Ore-Dressing Plant Performance Improvement By Auditing

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Abstract

The sustainable viability of mineral enterprise during recession time depends on improving concentrate product quality, generating readily salable by-products, improving recovery, throughput, and reduction of expenses at minimum unit cost rate and maximum unit profit rate. The present paper discuses the importance of process plant audit for improving the graphite mineral processing plant performance. The audit reduced the tail losses to2.6%FC , increased the concentrate grade to 96%FC, increased the recovery from 70% to 85% in plant and doubled the revenue

1 Introduction

The viability of a mineral enterprise necessitates the development of specific techno-economic model. The techno-economic model predicts the operating strategy during the economic recession. The co-dependence of process variables, interdependence of different operations in a mineral enterprise, non-quantifiable factors needs continuous monitoring. This continuous monitoring and generation of techno-economic model is difficult. Hence, age old philosophy of improving viability by maximizing recovery and productivity seems unsustainable till significant overall unit cost rate reduction and enhancement of overall unit profit rate is achieved.

With stress on cost reduction, project engineers engaged in multiple projects, usually opt profitable projects than looking into performance improvement studies. However, the performance improvement of the plant needs the routine auditing studies, for reducing the overall unit cost and to improve the cash flow.

Audit is defined as a formal, thorough and periodic examination – evaluation of a system. The global audit is divided into geological audit, mining audit, marketing audit, energy audit, process audit and environmental-safety audit. The present paper deals with metallurgical process audit and its role in plant overall performance improvement. A few case studies are discussed, to reinforce the importance of auditing for performance improvement.

2 Process Auditing

The aim of process auditing is to understand the effect of the process variables on the profitability. Table 1 denotes the steps and out line of process auditing. The performance improvement studies by process auditing demands time and money.

It is frustrating due to ill defined objective, improper problem identification and lack of will for implementation. It is a tough job as conceptual ideas have to be sold enumerating the costs, time and risk factors with relation to the benefits obtained.
The problem compounds if the historical data is improperly logged and improper location of sampling points in the circuit. However, the total involvement of plant team with proper communications is the key to solve the problems associated with auditing. The data is analysed logically, scientifically, stastically keeping techno-economics in view. Once the problem is identified, test works under simulated conditions, based on evolutionary and

revolutionary concepts, are conducted. Conclusions are drawn evaluating the alternatives for solving the problems. The recommendations are made based on sustainable benefits. After on-site implementations, circuit is sampled, the results with techno-economic benefits are evaluated with reference to base line and projected values. Recommendations for improvements are suggested.

3 Auditing Of A Graphite Flotation Plant

The flexibility of process auditing for diverse cases to improve the overall performance of plant from techno-economic view point are discussed below. The program objectives vary due to the time, money and operating philosophy constraints of the company. The process auditing has to be flexible to cater the present needs in stages with an integrated approach in future.

ROM graphite is crushed to -10mm in two stages using a primary jaw crusher and an impactor both in closed circuit with 40 and 10mm DD screen.-10mm crushed fines is ground to -30mesh in open circuit rod mill. The RMD is subjected to rougher and scavenger flotation in mechanical cells. The rougher float is cleaned twice using mechanical cells and 900mm column with regrinding before every cleaning stage. The II cleaner float is screened over 72 mesh. -72 mesh fraction is cleaned twice using 600mm columns with one regrinding between cleaning stage. The column tails are scavenged in 1200mm column and the float is fed to 72 mesh screen undersize The +72mesh flaky concentrate and IV cleaner fine concentrate are dewatered. The plant was designed to handle 250TPD graphite, yielding +95% FC concentrates with 90% FC recovery for ROM graphite assaying 17%FC.However, the plant was operating at lower throughput, yielding inferior concentrate grade with low recovery. Systematic sampling followed by lab scale test work simulating plant design conditions indicated the dilution and mismatching size of cells was the reason.

Flotation circuit was rearranged in CCC mode maintaining the pulp density and cell volume. A middling thickener was used ahead of flotation for recirculating cleaner tails and scavenger float. The plant could produce the designed +96% FC concentrate with +85% FC recovery nearly maintaining the throughput at stipulated MOG.

Table 2 indicates the salient results. Efforts are on to produce finer mill feed by enhancing crushing to improve the throughput to designed levels. Also putting a screen ahead of rod mill to screen out 0.6 mm from feed to increase the throughput and reduce slime losses is on the anvil. The benefits are stipulated 250 tpd production with maximum recovery with grade for concentrate can be achieved. The results are not presented here as trials are underway.

4 Conclusion

The viability of project is improved through systematic process auditing and implementation, by reducing the inventories, overall operating cost and improving the sales and the cash flow by (a) improving concentrate quality to 96%FC, (b) reducing the tail losses to 2.5%FC, (c) improving the throughput and availability.

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Table 1: Results of plant audit of graphite plant

Particulars	Base line	Modified
TPH ROM	7.8	7.0
Feed %FC	15.6	15.6
Conc %FC	93.73	96.00
Tails %FC	5.15.	2.60
FC% Recovery	70.6	85.0
Revenue Rs/hr	9200	18000