYSTEMS ENGINEERING**

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**PROJECT PROPOSAL**

**TITLE: DESIGN OF DUST CONTROL MEASURE IN CEMENT MANUFACTURING INDUSTRY**

**CASE STUDY: ATHI RIVER LTD, ATHI RIVER PLANT**

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**SUBMITTED TO: MR. ALBERT INIMA**

**DATE OF SUBMISSION:**

**DECLARATION**

I declare that this project, except where specifically acknowledged, is my original work. This report has not been in whole or in part submitted for any degree or examination at any other University.

Audrey Angusu Malwa

Signature………………………. Date…………………………...

This project report has been submitted for examination with my approval as University Supervisor

Mr. Christian Thine Omuto

Signature………………………. Date…………………………...

**DEDICATION**

I dedicate this Project to my Dad, Mr. Benjamin Malwa Langwen, my Mum, Mrs. Beatrice Mwimbi Malwa, my siblings Angela Ajando Malwa, Sean Allan Achina Malwa, Natalie Mideva Malwa and to my friends for their constant support throughout this journey.

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In conclusion, I extend my sincere thanks to my family, colleagues and friends for their constant encouragement, prayers and best wishes.

**ABSTRACT**

In any manufacturing company, cement manufacturing company to be precise, the need for a clean and safe environment is not an option, it’s mandatory. This is to create a workable surrounding for the workers and machinery in use at any particular time, hence bringing much to the table in terms of increased produce and profitability for the company as a whole.

Some, if not most, of the cement manufacturing companies do not meet this standard on one reason or another but majorly due to one factor, dust. Accumulation of dust in the company plays a great role in that, much work would be done or redistributed to dust other than focusing solely on production of the cement for the company. Thus, it would decrease the profitability of the company either by the increase of health issues reported by the workers, the degradation of the machineries or the reduced quality and quantity of the products.

Hence, there will be need for the company to search for means of reduction of the dust being eliminated to the surrounding, this is in order to create a solution for further damages it may bring in the future rather than postponing or searching for short term solutions that would incur more costs. This solution can be brought about by the design of a system that can be installed in the problematic areas, thus either reducing or eliminating the emissions of the dust to the environment.

This would bring a reduction in the percentage of the dust in the environment, even if it’s by a minimal percentage than taking short cuts or no action at all.

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# LIST OF ABBREVIATION

CCR-central control room

ESP-electrostatic precipitators

BMP-best management plan

ARM-Athi River Mining

CBD-Central Business District

GDP-Gross Domestic Product

TSP-Total Suspended Particles

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# LIST OF SYMBOLS

µM-micrometers

HP- horsepower

M-metres

Kg-kilogram

kW-kilowatt

ft-feet

km-kilometres

# 1.0: INTRODUCTION

## 1.1: BACKGROUND INFORMATION

Athi River Mining (ARM) Cement Limited formerly Athi River Mining Limited is a mining and a manufacturing company in Kenya, the largest economy in East African Community. The company is involved in cement manufacturing with branches in Kilifi County and others in Tanzania and Rwanda (Mugwe, 2016). They also have different divisions other than the Cement division, that is, Silicate, Special products, Mineral and Mavuno divisions. Which all have their work duties and work flow that grow the company to where it is at the moment.



***Figure 1.0: Map of the various ARM Cement PLC around Africa. Source: ARM Cement PLC website.***

The Company’s main goal is to deliver excellence in product quality and customer service. To achieve this goal, it requires a deep, unwavering commitment to communication, transparency, ethical behavior and teamwork. Whenever one is moving forward together, success takes care of itself. And the best and quickest way to succeed is to help others succeed.

Throughout the mining and processing of minerals, the mined ore undergoes crushing, grinding, cleaning, drying, and product sizing operations as it is processed into a marketable commodity. These operations are highly mechanized, and both individually and collectively these processes can generate large amounts of dust. If control technologies are inadequate, hazardous levels of respirable dust may be liberated into the work environment, potentially exposing workers. Accordingly, federal regulations are in place to limit the respirable dust exposure of mine workers. Engineering controls are implemented in mining operations in an effort to reduce dust generation and limit worker exposure such as filter bags of which not all the dust is well captured.

Dust collection systems are the most widely used engineering control techniques employed by mineral processing plants to control dust and lower workers' respirable dust exposure. A well-integrated dust collection system has multiple benefits, resulting in a dust-free environment that increases productivity and reclaims valuable product. The efforts that have been previously employed to reduce the volumes of dust are many.

For instance the fabric filter bags, are some of the ancient dust control mechanisms. They were used in industrial application to serve the purpose of recovering economical products from dust on fumes in non-ferrous refining and smelting exercises. The filter bags were modified and the Reverse air Jet system was introduced making the entire process more advantageous through the use of mechanical shakers to clean off the bags. The Pulse Jet Filtration system was introduced at the end of the 50’s, this system was able to provide a uniform air flow, a continuous cleaning filter and a high air-to-cloth ratio. It contained almost no moving mechanical parts as it was very simple. The legislation further forced the speed up of developments in industries, power stations and waste incinerators in the 70’s and 80’s to use air pollution control systems. This guaranteed an interesting building market for the filter industries.

Apart from the dry methods above used to eliminate dust in cement plants, there are also the wet process functioning to achieve the same target, commonly termed as the wet dust suppression which mainly uses water sprays, mists and water guns to control dust in roads, piles and processing operations. Some of these include the wet scrubbers. A wet scrubber works in the sense that the collecting medium is by water or any other liquid in order to accomplish its task. They work by creating a wet target for the dust particle collection, hence requiring significant amount of water for it to work efficiently making it as one of its disadvantage apart from increased energy costs.

Hence, this makes my design more susceptible for use, as it would accomplish particulate collection through water as the wet scrubber, perform in various moisture and temperature conditions but the advantages it has is that it wouldn’t need significant amount of water for its operation or high energy costs. It would operate on a more specified direction on the raw materials being mixed up as that is where the major issue comes up, as most of the filters would not be able to accomplish collecting that significant amount of dust.

In Kenya, the manufacturing sector grew at 3.5% in the year 2015 and in the year 2014 it grew by 3.2%, which contributed to a GDP of 10.3%. However, on average the manufacturing sector has been growing at a snail pace than the economy, which expanded by 5.6% in the year 2015. Hence, this implying that there is reduction over time in the share of manufacturing in GDP. As a result, it can be argued that Kenya is undergoing a premature de-industrialization in the context where manufacturing and industry are still relatively under-developed, as Kenya seems to have peaked at a point much lower than in much of the Asian continent. This is as a result of challenges faced in the manufacturing industries to lower its productivity.