

# DNV Energy News

Information from DNV to the energy industries No. 1 April 2007

## Wake-up call from Texas City

### Also inside:

- CO<sub>2</sub>: keep the red flag flying
- US Coast Guard breakthrough for DNV
- Transpetro: doubling the Brazilian pipeline web



Energy supply is increasingly listed at the top of the global political and business agenda. The world needs energy supplied safely and securely at affordable prices. Hydrocarbon-based energy must be made much cleaner and renewable energy must obtain a bigger share of the overall energy picture.

Such requires push on technology boundaries and market mechanisms to step up to the environmental challenges ahead. If not, the energy future will be uncertain, expensive and dirty.

DNV Energy is in the midst of all this, helping all major businesses and societies to solve energy challenges, from the cold of the Arctic to the heat of Latin America. We are addressing all parts of the value chain – from the exploration of oil fields to the capture and storage of CO<sub>2</sub> – and from idea conception to the implementation of renewable and cleaner energy production.

This is something you will notice in this issue of *DNV Energy News*, our newsletter to customers and partners worldwide. Here we present our global presence within the energy industry, such as our involvement in Europe's and US' carbon capture and storage programmes.

The Texas City Refinery accident in March 2005 provides key learning points to the energy industry in general and the refining industry in particular. DNV has analysed the recent post-event reports and has developed a set of 'go beyond recommendations' which you can read about in this newsletter.

DNV also assists companies with huge growth ambitions, such as Transpetro, Brazil's major pipeline company. Expansion plans are addressing all facets of business ranging from economy, technology, safety, environment and social aspects.

An important recent milestone is the US Coast Guard's authorisation of DNV to carry out plan reviews and inspections on its behalf of all types of offshore units which are classed by DNV and operating on the Outer Continental Shelf (OCS), regardless of flag. This is a major recognition of DNV's expertise and industry contribution over the years.

GlobalSantaFe, one of the world's largest offshore oil and gas drilling contractors, is now being helped by DNV to perform technical assurance assessments on its newbuild semisubmersible, Development Driller III. The goal is to increase safety, reduce downtime, and improve the overall rig performance.

DNV has been assisting oil and gas companies in safeguarding and improving business performance for many years. Today, we are committed to continue to do so in the wider energy perspective.

*Remi Eriksen, Chief Operating Officer, DNV Energy*

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Front cover photo:  
Getty Images



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## Arctic: DNV report on exploration technology in cold climates

DNV Energy has completed a study on technological innovations for safer and more environmentally sound oil exploration in the resource-rich, but vulnerable, northern parts of Norway, as well as to identify potential technological challenges.

The report was carried out on behalf of the Norwegian Society of Chartered Technical and Scientific Professionals.

Says Kim Mørk, DNV Energy's director of segment for Arctic operations and technology: "In taking oil and gas exploration into the Arctic area, which is characterised by a vulnerable environment or dominated by low temperatures and severe ice conditions, the industry is in need of consistent guidance and support to achieve sustainable field developments."

The DNV report discusses technologies related to drilling and well operations, oil and gas production, aerial emissions, seismology and mapping in the pre-drilling



DNV Energy has completed a study on technological innovations for safer and more environmentally sound oil exploration in the Arctic.

phase, petroleum related shipping, and spill reduction due to mishaps.

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## China: DNV delivers LNG services

China National Petroleum Corporation (CNPC) has signed a contract with DNV Energy to provide technology services for CNPC's Dalian LNG import terminal project.

According to the contract, DNV Energy will provide Reliability Availability Maintainability (RAM), Safety Integrity Level (SIL), Risk Based Inspection (RBI) on material selection, and Quantitative Risk Assessment (QRA) services to the Dalian LNG project.

Natural gas is increasingly seen as one of the fuels of the future. This not only reflects the ability of natural gas to compete directly on a cost basis, but also the growing recognition of its environmentally friendly characteristic.

This fits in well China's energy strategy, which puts LNG high on the energy development agenda. CNPC has received government approval to construct three LNG terminals in the Dalian Liaoning, Tangshan Hebei, and Rudong Jiangsu provinces respectively.

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## Houston: Offshore Technology Conference

In addition to a number of activities at the Offshore Technology Conference in Houston, 30 April-3 May 2007, DNV is delivering a number of papers:

- Paper no. 18649 – *An Efficient Approach to Compliance for FPSOs* by Kumar Mony, DNV
- Paper no. 18623 – *A Guideline: Corrosion Protection of Floating Production and Storage Vessels* by K.P. Fischer, T. Sydberger, A. Pedersen, K. Lonvik, DNV
- Paper no. 18904 – *Riser Integrity Management: Recent Advances in the Deepwater Industry Practice* by M. Chezhian, K.J. Mork, DNV; P. Lespinasse, Total; T. Farrant, BP; M. Soreide, Statoil
- Paper no. 18907 – *An Independent Remote Monitoring System for Gulf of Mexico Deepwater Floating Production Systems* by J.T. von Aschwege, BP; K. Jassal, DNV; R. Barker, BMT-SMS
- Paper no. 18781 – *Second LNG Joint Sponsor Project* by C. Deetjen, DNV (U.S.A.) Inc.; G. Andreassen, DNV
- Paper no. 18788 – *The Need to Factor Asset Risk Into LNG Terminal Agreement Negotiations* by P. Fanailoo, DNV (U.S.A.) Inc.; S.C. Sparling, Sutherland, Asbill & Brennan
- Paper no. 18899 – *Optimal Design Approach for Extreme Nonlinear Riser Response* by K.J. Mork, M. Chezhian, N. Sodahl, O. Hagen, O. Steinkjer, DNV
- Paper no. 18770 – *A New Method of Testing for Change-in-Length Properties of Large Fiber-Rope Deepwater Mooring Lines* by J. Flory, Tension Technology Intl.; V. Ahjem, DNV; S.J. Banfield, Tension Technology Intl.

## Norway: Statoil towards world-class operation and maintenance

During the past two years, DNV has helped bring Statoil towards their vision of achieving world-class standards in the fields of operation and maintenance.

A Statoil and DNV team developed and performed an operation and maintenance benchmarking of all Statoil offshore installations in Norway in 2005. This analysis revealed a number of critical issues which had to be dealt with. There was an overall reduction of production availability over the past 5–6 years, and a need for better prioritisation of safety and production critical failures. Also, it was discovered that Statoil had different operation and maintenance management practices across 19 operating assets.

Based on these findings, the R&V-T



More than 3,000 Statoil employees have been trained. Photo: Statoil

project 'Availability and Maintenance Initiative' was established in the spring of 2006, involving a large Statoil and DNV team. The main task was to implement new management principles to capitalise on the newly identified opportunities. Also, training of more than 3,000 employees has been carried out.

"The results of the project will be in accordance with Statoil's vision of achieving 'World-class plant availability and performance'," says Espen Ruud, DNV's project manager.

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## Germany: Blowing in the wind

German wind turbine manufacturer REpower Systems AG has entrusted DNV Energy with the manufacturing survey of its wind turbine blades in Denmark and Spain.

REpower expects to manufacture over 1,000 individual blades in 2007 at its sub-

contractor LM's manufacturing facilities in Denmark and Spain, with possible expansion into India and China in 2008. This contract decision coincides with REpower's first ever US delivery contract, with the turbines to be manufactured in Germany and the blades to be manufactured in Spain.

Having grown in the past few years, the wind energy market is dynamic, with tur-

bine manufacturers expanding into new countries like never before. DNV Energy offers well-established third-party design certification and verification wind services. These range from wind turbine blade manufacturing surveys to full wind turbine park reviews.

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## DNV services to the energy industry

### Enterprise Risk Management

- Company-wide risk management
- Integrated risk management
- Project risk management
- Change management and process improvement
- Due diligence

### SHE Risk Management

- Management systems and performance standards
- Technical risk and consequence assessment
- Emergency planning, response and investigation
- Human factors and occupational health
- Environmental impact and risk assessment

### Operations Excellence

- Investment risk and solution screening
- Asset technology and lifecycle economics
- Performance forecasting
- Asset appraisal

- Operation optimisation
- Lifetime extension
- Asset safety system reliability

### Offshore Classification

- Classification related to building and operation of MOUs and FPSOs
- Classification of tanker conversions to FPSOs

### Verification

- Risk-based plant verification
- Risk-based subsea verification
- Risk-based structures and facilities verification
- Risk-based pipeline verification
- Product verification
- Marine operation verification and warranty services
- Rules/standards/regulations consulting

### Technology Qualification

- Qualification of new technical solutions
- Materials technology
- Technical analysis

- Development of technical standards
- Laboratory services

### IT Risk Management

- IT service management
- Software process improvement
- Information security
- Information management

### Training

- Risk management
- Pipelines
- Materials and corrosion
- Industry standards and recommended practices
- Safety management
- Management systems

### Certification

- Management system certification
- Climate Change
- Corporate Responsibility

# Keep the red flag flying

**“We must scale up the technology for CO<sub>2</sub> capture and storage and make it more cost-efficient. This is a top priority for the European Commission,” says Dr Pierre Dechamps of the European Commission.**

Dr Dechamps of the European Commission’s research department is happy about the European Council’s recent historic decision regarding the necessary cuts in greenhouse gas emissions. At the same time, he thinks it is important to keep the red flag flying.

“A reduction of 20 per cent CO<sub>2</sub> by 2020 is not enough if we stop at that level. We need to cut emissions by 50–75 per cent by the middle of the century if significant results are to be achieved,” he says.

“This is an important step and a leap forward from the Kyoto Protocol, where the aim was an eight per cent reduction for the EU compared to the 1990 level. In other words, this is not enough, but it is the way to go. We have established the goal; the next question is how to get there.”

Just as important as the EU commitment to a concrete reduction is the fact that CO<sub>2</sub> capture and storage (CCS) is now a top priority for the Commission. “Europe is showing the way, and hopefully countries such as the USA, Australia and the developing countries will follow suit,” says Dr Dechamps, who admits that this will be very difficult.

## Consensus change

Until a few years ago, there was a broad consensus that general energy efficiency and a gradual shift from fossil fuel towards more sustainable energy were sufficient to halt increased CO<sub>2</sub> emissions.

“But we were all wrong,” says Dr Dechamps. “Fossil fuel is still the dominant energy source, and is likely to remain the main source of global energy supply for the foreseeable future. Renewable energy is still expensive compared to fossil fuels, or should we say fossil fuels are too cheap?”

The current scientific consensus is that man-made CO<sub>2</sub> emissions have increased the concentration of greenhouse gases in the atmosphere and are contributing to global climate change.

“The research community is currently developing transition technology that will enable us to use fossil fuel without creating the emissions. The aim is first and



**“We need to realise that if we do not deploy the technology on a large scale and soon enough, we are in trouble, says Dr. Pierre Dechamps of the European Commission’s research department.**

foremost to reduce CO<sub>2</sub> emissions from power plants, which are today responsible for one third of these emissions,” says Dr Dechamps. “Furthermore, the most important issue at hand is to eliminate

emissions from coal-fired plants, which produce more CO<sub>2</sub> than gas-fired plants.”

This does not mean that capturing CO<sub>2</sub> from gas-fired plants is not important, but coal is the real problem in terms of the

## EU leaders to fight global warming

In March 2007, EU leaders agreed on a set of key measures and binding targets to fight global warming. The EU has also reaffirmed its efforts to use green sources of energy, including wind turbines and solar panels.

The EU Commission is targeting:

- 20 per cent reduction of CO<sub>2</sub> by 2020
- 20 per cent energy efficiency by 2020
- 20 per cent of energy consumption from renewable energy by 2012
- Use of 10 per cent bio fuel by 2020
- By 2020, all new coal fired plants are to be fitted with carbon capture and storage technology

Funding and emissions:

- Frame Program 7 (FP7) has a total budget of 50 billion Euro, where 2,3 billion is allocated to energy research
- All coal reserves represent 3,000 giga tons of CO<sub>2</sub>
- All oil and gas reserves represent 300 giga tons of CO<sub>2</sub>

overall carbon quantities locked in the geology.

“At the same time, only 3 per cent of the total emissions from a gas-fired power plant consist of CO<sub>2</sub>, compared to 10 per cent CO<sub>2</sub> from burning coal, making CO<sub>2</sub> capture from gas more difficult,” Dr Dechamps explains.

### Sense of urgency

The focus on the CO<sub>2</sub> emissions problem in recent years has resulted in technology that enables us to capture CO<sub>2</sub>. However, the scale of CO<sub>2</sub> capture is still on a pilot level. Today capture is carried out in only a few plants that produce from one to 10 MW. By comparison, big coal plants produce 1,000 MW.

The challenge is to scale up the technology and make it more cost-efficient. Then we must deploy it everywhere as quickly as possible, keeping in mind that it takes from three to seven years to build a full-scale plant.

“We need to realise that if we do not deploy the technology on a large scale and soon enough, we are in trouble. In order to achieve this, it is important that we continue to focus on research, legal and regulatory frameworks and incentive systems,” says Dr Dechamps.

### Incentives disabled

There is a broad range of issues to be discussed, including the relationship with the waste and water directives, storage safety, liability and a whole set of new legislative issues. Then there is the question of standardisation and monitoring schemes. Today, the new technology is not part of the EU trading scheme or the Kyoto Protocol. The technology is simply not recognised, thus disabling important economic incentives.

“In this respect, DNV and similar companies will play an important role in establishing certification and quality assurance schemes,” says Dr Dechamps. “In addition, there will be local health and safety aspects to consider. In the long run, the liability will lie with the state. In order to transfer the ownership of the CO<sub>2</sub> storage site to the state, there will be a strong demand on certification companies to ensure that storage is carried out properly.”

*Text and photo: Ole Magnus Grønli*

# Carbon capture and storage: Speed up, please

**“The need to deal with the climate change threat quickly does not allow us the luxury of waiting until all the aspects have been looked at and agreed upon. It’s time to put global warming in the basement,” says Elisabeth Tørstad, DNV’s Cleaner Energy director.**

The world has to make important, long-term decisions on an uncertain basis, and our common challenge is: how do we make intelligent choices and how do we manage the associated risks?

DNV has a long history of working in the energy and environmental sector, and is now increasing its focus on sustainable energy and CO<sub>2</sub> capture and storage. This focus area is a good match for the challenges posed by the recent EU summit’s commitment to a 20 per cent cut in greenhouse gas emissions by 2020.

Elisabeth Tørstad is the first to admit that the 20 per cent target for CO<sub>2</sub> emission reduction is a huge challenge.

Says Ms Tørstad: “A number of policies and the industrial implementation of these need to be put in place in order to meet this target. Most of these suffer from a lack of maturity in terms of technology, economy, infrastructure or common acceptance criteria.”

She is convinced that the key in this context is to obtain a common, transparent decision-making basis in terms of acceptance criteria and qualification methods – all the way from policy making to industry implementation.

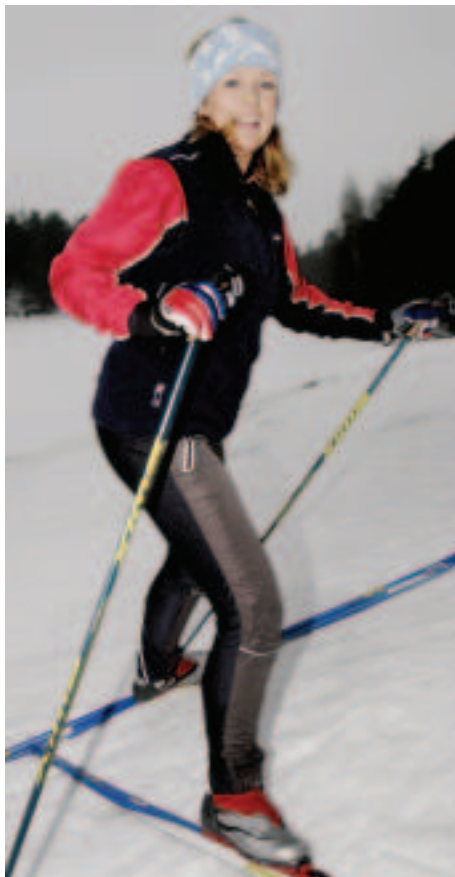
A sustainable energy portfolio includes the use of fossil fuels, and reducing emissions from power plants using fossil fuels through carbon capture and storage is a vital tool for meeting the target. But carbon capture and storage also pose challenges.

### Stockpiling for 100 or 1,000 years?

“On the one hand, we have technological questions related to such storage. What kind of requirements are we to stipulate for the storage utilities? How much leakage can be allowed, if any, and what is the definition of long-term or permanent storage; is it 100 years or 1,000 years?” she asks.

“On the other hand, we have questions related to ownership and responsibility. Who is the owner of the problem and the solutions, and who will provide guarantees that no leakage will take place?”

While pointing at the range of uncertainties, she underlines that we must avoid ending up as a lame duck because of all the unanswered questions. In order to implement carbon capture and storage at the pace needed to enable a significant impact from 2030 and onwards, policymakers need to support research and full large-scale testing and to provide sufficient long-term investment incentives.



**Elisabeth Tørstad, DNV’s Cleaner Energy director.**



Elisabeth Tørstad is trying to mitigate climate change. "I love skiing, and I would appreciate the world climate remaining able to offer skiing opportunities in the future too," she says.

"DNV's aim in this picture is to put uncertainties and the risk factors at stake in perspective and establish a common understanding and trust between the parties involved," says Ms Tørstad.

Understanding and managing risk is a prerequisite for being able to make decisions and, when several parties are involved, the decision basis and risk picture need to be transparent and well understood by all stakeholders.

"We aim at enabling involved parties to make the right decisions, and at moving decisions forward, thus shortening the time span from policy making to industry implementation," she says.

#### 40 clean people

Together with her team of 40 'clean engineers and consultants', she is employed in several exciting projects with international clients – within the whole CO<sub>2</sub> value chain of capture, transportation and storage. DNV is currently establishing acceptance criteria and standards for CO<sub>2</sub> capture and storage, both in Europe and the USA. Her team is also working with Gassnova, the Norwegian centre for gas power technolo-

gy, developing good practice for evaluating different technical solutions for capturing CO<sub>2</sub>.

It has been questioned why gas-fired power plants are not already equipped with capture devices, as this technology is known and established. The reason for this is a combination of political priorities, technology and economy. Most of the few CO<sub>2</sub> capture plants in operation today are significantly smaller than the ones planned in Norway, and none are directly comparable on a technical level. In addition to this, the technology must offer high energy efficiency in order to minimise the energy used on the capture process.

"Today's technology can only to a certain extent be used in capturing CO<sub>2</sub> from medium or large size gas-fired or coal-fired power plants," explains Ms Tørstad.

Geological storage of CO<sub>2</sub> is recognised as one of the best solutions for limiting the climate change problem. Norway has been using the reservoirs in the North Sea for storing CO<sub>2</sub> for many years.

"In my opinion this kind of storage has the potential to be safe and good," she says.

#### Worldwide attention

The Americans are also investigating geological storage options. Established in 2003, WESTCARB (West Coast Regional Carbon Sequestration Partnership) is one of seven research partnerships exploring regional carbon sequestration opportunities and conducting pilot-scale validation tests.

"DNV is developing new verification systematics for these onshore projects," explains Ms Tørstad.

Subsea storage, however, has its advantages because possible leakage will not cause global heating, since CO<sub>2</sub> will dissolve in water. On the other hand, CO<sub>2</sub> release on a large scale would have a negative impact on the maritime environment.

There are different views on subsea storage, but Norway and Great Britain are in favour of using the North Sea basin for storage, while other countries are aiming at storage in onshore geological structures and man-made constructions.

"Regardless of which solution the different nations choose, we have not much time to lose," she concludes.

*Text: Ole Magnus Grønli*

*Photo: Nina Eirin Rangøy*

## Cleaner energy

Development and operation of cleaner energy power plants is associated with a complex risk picture – ranging from political processes to long-term metrological prognoses.

DNV assists clients in analysing and managing the risk elements related to their business. This can be establishing and improving effective control and management systems, in addition to supporting in managing corporate risks.

Services are offered within technical consulting, establishment of acceptance criteria, and verification. DNV's primary areas of focus are wind energy, nuclear energy, and CO<sub>2</sub> capture and storage from gas and coal power plants.

DNV also provide validation or verification/certification as required by the Kyoto Protocol for Clean Development Mechanism projects.

# A wake-up call from Texas City

Two years ago, the US refining industry suffered its worst accident in 20 years at Texas City, causing 15 fatalities and injuring 170 persons. In relation to this, two major investigations recently produced a number of valuable recommendations to the refining industry. However, DNV suggests that other industries should also learn key lessons, and even go beyond these reports in order to achieve a major improvement in business and safety performance.

The Baker Report in January 2007 looked at the safety management systems and culture inside BP's US refineries, and in March the US Chemical Safety Board reported on the accident itself. Both assessments generated numerous valuable recommendations.

Graham Bennett, DNV Energy's downstream business manager, claims the Texas City accident should act as a wake-up call to the refining industry, as it demonstrates that major assets are insufficiently protected by current safety processes and investment strategies. The good news is that trends in personal injuries in the refining industry have been very good, with a major improvement since the early 1990s. However, the trend in major refinery accident damage has been poor to mixed, with many serious incidents and increased losses over the past five years.

"Very few of the root causes of the Texas City accident were unique, and many have been seen several times before in major accidents. Also, several other incidents with lesser impacts could have escalated to the same severity in other locations had the circumstances only been a little different. So not only the downstream and process industries can learn key lessons from this accident; other industries should be looking at the opportunities stated in the reports to improve performance and safety," he emphasises.

For the upstream industry, for example, there is much to learn from a careful review of these two reports, and a more general examination of whether its personnel and assets are sufficiently protected against large process accidents."

In Europe, a number of industries have benefited from the lessons learned from the Piper Alpha platform accident in 1988. "There were two total loss events in the 1980s in the North Sea, and the Offshore safety case regime has ensured since then that no process event has caused a total



Very few of the root causes of the Texas City accident were unique, and many have been seen several times before in major accidents.

loss. Further, it has led to a 75 per cent decline in loss of containment incidents over the past ten years. This is a key indicator for major accidents. Even the onshore European safety case regulations and railway regulations have been updated to reflect some of the best aspects of the offshore regulations,” says Graham Bennett.

#### Baker’s ten recommendations

Graham Bennett explains about the Baker Panel: “This was a blue ribbon panel established by BP after the Texas City disaster; it did a thorough job of assessing the underlying concerns related to process safety management systems and corporate culture. It highlighted performance evaluation, corrective action and corporate oversight as key issues in BP’s US refining operations.”

The panel concluded that many of the issues identified would probably apply to the whole industry, and it provided recommendations in ten broad areas:

1. Process safety leadership – Leadership related to process safety must be clearly articulated, exercised and demonstrated at the highest corporate level, including by the Board and Group CEO.
2. Integrated and comprehensive process safety Management (PSM) System – Implement a comprehensive PSM system to continuously identify, reduce and manage process safety risks.
3. Process safety knowledge and expertise – Implement a system to ensure that the executive management and all personnel possess an appropriate level of process safety knowledge.
4. Process safety culture – Involve the relevant stakeholders to develop a positive, trusting and open process safety culture at each asset.



**“Not only the downstream and process industries can learn key lessons from the Texas City accident,” says Graham Bennett.**

5. Clearly defining expectations and accountability for process safety – Clearly define expectations and strengthen accountability for process safety performance at all levels.
6. Support for line management – Provide more effective and better coordinated process safety support for the line organisation.
7. Leading and lagging performance indicators for process safety – Develop, implement, and periodically update an integrated set of leading and lagging indicators for process safety.
8. Process safety auditing – Implement an effective system to audit process safety performance.
9. Board monitoring – The Board is to monitor the progress of the Panel’s findings and publicly report its findings.
10. Industry leader – BP should use the lessons learned to transform the company into a recognised leader in process safety management.

**“Both reports produced a realistic analysis of the accident and identified needs for operational improvements. However, DNV is not completely convinced.”**

#### Specific causes analysed

The report from the US Chemical Safety Board was directed at the accident itself, and the Board carried out a thorough analysis of specific causes. The recommendations are well founded and quite broad in scope. They address needs for improvement in BP’s top management and in the Texas City refinery processes, as well as needs for improvement in the occupational safety and health administration’s management of process safety. The need for industry-wide developments was expressed by API, CCPS, and relevant chemical industry unions.

A short summary of the Chemical Safety Board’s recommendations is as follows:

- The need to develop suitable process safety metrics
- Measures to prevent fatigue in key process safety workers
- The need to enhance the occupational safety and health administration inspection programmes to better focus on process safety
- Extend management of change reviews to address organisational changes
- BP should appoint a board level process safety specialist
- BP Texas City should ensure its safety critical equipment is identified and suitably maintained
- The incident reporting system should be enhanced.

“The Chemical Safety Board’s findings were harsh on BP, but in fact DNV believes that most of BP’s identified deficiencies could be found in other companies to some degree,” Graham Bennett points out.

*Continued on next page*

### Go beyond recommendations

Says Robin Pitblado, director of the health, safety and environment service area in DNV Energy: "Despite the two reports, DNV believes that these did not fully recognise hard-won lessons learned from abroad and thus are not, on their own, the holistic approach necessary to achieve the next major step-change improvement in process safety.

"Some additional steps, with a clearer underlying risk basis, are necessary to ensure process safety and to safeguard a company's corporate reputation and business performance," he suggests.

The basic recommendations of the two reports should be implemented along with ideas that have generated success in the North Sea, for example. DNV proposes that the solution lies in implementing the following broad risk-based programme:

1. A suitable holistic risk assessment to underpin process safety improvements.
2. A consolidated Hazard and Risk Register – identifying all risks and with expanded details on the main risks.
3. Systematic identification of the most important safety barriers/controls – both hardware and administrative systems (safety critical aspects).
4. Performance standards for each safety critical aspect.
5. Each safety critical aspect should be evaluated (by interviews with supervisors and technical staff) and it should be verified that sufficient controls are in place for the level of risk and for performance standards to be met.
6. Tracking metrics (leading indicators) must be developed for each safety critical aspect using recent site data and real-time enterprise software tools where available (e.g. SAP, PeopleSoft) to capture the current state of controls with the best available information.
7. Audit tools – for the management system, including audit items derived specifically from item 3 above.
8. Incident investigations should be thorough, as recommended by Baker and CSB, and more specifically should be linked to the Hazard and Risk Register and the identified controls that must have failed, and again linked back to item 3 and update item 5, i.e. capturing important lessons learned.
9. An effective action follow-up and close-out system to ensure that actions recommended in incident reviews are effectively implemented.
10. Business key performance indicators that include shared targets for asset integrity and process safety, and allow for a long-term perspective.

DNV also suggests that companies:

- Should increase their top management's commitment to, and awareness and leadership of, process safety to match that achieved today for personnel safety.
- Should have more focus on process safety issues through tools such as risk assessment and risk registers.
- Should identify key controls and control accountability.
- Must have in place evergreen processes to control both hardware and procedures.
- Must have suitable and easily understood process safety metrics that are regularly reviewed and on the management agenda in order to benchmark risks.
- Should initiate a fuller use of accident investigation to verify a control's effectiveness.
- Must establish solid action prioritisation, management follow-up and close-out tracking systems.

### No longer any reason to delay

"These approaches have been applied very successfully in the North Sea; the best parts of them can be implemented elsewhere without the full costs of the specific regulatory regimes being applied here. Gains of 2–3 times the current process safety performance should be achievable, so the measures are very cost effective. By securing reliability and uptime, the assets also deliver improved business performance," Robin Pitblado emphasises.



**"Refineries worldwide should commit to making a step-change improvement in process safety and achieve this within five years," says Robin Pitblado.**

He concludes: "It is fortunate that the need for such improvement arrives at a time when industry has adequate resources due to the high oil price, thus having the opportunity to secure the assets and invest for the future.

"The lessons are clear, and there is no longer any reason for the industry to delay action. Refineries worldwide should commit to making a step-change improvement in process safety and achieve this within five years."

*Text: Svein Inge Leirgulen*

## DNV's service line

Going beyond HSE compliance

- Quantified Risk Assessments and communication tools
- The Refinery Risk Manager
- Operations Excellence and Change Management
- Environmental Risk Management
- Performance Forecasting
- Integrated management systems development
- Emergency planning/Business Continuity
- Due Diligence Services
- Implementation support
- Incident/accident investigations

**"The lessons are clear, and there is no longer any reason for the industry to delay action."**

# US Coast Guard breakthrough

The US Coast Guard has authorised DNV to carry out plan reviews and inspections on its behalf of all types of offshore units which are classed by DNV and operating on the Outer Continental Shelf.

The US Coast Guard (USCG) has completed an in-depth review of the regulations under the US Outer Continental Lands Act, relating to the acceptance of plan reviews and inspection of floating offshore installations and facilities by selected classification societies. Following this thorough review, the USCG has announced that it will accept plan reviews and inspections by DNV.

DNV was already fully authorised by USCG to carry out approvals and surveys of US-flagged ships and mobile offshore units under the Alternative Compliance Program.

“Previously, however, the access to this work for floating offshore installations was limited, even for DNV-classed units. The latest acceptance of DNV – which now includes tension leg platforms, spars, production semis, FPSOs and floating drilling units – is based upon many factors, including our experience and technical competence,” says Antony D’Souza, head of DNV Offshore Classification in North America.



Antony D’Souza, head of DNV Offshore Classification in North America, will bring new capabilities to this critical role.

“DNV will now bring new resources and capabilities to this very demanding market, ultimately enhancing the safety and quality of offshore structures, as well as reducing delays and costs,” he promises.

## Great recognition

Antony D’Souza expresses that this additional authorisation also signifies further recognition of DNV’s ability to help USCG to achieve safe and efficient design, construction and operation of the full range of shipping and offshore units.

Operators will now have a real choice regarding which Certifying Entity to use. “This will lead to improved quality due to competition, better responsiveness and cost-efficiency. It also allows USCG to tailor its involvement depending on the complexity of the design and confidence of the Certifying Entity,” concludes Antony D’Souza.

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## About USCG

The United States Coast Guard (USCG) is a military branch of the United States involved in maritime law, mariner assistance, and search and rescue, among other duties of coast guards elsewhere.

One of the seven uniformed services of the United States, and the smallest armed service of the United States, its stated mission is to protect the public, the environment, and the United States economic and security interests in any maritime region in which those interests may be at risk, including international waters and America’s coasts, ports, and inland waterways.

[www.uscg.mil](http://www.uscg.mil)

# Doubling the Brazilian pipeline web

Transpetro's natural gas director, Marcelo Rennó, has a daunting assignment in the coming three years: he must more than double Brazil's network of onshore gas pipelines. This tremendous effort requires him to focus on finding the best technology and making risks as manageable as possible, while ensuring that Transpetro is a good corporate citizen in relation to the local public.



Transpetro is responsible for the management, operation and maintenance of 10,000 kilometres of pipeline in Brazil. During the next three years, Transpetro will add an additional 4,000 new km reserved for gas products. This will more than double the existing 3,000 km currently reserved for Transpetro to operate.

Including the liquid pipelines, Transpetro will be responsible for more than 15,000 km of pipeline in 2010. A significant number of kilometres will also be built to transport ethanol, the alternative fuel powering most of Brazil's automotive industry. The total Brazilian network will be about 20,000 km.

## Centralised control

To Rennó, controlling the risk throughout the distribution chain is the chief concern; "Transpetro is working hard to minimise the risk of leakage to zero. Therefore, we can't look into the future without improving the quality of the materials, safety levels, construction aspects, inspections, inspection tools, leakage control systems and maintenance work, as well as adding to the software and system automation," he says.

2000 stands out as a bad year for pipeline transportation in Brazil, as the country experienced two major leaks. Rennó remembers it well. "Since then, we have also invested USD 1 billion in an integrity system to discover potential leaks and benchmark the transportation," he points out.

"All operations are today managed from the national control centre in Rio. From here, we oversee the safety and 'the big picture' of all the operations simultaneously. Also, we can perform simulations of changes before they go live. At this centre, we also share all the integrity analyses and activities between the oil and gas transportations. This is very important to us," he emphasises.

## The Transpetro gas pipeline network

Due to the long distances involved, the Transpetro gas pipeline network is administered by regional managements. These are responsible for the maintenance of the installations and execution of the local operations. The structure is: North-Northeast Network (Ceará, Rio Grande do Norte, Paraíba and Pernambuco States), Southern-Northeast and Espírito Santo Network (Sergipe, Bahia and Espírito Santo States), and Southeast-South Network (Rio de Janeiro, Minas Gerais and São Paulo States).

The domestic natural gas is produced in several Brazilian states, from São Paulo

(Southeast Region) to Ceará (Northeast Region). The imported natural gas comes from Bolivia.

Today Transpetro transports around 35,000,000 m<sup>3</sup> of natural gas each day.

In 2010, around 120 million m<sup>3</sup> will be transported daily:

- 70 million m<sup>3</sup> from domestic production
- 30 million m<sup>3</sup> imported from Bolivia
- 20 million m<sup>3</sup> of LNG



Transpetro's 'Family Agriculture in Pipeline Rights-of-Way' project helps local communities plant community vegetable gardens alongside pipelines. At the same time, the pipelines are being protected by preventing undesirable, unorganised and irregular occupation.



"As a continental country, Brazil needs an efficient network of pipelines. The total network counts about 20,000 km, but will expand due to the demand and the size of the country. Obviously, the pipeline business will become very active in Brazil in the coming years," says Marcelo Rennó, the natural gas director of Transpetro – Petrobras Transportes S.A.

### Capacity and integrity challenges

"Our biggest challenge towards 2010 will be to install the pipelines in chronological order and on time. We have a generous development budget, but a bottleneck may arise because there is an enormous number of oil and gas developments around the world, so supplier capacity is limited. This concerns all facets of our mission, from vessels to pipeline production," says Rennó.

Another challenge is the onshore pipeline construction. According to Rennó, offshore pipeline technology has progressed rapidly over the past 30 years.

"However, as regards onshore developments, progress has suffered. The onshore pipeline business must be improved with new equipment, new construction methods, and safer, faster methods of expediting construction work. I am glad that the industry has started to face these challenges," he says.

### Liquefied gas on the rise

"Today, Brazil is not able to import liquefied natural gas (LNG). But in the near future this will become a reality, and there will be two import plants, one in the Rio area and one near Fortaleza. With these installations, Brazil can import 20 million

m<sup>3</sup> per day. So in 2010, when we have the extended natural gas network, we will be able to link LNG and the imported gas from Bolivia with domestic gas from the south-east and north-east regions of Brazil," he explains.

Despite his optimism, Marcelo Rennó is already anticipating the potential safety issues: "LNG has the best track record and history for accidents. It is one of the safest industries in the world. It is very important to know how to perform risk assessments of these operations, and of course we will carry out risk analyses involving environmental and safety aspects. The industry is very conservative about safety. We need to talk, show and prove that everything we are going to install has had a risk assessment with methodology performed on it, and that we safeguard and install the plant in accordance with international standards. We will arrange public hearings and all the necessary steps for safeguarding the operation."

### Socially responsible pipelines

Last year, Petrobras and Transpetro won an acclaimed award for its 'Family Agriculture in Pipeline Rights-of-Way' project. This is an innovative initiative to plant community vegetable gardens alongside

pipelines; it has already started in the municipalities of Nova Iguaçu and Duque de Caxias in the state of Rio de Janeiro.

"It is very important for us as a transportation company to have good relations with the local community where the pipelines are built. This is why we established this self-sustainable project to generate income. It also promotes the rational and monitored use of land along the pipelines by means of planned and safe occupation. In this manner, the areas alongside the pipelines are protected by the local communities, which now actually become our partners in monitoring the area while simultaneously preventing undesirable, unorganised and irregular occupation," says Rennó.

The pilot project will soon involve 100 low-income families and includes agricultural training, which is essential, especially considering that some of the participants have never worked on the land before. Transpetro also supplies individual protective equipment, such as boots, gloves, hats, raincoats, trousers and long-sleeved shirts.

"This project will become a model for other pipeline areas in Brazil. We see it as a very important effort, not least because we have a venue in which to communicate with the local communities. Their involve-

ment is vital for the expansion of new pipeline areas. On the other hand, we prove that our concern for social welfare involves not only words and promises but also actions,” concludes Rennó.

*Svein Inge Leirgulen*

## Transpetro snapshot

Transpetro, a fully-owned subsidiary of Brazil's national oil and gas company Petrobras, is responsible for the transportation of gas, oil and derivatives through pipeline networks, a tanker fleet, marine terminals and distribution bases located in Brazil.

### Maritime transportation

Transpetro has a fleet of 50 tankers and is currently undertaking an ambitious project to construct 42 new vessels.

### Terminals

Petrobras has 24 maritime terminals and 20 onshore terminals managed by Transpetro. These terminals receive and store imported oil from ships and pipelines.

### Pipelines

Transpetro is responsible for the operation and maintenance of 10,000 km of pipelines, of which 7,000 km transport liquid and 3,000 km transport gas.

### Natural gas processing

Transpetro operates the largest natural gas processing plant in Brazil (Cabiunas Terminal), which processes all the gas coming from the Campos basin, which is the largest oil and gas production field in Brazil.

# Technical assurance for GlobalSantaFe's Development Driller III

Over the past ten months, DNV has been working closely with GlobalSantaFe to perform technical assurance assessments on the critical systems of its newbuild semi-submersible, the Development Driller III (DD-III).

The main objective of the technical assurance assessments is to ensure that the rig delivered will meet the technical expectations of GlobalSantaFe and its client, BP, by increasing safety, minimising downtime, and increasing reliability.

The technical assurance reviews utilise tools such as HAZIDs/FMECAs. The technical sessions focused on identifying single point failures in the systems analysed. Critical systems reviewed include bilge and ballast system, cooling system, watertight integrity, mooring system, thrusters, well activity centre (i.e. active heave drawworks, bridge racker, tailing arm, hydraulic system, and operator's control chair), emergency evacuation, fixed fire fighting, and fire and gas detection systems.

“The results of the technical studies include making physical modifications to the systems, modifying the operating envelopes, and updating maintenance schedules. The final recommendations, once implemented, will increase safety, reduce downtime, and improve the performance of the rig,” concludes Alf Henry Aker, head of department for Systems and Components, DNV Energy Houston.

“With the significant increase in rig rates, the costs of failures are substantial. Shutdowns cost in the range of USD 10,000–20,000 per hour; obviously GlobalSantaFe will gain from minimising such incidents,” he points out.

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GlobalSantaFe's Development Driller I&II.

## GlobalSantaFe

GlobalSantaFe is one of the world's largest offshore oil and gas drilling contractors and a leading provider of drilling management services.

The company owns or operates a contract drilling fleet of 37 premium jackup rigs, six heavy-duty, harsh environment jackups, 11 semisubmersibles, and three dynamically positioned, ultra-deepwater drillships, as well as two semisubmersibles owned by third parties and operated under a joint venture agreement.

In addition, an ultra-deepwater semisubmersible is under construction and scheduled for delivery in early 2009.

[www.globalsantafe.com](http://www.globalsantafe.com)

# New method to protect against major oil and gas fires

To protect against major fires on oil and gas platforms, the detailed design of safety systems can now be carried out using a new optimisation method developed by DNV. Critical safety systems, such as flares and passive fire protection, are optimised using a detailed fire risk analysis and computational fluid dynamics fire simulations.

Traditional standard design heat assuming a constant heat flow for a certain duration – such as 250 kW/m<sup>2</sup> for 15 minutes – are general and, in most cases, far too conservative. This may mean that structures and pipes are protected using too much passive fire protection, which can lead to increased corrosion, cost and weight.

Asmund Huser, DNV Energy's expert in this field, explains that the new method is more detailed than traditional methods. "For particular fires, the fire loads may also be more severe than the traditional standard heat loads. These variations from smaller to higher heat loads are captured in the analysis, ensuring that the total safety level is increased compared to tradi-

tional methods in a cost-effective manner," he points out.

"Owners can now choose where measures should be implemented in order to achieve the best possible safety for their investments."

Results from the analysis also show the design accidental loads for fires, as well as escalation probabilities.

The complex, dynamic behaviour of fires has posed special challenges when establishing the method. This has now been thoroughly studied, using detailed computational fluid dynamics calculations on several platforms in a development project started in collaboration with Statoil in 2001.



**Asmund Huser has developed a new and optimised method to prevent oil and gas fires.**

The optimisation service is offered using two computer programs developed by DNV: DNV ExpressFire and DNV PFPro.

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# Fitness for service certificate to LNG pipeline revolution

InTerPipe's (ITP) highly insulated pipe-in-pipe technology for subsea, oil and gas flowlines has gone through eight years of development to be able to transport LNG. A formal technology review process has culminated in DNV issuing a Certificate of Fitness for Service to ITP's pipe system, proving it is fit for deployment in LNG projects.

The transportation of LNG through the subsea ITP triple pipe-in-pipe system may revolutionise the siting, safety, security and economics of LNG import and export terminals. By transporting LNG through subsea or buried pipelines, a project can:

- Eliminate the trestle, thus dramatically reducing costs
- Increase security, as the pipeline is buried and thus not visible
- Increase siting options by allowing loading or offloading further offshore or transporting LNG onshore
- Decrease the environmental and visual impact
- Decrease or eliminate the need for dredging.

The technology was developed and qualified by ITP in cooperation with various industry partners through joint industry

projects and engineering studies starting in 1998. The technology development has complied with the DNV Technology Qualification Process as defined in DNV RP-A203, Qualification Procedures for New Technology.

Says Afzal Hussain, senior engineer in DNV Energy: "In 2006, a FEED (Front End Engineering Design) study was carried out to obtain the DNV Certificate of Fitness for Service. This was a necessary criterion for the project to consider the subsea LNG pipe as a technologically viable alternative. Through this study, ITP completed the formal DNV technology qualification process, which culminated in DNV issuing the Certificate of Fitness for Service to ITP."

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# Launching material and corrosion research centre in Ohio

DNV has launched a new material and corrosion research centre in Columbus, Ohio. It is being founded in close cooperation with Ohio State University and CC Technologies. The centre is intended to develop new technology and methodologies related to the enormous challenges the US economy is facing due to material corrosion.

DNV Research and Innovation and CC Technologies, a recognised technology leader in corrosion and materials, have established the Ohio material and corrosion research centre in Columbus, Ohio, USA. A cooperation agreement with Ohio State University will also strengthen the research activities and access to personnel.

Explains Neil Thompson, the chairman of CC Technologies and global onshore

pipeline director of DNV Energy: "The research centre will develop new technology and methodologies related to the enormous challenges the US economy is facing due to material corrosion. It is intended to be a major research player in this field."

Narasi Sridhar is employed as manager of the centre. He is a recognised expert in the corrosion research and development community in North America, and comes from a position as program director of the mechanical and materials engineering division of the Southwest Research Institute (SwRI) in San Antonio, Texas.

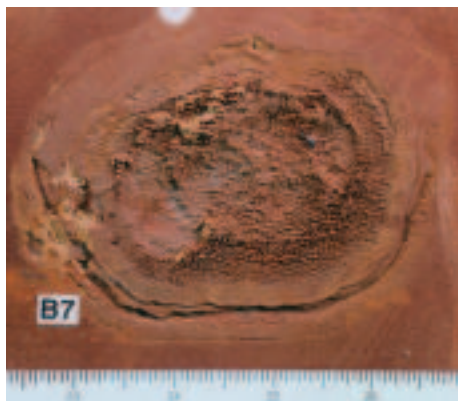
## Will deal with US corrosion challenges

Neil Thompson, who also has been instrumental in setting up the research centre, notes: "There is obviously a need for the further development of knowledge, methodologies and technology to deal with the increased impact corrosion has on the US economy."

The study 'Corrosion Costs and Preventive Strategies in the United States' performed by CC Technologies and supported by NACE International, was presented to the US Congress in 2002-2003. The study estimated the total annual economic impact of corrosion on the US economy to be USD 276 billion in direct costs. Indi-



"The centre in Ohio will be a major research player in the field of material corrosion," says Neil Thompson, chairman of the DNV unit CC Technologies.



A study estimated the total annual economic impact of corrosion on the US economy to be USD 276 billion in direct costs.

rect costs, including social costs, could easily double this amount. The direct cost of corrosion is equivalent to three per cent of United States GDP (1998 dollars). In addition, the study indicated that most of these costs were related to ageing infrastructures.

Since the CC Technologies study, the US Congress has passed new regulations governing pipeline integrity, for typically large diameter, high-pressure natural gas and product transmission pipelines, and has established an Office of Corrosion Control and Prevention Policy within the US Department of Defense (DoD).

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## We welcome your thoughts!

DNV is a global provider of services for managing risk. Established in 1864, DNV is an independent foundation with the objective of safeguarding life, property and the environment. DNV comprises 300 offices in 100 countries, with 7,000 employees.

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