

Innovations for Optimisation at Liulihe Cement

Chris Polizzi, C.P. Ganatra, Zhang Yong and Bob Rodriguez, W. L. Gore & Associates, Inc., Elkton MD, USA, describe recent filter installations in a Chinese cement plant.



Caption

Introduction

The cement industry on a relative scale is very transparent and the basic process know-how is no secret. The key, however, is to optimise the entire operation, process by process (raw milling, calcining, finish milling, etc.). This is where plant operation skills are very important. Similar equipment installed at two different plants may consume different energy levels, yield different production rates, and produce varying qualities of cement. The key is the plant personnel, and how they fine-tune the equipment at their plant to achieve an optimal level. Fine-tuning and optimisation is the main concept of this article, and is practiced at a plant owned and operated by Liulihe Cement in China. This plant recently optimised their cement finish mill system using special ePTFE membrane filters in the baghouse venting their high efficiency separator. They fine-tuned the entire milling process to take advantage of these low-pressure drop filter bags that provide higher air volume compared to previous non-membrane filters, which they have been using. The result of the optimisation has been a substantial increase in production through the mill.

Background

China is the world's largest producer of cement. The Chinese cement industry currently produces in excess of 550 tpa which is more than six times that produced by

either the US or India, who are second and third respectively. China is estimated to have over 13 000 kilns in operation, of which only 110 are modern precalciner kilns. Therefore, about 80% of Chinese production is carried out by old vertical shaft kilns. This means that only approximately 20% of the total production is produced using modern rotary kilns which will be referred to in this article. The author states that the quality of cement produced by these plants is world class, whereas the cement produced by the other 80% (vertical cement plants) is typically consumed locally. Many of these modern plants are strategically located to serve large Chinese markets as exports out of China were less than 10 million t in 1999.

The Chinese government has been active in encouraging cement producers to close outdated plants and has placed great emphasis on building plants capable of producing higher-grade cement. Various incentives are being offered to motivate cement companies to build new, state-of-the-art facilities. In addition, many international cement companies have developed vested interests in building new cement plants and/or acquiring existing plants in China as it opens its borders to global investors. Several of the top global cement companies have been active in China. Lafarge, Holderbank and Heidelberger have sought out opportunities and made cement plant acquisitions in China. In addition, many Japanese companies have developed joint ventures in China with local plants and in some cases have provided part of the machinery and capital for the expansion. The result of all these activities continues to fuel the expansion of the country's cement industry into the global arena.

Liulihe Cement Company belongs to Beijing Building Materials Group Company Ltd. (BBMG). BBMG group has three plants, namely Liulihe, Beijing, and Yanshan. Liulihe is the largest of the plants and in fact it is the largest plant in the Beijing area.

Plant details

The Liulihe plant has been operating for over 40 years. Today the plant has seven kilns with one being



Caption?

a 2000 tpd pre-heater kiln. Total capacity is roughly 1.5 million tpa and current plans include construction of a 2500 tpd production line.

Optimisation plan

One of the finish mills at Liulihe was originally commissioned in 1994. The milling circuit includes a ball mill supplied by Tangshan Cement mechanical plant, and an N2000 O-SEPA high efficiency separator designed by Onoda Engineering, Japan. The separator vents the ball mill, which is 4.2 m in dia and 11 m long. The ball usage of the mill is approximately 182 t (approximately 400 kg/t). The original production rate of the O-SEPA system was 72 tph, but during 2000, plant personnel on site confirmed the actual average throughput was only about 60 to 65 tph, or about 10-16% below the rated design capacity. Since the actual production rate was lower than the design level, an investigation began which determined that there was inefficient air volume to the separator and as a result of elevated pressure losses at the baghouse, was a primary cause of the bottleneck.

Alternatives

At this stage different alternatives were considered which led to a discussion around the filter media being used in the separator baghouse. A decision was made to upgrade the filter media. Unlike a typical filter bag purchase, where bag life or reducing maintenance costs of the bag house are primary items to evaluate, the situation was quite different. A production bottleneck was at the center of the problem. This type of macro vision sometimes helps solve major problems normally not visible when just troubleshooting a single component.

The O-SEPA system's actual production was lower than the rated design level (60-65 tph vs. 72 tph) and improper and inefficient air through the separator appeared to be the main problem. Therefore, the challenge was to get more air volume through the separa-

tor. One clear way to do this was to replace the current filter bags with higher efficiency, lower 'filter drag' filters. At the time Liulihe was using conventional polyester bags purchased from a local supplier and the filter bags typically lasted about a year. This is when W. L. Gore & Associates, Inc. (Gore) was contacted.

Concept of ePTFE membrane high flow filter bags

Liulihe contacted Gore who had developed the polytetrafluoroethylene (ePTFE) membrane filter media, which is sold under the GORE-TEX® Filtration Products trademark.

After a lengthy evaluation, GORE-TEX® High Flow filter bags were chosen because the new material represented significantly higher ROI in terms of cost versus performance. The new filter media specifications met the application needs, and Gore's technical support was viewed as a significant benefit. In addition to recommending ePTFE membrane filter bags, Gore would be providing engineering services on-site at the Liulihe plant.

The Liulihe baghouse was equipped with GORE-TEX High Flow polyester filter bags (16 oz/yd²) in June 2000. Upon start-up, there was a significant reduction in the baghouse operating differential pressure and an increase in airflow; however, the production level remained unchanged. Engineers visited the plant after the bags were installed, and by further adjusting the filter bag cleaning sequence and the cleaning frequency, increased airflow was achieved, thereby improving separator efficiency. Adjustments to the cleaning air pulse pressure further optimised the airflow and, subsequently, the O-SEPA's performance. Finally, Gore engineers made recommendations on adjustments to be made to the O-SEPA separator itself in order to match its performance characteristics to the higher flow rate.

High efficiency separators need a recommended level of airflow to achieve high efficiency or maximum production rates. The airflow through the separator provides the final separation of product (cement) from coarse material. In non-optimised mill circuits, the maximum airflow recommended by the separator manufacturer are typically not reached and, therefore, usually do not achieve the design production rate.

Results

After the modifications and adjustments to the baghouse and separator were complete, the Liulihe plant achieved a production rate of 80 tph which exceeded the rated specifications for the O-SEPA by almost 10 tph. The production rate was 23% higher than before optimisation, and 14% higher than the original rated capacity of the separator.

Future work

Liulihe is now building a state-of-the-art 2500 tpd production line. They have already decided on GORE-TEX membrane filter bags for use in the kiln/raw mill exhaust baghouse, as well as the coal mill baghouse.

Enquiry no: