HEALTH, ENVIRONMENT AND SAFETY IN THE PETROLEUM SECTOR

A SPECIAL PROJECT WITHIN THE OIL & GAS PROGRAMME

A supplement to the “Oil & Gas” programme plan
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1. SUMMARY

The Norwegian Ministry of Labour and Government Administration submitted the Storting\(^1\) White Paper No. 7 (2001-02) on health, safety and environment (HSE) in the petroleum industry. The paper highlights unacceptable or unfortunate trends, necessary measures and points out who is mainly responsible for implementing these measures.

In cooperation with an external working group, and based on the Storting White Paper No. 7, the Research Council of Norway has established a five-year R&D programme aimed at capacity building in the field of HSE in the petroleum industry. This R&D effort was initiated in 2002, and is planned to run until the end of 2006. From the White Paper on HSE in the petroleum industry, four major research topics have been chosen:

- HSE culture
- Change – organisation – technology
- Decision support tools
- Physical work environment and health

One capacity-building project has been established within each of these topics, and closely associated industry projects are being established.

The Norwegian Ministry of Labour and Government Administration assumes that the industry actively supports, also financially, the research initiative regarding health, environment and safety in the petroleum sector.

2. BACKGROUND

The Norwegian Ministry of Labour and Government Administration submitted the Storting White Paper No. 7 (2001-02) on health, safety and environment (HSE) in the petroleum industry. The paper highlights unacceptable or unfortunate trends, necessary measures and points out who is mainly responsible for implementing these measures. With this Storting White Paper, the ministry wishes to underline its expectations that the industry emphasises these issues in decision support, planning and operations.

Significant social changes, as well as recent technological and organisational developments in the petroleum industry have led to an increasingly complex risk situation. Experiences from the 1990s have shown how necessary it is that knowledge of the HSE-related consequences of decision support is constantly updated, in step with the general developments. The overall knowledge base is slowly eroding, and

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\(^1\) Storting = Norwegian parliament
the challenge is thus to find the right focus and the most suitable and effective way to organise research and capacity-building.

Therefore, the Ministry of Labour and Government Administration has initiated this input in the field of petroleum-related HSE research, and has proposed the implementation of a five-year R&D programme in cooperation with the Research Council of Norway. The Storting approved the allocation of NOK 15 million for this purpose in its 2002 budget, and it intends to grant further funding of NOK 15 million per year until the end of 2006.

The R&D efforts are to emphasise the **prevention of serious personal injuries and major accidents**, including production and delivery interruptions.

The Storting White Paper No. 7 focuses especially on the following areas:

- Methods and tools for managing health, environment and safety issues in dynamic change and decision support processes, including decision support under uncertainty
- Risk-based management of complex technological and organisational systems, including information security and ICT vulnerability
- Potential for, and limitations of using human resources in HSE-related work, including monitoring and control room functions
- A clear focus on employees’ physical work environment and health
- Management of HSE expertise and risk communication

According to the Ministry of Labour and Government Administration, a national commitment is needed, equivalent to the effort of the 1980s, which was titled *Sikkerhet på sokkelen* ("Safety on the continental shelf"). This requires that the industry actively supports, also financially, the ministry’s research initiative regarding health, environment and safety in the petroleum sector.

### 3. PERSPECTIVES AND CHALLENGES

The developments in the petroleum industry in the 1990s were marked by international oil company mergers, downsizing and changes in company planning and operations, partially due to increasing demands on profitability. The industry itself and public authorities clearly demanded that these changes should not occur at the expense of health, safety and environment. In the past few years, however, it has been pointed out from various sides that this has been the case after all.

Since the 1990s, British HSE authorities have made considerable efforts regarding research, resource development and capacity building in the relevant inspection authorities. This input resulted from the recognition that the authorities themselves have to set the agenda and initiate capacity building processes in the petroleum industry.
In Norway, the overall focus on HSE research was reduced in the same period. This applies to both privately and publicly funded research. The low priority thus given to HSE-related research has led to a gradual deterioration of the overall knowledge base.

The proposal of the Standing Committee on Local Government to the Storting on HSE in the petroleum sector of 07 May 2002 (Inst. S. nr. 169 – 2001-02) underlines the importance of HSE research being based on an integrated approach to the concept of health, safety and environment. The proposal also points out that HSE research is to contribute to the professionalisation and renewal of management processes in the petroleum industry.

Therefore, HSE-related research must challenge myths and establish perceptions of reality regarding the conflicts between the creation of values on one side, and HSE considerations on the other. This requires a focus on the benefits of emphasising HSE, models and tools which appreciate strength and flexibility in relation to future challenges, and the development of new management strategies.

HSE-related R&D activities are being conducted under the auspices of both the industry and public authorities. These activities must be seen in connection with the current HSE research commitment. Vitalisation and innovation in a dynamic, creative scientific network is needed, in close cooperation with the users of such expertise.

In order to achieve this, the current HSE programme aims to enable:

- Cooperation between a multitude of Norwegian research and educational institutions
- Cooperation between research projects
- Cooperation between user-controlled innovation projects and scientific research
- Introduction of a new type of expertise in the field of HSE research
- Follow-up of technology development resulting from the Oil and Gas Innovation Programme, Demo 2000 and the OG21 strategy

4. OBJECTIVES OF THE HSE STRATEGY

For Norway, it is extremely important that the petroleum sector remains a leading industry, generating values for society by deliberately emphasising quality, knowledge and creativity, and which continuously strives for improvement.

The general objective of the HSE-related R&D activities is that the Norwegian petroleum industry shall be a national and international leader within the entire scope of health, environment and safety issues.

The current HSE strategy is to:
- be based on an integrated approach to the HSE concept, and thus enable the integration of HSE in the industry’s planning, decision
support and operations. This can contribute to renewing management processes.

- contribute to improving the HSE culture among all participants of the petroleum industry.
- help all employees experience a well-balanced and inclusive work environment and a reliable industry.
- promote the firm belief within the sector that a good work environment and HSE-efforts result in the most profitable companies.
- challenge myths and establish perceptions of reality, thus helping the industry to better see the benefits of investing in a stable and well-functioning work environment, robust solutions and HSE efforts.
- prove that employee participation is a natural and profitable part of the work and research process.

Emphasis shall be placed on developing scientific expertise which can strengthen HSE-related training activities. This will enable long-term capacity building by linking students to the R&D projects. Furthermore, new types of expertise shall be utilised in HSE research. A higher level of expertise will result in improved qualifications among those applying for positions in the oil and gas industry, and the possibility for further education of the sector’s personnel in general.

A major prerequisite is the establishment of close cooperation between research institutes and the users of HSE expertise throughout the entire R&D project. Scientists, industrial managers, labour unions and public authorities are to be actively involved in the work, so that they can identify themselves with the HSE project, affect its development, and benefit by the application of its results. “Users“ shall include all management levels in the petroleum industry. The HSE project therefore promotes an active communication strategy in order to disseminate information about what, why and how research is carried out, and to spread the results from the projects.

The R&D strategy thus has clear-cut visions and ambitions:

- A marked focus on the safety, health and welfare of the employees, in the short and long term.
- Improvement of the HSE culture at all levels of the industry.
- An integrated approach to the concept of HSE, and an appropriate integration of HSE considerations in decision support processes.
- A positive approach to HSE as a contributor to a sustainable and competitive petroleum industry.

5. RESEARCH PRIORITIES

Implementation of the R&D strategy is based on two types of projects: capacity-building projects and user-controlled innovation projects. Four major research topics have been determined, and each of these is linked to a relatively large capacity-building project:
The capacity-building projects are managed and carried out by academic institutions. The user-controlled projects are managed and conducted by companies, but shall be theoretically based on, and related to, at least one of the capacity-building projects.

The R&D strategy will promote active cooperation and the exchange of information between all four of the capacity-building projects.

The research projects will shed light on the relevant issues, and help to develop theories, models and methods. Project management will be based on groups of senior scientists from various R&D environments, in cooperation with multi-disciplined reference groups.

Criteria for the R&D strategy include that the research:
- contributes to new knowledge and understanding, as well as capacity building
- is relevant for the petroleum sector in general, and/or for major parties and stakeholders in the sector.

**Specific goals**
The capacity-building projects are to generate:

- New theories, methods, models and insights
- At least two scientific articles per year within the project’s framework
- At least two annual scientific presentations at conferences, etc.
- A foundation for the development of standards
- At least seven completed PhD degrees within the framework of the HSE programme
- Several completed projects at the MSc level
- Improved and updated educational material within the field
- Memos, reports, etc.
- Seminars and workshops

### 5.1 HSE culture
In the Storting White Paper No. 7 (2001-2002), HSE-culture is described as an important issue and an area of priority. Separate regulations on HSE culture have also been issued for the industry (§ 11 in the general regulations). In these, it is stated that "whoever is responsible shall
promote a safety-minded culture which includes all areas, and ensures that everyone takes on responsibility for HSE”.

It is important to underline that a sound HSE culture is a goal in itself. It is a goal which the industry should strive to achieve, disregarding regulations and white papers. The project’s goal is to develop theories, methods, models and insights which can help to define and generate a good HSE culture within the entire petroleum sector. There are a number of unclear issues, misunderstandings and diverging opinions regarding HSE culture. It should thus be a main objective to reach an agreement on the interpretation of this concept. It is furthermore necessary to develop an understanding of what to consider as a sound HSE culture.

The capacity-building project and affiliated company projects shall contribute to a more coherent approach to HSE and an appropriate integration of HSE considerations in decision support processes and day-to-day operations.

In a period of extensive organisational and technological changes, this represents a major challenge. Research on HSE culture should therefore primarily be related to the ongoing changes. This implies that the research should strive to be interdisciplinary, and that it generates new insights.

5.2 Change – Organisation – Technology

The Storting White Paper No. 7 (2001-2002) underlines that change management is an especially important area.

The general objective of this area of priority is to develop knowledge which can improve the ability of stakeholders in the Norwegian petroleum industry to maintain high HSE standards in a situation of organisational and technological changes. This includes identifying the organisational and technological changes which can be expected within the next decade, e.g., projects resulting from OG21 (Oil and gas technology strategy for the 21st century).

The capacity-building project shall help to develop methods for surveying and analysing the current, complex systems for offshore development and operations. Due to the rapid technological and organisational changes, today’s models for risk management may not be sufficient for handling risk situations in the future. Such changes place significant demands on employee participation. The conditions for such participation must thus be systematically assessed in order to enable the necessary confidence and respect.

5.3 Decision support tools

An important message of the Storting White Paper No. 7 (2001-2002) is that HSE considerations are too often still regarded as conflicting with the demand for profitability. Due to this attitude, more creativity is still being used to reduce HSE investments than to increase the creation of values by
investing in HSE measures. This is a main reason for the continued weakening of HSE considerations, or that these aspects are considered too late in the planning and decision-making processes.

The white paper underlines the need for providing decision makers with better tools – tools which enable them to take complexity and uncertainty into consideration. Research and development are needed to develop economic models, risk analysis and HSE indicators.

Today’s risk analysis often consists of statistical methods and documentation tools, without really being able to influence the decisions being made. Such analyses rather reflect historic trends than changes in status and activities, and they do not register factors of significance for safety. In the industry, many different HSE indicators are presently in use, but are only to a limited degree risk-based. The current HSE indicators must be assessed with regard to their suitability, thus enabling a ranking and a standardisation of their use.

The capacity-building project will generate new insights and knowledge. The project shall contribute to developing stronger, more creative and viable scientific environments in the field.

5.4 Physical work environment and health

In connection with offshore activities, the Storting White Paper No. 7 (2001 – 2002) focuses specifically on challenges related to the working environment, work-related illness, absence due to illness and ageing.

Analyses conducted as part of the Norwegian Petroleum Directorate’s project “Development of the risk level – Norwegian continental shelf” show that the extent of health problems among offshore workers is generally related to gender, shift work schedules, type of work and age.

The topic’s capacity-building project is linked to four sub-areas:

Shift work, ageing and exclusion, exposure to chemicals and exposure to noise.

It is important to consider these areas in relation to each other. For example, exposure to certain chemical (“ototoxic”) compounds can promote loss of hearing when workers are exposed to noise simultaneously. Accordingly, shift work must be seen in connection with ageing and exposure to chemicals and noise, since these factors affect one’s recuperative ability. A specific feature of offshore work is that working hours are longer than in land-based activities. Thus the time of exposure is different than what studies of other industries have shown. So far, we lack an overall picture of the effects of the work schedule in the Norwegian petroleum industry – even though the concentrated 12-hour shifts distinguish the sector from other industrial activities.

The general living conditions for offshore workers are rather special, alternating between the isolation of rig life and long periods at home.
There is not much specific knowledge with regard to how this affects the workers’ health in the long run.

Exposure to chemicals on the oil rigs is a complex issue, and certain groups of employees in the industry have been exposed to many types of compounds. The health effects of exposure to chemicals in various periods of time should be studied. For example, the composition of drilling mud and the types of paints used for surface treatment have changed through the years. The frequency of symptoms that can be related to long-term exposure to harmful working conditions increases with increasing average age of offshore workers. This represents a major challenge to the entire petroleum industry.

In many operations, exposure to noise is considerable. Noise is often coupled with vibrations, and studies of the effect of the offshore workers’ total exposure to vibrations (whole body) are also relevant.

The project will generate new knowledge about the work environment and health of offshore workers, especially in the areas of chemical health hazards, noise problems, shift work and ageing/exclusion. The project will contribute to strengthening the professional expertise in both the industry and educational institutions.

6.  PROJECT MANAGEMENT, MEASURES AND BUDGET

6.1.  Capacity building through cooperation

A tripartite forum for safety in the petroleum industry, the "Safety Forum", was used as a reference group in the preparation of the HSE white paper. The work has helped to create new arenas for HSE-related dialogue, and has facilitated a common understanding of the issue among the various stakeholders. The work has thus contributed to establishing a common frame of reference for identifying and solving the challenges which face the sector.

In the development and follow-up of HSE research in the petroleum sector, emphasis was placed on continuing the cooperation between authorities, labour unions, oil and gas companies, suppliers, research institutes and educational institutions. An expert group has been established in order to secure this cooperation under the auspices of the Research Council, and to facilitate the linkage of the HSE project with the industry.

By joining forces, the involved research environments can achieve greater cost-efficiency and improve the quality of their research. When initiating the R&D project and the associated capacity-building projects, it was therefore appropriate to utilise the already existing cooperation between NTNU – Norwegian University of Science and Technology, HiS - Stavanger University College, UiO – University of Oslo/TKsenteret - Centre for technology, innovation and culture, SINTEF and RF – Rogaland Research.
In addition, UiB – University of Bergen, IFE - Institute for Energy Technology and AFI – Work research institute, were also invited to join the cooperation.

6.2 Applying results
It is vital that the HSE project’s results and recommendations can be operationalised. Its criteria and methods should thus be as simple and clear as possible.

If the research results are to be put to use, it is important that the users of the knowledge generated can identify themselves with the project contents.

In addition, active knowledge dissemination and communication is required in order to inform about why and how the various activities are being carried out.

6.3 Follow-up
During the project period, a separate project will be initiated. The project will deal with the following issue:
“What are the various stakeholders learning about HSE-related issues, what kind of information exchange is occurring between them, and how does this knowledge contribute to improved HSE?”

6.4 Budget
The HSE project is a five-year project, and the Ministry of Labour and Government Administration intends to allocate NOK 15 million per year from 2002 to the end of 2006.

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