

MOPANI COPPER MINES / MIPAC

Plant Wide Control System, Mufulira Smelter Upgrade, Mufulira, Zambia

Ringmaster par excellence

MOPANI Copper Mines is a fully integrated copper production plant in northern Zambia, on the Congo border. The company consists of underground mines, concentrators, a smelter and a refinery.

In 2004, Mopani embarked on a major project to upgrade its aging Mufulira copper smelter with the objective of improving efficiencies, growing production and reducing environmental impacts. As a result of the smelter upgrade (completed by May 2006), Mopani has an increased capacity of more than 650,000 tonnes of copper concentrates, which is up from 420,000 tonnes in 2005.

Mopani adopted a Plant Wide Control System (PWCS) approach proposed by MIPAC and Xstrata Technology, and engaged the former to lead the implementation and process control.

The Queensland-headquartered company worked directly with five vendors from four countries and ensured Mopani received a coordinated control system across the entire plant.

The PWCS project can be broken into the following distinct phases.

1. Plant wide instrumentation and control design standards

During the first phase of the project, MIPAC produced a package of plant wide control engineering standards that would guide design work and ongoing maintenance at the Mopani smelter. Rather than roll out a generic set of standards, the package was tightly tailored to the requirements of a harsh environment, such as a copper smelter in a developing country. These standards were provided to each plant vendor. Due to the tight schedule and requirements of not interfering unduly in the vendor packages, a pragmatic approach was adopted. Critical areas of the standards that would affect the implementation of the PWCS were enforced. However, other nicety type items were overlooked in the interests of not upsetting the balance between schedule, responsibility and ongoing operational needs. The major issues included items such as electrical control circuitry design, signal transmission media, etc.

2. Control system design and specification

The control system selected for the project was the Yokogawa CS3000, which incorporates Yokogawa's new network technology of V-Net IP. The system comprised five operator interfaces (dual head), one engineering workstation and five field control stations. Having a common PWCS facilitated the implementation of a central control room for the smelter to allow efficient use of operational staff and far superior interaction between the operators. To meet the requirements of not interfering in each package vendor's design work, it was essential to have clear and simple interfaces between the control system (by MIPAC) and the field instrumentation design (by each vendor). To achieve this, simple battery limits were devised.

Each vendor supplied an I/O quantity, broken down into signal types, and MIPAC designed marshalling cabinets with corresponding sufficient terminal capacity. The vendor was then free to complete their field cabling design up to the terminals with no restrictions or further interaction required. MIPAC then took the termination design and patched the signals through to the Yokogawa I/O cards.

With hardware costs now low, the pragmatic decision was made to allocate a separate controller for each plant area. This resulted in each vendor having their own controller and allowed for ample spare capacity to implement high speed logic to improve response time on certain applications.

The system was procured in Brisbane with MIPAC overseeing construction and testing to the level of quality required for such a remote location as Mufulira.

3. Application software development

The application software was developed in Brisbane over 12 months. Standards were developed; then the software for each plant area was implemented to meet the documented functional requirements supplied by each package vendor.

The allocation of a dedicated controller to each plant area reaped huge benefits during this phase, with the clear segregation facilitating a plant by plant development approach.

The following was programmed into all plant areas: consistent operations screens; first out alarm trapping for all interlocks; extensive alarm minimisation implemented at base level of logic; and clear diagnostic pages for all equipment and sequences with integrated help messaging.

A pleasing result of the project was the ability to link the ISASMELT performance to the acid plant. Implementing advanced control logic between the two plants facilitated improved operations.

Once the configuration for an area was complete, representatives from the relevant package plant supplier attended factory acceptance testing at MIPAC's Brisbane headquarters. The tests were conducted successfully and demonstrated to each plant package supplier that the configured software fulfilled all control requirements for the plants. Comprehensive test documentation was developed for this testing, and was migrated to site for recording of commissioning test progress. All software development was completed by February 2006, ensuring the overall project schedule was not impacted by late delivery.

Final results

THE results of the PWCS project included:

- Reduced project costs through economical project implementation by one group, which minimised design group interfaces.
- Efficient and cost effective ongoing control system maintenance due to commonality of equipment and consistency of design.
- Minimised project risk through use of a company with a proven record.
- Cohesive approach to instrument design standards, control system design and configuration.
- More efficient operations resulting in less wastage of natural resources and fewer incidents such as plant downtime due to unknown causes.

Fit with corporate strategy

THE project fits the two key strategies for Mopani and its major shareholder, Glencore International.

1. Get the upgrade done as quickly as possible with the least impact on current operations and production.
2. Don't compromise the ongoing operations of the plant in order to meet the short upgrade time-frame.

