centrica storage

ROUGH OFFSHORE FACILITIES

ENVIRONMENTAL STATEMENT

2014

Contents

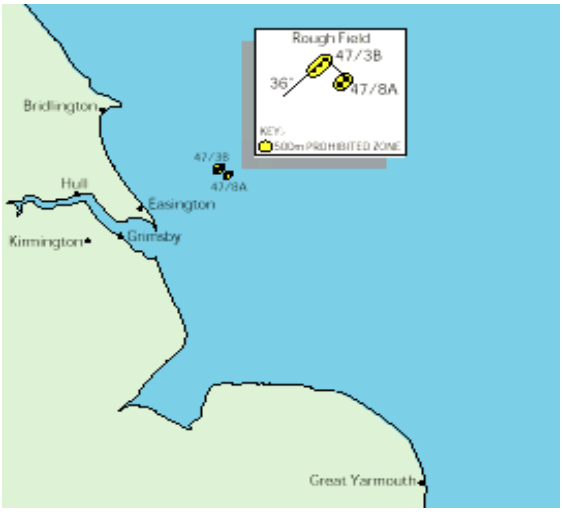
1.0 Facility Description

1.1 Overview.

The Rough offshore gas storage field, located approximately 29 kilometres off the east coast of Yorkshire is the UK's largest facility for the storage of gas. The field is designed to meet peak winter demand by injecting gas supplied from Centrica Storage customers via the Easington onshore terminal into the Rough Field Reservoir approximately 300 mts below the seabed. This stored gas is then available to be produced back into the National Transmission System at rates of up to 45 million cubic metres per day – equivalent to approximately 10% of the total gas supplied in the UK during the coldest winter day.

There are two complexes within the Rough Field, Alpha and Bravo. Alpha comprises two bridge-linked platforms, whilst the larger Bravo complex comprises three bridge-linked platforms. The complexes are about 2 kilometres apart and are designed to produce or inject gas via the reservoirs 30 wells.

Rough Facilities Location Map.



1.2 Process Description.

During Injection, gas taken from the national transmission system is compressed at the Easington terminal and transferred to the offshore Bravo complex via a 36-inch subsea pipeline. On the Bravo two Rolls Royce Avon gas turbines drive two centrifugal compressors which force the gas under pressure down the wells into the storage reservoir.

During Production, the gas retrieved from the reservoir is essentially the same as that which was injected. However, the nature of the reservoir results in some contamination with water and indigenous hydrocarbons, necessitating treatment (separation and dehydration) on the offshore platforms. Gas

flows to the surface under reservoir pressure through the wells. Water and condensed hydrocarbons are removed by the offshore process prior to transmission via the 36-inch sealine to shore. The small quantities of produced water are discharged offshore and the condensed hydrocarbons are re-injected into the pipeline and carried ashore with the gas.

Following the offshore incident in February 2006 the dehydration process utilising the TEG regeneration heaters is not operational. Corrosion inhibitor is now injected on both platforms to prevent corrosion of the sealine together with a hydrate inhibitor. Effluent from the wet gas operation is now received at the Terminal and tankered offsite to an effluent treatment plant. Disposal options are being reviewed prior to the next production season.

2.0 Environmental Issues

2.1 Introduction

The principal constituent of the natural gas stored at Rough Offshore is methane. The reservoir used to store the gas also contains a light liquid hydrocarbon known as condensate. Condensate is removed from the gas stream at the onshore terminal at Easington and is distributed by an onshore pipeline to be processed and used as an industrial fuel. Natural gas, due to its chemical composition, ease of use and high energy efficiency makes it the cleanest of all fossil fuels, generating almost 40% less carbon than hard coal for the same amount of energy supplied. The use of natural gas over other fossil fuels such as coal or oil therefore results in a decrease in greenhouse gas emissions per unit of energy.

The nature of the business means that the product (natural gas) is not produced "raw" from this facility but is brought in from the national grid, stored, and sent back to the national grid. It can be appreciated therefore that there is little scope for reduction in raw material usage, however recycle/reuse does take place in a number of areas and will be detailed below.

2.2 Significant Environmental Aspects.

There are five main environmental aspects associated with offshore operations.

1/.	Release to air	(Atmospheric Emissions)
2/.	Release to sea.	(Aqueous Discharges)
3/	Energy Usage	(Gas Turbine Generators & Compressors)
4/.	Reuse-Recycle	(Waste Products)
5/.	Unplanned Releases.	(Incidents)

- **Atmospheric Emissions**

The Rough operation is characterised by a number of sources of atmospheric emissions typical of offshore gas developments. Main Power generation and gas compression turbines are run on fuel gas, which is derived from the gas storage reservoir during production & standby and from injected gas during injection, whilst emergency back-up generators and firepumps are diesel driven. Combustion emissions from gas fuelled turbines include carbon dioxide, oxides of nitrogen, carbon monoxide and unburnt hydrocarbons, while the combustion of diesel on site also gives rise to emissions of sulphur dioxide. Combustion emission levels from gas turbines are linked to the amount of energy required for normal process operations as well as the efficient operation of these machines. Emissions from diesel plant are minimal due to the use of low sulphur diesel and being emergency use only.

Natural Gas (methane) emissions primarily occur from venting during normal plant operations and fugitive emissions from valves & pipe flanges etc. It should also be noted that depressurising the plant by venting to atmosphere during emergency situations is an important aspect of safe operations.

Therefore, although this can be seen as a significant environmental impact it is recognised that there is no alternative, safety takes priority over the environment in this situation. Robust operating and maintenance procedures reduce the likelihood of emergency releases.

- **Aqueous Discharges**

Aqueous discharges are principally associated with the small amounts of oil in water produced during normal production operations. In addition there are discharges of sewage, cleaning and maintenance chemicals, anti-biofouling chemicals and service water from the accommodation facilities. In terms of volume, the seawater used by the cooling water systems is by far the biggest during operation. However, as this system works on the basis of direct flow through with the addition of heat, the effect on the marine environment is considered small.

- **Energy Usage**

Most of the energy consumed by the field is used to drive the gas re-injection compressors and power generation turbines. The energy required for gas re-injection generally increases as the reservoir becomes full because the reservoir pressure increases. It is not possible to compare annual consumption because the reservoir is filled to different levels each year. This of course makes it problematic to target improvements in energy usage as there is no consistent baseline to work to. Nevertheless, reduction in energy usage is one of the current environmental objectives. The existing compressors have been upgraded to increase the power of the two injection compressor trains to inject gas from the NTS into the Rough field with enhanced performance characteristics across the whole injection season. This has resulted in @ 20% reduction in fuel gas usage and therefore a reduction in atmospheric emissions.

- **Re-Use/Recycle.**

Waste oil and condensate contaminated with water is returned to shore and for recycling. Methanol is injected onshore to prevent hydrates from forming in the process pipework. It is recovered from the produced water and re-used. Fluorescent light fittings, scrap metal, waste paper, cardboard etc are sent onshore for recycle/re-use.

- **Unplanned Releases**

Emissions and discharges for unplanned events e.g. oil spills, have been identified and characterised and the magnitude and significance of their effects evaluated. This category includes oil spills from platform topsides, i.e. during diesel bunkering from supply vessel, tank rupture, bulk chemical spills, pipeline failure and plant failures leading to emergency venting to atmosphere. An Emergency oil spill contingency plan is in place to deal with unplanned aqueous releases.

3.0 Meeting Legal Requirements: The Offshore Environmental Regulatory Regime

The present offshore environmental regulatory regime has evolved over the past 30 years in response to the impacts on the environment posed by the development of the offshore oil and gas exploration and production industry. The regime combines various regulatory requirements with specific schemes entered into voluntarily by the industry. Regulatory control of environmental discharges & emissions from normal operations on offshore installations is fragmented and historically has been less stringent than the regime onshore.

Environmental Permitting Regulations (EPR)

The Environmental Permitting Regulations (EP Regulations) came into force on 6th April 2008 making existing legislation more efficient by combining Pollution Prevention and Control (PPC) and Waste Management Licensing (WML) regulations.

The Environmental Permitting (England and Wales) Regulations 2010 came into force on 6 April 2010 and were amended in 2012 by The Environmental Permitting (England and Wales) (Amendment) Regulations 2012 to provide a consolidated environmental permitting system in England and Wales and extend the environmental permit system to cover water discharge consents**,** groundwater authorisations and radioactive substances authorisations.

PPC (Pollution Prevention and Control) regulation came into force in 2007 for both offshore and onshore operations. Combustion equipment and associated emissions to air is the focus for offshore operations together with 'Best Available Techniques'. A permit to operate offshore must be obtained from the Offshore Regulator which also sets conditions to improve environmental performance

The Offshore PPC Permit was received on 17th August 2007 to operate gas combustion plant ie Gas turbines, Diesel engines including cranes etc subject to certain qualifications and provisions. The permit also requires reporting of annual emissions of oxides of nitrogen, oxides of sulphur, carbon monoxide, methane and non-methane volatile organic compounds.

Overall, there are a number of regulations that have relevance to atmospheric and aqueous discharges as well as those which cover the disposal of waste from an offshore installation through to its eventual disposal onshore, as detailed below.

Atmospheric Emissions.

Fuel Use: fuel gas, diesel etc.

The EU Emissions Trading Directive

Phase I came into force on 1st January 2005 to establish a scheme for greenhouse gas emission trading within the European Community. This scheme is mandatory to tackle CO2 emissions from combustion sources from a number of specific industrial activities. A permit to emit CO2 is required only for the 47/3B platform as the accrued rating is > 20 MW(th). If the installation reduces their emissions below the allowance they can trade the surplus, if they require additional allowances these will be bought from the market.

An external verifier validates annually the data and the management system. This report is then submitted to the Offshore Regulator.

Phase II commenced in 2008 but has no additional impact on the offshore platform however there is a 25% reduction in allowances.

Phase III came into force 1st January 2013 with allowances for electricity generated for own use or sale to be purchased from the open market. The final allocations have not been confirmed as yet.

(Note EU ETS is only relevant to the 47/3B platform as there is no combustion equipment on the 47/8A platform)

Energy Savings Opportunity Scheme (ESOS)

ESOS is a mandatory energy assessment scheme for organisations in the UK that meet the qualification criteria. The Environment Agency is the UK scheme administrator.

Organisations that qualify for ESOS must carry out ESOS assessments every 4 years. These assessments are audits of the energy used by their buildings, industrial processes and transport to identify cost-effective energy saving measures.

Venting

A consent to vent is required from the Offshore Regulator and forms part of the production license issued under the Petroleum Production Regs 1988. Reports of the amount of gas vented must be submitted to the Offshore Regulator and Oil and Gas UK.

Aqueous Discharges.

Produced Water

The Petroleum and Submarine Pipelines Act 1975 allows the discharge to sea of produced waters subject to license conditions.
The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regs. 2005 replaced POPA (Prevention of Pollution Act) and are designed to encourage operators to continue to reduce the quantities of oil discharged. The objective is to introduce a more robust and effective approach to the management of oil discharges. To achieve this, the Regulations:

- Update the definition of oil thereby including condensate
- Introduce a permitting system for oil discharges and recover associated costs via permit fees
- Strengthen the powers to inspect and investigate oil discharges, whether these are lawful or unlawful

Reports must be submitted monthly to the Offshore Regulator on volume of water produced, oil in water concentration and oil discharged even if the platforms have not been in production mode.

Drainage Water

There is a statutory requirement to record & report any release of oil under the **Merchant Shipping (Prevention of Oil Pollution) Regs 1996**

Machinery space drainage from an offshore installation shall not discharge any oily mixture with an oil content of 15ppm or more. A UK Oil Pollution Prevention Certificate (UKOPPC) is required.

Chemicals

There is a statutory requirement under the **Offshore Chemical Regs. 2002** to record the use and discharge of chemicals from offshore activities. The aims are to reduce the use and discharge, carry out risk and hazard assessments and use more environmentally friendly materials. This includes production chemicals to deck cleaners. A permit to use and discharge chemicals is required from the Offshore Regulator that specifies actual quantities allowed. Any changes to quantities and / or additional chemicals used must be applied for prior to use. Reports must be submitted quarterly to the Offshore Regulator on chemical usage and discharge.

Waste

There is a statutory requirement under the **Merchant Shipping (Prevention of Pollution by Garbage) Regs. 1998** that no waste is to be disposed of at sea except food waste that has been ground to less than 25 mm. All other waste must be returned to shore for disposal under the Environmental Protection Act 1990. An annual report on quantities of waste generated and disposal routes are submitted to the Offshore Regulator.

Unplanned Discharges

There is a statutory requirement under the **Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regs. 1998** for offshore operators to have a formally approved Oil Spill Contingency Plan in place. The aim of the Convention is to

increase the level of effective response to oil pollution incidents and to promote international co-operation. Oil Spill Contingency Plans are to be referred to as Oil Pollution Emergency Plans (OPEP) to fully align with the existing regulations. The **Offshore Installations (Emergency Pollution Control) Regs. 2002** give the Government power to intervene in the event of an incident involving an offshore installation where there is or may be a risk of significant pollution, or where an operator has failed to implement proper control and preventative measures. This regulation applies to chemical and oil spills and a PON1 must be completed for both types of incident.

4.0 Environmental Management System

4.1 Overview

Although the use of an environmental management system is not a requirement under law such a system is invaluable in managing legal requirements such as those outlined in 3.0 above as well as developing a program of continuous environmental improvement. This will become even more important as the offshore regulatory regime moves more towards that implemented onshore and commercial pressures for "green business" increase.

The Environmental Management System (EMS) utilised at the CSL operational facilities is registered to ISO 14001. This system ensures that activities that might have a significant impact on the environment are properly managed and controlled. Also required is a commitment to continuous improvement in environmental performance

4.2 Management of environmental aspects

To ensure a systematic approach is adopted to managing the Environmental aspects of its activities, Rough has developed an EMS whose stated primary objectives are to...

- Ensure sustainable compliance with legislation and policy.
- Ensure that all aspects and impacts are formally identified and assessed in a structured manner and that practicable control measures are identified and implemented;
- Emphasise the elimination or prevention of environment aspects and impacts rather than corrective action;
- Establish the standards for environmental planning, operation, audit and review;
- Achieve, enhance and demonstrate sound environmental performance built around the principle of continual improvement.
- Integrate environmental considerations into the management of all activities;

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
January 2015

centrica

4.4 Current Environmental Improvement Programme

Key Performance Indicators are set annually for all sectors of the Business. The Environmental Improvement Scorecard is developed in line with the commitment to “continuous improvement” within ISO 14001, and is designed primarily to address those environmental impacts identified as "significant" as well as other areas such as environmental awareness training and legislation. Progress against the scorecard is monitored at the quarterly Environmental Management Team meetings.

The 2014 Environmental Programme

- Offshore Oil Pollution Emergency Plan 5 yearly review
- Offshore PPC Energy review and update
- F-gas certificate 3 yearly review

The 2015 Environmental Programme

- Energy Savings Opportunities Scheme (ESOS)
- ISO14001:2015
- Environmental Reporting – RAPOR replacement

Offshore Performance Data

Evaluation of Environmental Emissions and Discharges 2012 to 2014 for the offshore Rough Field

From 1995, information on the environmental impacts of the Rough Field has been collated on an annual basis. This section summarises the trends that have been identified in emissions and discharges and relates them to the annual quantity of gas processed. (ie gas produced and injected)

On 16th February 2006 there was an incident on the Rough 47/3B platform involving the catastrophic failure of a production cooler with the glycol dehydration equipment being removed from the production process. The 36" sealine to the Easington Terminal is now operated wet. Additional chemical injection facilities have been added to the platform to inhibit hydrate formation and corrosion in the sealine and risers.

Fig. 1 Quantity of Gas Processed

The annual volume of gas processed in 2014 was 4734 million standard cubic metres (scm) a 32% decrease on 2013. The quantity of gas processed is dependant on the customer demand.

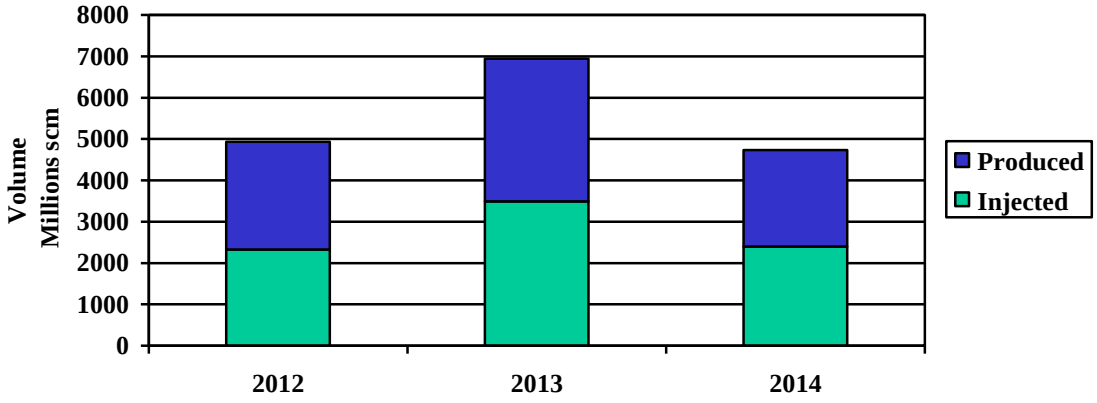
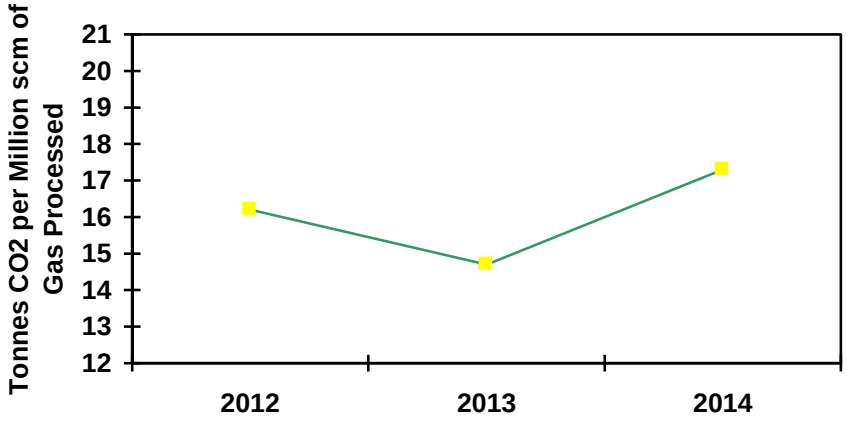


Fig. 2 Comparison of CO2 Emissions relative to Gas Processed



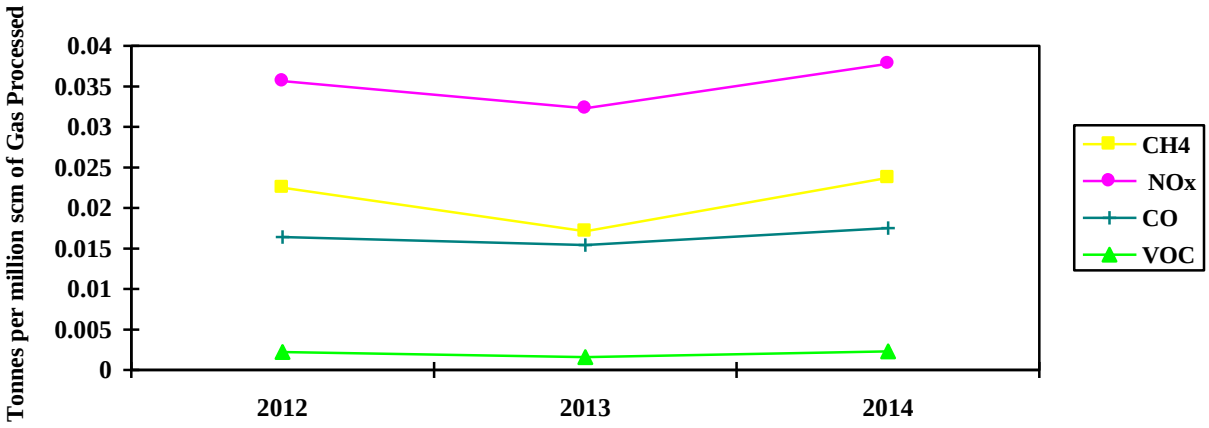
There has been a decrease in CO2 emissions relative to the total amount of gas processed (gas processed in 2014 = 4734 mmscm and = 6941 mmscm in 2013). Less fuel gas was used and a significant decrease in gas injected in the 2013 / 2014 production season resulting in an increase in

tonnes of CO2 / million scm gas processed. Diesel usage is taken from Offshore bunkering delivery notes and start and end of year inventory of the diesel storage tank. The total release of CO2 was 83351 tonnes for 2014 compared with 102096 tonnes for 2013. CO2 emissions arising from transport, helicopters and supply vessel operations contribute 6.3% of the total.

Emissions for fuel gas usage are calculated based on a site specific emission factor which is more accurate than the previously used UKOOA default factor.

CO2 reported for EU Emissions Trading Scheme (ETS) is based on fuel gas and diesel usage for the process combustion plant. The CO2 emissions under ETS have been externally verified as 78084 tonnes for 2014 compared with 96419 tonnes for 2013 (annual allowance is 85055 tonnes). Additional allowances were bought from the market.

Fig. 3 Comparison of other Atmospheric Emissions relative to Gas Processed



Methane is the principal atmospheric emission. Natural gas comprises approximately 90% methane which is emitted unburnt from the vent in common with most gas platforms. NOx and CO emissions are related to the burning of fuel gas and diesel.

Fig. 4 Comparison of oil discharged against water produced

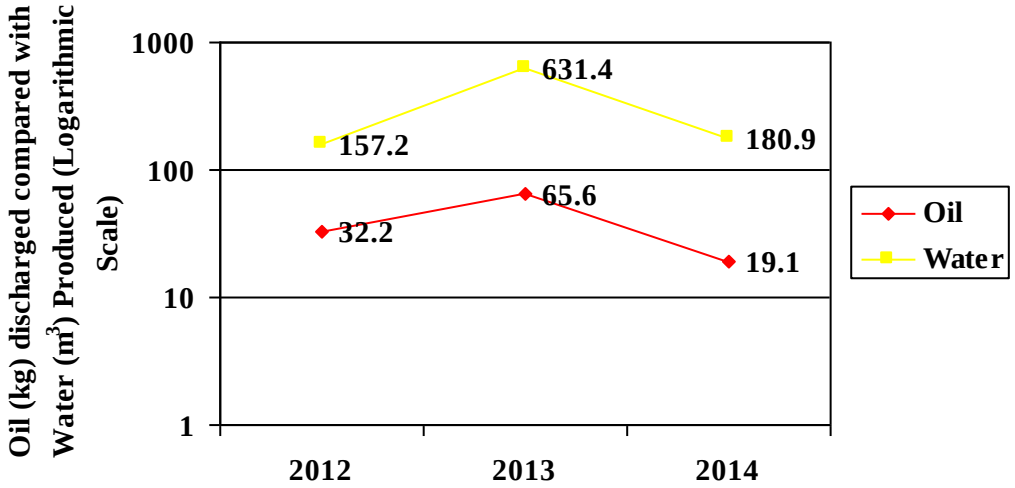


Fig. 5 Discharges to Water in 2014

Platform	Produced water m3	Oil discharged kg
47/8A	155.9	18.74
47/3B	25	0.38

In 2014, a total of 180.9 m^3 of produced water compared to 631.4 m3 for 2013 was reported as discharged containing approximately 19.1 kgs of hydrocarbons compared to 65.6 kgs for 2013. The significant increase in produced water and hence hydrocarbons is related to the shorter production season in 2014 compared to 2013.

Note in December 2014 the 47/8A platform produced 40.1 m3 however did not analyse the oil concentration therefore an associated oil discharged was not possible to calculate – see OPPC non-conformance section.

OPPC non-conformance reports in 2014

47/8A platform

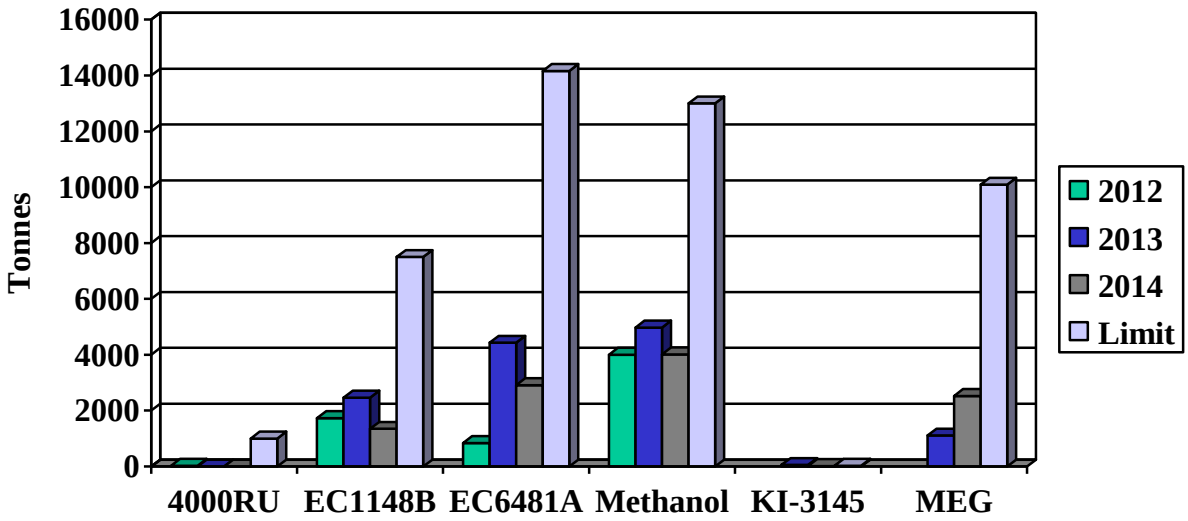
- Breach of the February oil in water limit OPPCNCF/01224
- Breach of the daily oil in water limit in February OPPCNCF/0092
- Failure to submit a monthly oil in water return for October within the time frame (note the platform was not in production mode and therefore no produced water being discharged) OPPCNCF/0462
- Failure to analyse oil in produced water in December OPPCNCF/0818
- Failure to carry out H2 bi-annual oil in water analysis

47/3B platform

- During a platform general alarm the FR deluge activated causing deluge to fire in the BD well bays. This resulted in water filling the drains tank and overflowing the contents of BD drains tank to the sea causing a sheen on the sea OPPCNCF/0432
- Failure to submit a monthly oil in water return for October within the time frame (note the platform was not in production mode and therefore no produced water being discharged) OPPCNCF/0463

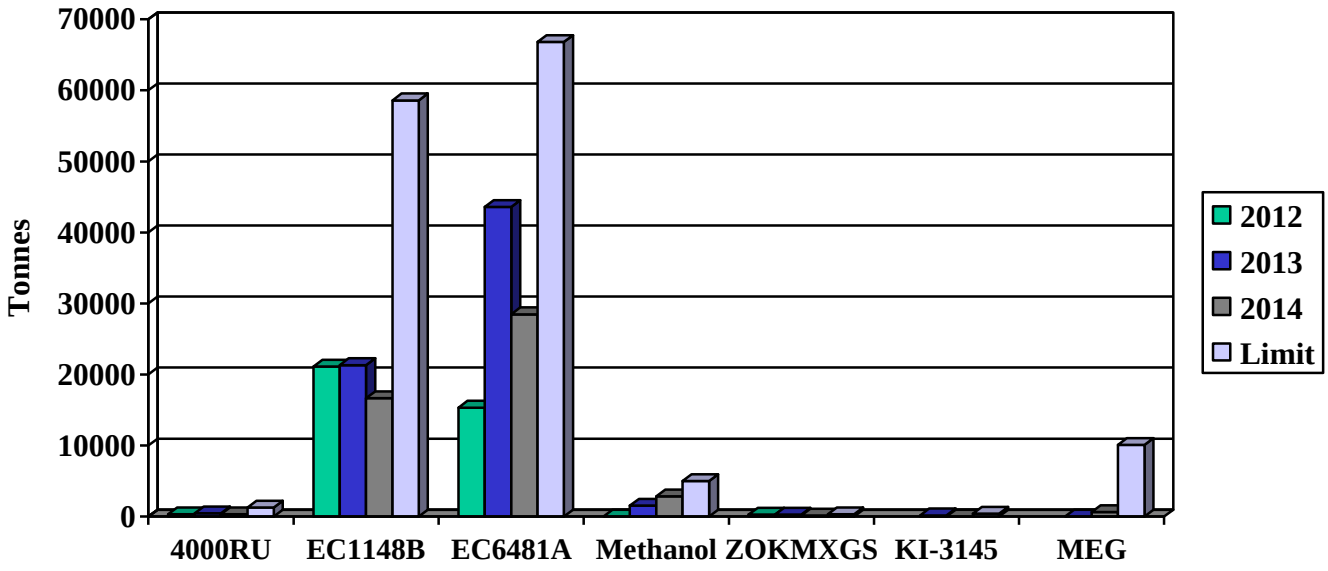
Fig. 6 Chemical Usage for 2014

47/8A platform



Chemical	Function Group	HQ/OCNS Ranking	Used kg	Discharge kg	Annual limit kg
Aq Degreaser 4000RU	Detergent / Cleaning Fluid	Gold	0	0	1000
EC1148B	Other	Gold	1351	0	7500
EC6481A	Gas Hydrate Inhibitor	Gold	2911	0	14165
Methanol	Gas Hydrate Inhibitor	E	4015	0	13000
KI-3145	Corrosion Inhibitor	Blue	13.9	0	29
MEG	Gas Hydrate Inhibitor	E	2525	0	10092

47/3B Platform



Chemical	Function Group	HQ/OCNS Ranking	Used kg	Discharge kg	Annual limit kg
Aq Degreaser 4000RU	Detergent / Cleaning Fluid	Gold	300	450	1016
EC1148B	Other	Gold	16647	0	58600
EC6481A	Gas Hydrate Inhibitor	Gold	28469	0	66800
Methanol	Gas Hydrate Inhibitor	E	2841	0	5000
ZOK MX GS	Detergent / Cleaning Fluid	Gold	125	125	306.6
KI-3145	Corrosion Inhibitor	Blue	5.8	0	403.7
MEG	Gas Hydrate Inhibitor	E	633	0	10092

Note EC1148B Corrosion Inhibitor, EC6481A hydrate inhibitor and methanol are chemicals used for the wet gas operation following the Offshore incident and are received at the Terminal for disposal and therefore not discharged to sea.

The use of these chemicals is based on gas production rates.

OCR non-conformance

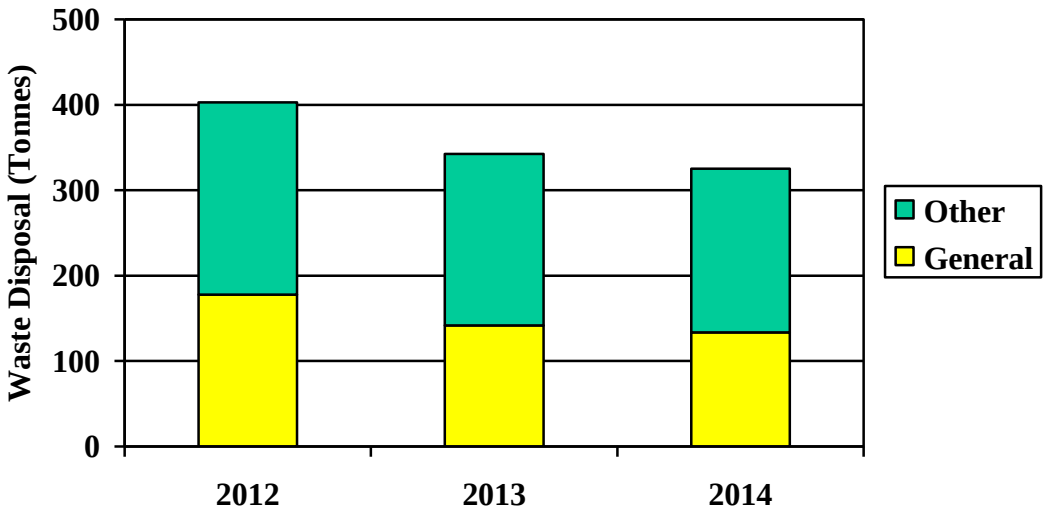
47/8A platform

- Breach of the annual limit of corrosion inhibitor KI-3145 used in the annuli (closed system)

47/3B platform

None

Fig. 7 Waste Generated for Onshore Disposal



Other waste is classified as hazardous and oil wastes and general waste is classified as commercial and scrap metal. The total waste generated for onshore disposal during 2014 was approximately 325 tonnes, a decrease of approximately 13 tonnes. Of this total 0.48% went to landfill, 99.5% was recycled and 0.005% was treated.

Operational Waste Generated for Onshore Disposal in 2014

Category	Reuse (t)	Recycling (t)	Waste to Energy (t)	Incinerate (t)	Landfil (t)	Other (t)	Total (t)
Group I - Special							
Chemical / Paints	0.000	0.968	18.712	0.000	0.025	0.000	19.705
Drums / Containers	0.000	2.935	0.000	0.000	0.000	0.000	2.935
Oils	0.000	0.000	8.000	0.000	0.000	0.000	8.000
Misc Special Waste	0.000	8.783	8.350	0.000	0.050	0.000	17.183
Sludges / Liquids / Tank Washing	0.000	0.000	143.690	0.000	0.000	0.000	143.690
Sub Total	0.000	12.686	178.752	0.000	0.075	0.000	191.513
Group II - General							
Chemical / Paints	0.000	0.000	0.005	0.000	0.000	0.000	0.005
Drums / Containers	0.000	0.080	0.000	0.000	0.000	0.000	0.080
Scrap Metal	0.000	35.015	0.000	0.000	0.000	0.000	35.015
Segregated Recyclables	0.000	25.818	1.001	0.000	0.000	0.000	26.819
General Waste	0.000	36.213	33.966	0.000	1.505	0.000	71.684
Sludges / Liquids / Tank Washing	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sub Total	0.000	97.126	34.972	0.000	1.505	0.000	133.603
Group III - Other							
Asbestos	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Radioactive Materials (exc.NORM)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Clinical	0.000	0.000	0.000	0.069	0.000	0.000	0.069
Explosives	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sub Total	0.000	0.000	0.000	0.069	0.000	0.000	0.069
Grand Total	0.000	109.812	217.417	0.069	1.580	0.000	328.878

Petroleum Operations Notices No. 1 (PON 1's) in 2014

47/8A platform

PON2631 (EV165411) – plant upset resulting in condensate being released to the caisson and to sea

47/3B platform

EV164795 – mystery sheen periodically seen during the production season

PON3143 (EV173403) – an oil sheen resulting from the blow down of B8 outer annulus

PON3167 (EV173708) - During a platform general alarm the FR deluge activated causing deluge to fire in the BD well bays. This resulted in water filling the drains tank and overflowing the contents of BD drains tank to the sea causing a sheen on the sea in Q3

PON3624 (EV181960) – mystery sheen periodically seen during the production season on 26th November.

Information in this statement has been obtained from various sources including the Offshore Environmental Registers and IMS procedures, Offshore Regulator and web sites.