BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

DESIGN OF TAILINGS IMPOUMDMENT FOR KILEMBE MINES

By

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MAY 2016

A report submitted in partial fulfillment of the requirements for the award of a bachelor's degree of science in Mining Engineering.

ABSTRACT

In order to extract minerals or metals from the earth in an economical way, it is necessary to crush large quantities of earth material into a range of fine to micro size particles and add additives to obtain them. However, in this process the waste that is generated is large and usually in form of slurry called "tailings." This material needs to be properly stored or disposed, requiring the design of tailings dams. Tailings management of a mining exploitation is a key in the economic development of the activity and especially of the natural and social environment of the site.

The abandoned Kilembe mine in Kasese district, western Uganda resumed mining activities and currently processes copper with the subsequent waste production from mineral beneficiation. The problem being experienced is lack of containment structure to retain the waste as it is associated with heavy metals, sulphide mineralization and some mineral values that may become potential deposit. The main objective of this study was to design an impoundment dam to store tailings and specific objectives were to carry out site investigation, to determine tailings characteristics influencing the design and to design the tailings impoundment dam and its components.

The methods of Tailings disposal, types of impoundments, Tailings discharge methods, basic structures for retaining tailings in impoundment, embankment construction methods, Tailings impoundment design and basic design concepts, major components of dams have been described in the literature review.

The methods used in data collection during the research included; desk study, consultations, observations and measurements, laboratory sample tests. Rainfall data for Kilembe, for a period of 11 years was obtained and Softwares like **MS Excel sheet 2013** were used in analyzing the collected data and **AutoCAD 2015** was used in generating the design drawings.

Results obtained from the field and laboratory experiments were analyzed and lead to the design of the dam and its components. The appropriate materials were sourced from within the impoundment as it is economical and method of construction was selected. Detailed drawings were generated using AutoCAD Software. From the analysed data, various challenges, conclusions and recommendations were drawn.

DECLARATION

I OCARE JOSEPH hereby declare to the best of my knowledge that this is my true and original piece of work and has never been submitted to any university or institution of higher learning by anybody for any academic award.

Signature.....

Date 27/05/2016

ACKNOWLEDGEMENT

First and foremost, I would like to thank Almighty God for His protection and guidance up to this stage in my life and the Department of Mining and Water Resources Engineering Busitema University for their academic and professional guidance given to me

Special thanks goes to my main supervisor Miss. Jacqueline Nangendo who has endeavored to give me all the necessary guidance, advice and encouragement through the course of this research project as well as my academic career. I would also like to thank the other members of department, Mr. Ddumba Joseph Lwanyaga, Ms. Egole Marion, Mr. Mugisha Moses, Mr. Mukiibi Ivan, Mr. Tugume Wycliffe and Mr. Nasasira Hillary for their expertise and help. I am so thankful for having had a full support from the department.

I would also like to thank the staff of Tibet Hima Mining Company Limited for their support during this research project. Specifically, I would like to recognize Eng. Mate Moses, and Project Manager, Mr. Kwatampora Alex for their time, suggestions, and assistance throughout this project

I finally appreciate my parents for the support they have given me and all my friends for the assistance they have given me in this research. May the Almighty God bless the work of your hands and may He make you live long enough.

LISTS OF SYMBOLS

Cu	Copper
Co	Cobalt
Ni	Nickel
Pb	Lead
P_H	Horizontal lateral thrust due retained tailings.
C_{metal}	Available heavy metal concentration of copper tailings or pyrite soils
$C_{background}$	Mean available heavy metal concentration of the unpolluted soils.

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CHAPTER ONE: INTRODUCTION

This chapter describes the global perspective on mine waste management, site location and previous tailings management, topography and climatic condition of the site. Defines the problem and objectives of the study, justification, scope and significance of the project.

1.1 Background of the study

1.1.1 Global perspective on mine waste management

Until recent decades, the majority of mines were small underground operations with correspondingly modest requirements for tailings disposal. Since that time, due to increasing demand, it has become economical to mine large lower-grade deposits by utilizing advances made by mining equipment manufacturers and developments in mining and milling technology, (U.S. EPA, 1994). This has greatly increased the amount of tailings and other wastes generated by individual mining projects and by the mining industry as a whole. Copper industry and others typically mine relatively low-grade ores that contain less than a few percent of metal values; the residue becomes tailings, (U.S. EPA, 1994). In copper mining, tailings can account for 95-99% of the crushed and ground ores, (Lu and Wang, 2012). Thus, tailings disposal is a significant part of the overall mining and milling operation at most hardrock mining projects.

The disposal of mill tailings is a major environmental problem, which is becoming more serious with the increasing exploration for metals and the working of lower-grade deposits. Apart from the visual effect on the landscape of tailings disposal, the major ecological effect is usually water pollution, arising from the discharge of water contaminated with solids, heavy metals, mill reagents, sulphur compounds, etc. (Chalkley et al., 1989). Waste must therefore be disposed of in both an environmentally acceptable and, if possible, economically viable manner, (Brawner, 1979)

Mine tailings, in particular, consist finely ground mill or mineral processing wastes remaining after extraction of mineral values. They may range from essentially medium sand to clay-sized particles, being transported to the disposal area in a wet form as a slurry (ICOLD et al., 1995).

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