







New patented 3D TRASAR™ Caster Technology helps a Major Steel Industry Player preserve the integrity of a slab casting machine and reduce Total Cost of Operation



INTRODUCTION

The steel industry is faced with enormous pressure to reduce Total Cost of Operation (TCO) and improve productivity. There is also increased effort to extend their asset life and enhance safety of the Continuous Casters which are at the heart of steel-making operations. For steel makers, problems with productivity, quality, cost and Caster maintenance may arise due to the corrosion and scaling which often occurs in Casters, because of extreme temperatures and high acidity levels. In answer to steel industry demands, Nalco Water has developed its proprietary 3D TRASAR Caster Technology, which provides a holistic approach aimed at reducing cost linked to corrosion and scale of the structure, segments and rolls of Spray Chamber equipment, mainly in Slab/Large Blooms/Round Continuous Casters using fluoride-based mold powder.

A major player in the steel Industry, based in South Europe, is an acknowledged global leader in steel-making process innovation. They are always working to find new ways to reduce their overall TCO and meet environmental standards. Many new Nalco Water Technologies such as Cast Clean™, SPRAYSURE™ and PURATE™, have been developed together with this customer and further opportunities for development are a constant focus.

CUSTOMER IMPACT	eROI™	ECONOMIC RESULTS
Reduce Maintenance cost to Segment/rolls, support structure and spray nozzles	 COSTS	40 k\$/yr.
Increased Productivity breakouts and production stops, increasing casting speed, improving quality of steel	 PRODUCTIVITY	180 k\$/yr.
Increased Asset life, by postponing Caster Revamping and Caster Replacement	 ASSETS	20 k\$/yr.
Enhanced safety, by protecting walkways	 SAFETY	10 k\$/yr.
		TOTAL : 250 K\$/Y

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

Nalco Water's innovative 3D TRASAR Caster Technology was applied on this customer's spray chamber for the continuous casting process and it resulted in the following improvements in cost, productivity, asset management and safety.

SITUATION

Continuous Casting is a core process used in steel making to solidify molten steel, preparing it to be shaped into a wide range of finished products. Corrosion is a major issue affecting continuous slab Casters worldwide. Acid corrosion can dramatically diminish the lifespan of the upper rolls and segments, as well as the supporting structure and walkways. Acid corrosion is caused by the formation of hydrofluoric acid (HF) due to a reaction which occurs when the spray cooling water comes into contact with the molten mold powder. In addition, the effect of general corrosion, or ordinary oxygen corrosion, must also be considered, as the water temperature in the spray chamber can be as high as 80°C.

Prior to the implementation of 3D TRASAR Caster Technology in the customer's steel shop, the life of the upper segments (0-2) was dramatically shortened due to the acidic environment created by hydrofluoric acid, a result of the reaction between the spray cooling water and molten mold powder. Some areas of the zero zone were subject to corrosion rates above 100 mpy as evidenced by several sets of corrosion coupons installed during the initial study conducted by Nalco Water's local and global teams. Additionally, some service structures were damaged due to exposure to the acidic water falling from the upper segments, creating a very serious concern about the safety of the plant.

The customer urged Nalco Water to fix the problem promptly, as the integrity of the casting machine was at risk, safety was compromised, and the time dedicated to maintenance activities hampered the achievement of the plant's production goals. To demonstrate success and to provide this customer with measurable outcomes and results, it was essential for the customer to share key steel-making operational data with Nalco Water regarding their:

- cost of caster maintenance
- cost of lost production due to scale and corrosion
- cost to safety linked to corrosion and scale.

SOLUTION

Nalco Water's proposed solution was 3D TRASAR Caster Technology. The following Key Performance Indicators (KPIs) for the implementation were agreed upon with the plant management:

- Ensuring the continuous monitoring of spray chamber corrosion rates and the severity and frequency of acidic episodes.
- Ensuring that treatment upgrades would not adversely affect the performance of the casting machine.
- Reducing the operating costs through savings in maintenance, machine availability, asset life and safety.
- Reducing corrosion rates in the spray chamber by 30% or more.

This holistic solution included the following proprietary automation, chemistry and service:

- **Proprietary equipment** to sample the water from the zero zone environment, monitor its quality and command the local addition of the inorganic buffer.
- **Dual pH control** on the cooling water by means of:
 - **An inorganic buffer** added directly into the lines that drive the cooling water to the upper segments with the feed rate being automatically controlled by the new 3D TRASAR Caster Technology based on the acidic event inside the spray chamber.
 - **A second inorganic buffer** dosed in the bulk water. This is common practice in the steel industry and can be considered an essential component of the proposed solution.
- **Best-in-class chemistry** to address both corrosion and scale control in the bulk water.
- **A CaF₂ scale inhibitor**, to minimize spray nozzles clogging and scale all around the spray chamber.



Figure 1: 3D TRASAR Caster Technology unit

RESULTS ACHIEVED

As a first step in the implementation of the solution, the local team strove to ensure that the water from the surroundings of the zero zone and segment one was collected and diverted properly into the 3D TRASAR Caster Technology unit. Adequate follow-up of the mechanical issues by both Nalco Water and the customer’s personnel was needed.

The above-mentioned initial effort enabled the 3D TRASAR Caster Technology to run smoothly, showing consistent results which revealed the occurrence of dramatic pH drops in the 3-4 range. The pH distribution prior to the application of the new treatment was as follows (the pH values recorded during outages were excluded from the analysis below):

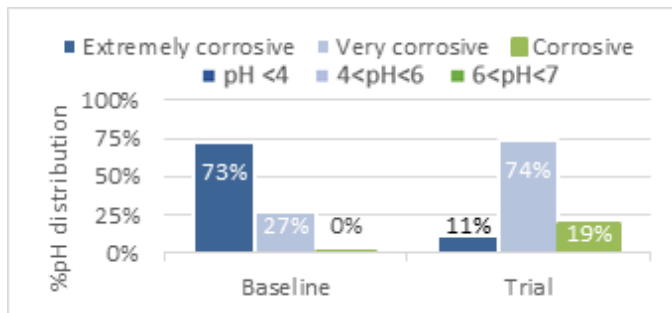


Chart 1: pH distribution inside the spray chamber

As can be seen in the above chart, the pH of the water in contact with the upper segments remained below values of 4 for 73% of the operational time, while it fell in the 4-6 range for the remainder of the time.

The pH distribution during the first three months of the trial following the implementation of 3D TRASAR Caster Technology evolved with the pH remaining above 6 for 19% of the time, from {4;6} for 74% of the time, and below 4 for only 11% of the time.

Corrosion rates measured through coupons submerged in the water collected by the 3D TRASAR Caster Technology confirmed the benefits of the newly implemented program, as corrosion rates decreased from 32 mpy. (baseline) to 8.3 mpy. after one month of treatment.

Subsequently, another set of coupons, evaluated after 90 days of exposure, revealed a corrosion rate of 15 mpy. In each case, the reduction in corrosion was much higher than the promised KPI (30%).

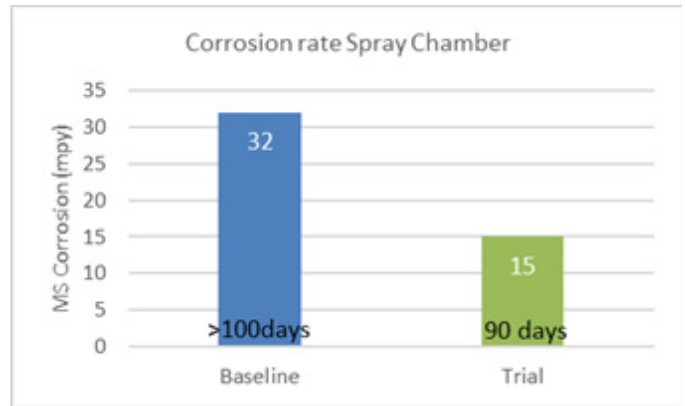


Chart 2: Corrosion rates measured on 3D TRASAR Caster coupons

Optimization of the corrosion treatment was only possible with the installation of the new 3D TRASAR Caster Technology and next generation 3D TRASAR Cooling Water Technology installed in the cooling system.

The ability of this innovative solution to keep the water pH of the spray chamber at acceptable levels while mitigating the effect of general corrosion is demonstrated by the data plotted in Chart 3, which corresponds to the three-month period referred to in Chart 2:

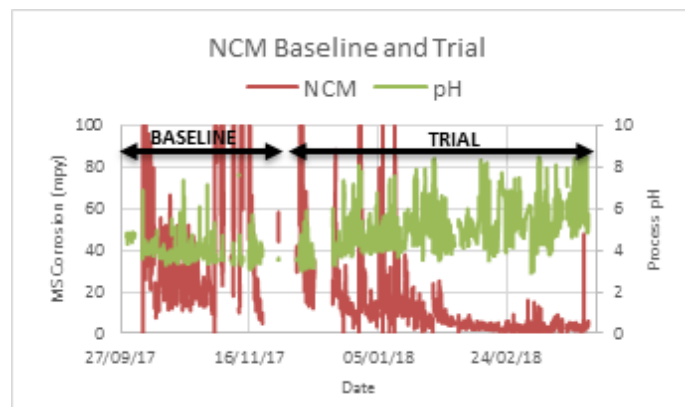


Chart 3: Online measurements provided by the 3D TRASAR Caster Technology Unit: corrosion rate and pH inside the continuous casting machine

The high pH values (green line) are due to production stops. The value is maintained in the 4-6 range almost 100% of the operational time. Online corrosion measurements rarely exceed 14 mpy. Wide temperature fluctuations are due to both production stops and changes in the steel grade casted.

CONCLUSIONS

The main results delivered by 3D TRASAR Caster Technology can be summarized as follows:

- 3D TRASAR Caster Technology proved effective in providing consistent information on spray chamber corrosivity, pH and water temperature.
- The data logging capabilities of 3D TRASAR Caster Technology, allows Nalco Water to provide customers with actionable insights regarding the performance of their treatment.
- Corrosion rates on the spray chamber environment were reduced by more than 50%.
- TCO savings of €250k per year were delivered.
- Machine availability, structure integrity and safety were improved, and peace of mind was delivered to the customer.

The customer's trust of Nalco Water and their willingness to openly share key steel-making operational data regarding cost of maintenance, cost of lost production due to scale and corrosion, cost of safety measures linked to corrosion and scale were crucial to the success of this project. The combination of Nalco Water's problem-solving approach, on-site expertise, and the application of new innovative digitally-enabled technology, delivered improvements and allowed the customer to meet their goals. With this case Nalco Water was able to prove that its new patented 3D TRASAR Caster Technology, offers significant game-changing improvements for the continuous casting process, as well as providing substantial benefits and best in class digital technology for the steel-making industry overall.

Nalco Water, an Ecolab Company

North America: 1601 West Diehl Road • Naperville, Illinois 60563 • USA

Europe: Richtistrasse 7 • 8304 Wallisellen • Switzerland

Asia Pacific: 2 International Business Park • #02-20 The Strategy Tower 2 • Singapore 609930

Greater China: 18G • Lane 168 • Da Du He Road • Shanghai China • 200062

Latin America: Av. Francisco Matarazzo • nº 1350 • Sao Paulo – SP Brazil • CEP: 05001-100

Middle East and Africa: Street 1010, Near Container Terminal 3, Jebel Ali Free Zone, PO BOX 262015, Dubai UAE

ecolab.com/nalco-water

Ecolab, Nalco Water and the logos are Trademarks of Ecolab USA Inc.
©2018 Ecolab USA Inc. All Rights Reserved 11/18 CH-2109E

NALCO Water
An Ecolab Company