Total Ore Processing Integration and Management

5th Quarterly Technical Progress Report 01 July - 30 September 2004

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Abstract

This report outlines the technical progress achieved for project DE-FC26-03NT41785 (Total Ore Processing Integration and Management) during the period 01 July through 30 September of 2004.

Table of Contents

Executive Summary	5
Introduction	6
Work in Progress	6
Minntac Mine	6
Hibtac Mine	7
Future Work	9
Dissemination and Outreach	9
Appendix	10

List of Graphical Materials

Figure 1	6
Figure 2	7
Figure 3	8
Figure 4	8
Figure 5	9

Executive Summary

Work in Progress: Minntac Mine

A 10-day ore segregation test, the most detailed so far, was performed during this quarter. Comparison data were collected for 18 days prior to and 18 days following the test. Detailed statistical analysis is underway. Charts of preliminary results are included in the Appendix. As in previous tests, the ore was segregated on the basis of A-factor, an index that reflects

Figure 1 shows that the energy required for the two ore streams did change during the test. There appear to be two causes for the higher power draw in the high A-factor line: a slightly different set point for the grind, and the greater resistance of the high A-factor ore.

Crude ore passing through the high A-factor line was subjected to a higher grind set point (higher percentage of particles passing 270 mesh, or 53 microns) than that for the low A-factor line. A finer grind takes more energy and time and ultimately lowers mill throughput. This equates to a higher kWh/ton, since more power is needed to achieve the desired grind set point. Data also indicate that the high A-factor crude ore was harder, and thus more difficult to grind anyway.

The rate at which a concentrator line produces product depends upon a complex interplay of variables such as magnetic iron concentration, ore hardness, grind set points, rod and ball charge levels, maintenance/breakdown disruptions, and power allotment. To confidently evaluate the effect of the test on concentrate production rate for both lines, these variables should be factored in along with consideration of the effects of shovel location changes. The concentrate production rate changes will be scrutinized with more sophisticated statistics, including a closer look at lab magnetic iron data, grind index, power rates, unaccounted losses, *etc.*

As it turned out, the start of the test coincided with the mining of a very low silica ore. This introduced some operational issues that may have confounded some of the data trends. More sophisticated statistical analysis is underway to separate these causes and parallel effects.

Work in Progress: Hibtac Mine

The WipFrag image analysis system installation is complete over the conveyor belts leading from the primary crusher.

An ore segregation test based on powder factor was begun at Hibtac Mine. Analysis will begin when data from the mine, mill, and image analysis system has been downloaded from the mine database.

Future Work

Two statistics professors with industrial experience will determine the relationships among data mined from the databases and the ore segregation tests of both mines.

Dissemination and Outreach

One technical paper and two presentations are being prepared for the SME Annual Meeting to be held in Salt Lake City, UT in 2005.

Introduction

This fifth quarterly report discusses the activities of the project team during the period 1 July through 30 September 2004.

Work in Progress

Minntac Mine

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Figure 1. Energy usage per ton of ore before, during, and after Ore Segregation Test #3.

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Hibtac Mine

The point-load strength and the density of the five ore layers being mined at Hibtac have been measured using samples from seven representative exploration coreholes. Figures 2 through 4 summarize the statistics of the results. Load was applied to each of the rock samples in one of two orthogonal directions: Sub-parallel to the visible layering (diametral) and perpendicular to it (axial). The anisotropy ratio is the ratio of the former to the latter. Data from one of the boreholes is not included in these figures due to its significantly different values. The results obtained by including those values is shown in the Appendix.

Figure 2. Diametral (parallel to layering) point-load statistical summary, excluding data from borehole 409.

Figure 3. Axial (perpendicular to layering) point-load statistical summary, excluding data from borehole 409.

Figure 4. Point-load anisotropy ratio statistical summary, excluding data from borehole 409.

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Figure 5 shows the results of the density measurements from the same representative boreholes.

Figure 5. Variation in density expressed as tonnage factor for samples of the ore layers at Hibtac Mine. Error bars are $\pm$ one standard deviation.

Future Work

Statistical Analysis

Two statistics professors with industrial experience will determine the relationships among data mined from the databases and the ore segregation tests of both mines.

Dissemination and Outreach

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Appendix: Charts from Minntac Mine Ore Segregation Test #3

Point-Load Measurement Statistical Summary, Including Data from Borehole 409: