

# Application and Benefits of Thermo's PACT Software

## CASE STUDY: Colton Plant

### Introduction

From time to time, Thermo has received suggestions from our customers on the advancement of the dynamic calibration process. These suggestions varied greatly in character and scope depending on the specific details of the plant making the suggestion. Thermo's software and applications teams, located in the San Diego R&D excellence center, launched a program to design an innovative response to our customer's comments. Thermo invited participation from California Portland Cement's Colton Plant for several reasons. The Colton plant has keen and active interest in pursuing process improvement and reducing cost, plus, they are very familiar with use and application of Thermo's PGNAA products. Together we worked to develop an advanced calibration tool that minimizes the manual labor and time consumed in dynamically calibrating PGNAA Analyzers. Beta testing would be performed by the team at California Portland Cement's Colton plant.

### The Beta Site

The Colton Cement Plant of the California Portland Cement Company has a long history of cement production in Southern California. The plant is located adjacent to its limestone quarry that provides a reliable source of high quality limestone. Over the years, many types of industrial and residential districts developed to surround the Colton plant. Today the plant obtains most of its raw mix additives from the waste products of these neighboring industries. The use of these locally available materials is financially attractive to the Colton plant, but it has brought with it challenges to maintaining consistent kiln feed. In 2002, Thermo Electron installed a CB-GN analyzer on the conveyor that transports the raw mix to Colton's two mills. The analyzer, in conjunction with RAMOS control software, controls the blend of materials from eight silos. This Thermo on-line PGNAA measurement and control system has dramatically reduced the variability of the kiln feed. The plant currently maintains a standard deviation of  $C_3S$  in the kiln feed of 4, based on XRF analysis of grab samples.

The Colton plant produces several types of clinker and many types of specialty cement in addition to ordinary Portland cement. Some of these specialty cements are designed for specific customers. This diversity of products requires that the raw mix design be changed frequently to produce the proper clinker for the changing product demand. Since many of the components of the raw mix are obtained on the "spot market" from a large diversity of sources, the current availability of additives may require the mix design for a specific clinker formulation to change each time this formulation is manufactured.

### RAMOS Versatility

RAMOS has the ability to store many raw mix formulations and the expected chemistries of many source materials. The process for changing the raw mix to produce a different clinker is very simple. The clinker type is selected from a menu on the main RAMOS screen and the expected chemistry for each silo is selected from each silo's menu when the type of material in a silo changes. The transition from one clinker type to the next proceeds smoothly as RAMOS adjusts the blend to the new requirements

### Affect on Calibration

Colton's experience, prior to adoption of the Process Audit and Calibration Tool (PACT), was that the raw mix did not always exactly achieve the desired quality when clinker types were changed. The cause was diagnosed to result from the radical change in the layering configuration of the material presented to the analyzer and the disparate moisture content of the various layers. This situation was not controllable due to the large variety and inconsistent availability of the raw materials.

The solution to the problem is to adjust the dynamic calibration of the analyzer to match the process change. This has been a manual process and required the operator to maintain a record of dynamic calibrations for each process configuration and enter them into the analyzer at the appropriate time. This, in fact, was not always successful because historical calibrations were not available for configurations that used new materials with no history of use at the plant.

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#### Before PACT

The Colton plant has always monitored their process closely. The laboratory collects and processes grab-samples at several points in the raw meal process and analyzes these in light of the process targets. Note: Colton has two mills. With respect to the raw mix control, the following process was followed:

- Select a time adjusted batch averages from the analyzer to correlate with lab data.
- Print the batch averages.
- Enter the analyzer batch averages in to a spreadsheet with the lab data.
- Calculate the offset between lab and analyzer.
- Make a trend plot of the offset data to decide if process adjustments of analyzer calibration adjustments were appropriate.
- Determine the magnitude of the adjustments for each oxide as required.
- Enter the changes into the appropriate \*.ini file using notepad.
- Reboot GM2000 to make the changes take affect.
- Closely monitor the analyzer for a while to be sure that no error was made in data entry.

#### After PACT

The Colton plant now achieves better analysis much more quickly and reliably.

- Import the laboratory data from the "Import tab of PACT.
- Examine the graphs automatically produced by PACT. Scatter plot, trend plot, and difference plot
- Examine the statistical significance calculations to verify that proposed calibration of PACT is desired.
- Click the Apply button and then the OK button to immediately implement the calibration.

#### Benefits of PACT

Colton experienced several benefits from adopting the PACT software package. The simplest was the ability to select a calibration from the calibration database and insert this calibration into the analyzer with a click of the mouse. This saved time and avoided data entry errors when changing clinker types.

Second, the calibration database provided an automated method for relating calibrations to process configurations. This made it quick and easy to find the correct calibration to mach a specific process configuration.

The most important benefit came from the speed and efficiency of the Software to import laboratory data, locate the associated analyzer data, and graph the comparisons so that calibration and process issues can be spotted and diagnosed quickly and easily. The several views of the process provided by the graphing and statistical analysis features provide enhanced process analysis with much less effort and time. Jerry Farr, Director of Quality Control, said, "Until now I only trusted two people to make calibration adjustments to the analyzer, now I can let all my technicians make the adjustments." The PACT software has contributed significantly to the ability of the Colton plant to reliably maintain its very low kiln feed variance.

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