OSPAR COMMISSION

Assessment of the discharges, spills and emissions from offshore installations on the Norwegian Continental Shelf 2016-2020

Offshore Oil & Gas Industry Series

2022

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. Les Parties contractantes sont l'Allemagne, la Belgique, le Danemark, l’Espagne, la Finlande, la France, l’Irlande, l’Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d’Irlande du Nord, la Suède, la Suisse et l’Union européenne.

Assessment of the discharges, spills and emissions from offshore installations on the Norwegian Continental Shelf 2016-2020

Contents

Executive Summary

This report presents the discharge, spill and emission data from offshore oil and gas operations on Norwegian Continental Shelf (NCS) over the period 2016–2020 and the assessment of the data. The annual data is provided in Annex 1.

a. Level of Activity

The Norwegian Continental Shelf (NCS) is a mature petroleum region. Many of the fields in production are old, but some still have large remaining reserves. The resource base in these fields is also increasing as small discoveries in the vicinity are linked to existing infrastructure. There is still a high activity level, with 231 wells drilled in 2020.
New fields have come into production since 2016 and new discoveries have been made in the last few years. Production declined by 4 % between 2016 and 2019, but recovered in 2020. Production increased by approximately 2 % in 2020 compared to the production in 2016.

Discharges & spills

The annual total quantity of *dispersed*[1] *oil (aliphatic oil)* discharged to sea from produced water and displacement water decreased slightly during the 2016–2020 period.

Produced water is the main contributor to the oil discharges from the petroleum industry. Discharge of produced water reached a maximum of 160 million m^3 in 2007. The volume of produced water discharged has slightly decreased between 2016 and 2020. Injection decreased from 2016 to 2018, but increased again in 2019 and 2020. The percentage produced water injected (26 %) is still small compared to the amount being discharged (74 %). Almost 60 % of the discharges of produced water comes from four large and mature fields. Discharge of displacement water remained stable over the assessment period.

The annual average dispersed oil content in produced and displacement water increased over the period. During the assessment period between three and eight installations on the NCS failed to meet the performance standard for oil content as an annual average. However, these installations typically had small discharge volumes as they reinjected most of their produced water. The total amount of oil discharged with water exceeding the performance standard was highest in 2016 and 2019 with 15,7 tonnes and 11,7 tonnes respectively, compared to 2-5 tonnes in the other years during the 2016-2020 period.

The number of oil spills to sea have varied from 36 oil spills in 2016 to 47 spills in 2020. There is typically no particular reason for the trend in the number of spills reported. The majority of oil spills are smaller than 1 tonne.

Chemicals

The use of chemicals was higher in 2020 compared to 2016, mainly due to higher drilling activity, resulting in an increased use of drilling chemicals (Figure 8).

[1]. “Aliphatics” and “aromatics” are defined by the reference method set in OSPAR Agreement 2005-15 (Solvent extraction, Infra-Red measurement at 3 wavelengths). In that context, “aliphatics” and “dispersed oil” mean the same thing.

The level of discharge seems to mainly coincide with the amount of water based mud used and discharged during drilling. Most of the chemicals used and discharged were non-substitution chemicals.

The total quantity of chemicals used offshore in 2020 was 432 601 tonnes, out of which 71 % (wt.) were on the PLONOR list and another 28 % (wt.) were other non-substitution chemicals, while 1 % of chemicals were substitution chemicals. There was no use of LCPA-substances during the assessment period.

Total quantity of chemicals discharged into the sea in 2020 was 94 904 tonnes on the NCS. Around 84 % (wt.) of these were listed on the PLONOR list and approximately 15 % (wt.) were other non-substitution chemicals. Less than 1 % were substitution chemicals.

It was a peak in the use of other substitution chemicals in 2018 and 2020. The peak in 2018 correlates with an increased use of chemicals at one field related to P&A operations (plug and abandon). The peak in 2020 correlates with in-situ production of sodium hypochlorite, and increased use of lubricating oil. It was a significant increase in reported discharge of other substitution chemicals from 2019 to 2020, due to reported in-situ produced sodium hypochlorite. Use and discharge of in-situ sodium hypochlorite was first reported in 2020, due to a new reporting requirement in Norway.

The number and quantity of chemical spills varies over the assessment period and no clear discernible trend is observed.

Atmospheric Emissions

Emissions of CO_2 decreased over the assessment period from 12,1 and 13,3 million tonnes (Figure 12). Variations are related to variations in the production levels, energy efficiency measures and hydropower from shore.

NOx emissions has varied between 41 and 45 thousand tonnes. Variations in NOx emissions are related to start up and shutdown of fields, rig activity, and production rate.

Reported emissions of methane were reduced by 21 % between 2016 and 2017. This is mainly due to new measurements and calculation methods for direct emissions. Emissions of methane have remained stable since 2017 (Figure 13). Emissions of nmVOCs have been quite stable during the assessment period from 2016 to 2020 (Figure 13). Emissions of SO_2 have varied between the high of 584 tonnes in 2016 to the low of 516 tonnes in 2017 (Figure 12). The variation in SO_2 is partly due to an incidient of flaring of gas due to H_2S issues, more exact knowledge of the H_2S content of the burned gas, and to the number of rig operations.

Récapitulatif

Ce rapport présente les données sur les rejets, les déversements et les émissions des opérations pétrolières et gazières offshore sur le plateau continental norvégien (NCS) pour la période de 2016 à 2020 et l'évaluation de ces données. Les données annuelles sont fournies à l'annexe 1.

a. Niveau d'activité

Le plateau continental norvégien (NCS) est une région pétrolière mature. De nombreux champs en production sont anciens, mais certains possèdent encore d'importantes réserves. La base de ressources de ces champs augmente également, car les petites découvertes à proximité sont liées aux infrastructures existantes. Le niveau d'activité reste élevé, avec 231 puits forés en 2020. De nouveaux champs sont entrés en production depuis 2016 et de nouvelles découvertes ont été faites au cours des dernières années. La production a diminué de 4 % entre 2016 et 2019, mais s'est redressée en 2020. La production a augmenté d'environ 2 % en 2020 par rapport à la production de 2016.

b. Rejets et déversements

La quantité totale annuelle d'hydrocarbures dispersés[2] (hydrocarbures aliphatiques) rejetée rejetée en mer à partir de l'eau de production et de l'eau de déplacement a légèrement diminué au cours de la période 2016-2020.

L'eau de production est le principal contributeur des rejets de pétrole de l'industrie pétrolière. Les rejets d'eau de production ont atteint un maximum de 160 millions de m3 en 2007. Le volume d'eau de production rejetée a légèrement diminué entre 2016 et 2020. L'injection a diminué entre 2016 et 2018, mais a de nouveau augmenté en 2019 et 2020. Le pourcentage de l'eau de production injectée (26 %) est encore faible par rapport à la quantité rejetée (74 %). Près de 60 % des rejets d'eau de production proviennent de quatre champs importants et matures. Le rejet d'eau de déplacement est resté stable au cours de la période d'évaluation.

La moyenne annuelle de la teneur en hydrocarbures dispersés dans l'eau de production et l'eau de déplacement a augmenté au cours de la période. Au cours de la période d'évaluation, entre trois et huit installations du plateau continental norvégien n'ont pas respecté la norme de performance pour la teneur en pétrole en moyenne annuelle. Cependant, ces installations avaient généralement de petits volumes de rejet car elles réinjectaient la plupart de leur eau de production. La quantité totale d'hydrocarbures rejetés avec de l'eau dépassant la norme de performance était la plus élevée en 2016 et 2019, avec 15,7 tonnes et 11,7 tonnes respectivement, contre 2 à 5 tonnes les autres années de la période 2016-2020.

Le nombre de déversements d'hydrocarbures en mer a varié de 36 déversements en 2016 à 47 déversements en 2020. Il n'y a généralement pas de raison particulière à la tendance du nombre de déversements signalés. La majorité des déversements d'hydrocarbures sont inférieurs à 1 tonne.

c. Produits chimiques

L'utilisation de produits chimiques était plus élevée en 2020 par rapport à 2016, principalement en raison de l'augmentation de l'activité de forage, ce qui a entraîné une utilisation accrue de produits chimiques de forage (figure 8).

[2]. Les "Aliphatiques" et les "aromatiques" Les aliphatiques et les aromatiques sont définis par la méthode de référence fixée dans l'accord OSPAR 2005-15 (extraction par solvant, mesure par infrarouge à 3 longueurs d'onde). Dans ce contexte, les termes "aliphatiques" et "hydrocarbure dispersé" signifient la même chose.

Le niveau de rejet semble coïncider principalement avec la quantité de boue à base d'eau utilisée et rejetée pendant le forage. La plupart des produits chimiques utilisés et rejetés étaient des produits chimiques non substituables.

La quantité totale de produits chimiques utilisée offshore en 2020 était de 432 601 tonnes, dont 71 % (poids) figurent sur la Liste PLONOR et 28 % (poids) étaient des produits chimiques non substituables, tandis que 1 % des produits chimiques étaient des produits chimiques de substitution. Aucune substance figurant sur la Liste OSPAR de produits chimiques devant faire l'objet de mesures prioritaires (LCPA) n'a été utilisée pendant la période d'évaluation.

La quantité totale de produits chimiques rejetée en mer en 2020 sur le plateau continental norvégien était de 94 904 tonnes. Environ 84 % (poids) figurent sur la Liste PLONOR, et environ 15 % (wt.) étaient des produits chimiques non substituables. Moins de 1 % étaient des produits chimiques de substitution.

L'utilisation d'autres produits chimiques de substitution a connu un pic en 2018 et 2020. Le pic en 2018 est en corrélation avec une utilisation accrue de produits chimiques sur un champ lié aux opérations de P&A (bouchage et abandon). Le pic en 2020 est en corrélation avec la production in-situ d'hypochlorite de sodium, ainsi que l'utilisation accrue d'huile de graissage. Il y a eu une augmentation significative des rejets notifiés d'autres produits chimiques de substitution de 2019 à 2020, en raison de l'hypochlorite de sodium produit in situ. L'utilisation et le rejet d'hypochlorite de sodium in situ ont été notifiés pour la première fois en 2020, en raison d'une nouvelle obligation de notification en Norvège.

Le nombre et la quantité de déversements de produits chimiques varient au cours de la période d'évaluation et aucune tendance claire ne se dégage.

d. Emissions atmosphériques

Les émissions de CO_2 ont diminué au cours de la période d'évaluation de 12,1 et 13,3 millions de tonnes (Figure 12). Les variations sont liées aux variations des niveaux de production, aux mesures d'efficacité énergétique et à la production d'hydroélectricité à partir du littoral.

Les émissions de NOx ont varié entre 41 et 45 mille tonnes. Les variations des émissions de NOx sont liées au démarrage et à l'arrêt des champs, à l'activité des appareils de forage et au taux de production.

Les émissions notifiées de méthane ont été réduites de 21 % entre 2016 et 2017. Cela est principalement dû aux nouvelles mesures et méthodes de calcul des émissions directes. Les émissions de méthane sont restées stables depuis 2017 (figure 13). Les émissions de nmVOCs ont été assez stables au cours de la période d'évaluation de 2016 à 2020 (figure 13). Les émissions de SO_2 ont varié entre le maximum de 584 tonnes en 2016 et le minimum de 516 tonnes en 2017 (figure 12). La variation des émissions de SO_2 est en partie due à un incident du torchage du gaz en raison de problèmes de H_2S, à une connaissance plus exacte de la teneur en H_2S du gaz brûlé, et au nombre d'opérations de forage.

1. Introduction

This report provides an assessment of the discharges, spills and emissions to the North Sea from offshore oil & gas installations on the Norwegian Continental Shelf (NCS) during the period 2016–2020. The purpose of the report is to assess trends related to the effectiveness of the OSPAR measures and the national regulation. Trends have been assessed using expert judgement and not by statistical analyses.

The assessment is based on data submitted by the operators on the NCS to the Norwegian authorities and reported by Norway in the annual OSPAR report on discharges, spills and emissions from offshore oil and gas installations. The assessment is based on the data available for the NCS at the time when the annual OSPAR report was submitted (Annex 1).

Where relevant, the performance on the NCS has been compared to the overall performance in the OSPAR area, using the following sources:

- "OSPAR report on discharges, spills and emissions from the offshore oil and gas activity in 2019" (OSPAR Commission 2020)
- "Assessment of the OSPAR report on discharges, spills and emissions from the offshore oil and gas activity 2009-2018" (OSPAR Commission 2020)

It should be noted that as Norway is the largest oil and gas producer in the OSPAR region, emissions and discharges on the NCS contribute significantly to the total emissions and discharges in the OSPAR area. OSPAR trends may therefore to a certain degree be driven by trends on the NCS, making a comparison of performance challenging.

The operators have used procedures for sampling and analysis given by the Norwegian Environment Agency (NEA), and quality assurance procedures described by NEA and the Norwegian Oil & Gas Association. Certified laboratories have been used.

2. Setting the scene

Level of Activity

Norway is the largest producer of oil and gas in the OSPAR region and there is a high activity level on the Norwegian continental shelf, with 231 wells drilled in 2020 and large discoveries made in the last few years.

While new fields have come into production since 2016 production declined by 4 % through to 2019, though recovered in 2020. Compared to 2016 production has increased by approximately 2 % in 2020.

The number of installations with discharges have remained quite stable since 2016.

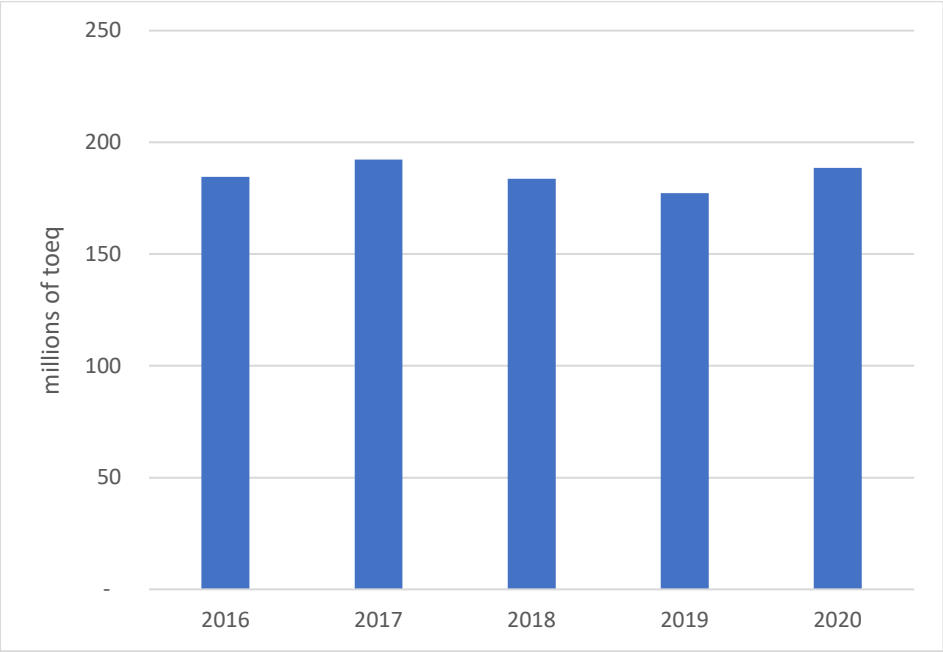

Figure 1: Annual total production of oil equivalents on the Norwegian Continental Shelf

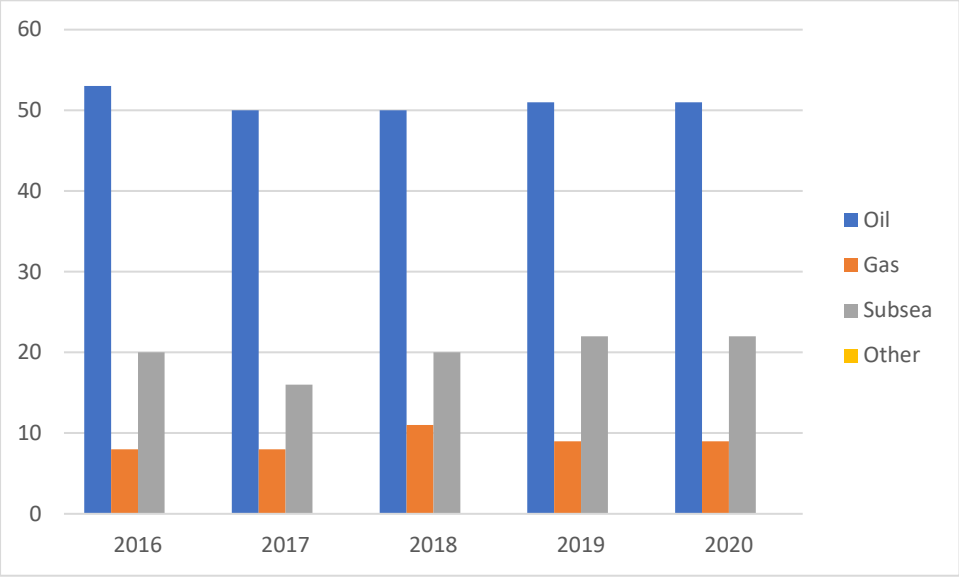

Figure 2: Number of installations on the Norwegian Continental Shelf[3]

The reported drilling activity on the NCS increased between 2016 and 2020, as shown in Figure 3.

[3] Different counting mechanims makes it impossible to compare numbers of installations in Norway with number of installations reported by other countries.

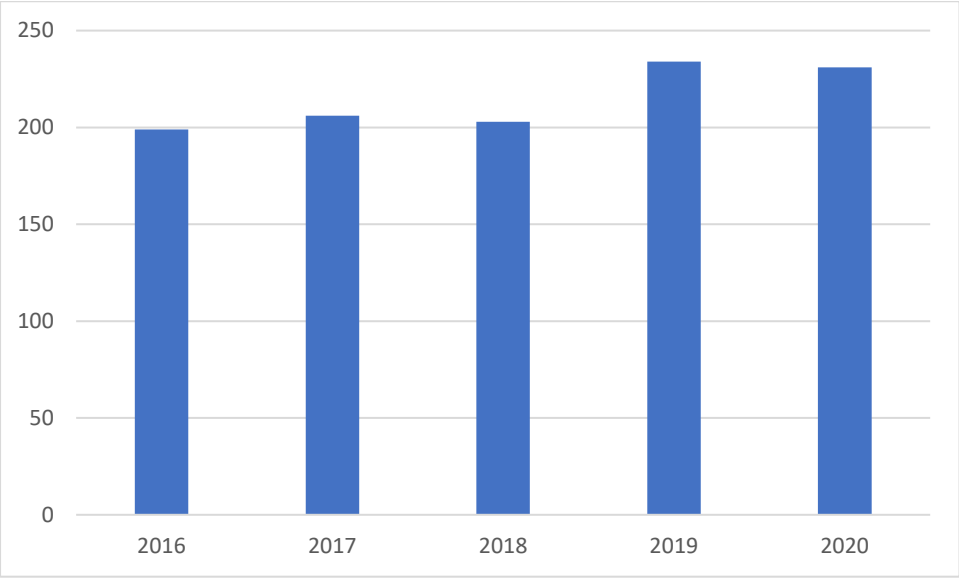

Figure 3: Number of wells drilled on the NCS, 2016-2020

3. Environmental Management

As required in OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems (EMS), Norwegian legislation requires the industry to have an EMS (Framework HSE regulation, Section 17, Duty to establish, follow up and further develop a management system)[4]. Operators may either have a certified EMS (ISO 14001 or EMAS) or an EMS that is in accordance with the principles of such a standard. The authorities do not issue formal approval related to their EMS. However, all audits examine parts of the EMS system, and failing to have one will have grave consequences for the operator, including withdrawal of the licence.

Requirements to document such management systems are stated in the HSE regulations, Framework regulation § 23 and Management regulation §§ 24 and 42.

4. Oil discharges

4.1. Discharges of oil to sea

Discharges of dispersed oil are regulated in accordance with OSPAR Recommendation 2001/1 (as amended). Norwegian regulations state that the oil content shall be *as low as possible and* not exceed 30 mg/L dispersed oil as a monthly average.

Produced water and displacement water

Produced water discharges account for about 79 % of total oily water discharged on the NCS. Discharges of produced water on the NCS decreased by about 9 % from 2016 to 2020 (Figure 4).

[4] HSE regulations - All regulations (ptil.no)

Injection of produced water is approximately the same in 2016 compared to 2020, with only a 1 % increase in 2020. The percentage produced water injected (26 %) is still small compared to the amount being discharged (74 %). Almost 60 % of the discharges of produced water comes from four large and mature fields. These fields do not inject or inject very little produced water due to lack of options considered technically and economically viable.

Displacement water accounts for approximately 20 % of the total water discharged into the NCS, and comes from three fields on the NSC. Discharges of displacement water decreased during the period 2016 to 2019, but increased in 2020. The amount discharged in 2020 was 6 % higher than in 2016. The last one percent of the total oily water discharged is mainly drainage water.

Comparing this with OSPAR overall figures, shows that:

- The discharges of produced water and displacement water were relatively stable during the 2016-2020 period both on the NSC and in the OSPAR area as a whole.

Discharges on the NCS accounts for approximately half of the discharges in the OSPAR area, and changes in Norwegian dicharges will therefore be reflected in OSPAR figures.

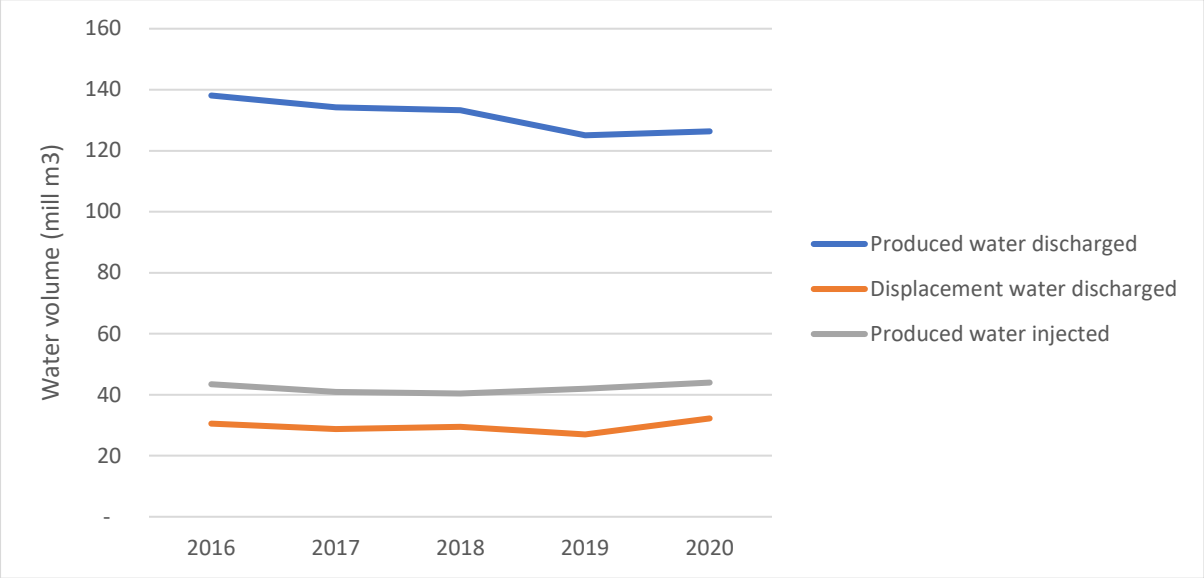

Figure 4: Discharges and injection of produced water and displacement water on the NCS 2016—2020

Dispersed oil discharged

The total quantity of dispersed oil discharged with produced water and displacement water seems to have had a decreasing trend during the period 2016-2020 (Figure 5). This seems mostly to correlate with reduced production and discharge of produced water. The decrease in discharges between 2016 and 2020 was approximately 11 %.

The decrease in discharge of dispersed oil is comparable with the majority of OSPAR countries where an overall average reduction of 17% has been seen and where the average concentration is 9,3mg/l in 2020.

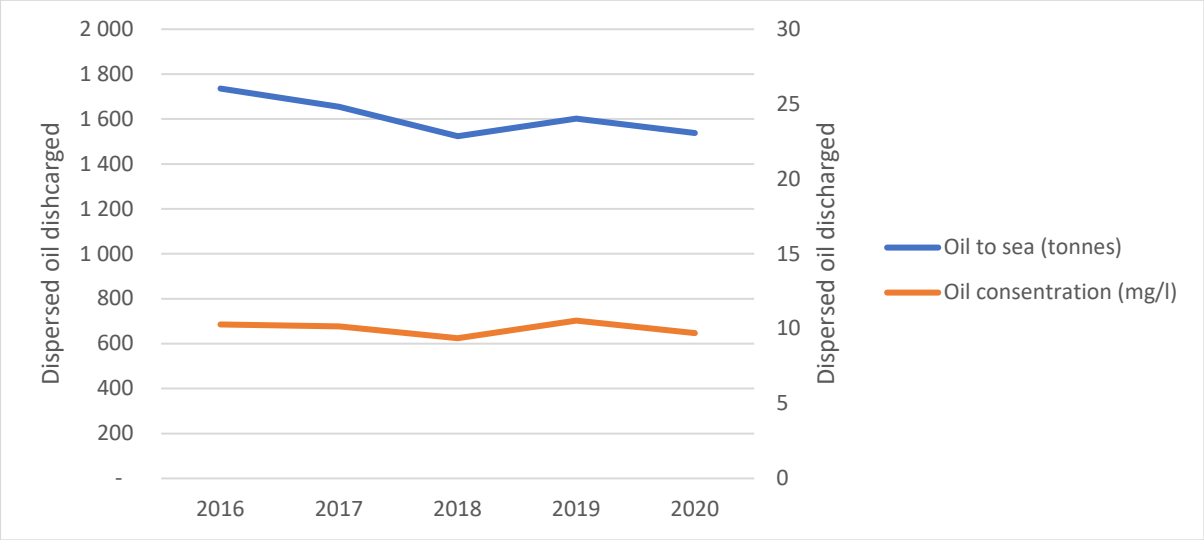

Figure 5: Quantity and concentration of dispersed oil discharges on the NCS, 2016—2020

The performance standard in Recommendation 2001/1 has been 30 mg/l calculated as a monthly average since 2007. Few installations failed to meet this limit with only six in 2020 (Figure 6). Their reason for not reaching the goal was mainly that they rely on produced water injection, and during short periods injection facilities fail, and water with high concentrations of dispersed oil are discharged. These installations could discharge produced water over a longer period in order to stabilise the water cleaning process, and thereby reduce the average oil concentration, but Norwegian authorities have rather decided to accept higher concentrations of oil for very short periods in order to minimize the total discharge of oil.

The quantity of dispersed oil discharged by installations that failed to meet the performance standard in the 2016-2020 period ranged between 2 and 16 tonnes (Figure 6). The peak in 2016 was due to challenging workovers and well start-ups leading to high concentration of particles making reinjection impossible in certain periods. The peak in 2019 resulted from the fall out of injection on one field over a period of four months.

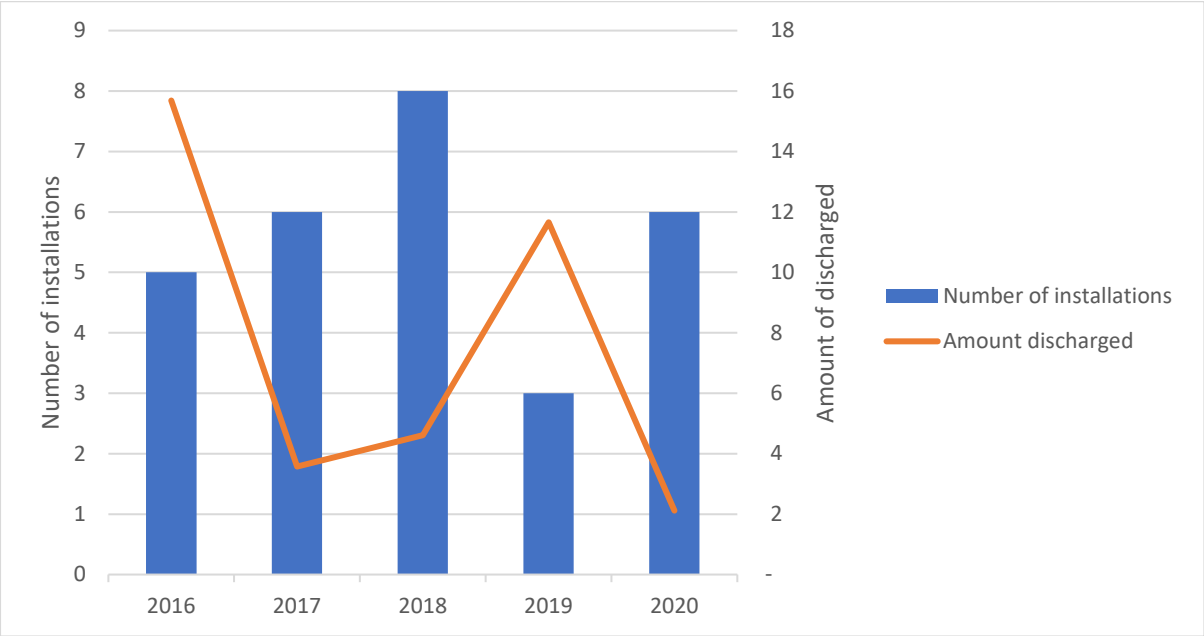

Figure 6: Installations on NCS failing to meet performance standards for concentration of oil in water discharged and amount oil discharged because of the excess in concentration

Norway also reports the dissolved oil content (as represented by BTEX components) in produced water discharges. OSPAR has not issued recommended discharge levels for these components as they rapidly biodegrade in seawater once discharged. The discharge of dissolved oil[5] (BTEX) during this assessment period has decreased from 2 221 tonnes in 2016 to 1 749 tonnes in 2020, a decrease of 20 %. This is a larger reduction than seen in dispersed oil during the same period, and the reason for this has not been thoroughly investigated.

4.2. Risk-based Approach (RBA)

In 2012, OSPAR adopted Recommendation 2012/5 for a risk-based approach to the management of produced water discharges from offshore installations. Norway has implemented the Recommendation as requirements in the HSE regulations and guidance for the petroleum industry. All operators discharging produced water have to perform and report substance based risk assessments, resulting in calculated field specific Environment Impact Factors (EIFs). One EIF refers to a volume of water of 100 000 m^3 where the PEC/PNEC ratio exceeds 1 for one or more components in the produced water.

The Norwegian operators have been performing risk assessments and implemented risk reducing measures since the late 1990s in accordance with the Norwegian national goals (zero-discharge) for the petroleum sector. The work was evaluated in 2003, 2005, 2006, 2010 and finally in 2016 in reports to the Government. The operators are required to report annually to the environmental authorities on measures taken to reduce EIF. Also specific requirements for achieving reductions have been imposed by the environmental authorities. As of the end of 2019 all installations included

[5] "Aliphatics" (or "dispersed oil") are regularly and frequently measured, while the sampling is much less frequent for "aromatics". Therefore data on "aromatics" may be less reliable.

within RBA process have been assessed. Of 45 installations 22 have been assessed to have the risk adequately controlled.

For the majority of the installations with produced water discharges, the main contributors to EIF are the added chemicals and the natural occurring components in oil. Dispersed oil contributes very little compared to the others mentioned. Substitution of certain chemicals (corrosion inhibitors, H_2S scavengers and biocides) has the main focus, but options for injection or improved water management and treatment are constantly being considered.

4.3. Spills of oil to sea

The number of oil spills to sea during the period 2016-2020 has been quite stable through the assessment period. From 36 oil spills in 2016 to 47 spills in 2020. There is typically no particular reason for the trend in the number of spills reported. The majority of oil spills are smaller than 1 tonne, 35 to 45 spills per year. While the annual number of spills larger than 1 tonne has been between 2 and 5 spills.

The quantity of oil from the spills peaked in 2019, which is a result of one event.

The amount of oil spilled on the NCS was less than 8 % (wt.) of the amount of dispersed oil discharged with produced water in the same period.

The number of spills and quantity spilled varies greatly across the OSPAR region, and is not possible to compare.

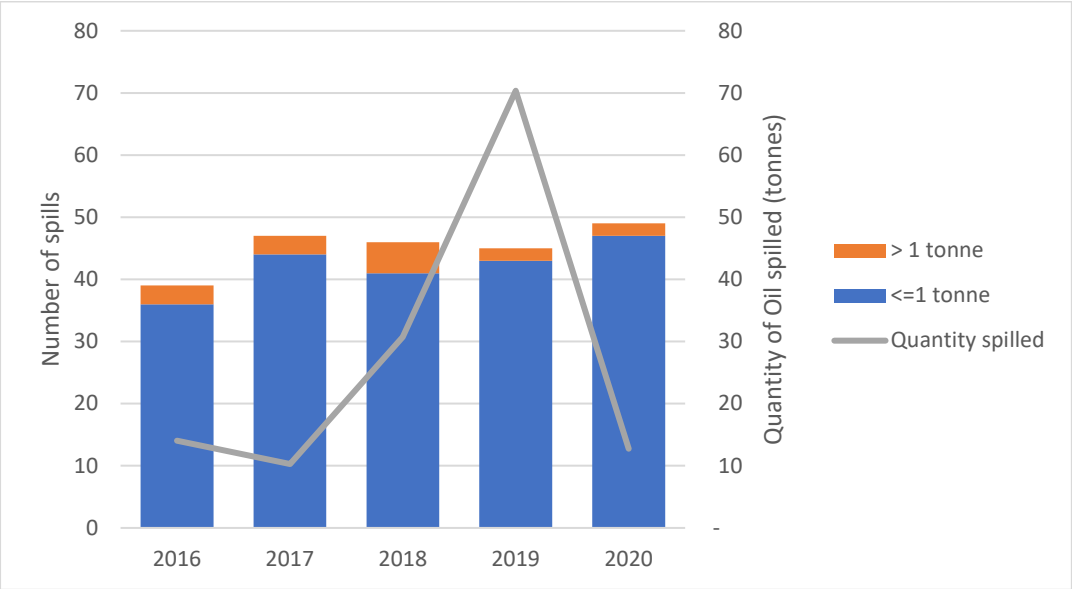

Figure 7: Quantity and number of oil spills on the NCS 2016—2020

4.4. Discharges of organic phase fluids

Discharge of cuttings contaminated with organic phase fluids (OPF) at a concentration greater than 1% by weight on cuttings is prohibited based on OSPAR Decision 2000/3. Norway regulates this under the Activities regulations section 68. Technologies able to reduce the concentration of oil to below the 1 % limit exist today.

In 2016 permission was granted to discharge cuttings drilled with oil based mud from the field Johan Sverdrup. Included in the terms for the permission, is that the oil concentration on cuttings discharged should not exceed 0,3 %, with an ambition to reach a concentration of 0,1 %. There were no discharge of cuttings drilled with oil based mud in 2016 through 2019. However in 2020 six wells at Johan Sverdrup were drilled with oil based mud and had a total discharge of 8,9 tonnes of oil based mud with treated cuttings. Measured concentration of oil on cuttings varied from 1,9 g/kg to 3,1 g/kg

5. Chemicals

5.1. Chemical Use & Discharge

In this report, the term *substitution chemical* is short for *chemicals which contain one or more substances which are candidates for substitution*, according to OSPAR Recommendation 2010/4. This includes chemicals which are

- on the OSPAR LCPA,
- inorganic with LC_{50} or EC_{50} less than 1 mg/l,
- have biodegradation less than 20 %, or
- meets two of three criteria
    - biodegradation less than 60 %,
    - BCF larger than 100 or Log $P_{ow} \geq 3$, or
    - LC_{50}/EC_{50} less than 10 mg/L.

The goal of OSPAR Recommendation 2006/3 was for substitution chemicals to be phased out by 1 January 2017. In addition OSPAR Recommendation 2005/2 set a goal that Contracting Parties should have phased out the discharge of substitution chemicals on the OSPAR 2004 List of Chemicals for Priority Action (LCPA) by 1 January 2010. There are no OSPAR measures for the other categories of chemicals classified within HMCS, as these are deemed not to pose a significant risk to the environment.

The Norwegian Environment Agency states that all pollution is illegal, and discharges and emissions from industry require a permit. All use of chemicals (except for emergency use) needs a permit. The permit states the volume of chemicals allowed to be used, and the volume allowed to be discharged. Use of substitution chemicals is only permitted if they are necessary for safety or technical reasons.

In addition, the HSE regulations for the petroleum industry states that evaluation, ranking and choice of chemicals is the operator's responsibility. The authorities do not register individual

chemicals, but the operators on the NCS run a common database where all chemicals are registered. The authorities have access to all information.

There was a decrease in total use of chemicals from 2016 to 2017 and an increas use of chemicals from 2017 to 2020. Use of chemicals is correlated with drilling activity, more specifically a combination of the amount of wells drilled and also the length and volume drilled per year, resulting in an reduced use of drilling chemicals from 2016 to 2017 and an increased use of drilling chemicals from 2017 to 2020 (Figure 8).

The level of discharge is quite stable through the assessment period, and seems to mainly correlate with the amount of water based mud used and discharged during drilling.

Most of the chemicals used and discharged were non-substitution chemicals.

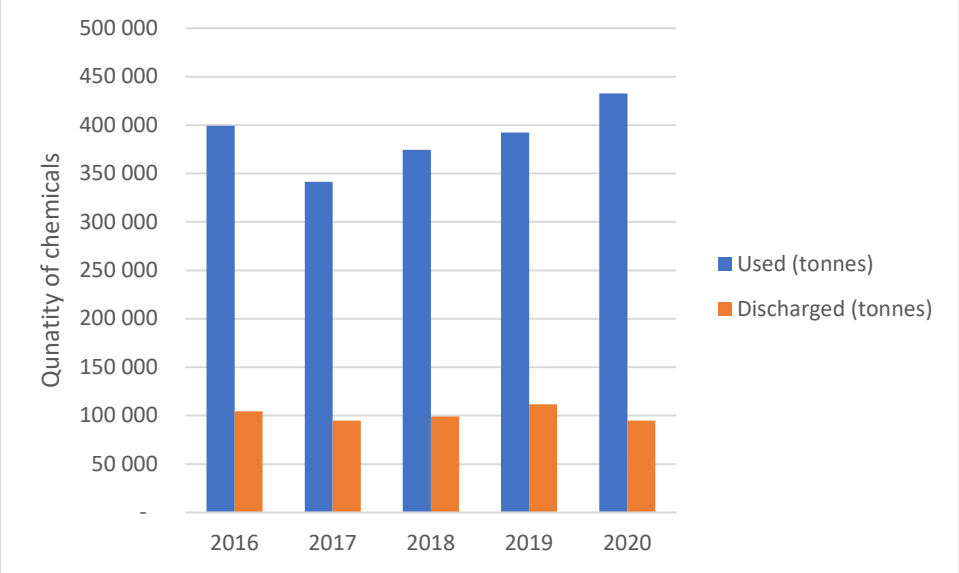

Figure 8: Total quantity of chemicals used and discharged on the NCS 2016—2020

Chemicals Used

The total quantity of chemicals used offshore in 2020 was 432 601 tonnes out of which 71 % were on the PLONOR list and another 28 % were other non-substitution chemicals, while 1 % of chemicals were substitution chemicals. There was no use of LCPA-substances during the assessment period. It was a peak in the use of other substitution chemicals in 2018 and 2020. The peak in 2018 correlates with an increased use of chemicals at one field related to P&A operations (plug and abandon). The peak in 2020 correlates with in-situ production of sodium hypochlorite, and increased use of lubricating oil. Use and discharge of in-situ production of sodium hypochlorite was first reported in 2020 due to a new requirement in Norway.

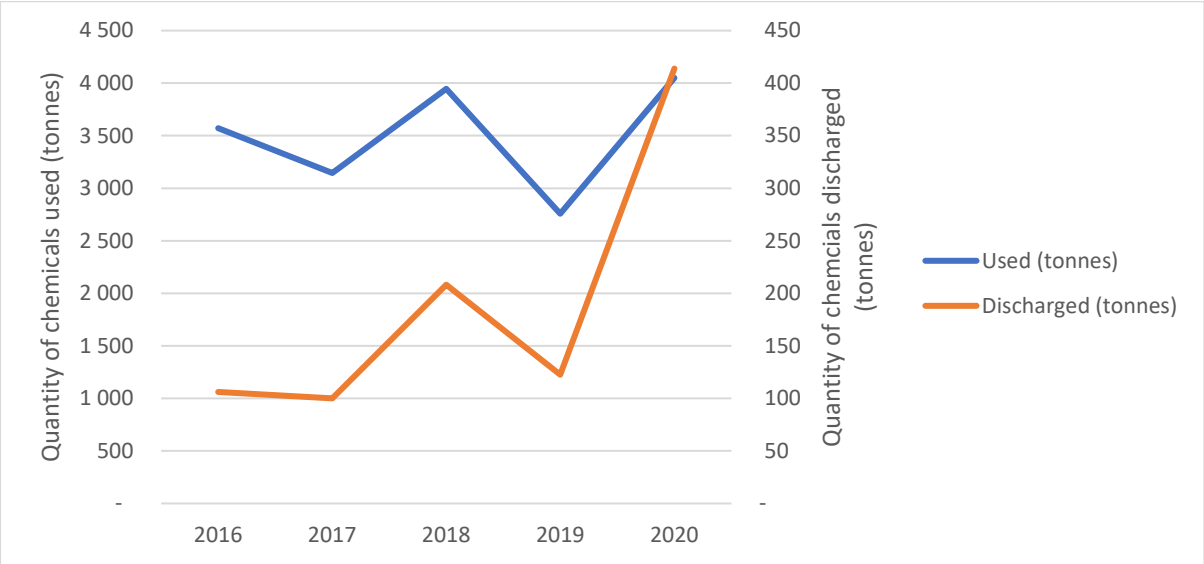

Figure 9: Quantities of substitution chemicals (other then LCPA chemicals) used and discharged on NCS, 2016—2020

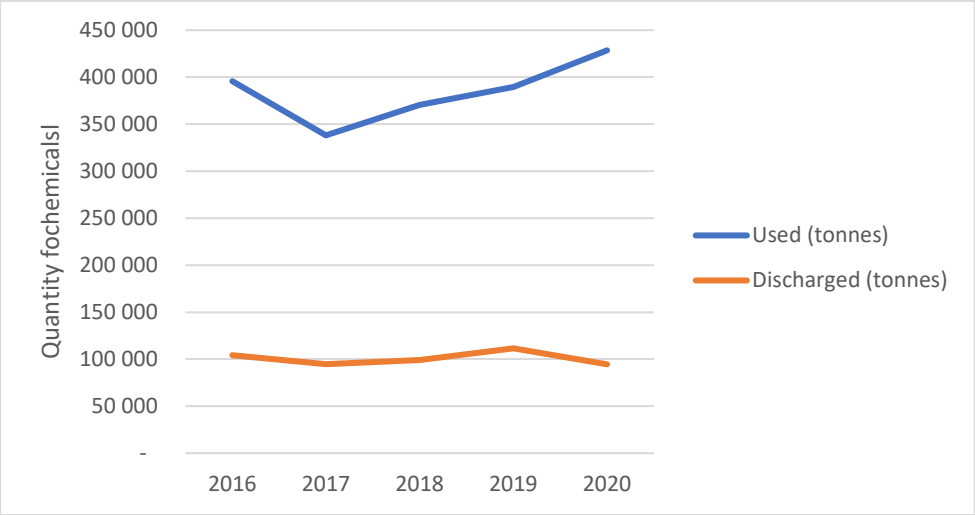

Figure 10: Quantities of chemicals not containing substitution candidates used and discharged on NCS, 2016-2020

On average OSPAR figures over the same period are comparable. Just under 70 % (by weight) of chemicals used were PLONOR and just over 29 % (by weight) of chemicals used Ranking chemicals, and 1 % were chemicals on the LCPA list or other substitution chemicals. Thus, the percentage relationship between the pre-screening categories in the OSPAR area correlates with the quantity of chemicals used on the NCS.

Chemicals Discharged

Total quantity of chemicals discharged into the sea in 2020 was 94 904 tonnes on the NCS. Around 84 % of these were listed on the PLONOR list and approximately 15 % (wt.) were other non-substitution chemicals. Less than 1 % were substitution chemicals. There was a significant increase in discharge of other substitution chemicals from 2019 to 2020, due to a new requirement in Norway to also report and classify in-situ produced sodium hypochlorite.

OSPAR average figures over the same period are comparable. Just under 83% (by weight) of chemicals used were PLONOR and just under 17% (by weight) of chemicals discharged were Ranking chemicals.

Plastics, Microplastics & Nanomaterials

Plastics, microplastics and nanomaterials are to be reported from 2020 onwards. At present there is only one year of data and it is not possible to comment on any trends or comparison with other Contracting Parties. Reported amounts of plastics are associated with some uncertainty related to whether the products are plastics or microplastics. This will be followed up in the next annual report. Definitions of plastics, microplastic and nanomaterial are given in OSPAR Recommendation 2010/03 on a Harmonised Offshore Chemical Notification Format.

Plastics & Nanomaterial category	**Quantity used, kg**	**Quantity discharged, kg**
Plastics	45	45
Microplastics	354	0
Nanomaterials	NI	NI

For the Norwegian data it should be noted that

1. Not all registered products have been recertified prior to the HOCNF update that allows substances to be identified as Plastic, Microplastic, and Nanomaterial so reported figures are likely to be underestimates,
2. Products reported as plastics was also checked out to be microplastic, but is now only reported as plastics to avoid double reporting.
3. Norway do not yet have data on nanomaterials.
4. Microplastics include the total quantities of the coated proppants where the entire coated particle is counted within the microplastic category as per the OSPAR definition.

5.2. Chemical Spills

The number of spills varies and no clear temporal trend is observed. The total quantity of chemicals spilled to sea was quite low in 2019 with a total of 53 m^3. However, there are large variations between years and no clear trend is observed.

The vast majority (around 90-98 %) of chemicals spilled were either on the PLONOR list or were Ranking substances.

Consequently,

- no clear trend is observed in the number of chemical spills on the NCS, nor in the OSPAR area

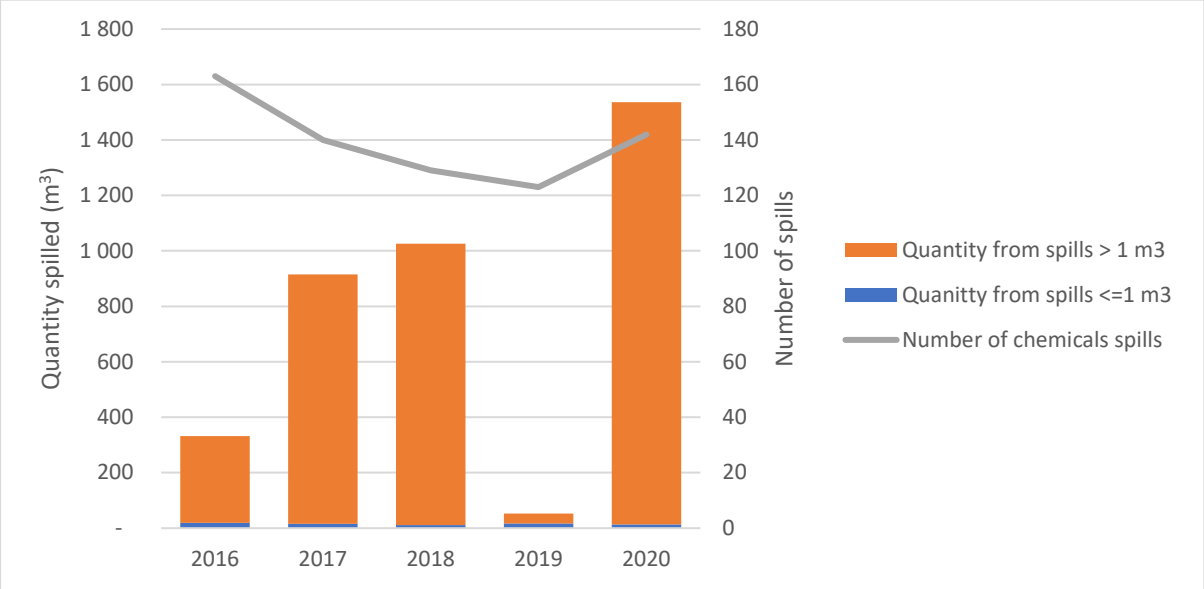

Figure 11: Number and quantity of chemical spills on the Norwegian Continental Shelf 2016—2020

6. Emissions to air

Atmospheric emissions are not covered by OSPAR measures or harmonised OSPAR measuring methodologies, but are regulated under Norwegian legislation. The atmospheric emissions from the Norwegian petroleum activities are reported annually to OSPAR.

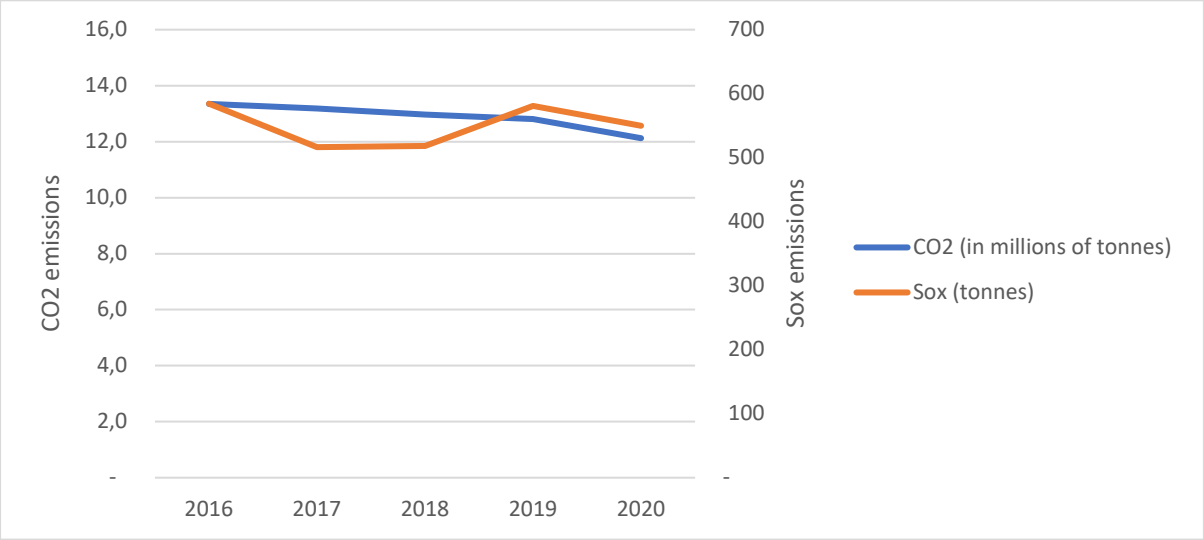

Figure 12: Emissions of CO_2 and SOx on the NCS, 2016—2020

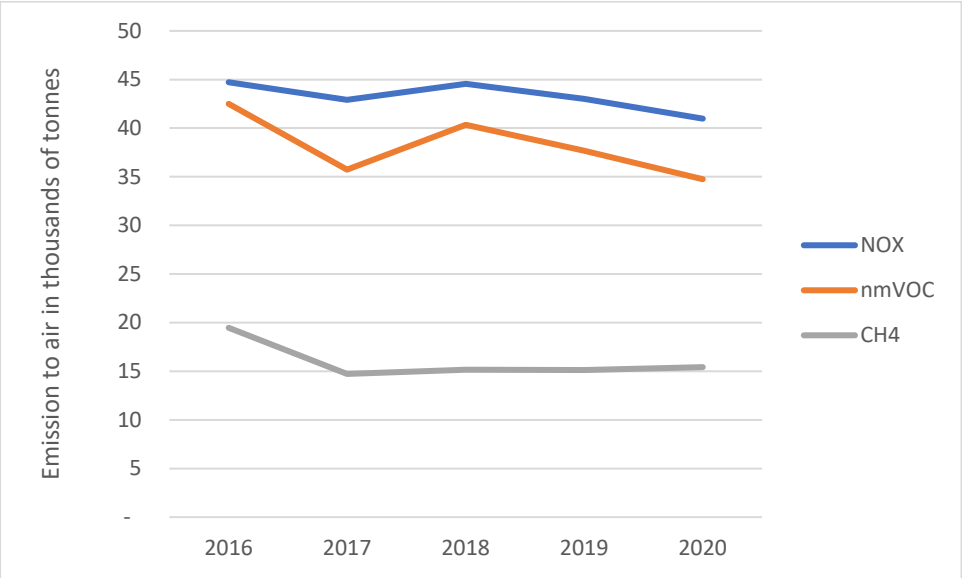

Figure 13: Emissions of NOx, methane and nmVOC on the NCS, 2016—2020

Emissions of CO_2 showed a downward trend between 2016 and 2020, a nine precent reduction, from 13,3 million tonnes to 12,1 million tonnes (Figure 12).

Emissions of CO_2 decreased over the assessment period from 12,1 and 13,3 million tonnes (Figure 12). Variations are related to variations in the production levels, energy efficiency measures and hydropower from shore.

NOx emissions has varied between 41 and 45 thousand tonnes. Variations in NOx emissions are related to start up and shutdown of fields, rig activity, and production rate.

Reported emissions of methane were reduced by 21 % between 2016 and 2017. This is mainly due to new measurements and calculation methods for direct emissions. Emissions of methane have remained stable since 2017 (Figure 13). Emissions of nmVOCs have been quite stable during the assessment period from 2016 to 2020 (Figure 13). Emissions of nmVOC decreased by around 80 % between 2001 and 2010, but since 2010 have been quite stable. The large reduction from 2001 was mainly due to a new regulation of emissions from offshore loading, resulting in implementation of vapour recovery units on the ships. Finally, emissions of SO_2 have varied between the high of 584 tonnes in 2016 to the low of 516 tonnes in 2017 (Figure 12). The variation in SO_2 is partly due to an incidient of flaring of gas due to H_2S issues, more exact knowledge of the H_2S content of the burned gas, and to the number of rig operations.

By comparison, there were a reduction across the OSPAR region for the period of 11 % for CO_2, 12 % for NOx, 3 % for nmVOC, 28 % for methane and 34 % for SO_2.

7. Counting of installations & QA procedures in Norway

7.1. Counting of installations

In OSPAR, the number of installations is detailed in the "Inventory of oil and gas offshore installations in the OSPAR maritime area ". However, since the number not only includes drilling and production installations, but also for example concrete foundations for bridges and gangways, the number does not clearly indicate the level of drilling and production activity.

Therefore, in the annual reports to OIC from Norway, the number of installations are counted in the following way:

One installation with discharges to water and air may be a fixed or floating drilling and/or production installations ("host installations") including all subsea wellhead templates with wells transferring oil and gas to the host installations. The operator of the host installation may or may not be the operator of the templates. Normally, the discharges are covered by one permit from the Norwegian Environment Agency. The host installation may consist of more than one structure. An example is Equinor's Norne field, which consists of the Norne FPSO, 6 Norne templates, three Urd templates (covering the Svale and Star reservoirs), one Alve template and one Marulk template belonging to Vår Energi AS (not shown in the picture).

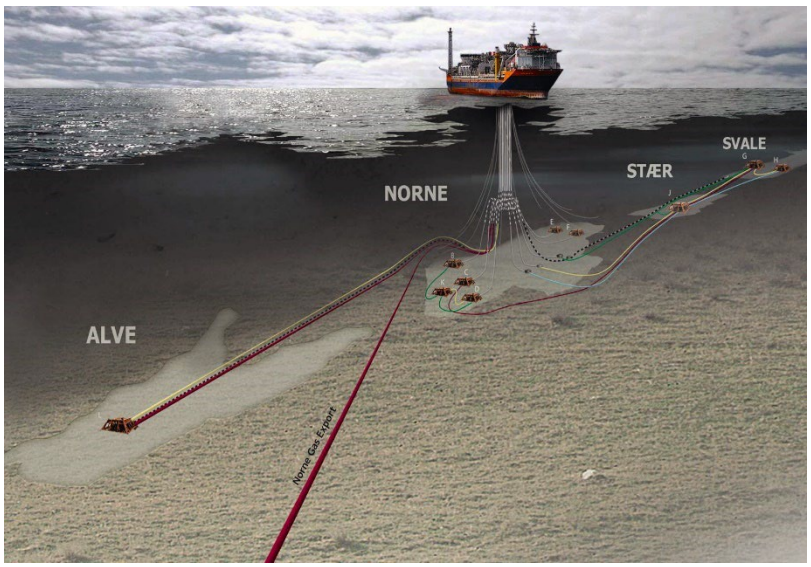

Figure 9: The Norne field

One field may have more than one installation which due to their size, complexity and integrity are counted individually. An example is the Statfjord field, which with three concrete base installations, and including the sub sea fields Statfjord East, Statfjord North and Sygna, are counted as 3.

A third example may be the Ekofisk field, wich includes eleven permanent installations counted as five installations in OIC context.

Figure 15: The Ekofisk field

The intention is that the change in number of installations shall reflect the change in activity.

7.2. Reporting requirements and quality assessment

The operators are required to report annually according to specifications from the Norwegian Environment Agency. Data related to drilling, production, discharges of water and oil, energy production and emissions to air, the use and discharge of chemicals, waste production and handling, etc., is entered into a common database. This database has been developed by the Norwegian Oil and Gas Association, and is paid for by the industry themselves.

The quality of data submitted is the responsibility of each operator. They are required to carry out systematic review of their own data. In addition, each operator has access to most data from the other operators. This enables them to compare and contrast their data to data from the other operators, and to relate them to data for previous years. The Norwegian Oil and Gas Association also carries out some quality assurance, but does not have any formal requirement from the authorities to do so.

Sampling and analysis has to be done according to national or international standards. The standards will be specific for each type of sample and each analysis. The operators have to include details related to this in their management systems. The authorities may at any time request to see the documentation.

The operators have a requirement to evaluate uncertainties in the reported numbers, and the results shall be included in the annual report. However, this is a difficult task, and we do not yet have a good procedure for how to assess the operators' conclusions, and act upon them. We need more experience, and we have cooperation with the parts of our organisation which deal with reporting from land based industry to find a way forward.

Appendix 1: OSPAR Measures associated with Offshore Oil and Gas industry

Discharges contaminated with oil

PARCOM Recommendation 86/1 of a 40 mg/l Emission Standard for Platforms[6];

OSPAR Reference Method of Analysis for the Determination of the Dispersed Oil Content in Produced Water (OSPAR Agreement number: 2005—15);

OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations (as amended);

OSPAR Recommendation 2012/5 for a risk-based approach to the Management of Produced Water Discharges from Offshore Installations

Use and discharge of drilling fluids and cuttings

OSPAR Decision 2000/3 on the Use of Organic-phase Drilling Fluids (OPF) and the Discharge of OPF-contaminated Cuttings;

Guidelines for the Consideration of the Best Environmental Option for the Management of OPF-Contaminated Cuttings Residue (OSPAR Agreement number: 2002—8);

Chemicals used and discharged offshore

OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals (as amended);

OSPAR Recommendation 2010/4 on a Harmonised Pre-Screening Scheme for Offshore Chemicals;

OSPAR Recommendation 2010/3 on a Harmonised Offshore Chemical Notification Format (HOCNF) (as amended);

OSPAR Recommendation 2006/3 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Which Contain Substances Identified as Candidates for Substitution;

OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action.

OSPAR Recommendation 2005/2 on Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Contain Added Substances, Listed in the OSPAR 2004 List of Chemicals for Priority Action.

[6] PARCOM Recommendation of a 40 mg/l Emission Standard for Platforms, 1986 was revoked for produced water only by OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations. However, this measure is still applicable in relation to ballast water, drainage water and displacement water from offshore installations.

Appendix 2 Data Annexes

Table 1: Number of installations on the NCS with discharges to the sea, or emissions to the air 2016—2020

	2016	2017	2018	2019	2020
Oil	53	50	50	51	51
Gas	8	8	11	9	9
Subsea	20	16	20	22	22
Other	0	0	0	0	0
Total	81	74	81	82	82

Table 2: Oily aqueous discharges to the maritime area

Table 2a: Oil discharged in displacement and produced water (in tonnes), 2016—2020

2016	2017	2018	2019	2020
Dispersed	Dispersed	Dispersed	Dispersed	Dispersed
1 736	1 655	1 524	1 603	1 538

Table 2b: Dissolved oil discharged in displacement and produced water (in tonnes), 2016—2020

2016	2017	2018	2019	2020
BTEX	BTEX	BTEX	BTEX	BTEX
2 221	2 106	1 920	1 901	1 785

Table 2c: Total volume of produced water and displacement water discharged, and produced water injected (in m^3/year), 2016—2020

	2016	2017	2018	2019	2020
PW*	138 101 839	134 202 747	133 239 937	125 054 292	126 347 509
DPW**	30 510 835	28 714 703	29 462 397	26 991 522	32 239 860
IPW***	43 421 496	40 942 535	40 406 443	42 020 624	43 990 805
Total	212 034 170	203 859 985	203 108 777	194 066 438	202 578 175

*Produced water

**Displacement water

*** Injected produced and displacement water

Table 3: Installations which do not meet OSPAR performance standard for dispersed oil in aqueous discharges

Table 3b: Number of installations with discharges failing to meet the 30 mg oil/l performance standard, valid from 2007 onwards, and quantity of oil discharged by these installations (in tonnes)

	2016	2017	2018	2019	2020
Number of installations exceeding 30 mg/l	5	6	8	3	6
Quantity of dispersed oil discharged	16	4	5	12	2

Table 4: Use and discharges of organic-phase drilling fluids (OPF) and cuttings

Table 4a: Quantities of oil and other organic-phase fluids discharged via cuttings (in tonnes), 2016—2020

2016	2017	2018	2019	2020
0	0	0	0	8,9

Table 4b: Number of wells drilled with OPF, with discharge of contaminated cuttings to the maritime area, 2016—2020

2016		2017		2018		2019		2020	
OBF	non-OBF OPF	OBF	non-OBF OPF	OBF	non-OBF OPF	OBF	non-OBF OPF	OBF	non-OBF OPF
0	0	0	0	0	0	0	0	6	0

Table 5: Spillage of oil and chemicals

Table 5a: Number of oil spills, 2016—2020 - Spills less than 1 m^3 (≤ 1 m^3) and spills above 1 m^3 (> 1 m^3)

2016		2017		2018		2019		2020	
<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne
36	3	44	3	41	5	43	2	47	2

Table 5b: Total quantity of oil spilled, in m^3, 2016—2020

2016		2017		2018		2019		2020	
<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne	<=1 tonne	> 1 tonne
1,6	15,1	5,1	7,1	2,9	33,7	1,6	82,2	4,0	11,2

Table 5a: Number of chemical spills, 2016—2020 - Spills less than 1 m^3 (≤ 1 m^3) and spills above 1 m^3 (> 1 m^3)

2016		2017		2018		2019		2020	
<=1 m3 (number)	> 1 m3 (number)	<=1 m3 (number)	> 1 m3 (number)	<=1 m3 (number)	> 1 m3 (number)	<=1 m3 (number)	> 1 m3 (number)	<=1 m3 (number)	> 1 m3 (number)
138	25	111	29	105	24	111	12	107	35

Table 5b: Total quantity of chemical spilled, in m^3, 2016—2020

2016		2017		2018		2019		2020	
<=1 m3 (m3)	> 1 m3 (m3)	<=1 m3 (m3)	> 1 m3 (m3)	<=1 m3 (m3)	> 1 m3 (m3)	<=1 m3 (m3)	> 1 m3 (m3)	<=1 m3 (m3)	> 1 m3 (m3)
19	313	16	899	11	1 015	17	36	14	1 522

Table 6: Emissions to air, 2016—2020

CO_2 (in millions of tonnes)

2016	2017	2018	2019	2020
13,3	13,2	13,0	12,8	12,1

NOx (in thousands of tonnes)

2016	2017	2018	2019	2020
44,7	42,9	44,5	43,0	41,0

nmVOC (in thousands of tonnes)

2016	2017	2018	2019	2020
42,5	35,7	40,3	37,7	34,7

CH_4 (in thousands of tonnes)

2016	2017	2018	2019	2020
19,5	14,7	15,2	15,1	15,4

SO_2 (in tonnes)

2016	2017	2018	2019	2020
584,3	516,4	518,4	580,8	550,0

Table 7: The use and discharge of offshore chemicals, 2012—2016

Table 7a: Quantity of offshore chemicals used in kg/year

Pre-screening category	2016	2017	2018	2019	2020
PLONOR	284 605 483	238 399 889	263 737 716	279 037 796	308 464 673
Inorganic LC50 or EC50 >1 mg/l	-	-	-	-	-
Ranking	111 065 322	99 720 887	106 846 389	110 434 878	120 086 278
List of Chemicals for Priority Action	0	0	0	0	0
Inorganic LC50 or EC50 <1 mg/l	134 810	102 232	110 223	101 881	591 693
Biodegradation < 20%	2 397 254	2 324 256	3 199 194	2 240 564	3 142 060
Substance meet two of three criteria	1 040 355	719 249	635 971	414 999	316 298

Table 7b: Quantity of offshore chemicals discharged in kg/year

Pre-screening category	2016	2017	2018	2019	2020
PLONOR	90 107 490	79 855 926	84 023 829	96 400 553	79 881 052
Inorganic LC50 or EC50 >1 mg/l	-	-	-	-	-
Ranking	14 231 555	14 720 476	14 929 452	15 114 331	14 609 021
List of Chemicals for Priority Action	0	0	0	0	0
Inorganic LC50 or EC50 <1 mg/l	74 639	62 551	70 258	71 085	326 667
Biodegradation < 20%	20 316	21 425	122 307	27 494	69 055
Substance meet two of three criteria	11 087	16 042	15 539	24 122	18 141

Table 7c: Chemicals spilled in kg per year

Pre-screening category	2016	2017	2018	2019	2020
PLONOR	230 887	633 551	743 642	20759	515 949
Inorganic LC50 or EC50 >1 mg/l	-	-	-		-
Ranking	112 954	46 410	52 823	17419	112 387
List of Chemicals for Priority Action	0	0	0	0	0
Inorganic LC50 or EC50 <1 mg/l	69	125	144		0
Biodegradation < 20%	1 398	1 277	1 106	949	2703
Substance meet two of three criteria	1 440	5 814	1 379	411	1529

Table 8: Norway total production in oil equilvalents (millions of tonnes)

2016	2017	2018	2019	2020
185	192	184	177	189

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