

FLUENT LINES™

WASTEWATER, PROCESS WATER AND PRODUCED WATER SOLUTIONS FOR OIL & GAS PRODUCTION AND HYDROCARBON PROCESSING • FEBRUARY 2006

VEOLIA WATER

Ushering In A New Era In Water & Wastewater Solutions

Veolia Water provides timely solutions to environmental and process challenges facing refiners and oil and gas producers, and for meeting increasing demands for improved efficiencies and safety.

LONG INFLUENCED BY INFRA-structure needs and increasing regulatory requirements, oil and gas producers and hydrocarbon processors are now also being swamped with tough new performance pressures brought about by market conditions. Because of this and other present-day realities, a rapidly growing number of producers and refiners are turning to Veolia Water to help solve key challenges for improving the efficiency, performance, reliability and safety of their critical water and wastewater systems.

Water Cycle Management

Veolia Water is the world leader in water technologies and services, with more than a century of international experience. As experts in the optimization of water and wastewater processes and systems, we provide state-of-the-art tech-



Veolia Water Solutions & Technologies optimizes water and wastewater processes and systems for both upstream and downstream operations to fully meet today's growing challenges.

nologies, engineering and design proficiencies, and operations, maintenance and management expertise to help customers reduce costs, lower water consumption, and meet safety and environmental compliance parameters.

Veolia Water's Solutions & Technologies group serves upstream and downstream operations through five business units in North America – HPD, a leader

in evaporation and crystallization processes; **Whittier Filtration**, providing key filtration systems for removing solid matter and impurities from liquid streams; **Kruger**, world-class innovator of advanced water and wastewater treatment technologies such as ACTIFLO®; **N.A. Water Systems**, specializing in the full spectrum of total solutions including turnkey design-build solutions; and **John Meunier**, offering an extensive line of specialized equipment and processes for water and wastewater treatment.

Being Flexible While Creating Simplicity

We realize the value of being flexible, of creating simplicity, and of identifying, defining and selecting the solutions you need, and then providing you with a number of viable, strategic options. This creative approach, together with proven technologies, significant technical knowledge and related experience – plus a dedication to being a true solutions partner for the long term – allows us to best meet the ever-evolving needs of our customers. ■

OUR NEW PUBLICATION

Welcome To FLUENT LINES

WELCOME TO *FLUENT LINES*, a periodic report from Veolia Water Solutions & Technologies published for professionals like you – refiners and oil and gas producers who are highly active in improving the performance and efficiencies of key systems and processes at their facilities.

The success of many of these systems and processes relies heavily on both the volume and precise characteristics of a single constituent: *Water*. As maintaining water quality becomes more specialized and complex, useful and timely information about critical water quality solutions becomes increasingly valuable.

This is the reason we've created *FLUENT LINES* – to provide you with useful data, case studies, new technologies and technology applications, industry news and more.

We hope you find value in reading this issue of Veolia Water Solutions & Technologies' timely publication for the upstream and downstream industries. If you wish to continue receiving future issues of *FLUENT LINES*, please fill out and mail the enclosed postage-paid reply card today. ■

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VEOLIA WATER

Quality Water Essential As Feedstock For HPI

The increasingly proactive and progressive nature of refinery operations is having a huge impact on water and wastewater parameters, demanding innovative technologies and solutions.

MOST REFINERIES USE ABOUT the same amount of process and cooling water as the oil they process. And in this era of refineries continuously running at maximum utilization rates, it's more critical than ever that process water meet stringent parameters at all times. Disruptions or bottlenecks due to transient conditions in process water quality are unacceptable.

Also, many refineries view their final production step to be gasoline blending. Really the final step is wastewater treatment. Waste feed composition and quality coming into the back end of a refinery can vary all over the map. Because waste stream processing and wastewater treatment together constitute the last refinery process, it is essential that treatment systems and operating procedures be in place to effectively handle whatever they receive, to maintain throughput



Refiners today require water and wastewater technologies and solutions that go well beyond simply meeting regulatory compliance.

while maximizing recovery and reuse and to meet all safety, environmental and health parameters.

A refinery's core mission is separating crude oil into products that serve the marketplace and fill the need to improve quality of life. But the increasingly proactive and progressive nature of refinery operations resulting from today's market conditions is having a huge impact on water and wastewater parameters. It is vital that water-related processes and technologies have the capability to quickly and effectively handle the refinery's needs at all times.

Beyond Compliance

Refiners today require water and wastewater technologies and solutions that go well beyond simply meeting regulatory compliance, and many are looking to Veolia Water Solutions & Technologies because this is where we excel like no other. It is our core competency.

Refiners call on us for innovative solutions for the full spectrum of site-specific challenges. Some are short of water or have difficulties with their water supply, such as an unreliable water source or

quality that is too variable. Other refiners have significant water reuse needs – water is simply too valuable to discharge.

Other times, it's a process water quality issue, such as a refinery experiencing a chloride buildup affecting its sour water strippers. Or, wastewater from a decanter has suddenly spiked with a change in crude charges, disrupting the wastewater treatment system to the point it won't comply or even fails.

These are just a small sampling of instances where Veolia Water Solutions & Technologies has come in, identified a problem's source, defined and selected the best solutions, and then provided our customer with a number of sound, strategic options in which we have integrated economic, technical and operational evaluations.

A Firm Foundation

Advanced technologies, innovative engineering and design solutions, and world-class operations, maintenance and management expertise are the foundations of Veolia Water. Veolia Water Solutions & Technologies provides the hydrocarbon processing indus-

try the complete range of water and wastewater solutions, including feasibility and compliance studies, advanced water and wastewater treatment technologies and turnkey installations. Veolia

Water also offers waste stream recovery operations and strategic, long-term service partnerships. Our worldwide depth of resources and financial strength give us the ability to invest in growth – pursuing new processes and technologies to further create value for our HPI customers. Our financial strength also allows us to be highly creative and flexible in our approach to providing

the best technologies and solutions for our customers.

An Ever-Evolving Process

Process water is an expensive commodity for a refinery. Not fully meeting wastewater treatment parameters can also be very expensive. Optimizing and maintaining essential water and wastewater treatment is an ever-evolving process for refineries. Veolia Water Solutions & Technologies can provide all the necessary ingredients vital for success. ■

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It is vital that water-related processes and technologies are able to quickly and effectively handle the refinery's needs at all times.

TECHNOLOGY PROFILE

The ACTIFLO® Process: Key To Efficient High-Rate Clarification



ACTIFLO® is an extremely compact, high rate water clarification process that offers increased treatment capacity without the large surface area requirements of conventional flocculation/sedimentation systems. If you

need high-rate water clarification at your facility, Kruger has the answer – whether it be a pilot unit (*above*) for an on-site study; an ACP ACTIFLO package plant, with 10 different models engineered as compact modular systems to provide long-term, high-rate clarification (*see article, right*); or a turnkey solution, which Kruger designs, custom-engineers and constructs for your site.

Total clarification solution. ACTIFLO achieves top performance where it counts the most – small footprint, high quality effluent, stability and reduced chemical consumption.

HOW ACTIFLO® WORKS

The ACTIFLO® high-rate clarification process, developed and patented by Veolia Water Solutions & Technologies, consistently produces high quality water even in varying raw water conditions. The water first enters a flash mixing zone for the destabilization of colloidal material. Here, raw water is mixed with coagulant in a high mixing energy environment. Retention time is about two minutes.

The water then enters the injection tank, where micro-sand and polymer are added in a high mixing environment, also at a retention time of about two minutes.

Maturation Zone

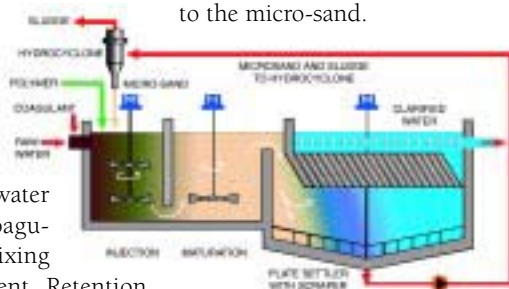
Following this, the water enters a maturation zone, which subjects the water to a more

gentle mixing energy and longer retention time: about six minutes. The longer retention time and lower energy mixing in the maturation zone allows the micro-sand ballasted flocs to grow bigger, so that they can trap random flocs and settle faster in the sedimentation tank. The polymer works like a glue to affix the flocs to the micro-sand.

Settling

The water then enters the settling tank where the micro-sand ballasted flocs settle out immediately, and the water counterflows up through settling tubes to collection troughs at the surface and exits the process.

The micro-sand and solids that settle out with the ballasted flocs are pumped from the



ACTIFLO® file photos

FITTING THE NEED

When a customer in St. James, La., recently needed to increase feed water volume for cooling tower operations, it ran into a potential problem. Expanded water clarification would be necessary to sufficiently remove solids from higher volumes of raw surface water, but the site did not have enough land available to add another conventional clarifier.

The solution was the installation of an ACP 750 ACTIFLO® package plant from Kruger, a VWS company. This compact clarification system uses micro-sand as a seed for enhanced floc formation combined with rapid settling (*see "How ACTIFLO Works," left*).

Small Footprint

The rapid settling characteristics of the sand-ballasted floc allow for designs with high overflow rates and short retention times. It also provides for designs with system footprints typically between five and 20 times smaller than conventional clarification systems of similar capacity. These special attributes provided the precise solution to the

Louisiana plant's need for higher feed water rates under extremely tight site conditions.

Highly Clarified Water, Fast

Raw water turbidities from the Mississippi River (the plant's water source) can often run as high as 400 NTU. The ACTIFLO system effectively reduces these turbidities to an average of only 2 NTU, while producing up to 3.85-million gallons per day (MGD) of highly clarified feed water with very low total suspended solids to serve the plant's expanded cooling water needs.

The ACTIFLO system reacts quickly to changes in raw water quality, providing consistently high quality feed water to the cooling towers. Plus, the interval between process start-up and steady-state conditions is only 10-15 minutes. ■

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While the plant's raw water turbidity can be as high as 400 NTU, the ACTIFLO® system rapidly produces cooling tower feed water with turbidity less than 2 NTU.

bottom of the settling tank to a hydrocyclone, where the micro-sand is cleaned from the solids by centrifugal force. The solids are continuously removed, whereas the micro-sand is reinjected back into the ACTIFLO system and continuously recycled.

The ACTIFLO process is an ideal solution for treating raw surface water and for recycling valuable process water, providing boiler feed, product water and cooling tower make-up water for hydrocarbon processing and oil and gas production applications. ■

How Well Does Your Refinery Handle Oily Wastes?

Today's high crude prices make it critical that every possible ounce of hydrocarbons be squeezed out of feedstock. Many refiners are turning to Veolia Water to maximize oil recovery from their waste streams.

SKYROCKETING CRUDE PRICES HAVE BEEN compounding the many challenges presented by operating at maximum capacities and dealing with heavier feedstocks. This is giving renewed meaning to the term "black gold," and making it more critical than ever that refineries squeeze every ounce possible out of their feedstock. It's also placing increasing performance demands on the back end of the refinery – on waste stream processing, recycling and recovery operations.



Role in profitability

Oily wastes have long brought high economic costs for refiners from an environmental compliance standpoint. But now, gaining maximum recovery from oily waste streams is playing an increasingly significant role in profitability. Because a certain amount of oil goes out in waste streams, this valuable raw material must be recovered to the

maximum extent possible and returned to the front end of the refinery. "Back-of-the-refinery" recovery operations are becoming increasingly critical as feedstock prices climb.

Process Solutions, a division of Veolia Water North America Operating Services, LLC, provides customers with custom-tailored oily residual waste stream processing, recovery and recycling solutions. This often involves the design, construction, ownership and operation of state-of-the-art and proprietary waste processing technology and equipment. Currently, 23 refinery sites rely on Process Solutions to carry out critical back-of-the-refinery operations.



At the Flint Hills Resources West Plant in Corpus Christi, Texas, Veolia Water handles all the refinery's waste streams. In addition to oil recovery, a slurry is prepared that is sent to the facility's coker unit for injection into its quench cycle, eliminating expensive off-site disposal.

Custom Solutions

At **Marathon's** Garyville, La., refinery, waste recovery operations have been carried out by Veolia Water since 1991. A waste recovery system, installed on-site and operated by Veolia Water personnel, includes an integrated, three-phase oily waste processing system combining centrifugal technology for sludge dewatering and oil recovery with thermal desorption for containment separation and recovery. An estimated 260,000 barrels of oil have been recovered from wastes at the site.



Many refinery sites rely on Veolia Water to carry out waste stream processing, recovery and recycling operations.

At the **Flint Hills Resources** West Plant, in Corpus Christi, Texas, Veolia Water handles all the refinery's waste streams. Through advanced treatment technologies, the components of oily wastes are separated out for oil recovery and waste recycling. Veolia processes API separator sludge to create a slurry that is sent to the facility's coker unit for injection into its quench cycle, eliminating

expensive off-site disposal and allowing recovered materials to be recycled for use in the refinery.

At the 170,000 bpd **Valero** Refinery in Lima, Ohio, Veolia Water has provided a service that has reclaimed approximately 200,000 bbls of recovered oil annually. In doing so, Veolia Water has also reduced the facility's off-site solid waste disposal.

A Strategic Decision

In dealing with oily residuals, technical and operating experience, advanced technologies, and knowledge of regulatory procedures are paramount to maintaining throughput while maximizing recovery and reuse and meeting the necessary environmental parameters.

The decision to have Veolia Water assist in waste stream recycling and disposal functions is a strategic one – often made by a refinery so it can better focus its efforts on its core mission as profitably as possible. This, together with cost savings, technical expertise, and advanced technologies, are today making refinery waste stream solutions from Veolia Water a compelling strategy. ■

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VEOLIA WATER
Solutions & Technologies™
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FLUENT LINES is published by Veolia Water Solutions & Technologies. For more information regarding technologies and services discussed in this publication, please fill out and mail the enclosed postage-paid reply card. Or contact:

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VEOLIA WATER NEWS BRIEFS

HOUSTON, TEXAS

Refinery Industry Veteran Joins Veolia Water Solutions & Technologies

Refinery industry veteran Dee Christopher has joined Veolia Water Solutions & Technologies' Oil & Gas team. He comes to VWS with more than 21 years of service in the refinery industry, bringing significant experience in process engineering, refinery economics, operations, supply and distribution. Christopher has previously served as process superintendent in charge of all refining operations, and plant manager, responsible for total facility performance, for Pennzoil.



Christopher's extensive experience with multi-facility operational and strategic planning in the industry will further enhance the role of the Oil & Gas team, which has been established to provide a focal point for commercial and technical coordination between Veolia Water business groups in North and South America. ■

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ALBERTA, CANADA

Two Technology Solutions For SAGD Produced Water Recycling

The tar sands of Alberta, Canada, hold more than 900 billion barrels of oil reserves. As much as 20 percent of this oil is recoverable directly through mining. Steam Assist Gravity Drainage (SAGD) is an alternative method to recover oil too deep to mine. SAGD projects require large amounts of water for high-pressure steam generation to assist in producing the low API crude.

Recycling produced water for steam generation can be an economical advantage for SAGD projects. Veolia Water Solutions & Technologies offers two very different technology options for effectively accomplishing this. One option treats produced water



Suncor Energy Inc.

through a series of chemical treatment steps to bring its quality up to meet the requirements of a once-through steam generator. The other option allows for the use of a relatively inexpensive and available boiler, instead of a steam generator, to provide the required process steam. Rather than undergoing all the rigorous chemical treatment steps involved with serving a steam generator, the produced water instead enters an evaporator where approximately 80 percent of it becomes high quality water that serves the boiler.

Both options for recycling SAGD produced water have certain advantages, and we'll soon be telling you more about these options and their benefits in a future issue of *FLUENT LINES*. ■

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CARLSBAD, NEW MEXICO

Project To Show How Produced Water Reuse Can Benefit State

Veolia Water is carrying out an innovative water reuse demonstration project, commissioned by a grant from the State of New Mexico, aimed as an initial step in helping the state potentially ensure future compliance with its annual compact for water delivery obligations to the State of Texas.

Several energy companies that operate in southeast New Mexico separate produced water and reinject it back to its source. This area of the state suffers tremendous water shortages, and the project's goal is to determine if this produced water can be treated to the point that it would be acceptable for discharge into the Pecos River.

The project is very important to the state. The Pecos River flows into the Rio Grande of Texas, and the river and lands within its watershed have a long and well-documented history as a regional economic development resource with environmental issues. This river is the water delivery point in the compact between New Mexico and Texas.

Veolia Water is preparing a pilot-scale mobile treatment system that will treat the produced



water using a variety of different processes, including induced gas flotation, walnut shell filtration, two-stage softening and reverse osmosis – to demonstrate it can attain the necessary water quality parameters. We'll post the results of this important project in a future edition of *FLUENT LINES*. ■

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HOUSTON, TEXAS

Lankford Moves To Houston Office To Serve As Oil & Gas Team Leader

Perry Lankford has moved to the Houston office of Veolia Water Solutions & Technologies to serve as Director of the Oil & Gas team. Lankford was originally brought on board in 2001 to be responsible for the industrial sales and industrial process engineering groups. Lankford has more than 30 years of water industry experience. Prior to joining VWS, he served as director of industrial environmental services at Black & Veatch, where he was responsible for the industrial water and wastewater business. In addition, he spent 21 years overseeing industrial wastewater treatment, groundwater treatment and toxicity reduction for Eckenfelder Inc. ■



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COMING SOON

Some Of What You'll See In Upcoming Issues of *FLUENT LINES*

- Advanced ion exchange technology improves performance for two Bakersfield, Calif., producers.
- Optimizing efficiencies through advanced filtration of FCC scrubber water.
- Technology Profile: Auto-Jet®, a premium, self-cleaning leaf filter engineered for filtration efficiency.

To receive your next issue of *FLUENT LINES*, please make sure to complete and mail us the enclosed postage-paid reply card today. ■

ENGINEERED SOLUTIONS

Engineered To Innovate: Broad Depth In Water And Wastewater Solutions Delivery

Veolia Water Solutions & Technologies possesses the engineering experience and related talent to provide solutions that best meet specific water challenges.

CUSTOMERS ARE FINDING THEY can best concentrate on their core missions, reduce expenditures and risk, and increase facility reliability by utilizing the core competencies of Veolia Water Solutions & Technologies.

One of our key core competencies is in design and turnkey services for petroleum refinery and oil and gas production water projects ranging in scope from feasibility studies to the design, construction management and operation of multi-million dollar water and wastewater treatment systems. Veolia Water Solutions & Technologies possesses the engineering experience and talent to develop solutions to best meet specific water challenges – whether they be with produced water, process water or wastewater.

Within the refinery, in-depth experience allows us to assess various waste sources and develop an

engineered solution providing wasteload reduction, segregated treatment, direct water reuse and materials recovery (see related article, page 3). We also develop turnkey solutions to best meet a refiner's precise process water treatment and conditioning requirements – for optimizing boiler feed water, for example, and cooling tower makeup.

For producers, we can develop water solutions to meet the most demanding requirements, including treating produced water to the point that it can be safely discharged into sensitive receiving waters rather than reinjected into the ground (see New Mexico article, page 4).

Feasibility Studies

Veolia Water Solutions & Technologies conducts feasibility studies and water and wastewater treatment facility evaluations that collect and analyze data and make recommendations for modifications and operating strategies to improve treatment performance and safety.

erating strategies to improve treatment performance and safety.

Design-Build Solutions

Having Veolia Water Solutions & Technologies provide design-build water and wastewater solutions



Veolia Water Solutions & Technologies provides proven, turnkey water and wastewater solutions to refiners and oil and gas producers.

can bring cost efficiencies as well as fast track, turnkey delivery of critical projects. We bring together all the necessary ingredients – the most appropriate technologies, engineering expertise and stringent construction management to ensure a successful water and/or wastewater treatment program for our customers. ■

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Our broad technological capabilities and applications experience provide key advantages.



HPD

HPD is a global leader in evaporation and crystallization technology, providing systems that recover valuable products and by-products, reclaim water, or reduce effluent volume. (815)609-2000



JOHN MEUNIER

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N.A. WATER SYSTEMS

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WASTEWATER, PROCESS WATER, AND PRODUCED WATER SOLUTIONS FOR OIL & GAS PRODUCERS AND HPI

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Please have a Veolia Water Solutions & Technologies representative contact me.

Send me more information (check the appropriate boxes, below):

- HPI Technologies and Solutions. Produced Water Technologies and Solutions.
- Waste Stream Processing, Recovery & Recycling Operations.
- Engineering Solutions. Actiflo® High-Rate Clarification.

Confidentiality Statement: All information will be kept confidential and will not be given or sold to any third-party outside the Veolia Water organization.

Name _____ Title _____

Organization _____ E-Mail _____

Address _____ City _____

State _____ Zip _____ Country _____ Telephone () _____

Please tell us about your special needs and/or challenges for process water or wastewater treatment:



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