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Raw mill fan upgrade at Titan Pennsuco

Titan's 6000hp raw mill fan was upgraded by AirStream in 2008. This joint paper describes how its improved design has provided a large efficiency increase and a greatly reduced wear rate, as well as reduced the need for heavy maintenance. As a result, the project also won the Global Fuels 2009 Most Innovative Technology for Electrical Energy Efficiency Award.

In 2003 Titan began the construction of a new 1.8Mt/y plant at Pennsuco, Florida. Soon after the contractor delivered the main process fans, concerns arose about the fans' light construction. Therefore, Titan invited AirStream Systems Inc to make a technical evaluation of the fans' suitability for handling the highly abrasive dust that was a result of the raw materials native to the region.

The relationship between Titan and AirStream began more than ten years ago when four large process fans were successfully upgraded at Titan's Roanoke Cement plant in Virginia. The project increased the fans' wear life while reducing the plant's power use by 1804kW.

At the Pennsuco site, AirStream examined the raw mill, preheater and coal mill fans. The findings indicated that all fan rotors would need some improvements if they were to attain a reasonable life. In particular, the raw mill fan was identified as the most likely to need repairs before completing the first year of operation. As shown in Figure 2, wear protection was minimal and consisted of partial liners of ribbed plate. The gas velocity in the rotor inlets was extremely high and topped 13,000fpm.

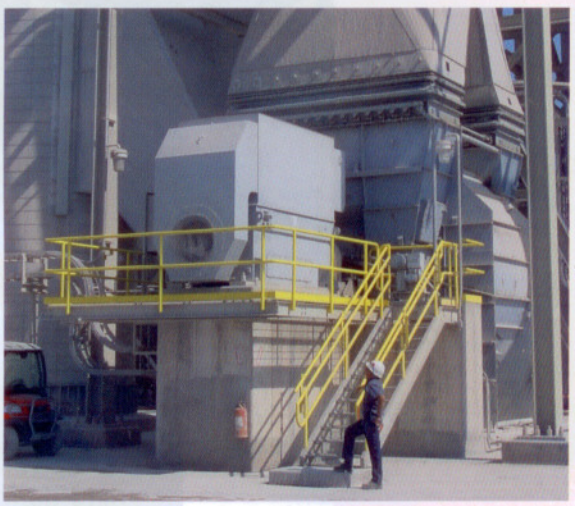

Figure 1 (right): AirStream's rotor upgrade.

Figure 2 (below): The original fan rotor in 2004. The lack of sufficient wear protection was a primary factor in its failure.

Wear rates are proportional to the square of the dust velocity and as a result, wear during the first year of operation (2004-2005) was severe. Uneven material loss often caused the fan vibration levels to rise above normal. Over the course of several repairs, the liners were changed to chromium carbide (CrC) and increased in size, and structural reinforcements were added to the blades as recommended by AirStream. Nevertheless, the fan still required monthly weld repairs to manage the wear (Figure 3).

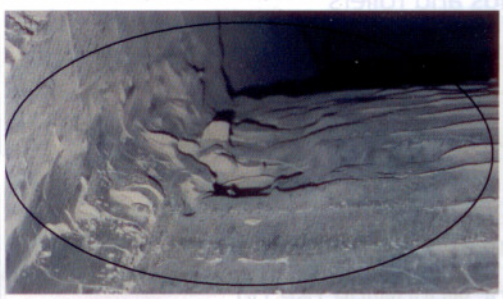

Figure 3 (Above): Repaired original fan rotor in 2006. It is clear from the image that there was a significant wear problem.

On-site performance tests revealed that the fan speed was close to the maximum, although fan pressure was only at 82% of the design value. AirStream proposed a rotor upgrade that could restore full performance while reducing power use by 787kW.

Throughout 2006-2007, frequent repairs of the CrC surfaces continued. In late 2007, Titan contracted AirStream to deliver a turnkey upgrade project of the raw mill fan. The project was very economical, reusing all fan components except the rotor and inlet cones, and needed only minor modifications to the fan housing. The installation took place during Titan's outage in early 2008 and the verification performance test was successfully completed in May 2008.

The new rotor has a diameter of 3.6m, is wider and has larger inlet areas, resulting in much lower dust velocities. All surfaces subject to wear are fully protected with liners.

In 2009, after 10 months of operation, the fan rotor was inspected by Titan and AirStream. Virtually no wear was evident (Figure 4). Titan concluded that: "This was an excellent investment for the company. We saved what we expected, and the maintenance people love the equipment as it does not need heavy maintenance!"

Figure 4 (Right): The AirStream Rotor in 2009 after 10 months of operation showed virtually no wear.