CASE STUDY: KONIAMBO NICKEL

Organisation:
Koniambo Nickel SAS – a joint venture between Société Minière du Sud Pacifique (SMSP) and Xstrata Nickel

Site:
Koniambo, Koné, Northern Province, New Caledonia

Year:
Commissioning 2012

Application:
Nickel Ore Refining

Challenges:
- Large gas volumes, high dust loads, collection of hot, fine ore particles with low emissions
- Positive isolation of individual filter compartments
- Remote site with limited, high cost resources for site installation

Solution:
- Outotec High Volume Low Pressure (HVLP), Pulse Jet Fabric Filters supplied for Hammer Mill Flash Dryer - Lines 1 & 2 and secondary de-dusting
- Pre-fabrication for transport in large single pre-assembled modules (PAMs)

Key Benefits:
- Low emissions, less than 20mg/Nm³
- Safe, low maintenance operation
- Reliable technology
- Complies with sustainable development principles – maximum ore collection efficiency with minimum energy consumption

CUSTOMISED FABRIC FILTER TECHNOLOGY

The Koniambo project is an open cut nickel mine and metallurgical plant located in the North Province of New Caledonia, an archipelago in the South Pacific, 1500km east of Australia.

This world-class industrial complex is a joint-venture partnership between Xstrata Nickel, one of the world’s largest global diversified mining businesses and Société Minière du Sud Pacifique (SMSP), a local mining company in the region.

The Koniambo complex will be among the world’s lowest cost producers of nickel with initial annual production of 60,000 tonnes of nickel in ferronickel per annum and substantial further high-return, expansion potential.

BACKGROUND

Based on its reputation in the industry, Outotec was involved in concept development for the fabric filters’ bankable feasibility studies from the project’s early stages in 2004. Outotec was subsequently contracted in 2008 to supply three custom designed fabric filter plants (baghouses) to the Koniambo site in New Caledonia.

The two main fabric filter plants were to collect fine nickel laden ore in the gas from the Hammer Mill Flash Dryers (HMFDs), with the third used to clean gases picked up from various hoods around the nickel plant.

UNIQUE TECHNOLOGY

Outotec had previously worked with Koniambo’s engineering and
procurement contractors in supplying High Volume Low Pressure (HVLP) pulse jet filter technology, so partnership was easily established. Additionally, Outotec’s long track record using HVLP technology in process industry and utility applications is well known. The HVLP technology is unique when compared to conventional technology, as its design uses low pressure pulses and a rotating cleaning system. This design results in high reliability, long bag life and low maintenance.

EXTENSIVE MODELLING

Extensive flow modelling was conducted to ascertain the optimum flow distribution using both physical modelling and Computer Fluid Dynamics (CFD). Once the overall design was finalised, a 1:10 scale model was built, with further testing carried out on gas distribution screens and baffles to ascertain optimum gas flow distribution. Additional CFD modelling was also used to confirm findings from the physical modelling. Testing of the scale model was verified by the University of NSW – Research Testing Facilities.

The solution and testwork were challenging as changes were necessary to the conventional baghouse layout to incorporate positive isolation guillotine dampers into each compartment. However the resulting Outotec design was engineered to overcome these challenging criteria, without altering the fabric filter plant’s footprint or compromising gas distribution.

PAM FEASIBILITY STUDY

Delivery of the PAMS presented a new and interesting challenge with the initial concept based on splitting the baghouse components into a number of large modules for shipment and erection at site. However, further discussions were held regarding even larger modules, leading to Outotec assessing the potential for each baghouse to be delivered as one large single module.

This large scale modular construction would require careful planning, delivery coordination and detailed route assessment, utilising Outotec’s previous experience in the delivery of PAMS to remote sites, including calciners to Gove in Northern Australia.

After considering issues such as the distance, the assembly configuration, local labour and infrastructure, the outcome of the study indicated that a full PAM delivery was feasible and the preferred method for the project. Outotec’s original contract scope was subsequently altered to include full PAM delivery of the fabric filters.

DELIVERING THE PAMS

The baghouses were constructed on temporary foundations overseas, with all steelwork, insulation, cladding, access and stairways installed. Mechanical equipment and piping were fitted and pre-commissioned where possible. This equipment included pulse cleaning systems, complete with pressure vessels, cell ventilation hatches and pulse air piping.

With construction complete, each pre-assembled baghouse was loaded
onto the ship using a number of Self-Propelled Modular Transporters (SPMTs). The SPMTs have a grid of several dozen computer controlled wheels, all individually controllable and steerable. Each wheel can swivel independently from the others, allowing the SPMTs to turn, move sideways, or even spin in place.

The SPMTs lifted the baghouses via transport beams attached low on the support structures. Once loaded onto the ship, the beams were welded to the deck, with shipping completed over a 4-6 week period. Upon arrival in New Caledonia, SPMTs were once again used to transport the fabric filter plants and lower them into position on the foundations at the nickel plant site.

The two HMFD baghouses weighed 1,158 tonne each, including transport steel, with the secondary filter plant PAM weighing 489 tonne including transport steel, giving a total of 2,805 tonne. The transport steel comprised of temporary beams and bracing added to the baghouse structures to accommodate the additional loads during shipment to site. The transport beams were sized to support the full dead load of the baghouses and the transport bracing was required to resist forces produced by the pitch and roll accelerations of the ship while at sea. The transport steel was removed once the PAMs were positioned on their foundations.

**CHALLENGES**

The location of a large nickel processing plant on a remote Pacific island presented difficulties in resourcing qualified expertise in construction. The decision to build the majority of the plant overseas was initiated by this factor.

With regards to the fabric filter plant, once its construction was complete, transportation to site was the next challenge, demanding additional engineering input, multi-lingual co-ordination and planning. For example, Outotec produced various engineering documents and drawings in three separate languages. Final installation of the plant at New Caledonia required internationally sourced supervisors and tradesmen to be flown in.

**UNIQUE PROCESS = UNIQUE TECHNOLOGY**

The nickel refining process at Koniambo is unique, with the ore milling and drying completed in one process (the Hammer Mill Flash Dryer) and the baghouse integrated into the main process flow sheet. Outotec’s baghouse technology is therefore not solely considered as pollution control equipment but also as solids separation devices, critical in ensuring reliable delivery of feed solids to all downstream equipment.

Each baghouse must be operational in order for its process plant to work, so high availability and reliability are essential. Both baghouses handle flash dryer off-gas when the dryer is operating and calciner off-gas when the flash dryer is not operating.

High dust load and fine particle sizing, combined with a high collection efficiency and low emission requirement, demanded careful selection of the bag filter material along with careful design.
of the gas flow path to each filter compartment. In addition, excellent quality control in both bag manufacturing and installation procedures were required for low emissions to be achievable.

The final design incorporates positive isolating guillotine dampers for safe personnel access. However, as previously mentioned, this design was achieved without compromising filter performance whilst still fitting within the original footprint constraints.

THE RESULT

Outotec delivered the fabric filter technology on time and, thanks to highly detailed planning, engineering and close co-operation with all parties, the baghouses were installed without any difficulties. With particulate emissions of less than 20 mg/Nm\(^3\), the baghouses will minimise any harm to the local environment as well as maximise the ore feed to the process, with a minimum energy consumption.

This project reinforced Outotec’s continued development in executing these types of large scale installations using very large PAMs.

Commissioning of the baghouses and associated infrastructure is due to take place in 2012.

Quick tip

Gas dispersion in your flotation cell

The gas phase of any flotation cell is critical for optimum cell performance. Understanding and varying these four key parameters can improve recovery. At one site, for example, up to 30% was achieved at the same grade:

- **Gas hold-up**
- **Bubble size and bubble size distribution**
- **Superficial gas velocity**
- **Bubble surface area flux**

Once you have the right tools and expertise to benchmark the gas dispersion in your current flotation cells, it becomes far easier to get the most out of your operation...

Quick tip

Thickener tank design options

Reviewing and questioning the way we ‘normally’ do things can result in simple, clever and more cost-effective options. Reviewing thickener tank design, for example, can bring substantial rewards. So what are your options?

- **Piece small fabrication**
- **Piece large fabrication**
- **Fully pre-assembled**
- **Bolt together**

When analysing the above options you not only have to look at a thickener’s capital cost, but also take installation time, risk and final quality or workmanship into consideration...