Upgrading to a modern quality control system

ABB's AutoLab and RMP successfully installed at Indocement's Cirebon plant

Reprint from World Cement April 2007

Upgrading to a Modern Automated Laboratory

Dr. Michael C Mound, Business Development Manager, ABB Switzerland Ltd, describes the latest upgrades at the Indocement Cirebon cement plant in Indonesia.

Introduction

The Indocement Cirebon cement plant in Palimantan, Indonesia (Figure 1) decided to implement a plan for combining and upgrading its laboratories in the P-9 and P-10 lines in late 2002. Much care was taken to try to utilise existing equipment and systems, and there was an increasing interest in modernisation and flexibility for increased laboratory throughput. A growing need was recognised for greater future capacity in terms of more samples and characterisation of more complex materials. At the same time, provision was needed for potential and planned expansions in a modular format. This required a careful compromise to ensure that existing equipment could be integrated successfully. To do all of this, refurbishing would be necessary for the older systems, to smoothly and efficiently communicate with recent and planned interfaces and control strategies. After much investigation, ABB's AutoLab was selected to execute the planned expansion and upgrade. In all cases, there was constant attention and concern for meeting and addressing the multiple requirements of flexibility, modularity, expansion of capacity, and conserving existing and reusable units wherever possible.

The challenge

An automated laboratory is a type of plant within a plant; that is, a miniature series of mechanical and analytical devices, all of which must work in harmony to produce reliable and reproducible quality information. This is necessary in order to monitor and control vital functions. In the case of Cirebon, this represented a major effort in terms of enhancement, as well as providing the means to managing complex raw materials. This latter requirement included a constantly changing mixture of sand and clay required for raw mix. To meet these needs while retaining flexibility for future requirements, the objectives of this type of automated laboratory had to advance faster than the previously acceptable versions. In earlier instances, labs only required simple, regular periodic upgrading or extensions to meet gradual increased sampling demands. The solution to this new and unique

Figure 1. The Cirebon cement plant.

situation involved a close cooperation with Cirebon plant personnel and ABB engineers and designers. This collaboration enabled a satisfactory solution based on a newly conceived combination of control strategies. The result was an achievement in terms of flexibility and reliable functionality.

Additionally, certain space constraints in the physical layout of the laboratory had to be resolved in order to allow room for new plant quality control requirements. Also, the team had to think about accommodating possible new technologies and devices and their associated accessories and communication needs. Following several iterations of structural and architectural designs, the final version of a coherent and efficient solution was accomplished. The illustration shows the final configuration and layout (Figure 2) of the automated laboratory, which satisfied the formula for meeting stated forward planning, as well as immediate needs for utility and maintenance of the AutoLab installed at Cirebon.

Table 1. PT Indocement Tunggal Prakarsa plant 9 - 10 Cirebon sample task list

No.	Material		Sampling point	Frequency	Sampling method	Contr/Meas items	Treatment of results
A	**Raw material**						
1	*Purchase material*						
	Silica sand		Truck scale	Daily	Manual	Oxides	Manual
	Iron sand		Storage yard	Daily	Manual	Oxides	Manual
	Trass		Truck scale	Daily	Manual	Oxides	Manual
2	*Stock pile*						
	P-9	Hi-lime P-9	Tripper BC	Daily	Auto sampler	Oxides	Manual
		Lo-lime P-9	Tripper BC	Daily	Auto sampler	Oxides	Manual
		Sandy clay	Tripper BC	Daily	Manual	Oxides	Manual
	P-10	Limestone	Tripper BC	Daily	Auto sampler	Oxides	Manual
		Sandy clay	Tripper BC	Daily	Manual	Oxides	Manual
3	*Weigh feeder*						
	P-9	Hi-lime CFW	W feeder BC	Per shift	Manual	Oxides	Manual
		Lo-lime CFW	W feeder BC	Per shift	Manual	Oxides	Manual
		Sandy clay recl	Reclaimer BC	Per shift	Manual	Oxides	Manual
		Sandy recl	Reclaimer BC	Per shift	Manual	Oxides	Manual
	P-10	Limestone CFW	W feeder BC	Per shift	Manual	Oxides	Manual
		Sandy clay recl	Reclaimer BC	Per shift	Manual	Oxides	Manual
		Sandy recl	Reclaimer BC	Per shift	Manual	Oxides	Manual
B	**Raw Mix**						
1	*Raw meal*						
	P-9	Raw meal online	ATC	30 mins	Automatic	LSF, IM SM	Automatic
		Raw meal collecting	ATC	2 hrs	Collecting	LSF, IM SM	Manual
	P-10	Raw meal online	ATC	30 mins	Automatic	LSF, IM SM	Automatic
		Raw meal collecting	ATC	2 hrs	Collecting	LSF, IM SM	Manual
2	*Kiln feed*						
	P-9	Kiln feed	ATC	2 hrs	Auto sampler	LSF, IM SM	Manual
	P-10	Kiln feed	ATC	2 hrs	Auto sampler	LSF, IM SM	Manual
C	**Product**						
1	*Clinker*						
	P-9	Clinker	Pan conveyor	2 hrs	Manual	Manual	Manual
	P-10	Clinker	Pan conveyor	2 hrs	Manual	Manual	Manual
2	*Cement*						
	P-9	Finish mill 1	ATC	2 hrs	Auto sampler	Oxides	Manual
		Finish mill 2	ATC	2 hrs	Auto sampler	Oxides	Manual
		Packing cement	Packer	Daily	Manual	Oxides	Manual
	P-10	Finish mill (OPC)	ATC	2 hrs	Auto sampler	Oxides	Manual
		Finish mill (PPC)	ATC	2 hrs	Auto sampler	Oxides	Manual
		Packing cement	Packer	Daily	Manual	Oxides	Manual

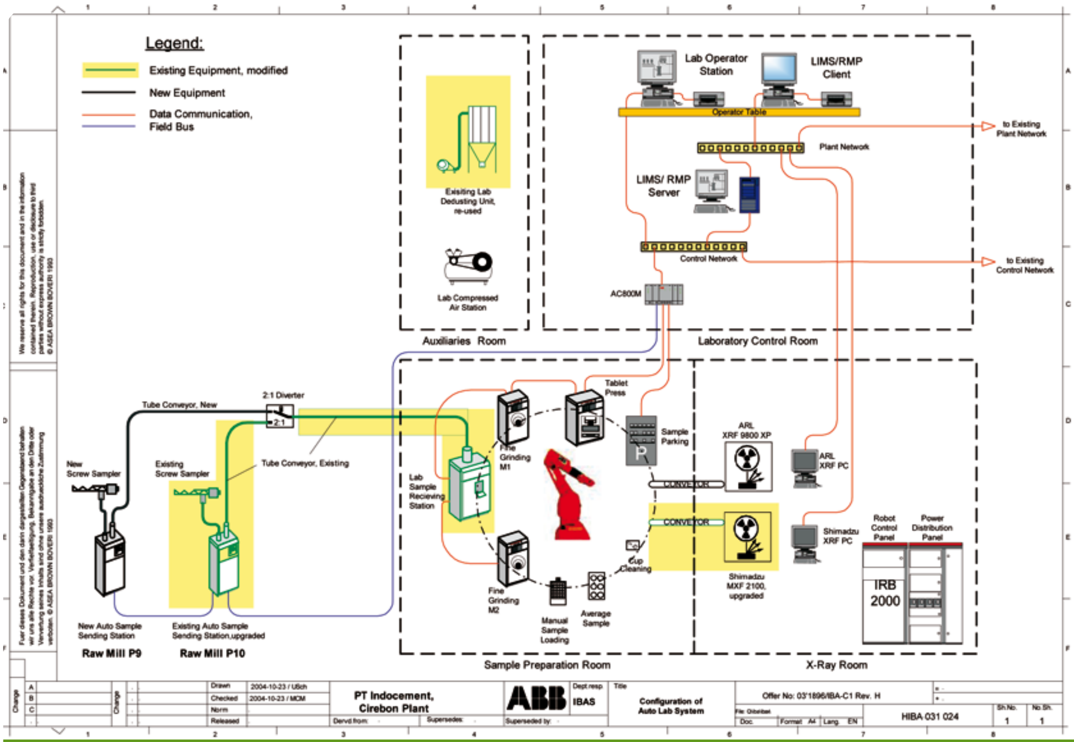

Figure 2. Plant within a plant.

Automation requirements of the laboratory function in the newest concept of these systems, which are driven by:

- The need for credible results, error-free sampling, preparation, and analytics.
- Time-dependent flexibility embodying reliability, ease of accommodating variations in sample throughput demands.
- Low maintenance costs and effort.

The sampling requirements for this project involved the following schedule of materials, frequencies and tasks. For control purposes, the raw mix optimisation (provided by the RMP Module from ABB's Expert Optimizer product) is included as a control for meeting the correct and constantly changing chemical characteristics of the raw materials.

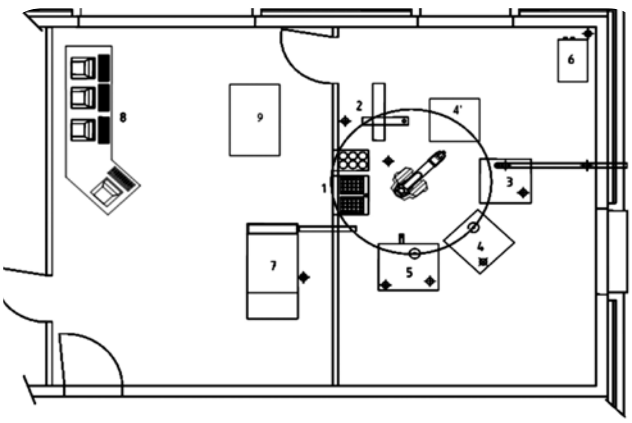

Figure 3. Laboratory process layout architecture.

Figure 4. ABB robot at work in the AutoLab.

Figure 3 shows the overall system, including the revamping of existing equipment and all integration.

Avoidance of potential "bottlenecks" due to differences in sample processing is partly addressed in the "buffer" function, now provided by a "parking" (interim decoupling) feature, which expands the possibility to order priorities and enable queue shifting of samples by batch, group, or location, on a time-dependent basis (Figure 4).

Life cycle and harmony

Presently, reliability rests on the robustness and availability of sample handling equipment and analysers will be conducted. The value of an integrated system is that the entire laboratory organism provides a cumulative value, as a modular process unit. Unequal levels of sturdiness and consistency in each component unit can upset this balance.

Demands placed on most of the older types of lab systems are far too great for economically imposing simple revamping and extension, which made the Cirebon case a major challenge. With the advent of intelligent machines, each with its

Figure 5. Operator workstation at the AutoLab exterior.

own microprocessor-based advances, seamless integration with early sampling, transport, and preparation machines can, if not carefully planned, result in a high cost of ownership compared to the alternative of using higher value adding units. These deliver increased quality results, greater sample diversity and higher sample throughput.

The Cirebon plant required the laboratory to handle more or as many samples with multiple analyses (with different techniques and instrumentation), on a time-sensitive basis. A combination of dynamic scheduling, multi-tasking, and interruptible preparation was needed to handle the load harmoniously.

For ABB, the challenge was considered an opportunity to provide this versatility in management, and control the vital quality lines of information, discipline and accessibility for operators and technicians. Given the pressing needs to meet the stated objective, the opportunity to respond permanently altered the look and feel of the near-term laboratory scene.

Conclusions

The automated laboratory installed at Cirebon represents a concerted effort to achieve success in meeting the objectives of preserving the investment in an earlier version of the laboratory, while meeting the needs of modernisation without degrading the total operation through compromise. Overseeing the laboratory has been made simpler and more rewarding (Figure 5).

As the laboratory itself has now assumed the role of a miniature “plant within the plant”, it must both reflect the constraints and meet the increasing demands of the plant it serves. This means that error-free, credible, repeatable, reliable, and flexible results, combined with cost-effective operation, must stream from the laboratory. The result has been preserving the initial investment of the automated laboratory and its components, while increasing both life cycle expectancy and both immediate and future resultant added value.

ABB Switzerland Ltd
CH-5405 Baden 5 Dättwil
Switzerland
Phone +41 58 586 8444
Fax +41 58 586 7333
E-Mail process.industries@ch.abb.com
www.abb.com/cement

3BHS 238980 ZAB E01 (07.07 500 World Cement)