Safety 30

Improving Safety and Increasing Production through Non-Intrusive Inspection

The Oil & Gas Technology Centre
Your Innovation Partner

ABB

Presenters

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Introduction

OGTC

As an industry-led research and knowledge organisation, we are backed by both the UK and Scottish governments to fund and direct projects that help to unlock the full potential of the UK North Sea. We aim to be the go-to technology centre for the oil and gas industry in the UK and internationally. Our vision is to help make the North East of Scotland a great place to live, work and invest. Within the Asset Integrity Solution Centre we are transforming ideas into solutions by encouraging, leading and co-funding industry-initiated technology projects to develop and deploy commercial-ready solutions. We are focused on delivering innovation in two key areas: Process Vessel Inspection (VI) and Corrosion Under Insulation (CUI).

ABB

ABB provides technical consulting and engineering services to improve performance in the areas of compliance, operations and engineering to customers in the chemical, petrochemical and oil & gas industries worldwide. ABB's risk based approach reduces safety and business risks cost effectively. ABB consultants work in partnership with customers, transferring knowledge to allow the benefits we deliver to be sustained and increased. We identify and implement pragmatic solutions based on technical excellence and industry expertise. This benefits our customers by reducing risk, optimising costs and improving production efficiency.

Agenda

- Intrusive Inspection
- Non-Intrusive Inspection (NII)
- NDT Technologies
- OGTC NII Initiative
- Phase 1 – Survey
- Phase 2 – Pilot Studies
- Benefits identified
- Potential for wider application across UKCS
- Barriers
- Phase 3

Inspecting Pressure Vessels

The traditional approach

Intrusive Inspection

The internal inspection of process pressure vessels has traditionally involved putting an inspector inside the vessel to carry out a visual examination.

Within the UK there is **no legal requirement** to carry out an internal examination of a pressure vessel.

- The examination must, however, be effective at detecting the predicted damage mechanisms
- It must also provide sufficient information to enable the vessel's integrity to be assessed and to determine the safe interval until the next examination

Internal inspection requires the vessel to be shutdown – a considerable amount of work is necessary to prepare the vessel for inspection and to return it to service.

- Persons entering the vessel are exposed to the risks of entering a confined space
- There are other associated Safety and Environmental risks

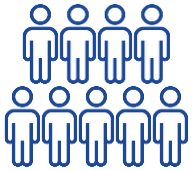
Inspecting Pressure Vessels

Entering pressure vessels increases risk

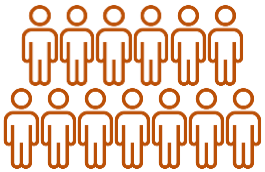
Risk to personnel

– Between 2003 and 2011 there were 22* fatalities in UK resulting from confined space entries

Oxygen depletion – 9



Other accidents - 13



Loss of containment - Hydrocarbon leakage

– A vessel entry typically involves the making and breaking of many flanged joints

– Increased potential for leakage when the equipment is restarted

Environmental

– Emissions associated with flaring, cleaning, purging and fugitive emissions

*Data excludes workers killed by the collapse of trenches

Inspecting Pressure Vessels

Risks to personnel from confined space entry

- Oxygen deficiency
  - 21% O_2 normal, < 17% O_2 leads to disorientation and incapacity
- Flammable substances and oxygen enrichment
  - > 23% O_2 increased fire risk

- Toxic gas, fume or vapour
- Ingress or presence of liquids
- Hazardous substances – NORM, pyrophoric scale, mercury
  - Exceeding Short Term & Long Term Exposure Limits (STEL & LTEL)

- Excessive heat and increased noise
- Difficult and awkward access within the vessel

Inspecting Pressure Vessels

Non-Intrusive Inspection (NII)

NII – inspecting from the outside

- With NII the pressure vessel is inspected from the outside which avoids the requirement for entry into confined spaces to perform the examination
- The inspection can be undertaken with the equipment on-line
- This approach is increasingly used across the process industries
- It has delivered significant safety improvement and financial benefits without compromising process safety

The Confined Spaces Regulations 1997

Regulation 4(1) **Work in confined spaces**

No person at work shall enter a confined space to carry out work for any purpose unless it is not reasonably practicable to achieve that purpose without such entry.

Inspecting Pressure Vessels

NII

NDT Techniques

The external examination is performed using Non-Destructive Testing (NDT)

Increasing computing power and the continuous development of new techniques means that the capability of NDT is increasing year on year.

A range of NDT techniques are employed:

- Ultrasonic – corrosion mapping
- Ultrasonic – shear wave
- Ultrasonic – phased array
- Acoustic emission
- Radiography
- Eddy current
- Laser scanning
- Metallography

The NDT technique (or combination of techniques) selected needs to be at least as effective as carrying out the intrusive inspection.

OGTC NII Initiative

Phase 1 & 2

Objectives

Our vision is to eliminate the impact of asset integrity on operational uptime by 2026. By engaging with all aspects of the industry to challenge themselves, to think and to do more to improve asset performance by driving technology forward, and to support our goals of achieving no vessel entry due to inspection by 2026.

The overall objective of the NII initiative is to inspire, accelerate, and fund technology innovation to overcome the challenges of confined space entry and pressure vessel inspection in the UKCS.

The objectives for each phase were:

– Phase 1 raise industry awareness, engagement and quantifying the gap across the UKCS as whole.

– Phase 2 focussed on demonstrating the savings through pilot studies with several UKCS operators to demonstrate the safety and cost benefits.

Phase 1

Survey of UKCS Operators

The Survey

A breakfast briefing was held on 9th March 2017 at OGTC's offices to put forward the case for increasing the amount of NII conducted on the UKCS. Companies who had already benefited from NII shared their learning and engaged in a debate with those who were interested in capturing the potential benefits. As well as operating companies the breakfast briefing was well attended by persons from Inspection and NDT service providers.

Following this briefing, nine Aberdeen based Operators agreed to be interviewed.

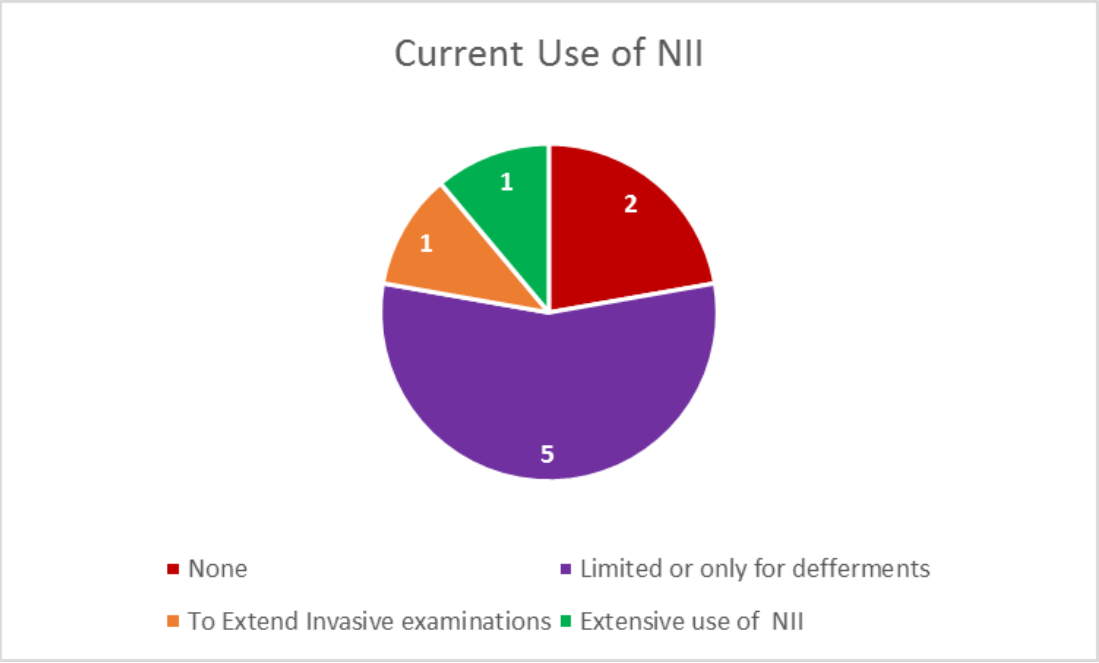
- 6 from companies operating offshore fixed platforms
- 2 from companies operating FPSOs
- 1 from a company operating a gas terminal

All of the participants were Senior Integrity/Inspection Engineers with extensive industry experience. The interviews focussed mainly on those areas of greatest interest; particularly, their current experience of using NII and the associated costs.

Phase 1

Survey of UKCS Operators

Findings – Current use of NII

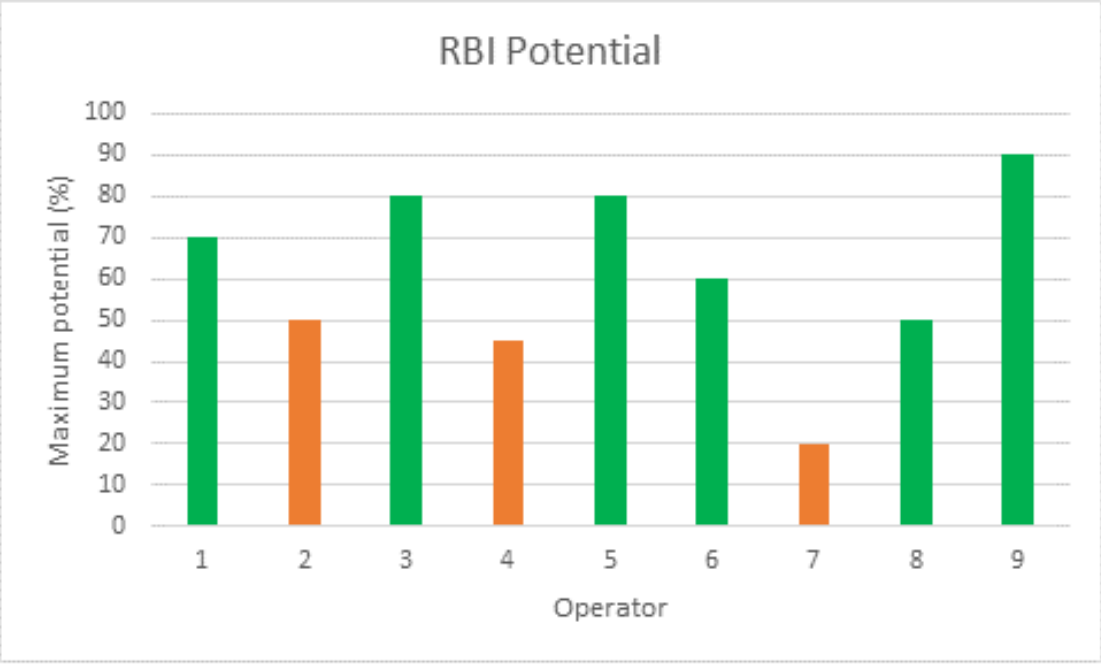


Only one of the eight companies operating offshore assets was making any significant use of NII

Phase 1

Survey of UKCS Operators

Findings – Scope for the potential application of NII



Key:

- Operator with some experience of NII
- Operator with no experience of NII

Phase 1

Survey of UKCS Operators

Overall Findings

The current use of NII within the UKCS is limited with some Operators currently making little or no use of NII.

The survey identified that NII offers the following benefits to the UKCS:

- Safety – up to 80% fewer confined space entries with a corresponding reduction in the number of line breaks and subsequent leak tests
- Financial - increased production and lower maintenance costs worth circa £242 million pa to the UKCS

Phase 2

Pilot Studies

Scope of the Pilot Studies

Four pilot studies with selected Operators to further demonstrate the potential to deploy NII technology.

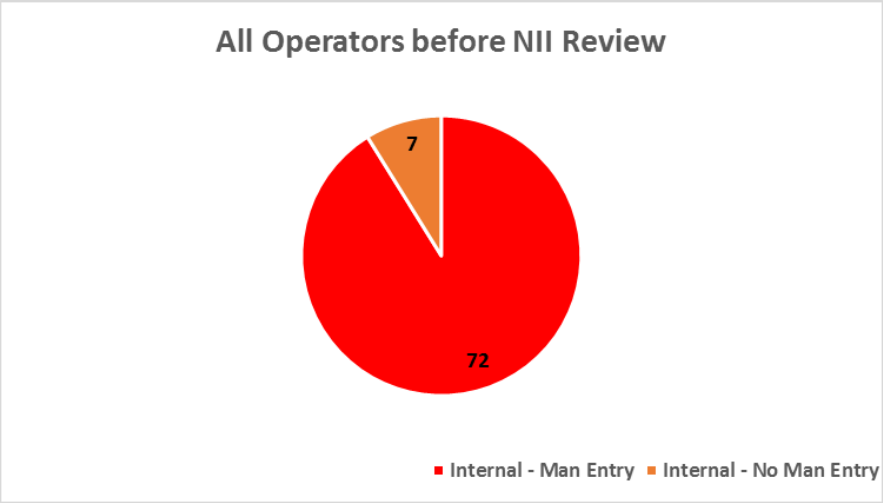
– The pilot studies comprised NII reviews of 79 vessels
– The 79 vessels are located on both fixed installations and FPSOs

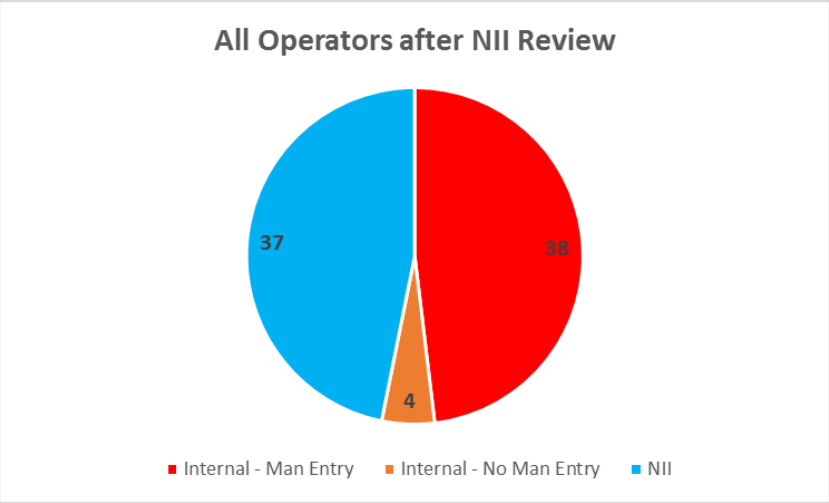
The pilot studies took place between October 2017 and February 2018.

Phase 2

Pilot Studies

Internal Inspection v NII



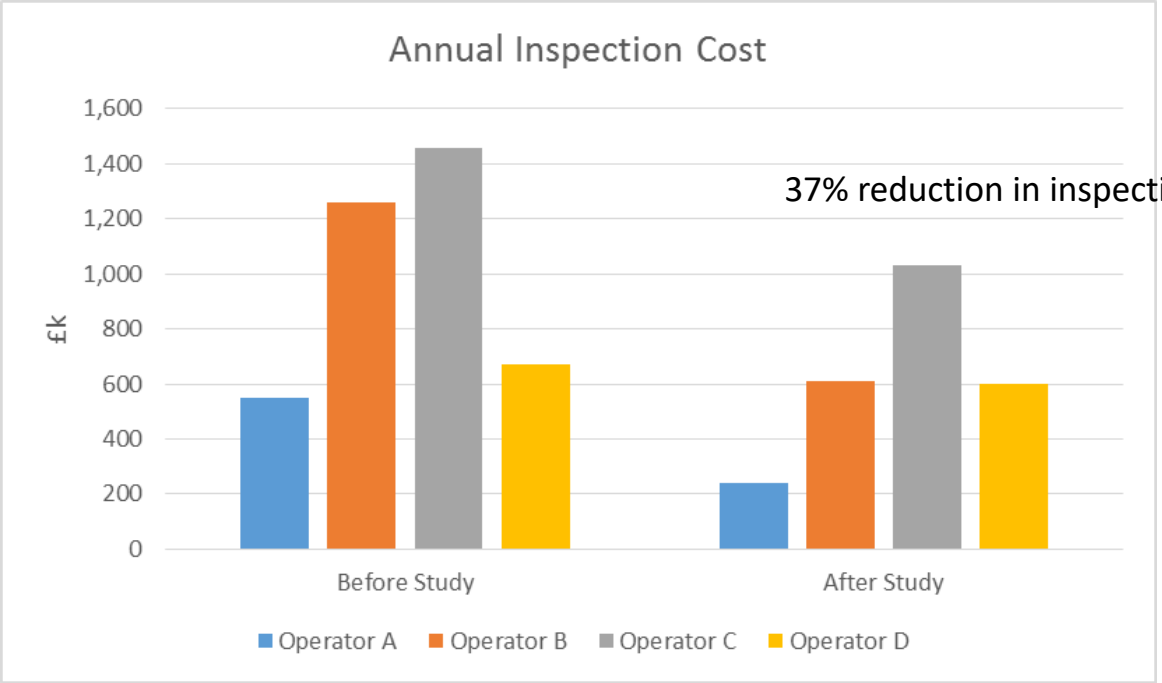


- 47% of the vessels reviewed were found to be suitable for NII
- The results varied considerably from 70% of vessels for one Operator to only 20% of vessels for another

Phase 2

Pilot Studies

Change in inspection costs (annualised basis)



37% reduction in inspection cost*

* Does not include the value of reductions in lost & deferred production

NII

Benefits identified

– Fewer confined space entries – 47% demonstrated with the potential for 70%

– A corresponding reduction in the potential for hydrocarbon releases

– Lower environmental impact from vessel inspection

– Significant reductions in the direct cost of inspection – 37% demonstrated

– Substantial Production Efficiency benefits from less frequent / shorter duration turnarounds

NII

Potential for application across UKCS

– There are circa 4,500 process vessels installed on UKCS installations

– On average these vessels are subject to inspection every 5 years

– This indicates that something of the order of 900 vessels have entries for inspection or operational reasons each year

– The NII initiative has demonstrated that this number could be reduced by circa 50%. Even greater reduction may be possible

NII

Barriers to Change

What's stopping us ?

The NII initiative has highlighted the following as the main barriers to realising the potential of NII:

– Conservatism in parts of the industry, due to a perception of the lack viable NDE techniques

– A lack of management engagement

– Concerns about regulatory compliance and the availability of data within the UKCS

– A lack of transparency of the overall cost of inspection

OGTC NII Initiative

Phase 3

Roll- out

– Engage with operators using NII to understand how they adopted the techniques

– Deepen adoption within the UKCS to realise the full value and sustainability of NII

– Understand behavioural or commercial barriers to the benefit of the wider industry

Questions