Subsea & Drilling Brazil Conference
Subsea Decommissioning
28th November 2019

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Agenda

- Who is NSRI and what do we do
- UK Decommissioning overview & industry practices
- Subsea Challenges and cost saving opportunities
- Research Opportunities for a global strategy
Vision Statement

NSRI is dedicated to advancing underwater technology and sharing cross industry knowledge within the subsea domain, to accelerate economic growth within the Blue Economy.

- Identify and engage research & business opportunity
- NSRI is not a funding organisation, however promotes & brokers funding opportunities
- Matchmaker; industry and academia, users, developers and entrepreneurs
- Clarify industrial challenges and promote best practice
- Promote technological advancement and user adoption
- Stimulate the UK industry and research to address future needs
Decommissioning across Blue Economy

- Oil & Gas
- Wind
- Wave, Tidal & Current
- Deepsea Mining
- Aquaculture
- Carbon Capture & Storage
- Defence

- Efficient logistics
- Subsea lifting
- Comms & Controls Systems
- Waste management – onshore
- Clean-up offshore

- Autonomous Operations
- Sensors & Monitoring
- Localised Power Generation

- Re-use & Re-purpose

Unlocking global opportunities

- Knowledge sharing
- Increase Efficiency
- Identify needs - framing research & facilitating testing

Economic Growth
Decommissioning in UK - Facts & Figures

- Over 186 Projects
- Over 7,500 Km of pipelines
- Close to 7,500 Km of pipelines
- Well P&A £7.9bn
- Facilities Removal £5.7bn
- Project Management £3.9bn

Source: Oil & Gas UK

Decommissioning is an emerging sector in the UK and Norway, accounting for 2% of total industry expenditure in 2010 increasing to 5% in 2015.

Over the next ten years, 186 projects are forecast for decommissioning with 33 in Norway and 153 in the UK.

On the UKCS, £17.6 billion is forecast to be spent on decommissioning from 2016 to 2025.

Between now and 2025, 53% (£9.4 billion) of UKCS spend will be in the central North Sea.

Well plugging and abandonment is the largest category of expenditure on the UK and Norwegian Continental Shelves at around 50%.

Over the next decade across the UK and Norway, more than 100 platforms are forecast for complete or partial removal.

Close to 7,500 kilometres of pipeline are lined up for decommissioning with over 1,800 wells to be plugged and abandoned.

In the past 12 months, UKCS cessation of production dates have been deferred for 33 assets, unchanged for 135 assets, and brought forward for 72 assets.

Source: Oil & Gas UK
Late-Life Operations

Asset Challenges:

- Maximise production recovery
- Maintain safe operations
- Reduce operating costs
- Targeted maintenance & integrity
- Predicting future oil and gas price
- Avoid operating at a loss
  \[ \text{Costs} > \text{Revenue} \]
- Cessation of Production (COP) is in sight...
Decommissioning Timeline

Today...

Pre-COP

- Late-Life Production
- Decom Planning

COP

- Well P & A
- Topside Preparation
- Subsea Preparation

Post-COP

- Topside Make-Safe
- Subsea Make-Safe
- Waste Management, Disposal & Recycle
- Liability & Monitoring

Stakeholder Engagement

Re-use

Significant optimisation opportunity both technically and commercially

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### Decommissioning – UK Landscape

**Regulators**
- Cessation of Production (COP)
- Establish uneconomic & no future use
- Wells abandonment - Well Operations Notification

**Enabling Bodies**
- Decommissioning Program
- Petroleum Operations Notification
- Decommissioning Safety Case
- Pipeline Safety Regulations

**Participants**
- Oil & Gas Authority
- Department for Business, Energy & Industrial Strategy
- HSE Health & Safety Executive
- OSPAR Commission
- *Front End Consultancies, Harbour Boards, the OGTC, marine.scot, The Scottish Government*

**Operators**
- Joint Venture Partners
- Well / Drilling Contractors & Service Companies
- Subsea & Heavy Lift Contractors
- Facilities & Engineering Contractors
- Harbours & Onshore Disposal Companies

**OSPAR**
- Oslo & Paris Commission. 15 countries agreement to protect the marine environment of North East Atlantic
- European standard that has set the scene for environmental expectations.
- It relies on industry to perform what is considered as ‘best practices’
Subsea Preparation - Complexity

- Daisy-chained or cluster
- Manifold and valves in-line
- Pigging may or may not be achievable
- Hydrocarbon range dry gas to heavy oil

- What should we leave in-situ?
  - What legacy remains
  - Impact to others
  - What is the cost of removal or monitoring

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Pipeline infrastructure – how clean is clean
- Not defined by OSPAR, considered industry practice - based on what?
- UK works to 30ppm, linked to oil particulate concentration in produced water, other regions more stringent

Challenges
- No consideration of ‘NORM’ naturally occurring radio-active material
- Laws of physics – difficulties to achieve turbulent flow so it is not flushing, only displacement
- What is the long-term environmental impact – minimal scientific evidence

Subsea Make-Safe Practices: Cleaning

**Wet gas:**
25,000 < GOR < 300,000 scf/stb

**Dry gas:**
No measurable liquids on primary separation

**Volatile oil:**
2000 < GOR < 6,000 scf/stb

**Gas condensate:**
3300 < GOR < 100,000 (typically 7,000 – 35,000) scf/stb

**Heavy and Black oil:**
GOR < 2,000 scf/stb, API < 22°
Subsea Make-Safe: Alternatives

- What are the alternatives?
  - Leave as is and allow natural degradation of residual hydrocarbon.
  - Consider micro-organic management (bacteria eating bugs).
  - Extend use of environmentally friendly natural bio-based dispersants (dispersants are formulations containing surfactants used in oil spill response). Ref Gutierrez, Heriot Watt University, Edinburgh.

Comparative Assessment:
- Safety during works
- Safety long-term
- Environmental impact during works
- Environmental impact long-term
- CO2 Emissions during works
- Technical feasibility
- Total Decommissioning Cost
- Total Residual Cost

Removal and or Left in-situ?
- P & A Monitoring
- Well Isolation
- Removal where practical?
- Removal Techniques
- Waste and Hazardous Management?
- Microorganic Management?
- PIG monitoring
- Flushing and or degradation – how clean is clean?

Topside
- Integrity – Corrosion & Fatigue
- Reman – Safety / Environmental / Cost
- Re-use
- Clean-up
- Where
- Rig to Reef
- Subsea
- Subsurface

How clean?
**Subsea Make-Safe - Opportunity**

**Light Hydrocarbon**
- Typical Costs $3-4m**
- 30 ppm
- Potentially up to $1-2bn across 186 projects

**Heavy Hydrocarbon**
* Heavy oils less likely to clean up to 30ppm, however will provide best endeavours
** Typical Costs $15-20m**

Considerations to be challenged:
- No standard
- No single instrument, measurement through laboratory testing
- Is there a need to flush - where is the scientific evidence
- Should we accelerate the degradation with micro-organic management
- Are we moving the issue onshore (what is the real environmental impact)

A potential opportunity to reduce decommissioning costs?
**Subsea Removal – Artificial Reef Opportunity**

Submerged structures not included in the OSPAR guidelines:
- Artificial islands
- Pipelines and cables
- Platforms and moorings
- Coastal defence structures e.g. breakwaters

- **US**:
  - 1st AR in 1830
  - Florida has issued over 350 licences, since 1918
  - Over 500 rigs-to-reefs in GOM
  - 26m above seabed

- **Italy**:
  - Before reefs
  - Small scale commercial fishermen in different
  - Trawlerman against
  - After reefs
  - Both groups support artificial reefs, increase catches

- **India**:
  - Artificial reefs projects since the 1990's
  - Artisanal fisheries
  - Community led
  - Environmental awareness

All of these act as Fish Aggregation Devices (FAD)
A logical pathway from science to policy

Phase 1 Formulate Hypothesis to test

• Increasing biodiversity increases ecosystem function and ecosystem resilience.

Phase 2 Perform Research

• Targeted analysis (laboratory, field and modelling studies) to examine the hypotheses.

Phase 3 Science results support Policy-making

• Policies developed, such as marine protected areas, regulation of exploitation, protective habitat classification.

Phase 4 Management

• Embed protection of biodiversity (as a proxy for ecosystem services) into policy and design suitable mechanisms for sustainable development.

Man-made structures – haven or hell

Prof David Patterson – St Andrews University and Executive Director of (MASTS) Marine Alliance, Science & Technology for Scotland (NSRI work closely with MASTS)

Haven/Hell?

Hell/Haven?

No scientific basis for exclusion of epifauna and other adhering marine biota in the EIA, increases diversity of the systems

Biodiversity and functionality is locally increased, less significant on larger scale but hotspots and connectivity may be important.

Opportunity to work together to increase knowledge and make better decisions
Conclusions and Way Forward

Conclusions:

- Decommissioning considerations are very active in UK.
- Subsea decommissioning is complex and still maturing, opportunities to reduce cost and consider alternate clean up strategies should be pursued.

Way Forward:

Brazil and UK both have significant subsea infrastructure, therefore opportunities exist to:

- Influence policy and industry through scientific research.
- Drive cost reduction through innovative methods and applications.
- Understand the total environmental impact (offshore and onshore).
- Share knowledge across sectors and geographies.

NSRI: Is in a good position to lead the way forward on behalf of industry as an impartial organisation with strong links in marine science research and a deep understanding of the subsea sector. Pipeline Decommissioning Environmental & Cost Reduction – PDECR™
Thank you

Obrigado

Thanks to our sponsors:

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