"Alcoa announced on July 22, 2005 that it will invest $330M in its Warrick, Indiana Operation mentioned in this article. Alan Cransberg, President, North America Primary Metals, stated that by reducing costs and increasing efficiency that the Warrick Operation has earned the right to grow."

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ALL FIRED UP

ALCOA SMELTING PLANT PURSUES EXCELLENCE IN RELIABILITY

By Paul V. Arnold

If you can't stand the heat, you better not seek employment at the Alcoa Primary Metals facility in southern Indiana.

Fire-breathing potlines and molten-metal-filled crucibles can push the production floor's ambient temperature near triple digits. Heat visibly radiates off machinery. Rivulets of sweat trickle down workers' cheeks and backs. Frequent breaks for water and Gatorade are a necessity.

It's a physically demanding environment, but the real heat referenced in the first paragraph relates more to this particular plant's position in the aluminum smelting industry. This site, part of Alcoa's massive Warrick Operations, was constructed in the late 1950s and began producing raw aluminum for the can sheet industry in the early 1960s. It's an old plant in an age- and technology-sensitive industry. There were 33 American smelting plants operating in 1980. Today, there are 13. Just 6 percent of the world's aluminum capacity will be produced this year at smelters more than 50 years old. The clock is ticking.

To this state, add in that:

- 25 percent of the plant's workforce is currently eligible for retirement through age or years of service;
- wages paid by the plant are among the highest in the industry; and,
- a few years ago, this smelter's maintenance costs per metric ton of aluminum produced were the second-highest in the global Alcoa system.

Can you feel the heat? Every employee at this plant does. But instead of awaiting a demise that seemed imminent, maintenance and operations personnel have stepped forward and taken action.

"We have to hitch it up if we want to maintain this standard of living and keep this plant alive," says smelting Alcoa Business System manager Mark Keneipp. "This is the new reality. You just have to deal with it."

It starts with a look in the mirror.

"Our challenge was and is to be cost-competitive in spite of our old age," says Keneipp. "We are not at the front of the age curve anymore. We must have a 15- to 20-year horizon to attract capital within Alcoa. If it is 25 to 30 years, that would be great. To do that, we have to continually prove ourselves as a lean, cost-competitive, stable and efficient plant."

This isn't an environment for the weak. But through hard work and perseverance, there are ample rewards.

CALLING TIME-OUT

Efforts to sustain Alcoa Primary Metals' presence in the southern Indiana manufacturing community began at the corporate level.

In 1997, Alcoa CEO Alain Belda began bringing Toyota Production System (TPS) principles to his company's 250 global locations.

TPS is a lean manufacturing philosophy built on "just-in-time" production, waste elimination and rapid problem-solving.

Photos by Photics LLC

Long, narrow aisles and high temperatures are characteristics of the potline areas at the Alcoa Primary Metals plant. The site's potlines produce 265,000 metric tons of aluminum each year.

Aluminum plant production manager Rodney Cunningham (left), process coordinator Larry York and senior staff process engineer Brian Audie stand inside of a vacant alumina tank on the grounds of Alcoa's Warrick Operations. The site traditionally used four such tanks as holding vessels for alumina, a key ingredient in the aluminum smelting process. Lean manufacturing initiatives and critical thinking led the plant to downsize to two tanks, saving the company a large sum of money.

JUST THE FACTS

Plant: Alcoa's Warrick Operations consisting of Primary Metals (smelting) and Rigid Packaging (fabrication) divisions in Newburgh, Ind.

Employment: Approximately 2,000 (740 PMD, 1,260 RPD).

Square footage: 120 acres under one roof, 9,000 acres overall.

Products: Aluminum sheet for beverage and foods can ends and tabs, plus other flat-rolled aluminum products.

Production volume: PMD, 265,000 metric tons; RPD, 800 million pounds.

FYI: Site became operational in 1960.

However, the Indiana smelter made an important discovery when implementing the system.

"TPS and flow and lean don't work if you have unstable, unpredictable equipment," says Keneipp.

Efficient, streamlined and cost-effective plant maintenance and machinery reliability must come first.

To illustrate his point, Keneipp offers a diagram called "the maintenance iceberg." Above the water are direct maintenance costs linked to materials, labor, overtime, contract services, and overhead and benefits. Under the surface lurk indirect costs tied to downtime, setup and startup, missed schedules, excess inventory, crisis management, emergency purchases and an overall ripple effect on production.

"The indirect components are held hostage by a plant's unstable equipment and processes," he says.

All of this waste gums up the system and drives up both operations and maintenance costs.

In 2002, this smelting plant had total maintenance costs in excess of $35 million. Its "painfully high" ratio of more than $137 in maintenance costs for every metric ton of aluminum produced (see "Just the facts" for annual tonnage) placed it second-to-last among Alcoa smelting plants worldwide. The global average in 2002 was $90 per metric ton.

This Alcoa plant and its leaders had two options.

General mechanic Dick Day has led organization, standardization and cost-savings initiatives in the plant's centralized tool crib.

Sherman Clark lends a hand as an overhead crane moves a crucible top into place.

"The plant manager, Royce Haws, said we were going to reduce our costs. It was not an option to stay where we were. It was going to happen," says Keneipp. "We could either do it the smart way or the short-sighted way. When you go shortsighted, those are scary days. It's tough to attract capital into the plant to go after the things that need to be done when you just defer maintenance. Nobody feels good about that approach. That's motivation for folks to seek something better."

CATCHING THE WAVES

If you haven't guessed by now, the Alcoa plant chose the smart approach to drive down maintenance costs. Maintenance leaders teamed up with consultants from Life Cycle Engineering (LCE) and the Ron Moore Group in early 2003 to create an approach called the Reliability Excellence Process, which was deployed in three "waves." The process is based on the belief that a formalized, well-defined partnership is imperative between maintenance and operations. In this partnership, operations owns the equipment and has a primary stake in reliability. Maintenance is an equal partner dedicated to provide timely and effective methods, skills, expertise and support.

"That's a big change," says reliability engineering superintendent Joseph Motz. "It used to be a silo environment with plenty of finger-pointing."

Some examples:

An operator noticed a potential problem. No fix was scheduled or made. The machine broke down. Who was to blame?

Or, maintenance showed up for a two-hour preventive maintenance job. While in the machine, it found additional issues and finished the PM job eight hours later, thus impacting output. Who was to blame?

The answer in these cases was both maintenance and operations.

"We had to realize we're all on the same team," says Motz. "We're all here to make aluminum. If we go in different directions and don't work together, the process doesn't work."

Wave 1 in the three-wave approach began in June 2003.

"Wave 1 was Ron Moore," says Keneipp. "We brought him in to speak with key plant leaders. He challenged the age-old paradigms. 'You need to take more of an asset-owner philosophy.' 'You're wasting money.' He shakes things up and opens eyes."

Wave 2 arrived in August with a full Reliability Excellence assessment by LCE. Over a two-week period, the firm conducted lengthy interviews with 90 operations and maintenance employees (hourly and salary), as well as the plant controller.

The information led to:

1) a financial analysis detailing the estimated value in closing the gaps to excellence in reliability compared to the implementation cost (presented as a return-on-investment calculation);
2) a preliminary master plan that outlined the processes and methodologies required to close the gaps.

"We wanted to look at our current condition and identify a target condition," says Keneipp. "The gap between those two is your pain or gain. Is it worth the effort to bridge the gap? We had to prove that worth to senior management. We had to prove there were merits in putting money into the old plant.

"Faced with all the facts, it was prudent to get money approved as soon as possible to proceed."

Wave 3 began in September. Operations and maintenance leaders:

- implemented the master plan
- educated all employees on their new roles and responsibilities related to increasing equipment reliability
- conducted workshops on proper reliability-enhancement techniques
- established defined processes and effective measures of progress

"This isn't easy. None of this stuff is," says potroom production manager Rodney Cunningham. "But if you have management commitment and a partnership between maintenance and operations, your chances of success increase. Without those things, you aren't going to make it."

RAISING THE BAR

Establishing definitions in a variety of areas have helped trigger improvements. A primary focus was to define "what is possible?" and "what is progress?"

An answer came in accepting overall equipment effectiveness (OEE) as a key plant-wide metric. OEE tracks sources of operating loss, including equipment availability, performance and quality, and is expressed as a percentage of optimum performance.

"It's basically defined by some past best performance," electrode production manager Tom Svoboda. "You saw it happen. It wasn't fictional or hypothetical. Whether the equipment was running extraordinarily that month or you were really on top of the process, it happened. The question is, if you did it during that one period of time, why can't you do it all the time?"

Using a sports analogy to illustrate the importance of 100 percent OEE, if a high jumper normally jumps 6 feet 6 inches but establishes a personal best of 7 feet, what specifically led to this peak 100 percent performance. Did he train differently? Did he change his diet prior to the meet? Did he wear different shoes? He literally raised the bar. What can be learned and what can be done to achieve that mark time and again?

Maintenance and operations worked together to define peak performance for plant functions (for example, anode assembly), processes (ore unloading), outcomes (scrap) and individual pieces of equipment (ring furnace). In compiling this information, it was determined that $8.3 million in annual cost savings were possible as the result of achieving OEE goals.

With the background information, current states were defined and target conditions established. Activities – work projects utilizing lean manufacturing tools such as kaizen and Continuous Improvement – took place. Progress was measured and analyzed. And, tangible benefits were calculated.

In 2004, $2.4 million in improvements were linked to OEE gains.

Looking deeper and taking actions also led to decreased maintenance expenses in the smelting plant. In the first year after beginning the reliability initiative, expenses dropped $1.9 million, from a baseline figure of $32 million to $30.1 million. In 2004, the figure fell another $700,000. The ratio of maintenance expenses per metric ton produced also dropped to $109 in 2004.

THE PLAN ON 'PLANNED'

A major effort also was made to better define elements of maintenance. Specifically, in this operator-led reliability system, "how does work get planned?" and "how does work get done?"

"Looking back, we were fooling ourselves into thinking that we were healthy," says maintenance manager Danny Reyes. "Many of our old metrics were out of touch. We thought our 'percent planned and scheduled work' was at 85 percent and our 'percent PM completion' was at 90 percent."

LCE informed the plant that it was using the wrong definitions.

"The 'percent planned and scheduled work' was really just 'percent scheduled.' Planning was very limited," Reyes says. "It was schedule compliance. Probably 10 percent of those jobs were planned."

WHAT ARE THE CHARACTERISTICS OF A PLANNED JOB?

1) There is an accurate time estimate for the job such that the supervisor would have a reasonable expectation on when he or she could assign the task.

2) There is an accurate estimate of needed resources in terms of crafts personnel, repair/replacement parts, tools, support equipment, etc.

3) All necessary information (blueprints, permits, safety-related, etc.) is obtained.

4) Job step sequence, procedures and instructions to accomplish the work are established.

5) All needed parts and materials are kitted.

6) As a built-in check to assure a quality planned job, periodically discuss the nature of the job with a supervisor and/or the craftsperson assigned to complete the job. Assure there is a full understanding of the scope of work and that the kitted job package is complete.

A 35-to-1 ratio of crafts personnel (140) to planners (four) was the crux of the problem.

"It did not work very well," says maintenance planner Larry McCubbins. "There was very little time to plan. You became a scheduler, and not a very good one at that."

A reactive environment thrives in this setting. "We were doing the 'home maintenance approach,'" says Keneipp. "That's the way you and I tackle projects on a Saturday morning. It's really unplanned and inefficient."

The plant has since added three planners for a total of seven, providing a more manageable ratio of 20-to-1.

"That makes it possible for these guys to set up, organize work, plan it, schedule it out with production centers, make sure all the parts are there, make sure the equipment is down and the time is allotted," says smelting maintenance superintendent Scott Deon.

Other keys to better planning:

1) A formal document now outlines the components of a planned job.

"The poor four planners we had trying to do everything didn't do things the same way," says Deon. "This new format now standardizes how to perform the work."

2) A formal, secure area is now used by the planners for job kitting. In the past, needed parts and materials were dispatched piecemeal to a job site. The pile might sit for weeks until all items arrived. During the waiting time, it was not uncommon for parts or tools to be moved, lost or used for another job.

"As the planner plans the job, he orders all the materials and has them delivered here," says McCubbins. "When everything for the job is here, we gather it on a pallet or two. The crafts then come and take it out to the job site and perform the work."

3) Effective communication.

"I used to think that I knew what people wanted. This process taught me that I didn't," says McCubbins. "I didn't know what they wanted and what was right for them. In the past, I planned the job and didn't ask questions."

Adds Deon: "With the shared responsibility with production, we now know which job comes first. The person who owns the

equipment should know what the most critical thing is. Before, I don't think we were guessing. But were we 100 percent? Probably not."

4) Focused, effective weekly meetings.

"Asset owners chair the meetings and area maintenance planner/schedulers are facilitators," says Keneipp. "If it's a planning meeting, we discuss how we're going to do this. If it's a scheduling meeting, we establish the schedule."

Also in regard to how work gets done, the plant took steps to document equipment history and to standardize maintenance task instructions.

"In the early days, you could get records, but then the documentation stopped," says rectifier station power engineer Dan Decastra. "So, we created a location on the server and began documenting. For this station, we created a 'bad boy' list. We picked out the big issues and started there. Now, you can go back to 2001 and see a history on the air switches, contacts, transformers and the skids."

Adds reliability engineer Jonathan Fulton: "Maybe one-third of our maintenance workforce could retire tomorrow if they wanted. That's a huge potential liability for us. And, it's hard to get a quality craftsperson from the outside. To address this, we are standardizing work processes and developing equipment history. By doing this, we can get people with technical expertise up to speed in a hurry."

CRIB NOTES

A final improvement example is how the plant better defined who buys maintenance products and how money is spent for tools and consumable-type materials.

In the past, assorted maintenance personnel in the smelting plant bought the hand tools, power tools, safety products, cleaners, material handling products and a hundred other needed items. Purchased products were housed at decentralized tool cribs around the facility and in a host of non-official holding spots (lockers, chests and cubby holes).

"As the plant kept expanding, areas were added. They had a little group and somebody did the ordering and they'd pool their supplies here and there," says general mechanic Dick Day. "We were spending a large amount of money trying to feed these satellite cribs. They weren't managed. People bought stuff, but it wasn't really accessible."

Molten metal is poured from a crucible in the Ingot Department of the Alcoa plant.

If a mechanic needed a particular tool, he'd hunt for it. It was around somewhere. If he couldn't find it, he'd order one. That purchased tool might disappear before it got to him. It led to wasteful and redundant spending.

To address this, a centralized crib was constructed and all satellite crib and cubby hole items were brought into this secure, gated area.

In came the worthless.

"We realized we had a lot of obsolete stuff – something for a piece of equipment we may have taken out 10 years ago," Keneipp says.

And, in came the valuable.

"It was amazing all that came out of the woodwork. Someone brought a cabinet over with more than $38,000 of pumps and jacks in it," says Day, who became the central crib's main attendant. "We started using what we had. For some materials, we didn't have to order anything for a year."

Today, Day is responsible for buying these maintenance-related products. He receives the purchases, stores the items and dispenses them as needed.

"We know what we have and where it is located," he says.

Day also has created a minimum/maximum system for a variety of products and embarked on efforts to standardize brands of power tools and welding supplies.

"With power tools, we have standardized mostly on DeWalt, and we are getting heavily into their cordless tools," he says. "For welding supplies, we have standardized our wire feed guns and the replacement parts for those guns."

He does his homework and finds innovative ways to cut costs.

A few examples are:

Gloves: "We used to buy a brand of gloves that had a little tab on it for $12 a

pair. That's what everybody 'had to have,'" he says. "You could buy the same gloves with a little elastic in it for $2.67 per pair. People liked them."

Hydraulic oil: "We bought it by the gallon at $8 a pop. Buying it in bulk, we now save $3 per gallon. I pour the oil into reusable jugs that cost 57 cents apiece."

Acetylene hose: "We used to buy it prepackaged in a spool. Now, we buy it on a 500-foot roll and cut off what the person needs. We save 25 percent."

Day says it's all common sense.

"I look at it as my money," he says. "If this is my business, this is how I'd run it."

MAKING THEM SWEAT

Through hard work, partnership, ownership and innovative thinking, this Alcoa smelting plant has become more stable, lean, predictable, reliable and cost-competitive.

OEE cost benefits are $4.4 million annualized for 2005 year-to-date compared to the 2003 baseline figure.

2005 year-to-date maintenance expenses are $27.1 million annualized and reflect a $4.9 million decrease from the 2003 baseline number.

Maintenance costs for the second quarter of 2005 were $96 per metric ton produced and sights are set for achieving $87 in the near future.

An LCE follow-up assessment put the plant in the "proactive conditions" category and work is under way to elevate into the "excellence" category.

There is optimism and momentum.

"When I was hired 15 years ago, we said, 'We're old technology. We can't compete with some of the more modern facilities,'" says Fulton. "For me, the reward is seeing us compete and have higher efficiency. We are producing better with our 40- or 50-year-old technology than at sites built 10 or 20 years ago."

While the heat won't ever completely go away for this plant, it is doing what it can to make the competition sweat. «