THE IMPACT OF HEAD GRADE ON THE ECONOMICS OF ROUTING NCHANGA CONCENTRATES

BY

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DECLARATION

I declare that this dissertation represents my own work and that it has not previously been submitted for a degree at this or another University.

Where other people's work has been incorporated, acknowledgement has been made.

Signature of Author:.....

Date:.....

This dissertation of Godfrey Chapa is approved as fulfilling part of the requirements for the award of the degree of Master of Mineral Sciences in Mining Engineering by the University of Zambia.

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ABSTRACT

The study addresses the problem of cost containment facing Zambia Consolidated Copper Mines Limited by focusing on Nchanga Concentrator because of its flexibility to change concentrate production strategy and because it's the company's largest concentrate producer with a 60% contribution to the company's total concentrate production. The study develops a flotation balance model for forecasting copper grades, recoveries and tonnages of concentrates and tailings with respect to copper head grades as part of a metallurgical production planning system. Furthermore, the study analyzes the economic effect of head grade at the Concentrator on the net monetary values of finished copper products obtained by treating concentrates and tailings at downstream alternative process plants with a view to contribute to the company's overall profits.

The flotation balance model development utilizes data from April, 1982 to March,1988 as reported in the Nchanga Concentrator monthly reports; while the economic analysis uses data furnished by Technical Services. The Box-Jenkins time series method together with mass balance equations are used in developing a flotation model for forecasting the monthly flotation performance. With respect to copper head grades, the forecasts of concentrates and tailings arisings in conjuction with costs and revenues associated with the downstream alternative process routes are used in analyzing

the economic impact of head grade on final copper products. The flotation balance model generates acceptable forecasts. Moreover, the economic analysis show that the head grade has a significant economic impact on the downstream finished copper products. Furthermore, because there's flexibility at Nchanga to change concentrate production strategy, optimal routing of concentrates affects the overall ZCCM economics and can contribute to the company's overall profits.

The problem of variations in the mineralogy of the feed to the Concentrator is revealed by the inability of the flotation model to predict sharp changes in the flotation performance. Despite this problem, the results of the research show that cost effective statistical applications represent a major step in the analysis of the overall economics of the flowsheets from ore at Nchanga Concentrator to final copper products with the objective of contributing to the company's profits.

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