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DIALOGUE

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THE LEGACY OF PIPER ALPHA

PIPER ALPHA 30 years

Front cover photo: NTBScanpix/PA Photos.

Why Piper Alpha?

The 30th anniversary of the Piper Alpha disaster falls this summer. One hundred and sixthy-seven people lost their lives when this platform in the UK North Sea was destroyed on 6 July 1988.

We have chosen to devote this issue of *Dialogue* to that incident – what went wrong, what were the consequences and how it remains relevant to safety work today.

A pertinent question might be – don't such old incidents as Piper Alpha and Norway's *Alexander L Kielland* flotel belong in the history books?

Haven't we exhausted their potential for teaching lessons, improving safety and making progress? Shouldn't we focus instead on the progress made on the Norwegian continental shelf and its current high level of safety?

The short answer is no. We must and will talk about such major accidents.

Because they remind us that we work in a high-risk industry which could be hit by disaster again. Because they show how badly things can go wrong if we don't work constantly to prevent incidents, reduce risk and improve safety.

Read and learn.

Øyvind Midttun
Editor

BY Eileen Brundtland

Still making its mark

The tragedy which hit Britain's Piper Alpha facility on 6 July 1988 remains one of the worst imaginable scenarios for everyone working in and with the petroleum industry. PSA director general Anne Myhrvold believes the incident is still highly relevant.

"Although the disaster didn't happen on the NCS, it's important for everyone working in this industry regardless of country," she observes.

"The accident served as a reminder that we must work constantly to prevent serious incidents, reduce risk and improve safety."

Important

"The industry fortunately doesn't have many major accidents to look back on," Myhrvold observes. "That makes it all the more important to commemorate Piper Alpha."

She says this disaster should be remembered both as the human tragedy it was and as an example of what a major accident means for the industry and the rest of society.

"We generally take it for granted that everyone comes home from work as healthy and whole as when they left. That's how it must be. It's nevertheless important to be reminded that the worst imaginable can actually happen."

Lessons

Myhrvold emphasises that Piper Alpha taught the industry many lessons, and believes the accident has had and retains great significance for safety work.

That applies not only on the UK continental shelf but also for the whole industry. Most importantly, the lessons after the accident are still relevant.

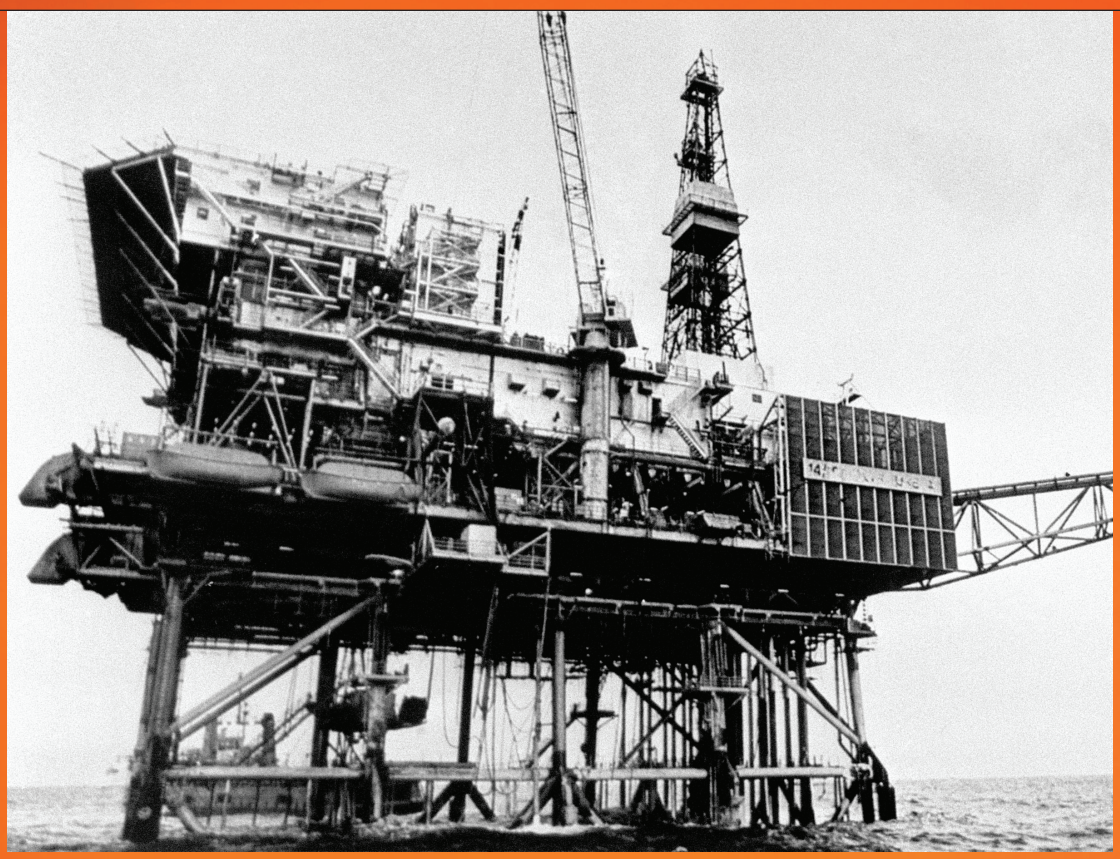
"We still see serious incidents, including on the NCS, which expose failings in key areas such as planning, expertise, management and compliance with procedures," Myhrvold comments.

"It's important to keep accidents like Piper Alpha in mind in order to check *that* we have learnt and, not least, that we *use* what we've learnt."

Although 30 years have now passed, she says it is important that young people entering the industry learn from history and understand the significance of what happened on the platform.

"Risk isn't something which can be reduced to arithmetic. All of us working in this sector need to be reminded from time to time of what can happen when things go really wrong."

Piper Alpha before disaster struck. It is important that young people entering the industry, learn from history and understand the importance of what happened on the UK platform, says PSA director general Anne Myhrvold. (Photo: NTBScanpix/PA Photos)



Responsibility

After the disaster, responsibility for safety in Britain's petroleum sector was transferred to the Health and Safety Executive (HSE). It remains there today.

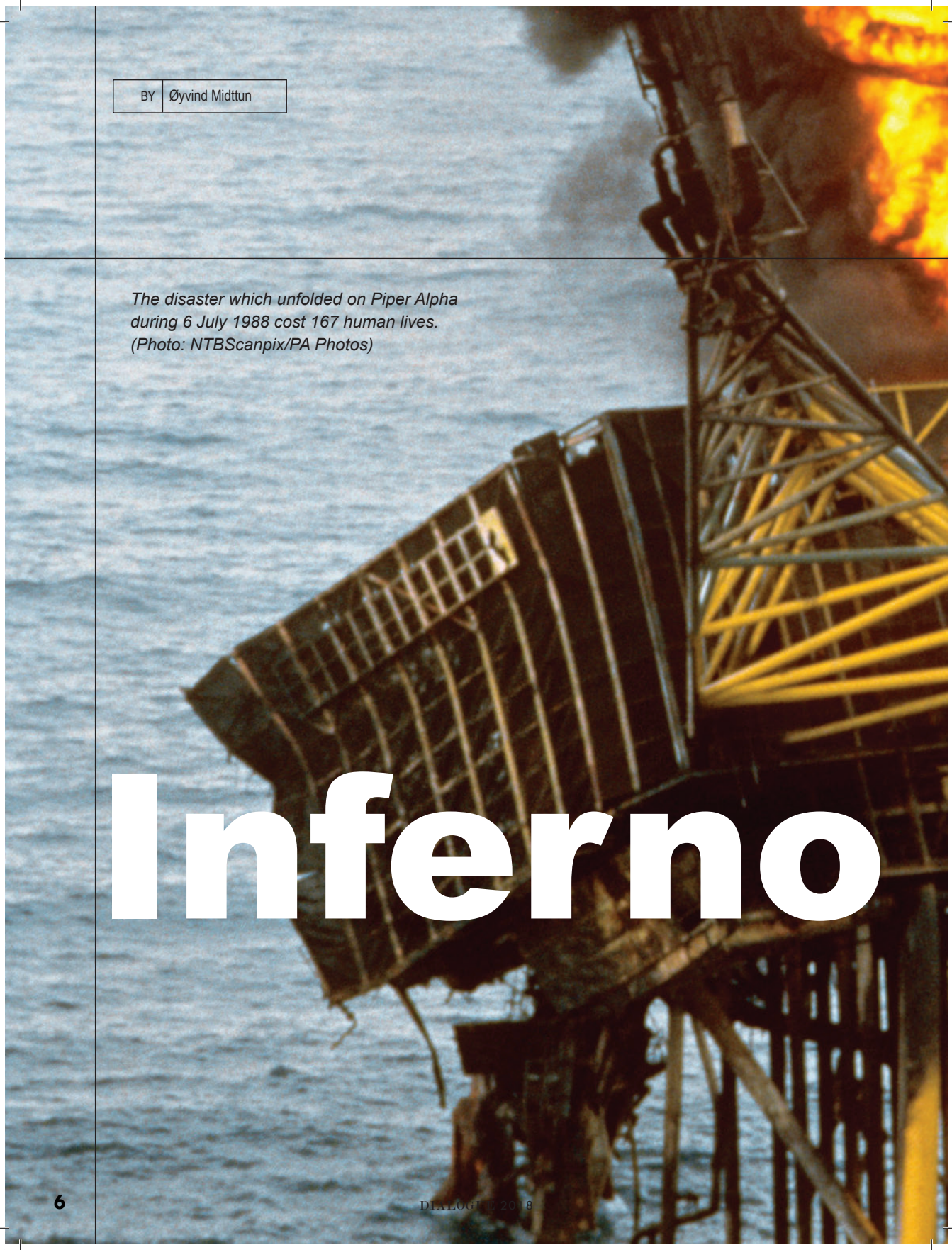
"Contacts between us and the HSE are close and good," says Myhrvold. "We face related challenges, and ensuring that we maintain a good collaboration is essential.

International

The UK is due to mark the 30th anniversary of the incident in Aberdeen on 5-6 June this year. Myhrvold will also be present at this event along with a number of top executives from the International Regulators' Forum (IRF).

"It's valuable that safety regulators from around the world come together at a Piper Alpha commemoration, in part to honour the 167 people who died," she emphasises.

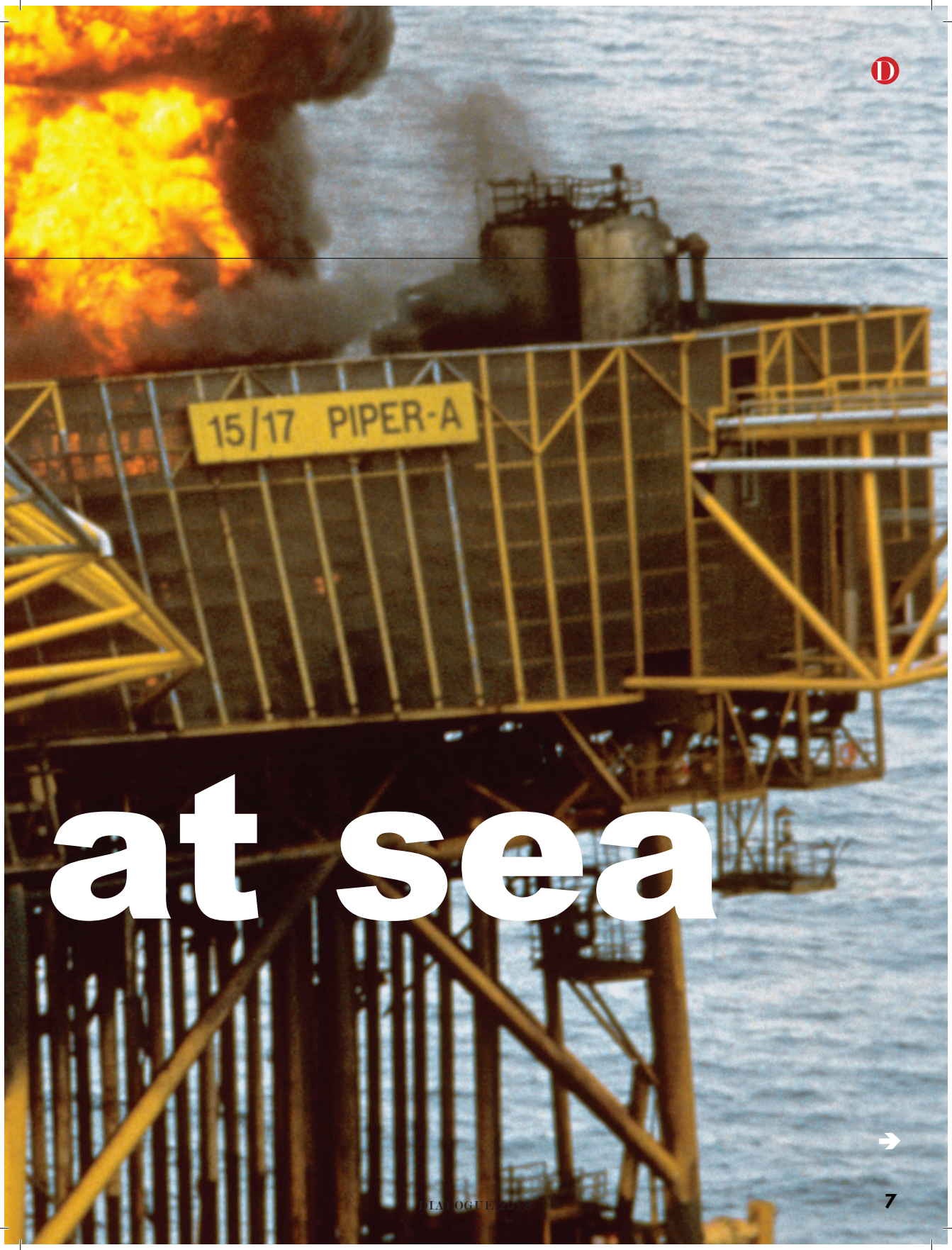
"This also allows us once again to assess the disaster in the light of today's safety position and efforts to prevent similar incidents." ●



BY Øyvind Midttun

The disaster which unfolded on Piper Alpha during 6 July 1988 cost 167 human lives. (Photo: NTBScanpix/PA Photos)

Inferno



at sea

No other accident in the offshore petroleum industry so far has cost so many human lives as the blaze which began on Piper Alpha in the late evening of 6 July 1988.

The disaster began to unfold after gas started to leak from a condensate pump. This was shut down for maintenance when an operating problem meant the other pump in the system also had to stop.

A failure of communication meant that the control room operator started up the unit being maintained without realising that the work was unfinished.

The substantial leak of condensate and gas which resulted caught fire and exploded before anyone managed to intervene.

CONVERTED

The Piper Alpha facility was originally designed and constructed for oil production, but was converted after a few years towards producing gas.

This was partly because the share of gas from the field rose as oil output declined, and partly because gas from nearby sources were sent to the platform for processing and transport to land.

Since the facility had been designed to produce oil, however, firewalls in the process area were not dimensioned to withstand the pressure which can arise from a gas explosion.

The blast which occurred on 6 July blew out several panels in a firewall. One of the fragments cut a pipe carrying condensate, and a new fire started.

PRINCIPLE

Piper Alpha's original design took a recognised approach in placing the most safety-critical areas as far as possible from vulnerable zones such as the control room and living quarters.

But that principle was breached when modifying

One of the Piper Alpha survivors comes ashore in Aberdeen. Many of those who survived had opted to jump into the sea, and were picked up by vessels in the area. (Photo: NTBScanpix/PA Photos)

Piper in brief

The Piper field was discovered in 1973 and came on stream three years later with Occidental Petroleum as its operator. It had been developed with one large production facility on a steel jacket.

This platform was one of the biggest on the UK continental shelf, and at peak produced more than 300 000 barrels of oil per day – or 10 per cent of total British crude output.

Originally constructed for oil production, Piper Alpha was converted towards producing gas after a few years as crude output declined.

The platform received and processed gas from several other fields. It was linked by pipeline to Tartan, Claymore and the MCP-01 pumping and gas compression facility midway between Frigg and the St Fergus terminal in Scotland.

the platform to accept and process gas from other fields. Gas compression, for example, was located close to the control room – a move which had consequences for the way the accident developed.

Firewater pumps on the facility were normally meant to start automatically when a blaze was detected. But they had recently been placed in manual mode.

This was because divers were working close to the platform, and it was feared they might be at risk from getting too close to the water intake while the pumps were running.

When the fire broke out, two people donned protective suits and tried to get to the pump room for a manual start-up. They were never seen again.

SHUTDOWN

Immediately after the explosion, the emergency shutdown (ESD) system on Piper Alpha was activated and the fire should therefore have died out by itself.

Instead, the blaze was kept alive and reinforced because facilities on other fields which were tied back to the platform continued to produce to it.

Piping damage caused by the explosion meant that large quantities of hydrocarbons flowed into the area which was engulfed in flames.

The control room had to be abandoned less than 10 minutes after the first explosion. Messages could no longer be given over the public address system, and organisation of further work became very difficult.

REFUGE

Emergency procedures specified that personnel should muster to the lifeboats, but the fire prevented that. People therefore sought refuge in the living quarters, with its protective firewalls.

Many of those on board chose to jump into the sea, and most of the survivors were picked up by ships which were in the area or arrived from elsewhere.

The fire and smoke, combined with the wind direction, rendered helicopter evacuation impossible. Smoke and combustion gases eventually began to enter the living quarters.

Despite the drama on Piper, the neighbouring Tartan and Claymore fields continued to produce and send gas to the Alpha facility.

This was because their managements lacked the authority to shut down production without clearance from land. Nor did they have an adequate overview of conditions on Piper.

FRACTURED

After the fire had been under way for 25 minutes, the riser from Tartan fractured because of the heat. It had a diameter of 45 centimetres and was under a pressure of 160 atmospheres.

A huge ball of fire then enveloped the whole doomed platform. The flames rose more than 100 metres into the air. The failure of the Claymore riser 25 minutes later further reinforced the blaze.

SANK

Two hours after the first explosion, Piper Alpha disintegrated. The bulk of the facility, including the living quarters, sank beneath the waves.

One hundred and sixty-five of the 226 people on board when the accident happened died. Another two people were also killed on a support vessel which took part in the rescue operation.

Thirty of the dead were never found. Of the 61 survivors, many suffered major burns. ●

The burnt-out remains of Piper Alpha on 7 July 1988, the day following the disaster. Two hours after the first explosion, most of the platform – including the living quarters – vanished beneath the waves. (Photo: NTB-Scanpix/PA Photos)

BY Øyvind Midttun

Learnt lessons

A lot has happened in the 30 years since the Piper Alpha disaster, but experience gained from it is just as relevant today, director Chris Flint at the UK Health and Safety Executive (HSE) emphasises in this interview.

How has this incident affected safety work – and the level of safety – in the UK over the three decades which have passed?
As a result of Piper, the UK offshore sector has a much stronger legislative framework specifically developed to address the Cullen inquiry recommendations. The enhancement of legislation with supporting guidance and performance standards offers clarity on compliance expectations across a range of complex technical areas.

The role of the permit to work, management of change and contractor management in the Piper disaster elevated the understanding of "softer" issues or management system arrangements and their potential impact on the management of major accidents.

Worker involvement and consultation are now a key part of offshore operations, with strong tripartite engagement established. The resultant standards have become embedded in day-to-day operations and, as such, have become part of the offshore safety culture.

What are the most important lessons learnt?
The lessons from Piper remain as relevant today as they were 30 years ago. They include the need for strong leadership in the area of major accident hazards, the need to achieve a balance between technical controls and effective management arrangements to deliver overall safety performance, and robust monitoring and auditing arrangements which offer assurance that controls remain effective.

As a regulator, we must ensure that the work we do

A survivor from Piper Alpha on their way into hospital. The fallout from the disaster proved far-reaching in the UK, and still makes its mark on discussions about safety. A major conference is being staged on this subject in connection with the 30th anniversary. (Photo: NTBScanpix/PA Photos)

Many people are concerned to transfer lessons from Piper Alpha to new generations. A lot of what was learnt from the accident is still equally relevant today. (Photo: NTBScanpix/PA Photos)

remains focussed on pertinent issues and that inspections and investigations are undertaken with sufficient depth to deliver learning and improvements in standards. Both the industry and the regulators must guard against complacency and find new ways to deliver key messages so personnel remain engaged, and must demonstrate a commitment to a strong, open safety culture.

Finally, we should ensure we do not limit learning to past events but continue to anticipate new industry developments and challenges and to adapt our approach to deliver a proportionate and robust level of regulation throughout an asset's life cycle.

How are you marking the 30th anniversary?

The HSE is on the organising committee for and is participating in the *Safety 30 Conference – Piper Alpha's Legacy: Securing a Safer Future* being held on 5 and 6 June 2018 at the Aberdeen Exhibition and Conference Centre. Lord Cullen, who chaired the public inquiry into Piper Alpha, will deliver a keynote address.

This is a joint conference between the UK oil and gas industry and the Global Offshore International Regulators' Forum. How the legacy of Piper has shaped current operations and how we continue to create an even safer future are the focus of the event.

In particular, the conference will look at how the lessons of Piper can be communicated to new entrants to the oil and gas industry from a post-Piper generation, and the importance of transferring experience from one generation to the next. ●

Maintaining awareness of the causes of Piper Alpha and the consequences of the accident is important, says Chris Flint, director of the energy division at the UK Health and Safety Executive (HSE). "The lessons from Piper remain as relevant today as they were 30 years ago," he says. (Photo: HSE)

The HSE in brief

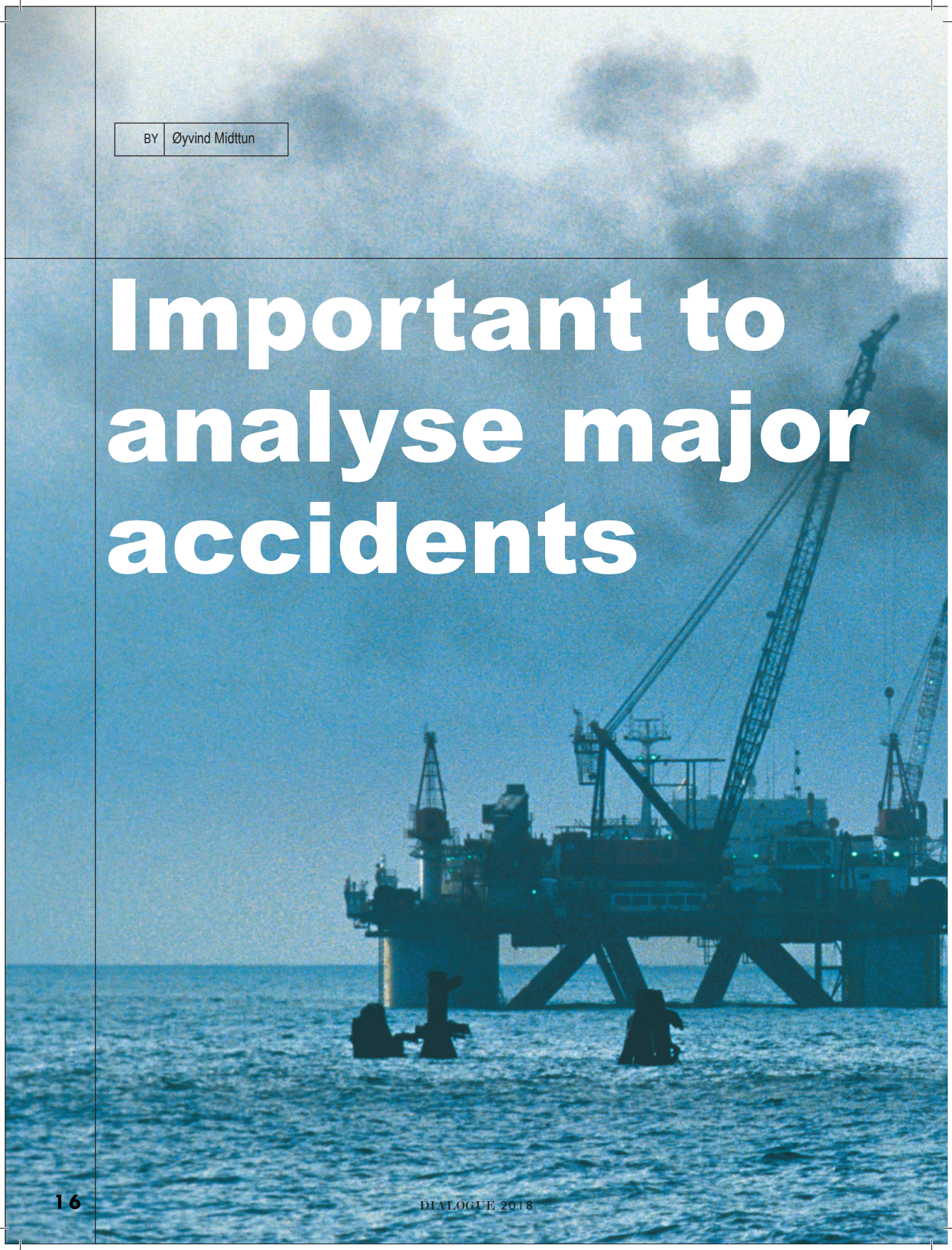
Following the Piper Alpha disaster, regulatory responsibility for offshore operations on the UK continental shelf were transferred from the energy department to the Health and Safety Executive (HSE).

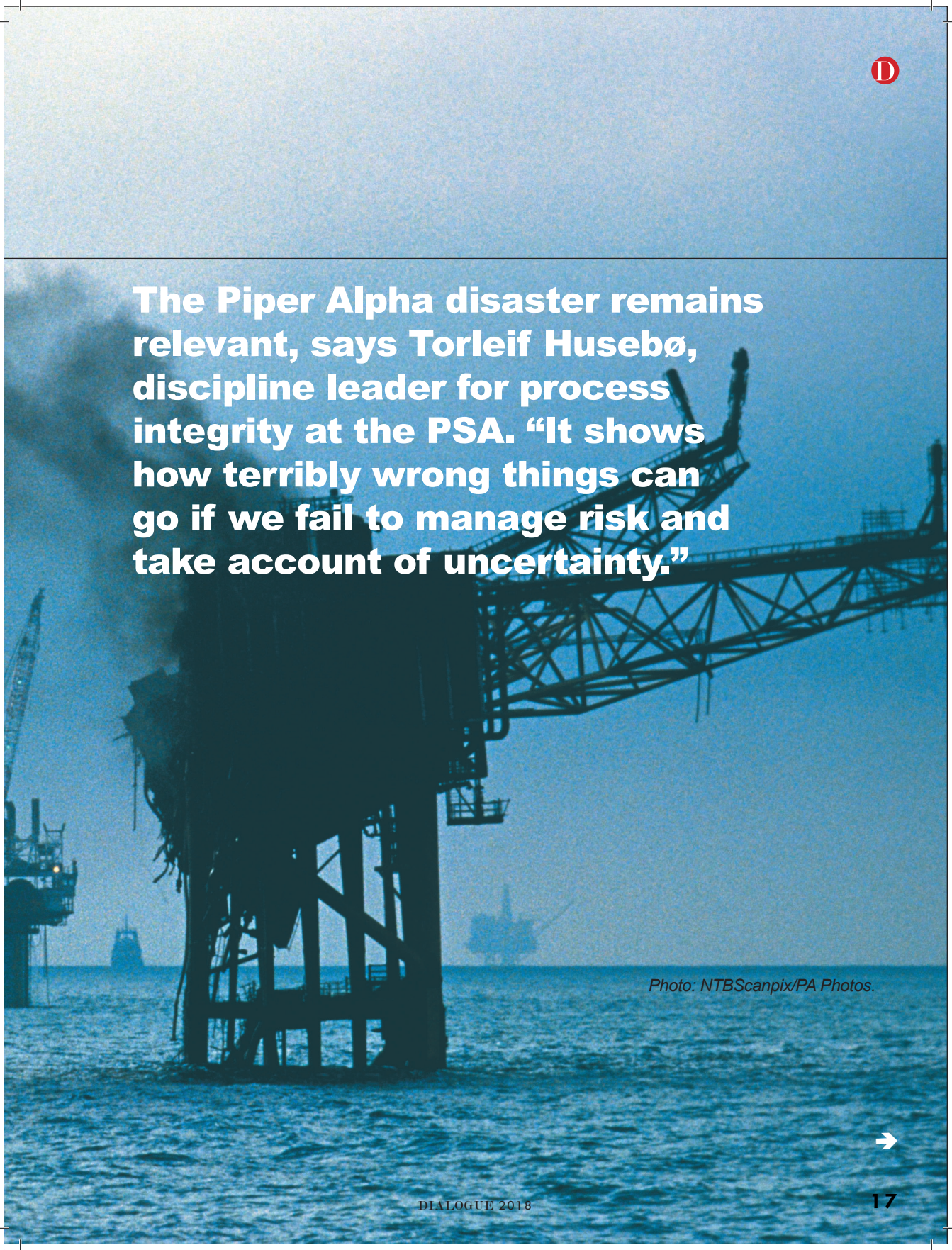
This agency supervises safety and the working environment in a number of industrial sectors, from agriculture and aviation to police and petroleum.

Follow-up of the offshore sector rests today with the HSE's energy division, headed by Chris Flint.

BY Øyvind Midttun

Important to analyse major accidents





The Piper Alpha disaster remains relevant, says Torleif Husebø, discipline leader for process integrity at the PSA. "It shows how terribly wrong things can go if we fail to manage risk and take account of uncertainty."

Photo: NTBScanpix/PA Photos.

This year's 30th anniversary of the UK offshore accident provides an opportunity to reflect on what went wrong, which consequences it had and why it remains relevant for safety work today.

BARRIERS

"An important reason why this incident developed into such a huge disaster was the safety barriers around nearby fields and facilities producing towards Piper," explains Husebø.

"Isolating energy between the facilities built on each of them controlling its own production. They were self-managed, there was nothing automatic about shutdowns and platform managements lacked a clear mandate to cease production."

This meant that halting output from a neighbouring facility which produced to Piper Alpha had to be based on a message from the *receiving* facility.

"The position on Piper was so serious and confused that the other installations weren't notified, and continued to produce towards a platform which then had at least two fires. That caused the incident to escalate into a disaster."

AWARE

"Leaders on the other facilities were early aware that something had happened on Piper," Husebø observes. "But they failed to make a balanced assessment of the assumed risks and weren't sufficiently cautious in their approach."

In other words, he says, they put production concerns ahead of safety on the basis of *assumptions* – that Piper had enough firewater to handle the position and that things were under control since pressure in their own pipelines stayed stable.

"An additional circumstance was that they hadn't trained on emergency response with the other facilities – they'd undoubtedly failed to envisage this type of major accident.

"Such a far-reaching incident was more or less inconceivable. When you haven't trained, it's difficult to be sufficiently well prepared to handle an actual event."

INQUIRY

The disaster was investigated by an official commission of inquiry headed by senior Scottish judge Lord Cullen, which began its work in November 1988.

After an in-depth examination of the actual incident and the British safety regime, this body submitted a report which ran to 800 pages.

It criticised operator Occidental and the British energy department and made a total of 106 recommendations for improving safety on the UK continental shelf (UKCS).

During its work, the commission had shown great interest in the structure of Norway's offshore safety regulations and regulatory regime.

A number of the proposals made were also inspired by the Norwegian regime, includ-

Torleif Husebø at the PSA emphasises that unforeseen things can always happen in petroleum operations. Disasters such as Alexander L Kielland *in 1980, Piper Alpha in 1988 and* Deepwater Horizon *in 2010 showed the big risk potential in this industry. (Photo: Anne Lise Norheim)*

ing the allocation of responsibility, the supervisory system and legal provisions.

TEST

"The Piper Alpha investigation also became in many respects an indirect test of our own safety regime," says Husebø.

After the *Alexander L Kielland* flotel turned over in 1980 with the loss of 123 lives, this regime was revised and a new division of regulatory responsibility adopted for operations on the continental shelf.

The consent system was introduced in 1985, when the principle of internal control in enterprises also emerged. Although regarded as uncontroversial today, the latter initially encountered fierce opposition from several quarters.

In the wake of the Piper Alpha investigation, however, these critical voices were muted. British improvement efforts following the disaster took Norway as a model to emulate.

BIG CHANGES

The disaster led to big changes in Britain's offshore safety regime, including the transfer of regulatory responsibility from the Department of Energy to the Health and Safety Executive (HSE).

"This was intended to establish a clear distinction between resource management and safety supervision by the state," Husebø notes.

A requirement to produce a safety case for various UKCS activities was also introduced as a result of the inquiry commission's recommendations, he adds.

"Key elements here are that the operator must provide a detailed overview of the risk picture on a facility, and that adequate measures and barriers are put in place to handle relevant scenarios.

"The safety case solution has many features in common with Norway's system of consents for conducting offshore activities."

CONFERENCE

Lord Cullen is due to be a keynote speaker at the conference being held by the International Regulators' Forum and Oil & Gas UK in early June to mark Piper Alpha's 30th anniversary.

Staged in Britain's oil centre of Aberdeen, this meeting will look at how the disaster has affected safety work down to the present day in order to address relevant issues.

A key theme at the conference is scheduled to be how experiences from the incident can be transferred to coming generations.

"It's important that we're constantly conscious of what happened with Piper Alpha and other major accidents which have hit the petroleum sector," observes Husebø.

He notes they show how terribly wrong things can go without expertise to manage risk and take account of uncertainty, and says Piper Alpha is still relevant to current safety discussions.

"In this case, the other platforms saw the fire but continued to produce because they thought the position was under control and failed to appreciate that they had a clear mandate to shut down."

BALANCE

"This challenge of ensuring balance between safe operation and creating financial

"Managements put production concerns ahead of safety on the basis of assumptions – that Piper had enough firewater to handle the position, and that things were under control since pressure in their own pipelines stayed stable."

value remains relevant in the petroleum sector," Husebø says.

"It's also a core element in risk management. Positive safety measures will usually have a positive effect on value creation. But safety-related measures usually also have a cost."

He points out that traditional economic methods are inadequate tools for analysing complex correlations involving great uncertainty – as when dealing with major accident risk.

"Financial cost/benefit assessments are important in a decision process, but it's also important to be aware of the limitations of such analyses.

"It's not the case that *all* safety measure must be adopted, but we in the PSA see many circumstances where such action is initially argued away because the short-term costs are excessive.

"That occurs especially when seeking to reduce the risk of incidents with a low probability, big consequences and great uncertainty – in other words, the elements of a major accident."

As a case in point, Husebø highlights the assessments made by companies related to investing in and implementing subsea isolation valves (SSIVs).

"Such devices can close pipelines in an incident and keep incoming oil and gas out. In a Piper Alpha scenario, with a fire from an ignited riser leak, an SSIV could have prevented the incident becoming a disaster."

Traditional cost/benefit analyses would generally find that the cost of such a valve exceeded the benefit measured in deaths, environmental damage and lost investment, he points out.

"To reach a balanced decision in such a case, however, weight must also be given to conditions which can be difficult to measure in monetary terms. These could include the loss of many lives – or the cost of a poor reputation."

NO GUARANTEE

Much has happened since 1988 in terms of risk understanding, regulations, technology and operational conditions. But it is impossible to guarantee that an incident like Piper Alpha could not happen again.

"As long as you pursue petroleum operations, unforeseen circumstances can arise," emphasises Husebø. "Accidents like *Alexander L Kielland*, Piper Alpha and *Deepwater Horizon* in 2010 show the big risk potential inherent in this industry."

On the other hand, the probability of an incident like the UK disaster of three decades ago is undoubtedly much lower than it was then – even if it is clearly greater than zero.

"We know that the level of safety on the NCS is high, and that progress has been made over time," Husebø says. "But history has limited value when it comes to predicting the future.

"We must remain conscious of the uncertainty and deal with it in an acceptable manner, so that the probability of such incidents is minimised." ●

BY Eileen Brundtland

Parallels seen

Senior union official Roy Erling Furre finds it scary that 30-year-old lessons from Piper Alpha are still relevant today.

"Along with the other major accidents in the industry, such as *Alexander L Kielland*, *Ocean Ranger* and *Deepwater Horizon*, the UK disaster contributed to major changes in safety work," says Furre.

Now head of HSE at the Norwegian Union of Energy Workers (Safe), he recalls that Norway's union movement had many contacts with Britain's Offshore Industry Liaison Committee (OILC) in the wake of Piper Alpha.

"The unions on both sides of the North Sea made a big commitment to preventing another major accident," he says, and points out that the OILC was founded because of the disaster.

"Workers on the UK continental shelf also reacted to the way they were treated before, during and after the incident. Pay was stopped immediately, which imposed added burdens on survivors."

EXAMPLE

"Here in Norway, the *Kielland* accident was still fresh in our minds then and Piper Alpha became another example of what can happen when major accident risk isn't under control," says Furre.

"When we look at the lessons learnt after the British accident, it's scary that some of them relate to issues which are still coming up.

"With Piper, for example, field managers didn't have authority to shut down – for financial reasons. So oil and gas from other platforms were pumped into the fire at a rate of 30 tonnes a second."

That recalls recent debates on the use of remotely operated control rooms, he comments. "Who's going to take the final decisions – the offshore specialists or the controllers on land?"

He also finds it concerning that this year's RNNP report from the PSA on trends in risk level in the petroleum activity shows that Norway's offshore safety climate is deteriorating sharply.

"A big fall in trust emerges from the workforce survey," he points out. "Moreover, the change of generations in the industry has removed a lot of expertise in recent years.

"Training budgets are being cut to the bone at the same time, and far fewer activities are planned to help build up a collective HSE expertise.

"I fear lost expertise and education cuts will also affect the major accident indicator in the longer term. Expertise must move up the agenda – then training budgets can't be set to zero." ●

A Norwegian offshore installation. Union leader Roy Erling Furre in Safe notes that a number of lessons from the disaster remain relevant today. “With Piper, for example, field managers didn’t have authority to shut down – for financial reasons,” he says. (Photo: NTBScanpix)

Tested Norway post-*Kielland*

Serious accidents like Piper Alpha do something with awareness in the whole industry across national boundaries, says Lill-Heidi Bakkerud at the Norwegian Union of Industry and Energy Workers (IE). "We must never lean back and relax."

Lill-Heidi Bakkerud, vice president of IE.

"The UK accident attracted enormous attention in the UK and in the companies, who turned their attention to the threat of gas leaks," says Bakkerud, who is vice president of IE.

"It's not easy to identify what the Piper Alpha disaster has meant for safety work on the NCS. We'd already had our national tragedy with the *Kielland* accident. That led to big changes in the way Norway and its petroleum industry think about safety.

"Perhaps the British disaster became the incident which made manifest that we'd adopted the changes which would guide us in the right direction. After all, the British took many of the same moves as us after Piper Alpha."

LESSONS

Lars Anders Myhre, head of IE predecessor Nopef, was a witness at the Cullen inquiry. Its report spelt out many lessons, and Bakkerud notes that a lot of these are relevant for safety and offshore preparedness today.

"We need to learn from such serious incidents, and Norway should also have appointed a commission or committee at the time to do that job," she says. "But nobody took the initiative."

POTENTIAL

Bakkerud notes that hydrocarbon leaks are still taking place in the industry, and that this kind of incident often has a major accident potential.

"Fortunately, such escapes have steadily declined in number on the Norwegian continental shelf since 2000 thanks to long-term and purposeful efforts by government, companies and employees.

"But we must never lean back and relax. Attention must always be paid to hydrocarbon leaks, because their consequences can be so serious." ●

Never good enough

Risk must be understood and handled well, says Knut Thorvaldsen, deputy director general at the Norwegian Oil and Gas Association. "Piper Alpha was – and is – a powerful reminder of the big accident potential in this industry."

Thorvaldsen describes Piper Alpha as an eye-opener for the whole sector. "Along with 2010's Macondo accident in the Gulf of Mexico, it demonstrates how vulnerable petroleum operations can be.

"These reminders illustrate the value of life and health, and why it's so incredibly important to be on your toes with regard to safety thinking."

Since the UK disaster, he points out, the trend for major accident risk on the Norwegian continental shelf has largely been good.

"Safety has advanced all the time through continuous improvement. But we can never say it's good enough. That's why it is important to work constantly on enhancing safety."

TRENDS

The PSA's RNNP study on trends in risk level in the petroleum activity shows continuous good progress since measurements began in 2000, says Thorvaldsen. "But we still have incidents off Norway we could have done without."

He believes Piper Alpha is a sharp reminder of how badly things can go if risk in the petroleum industry is not well managed.

"The British accident also had a powerful impact in Norway. Lessons from it led in part to stronger awareness of the importance of good barrier management.

"Its causes related to work on hydrocarbon systems and misunderstandings between day and night shifts. These are still highly relevant and something we must always take care of.

"However, systems are greatly improved today. After Piper Alpha caught fire, extinguishing water was unavailable and chaos reigned.

"Now, many safety systems are automatically activated and prevent the consequences becoming so serious. We have explosion-proof walls and deluge systems, for example." ●

Knut Thorvaldsen, deputy director general, Norwegian Oil and Gas Association.

Photo: NTBScanpix/PA Photos.

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