

# Processing High Acid Crudes Reliably with Nalco Water's Scorpion™ Program Refiner Realizes over \$59 Million in Increased Profits



## BACKGROUND

A refinery in Asia was originally designed to process conventional crude oils with a Total Acid Number (TAN) under 0.3 mg KOH/g. For various reasons there was an extended delay in the commissioning of the refinery - almost sixteen years. When finally commissioned, the refining scenario was totally different, with unacceptably low refining margins. To continue operating economically, the Refiner was considering all available options to improve profitability. The refining capacity was increased to obtain economies of scale. Complexity was raised by adding conversion units to increase profitability by upgrading residual streams. These measures increased profitability. However, the refining margin was still not up to expectation.

To further improve profitability, the Refiner opted to process High Acid Crudes (HACs). HAC's are discounted versus conventional crude oils due to their acidity and associated corrosion potential. The price differential during this period varied in the range of \$1 to \$6 per barrel. Because of the corrosion risks to the reliability of the refinery, they could only process a limited quantity of HACs in the crude mix. Full advantage of the crude price differential may not be taken advantage of.

## SOLUTION

Knowing that Nalco Water has been helping refiners globally to process HACs with a track record of no corrosion failures since 1982, the Refiner contacted Nalco Water. A Nalco Water expert conducted a detailed Risk Assessment at the refinery. This assessment takes into account all factors affecting corrosion due to HACs such as, but not limited to TAN, sulfur content, temperature, flow velocity and turbulence and metallurgy. The risk assessment classifies corrosion risks in each section of the involved operating units as low, moderate or high and provides recommendations to deal with each category.

| PROBE LOCATION DETAILS |             |             | CORROSION RATE |
|------------------------|-------------|-------------|----------------|
| No.                    | Service     | Type        | MPY            |
| 1                      | HK PA line  | Cieon Probe | 3.38           |
| 2                      | LGO PA line | Cieon Probe | 5.82           |
| 3                      | HGO PA line | Cieon Probe | < 1            |
| 4                      | RCO line    | Cieon Probe | < 1            |
| 5                      | RCO line    | Cieon Probe | < 1            |
| 6                      | LVGO line   | Cieon Probe | 0.118          |
| 7                      | LVGO line   | Cieon Probe |                |
| 8                      | HVGO line   | Cieon Probe | 2.32           |
| 9                      | HHVGO line  | Cieon Probe |                |
| 10                     | HHVGO line  | Cieon Probe | < 1            |
| 11                     | HHVGO line  | Cieon Probe |                |
| 12                     | VR line     | Cieon Probe | 2.36           |
| 13                     | VR line     | Cieon Probe |                |

## ANNUAL SAVINGS



## ASSETS

Improved asset reliability  
**\$59,160,000**



## TOTAL VALUE DELIVERED

**\$59,160,000**

Based on the risk assessment and survey of the unit, detailed recommendations for corrosion monitoring and chemical inhibition were developed, incorporating Nalco Water Best Practices for HAC processing. The Refiner implemented these recommendations in partnership with Nalco Water's site team. With these in place, the Refiner has been processing HAC for eighteen months to date. Crude TAN as high as 0.9 mg KOH/g and side stream TANs up to 1.8 mg KOH/g has been processed while maintaining corrosion rates at low levels.

## RESULTS

After proper chemical passivation, Nalco Water's Scorpion HAC program was started. The first batch of HAC was successfully processed and the system health reviewed by Nalco Water HAC experts. Low corrosion rates of 3 to 5 MPY were consistently recorded by carefully placed corrosion probes and FSMs – 110 monitoring locations in total. With continuous monitoring, chemical inhibition and regular expert reviews, the Refiner increased the proportion of HACs in the crude mix, improving refining margins. Till date, HAC has been processed for eighteen months. Corrosion rates from probes and FSMs remain low. These low rates were confirmed with regular Ultrasonic Thickness gauging conducted by the Refinery Inspection Department.

Almost 60 million barrels of HACs have been processed till date. With a discount of \$1 to \$6 per barrel versus conventional crude oils, the Refiner has realized over \$59 million in increased profits while maintaining the reliability of the process units.

## CONCLUSION

In the current competitive and difficult refining environment, one immediate option of increasing profitability is through the processing of discounted HACs. While some refiners have not taken up this option due to the negative impacts on refinery reliability, others have significantly increased their refining margins by running HACs.

Nalco Water is the pioneer in developing and providing comprehensive HAC programs globally. Since 1982, no refinery utilizing Nalco Water's Scorpion Program has ever had a HAC related failure. This is proven technology. The \$60 million increased in profits in this case is just one among many.

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