New lime mud dryer kiln helps James River's Pennington, AL, mill meet environmental restrictions

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Operating experience shows new kiln meeting mill's demands of increased capacity, reducing operating costs and environmental emissions, and supporting the capacity of a new chemical recovery unit.

A new lime kiln (**Fig. 1**)—a first of its kind in North America—began operation at James River Corp.'s Naheola Mill in Pennington, AL, in February 1993. With a design production capacity of 500 tons/day of 88% available CaO, reburned lime, this kiln is equipped with a lime mud dryer (LMD) and a sector cooler. It replaced two 1960 vintage kilns with a combined average lime production of 325 tons/day. In operation for over two years, the new system is examined and the operating experiences of both the old and the new systems is compared.

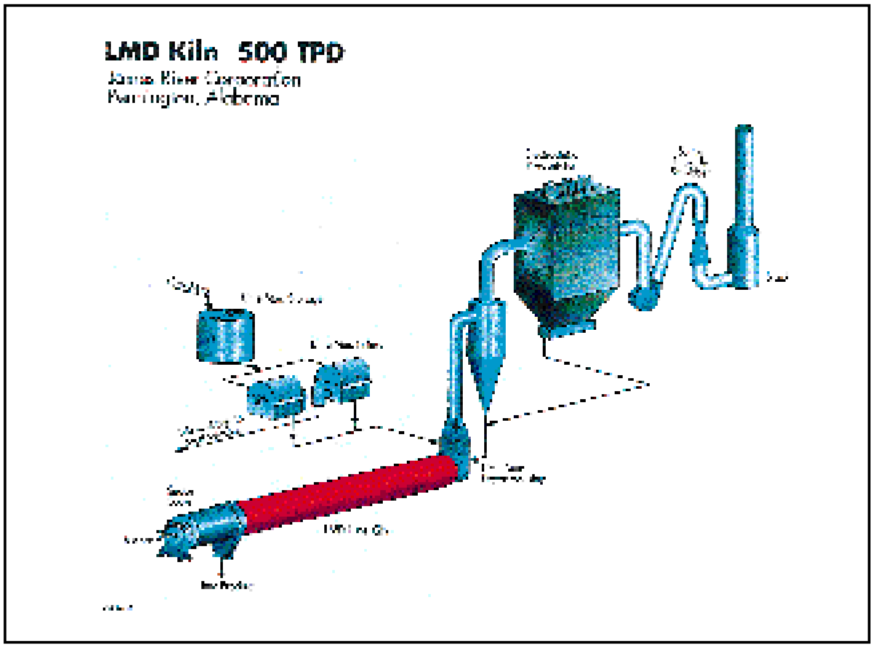
How it works

Ahlstrom's LMD system (**Fig. 2**) uses an external dryer instead of the conventional chain section to dry the lime mud. Hot kiln flue gases are used in the dryer to dry the mud. The mud and gases travel from the LMD to a cyclone where they are separated. The dried mud returns to the kiln while the gases enter an electrostatic precipitator followed by a scrubber designed to remove SO_2. The sector cooler has replaced the conventional tube cooler design. Its primary function is to recycle heat from the product exiting the kiln. This is done by preheating the secondary air using radiant heat from the burning zone and shell of the kiln. The cooler consists of two cylindrical shells that are located at the hot end and are enclosed about the kiln shell. The first shell or inner shell of the cooler is installed away from the shell of the kiln providing an airspace between the kiln and the cooler. Ambient air that passes through this airspace is preheated by the kiln and the cooler's radiant heat. Before entering the kiln as preheated secondary air, the air enters the second shell or outer cooler. The first (inner) cooler and the second (outer) cooler are connected by partitions. These partitions run the length of the coolers and are designed to provide a path for the hot lime product and cooling air to travel. The hot product travels upward by flights found in the partitions and exits into the reburned lime conveying system (**Fig. 3**).

1. South view of lime kiln

The noncondensable gas (NCG) system is a low-volume high-concentration system (LVHCS). NCG emissions are collected from three piping systems. One source is from the blow heat recovery secondary condenser collected from a batch digester operation and the other two are from continuous sources. The continuous sources are the Kamyr turpentine secondary condenser and the evaporator hotwell system. The three source pipes are combined into a common header in which the gases are carried to a single injection nozzle at the kiln. The motivation of the gases occurs by negative pressures obtained by steam educators located near the kiln. The NCG piping from the sources is protected by pressure-vacuum relief breakers and flame arrestors.

A new standby incinerator is used as backup in the event the gases will not enter the kiln. This incinerator operates with natural gas.



2. LMD kiln processes 500 tons/day at James River Corp. in Pennington, AL

Reasons for choosing this kiln

1. With the sector cooler system, preheated primary and secondary air is used rather than cooler ambient air to increase fuel economy.
2. With a lime mud dryer design a kiln of shorter length can be installed at a lower cost. The dimensions of the kiln are 13 ft and 1-1/2 in. (4.0 m) in diameter by 311 ft and 8-3/16 in. (95.0 m) long.
3. The kiln height is lowered resulting in a low installed cost (due to sector cooler vs. tube coolers).
4. There is no chain section, thereby reducing maintenance cost.
5. The shorter kiln allows for a quicker response time to upsets in the system to obtain a better quality product.
6. The new kiln replaced two existing undersized 9 ft (2.74 m) in diameter by 250 ft (76.20 m) long 1960 vintage kilns that had a combined average production of 325 tons/day.
7. The kiln's new technology is intended to meet the new environmental restrictions.

Distributed control system

The kiln at Pennington uses a Honeywell TDC 3000 system that interfaces with four Allen-Bradley PLC-5 programmable logic controllers. This system replaced the old analog-type control panel. The physical connection between the Honeywell and the Allen-Bradley is made by two programmable logic controller gateways.

Operating information

Typically, the TRS on the scrubber stack runs below 1 ppm. A control scheme is now in place to control the amount of caustic that is being added to the scrubber for TRS control. Before this control scheme was put in place, caustic was added manually, which over time would cause the scrubber to plug its recirculating flow. As a result, the scrubber would have to be acid washed about every three weeks. With the control system in place, the scrubber requires acid washing less than twice/year.

Old system vs. new system

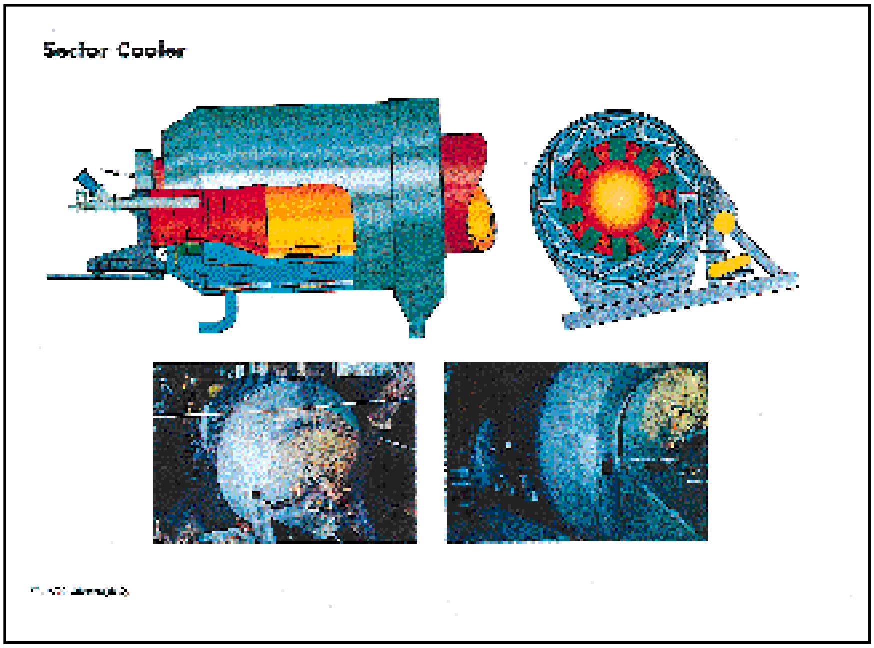
Lime balls—With the old system, lime balls had to be manually removed or knocked through the lime grate at a frequency of every three to four hours because of the size of the lime balls. With the new system, lime balls have not caused any interruption in production.

Rings in kiln—With the old system, soda rings within the kiln were a common occurrence that usually caused operational upsets that slowed lime production. With the new system, some rings have been experienced but no effect on production has occurred.

Brick life—With the old system, brick life would average about 1 to 1-1/2 years. Since startup of the new system, brick wear has been 1/4 in. (6.35 mm).

Responsiveness—The old system was responsive to operational upsets. Any upsets in operating parameters would be seen several hours later. The new system is more forgiving in that response to operational upsets is very slow which in turn makes this system a very operator friendly system.

3. NCG collection and incineration



Lime quality—With the old system, lime pelletization was nonuniform. Sizes of pellets would range from 1/2 in. (12.7 mm) to 3 in. (76.2 mm). With the new system, lime pelletization has been very uniform. Sizes range from 1/4 in. (6.35 mm) to 1/2 in. (12.7 mm).

Green liquor line scaling—With the old system, green liquor lines had to be acid cleaned with a frequency of two or three months. Since startup of the new system, the green liquor lines had to be acid cleaned only once.

Slaker rake scaling—With the old system, the slake rake had to be mechanically cleaned about every six months. Since startup, the slaker rake has not required mechanical cleaning.

Temperature of slake—No slaker temperature control could be maintained with the old system due to lime pellet nonuniformity and high temperature of the lime. With the new system, the slaker has run at a green liquor flow rate of 1300 gal/min (4921 L/min)—compared to previous high of 1100 gal/min (4164 L/min)—while maintaining fairly constant slaker temperature and experiencing no operational problems.

Causticizers/slaker bowl—With the old system, the causticizers and slaker bowl would have considerable scale buildup when inspected. With the new system, the causticizers and slaker bowl had no appreciable buildup upon inspection.

Dusting problems—With the old system, dusting was a considerable problem. Due to the cooler lime and its associated handling improvements with the new system, dusting has not been an issue.

Fuel consumption—With the old system, fuel consumption was 10–11 million Btu/ton. With the new system, the fuel consumption is less than 5 million Btu/ton.

Makeup lime usage—With the old kilns, fresh lime makeup was 100 lb/ton. With the new system, the makeup has been 10 lb/ton.

Operator comments—This is considered the most important point of the comparison between the old system and the new system. Operators have commented that they like operating the new system over the old system due to the distributed control system and the responsiveness to operational changes.

Conclusion

Since the startup of the new lime kiln system, lime quality has improved greatly. Operators appreciate the the ease of operation. And, while the old lime system's design pulping capacity of 1250 a.d. tons/day could be achieved with no makeup liquor, the new lime kiln system design capacity of 1400 a.d. tons/day (actual design is 1515 a.d. tons/day average with a design peak of 1772 a.d. tons/day) could be achieved with minimal fresh lime makeup and by improving runnability and optimizing the existing slaker, causticizer, and clarification equipment. TJ

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