

# CUTTING EDGE™

ESSENTIAL INNOVATION FOR THE PETROLEUM INDUSTRY

VOLUME  
02



## Shedding Light on Systems Sustainability

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An Integrated Effort to  
**Maximize Oil** Recovery

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Full Steam Ahead: Technology  
Boosts **Oil Sands** Processing

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# LETTER FROM EDITOR



*Operational safety has always been our industry's paramount concern. Ensuring that employees return home safely to their families, and that communities are not placed at risk through oil and gas operations, are the cornerstones of our commitment*

*to safety. More recently however, the term 'sustainable operations' has entered our vocabulary, representing a corporation's responsibility to operate in a manner that meets the needs of the present, without compromising the ability of future generations to meet their own needs.*

This goes beyond merely ensuring a safe working environment. In 2005, the United Nations World Summit defined sustainable operations as those that provide sustainable economic development, social development and environmental protection. These three interdependent and mutually reinforcing pillars are the foundation of a company's sustainability program.

Nalco has delivered significant environmental, social and economic benefits to customers since our inception. We help customers reduce their consumption of energy, water and other natural resources; minimize their environmental emissions; and improve their productivity and commercial offerings — all while improving their bottom line. Technology is the key enabler, providing programs which positively impact the sustainability of our customers' operations.

This issue of Cutting Edge highlights several of our technologies that drive sustainability, including the latest in on-line, real-time diagnostics and automated control, 3D TRASAR® technology. This innovation won the 2008 Presidential Green Chemistry Challenge Award from the U.S. Environmental Protection Agency for its proactive approach to optimize the operational efficiency and reliability of cooling water systems, while minimizing their environmental impact. 3D TRASAR technology is now being applied to boiler systems, offering a true step-change improvement over conventional technologies and dramatically improving operational sustainability.

We also examine how the drive towards renewable biofuels is presenting significant challenges to biofuel producers. The main culprit is the relatively unstable nature of the natural components that, upon degradation, lead to deposition and enhanced corrosion in fuel distribution lines and engine intake systems. Our latest advances in fuel additive technology minimize these detrimental effects and maximize the use of biofuels.

The increasing global demand for hydrocarbons has highlighted the critical challenge of maximizing production from existing assets in a responsible manner. This issue also spotlights how Nalco, through its recent joint venture, TIORCO® LLC, is investing in Research & Development to address the significant technical challenges associated with the science of enhanced oil recovery.

Similarly, our dedicated Oil Sands Research Group is providing sustainability improvements to our customers in heavy oil production. To combat boiler tube failures in the generation of steam used in Steam Assisted Gravity Drainage (SAGD) operations, we feature a new, differentiating dispersant technology which reduces down time, minimizes energy consumption and CO<sub>2</sub> emissions, and improves the overall safety of the steam generation process.

Another significant production challenge is the presence of certain types of bacteria, whose metabolic byproducts can be extremely corrosive. We have recently pioneered the use of the latest molecular microbiology techniques to identify the actual species of bacteria present in oilfield systems. This has enabled a more comprehensive understanding of the potential for microbiologically influenced corrosion and allows proactive mitigation programs to be established. This significantly reduces the probability of failure and minimizes risks to both operations personnel and the environment.

This issue of Cutting Edge demonstrates Nalco's commitment to help our customers meet their sustainability goals. Though the terminology may be new, this has been our company's focus during our 80+ year history. Today more than ever, technology plays a critical role, enabling our customers to maximize their operations without compromising the ability of future generations to meet their own needs.

#### Footnote:

Nalco is a member of the Dow Jones Sustainability World Index which tracks the financial performance of leading sustainability-driven companies worldwide. We are also a member of the United Nations Global Compact, the world's largest corporate citizenship and social responsibility organization.

David Horsup, Ph.D.

A handwritten signature in black ink, appearing to read 'David Horsup', with a stylized flourish at the end.

Vice President, Research  
Energy Services

## COVER STORY



### SHEDDING LIGHT ON SYSTEMS SUSTAINABILITY

Refineries and petrochemical plants possess some of the most challenging water treatment environments of any industry. For many operators, these challenges are mounting as they attempt to maximize their profitability with minimal impact to the environment.

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Oil producers with aging fields are constantly attempting a delicate balancing act of minimizing water production and maximizing oil production...

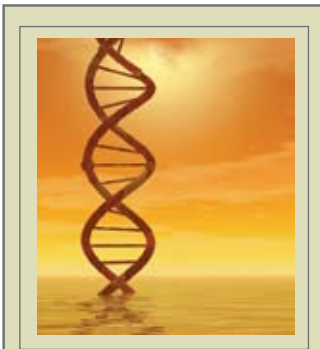
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#### FULL STEAM AHEAD: TECHNOLOGY BOOSTS OIL SANDS PROCESSING

Oil sands are heavy oil deposits that, while abundant, are impossible to extract by conventional means given their extremely high viscosity...

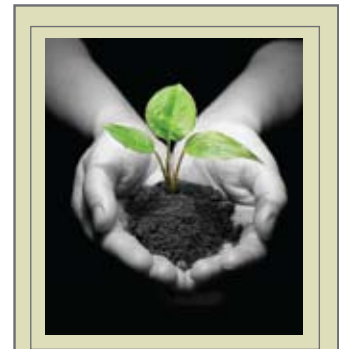
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#### BETTER BACTERIAL CONTROL? IT STARTS IN THE GENES...

Nalco has recently developed a better detection methodology that does not rely on bacterial growth as the basis for identifying microorganisms...

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#### ADDING NEW LIFE TO BIOFUELS

Newly developed additives ensure that ethanol and biodiesel resist oxidation and degradation when used in fuel blends...

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For more information about the Nalco technologies featured in this issue, please call 1-281-263-7000 or email [CuttingEdge@nalco.com](mailto:CuttingEdge@nalco.com)

## NEWS AND UPDATES

#### NALCO OPENS NEW TECHNOLOGY CENTERS IN BRAZIL AND CHINA

Nalco recently opened new research and development facilities in Campinas, Brazil and Shanghai, China

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# An **Integrated** effort to **MAXIMIZE** oil recovery

Oil producers with aging fields are constantly attempting a delicate balancing act to minimize the inevitable uptick of water production and, simultaneously, maximize oil production. Successfully balancing these priorities often dictates whether a field will be economically viable, and requires the right partner with the right production enhancement technologies.

A new joint venture, TIORCO LLC, was formed in 2008 to address this challenge. Bringing together three decades of enhanced oil recovery (EOR) expertise from Nalco-subsiary TIORCO Inc. with the world-wide presence and unique product offerings of Stepan Company, TIORCO LLC is the world's first single-source EOR provider.

TIORCO's strength lies in its unique position as a service provider that is not tied to any one solution. We review our full portfolio of technologies and recommend the most cost-effective service, which may include:

- Identification of injector-to-producer connectivity
- Total zone isolation and matrix and water shut-off in gas and oil wells
- Maintaining water injectivity by stabilizing migrating and swelling clays
- Volumetric sweep improvement
- Surfactant flooding

**Our new, 5,000 square foot, state of the art laboratory in Denver, USA provides customers around the world with comprehensive analysis and process design services for all TIORCO technologies including polymers, Colloidal Dispersion Gels (CDG), bulk gels, BrightWater® technology, and Alkali/Surfactant/Polymer (ASP) packages.**

Some of the capabilities in our new facility include:

- Comprehensive water and crude oil analysis
- Automated interfacial tension measurements
- Concentration analysis of polymers and surfactants and phase-behavior studies of ASP systems
- Long slim-tube sand-packs (40 feet or longer with the capability to measure pressure over multiple sections) to measure the flow diversion properties of BrightWater technology and CDGs

Laboratory data and results from flow experiments also provide input to oil recovery simulation models for process design and economic evaluation by TIORCO's experienced reservoir engineers.

### Alkali/Surfactant/Polymer (ASP) Technology

Primary and secondary production operations may typically recover only 40-50% of oil, leaving a great deal of economically viable residual oil behind in pore throats or the smallest pore spaces of the reservoir rock.

One technique that TIORCO specializes in is the design and implementation of ASP projects which recover more of this residual oil by employing:

- Surfactants, which reduce the energy, or interfacial tension, between water and oil to allow greater oil recovery
- Alkali components, which prevent surfactant adsorption to the rock
- Polymers, which increase the viscosity of injected water and divert more water to unswept portions of heterogeneous reservoirs, directing more incremental oil to the producing wells.



TIORCO begins every ASP project with a careful study of any potential chemical-reservoir interactions. An in-depth analysis of the project's injection water is first conducted to ensure its technical and economic suitability as the chemical treatment carrier.

Core flooding—an essential screening step and the basis for designing a pilot field ASP project—investigates potential incompatibilities between injected fluids and the rock. Representative core samples from the reservoir are analyzed with state of the art Formation Response Testers operating under reservoir temperature and pressure conditions. This provides insight into the effectiveness of various surfactant and polymer packages in mobilizing residual oil.

The core flood data is input for a computer-based reservoir simulation, which is used to scale up the laboratory results to the field project such that chemical injection can be optimized for maximum oil recovery.

This process is but one example of how TIORCO is setting the benchmark as the industry's one-stop integrated provider of EOR solutions.



## Problem solving and innovation in SAGD production

A SAGD customer reported steam-generation problems and bulges or ruptures in their OTSG boiler tubes, forcing them to shut down the steam generators and scale back production (Figure 1). Nalco's Oil Sands research and Customer Analytical groups provided forensic support in the form of water, deposit and metallurgical analyses.

Deposits on OTSGs are historically organic (coke), inorganic (silica and its salts), or a mixture of the two. These deposits typically insulate an OTSG's heat transfer surface, causing metallurgical failure due to overheating.



Figure 1: Side and cross sectional views of a failure, showing multiple bulges and a rupture at a bulge apex

Limiting deposit formation is vital. Once formed, deposits lower boiler efficiency, forcing the operator to shut down the OTSG and remove them via pigging.

This is a costly solution: if the process is not producing steam, the operator isn't making bitumen. Nalco identified the major components in the bulk internal surface deposit as silica (17%), magnesium (11%) and carbon (43%), with various other minerals such as calcium present in smaller amounts.

The deposit cross section showed stratified layers (Figure 2), indicating they were not just a one-time occurrence, but a series of occurrences that led to the OTSG tube failures. Further analysis using energy dispersive spectroscopy (EDS) mapping characterized the elemental distribution in the stratified deposit layers.

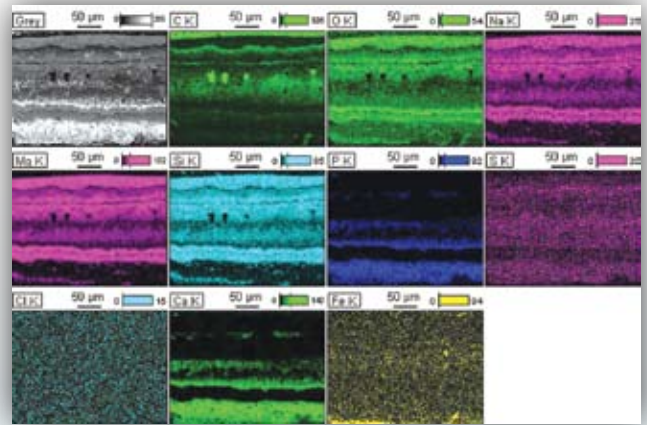


Figure 2: The deposit has distinct layers of dark and light deposits much like a tree ring, and EDS mapping was used to characterize the composition of the layers.

## Nalco used this information to portray the likely problem(s):

- High silicon and magnesium concentrations indicate problems in the warm lime softener
- High carbon content indicates that oil is making its way to the OTSG
- High calcium concentrations point to problems in the ion exchange area

With the deposit's composition identified and using our extensive boiler expertise, a new antiscalant was developed for OTSGs and evaporators.

A field trial was conducted to gauge the antiscalant's effectiveness by measuring the mass balance of silica between the inlet and outlet of a steam generator tube. Figure 3 presents the data, with the two curves representing the presence (green) and absence (red) of the antiscalant.

The slope of each curve indicates the extent of deposition in the tube. In the absence of antiscalant, the slope of 0.89 indicates that only 89% of soluble silica transported through the tube and 11% deposited onto the tube surface. By contrast, with a slope of essentially 1.00, the antiscalant curve indicates zero deposit formation.

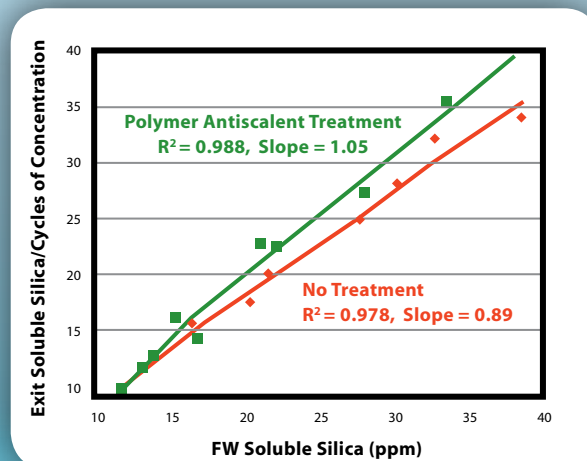


Figure 3: A Comparison of Soluble Silica Transport With and Without Antiscalant

By combining the latest analytical technologies with application expertise and focused research, Nalco can provide cost-effective solutions for many problems plaguing SAGD bitumen production. These solutions can maximize the safety, profitability and environmental compliance of a producer's SAGD operation.

At a feedwater flow rate of 150 m<sup>3</sup>/hr with an average of 20 ppm soluble silica in the feedwater, 89% transport translates to about 180 Kg of silica deposited in the OTSG each month. With antiscalant treatment, virtually no deposition would occur over a wide range of feedwater silica concentration.



# Better Bacterial Control?

*It starts in the genes...*

The presence of bacteria in production pipelines and topside systems is nothing new to the oil field, nor is the problem they cause—aggressive attack known as microbiologically influenced corrosion (MIC).

Of course, in order to effectively prevent these bacteria from propagating and putting your equipment at risk of failure, you have to first identify which strains are present. Conventional thinking holds that serial dilution is the best detection method for this application, and it is widely used in the oil field today. However, serial dilution typically detects only 1-10% of the bacteria in a given sample, because bacteria are accustomed to a specific environment and do not grow well in synthetic laboratory media.

Nalco has recently developed a better detection methodology that does not rely on bacterial growth as the basis for identifying microorganisms. Instead, our molecular microbiology methods allow for bacterial speciation to be performed on any sample—produced water, oil emulsions, or solid debris—to provide a comprehensive list of organisms present, independent of growth in culture.

This process begins by extracting the bacteria's total DNA and then amplifying it using a method known as polymerase chain reaction, or PCR. The PCR is performed using synthetic DNA that precisely matches conserved regions of the bacterial genome from sulfate reducing bacteria (SRBs), acid producing bacteria (APBs), iron reducing bacteria, and others. This allows us to amplify all bacterial DNA in a single PCR.

In between the conserved regions is a hypervariable region of DNA that varies dramatically from one bacterium to the next. The presence of this variable region allows the amplified DNA strains to be separated based on their nucleotides. Separated DNA is then excised, sequenced, and analyzed to determine the exact genus and species of bacteria present.

**The payoff? For the first time, the customer knows the exact identity and extent of diversity of organisms present in their system.**

A positive serial dilution bottle for SRBs, by contrast, tells the customer that SRBs are present—with no indication as to identity. Without that knowledge, the ability to assess the risk of MIC or evaluate the effectiveness of a bacterial mitigation program is nearly impossible..



Bacterial DNA from unique organisms is separated using DGGE and visualized by illumination with ultraviolet light

Nalco has incorporated this DNA technology into a new three-point system of sample analysis that also includes enumeration by serial dilution and a new enumeration method by adenosine tri-phosphate

(ATP) quantification. While serial dilutions alone are insufficient detection methods, they provide useful insight by enumerating culturable APBs and SRBs to indicate MIC risk. In addition, enumeration by ATP quantification is a fast screening tool that can identify those microorganisms that are important in MIC but cannot be grown by traditional culture methods. Combining the information provided by these methods with the DNA profile obtained by the molecular analysis provides tremendous insight into the bacteria in a given system.



Biofilm present on a carbon steel biostud located in a produced water system

Case in point: a Nalco customer in the Gulf of Mexico performed routine serial dilutions on-site to monitor for growth of APBs and SRBs, and the results were consistently negative. However, Nalco used its three-point system on a collected water sample to determine if the client was missing something. While our laboratory work confirmed that no bacteria would grow via serial dilution, we identified several different organisms using DNA amplification, which was confirmed by a second type of molecular analysis called fluorescence in-situ hybridization. Based on these results, we determined that there was a potential risk for MIC at the asset and that some type of mitigation program should be considered.

The extensive insight provided by our analyses allowed our customer to implement the right mitigation program for their asset and prevent MIC from creating a costly, and potentially catastrophic, situation.



DNA extraction being performed in Nalco's microbiology lab



Adding New

**LIFE**

to Biofuels

Worldwide interest in biofuels, such as ethanol and biodiesel, continues to rise. The use of bio-based fuels as blending components with petroleum fuels is common in many countries today. Properties such as the high octane number of ethanol and the elevated cetane number of biodiesel are desirable in clean-burning fuel formulations.

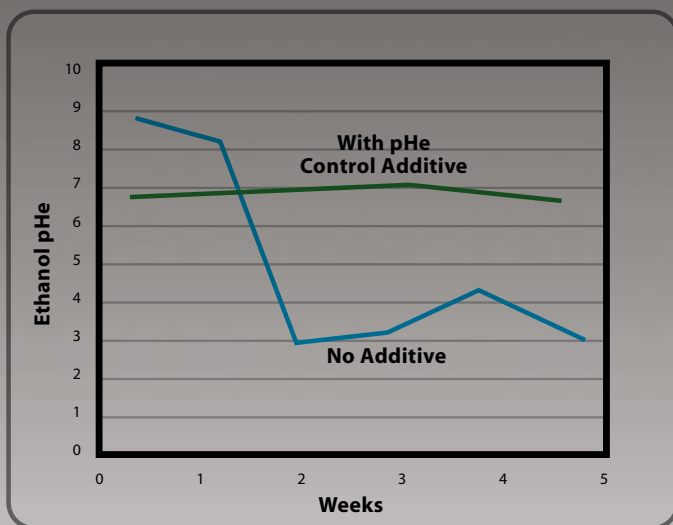
Along with their desirable properties, ethanol and biodiesel have traits consistent with many natural products – they biodegrade. Although biodegradation may be beneficial if a fuel spill occurs, degradation is not beneficial when fuel is held in a vehicle tank or stored at a neighborhood service station for daily consumer use. Products of ethanol and biodiesel degradation can lead to problems in vehicle fuel intake systems and in commercial fuel distribution lines such as deposit formation and corrosion.

Nalco has developed additives to ensure that ethanol and biodiesel resist oxidation and degradation when used in fuel blends. The natural tendency of ethanol to oxidize to form acidic compounds is measured by a specific ASTM test designed to sense the acid strength, or pHe, of ethanol. The ASTM D4806 specification for fuel-grade ethanol establishes a pHe range from 6.5 to 9.0 as the required range for ethanol used in fuel applications. Nalco can significantly improve the properties of

ethanol used in fuel blending by the addition of a multi-purpose additive that:

- **Maintains ethanol pHe, thereby preventing acid build-up in ethanol**
- **Provides a protective barrier on metal surfaces exposed to ethanol**

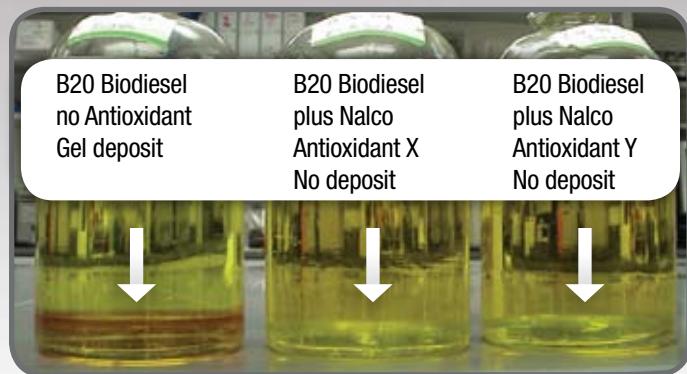
The rapid rate of ethanol pHe degradation and the ability to control change in ethanol pHe by Nalco additive addition are demonstrated in the chart.



Natural fats and oils – triglycerides – used to produce biodiesel fuel originate from a variety of sources such as soybeans, canola seeds, and animal fats. Typically, only vegetable products that produce a high oil yield or waste animal fats that have not degraded are used to produce fuel grade compounds. The primary process used to synthesize fuel-grade compounds from triglycerides is called transesterification. By this process, the saturated and unsaturated fatty acids that make up the triglyceride are reacted with methanol and converted to fatty acid methyl ester or FAME compounds. The FAME compounds are readily soluble in petroleum diesel fuel and are blended into diesel fuel at rates typically ranging from 2 percent to 20 percent and are respectively sold commercially as B2 and B20 biodiesel. Other blends such as B5 and B10 are also marketed.

Immediately upon production and throughout the transportation and storage process, biodiesel oxidizes and degrades. The unsaturated FAME compounds are the most reactive with oxygen in the air. Upon reaction, FAME degrades to form a wide variety of low molecular weight, gel-like, carbonyl compounds that are insoluble in diesel fuel. Accumulation and eventual precipitation of these compounds as a gel-like deposit in a B20 biodiesel blend without antioxidant addition is shown to the left. Biodiesel with Nalco antioxidant addition remains stable.

Nalco biofuel additives used in ethanol and biodiesel effectively inhibit degradation of these important alternative fuel sources. As a result, compounds do not form in these fuels that may lead to corrosion, filter plugging, and deposit formation in fuel distribution and storage equipment and in vehicle fuel intake systems.



# Shedding Light on Systems Sustainability

Refineries and petrochemical plants possess some of the most challenging water treatment environments of any industry. For many operators, these challenges are mounting as they attempt to maximize their profitability with minimal impact to the environment.

While a sustainable water treatment system can provide tangible benefits to a plant and its local community, an improperly managed system can result in increased maintenance costs, inefficient use of water and energy, increased emissions, and lower profits. As the global leader in water treatment, Nalco's global research and development team has been committed to developing leading edge technology that delivers sustainable development to our customers.

Over the past 20 years, our development of hardware technology, information management, and chemistry focused on water management has evolved to become the most advanced cooling water platform technology available — 3D TRASAR® technology. This state of the art technology monitors key system parameters to detect system variations that can lead to process stresses. It then takes corrective action—directing the chemical feed pumps to deliver the correct amount of chemical to the system and notifying appropriate personnel of the event via wireless communication.

By quickly addressing and correcting potential system upsets, 3D TRASAR technology results in optimized

utilities systems with a significantly reduced risk of downtime and a savings in energy and water requirements, providing both economic and environmental benefits in the process.

3D TRASAR technology's positive impact on water processing facilities across many industries has allowed Nalco to install more than 10,000 units since its introduction. Since 2004, Nalco's Energy Services Downstream Division has installed 3D TRASAR systems on nearly 70% of the cooling towers that the division manages worldwide.

Operators of these cooling towers are experiencing firsthand the significant sustainability gains that the 3D TRASAR program provides. Over a five-year period, one major chemical company employing 3D TRASAR technology has realized water savings of 1 billion gallons per year and a 70% reduction in exchanger cleanings, resulting in an annual maintenance cost savings of \$4 million. The technology has also provided significant savings in energy costs and related greenhouse gas emissions over that time period.

Nalco was honored with the 2008 Presidential Green Chemistry Challenge Award for 3D TRASAR technology for cooling water, an award that recognizes outstanding technologies that incorporate the principles of green chemistry into chemical design, manufacture, and a customer's use to impact sustainability goals.

## Boilers Benefit from 3D TRASAR Automation

Thanks to Nalco's initiative to continually improve the 3D TRASAR program, the technology is now available for boiler systems. The 3D TRASAR Boiler program uses the proven 3D TRASAR platform to improve boiler reliability, optimize energy and water usage, reduce greenhouse gas emissions, and reduce the total cost of operations.

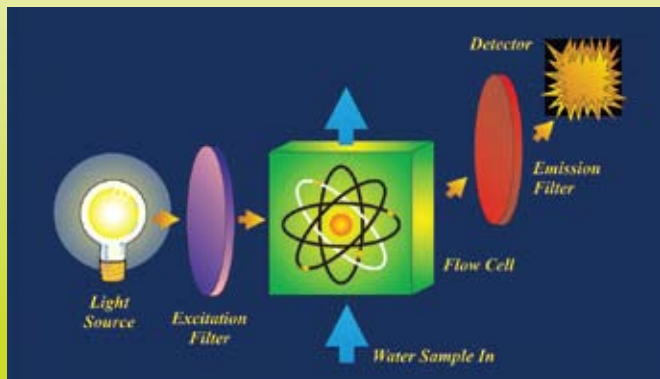
The technology can be customized and upgraded to meet a system's needs and includes web accessibility and easy reporting capabilities.

### 3D TRASAR Boiler Automation delivers these benefits through three main components:

- Internal Treatment Control
- Pre-Boiler Corrosion Control
- Cycle Optimization & Control

## 3D TRASAR Internal Treatment Control

For real-time protection of a boiler's internal workings, 3D TRASAR technology monitors treatment chemicals to ensure that accurate control is maintained. The control system combines an on-line fluorometer consisting of a flow cell, an LED light source, filters, and detectors with specific TRASAR® chemistries—including all polymer, phosphate, and chelant programs—that contain a uniquely fluorescing molecule. The fluorometer's filters and detectors are tuned to specific light frequencies unique to TRASAR chemistries. The LED source is extremely bright at the appropriate frequencies to reliably and repeatedly measure the chemical properties of the flowing water, allowing for precise detection of how much chemical has been fed in order to determine chemical dosage.



The 3D TRASAR controller uses these measurements to automatically respond to boiler system changes and maintain optimum treatment levels to keep boilers clean and free of scale and deposits.

## 3D TRASAR Pre-Boiler Corrosion Control

Corrosion can severely threaten asset life and significantly reduce the performance of a boiler feedwater system, particularly in the case of aggressive, localized oxygen pitting attack. Oxygen scavengers may be injected to mitigate this, and several monitoring methods have been used to monitor their effectiveness.

For example, for 80 years the industry has controlled scavenger dosage by maintaining a prescribed residual level based on periodic testing and manual adjustment. Some plants may even perform deaerator studies to optimize plume and dome and storage temperature differential. Another common practice is to slave the product feed to feedwater flow, which then increases or decreases dosage according to boiler system water demand. Many plants utilize online dissolved oxygen monitoring or oxygen wet testing, while some even measure iron in the feedwater for an estimate of program effectiveness and corrosion protection.



However, each of these conventional measurements is indirect, making a real-time indication of system conditions unavailable. This commonly leads to scavenger overfeed, an unnecessary chemical expense that increases conductivity and the need to blow down. More importantly, past practices have led to flow-accelerated corrosion in many units, an issue that must be corrected.

At the heart of the 3D TRASAR Boiler Technology is the patented Nalco Corrosion Stress Monitor (NCSM), a powerful new tool that provides a direct correlation to system conditions and responds to real-time system stresses, offering new control and diagnostic capabilities that never existed before. In addition, the feedwater is not cooled or otherwise conditioned, eliminating potential errors due to sampling or changes in water chemistry.

The NCSM technology minimizes preboiler corrosion by measuring and reacting to the net oxidation/reduction potential of the bulk feedwater at the boiler's actual operating temperatures and pressures, *(continued on page 14)*

providing better pre-boiler corrosion stress control than has been available before.

The NCSM detects changes in oxidation/reduction stress, determines the corrective action, and responds in real-time by changing oxygen scavenger or metal passivator feed to protect the system.

Feature	Nalco Corrosion Stress Monitor	Scavenger Residual	Dissolved Oxygen Test	Dissolved Oxygen Monitor	Corrosion Monitor	Room Temp ORP
Response Time	Very Fast	Slow	Slow	Medium	Slow	Slow
Sensitivity	Very High	Medium	Medium	Medium	Poor	Low
Accuracy	High	Medium	Medium	High	Poor	Low
Precision	High	Medium	Medium	High	Poor	Low
Dosage Control	High	Poor	Poor	Poor	Poor	Poor
Corrosion Control	High	Poor	Poor	Medium	Poor	Poor

A comparison of methods used to monitor and control oxygen scavenger and pre-boiler corrosion stress shows the benefits of implementing the NCSM technology

NCSM technology allows real-time direct measurement and response to system stresses caused by a variety of mechanical, operational and chemical variations, including but not limited to:

Mechanical	Operational	Chemical
Deaerator performance Pump leaks	Load changes Startup and shutdown Condensate flow Makeup flow Process leaks	Dissolved oxygen Oxygen scavenger/passivator dosage Condensate treatment recycle pH Temperature

### 3D TRASAR Cycle Optimization & Control

Nalco's 3D TRASAR Boiler technology also helps optimize and control boiler blowdown by yielding a precise measurement for boiler cycles. The value is read in both the boiler feed water and boiler blowdown. The 3D TRASAR controller can then accurately measure cycles and automatically blowdown to maintain the desired cycles of concentration. Conventional methods of monitoring and/or controlling cycles often lead to inaccuracies, as depicted in the table below.

Conductivity	Silica	Flow	3D TRASAR TECHNOLOGY
Varies in the BFW	Varies in the BFW	Requires properly calibrated analyzers	Constant level in the BFW
Not valid for high purity systems	Can be difficult to accurately measure due to detection limits	Can be difficult to calibrate based on location	Easily detected at low levels
			Easily maintained & calibrated
			Provides additional diagnostic benefits

The need to manage the operating, economic, and environmental stresses on any utilities system requires a partner with the right mix of technology and technical expertise. If the goal is to minimize the stresses on your cooling or boiler system by improving reliability, optimizing energy and water usage, lowering greenhouse gases, or reducing total cost of operations, 3D TRASAR technology is the answer.



## Nalco Opens New Technology Centers in Brazil & China

Nalco recently opened a new research and development facility in Campinas, Brazil, serving Latin America. The US \$2 million investment will serve Nalco's energy, water and process customers throughout the region.

A new technology center was also opened in Shanghai, China to support the needs of our Asia-Pacific customers. This five story, 70,000 square foot facility will also support our business operations and is the latest in a series of expansions by Nalco in China that includes a new manufacturing plant that opened in the Nanjing Chemical Industrial Park last year.

## Nalco Hosts Technology Symposium

The annual Nalco Technology Symposium was hosted in Naperville, USA, in December. Over 150 posters were presented on current research in progress across the company. The event was attended by over 300 Nalco researchers with representation from all geographic regions.

An Energy Technology Symposium Series was initiated in 2009 in Sugar Land, USA. This series spotlights recent developments in R&D in key application areas. The first two symposia focused on deposition control and chemical synthesis.

### Publications & Industry Presentations

- » Dr. Valerie Beucler was an invited speaker at the European Ethylene Producers Conference in Lyon, France. Dr. Beucler presented a case study, together with Total Petrochemical Research and Technology on how 3D TRASAR technology was used to mitigate the impact of hydrocarbon leaks at Total's Petrochemicals facility in Antwerp.
- » The 3-day European Refining Technology Conference water treatment training course will be held in London early 2010 under the direction of Dr. G. Townsend of Nalco. The ERTC wastewater treatment course, taught by Nalco Energy Services, was held both in London and Kuala Lumpur (ARTC) in 2009.
- » A paper entitled '*Primary Fractionator Fouling Control*' by Dr. Beata Manek has been accepted for publication in the 13th annual Asian Refining Technology Conference in Singapore in 2010.
- » A review titled '*The Use of Ethanol and Biodiesel in Fuels Today*' was presented at the October 2009 National Petroleum Refiners Association Q&A Session in Fort Worth, USA by Kim B. Peyton and Phillip Bureman.
- » '*Preventing Sediment Formation in Biodiesel Fuel Blends*', published in Biodiesel Magazine, was discussed by Dr. Tim McGinnis at the October 2009 Biodiesel Technical Workshop in San Antonio, USA. This article was co-authored by Dr. McGinnis, Kim B. Peyton, and Phillip E. Bureman.
- » The paper '*Strategies for Optimizing Foamer Combination Products: A Statistical Design Approach*' by Dr. Duy Nguyen and Dr. Fenfen Huang, was given at the European Gas Well Deliquification Conference in the Netherlands.
- » A workshop on Chemical Foamers for Gas Well Deliquification was given by Dr. Duy Nguyen and Martin Willis at the European Gas Well Deliquification Conference in the Netherlands.
- » A paper entitled '*Compositional Variations between Precipitated and Organic Solid Deposition Control (OSDC) Asphaltenes and Effect of Inhibitors on Deposition by Electrospray Ionization Fourier Transform-Ion Cyclotron Resonance Mass Spectrometry (FT-ICR)*' was jointly published in Energy and Fuels (November) by Dr. Priyanka Juyal, Dr. Andrew Yen, Steve Allenson; Chevron and Florida State University.
- » NACE paper #14834 entitled '*Bacterial Characterization and Biocide Qualification for Full WellStream Crude Oil Pipelines*' jointly published by Dr. Vic Keasler, Brian Bennett, Ben Bromage and ExxonMobil was accepted for publication at the NACE 2010 conference.
- » NACE paper #14267 entitled '*Compatibility of Tetrakis (hydroxymethyl) Phosphonium Sulfate (THPS) and Ammonium Bisulfite*' by Dr Jennifer Moore, Dr. Vic Keasler and Brian Bennett was accepted for publication at the NACE 2010 conference.

# Want to work...

Nalco Company's Energy Services Division has outstanding opportunities for excellent scientists in all areas of the oil and gas industry. From the 'perforations to the gasoline pumps', Nalco's team of scientists provide cutting edge, cost-effective solutions to critical real-world problems. Whether it's helping to maximize oil and gas production in a declining asset, ensuring the safe and reliable production from extreme environments like ultra-deepwater, or minimizing energy consumption during refining operations, Nalco has a team of highly trained scientists driving innovation in this technically demanding field.

Our global R&D Center is located in the beautiful city of Sugar Land, just outside of Houston, Texas. Our new R&D Center serving the eastern hemisphere is located in Pune, India. We have excellent opportunities at both locations for outstanding, innovative scientists, preferably with a PhD in a technical discipline. Prior exposure to the oil industry is preferable but not a prerequisite. Strong communication skills, a willingness to travel, and a creative, positive attitude are essential. Nalco Company offers a competitive salary and an exceptional benefits package.



- ▶ In a dynamic environment, grappling with some of the most critical research and technological challenges facing our world today?
- ▶ Alongside world-class scientists, renowned globally for their technical expertise?
- ▶ For a company committed to making a difference in the lives of the world's population?

Please visit [www.nalco.com](http://www.nalco.com) to review current opportunities

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