NALCO

Essential Expertise
for Water, Energy and Air

Annual water reduced 7.2 million gallons

Freescale Semiconductor and Nalco team up to save water, reduce operating costs and improve results

Background

Semiconductor fabs use large volumes of water in the manufacturing process. This water is used to convey process chemistry and to wash and rinse the wafers at many stages during fabrication. Semiconductor fabs also have large chiller systems that are used to supply chilled water to the production area's PCW (Process Cooling Water).

Regulating the fab's manufacturing environment is critical, as even slight variations of temperature and relative humidity within the manufacturing process can have a profound effect on chip quality, and the cost of downtime is very high. The chiller assets used to provide this climate control have high value, as well.

Three primary types of water related stress exist in cooling water systems – corrosion, microbio and scale. These stresses can be exacerbated by varying water quality, high temperatures, etc.

An adaptable, responsive water treatment program can help to control all of these stresses, and help optimize mechanical, chemical and operational conditions accordingly.

Situation

Freescale Semiconductor is a major semiconductor producer manufacturing MEMS, microcontrollers, radio frequency transceivers and amplifiers. One of manufacturing fabs is in Austin, Texas. The fab has a cooling tower in a central utility system, supporting the chillers that supply Process Cooling Water (PCW) to the fab. Like most semiconductor manufacturers, Freescale has a strong environmental and local community commitment. The utility staff needed to be able to continue to support the manufacturing processes, but also wanted to reduce the amount of water the fab was consuming and discharging.

Environmental Results	eROI	Economic Results
Annual city water consumption reduced by 7.2 million gallons (27,250 m^3) Net water reuse/recycle of 15.7 million gallons	water	Annual savings of $70,865

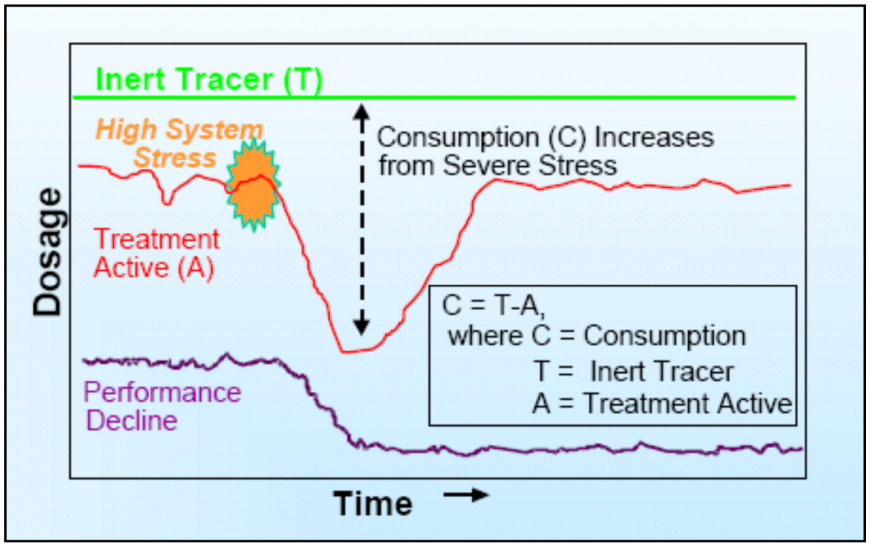
"Integrating the Cooling Tower into a Fab's Water Conservation Strategy" Originally presented at ULTRAPURE WATER® Micro, November 16-17 2010, Phoenix, AZ

The primary problem facing the fab was finding a way to reduce water consumption and discharge, but not jeopardize utility support functions. A natural conclusion would be to try to use water reclaimed from the fab's processes to the utility center's cooling towers, but this could only take place with some sure way to protect the utility center and the fab manufacturing environment it supports. Typical contaminants in the water coming from various fab processes included phosphates, fluorides, sulfates, chlorides, ammonia and silica, as well as naturally occurring hardness (calcium and magnesium).

Any water re-use framework would have to include provisions to deal with these contaminants to ensure system protection against corrosion, microbio and scale. Unfortunately, the existing cooling tower treatment program at the fab was incapable of coping with the variable water quality that would result from such a reclaim scenario. An additional investment of approximately $60,000 - $120,000 would be required to revamp the existing cooling water treatment system to safely use the reclaimed water.

Program

After extensive discussions with Freescale personnel and developing a solid understanding of the reclaimed water streams involved,



Nalco 3D TRASAR Technology for Cooling Water adapts in real-time to changing system stresses

Nalco proposed the use of its 3D TRASAR® Technology for Cooling Water. In parallel with this work, the chemical delivery systems were also upgraded.

3D TRASAR Technology for Cooling Water uses four major innovations to provide adaptable, flexible control for microelectronics fabs that want to reclaim water streams to the cooling tower:

- Real-time corrosion monitoring and control
- New chemistry that overcomes many of the weaknesses of traditional polyphosphate scale and corrosion inhibitors
- Tagged and inert fluorescent polymers that enable the chemical program to adapt in real time to changes in stress
- A fluorescent bio-reporter molecule that responds to an enzyme present in all respiring organisms – the change in the level of the bio-reporter molecule is used to adjust the control response

Implementation

Freescale and Nalco put into place a process that included complete overhaul of automation systems, technical approach and goal-based planning. This included the earlier described improved chemical delivery method, 3D TRASAR Technology for Cooling Water, results documentation, and summarizing progress and setting new goals.

Chemical delivery and drum handling:

Below is a photograph of the previous and Nalco chemical delivery and storage system – Nalco PORTA-FEED® system drastically reduced the number of water treatment chemical drums on site, concomitantly reducing the number of water treatment chemical drums handled.

Before

After

New chemical treatment program automation

The photo below shows the previous chemical control automation and feeding system versus Nalco 3D TRASAR Technology for Cooling Water.

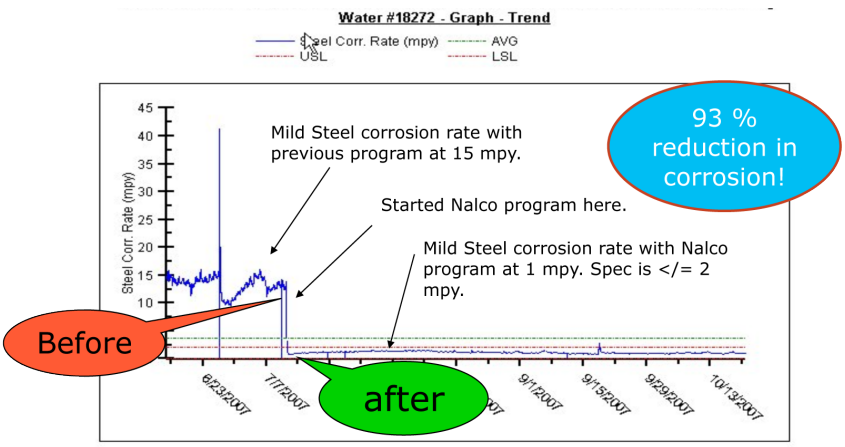
Before

After

System performance

The graph shows the drastic reduction in corrosion realized after switching from the previous program to Nalco – corrosion was reduced 93% and real-time corrosion data is now provided.

Part of the 3D TRASAR system includes Nalco 360 Service, an Internet-based expert center that looks at trends, reviews alarms, and troubleshoots systems 24/7. This expert center is staffed by Nalco chemists and chemical engineers knowledgable in cooling systems. The network enables the expert center to contact local Nalco personnel or fab staff via email or cellular devices and take corrective action before a small problem becomes a large incident.



Environmental/Economic Results

The 3D TRASAR program's ability to tolerate water quality of higher variability enabled the fab to increase the cycles in the cooling tower from 7 to 15. Also, it was possible to use more reclaimed water.

- City water consumption was reduced by 7.2 million gallons (27,250 m^3) annually, resulting in a $23,680 savings
- Discharge flows were reduced by 8.5 million gallons (32,180 m^3) annually, resulting in a $47,185 savings

Other savings and highlights

Labor to operate the program was also optimized, enabling a savings of $30,000, and allowing operations labor to be applied to higher value tasks. Overall program costs were reduced by $14,000 in addition to the above listed savings.

Lastly, the project came in under budget, ahead of schedule, and exceeded savings targets.

Total savings realized: $114,865.

Upcoming projects and continuous improvement

Additional projects underway, or under consideration:

- A cooling tower bio-detergent program to further improve tower cleanliness and reduce the need for manual cleaning, and reduce filtration backwash costs
- New boiler water treatment control technology with technology similar to the 3D TRASAR Cooling Water program that should improve control, and optimize the operational time spent running the treatment program. Projected annual savings are $10,285
- Improved automation and treatment programs for the PCW (Process Cooling Water) systems
- Remote chemical tank level monitoring to optimize inventory control, provide just-in-time delivery, and reduce labor directly associated with those tasks

Nalco reports Environmental Return on Investment (eROI) values to customers to account for contributions in delivering both environmental performance and financial payback.

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