

The Comalco Alumina Refinery

Australian teamwork at its best

Building the first new alumina refinery in the world for 20 years could have been a daunting task. However, with the assistance of Australian steel fabrication expertise, under the direction of Bechtel and Comalco, the new Comalco Alumina Refinery was assured of success. The refinery is located on a 70 hectare greenfield site at the Yarwun Industrial Estate, 10km north west of Gladstone, Queensland.

Officially opened on 4 March 2005, the alumina refinery was constructed on time and within budget and offered a great opportunity for the Australian steel industry to demonstrate its capabilities and expertise.

Alumina produced at the refinery supplies Comalco's own aluminium smelters in Australia and New Zealand, as well as outside customers. The refinery is designed to produce 1.4 million tonnes of alumina each year and boost Comalco's total production to 3.5 million tonnes per year.

Refining process

The refinery uses the Bayer process. In this method, grinding mills prepare the bauxite for the high temperature digestion process where aluminium hydroxide is dissolved from the bauxite into a solution of caustic liquor. The resultant liquor and solids are separated in clarifiers. The liquor is sent to precipitation and the solids are washed and pumped to residue storage. Open top precipitator tanks allow hydroxide crystals to form from the super saturated liquor. These crystals are heated in calciners to drive off water and produce the white alumina powder that is then stored for shipment.

Government and industry support

Both the Federal and Queensland governments supported the project with large injections of money and infrastructure development. Queensland spent \$150 million on common-use port facilities, and road/rail infrastructure. The Federal Government assisted with a \$137 million interest-free loan, of which \$102 million went to the construction of a steam plant and the remainder was allocated to research and development through the Rio Tinto Foundation for a sustainable minerals industry.

The project was subject to the Queensland Government's Local Industry Policy which requires eligible project proponents to show how they intend to provide full, fair and reasonable opportunities for local companies to bid for work. To achieve this, the project implemented both a Local Industry Participation

Plan and an Australian Industry Participation Plan. The Industry Capability Network (ICN) worked with the project team to achieve a high local industry participation rate.

This project was the focus of the Australian Fabricated Steel (AFS) campaign where the steel industry harnessed its resources to demonstrate the capability, competitiveness and quality of the Australian steel industry. This campaign was heavily supported by BlueScope Steel, OneSteel, Smorgon Steel Group and steel distributors, suppliers, fabricators and detailers across the country.

Once the decision was made to build the plant, local industry was involved from the start assisting both Comalco and the construction manager company, Bechtel, to achieve a successful project. At the important design stage, OneSteel Market Mills collaborated closely with Bechtel design engineers to develop a series of efficient steel connection designs for the project. Together they worked to optimise the steel design to Australian standards.

Six major subcontracts were let on the project to John Holland SMP (formerly Transfield Construction) steelwork contractors, Thiess Golding Joint Venture, CBI, Downer, Bechtel Direct and United KG. As the project progressed, a total of 14 steel fabricators were involved to ensure the 20,000 tonnes of structural steel and plate met the critical project targets.

The construction of the refinery has provided significant benefits, both nationally and locally, with 86 percent of the \$1.5 billion capital cost spent in Australia.

Pre-assembly of steel components

To reduce the peak site workforce and the demand on accommodation in Gladstone, pre-assembly of structural steel components was carried out in Brisbane. This offsite manufacturing and consolidation (MaC) strategy enabled major structural steel modules to be assembled at Hemmant in Brisbane. The scope of the MaC strategy included the offsite manufacture and consolidation of tanks, structural steel, walkways, piping, insulation, cable ladders and electrical equipment. The completed modules were then shipped on barges to Gladstone.

Safety

The safety of workers was a high priority on the project and workers achieved the goal of one million manhours without a lost time injury





a number of times during construction. This was a demonstration of the outstanding safety culture implemented on site from the start of the project.

BlueScope Steel took a leading role in supporting high safety standards by running presentations detailing the chain of responsibility legislation on road transport (see *steel Australia* Vol 17, no 4, December 2004 page 23). This shared learning, in partnership with Comalco and Bechtel, contributed to improved practices and a safer workplace.

Speaking at the official opening in Gladstone, Comalco Chief Executive Oscar Groeneveld, commented: "I have been particularly impressed with the way that the local community and local industry have embraced this project. Not only was the project finished on time and on budget, it also delivered a safety record that has set new benchmarks for a project of this size."

Refinery demonstrates industry strength

Fabrication of the structural steelwork for the Comalco Alumina Refinery in Australia demonstrated the many strengths of the Australian steel construction industry to undertake major projects in Australia. These include:

Fast response time - The established presence in the region of local companies enables them to respond quickly to changing requirements, variations and extensions of time.

Skilled labour and teamwork - A pool of established labour capable of delivering quality work. Many teams of contractors move from project to project throughout Australia and have worked together to the point where they can quickly adapt to local conditions as well as bring on board high levels of skills.

Top: The scope of the MaC strategy included the offsite manufacture and consolidation of the steelwork. The completed modules were shipped on barges to Gladstone.

Middle: These large structural steel units arrived on site already fitted with components such as insulated pipe, cable trays, mechanical pumps and hand rails. They were then lifted into position with heavy capacity cranes and assembled like Lego bricks into place.

Bottom: Heavy structural steel supports the complex network of process piping.

Value added services - The ability for local companies to provide value added services not available from global supply chain members.

Cost savings - This can occur early in the life of a project. Quick response and the capacity of the industry, including design engineers, to get a project started can lead to significant cost reductions.

Significant cash flow advantages - Through the implementation of a number of practices, contractors (and therefore the project owner) benefit through cash flows being 'protected'. For example, reducing handling of components, lower on-site inventory levels and pre-production work can free up cash for alternative activities.

Enhanced communication - Breakdown of information flow is well recognised as the greatest cause of disruption on projects. Poor communication skills and channels are often the cause of these breakdowns. All the organisations on the Comalco Alumina project had English as their first language which minimised language barrier problems. Local communications are cheaper than the expensive option of sending people overseas.

Reduced inspection costs - On-site inspection costs can be significantly reduced where the personnel involved are resident in the region.

Reduced wastage and re-work - Through enhanced communication channels chances of misinformation and mistakes in interpreting site plans, local regulations and environmental matters can be minimised. Minimising costly re-work can be a huge financial benefit to all concerned. Through the growth of contract relationship management and partnering, local companies can offer a significant competitive advantage.

Administration costs - Local companies do not have to pay for transaction costs related to clearance charges, fluctuations in the exchange rates, importation costs such as demurrage, along with other administration costs.

Flexibility The ability of locally based companies to be innovative and respond to changing conditions such as climate, and variations to the original planning and design work is a key competitive advantage.

Shorter lead times Transport of finished goods from overseas can be affected by a number of time slippages. These include delays in leaving port, slow clearance of goods from ports and long distances from some deep water ports to



the construction site. This means shorter lead times with locally-based manufacturing.

Ongoing support Whole of life costs, including maintenance costs, are reduced when local subcontractors are part of the construction team and remain available on completion of the major works. Local companies have the ability to source replacement parts (or parts that may need to be re-engineered to certain specifications) and service a project's ongoing needs.

Reduced damage risk - Modules and equipment locally manufactured are less likely to be subject to damage and deterioration en-route.

Key advantages for using local steel fabrication

- Firm prices free from foreign exchange fluctuations
- Ease of ordering extra materials from local suppliers
- Multiple suppliers and delivery points reduce risk
- Reduced levels of handling of goods and services
- Larger sizes of fabricated modules can be economically delivered to site
- Technological sophistication
- High level productivity
- Political stability
- Industry sector prepared to work collaboratively, and
- High occupational health and safety standards.



Top left: On the move – transfer tower two.

Top right: The screening buildup in the MaC yard.

Middle: Beam, column and brace connections.

Bottom: Holding tanks nearing completion with the structural steelwork well under way.