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DIALOGUE

A JOURNAL FROM THE PETROLEUM SAFETY AUTHORITY NORWAY

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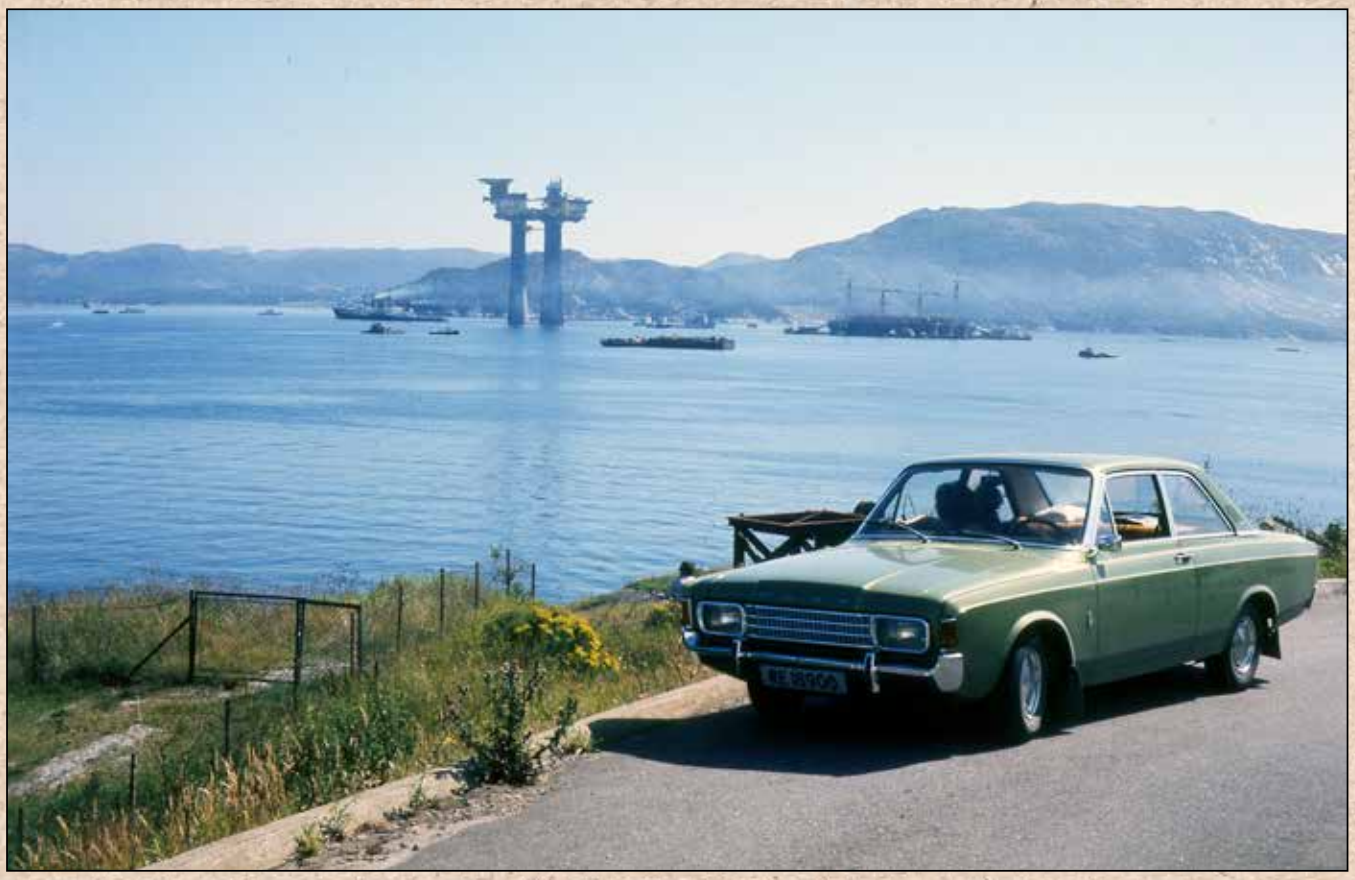
50 YEARS OF SAFETY



Platforms under construction in the Gands Fjord off Stavanger in the mid-1970s. Norway's oil history is not only about big structures and engineering skills, but also about the creation of a safety regime – about regulations and accidents, audits and triumphs, the Norwegian model, and trust and responsibility. The Norwegian Petroleum Directorate, and later the PSA, have played a key role in shaping the system which underpins today's level of safety. (Photo: Øivind Anda Pettersen/Norwegian Petroleum Museum)

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Abbreviations used in this issue
HSE: Health, safety and the environment
NCS: Norwegian continental shelf
NPD: Norwegian Petroleum Directorate
PDO: Plan for development and operation
PSA: Petroleum Safety Authority Norway
RNNP: Trends in risk level in the petroleum activity
WEA: Working Environment Act

LOOKING BACK

DO YOU RECALL?

Are you old enough to recall when the first oil people came to Norway in the 1960s? Remember the drilling rigs? The discovery of Ekofisk in 1969?

Do you recall the political discussions? The establishment of the NPD and Statoil in 1972?

Do you recall the tragedies? The accidents in the early years, the Bravo blowout in 1997, the *Alexander L Kielland* disaster in 1980? Do you remember those who died, the seriously injured?

Do you recall the triumphs? Constructing huge concrete and steel platforms? The celebrations when Gullfaks, Troll or Johan Sverdrup were discovered?

Do you recall the fights between employers and unions in the 1990s, the creation of the Safety Forum and the launch of the RNNP tool?

Do you recall Ormen Lange and the subsea records? Do you remember the oil price slumps, mergers and acquisitions? All the small and medium-sized companies which came – and went?

Do you recall the creation of the PSA in 2004? Do you remember that we acquired responsibility for petroleum plants on land? That we constantly developed regulations and were given wider responsibilities?

Do you recall that none of this simply happened?

OUR CHOICES

When we look back, history is fixed. But it was not inevitable that things would turn out the way they did. They could have been different. The past never has only one possible outcome.

The story of the past is written by the choices we humans make. Politicians, civil servants, company executives, employees, you and me.

History is not a chance matter for Norway's oil sector, either. Admittedly, the presence of wealth beneath the NCS was a happy accident. But the rest was about our choices.

We chose to draw a clear distinction between politics, administration and commercial operations. We chose to make demands on the companies. We chose to make safety the top priority.

It was our choice to Norwegianise the NCS, introduce tripartite collaboration and gain employees the right to codetermination. We chose to learn from the accidents.

We chose to rely on each other and build trust.

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STORIES ABOUT THE PAST

Knowing Norway's oil history is important – not only to see where we're coming from, but also to understand why our petroleum safety regime takes its present form.

Why is trust so central? Why are the regulations performance-based? Why must the companies think risk reduction as early as the design phase? Why is the allocation of responsibility key? Why do we demand continuous improvement?

Why have the Storting (parliament) and government repeatedly emphasised the ambition that Norway should lead the world for HSE?

And why is it exactly that the PSA has been given supervisory responsibility for such new areas as offshore wind power, carbon management and seabed minerals?

VALUABLE EXPERIENCE

In 2022, it is 50 years since the Storting voted to establish the NPD and gave it responsibility for safety and resource management on the NCS. Eighteen years ago, it was split in two, with safety transferred to a new authority – the PSA.

This issue of *Dialogue* celebrates the 50th anniversary with some stories from the decades which have passed since the oil prospectors arrived in the 1960s.

Norway's oil history is also the story of how the Norwegian safety regime came to be – of regulations and accidents, supervision and successes, of the Norwegian model, and of trust and responsibility.

The NPD, and later the PSA, have played a key role in shaping the regime which underpins today's level of safety. The model is robust but, if it is to survive, must be respected by all.

Right now, the oil and gas sector is in full flood, with a number of new developments on the way. At the same time, we are seeing the start of a green shift, with the oil companies working to reduce greenhouse gas emission, investing in renewable energy and investigating new priority areas.

Knowledge of history, experience and lessons learnt provides an important basis for today's safety work – and for the choices we face both in further development of the petroleum sector and in moving into fresh fields. *

ØYVIND MIDTTUN, editor

EARS

1960s

BY ASLAK SIRA MYHRE

Oil kid

Service station kids, *painting by Tor-Arne Moen.*

"Norway didn't become an oil nation because we were lucky. People often say we got something undeserved, that we're a humble and unsophisticated folk who've stumbled on an oil mountain where we sit and incubate our petroleum wealth.

When Norwegian law of the sea expert, diplomat and politician Jens Evensen secured Norway a disproportionately large share of the rights to the continental shelf, you could say we were lucky. That the oil should lie precisely in our seas can in any case be put down to chance.

From then on, though, it's been all about commitment, sacrifice and eventually expertise – not luck.

The Norwegian oil wasn't easy to get at. On the contrary, it lay below ground in a rough, deep sea. Technology for recovering it didn't exist, nor did the model for gaining the greatest possible national control over the new resources. And the method for ensuring that the oil created prosperity was absent.

For 20 years, Norway as a state devoted much of our national resources to building up this industry, to creating the technology and to building models intended to ensure that the Norwegian mainland benefited from the oil.

Over the same period, the union movement in the petroleum sector took the lead in improving conditions for those working on land and offshore. Personnel there led the way in radical, nationwide campaigns for social reforms and solidarity.

Being an oil worker on the NCS is a high-pay job, with high status in western Norway. Just across the boundary in the British sector, it's regarded as a poorly-paid rubbish job.

And the government borrowed money for 20 years to finance what was to become future revenues. During these years, the country moved from knowing nothing about oil to being a world technology leader.

It's untrue that Norway isn't a knowledge nation. It's just that the knowledge we've built up can't be converted into pleasant chatter on Friday night TV. ✶

Extract from *Oljeunge*
(Oil Kid) by Aslak Sira Myhre,
published in *Herskap og tjenere*
(Upstairs, Downstairs), 2010,
Forlaget Oktober
(Reproduced by permission.)

1960s

- **1965:** First licences to prospect and drill for underwater petroleum deposits on the NCS. Safety requirements included in the terms.
- **1966:** First wildcat on the NCS.
- **1969:** Ekofisk field discovered.

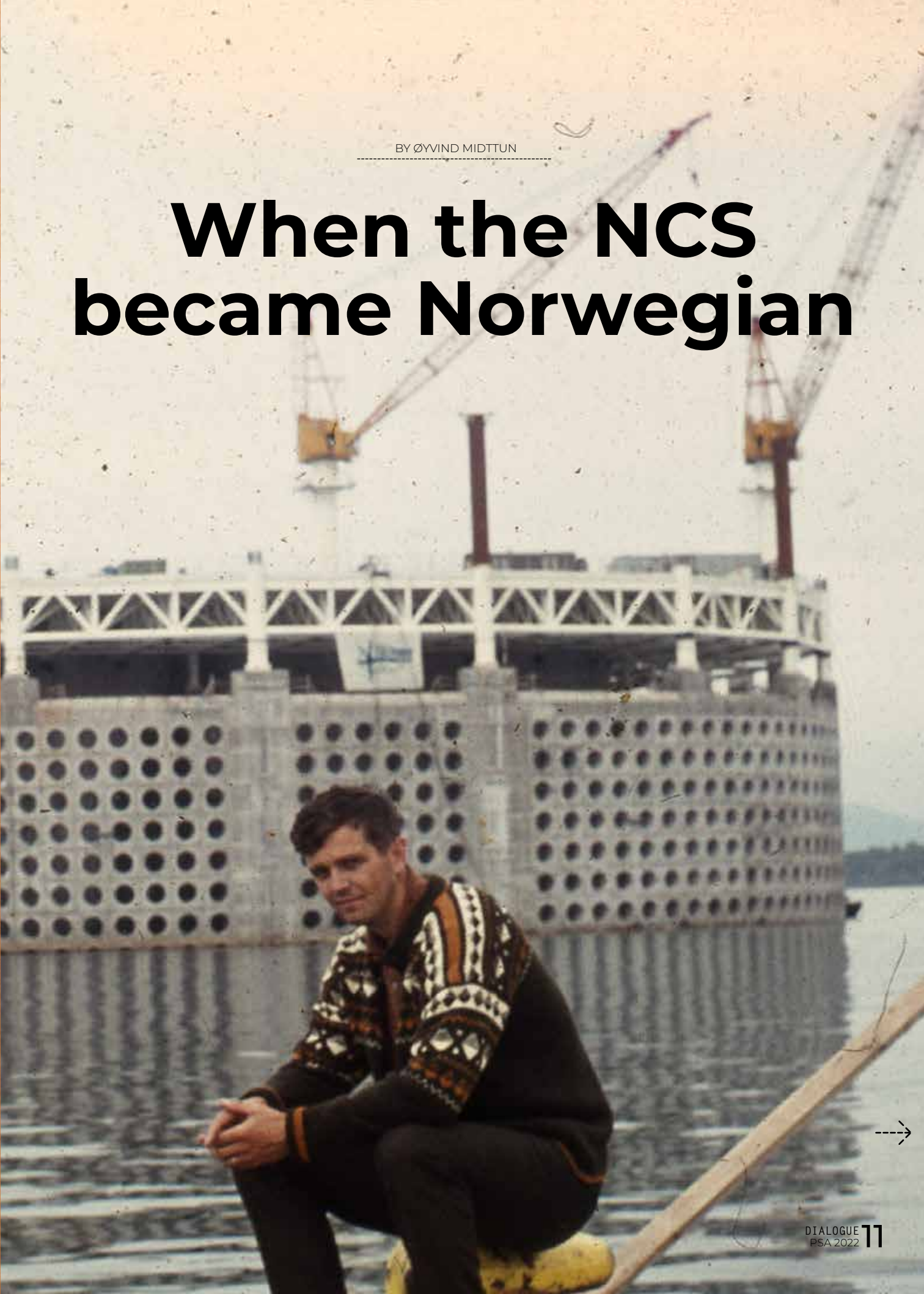
Ocean Traveler *preparing to drill the first wildcat on the NCS, which was spudded on 19 July 1966. (Photo: NTB)*

1970s

The Ekofisk Tank (2/4 T), the world's first big concrete structure built for the petroleum industry, became a landmark and tourist attraction during construction in Stavanger from 1971-73. (Photo: Ommund Lunde/ Stavanger municipal archives)

BY ØYVIND MIDTTUN

When the NCS became Norwegian



An American work culture was dominant on the NCS from the start of Norway's oil adventure until the end of the 1970s. Extending the Working Environment Act (WEA) offshore was an important milestone in making the new industry Norwegian.

The number of accidents in the petroleum sector was high during the 1970s, which eventually focused great public attention on NCS working conditions.

Another incident occurred on 1 November 1975 when a riser on Ekofisk Alpha caught fire. The platform was evacuated, but three crew died because a rescue capsule fell during lowering.

TURNING POINT That accident proved a turning point in securing a greater commitment to safety on the NCS.

"The fire on 2/4 A led directly to the establishment of the safety delegate system on Ekofisk and later to the introduction of the WEA," says researcher Trude Meland at the Norwegian Petroleum Museum.

Immediately after the accident, the Ministry of Industry ordered operator Phillips Petroleum to let the workforce elect safety delegates.

A safety and environmental committee was also established, and became a forerunner of today's working environment committee (AMU) at the operator.

"The accident showed that a new regulatory regime was required," Meland explains. "The companies couldn't police themselves.

"Naturally, the American executives in Phillips found the order to introduce safety delegates very strange. Was an employee to be allowed to halt production, they wondered.

"At the same time, the companies were pretty geared up at this time to satisfy the demands set by the Norwegian authorities, so the system was introduced."

INQUIRY Two weeks after the Alpha accident, a commission of inquiry was appointed with director general Kåre Halden at the Ministry of Local Government and Labour as its chair.

Asked to assess if parts of the WEA, then under preparation, should also apply on the NCS, the commission gave this its support when it reported in the summer of 1976. With some exceptions, the Act was extended to fixed facilities from 24 July 1977.

"That was the great dividing line," says Meland. "The WEA represented a big step forward for Norwegian workers, and particularly for personnel on the NCS."

The Act demanded a fully acceptable working environment. It covered such matters as the duties of employers and employees, worker participation, working hours and job security.

CODETERMINATION The WEA secured codetermination for employees by making elected safety delegates and an AMU – with representatives of both management and workers – obligatory. Management was required to collaborate with the delegates.

"It represented a radical shift," says Meland. "The workers were now to occupy centre stage. Workplaces should be tailored to employees, who had the right to be consulted.

"This was disquieting for employers on the NCS – but not so radical in mainland Norway, where a long tradition of 'tripartite' collaboration prevailed between employers, unions and government, and where trust between management and workers was greater."

NORWEGIANISATION Meland believes that the extension of the WEA to the NCS must also be seen in light of the Norwegianisation policy which set its stamp on the oil sector for much of the 1970s.

"This was part of a process which took place at all levels during that period," she says, and notes that Norwegianisation was about the ownership of resources.

It also covered prioritisation of domestic companies, building up national expertise, getting locals into senior jobs and extending the country's labour relations system offshore.

"The WEA played its part in making the continental shelf Norwegian," Meland says. "It was about ensuring that offshore workers were on an equal footing with their counterparts on land. That was key."

PLATFORMS ONLY However, the WEA only applied to fixed facilities offshore – the platforms. Work on mobile units – the rigs – was regarded as maritime activity and remained subject to the Seamen's Act.

The differences between fixed and mobile facilities were great and persisted for many years.

"They were two completely different worlds," observes Meland. "Norwegians secured key roles on the fixed units from an early stage, which coloured the working environment and culture there.

"That in turn influenced the introduction of the WEA, which was accepted very quickly and with little conflict. The whole Norwegianisation process had then been under way for some time.

"On the rigs, American drilling contractors dominated and it took a long time before the leadership became Norwegian. Drilling wasn't an easy occupation for nationals to enter. Even though the plan was to train them up, the first Norwegian drillers were not in place until the early 1980s."

American management remained stronger on the rigs for much longer, she says. "Mobile units were considered part of the fleet in foreign service.

"A good working environment has a positive effect on health, motivation and sickness absence among employees, as well as on productivity and profitability. It also cuts costs for society."

Roar Høydal, discipline leader, PSA

"The WEA wasn't introduced, working hours differed from the platforms and pay was lower. An offshore supplement negotiated in 1981 didn't benefit rig workers, for example."

Regulatory responsibility for mobile units was transferred from the Norwegian Maritime Directorate to the NPD in 1985, while the WEA was extended to them in 1992.

FOUNDATIONS Regulators, unions, the internal control principle, allocation of responsibility, the WEA, tripartite collaboration and trust – the foundations of today's safety system were developed in 1975-82, says Meland.

"The *Alexander L Kielland* disaster in 1980 manifested the importance of safety work, but much was under way or in place before that," she adds.

RESEARCH NEEDED She believes that more research is needed on factors related to the introduction of the WEA and its significance. "Many books have been written on Norway's oil history, but little research done.

"Too few questions have been asked. We ought to know more, for example, about how downturns and the business cycle have affected the working environment and safety.

"That's also important for understanding today's position and challenges. Trust and tripartite collaboration come under pressure in hard times. But undermining trust is dangerous. It's among the most important things which need protecting."

FUNDAMENTAL The current version of the WEA came into force on 1 January 2006, building on the 1977 Act and earlier industrial safety legislation.

"It's fundamental to working life in Norway, including in the petroleum industry," says Roar Høydal, discipline leader for occupational health and safety at the PSA.

The Act can be regarded as a framework and a recipe book, setting goals, requirements and rules which ensure a positive working environment for individuals, enterprises and society.

It has been developed to provide secure terms of employment and equal treatment in the labour market – and to protect against physical and mental harm.

Another purpose is to ensure that the working day is meaningful and promotes health, and to contribute to a more inclusive workplace.

"The WEA regulates basic requirements for the working environment and specifies requirements for systematic efforts on HSE by the companies," says Høydal.

"It establishes the rights and duties of both employers and employees, points out the direction of travel and sets priorities."

CONTINUOUS A key aspect of the WEA is its emphasis that efforts to improve the working environment are a continuous process, where active use must be made of employee experience.

Worker participation is regarded as so important that employers are subject to legal requirements on both the content of and the process for such involvement.

MORE DETAILED A number of regulations have been introduced to amplify the requirements of the Act by providing more detailed provisions.

"We supervise compliance by companies in the petroleum sector with the requirements of the WEA and associated regulations," explains Høydal.

"In addition, we have our own specific regulations for the oil and gas sector which supplement the Act.

"Our assessment is that most companies work systematically with the working environment, although areas requiring improvement always exist."

He adds that it pays to have a good working environment. "This has a positive effect on health, motivation and sickness absence among employees, as well as on productivity and profitability. It also cuts costs for society.

"The key to success is to work preventively, systematically and on the basis of knowledge." ★

From the derrick on Statfjord A. The Norwegianisation policy, which characterised the country's petroleum sector for much of the 1970s, required the foreign oil companies to adapt to a national system – not vice-versa. Development of requirements for, checks on and administration of safety on the NCS was an important part of this approach. (Photo: Hilde Hysing-Dahl/Norwegian Petroleum Museum)

1970s

- **1972:** Storting (parliament) approves the creation of the NPD and Statoil.
- **1975:** Fire in riser on Ekofisk 2/4 Alpha facility. Three people die. Political turning point for increased commitment to offshore safety.
- **1976:** NPD rejects Mobil/ Statoil plan for Statfjord B and calls for quarters to be moved. Named “the most expensive letter in Norwegian history”.
- **1977:** Oil blowout on Ekofisk 2/4 Bravo. This incident prompts a thorough review and evaluation of the safety regime.
- **1977:** WEA extended to fixed facilities on the NCS.
- **1978:** Storting decides that the NPD will report to two ministries – Local Government and Labour for safety, and Industry (now Petroleum and Energy) for resource management.

1980s

The Troll A facility being towed to the field. It was the tallest structure ever moved by humans. (Photo: Dag Magne Søyland/Equinor)

BY OLAV HOVE

Giant without compare

Several of the largest field developments on the NCS saw the light of day in the 1980s. The biggest of them all was the veritable troll, which became famed far beyond the country's borders.

The small community of Vats north of Stavanger was witness in May 1995 to a sight nobody had seen before – the departure of the tallest structure ever moved by humans.

Towing the Troll A gas platform out to the North Sea was a source of astonishment and not least pride at Norwegian engineering skills.

"A wonder of the world, neither more nor less, was on its way down the Bokna Fjord," says Bjørn Vidar Lerøen. "But we can't begin there, because there are so many dimensions involved."

The former oil journalist, consultant and author knows Norway's oil history well, and feels the need to sort through his memories before starting to talk about Troll.

This tale covers such aspects as geopolitics, technology development, engineering skills and exemplary resource management.

"May 1995 is definitely not the place to start," explains Lerøen. "But Troll made its mark on the whole 1980s, in many areas."

"IMPOSSIBLE" CHALLENGE After well 31/2-1 in 1979 had proven what was to become the Troll field, it soon became clear that a thin layer of oil lay beneath the big gas reservoir. That sparked a major technology hunt.

Both development operator Shell and production operator Statoil believed this crude was inaccessible and wanted to concentrate on the gas.

But the NPD, which had a dedicated team of specialists for the field, thought differently. And Norway's Norsk Hydro company believed it had a solution for reaching the oil with the aid of horizontal drilling.

"Although this technique actually has a very long history, applying it in its traditional form wasn't possible on Troll," says Monica Ovesen, discipline leader for drilling and well technology at the PSA.

She explains that drilling horizontally has roots extending back to California in the 1930s, when people wanted to drive wells from land to reach oil deposits just off the coast.

They put wedges at a certain depth to function as a ramp for the drill string, Ovesen says. "Other methods were used, including 'deviated' wells, but they weren't good enough for Troll."

SAFETY CHALLENGES Earlier versions of horizontal drilling provided insufficient control, and the 20-metre-thick oil zones under the Troll gas called for great precision in guiding the bit.

Extensive work between approval of the original PDO for Troll in 1986 until it came on stream in 1995 resulted in a rotating, continuously steerable system which is still in use.

"Put simply, this solution involves placing the sensors used for guidance as close to the bit as possible," says Ovesen. "That reduces deviations and enhances precise control."

Where the safety of drilling operations is concerned, this approach had both positive and negative aspects, she explains.

"There were fewer wells, and thereby less drill-floor work – a safety gain. At the same time,

longer wells created issues related to downhole stability – a challenge for safety."

Noting that complexity also increases, she says this is manageable in safety terms. The longest well on Troll is 10 042 metres, with a horizontal section of no less than 8 022 metres.

PLATFORM DESIGN Troll was not only innovative and important for drilling. Work on platform design was a key feature throughout the 1980s, including when planning Troll A.

This was the first of three large facilities on the field, and a number of concepts were considered. They included a platform standing on the seabed and various floaters – known as "little trolls".

But the ultimate choice was a Condeep – a fixed facility supported by a huge concrete gravity base structure (GBS). Nobody had proposed building anything like it before.

The dimensions were enormous. Various illustrations placed Troll A alongside such edifices as Oslo's City Hall and the Eiffel Tower in Paris, but it loomed over both.

"Troll A was the equivalent to a Moon landing," observes Lerøen.

BIG FIELDS FIRST But he points out that, amidst all the pride over technological and engineering achievements, an element of luck must be admitted in the story of both Troll and Norway's oil sector.

"We were fortunate in finding the big fields early – Ekofisk, Statfjord, Snorre, Oseberg and Gullfaks. That's been highly significant in many ways."

"Extensive work between approval of the original PDO for Troll in 1986 until it came on stream in 1995 resulted in a rotating, continuously steerable system which is still in use."

Moniva Ovesen, discipline leader for drilling and well technology, PSA

At 472 metres high overall, the Troll A platform set a record as the world's tallest movable structure built by humans. (Illustration: Equinor)

Concrete controversy

One of the very first big concrete Condeeps on the NCS was Statfjord A. After a number of modifications, the NPD's safety division decided this design was sufficiently secure and gave the green light for construction in 1976.

Following many further adjustments and changes, the facility was ready to come on stream in 1979. Operator Mobil proposed a straight copy of Statfjord A for the second platform.

The NPD then put its foot down, and rejected the project on the basis of an overall safety assessment. In a response later dubbed "the most expensive letter in Norwegian history", it demanded that the living quarters be placed on another platform.

After many meetings and long discussions, Mobil produced a new layout for the topsides on Statfjord B to improve separation of the quarters from areas where fire or explosion could occur.

The same concept also formed the basis for the Statfjord C facility and the three Condeeps on Gullfaks.

This approach to managing safety by building in prudent solutions at the planning phase was eventually extended to cover a number of other types of risks.

In his view, the economic backbone provided by these discoveries, along with the experience gained from developing and operating them, was crucial for the technological achievements.

"The financial power which the big fields gave us has also equipped the country for the future we're now entering."

But he emphasises that Norwegian oil history would have looked very different without the unique interaction between oil companies, suppliers, technology teams, government and unions.

"We had a generation of politicians and civil servants who saw the opportunities. And that naturally reflects another important element – the Norwegian temperament and mindset.

"Moreover, the administrative system provided orderly conditions and predictability. We can be proud of that as well.

"Norway also went against the flow. Most countries flared their associated gas, for example, but we decided to look after it all – a far-sighted decision we were almost alone in taking."

US PRESSURE Troll gas attracted unexpected international attention in the 1980s. US president Ronald Reagan, concerned about America's energy supplies, suddenly saw an opportunity on the NCS.

He thought the Troll gas could be important at a time when the Cold War was at its chilliest. Reagan feared that the world – and particularly Europe – would become too reliant on Soviet gas.

Troll could offer a chance to lessen that dependence. He accordingly argued three times in the US National Security Council that the field had to come on stream as soon as possible.

The Norwegians had to move faster, he asserted, and offered both cash and competence. "But Norway responded that it wanted to take time to develop Troll," Lerøen observes,

And it did take time. Reagan did not get his way. The field was not in production before the mid-1990s, long after the Cold War was over.

"That's a good example of Norwegian resource management," says Lerøen. "You shouldn't go too fast, regardless of who's applying pressure. Decisions must be properly grounded."

PARALLELS Lerøen sees parallels with today's position in the wake of Russia's invasion of Ukraine and the significance of Norwegian gas for an EU which wants to become independent of Russian gas.

"That illustrates the important role of energy in international politics – for stability, peace and prosperity," he emphasises.

"Troll has made its mark on Norway and the world in so many ways, and will continue to do so. When it was discovered, the field was expected to deliver gas for 70 years – a tremendous perspective.

"Nobody knows whether this still holds good, because there are too many uncertain variables. But Troll's significance for technology, economics and Norwegian pride will last far beyond this time frame." ✶

1980s

- **1980:** *Alexander L Kielland* accident – 123 people die. Follow-up of the accident prompts extensive changes to the existing organisation of regulatory responsibility for HSE.
- **1985:** Storting passes the Petroleum Act. NPD receives lead responsibility on developing regulations for and supervising safety and the working environment in the petroleum sector (both fixed and mobile facilities).

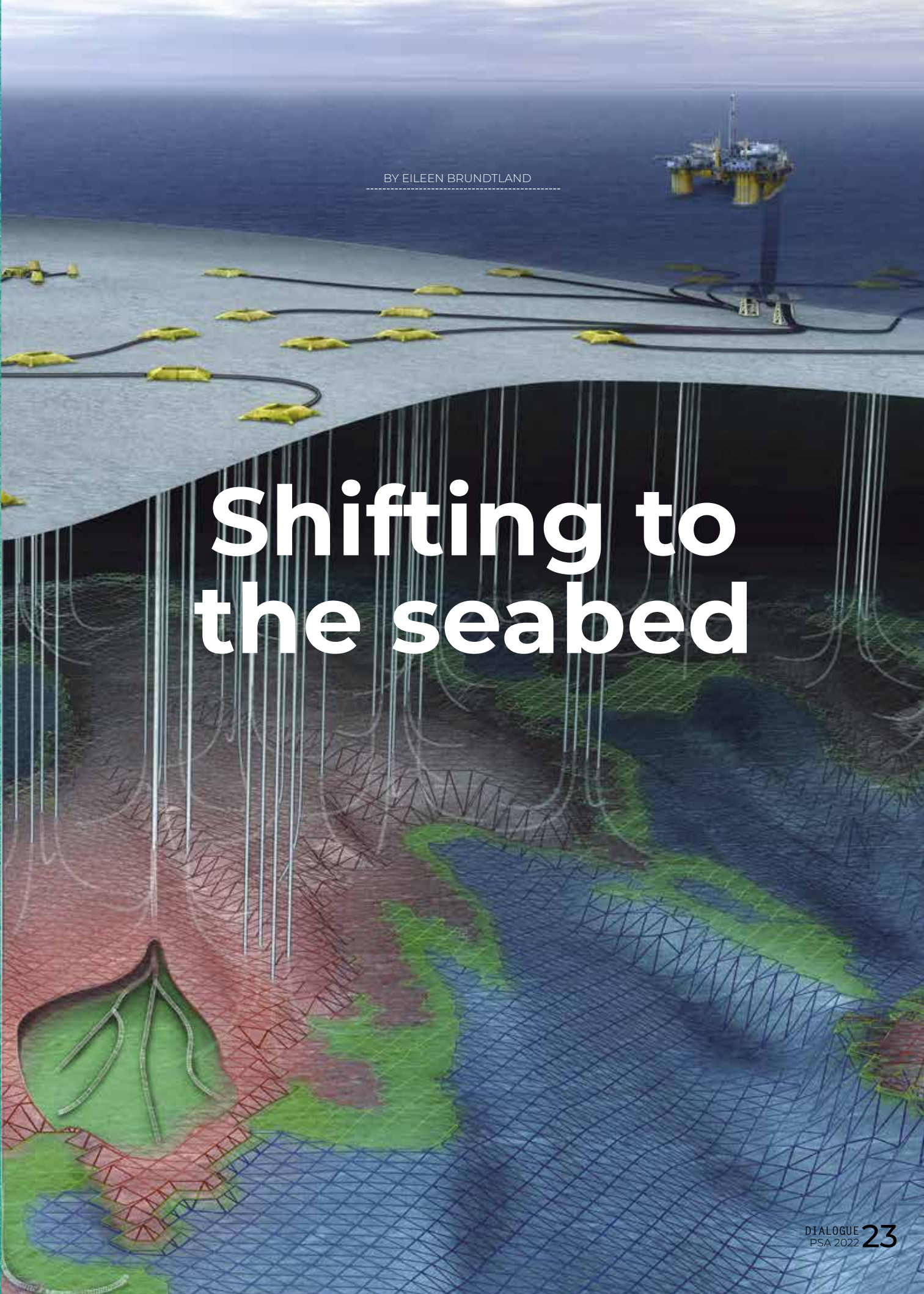
No single accident in Norwegian petroleum history has cost more human lives than the Alexander L Kielland *disaster in 1980. (Photo: Bjørn Sigurdsøn/NTB)*

1990s

The Troll field, with a network of subsea wells tied back to a floating production platform. A key trend in the 1990s was that seabed installations were largely tied back to floaters – either semi-submersibles or monohulls. (Illustration: Equinor)

BY EILEEN BRUNDTLAND

Shifting to the seabed



Underwater technology occupies a key place in the conquest of the NCS. Progress in this area really picked up speed in the 1990s, and Norway ranks today as a leading exporter of subsea solutions.

The move to the seabed became the key to continued development of the NCS after the first large fields were brought on stream in the 1970s and 1980s.

Discoveries previously considered non-commercial became accessible with the aid of subsea solutions. More than half the petroleum produced on the NCS today comes from seabed wells.

"This technology made it possible to reach waters too deep for fixed steel and concrete installations," says senior researcher Kristin Øye Gjerde at the Norwegian Petroleum Museum.

"It also became feasible to extend a network of seabed wells across a large area and thereby increase recovery from fields with complex reservoirs."

With Arnfinn Nergaard, Gjerde has written *Getting down to it. 50 years of subsea success in Norway,* on how the country became one of the world's leading exporters of underwater technology.

SOLUTIONS AND STANDARDS Activity in the Norwegian petroleum sector during the early 1990s was characterised by low oil prices, high costs and great uncertainty about the resource base.

However, the use of seabed wells on Frigg, Gullfaks and Tommeliten during the 1980s had shown that it was possible to produce from subsea installations.

That opened the way to using advanced underwater solutions for developing many discoveries previously regarded as unprofitable or inaccessible.

A big oil-price slump in 1986 had made finding cost-efficient approaches important. Field developments in the 1990s were driven by two opposing requirements.

On one hand, new technology was essential for overcoming such challenges as piping unprocessed wellstreams over long distances. On the other, standardising existing methods would help cut costs.

"The 1980s was about developing and adopting new solutions," says Gjerde. "In the next decade, the companies began to ask whether things could be simplified by re-using these innovations."

She explains that the breakthrough came with the subsea wells tied back to Draugen and the Statfjord satellites, which were being developed more or less simultaneously.

"Norway's Kongsberg Offshore came up with the idea of supplying virtually identical equipment on both fields, which sharply reduced costs. That marked the start of what became mass production of modularised subsea facilities."

The new seabed modules were quicker to produce and simpler to install, making them more cost-effective than platform-based concepts.

This coincided with the launch of the Norsok project in the early 1990s, which aimed to reduce execution time and costs for building and operating facilities on the NCS.

An important part of this effort involved developing a number of Norwegian standards for the subsea area. Since few international equivalents existed, the bulk of these were

adopted by the International Organisation for Standardisation (ISO) in the 2000s.

FLOATERS A key feature of the 1990s was that subsea wells largely came to be tied back to floating platforms or production ships. Åsgard, on stream from 1999, was the biggest field developed in this way – with three floaters and more than 50 seabed wells.

Nine large subsea developments tied back to floating units were implemented in 1995-2001, and such tie-ins were used for more than half of all new seabed wells on the NCS in the 1990s.

"In reality, the arrival of the floaters put the nail in the coffin for concrete platforms," observes Gjerde.

SUBSEA TO SHORE Important technological advances in the 1990s also made it possible to tie subsea wells directly to processing facilities on land.

Scientists at the Institute for Energy Technology, Sintef and the Norwegian University of Science and Technology (NTNU) took a key step forward with multiphase flow in pipelines.

This allowed unprocessed wellstreams – a mix of oil, water and gas – to be piped more easily over long distances, and again helped to make non-commercial finds relevant for development.

One example is Snøhvit in the Barents Sea. First discovered in 1984, it was not brought on stream until 2007 when long-distance pipeline transport of its gas became feasible.

Thanks to multiphase flow technology, gas and condensate can be piped 143 kilometres from this field to the Hammerfest LNG plant on the north Norwegian coast.

The Åsgard A production and storage ship is one of three floating facilities on this Norwegian Sea field. More than 50 subsea wells have been drilled down on the seabed. (Photo: Øyvind Hagen/Equinor)

"As more and more equipment and processes are placed on the seabed, the need for management and control increases. That in turn makes bigger demands on instrumentation and reliability. It's important the companies understand this, and continue working to develop norms and standardised solutions."

Trond Sundby, principal engineer, PSA

SUBSEA FACTORIES Technology developed in the 1990s laid the basis for big breakthroughs which were to become important in the following decades, such as subsea compression and separation.

Both these solutions are key components in the concept of a "subsea factory", and making this a reality became an important target for Statoil in the 2010s.

"After oil prices fell in 2014, there was less talk that everything had to be done on the seabed," Gjerde notes. "Instead, the companies picked the best from every world.

"If the water depth is shallow enough, a fixed steel platform might be the best answer. Elsewhere, a floater could prove more appropriate."

WORLD LEADER Technological progress in this period also provided a basis for export sales, making it possible for Norwegian companies to get established almost everywhere with production offshore.

That has particularly meant a lot for the supplier industry. Subsea technology ranks today as one of Norway's largest export sectors, on a par with foreign sales of fish.

Gjerde is convinced that subsea expertise will also be important in the future: "It's highly relevant for floating wind power, aquaculture and possible recovery of seabed minerals."

SAME SAFETY DEMANDS "From the perspective of personnel safety, subsea facilities represent a good answer because no people are present," says principal engineer Trond Sundby at the PSA.

Safety work in this area therefore concentrates primarily on preventing leaks to the sea, he explains, and emphasises that the regulatory demands are the same as for surface installations.

"The requirements for double barriers and that a facility must default to a safe condition if a fault occurs also apply subsea," he notes.

Figures from the section of the RNNP (RNNP AU) tool on acute emissions show that few leaks have occurred from seabed facilities and pipelines.

"The industry must nevertheless do more in this area," Sundby says. "As more and more equipment and processes are placed on the seabed, the need for management and control increases.

"That in turn makes bigger demands on instrumentation and reliability. It's important the companies understand this, and continue working to develop norms and standardised solutions."

GOOD RESOURCE UTILISATION Like Gjerde, he emphasises that subsea technology is also relevant for new offshore activities. "The industry has been able to think long-term and in a solution-oriented way.

"If it manages to remain just as forward-looking in terms of technology development and standardisation as it was in the 1990s, steady subsea improvements will be possible. And that'll be useful for offshore wind power facilities, for instance."

Sundby believes underwater solutions will be an important part of the petroleum industry for many years to come.

"This technology has proved crucial for recovering more of the resources. Even more new oil and gas discoveries will therefore be tied back to existing facilities using subsea methods."

CAPACITY AND EXPERTISE At the same time, concern is growing that the expertise might wither. Many capable specialists at the subsea suppliers were lost during the 2014 downturn.

The industry is also currently experiencing a change of generations, with many of those who were involved in building up the sector now taking retirement.

"We have very able suppliers in Norway," says Sundby. "The threat is that we'll lose both history and knowledge. That's a challenge.

"Expertise in the industry is important both for the petroleum sector and for new ocean activities such as offshore wind power." ✱

1990s

- **1992:** NPD introduces regulations for mechanised pipehandling on the drill floor, after much conflict.
- **1992:** WEA also extended to mobile units.
- **1993:** Norsok project launched. Important industry collaboration on industrial standards.
- **1999:** RNNP tool established. First annual report issued in 2001.

Regulatory requirements are the same above and below the waves.

2000s

Edvard Grieg came on stream in 2015 with Lundin as operator. The company prequalified for this role in 2004 as one of the newcomers to the NCS after 2000. (Photo: Lundin Energy Norway)

BY OLAV HOVE

Small but significant

A new phase in Norwegian oil history began in the 2000s, when a number of new companies appeared on the NCS. They brought creativity, innovative thinking and eagerness to explore. But safety requirements remain unchanged – regardless of size.

Depressed oil prices at the end of the 1990s prompted a number of mergers between some of the world's very largest oil companies, or supermajors. On the NCS, where the majors had dominated for many years, the result was fewer players and reduced exploration.

The new millennium also opened with a crisis of confidence. Ormen Lange, the last really big discovery on the NCS, was proven in 1997. Many felt the days of the big finds was over, and the companies lost interest in exploring.

Jarand Rystad, CEO of analysis company Rystad Energy, remembers that period well, and says a mastodon philosophy, an elephant sickness, prevailed on the industry.

"Only big fields – or elephants – were interesting, and the perception was that none were left to find. There was far too little active exploration. Something had to be done."

ATTRACTIVENESS The Norwegian government took several steps to boost the attractiveness of the NCS, primarily through amending the offshore tax regime.

A reimbursement system for exploration costs ensured that companies with no production – and therefore no revenues – received the same tax benefits as those which were producing.

"An exploration company no longer needed to produce, and could thereby devote its resources to exploring," says Rystad. "That created a very important diversity."

In addition, exploration acreage was awarded more frequently and extensively. The awards in predefined areas (APA) scheme, introduced to supplement the regular licensing rounds, aimed to achieve more effective exploration in mature parts of the NCS.

Third, the government made active efforts to extend the range of players rather than being mainly concerned to retain the big Norwegian operators and the largest international companies.

These participants were involved in every phase on the NCS, from exploration and development to operation and sales. The door was now opened to small and medium-sized companies – preferably the exploration specialists.

And the cure worked. Within a few years, as many as 50-60 new companies had made their entry to the NCS.

DIVERSITY Bjørn Thomas Bache, director of supervisory activities at the PSA, says that these newcomers were characterised by great diversity.

"They came from different cultures and had varying ambitions," he recalls. "Some secured licence interests with the aim of becoming operators, others had a strategy of growth through acquisitions. And some concentrated solely on exploration in order to sell out if a discovery was made."

But all had to respect the Norwegian safety regime. "The regulations were the same for every company, large or small," says Bache.

In order to ensure that companies had the necessary capacity and expertise, the government introduced a prequalification system for licensees and operators which still functions today.

The PSA is involved in these assessments.

Anyone wanting to pursue petroleum activities on the NCS must show they can add to value creation and have HSE capabilities which help to strengthen safety.

"A company must document that it has expertise and capacity in HSE as well as an adequate management system and financial strength," explains Bache. "It must also have the necessary competence and organisation in Norway."

CLOSE FOLLOW-UP He reports that virtually all the companies have arrived with broad expertise. But the PSA has nevertheless found it important to follow up these new players closely.

"The Norwegian Oil and Gas Association established a dedicated network for smaller companies early on, and its HSE forum became a good arena for collaboration with us," he says.

"That's functioned well and has been necessary, particularly with regard to spreading information about Norway's safety regime. We always conduct an audit, for example, when a company is to drill its first well as operator."

Bache emphasises that the new players on the NCS have made many positive contributions, including with regard to safety. But he says Norway's petroleum sector has no room for freeloaders.

"The regulations set clear requirements. Operators have overall responsibility for activities being conducted prudently and within the rules. But licensees also have duties."

PETROPRENEURS Many of the small newcomers were nicknamed "oil mosquitos", but Bache is not keen on that term. Nor is Rystad, who prefers the word "petropreneurs".

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"A company must document that it has expertise and capacity in HSE as well as an adequate management system and financial strength. It must also have the necessary competence and organisation in Norway."

Bjørn Thomas Bache, director of supervisory activities, PSA

He nevertheless admits that the smallest companies had certain features in common with mosquitos.

"They arrived in great numbers, and many of the big players disappeared in their wake. But they were much less irritating than mosquitos, and contributed something important.

"If you look at the geology on the NCS, interesting formations outnumber exploration geologists. In the early 2000s, we needed more eyes and brains to investigate these – and got them."

SWEDISH SUCCESS Many of the companies which appeared on the NCS during this period vanished fairly quickly, without achieving anything of note. Others did better, and have remained.

A few became success stories. Rystad highlights Swedish-owned Lundin Energy Norway, which subsequently merged with Aker BP, as one of these.

"Lundin is clear evidence that the measures adopted by the government worked. In its early phase, this company depended entirely on the reimbursement scheme."

In 2010, the company made the giant Avaldsnes discovery in the Norwegian North Sea – later renamed Johan Sverdrup.

ASSESSMENT The question which remains to be resolved is what this shift in Norwegian oil management and the increased diversity has led to in the longer term. Rystad feels the answer is fairly clear.

"These new companies added creativity, innovative thinking and increased activity to the NCS. That's enough in itself to say the change has been a success.

"If you look at value creation alone, the result also seems surprisingly good. The companies which needed the reimbursement scheme have created as much value as those already producing and paying tax." ★

Great diversity characterised the new company arrivals. But all were required to respect Norway's safety regime. (Photo: Lundin Energy Norway)

2000s

- **2000:** Acknowledgement of compliance (AoC) scheme introduced. Obligatory from 2004.
- **2001:** Safety Forum established.
- **2004:** PSA established by hiving off the NPD's safety division. Receives supervisory responsibility for operations on the NCS and at petroleum plants on land.
- **2004:** Regulatory Forum established.

2010s

Goliat, the first oil field in the Barents Sea, came on stream in 2016. A knowledge project pursued by the industry and the government in the 2010s was important for preparing them to pursue activities on the far northern NCS. (Photo: Anne Lise Norheim)

BY EILEEN BRUNDTLAND

Hot and cold in the far north

New areas of the Barents Sea were opened in the 2010s, and important knowledge gaps closed. Exploration set new records. The coldest part of the NCS is now hotter than ever – because of a war.

The far north of the NCS attracted much attention in the early 2010s, with Norway and Russia agreeing a boundary in the Barents Sea and great expectations aroused by its Barents South East area.

The latter was opened for petroleum activities in 2013, while the NPD estimated that about 40 per cent of Norway's undiscovered petroleum resources lay beneath the far northern NCS.

Exploration activity in this region was nothing new – the Barents Sea was opened for drilling in 1980, and several discoveries had already been made.

However, little had been done up to 2010. The question was whether the industry knew enough to handle the risk associated with exploring for, developing and operating fields in these vulnerable waters.

The need to close knowledge gaps led to extensive work being done to learn more, both by the petroleum sector itself and by the authorities.

PROJECT Industry association Norwegian Oil and Gas got to grips with the issue through a project on HSE challenges in the far north which involved companies, unions and the government.

Its goals were to increase knowledge about challenges in this region, and to help establish a shared understanding of the issues involved.

"When we launched the project, views varied about how far activities in the far north differed from those in more established areas of the NCS," says Aud Nistov, manager for HSE and standardisation at the association.

"Some people felt petroleum operations in the Barents Sea were exactly like those in the North and Norwegian Seas. Others feared big challenges related, for example, to cold and distance."

She headed work on the project, which identified important issues related to a number of topics, such as climate and communication as well as health and the working environment.

Others include helicopter logistics and emergency response, risk management and design, general preparedness and infrastructure, maritime logistics and icing control.

"We started with a literature study which provided an overview of what we already knew and where we needed to learn more," Nistov explains.

"Our findings were then shared with the industry through a series of themed work seminars. Everything was presented in a report, which included a list of the questions which had

been clarified and a few aspects where more work was needed.

"It was important that both sides of the industry acquired a common understanding of what we knew and didn't know. Some of this had been known since the days of the heroic Polar explorers, but was not systematised and shared.

"Other areas required more research and new solutions. But the most important consideration was nevertheless that the project was taken over and further pursued by the industry itself."

Among other examples, she highlights the Barents Sea exploration collaboration (Basec). A number of operator companies involved in exploration drilling in these waters joined forces to share experience from their operations.

"The knowledge project has been important, but will first become significant for safety when its findings are applied in day-to-day activities," Nistov emphasises.

BIG COMMITMENT As a result of the big interest in the far north, the PSA was given funding for six large knowledge projects pursued over several years.

It also highlighted the far north as one of its top priorities in 2014-16. And the specialist Arctic Safety conference was staged three times in 2013-18.

In addition, the Arctic Offshore Safety Forum was established in 2015 to share knowledge between official regulators in countries with petroleum operations above the Arctic Circle.

"Our most important message to the industry is that the challenges in the far north must be overcome through collaboration and knowledge sharing," says Finn Carlsen, director of professional competence at the PSA.

"The knowledge project pursued by the industry and government in the 2010s was important in

"Once it's decided to pursue petroleum operations in an area, a high level of activity is positive."

Finn Carlsen, director of professional competence at the PSA.

preparing the industry and the authorities for activity in this region.

"Developments in the Barents Sea have so far shown that it is possible to operate under the prevailing conditions in these waters."

NEW BOOST Enthusiasm for the far north cooled somewhat in the late 2010s. A combination of disappointing exploration results and an oil price dropping towards USD 30 per barrel meant profitable projects were put on the back burner.

"But we mustn't forget that big volumes are already being produced in the Barents Sea from both Snøhvit and Goliat," cautions Carlsen.

"And even though the size of the discoveries made perhaps falls short of expectations, substantial fields such as Johan Castberg and Wisting are in the process of being developed."

Located about 100 kilometres north of Snøhvit, Johan Castberg is due to come on stream in 2024. And a PDO for Wisting, which lies some 300 kilometres off northern Norway, is expected in late 2022.

Carlsen feels the increased interest in these waters is good for safety. "Once it's decided to pursue petroleum operations in an area, a high level of activity is positive.

"It means better infrastructure and more resources for developing good standards. Again, collaboration is important. Companies exploring or operating fields in the Barents Sea must cooperate on finding good solutions."

INTERNATIONAL POLITICS Future activity in the far north, sustainability and political conditions in Europe are all subjects high on the agenda in the industry today.

"The international political position in Europe means that safety and regularity are more important than ever," emphasises Carlsen.

That also applies to the far north of the NCS, where one of the big questions is the status of the Barents Sea as a gas region.

"If the position in Europe means that demand rises for Norwegian gas, this will be significant for Barents Sea developments," says Carlsen.

"That'll also change company assessments of the profitability of smaller existing discoveries. Exporting gas from the region has been constrained by liquefaction capacity at Hammerfest LNG.

"Gas pipeline operator Gassco is now assessing opportunities for and the consequences of expanding such exports, both via the pipeline system to Europe and by increasing LNG capacity."

He notes that another option has also been introduced through the Barents Blue project focused on the far northern county of Finnmark.

"This calls for natural gas to be piped ashore there in order to produce ammonia which can then be freighted from the region by ship." ✱

The floating facility for Johan Castberg being outfitted at Stord in western Norway. This has come furthest of several large projects currently under way in the Barents Sea. (Photo: Øyvind Midttun)

2010s

- **2011:** Common regulations for petroleum activities offshore and on land.
- **2018:** PSA given regulatory responsibility for carbon transport and storage.

2020s

Aker BP and Equinor plan to develop a number of discoveries between Oseberg and Alvheim in the North Sea, with a PDO due to be submitted in 2022. Provisionally called Nokia, this will be one of the biggest projects on the NCS in coming years. (Illustration: Aker BP)

BY ØYVIND MIDTTUN

Intensive and a little concerned

The early 2020s is a hectic time on the NCS, with the level of activity rising, a record number of developments on the way and a fight over the best brains. In these conditions, the PSA wants attention given to capacity and competence.

Since the start to production on Ekofisk, 119 fields have been developed on the NCS. At 31 December 2021, 94 were on stream – 71 in the North Sea, 21 in the Norwegian Sea and two in the Barents Sea.

Most PDOs are more or less fulfilled. Even after 50 years, however, projects are still failing to meet schedules, budgets and quality. That can affect HSE requirements in both development and operational phases.

CONSEQUENCES

A period of particularly high development activity is looming for the NCS. But experience shows that it is hard to stick to plans and costings at such times.

"The pressure may have consequences for complying with safety and working environment requirements," says Inga Lina Austnes, who works with Per Eivind Steen on project follow-up at the PSA.

"That's because it can affect the quality of technical deliveries and of safe start-up and operation."

The main reason for the increase in activities is temporary changes made to Norway's petroleum tax regime in 2020 as a stimulus during the coronavirus pandemic.

These measures, which include tax reliefs for development plans submitted before the end of 2022, were adopted at a time when oil prices were low.

These have subsequently risen, alongside record demand for Norwegian gas as a consequence of the war in Ukraine. That has further lowered the investment threshold at the companies.

While just eight PDOs were submitted to the government in 2021, several tens of such applications are expected this year.

CONCERNS

An important question in these circumstances is whether the industry has sufficient time and enough personnel to carry out such levels of work.

"The high level of activity will put pressure on resources," says Steen. "Adequate capacity and competence are crucial for good project execution.

"This concerns the actual PDO, the preconditions for these plans, and capabilities in the execution phase. Realising a number of these projects depends on hitting the 2022 deadline."

He points out that the basis for good execution is laid in the planning phase.

"When schedules are speeded up and thereby squeezed, a danger exists that decisions get taken on an inadequate basis. An insufficiently matured decision base can affect the whole course of a project."

SUFFICIENT

"Most companies can perhaps stretch to delivering a PDO, but the question is whether they can manage to secure sufficient capacity and competence for the execution phase," adds Austnes.

"We've also seen that a connection exists

between incidents in the early production phase and weaknesses in design and fabrication."

To avoid that, it is important that the companies utilise the overall knowledge and experience they have built up through 50 years of developments, she emphasises.

"They should purposefully draw on lessons learnt in earlier projects, and share experience between them."

STUDIES

The PSA has acquired much information on how companies can manage future developments in ways which ensure that safety is well taken care of.

In 2019, for example, it commissioned a study of the Goliat, Aasta Hansteen and Ivar Aasen developments which aimed in part to identify challenges.

Underlying causes and recommendations for improvements in the companies' execution methods and government follow-up were also covered.

The subsequent report contains many important lessons for the oil companies, the suppliers and the authorities.

A new study was carried out on behalf of the PSA in 2021 to identify indicators which can be used to spot HSE challenges in projects as early as the pre-PDO planning phase.

Among other benefits, these indicators can say something about the status of the work on maturing a project and identifying risk.

"Most companies can perhaps stretch to delivering a PDO, but the question is whether they can manage to secure sufficient capacity and competence for the execution phase."

Inga Lina Austnes, company contact, PSA

«Licensees must make provision for the operator to do its job as required by the regulations.»

Per Eivind Steen, PSA

2020s

- **2020:** PSA given regulatory responsibility for renewable energy production offshore (including wind power).
- **2022:** PSA given regulatory responsibility for recovery of seabed minerals.

A third study now under way aims to pinpoint similar indicators for the phase between submitting a PDO and bringing a field on stream.

Also being pursued on behalf of the PSA, this work is due to be completed towards the end of 2022. All these reports are or will be available at psa.no.

RESPONSIBILITY Steen emphasises that licensees also have a clear responsibility to contribute to work in a production licence.

"They must both support and challenge the operator – and are under an obligation to take action if they uncover conditions which don't comply with the rules," he says.

"Operators are responsible for executing developments on the NCS in accordance with the PDO and applicable safety requirements. Licensees must make provision for the operator to do its job as required by the regulations."

SUPERVISION The PSA supervises the work of the companies during the planning and development phase, and participates as an observer in a number of production licences.

Its attention in the early phase is concentrated on project management by the company and how it works to ensure that safety is taken care of once the facility becomes operational. ✶

TEN COMMANDMENTS FOR DEVELOPERS

Project development on the NCS has improved a great deal since such activities began in 1970, and meets a high international standard today for both HSE and value creation.

The study of field development projects on the NCS carried out for the PSA in 2019 summarised company experience with project developments in 10 key learning points or "commandments".

1. A good HSE result equals high value creation

2. A good and detailed concept selection process, independent of company policy considerations, lays the basis for all future value creation (and for good HSE)

3. Accurate technical detailing/maturing at choice of concept (decision gate 2) and PDO (DG3), plus sensible use of new technology, are the most important requirements for a successful project

4. The project organisation must ensure learning and experience transfer, and have clearly defined responsibilities – with associated delegation of authority and a thoroughgoing "one team" mindset

5. Early involvement of the industrial safety organisation and future operations personnel is crucial for the HSE quality of the end product

6. Strategies for project and contract execution must be tailored to the assignment's complexity and market capabilities (which change over time)

7. Prequalification for and evaluation of key contracts must give heavy emphasis to the contractor's execution capability, understanding of risk and level of expertise

8. The follow-up team must have good expertise on risk and project management, the work content of the contract and the contractor's culture and attitudes, and ensure continuity in key posts (both its own and at the contractor)

9. Technical documentation and project status must always be completely truthful and available to the joint venture and the government

10. Principles, criteria and the division of responsibilities for testing the facility, delivering to operations and starting production must be established early in order to achieve a safe start-up

MILESTONES

EARLY YEARS

When the first exploration well was spudded on the NCS in 1966, regulatory responsibility for safety rested with the then Ministry of Industry.

No regulations for safety and the working environment had been put in place, but the government assumed that the companies would comply with recognised norms.

US industrial standards dominated, which was natural enough since most of the early players were American. The companies brought not only valuable knowledge and experience, but also a work culture alien to Norway in a number of ways.

Many of the Norwegians employed in the early days had little or no relevant technical education. Training often consisted of a quick introduction by the individual's supervisor.

Statistics for accidents and injuries in these years are very deficient, but risk – particularly for personal injury – was undoubtedly pretty high.

REGULATOR CREATED

Establishing state oil company Statoil and the NPD by the Storting (parliament) in 1972 clarified the division of roles between government, industry and regulators.

The NPD was initially responsible for regulating both resources and safety. But the job of safety regulation was separated off in 2004 to the PSA.

Work on a regulatory regime for safety led to the first regulations – for drilling in 1975 and production in 1976. This created a formal and predictable safety role for the NPD.

*The Storting voted to establish the NPD in 1972. (Photo: Arne Ove Bergo/*Dagsavisen*/Samfoto)*

FOR SAFETY

BLOW-OUT!

Among the many serious accidents which occurred in the early years, the oil blowout on the Ekofisk 2/4 Bravo platform in 1977 was particularly significant for safety developments.

Nobody died or was seriously injured, but this incident was a serious wake-up call to the whole of Norwegian society about the potential for major accidents in offshore petroleum operations.

The investigation report after the blowout identified a lack of expertise as one of its direct causes.

A number of measures were instituted by the government, including the appropriation of large sums for research programmes on safety.

The Bravo blowout happened in April 1977. (Photo: Oddvar Walle Jensen/NTB)

RESPONSIBILITY CLARIFIED

The detailed requirements in the initial regulations and the way they were enforced meant that the players did not take full responsibility for their own decisions. Instead, they relied on the specific demands and orders imposed after NPD inspections.

However, guidelines on internal control issued by the directorate in 1979 emphasised that responsibility for safety rested with the companies concerned.

That laid the basis for a shift of orientation in government regulation away from specifying technical details towards exercising supervision of the company's own management.

At the same time, a gradual process began to replace specific regulatory rules with performance-based requirements which identified what had to be achieved.

MILESTONES

REGULATORY REORGANISATION

The *Alexander L Kielland* flotel disaster in 1980 and the subsequent technical investigation focused attention on the way the government's regulatory responsibility was organised.

It emerged that unclear boundaries between agencies could impose restraints on further safety improvements.

The government accordingly decided that the NPD would be the lead regulator from June 1985 for offshore petroleum operations, covering both fixed and floating facilities.

Various other agencies which had previously had a regulatory responsibility for these structures would now be confined to giving technical advice to the NPD as and when required.

Furthermore, improved coordination was established between those regulators which were still to have an offshore role.

The Broken Chain *monument commemorates the* Alexander L Kielland *disaster in 1980. (Photo: Kai-Wilhelm Nessler/Samfoto/NTB)*

UNIFIED REGULATIONS

Following the 1985 reorganisation, the NPD became the owner of many regulations developed by other agencies with differing approaches as well as overlapping and contradictory provisions.

A comprehensive revision of these ordinances resulted in 14 regulations divided into technical subjects relevant for the industry. These came into force in 1992.

It eventually transpired that this structure was sub-optimal in terms of the growing attention being paid to a company's own ability to manage the safety of its activities.

Another regulatory reform completed in the early 2000s split the regulations up in accordance with the main functions in the industry's operations, an approach which has persisted with minor modifications.

FOR SAFETY

THREE PARTIES

Collaboration between companies, unions and government has always been a cornerstone of supervision by the NPD and later the PSA, and remains a precondition for the current regime.

This relationship was formalised in 2001 with the creation of the Safety Forum to initiate, discuss and follow up relevant safety, emergency preparedness and working environment issues.

With the PSA in the chair, this tripartite body deals with major accident and working environment risk, collaboration and a number of other significant conditions in this area.

Another important arena for tripartite action is the Regulatory Forum for information, discussion, advice and feedback on the work of developing and maintaining the regulations.

RNNP

The 1990s were characterised by company mergers and the outsourcing of non-core activities, creating uncertainty about possible negative effects on safety.

Up to 2000, the PSA developed an instrument in cooperation with the companies and the unions to determine whether risk was increasing or decreasing.

Known as the trends in risk level in the petroleum activity (RNNP), this tool processes data about a large number of risk types in an advanced computer model.

It has put an end to lengthy discussions between the parties about how risk is developing, so that energy can be devoted to those areas with the greatest need.

The annual RNNP report has become an important part of the basis for planning the PSA's supervisory activities. It also helps the companies to plan their risk-reduction efforts.

The RNNP tool also provides an important basis for the PSA's supervision. (Photo: Morten Gjerstad)

MILESTONES FOR SAFETY

Anne Myhrvold, director general, PSA.

A NEW AGENCY

The government resolved in late 2002 to establish a new regulator to take over work on safety and the working environment in the petroleum sector from the NPD.

Effective from 1 January 2004, the creation of the PSA had no immediate impact on the regulatory regime. This continued to be maintained and developed in line with existing principles.

The PSA also took over regulatory responsibility from the start for eight petroleum-related facilities based on land in Norway.

EXPANDED RESPONSIBILITY

In recent years, the PSA's responsibilities have been expanded in order to apply its knowledge of and experience from supervising safety in the petroleum sector to new areas.

These include carbon transport and storage, renewable energy generation at sea (offshore wind power) and recovering seabed minerals.

"The PSA's expertise is supervising industrial energy activities both offshore and at land plants. In its areas of responsibility, it will ensure well-functioning parameters as well as clear and competent supervision," says Anne Myhrvold, director general of the PSA

"In that way, the authority will help ensure that the energy transition and the new industrial activities are pursued well and prudently." ✶

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