



# Essential Expertise and Superior Technology Deliver Major Improvements in Production Efficiency, Sustainability Performance, and Reduced Operating Costs at a Major Aluminium Complex in the Mediterranean Region

**NALCO** Water  
An Ecolab Company

CASE STUDY - MINING

CH-1382E



## INTRODUCTION

A major regional mining company operates a vertically-integrated complex located in the Mediterranean region, which includes a bauxite mine, alumina plant, smelter, cast house, and steam station. The plant can produce up to 250,000 tonnes per year of aluminium hydroxide and metallurgical grade alumina using the Bayer process. The company makes a very strong commitment to Corporate Social Responsibility (CSR), including strict adherence to its Environmental Policy which is applied rigidly across all of its production operations, and to its Quality Policy and its accreditation to the ISO 9000 Quality Standard. Commercial pressures are ever present, and continue to drive management to seek out increased production efficiencies and reductions in cost.

### CUSTOMER IMPACT



### ECONOMIC RESULTS

Reduced gas energy demand by 29.5 million kWh per year through reducing the process liquor volume required per tonne of production



Energy cost savings of €619,000 per year delivered through increased process efficiency

Elimination of over 5450 tonnes of indirect CO<sub>2</sub> emissions per year



Eliminated CO<sub>2</sub> equivalent to annual emissions from 1,700 cars

Improved overall alumina quality, reducing average content of -45 micron fraction by 12.8%, reduced attrition index by 1.2%, and eliminated anti-foam use from fines thickeners



Overall improvement in operational profitability, and cost reduction, deliver a combined value of over €743,000 per year

Increased efficiency of the decomposition process by 1.1%, and increased decomposition yield by 4.6 kg/m<sup>3</sup> (5.2%)

Payback of investment with Nalco Water less than 6 months

All data verified by the customer

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.

## BACKGROUND

Management at the plant are very focused on staff safety, minimisation of resource use, and overall production cost-efficiency. To assure this, the company expects the best on-site expertise from its supplier partners, superior technologies, and improved sustainability performance through better energy and overall resource management. In particular, management were looking for new ways to improve the cost-efficiency of the overall production process on site, and were particularly interested in identifying ways to improve yield performance. The decomposition of seeded super-saturated sodium aluminate solution is the slowest reaction in the Bayer process, and it is well-known that any improvement in reaction rate can bring both a significant reduction in operating costs as well as increased production and profitability.

## CURRENT SITUATION

The plant was originally constructed to produce floury (fine) alumina, and as with many similar plants was in the process of converting to the production of sandy alumina. Management at the plant wanted to reduce the level of fine alumina produced (then achieving a maximum content of the -45 micron fraction of 56.5% and an average of 34.35%), maintain or improve decomposition yield (then running at 89.2 kg/m<sup>3</sup> of the aluminate liquor), and reduce the amount of antifoam currently dosed to the fine hydrate thickeners, currently being provided by a global competitor.

Nalco Water has a long experience of using Crystal Growth Modifiers (CGM) to support this type of transition and also to improve production efficiency. The CGM chemistry is usually applied to a hot sodium aluminate solution prior to seeding, being dosed upstream of the decomposition unit. The decomposition process then promotes the crystallisation of aluminium hydroxide from the super saturated sodium aluminate solution.

The unique mineralogical and chemical characteristics of the bauxite available at this particular site placed great stress upon the processing, in particular during the decomposition process, however it is just such conditions that can be comprehensively addressed by the Nalco Water CGM chemistry.

On the basis of its track record and experience in treating other similar systems, a team of specialists from Nalco Water was invited on to site by plant management to propose an alternative and robust solution.

## WHAT WERE THE CUSTOMER'S GOALS?

Key Performance Indicators (KPIs) for the customer included:

- Safe operation
- Consistent asset reliability and availability
- Improved production efficiency
- Enhanced quality of aluminium hydroxide and metallurgical alumina produced
- Reduction in the Total Cost of Operation
- Reduction in maintenance and the cost of energy
- On-site support
- Outstanding supplier performance

Nalco Water was asked by the customer to identify any new opportunities to better achieve the stated KPIs that might be available.

## ACTION PLAN

Specialist staff from Nalco Water reviewed all aspects of plant operation, especially the decomposition process, to identify areas for improvement which would positively impact upon the customer's stated KPIs. A full survey of the system was carried out, identifying the parts of the process that were critical to the maintenance of production efficiency. The Nalco Water specialists were able to explain to plant management the root causes of the range of problems being experienced, something that had not been delivered by the competitor, and how treatment application would be determined by actual need. Nalco Water was able to propose a comprehensive programme that exactly met the management's desire for specialist on-site service and support, and would offer the peace of mind required. The Nalco Water proposal was accepted and applied initially to a trial on the production system, and then on to full scale application.

## RESULTS

By introducing superior technology, on site essential expertise, and using knowledge derived from treating many similar systems worldwide, Nalco Water delivered a comprehensive programme capable of consistently improving the performance of the production system. The application of CGM technology and associated on-site service, monitoring and reporting, increased the efficiency of the decomposition process by 1.1%, and improved overall decomposition yield by 4.5kg/m<sup>3</sup>, a significant improvement of 5.2%. Alumina quality improved, reducing the -45 micron fraction by 12.8%. In addition the need for antifoam for the fines thickeners was eliminated altogether. Overall this reduced operating costs by €124,000 per year.

By reducing the energy demand associated with the heating of process liquors, a reduction in 29.5 million kWh of natural gas, and the associated 5450 tonnes of indirect CO<sub>2</sub> emissions were eliminated, saving over €619,000 per year in energy costs. Payback on the initial investment with Nalco Water was recovered in less than six months, with all data being verified by the customer.

Nalco Water staff also provided technical training on the fundamentals of the decomposition process, the mechanism of crystal growth modification and its impact on product quality, yield, and process efficiency. A protocol was established to regularly gather the data necessary to optimise the decomposition process using critical Key Performance Indicators, and further advanced training delivered to enable staff on site to take corrective actions based upon the results observed.

## CONCLUSION

Management at the plant have confirmed that the Nalco Water programme remains superior to any similar competitive technologies, and continues to bring substantial benefits to the company. As a result of using the Nalco Water programme, the production efficiency and cost performance of the whole production operation have been improved. The combination of the Nalco Water problem-solving approach, on-site expertise, and the application of superior technology, delivered improvements in performance and production continuity. The customer was now able to monitor and improve the reliability of key strategic assets whilst maximising production and profitability, and has begun to involve Nalco Water in the identification of additional opportunities for improvements at the plant.

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