

## **SUMMARY REPORT**

### **1. Rationale and Background**

Over the coming decades, society faces a significant challenge to ensure a secure, safe and affordable energy mix while continuing to tackle climate change by reducing carbon emissions.

In pursuing its remit, NERC invests in world-leading research, training and innovation across the energy spectrum to provide society with evidence and expertise to inform decision-making.

As part of its core strategy - the [Business of the Environment](#) – NERC is developing an innovation activity with the oil and gas sector. NERC focus is to understand the challenges and issues facing the sector as a whole, and to explore where opportunities exist for NERC-remit science to be translated for its maximum benefit and impact.

With this in mind, NERC, in collaboration with the NERC Centre for Doctoral Training (CDT) in Oil & Gas based at Heriot-Watt University hosted two workshops bringing together industry, academic and government representatives to scope the biggest challenges facing the oil and gas sector in the UK and the opportunities for NERC-remit science to be translated to address these and inform decision-making.

These scoping workshops were held in early 2015 on the subjects of Decommissioning and Extending the Life of Mature Basins in the UK Continental Shelf and West of Shetland.

This report, produced by NERC with administrative assistance from the CDT Secretariat at Heriot-Watt as facilitators of the workshops, summarises the output from the first of these on the subject of Decommissioning.

### **2. Purpose of the Workshop**

The aim of the Decommissioning Innovation Scoping Workshop, held in Aberdeen on 1<sup>st</sup> April 2015 was to bring together industry, academic and government representatives in the thematic area of decommissioning to consult on and determine the topics of greatest importance in addressing the challenges facing industry as it seeks to manage the environmental impact of these activities.

Outputs from the Decommissioning Workshop, as captured in this report, will be used to:

- Inform a future NERC Innovation funding call in the area of decommissioning (Announcement of Opportunity expected autumn 2015 for innovation projects focused on translation of existing NERC-remit knowledge, data and expertise to provide innovative approaches, solutions and tools to address real-world issues and opportunities facing UK industry); and
- Where clear gaps in research are identified, inform strategic discussions within NERC which feed into the NERC prioritisation process for new strategic research.

More broadly, outputs from the Innovation Scoping Workshops will also guide themes drawn out within NERC's planned strategic investment in a 5 year, £5m Innovation Programme in themes pertinent and relevant to the oil and gas sector (expected to be launched in 2016).

This Innovation Programme will aim to help the industry to understand and scope the scale of environmental challenges it faces and ways to address these by:

- Providing a neutral, open interface with the vast body of UK environmental data, knowledge and expertise;
- Building effective partnerships to facilitate access to that body of knowledge; and
- Translating the knowledge and expertise generated by NERC investments into innovative, industry-relevant tools and approaches.

### **3. Format of Workshop**

The workshop agenda covered the key challenges for the sector surrounding the environmental impacts of offshore infrastructure and assessment of decommissioning options.

A copy of the day's agenda and delegate listing are attached as Appendices A and B. Representatives from various sections of industry gave short context-setting presentations in the morning session. This included presenters linked to gas (Centrica) and oil (Shell) assets, as well as a consultancy (Strategic Decom), and a research programme funded by the industry trade body on decommissioning (INSITE). The purpose of this was to set the scene for afternoon break-out sessions where delegates were placed into facilitated balanced groups of 10 or 11 people covering industry, academia and government/NGO organisations to consider the following three broad areas:

- Perspectives on current and future industry challenges
- Current research landscape
- Opportunities and gaps

Two questions under each theme were posited as an aid to the group discussions. There was then a short feedback opportunity for each group to the conference after each session.

### **4. Key Themes Identified**

The output from the break-out sessions has been collated under five main themes: Common Terminology and Cross-sector Collaboration; Data; Monitoring; Degradation of Materials; and Communication. A short overview has been provided for each section followed by comments taken from the break-out sessions and presented here as bullet points.

#### **4a. Definitions and Collaboration Across Industries**

It was commonly agreed that the marine environment is shared by a wide variety of users all of whom potentially impact that environment to a greater or lesser extent. The main objective was that there should be wider consultation on this issue to ensure that lessons

learned from other users can be taken into account and that decisions include the consideration of knock-on consequences for other industries. Users and researchers in all aspects of the marine environment should collaborate more, sharing data and resources. There was also a need for common definitions to be agreed so that a shared terminology could be adopted throughout decommissioning activities.

- One governance for the sea - not just oil and gas interests. Do other industries such as shipping or fishing deposit more pollutants into the marine environment or bring about greater destruction of marine populations than oil/gas sector?
- Knowledge Sharing - Monitoring to transfer experience between organisations of all kinds
- Are artificial environments important and as valid as what was there previously? Where is the science to demonstrate the importance of decommissioning? The environment does not have a tangible 'value' versus the cost of protecting

Delegates agreed that clarification and agreed definitions would be helpful to ensure that data is collected and monitoring systems established on a commonly agreed basis to allow for proper comparison and long-term evaluation of success/failure.

- Define 'good' and 'bad' with regards the environment. Habitats directive - what is the end goal? What's clean? (particularly for pipelines - prod water level currently used)
- Research is needed to see what impact oil and gas installations have on the natural environment. Define 'natural environment' when a new 'artificial' environment has been created - which is preferable?
- Emphasis on recycling - BUT – re-smelting is highly energy intensive, so what other uses may exist? We need to define what we mean by 'recycle'. What can and cannot be reused needs to be categorised in order to obtain the best energy result. How clean is clean? Define an acceptable level.

#### **4b. Data Issues**

Many aspects of data collection and use were highlighted by delegates. In particular the issue of agreeing and establishing baselines for monitoring purposes was regarded as being worthy of further research despite the fact that the North Sea's baseline was effectively 50 years' ago before offshore oil and gas exploration began. The sample area size was discussed, as was using analogue models from other structures that have been in the water for much longer e.g. WW2 shipwrecks.

- There is a lack of clarity/consistency in determining baseline requirements. Where is the baseline? - Evidence base (sustained period monitoring). Time trends - seasonal, day/night, rig vs. control
- Environmental baseline ignored - put off, seen as a liability. EIA is not seen as a priority at present – more ecological data is needed, which requires a standard, long term process
- Sampling techniques haven't moved on - 0.5m sampling of drill cutting piles 7m deep. Sampling disturbs the pile and pollutes the water column.
- Modelling dispersal of contaminants, especially down-scaling to a local area, not whole ocean

- Datasets / analytical chemistry has progressed, so it's difficult to determine the baseline we need to get back to, or do we want to go back to pre-structure environment?
- APE contamination - recent report 2011?
- Dream/Proteus software - specific industry models already in use, came from research
- 50/100 cases all heeding the same model are needed - approach to make a model/technique commercially viable. Regulatory driver is useful, but we need the data to inform policy = a vicious cycle. Drill cuttings only need to be kept for 5 years onshore. Cleaned of contaminants before dispersal on/off-shore, so no use for data extraction
- Spend money dealing with the drill cuttings, not on research to decide whether it's best to leave, spread or remove. Review of industrial clean-up techniques
- Additional deposits down for safety e.g. pipelines. Rock dumping - cuttings - we don't know where they are so need a detailed map of all deposits associated with oil and gas to inform decisions
- Need area data - not by asset. Cost of maintaining monitoring programmes over time?
- Regional versus local impact - protected species - data (good data!) needed on what exists now
- Region vs. site by site surveys - need to understand baseline
- Seabed data - It does exist, but what quality / screening?
- What is the tipping point: effect across space (local) or time (duration)?
- Artificial structure vs. natural environment and variation - seasonal, temporal
- Localised/regional, mobile species movement, interaction between species and within environment, interaction with man-made structures
- Big data: access, usability, value

Another key issue discussed was the sharing of data between interested parties, and which body should be responsible for setting up the protocols to ensure the publication or at least wider access to both existing and newly acquired data

- Review existing industry data - use high resolution seismic. Free hydrocarbons detection on land – develop to use sub-sea
- We don't know what is out there! Mapping, cataloguing, data
- Lists of assets and lessons learned - formats to be centralised
- Data collection, sharing - we need information on what is there, for the whole North Sea
- Fear of data falling into the wrong hands. FOI - fear of data becoming available publicly - data does not have to be given out. Data access is too complex and variation is not well understood. Very little GOOD data exists
- Information accuracy is a problem - need clearer guidelines
- Will enough data exist in time to influence policy that is required now?
- What is the best way to make data available to users e.g. formation of an electronic repository?
- High quality, peer reviewed research is required to be the basis for dissemination. Challenge = no central collection of data. Opportunity to collect raw data - all collected survey data for all industries, i.e. open data sharing. A data sharing initiative is needed - academia could offer this

- Where is the existing data? It needs to be compiled and combined with other disciplines.
- Encourage JIPs - shared ownership of data.

#### **4c. Monitoring Techniques, Periods and Schemes**

Allied to the issues of consistent data collection is the establishment of regulated and agreed monitoring protocols covering techniques, time periods and baselines. The acquisition, creation and assessability of big datasets were all recognised as key topics to be addressed.

- Environmental Impact Assessment as a design tool - there to dictate best practice - as platforms are not standard, so there is currently no standard best practice
- Use of modelling & simulators for assessment - identify sensitive pathways, validate with samples
- Use of existing structures for research & analysis, especially for material degradation
- Comparative Assessment used to justify decision - little scientific evidence for its use and no systematic process for evaluating the methodology
- Impacts of hard structures in soft sediment?
- Mapping the landscape as it currently stands - whose role is this? Oil and Gas Authority (OGA)?
- A number of mapping projects are being conducted - OGIC Decomm North Sea, Sensors InnoCentre
- Baselines - hard to get - what is natural? Natural variation, cycles, location...
- Pre-installation in 70s? Pristine baseline? Localised or North Sea wide? - Needs consistent methods and sampling process - comparative analysis rather than baseline
- Standard methodology - not 'bespoke' - but need to develop the standard. A timeline is needed to change research, show results and their value
- Risk-based methodology based on trusted data that then accurately guides the regulatory processes / liability question How to undertake long term monitoring without having a greater impact on what remains?
- Issue of scale 0 pinpoint effect, irrelevant to the North Sea. Issue of cumulative effects - one platform influences another
- Standard methodology - not 'bespoke' - but need to develop the standard. A timeline is needed to change research, show results and their value
- Comparative ecosystem function - compare an area with a rig with one without one. How has the environment adapted?
- Cost effective sampling - big survey vessels are extremely expensive, fishing vessels are often suitable – one way to promote collaboration across different industries with a vested interest in the North Sea
- Use of drones in surveying rigs
- Unmanned vehicles = use of technology to increase efficiency.
- Smart buoys and detection methods - water sampling

#### **4d. Degradation of Materials**

Delegates identified that the creation of cuttings piles on the seafloor has the potential to change the environment either through contamination or else by setting up whole new ecosystems and biological communities. It was self-evident that more information is

required regarding the natural degradation processes as well as that of man-made materials introduced into the marine environment.

- Natural degradation - what is known about this in the long term?
- No access to pipelines so what happens if the pipeline is left dirty? What are the degradation pathways? What needs to be monitored and for how long?
- How fast do the different elements of the rig degrade? Geographic variability, Gulf of Mexico vs. North Sea
- Structural integrity over time
- How does concrete and steel degrade? Degradation modelling
- Cathodic protection for steel structures - if removed - degradation will be much quicker
- Possible test bed demonstrator project - improve prediction opportunities

#### **4e. Communication**

A number of delegates were concerned about the perception of decommissioning activities, not just in the 'external' world of the public, press and stakeholders more immediately involved with a particular decommissioning project, but also within the 'internal' world of organisations already knowledgeable about aspect of oil, gas and/or the environment e.g. government regulators, NGO's and even other disciplines within the oil & gas sector itself.

Research outcomes need to be assessed over time and received wisdom can change with new evidence or the testing of new theories. Regulators need to keep being informed and be aware of the long timeline (hundreds of years) over which the environment will be affected.

Industry and consultants also noted that the economic factors influencing decisions on decommissioning options should be more widely debated and understood. It is possible to have great research output but it cannot be trialled because the costs are either too great and are not included in the original research proposal or there it is not clear if there will be sufficient demand to make the technique/equipment etc. viable. This connects back to the data collection/monitoring issue for example – the technique has to be applicable to a number of sites/structures, not just a bespoke solution for an individual project.

- Research into how to communicate complicated science - acceptability is not the same as science
- An honest assessment - is it worth removing it at all? Too little focus on researching solutions
- Communication - address concerns and involve the public!
- Fiscal regime for MER. Commercial aspect to application of research – industry interested in cutting costs
- INSITE/OSPAR interface - how to get science into OSPAR - are NGOs involved enough?

#### **5. Conclusions and Key Research Themes Identified**

A number of recurrent themes and questions were identified throughout the course of the workshop that could be used to inform the Innovation Programme or future research. The following bullet points are taken from the break-out session outputs and show the breadth

of issues, some general, some very specific, that delegates identified as needing attention from the research community.

- What data exists currently? Understanding (benthic) connectivity, Establishing a baseline and understanding variability
- Cost vs. Environmental impact - pros and cons of leaving installations in place need to be better understood
- Are the big platforms worth removing? How will they degrade? We don't know!
- Where should the jacket be cut?
- Temporal variations in seabed morphology - how dynamic are seabed environments? Data measured for existing wind turbines - where is that data?
- There is a focus upon marine mammals - biodiversity has greater complexity.
- Long term monitoring of mammals - hydrophone sensors left on sea surface for months - monitoring is a huge task / priority
- Research is required to find out if certain species actively avoid or seek out some installations
- CCS or geothermal potential? Gas storage - is this economic?
- Look at the onshore effects of decommissioning e.g. disposal of marine structures in landfill etc.
- Is an abandoned rig the same 'environment' as an active one? Structure vs. Activity - no baseline for either
- Hydrocarbon leakage - how much is damaging? Seepage to be considered a natural process?
- Unmanned/Autonomous Surface Vehicle (USV/ASV) improvements will reduce costs. Carrying of large payloads - powered from renewable energy sources?
- Can we improve our analysis time? We need more monitoring of the impact to help provide a model for interim decision making - make this more secure / less risky
- Particulate removal
- Drill cuttings - disturbance, injecting microbes? Survey of cuttings - potential leaching rates - what are the thresholds?
- What is happening in the subsurface once everything is removed?
- Build in adaptation to any long term monitoring programme
- A process is required for merging data sets, producing a combined set which can be interpreted
- Biodiversity - or functional capacity of ecosystem: Which do we consider to be more important?
- Commercial concerns versus new techniques being used in research. Sensor technology at depth. Difficult to get permission to try out new kit / too costly to trial
- Need to build confidence in the Autonomous Underwater Vehicle (AUV) industry/ technology
- Wells - reuse for Carbon Capture & Storage (CCS), As Low As Reasonably Practicable (ALARP), guidance - different approaches
- Contaminants / persistence - impact on fisheries of leakage
- Leakage - significance? Remedial action?
- Reuse - pipelines, engines, storage, compressor?
- How to measure contaminants/composition of residue in vessels
- Review the way we assess risk – Risk Based Authentication (RBA), ALARP?
- Net Environmental Benefit Analysis (NEBA)
- Are wells going to start leaking in 100 years' time? High pressure reservoir recharge?

- Opportunity to change framework (EIA) to make this more impactful on industry decisions
- What are the key questions that policy makers have? Is there an alignment of interests?
- Legislation driving decisions and processes - research outcomes need to drive legislation



## APPENDIX A DECOMMISSIONING WORKSHOP AGENDA



### **NERC INNOVATION WORKSHOP – DECOMMISSIONING, 1<sup>st</sup> April 2015, AECC**

- 9:00 a.m.      *Registration (tea/coffee available)*
- 9:15 a.m.      Welcome and Introductions - Prof. John Underhill, Shell Chair of Exploration Geoscience, Heriot-Watt University
- 9:25 a.m.      Welcome and background to the workshop – Robyn Thomas, Senior Innovation Manger, Natural Environment Research Council
- 9:35 a.m.      Overview of the challenges facing the sector – Bob Hemmings, Strategic Decom
- 9:50 a.m.      Case Study: Decommissioning Brent - James Blackburn, HSE Manager, Brent Decommissioning, Shell UK
- 10:10 a.m.     Case Study: Southern North Sea – Ian Whitehead, Centrica
- 10:30 a.m.     The Regulator’s Perspective - Dr. Sarah Dacre, Environmental Management Team, Energy Development Unit, Department of Energy & Climate Change
- 10:45 a.m.     Investigating the Influence of Man-made Structures in the North Sea: The INSITE Programme Foundation Phase – Richard Heard, INSITE Programme Director
- 11:00 a.m.     *Coffee/Tea break*
- 11:30 a.m.     Break-out Session 1    Perspectives on current and future industry challenges
- What are the strategic areas of interest?
  - What will this look like in 5/10 years’ time?
- 12:15 p.m.     Break-out group feedback to workshop
- 12:45 p.m.     *Lunch*
- 13:45 p.m.     Break-out Session 2    Current research landscape
- Are there opportunities for research to inform regulatory guidance and policy formulation?

- What are the challenges for research in addressing environmental baselines, long-term monitoring and bio-diversity?

14:30 p.m. Break-out feedback to workshop

15:00 p.m. *Coffee/Tea break*

15:15 p.m. Break-out Session 3 Opportunities and gaps

- What knowledge gaps need to be addressed?
- What existing/new technologies and assessment methods could be applied to the decommissioning activity?

15:50 p.m. Break-out feedback to workshop

16:10 p.m. Next steps – Sarah Keynes, Knowledge & Innovation Officer: Natural Resources, Natural Environment Research Council

16:20 p.m. Conclusion – Prof. J. Underhill, Shell Chair of Exploration Geoscience, Heriot-Watt University

**Follow up contacts:**

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## **APPENDIX B DECOMMISSIONING WORKSHOP, 1st April 2015 – DELEGATE LISTING**

<b>Forename</b>	<b>Surname</b>	<b>Organisation</b>
Patrick	Gbaya	Aberdeen Oil Corporation
Martin	Williamson	AECOM
Jillian	Price	Amec Foster Wheeler
Zoe	Crutchfield	ARUP
Les	Brodie	Attric
Carol	Barbone	BG Group
Andy	Clucas	BG Group
Angus	Pearson	BG Group
Joe	Ferris	BMT Cordah
Gareth	Jones	BMT Cordah
Deborah	Morgan	BMT Cordah
Donald	Orr	BP
Robert	Gatliff	British Geological Survey
Konstantin	Nazaruk	Canadian Natural Resource Intl. (left)
Myrtle	Dawes	Centrica
Ian	Whitehead	Centrica
Deji	Legunsen	Chevron Upstream Europe
Steve	Cromar	ConocoPhillips
David	Reaich	ConocoPhillips
Bill	Cattanach	DECC
Victoria	Crossland	DECC
Sarah	Dacre	DECC
Karen	Seath	Decom North Sea
Michele	Eaves	EnQuest
Andrew	Corse	Fairfield Energy
Farah	Chaudry	Gardline Environmental Ltd
John	Morse	Gardline Geosciences Ltd.
Sean	Hayes	Genesis Oil & Gas Consultancy
Martha	O'Sullivan	Genesis Oil & Gas Consultancy
Gordon	Picken	GP Decom Ltd
John	Hartley	Hartley Anderson Consultancy
Anna	Clark	Heriot Watt University
Teresa	Fernandes	Heriot Watt University
Kate	Gormley	Heriot Watt University
Lea-Anne	Henry	Heriot Watt University
Lorna	Morrow	Heriot Watt University
Douglas	Pritchard	Heriot Watt University
John	Underhill	Heriot Watt University
Gordon	Winton	Heriot Watt University
Caitlin	Forsyth	Industry Technology Facilitator
David	Riddell	Industry Technology Facilitator
Jenni	McDonnell	Innovate UK / KTN
Richard	Heard	INSITE
Suzanne	Lumsden	Iona Energy
Bethany	Graves	Joint Nature Conservation Committee

<b>Forename</b>	<b>Surname</b>	<b>Organisation</b>
Becky	Hitchin	Joint Nature Conservation Committee
Jim	Ayton	Lloyds Bank Commercial Banking
Adam	Jones	Maersk Oil North Sea UK Limited
Liz	Galley	Mara Environmental Ltd
Callum	Falconer	Marathon Oil
David	Paterson	MASTS
Peter	Hayes	Marine Science Scotland
Derek	Moore	Marine Science Scotland (retired)
Stephen	Thompson	Mitsui & Co. Europe plc
Elizabeth	Linley	National Oceanography Centre
Sarah	Keynes	NERC
Robyn	Thomas	NERC
Ron	Smith	Nuvia
Ian	Phillips	Oil & Gas Innovation Centre
Ken	Cruickshank	Oil & Gas UK
Gillian	Kinsella	Oil & Gas UK
Andy	Leonard	Oil & Gas UK
Louise	O'Hara Murray	Oil & Gas UK
Mary	Wilson	Petrofac Facilities Management Ltd.
Benedict	Gove	RSPB
Rob	Schneider	Scottish Oil Club
Kate	Black	Seascope Environmental Ltd.
Fiona	Birkinshaw	SEPA
James	Blackburn	Shell UK
Fred	Ducellier	Shell UK
Ann	Montgomery	Shell UK
Liz	Paddon	Shell UK
Malcolm	Salisbury	Shell UK
Duncan	Thomas	SLR Consulting
Bob	Hemmings	Strategic Decom
Ron	Curley	Talisman Sinopec
Ann	Meek	Talisman Sinopec Energy UK
Calum	MacPherson	Total
Forbes	Sinclair	Total E&P UK
Ciara	McGarry	Trilogy Environmental Solutions
Michael	Essex	UK Trade & Investment
James	Anderson	University of Aberdeen
Stewart	Chalmers	University of Aberdeen
Toyonobu	Fujii	University of Aberdeen
Elvina	Gontikaki	University of Aberdeen
John	Howell	University of Aberdeen
Alan	Jamieson	University of Aberdeen
Alex	Kemp	University of Aberdeen
David	Lusseau	University of Aberdeen
Luis	Perez	University of Aberdeen
Lloyd	Potts	University of Aberdeen
Srinivas	Sriramula	University of Aberdeen

<b>Forename</b>	<b>Surname</b>	<b>Organisation</b>
Paul	Thompson	University of Aberdeen
Dan	Mayor	University of Aberdeen/NOC
Tiago	Alves	University of Cardiff
Michael	Brown	University of Dundee
Peter	Grassl	University of Glasgow
Harrison	Brook	University of Lancaster / RSPB
Quentin	Fisher	University of Leeds
Nick	Nikitas	University of Leeds
Katherine	Morris	University of Manchester
Yves	Plancherel	University of Oxford
Elsa	João	University of Strathclyde
Emek	Kurt	University of Strathclyde
Stuart	McKenna	University of Strathclyde
Alex	West	Westlord Associates
Graham	Ling	Wood Group Kenny
Graham	Taylor	WorleyParsons Consulting
Peter	Tipler	Xodus Group
Maurice	Golden	Zero Waste Scotland
Cheryl	Robb	Zero Waste Scotland