OSPAR COMMISSION

Assessment of the impact on the marine environment of offshore oil and gas activity - an overview of monitoring results in the United Kingdom, the Netherlands and Norway

Offshore Industry Series

2007

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. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

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. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, 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 et la Suisse et approuvée par la Communauté européenne et l'Espagne.

Assessment of the impact on the marine environment of offshore oil and gas activity – an overview of monitoring results in the United Kingdom, the Netherlands and Norway

Background

The OSPAR Joint Assessment Monitoring Programme requires by 2007 the preparation of an assessment of the impact on the marine environment from offshore oil and gas activities (JAMP Product OA-1). The purpose is to assess progress against the objective of the offshore strategy and to contribute to the overall assessments of the impacts of offshore oil and gas activities in the North-East Atlantic and to the Quality Status Report 2010.

The assessment should consider the impact and, if possible, trends of concentrations in the marine environment for selected chemical and biological parameters as a result of discharges and losses from offshore installations. In 2006 the Offshore Industry Committee agreed on a pragmatic approach to this task which involved the collection and assessment of available information in OSPAR Contracting Parties.

Contracting Parties were asked to provide an assessment of available monitoring data. By 15 February 2007 reports were received from the United Kingdom, the Netherlands and Norway. No information has been received from the other Contracting Parties.

Monitoring activities

Monitoring activities have been performed in all three countries to look at effects of discharges in the sediments and in the water column. Effects on migrating birds of flaring and light from offshore installations has been monitored at the Dutch Continental Shelf and studies on the effects of seismic activity on fish and marine mammals have been performed on the Norwegian Continental Shelf. An overview of the performed monitoring activities in the United Kingdom, the Netherlands and Norway are given in Annex 1. The reports from the three countries are available in the OSPAR Secretariat.

Monitoring results

Monitoring of sediments contaminated by discharges of oil-based muds (OBM) has shown that the benthic communities close to the discharge points have been highly modified, and with a transitional zone with detectable effects on benthic fauna and an outer zone with no detectable effects on the fauna. This is shown in all three countries. The areas contaminated with OBM are decreasing and so are the benthic effects. The Dutch study found biological effects out to 250 meters from the discharge point 20 years after the discharge. The latest data from Norway show a total contaminated area of 155 km^2 on the Norwegian Continental Shelf. This is chemical contamination and not biological disturbance and the area also includes sites where OBM has never been operationally discharged. Hydrocarbon contamination at these sites may be caused by produced water or accidental spills.

The Dutch study on effects of discharge of water-based muds (WBM) cuttings showed no detectable effect on the benthic community. Norwegian monitoring and one-off surveys have shown a disturbance of the fauna typically out to approximately 50 meters from single wells. The disturbance is most likely caused by the physical impact of the cuttings, and species living in or on the sediment dies. However, a rapid colonization is observed, but the composition of species may change if the grain size is changed. In areas with several production wells the area affected is larger and effects may be caused by other discharges than WBM and cuttings.

Results from Norwegian water column monitoring in the last few years show positive results in the sense that the methods used are now functioning. It is crucial to know enough about how the plume of produced water is mowing to be able to place the cages with test species at the right spots. The results show that caged mussels in the effluent accumulate PAH and that the levels decrease with increasing distance from the discharge. The levels of PAH's in the mussels are

however very low. The biological effects (biomarkers) also show gradients with stronger responses in the cages closest to the produced water discharge. The levels of PAH-metabolites suggest a moderate exposure level. The Dutch study showed an accumulation of naphthalene in blue mussel in a distance of 1000 meters from the platform. The analyses of wild fish in the Norwegian Tampen area have shown increased levels of DNA-adducts in haddocks. A different lipid content or lipid composition of the cell membranes has been shown in cod and haddock from the Tampen area compared to other areas in the North Sea. These effects may be due to the fish feeding on old cuttings piles, and are not necessarily a result of today's produced water discharges. It is, however, not concluded what these findings mean for the individual fish, the populations or the ecosystems as such.

Other monitoring activities or studies than the monitoring of impacts of discharged have also been performed by the three countries. The Dutch study on birds suggests that the chance that flaring directly impacts a flock of birds is small and only significant at night during the migration periods. Sound did not appear to have any affect on seabirds or songbirds during migration. But the study calculates that about 10 % of the total bird population crossing the North Sea is impacted in some way by the light emitted from the main deck at offshore installations. The Norwegian study on impacts of seismic surveys on fish showed that impacts (including mortality) on fish and their early life stages only occurred immediately adjacent (< 5 metres) to the sound source. This impact was not significant at the population level and did not affect recruitment into commercial stocks. Fish show a startle response to impulsive sound and the effect may be observed up to 30 km from the source. There is no documented impact on marine mammals from seismic exploration activities other than a behavioural response, where animals moved away from the sound source.

Conclusions

The sediment monitoring in all three countries shows that there are still areas at the seabed affected by earlier discharges of OBM. There is both a chemical contamination and to a lesser extent biological disturbance in these areas. However, the area of contamination and biological disturbance is decreasing. There may be some divergences between the Dutch and the Norwegian conclusion on the effect of discharges of WBM and cuttings. The Dutch study on a single well concluded that there where no adverse effects on the benthic community. The Norwegian monitoring and single studies show significant disturbance of the benthic fauna at the sites, but in short distances from the discharge points. The effects are most likely to be caused by the particles and burial of the individuals, and the sites are rapidly recovered.

Results from water column monitoring show that mussels and fish are exposed to hydrocarbons from produced water and that the levels are decreasing with increasing distance to the discharge points. Biomarkers also show the same gradient from the discharge point, but it is still uncertain how the specific biomarkers affect the individual fish, the populations or the ecosystems. Research work is needed to find a better link between biomarkers and ecological risk.

There are significant effects on migrating birds on the Dutch Continental Shelf of the flaring at night and/or the light emitted at the main decks of platforms.

Impacts of seismic exploration on fish are localised in the immediate vicinity of the sound source. There are no data that indicate serious long term effects on fish or marine mammals.

Annex 1

Overview of monitoring by OSPAR Contracting Parties

Sediment monitoring

UK	The Netherlands	Norway
• Single well resurvey of three wells drilled in the eighties with WBM, low tox OBM and diesel OBM, grab sampling with analyses for grain size, hydrocarbons, metals and fauna (2004) • Survey of several producing North Sea fields with good time series of data, grab sampling with analyses for grain size, hydrocarbons, metals and fauna (2005/2006) • Survey of North Sea fields with intermediate sized drill cuttings piles (2006) • Fladen Ground survey, regional survey to complement hydrocarbon data with grain size, metals, dioxins, radionuclides and fauna (2005) • DTI SEA programme surveys, for grain size, hydrocarbons, metals and fauna, all of UKCS (1999→?)	• Effects of WBM cuttings discharge, benthic sampling 2 months and 1 year after dumping of drill cuttings (1991) • Recovery of OBM cuttings discharge sites, oil concentrations and fauna analyses (4 sites in 2005)	• Regional monitoring every three years in each region, grain size, chemistry and fauna • OBM cuttings pile at Ekofisk every three years, distribution, chemistry and leakage • WBM cuttings piles after exploration drilling in the Barents Sea for several wells (2004-2006 • The MAREANO programme surveys, seabed geophysical mapping, photography and sampling (2006→)

Water column monitoring

UK	The Netherlands	Norway
-	• Effects of produced water discharge on blue mussel at a gas production platform, field validation of default values as applied in CHARM (1998) • Effects of drilling fluid discharge from a test drilling on the behaviour of caged mussels 46 meters from the discharge point (Mosselmonitor®) (2000)	• Effect monitoring every year in selected regions. Blue mussel and cod in cages placed in the produced water effluent from different fields • Condition monitoring on every third year with sampling of wild fish both in a contaminated and not contaminated area

Other monitoring activities

UK	The Netherlands	Norway
-	• Impact of flaring, noise and light on migrating birds (2003) • Effects of different colours of light on migrating birds (2005)	• Mapping of seabirds (the SEAPOP programme) and mapping of sea mammals, not looking specifically for effects from the petroleum industry • Effects of seismic activity on fish, fish catch and sea mammals

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

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