

# LIME KILN

## *Lime Kiln Advanced Process Control OptiLime-2100*

**THE LIME KILN PROCESS** presents one of the most challenging measurement and control solutions in the Pulp and Paper mills. The complex dynamics and multi-variable nature of the lime kiln process, with its non-linear reaction kinetics, long time delays and variable feed characteristics, make the process inherently difficult to operate efficiently.

During its operation, many interconnected variables must be considered and control actions must be designed to meet multiple and sometimes conflicting objects. An additional difficulty is the reliability and/or accuracy of some of the measurements that are needed for even the basic controls. The operation may also be upset by severe disturbances. Certain process variables must also be maintained within predefined constraints in order to ensure safe operation of the process and to protect the environment.

These complex, multi-dimensional demands of the kiln process, have typically exceeded the capabilities of previously attempted advanced control systems. As a result, most kilns still separate without supervisory-level controls.

**THE DURALYZER-NIR™ LIME PROCESS ANALYZER** utilizes an extremely simple sample extraction technology conveniently located between the kiln outlet and lime bin. A simple water flow arrangement carries the lime pebble/powder sample to the

analyzer. At the same time, the water dissolves the sample with the same effect as the slaking reaction in a slaker. The end result is a dissolved lime sample, of which the Residual Carbonate ( $\text{CaCO}_3$ ) can be measured directly by the Reflective NIR principle.

The Lime process analyzer has been designed for ease of operation and minimization of short and long-term maintenance requirements. This has a net effect of minimizing the overall cost of ownership. Scheduled maintenance requirements have been kept to a minimum and include periodic bulb replacement in the light source enclosure, sample cell optics cleaning.



## LIME KILN CONTROL OBJECTIVES

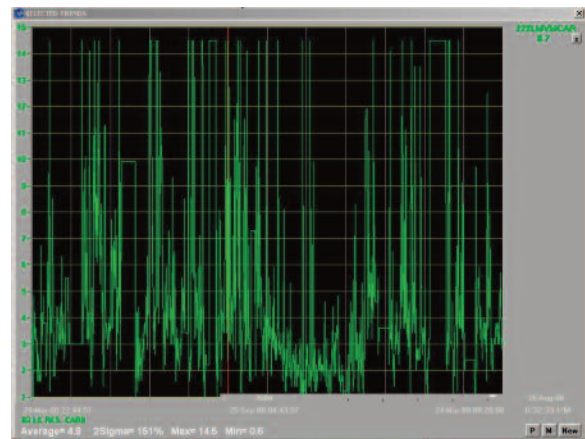
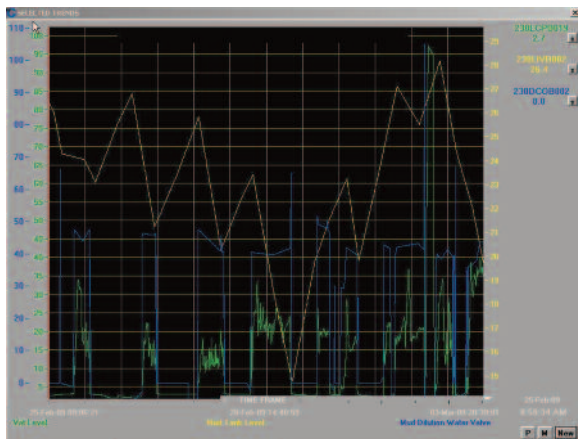
OptiLime-2100 Solution optimizes the entire lime kiln process. Its primary objective is to increase capacity to achieve higher production rates, while simultaneously producing more consistent lime at higher quality—all while achieving lower overall energy consumption and reduced environmental impact

## LIME KILN CONTROLS

**LIME KILN TEMPERATURE PROFILE CONTROL** is the most important part of the advanced control scheme. The objective of the temperature profile control is to provide optimal conditions for all four process zones: drying, heating, calcining and burning. This control compensates for changes in lime mud moisture, production rate and filling degree.

**THE HOT-END TEMPERATURE TARGET** is the most important control parameter. The hot-end advanced temperature control is a vital part of the reduction of the variability of the lime residual carbonate level. The midsection and end-temperatures are used for monitoring the temperature profile and preventing over-temperature excursions. The calcination process is stabilized by controlling the temperature profile in the lime mud as it is flowing through the kiln.

**THE PRIMARY CONTROLLERS** in OptiLime-2100 are Model Predictive Controller (MPC) and Statistical Process Controller (SPC). These Controllers are located in Delta-V based industrial PC with connection to DCS utilizing a built in OPC link.



## MORE CONTROL MODULES

- Residual Carbonate Module
- Production Module
- Energy and TRS Module
- Limits Module
- Stabilizer Module
- Controllers Module

