



DOWNSTREAM SOLUTIONS

Unique solutions.
Significant value.
Enable clean energy.

With the right strategy, the right technology, and the right team, we are taking energy forward by developing novel solutions that deliver significant value for our customers.

Utilizing a combination of tools and expertise from our diverse portfolio and include offerings that entail Chemistry, Mechanical Solutions, and Technical Expertise.

ALCHEMIA™

BIOQUEST™

DEMANDTRAC™

FLO NOW™

LIFESHIELD™

LIFESPAN™

SMARTGUARD™ 2820

SPECTRACLEAR™

TOPGUARD™

CRUDE OIL
MANAGEMENT™

ALCHEMIA™ contaminant removal >

ALCHEMIA™ solid removal

ALCHEMIA™ sulfur removal

BIOQUEST™ renewable fuel technologies

DEMANDTRAC™ tagged polymers for scale control

FLO™ NOW instant drag reduction

LIFESHIELD™ non P corrosion inhibitor for cooling towers

LIFESPAN™ blending model

SMARTGUARD™ 2820 low phosphorous corrosion control inhibitor

SPECTRACLEAR™ greener option chemistry for wastewater treatment

TOPGUARD™ corrosion risk monitor

TOPGUARD™ field amine monitoring

TOPGUARD™ overhead corrosion control

TOPGUARD™ 1130 salt control

TOPGUARD™ spray modeling

Crude Oil Management™

Maximize the value of your hydrocarbon stream with reliable contaminant removal solutions

- Access to a wide range of filtration technologies that include a variety of media
- Access to the largest fleet in North America
- Utilize our in-house and strategic partner's technical expertise to provide solutions quickly
- Mobilize quickly to address challenges
- Utilize our wide range of chemistries to supplement where needed
- Address many applications such as fuel quality, water purification, intermediates, and other hydrocarbon and water streams
- Remove varying particulates, color bodies, entrained water
- Ability to process a wide range of volumes through our media

ALCHEMIA™
contaminant removal solution



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Crude Oil Management™



Upgrade products and penetrate more profitable markets while reducing costs associated with high metal content and eliminating tank containment bottlenecks

- Lower quality feedstocks can improve refinery profits
- Address elevated levels of ash, aluminum, and silica content in slurry feed which can hinder the performance of downstream units, limit profit improvements
- Process solutions to improve slurry quality to be more reliable and efficient as feed content changes
- Treat live tanks and avoid associated unit shutdowns or tank containment
- Extend time between tank cleanings
- Improve operations at renewable diesel facilities, and novel bench scale plant to determine system requirements and performance

ALCHEMIA™

solids removal

VIEW CASE STUDY

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solids removal

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CASE STUDY: NORTH AMERICA REFINERY

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Baker Hughes efficiently improves slurry oil quality to boost refinery processing flexibility and profitability

90%
reduction of
ash content

~ \$8-10/bbl
ash removal yielded
incremental value

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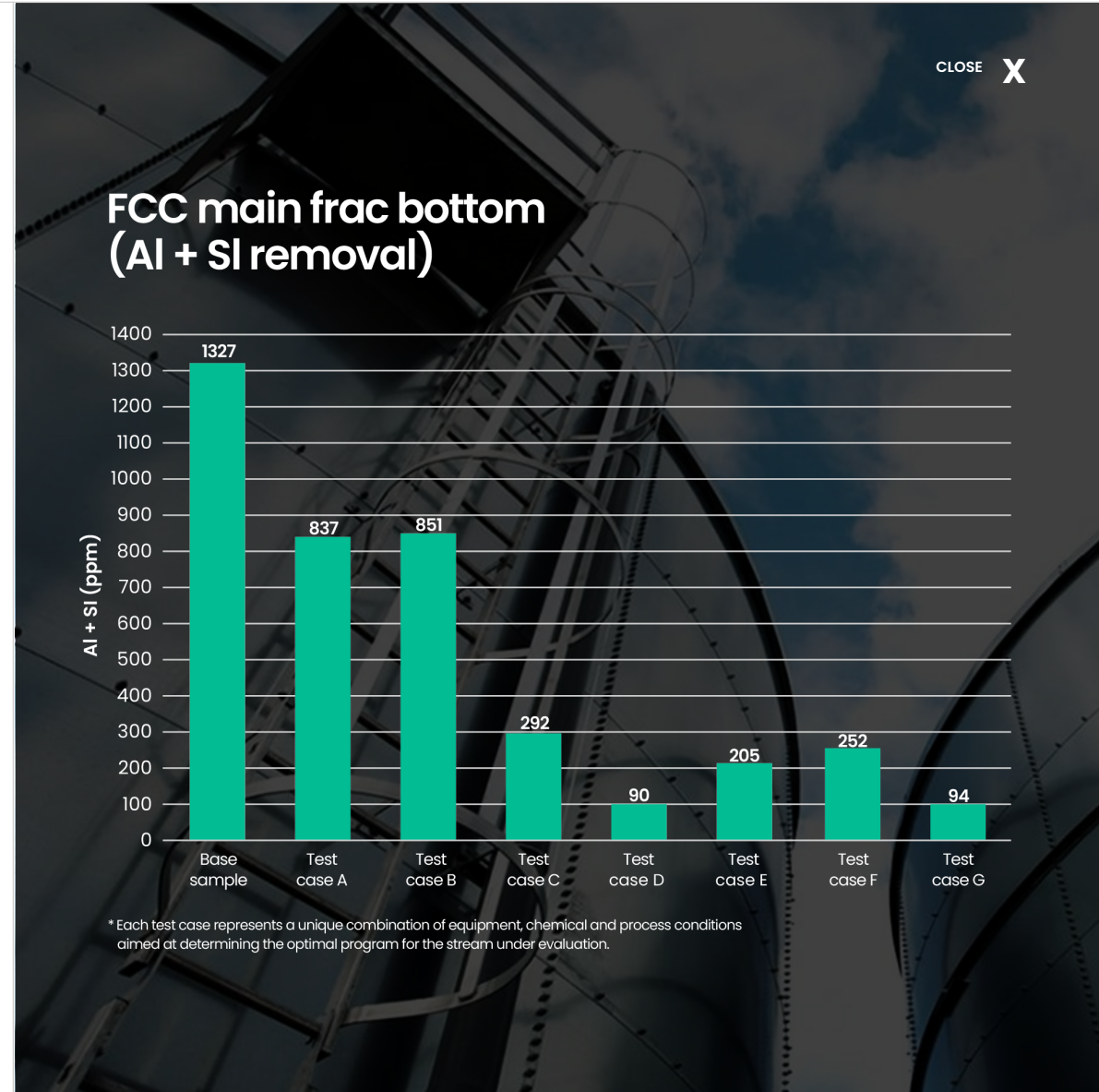
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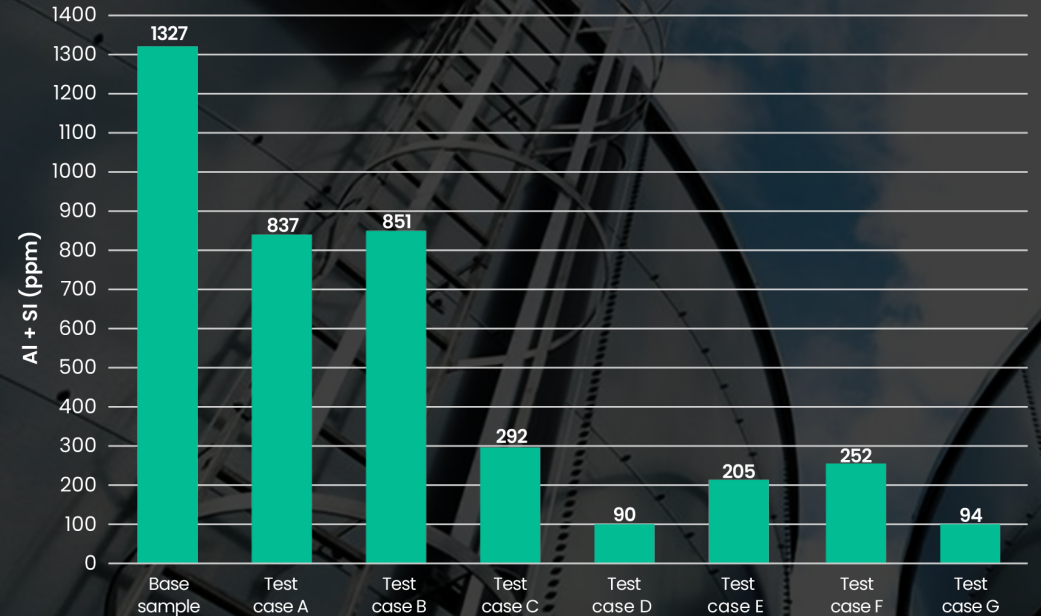
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FCC main frac bottom (Al + Si removal)



* Each test case represents a unique combination of equipment, chemical and process conditions aimed at determining the optimal program for the stream under evaluation.



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Crude Oil Management™



Reliably remove sulfur to maximize the commercial value of your hydrocarbon stream

- Meet commercial sulfur specs to maximize product market value
- Avoid costly treating alternatives like hydrotreating or purchasing sulfur credits
- Minimize penalties for violating regulatory sulfur limits

ALCHEMIA™
sulfur removal

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CASE STUDY: GULF COAST, NORTH AMERICA REFINERY

ALCHEMIA sulfur removal technology installs quickly, and effectively treats naphtha stream to deliver on-spec product with no shutdowns

<10ppm

reduction of H₂S and mercaptans

\$30MM

cost savings

30 days

continuous treatment with zero downtime

ZERO

loss in charge rated during hydrotreated outage



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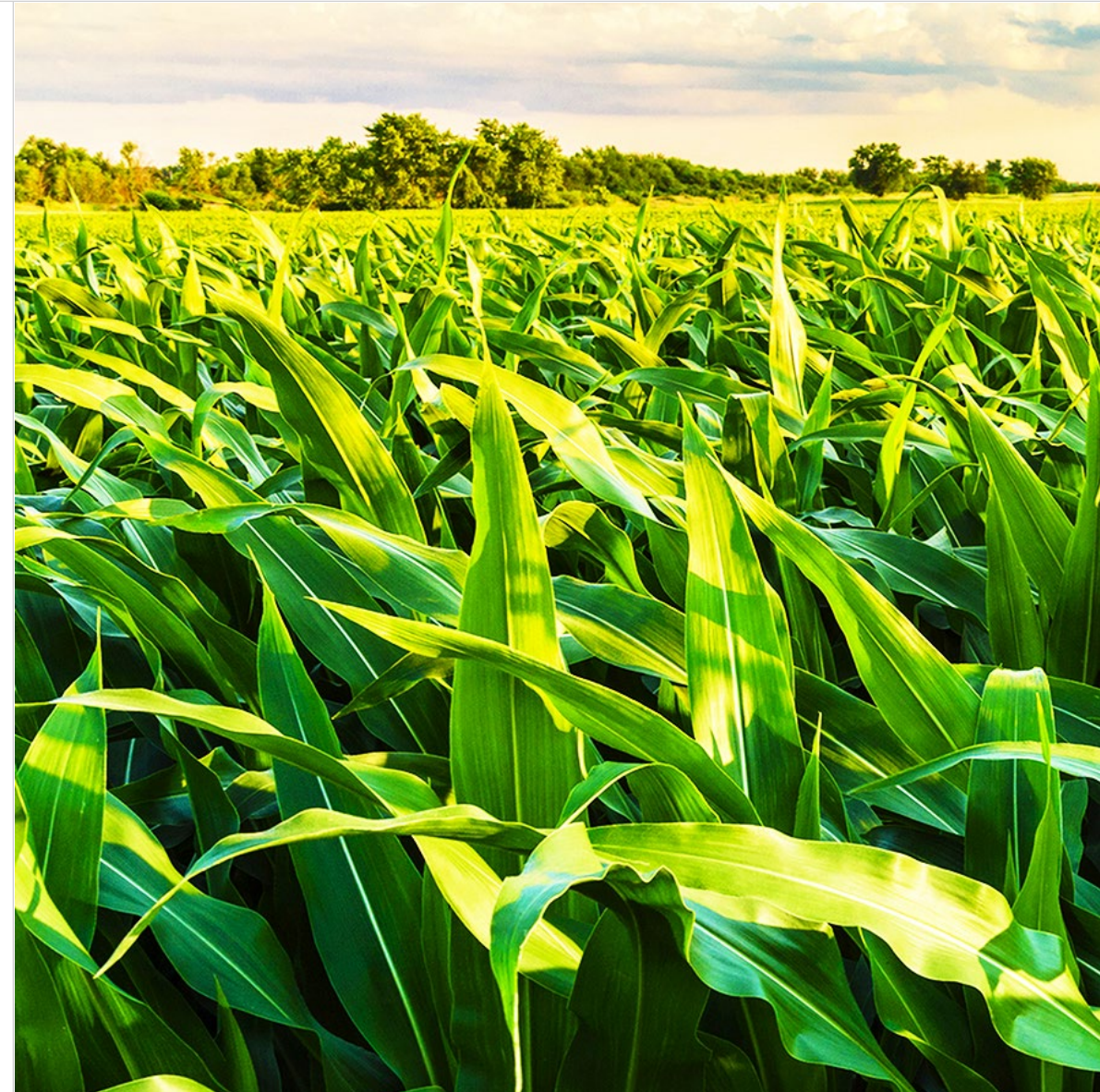
Crude Oil Management™



Enhance renewable fuel production capabilities

- Baker Hughes is the leading North America chemical vendor in the renewable diesel space
 - Process treatment
 - Water treatment
- Increase contaminant removal and lower waste production in feedstock pretreatment
- Developed unique demulsification chemistry for the new pretreatment technology Hydrothermal Cleanup by working directly with ARA
- Reduce down-time due to organic and inorganic fouling in exchangers and reactors
- Manage high organic loading to WWTP smartly and efficiently
- Tailored finish fuel additives to meet the unique needs of renewable diesel

BIOQUEST™
biofuel additives



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Lengthen heat exchanger life by using tagged cooling water polymer through improved on-line measurement

- More accurate measurement of chemical residual in cooling tower systems increasing treatment performance and optimizing cost control
- Forms part of the VIVID™ on line chemical treatment application
- Halogen stable azole option for chlorine based systems
- Enables simultaneous online measurement of both scale and corrosion inhibitors

DEMANDTRAC™
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Crude Oil Management™



Increase capacity and product throughput with rapid drag reduction solutions

- Enhance product throughput by eliminating residence time in transfer lines
- Reduce cargo tanker demurrage to avoid downtime and fees
- Increase processing availability for enhanced scheduling flexibility
- Improves mobilization with a mobile, self-contained system
- Industries only short-line drag reducer

FLO™ NOW
instant drag reduction

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CASE STUDY: GULF COAST, NORTH AMERICA REFINERY

FLO NOW instant drag reduction increased FCCU throughput, revenue during refinery turnaround

51%
reduction of frictional pressure loss of LSVG import pipeline

54%
increased refinery FCCU feed rate

\$4M
gains from additional FCCU throughput during turnaround

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Crude Oil Management™



Meet low-phosphorus effluent mandates using non-phosphorus passivating cooling water polymers

- Enables compliance with environmental mandates
- Reduces water footprint
- Treats zero hardness water
- Enhanced corrosion protection maintaining your assets for longer
- Faster more efficient passivation on clean or start up of heat exchanger systems
- Non P chemistry kinder to the environment and less impact on your wastewater plant

LIFESHIELD™
non P corrosion inhibitor
for cooling towers

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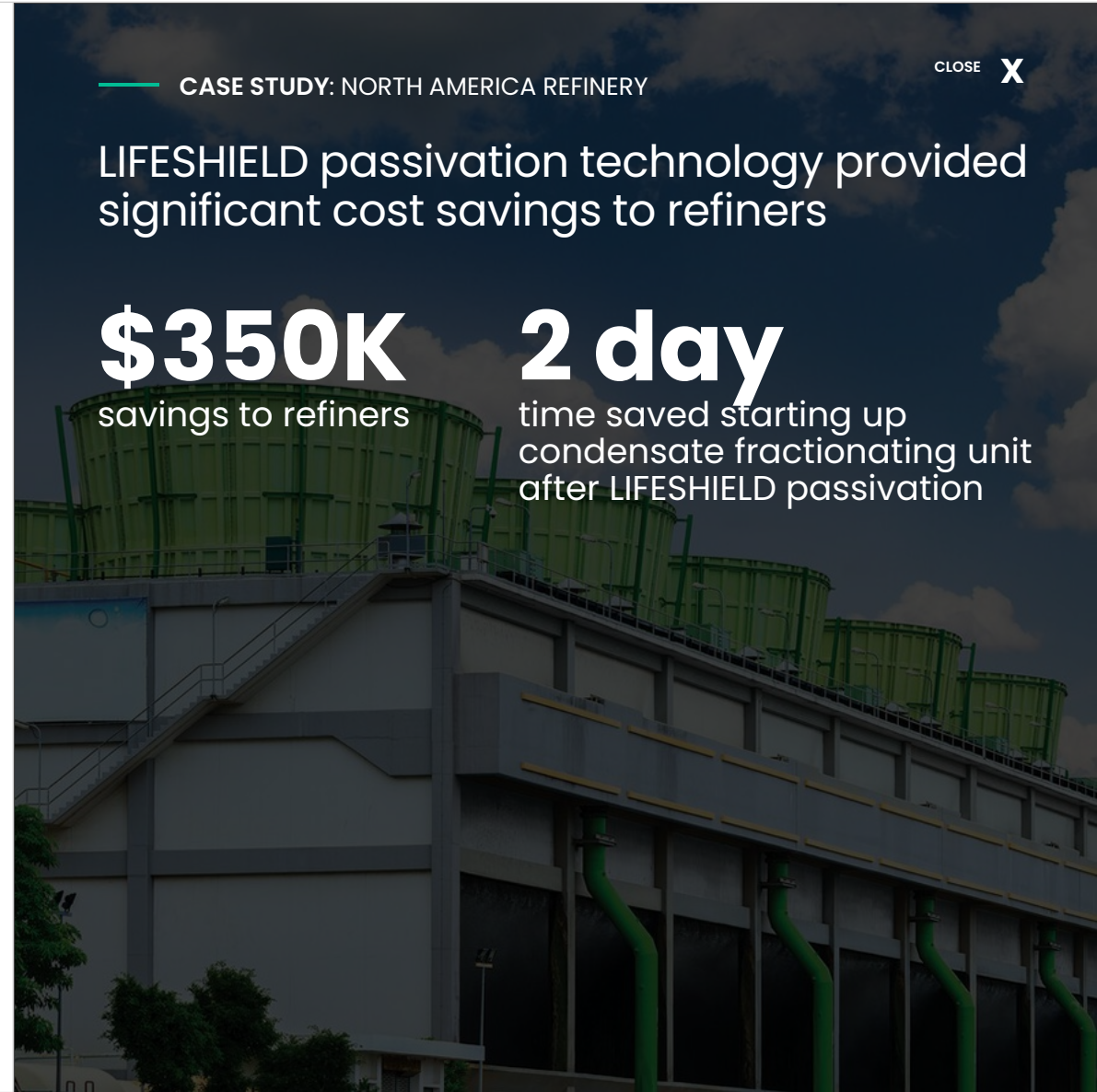
CASE STUDY: NORTH AMERICA REFINERY

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LIFESHIELD passivation technology provided significant cost savings to refiners

\$350K savings to refiners

2 day time saved starting up condensate fractionating unit after LIFESHIELD passivation



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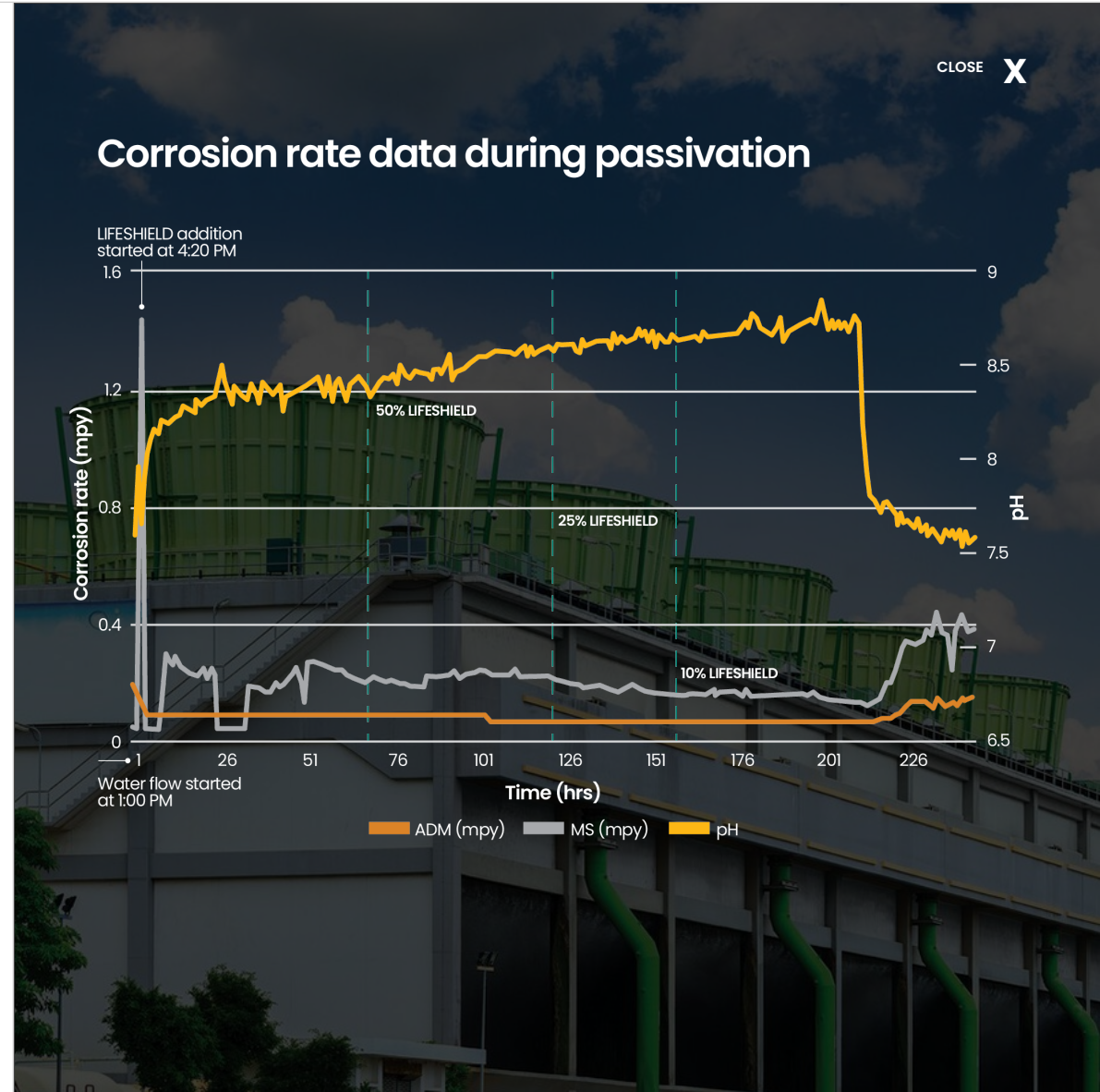
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Crude Oil Management™

Timely determination of optimal crude blending strategy

- Cloud-based technology
- Provides stability data for planned or potential crude blends
- Assesses impact of crude oils new to the refinery
- A key component of decision making to maximize feedstock flexibility
- Avoid off-spec fuel problems that lead to lost profits and regulatory challenges

LIFESPAN™
Blending model

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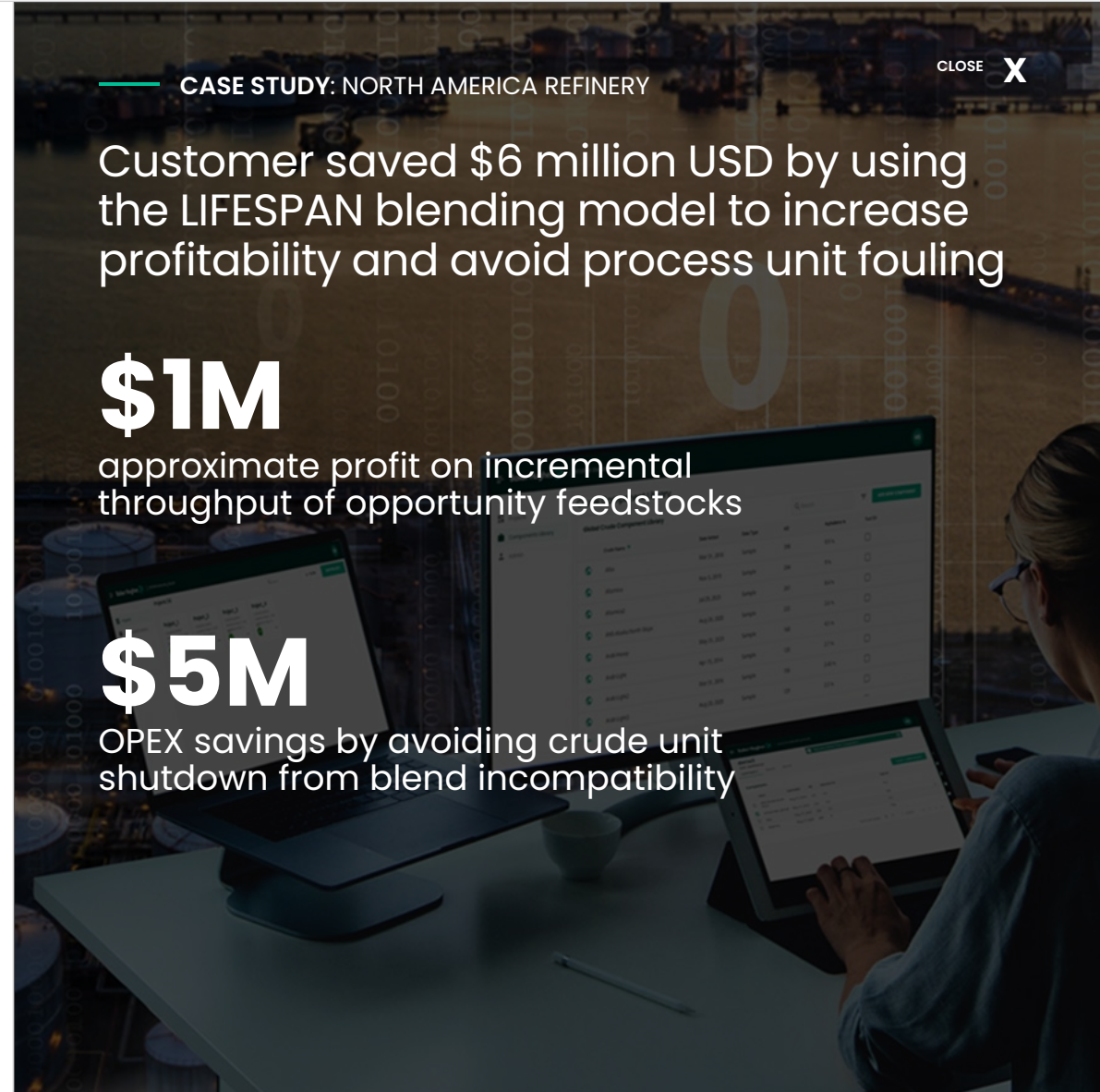


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Blending model

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CASE STUDY: NORTH AMERICA REFINERY

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Customer saved \$6 million USD by using the LIFESPAN blending model to increase profitability and avoid process unit fouling

\$1M

approximate profit on incremental throughput of opportunity feedstocks

\$5M

OPEX savings by avoiding crude unit shutdown from blend incompatibility

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Crude Oil Management™

Minimize impact on downstream catalysts and maintain integrity of process equipment

- Maintains integrity of process equipment:
 - <10 MPY target on all circuits
- Allows processing of higher acid crude slates for maximum economic benefit
- Minimizes phosphorous impact on downstream catalysts
- Minimizes phosphorus poisoning of downstream catalysts
- One component of the SMARTGUARD high temperature corrosion control toolbox

SMARTGUARD™ 2820

low phosphorous corrosion control inhibitor

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CASE STUDY: NORTH AMERICA REFINERY

Baker Hughes enabled higher TAN crude processing and increased catalyst life

2 yrs
extended catalyst life

No loss
catalyst bed activity through first six months

>50%
phosphorus levels were decreased

<2 MPY
HVGO circuit corrosion rate

20%
increase in crude TAN fed

SERVICE

SMARTGUARD™ corrosion risk assessment
SMARTGUARD™ 2820 low phosphorous corrosion inhibitor

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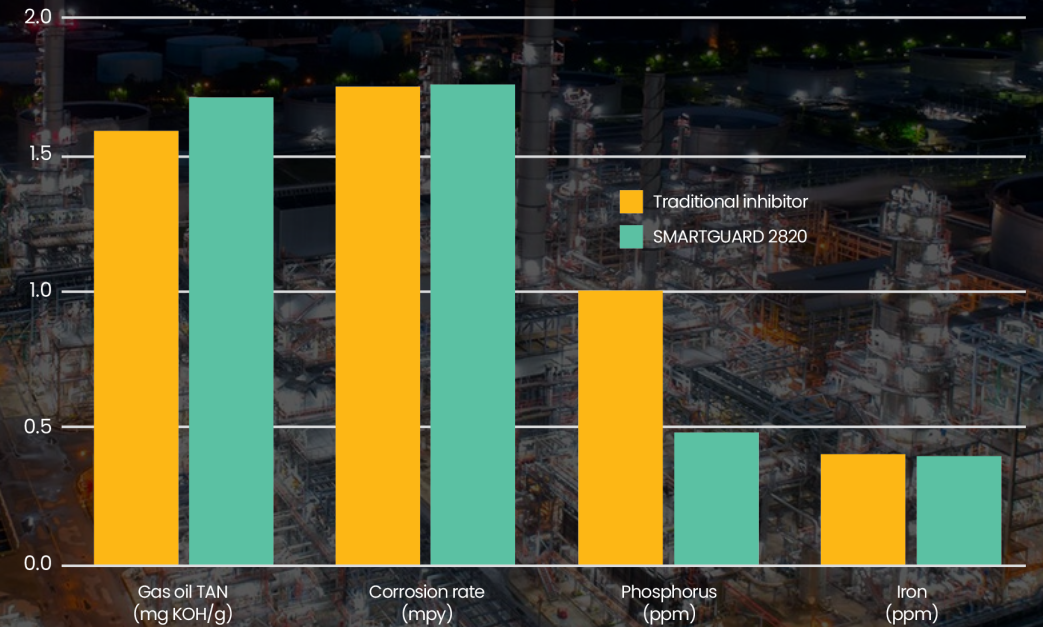
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HVGO treatment performance



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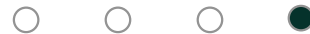
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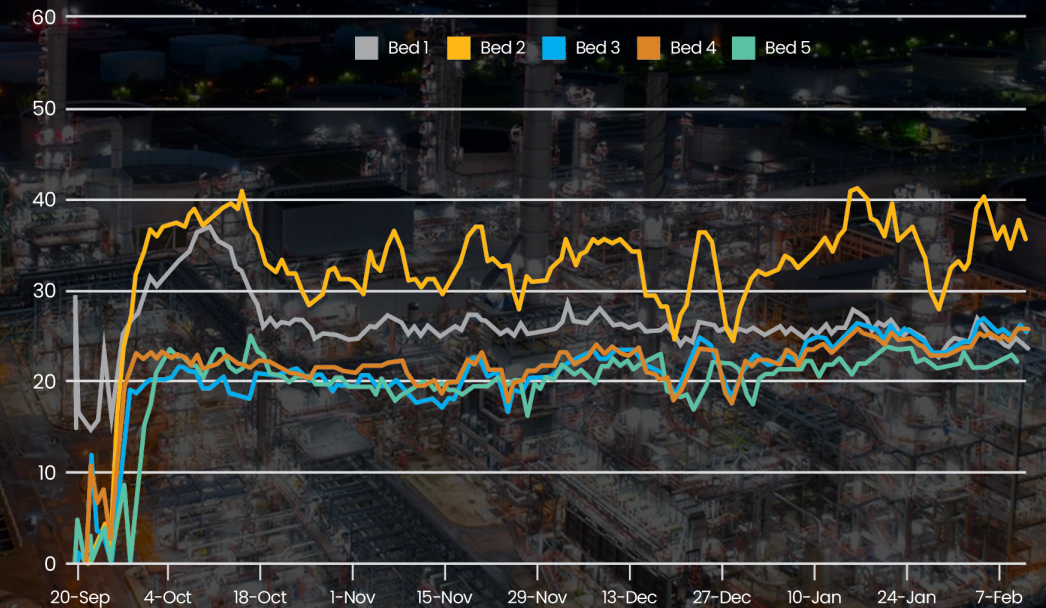
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Catalyst bed activity



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Crude Oil Management™

Separated oil from water, dehydrating the oil and reducing waste

- Replacements to traditional metal-based coagulants which can impact biological systems
- More effective on colloidal particulates for improved compliance on TSS or pretreatment
- Replacements to traditional polyacrylamide flocculant chemistries with easier simpler make down and Injection systems
- Metals removal from water process systems and so aids environmental compliance
- Reduces sludges volumes and in turn operational costs
- Improved oil / water separation performance and can be used in desalter, slop tanks, water draw systems

SPECTRACLEAR™

greener option chemistry for wastewater treatment

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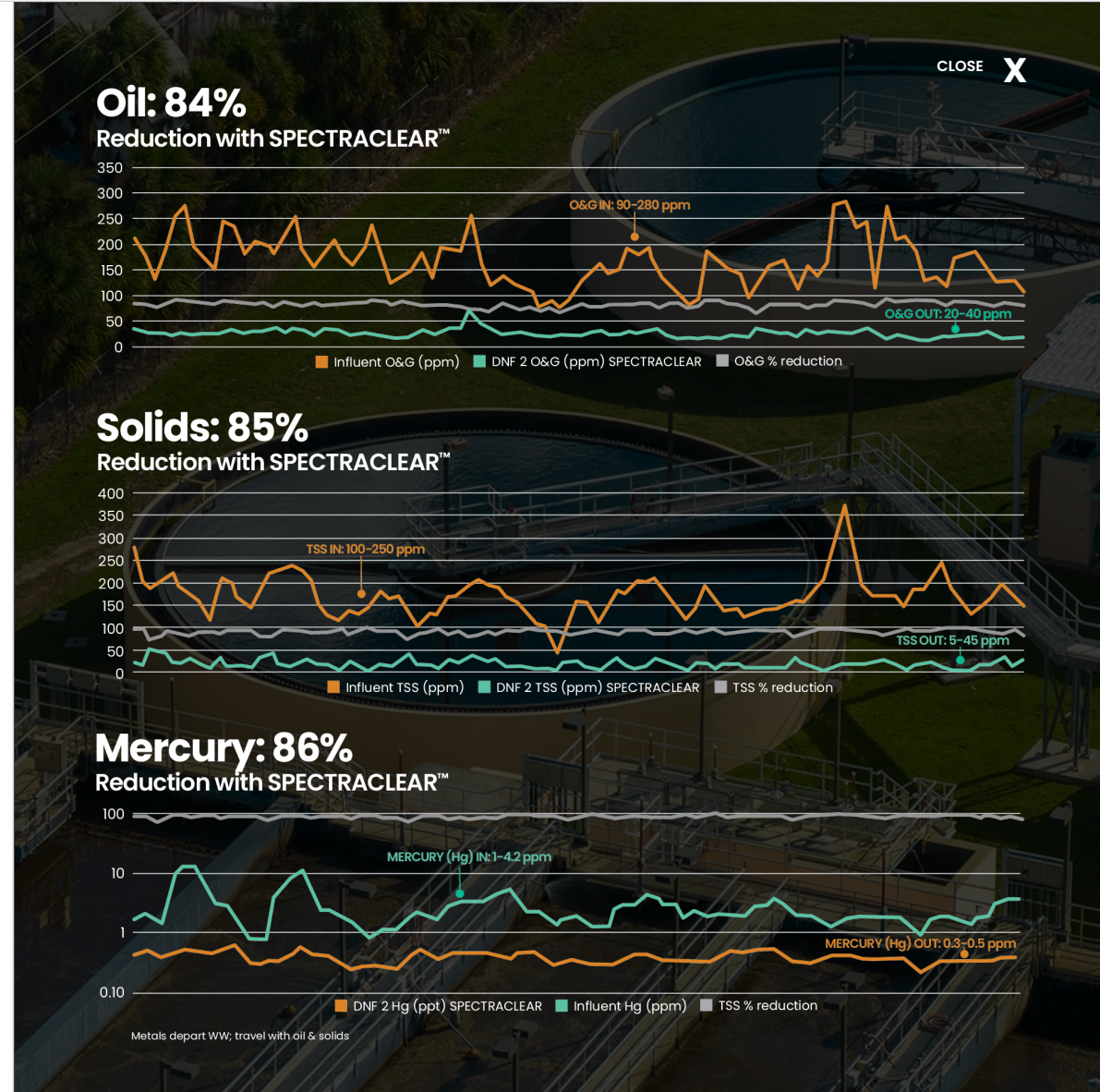
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Generate the data to make the best financial outcomes

- Process-simulation based tool
- Utilizes proprietary amine/HCl thermodynamic data
- Provides data to assess risk of overhead corrosion and determine appropriate mitigative actions

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TOPGUARD™
corrosion risk monitor

VIEW CASE STUDY



CLOSE X

CASE STUDY: NORTH AMERICA REFINERY

Asset Reliability program reduced corrosion and prevented an unplanned shutdown

\$5MM
increased annual profitability

No more
unplanned shutdowns

26 months
extended overhead vapor line life

50%
reduced corrosion

SERVICE

SMARTGUARD™ corrosion risk assessment
SMARTGUARD™ 2820 low phosphorous corrosion inhibitor

DOWNSTREAM SOLUTIONS

ALCHEMIA™ contaminant removal

ALCHEMIA™ solid removal

ALCHEMIA™ sulfur removal

BIOQUEST™ renewable fuel technologies

DEMANDTRAC™ tagged polymers for scale control

FLO™ NOW instant drag reduction

LIFESHIELD™ non P corrosion inhibitor for cooling towers

LIFESPAN™ blending model

SMARTGUARD™ 2820 low phosphorous corrosion control inhibitor

SPECTRACLEAR™ greener option chemistry for wastewater treatment

TOPGUARD™ corrosion risk monitor

TOPGUARD™ field amine monitoring >

TOPGUARD™ overhead corrosion control

TOPGUARD™ 1130 salt control

TOPGUARD™ spray modeling

Crude Oil Management™

Proactively manage crude unit overhead corrosion risk

- Refinery-based technology for tramp amine measurement
- Provides data in as little as one hour for input to the CRM
- Allows refiner to make timely decisions

TOPGUARD™ field amine measurement services

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TOPGUARD™
field amine measurement services

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CASE STUDY: US GULF COAST

CLOSE X

Baker Hughes TOPGUARD program allows refiner to realize additional revenue

\$5-10MM

anticipated additional revenue for refiner

3X

weekly on-site measurement of MEA levels with FAMS

Defined

actual salt corrosion risk combined with CRM program

5°F

reduced overhead temperature to improve diesel and jet yields

Removed

unnecessary operating constraint

SERVICE

TOPGUARD™ field amine measurement services (FAMS)
TOPGUARD™ corrosion risk monitor (CRM)

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Crude Oil Management™



Manage corrosion risks in refinery overhead systems

- Utilizes toolbox of chemical, engineering and instrument technologies
- Maintains Integrity of process equipment
- Provides tools to push operating window for maximum profitability without risking asset reliability or limiting product focus
- Allows refiner to make informed decisions to maximize refinery profit via:
 - Increased discounted crude processing
 - Optimized operating envelope
 - Extended asset life, reduced maintenance costs
 - Avoiding unplanned shutdowns

TOPGUARD™
overhead system corrosion control

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TOPGUARD™
overhead system corrosion control

VIEW CASE STUDY



CASE STUDY: NORTH AMERICAN REFINERY

CLOSE X

Asset Reliability program reduced tower corrosion, enabled extended run times, reduced maintenance and lost opportunity cost

2.5 yrs
severe tower corrosion without TOPGUARD

50%
fewer maintenance cycles, reduced opportunity & maintenance costs

2.5 yrs
minimal tower corrosion with TOPGUARD

7.5 yrs
current run plan, reduces opportunity & maintenance costs by 2/3

5 yrs
successful run with TOPGUARD

SERVICE

TOPGUARD™ field amine measurement services (FAMS)
TOPGUARD™ corrosion risk monitor (CRM)
EXCALIBUR™ amine removal technology

ALCHEMIA™ contaminant removal

ALCHEMIA™ solid removal

ALCHEMIA™ sulfur removal

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TOPGUARD™ corrosion risk monitor

TOPGUARD™ field amine monitoring

TOPGUARD™ overhead corrosion control

TOPGUARD™ 1130 salt control

TOPGUARD™ spray modeling

Crude Oil Management™



Minimize corrosion caused by amine and ammonia hydrochloride salts

- Enables increased opportunity crude processing
- Extends equipment life
- Avoids unplanned unit shutdown for repair
- Increases operating profitability

TOPGUARD™ 1130 salt control additive

VIEW CASE STUDY



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TOPGUARD™ 1130
salt control additive

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CASE STUDY: NORTH AMERICA REFINERY

CLOSE X

Baker Hughes enabled uninterrupted operation by eliminating crude overhead exchanger failures

80%
reduction in corrosion rates

ZERO
reduction in unit charge

\$1 MM
annual profitability recovered

SERVICE

TOPGUARD™ 1130 salt control additive
TOPGUARD™ corrosion risk monitor

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TOPGUARD™ 1130 salt control

[TOPGUARD™ spray modeling](#) >

Crude Oil Management™

Successfully prevent corrosive salt formation

- Assesses feasibility of water washing to manage salt corrosion
- Provides engineering-based wash water equipment design
- Extend equipment life
- Reduces maintenance and repair costs

TOPGUARD™
spray model



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TOPGUARD™ 1130 salt control

TOPGUARD™ spray modeling

Crude Oil Management™



Improve feed flexibility while maximizing throughput

Toolbox

- Specialty demulsifiers for tank pretreatment of crude oils
- XERIC demulsifiers for heavy oil processing
- Fast water drop additives for under-sized desalter equipment
- LIFESPAN Blending Model and Asphaltene Stabilizer products
- Slop Oil Management
- Desalter optimization

Provides stable desalting operations

- Excellent salt removal
- Improved brine quality
- Reduced re-run of emulsion (slop)

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Improve feed flexibility while maximizing throughput

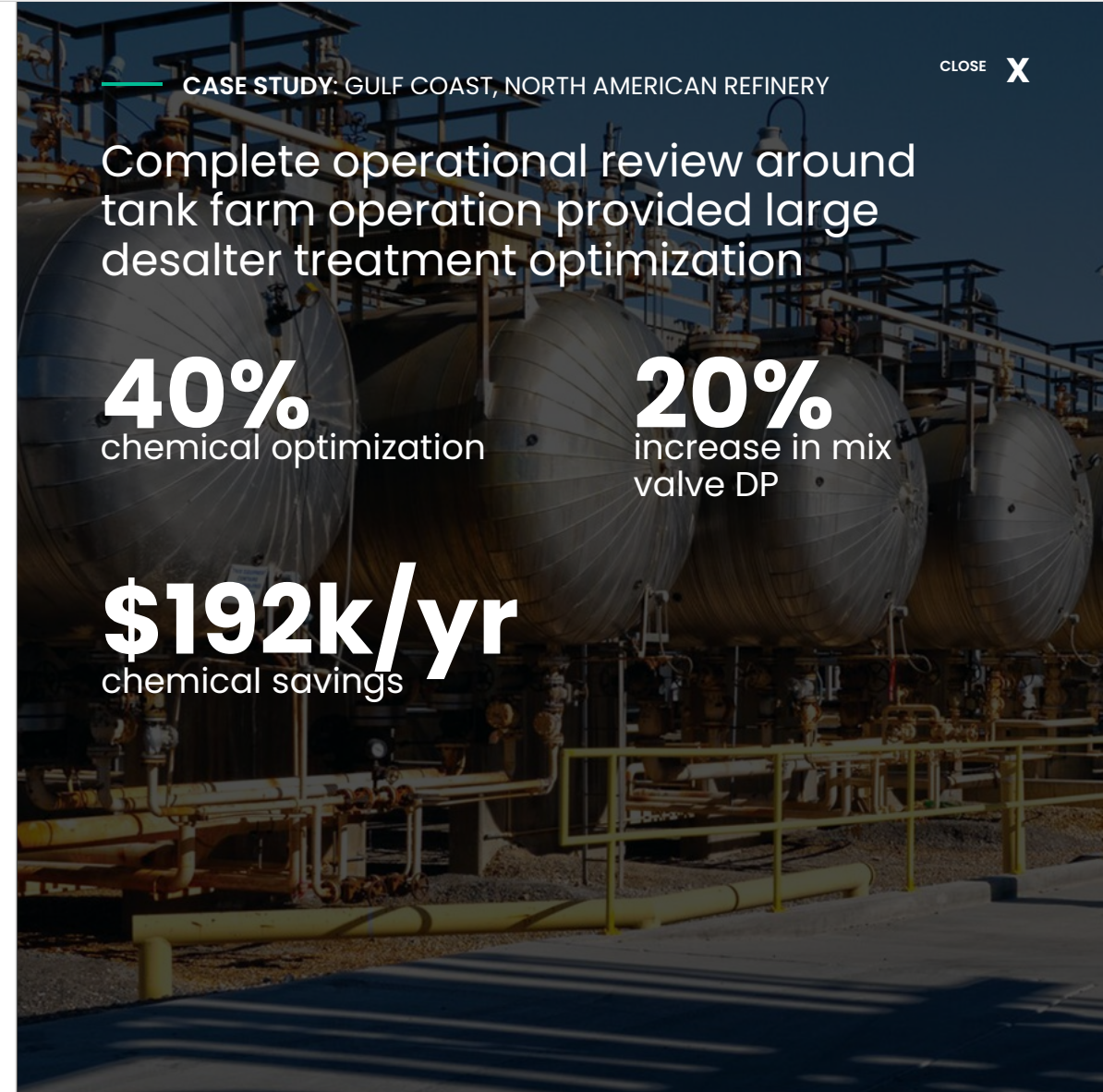
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CASE STUDY: GULF COAST, NORTH AMERICAN REFINERY

CLOSE X

Complete operational review around tank farm operation provided large desalter treatment optimization

40%
chemical optimization

20%
increase in mix valve DP

\$192k/yr
chemical savings

Baker Hughes 