2019 Annual Environmental Performance – Rough Offshore Facilities

OLP/72/8

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1 Forward

In 2016, Centrica Storage Limited (CSL) conducted testing and verification work on all of the Rough field wells. After experiencing several issues associated with the integrity of the wells, during 2017 CSL made the decision to no longer operate the Rough field as a storage facility. CSL submitted a Field Development Plan Addendum and received approval to permanently cease Storage Operations and operate the Rough field as a Production Facility.

CSL now produces gas from the Rough field under a Production Licence. From Q4 2017 until November 2018, gas was extracted from the Rough field under its own pressure (High Pressure mode). From November 2018, the Rough Compressor at the Easington Gas Terminal has been used to extract gas from the Rough field (Medium Pressure mode). Operation in this mode will continue until Q1 2021, then from then on, CSL will extract gas in a Low Pressure mode until the Cessation of Production.

After the decision was made to permanently cease Storage Operations, it was also decided to permanently withdraw the Rough 47/8 Alpha platform from service and start the preparations to decommission the platform. During 2018, Well Plug and Abandonment (P&A) work was initiated leaving the Rough 47/8 Alpha wells in a mechanically plugged state. During 2019, a jack-up vessel was acquired to support Non-Permanently Attended Installation (NPAI) enabling works to enable the de-manning of 47/8 Alpha platform. It is planned that by the end of 2021, a drill rig will be used to support the full plug and abandonment of the Rough 47/8 Alpha wells, therefore isolating the platform from the reservoir. Completion of decommissioning of the 47/8 Alpha platform has been proposed to be undertaken at the same time as the decommissioning of 47/3 Bravo platform.

For all the above mentioned activities, environmental aspects and impacts were assessed prior to commencement of the work and monitored throughout, giving consideration to the whole life cycle impacts on resources to prevent pollution, reduce waste and ensure their efficient use.

Throughout 2019, as per the Centrica Environmental Policy (Appendix 1), CSL have continued to place a huge importance on their environmental responsibilities and continue to be committed to understanding, managing and reducing the environmental and ecological impacts of our activities through innovation, technology and cultural change. As part of this, CSL successful transitioned from ISO 14001:2004 to the updated ISO 14001:2015 standard in 2018 and continue to maintain certification.

2 Executive Summary

Centrica Storage Limited owns and operates the Rough Gas Facilities which is located approximately 29 kilometres off the east coast of Yorkshire. The platforms are permitted to undertake regulated activities under a Production Licence, Consent to Vent, OPPC Permit, Chemical Permit, Greenhouse Gas Permit, PPC Permit and Consent to Locate. Under these permits and consents, CSL have the requirement to monitor, record and report emissions released to air and water. The amount and classification of waste is also required to be reported.

Throughout 2019, the Rough Offshore Facilities operated for 206 days. During this time, 1,073.3 Mscm of gas was produced. There was a planned maintenance outage on the 47/3B platform between 4th June 2019 to 1st November 2019. This outage allowed essential maintenance to be carried out and absolved 7,769 hours of Safety and Environmental Critical Element (SECE) maintenance backlog.

Releases to Air

Under the Greenhouse Gas Emissions Permit (UK-D-IN-13143) the Rough Gas Facilities released 16,737.8 tCO_2e during 2019. This is a 1,076 tonne decrease on 2018 emissions.

Releases to Water

The 47/3 Bravo generated Produced Water on 205 days, with a total of 2984.3 m^3 of Produced Water discharged to sea and 66.7 kg of associated oil.

The Produced Water was analysed for radioactivity during Q1 and Q2. With no radiation detected from these analyses, it is considered that the Produced Water generated in 2019 was not radioactive.

All chemicals used were within permitted limits. Throughout 2019, the Rough Gas Facilities discharged a total of 804 Kg (permit limit – 6,866 Kg) of chemicals into the sea. All other chemicals used were returned to shore through the sealine.

Waste

The Rough Gas Facilities generated a total of 435.3 tonnes of waste throughout 2019, of which 90 % (390.7 tonnes) was recovered (recycled or sent for treatment). From the total amount of waste generated, 212.6 tonnes was categorised as non-hazardous and 222.7 tonnes as hazardous waste.

Non-Conformities

CSL exceeded the maximum concentration for Oil in Water on 13 occasions and exceeded the Monthly Average Oil in Water concentration 2 times during 2019.

CSL submitted 5 PON1's in 2019, one of which was from an unknown third party, for the non-regulated release of oil to sea.

CSL also submitted Non-Conformities for not completing the analysis of the H1 2019 Bi-Annual Produced Water sample and the Q4 2019 NORM sample. In addition to this, a Non-Conformity

was submitted for the on permitted discharge to sea of the drainage water from the BD Drains Tank (BD02-T-5014).

Throughout 2019, apart from the non-conformities mentioned above, all releases to the environment have been within the permitted limits set out by the various Permits and Consents under which the Rough Gas Facilities operate.

3 Introduction

3.1 Site Location & Operation

The Rough offshore gas field is located approximately 29 kilometres off the east coast of Yorkshire. The Rough Offshore Facilities comprises of the Rough 47/8 Alpha (two bridge-linked platforms) and Rough 47/3 Bravo (three bridge-linked platforms) complexes. The complexes are approximately 2 kilometres apart and were designed to produce gas from the reservoirs 30 wells. There are now 14 operational wells available for production of natural raw gas.

During production, the nature of the reservoir results in some contamination with water and indigenous hydrocarbons, necessitating treatment (separation and dehydration) on the offshore platforms. 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 to sea and the condensed hydrocarbons are re-injected into the pipeline and carried ashore with the gas.

Corrosion inhibitor is injected on the 47/3 Bravo platform to prevent corrosion of the sealine. Hydrate inhibitor is also injected into the sealine pipe to prevent the build-up of hydrates. Effluent from the wet gas operation is received at the Easington Gas Terminal.

3.2 47/8 Alpha

With the 47/8 Alpha no longer operational, CSL made the decision to isolate the platform from the reservoir through Plug and Abandon of the wells. In addition to this, CSL also made the decision to de-man the installation in 2019. The mechanical plug and abandonment work took place from October 2018 through to March 2019, with the Non-Permanently Attended Installation (NPAI) enabling works taking place in May 2019.

The necessary environmental permits were applied for and approved, with all work activities for both projects conducted in accordance with these permits

3.3 Environmental Permits

The Rough Gas Facilities operate under the following permits.

3.3.1 Production Licence

From 17th January 2018, CSL obtained and are operating under a Long Term Production Consent (PCON/4517/0 (Version 2)) which permits CSL to extract gas from the Rough Gas Field until 31st December 2020.

3.3.2 Consent to Vent

The Consent to Vent (VCON/4957/0) permits CSL to dispose of unignited natural gas into the atmosphere won under the Rough Gas Field Petroleum Production Licence.

The purpose of venting under this consent is to

- facilitate the planned start-up, shut-down or maintenance of plant and equipment, or to ensure its efficient operation, or

- to protect plant, equipment or persons.

As venting is a loss of primary product, CSL endeavour to limit the amount of gas lost through venting.

3.3.3 OPPC Permits

The Rough Offshore Facilities operated under two Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 permits. These permits allow the discharge of oil in accordance with the arrangements described within the permit for the Rough AD platform (OLP/74/5 (Version 1)) and the Rough BP platform (OLP/72/6 (Version 1)).

3.3.4 Chemical Permits

During 2019, the Rough Offshore Facilities operated under two Offshore Chemicals Regulations 2002 permits, the 47/8 Alpha (CP/300/9) and the 47/3 Bravo (CP/197/12). In addition to this, the 47/8 Alpha Plug and abandonment work was conducted under a separate chemical permit (CP/1766/7). The permits require that all chemicals used or discharged during the course of the operations are listed on the permit. Where chemicals are discharged to sea, the discharge is undertaken in accordance with the conditions detailed within the permit and appropriate measures are taken to minimise discharge.

For the Plug and Abandonment works, under a Well Intervention Operation, a third chemical permit (CP/1766/7) was applied for and approved. The chemical permit was valid between the 9th October 2018 and 31st March 2019, with chemical usage reported by 30th April 2019.

3.3.5 Greenhouse Gas Permit

The Greenhouse Gas Emissions Permit (UK-D-IN-13143) authorises CSL to emit Carbon Dioxide through the combustion of natural gas, diesel, and Liquefied Petroleum Gases (LPG) from listed regulated activities. CSL are subjected to several conditions, including the monitoring and reporting of such emissions, and the surrendering of allowances and notification requirements.

3.3.6 PPC Permit

The Rough BD Platform operates under the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 Permit (PPC/70/3). The permit authorises the use of listed combustion equipment, ensuring that appropriate measures are taken to minimise discharges, emissions and waste. The permit sets limits on the total annual emissions of air polluting substances (Nitrogen Oxides, Sulphur Oxides, Carbon Monoxide, Methane and Non-Methane Volatile Organic Compounds) from the listed combustion equipment.

3.3.7 Consent to Locate

The Consent to Locate designates the geographic location of the platforms (47/8 Alpha – CP/151/1 and 47/3 Bravo – CL/150/5) and the aids required to ensure safe navigation of vessel at sea.

During the 47/8 Alpha NPAI enabling works, the 47/8 Alpha Consent to Locate was varied to allow a combined operation at the platform with the Seajack Kraken Jack-Up vessel.

3.4 Environmental Management System

CSL have a certified ISO 14001:2015 Environmental Management System which demonstrates our commitment and responsibility to understand, manage and reduce the environmental impact of our operations in a manner which protects the environment and its resources. The environmental management system is integrated within health and safety, as well as the business management activities. Central to the environmental management system is strong leadership, continuous enhancement and good performance baselines. Annual environmental improvement plans are developed to measure and report improvements. The environmental management system is audited internally and externally.

4 Emissions Monitoring

A condition of all the permits described in Section 3.3 is the monitoring and recording of emissions from the activities undertaken by the Rough Offshore Facilities. Throughout 2019, CSL have undertaken the required monitoring of all emission sources and ensured that all reporting requirements have being fulfilled. The following sections discuss the monitoring of each of these activities.

4.1 Releases to Air

Releases to air are emissions of Carbon Dioxide (CO_2), Carbon Monoxide (CO), Oxides of Nitrogen NOx), and Methane (CH_4). The quantities of the above gases are calculated from the total volume of fuel gas used, diesel usage, gas vented, and an estimated release of fugitive emissions. The monitoring of emissions includes those from routine, non-routine and abnormal operations, and includes start-up, shut-down and emergency situations.

4.1.1 Fuel Gas Consumption

4.1.1.1 47/8 Alpha

There is no qualifying combustion equipment on the 47/8 Alpha platform therefore the platform is exempt from the EU Emissions Trading Scheme and does not hold a PPC Permit.

4.1.1.2 47/3 Bravo

The total fuel gas consumption and calculation factors for the 47/3 Bravo platform are metered at one fuel gas metering point. This metering point consists of two dual Micro Motion CMF300 coriolis meters and transmitters (FE562260 A & B) operating in duty/stand-by parallel configuration. Secondary pressure (PT562259) and Temperature (TT562262) are also used to calculate flow at reference conditions to provide compensation to raw mass flow rates for the ISO 6976/AGA8 flow calculations. Data from the meter is transferred to a dedicated FloBoss S600+ flow computer on a 5-minute cycle.

Gas composition is taken from continuous online gas chromatographs for AGA8 and ISO6976, NCV calculations, and a site-specific emission factor which are certified annually by an ISO17025 approved organisation. Monthly manual samples of Rough Fuel Gas, taken from the Easington Gas Terminal, are analysed by an ISO17025 certified laboratory. Uncertainty analysis of emissions factors is undertaken to ensure that the flow weighted monthly analysis is within the +/- 0.5% uncertainty threshold for EU ETS top tier monitoring of NCV and emissions factor.

The total CO_2 emissions is calculated using the ISO6976 methodology and is a product of gas combusted, a net calorific value (NCV), an emissions factor (EF) per unit of fuel used, and a standard oxidation factor (OF).

4.1.2 Diesel Consumption

Diesel is used for Power Generation during routine maintenance shutdown, the Heating Medium heater, firewater pumps and crane activities. Diesel on the platform is consumed in relatively small quantities compared to fuel gas usage. Consumption of diesel is considered to be equal to the amount of diesel bunkered on the platforms, therefore equal to the quantities recorded on the

bunker delivery notes. The density factor (0.8540 t/m^3) used to convert litres to tonnes is obtained from the most recent Digest of UK Energy Statistics (DUKES), Annex A, Average conversion factors for petroleum found at: https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes

The NCV factor (42.5688 GJ/t) and Emissions Factor (74.9375 tCO2/TJ) for diesel are taken from the UK GHG Latest UK inventory factors. These factors are sourced from the GOV.UK website at https://www.gov.uk/guidance/participating-in-the-eu-ets#complying-with-the-eu-ets

The total CO_2 emissions is calculated using the ISO6976 methodology and is a product of diesel combusted, a net calorific value (NCV), an emissions factor (EF) per unit of fuel used, and a standard oxidation factor (OF).

4.1.3 Venting

Venting of natural gas represents a loss of primary energy and the largest source of unburnt hydrocarbon emissions from the platforms. Venting of natural gas is required as a result of planned maintenance or blowdown situations. The amount of gas vented is recorded on the IMAC system.

4.1.4 Fugitive Emissions

Fugitive emissions are emissions of gas from pressurized equipment due to leaks, weeps and seeps, and other unintended or irregular releases from operating activities. These emissions cannot be measured; therefore it is considered that 48 tonnes of fugitive emissions are released every six months from the platforms.

4.2 Releases to Water

The releases to the surrounding sea are subject to the OPPC and Chemical permits. The discharge of these substances is controlled and emitted through dedicated emission points that are specified on the above mentioned permits.

4.2.1 Produced Water

4.2.1.1 47/8 Alpha

The 47/8 Alpha platform does not generate Produced Water; therefore there are no requirements to monitor and sample Produced Water.

4.2.1.2 47/3 Bravo

Produced Water is water which is generated from the reservoir and is extracted along with the extraction of the gas. The water can be contaminated with hydrocarbons and Naturally Occurring Radioactive Material (NORM). The OPPC permit requires the sampling and reporting of oil content at least monthly, an analysis for NORM quarterly, and the in-depth bi-annual analysis of the water. The equipment used on 47/3 Bravo to process Produced Water before sampling and discharging to sea are described below.

- An Inlet Separator – this is a vertical 2-phase separator which acts as a sand trap to minimise sand erosion and blockage of the downstream equipment.
- An Injection Separator – this provides hold-up and separation for bulk liquids.

- Test Separator – allows liquid separation. Condensate will separate from the water phase and is then routed off.
- Off-Spec Condensate Vessel - a horizontal three phase separator with recently-installed baffles and inclined plate pack to assist oil-water separation.
- Oily Water Separator - is an inclined plate separator that separates hydrocarbons from the produced water.
- Oil Absorption Media Filter Package - removes any residual hydrocarbon from the water phase prior to discharge. The water samples for the required permitted analysis are taken from a sample point after the Oil Absorption Media Filter Package prior to discharge.

4.2.1.3 Oil in Water

Analysis of Oil in Water should use the OSPAR reference methodology for oil in produced water. However, this methodology requires the use of gas chromatography using a flame ionisation detector and n-pentane as an extraction solvent, which is unavailable on the platform. CSL use a simpler BEIS approved analytical methodology which is correlated against the OSPAR Reference Method.

4.2.1.4 Radioactivity

There is a requirement under the Radioactive Substances Act 1993 to determine whether produced water is radioactive as defined in Schedule 1 of Radioactive Substances Act 1993. For each Quarter, while generating Produced Water, a sample is taken and sent to Public Health England to undertake the analysis and detection of Polonium-210 (Pb-210), Actinium 228 (Ac-228) and Radium 226 (Ra-226). The analysis follows the fully documented procedures contained in CRCE Glasgow Radiochemistry Group Technical Manual.

4.2.1.5 Bi-annual Water Analysis

The bi-annual water analysis includes testing for the presence of Polycyclic Aromatic Hydrocarbons (PAH), BTEX chemicals (benzene, toluene, ethylbenzene and xylene heavy metals), Heavy Metals, Phenols and Alkyl Phenols, Organic Acids, Oil in Water, NPD's (Naphtalenes, Phenanthrenes, Dibenzothiophenes) and Inorganic compounds.

The purposes for undertaking the bi-annual water analysis is to build-up a regulatory database of information on the amounts of various constituents of produced water discharged to sea.

4.2.2 Chemical Permits

Under the Chemical Permits, all chemicals used are to be monitored and their usage recorded. The chemicals used are essential to the operation and are used sparingly and responsibly to ensure limited impact on the environment.

Under the 47/3 Bravo Chemical Permits, apart from ZOK MX GS and Offshore Degreaser EF, which are discharged to sea, all other chemicals permitted and used on the Rough Offshore Facilities are returned through the 36-inch sealine pipe to Easington Gas Terminal, to be treated ashore.

The 47/8 Alpha Plug and Abandonment Chemical Permit allowed for the use of chemicals associated with the mechanical plug and abandonment of wells. The chemical permit also allowed

for the discharge to sea of flushed hydrocarbons from the wells, as long as they were under a permit limit concentration.

At the completion of the NPAI enabling work, only deck cleaning chemicals have remained on the permit.

4.3 Waste

CSL have a Duty of Care and takes measures to ensure that all controlled waste generated on the Rough Offshore Facilities are treated, segregated, stored, and disposed in an appropriate manner to prevent the likelihood of pollution or harm to health. The Offshore 47/8 Alpha Garbage Management Plan (DOC-CSL-HSE-ENV-006a) and the Offshore 47/3 Bravo Garbage Management Plan (DOC-CSL-HSE-ENV-006b) provides a detailed description of how waste is managed on the platforms.

The waste generated on the platforms are separated into various waste streams but can be categorised into General/Industrial waste and Hazardous waste. The waste is transferred to the support vessel before been sent to shore to a treatment or disposal facilities. The transfer of waste is accompanied with appropriate transfer documentation.

5 Emissions Reporting

A condition of the Permits is the reporting of emissions from the regulated activities undertaken at the Rough Offshore Facilities. CSL have fulfilled its responsibility to report the 2019 emissions and below is a discussion of the Rough Offshore Facilities performance against the permit conditions. Trends, using historical data, have also being discussed.

5.1 Performance

Throughout 2019, the Rough Offshore Facilities operated for 206 days. During this time 1,073.3 Mscm of gas was produced. Between 4th June 2019 and 1st October 2019, the Rough stream was offline which allowed an extended period of essential maintenance to be carried out to ensure the safety and integrity of the assets.

5.1.1 Environmental Observations

CSL run an HSE Observation system which allows all employees and contractors to report activities which they may consider to be unsafe or may cause an incident which is harmful to personnel, the environment or plant. The observations are reviewed in a daily meeting by the OIMs, Supervisors, and HSE advisors. These meetings allow opportunity for discussions on safety and environmental themes and include any significant learning from monitoring activities, accidents and near misses.

During 2019, there were 7,905 observations raised on the platforms, of which 1,109 were directly related to environmental concerns. CSL consider that the number of observations raised in 2019 has had a direct contribution to the prevention of potential incidents.

In addition to the above observations, 45 offshore workers, including managers and supervisors have undertaken the Energy Institute's Offshore Environmental Awareness Training to increase their understanding and awareness of environmental aspects and impacts associated with an offshore oil and gas producing platform.

5.2 Releases to Air

5.2.1 EU ETS Emissions

Through the combustion of fuel gas, diesel and LPG, Rough Gas Facilities released 16,737.85 tCO_2e during 2019.

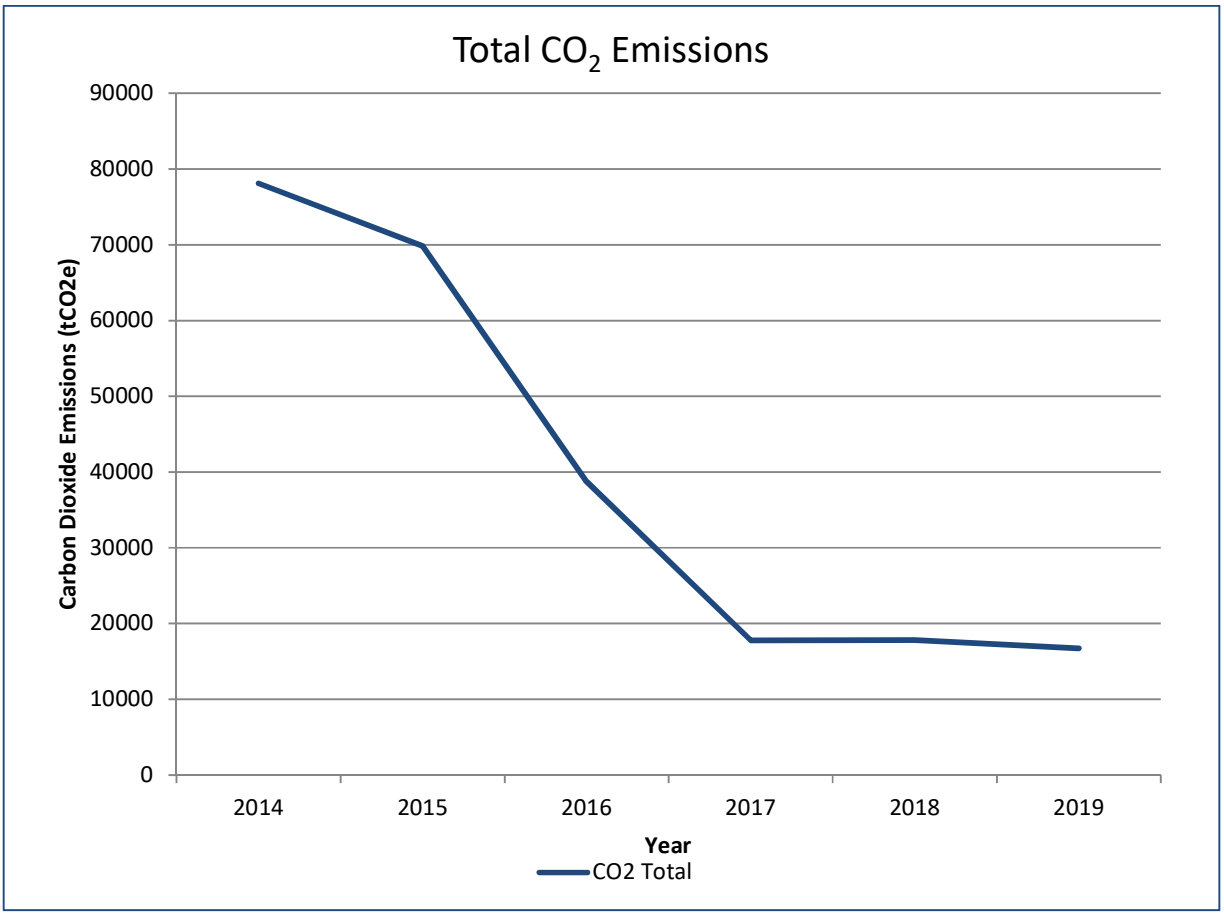

Figure 1: Annual CO2 emissions from Rough Offshore Facilities.

There has been a reduction in CO_2 emissions since 2014, with the CO_2 emissions plateauing after the cessation of storage operations (injection of gas). Due to large amounts of fuel gas combusted for inject operations, the trend in CO_2 emissions and gas injected was directly proportional. With the amount of gas injected reducing from 2014 until the cessation of storage operations in mid-2016, CO_2 emissions also reduced. Now that injection operations have ceased, CO_2 emissions have stayed constant from 2017, however CSL are continuing to look for opportunities to further reducing CO_2 emissions.

Although overall CO_2 emissions have remained constant for the past three years, the amount of CO_2 emissions from the combustion of diesel as increased (Figure 2). From 2016 to present, there has been an increase in the number of days each year that the RGT's have operated on diesel, instead of fuel gas, accounting for the increase in Carbon dioxide emissions from diesel.

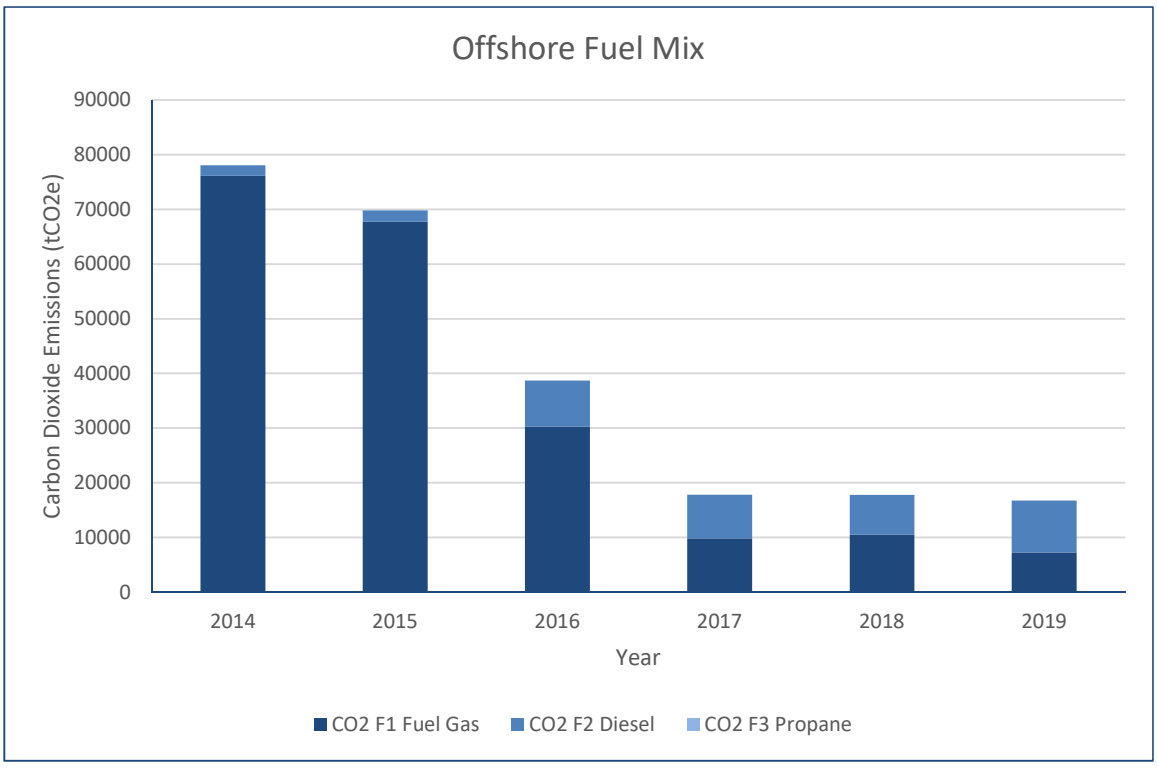

Figure 2: CO2 emissions from the different fuel types.

5.2.2 Non-Greenhouse Gas Emissions

Through the operations on the Rough Gas Facilities the following releases were calculated.

5.2.2.1 Nitrogen Oxides (NOx)

There was a total of 56.2 tonnes of Nitrogen Oxides (NOx) released during 2019. The amount of NOx being released from the Rough Gas Facilities has declined since 2014. This is in line with the reduced use and removal of the RR Avon 1535-161 Gas Turbines, used for gas injection operations, and therefore the reduction in fuel gas consumption.

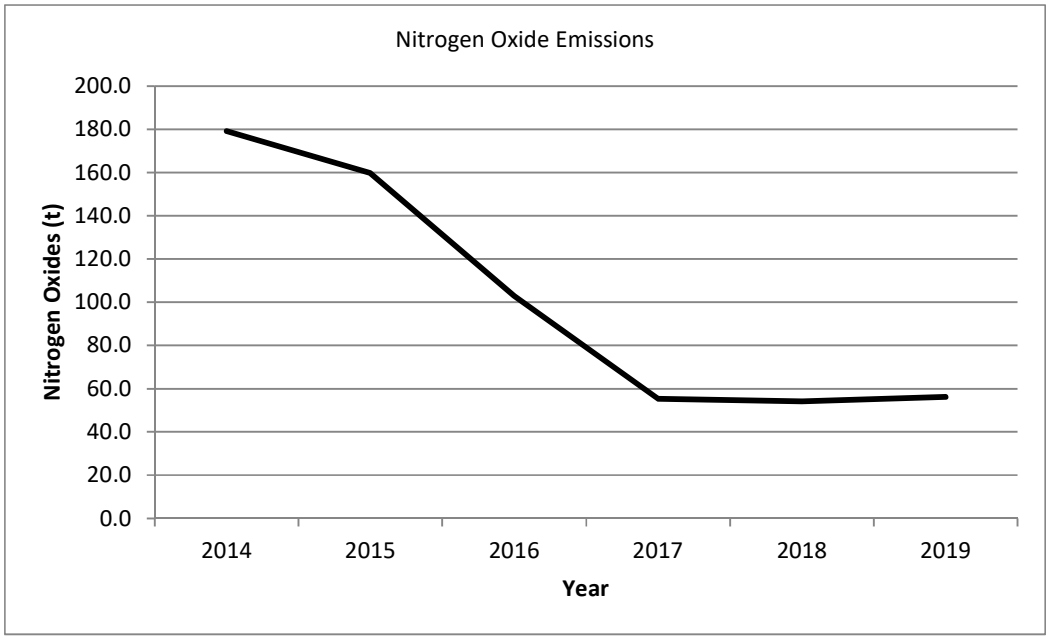

Figure 3: Nitrogen Oxides (NOx) released to the atmosphere in 2019.

5.2.2.2 Sulphur Dioxide (SO_2)

There was a total of 11.9 tonnes of Sulphur Dioxides (SO_2) released during 2019. The increase in SO_2 emissions in 2016 onwards is due to the increase in diesel usage previously discussed.

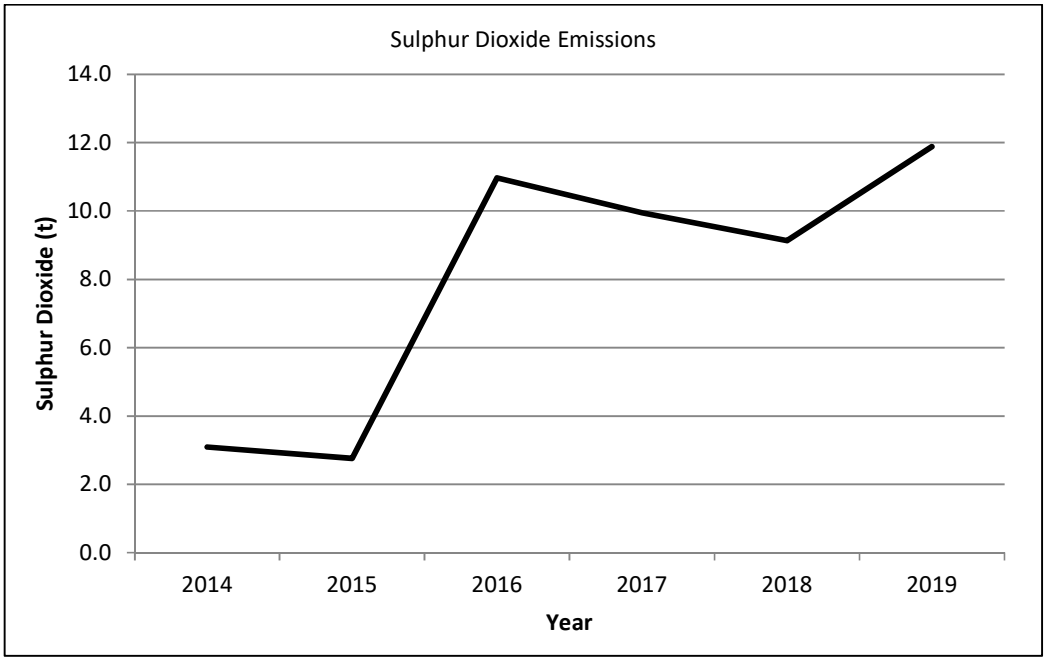

Figure 4: Sulphur Dioxide (SO2) released to the atmosphere in 2019

5.2.2.3 Carbon Monoxide (CO)

There was a total of 10.6 tonnes of Carbon Monoxide (CO) released during 2019. The CO emissions continue to follow a downward trend following a spike in CO emissions in 2015. This is in line with the reduction in fuel gas and diesel usage.

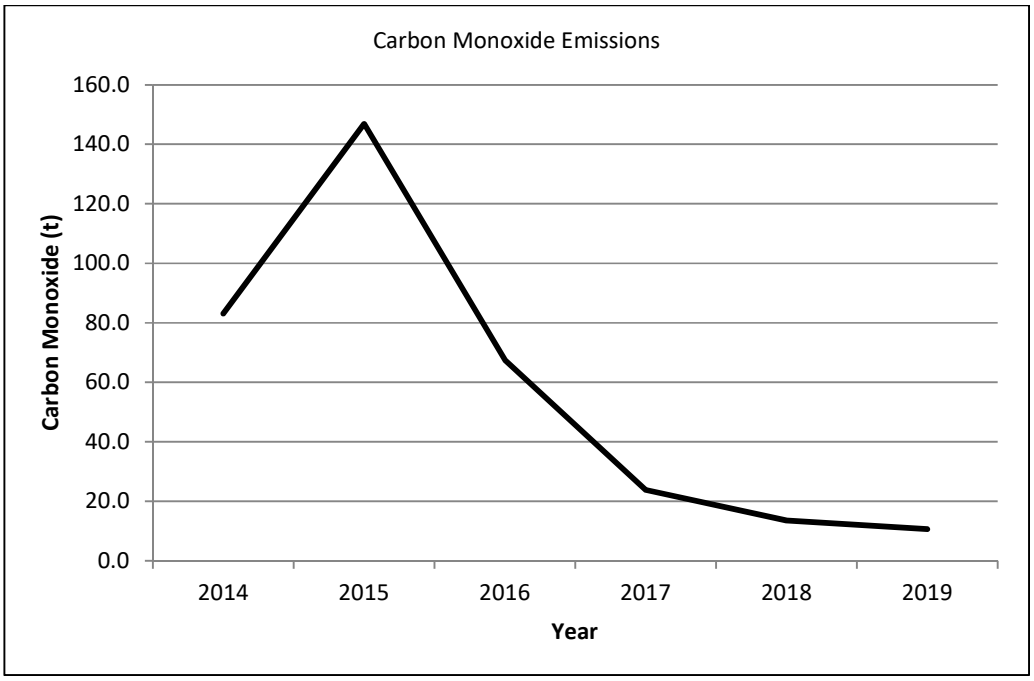

Figure 5: Carbon Monoxide (CO) released to the atmosphere in 2019

5.2.2.4 Volatile Organic Compounds (VOCs)

There was a total of 36.7 tonnes of Volatile Organic Compounds (VOCs) released during 2019. The amount of VOCs released is in line with the amount of gas vented. Due to the venting of gas been a lose of primary product, CSL endeavour to reduce venting to as low as reasonably practicable (ALARP).

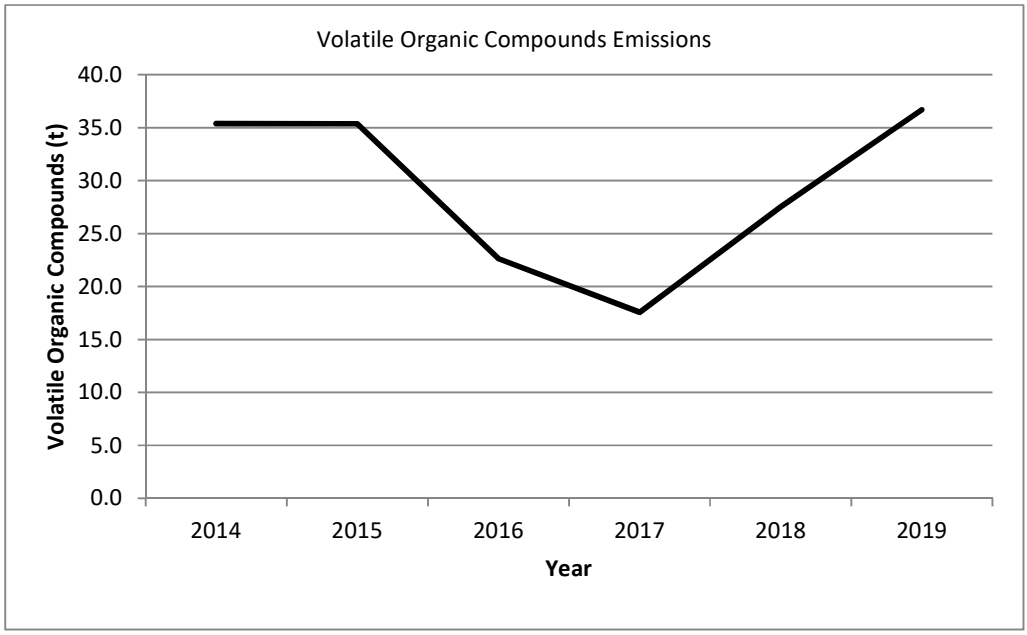

Figure 6: Volatile Organic Compounds (VOCs) released to the atmosphere in 2019

5.2.3 Methane Releases

Methane released is calculated by the amount of gas vented and the estimated amount of fugitive gas. During 2019 it was calculated that 323.9 t of methane was released into the atmosphere.

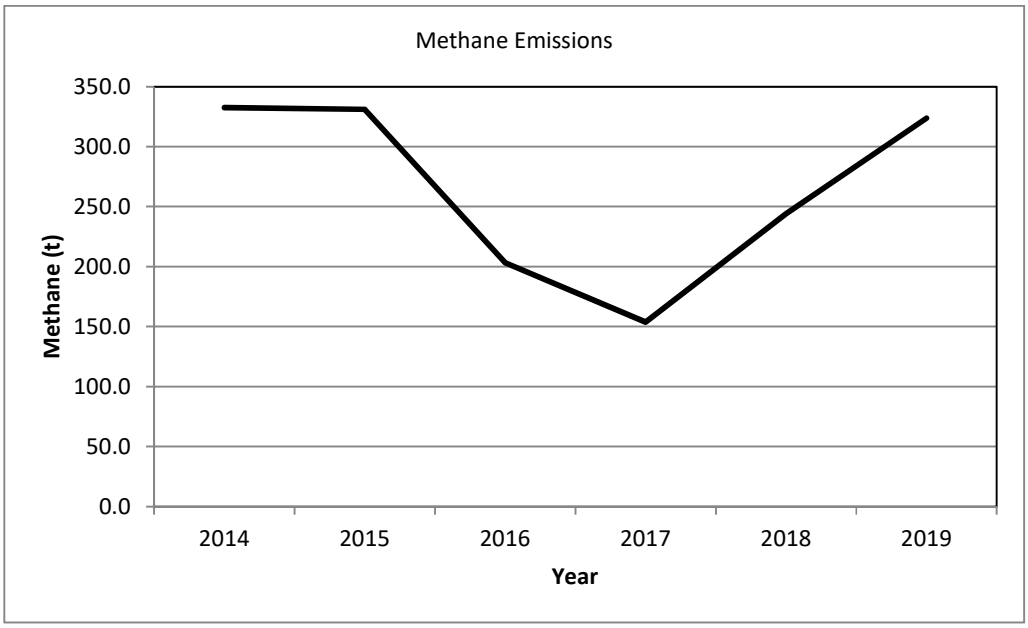

Figure 7: Methane released to the atmosphere in 2019

5.3 Releases to Water

5.3.1 Oil in Water Content

At the end of 2017, CSL applied for and obtained approval for a transition from storage to production operation licence. A review of the reservoir by a registered third party subsurface specialist, identified that with the production of native gas, produced water would continue to be generated at a rate which is constant to the gas production rate and it is considered very unlikely that there will be any significant influx of formation water. As production rates decrease throughout the life of the reservoir, so will the rates of produced water generated.

During 2019 the 47/3 Bravo produced gas on 206 days, of which, produced water was generated on 205 days. Throughout 2019, 2984.25 m^3 of produced water was discharged to sea with 66.71 kg of associated oil.

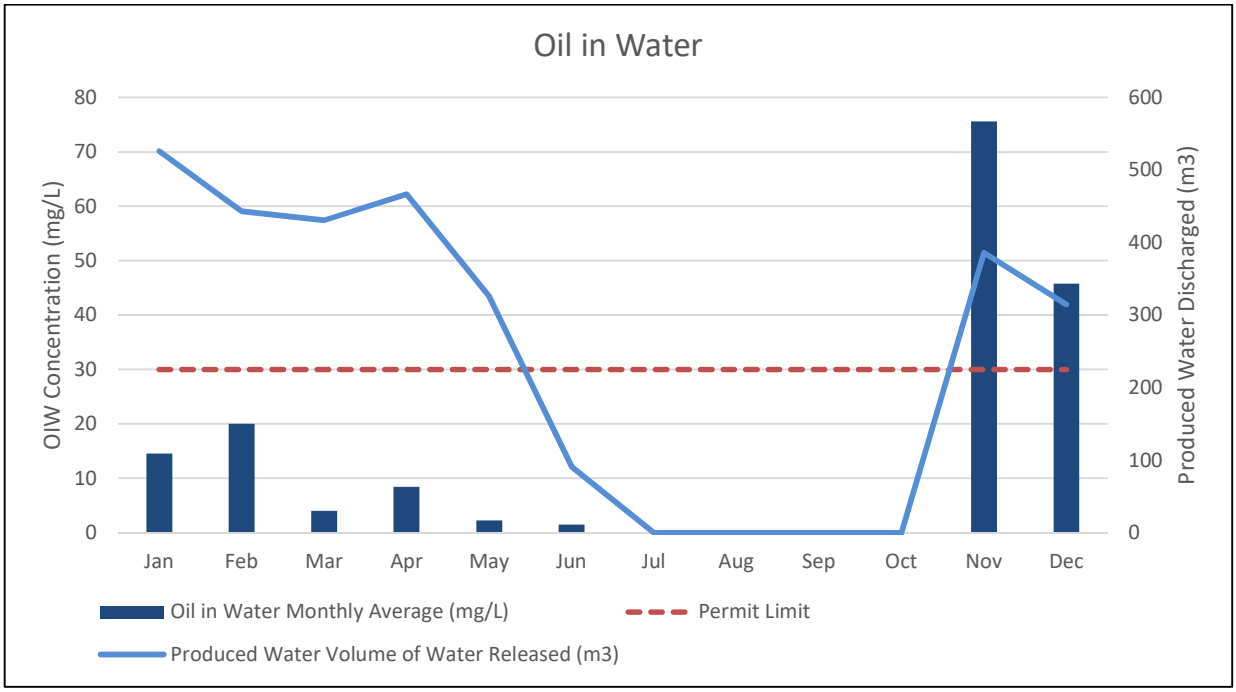

Figure 8: Monthly breakdown of Produced Water discharge and associated oil release.

When produced water was generated, samples were taken and analysed on the platform at least once per day by qualified production chemist or trained Operations Technicians. CSL were compliant to the maximum concentration limit (100mg/L) and monthly average concentration limit (30mg/l) during the first half of the year before coming offline on the 4th June 2019. When returning to production after a prolonged shutdown, CSL experienced 13 non-compliances of the maximum concentration limit (100mg/L) and were non-compliant in November and December 2020 for the monthly average concentration limit (30mg/l). For each exceedance, an OPPC non-conformance report was submitted to the regulator (see Section 6.1 for more details of the non-conformance).

5.3.2 Radioactivity

A Sample of Produced Water was taken in Q1 & Q2 and sent to Public Health England to undertake analysis. No test was conducted in Q3 due to the 47/3 Bravo been in a prolonged shutdown. A test was conducted in Q4 but could not be analysed. A non-conformance report was submitted to the regulator (see Section 6.4).

Where radioactivity had been detected, the activity concentration was recorded. Where no radioactivity was detected, the laboratory limit of detection (LOD) was provided.

From the analytical results (Table 1), it can be seen that the LOD was recorded for all samples tested; therefore, produced water extracted from the Rough gas field in 2019 would not be considered to be radioactive.

Table 1: Summary of Radiation Analysis of Produced Water.

Quarter	Sample Date	Test Date	Tested Radioactivity Concentrations				
			Pb-210 (Bq/g)	Ac-228 in soluble (Bq/g)	Ra-226 in soluble (Bq/g)	Ac-228 in particulate (Bq/g)	Ra-226 in particulate (Bq/g)
Q1	09/01/19	23/01/19	0.0000050*	0.000040*	0.00040*	0.352*	1.44*
Q2	13/04/19	20/05/19	0.0000050*	0.000040*	0.00040*	0.363*	1.46*
Q3	Non -Operational						
Q4	Sample could not be analysed						
*Laboratory Limit of Detection (LOD)							

5.3.3 Bi-Annual Analysis of Produced Water

For the purposes of building up a regulatory database of information on the amounts of various constituents of produced water discharged to sea, for Q2 2019, an accredited laboratory, on behave of CSL, have undertaken a detailed analysis of Produced Water. The results of this analyse was reported on the UK Energy Portal.

The Q1 Bi-Annual Analysis was not completed due to the 47/3 Bravo unexpectedly coming offline earlier than expected (4th June 2019), therefore a test could not be taken after this time. A non-conformance was submitted to the regulator for the analysis not been conducted.

5.3.4 Chemical Permits

5.3.4.1 47/8 Alpha – Plug and Abandonment Works

During the Plug and Abandonment project, a number of well chemicals were used for each individual well and pressure testing. The table below only shows the chemicals used for each well (not a complete list of chemicals on the Chemical Permit).

Table 2: Plug and Abandonment Project Well Chemical Usage

Well	Chemical	Permit Limit (Kg)	Amount Used (Kg)
A01	Ethylene Glycol MEG	315	11.2
A02	Ethylene Glycol MEG	315	212.4
A03	STARCIDE Baroid	185	10.2
A04	Ethylene Glycol MEG	315	256.0
A05	Ethylene Glycol MEG	315	11.2
A06	Ethylene Glycol MEG	315	33.5
Pressure Testing	Ethylene Glycol MEG	2,146	1961.0

Due to an incident on Well A03, were the tool become stuck in the well head, emergency well kill chemicals were used. The chemicals used are listed below.

Table 3: Chemical Usage on Well A3 well kill

Chemical	Permit Limit (Kg)	Amount Used (Kg)
ThermaSet®	7,650	6243.93
ThermaSet® Cleaner v2	5,178	3986.13
CIT TBCP, Curing Initiator T TBCP	564	20.5
Curing Initiator 65 L40LV	720	170
Micromax	3,000	3,000

The Chemical Permit also allowed for the flushing of each well and the discharge to sea of those fluids, including the hydrocarbons, with a concentration less than 168mg/L, contained within the fluid. The below table shows the permit limits and amounts of fluid discharged and the associated hydrocarbons for each well.

Table 4: Fluid discharge to sea for the Plug and Abandonment Project

Well	Volume of Fluid Discharged (m3)		Hydrocarbons Released	
	Permit Limit	Volume Discharged	Permit Limit	Mass Discharged
A01	53.3	51.7	9.0	6.1
A02	30.8	8.0	5.2	0.9
A03	55.3	0.0	9.3	0.0
A04	49.8	47.7	8.4	3.7
A05	63.9	47.7	10.7	4.5
A06	66.5	43.7	11.2	3.3

5.3.4.2 47/8 Alpha

With the suspension of gas extraction on the 47/8 Alpha platform, only deck maintenance chemicals and methanol were used throughout 2019, included deck chemicals and jack-up grease used during the COMOPS with the Seajacks Kraken.

Table 5: Chemicals Used under Chemical Permit CP/151/1 in 2019.

Chemical	Permit Limit (Kg)	Amount Used (Kg)
Offshore Degreaser EF.	1,000	40
Rigger XL-N	1,080	0
Cleanup DG-N	1,500	0
Methanol	13,000	184
SOBO S Gold*	210	183.75
ThredOn*	520	130

*Used on the Seajacks Kraken during the NPAI enabling works COMOPS.

5.3.4.3 47/3 Bravo

Figure 9 shows the usage of Corrosion and Hydrate Inhibitors on the 47/3 Bravo platform. All chemicals were within the permit limit and were sent back to shore in the 36-inch sealine pipe. These chemicals are used to pervert the build-up of hydrates and corrosion in the pipeline.

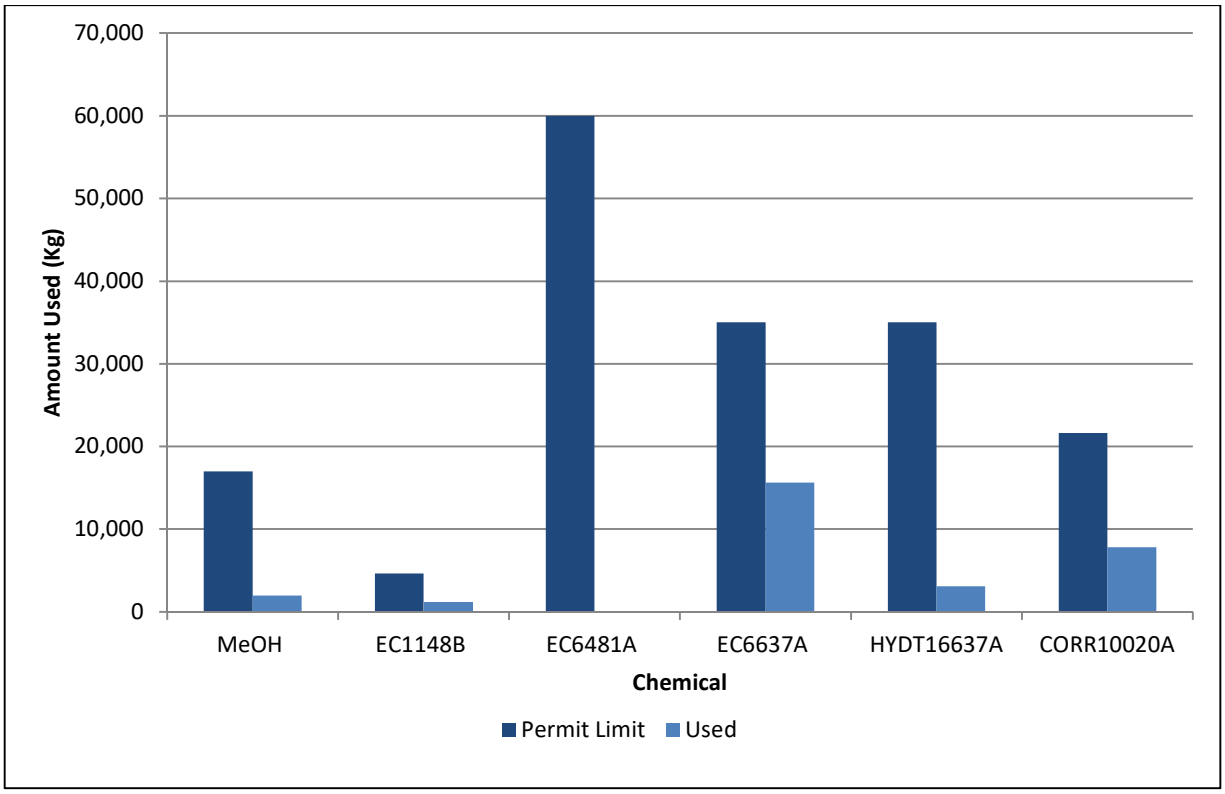

Figure 9: Corrosion and Hydrate Usage on 47/3 Bravo in 2019.

CSL changed corrosion inhibitors on the 21st January 2019 from EC1148B to CORR10020A. For the 2020 Chemical Permit variation, EC1148B has been removed. During 2019 the manufacturer of EC6637A changed its name to HYDT16637A. This is reflected in the 47/3 Bravo Chemical Permit and CSL's subsequent use of these chemicals.

Figure 10 shows the usage of wells chemicals and deck cleaning fluids. All chemicals were within the permit limits. A total of 450 Kg of chemicals (ZOK MX GS, Offshore Degreaser EF) were discharge to sea throughout 2019. Under the permit, a maximum of 1,557 Kg of chemicals were permitted to be discharged to sea.

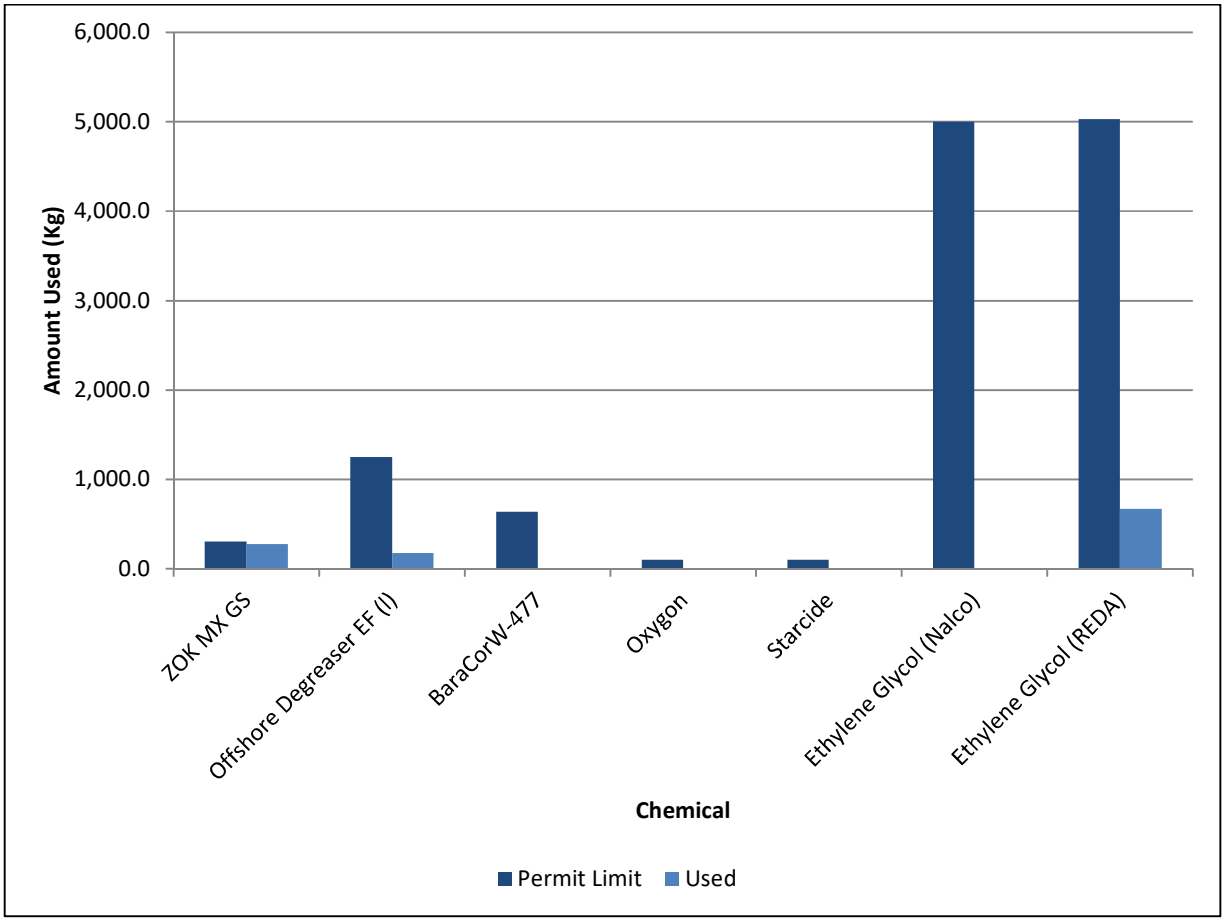

Figure 10: Wells and Deck Cleaning Fluids chemical usage on 47/3 Bravo.

5.4 Waste

5.4.1 Total Waste Generated

The total amount of waste generated from the Rough platforms throughout 2019 was 433.3 tonnes. The increase in waste generated during 2018 and 2019 was due to the waste generated from the Plug and Abandonment work and the NPAI enabling works conducted on 47/8 Alpha platform.

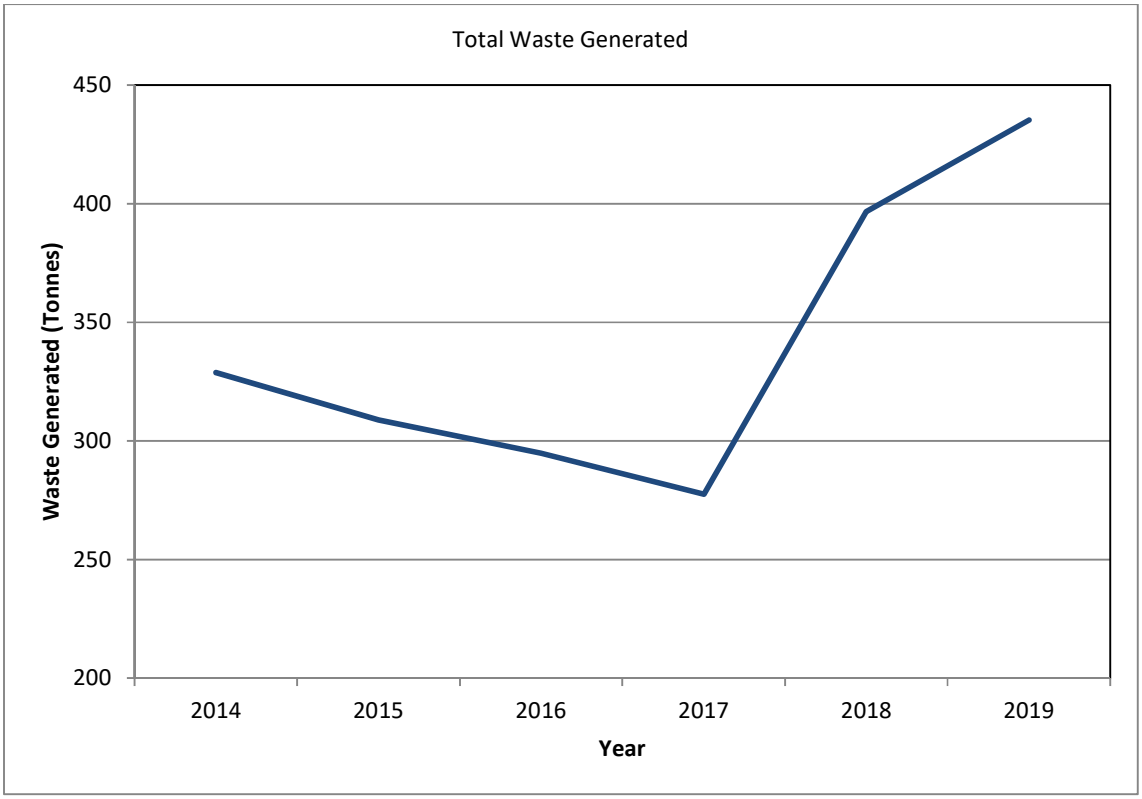

Figure 11: Total waste generated from the Rough Offshore Facilities (2014-2019).

Figure 12 shows the breakdown of hazardous and non-hazardous waste generated from both the 47/8 Alpha and 47/3 Bravo platforms throughout 2019.

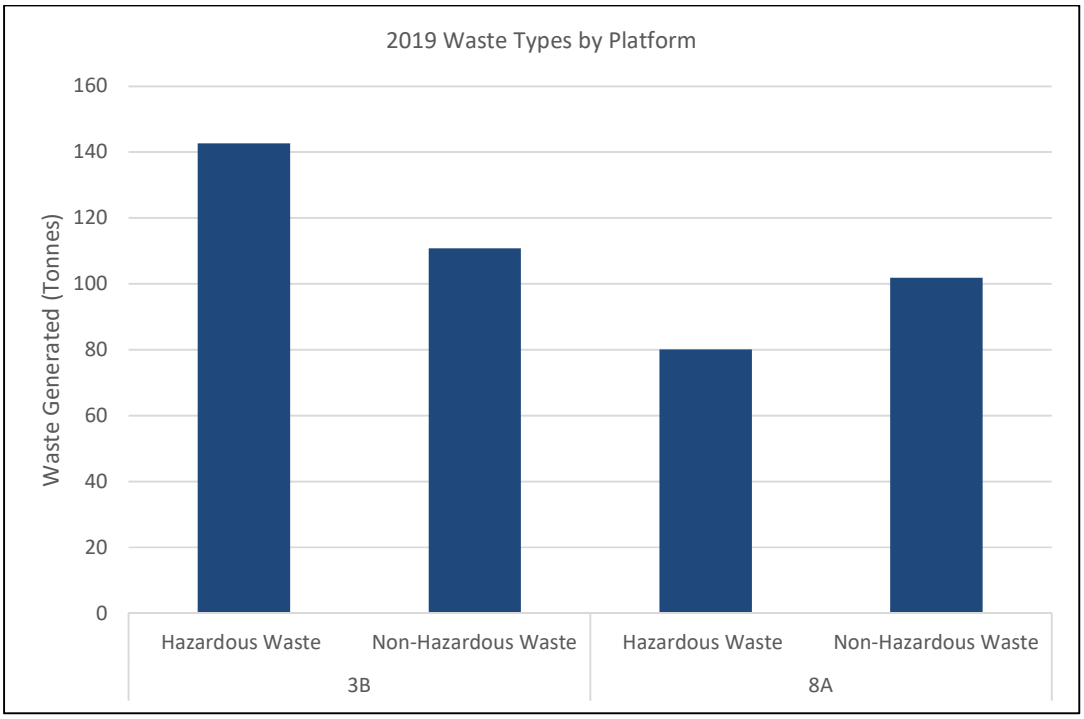

Figure 12: Hazardous waste and non-hazardous waste generated from the Rough Offshore Facilities (2019).

5.4.2 Final Disposal/Recycling

Waste generated on the platforms are transferred to the support vessel to be offloaded ashore where it then goes to appropriate waste facilities. This waste is separated into either final disposal or recycled. Of the total amount of waste generated, 390.69 tonnes was recycled (90%) in 2019.

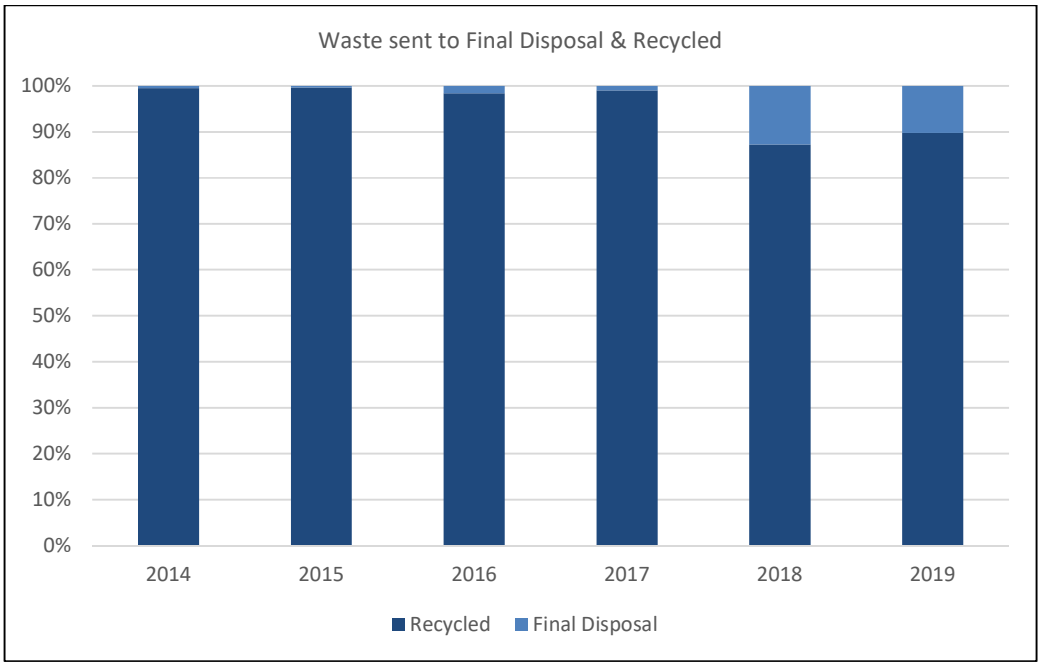

Figure 13: Breakdown of the final destination of generated waste from the Rough Offshore Facilities.

5.4.3 Non-Hazardous/Hazardous Waste

The waste which leaves the platforms can also be categorised as non-hazardous or hazardous waste. Out of the total waste generated, 212.6 tonnes was categorised as non-hazardous and 222.7 tonnes as hazardous waste. Since 2014, the amount of hazardous waste generated on the platforms has continued to decrease, however, in 2018 and 2019 there has seen an increase in hazardous waste due to the Plug and Abandonment works and NPAI enabling works on the 47/8 Alpha.

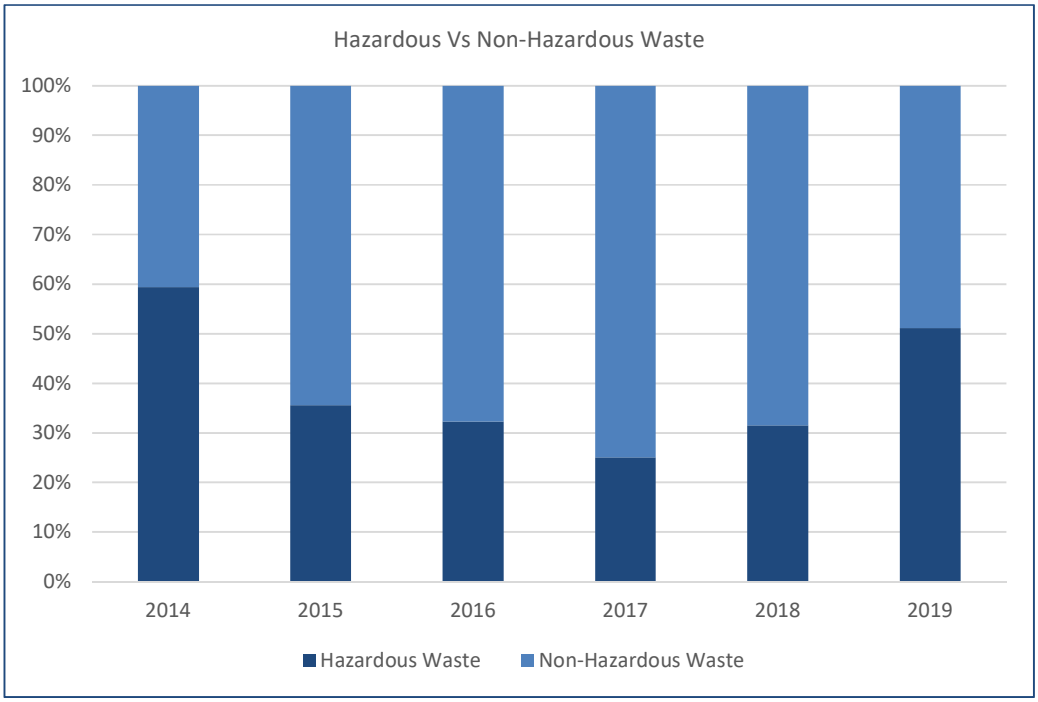

Figure 14: Historical Non-Hazardous and Hazardous Waste generated from the Rough Offshore Facilities.

6 Non-Conformities

Throughout 2019, CSL have reported a number of non-conformities to the Regulator and are discussed below.

6.1 Oil in Water

During 2019 the 47/3B platform produced gas on 206 days, of which, produced water was generated on 205 days. Out of the 205 days that produced water was generated, CSL exceeded the maximum concentration limit of 100mg/L on 13 days and monthly concentration limit of 30mg/l on 2 occasions. For each exceedance an OPPC non-conformance report has been submitted to BEIS.

Table 6 shows the monthly breakdown of the number of days produced water was generated, the number of maximum concentration non-conformities and the monthly oil in water average.

Table 6: Summary of Oil in Water non-conformities.

	No. of Days Online	No. of Days Produced Water Generated	No. of Days of Maximum Concentration Non-Conformities	Oil in Water	
				Monthly Average (mg/L)	Mass of Oil Released (Kg)
January	30	30	0	14.57	7.66
February	28	28	0	20.04	8.88
March	31	31	0	4.06	1.75
April	30	30	0	8.47	3.95
May	27	27	0	2.28	0.74
June	4	4	0	1.50	0.14
July	0	0	0	0	0.00
August	0	0	0	0	0.00
September	0	0	0	0	0.00
October	0	0	0	0	0.00
November	30	30	10	75.63	29.19
December	26	25	3	45.74	14.39
Annual Total	**307**	**307**	**88**		**66.71**

On returning to operation on the 1st November 2019, after been offline from 4th June 2020 to 31st October 2019, CSL experienced high Oil in Water concentrations in the Produced Water due residual liquid build-up during the period of non-operation. When bringing wells back online, CSL monitored well performance including liquid production, to try and balance the removal of residual liquid build-up and controlling the amount of liquid throughput, in order to obtain optimal well performance as soon as practicable and maintaining OPPC permit compliance. Once reaching optimal well performance, including the removal of residual liquid build-up, OIW concentrations become lower and more consistent.

6.2 Bi-Annual Produced Water Sample

The H1 2019 was not taken and sent to be sampled. This was due to the sudden suspension of the Rough 47/3 Bravo platform production in early June, which meant that produced water was not

generated and a representative sample could not be obtained before coming offline, therefore an analysis for H1 2019 could not be conducted. To prevent a recurrence of this, a Work Order has been generated in SAP to ensure that when operational the Bi-Annual Produced Water sample is taken within the first 3 months of the reporting period.

6.3 IR Standards and Calibration graphs

Due to the early suspension of operations on the 47/3 Bravo in June 2019 and remaining offline until November 2019, a condensate sample for the development of the Infra-Red Standards and Calibration graphs for the validation of the Oil in Water concentration against the GC-FID correlation results could not taken before the scheduled sample in July 2019.

When CSL came back online on 1st November 2019, the IR Standards and Calibration graphs had expired. A representative condensate sample was taken immediately and was sent to be developed to generate new IR Standards and Calibration graphs.

Until the new IR Standards and Calibration graphs were developed, CSL used the expired IR Standards and Calibration graphs to calculate the Oil in Water concentration and then re-calculated the Oil and Water concentration when the new IR Standards and Calibration graphs were developed.

6.4 NORM Sample

The Q4 2019 NORM sample was taken but was sent to the same laboratory as the H2 2019 Bi-Annual Sample. The NORM sample should have been sent to the Public Health England laboratory for analysis, therefore the Q4 2019 NORM sample was not analysed.

6.5 Unpermitted Discharge from the BD Drains Tank (BD02-T-5014)

Due to prolonged heavy rainfall on the 10th November 2019, the BD Drains Tank (BD02-T-5014) filled-up and approximately a few litres of water overflowed through the air breather vent of the Tank and discharged to sea. This discharge was not in accordance to the Discharge Location specified on the permit.

6.6 PON1's

In 2019, CSL submitted 5 PON1's to the regulator with regards to non-regulated oil releases to sea, one of which was from an unknown third-party. A review of these submissions is below:

Table 7: Summary of submitted PON1's during 2019.

Date	PON1 Ref	Category	Description	Min Quantity Released	Max Quantity Released	BEIS Status
13-Jan-19	PON1/8120	Oil Release	Unpermitted release of drainage water from the BD Drains Tank through operational activities	0 tonnes	0.0001875 tonnes	No Further Action Required
21-Jan-19	PON1/8147	Oil Release	Unpermitted release of drainage water from the BD Drains Tank through operational activities	0 tonnes	0.0001875 tonnes	No Further Action Required
18-Mar-19	PON1/8288	Oil Release	Unpermitted release of drainage water from the BD Drains Tank through operational activities	0 tonnes	0.0001875 tonnes	No Further Action Required
21-Jul-19	PON1/8678	Oil Release	Failure of fixed small bore fitting which had become loose on the BP Crane.	0.000022 tonnes	0.000243 tonnes	No Further Action Required
20-Nov-19	PON1/9088	Oil Release	The standby vessel was mobilised at the request of HM Coastguard to carry out a visual inspection within the 500 metres of the Rough 47/8 Alpha and 3.5 miles away from the platform, after satellite images identified the potential of an oil sheen. Upon visual inspection, there was no evidence of residual oil in the water.	0 tonnes	0.001 tonnes	In Review

7 2019 Audits

External ISO14001 audits were completed in June and December 2019. From these audits there were three minor non-conformities observed and two observations documented which were specific to the offshore operations. Corrective and preventatives actions to address all findings and observations have been identified and completed.

Both internal and external EU ETS verification audits were undertaken in November 2019 and December 2019 respectively. Necessary corrective and preventative actions have been identified for all findings and were implemented prior to the submission of emission data. The emissions data has been submitted, as well as the submission of the required allocated allowances for 2019 emissions.

8 Future Activities

In 2018, CSL received approval to permanently cease Storage Operations and operate the Rough field as a Production Facility. At the beginning of 2018, CSL extracted gas from the Rough field under its own pressure. From November 2018, gas has been extracted, with the assistance of the Rough Compressor at the Easington Terminal, in a Medium Pressure mode. This is due to continue until Q1 2021, when CSL will produce gas in a Low Pressure mode until the Cessation of Production, again with the assistance of the Rough Compressor.

After the decision was made to permanently cease Storage Operations, it was also decided to permanently withdraw the Rough 47/8 Alpha platform from service and start the preparations to decommission the platform. During 2018, Well Plug and Abandonment work was initiated, with the wells currently mechanically plugged. In May 2019, a jack-up vessel supported the Non-Permanently Attended Installation enabling works. At the completion of this work, the 47/8 Alpha was de-manned. During 2020, it is planned to complete the full Plug and Abandonment of the 47/8 Alpha wells, therefore isolating the platform from the reservoir, in preparation for the complete decommissioning of 47/8 Alpha at the same time as the 47/3 Bravo decommissioning.

9 Summary

During 2019, CSL produced 1,073.3 Mscm of gas from the Rough Gas Facilities and exported it into the NTS. The production of gas was in accordance with the regulated activities described within the Permits and Consents under which CSL operate.

CSL have reported 17 OPPC permit non-conformances to the regulator during 2019. CSL have implemented corrective and preventative actions to rectify and prevent recurrence of these events.

In 2020, CSL will continue to endeavour to operate within permitted limits and look for opportunities to improve their environmental performance and reduce their environmental impacts.

Appendix 1: Centrica Health, Safety, Environment and Security Policy

Centrica Health, Safety, Environment and Security Policy

At Centrica creating an incident free workplace is our top priority. All employees and business partners are required to comply with this policy and our commitments outlined below.

We are committed to:

- **Assessing**, understanding and managing our HSES risks and impacts
- **Enabling** the creation of a positive culture holding each other accountable, helping us to: achieve our HSES goals; support business growth; and realise our vision of an incident free workplace
- **Proactively** supporting employee health and safety, seeking ways to protect the environment, including the prevention of pollution, efficient use of resources and the reduction of waste and carbon emissions
- **Empowering and encouraging** personnel to work in a safe way
- **Helping our customers** to move towards a low carbon future through our products and services
- **Intervening** if we believe that the work environment or task is unsafe or may cause environmental damage, or we see an unsafe act
- **Learning** from our successes and incidents, and freely sharing lessons with business partners
- **Working with stakeholders**, suppliers and business partners in the pursuit of good practice in HSES
- **Continually improving** and setting measurable objectives and targets in business plans to enhance HSES performance
- **Developing** and testing prioritised incident response and recovery plans to protect our people, the environment and minimize business impact
- **Ethically conducting our business** and complying with regulatory and other applicable requirements

Our HSES management system enables the delivery of these policy commitments, is structured in line with recognised good practice, and is routinely assured. Independent certification to ISO 14001 is maintained for our environmental material operations.

Our performance is reviewed regularly and relevant results published.

Iain Conn
Group Chief Executive
January 2018

centrica