Increase in Bauxite Grinding Mill Throughput

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Abstract

Ground bauxite slurry supply is a key factor in stable alumina refinery operation. Maaden refinery has three semi-autogenous grinding (SAG) mills and the requirement to sustain refinery's demand was more than two mill operations. This left very little time window for maintenance activity of SAG mill. Refinery suffered high production losses because of this bottleneck.

Various initiatives were undertaken to improve mill throughput so that two mills can supply the demand of the refinery. The one that worked most effectively was changing the cyclone design. Cyclone receives the mill output and classifies the slurry based on bauxite size fraction. While the cyclone overflow captures the finer fraction and becomes the input for the refinery, the underflow, having the coarser fraction is recycled back to mill as part of closed-circuit grinding design.

The cyclone capacity was the bottleneck to increase the mill throughput. The design was reviewed and changed. A trial newly designed cyclone was installed. The throughput could be increased by about 10 %. This is enough to run the refinery using two mills, sparing the third one for maintenance without affecting production.

Keywords: Bauxite grinding mill, Bauxite size fraction, Cyclone design.

1. Introduction

Maaden Alumina Refinery was established and start producing smelter grade alumina (SGA) in 2014. As a mining leader in Saudi Maaden has its own captive mine at Al Ba'itha. The Al Ba'itha mine is the only bauxite mine in the Middle East. It is an open pit mine with an annual capacity of over 4 million tonnes of bauxite ore. The bauxite ore is refined in the Gulf Cooperation Council (GCC)'s first alumina refinery at Ras Al Khair (Maaden Refinery) to produce 1.8 Mt of alumina per year, which is processed in the Maaden smelter to produce aluminium metal.

Ground bauxite slurry supply is a key factor for the stable alumina refinery operation. Maaden Refinery has three semi-autogenous grinding (SAG) mills. The Refinery's demand requires more than two mill operations. This left very little time for maintenance activity of SAG mills. The Refinery suffered production losses because of this bottleneck.

Various initiatives were undertaken to improve mill throughput so that two mills can supply the demand of the refinery. The one that worked most effectively was changing the cyclone design. Cyclone receives the mill output and classifies the slurry based on bauxite size fraction. While the cyclone overflow captures the finer fraction and becomes the input for the refinery, the underflow, having the coarser fraction, is recycled back to the mill as part of closed-circuit grinding design.

The cyclone capacity was the bottleneck to increase the mill throughput, other components of the closed-circuit grinding system still had leftover capacity. The design was reviewed and changed. The spigot size was increased from 6-inch to 7-inch. A newly designed cyclone was installed as a trial. The throughput could be increased by about 10 %. This proved to be enough to run the refinery using two mills if all the six cyclones were to change, sparing the third mill for maintenance without affecting production.

2. Materials and Methods

2.1 Material

Simulation was done with Standard software and a 7-inch spigot was chosen for the trial. In order to accommodate the increased spigot, the lower cone was also to be truncated. Keeping in consideration the room available on site, a set of new lower cone, 7-ich spigot and splash guard, both housing and liner material, were procured. (Figure 1).

2.2 Installation of Modified Cyclone

The picture below shows the actual installation of the modified cyclone. The lower cone, spigot and splash guard were the newly installed components, fixed to the existing upper cone.

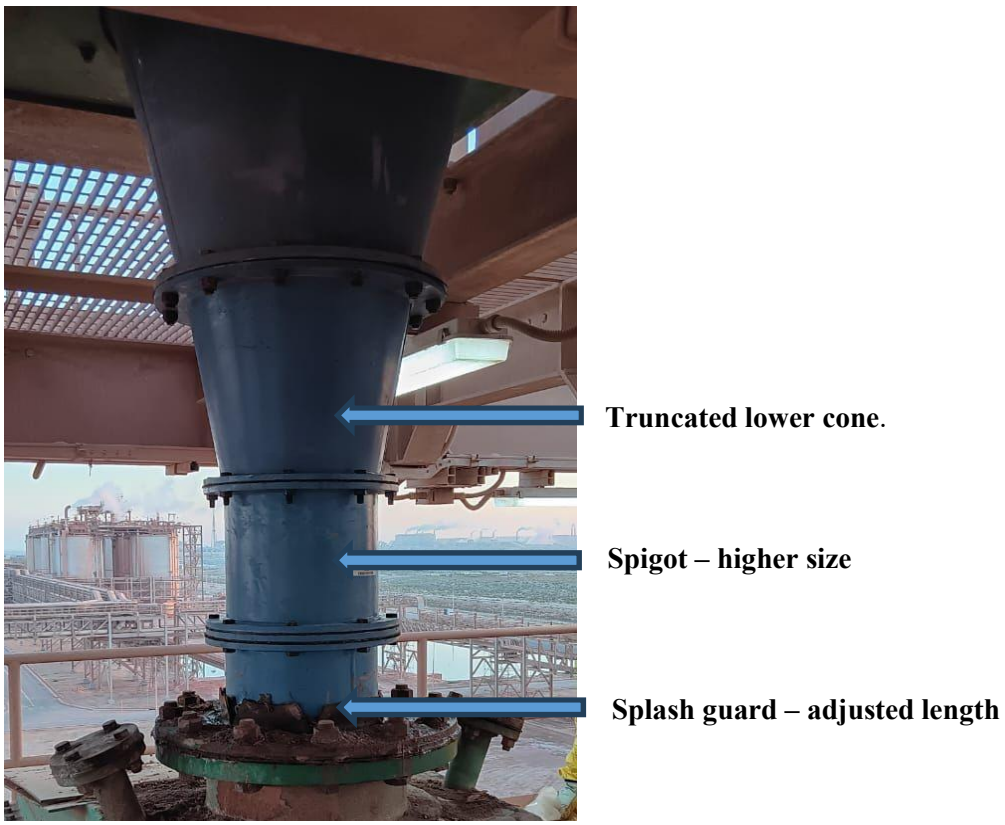

Figure 1. Picture of installed cyclone

2.3 Methods

The basis of any throughput increase was to feed more bauxite to the Mill and Cyclone. This would increase the inlet pressure limit in the trial cyclone. Some adjustments were made in the milling circuit control for conducting the trial.