

Making aluminum a bit lighter

Alcoa's Warrick Primary Metals reduces maintenance costs by 25% through its reliability excellence process

Alcoa's Warrick Primary Metals produces some 265,000 metric tons of aluminum annually. The plant was built in the 1950s, and its annual maintenance costs were among the highest in the world for an aluminum smelting operation.

Facing competitive market pressures, Alcoa embarked on a comprehensive reliability excellence process designed to decrease maintenance costs and produce sustainable performance measures. The process involved a thorough self-examination of internal processes, procedures and asset ownership/accountability based on Life Cycle Engineering's Rx Methodology.

As a result of the effort, Alcoa has reduced maintenance costs per metric ton produced by 25%. Warrick Primary Metals is now one of the most efficient Alcoa smelting groups.

Faced with an aging aluminum smelting production facility built in the late 1950s and high plant maintenance costs, Alcoa's Warrick, Indiana, and corporate management teams embarked on an aggressive plan in 2003 to engage all constituent employees – labor-management, operations-maintenance, union and non-union – in a Reliability Excellence Process designed to improve the facility's competitiveness through a lower unit cost per metric ton of aluminum by reducing maintenance and operations expenses and enhancing throughput.

Alcoa's Warrick Primary Metals has been in continual production since 1960, today producing 265,000 metric tons of primary metals for beverage and food cans and other flat-rolled aluminum products. Warrick Primary Metals' 2003 base-case maintenance costs for each metric ton of aluminum produced was high by comparison to other Alcoa aluminum smelting facilities. Average maintenance cost in 2003 in the Alcoa family of companies was almost 15% lower on a per metric ton basis.

The imperative facing the 700 employee at Alcoa's Warrick Primary Metals was simple – reduce unit costs per ton. The *status quo* was not an option. Why? Alcoa has options for how it invests dollars in production facilities. Warrick Primary Metals needed to demonstrate that it was a vital and viable competitive aluminum production facility – not only within Alcoa, but also within the broader market context.

Analysis to action

Alcoa's management team approached these competitive challenges by taking a long-term, systematic view of cost issues. The company's lean manufacturing system was producing results, but sustainability continued to be an issue because of unreliable equipment and unstable processes. It became obvious that a different approach to maintenance and reliability would be necessary to obtain the sustainability needed to drive the needed results. The company engaged Life Cycle Engineering (LCE) and the Ron Moore Group (RM Group) to produce an Alcoa-focused Reliability Excellence Process that was deployed in three "waves."

Wave 1 commenced in June 2003 with RM Group imploring key plant leaders to take an “asset owner” philosophy. This approach focuses on accountability. Wave 2 followed in August 2003 with a full Reliability Excellence assessment using LCE’s Rx Methodology. During this process LCE conducted interviews with more than 90 operations and maintenance constituents within Warrick Operations covering both hourly and salaried employees. The outcome of this effort was:

- A detailed financial impact analysis, including costs and return on investment (ROI) scenarios related to improvements in maintenance.
- An implementation plan designed to close gaps in maintenance processes and practices.

Wave 3 took hold in September 2003 with operations and maintenance teams taking on a leadership role in plan implementation. During this wave, operations and maintenance leadership conducted an employee education program, explaining new roles and responsibilities under the new Reliability Excellence Process. In addition, training workshops on reliability enhancement techniques were held. Maintenance processes and performance measures were established and communicated as well.

Implementation

As part of the implementation process, Alcoa defined overall equipment effectiveness (OEE) levels for plant equipment performance as a means to gauge improvements. OEE measures were established by examining historical plant equipment performance levels to determine optimum capabilities.

Operations and maintenance teams worked together to apply OEE measures within each discrete work function in the smelting plant. This effort established both current and optimal/desired performance conditions, thus providing a target for improvement. With this information in hand, Alcoa applied lean manufacturing and continuous improvement tools to target and capture tangible benefits. OEE goal setting identified more than \$8 million in potential annual savings.

As a result of the three-wave reliability process, Alcoa determined that it needed to redefine asset ownership and accountability issues with respect to plant performance. This led to setting accountability for asset ownership and plant performance on its operations teams.

Alcoa redefined its maintenance planning approach, placing increased emphasis on proactive programs and processes that saw operations and maintenance teams meeting regularly to review needs, determine priorities and move needed maintenance jobs into scheduling. Improved communication resulting from these meetings between operations and maintenance enabled operations teams to have direct input into when jobs were scheduled and worked.

Further, Alcoa revamped its parts and tools distribution approach, moving from a decentralized model to a centralized model. This process involved inventory of equipment such as hand tools that were distributed throughout the facility.

Through this centralization effort and planned maintenance approach, Alcoa now prepares work kits having the necessary parts for each maintenance job. Tools and other necessary equipment are assembled centrally. This ensures that when a job is ready to be worked, maintenance teams have

everything they need to complete a job on time and that the equipment is moved back into production according to schedule.

In reviewing its maintenance process, Alcoa determined that its ratio of crafts personnel to maintenance planners was too high. It invested in adding three maintenance schedulers to improve the ratio from 35:1 to 20:1, further enhancing the company's ability to carry out maintenance proactively rather than reactively.

Along with refining its maintenance approach, Alcoa focused attention on improving documentation associated with equipment performance and maintenance history. Alcoa established a documentation section on its information technology server and subsequently began to develop "bad boy" lists of equipment that had performance issues. This further enhanced planned maintenance activities by enabling operations and maintenance equipment reliability teams (ERT) to better prioritize maintenance by identifying its effect on production.

As part of the effort, Alcoa placed increased emphasis on standardizing and documenting maintenance tasks. Alcoa estimates that as much as 30% of its workforce is eligible for retirement. As those long-term employees begin to leave the company, new staff will draw on the deep knowledge base that has been built up through the documentation process – both in terms of equipment performance and task definition.

Problems encountered and solved

The principle challenge Alcoa faced was to reduce costs and improve revenue. Alcoa attacked the cost issue by focusing on controllable costs such as improved maintenance. Improved revenue could result from getting more production out of existing equipment and attracting capital for new equipment.

Alcoa asked itself: "What delivers both reduced costs and improved revenue?" The answer is reliability. With improved maintenance, came increased plant reliability. Improved reliability led to greater output at lower costs per metric ton. Improved plant performance and competitiveness boosted Alcoa's confidence in investing in Warrick Operations.

Quantitative results

The Reliability Excellence Process has had a dramatic impact on Warrick Primary Metals. In fact, the resulting improvements in plant performance and reduced maintenance costs have turned the plant around and ensured a long-term future for Warrick Primary Metals.

Quantitative results from LCE's Rx Methodology are nothing short of impressive. Among these are:

- Maintenance costs have been reduced by 25% from a 2003 base period compared to 2006 year to date. This exceeded original expectations and engendered an environment in which the workforce now knows that success is attainable.
- OEE achieved a cost savings of \$5.7 million in 2006 through improved equipment and process stability.
- Cumulative maintenance and reliability cost savings since Warrick Operations began implementing Rx in 2003 have produced a return on its investment of 16 to 1.

These improvements figured prominently in Alcoa's July 2005 decision to embark on a \$400 million-plus capital investment plan for a variety of improvements for the Warrick Primary facility. Capital improvements will continue through 2010 and will involve upgrading a Newburgh, Ind., power plant for improved environmental and reliable power production performance for downstream smelting operations at Warrick. Some 90% of the power plant's production is used for Warrick Operations.

The investment represents a long-term commitment to many Warrick Operations communities. Without significant reliability improvements resulting from the Rx initiative, these investments might have gone elsewhere in the Alcoa family worldwide.