Cokebusters

MECHANICAL DECOKING

ABOUT US

Back in 1993, members of the Cokebusters team worked on the first mechanical decoke in Europe. Smartpig research and development began in the late 1990s, with the first patent application made in May 2000.

In April 2005, the incorporation of Cokebusters Ltd. brought together “pigging” and tube inspection under one roof. The company has been going from strength to strength ever since, with our team of engineers and operators continuing to develop innovative solutions which enable us to best serve our clients around the world.

From our two headquarters in the United Kingdom and the United States, we are able to consistently deliver high quality services to the oil and petrochemical industries worldwide.

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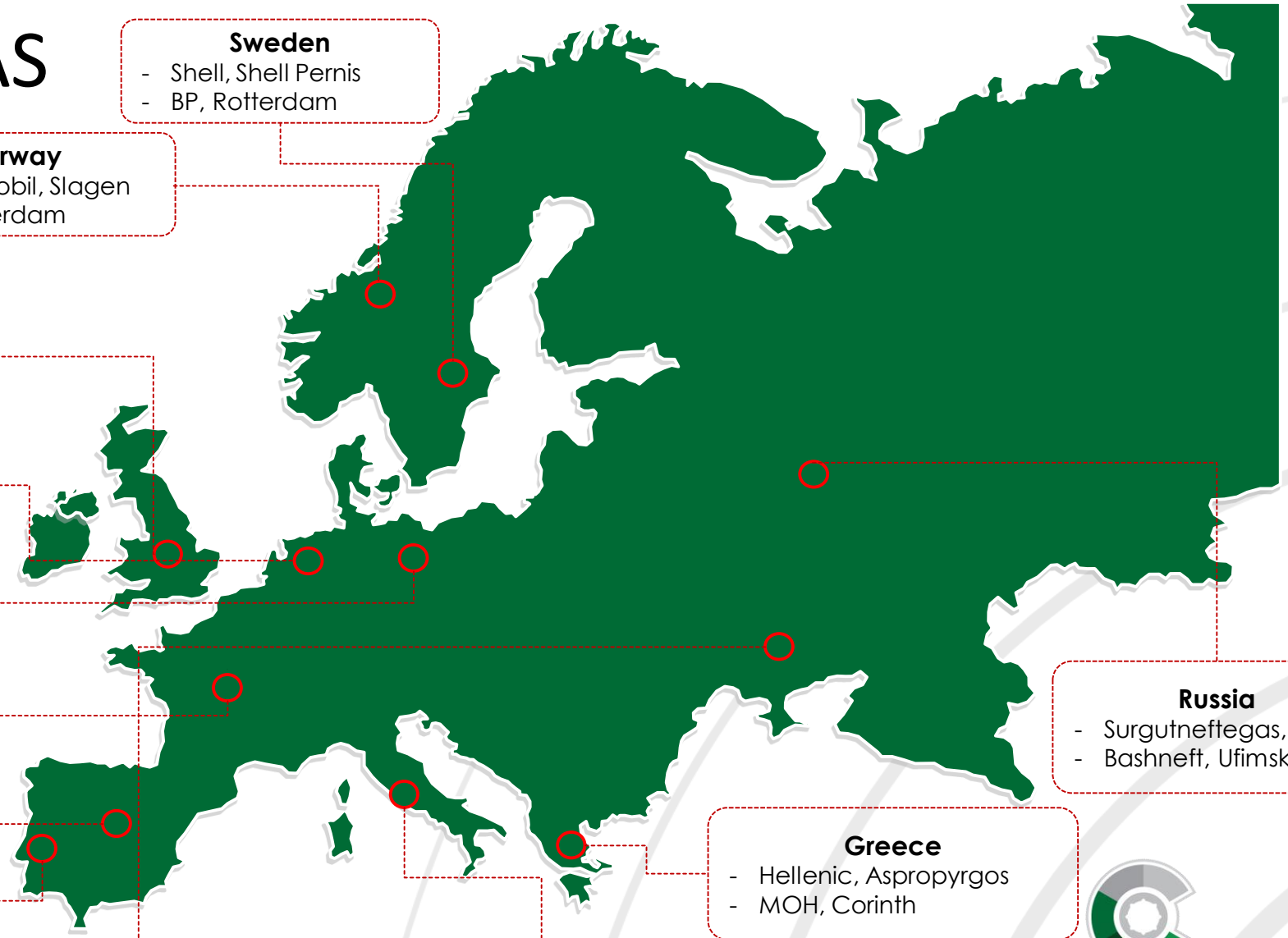
OPERATING AREAS



Sweden
- Shell, Shell Pernis
- BP, Rotterdam

Norway
- Exxon Mobil, Slagen
- BP, Rotterdam

Netherlands
- Shell, Shell Pernis
- BP, Rotterdam

United Kingdom
- Exxon Mobil, Fawley
- Phillips 66, Lindsey Oil
- Essar Energy, Stanlow

Netherlands
- Shell, Shell Pernis
- BP, Rotterdam

Germany
- Shell, Godorf Cologne
- TOTAL, Buna SOW Leuna

France
- TOTAL, Gonfreville l'Orcher
- Exxon Mobil, Port Jerome

Portugal
- Galp Energia, Sines
- Galp Energia, Porto

Spain
- Repsol, Cartagena
- Petronor, Bilbao

Ukraine
- Ukrtatnafta, Kremenchuk
- BP-TNK, LINOS

Italy
- ENI, Sannazzaro
- Exxon Mobil, Esso Augusta

Greece
- Hellenic, Aspropyrgos
- MOH, Corinth

Russia
- Surgutneftegas, Kinef
- Bashneft, Ufimsky

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FIRED HEATERS

Fired Heaters are an essential component of most process plants.

Fired Heaters are a major consumer of energy and even the smallest efficiency improvements can save thousands of dollars.

Even a 1% improvement in thermal efficiency can translate into energy savings of >$500,000 per year.

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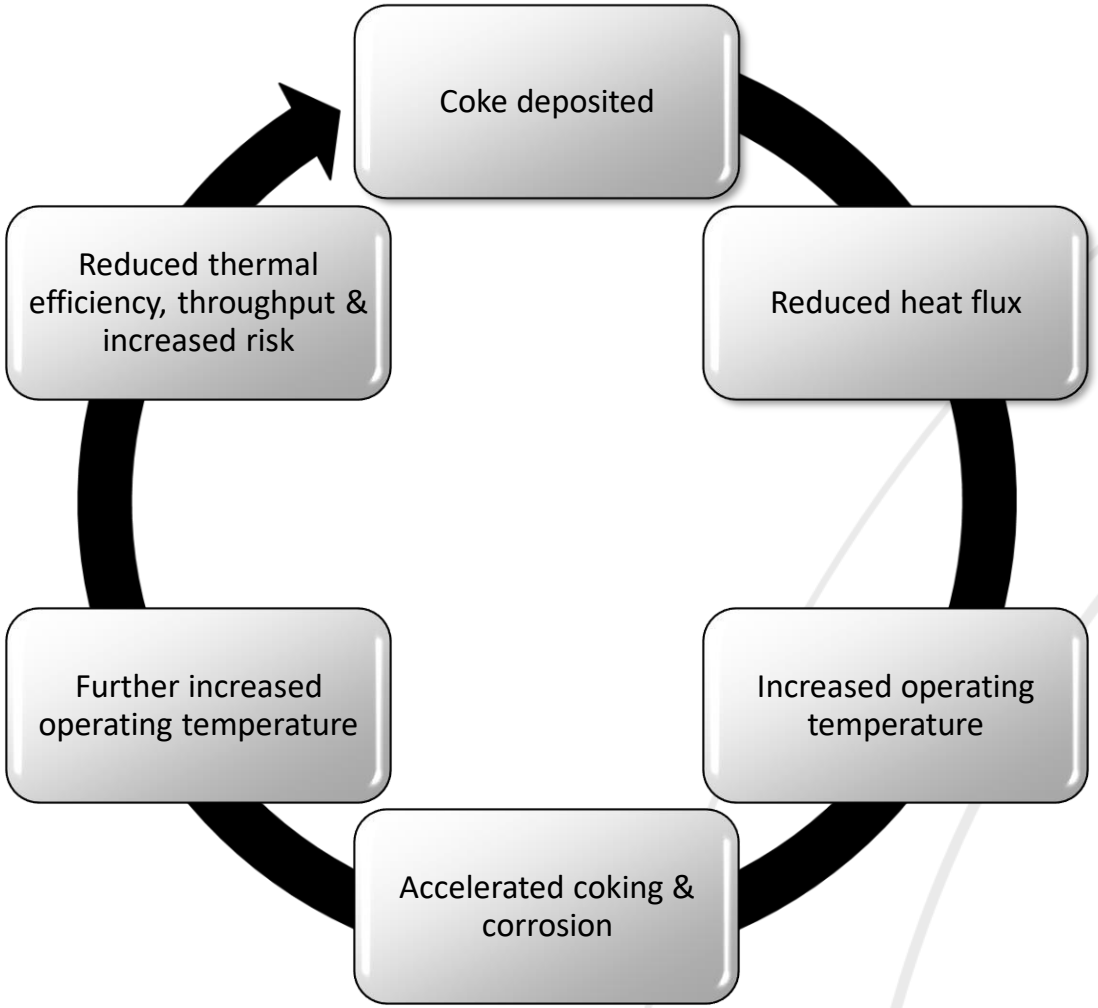
CIRCLE OF COKING



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PREVENTATIVE MAINTENANCE

Defined as…

"Maintenance that is regularly performed on a piece of equipment to lessen the likelihood of it failing."

Proven within industries worldwide to increase productivity and efficiency.

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DECOKING

Regular mechanical decoking ensures that process tubes do not become blocked.

A blockage will typically result in either tubes having to be replaced or jetting implemented to obtain passageway for mechanical decoking.

Blockages will significantly **increase** downtime.

Regular mechanical decoking maximises heat flux/transfer and throughput – in a typical 4” SCH40 coil, an even 5mm layer of coke can **reduce** throughput by **18%.**

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DECOKING

Coke can contribute to various tube corrosion mechanisms such as sulphidation, carburisation, embrittlement and metal dusting.

Continued corrosion can result in premature tube failure.

A regular decoking schedule will always increase long term productivity and net refining margins.

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OUR EQUIPMENT

Series 21 double pumping unit

Modern machinery – power and reliability

Scraper pigs – Durable & Flexible

Skilled and experienced personnel

Directly employed & trained – No agencies, sub contractors or temporary staff

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S21 DOUBLE PUMPING UNIT SPECIFICATION

Two turbo diesel engines and two water pumps are controlled independently to enable two passes to be cleaned simultaneously.

Onboard electronics control Engines and water pumps independently

Two-stage filtration system for on-board collection and storage of coke and scale fragments

Automatic emergency Chalwyn™ and Roda Deaco™ shut down

Exhaust systems equipped with spark arresters

Pressure and flow monitored digitally through bespoke software

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SCRAPER PIG SPECIFICATION

Extensive range of pigs to decoke tube sizes 1” to 12”

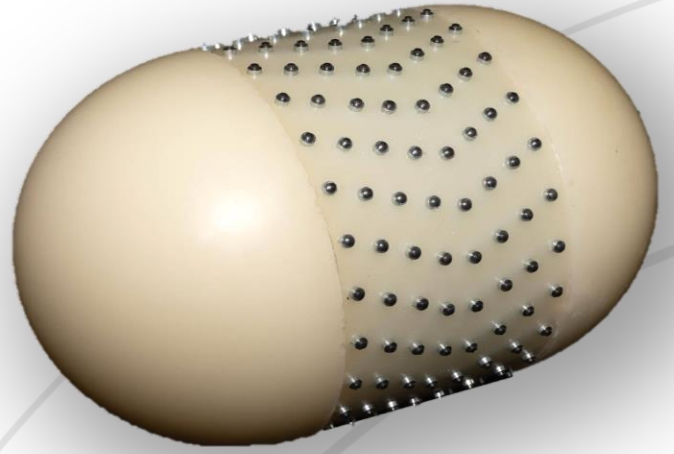
Pigs function Bi-Directionally for increased efficiency

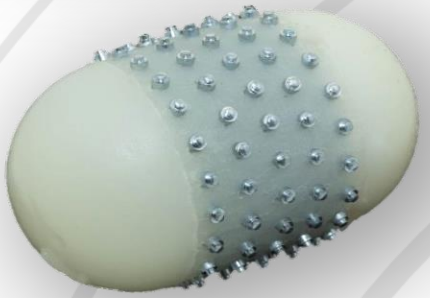
All Pigs are manufactured to a Patented design in Hawarden UK

Designed to ensure 360° circumferential coverage with minimal damage to return bends and pipework

Designed to manoeuvre short radius return bends, plug headers, mule ears and flat-back bends

Each pig contains up to 308 titanium pins for maximum coke removal per run





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SMARTPIGGING

Radially mounted, ultrasonic immersion probes

Propelled using water flow

Flow controlled by decoking pumping unit (or other suitable pump)

Requires a clean internal tube wall

Data stored within the tool and downloaded to laptop following inspection

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SPECIFICATION

2.5-12 Inches
Tube Diameter Range (Internal)

+/-0.1mm
Static Accuracy (Wall Thickness)

±0.75%
ID Accuracy (Full Scale)

+/-50mm
Axial Location Accuracy

8hrs
Battery Life

0.3 – 0.8m/s
Running Speed

Bidirectional

30,720
Individual Wall Thickness Measurements

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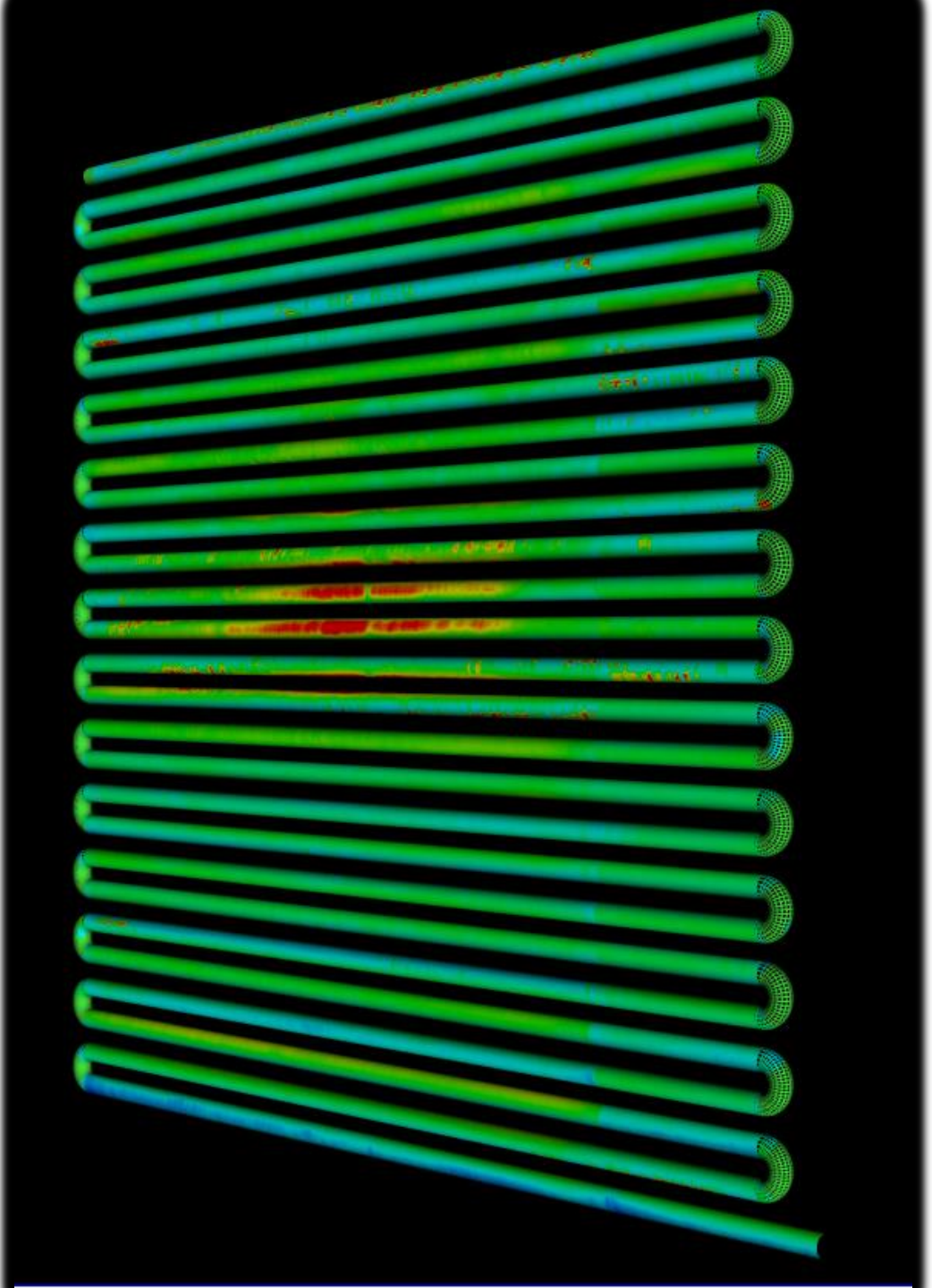

DATA ANALYSIS & REPRESENTATION

- Data viewable after 10-20 minutes of upload
- Multiple analysis methods for rapid anomaly identification & verification
- Individual A-scans recorded from each individual pulse/measurement
- 3D C-scans and interactive software provided with each report

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DEFECT DETECTION

Ability to accurately detect and quantify:

Internal metal loss (local and general)

External metal loss (local and general)

Fretting

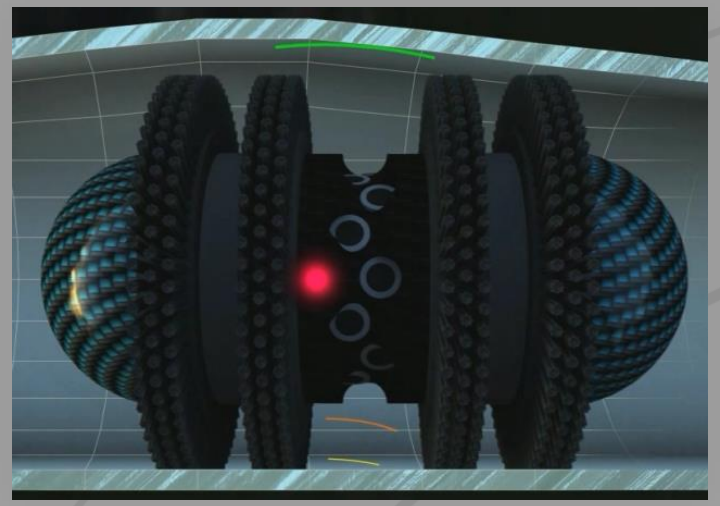
Creep (bulging, ovality, swelling)

Internal fouling (including coke thickness & location)

Areas of pitting

Historic repairs

Dents



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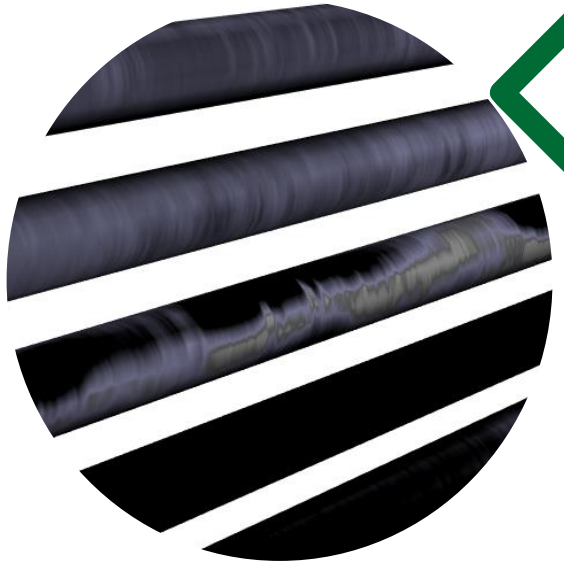
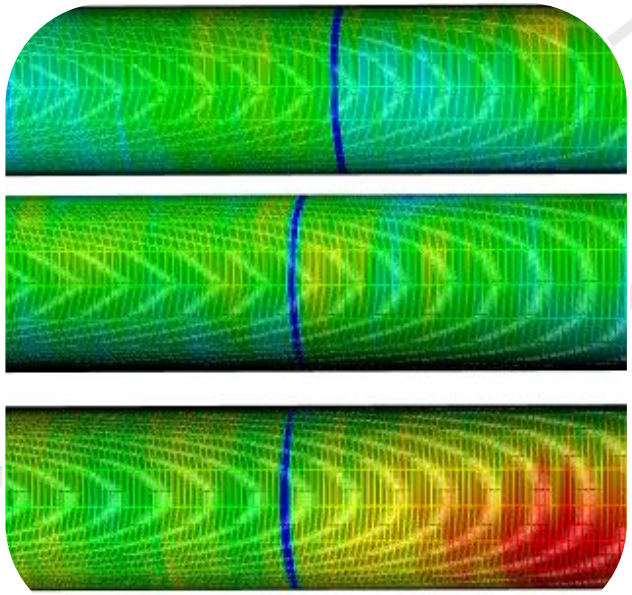
DEFECT DETECTION



Highlights areas of remaining fouling & hotspots

*Coke scans can be provided as a service



Highlights localised defects

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FFS & RLA

- Level 1 & 2 Fitness For Service assessments in accordance with API 579/ASME FFS-1
- Carried out on individual local and general metal loss anomalies identified from smartpig inspection
- Tmin/MAWP calculations provided
- ALS able to carry out Level 3 assessments
- Remaining Life Assessments carried out in accordance with API 579
- Carried out for each ‘zone’ within each pass

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BASELINE INSPECTION

Baseline inspections remove uncertainty caused by manufacturers tolerances, and equip engineers with the data required to confidently make decisions on maintenance, repair and inspection activities.

Should **ALWAYS** be carried out during commissioning to maximise the accuracy of all future Fitness for Service and Remaining Life Assessments.

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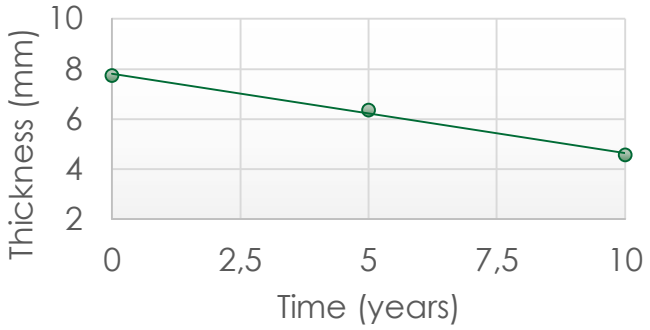
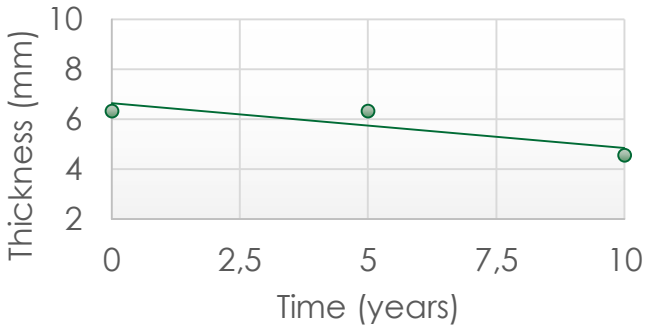
BASELINE INSPECTION

Graph 1



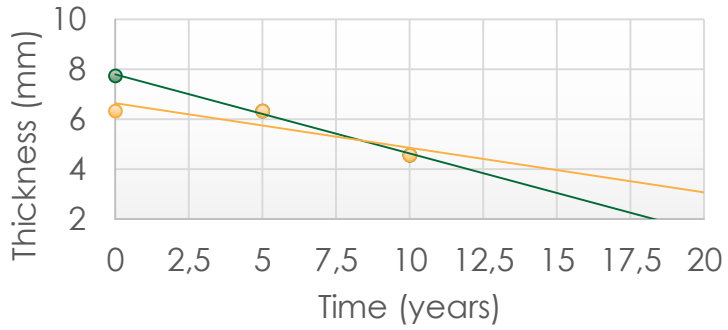
Average wall thickness for the coil from three separate smartpig inspections carried out over ten years.

Graph 2



Graph 2 demonstrates the same results, except the average wall thickness obtained from the baseline inspection (0) has been replaced with the specified nominal wall thickness.

Graph 3



As Graph 3 illustrates, had the coil continued to deteriorate as it had over the first five years, by year eighteen, wall thickness would have been as low as 2mm.

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CONVENTIONAL NDT VS SMARTPIGGING

Manual UT	Smartpigging
Access	No physical access to the coil is required
Surface preparation required	Limited furnace preparation
3-point wall thickness measurements	Able to detect, locate and quantify internal fouling/coke
Unable to detect pitting or creep damage	Able to detect localized defects, creep damage and pitting
No C-Scans; difficult to model corrosion patterns	Able to produce full colour coded 3D models of process coils/tubes

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FINANCIAL CONSIDERATIONS

Q. Approximately how long would it take to carry out a handheld UT inspection of a typical 4-pass fired heater process coil? What would the typical cost be?

A. It would usually take 4 shifts longer than smartpig. The cost is around $75k (comparable to smartpigging) not counting added downtime and lost production. Obviously this does not include any inspection of convection coils. – ***Process Engineer, Exxon Mobil, USA***

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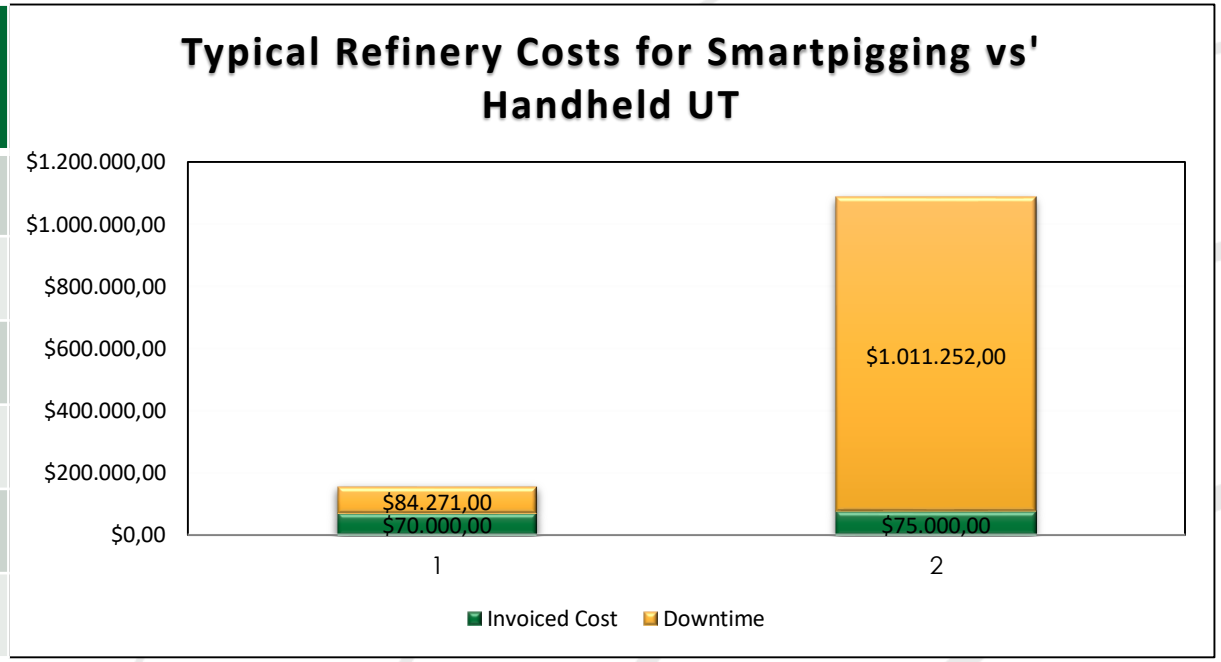
TRUE COST OF CONVENTIONAL NDT

Estimated Losses From A 100,000 bbl/day Capacity Crude Unit	
Crude Processing Capacity	100,000 Bbl
Net Refining Margin	$2.12 / Bbl
Losses in Refinery net Margin	$212,001
Total Staff Cost	$869m / yr
Staff Costs Without Return	$293,625
Total Losses Per Day	**$505,626**



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CONCLUSIONS

Regular mechanical decoking and in-line inspection has been consistently proven to:

Increase efficiency
(environmental impacts)

Minimise risk

Increase productivity
(net refining margin)

Improve safety

Save on maintenance costs

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