

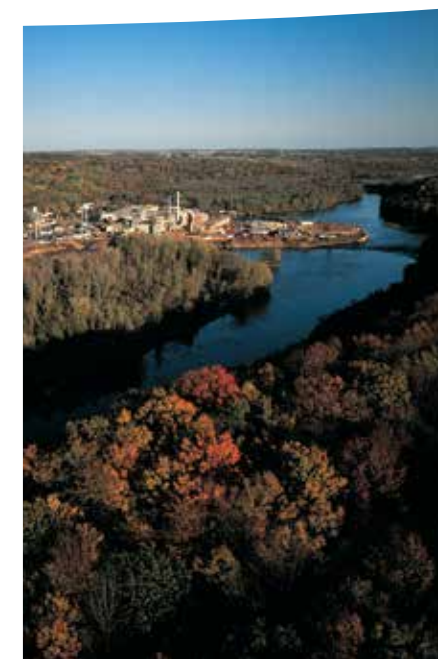


NALCO Water Innovation Delivers Value

for the alumina industry

Nalco Innovation Delivers Value for the alumina industry

Today's alumina processing industry is constantly challenged to improve safety, profitability, efficiency, product quality and environmental performance. Nalco combines global leadership, years of industry experience, innovative technologies and local expertise to deliver the results you need.



Your goals are our goals

Nalco partners with alumina processors worldwide to deliver economic and environmental value, through our reliable, cost-effective and safe solutions. We help you:

Place safety first

- ◆ improve environmental safety
- ◆ establish and practice safety culture at all levels



Increase profitability

- ◆ Increase yield/recovery
- ◆ optimize plant performance
- ◆ reduce total cost of operation (TCO)



Improve efficiency

- ◆ increase throughput
- ◆ automate operations
- ◆ reduce downtime



Improve quality

- ◆ improve precipitation - crystal growth modifiers (CGM)
- ◆ improve solid/liquid separation - automation, flocculants
- ◆ control moisture - dewatering aids



Meet environment, health and safety standards

- ◆ conserve energy - CGM, hydrate flocculant, antiscalant
- ◆ reduce water consumption - residue/tails management, water treatment
- ◆ meet EH&S standards and regulations - dust control, non-dangerous, biodegradable chemistries



Your partner for sustainable growth

Nalco is an Ecolab company. Ecolab is the global leader in water, hygiene and energy technologies and services that protect people and vital resources. Ecolab delivers comprehensive solutions and on-site service to promote safe food, maintain clean environments, optimize water and energy use and improve operational efficiencies for customers in the food, healthcare, energy, hospitality and industrial markets in more than 170 countries around the world.

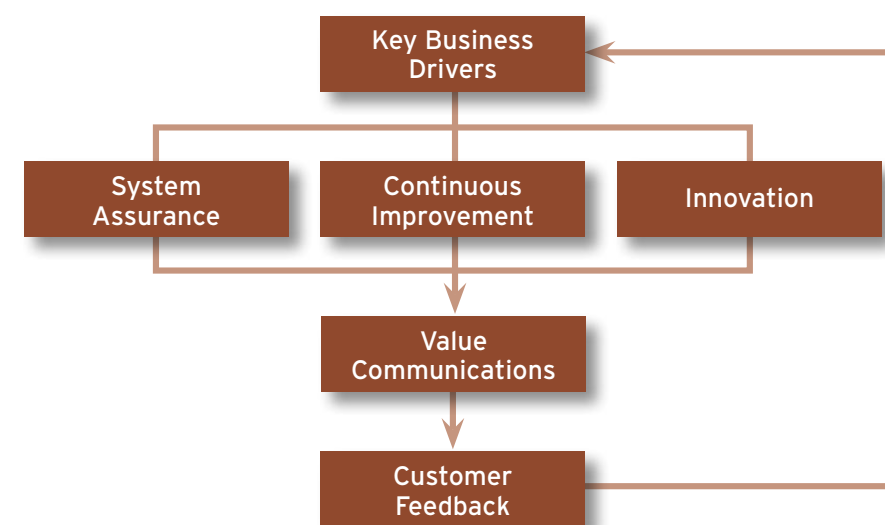
With an 80-year track record, Nalco is the world's leading process and water treatment solutions provider. Our innovative solutions are carefully designed to deliver significant economic and environmental value. Supported by a comprehensive network of supply chain facilities and research centers, our global presence enables us to offer a consistently high level of programs and services to local, regional and multinational customers.

Water plays a critical role in virtually all mining and mineral processing activities. In the context of decreased availability and growing demand, water has become a strategic resource. Alumina processors now require solutions that demonstrate sustainable ongoing water management. Our mining process technologies and application expertise, coupled with our core water treatment knowledge, make Nalco the perfect partner to assist with all aspects of sustainable water use.



CMV process

Using our CMV (communicating & maintaining value) process, our local account team works directly with you to prioritize your needs. We work with your technical and operations personnel to develop a service and improvement plan to deliver maximum performance from your existing applications. We leverage industry experts, process and technologies in a manner that is tailored to your operations and key business drivers.



Complete solutions to your challenges

We deliver comprehensive customized solutions including chemicals, equipment and services:

- ◆ Bauxite flow improvers and dust control
- ◆ Mud thickening, liquor clarification and mud washing
- ◆ Scale control
- ◆ Liquor organics (humate) removal
- ◆ Liquor filtration
- ◆ Trihydrate yield increase and sizing control
- ◆ Oxalate control
- ◆ Foam control
- ◆ Trihydrate classification, slurry pumping and dewatering
- ◆ Tails management
- ◆ Boiler and cooling water treatment
- ◆ Integrated Water Management (IWM)
- ◆ Dosing and monitoring equipment
- ◆ Engine coolants

Industries we serve

- Alumina
- Coal
- Copper & base metals
- Gold, silver & platinum
- Industrial minerals
- Iron ore
- Phosphate & potash
- Sand, gravel & aggregate

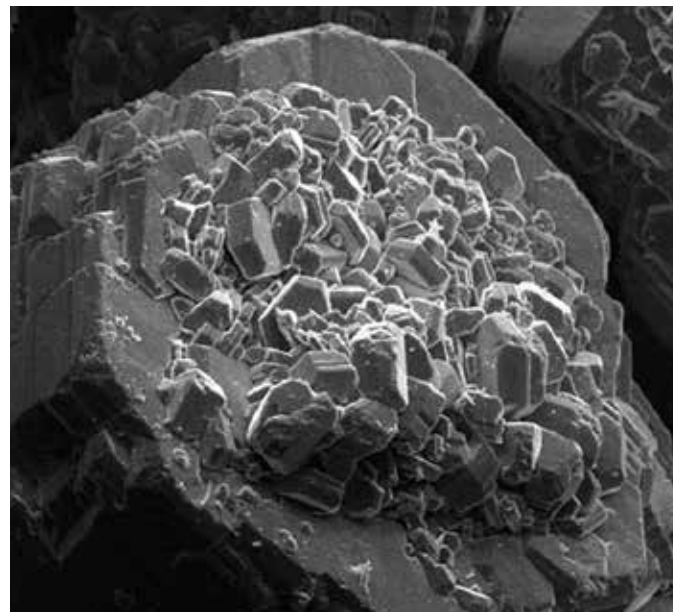
Innovation at Nalco

At Nalco, we recognize that innovation is key to the future. While we are proud of having developed and implemented a large percentage of the chemical technologies employed in the industry today, we understand that a company can never rest on past successes. We continuously strive to advance these innovations and provide even more effective solutions.

In our commitment to addressing your challenges, we place great emphasis on R&D. Our carefully assembled teams of over 600 researchers, including 330 PhDs, drive our customer-focused technical research centers across the globe: in Naperville USA, Leiden Netherlands, Singapore, Perth & Sydney Australia, Shanghai China and Pune India.

Our latest technologies:

- ◆ RRA™ and RRX™ red mud flocculants
- ◆ HyClass™ hydrate classification technologies
- ◆ CGMax™ high performance crystal growth modifiers
- ◆ DustBind™ Plus dust control programs
- ◆ SCALE-GUARD™ washer scale control programs
- ◆ PowerDry™ trihydrate dewatering aids
- ◆ FoamGuard™ foam control programs
- ◆ RMT™ red mud rheology improvement and clarification aids
- ◆ FilterMax™ hydrate and seed filtration aids
- ◆ 3D TRASAR™ water management and automation



RRA and RRX red mud flocculants

RRA and RRX polymers are part of Nalco's latex flocculant range specifically designed to meet the challenges that the alumina industry faces in managing deteriorating bauxite resource quality. These chemistries offer optimized dispersion and functional group incorporation to ensure maximum fines capture of iron and silica, positively impacting:

- ◆ security filtration operation, capacity and costs
- ◆ alumina and soda losses
- ◆ settling and washing vessel life
- ◆ maintenance cost and energy consumption
- ◆ red mud disposal

HyClass hydrate classification technologies

HyClass trihydrate flocculant technology range has been specifically designed to achieve a new level of performance in hydrate classification, improving productivity and reducing TCO.

- ◆ greater fines capture boosts production
- ◆ faster settling rate improves throughput
- ◆ improved underflow rheology increases productivity
- ◆ reduced scaling extends vessel life

CGMax high performance crystal growth modifiers (CGM)

Nalco's CGM and new CGMax programs are specifically designed for use within the precipitation circuits of the Bayer process of alumina. These additives provide additional control of agglomeration and nucleation mechanisms, positively impacting:

- ◆ final product sizing control
- ◆ liquor yield
- ◆ hydrate classification
- ◆ oxalate interference control

DustBind Plus dust control programs

Nalco's dust control aids are used across a broad range of industries to reduce the health and safety hazards related to dust. Application of Nalco DustBind Plus on dried red mud disposal areas has demonstrated superior effectiveness compared to the application of water alone.

- ◆ reduced dust formation
- ◆ increased water savings

SCALE-GUARD washer scale control programs

Nalco SCALE-GUARD washer scale control programs have been designed to reduce scaling rates, increase tank availability, extend vessel life and reduce cleaning downtime. Scale reduction is achieved by improving liquor clarity and increasing liquor stability within the tank to reduce its propensity to auto precipitate.

- ◆ reduced maintenance costs
- ◆ reduced alumina and caustic losses
- ◆ potential plant A/C increases without additional press floor scaling

FoamGuard foam control programs

Nalco's new FoamGuard technology was developed for both hot-end and cold-end applications to prevent foam formation and stabilization in critical parts of the Bayer process circuit. FoamGuard technology range has been specifically designed to achieve a new level of performance in foam prevention resulting in improved productivity and reduced TCO without any downstream impact.

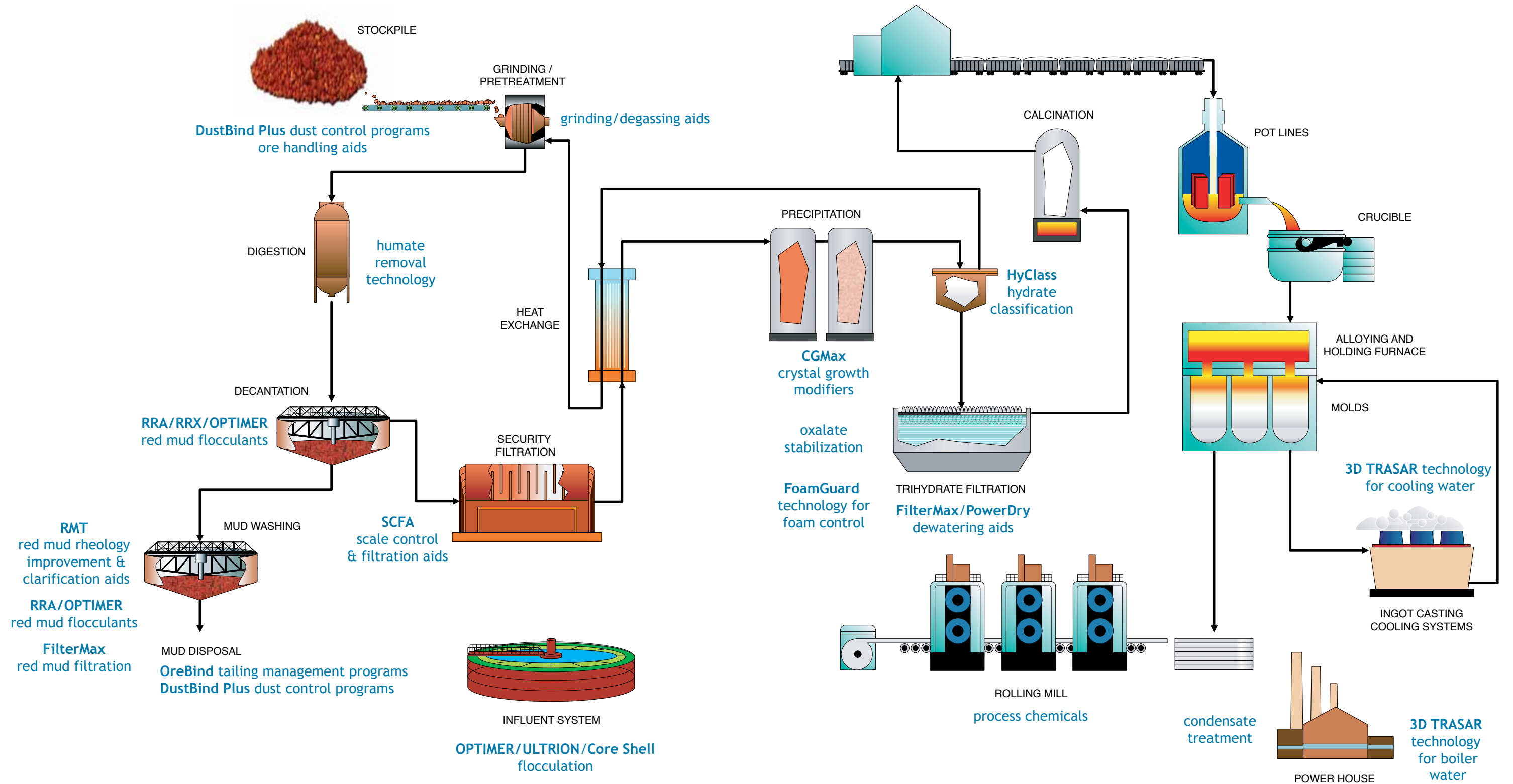
- ◆ improved refinery flow control
- ◆ reduced solids carryover in classification
- ◆ improved precipitation operations by improving heat transfer
- ◆ eliminated safety hazards due to foam overflow

3D TRASAR water management and automation

3D TRASAR technology is Nalco's integrated approach to water management, delivering optimized, cost efficient and sustainable solutions to provide peace of mind. Combining Nalco's unique chemistry with real-time monitoring tools enables a quick response to cooling water, boiler and reverse osmosis (RO) system problems, reducing TCO.

- ◆ real-time monitoring and control
- ◆ water and energy savings
- ◆ asset protection and plant reliability

Nalco innovation delivers value



Solutions for the alumina industry

Trihydrate CGM programs

- Control particle sizing
- Control secondary nuclei generation
- Aid cementation to reduce particle breakdown (attrition)
- Improve precipitation control
- Enable plants to operate under high yield conditions without compromising product sizing
- Increase product yield and quality

Trihydrate flocculants for classification circuit

- Improve overflow clarity
- Increase settling rate
- Improve underflow rheology
- Reduce scaling
- Improve productivity and reduce application costs

Oxalate stabilizers

- Improve oxalate control
- Minimize sizing and soda issues due to solid oxalate in the process
- Stabilize oxalate in solution for all or part of the precipitation process
- Allow oxalate precipitation in side stream oxalate removal plants

Foam control agents

- Reduce foam in precipitation and red mud residue areas
- Eliminate hazards due to foam overflow
- Improve solid/liquid separation
- Reduce solids carryover in clarification
- Improve precipitation operations
- Improve yield

Security filtration additives and scale control

- Prevent undesirable alumina trihydrate precipitation
- Maintain flow rates by inhibiting scale deposition
- Improve filtrate quality, reducing downtime due to filter blinding
- Increase liquor filtration rates and filter cycle times
- Reduce TCA dose without sacrificing filtration rates or cycle times
- Reduce maintenance costs

Flocculants for decanters/settlers and washers

- Increase mud compaction and alumina recovery
- Reduce energy consumption
- Extend vessel life
- Increase alumina production
- Increase soda recovery
- Improve residue disposal management
- Reduce red mud separation costs

Humate removal aids

- Control overall circuit liquor humate levels (HMW organic impurities)
- Improve mud settling behavior
- Reduce foam generation
- Increase plant productivity

Bauxite handling aids

- Manage feed bauxite moisture problems
- Improve bauxite handling (transport/storage silos)
- Increase grinding mill throughput

Tails/residue management programs

- Address tails storage facility (TSF) limitations
- Enable rapid water recycling
- Reduce capital expenditure on TSF
- Improve site closure options
- Extend TSF life

Dust control programs

- Improve safety and visibility on roads, conveyor systems, transfer areas, etc.
- Reduce or eliminate impact on community
- Provide safe work environment
- Conserve water
- Recover value of previously lost dust particles
- Reduce road maintenance, labor and equipment costs

Scale/corrosion control programs

- Minimize corrosion, prevent scale and other deposits
- Minimize risk and enhance reliability
- Improve steam quality, cycle reliability and capability
- Reduce water usage and TCO

Integrated Water Management (IWM) programs

- Enhance water management efficiency
- Increase reuse and recovery of water
- Improve product yield due to higher quality process water use
- Reduce TCO

Filtration/dewatering aids

- Optimize cake moisture and handleability
- Improve cake drainage by increasing cake voidage
- Improve filtration quality, reducing downtime
- Increase throughput

Value delivered

RRA reduces soda consumption by 5,000 TPY

A major alumina refinery consulted Nalco about increasing underflow density and reducing NaOH (caustic soda) consumption. Following a thorough audit, Nalco proposed using RRA flocculant polymer technology to replace the conventional flocculant. Benefits were observed almost immediately. After only minor dose optimization, the customer reported improvement in average underflow densities as well as security filtration performance. Soda consumption reduced by 5,000 tons per year from increasing decanter underflow mud density by 11-18 percent on a g/L solids basis (or 2-3 percentage points). RRA flocculant dose was 20-30 percent lower. Vessel stability was maintained with no change in liquor filtration. The customer also achieved improvements in underflow density, vessel life and throughput and significant cost savings from reduced soda and flocculant consumption.

RRA program reduces flocculant usage by 35%

A refinery customer processing Jamaican bauxite was operating an ultra high-pressure decanter. The customer required a shear-resistant, quick-acting, and efficient flocculant, capable of withstanding the stresses of a rise rate above 40 m/hr. After consultation with Nalco's team, the refinery switched to Nalco's new RRA program. Following application, flocculant usage dropped by 35 percent. The customer also reported more consistent vessel operation and control and a significant reduction in the amount of topside scale. The customer is now also evaluating the potential for increasing underflow solids.

CGM program helps sizing control and boosts production

An alumina refinery in Asia Pacific was experiencing problems with unacceptable fines generation in the precipitation circuit. Following a thorough plant evaluation, Nalco recommended implementation of a tailored CGM regime. Combined with careful process changes, the program successfully agglomerated the fine material in the circuit, eliminated the root cause of the fining episode and prevented further fine particle generation. Nalco's CGM program rapidly re-established particle size control in the plant. Recognizing CGM's potential for enhancing production, refinery management altered process conditions to favor higher production. Although this action typically results in unacceptably fine product, ongoing program application maintained sizing within required specifications. The customer not only resolved the sizing crisis but also achieved an increase in production.

SCALE-GUARD reduces scale by 50% and increases vessel life

An alumina refinery was experiencing scale build-up on the tank walls, feedwell and rake mechanism which was decreasing front washer online time. The customer sought to reduce the scaling rate and maintenance efforts during turnaround. After consultation with Nalco, SCALE-GUARD was dosed in conjunction with the existing flocculant. Following program application, scaling reduced by approximately 50 percent. Rake torque stayed relatively constant through vessel life due to the minimized scale buildup which also improved vessel stability and underflow density. Remaining scale was more brittle making it easier to remove. This scale reduction increased vessel online time by 20 percent, which in turn reduced maintenance cost and improved efficiency.

HyClass technology cuts cost and improves solids capture by up to 40%

A refinery's productivity was suffering due to heavy solids losses from poor overflow clarity and underflow rheology. After trying various hydrate flocculants, the customer converted to HyClass. HyClass application resulted in a consistent improvement in fines capture, faster settling rates and improved underflow rheology (higher underflow densities with excellent pumpability). HyClass yielded the same overflow solids as the former product - but at only 60 percent of the dose. At the same dose as the former product the overflow solids were reduced by 50 percent. The technology also extended equipment life, including rakes and vessels. Scale build-up was virtually eliminated from processing equipment, which in turn reduced maintenance costs and extended time between major rebuilds, all of which contributed to greater productivity.

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