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Introducing a Risk Based Dynamic Oil Spill Response Regime for the Norwegian Continental Shelf. Response from Operators, Authorities and other Stakeholders

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Abstract

By July 1st, 2001, the Norwegian Clean Seas Association for Operating Companies (NOFO) completed a three-year R & D programme for development of a dynamic, risk based oil spill response regime for the entire Norwegian continental shelf, including coastal areas and the shoreline.

The results from this programme are made available for operators, authorities, other stakeholders and the general public through the NOFO web site <http://www.nofo.no>. This web includes operational plans, documentation of methodology and analyses, as well as intuitive interfaces to databases, oil spill sensitivity maps and GIS tools.

Significant effort has been made to train the personnel included in the oil spill response organisation. In this process, industry, authorities and local community personnel have been involved.

The content of the web serves as reference and documentation for authority audits of fields and installations.

An important area of use is for cost effective analysis and evaluation of oil spill response requirements for new developments and exploration drilling, as basis for consent applications.

Comments and suggestions from audits and consent applications have been actively collected and organised through the first six months of operation of this new regime.

Additionally, the response from industry users, stakeholders and the general public to this form of open and transparent information sharing has been invited and reviewed.

This paper presents our experiences from these processes, along with our objectives for further development.

Introduction

Norway is among the world's main producers of oil and gas. In 1999, 168 600 000 Sm³ of oil and 48 257 000 000 Sm³ of natural gas were produced¹. In year 2000, Norwegian production was 3,3 million barrels per day, which is app. 4,3 % of the global oil production².

The major part of the Norwegian Continental Shelf should be considered as being in a mature stage of development. Key figures include:

- 1056 Exploration wells
- 1533 Development wells
- 79 Sub sea installations
- 37 Production platforms
- 3 Production ships
- 5 Loading buoys
- 7 877 km oil and gas pipelines

In year 2001, a total of 47 fields were in production on the shelf, and 30 exploration wells and 129 development wells were started in 1998.

The Norwegian coastal and shelf areas are also rich in other natural resources. Historically, fisheries has been, and is, one of the most important industries in Norway. The development of aquaculture of Atlantic salmon during the last ten years has placed Norway among the worlds leading suppliers of fish and shellfish. Norwegian marine areas contain important ecological resources on a national as well as an international scale³. The management and protection of these resources has been and still is a major concern for Norwegian authorities as well as the operators on the Norwegian shelf.

From the above, it is evident that oil spill contingency and emergency response planning are important issues. In 1998,

The Norwegian Oil Industry Association (OLF) assumed the responsibility to plan, coordinate and command operations also in near shore and onshore oil spill combat and cleanup operations. OLF commissioned the implementation to NOFO.

The development and implementation of this regime, as well as the associated tools, were described in the proceedings from the SPE International Conference on Health, Safety, and the Environment in Oil and Gas Exploration and Production held in Stavanger, Norway, 26–28 June 2000⁴. A brief summary of the main aspects are given to facilitate readability and understanding.

The topic of the present paper is the experiences drawn from using the results from the implementation phase of the work. These are presented for the individual issues a) the emergency response level, b) the Oil Spill Contingency Planning and Response System (OSCPS), c) the organization and technical resources. Additional issues are presented in separate subsections, and the overall conclusions and ways forward presented in separate sections.

Objectives

The main objective of the project was to establish a cost-effective, flexible and documented system allowing Norwegian operators to analyze, evaluate and implement measures at sea, in coastal waters and at the shore. Further objectives for the project include that the:

- regime or response level should be dynamic, reflecting changes in activities, sensitive environmental resources and the resulting risk levels.
- standards developed should facilitate compatibility and comparability of site specific studies, irrespective of choice of consultants.
- data sets compiled should be available for and used by NOFO members in their analyses and planning.
- open availability and transparency of the analytical approach and underlying assumptions should increase the understanding of oil spill and emergency response issues.

Results

The development and implementation project was completed according to plan. By July 1st, 2001, NOFO had completed the oil spill contingency analyses and established an emergency response level for the entire Norwegian continental shelf. This level was detailed in a series of regional plans, specifying resources, mobilization points and response plans etc.

Emergency response level

The establishment of a risk based response level was based on a series of tasks, including:

- Compiling a dataset on the activity levels and number of operations on all installations and field on the shelf.
- Establishing a national data sets on blowout frequencies and durations⁵.

- Compiling weathering characteristics for all Norwegian crude oils⁶.
- Undertaking oil drift simulations for 11 major field centers on the shelf⁷.
- Developing a GIS interface to national atlases on areas of particular environmental sensitivity^{8,9}.
- Developing and implementing national classifications of sites of high environmental priority¹⁰.
- Establishing an industry standard methodology of oil spill contingency analysis.
- Performing regional oil spill contingency analysis
- Establishing regional oil spill response plans.
- Signing agreements with resource providers to ensure that the requirements of the oil spill response plans were satisfied.
- Preparing a program for verification of the new regime, and training of all partners of the overall organization.

Oil Spill Contingency Planning System (OSCPS)

The NOFO OSCPS is an Internet portal to issues on oil spill contingency planning and emergency preparedness on the Norwegian Continental Shelf, providing immediate access to:

- Documentation of the emergency preparedness level established for the offshore oil and gas production on the Norwegian Continental Shelf, in a series of regional plans
- An operative plan, to enter into effect in the case of an accidental event on the shelf
- Documentation of the basis for establishing the risk based emergency preparedness level
- Databases, datasets and information relevant for environmental and oil spill contingency evaluations
- Industry standards for analysis and reporting
- Archives of analysis and oil drift simulations
- Web and GIS tools for oil spill contingency analyses, training and operations

The overall structure of the OSCPS Web is outlined in **Fig. 1**, and the individual tools are shown in **Fig. 2**.

The OSCPS is available at <http://planverk.nof.no>. The language of the system is Norwegian, but a brief English outline of the system with links to technical papers are available at <http://planverk.nof.no/welcome.htm>.

Organization and resources

In the case of oil spills from offshore installations, the operator has the responsibility for oil spill combat, cleanup and restoration, using NOFO to implement all practical measures.

In order to provide the operators with the required resources, NOFO has developed a network including national, regional, local as well as international resources (**Fig. 3**).

The core of the combat organization is NOFO personnel (**Fig. 4**), NOFO's heavy offshore equipment and a "fire brigade" of dedicated personnel from the operating companies (**Fig. 5**).

Access to resources and personnel for oil spill combat in near shore waters and along the shoreline are secured by

agreements with the Norwegian Pollution Control Authority and with oil spill combat groups maintained by the municipalities along the coast.

Agreements have been made with contractors for aerial monitoring, and with research institutes for chemical and biological monitoring of the fate and effects of a potential oil spill.

The total resource base includes dedicated oil spill combat vessels (19 offshore, > 100 near shore), high capacity skimmers (30), booms (app. 100 km), helicopter based chemical dispersion, cleanup groups and trained personnel (several hundred).

Overall response

The overall response to the new regime and publication of the OSCPS has been positive.

Norwegian operators have changed the oil spill contingency plans for the individual installations, linking these to the regional plans documented in the OSCPS. Further, the operators have adopted and applied the analytical methodology for a series of site specific analyses of exploration activity.

Norwegian authorities are actively using the OSCPS in their control and verification process of the operations on the shelf. The authorities have also expressed that it is positive that site specific evaluations and analyses are based on the same set of "agreed facts" and assumptions that was established through the development project.

Intermunicipal oil spill combat groups along the Norwegian coast are using the OSCPS as a convenient resource in accessing relevant information. The predefined web based maps of priority resources and sites are useful for NOF members and partners of the organization.

There has been no direct responses from other NGOs. However, it seems from hearing comments to consent applications that the "agreed facts" of the OSCPS are no longer a significant issue.

As of early November 2001, the new regime has been in effect for some four months, and the extent of responses necessarily limited. Significant responses obtained during the first quarter of 2002 will be presented at the conference in March.

Experiences

Emergency response level

In establishing the emergency response level, a documented analytical approach was followed. This approach may be distinguished in a) the analytical method, specifying relations between releases, oil types, oil drift, metocean and presence and vulnerability of resources, and b) definition of the term "reasonable relation to the probability and consequence" which is given in Norwegian Law. On the latter issue, the response level includes 80 % of all potential incidents and 80 % of all potential outcomes in terms of oil drift.

From this basis, the most conservative events in terms of distance to shore and oil types were selected as a basis for the establishing the response level.

As a result, the response level is sufficient for all fields on the shelf, as well as the majority of the exploration and appraisal wells. This significantly simplifies the oil spill contingency analysis and planning for these activities.

OSCPS

The Oil Spill Contingency Planning System has proved an important and useful result of the project. As it is available on the Internet, it provides a common reference for documents and discussions, significantly reducing the paper volume of documentation and reports.

The standards that were developed has been applied by the operators and included in the scope of work for new studies.

As NOFO maintains an archive of all oil drift simulations and weathering studies of oil types, the knowledge base is rapidly increasing and is used by the operators in planning their activities.

As the data inventories are available in extenso on the web, an unprecedented overview of resources (oil spill combat and environmental), environmental data and oil drift simulations has been achieved, for all interested parties.

Providing this overview has also highlighted the priorities to be applied in oil spill combat operations, and this is an issue where there are clearly conflicts of interest. The OSCPS follow the national guidelines, and these do not necessarily coincide with local priorities. An example are whether bird cliffs or fish farms should be given priority for combat and protection.

Another experience is the applicability of GIS in analysis as well as training. The suite of GIS tools has been extended, to also include an interface to the operational oil drift model used by authorities as well as operators.

While the majority of the information in the OSCPS will available in a digital format only, the operational plan and the regional plans are also needed in paper format, for distribution to all involved parties, including vessels. For these parts of the OSCPS, downloadable files in a printable format are available.

Organization and resources

Organization

That the new organization, including a large number of parties, at a national as well as a local level, actually works, has been a very positive experience. Important factors in this context are to have clearly defined roles and responsibilities.

The organization includes a cost effective use of the total resources available for oil spill combat in Norway, whether private, national or local. As one organization now includes planning and implementation of combat from offshore through near shore and coastal waters, and eventually to the shoreline, it is argued that the total response capability has been improved.

Training and exercises

NOFO has established an ambitious plan for training and exercise (**Fig. 6**). In addition to training of NOFO personnel and resources, several joint exercises each year with all members of the organization are given high priority.

Two large scale joint exercises have been undertaken during summer and early autumn, involving app. 500 personnel and significant technical resources. The feedback from these exercises has been unexpectedly positive, especially in terms of building a network of relations between the persons and parties involved. The term “new team spirit” in the emergency preparedness field has been frequently used.

Resources

There has been no investments in new technical equipment and resources. The rationale for this is that development of the human resources part of the organization is considered the main factor in improving the oil spill combat capability.

Experience from the project has provided important input to defining criteria for further development of the “next generation” combat equipment.

Alternatives

There are several alternatives to the approach chosen in this project. For the main aspects of the project results, some alternatives are outlined below.

Emergency response level

Given that the system is dynamic, one alternative approach would be to “tune” the response level closer the “risk level”, by choosing less conservative oil types and locations.

The consequence of this alternative would be a significant increase in the maintenance costs of the regime, in that information on activities, oil types, oil drift and environmental sensitivity would need to be updated on a frequent or semi-continuous basis.

With regards to methodology and standards, an alternative could be to exclude these issues in the project. The result of this would have been an ongoing discussion between operators, authorities and stakeholders on the issues which are now “agreed facts”. In addition, there would still have been difficult or impossible to compare results from different field and installations.

OSCPS

The project was implemented such that data applied in the analysis was systemized and compiled in data inventories and data bases.

An alternative to this would be that this process would need to be repeated from “scratch” at the next revision of the response level. In addition, this process would also be carried out for the individual site specific analyses undertaken by the operators.

With regards to documentation and distribution, an alternative would have been to publish the regional plans and standard report on paper, keeping documentation and assumptions as “in-house” information. This alternative would

require more efforts in ensuring distribution and availability when updating the response level. Also, the analytical approach and underlying assumptions would not be generally available.

Organization and resources

Given the responsibilities placed on the operators to plan, coordinate and implement oil spill combat operations also in near shore waters and the shoreline, an alternative to entering into agreements with resources owner would be for NOFO to invest in the required resources.

This alternative would involve significantly increasing NOFO staff, as well as significant investments in new equipment. As a rough estimate, annual operating costs would increase by a factor 10. In addition, the investment in equipment is estimated to US\$ 10 million.

Another aspect of such an alternative is that the result would be duplicate oil spill combat organizations, which is not an effective use of resources in a larger context.

Economy

The chosen approach is considered to be a cost effective solution. However, the total costs for emergency preparedness are more clearly visualized now than was the case previously.

Earlier, such costs were elements in each drilling project for all individual operators, and thus not immediately easy to identify and summarize. This has been, and is, an important issue to communicate to the involved parties.

When looking at the total oil spill combat capability for the Norwegian shelf, for events under the responsibility of operators as well as authorities, there has in reality been a shift in the location of costs. Of these total costs, the offshore operators part has been increased by app. US\$ 1 million.

Reaching the objectives?

The project has reached all the main objectives. There is a consensus with regards to the emergency response level. The principles applied in the process are also in line with the new set of Regulations on the Norwegian Shelf, entering into effect in mid 2002.

In addition, it seems that the results from the project also has unanticipated areas of use, thus providing “added value”. An example of this is that data compiled in the OSCPS now form the basis for regional environmental impact assessments, and that local oil spill combat groups use the system for the purpose of general pollution combat, where the pollution originates from other sources than offshore oil installations.

Conclusions

The responses to the results of the development work has in general been positive, from all involved parties. NOFO has achieved

- Integration of the resources and organizations involved in oil spill response in Norway. This includes private and governmental resources, on national, regional and local levels.

- Increased networking and relation building between the parties involved.
- Increased awareness of oil spill response within the industry.
- Increased number of joint training courses, tabletops and field exercises, improving the Norwegian oil spill response capability.

The principles of transparency and availability have provided good responses.

Using Internet as a basis is an effective platform for updating and disseminating information, but there still is a need for paper copies of selected parts.

Although the approach is cost effective, costs are now clearly visualized, and cost-effectiveness needs to be actively communicated to the parties involved.

The way forward

At the start of 2002, all operators and relevant authorities will have a CD version of the OSCPS and the GIS tools. These are also publicly available on the Internet. Main issues in the further development and maintenance are to:

- Update the emergency response level at prescribed intervals.
- Evaluate and implement the new regulations from the Norwegian authorities.
- Further develop the data and reporting standards, including also other aspects than oil drift simulations.
- Develop networking within the organization through training and exercises.
- Define criteria for the next generation combat equipment, with emphasis on mobility, versatility and robustness.

There is also an overall intention of the industry to develop the principle risk based emergency preparedness, where responsibilities and costs as distributed among the "risk owners".

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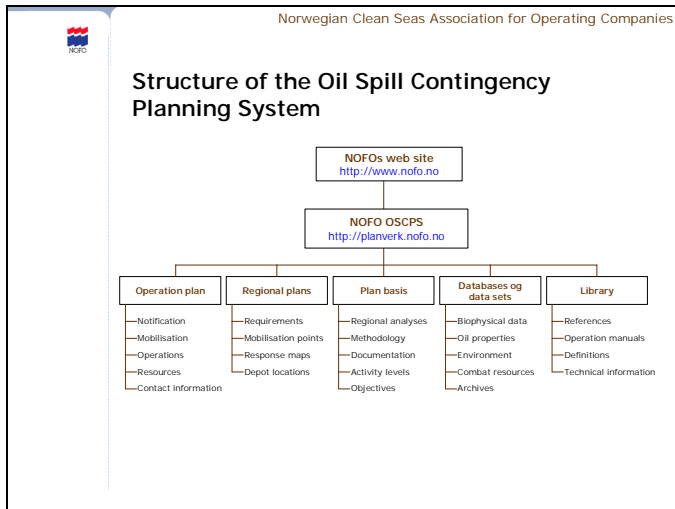


Figure 1. The overall structure of the Oil Spill Contingency Planning System (OSPCS).

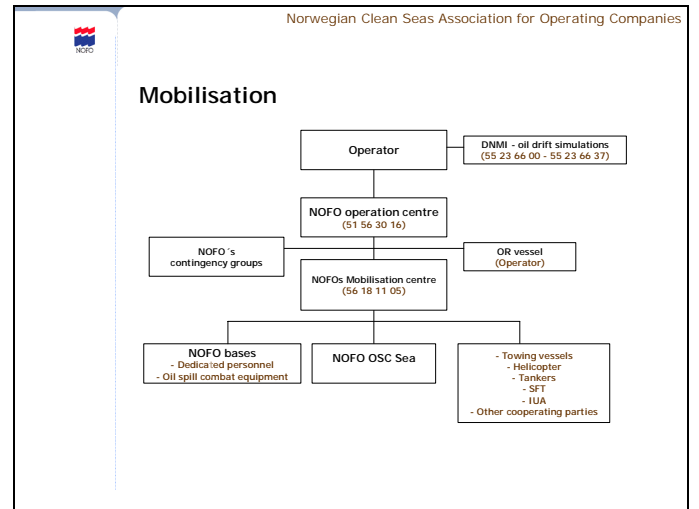


Figure 4. Mobilisation diagram.

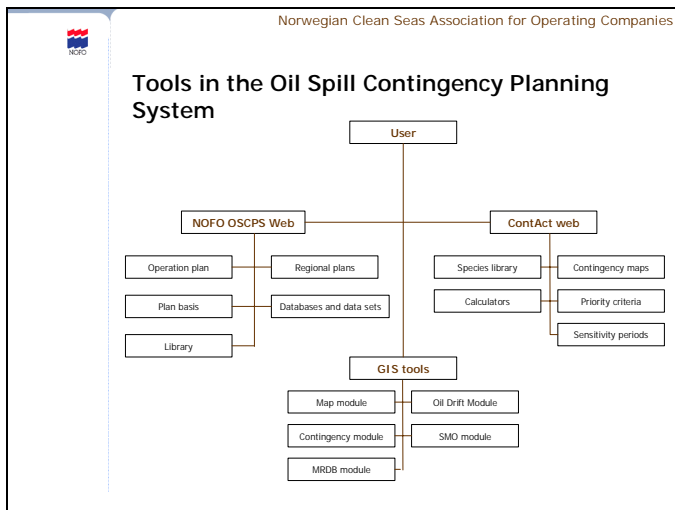


Figure 2. Tools in the OSPCS.



Figure 5. The "fire brigade".

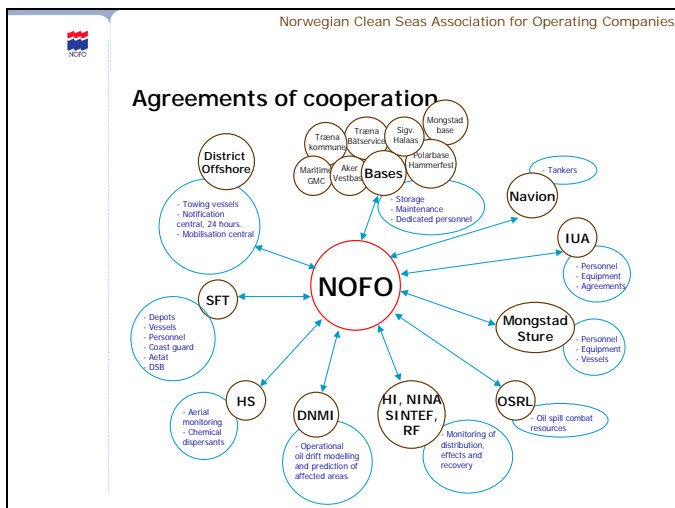


Figure 3. The network

Norwegian Clean Seas Association for Operating Companies

Training and exercises

Type and parties	Annual frequency
Exercises using NOFO equipment	10 – 14
Table top exercises with members	6 - 10
Table top exercises with SFT/IUA	2 – 4
Joint exercises NOFO – Operator – SFT – IUA	2 – 4
NOFO courses	Minimum 2
Meeting of contingency groups	Minimum 2 , Special courses as needed
Interpretation of remote sensing data	1
Training in use of computer tools	1

Exercises to be performed jointly where feasible

Figure 6. Plan for exercises and training.