

A Major Aluminum Casting Facility in North America Partnered with Nalco Water to Reduce Scrap Rates, Casting Water Variability and Operational Costs



BACKGROUND

When one of the largest ingot casting facilities in the U.S. needed help improving their water treatment systems, they turned to Nalco Water over the incumbent vendor and other companies.

The customer faced increasing costs, decreasing recovery rates in key alloys and the loss of technical expertise and focus in their incumbent vendor.

During contract negotiations, it became clear that a detailed and specific program was needed to identify and track all the important issues raised during the bid. Nalco Water proposed a combination of proprietary technology, on-site expertise, process management, digital monitoring, automation and accountability.

Nalco Water's 3-Year Plan Outlined

Improvement	Benefit
1 - Improve recovery in key alloys.	More valuable metal cast
2 - Reduce downtime between casts.	More time to cast and can exceed the target
3 - Make the casting water predictable and stable.	Allows them a variety of recipes for different alloys
4 - Reduce overall costs.	Contributing to the plant's bottom line

SITUATION

Casting Water Stability

The customer's makeup water comes from an on-site potable water plant utilizing multiple deep wells. Water quality varied from well to well and the sequence of well use was dictated by factors other than casting stability.

Nalco Water resolved the variability using a custom-designed equipment package providing critical continuous control for key casting parameters (e.g., Total Hardness, Alkalinity and Turbidity), with redundant backups, a cooperatively developed programmable logic controller (PLC) control program, and highly knowledgeable staff to ensure the customer's Quality Measurement System water requirements were benchmarked appropriately. Nalco

ANNUAL SAVINGS



PRODUCTIVITY

Year 1

\$1,900,000

Year 2

\$900,000

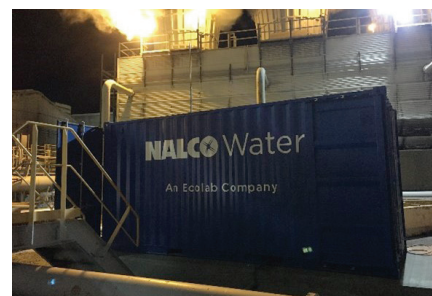
Year 3

\$500,000

TOTAL VALUE DELIVERED

\$3.3 million

Water proprietary products would be monitored by their 3DTRASAR™ Technology.



As a result of the sampling protocol implemented by Nalco Water (with 53,000 samples representing a Process Performance Index (Ppk) > 1.3), the customer's expectations for stable casting water were met. Nalco Water was twice awarded the Best Quality Measurement System by the Casting Department.

KPI Target	Performance Expectations	Weighted Allocations	Year
Alkalinity Control	Ppk > 1.3 Monthly	5%	5.0
pH Control	Ppk > 1.3 Monthly	5%	5.3
Hardness Control	Ppk > 1.3 Monthly	5%	5.2

NALQUENCH™ Technology

When Nalco Water introduced its NALQUENCH Technology line of casting water products, two commitments were made:

1. The corrosion and scale inhibition products would perform properly, effectively protecting the customer's assets.
2. The chemistry added to the casting water would not change casting quench over a broad range of doses (0-500 ppm).
The claim was backed with quench specific research.

By introducing the NALQUENCH products first during the transition from the incumbent vendor, the Casting Department was able to adjust their practice as the competitors' products faded away.

Nalco Water Expertise

Next, the Nalco Water team addressed casting water issues responsible for lower than desired recovery rates due to variability or control issues.

	Location	Cause	Remedy
Source Variability	Potable plant	Well sequence	Profile and monitor
Aluminum Pitting Corrosion	Inside casting molds	Galvanic attack, high oxidant	Barrier inhibitor (Azole)
Long turn times between casts	Casting pit	Scrubbing start blocks	10% Phos-acid sprayers
Alkalinity vs. pH	Casting	pH is easy but inaccurate	2 Titrating analyzers
Conductivity vs. T-Hardness	Casting	Conductivity is easy but inaccurate	2 Titrating analyzers
Oil in Casting Water	Pit hydraulics	Leaks	Visual tracking

SOLUTION

The Nalco Water team worked with the customer's Casting team and contract holder (Purchasing) to identify 12 metrics to measure the success of the proposed program. In addition, six financial metrics were selected for use in evaluating the financial impact of the program.

- **6 "Best in Class"**
- **39 "Meets All Requirements"**
- **Eliminated 27 Yellow and 8 Red**

45 Areas of Audit	Apr-18	Mar-19	Jul-20
Blue: Best in Class	-	-	6
Green: Meets all Requirements	3	10	39
Yellow: Meets some requirements	21	27	-
Red: No QMS system in place	21	8	-

1. The customer's water plant was suspected of being a primary source of variability in the casting water. Water samples were collected monthly from each well for four months, then every 90 days. The well field was "hard on one end, soft on the other in almost staircase fashion." The water plant runs their lead well 100%, adding other wells as needed (totaling as many as five wells in the summertime). Based on this analysis, a matrix was created that paired high- and low-hardness wells and accommodated removing wells from service without shifting the water to casting. The Nalco Water technician calls the water plant daily for the well sequence. If the sequence deviates from the previous day, Casting is notified, and additional attention is given to the plant to make up the lag from well to casting which can be up to 20 hours.
2. Molds are constructed of three dissimilar metals. The solution to this "Galvanic Cell" was found by field testing all inhibitors on site. Monitoring the effectiveness of the solution involved additional corrosion coupon racks of "galvanic" coupons; a 5,000 series aluminum coupon, bolted to a 316 Stainless coupon with a stainless steel bolt. Coupons are submitted to the lab on a 90-day cycle and adjustments made to the azole residual.
3. Simple is best. The customer had failed to find an alternate bench test to the USEPA Method 1664 test for FOG. The casting system was plagued by "surprise" dumps of hydraulic fluids into the casting water. Various surface tensiometers were trailed without success. The solution came from a Nalco Water lab technician who observed varying amounts of foam on the system clarifier. By estimating the amount (%) of foam in the bell, center-well and near the weir, and tracking over time, a numeric score would alert the lab technicians who would in turn alert the Casting team.
4. Alkalinity and Hardness. Nalco Water's skilled on-site technicians gathered comparative data about the benefits of using surrogates for the true casting variables. In forgiving systems, a simple in-line pH meter can substitute for an expensive alkalinity analyzer. In unforgiving systems, the span between pH values of one unit versus 10 units (Log scale) can be enough to scrap a drop. The same is true for using a conductivity monitor instead of calcium or total hardness. Where an analyzer can track the critical value (calcium for instance), conductivity adds in all ionic species as if they all have the same impact on quench. Because of the Casting Department's contract requirement of a Ppk > 1.3 for both metrics, the easier and less-expensive surrogates cannot be used.

RESULTS

The customer was happy with the success of the multi-pronged program of innovative technology, on-site expertise and digital monitoring. The table below highlights the benefits this ingot casting facility achieved in partnering with Nalco Water.

Description	Financial Achievement
(1) Reduce overall scrap rate and improve recovery in key alloys.	a. Water-related scrap down \$800K in three years b. Water-related aborts down \$74K in three years
(2) Reduce downtime between casts.	a. Block spray system
(3) Make the casting water predictable and stable.	a. Quench deviation in spec 31-consecutive months
(4) Reduce overall costs.	a. Total savings accounted for: \$3.3M

CONCLUSION

The collaboration between the plant and the Nalco Water team was the foundation of retaining this business over a long period of time. The customer continues to be happy with the support given from Nalco Water and their success in solving their biggest problems.

Nalco Water, an Ecolab Company

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