

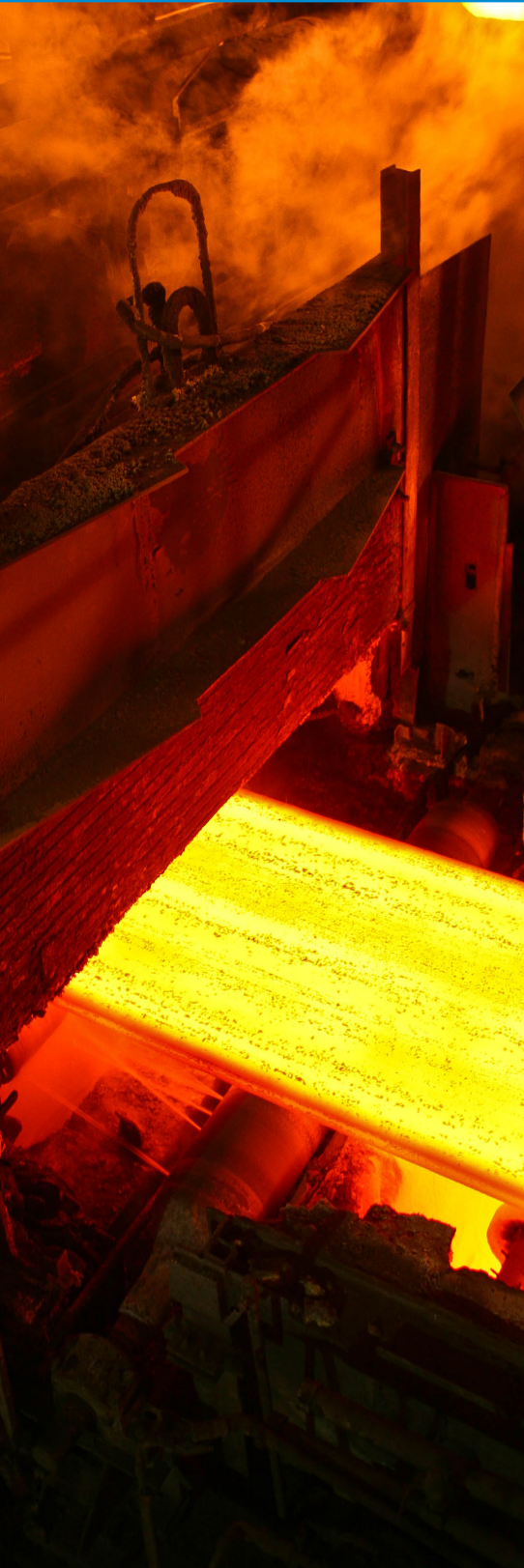


# Nalco Cast Clean™ Improves Thin Slab Caster Plant Profitability by more than \$5.9 million per year

**NALCO**  
An Ecolab Company

CASE STUDY - PRIMARY METALS

CH-1472



## BACKGROUND

The Thin Slab Casting Process was first developed by SMS Demag in the late 1980's and revolutionized the steelmaking process by allowing scrap steel to be melted, cast, and hot rolled into a coil of steel all in one continuous process. The success of this process relies on the ability to cast an extremely thin slab 35-65 mm thick (14 - 2.6 inches), which reduces the number of caster segments and finishing mill stands necessary to produce a coil of steel.

The casting speeds required to properly extract heat for the steel solidification process at this thickness are much higher than in conventional "thick slab" casters. CSP casters typically produce slabs at speeds ranging from 4.5 to 5.5 meters (177 to 216 inches) per minute with peak speeds of up to 7 meters (275 inches) per minute compared to conventional slab casters that cast at below 2 meters (79 inches) per minute.

At high casting speeds, the heat flux across the copper mold has been calculated to be in excess of 1,000,000 BTU/ft<sup>2</sup>/hr (2,710,645 kcal/m<sup>2</sup>/hr) and the waterside meniscus (solidification point) skin temperature has been measured

to be greater than 1,777°C (350°F). Waterside mold water system deposits are known to cause uneven and/or poor heat transfer that can lead to breakouts, excessive copper mold wear, and surface cracking defects. Thus, the performance of the mold cooling water system plays a critical role in the overall success of the Compact Strip Process.

## SITUATION

A SMS Demag caster capable of producing 1.6 million tons per year was experiencing a high rate of longitudinal cracking type surface defects, particularly in crack-sensitive grades. This CSP caster operates with casting speeds beyond 5.3 meters (209 inches) per minute to maximize mill productivity, putting additional stress on the caster cooling water systems. After little progress was made after two years of troubleshooting and more than \$150,000 worth of investments in new water treatment equipment and system modifications with another supplier, Nalco was asked to investigate the problem.

Nalco conducted a two-month audit that involved data analysis and benchmarking of water system Leading Performance

### CUSTOMER IMPACT

36 fewer mold shipments and cleanings



### ECONOMIC RESULTS



\$2,700,000/year

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

(Continued on Reverse Side)

Indicators and Thin Slab Caster Key Performance Indicators against Nalco Global Best Practices. This audit process revealed a direct relationship between mold water quality, waterside copper mold deposition, mold wear rates, and longitudinal cracking.

## KEY AUDIT FINDINGS

1. Excessively high Total Organic Carbon (TOC) concentrations were experienced in the Mold Water System due to the application of a poorly engineered non-oxidizing biocide feed program. The high TOC caused stable foam to form in the Mold Water System which inhibited heat transfer, increased skin temperatures, and ultimately led to the formation of non-uniform copper oxide deposits as the copper auto-oxidation was reached.
2. High levels of tolyltriazole (TTA) copper corrosion inhibitor were experienced due to a lack of understanding on how TTA films form which generated an unusually thick and non-uniform organic TTA deposit.
3. Inadequate iron removal practices resulted in high soluble and total iron levels which caused non-uniform iron oxide deposits to form on the mold coalface surface.
4. The non-uniform deposits that formed on the copper mold coldface generated uneven heat transfer across the width of the mold, resulting in thermal stresses on the newly formed slab, excessive copper mold wear rates, and longitudinal surface cracking on the finished product.

## PROGRAM

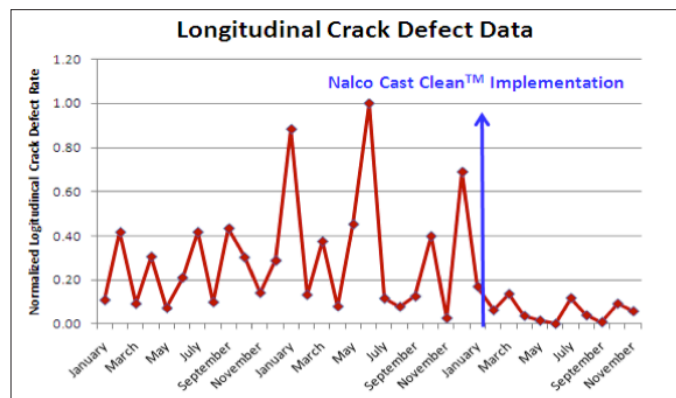
Nalco recommended the utilization of its Nalco Cast Clean mold water treatment service to improve the performance of the Mold Water System and reduce longitudinal cracking. Nalco Cast Clean service combines:

- Nalco TRAC™ Inhibitors and biocides engineered for High Heat Flux Mold Systems
- Real-time Inhibitor Control using Advanced 3D TRASAR® Automation
- Web-based Monitoring of Critical Leading Performance Indicators
- 24/7 Mold System Health Check with Nalco 360™ Service
- Application of Nalco Global Mold Water Best Practices



## RESULTS

After the Nalco Cast Clean service was implemented, an immediate improvement in product quality, mold cleanliness, and mold life were noted. The frequency of longitudinal crack defects dropped by more than 81% and resulted in 7,000 fewer tons of steel that were rejected either internally or externally by the customer. In addition, mold campaign life was increased by 63% and casting speeds were increased by 2% without any increase in the longitudinal crack frequency rate.



## TOTAL COST OF OPERATIONS SAVINGS

The Total Cost of Operations savings associated with the improvements made have been estimated at more than **\$5,900,000** per year.

- 7,000 tons/yr of rejected steel @ \$100/ton avg cost = \$700,000/year
- 25,000 tons/yr of additional steel @ \$100/ton avg profit = \$2,500,000/year
- 36 fewer mold shipments and cleanings @ \$75,000/mold = \$2,700,000/year

## Nalco, an Ecolab Company

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