A large offshore oil and gas platform with multiple yellow structures and cranes, situated in the middle of a dark blue ocean under a cloudy sky. The platform is connected by a long walkway to a smaller structure on the right.

Exploration & Production

Environmental Performance
Review 2016

centrica

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Foreword



Centrica's exploration & production business faced a transitional year in 2016, as we began delivering on our strategy of becoming a sustainable, agile European E&P company.

While we moved to a new structure and operating model to deliver this strategy, I am delighted that our focus on safe operations remained unchanged and that the hard work of our teams across the UK, Netherlands, Norway and Canada is reflected in a production of 71.2million barrels of oil equivalent in 2016.

2016 was also a year of firsts for Centrica, as we celebrated first gas from the major Cygnus field in the southern North Sea, a development now on course to be the single largest producing gas field in the UK North Sea and where we have a 48.75% non-operated stake. Our team

in Norway also submitted the Plan for Development and Operation for its first operated development project, Oda – an exciting development scheduled to come on stream in 2019.

Our environmental obligations are of prime importance throughout all operations, and investment in our Morecambe Bay assets continued last year with the completion of the Barrow Terminals Project. This was an £84million operation to transfer all the gas processed at the South Terminal to the newer North Terminal, which uses more environmentally-responsible methods in processing. We are also acutely aware that our obligations go beyond the production life of our assets, and safely and successfully decommissioned two subsea fields in the southern North Sea last year – more than 95% of the waste from the Stamford and Rose fields was recycled, and we made sure that none went to landfill.

Despite the work we have done in the past 12 months to ensure safe and efficient operations during a challenging time for the sector, we know we cannot be complacent, as the impacts of lower prices continue to be seen across the industry. The safety of our people and our environmental responsibilities are our top priorities, and this will continue through the life cycle of our assets.

Ken Robertson

HSE and Technical Director



Group Environment Policy

At Centrica we are committed to understanding, managing and reducing the environmental and ecological impacts of our activities through innovation, technology and cultural change.

We are committed to:

Assessing, understanding and managing our environmental risks and impacts, placing special emphasis on minimising major accident risks.

Enabling and encouraging our employees to help us achieve our environmental goals.

Proactively seeking ways to reduce our carbon emissions.

Reducing waste and using resources efficiently.

Developing renewable and low-carbon energy sources, products and services.

Encouraging our customers to move towards a low carbon future by helping them make informed decisions about the use of our products and services.

Working with our suppliers and business partners to pursue responsible environmental practices.

Publishing regular performance reports and openly discussing our environmental performance with internal and external stakeholders.

Continually improving and setting measurable objectives and targets to prevent pollution and reduce our environmental impacts.

Complying with environmental legislation, regulations and other applicable requirements.

We will implement comprehensive environmental management systems that are routinely audited in all our businesses and attain certification to ISO14001 or equivalent in our exploration and production, power generation and servicing and installation operations. Our performance is reviewed regularly by the Centrica Executive Committee.

Iain Conn

Chief Executive

Our Operations

Centrica's European Exploration & Production business operates in three business asset groups– North Sea, Morecambe and Norway. The North Sea assets include facilities in both the UK and the Netherlands.

This review covers our performance in the European assets which are within the OSPAR region.



North Sea Assets

Centrica operates assets in the central and southern North Sea. Our operated oil field, Chestnut is in the central part of the UK North Sea and has been in production since 2008. Operated gas assets in the Southern North Sea includes facilities in the Netherlands and UK sectors. Facilities include the Hummingbird Spirit floating production, storage and offloading (FPSO) vessel at the Chestnut field, manned fixed platforms at J6-A and at F3-FA and seven not permanently attended installations (NPAI) and one subsea asset.

In addition to routine operations at these facilities, in 2016 we decommissioned the subsea fields Stamford and Rose in the Southern North Sea. Plans for the decommissioning of ST-1 and the Audrey NPAIs

and associated infrastructure have also been further developed.

In our non-operated North Sea portfolio, we have interests in the Cygnus gas field, the largest single producing gas field in the UK North Sea, as well as the Armada, Alba, Brae and Beryl assets. The Cygnus gas field came on stream in December 2016.



Morecambe Assets

The combined fields of Morecambe Bay remain a cornerstone asset for Centrica. The area continues to provide a significant portion of the UK's gas supply. Centrica's East Irish Sea fields have been producing gas since 1985, supplying more than 6.5 trillion cubic feet of gas for UK homes and businesses. The hub also includes the Barrow Gas Terminals, which together process all the gas from Centrica's assets in the East Irish Sea as well as some third-party fields.

The Morecambe Bay fields are produced via three bridge-linked installations, forming the Central Morecambe platform, as well as seven NPAIs and two subsea tiebacks.



Norway Assets

Since entering Norway in 2006, Centrica has built a solid portfolio of assets on the Norwegian Continental Shelf. We will continue to explore, develop new projects and maximise the output of producing assets. We operate the producing Vale field, which flows back to the Statoil Heimdahl platform. We are also continuing planning of the Oda and Fogelberg field developments. Our non-operated interests include stakes in major Norwegian fields such as Valemon, Heimdal, Statfjord and Kvitebjørn.

Our EMS

The Centrica Environmental Policy outlines our responsibilities in relation to environmental stewardship and our commitment to continually improve our environmental performance. The environmental management of our operations are integrated within health and safety as well as the business management activities. This integrated system ensures the embedding of environmental requirements into business practices for maximum benefit.

The following key impacts and risks are managed within routine operations:

- Carbon dioxide emissions from power generation and flaring
- Oil discharged in produced water
- Chemical use and discharge to sea
- Waste generation and disposal
- Unplanned events – emissions, discharges and permit non-compliances

Performance is reported to the regulators and within Centrica to operations and senior management and a number of other forums such as to the Carbon Disclosure Project. Performance data is also available on the Centrica website (www.Centrica.com).

Improvements in performance are planned and managed within the annual improvement planning cycle. These improvements are approved by senior leadership and aligned with business operational plans. Maximum benefit from strategic initiatives and improvements can be achieved across the exploration and production business through this planning process.

Our management systems are certified to ISO14001¹. In 2017 we plan to transfer to the new ISO14001 standard prior to the deadline in 2018.

This report summarises the performance and initiatives of Centrica's exploration and production operations in 2016 and the planned improvements in 2017 as required by OSPAR².

¹ ISO 14001 is an internationally recognised standard for environmental management systems

² OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry

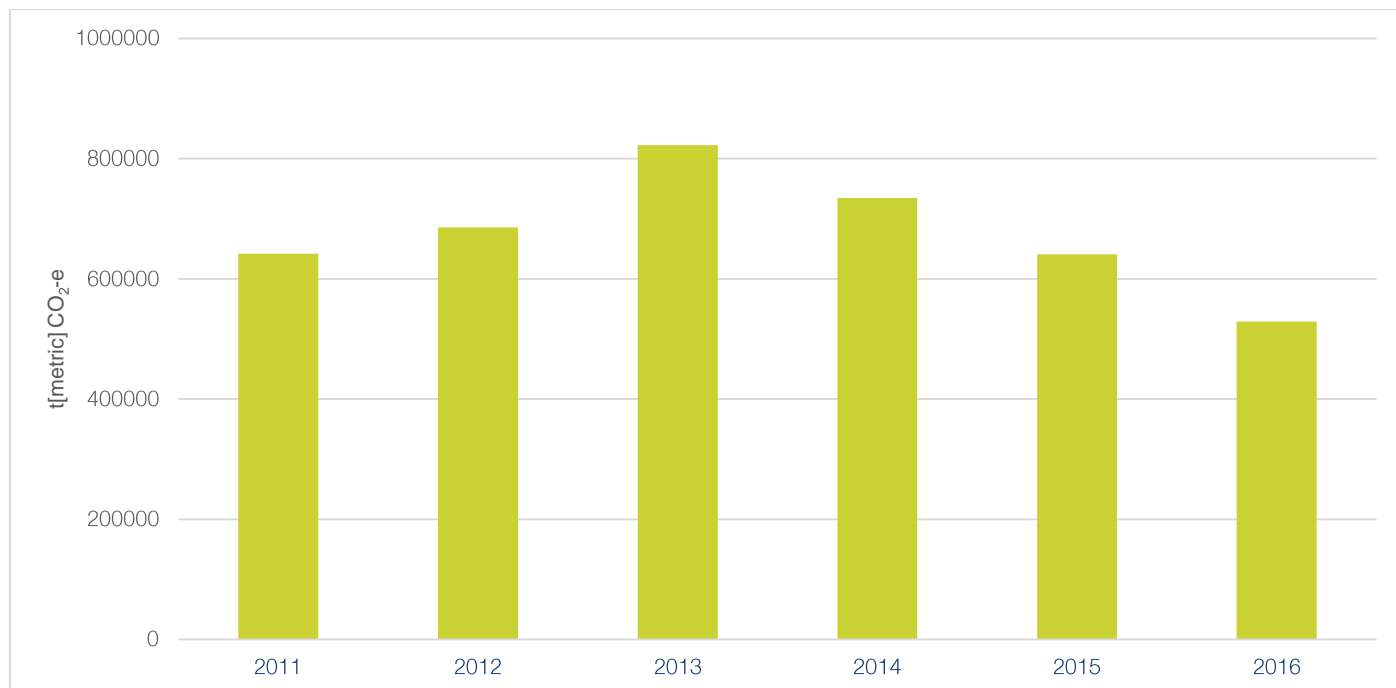
Our Performance

The environmental performance of our activities in 2016 is summarised below and presented in detail in the Appendix.

Carbon dioxide emissions

The emissions from our offshore and onshore installations are shown from 2011 to 2016 in Figure 1 and in Figure 2 for our higher emitting facilities.

Figure 1 – Historical carbon dioxide emitted (EU ETS)

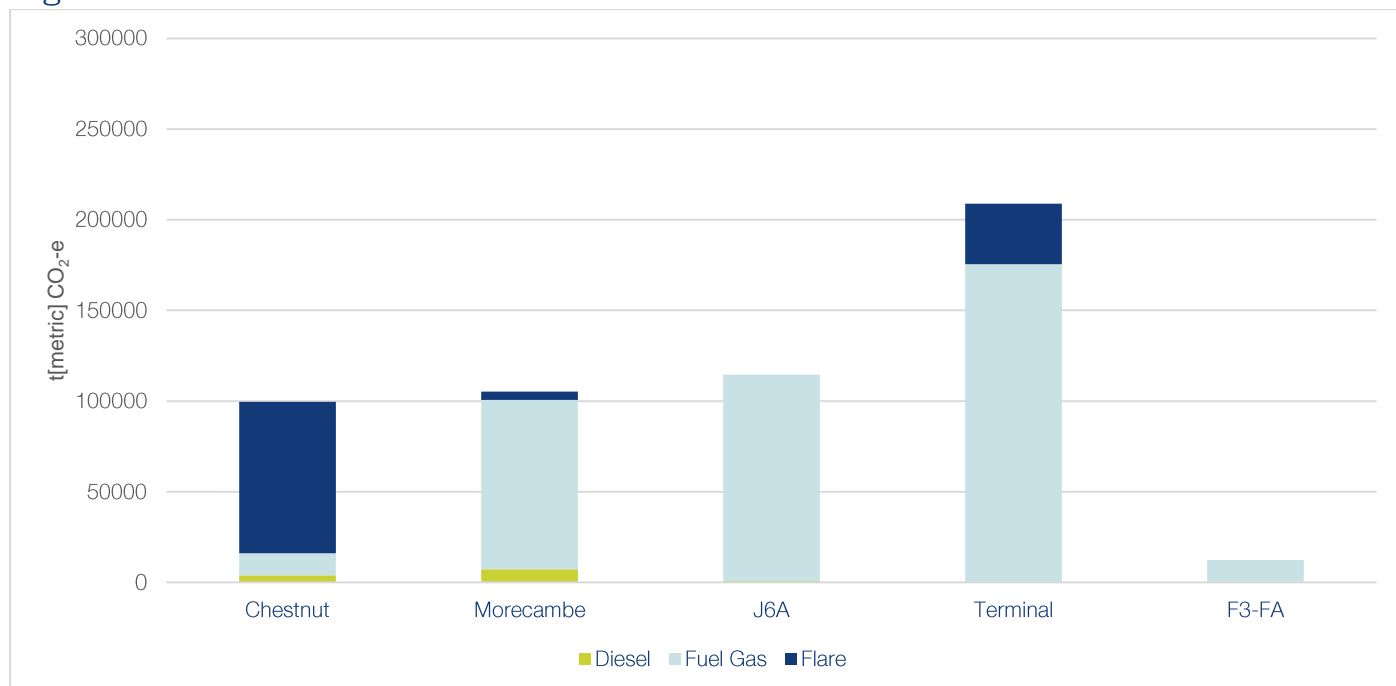


Emissions data for all Centrica Assets are in the Appendix. The majority of emissions to atmosphere are from turbines used for power generation and gas compression. The emissions from the Not Permanently Attended Installations are considerably lower than the higher emitters in our portfolio, due to the lack of process and compression equipment on these smaller facilities.

In 2016, Asset emissions were impacted by the following

- Intervention activities at the Chestnut Hummingbird Spirit resulting in lower direct CO₂ emissions from combustion.
- Increased diesel use on South Morecambe Platform in 2016 due to an extended shutdown following operational issues at the Barrow Gas Terminals

Figure 2 – Carbon dioxide emitted in 2016



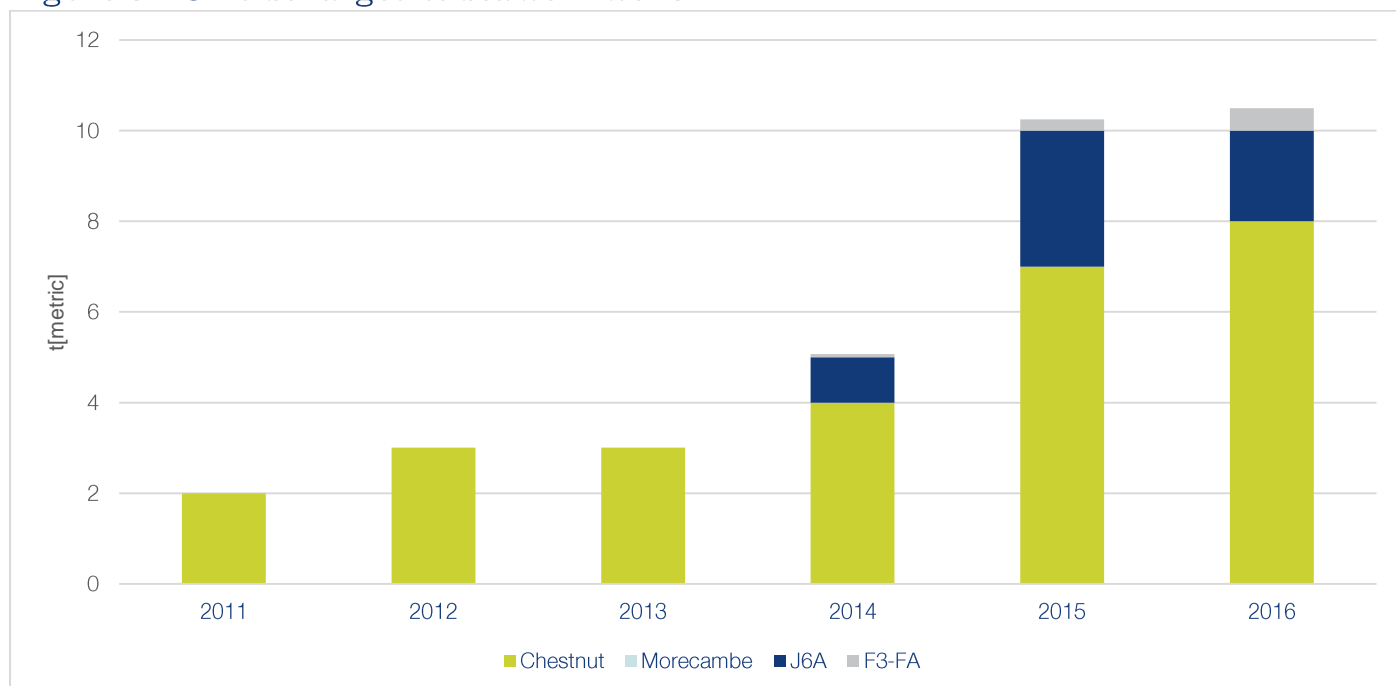
Carbon dioxide from the combustion emissions at the Hummingbird Spirit FPSO, Morecambe Bay, J6-A in the Greater Markham Area (GMA) and the Barrow Gas Terminals are part of the EU Emissions Trading System (EU ETS). In 2016 Chestnut, Morecambe and the Barrow Gas Terminals met the ETS free allowances limits.

Carbon dioxide emissions continue to decrease from our assets due to a reduction in production due to operational issues e.g. F3-FA has encountered well flow issues and we have had an extended shutdown in the Morecambe asset this year.

Oil discharged in produced water

Oil is discharged to sea in produced water following treatment at the Hummingbird Spirit FPSO, Morecambe Bay, J6-A and F3-FA facilities. The total oil in produced water discharged from these facilities over the past five years is shown in Figure 3. All oil to sea discharges in produced water were within the oil tonnage permitted limit (where applicable) in 2016.

Figure 3 – Oil discharged to sea 2011-2016



The increase in oil discharged in produced water in 2016 from our assets was largely due to increased water production from the wells at the Chestnut field. The uptime of the produced water reinjection system on J6-A was greater than in

2015, however a full year of performance is yet to be achieved and investigations are underway to optimise the system. The elevated water and oil discharge at F3-FA in 2016 from the 2015 level was due to increased water breakthrough.

Chemical use and discharge to sea

The amount and type of chemicals used for our offshore operations differ depending on the activities and reservoir types, for example the rock type to be drilled, well design and production functions. In 2016 our drilling activities decreased which is reflected in the low overall chemical use in our operations compared with 2015.

A routine review of the technical justifications for chemicals flagged for substitution is carried out within Centrica, to ensure opportunities for minimisation of use and/or discharge are realised.

In 2016, research was conducted for a replacement corrosion inhibitor at GMA and F3-FA, as the current chemical carries a substitution warning. After extensive testing of several chemicals a suitable product was selected and its use implemented. In order to further minimise the discharge of chemical products, Centrica is looking into other GMA wells to investigate their suitability for produced water re-injection.

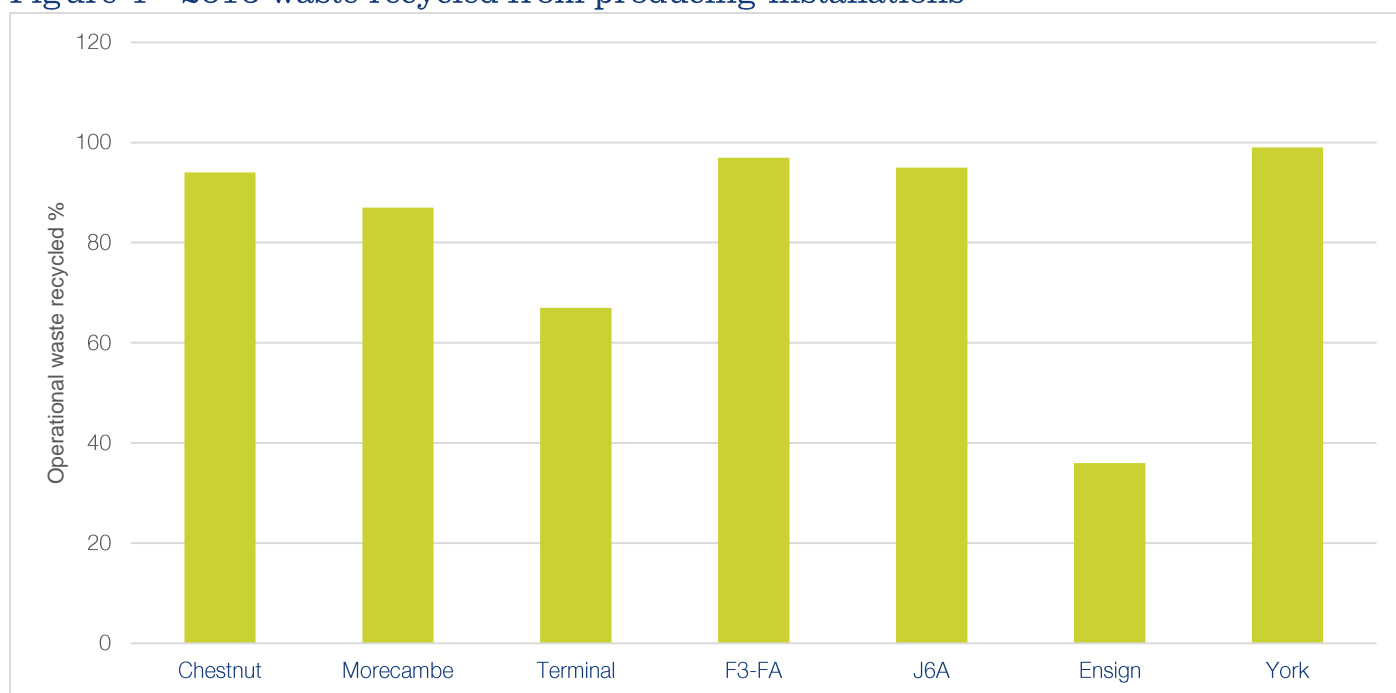
Waste generation and disposal

The management of waste is a key environmental issue for the oil and gas industry, which will become increasingly important as decommissioning activity accelerates in the North Sea. Issues presented by the production of waste range from the increased safety risk from handling hazardous wastes to the limited space available for final disposal in landfill.

In 2016 we focused attention on the opportunities to reduce waste production of our producing assets and improve management by developing a key performance indicator for waste across all our assets.

In 2016 (Figure 4), the average recycling percentage increased from 65% in 2015 to 83%. We will be reviewing performance in 2017 to identify further opportunities for improvement.

Figure 4 – 2016 waste recycled from producing installations



Unplanned events

Spills to sea

There were 10 spills to sea in 2016 - four were oil and six were chemical hydraulic fluids. The four oil spills to sea released less than 36 kg of oil in total, an increase on 2015. The majority (35 kg) was released from our Morecambe Bay offshore assets across three separate incidents. Corrective maintenance and change in procedures when handling diesel have been implemented to prevent reoccurrence. The other small oil release was due to a flare drop out incident in the Southern North Sea.

The six chemical releases were all hydraulic fluid related to subsea operations and totalled less than 351 kg. The majority of the release amount was due to the testing of subsea equipment at one asset. The remaining five releases were from remotely operated vehicles (ROV) and sampling equipment in relation to preparatory decommissioning operations. Centrica investigated these minor hydraulic oil releases in collaboration with our contractors and has put in place a more detailed evaluation of ROV systems as part of the overall vessel assurance programme, exceeding the requirements of current International Marine Contractors Association guidance.

Other regulatory non-compliances

Nine permit non-compliances were submitted in 2016 to the UK regulator, and none were submitted to the Netherlands or Norwegian regulators. Two were related to the F-gas regulation, three to the Oil Pollution Prevention and Control permitting conditions, two for the Offshore Chemical Regulations and one for each of the EU ETS reporting requirements and the Merchant Shipping OPPOC Regulations 1998 as amended.

All events were recorded and investigated to provide lessons learnt for future activities.

Onshore Performance

Barrow Gas Terminals

Until 2016, hydrocarbons from the Morecambe Bay assets were processed at the South, North and Rivers Gas Terminals³. The £84m Barrow Terminals Project was commissioned in January 2016, and the construction of the new pipeline between the South and North Morecambe Terminals allowed all of the gas from the South Morecambe field to be processed through the North Morecambe Terminal. This will improve the efficiency of the gas processing on site leading to environmental benefits such as significant reductions of carbon dioxide, oxides of nitrogen and carbon monoxide emissions from combustion activities on site as shown in the table below.

Table 1 Emissions to Atmosphere of NO_x, CO and CO₂ from the SMT

South Morecambe Terminal Emissions to Atmosphere	Oxides of nitrogen - NO _x (tonnes)	Carbon monoxide - CO (tonnes)	Carbon dioxide - CO ₂ (tonnes)
2014	101	54.6	117,500
2015	52.9	23.2	79,900
2016	9.9	2.9	14,870

The project has also eliminated the need for the use of hydrochlorofluorocarbons (HCFCs) on South Morecambe Terminal, which are ozone depleting substances and subject to phase out under the Montreal Protocol. Work has now started to demolish redundant equipment on the South Morecambe Terminal, with the sea line and the National Grid link both isolated in late 2016. The project will also ensure any remaining inventory on site is removed, clean the pipework and vessels so that it poses no further risk to the environment.

In 2016 there was only one notification to the Environment Agency regarding a gas release of approximately 13.8 tonnes from North Morecambe Terminal. The release occurred after the failure of one of the tubes on the dew point fin fan cooler. A full investigation was completed into the failure mechanism and the terminals did not operate until new tube bundles for the cooler had been fabricated and installed.

³The terminals operate under an Environmental Permit which is regulated by the Environment Agency (EA).



Case Study: Stamford and Rose Decommissioning – Zero waste to landfill

Decommissioning of infrastructure is a waste management project on a large scale. One of the project teams' aims is to decommission the infrastructure in a way that balances technical feasibility, safety risks, environmental impacts and risks, societal impacts and cost. Legislation is in place to control both the production of waste and the management of any produced waste to minimise environmental impact.

There are options to decommissioning infrastructure *in-situ* and remove infrastructure which require detailed comparison during planning. Any items removed need to be reused or treated as waste following the waste hierarchy (from reuse, recycle, waste converted to energy,

incineration then finally disposal to landfill). Re-use is the preferred option under legislation and Centrica's environmental policy, but re-use opportunities are often difficult to identify for material that has been in the marine environment for many years.

Waste from the Rose and Stamford decommissioning activities in 2016 totalled more than 1,000 tonnes and included:

- Sections of pipeline (steel)
- Sections of umbilical (plastic, steel and copper)
- Mattresses (concrete and polypropylene rope)
- Grout and sand bags (concrete, sand and polypropylene sacks)

Decommissioning waste management presents a number of challenges with the potential for contaminants to be on or in the items to be removed due to being in the marine environment or in contact with hydrocarbons for a long time. These contaminants can include hydrocarbon residues, production chemical residues, normally occurring radioactive material, marine growth and chemicals used during decommissioning. All items have to be checked for contaminants and managed to minimise the potential for personal safety issues as well as environmental impact.

Of the 1,000 tonnes of infrastructure removed, none was disposed of to landfill. Less than 1% was used for energy from waste (used as fuel for power or heat). All of the remaining material has been recycled (treated and processed as a new product). Successful completion was confirmed with a seabed overtrawl.

2016-2017 Environmental Improvement Plans and Performance

	Initiative	Progress
Risk management – environmental integrity	Continued cross-regional focus on the management of process safety to reduce the potential for Major Accident Hazards and regulatory non-compliances.	<p>Continued development and embedding of the Process Safety and Maintenance Excellence projects was carried out in 2016. Environmentally important equipment and elements were identified for all UK and Netherlands assets in 2016.</p> <p>In 2017 we will review the existing planned inspection and maintenance for the identified elements.</p>
Carbon/energy management	Development of carbon savings and energy efficiency opportunities	<p>In 2016 we reviewed and assessed the energy saving opportunities highlighted by the UK Energy Savings Opportunities Scheme (ESOS) and the Netherlands MJA (Meer Jaren Afspraak – Energy Efficiency Agreement). All opportunities are now tracked for the European business. Performance will be monitored and reporting to the business will be developed in 2017.</p> <p>Centrica's Netherlands assets started work towards the ISO50001 energy management certification to support the Netherlands regulatory requirements.</p>
Performance	Common reporting system across the E&P business and review all performance metrics.	<p>In 2016 we continued embedding and optimising the myHSES online system for management of HSES performance. We now have a fully automated data submission and reporting tool.</p> <p>In 2017 we will be further enhancing our reporting tool to increase efficiencies in internal reporting.</p>
Awareness and training	Improvements in environmental awareness training across North Sea and Morecambe assets	In 2016 we reviewed the existing competency requirements for environmental awareness and in 2017 we plan to enhance the training and awareness for operational staff.
Waste management	Development of waste key performance indicator and opportunities for improvement.	<p>A cross asset waste KPI has been developed in 2017 and reported to the assets. Opportunities for improvements will be identified through the remainder of 2017.</p> <p>The existing waste initiative in Netherlands is continuing with the skip assessments and weekly reports to operations.</p>
ISO14001 Compliance	Transfer to the 2015 ISO14001	We carried out a gap analysis of our management system against the new standard in 2016. In 2017 we will start the process of transferring our certificates to the new ISO14001 standard.

Appendix

Performance Data

KEY INDICATOR	Morecambe		North Sea					Norway
	South Morecambe	Total of 7 NPAs and subsea infrastructure	Chestnut	J6-A	F3-A	Total of 5 NPAs and subsea infrastructure	Wells and Projects ² Operations	Vale
Annual average oil in produced water mg/l	11.5	N/A	10.3	13	20.7	N/A	N/A	N/A
Tonnage of oil in produced water to sea	0.01	N/A	8.1	2.16	0.49	N/A	N/A	N/A
CO ₂ from combustion for power generation and compression (t)	100,596 ¹	N/A	17,613 ¹	113,958 ¹	12,325	519	N/A	N/A
CO ₂ from flaring (t)	4,621 ¹	N/A	83,516 ¹	N/A	N/A	N/A	N/A	N/A
Number of substitution chemicals in use	0	1	6	2	1	0	33	1
Amount of permitted chemicals discharged (t)	7.7	0.75	225	969	0.90	0.3	429	0,37
Percentage of permitted chemicals discharged with a SUB warning (%)	0	0	38	39	0	0	0	73
Waste amount (t)	500		55.8	33.8	10.9	16.7	3473	N/A
% of total waste reused/recycled/waste to energy	87		94	95	97	82	41	N/A

¹ = ETS Verified Data

² = Project data included

The NPAs have no discharge of produced water to sea and the power generation on the facilities is diesel driven below 20MW and produces limited emission. Subsea infrastructure emissions/discharges and waste are managed via the host installations unless there is an intervention activity at the subsea location.

Morecambe NPAs and subsea infrastructure = Five DPs, Calder and Millom West NPAs, subsea infrastructure for Rhyl and Dalton. Waste and emissions included in S Morecambe

North Sea NPAs = Ensign, Audrey XW and WD, ST-1, Grove and Chsiwick plus subsea infrastructure for Trees, A-Fields, Eris/Ceris, Seven Seas, Kew and Stamford.

Our fields are produced back to the following facilities: A-fields back to Conoco-Phillips LOGGs platform / Trees fields to the Marathon Brae Alpha platform / Vale field to the Statoil Heimdahl platform.

Unplanned event data

KEY INDICATOR	Morecambe		North Sea						Norway
	South Morecambe	Total of 7 NPAIs and subsea infrastructure	Chestnut	J6-A	F3-A	UKCS Other	Total of 5 NPAIs and subsea infrastructure	Wells and Projects	Vale
Number and total tonnage of oil spilled	2 (<0.034)	1 (<0.001)	0	0	0	0	0	1 (<0.001)	0
Number and total tonnage of chemicals spilled	0	0	0	0	0	0	1 (0.348)	5 (0.03)	0
Number of environmental permit non-conformances	4	0	4	0	0	0	0	1	0

Morecambe Other =Five DP, Calder and Millom West NPAIs, subsea infrastructure for Rhyl and Dalton

UKNS Other = Ensign and York NPAIs, subsea infrastructure for Trees, A-Fields, Eris/Ceris, Seven Seas

GMA – Greater Markham Area Other = Chiswick, Grove and ST-1 NPAIs, subsea structure for Stamford and Kew

Our fields are produced back to the following facilities:

- A-fields back to Conoco-Phillips LOGGs platform
- Trees fields to the Marathon Brae Alpha platform
- Vale field to the Statoil Heimdahl platform.

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