



OSPAR
COMMISSION

*Protecting and conserving the
North-East Atlantic and its resources*

Impacts of certain pressures of the offshore oil and gas industry on the marine environment – stocktaking report

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.

Impacts of certain pressures of the offshore oil and gas industry on the marine environment – stocktaking report

1.	Introduction	3
2.	Background information	3
	2.1 Possible releases of oil and chemicals from disturbance of cutting piles	3
	2.2 Impact of oil and chemicals from the offshore industry on the environment	4
	2.3 Impacts of noise from the offshore oil and gas industry on the marine environment	4
3.	Summary of the key findings	5
	3.1 Possible releases of oil and chemicals from disturbance of cutting piles	5
	3.2 Impact of oil and chemicals from the offshore industry on the environment	5
	3.3 Impacts of noise from the offshore oil and gas industry on the marine environment	6
4.	Gaps and recommendations	6
	4.1 Possible releases of oil and chemicals from disturbance of cutting piles	6
	4.2 Impact of oil and chemicals from the offshore industry on the environment	7
	4.3 Impacts of noise from the offshore oil and gas industry on the marine environment	7

1. Introduction

In order to assess progress against the objectives of the Offshore Industry Strategy, the OSPAR joint Assessment and Monitoring Programme 2014-2021 requires the preparation of a stocktaking report on impacts of certain pressures of the offshore oil and gas industry on the marine environment (JAMP product O-1). The report is based on draft assessments prepared for the Offshore Industry Committee (OIC) on the impacts of¹:

- possible releases of oil and chemicals from disturbance of cutting piles;
- oil and chemicals from the offshore industry on the marine environment, and;
- noise from the offshore oil and gas industry on the marine environment.

The following report consists of a short summary of the background, key findings and an identification of gaps and recommendations on each topic.

The stocktaking report is one of several steps in preparation for the overall assessment of impacts of the offshore oil and gas industry on the marine environment in 2020.

2. Background information

2.1 Possible releases of oil and chemicals from disturbance of cutting piles

OSPAR has raised concern about possible releases of oil and chemicals from disturbance of cutting piles, either from decommissioning activities or from bottom trawling after decommissioning. The 2009 assessment² concluded that disturbance of cuttings piles and the subsequent release of oil would not result in significant impacts on the marine environment and no further OSPAR measures should be developed, but it was noted that this agreement should be kept under review.

Only the UK and Norway have had activities in the near vicinity of cutting piles since 2009. Oil & Gas UK (O&G UK) has focused on current technological capability to map, core, sample and measure the leaching rate from cuttings piles. Norway has undertaken environmental monitoring during dredging activity in 2010, 2012 and 2014. The dredging of large amounts of materials in Norway has been necessary in relation to the removal of steel jackets, the installation of new pipelines and re-routing of existing pipelines, and subsea preparatory work to ensure the required geotechnical stability for the safe placement of spud cans.

Between 1 500 m³ and 4 000 m³ of material was relocated during the dredging operations at Ekofisk/Albueskjell (2010) and Valhall (2012, 2014) installations. In general, the seabed conditions in these areas are poor. This is mainly due to discharges of oil-based drilling muds during the period 1982-1991, and the contaminated cuttings are still present on the seabed. Methods used in the environmental monitoring included seabed sampling and chemical analyses before and after dredging. Submerged environmental monitoring rigs fitted with attached measuring instruments were also deployed.

¹ OIC documents: OIC 14/13/2, OIC 14/13/Info.1, OIC 15/10/2, OIC 15/10/6, OIC 16/08/02, OIC 16/08/03, OIC 16/08/04. These documents may be obtained by contacting the OSPAR Secretariat: secretariat@ospar.org.

² Assessment of impacts of offshore oil and gas activities in the North-East Atlantic. Publication number 453/2009.

2.2 Impact of oil and chemicals from the offshore industry on the environment

This impact assessment is based on available data relating to the monitoring of environmental concentrations and impacts of oil and offshore chemicals. The OSPAR Quality Status Report (QSR) 2010 reported on monitoring results from installations discharging produced water which showed that mussels accumulate polycyclic aromatic hydrocarbons (PAHs) from the surrounding seawater. Concentrations of PAHs decreased with increasing distance from the installations. Levels of biological responses in mussels showed similar gradients to those observed for contaminant concentrations. Results also indicated that the concentrations of PAHs and alkyl phenols and measured biological responses in wild fish caught in the vicinity of offshore installations in 2002 and 2005 showed a mixed pattern, with no significant evidence of increased concentrations, but with some elevated biological responses suggesting past exposure. Norway was also able to provide the results of water column monitoring (WCM).

2.3 Impacts of noise from the offshore oil and gas industry on the marine environment

There are a number of distinct phases of oil and gas operations, ranging from initial seismic exploration to drilling to production and then to decommissioning. The most significant underwater noise associated with each phase is dependent upon the nature and scale of the specific activities. Geophysical surveys associated with the exploration and management of hydrocarbon reserves are a source of anthropogenic noise. Drilling for hydrocarbons requires the use of mobile drilling units or drilling equipment installed on fixed platforms, and the position keeping propulsion mechanisms of some mobile drilling units are also a notable source of noise. Infrastructure installation activities involving underwater hammer piling, and the occasional use of explosives for well abandonment or the decommissioning of facilities are also a source of underwater noise.

Wide-ranging studies on noise impacts related to offshore oil and gas activities mainly covering seismic surveys, pipelay noise and piling have been reported by Contracting Parties. Details of these studies were presented at OIC 2015. A summary of impacts of marine mammals, fish and other species was also included in OIC 2016 draft report on Inventory of Measures and Techniques to Mitigate the Impact of Seismic Surveys.

Since 2006, the International Association of Oil & Gas Producers (IOGP) has coordinated a Joint Industry Programme (JIP) on Exploration and Production Sound and Marine Life³. The JIP has brought together 14 leading, global oil and gas companies who, by the time the current third phase of activity draws to a close in 2017, will have commissioned research investigations and reviews on this topic amounting to expenditure of in excess of \$50 million. Groups in North America, Europe and Australasia have commissioned research activities. The JIP has also benefited from co-funding by some US regulatory agencies notably the Bureau for Ocean Energy and Management (BOEM). The programme focuses its activities in five key areas (the number of individual projects commissioned under each heading for the first two research phases is shown in parentheses):

1. Sound source characterisation & propagation (16 projects)
2. Physical, physiological and hearing effects (14 projects)
3. Behavioural responses and Biological significance (39 projects)
4. Mitigation and monitoring (19 projects)
5. Technology development (4 projects).

³ <http://www.soundandmarinelife.org/>

3. Summary of the key findings

3.1 Possible releases of oil and chemicals from disturbance of cutting piles

The report delivered by the UK at OIC 2014 stated that in light of currently available information the conclusion of the 2009 review was still valid, i.e. that disturbance of cuttings piles was unlikely to result in releases of oil that would lead to increased impacts on the marine environment.

A spatial and temporal assessment of North Sea benthos using the UK data has found that the spatial extent of the impact footprint is greatest within the first one to two years after drilling, but with time the spatial extent of the footprint is reduced and in some cases reduces to ~50 m. The environmental reduction in the extent of the impacts and the signs of recovery within the benthic dataset were detectable. The capacity for recovery was notable, supporting the management option of leaving cuttings piles *in-situ*.

The contaminant content of the top (approximately 10 cm) layer of a cuttings pile is often relatively low, having leached into the water column over time. This suggests that the release of contaminants into the water column by over-trawling of cuttings pile is unlikely to be significant. The amount of sediment disturbed depends primarily on fishing gear and rigging type, hydrodynamic conditions and sediment type. Results suggest that scallop dredging gear has the greatest potential for sediment disturbance; the majority of historic cuttings piles are not in scallop dredging areas.

Environmental monitoring conducted during and after the dredging activity in Norway from 2010 to 2014 indicates that dredging contaminated drill cuttings can influence the water and sediment quality near the site. There is also expected to be some dispersion of finer particles that could settle further away from the site (at least 1 km away).

The monitoring data shows that the disposal and settlement of cuttings did not significantly change the conditions on the seabed since they were already poor. However, based on visual and chemical analyses the benthic environment was slightly impacted. The concentration of hydrocarbons in the water during the dredging was particularly high for some oil-derived compounds. This may have temporarily negatively influenced the local organisms. The contamination of the water column was expected to be reduced soon after the dredging stopped, and comparable to the situation prior to the dredging. The water currents will transport and dilute the contaminants, which are mainly bound to particles that will re-settle, and the local seabed is expected to recover to the condition prior to the dredging within a few years.

3.2 Impact of oil and chemicals from the offshore industry on the environment

Data from Norwegian water column monitoring in 2012 and 2013 shows similar findings to those presented in the QSR 2010.

Significantly higher concentrations of PAH and NPD (naphthalene, phenanthrene and dibenzothiophene) were found in caged mussels located 500 m from an offshore installation in the 2012 survey. Histopathological analyses of mussels' digestive gland also indicated a minor stress condition in caged mussels located 500 m and 1000 m from the platform.

In 2013, the monitoring investigated the potential biological effects on local fish species. By targeting demersal fish the impact of produced water was expected to be less marked, whilst impacts from drill cuttings and other sediment sources on the benthos and sedentary species were likely to be greater. However, significant increases in DNA adducts, COMET tails and histological effects, and a decrease in acetylcholine esterase inhibition were observed in fish collected from around the platforms when compared to the reference location.

In general, results from monitoring of the water column have shown some effects, such as higher concentration of PAH and NPD and some biological responses in caged organisms near the platforms. Increased levels of PAHs, alkyl phenols and measured biological responses also suggest effects in wild fish caught elsewhere in the North Sea.

In 2012, the Norwegian Research Council published the report “Long term effects of discharges to the sea from petroleum related activities - Results of ten years of research”⁴. The report stated that although production chemicals may contribute significantly to the theoretical impact when modelling the environmental risk of operational discharges, the compounds have not received particular focus in the Norwegian monitoring programmes. This emphasizes that there should be an increased focus on parameters that could detect such impacts for future water column monitoring.

Monitoring data are limited and did not allow conclusions to be drawn on the significance of the observed biological responses for marine life and ecosystems. Through the introduction of the Risk Based Approach (RBA) (OSPAR Recommendation 2012/5) the environmental risk of discharges of produced water will be calculated for all relevant installations in the OSPAR area by 2018 at the latest. The purpose of the RBA recommendation is to assess the environmental risk (*e.g.* expressed as PEC/PNEC) posed by discharges of oil and other substances discharged with the produced water, with the aim of finding appropriate measures to reduce the risk to acceptable levels. Risk assessment at a substance level may also help identify substances for further investigations of possible biological impacts on marine biota. The risk assessment step will not provide information on the actual impacts on marine biota, but the recommendation includes the potential for environmental monitoring in order to detect changes in the receiving environment and to verify the impact hypothesis. More data relevant to describe possible impacts might therefore be available in the years to come.

3.3 Impacts of noise from the offshore oil and gas industry on the marine environment

There are difficulties associated with quantifying the occurrence, scale and extent of the potential impacts of underwater noise, as there is great variability in the characterization of the sound relating to the noise-generating activities, the propagation of the sound and the sensitivity of different species to the measured and estimated levels of sound. Data on all these aspects are generally limited. The relatively intense concentrations of anthropogenic activities in some parts of the OSPAR area, especially in Regions II and III, and the probability that the level of these activities will increase, makes it important to improve understanding of the potential effects of the most significant sources of underwater noise - seismic surveys, pile driving and the use of explosives.

4. Gaps and recommendations

4.1 Possible releases of oil and chemicals from disturbance of cutting piles

The 2009 OSPAR assessment of impacts of offshore oil and gas activities in the North-East Atlantic concluded that disturbance of cuttings piles does not result in significant impacts on the marine environment. New data supports that conclusion, as no significant effects on the seabed have been observed, although there may be a temporary effect on the water and sediment quality near the site of disturbance. Contamination of the water column is expected to be limited to during and immediately following the disturbance and the local seabed is expected to return to its prior status within a few years.

Prior to any activity likely to result in significant disturbance of a cuttings pile, it is important to assess the nature of the disturbance resulting from the proposed activity (*e.g.* different dredging techniques), the amount of material that will be disturbed, and the degree of contamination. In addition, the timing of the operation with regard to vulnerable marine organisms may be an important factor that will determine if an operation can be conducted without environmental impacts.

⁴ Research Council of Norway, 2012: Long Term effects of discharges to the sea from petroleum related activities – The results of ten years research.

4.2 Impact of oil and chemicals from the offshore industry on the environment

There are still knowledge gaps on potential impacts on the marine environment relating to discharges of oil and chemicals from the offshore industry. Existing monitoring data does not allow to confirm whether or not the observed biological responses are of significance for marine life and ecosystems. There is still a lack of knowledge on the effects of different chemicals and compounds in produced water. Ongoing RBA calculations could potentially generate data that will allow us to target further research and monitoring for a better understanding of possible effects.

4.3 Impacts of noise from the offshore oil and gas industry on the marine environment

In order to enable a better definition of sensitive areas and seasonal restrictions, further studies on the abundance and distribution of marine mammals would be useful for areas where there are significant knowledge gaps. There is also the need for improved understanding of noise impacts, as there is uncertainty about the thresholds for physiological effects that could result in avoidance behaviour or physical injury. Guidelines to prevent or minimise the impact of noise on marine mammals currently vary from region to region and there is international recognition of the need for more consistent, evidence-based, guidance.



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**OSPAR's vision is of a clean, healthy and biologically diverse
North-East Atlantic used sustainably**

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