English summary

DCE has developed a proposal for a drilling mud and chemical use and discharge strategy in connection with oil exploration activities in Greenland.

The strategy, when approved by Greenlandic authorities, will provide basis for development of guidelines for regulating drilling mud selection, use, discharge and removal / disposal.

This memorandum will treat following subjects:

1) Drilling mud (and the drilling mud chemicals)
2) Regulation according to the OSPAR convention and on the Norwegian and Danish shelves
3) Environmental assessment of drilling mud chemicals, including the OSPAR system in relation to protection of arctic environment and organisms
4) Technologies for treatment and disposal of drilling cuttings and mud
5) Recommendations and identification of knowledge gaps.

It is mainly based on experience and information gathered from:

- Norway (Klima og Forurensningsdirektoratet (KLIF), Oljedirektoratet og Miljøverndirektoratet);
- Denmark – North Sea (Miljøstyrelsen og Energistyrelsen);
- The documents of the OSPAR convention.

Furthermore, technical data and information is obtained, through meetings and other dialogue from Danish and Norwegian authorities as well as operators and industries which presently are important participants in the offshore industry.

Selection of drilling mud may be critical for the drilling efficiency as well as it may be critical with respect to environmental impacts due to the following processing and / or discharge of waste drilling mud (and cuttings).

Water based drilling mud systems can be of the least environmental impact and may be discharged to sea after accomplishment of drilling. Discharge or spill of oil based drilling mud may result in significant environmental impacts, thus according to regulative of Norway and Denmark, this drilling mud type must be collected for treatment and disposal / re-cycling in land. Use of oil based drilling mud may result in a more efficient drilling operation and reduce the consumption of drilling mud compared to water based drilling mud.

The present regulation regarding environment protection in connection with oil exploration activities in Greenland is to a wide extent based on the Norwegian legislation especially for the Barents Sea, and DCE has exchanged knowledge with the Norwegian authorities, KLIF. The Greenlandic authorities has also included the decisions, recommendations and agreements of the OSPAR convention for protection of the marine environment in the North-East Atlantic for the regulation of oil exploration activities off the west coast of Greenland, although this area is not part of the North-East Atlantic. In the OSPAR system the offshore chemicals are screened for toxicity, biodegradability, and bio-accumulative properties. The chemicals are usually environ-

mentally assessed on data from standard tests on organisms and under laboratory conditions which may not always imitate arctic conditions. This may result in uncertainties regarding the knowledge base for the assessments and it is assessed that these uncertainties could be reduced by development and introduction of tests targeting arctic conditions.

The oil exploration drilling campaigns in 2010 and 2011 in Greenland used water based drilling mud. Due to relatively unknown geology, the drilling mud system applied for needed to contain a chemical that, in accordance with the Norwegian and Danish colour coding of offshore chemcials, was categorised as red. According to OSPAR, chemicals in the red category should be substituted with more environmental friendly solutions to reduce the discharged amounts of chemicals categorized as red to the sea. DCE has recommended, and it has been adapted by the Greenland authorities, to follow the OSPAR recommendations of substitution and thus reducing discharge of these chemicals. To meet this objective, chemicals categorized as red must be substituted with more environmental friendly alternatives or oil based drilling mud can be introduced, which is not allowed discharged. This strategy follows the trend in Norway and Denmark. It is thus recommended to introduce the option of using oil based drilling mud in Greenland under condition of a no discharges of drilling mud / cuttings to the marine environment policy. The requirements to HSE and technical solutions must be of such high standards that prevent accidental spills during drilling or transhipping effectively. The oil based drilling mud waste (and the produced cuttings) should be transported to land-based treatment facilities for treatment, disposal / re-cycling. At present no such facilities are established in Greenland, thus the oil based drilling mud waste will need to be transported to and received in a country other than Greenland. It is assessed, though, that treatment facilities can be established in Greenland forward looking.

Furthermore, as part of the future strategy for selection and approval of drilling mud system / chemicals in connection with oil exploration drilling applications for Greenland, it is proposed that an analysis on environmental pros and cons of several relevant drilling mud systems is required as part of the Environmental Impact Assessment (EIA). Introducing this requirement will ensure that the drilling mud system selected, which is within the frames of the regulation already implemented for Greenland, also in an overall environmental context will impact the Greenlandic marine environment the least. This analysis is to be considered as a supplement to the overarching principle of using Best Environmental Practice (BEP) and Best Available Techniques (BAT).

Recommendations

The memorandum is summarised in following recommendations:

1. It is recommended that regulation of offshore oil / gas activities in Greenland continues to follow the guidelines of the OSPAR convention, including the established regulation and strategy for offshore chemicals
2. It is recommended that Greenland participate actively in OSPAR Offshore Industry Committee (OIC) and contributes to development and accomplishment of strategic goals within offshore oil / gas activities in the Arctic

3. It is recommended to continue the focus on impurities in drilling mud minerals and chemicals and bring this issue to focus with regard to admittance of offshore chemicals to OSPAR PLONOR list. The content of Mercury in barite is an example of unwanted impurities in a PLONOR listed mineral. Release of Mercury to the marine ecosystem is an issue of high concern in the Arctic
4. It is recommended that off shore chemicals continues to be classified and categorised according to the guidelines implemented in Norway and Denmark, including that all chemicals and products are registered in PROBAS
5. It is recommended to implement more severe requirements for data information with respect to critical chemicals, which comprises the supplementary requirements implemented in Norway for chemicals with moderate biodegradability (20 % ≤ BOD28 < 60 %). The supplementary requirements include a detailed assessment of the chemicals' degradability products and the risk to the environment of these derivatives
6. It is recommended to continue the regularly information update on regulation of oil / gas activities in the Barents Sea, including administration of sea discharge regulations as well as Norway's requirements regarding data information and environmental assessment for offshore chemicals for use in the northern part of the Barents Sea
7. It is recommended to keep and possibly amend the knowledge exchange between the authorities of Greenland and Norway / Denmark, i.e., by annual meetings
8. It is recommended to implement more rigorous requirements to data information on potential critical chemicals, which are under consideration for discharge in high arctic seas, including requirement for test data on biodegradability, toxicity and bioaccumulation with arctic organisms and under arctic conditions
9. It is recommended to include supplementary lists for potential environmental harmful substances, i.e., the European Commission list for candidates of endocrine disrupters substance in Category 1 og 2) in assessments of potential impacts of these substances on arctic marine mammals and contamination of human food sources
10. It is recommended that, prior to selection and approval of drilling mud system / chemicals in connection with oil exploration drilling applications for Greenland, an analysis on environmental pros and cons of several relevant drilling mud systems is presented which included treatment technologies for drilling waste as part of the Environmental Impact Assessment (EIA) to ensure that the drilling mud system selected in an overall environmental context will impact the Greenlandic marine environment the least. If the analysis results points toward selecting an oil based drilling mud system, DCE recommends
    a. that no drilling mud or cuttings are discharged to sea and that the risk of spills are minimised through HSE requirements
    b. to raise requirements for self-control and inspections.

Knowledge gaps

Biodegradability at arctic conditions – low temperatures and arctic bacteria strains

In general, there is a need for knowledge focused on offshore chemical degradation at arctic conditions, e.g., if critical chemicals, which are easily degradable in standard test, are moderate to slowly degradable under arctic test conditions.

Toxic effects of offshore chemicals on arctic organisms and arctic ecosystems

Presently, the knowledge concerning toxicity of offshore chemicals specifically on arctic organisms is limited. Arctic organisms are often characterised by slow growth and development. The exposure risk for the sensitive larvae stages is hence increased. In studies comparing sensitivity / tolerance of temperate and arctic species this issue of slower growth of arctic organisms is usually not included, and that effects may become apparent later than in temperate species. To reduce the uncertainty regarding different effects in arctic and temperate organisms, studies targeting this issue are needed.