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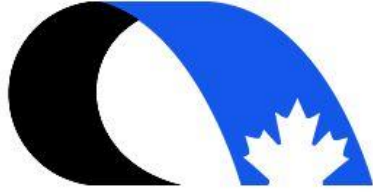
UK Operations Environmental Performance

Murchison Decommissioning 2017



Annual Report 2017

SHE-REP-215



CNR International

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**UK Operations
Environmental Performance
Annual Report
2017**




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1 BACKGROUND TO THIS REPORT

The 1992 OSPAR Convention is the current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. It combined and up-dated the 1972 Oslo Convention on dumping waste at sea and the 1974 Paris Convention on land-based sources of marine pollution.

Work under the Convention is managed by the OSPAR Commission, made up of representatives of the Governments of fifteen Contracting Parties (including the United Kingdom) and the European Commission, representing the European Community.

The Offshore Oil and Gas Industry Strategy of the OSPAR Commission sets the objectives of preventing and eliminating pollution and taking the necessary measures to protect the maritime area against the adverse effects of offshore activities so as to safeguard human health, and conserving marine ecosystems and, when practicable, restoring marine areas which have been adversely affected.

To implement this Strategy, the OSPAR Commission has adopted Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry. The UK Government has fully adopted this Recommendation, and therefore requires that all operators controlling the operation of offshore installations on the UK Continental Shelf should have in place an Environmental Management System (EMS) that is designed to achieve:

- the environmental goals of the prevention and elimination of pollution from offshore sources and of the protection and conservation of the maritime area against other adverse effects of offshore activities; and
- continual improvement in environmental performance; and
- more generally, to achieve the objectives of the OSPAR Offshore Strategy.

The OSPAR Recommendation states that Contracting Parties should also encourage operators to make publicly available an annual statement setting out:

- a brief description of the Environmental Management System;
- the environmental policy of the operator including environmental goals, objectives and targets set for significant environmental aspects and impacts; and
- a summary of performance in relation to that environmental policy, those goals, objectives and targets, and any relevant legislative requirements.

This report describes CNR International's EMS and company environmental performance against internal targets and legislative requirements. We welcome any comments and suggestions from members of the public and regulators in relation to this document, which should be sent to:

**SHE Manager
CNR International (UK) Ltd
St Magnus House
Guild Street
Aberdeen
AB11 6NJ**

2 CNRI'S OPERATIONS

Canadian Natural Resources Limited (CNRL) is an independent oil and gas exploration and production company with operations in core areas located in Western Canada, the U.K. sector of the North Sea, and offshore West Africa. CNRL's headquarters are in Calgary, Canada, with international operations based in Aberdeen, Scotland.

During 2017, CNR International UK (CNRI's) North Sea operations were focused in four areas: Ninians, T-Block, Banff and Kyle, and removal of the Murchison jacket structure. CNRI operates its fields with a majority working interest, which provides a strong basis for future exploitation and exploration in reserves close to existing reservoirs.

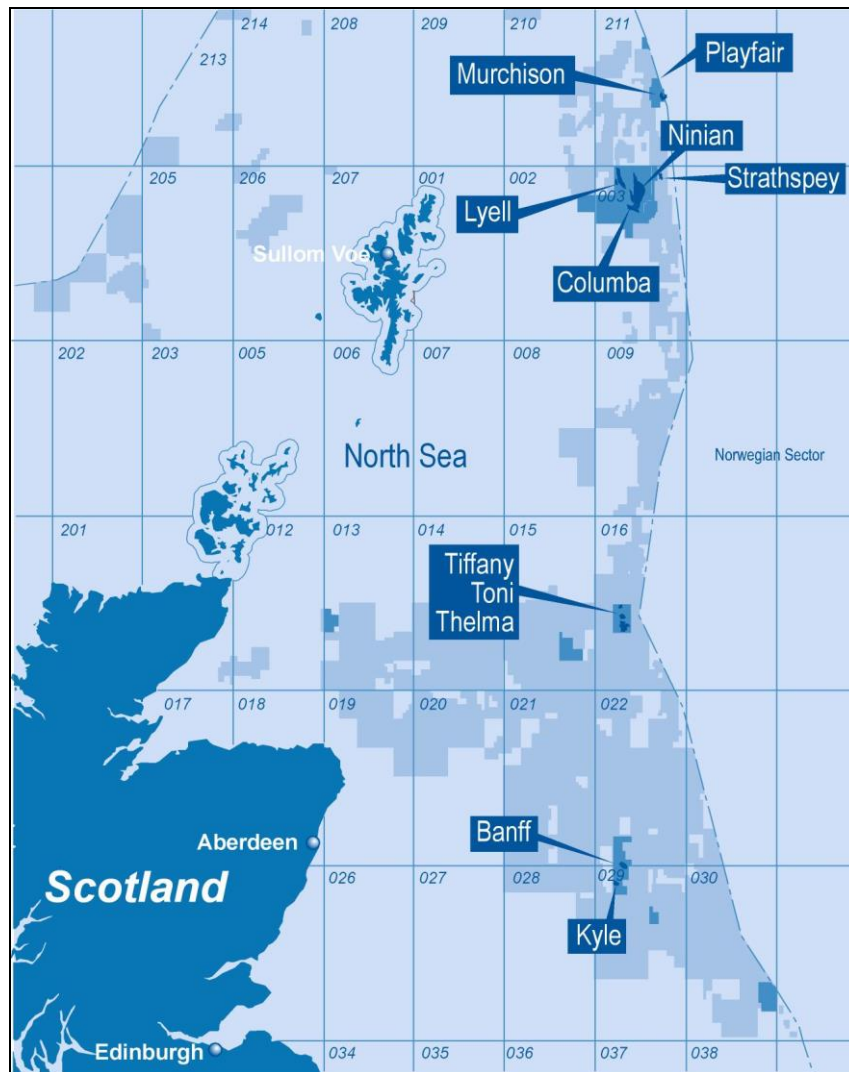


Figure 1 Location of CNRI's operations in the North Sea

The **Ninian** Field hub consists of three fixed platforms (Ninians Northern, Central and Southern) in the Northern North Sea, with the **Columba** field developed as extended reach wells and the **Lyell** and **Strathspey** fields as subsea tie-backs. Crude oil from the Ninian and associated fields is exported to the Sullom Voe Terminal where CNRI has a 22% working interest.

The **Banff** and **Kyle** Fields are located in the Central North Sea and are produced via subsea templates to the Petrojarl Banff Floating Production Storage and Offtake vessel (FPSO), which is operated by

Teekay Petrojarl Production. Crude oil from the Banff and Kyle fields is exported via shuttle tanker from the linked Apollo Spirit Floating Storage Unit (FSU).

The **T-Block** in the Central North Sea consists of three oil and gas fields **Tiffany**, **Toni** and **Thelma**. The Tiffany Field is developed from a traditional fixed steel jacket platform. Toni and Thelma are developed from subsea templates tied-back to the Tiffany platform. Crude oil from the fields is exported via the Brae/Forties pipeline through the Forties Pipeline System to the INEOS-operated terminal facilities at Cruden Bay.

Decommissioning Operations

The **Murchison** Field is located in the Northern North Sea, close to the UK/Norway boundary. The Murchison platform and associated infrastructure is being decommissioned, with the topsides removal operations completed during Q3 2016 and jacket removal during Q2 2017. Future operations will include decommissioning of the remaining subsea infrastructure and abandonment of the subsea MS2 well.

The Ninian Northern platform ceased production in May 2017 followed by well plug and abandonment operations and engineering down and cleaning of the topsides structure. The platform was down manned in Q2 2018 and entered an idle phase until 2019/ 2020, when preparation and removal of the topsides is planned to take place. Following that, a campaign to remove the jacket will be undertaken.



SSCVs Hermod lifting the first section of Murchison's jacket

3 CNRI'S SHE MANAGEMENT SYSTEM

CNRI's integrated Safety, Health and Environmental Management System (SHEMS) helps the company to:

- comply with Safety, Health and Environmental (SHE) legislation and industry standards;
- manage SHE risks in the business; and
- deliver continuous improvement in SHE performance.

The scope of SHEMS is offshore oil and gas exploration and development activities, and associated onshore support. The system structure conforms to the broad principles of the HSE publication Successful Health and Safety Management HS(G)65 and meets the requirements of general and offshore installation-related regulations.

In the North Sea, CNRI's directly operated platforms (Ninian Northern, Ninian Central, Ninian Southern and Tiffany) are certified to ISO14001:2004 by ERM CVS, who are UKAS accredited verifiers of management systems. Decommissioning activities on Murchison and Ninian North are also included in the scope of our EMS certification. The Petrojarl Banff FPSO is owned and operated by Teekay Petrojarl ASA, who also have certification to ISO14001 for their EMS.

3.1 SHE MANAGEMENT SYSTEM STRUCTURE



The SHE Management System implemented on CNRI's offshore installations and within the onshore support organisation can be represented as a pyramid consisting of four levels:

- Policy
- Management Standards
- General Procedures
- Installation/Location Specific Procedures

3.2 SHE POLICY

CNRI takes all reasonable precautions to achieve the goal of harm-free operations. Our SHE Policy is a public commitment to conducting business in a manner that protects the health and safety of people and preserves the integrity of the environment within which CNRI operates. CNRI's SHE Policy is enshrined in CNRI's Statements on Environmental Protection (see below), Health and Safety, and Asset Integrity Management.



**CORPORATE STATEMENT ON
ENVIRONMENTAL PROTECTION**

Environmental protection is a fundamental value of Canadian Natural Resources Limited (Canadian Natural). The Corporation recognizes that every employee and contractor has a vital role to play in identifying, minimizing and mitigating environmental impacts from our operations. Canadian Natural's commitment to environmental management will be incorporated into business activities through the following guiding principles:

- Ensure all employees and others engaged on Canadian Natural's behalf are aware of the commitment to minimizing and managing environmental impacts resulting from Canadian Natural's operations;
- Provide strong leadership to the identification, assessment and management of environmental risks at all levels of the organization and promote a participative culture;
- Proactively identify, evaluate, minimize and mitigate the environmental impacts of Canadian Natural's business throughout all aspects of our operations;
- Identify significant changes affecting environmental management systems, respond appropriately to issues and concerns and provide a mechanism for feedback;
- Ensure appropriate processes are developed and implemented to prevent pollution, including waste and emission management programs;
- Ensure that effective emergency response measures are in place and provide prompt and effective response to any emergency situation;
- Investigate environmental incidents effectively to prevent recurrence and communicate and implement lessons learned across all parts of the organization, including those from the experiences of others;
- Communicate with the public regarding Canadian Natural activities;
- Ensure that Canadian Natural operations comply with government regulations, industry guidelines and company policies and procedures concerning environmental management; and
- Use energy and other resources efficiently at Canadian Natural operations.

Canadian Natural's management will be responsible for developing specific operational procedures and standards that are consistent with this policy and are accountable for the maintenance, regular review and interpretation of this policy. Canadian Natural expects its suppliers, partners and business associates to have compatible environmental procedures and values.

Canadian Natural's management is committed to achieving continual improvement in environmental performance through annual environmental objectives and targets. Performance is reviewed and corporate status reports are presented regularly to management and the Board of Directors.



Steve Laut
President



Tim McKay
Chief Operating Officer

Next Revision Date: June 16, 2019



3.3 SHE MANAGEMENT STANDARDS

Ten Management Standards support CNRI's SHE Policy. These describe the expectations and requirements for performance in relation to key aspects of SHE management. They allow for some flexibility in terms of SHEMS implementation, so that different parts of the company can meet these expectations in different ways, depending on their particular legal and other business drivers.

The ten Management Standards are:

1. Leadership and Commitment
2. Performance Management
3. Managing SHE Risks
4. Competence and Personal Development
5. Communication and involvement
6. Working with Third Parties
7. Change Management
8. Information and Documentation
9. Emergency Preparedness
10. Incident Reporting, Investigation and Analysis

3.4 GENERAL AND INSTALLATION SPECIFIC PROCEDURES

General Procedures support specific Management Standards and, where a documented procedure is needed, they describe the arrangements in place to meet the appropriate standard, for example incident investigation or oil spill response. These procedures are intended to provide consistency across the organisation: they are applicable to any operation and are generally not specific to any one location or installation.

Installation and location specific procedures are particular to an operation or activity; they define the arrangements that CNRI has determined are needed to conform to General Procedures and thus meet the spirit and intent of the Management Standards.

4 CNRI'S SIGNIFICANT ENVIRONMENTAL ASPECTS

CNRI's SHE Management System requires identification of the elements of activities that can interact with and therefore have an effect on the environment (called 'aspects' in ISO14001 standard terminology). This is done so that a means to control or minimise any potential negative environmental effects can be put in place.

In common with most offshore oil and gas operators, CNRI has identified the following significant environmental aspects of its operations:

- Atmospheric emissions, in particular of carbon dioxide;
- Oil discharged in produced water;
- Solid waste generation and disposal;
- Chemical use and discharge; and
- Oil and chemical spills.

CNRI regularly monitors and reports its performance in terms of environmental emissions and discharges as required by UK legislation and the internal SHE Management System. This information is reported via the Environmental Emissions Monitoring System or EEMS, which is a database of environmental information that is accessible by oil and gas operators and by the regulator BEIS (Department of Business, Energy and Industrial Strategy). We also regularly report our SHE performance via monthly and quarterly internal reports and contribute to Canadian Natural's annual Stewardship Report to Stakeholders (available via www.cnrl.com).



Ninian Northern Navigation Aid installed to mark the platform's location during the idle phase

5 ENVIRONMENTAL PERFORMANCE

The environmental performance charts below have been compiled using EEMS data to ensure consistency of reporting.

5.1 ATMOSPHERIC EMISSIONS

The majority of power generated on CNRI’s offshore installations is from gas-fired turbines, with a smaller amount of diesel also used in generators when fuel gas is not available. CNRI continues to look at emissions reduction opportunities identified in installation specific energy assessments, as well as emissions reduction opportunities identified by both on and offshore personnel.

CNRI is a member of the EU Emissions Trading Scheme, which seeks to reduce CO2 emissions using a ‘cap and trade’ scheme. During 2017, CNRI installations emitted remained stable at 1.01 million tonnes of CO2, compared with 1.01 million tonnes in 2016 and 1.00 million tonnes in 2015. (Note: the Apollo Spirit is outwith the scope of the EUETS as it falls below the minimum installed power generation capacity threshold.)

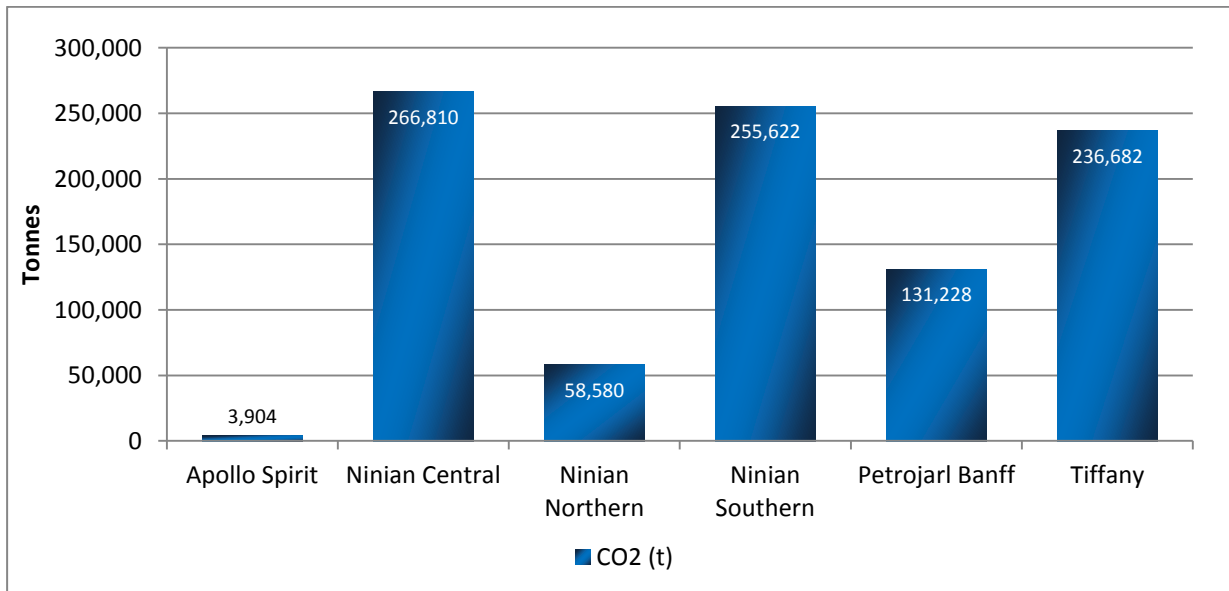


Figure 2 Total carbon dioxide emissions in 2017

CNRI restricts the flaring of gas wherever possible by using it in a variety of ways: produced gas is used for fuel, re-injected to provide reservoir support, used for artificial lift to production wells, and ideally, exported as sales gas. In some cases, however, an installation might not have a gas export route and would have no option but to flare its excess gas. Installations also need to maintain a minimum level of flaring for safety reasons.

The amount of gas flared in 2017 and associate CO2 emissions were higher than previous years. A total of 355 kilotonnes of CO2 were emitted in in 2017(Figure 3), compared with 311 kilotonnes in 2016 and 300 kilotonnes in 2015. Flare rates were higher on the Tiffany due to gas compression being offline and produced gas being routed to flare and on Ninian Southern during the refurbishment of the fuel gas system. The higher diesel usage on NSP is also associated with the refurbishment of the fuel gas system.

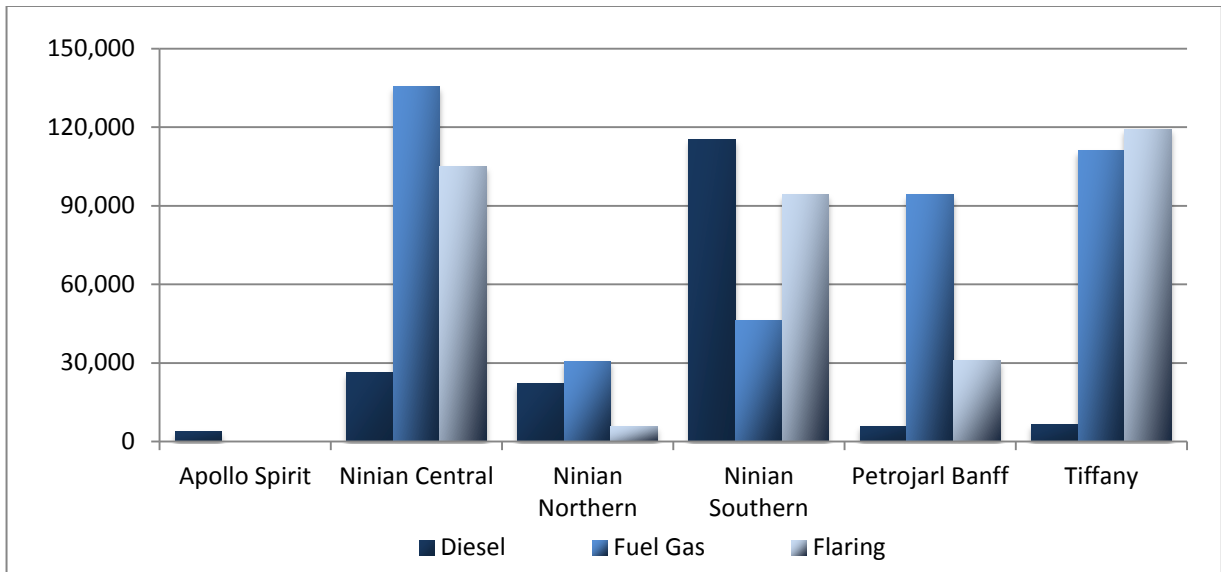


Figure 3 Sources of carbon dioxide emitted during 2017

In addition to CO₂, a range of other atmospheric emissions are regulated under the Pollution Prevention and Control (PPC) Regulations. Figure 4 shows our performance in 2017. The majority of these emissions are derived from power generation on the installations. The NO_x emissions on Ninian Southern are associated with the high diesel consumption during 2017.

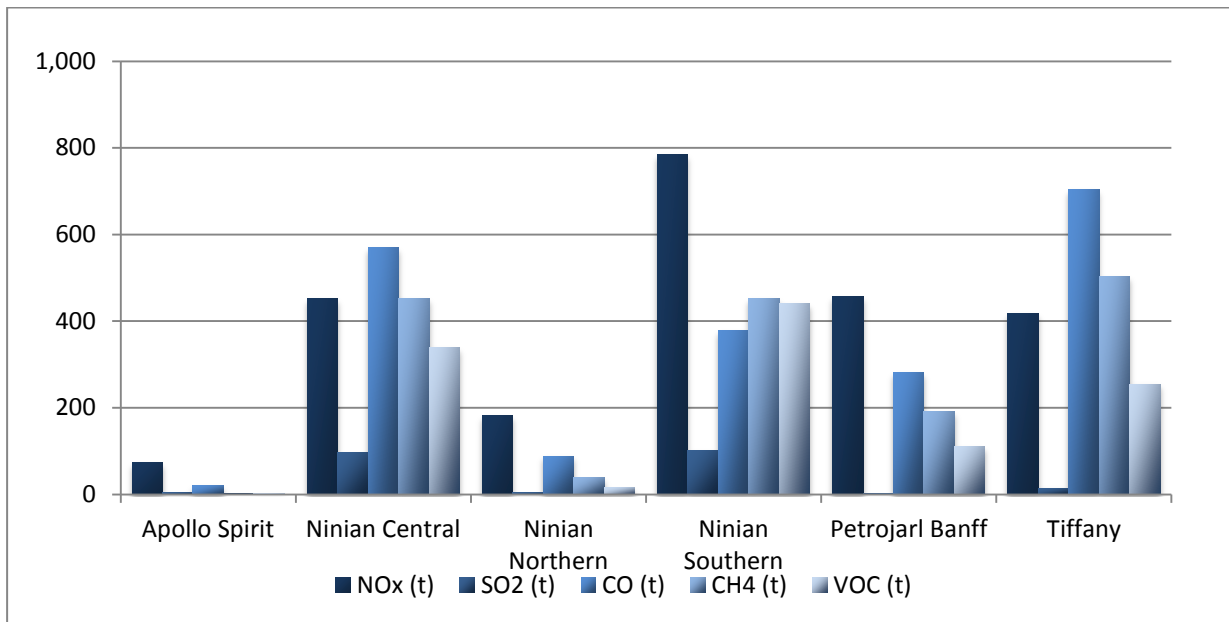


Figure 4 Other atmospheric emissions during 2017

5.2 OIL DISCHARGED IN PRODUCED WATER

Oil and gas reservoirs have a natural water layer (called formation water) that, being denser, lies under the hydrocarbons. As reservoirs become depleted of oil and gas, seawater is usually injected into the reservoirs to support hydrocarbon recovery. Both formation and injected waters are eventually produced along with the hydrocarbons and, as an oil field matures, the volume of produced water tends to

increase as the reservoir fills with injected seawater. The ‘water cut’ or amount of water in produced fluids from wells on mature assets can be >95% by volume compared with the oil content.

On CNRI’s offshore installations, produced water is separated from hydrocarbons in gravity separators and treated to remove as much oil as possible before it is discharged to sea. Because produced water inevitably contains traces of oil, its discharge to sea is strictly controlled by the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005, which define the average oil content of the water that may be discharged and place other limits on the amounts of oil that may be discharged (for example).

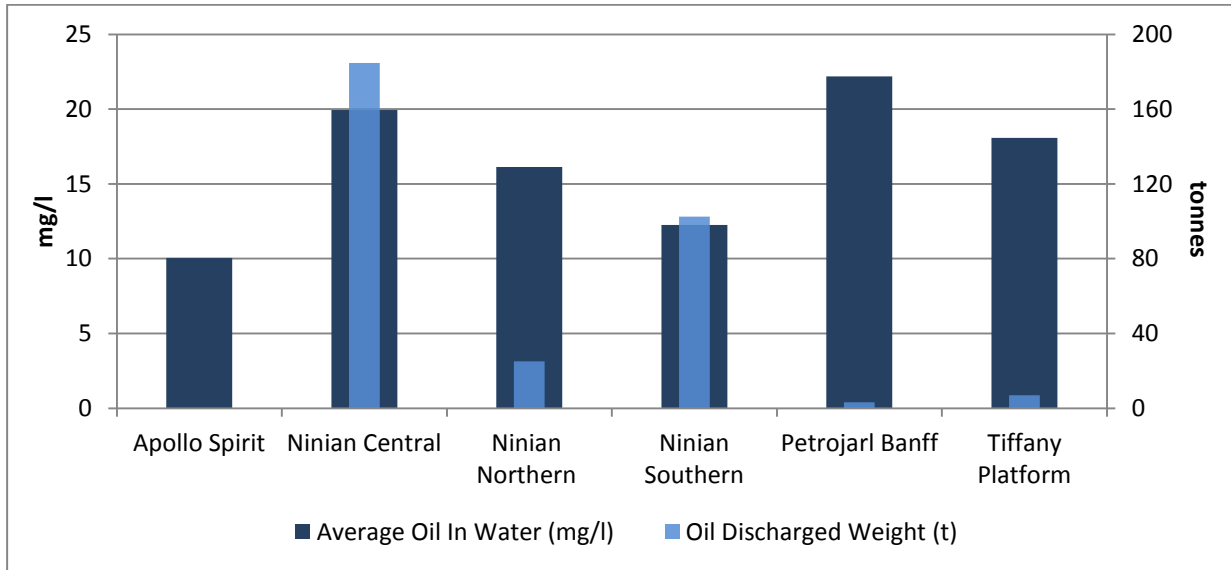


Figure 5 Average oil in water quality and oil discharged in 2017

In 2017, the amount of oil discharged in produced water from CNRI platforms (322 tonnes) was almost 31 tonnes less than in 2016 (353 tonnes). Average quality of produced water discharged in 2017 across all CNRI assets was 16.3 mg/l, similar to 2016 (16.6 mg/l). Volumes of produced water discharged were 19.7 million cubic meters, also lower than 2016. The decrease in produced water volumes and associated oil discharged with produced water are attributed to the cessation of production of the Ninian Northern platform. Produced water quality on each platform over the year was well below the legal limit of 30 mg/l for the monthly average set by the Regulator.

5.3 SOLID WASTE GENERATION AND DISPOSAL

CNRI has to ensure that the segregation, transportation and eventual disposal of wastes generated during their offshore operations are managed in accordance with legislative requirements. The Environmental Protection Act 1990 introduced the ‘Duty of Care’ with which all waste producers must comply. Hazardous waste that might be harmful to human health or the environment (also known as Special Waste) is governed by specific legislation, which includes strict handling and disposal requirements.

The offshore industry as a whole recycles a large fraction of its waste and CNRI works closely with its waste management contractor to identify recycling routes for as much of its waste as possible. CNRI currently recycles metal, wood, paper and cardboard, glass, plastics, aluminium cans and empty oil/chemical drums. CNRI is also working to reduce the volume of waste generated offshore, especially of hazardous wastes such as oil-contaminated rags and other similar items. CNRI’s waste management

contractor conducts regular random skip audits and provides monthly lists of ‘observations’ which allow focus on improvements in offshore waste management.

Operational waste excludes all drilling-related waste (i.e. drill cuttings and tank washings) and decommissioning waste.

In 2017, 1,218 tonnes of solid operational waste (Figure 6) were generated (up from 1,004 tonnes in 2016). The amount of waste sent to landfill was 362 tonnes compared with 332 tonnes in 2016. In contrast, 828 tonnes of waste were routed either for reuse, recycling or waste to energy in 2017, accounting for 68% of the total waste generated. A further 28 tonnes of were routed to other disposal routes.

Drilling waste is primarily made up of drill cuttings and tank washings. In 2017, drilling operations were conducted on Ninian Southern platform, but all liquid waste generated during the drilling operation was reinjected into a disposal well. Well intervention operations on other platforms generated around 40 tonnes of liquid waste/sludge.

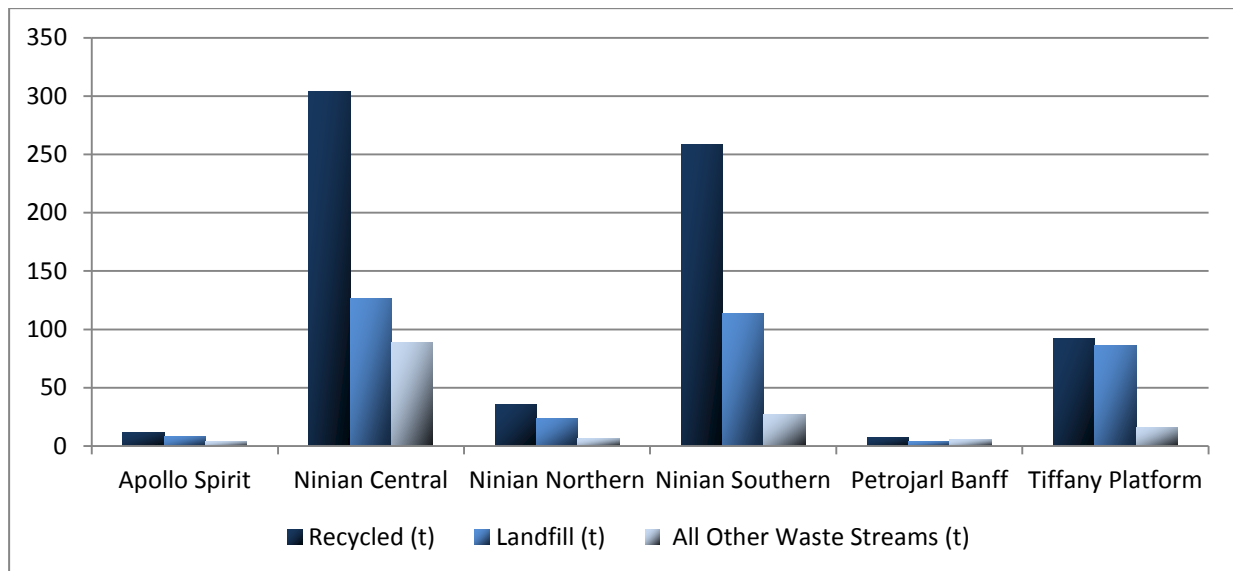
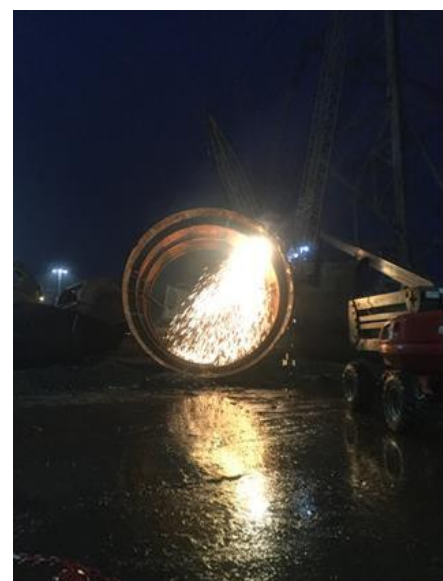


Figure 6 Operational waste generated and disposed of during 2017

Decommissioning waste was generated due to the ongoing Murchison decommissioning programme. A total of 165 tonnes of waste were sent to UK, of which 65% were recycled (including waste to energy).

The Murchison Jacket Removal Campaign was completed in June 2017 following the successful completion of the topsides removal in 2016. In total around 40,130 tonnes of topsides and jacket material were removed from the North Sea during the project. Demolition of the topsides modules has been completed, while dismantlement of the jacket structure continues at decommissioning site in Norway. The waste recovered ranges from electronic equipment, brass, concrete, naturally occurring radioactive material and of course a large volume of steel. Landfill disposal is only being used for materials which have no other possible disposal route. The total recovery rate for all materials at the end of 2017 was approximately 95%.



Murchison Decommissioning - cutting jacket into smaller sections for recycling

5.4 CHEMICAL USE AND DISCHARGE INTO THE MARINE ENVIRONMENT

All chemicals used offshore during oil and gas production must be approved by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), and their use and discharge is controlled under the Offshore Chemicals Regulations 2002. Each chemical used must be risk assessed by the operator as part of the permitting process, and any chemical which has particular hazardous properties (such as low biodegradability or high toxicity) requires additional justification for its use.

Production chemicals have a number of functions, including corrosion, scale and hydrogen sulphide inhibitors and biocides to prevent microbial souring of reservoirs. Also deoilers and demulsifiers to help to separate oil from produced water.

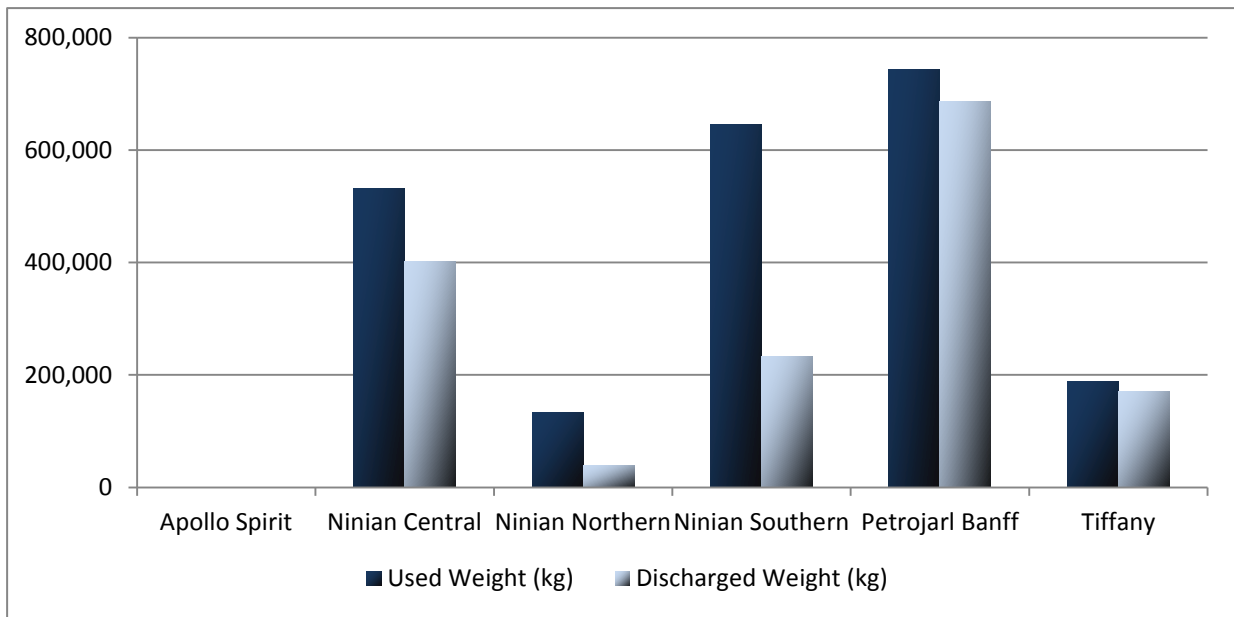


Figure 7 Production chemical usage and discharge during 2017

The total amounts of production chemicals used during 2017 (Figure 7) decreased when compared to 2016 for all assets with an overall decrease of 14% of total chemicals used and 10% of total chemicals discharged. Ninian Northern reduction was the most significant (43% use and 64% discharge) due to cessation of production.

A wide range of chemical products are used during drilling operations, including complex fluids known as drilling muds, which are used to cool and lubricate the drill bit, to remove rock cuttings from the well bore, to prevent the hole from collapsing, to cement casings and clean wells. Chemicals are also used during intervention and workover operations, including during emergencies, for example to prevent losses of drilling fluids to the formation.

The chemicals used and discharged during drilling and intervention operations are a reflection of activity during the year. The vast majority of these chemicals are not discharged to sea, as seen in Figure 8. Of those discharged to sea during 2017, 93% were classed as Posing Little or No Risk (PLONOR), 1% had a SUB warning and the remainder 6% had no warning associated with their use.

During 2017, twelve production and five drilling chemicals with components marked for substitution were used by CNRI. The vast majority of the chemicals used had no substitution warning (Figure 9); over 77% of the weight of chemicals discharged during CNRI's operations PLONOR or had no warning label associated with them ('others'), which is similar to 2016 (76%).

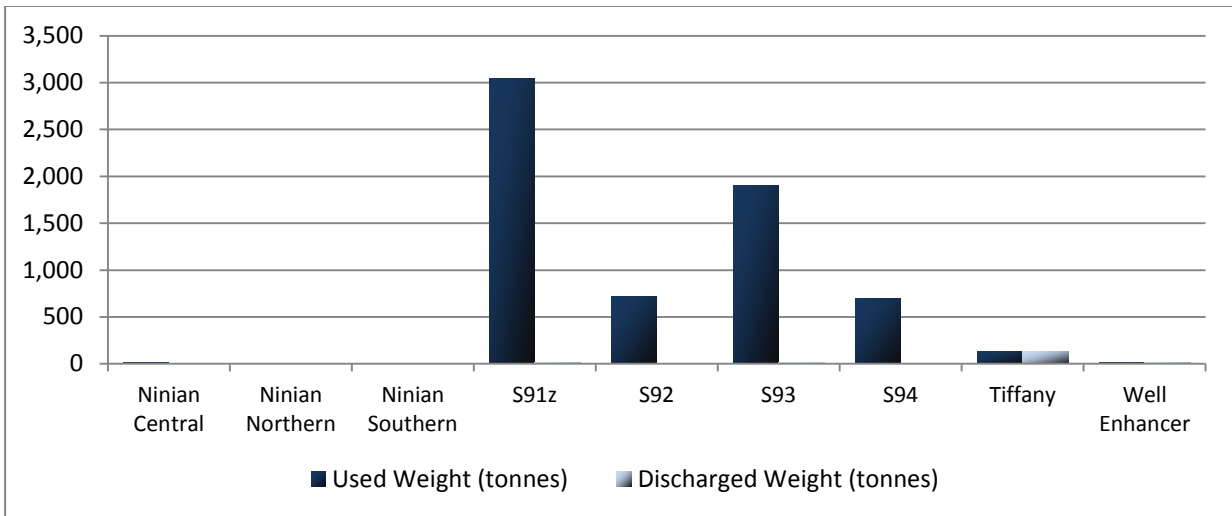


Figure 8 Drilling and well intervention chemical usage during 2017

Five chemicals with substitution warnings were removed from Production Chemical Permits in 2017 and one from the Drilling and Well Service Chemical Permits. Laboratory tests have been conducted for a new deoiler but no alternative of equivalent performance was identified. A new production chemical supplier has been appointed by CNRI and various alternative sub-free chemicals have been proposed to be tested during 2018.

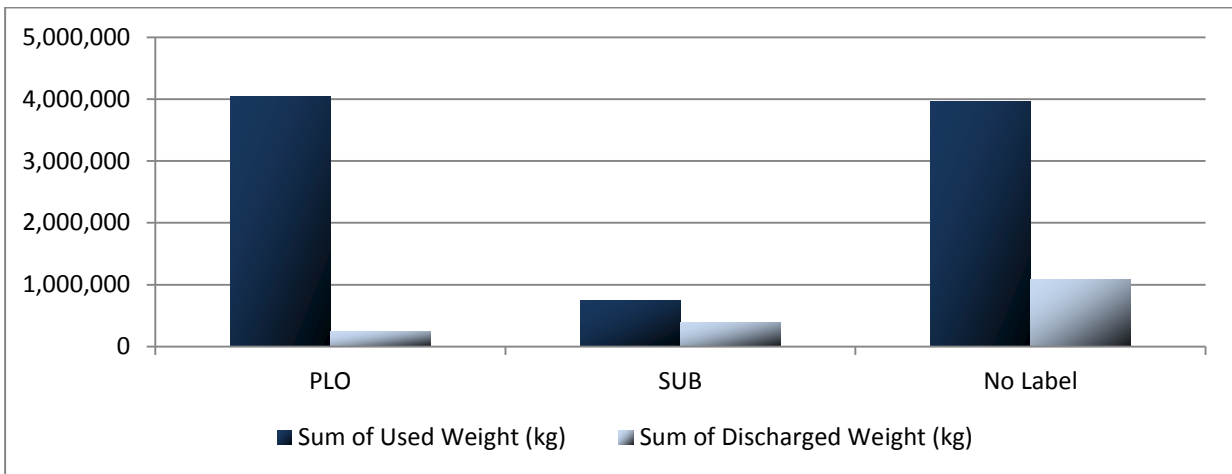


Figure 9 CNRI's chemical usage by CEFAS label during 2017 (all operations)

5.5 ACCIDENTAL RELEASES AND PERMIT NON-CONFORMANCES

All discharges of oil to sea, other than those regulated under an OPPC Permit, must be reported to the relevant authorities, regardless of volume. These reports are made on a PON1 (Petroleum Operations Notice 1) form, and include notification of accidental releases of oils and chemicals to sea, and permitted discharge notifications which report higher amounts of oil discharged to sea under an OPPC permit (>1 tonne in any 12 hour period) or unusual sheens which have the potential to cause environmental impact or affect other users of the sea.

CNRI takes its responsibility to prevent accidental discharges of oil and chemicals to sea very seriously. Procedures are in place to prevent spills (during chemical or diesel handling for example) and our Integrity Management System is designed to ensure that hydrocarbons remain securely within the process system on all installations.

CNRI investigates all accidental releases to sea and permit non-conformances to ensure that lessons are learned and actions are identified and carried out to prevent reoccurrence. Government approved Oil Pollution Emergency Plans (OPEPs) are in place for all offshore installations and CNRI is a full member of Oil Spill Response Limited, the world’s largest spill response organisation.

A total of 11 accidental releases were reported in 2017, compared with 17 in 2016: 9 were oil spills and 2 chemical spills. In total, 1.09 tonnes of oil were spilled to sea during 2017, compared with 0.67 tonnes in 2016. The largest release was an ongoing produced water leak on Ninian Central, where approximately 0.8 tonnes of oil was released to the marine environment via a defect on the produced water caisson between July and December.

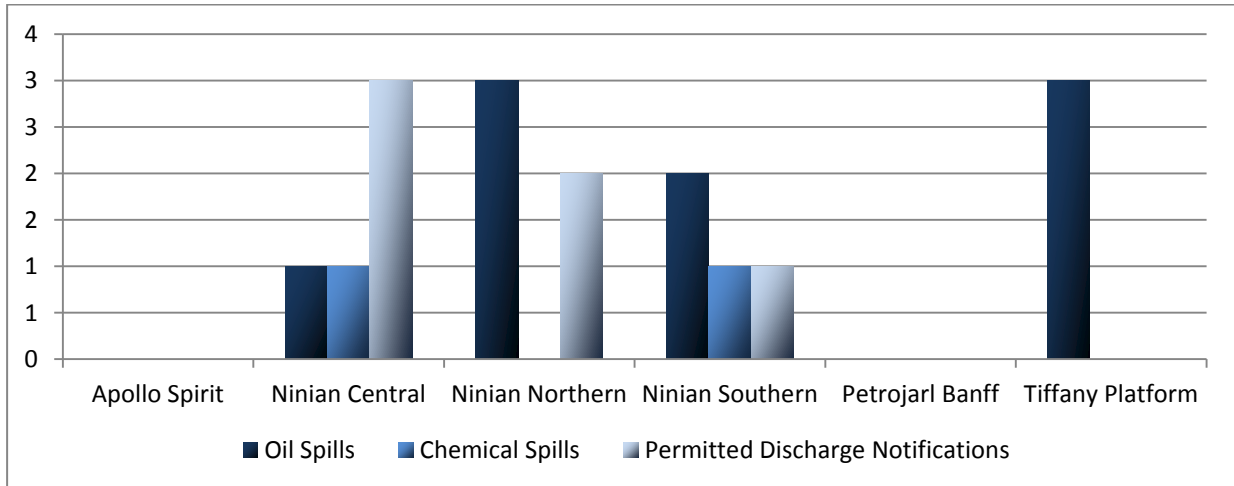
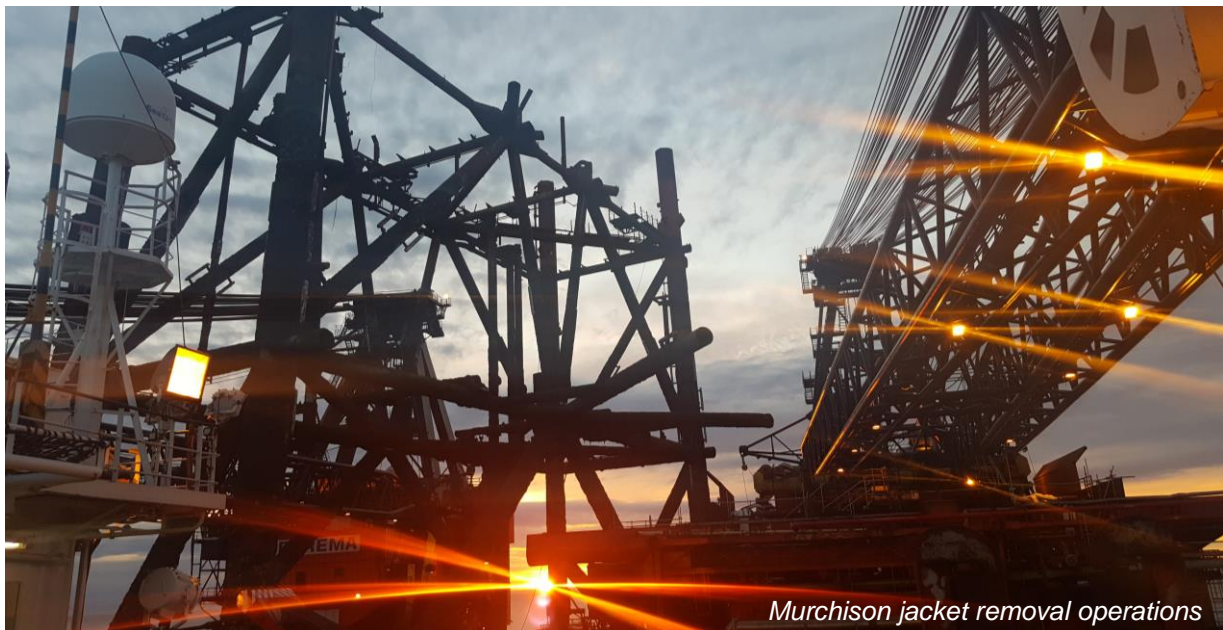


Figure 10 PON1 notifications during 2017

During 2017, there were two chemical releases, with a total of 0.09 tonnes of chemicals spilled to the sea. The six PON1 Permitted Discharge Notifications were related to produced water separation issues resulting in abnormal sheens or ‘out of spec’ water quality.

CNRI submitted 6 non-compliances with Oil Discharge Permits issued under the Oil Pollution Prevention and Control (OPPC) Regulations (compared with 12 in 2016). Three of these events were associated with metering issues and three associated with permit conditions not being met.



6 2017 ENVIRONMENTAL TARGETS

CNRI develops an annual SHE Improvement Programme for all of its operations. This programme includes targets for a series of leading and lagging performance indicators and sets out the means by which these are to be achieved, as well as improving company SHE performance in general.

For 2017, four specific environmental targets were set, based on the historical performance of CNRI's operations in both UK and West Africa:

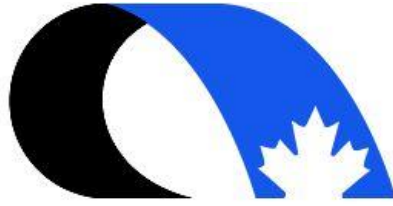
- To have fewer than 0.45 reportable spills per million barrels of oil equivalent production (BOE)
- To spill less than 0.02 tonnes of oil per million BOE
- To achieve an average oil in produced water concentration of < 20 mg/l
- To emit no more than 0.067 tonnes of carbon dioxide per BOE

How did we perform against these targets?

- ✓ Reported 0.37 spills per million BOE (12 spills in total – 11 UK and 1 Africa)
- ✗ Spilled 0.05 tonnes oil per million BOE (0.67 tonnes oil spilled in total)
- ✓ Achieved average oil in produced water concentration of 16.32 mg/l
- ✓ Emitted 0.067 tonnes of carbon dioxide per BOE

The 2018 SHE Improvement Programme for the UKCS includes key performance indicators for oil discharged in produced water, number and volume of reportable spills and leaks, and greenhouse gas emission intensity. Performance against these targets will be reported in the 2018 Environmental Performance Annual Report.





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