

FORUM



THE CORPORATE MAGAZINE OF DET NORSKE VERITAS No. 4/2000

CERTIFICATION

Promoting global trade - and saving lives

Also inside:

BP leads the climate-change debate

Saab drives for quality

Securing the Chernobyl bequest

3 EDITORIAL
Beyond evolution – rejuvenation

4 PROFILE
Steering towards the global economy

6 MANAGEMENT
Quality drives expansion at
Saab Automobile AB

TECHNOLOGY

8 THE MODERN ROV
displays new versatility

10 INFORMATION SECURITY
ensures client confidentiality

CERTIFICATION

13 MEDICAL EQUIPMENT
A new lease of life ...
thanks to certification

16 CD-ROM MANUFACTURE
is a worthy task for the monks of
St Wandrille

19 TOYOTA in NORTH AMERICA
ISO 14001 helps protect the
environment

22 ...and HONDA in ITALY
promotes social accountability

24 HARMONISATION
Carmakers seek global quality
standard

26 PETROBRAS
At the forefront of offshore
technology

28 GREENHOUSE GASES
BP takes initiative in the
climate-change debate

30 LETHAL LEGACY
... and how DNV is helping build
a safer future for Chernobyl
nuclear plant

32 SPORTING SAFETY
Safety-management planning
for Sydney's Olympic Games

SAFETY MANAGEMENT

34 ZERO TOLERANCE
for industrial injuries at Kimberly-
Clark ...

36 and SAFETY TRAINING
pays dividends at Cargill Inc.

38 MARINE PROPELLERS
Maintaining a worldwide reputation
at Rolls-Royce AB, Kristinehamn

40 ROYAL DANISH NAVY
adopts ship classification

42 AIRCRAFT FINANCE
DNV's Avitas provides valuations,
consulting and advice

44 RAILWAY CONSTRUCTION
Hong Kong's population boom demands
extensive – and safe – new rail links

46 VIEWPOINT
Clean water for all

48 NEWS

50 LAST WORD
EFTA's Paal Frisvold foresees
stringent new laws for shipping

51 DNV WORLDWIDE

*DNV Forum is the corporate magazine of Det Norske Veritas.
It is published for Det Norske Veritas by
DNV Corporate Communications
N-1322 Høvik, Norway.
Tel:+47 67 57 99 00. Fax:+47 67 57 91 60.*

HEAD OF MEDIA SECTION
Per Wiggo Richardsen

EDITOR
Stuart Brewer

EDITORIAL CONSULTANT
R.Keith Evans

PICTURE EDITOR
June Myklatun

ADMINISTRATION
Gro Huseby

DESIGN
DRD DM, Reklame & Design as.

PRINT
Stens Trykkeri, Norway

COVER PHOTO
Scanpix/Pete Saloutos

*No responsibility is accepted by the publishers for
statements made by authors, nor for attributable comment.
Reproduction permitted with acknowledgement of source.*

Copyright Det Norske Veritas 2000

*Det Norske Veritas is an autonomous, independent
foundation with the objective of safeguarding life,
property and the environment. The DNV organisation
comprises 300 offices in 100 countries, with a total of
5,500 employees.*

VISIT OUR WEBSITE
www.dnv.com



Miklos Konkoly-Thege

Rejuvenation the key to success

According to Miklos Konkoly-Thege, Chief Operating Officer of DNV's Business Area General Industry, DNV is now in a transformation phase - 'a transformation of one of the most important elements of the company, and that's us and the way we work.' He believes that the new economy, in its wider sense, is about more than just Information Technology. 'It's also about doing business differently from the way we've done it in the past. It's about abandoning old-economy technologies and adapting to meet customers' ever-changing needs and requirements.'

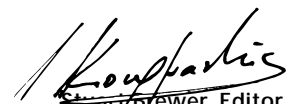
Konkoly-Thege believes that DNV's mission, values and behaviour all contribute to the evolution of the company, and that DNV has been able to accelerate this transformation for several reasons. First, global communications are vastly better. Second, we now have the internet and e-commerce. And third, borders, in terms of trade, are coming down. 'There's much more openness in terms of markets,' he says.

Indeed as international trade continues to grow, so too does the need for widely accepted documentation confirming that services, products and organisations comply with the requirements placed on them. Such confirmation can be Certification by an independent third party such as DNV.

The Certification features in this issue of *DNV Forum* reflect many of the changes and challenges at the heart of DNV's approach to its changing business world. The growing importance of product certification, a commitment to improve quality and environmental standards, and a 'willingness to embrace the certification world in all its forms,' are recurring themes in the pages which follow.

For the principal players in the industries DNV serves, Konkoly-Thege believes it is important to focus on creating trust and confidence in DNV's certification procedures. 'Only by keeping this in mind can we contribute to a more open international trade, and eliminate costly re-testing, multiple inspections and repeated certifications which must inevitably be paid for by the end user.'

We hope you enjoy this issue of *DNV Forum*, and that its contents will inspire innovation and help you, our clients, to meet the new challenges ahead.


Stuart D. Brewer, Editor
Stuart.D.Brewer@dnv.com

Steering towards the NEW GLOBAL ECONOMY

DNV's new chief executive officer Helge Midttun recognises that the global economy is changing, and its direction is clear. The 'production' economy, characterised by physical products, is developing into a knowledge-based economy, and in turn to a growing need for independent third-party players. Helge Midttun is well placed to lead DNV into this challenging future.



Helge Midttun (45) is the first non-engineer to head DNV. His background as a business economist, with extensive management experience in a world characterised by economic change, gives him a sound foundation on which to further develop DNV.

Midttun, who took over as DNV's chief executive officer in May of this year, has a business degree from the Norwegian School of Economics and Business Administration. He has a sound insight into economic developments, as well as substantial experience as the head of Norwegian-based companies with international perspectives.

The knowledge-based economy has already created a demand for new services, and this demand will continue to increase. Helge Midttun describes DNV's position for facing these challenges: 'DNV is in a unique situation. It is just the type of "knowledge" company that will be increasingly required by the markets.'

'DNV is respected by major customer groups and our brand name is well known. We are acknowledged to be independent, our employees have sound expertise in our markets, and we have a global presence. Our challenge will be to make this knowledge available, so that we can help our customers to safeguard life, property and the environment.'

A leader in certification

DNV has issued more than 30,000 certificates for management systems. The company that Helge Midttun heads is one of the largest certification companies in the world - a position won over the past 10-15 years.

To put current economic developments into concrete terms, Helge Midttun points out examples from the rapidly growing IT industry and the new services it has developed. 'Customers no longer meet suppliers face-to-face. Services, in particular, can be bought on the Internet. Customers therefore depend on their suppliers being credible, and on the systems used being sufficiently secure.'

'As an independent third party, DNV can help by certifying such systems. We can verify and certify in accordance with quality requirements and standards. In a market with increasing trade, more open boundaries, fewer obstacles as regards distance, and more stringent security requirements, this need becomes greater by the day.'

Advisory Services

DNV also has traditions going back more than 130 years in ship classification. Midttun points out how development of the knowledge-based economy will influence our customers' need for classification services. 'Our services have always been based

on DNV's knowledge. But the classification system will not remain unchanged. It is under development and under pressure. The difference between the various classification societies' rules is diminishing, and the products we offer our customers are becoming increasingly alike. Personally, I think things will develop in the direction of more transparency in the various classification societies' Rules.

'The main competitive factor in the future will be how we apply our expertise to help customers gain added value through the use of our services. We must provide them with more advisory services, in addition to traditional classification services. We can, to a greater extent, offer shipping companies our technical expertise, so helping them throughout all the phases of a ship – from pre-contracting to scrapping. Previously, we have probably been too much the controller. Now we must be the consultant that finds solutions together with the customer – irrespective of whether this is a shipowner, oil company or shipyard.' Midttun emphasises that it is important for DNV to differentiate between its roles here: 'We have one role as an independent third party and another as an advisor.'

Class societies must be restructured

Helge Midttun has told the international shipping press that he expects structural changes to be made in the classification societies. 'It would be naïve to think that the classification societies, as we know them today, will exist forever. Surroundings change, the structures of shipping companies and shipyards today can hardly be compared with what they were like 20 years ago. Although the classification societies have, of course, developed, their structures have remained much the same. The major players have been the same for many decades.

'We must primarily work towards having strong classification societies, with no doubt as to the safety and integrity that they are to safeguard. With increased demand for global presence, technological developments and a constantly high level of expertise, I don't think there is room for all the classification societies that currently offer their services, which means that a restructuring will be carried out.

'This is one of the reasons that, for example, DNV has held discussions with Germanischer Lloyd to reach, if possible, binding forms of cooperation.'

'It would be naïve to think that the classification societies, as we know them today, will exist forever.'

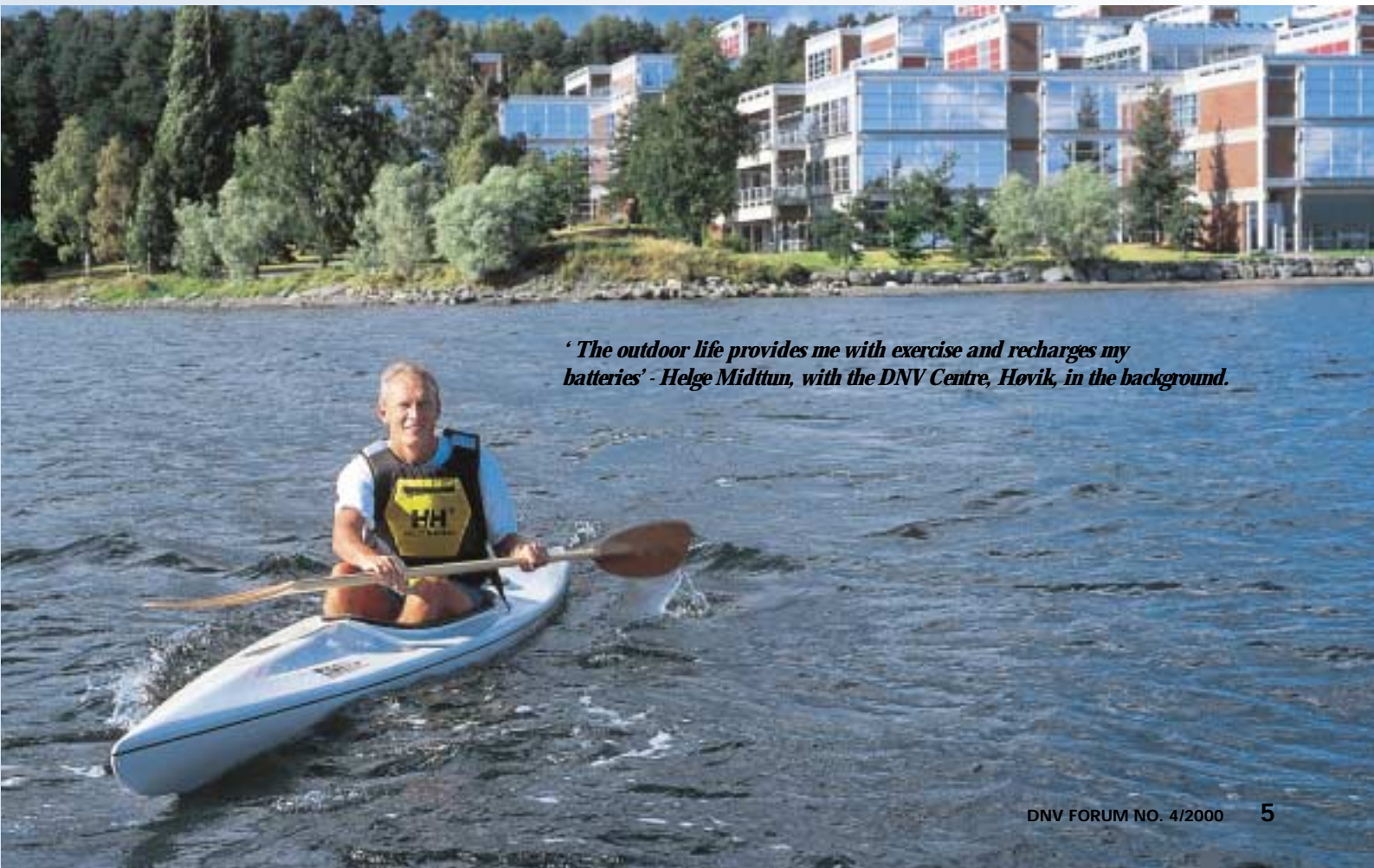
DNV's new CEO is also interested in the other classification societies. In the wake of the *Erika* sinking off the coast of France, and other recent incidents, there has been criticism of the classification societies.

Questions have been asked about the various players' abilities to take care of their responsibilities and contribute to increased safety.

Explains Midttun, 'I've made critical comments, too. However, I'm proud of the fact that DNV has the fewest port-state detentions throughout the three major port-state control regions. We should be pleased about this, and make sure that we maintain this position in the future too. We must never in any way compromise on safety, and we must say "no" if there is any doubt as to whether the customer is taking care of safety. But we must not become arrogant, and must always have in mind the goal that everything can be done better. For example, through the International Association of Classification Societies, we must take the initiative and push for joint improvements, and for the classification societies' role as a third party contributing to increased safety through wider trust and respect.'

Per.Wiggo.Richardsen@dnv.com

Photos: Kim Larsen



'The outdoor life provides me with exercise and recharges my batteries' - Helge Midttun, with the DNV Centre, Høvik, in the background.



Quality drives expansion of Saab luxury cars

Photo: Courtesy of Saab

Driving for quality:

'Quality and productivity don't need to be dictated; they're the aims of each individual - working to give us a better product,' says Saab's Ragnar Drake.

Within the next of five years, Saab aims to be a complete luxury-car manufacturer, to have doubled its production and to have launched new models. These are the very ambitious goals of the company's owner, General Motors, which is investing a total of SEK 30 billion in order to reach them.

'Central to GM's expansion plans is its strong focus on quality and delivering a product that our customers want and trust,' says Ragnar Drake, quality system manager at Saab Automobile AB, in Trollhatan, Sweden.

Dramatic changes are about to take place within Saab Automobile. An investment of SEK 30 billion will be made over the next few years with the aim of turning Saab into one of the world's leading luxury-car manufacturers. 'Saab is an enormously strong brand name and the company manufactures top-quality cars. It is high on GM's agenda for achieving growth in the luxury sector. GM is now making a long-term investment in Saab,' says Drake.

While Volvo, Mercedes, Audi and BMW have a wide range of luxury cars, Saab currently has only two model lines: Saab 9-3 and 9-5. Saab has plans to do something about that and will roll out five to eight new models over the next five years.

IN SUMMARY:

- *In an effort to combat market competition and become the world's leading luxury-car manufacturer, Saab is investing SEK 30 billion in its operations.*
- *The number of models will be increased by between five and eight, giving Saab a more complete range*
- *DNV's certification to ISO9001 is helping to maintain recognition by Saab's worldwide customer base that it is a quality supplier*

Drake states that central to achieving its goals is 'Saab's ability to maintain the high quality to which our customers have become accustomed over the years. Consequently, we make a big effort from the very start: right from the drawing board to the assembly line, we work with high-tech computer systems, advanced software and, above all, with computer aided design and manufacturing tools.'

According to Drake the effort is worthwhile, with Saab reaching higher levels of quality much more quickly, in terms of both details and the finished product. But despite the use of high-tech, Saab relies on its staff to perform effectively during the various steps in the development process. Says Drake, 'Quality and productivity don't need to be dictated; they're the aims of each individual - working to give us a better product.'

Quality control is vital

Recent controversies at both Ford and Mitsubishi have highlighted the increasing importance of quality controls. Jac Nasser, CEO of Ford, recently appeared before the House Commerce Subcommittee in Washington to defend Ford's role in one of the largest-ever product recalls in the auto industry. Almost 90 people have been killed and 250 injured driving Ford Explorers, the most popular sports utility vehicle in the U.S. As a result of the crisis, Nasser and other Ford executives are acting quickly to improve quality and supplier controls. Failure to deal effectively with product recalls can be disastrous, as Mitsubishi Motors of Japan has learned: its shares have fallen by more than 30 per cent since it announced a 20 year cover-up of customer complaints this summer.

'Every carmaker has its problems - the big difference is how they deal with the problems at customer level' - Ragnar Drake

Comments Drake, 'The stakes are high in the auto industry, and every carmaker has its problems - the big difference is how they deal with the problems at customer level. At Saab, we have made a concerted effort to become a customer service company with a strong focus on product quality and dependability. As part of our total quality drive we assigned DNV to carry out our ISO 9001 certification. The standard is a set of requirements for our management system, incorporating all the activities associated with quality, and addressing those activities which help ensure the customer's needs are met. More specifically, certification addresses the design and manufacture of automobiles, engines and transmissions, as well as parts supply and distribution. We're also in the process of implementing an environmental management system in line with ISO 14001 at all our facilities.'

Work on increasing production capacity has already started at Trollhatan. The work of extending the body and assembly plants started earlier this year. Construction of a new press line is also in progress. 'The upcoming Saab model range will provide scope for further broadening our customer base and achieving sales volumes substantially above today's figure of approximately 130,000 cars per year,' says Drake. 'The drive in Saab's most important markets, such as the U.S. and the U.K., will continue - as will our focus on providing high quality cars that our customers want and can trust.'

Stuart.D.Brewer@dnv.com

Remotely Operated Vehicles (ROVs) have been in use for many years at sea, often sent down to perform maintenance tasks by remote control, or for filming shipwrecks. Filming of the opening shots of the movie Titanic is a good example of such work. The manufacturer of the ROV used at that time was Houston-based Oceaneering, a leading supplier of ROV services to the offshore industry. DNV selected Oceaneering to help develop a new offshore ROV to be used for scanning hulls and other parts of offshore structures.

THE MODERN ROV

'performance like a jet fighter'

'The hull scanning of FPSOs is based on the new DNV technology for thickness measurement scanning of ships and offshore structures called Resonance Thickness Measurement, RTM,' says Jostein Jacobsen. He is DNV's project manager for the RTM development project. 'The technology is based on a novel application of the half-wave resonance method. This is an acoustic system, which sends a signal through steel, and by measuring the resonance can calculate its thickness. The method can assess the exact condition of any vessel, including FPSOs and other steel offshore structures.'

First of a family

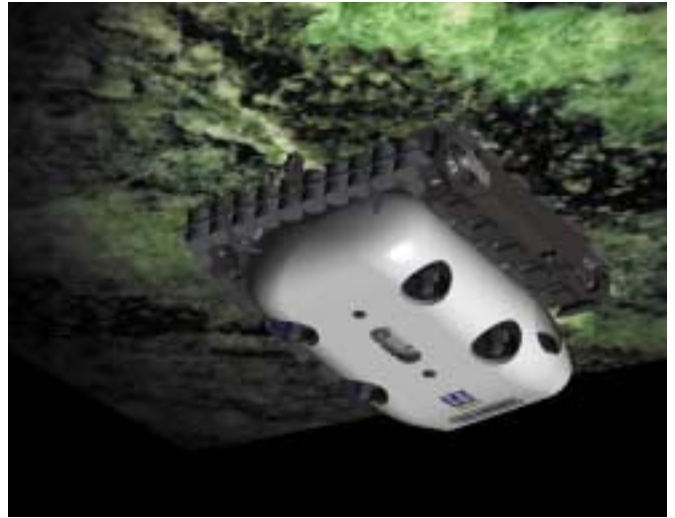
It is a grey, rainy morning in Stavanger on Norway's west coast. Here for the first time we see the Oceaneering 'Millennium' ROV, which, together with the 'Magnum' version, is used in the North Sea. These ROVs, painted in bright yellow, are equipped with two arms with mechanical 'claws' and lowered from supply vessels to perform underwater maintenance. They are operated by cable and an integrated video system.

The new DNV ROV is small, versatile and operates in six degrees of freedom. Oceaneering's project manager Alf-Kristian Aadland explains 'This new design has six thrusters. We can compare its manoeuvrability with that of a jet fighter. It can roll and loop and move in all directions. In ROV terms, this is new, and it has been an interesting challenge to develop to the requirements of DNV.'

President of Oceaneering International, T. Jay Collins, says: 'We are pleased to be working with DNV to develop inspection technologies and to incorporate them into a new series of capabilities for our offshore customers. Oceaneering and DNV bring world class experience to this combined effort to enhance the inspection, maintenance, and repair of floating systems. This hull-inspection ROV is the first of what we hope will be a family of new technologies to reduce costs, provide fast, accurate information, and add value to our customer's projects.'



Jay Collins - bringing Oceaneering's experience to work with DNV on enhanced inspection capability.



The ROV can scan a hull at the speed of one square metre per second at an accuracy of less than one millimetre on hull thickness.



Ease of scanning

Jostein Jacobsen describes the ROV's advantages: 'Using RTM technology means that our customer's FPSOs or other offshore structures can remain operational all the time. Scanning the vessels with our ROV can be done while production goes on as normal. FPSOs are designed to remain on location for many years, and discontinuing production for one to go to a yard for maintenance is costly. Our ROV can be taken to any location at short notice. In fact, the entire system fits easily into a helicopter, including the DNV and Oceaneering operators.' The new ROV, due to its manoeuvrability, can also move into the turret area of an FPSO and perform scanning as well as video recording of the condition of the structure and production lines.

The ROV can scan at a speed of $1\text{m}^2/\text{sec}$ using several sensors and advanced data processing. Combined with a high-accuracy navigational system, the data can be dumped directly into a 3-dimensional digital model, such as DNV's Nauticus system. The ROV itself weighs some 60 kilos, the entire system 150 kilos.

Magne.A.Roe@dnv.com



At the Oceaneering workshop in Stavanger, with a Magnum ROV. The project team (from left to right): Alf-Kristian Aadland, Jostein Jacobsen, Rune Hansen, Charles B. Hansen and Robbie J. Honigan.

CLIENT CONFIDENTIALITY

With clients such as Volvo, Saab, ABB, Electrolux, Ericsson and Hasselblad, Swedish consultancy company Gesab Engineering AB must prove that it takes information security seriously.

Many people think of information security as having to do with IT systems. But it encompasses much more than that. No matter how a company's information is stored, be it on PCs, programs, papers, or in employees' brains, it should be suitably protected.

BS 7799, the British Code of Practice for Information Security Management, was developed in response to demands by industry, government and commerce for a common framework to enable companies to develop, implement and measure effective security management practices, and to provide confidence in inter-company trading.



Photo: Megapix/Lehn



Reported crimes regarding manipulation of information have risen by 80 % since 1995, and the number of thefts of information by 22 %. Of these, employees account for 65 %.

Gesab Engineering AB, a consultancy firm in Sweden, is in the process of being certified by DNV. Says Vigleik Bolneset, managing director: 'Our business is to process other companies' information. If anything of what we do leaked out, it could be extremely costly and damaging to our customers. That's why we must make sure that none of the information we have falls into the wrong hands. It's not primarily hackers who threaten our information security, but rather what we talk about. Confidentiality, both internally and externally, shows that we are a company to be trusted.'

'Creating an information security system requires the attention of top management, because this work is so strongly linked to a company's policy and vision.'

Rewarding competence

Gesab Engineering AB is involved in product development, construction and production techniques, in addition to training CAD designers. It has seven offices in Sweden, and others in England and Germany. Its customers include companies in the defence and automotive industries – hence the importance of confidentiality. Gesab represents a type of company whose customers are constantly making demands of their management systems. In information security, Gesab has chosen to be ahead of those making the demands.



*Erik Fogelberg,
information security manager of
Gesab Engineering AB:
'Our employees are made to feel
responsible for the company's
information security.'*

Says Erik Fogelberg, information security manager of Gesab, 'Contrary to what we often hear from other companies, we make our employees, not our customers, the centre of attention. We take care of our people through a creative, positive working environment. Training in information security is done in small groups and workshops to ensure that the participants feel they are responsible for our joint information security. At the end of the day, everything depends on our employees' loyalty. Happily, very few of our employees leave the company.'



*Vigeik Bolneset, managing
director of Gesab Engineering AB:
'In Sweden, DNV is recognised
as the most stringent certifying
body. That is why we chose them.'*

Safeguarding information

Vigeik Bolneset considers that DNV sets the most stringent certification requirements. 'That is why we selected DNV.' The company's information-security management is being certified to the BS 7799 standard. It is based on a risk analysis in which threats to and vulnerabilities of assets are assessed in relation to a company's business perspective. The analysis thereby identifies the company's vital information assets and creates a strategy for how to retain this, even if key employees should leave the company.

Says DNV's information security auditor Birger Berggren, 'Everyone talks about IT security, but that's only a small part of the whole. A risk analysis has to cover the entire company. In turn, it makes it possible to improve business.'

Based on the findings of the risk analysis, a business continuity plan is made to safeguard operations in a number of areas, should unforeseen events take place. The company then must show that the routines, procedures and processes work.

DNV's marketing manager for BS 7799 in Sweden, Inger Nordin, explains, 'The standard demands continuous follow-up. After six months to a year, the company has to examine the risks again and check if they have been minimised in reality.'

'Our requirements are that we must be fully operational within five days following any emergency incident,' comments Erik Fogelberg. 'We are working on integrating all our systems, including quality and environmental, in order to develop a fully comprehensive management system.'

*Marketing manager
IT & Information
Security Inger Nordin
and auditor
Birger Berggren,
DNV Sweden, are
responsible for
Gesab's certification.*



'BS 7799 gives us a marketing advantage, because it gives us a stamp of seriousness in the business sector. We have fewer problems regarding accessibility to information because our data systems and computer systems function better and we've achieved better working methods. We've also managed to cope with viruses and hackers.'

Christine.Calvert@dnv.com

Why certify your information security management system?

Such a system entails implementing an information security policy with the aim of managing business risk.

A BS 7799 certificate will:

- Demonstrate to a company's clients, partners and employees that it has a strong commitment to confidentiality.
- Provide evidence by a third party that security requirements are met.
- Drive the policy implementation process.
- Demonstrate due care, so helping reduce risk and avoid liability.

A NEW LEASE OF LIFE

Biomedical engineering enables today's remarkable developments in medical knowledge to be applied in practice.

DNV is involved in the CE labelling of medical equipment - a matter of life or death, and fully consistent with DNV's objective of safeguarding life, property and the environment.

The stent is placed in the Cardiac muscle artery via a catheter in the groin, and is pumped up and left in the cardiac muscle in order to ensure the continued free flow of blood.

CERTIFICATION

71-year-old Johan Dybdahl from Kristiansand in southern Norway lay reading a book as he was wheeled into the operating theatre. The arteries to his cardiac muscles had become blocked. He had been through this before - he had had a cardiac operation a few years ago, at which time his whole chest had to be opened up. This time it's easier. He does not even need a general anaesthetic, and can watch the entire operation.

The doctor, Arne Johannes Tofte, and radiographer Inger Johanne Saastad have entered a catheter via the groin. They can watch the catheter searching for the cardiac muscle's blocked arteries on large X-ray screens. Dr Karleif Vatne is watching the operation in the next room - and explaining to me just what is happening. We can see the two doctors conferring. The atmosphere is very calm. When the operation is over, three metal stents - tubes to keep the arteries open - have been left in Johan Dybdahl's cardiac muscle artery.

Vital inspections

Dr Karleif Vatne was the first doctor in Norway to use stents in cardiac operations. He cannot overemphasise the importance of properly inspecting the technical equipment used. 'After all, we're talking about human lives. There's no use having inferior inspections. Nor must we go to some certification company in order to get away with a simpler, and maybe cheaper, inspection.'

Eugenie Husebye, who heads DNV's work on medical equipment, points out that CE labelling by DNV is in accordance with all the latest rules and provisions. 'The equipment used in this kind of surgery is classified as a Class 3 product, so no errors are tolerated,' she explains. 'There's always a risk that something can go wrong - a calculated risk with all medical equipment - but that risk must be evaluated.'

Ms Husebye explains that all the equipment used in the operation we have just seen is CE labelled. 'We look at the technical documentation on each product and then inspect the entire process. The plastic used in the catheter balloon used to unblock the artery is assessed by risk analysis. The same is true of the stainless steel used in the stent that will keep the artery open - and of everything else involved.'

ISO certified, CE labelled

The Saint Côme Chirurgie facilities in Marseille and European Catheter Technology (E.C.T.) facilities in Toulouse are both ISO certified and CE labelled by DNV. 'The CE standards are very strict. Our products are in the maximum-risk class - Class 3. DNV has carried out a complete audit of our work,' states Ms Christiane Fouere, who started Saint Côme Chirurgie together with her husband in 1993. He invented and patented the metal stents of their company.



'We have specialised in stents and balloon catheters. In future, we'll also make narrow radiology products for use in brain surgery.' In the same way as balloon catheters are used to open cardiac arteries and stents are left in to keep arteries open, new methods will also make brain operations easier and less risky than they are today.

Says Christiane Fouere, 'New technology is changing the face of medicine. In future, doctors will avoid surgery as much as possible. Surgical procedures will only be necessary in critical situations. For example, a bypass operation needs at least 3-4 weeks of convalescence - and involves a risk of serious problems. Now the doctors put in stents straight away - so the market keeps on growing.'

All safety aspects considered

Philippe Periphanos at DNV in Marseille works with Sterling Kwartz to certify Saint Côme Chirurgie's quality system, and to CEMark its Class 3 products. Kwartz is Dutch, living in France, and has considerable experience of working on medical hazards. Together, the two have conducted the audit, with Periphanos responsible for following up the directive itself, and the medical expert, Kwartz, responsible for the technical side of the product.

'It's particularly important to take all the safety aspects into consideration,' states Periphanos. 'A stent has to be inserted into the body. The risk analysis must be checked. Added to this,



71-year-old Johan Dybdahl having his cardiac arteries unblocked at Rikshospitalet. Three stents are placed in the cardiac muscle to keep the arteries open.

we have to follow a checklist of essential safety requirements. When dealing with a Class 3 product, we must also carry out qualitative surveys and evaluate if the risk analysis covers all the relevant risks. This is where we apply DNV's skills and experience of systematics, certification, medical knowledge and risk assessment for the benefit of the manufacturer and – most importantly – of the patient.'

CE labelled for life

More and more products will be CE labelled. It is important that people who come into contact with these products know what CE labelling involves, and that they can trust the label.

'The CE standards are very strict, and they have to be,' states Ms Fouere. 'Without CE labelling, a product is worthless. Once it is CE labelled, the product can carry out its function and both save and prolong life.'

In Kristiansand, Johan Dybdahl is hopefully still enjoying life. Maybe he's sitting reading? At least he is not bothered about the three stents he had inserted into his cardiac muscle. They have given him a new, better life and, hopefully, many good years ahead of him. CE labelling has undoubtedly helped.

Harald.Brathen@dnv.com
 Photos: Knut Vadseth

The Medical Devices Directive (MDD)

Directive 93/42/EEC (MDD) was adopted on 14 June 1993, as part of the process of removing barriers to free movement as well as of securing the safety aspects of medical devices within the EU/EFTA member states. Until the implementation of the MDD, medical devices were covered by local laws and regulations in each individual country. The directive became mandatory on 14 June 1998.

DNV Region Norge AS (DNV RN) has been appointed the Notified Body for all medical devices under the directive, with the identification number 0434. Its main task is to verify all assessments and take a uniform approach to the MDD. This is done by supporting the local DNV units, which carry out the CE assessments at clients' premises.

In total, DNV has issued 600 certificates. Today, DNV is involved in the CE assessment of medical devices in Europe, America, Australia and Asia. Its success is due to it having highly qualified personnel in the local DNV units, and to good co-operation between them and DNV RN. DNV Italy has been especially active. Taiwan is catching up, and new countries to come are China, India and Brazil.



'New types of technology are on their way in,' confirms Ms Christiane Fouere, of Saint Côme Chirurgie.

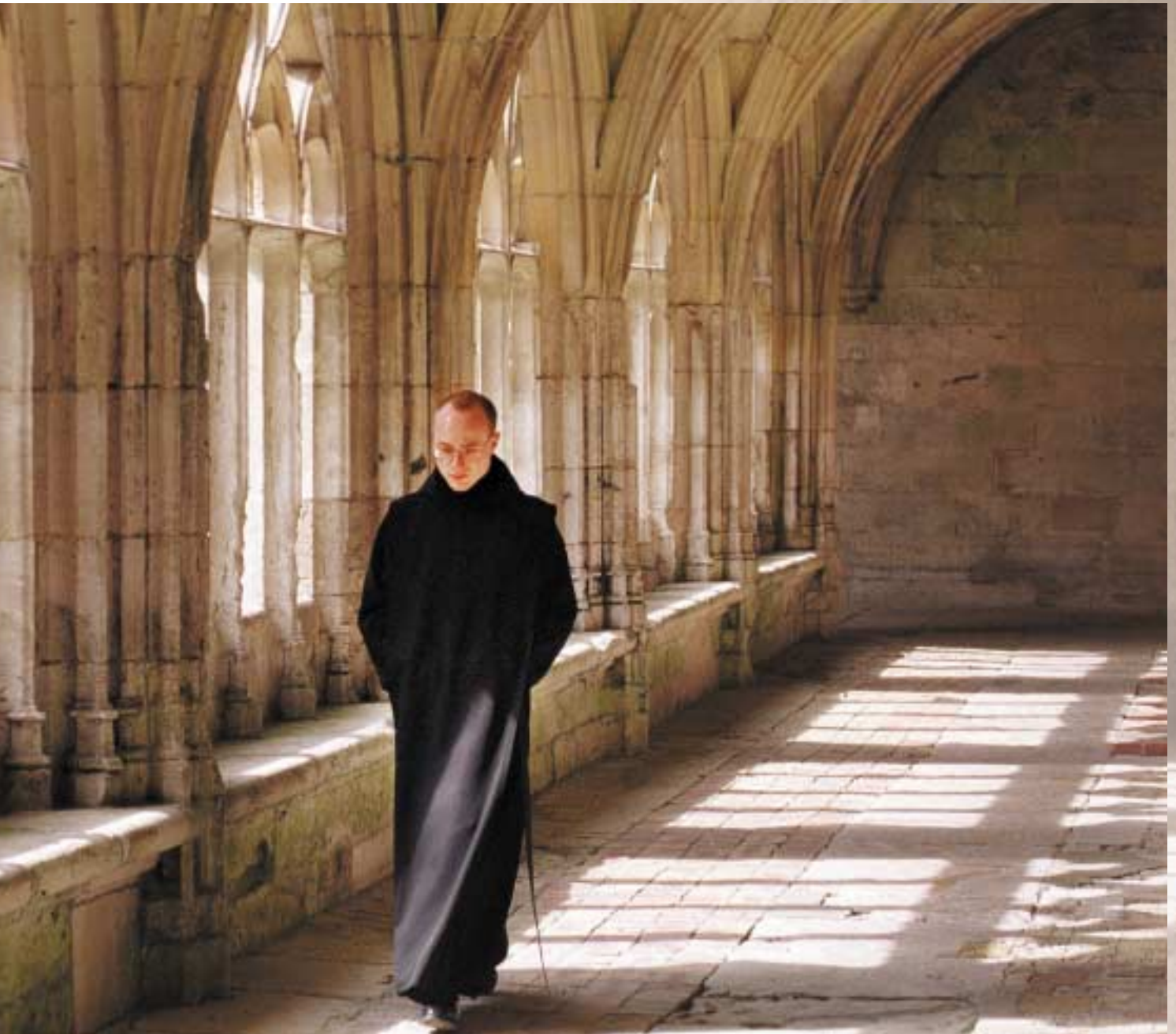
Producing CD-Roms: a worthy task for **THE MONKS OF ST. WANDRILLE**

Tradition and modernity. Humanity and knowledge. Peace and realism. The impressions are many and the emotions mixed. One does not know what to expect at this DNV-certified Benedictine monastery, founded in the 7th century on the river Seine west of Rouen, France.

Quality takes top priority with the monks. The monastery production plant contains state-of-the-art equipment for printing, copying, and producing CD-ROM discs. France's most advanced companies are on its customer list. In 1999, Fontenelle Microcopie, as the plant is named, won the Normandy quality-assurance award. The facility is now aiming for the French and even the European award.



CERTIFICATION



St Wandrille monastery. A unique society, and a 'factory' with which few companies can compete.

CERTIFICATION

We all have our preconceived notions as to what a monastery is. What the people are like. How strict and serious, and even boring, their lives are. When Brother Nicolas Vinot Prefontaine tells us that the lights go out at 10pm, and that the monks get up at 5am, I can't help asking: 'What happens if you don't put the lights out at 10pm?' 'Then I end up very tired', he replies drily.

ISO certification adds dynamism

'Many people think that we lock ourselves away when we enter a monastery. But the opposite is true,' says Brother Nicolas, quality-assurance manager of the production plant which DNV recently certified to ISO 9002. 'We open ourselves up to God – and to people.'

'The goal for our production plant is to have total quality – and to maintain this quality,' says the head of the monastery and its 'factory', Father Didier le Gal. 'We have looked on ISO certification as a helpful tool that adds dynamism to the entire company and its employees.'



Father Jean-Charles Nault and Joël Thomas discuss the work in hand.

Michele Planeix-Dumas is the DNV auditor performing the ISO 9002 certification. 'It has been both different and valuable to work with the monks', she says. 'Their system is fine. They have it all written down correctly. They are concentrated and dedicated about what they have done and will do. And they are totally unaware of stress, without all the disturbances we have in our everyday life. I have sometimes found the same dedication in smaller companies, but seldom in large ones.'

Technology, quality and culture

'Three criteria are necessary to success: technology, quality and culture,' emphasises Father le Gal.

Fontenelle Microcopie has more than 30 employees, 12 of whom are monks. The others are 'civilian' employees – all men from the surrounding area. This is a different kind of workplace for them, but obviously a better one. The staff turnover rate is far lower than at other companies. Any problems are discovered and dealt with through employee surveys and dialogues.

The employees have participated in various historical projects, such as a study of Roman and Gothic art. This year, geology is the theme. How were the Alps formed? What flora and fauna are to be found there? It ends up with a trip to the Alps, in which all the employees take part. 'We look on knowledge as a way of making people tolerant,' says le Gal, who can also see the benefits and joys involved in passing on this knowledge to the employees' families. 'Instead of just talking about sport, they can also talk about cultural issues at the dinner table.'



Father Didier Le Gal, Head of Fontenelle Microcopie, and quality manager brother Nicolas Vinot Préfontaine in the gardens of St Wandrille.

Breakfast with the customers

Some of the employee training involves everyone, irrespective of their jobs, going out to meet the customers. Customers are also invited to breakfast at the monastery four times a year.

Seminars are arranged biennially, the latest one being in October last year on the theme of 'Human beings and quality'. Top speakers from the monastery and well-known French companies attracted an audience of close to 100.

Leading industrialists also come here for 'a break', and perhaps to seek relief from a hectic working life. They may live in the monastery and join the monks in prayer, conversation and self-denial for up to 10 days.

Profit used on social work

The profit generated from CD-ROM production is spent on running both this monastery and others, and on extensive social work, perhaps the most important of which is work with deprived young people who have to be helped into real life. Real life is also where St Wandrille monastery is to be found – with its own website (www.st-wandrille.com) – in English too – and an e-business scheme planned for implementation in a year or two.

A unique society. A society from which we could all learn a lot.

Harald.Brathen@dnv.com

Photos: Nina Eirin Rangøy

How Toyota protects **THE ENVIRONMENT**

In 1999, Toyota produced more than one million vehicles in its North American plants. ISO 14001 certification of its plants and suppliers by DNV has helped improve environmental performance. ‹



CERTIFICATION

Toyota places great importance on protecting the environment. That has long been the case with its cars and trucks, which feature state-of-the-art emission controls, and the newly introduced 'hybrid' vehicles. But it is also true for Toyota's manufacturing operations in North America. At each facility, a priority is to protect the environment.

ISO 14001 a baseline

Says Kevin Butt, assistant general manager for Environmental Affairs at Toyota, 'We want improvement of the environment. We are always seeking ways to actually redesign the process itself so less waste is produced.' Toyota Motor Manufacturing North America Inc. (TMMNA) was initially sceptical of the ISO 14001 process, as the company already had well established and effective management systems. 'Our first impression of ISO 14001 was that it was too vague, with little impact, and not adding value. We considered it a baseline, but not all we needed. But it works if your registrar holds you responsible, and that is just what DNV's auditors do.'

'ISO 14001 makes possible continuous control of results. ISO 14001 compares to Toyota's own production philosophy and fits very well into our production system. We emphasise pro-active management and total employee involvement. It makes environmental awareness everyone's business inside our plants. These standards can only make our already good environmental systems even better. ISO 14001 certification is a natural development of Toyota's manufacturing philosophy, which seeks to reduce waste and improve quality in all areas of production.'

Reinforcing the production system

'We began the process early in 1997,' continues Butt. 'The first registration was received in October 1997, and the last will be in December this year. We covered all the North American plants, and we went at them step-by-step. So what we learned from one plant we could take to the next, and not have to reinvent the wheel each time.'

Toyota was also the first automaker to secure full ISO 14001 registration in the United Kingdom and in Japan. And Toyota in the U.S.A. is actively working on the registration of its support organisations, including Toyota Logistics Services and Toyota Marine Operations in Florida.

Says Butt, 'Toyota has had a very good environmental management system, but I think this process, ISO 14001, actually reinforces our production system of plan/do/check/action.'

Certifying the suppliers

Toyota now spends more than \$10 billion per year for parts and materials from hundreds of North American suppliers and partners. Each job created by Toyota in North America produces 5 or more additional jobs 'downstream,' meaning Toyota's manufacturing investment in North America is actually responsible for more than 150,000 jobs overall.

Toyota's Green Supplier Guidelines' outlines the initial steps its suppliers must take. The outlines have resulted in a few questions, but a largely positive response.

Says Tim Johnson, assistant manager, Environmental Affairs, 'Toyota expects 100 percent compliance from its North American suppliers. To make it easier for them to follow the ISO 14001 certification guidelines, we have created and are providing a CD-rom containing our guidelines and other useful information, free of charge. For the suppliers, it is of course a cost issue. It's also a question of credibility. A credibility that is strengthened by the fact that a third party is taking care of the auditing.'

Kevin Butt considers DNV's auditors to be tough. 'We feel that DNV is our partner, and is helping us improve, not only in certification. We've actually learned more about our manufacturing operations by going through the ISO 14001 process. The ISO process is a bottom-up, top-down approach, and everyone is involved; I think it's been a great learning experience for a lot of our team members.'

Knut.Anders.Andersen@dnv.com



Assistant manager Tim Johnson (left) and assistant general manager Kevin Butt find that ISO 14001 certification by DNV fits very well into Toyota's production system.

CERTIFICATION

In 1999, Toyota produced more than one million vehicles in North American plants.



Toyota in North America

Toyota Motor Manufacturing North America (TMMNA) is the parent company of Toyota's manufacturing operations in the United States and Canada.

700 employees in Erlanger, Kentucky, provide centralised support to Toyota's ten North American manufacturing plants in several key areas, including purchasing, production control, production engineering, quality control and administration.

Manufacturing

In five states and Canada, Toyota is building cars, trucks, engines and components with parts from domestic and global sources.

In 1999, Toyota produced more than one million vehicles in North American plants.

Toyota also produces various key components in North America, such as engines, truck beds, catalytic converters, aluminium wheels, steering columns and aluminium engine parts. In 2001, Toyota's West Virginia plant will add automatic transmissions to its production. This will be the first plant outside Japan to manufacture Toyota automatic transmissions.

Today, Toyota's North American investment is nearly \$12 billion and its total employment is 31,000 people, including 20,000 alone at manufacturing plants in California, Indiana, Kentucky, Missouri and West Virginia, and in British Columbia and Ontario, Canada.

Toyota and the environment

Virtually 99 percent of all scrap metal generated by Toyota plants is now recycled. In addition, many waste materials such as plastic wrap, paint solvents, used oil and packaging are recycled. Engine blocks too, keeping 500,000 pounds of material from ending up in the landfill. Toyota vehicles are now 85 percent recyclable. Shredders allow steel and non-ferrous materials to be recycled. New processes also enable recycling of urethane foam, copper, glass and plastic bumpers.

In addition to recycling, Toyota also actively seeks ways to produce less waste. For example, anti-chip paint is now applied by roller rather than sprayer. This saves paint, reduces emissions, eliminates the need for plastic masking and holds down cleaning costs. The redesigned process reduces wastes by 40 percent.

Toyota's 'Green Supplier Guidelines'

Represent the initial steps suppliers must take as partners in protecting the environment. The Toyota Supplier Environmental Programme incorporates the following elements: ISO 14001 certification, a chemical ban list and a hazardous materials transportation management system.

To maintain credibility, objectivity and consistency of ISO 14001 certification, Toyota also requires third-party certification from its suppliers.

Toyota expects that suppliers providing direct raw material, indirect raw material and/or parts and components, develop and implement an environmental management system that conforms to the ISO 14001 standard. The environmental management system for each facility supplying the raw material/and or parts to or for Toyota must be certified by an external 14001 auditor by the end of 2003.

Toyota and ISO 14001 Certification

ISO 14001 is a voluntary standard that deals with a company's environmental management system. The certification process verifies that each Toyota plant has a formal environmental policy as well as a management system designed to track environmental performance and established mechanisms for continuous improvement.

ISO guidelines call for corporations to learn how environmental laws and regulations specifically apply to the individual company. Toyota employees and managers are encouraged to adopt personal responsibility for the environmental standards in their areas, and to establish their own objectives and standards.

A COMMITMENT TO ETHICS

'Being certified to SA 8000 by Det Norske Veritas demonstrates Honda's respect for the individual,' says Michele Della Zizza, business administration manager for the Honda Logistic Centre in Italy. Honda Logistic is the first in the Honda Group, and the first company in Italy, to be certified to this standard by DNV.



With the increase in globalisation of all aspects of business, including the outsourcing of most manufacturing to contractors, and in turn to subcontractors, the need for one auditable, global standard resulted in the Social Accountability standard SA 8000. The standard is based on the principles of the 11 Conventions of the International Labour Organisation, the Universal Declaration of Human Rights, the United Nations Convention on the Rights of the Child, and the management process used by the international quality and environmental standards ISO 9000 and 14000.

SA 8000 was published in October 1997 in order to address and eliminate unfair and inhumane labour practices. With the objective of ensuring ethical sourcing of goods and services, it is a voluntary standard and can be applied to any organisation of any size, across all industries and across cultural and geographical boundaries worldwide.

For employees of firms in industrialised countries, SA 8000 underscores its commitment to corporate social responsibility.

Says Della Zizza, 'After being certified with regard to quality and the environment, we looked into the special characteristics of our company. We had to ask ourselves: What distinguishes Honda, and makes it unique inside its operational environment? Obviously, respect for the individual is the base for the company's entire philosophy. The one international standard that matched our company's philosophy was SA 8000.'

'The certification scope covered our core business: Storage, handling, packaging and distribution services of car, motorcycle and lawnmower spare parts for Honda products everywhere.'

CERTIFICATION

Honda Logistic's Michele Della Zizza, pictured in one of Honda's 'green lungs': 'Staff are known as associates. We all wear the same white T-shirts at work to demonstrate that we are all equal.'



Photo: Rune Korsvoll

Living by a philosophy

In order for a company to become registered to SA 8000, it must first assess its current work environments and determine the degree to which they already comply with the standard and with local laws. Companies with policies and practices already in compliance with SA 8000 must document and integrate them with existing management systems.

The DNV certification process is carried out in defined stages, which is cost-effective and allows maximum opportunity for feedback and discussion, with a constructive approach by the certification body.

A report is issued at each stage, giving the findings in understandable language. This allows problem areas to be identified and corrective action taken at the earliest opportunity, with minimum cost and disruption to business.

Della Zizza explains, 'When I started working on the certification process, since no other company in Italy had such experience from this kind of process, I had to write an SA 8000 handbook manual, then write down our operational procedures. I studied international rules and human rights legislation to get a picture of what was important.'

A marketing tool

There is growing interest in social accountability in the media, and Della Zizza believes that in the future SA 8000 will be important for marketing purposes. 'For large companies which purchase products or services abroad, it will ensure that they can be certain that no abuse or misuse of workers is going on. SA 8000 will be important for the whole Honda Group in the future.'

Christine.Calvert@dnv.com

HARMONISATION the keynote

QS-9000, VDA 6.1, AVSQ, EAQF, ISO/TS 16949. Though these abbreviations are incomprehensible to the uninitiated, they are extremely important for the quality of the global automotive industry. They are all quality standards issued by the national car-manufacturer organisations – with one exception, the ISO standard ISO/TS 16949. More and more players in the automotive industry now seek harmonisation and just one standard – the ISO/TS 16949.

‘We have worked since 1996 to achieve harmonisation of our supplier quality system requirements for the benefit of the automotive industry,’ reads a communiqué from the International Automotive Task Force (IATF). ‘We have previously agreed to a common supplier automotive-quality requirements document, ISO/TS 16949, which, with its customer-specific attachments, satisfies our respective current requirements documents: AVSQ, EAQF, QS-9000 and VDA6.1.’

Improved quality worldwide

The IATF is an ‘ad hoc’ group of vehicle manufacturers and their respective trade associations, formed to provide improved quality products to customers worldwide. Specifically, the purposes for which the IATF was established are:

1. To develop a consensus around fundamental quality system requirements, primarily for the participating companies’ direct suppliers of production materials, product or service parts or finishing services (e.g. heat treating, painting and plating). These requirements shall also be available for other interested parties in the automotive industry.
3. To develop policies and procedures for a common IATF third-party registration scheme to ensure consistency worldwide.
4. To provide appropriate training to support the ISO/TS 16949 requirements and the IATF registration scheme.
5. To establish formal liaisons with appropriate bodies to support IATF objectives.

IATF members include the following vehicle manufacturers: BMW, DaimlerChrysler, Fiat, Ford, General Motors (including Opel Vauxhall), PSA Peugeot-Citroen, Renault, Volkswagen and their respective trade associations – AIAG (U.S.A.), ANFIA (Italy), FIEV (France), SMMT (U.K.) and VDA (Germany).

ISO/TS 16949 jointly developed

The ISO/TS 16949 technical specification was jointly developed by the IATF members and submitted to the International Organisation for Standardisation (ISO) for approval and publication. The document is a common automotive quality system requirements catalogue based on ISO 9001:1994, AVSQ (Italian), EAQF (French), QS-9000 (U.S.) AND VDA6.1 (German) automotive catalogues. This document, coupled with customer-specific requirements, defines quality system requirements for use in the automotive supply chain.

The IATF is also developing a common registration scheme for supplier third-party registration to the ISO/TS 16949. The registration scheme will include third-party auditor qualifications and training and common rules for consistent global registration. Some of the benefits of the IATF registration scheme include:

- improved product and process quality
- confidence in global sourcing
- reassignment of supplier resources to quality improvement
- a common quality system approach in the supply chain for supplier/subcontractor development and consistency
- a reduction in multiple third-party registrations.

An option for suppliers

The ISO/TS 16949 does not replace AVSQ, EAQF, QS-9000 or VDA6.1. The document represents an option for suppliers. In the future, IATF plans to revise the ISO/TS 16949 to align with the ISO 9001:2001 text.

With ongoing support from the executive managements of the IATF participating organisations, IATF will provide the opportunity for other automotive manufacturers utilising the ISO 9001-based quality system requirements to participate in this



The automotive industry is becoming more international. This Swiss-registered Smart, built in Germany by DaimlerChrysler, and with a Norwegian driver, was photographed in France.

alignment effort and continue to work towards management of the global third-party automotive registration scheme by a common international automotive organisation. The IATF is convinced that ISO/TS 16949 and the common global registration scheme, implemented in the spirit of continuous improvement, will enhance quality systems while eliminating redundant requirements and thus reducing costs.

Emphasis on self-assessment

‘China, Iran, Russia, Poland and Hungary are important new areas for those of us with the German standard,’ says Jürgen Schulz, the head of the German Verbandes der Deutschen Automobilindustrie (VDA). Indonesia also came on the map recently, when the DNV-certified Epcos – one of the world’s largest suppliers of thermistors, multi-layer ceramic condensers and varistors – was certified in accordance with VDA 6.1.

Jürgen Schulz believes it will take a few years before the automotive industry agrees on one standard. ‘We’ve managed to combine VDA6.1 and QS9000 very successfully. This standard has, in my opinion, been better and cheaper to relate to than the new ISO standard,’ he says. ‘I think we’ll have more self-assessment in the future. Self-assessment started with VDA 6.4. Companies like these certificates. They show that the company is qualified. VDA wants to make rules that ensure independence in internal self-assessment. For certification bodies such as DNV, there is almost certainly a future in certifying self-assessments. I also believe there will be fewer system audits, and more process audits. VDA 6.3 is made for this. In future we must optimise the process, save and be cost-conscious.’

One common standard makes sense

‘It would make sense if we one day had one common automotive standard for suppliers all over the world,’ states Harold Hodder of the Americas Division of the International Automotive Oversight Bureau (IAOB). ‘Oversight activities with the five countries involved are up and running. We have started the process of witnessing the auditors and registrars. So far the results are encouraging. We regularly meet to calibrate activities and to compare results. This is one of the objectives of having a global certification scheme. There is more activity in Europe than in the U.S.A. It is a logical move for all these countries to have one common standard. There have been more audits and more certificates are issued in Europe, but American suppliers are increasing.’

Roger Howe, General Manager of DNV Certification Inc, based in Houston and responsible for coordinating DNV’s TS 16949 activities with the American IAOB, concurs with Harold Hodder’s view. He also adds ‘The success of TS 16949 as a third party registration tool will depend very much on the automotive industry’s willingness to work with the registrars to maintain overall quality of the audits and give direct feedback on problems encountered with registered companies. This feedback should be to both the registrar community and the individual registrar. Only in this way will registrars be able, individually and collectively, to modify their audits to help locate and remove programme and process problems.’

Harald.Brathen@dnv.com

Petrobras pioneers offshore **RESEARCH AND DEVELOPMENT**

When the Brazilian state-owned oil company Petrobras was founded in 1953, the goal then was to create an oil exploration and production monopoly. Today, the country's biggest company is changing direction: the monopoly period is over, and Petrobras is striving to become a transnational corporation, competing against the world's oil majors.

'It is crucial now that we build on the advances we have made, and stay at the forefront of offshore research and development,' says Claudio Siqueira Vianna, head of exploitation at CENPES, Petrobras' Research and Development Centre.

Petrobras is a mixed capital corporation linked to Brazil's Ministry of Mines and Energy. It operates in the exploration, production, refining, processing, trading, and transportation of crude oil.



CERTIFICATION

Over the past few years, Petrobras has made important hydrocarbon discoveries in constantly deeper waters, and is recognised as one of the world's most advanced companies in the deepwater sector. Says Vianna, 'The company is spending around US\$ 200 million per year on research and development, and this will continue to ensure we become the leader in this area of technology.'

According to Vianna the company owes its performance record to its determination to develop new technologies. In 1996, the company's technical training centre became the Centre for Research and Development, CENPES.

Says Vianna, 'After the company centred its attention on the Campos Basin, Petrobras R&D began to focus on offshore production, especially in deep and ultra-deep waters. Thus Petrobras' programme for Technological Innovation on Deepwater Exploitation Systems - PROCAP - was created to develop the necessary technology for producing at water depths of up to one thousand metres. That programme was followed by PROCAP 2000, aiming now at the 2,000m water depth target.'

Extensive certification

Petrobras' research and development centre is equipped with the latest in oil technology. All technological investment occurs in parallel to investment in quality and environmental protection. In 1998, thirteen ISO 9000 certificates were received, including certification of the logistics and commercialisation process for the company's main products. The 50 certificates earned since 1994 encompass production, storage, transportation, distribution and marketing of gasoline, diesel, lube oils, paraffins, jet fuel, solvents, bunker oil, liquefied petroleum gas, and fertilisers.

Recently, Det Norske Veritas was assigned to carry out ISO 9000 certification relating to three sectors of CENPES. The Basic Engineering Department provides basic engineering design of oil and gas and process industry installations. RETEP (Well Engineering Technology Network), provides design and development of drill engineering and related laboratory services. And the latest ISO 9000 certificate was awarded in March 2000 to DIPLOT/SEMEC Department, which provides magnetic pig inspection services. Commenting on the certification process, DNV's Lincoln Mojon says 'the certification process is a standard type of work. The process starts with a pre-assessment of the quality system, when we review the documentation and make a general evaluation of the system.'



CENPES is a recognised world-class R&D centre with a history of technological excellence.

Then we carry out the initial audit. If any problems are reported during this audit, the company has to solve them before it receives the certificate. After the findings are closed, the certificate is issued, valid for three years. During this period, maintenance audits are carried out every six months. This is a standard process, and is being done for the three units of CENPES independently. The objective of CENPES is to obtain ISO 9000 certification of all departments.'

Meanwhile Petrobras' pioneering deepwater developments are moving ahead. The company recently put its record-breaking Roncador field on production, just three years after its discovery. The first phase of the development focuses on the north eastern sector of the field in water depths varying between 1,500 and 1,590m. This area will eventually produce about 180,000b/d from 21 producing and five injections wells. The second and third development phases will focus on the south eastern and south western sectors of the field. The Roncador development has beaten Petrobras' previous record for deep water development that was set in August 1997 for the Marlim South field, in 1,709m of water.

Continues Vianna, 'Increasingly, oil production from ultra-deepwaters has become the new challenge to be met by the industry. With the depletion of our onshore and shallow offshore reserves, the industry's path has been to undertake oil exploration in ever-deeper waters.'

'The new challenges have required new technological solutions to be found, either by adapting existing technologies or by developing new alternatives, so as to make it possible to produce oil in extremely adverse conditions.'

Stuart.D.Brewer@dnv.com

IN SUMMARY:

- *BP has taken the lead in the climate-change debate. The oil major recently commissioned a partnership of three companies, KPMG, DNV and ICF Consulting, to provide an independent audit of its greenhouse gas emissions*
- *The audit project is the first of its kind for a major corporation, and will provide valuable learning to organisations involved in managing greenhouse gas emissions.*

New economy, NEW COMMODITIES

'In responding to the challenges of global climate change, businesses will increasingly have to account for and report on greenhouse gas emissions,' says Nick Hughes, BP's climate manager for Europe. The oil major has recently introduced a group-wide GHG trading scheme as part of its programme to achieve cost-effective emission reductions.

In 1998 BP's CEO Sir John Browne committed the company to reduce GHG emissions by 10 per cent below their 1990 level by 2010. Based on an estimated emissions level of 100 million tonnes in 1998, this commitment represents a total reduction of more than 50 million tonnes over the period to 2010, taking into account growth over the period.

Nick Hughes explains, 'To deliver this target in the most cost-effective way, BP has launched a group-wide system of emissions trading between our business units. This trading system went live at the start of this year and is the first-ever corporate global GHG emissions trading system.'

'Each business unit (BU) is allocated an annual GHG allowance. Those BUs which can reduce emissions below their "allowance" can sell excess allowances to other BUs facing higher emission abatement costs or needing extra allowances to accommodate growth. The trading system will allow the BUs to find innovative and cost-effective ways to reduce emissions.'

Transparency

To reinforce its commitment in a transparent way, BP commissioned a team from DNV, together with financial auditors KPMG and US-based GHG specialist ICF, to undertake an independent audit of its GHG emission data. Says Hughes, 'This project was designed to underpin BP's commitment to reduce its GHG emissions in a transparent way, establishing the credibility of emissions reductions to all internal and external stakeholders. The project was also to provide valuable learning in the audit and verification of GHG emissions across a diverse business, making this experience available to other interested organisations; and to help ensure that GHG allowances are traded on a transparent and credible basis.'



'Greenhouse gas emissions trading reflects a convergence of environmental and market-based mechanisms' says BP's Nick Hughes.

Risk-based auditing by DNV

The initial audit focused on emissions reported for 1990 (this represents the baseline for the Group target) and 1998, on which trading allocations have been based. According to Philip Comer, DNV's project manager, the audit proved a challenging assignment as there are no agreed GHG reporting standards. Says Comer, 'A special feature of the audit was the amalgamation of principles of both financial and environmental auditing practices, which has given added value to the process. A risk-based audit approach was used, drawing on an understanding of BP's risks and controls as they relate to GHG information and their impact on the completeness, accuracy, and consistency of the reported data.'

'As a result of increasing interest in greenhouse gas trading, city traders see a potential market; and are sensing that a carbon-constrained economy will lead to business opportunities.'

The audit team verified that the GHG data collected and reported by BP was of high quality, although a number of issues were identified such as the need to identify 'best practice' for data management systems and transfer these across the Group. Says Hughes, 'Given the developmental nature of BP's GHG emission reporting programme, the audit findings are consistent with expectations of a pioneering effort where industry and international GHG emission reporting and verification guidelines are only now emerging. The learning from BP's efforts to secure high quality group-wide GHG reporting, and the auditors' experience in verifying the accuracy and consistency of the reported data, will provide valuable input into this rapidly developing discipline.'

National trading systems

Commenting on the future of external gas trading, Hughes believes that governments are becoming increasingly interested in the concept of greenhouse gas trading. 'It's one of the mechanisms proposed in the Kyoto protocol. Five or six countries are interested in establishing national trading systems to help meet each country's commitments made under Kyoto. As an example, the British government has recently set aside GBP 30 million to help build a U.K. trading system. Norway is also looking at setting up a trading scheme, and the EU as a whole is working in this direction.'

Concludes Hughes, 'As a result of increasing interest in greenhouse gas trading, city traders see a potential market; and are sensing that a carbon-constrained economy will lead to business opportunities. After all, scarcity is one of the first laws of economics. It's interesting that we're now seeing people in legislative circles thinking about how they can encourage it, and companies like ourselves and Shell trying it out internally - and the finance sector is beginning to position itself. A level of momentum is building up that would certainly suggest that the concept is being taken seriously.'

Stuart.D.Brewer@dnv.com

Securing the Chernobyl bequest



The explosion at the Chernobyl nuclear plant on 26 April 1986 has left a lethal legacy that will endure for a thousand years. The catastrophe at Chernobyl is the worst accident in the history of commercial nuclear power, and the environmental consequences have prompted an international response. Co-ordinating this effort and planning for the future are the challenges facing the Chernobyl Shelter Fund's implementation plan as it moves to the critical second phase.

The explosion of the reactor core of Chernobyl Unit 4 in 1986 sent up tons of radioactive material into the atmosphere. Serious contamination affected the population and vast areas of the Ukraine, Belarus and Russia. Within days the wind had spread radionuclides over much of Europe and beyond. This latter contamination, however, represents only a few per cent of the nuclear inventory of Chernobyl Unit 4. In excess of two hundred tons of uranium and nearly a ton of radionuclides, comprising 80 per cent plutonium, remain within what is left of the reactor.

In the months immediately following the disaster the authorities in the Ukraine and Russia raced to build a shelter over the wrecked reactor. The urgency of the work and the impossibility of direct access to the reactor meant that the shelter could not be built to conventional building standards. The shelter's structure subsequently deteriorated with the roof and other elements threatening to collapse.

In the years after the accident, although numerous technical solutions were offered for the precarious structure, none were deemed suitable because of the uncertainties associated with the condition of the shelter. In early 1997, on the initiative of the European Union, Ukraine and the United States, the Shelter Implementation Plan (SIP) to protect people and the environment from the enormous radioactivity remaining in the reactor, some 95% of its original inventory, was developed. The Chernobyl Shelter Fund (CSF) was set up in December 1997 to fund the SIP.

The CSF is administered by the European Bank for Reconstruction and Development (EBRD) and overseen by the Assembly of Contributors representing more than 20 countries and the EU. It is planned that over the eight to nine year project the shelter will be transformed into a stable and environmentally safe system that will last for many decades. The entire project is estimated to cost US \$768 million and represents the largest venture ever undertaken by the EBRD. The value of the programme can be better appreciated if the costs of equivalent Western labour and materials are used, in which case a figure of US \$5 billion would be more accurate.

According to Vince Novak, Head, Chernobyl Shelter Fund and Director of the EBRD's Nuclear Safety Unit, 'The project is unique in terms of the level of radioactivity and uncertainties involved. There was considerable risk to the European Bank's reputation if the Chernobyl project did not go well.'



Investigative and engineering tasks, the main objective of Phase 1 of the SIP, are now substantially complete. Urgent repairs to the reactor's ventilation stack and the shelter's roof beams have been carried out. By the end of this year the Shelter stabilisation concept and the strategy of confinement will be finalised and integrated, and the transition to Phase 2 completed.

To facilitate the transition, Det Norske Veritas was commissioned by the EBRD to carry out a comparative risk assessment of five alternative

NUCLEAR SAFETY



Chernobyl Unit 4 immediately after the explosion. Many people died and many more still suffer the consequences. Tens of thousands of people were evacuated and still cannot return to the 30 kilometre exclusion zone around Chernobyl.



The butress wall of the shelter.

Funding for Phase 2 of the Shelter Implementation Plan has been secured and an industrial structural model chosen. It was expected that Russia would contribute to the funding but in the end decided not to do so. Russian design institutes, nevertheless, have been encouraged by the Russian government to co-operate with the SIP.

A decision over the nature of the stabilisation and confinement work will be taken before the end of 2000. This is the most important contract, and further project definition will be necessary to prepare it for international tender. A cost-benefit analysis will identify which alternative proves to be the optimum.

To assist the EBRD and the Assembly of Contributors an International Advisory Group was set up in July 1998. The Group provides independent technical advice and has been actively involved in all the recent strategic decisions. Pal Bergan, DNV's Head of Corporate Research & Development and a member of the International Advisory Group, says 'The project has a unique composition involving technical, economic, political and ethical dimensions, with radiation as well as monetary budgets central to the decision making. The complexities of the Chernobyl legacy are a warning to the nuclear industry around the world.'

The international co-operative effort and oversight of this project is an impressive testimony to what can be achieved in the most critical of circumstances. Indeed, the processes deployed to address the uncertainties surrounding the Chernobyl reactor site and the identification of solutions should encourage those involved in less complex projects that seemingly intractable problems can be solved.

Eric.Beech@dnv.com

Photos: Courtesy of EBRD

industrial structural models for Phase 2. Using available information, uncertainties which dissimilarly affect the choice of the industrial structural model were identified and quantified relative to the cost and schedule objectives.

DNV used part of its Project Risk Management (PRM) methodology to conduct the work. The resulting activity model was then fed through a Vite Project simulation. DNV had earlier contributed to the research efforts at Stanford University which led to the formation of Vite. Finally, a definitive scenario was produced to determine the relative ranking of each industrial structural model. Commenting on the overall effort Vince Novak said, 'DNV's approach focused on issues of interface and interaction in large projects. This analysis was very helpful.'

The Olympic Games are the pinnacle of international sport and the focus of world media attention. This Autumn, the eyes of the world were on Sydney, Australia. The organisers of the Sydney 2000 Olympics commissioned Det Norske Veritas to prepare Venue-Specific Safety Management Plans for a number of events and facilities.

Safety Management Plans were to guide staff who were setting up each venue to identify safety hazards. Without them, the focus of the management team could be solely on the event, and important safety issues could be overlooked.

The events and facilities covered included the marathon, triathlon, road cycling, sailing, football, and beach volleyball. Sydney Olympic Park Entertainment Centre, Darling Harbour and the Press and Broadcasting Centres were also subject to the plans.

Many of the events were held in public places in Sydney, including swimming in Sydney Harbour as part of the triathlon, the marathon through the streets of Sydney and the beach volleyball on Bondi Beach. Thousands of competitors, as well as spectators, took part over the 19 days of the Games.

The DNV team in Sydney worked closely with each venue management team to prepare safety plans specific to the needs of each event. Workshops were held to identify hazards and develop management strategies to minimise the risks.

Unexpected risks

Many hazards were common for all the venues, such as cables that could trip passers-by or could be exposed to damage from scaffolding for TV cameras or banks of temporary seating. For the triathlon, the identified hazards included such diverse items as:

- Golf carts used by officials, which could be operated at unsafe speeds and thus required speed governors;
- The need for Material Safety Data Sheets to be available at appropriate locations for any dangerous or toxic materials;



- The need for equipment and procedures for water based-accidents (including staff or spectators falling into the harbour);
- The management of risk from marine life in the harbour, from sharks to sewage.

For the beach volleyball, it was essential to check the sand daily for foreign objects such as broken glass and other sharp items. Other venues had their own specific hazards.

In each plan, four stages were identified: design, bump-in, competition and bump-out. Bump-in was the final preparation for competition, which included erection of temporary barricades, portable toilet facilities, food outlets and marshalling areas. Bump-out was the removal of such facilities.



SYDNEY OLYMPICS

The main Olympic Arena

Photo: Australia Tourist Commission

Safety audits

Media focus was naturally on the competitors, but attention had to be paid to the safety of the public and games officials before, during and after the competition. DNV designed the VSMPs to include photographs of typical safety hazards identified during trial events held in the months before the Olympics. These were an easily remembered prompt for the venue team when checking for hazards at the sites. Audits of the sites were carried out at all phases of the operation, and daily during competition. The presentation of the VSMPs, with photographs and short descriptions of the hazards to watch out for, was recognised by the venue management teams as an excellent method of transferring essential information to busy people who would not have the time to read a large manual.

The safety management team for the Sydney Games recognised that these VSMPs were an essential tool to manage the risks to the Games, and to make them safe for everybody. DNV contributed through assisting in the management of hazards that could impact on the life and health of the competitors, spectators, officials and the media.

In the event, it is acknowledged worldwide that these Year 2000 Olympics were among the most successful ever held.

Robert.Hutchison@dnv.com

DNV assists Kimberly-Clark's ZERO TOLERANCE FOR INJURIES



Ask employees at Kimberly-Clark's nonwoven facility in Neenah, Wisconsin about the importance of safety on the job, and they're sure to say it's a value, a part of everything they do. The facility has the record to prove it; plant employees have celebrated an entire year without a single injury.

How did they do it? According to mill manager Dean Hilmer, every employee in the plant knows the importance of safety on the job and their responsibility to ensure it. 'We only got this far as a team and we can only go forward as a team,' Hilmer says. 'It will take continuing commitment by every single employee to never have another injury. We must continually look out for our own safety, and that of our teammates, and be willing to help each other in any way that we can.'

Safety first

Such success is what Kimberly-Clark facilities around the globe strive to achieve, a goal strongly supported by the top tiers of management. In fact, Kimberly-Clark CEO Wayne Sanders often reiterates the importance of safety to employees. 'There is nothing, nothing more important than your safety,' Sanders says. 'There is no production goal, there is no cost- or time-saving measure, and there is no competitive advantage that is ever worth a human life, or for that matter an injury of any kind.'

Being a trusted part of peoples' lives affects the way Kimberly-Clark operates.

Photo: Scanpix/Ariel Skelly

SAFETY MANAGEMENT

Kimberly-Clark, maker of Kleenex facial tissue and one of the world's largest consumer companies, has emphasised safety since its foundation, when 'Deal fairly with employees' was one of the founding principles. This has continued through the years, including being a founding member of the U.S. National Safety Council in 1912. But after a serious accident in 1993, the company realised that something was missing from its safety approach.

Safety and loss control

Through careful evaluation and a partnership with DNV, Kimberly-Clark decided to take a more systematic approach to safety. 'We feel we are a trusted part of people's lives, which affects the way we work,' says James Morgenstern, vice president for Safety, Quality and Consumer Services. 'Having a poor safety system can affect how our products are perceived in the market. Therefore, we made up an action plan in which a systematic approach to control losses is basic in our safety strategy. We believe safety is a constant value and becomes a part of our daily work.'



'Having a poor safety system can affect how our products are perceived in the market,' says James C. Morgenstern

The need for a systematic approach led to a partnership with DNV, including initial assessments and training of key personnel at K-C. DNV provided support during the development of K-C's Safety and Loss Control Management System, a customised approach to Modern Safety Management based on the K-C Safety and Hygiene Policy Statement and Instructions. This includes cornerstones such as management leadership and commitment, employee involvement and hazard identification, prevention and control.

Visible results

How's it going so far? Since K-C took the first steps toward a systematic approach in 1993, the company has seen a 45% reduction in its total recordable injury/illness incident rate in North America. Since the company implemented the Safety and Loss Control Management System worldwide last year, it has experienced a 14% reduction in the global lost workday rate.

'DNV has been an important player in helping us to adapt modern safety management principles into our system,' Morgenstern says. 'By making use of DNV's expertise, we have been able to implement a system accepted worldwide, which is very important for a global organisation.'

Although Kimberly-Clark has already made great progress in terms of safety, the company continues to set ambitious goals for the future.

'We think zero incidents is a realistic goal,' says Morgenstern. 'We are convinced we can get there because we have the system and tools, and a committed team of colleagues heading for it.'

Beate.v.orbeck@dnv.com



Safety first at Cargill

Over the past 24 years 23,000 employees of the U.S. company Cargill Inc. have been trained by DNV in basic safety principles. During these years the company has doubled the size of its business while reducing incident rates by 50% or better. A major contributor to this success is a management team that puts safety in the forefront of productivity.

All work, however urgent, must be done safely,' says Dave Larson, executive vice president of Cargill. 'Risky operations are a part of our employees' daily work, and we must make sure our managers understand the seriousness of the situation and are capable of communicating the safety message to all involved.'

He points out that there are no magic bullets in this strategy. It's just a matter of gaining trust from the employees. 'Managers must "walk the talk"; go out in the field, talk about safety, listen to those involved, get their point of view and do something about it.'

Highlighting communication

U.S.-based Cargill is one of the world's largest privately owned companies. It crosses cultures in over 100 different business units with a work force of 85,000 employees in 59 countries, largely engaged in the processing, handling and transportation of food products. The company has implemented a safety culture that runs throughout the whole organisation, highlighting communication as the main tool to get the message through from the very top down to operating employees.



'Safety is all about behaviour, and it starts with the management,' says Dave Larson, executive vice president.

As its operations expanded during the 1970s, Cargill realised an increased emphasis on safety was needed. The high complexity of operations and a more demanding market with an increased focus on low costs and high quality products and services made Cargill consider how to change its operations in a cost-effective way. A strategy was developed to include training personnel throughout the organisation in fundamental safety concepts and principles.

'It's just a matter of gaining trust from the employees.'

'It is very important that all people in our organisation understand and believe in the same concept,' says Joe Botos, vice president for Environment, Health and Safety. 'It has been made possible by the intensive safety training executed by DNV staff all over the world for the past 25 years. In co-operation

SAFETY MANAGEMENT



with DNV we have produced a training package based upon modern safety principles tailor-made to Cargill operations. In this way a consistent message has been communicated to all employees, which has been a major contributor to the safety success of our organisation.'

Achieving control

One important element in Cargill's safety training is to understand the factors that cause incidents, so that effective control measures can be implemented. By making use of the Loss Causation Model developed by the International Loss Control Institute (now a part of DNV), participants learn how to control the safety aspects of the operation by focusing on basic causes and management systems instead of on symptoms. Cargill has applied a strategic approach to the problem by controlling ongoing activities on a continuous basis. They are making use of the ISMEC principles, that is to say: Identifying work necessary to control loss, setting standards for leadership performance, measuring performance against those standards, evaluating performance, commending compliance and correcting deficiencies in performance standards.

At Port Cargill in Minnesota, five different business units dealing with fertiliser, salt and grain products operate in close proximity. The ISMEC principles have been practised at this location for years with great success. Over 100 employees are engaged in unloading, storing and distributing agricultural products, with over 300 trucks, cars and barges arriving each day. Last year Port Cargill spent \$2M on improvements in the fertiliser unit to improve the safety aspects of the operation. A 'buddy' system has been implemented in all five business units, in which everyone is watching out for each other to avoid potential risks in daily operations. Once a month all employees get together in safety meetings where current issues are discussed and new solutions put forward to old problems. A number of operations at Port Cargill involve repetitive and routine tasks. Job rotation is one of the measures being implemented to avoid incidents caused by routine-based operations.

'We must make sure our employees see an ownership of what they do,' says Botos. 'They have a right to refuse work if they consider it unsafe. It is the management's responsibility to open up communication and contribute to change if needed, even if production suffers. In this way the safety principles at Cargill enable the employees to control their own destiny, by involving everyone in managing their own operations in a safe and controllable way.'

Beate.v.orbeck@dnv.com

Photos: Courtesy of Cargill Inc.



Port Cargill in Minnesota is home to five different business units dealing with fertiliser, salt and grain products.

THE ROLLS-ROYCE OF PROPELLERS

Following acquisition of the British engineering company Vickers by Rolls-Royce, Kamewa AB, a part of Vickers, became Rolls-Royce AB. The company is located in Kristinehamn, Sweden and recognised as one of the world's leading manufacturers of marine propulsion systems. Rolls-Royce AB has an agreement with DNV that greatly reduces its classification costs.



A year ago Kamewa AB, now Rolls-Royce AB, signed a unique Manufacturing Service Arrangement (MSA) agreement with DNV which meant that a major part of the on-going inspection and surveys could be carried out by the company itself. 'We have cut our classification costs and our production is running more smoothly. There's less disturbance when the expertise is in-house,' says Gunnar Sandberg, quality-assurance manager. He feels the cooperation with DNV is going well, for both classification and certification. The company has been ISO 9001 certified by DNV since 1993.

Under the MSA agreement, DNV carries out an inspection of the company's quality-assurance system and all the production routines. These are then certified as complying with DNV's classification rules. Audits are carried out regularly. This type of agreement is reached from time to time with companies that mass-produce large volumes, but at Rolls-Royce AB each propeller or propulsion system is unique. On DNV's part, this has been effectively a pilot project to see if self-inspection works for such varied production.

Maintaining product quality

Rolls-Royce plc is a global power-systems company providing power for land, sea and air. The company is establishing leading positions in civil aerospace, defence, marine and energy markets. Through a series of international acquisitions, including Vickers with Kamewa AB, the marine business of Rolls-Royce is now the largest supplier of marine propulsion systems and equipment in the world.

Rolls-Royce AB, the former Kamewa AB - Karlstads Mekaniska Werkstad from 1894 to 1980 - is best known in the marine world for the controllable-pitch Kamewa propeller, developed in the 1930s from its water-power turbines and now marketed under the name Kamewa-Ulstein; and more recently for marine thrusters, water-jet propulsion units widely used in high-speed

A newbuilding yard selects a classification society for the entire production chain. The same propeller design can be classified according to one Classification Society's rules at one time and to those of another society the next time. Rolls-Royce AB has an agreement with DNV for the self-inspection of certain elements.



Lars Olav Lindalen, DNV surveyor, and Göran Karlsson, head of classification at Rolls-Royce AB, inspect the packing surface of a propeller boss due for delivery to Italy's Fincantieri shipyard. When finished, the propeller will weigh 76 tonnes and have a diameter of 5.7 metres.

craft, and podded, electric-powered propeller units installed in a number of recent large cruise ships. The company's manufacturing plant has grown vastly over the years, and since 1964, when propeller production first outstripped that of hydro turbines, extensive new facilities and modern machine tools have helped maintain a quality profile for its products.

DNV's contribution spans 40 years

'My father was a surveyor here for more than 25 years. I was almost born into DNV,' says Lars-Olav Lindalen, a senior DNV surveyor who has been with the company for 22 years himself.

After a few years out in the DNV world, during which time he worked on oil rigs and on newbuilding inspections, he returned to Kristinehamn in 1991; much of his work is related to Kamewa operations in some way or other, and he also visits the subcontractors – such as Alco Metaller, which makes the propeller blades, Johnson Metall, which casts components, and Scana Björneborg, a supplier of propeller shafts.

Relam@heijbel.se

ROYAL DANISH NAVY adopts ship classification



Rear Admiral Paul Bjørn Sørensen of the Royal Danish Navy, flanked by Rolf E. Pedersen, chairman of the DNV naval committee (left), and the head of DNV's classification activities in Denmark, Henrik Bach.

The Royal Danish Navy is the first to have DNV class all its ships. If all goes as DNV and the Danes intend, this will mean a better Navy at lower cost.

Says Rear Admiral Bjørn Sørensen, Chief of the Royal Danish Navy's Materiel Command: 'We have good ship projects that have been agreed by our politicians. We also hope that we can continue with this programme after the next Defence Agreement, since that means our fleet will be completely renewed in ten years' time.'

The Danish navy has never been afraid of trying out new technology, and has been a pioneer, particularly in containerisation. Denmark has a number of flexible ships that, by quickly changing their weapons and equipment, can undertake a wide variety of tasks.

'Maritime operations are in general conservative, and the same is true of national navies,' states Admiral Sørensen. 'When the NATO countries assessed aspects of containerisation of weapons and equipment in naval ships in the mid 1970s, Denmark was quick to start using them. We had our first project ready in 1985 and obtained our first grant then. The first ship was ready in 1987 and we had 14 ships by 1994. Later, a number of corvettes were also modified. We've had several delegations visiting us, including some from France and the U.S.A., and they have shown great interest in our containerisation concept. We've seen clear synergy effects in our fleet, and longer time in service than for conventional ships. Among other things, we don't have long downtimes due to errors in the weapons systems. If something goes wrong, we just switch containers - quick and effective.'



Newbuilding and training

Denmark is to build two new large 'standard-flex' ships, as support ships for naval operations. Later on the Royal Danish Navy has plans for 2-4 ships in a patrol version. Three 60m inspection vessels will be built to operate in Greenland and the Faeroe Islands. Sixteen smaller vessels with one or two container sets are also planned under a programme extending over the next eight to ten years.

The agreement with DNV will cover the training of personnel, IT systems - in which DNV's Nauticus will be used in a separate stand-alone solution - class-entry for ships that are already in operation, newbuilding contracts and additional services, including work during the pre-contract phase.

Five naval staff will be trained to carry out tasks as non-exclusive surveyors. A further two will become rule engineers whose task will be to maintain the Navy's own rule database - similar to Port State rules in commercial shipping. Shipping company inspectors - project engineers as in the shipping companies - will also be trained. They will be taught about classification in general, and emphasis will also be placed on defining the shipping company's role and that of the classification society.

Lower costs throughout

Rear Admiral Sørensen admits that cuts in grants mean that the realities of life have to be faced: 'The entire Navy is being restructured. Most of its activities have been moved to the naval stations at Frederikshavn and Korsør. The Naval Materiel Command central staffs will be reduced and, besides developing our own capacity, we've also looked into the opportunities for bringing in outside expertise. That's where DNV and the other classification societies came into the picture. With our areas of

operation, we saw an advantage in using DNV. Through training both our current and new personnel, we can brush up the Navy's knowledge and also gain new impulses from international shipping. We achieve a higher level more quickly this way than if we were to do everything ourselves. Similarly, when new ships are being built, the yards will have the classification societies in at an early stage.'

Admiral Sørensen says that Danish yards and the shipyard association are positive to the new moves. They are also used to working with classification societies when building conventional ships.

Emphasises Sørensen: 'If we can rationalise our procedures, we get more defence for our money. We have planned this for several years. Naturally, there will always be a certain amount of uncertainty regarding anything new, but in general I expect the new procedures will serve us well.'

Systematics and experience transfer

Admiral Sørensen gives credit to DNV's knowledge of systematisation and experience feedback. 'The Navy's own experience can also be picked up by the system. Thus errors can be avoided in the future. Key tasks for the Navy's own people will be to develop ships and weapons projects and control the fleet stations. But as much as possible is to be decentralised. In our relationship with DNV, there will be a clear dividing line between a ship's technical systems and its weapons systems. The latter will be dealt with solely by Naval staff.'

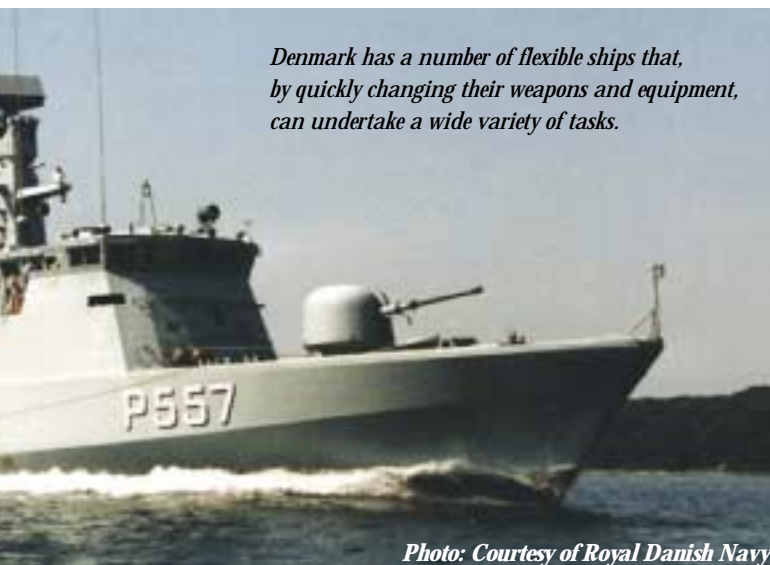
Challenge for DNV

'DNV's main challenge will be the IT system and the training of the Navy's own people,' explains Henrik Bach, head of DNV's classification activities in Denmark. 'They will be given training, which will partly be carried out at DNV's headquarters in Norway and partly here in Denmark. This is a challenging task for DNV, and I'm looking forward to see things develop as the Navy gains experience with the classification role.'

DNV's own admiral, Rolf Pedersen, former head of the Royal Norwegian Navy's Materiel Command and now head of DNV's Naval Surface Craft Technical Committee, feels it is very positive that Denmark has started to use the DNV Rules for Naval Surface Craft.

'These are good Rules that we will further develop as regards health, safety and environmental aspects, for the Navy's combat sustainability and for Composite Materials. We've received 1,900 comments from the 10 NATO-countries plus two others on this committee. This represents a unique quality assurance of the Rules. Once we start to use the new Rules, we may find some things have to be changed. The Rules must keep up with the times. Denmark has gone ahead and shown us the way.'

Harald.Brathen@dnv.com



Denmark has a number of flexible ships that, by quickly changing their weapons and equipment, can undertake a wide variety of tasks.

Photo: Courtesy of Royal Danish Navy

VALUE for the world's airlines

Will a five-year-old Airbus A320 be worth US\$ 26 million in the year 2015? David B. Fate is executive vice-president and head of Transamerica Aircraft Finance Group. He and his staff are specialists in financing aircraft. It is crucial for them to know the value of the assets for which they are lending money - not only the current value, but also their value in up to 20 years' time.

'Financing aircraft may not be very different from financing any income-producing asset, in principle,' explains Fate, 'but with lending and leasing amounts that normally exceed ten million dollars, each individual credit proposal has to be subject to a thorough evaluation.'

Fate and his staff receive a constant stream of financing proposals. Airlines such as Continental, US Airways, TWA, Northwest Airlines and SAS are on his customer list, along with a number of regional airlines. In some cases, a complex transaction can take weeks to complete. During that time, the airline's credit-worthiness is carefully assessed, and a third-party evaluation made of the collateral value throughout the entire credit period.

Avitas as a partner

From Transamerica's offices in Dallas, Texas, the analysts keep an eye on much of the U.S. and overseas aircraft industry. 'Aviation is a sector with few players, and one in which everyone typically knows everyone else, but it is also an industry with huge investments and values,' says Fate. 'We specialise in financing, but to protect our investments, we need technical assistance from experts who can carry out everything from the assessment of an airline's maintenance operations to an evaluation of the technical aspects of an aircraft. We get that kind of expertise from Avitas.'

To Transamerica, Avitas is an important business partner, and the company makes use of a wide range of Avitas' services. Says Fate, 'We make a lot of use of the Avitas Blue Books. These, and other Avitas services, enable us to do our work efficiently. Time is our most valuable resource, so our decisions rest on Avitas' opinions.'

Knut.Anders.Andersen@dnv.com

Transamerica

Transamerica Aircraft Finance Group is a unit of Transamerica Equipment Financial Services Corporation, the equipment financing subsidiary of Transamerica Corporation.

Transamerica is an insurance and financial services leader, and wholly-owned subsidiary of AEGON N.V, which has more than US\$200 billion in consolidated assets.

Transamerica Aircraft Finance assists companies in acquiring assets, and refinancing or restructuring transactions by providing loans and leases secured by aircraft, aircraft engines and related equipment.

AVITAS

Wholly owned by DNV, Avitas is a full-service consulting company providing a wide range of advisory and technical services to airlines, aircraft manufacturers, industry suppliers, maintenance providers, aircraft lessors and lenders, legal counsel and government bodies.

Avitas is headquartered in Chantilly, Virginia, with offices in Miami and London. Its senior staff members have specific hands-on aviation industry experience in such areas as airline management, marketing, planning, operations, maintenance, engineering and aircraft financing. Hence, the company has both practical and theoretical knowledge of the complex aviation industry.



Specialists in aircraft financing. Seated, left to right: David B. Fate, executive vice-president and head of Transamerica Aircraft Finance Group; Dean Stubbe, senior vice president and national marketing manager. Standing, left to right: Dirk N. Stock and Jeffrey L. Wilkison, senior credit analysts.

Avitas expertise covers a broad range of aviation disciplines, providing assistance and counsel in the following areas:

- Technical Consulting
- Maintenance and Engineering
- ICAO Regulatory Compliance
- Valuations
- Assistance to Aircraft Lessors and Lenders
- Assistance to Legal Counsel
- Publications
- Strategic Planning
- Special Studies
- Competitive Situation Analysis
- Operations Support

Avitas publications, respected throughout the industry, include:

BlueBook of Jet Aircraft Values

A reference volume containing base value, market value and future base value forecasts for over 75 Western-built jet aircraft including regional jets. The value matrix is accompanied by an informational page which describes briefly the type, its production history, engine options and summary specifications such as dimensions, capacities, takeoff weights and performance.

BlueBook of Commercial Turboprop Aircraft Values

Identical in format to the BlueBook of Jet Aircraft Values, this reference contains values for some 34 turboprop-powered aircraft in commercial service.

BlueBook of Jet Engine Values

The companion volume to the BlueBook of Jet Aircraft Values, this compendium contains values for all engines with commercial jet applications. It includes a brief market summary for each engine series, photo, fleet statistics, current market value, base value and future base values for the next 10 years.

Aircraft Block Hour Operating Costs & Operations Guide

This guide provides direct operating costs for flying operations and maintenance, and average aircraft utilisation per day for various operational indices such as departures and seat mile operating costs for most major jet aircraft and several turboprop aircraft.

Global Outlook for Air Transportation

Contains the economic outlook, traffic outlook and aircraft outlook for the next 20 years, as well as special reports on significant current issues and trends affecting commercial aviation.

Photo: Courtesy of Avitas

Massive railway development can be expected in Hong Kong over the next decade and beyond. Despite its small land area, Hong Kong's present population of 6.5 million is likely to reach 10 million or more in a decade. A large proportion of them will need to travel by train.

SAFETY IN RAILWAY

Hong Kong's central urban areas are rapidly filling up and cannot sprawl any further. Accommodation near one's workplace is prohibitively expensive, and so many new towns have sprung up, such as Sha Tin, Tai Po, Yuen Long Tuen Mun and Tseung Kwan. People who live in a new town and work in the central urban area have to travel relatively long distances to work, and good public transport connections are essential.

Many of the buses in use today are highly polluting, emitting clouds of black smoke and fumes due perhaps to poor maintenance or the use of low-grade diesel fuel from China. Since much of Hong Kong's electric power is generated using natural gas, electric railways are seen as being non-polluting, and thus the transport mode of the future.

Building in safety

DNV is one of the consultants in Hong Kong working for the two railway companies, Mass Transit Railway Corporation (MTRC) and Kowloon Canton Railway Corporation (KCRC) to provide systems (safety and reliability) assurance of the design of new railway projects.

But just designing in safety is not the only problem to be solved. Railways must first be built, and the construction industry has the worst safety record in Hong Kong, with risks approaching one death per worker per thousand years.

For its new Westrail Project of suburban railway construction, KCRC required its contractors to implement safety management systems and demonstrate by auditing that such systems were in place and being operated. After reviewing the available systems KCRC identified DNV's International Safety Rating System (ISRS) as the best. KCRC follows a competitive tendering system which weighs technical merit against the fee quoted. Scoring very highly technically, DNV won the contract to audit all of the KCRC Westrail Construction Contractors annually until late 2003 (74 audits), with an option to include contractors for the forthcoming Eastrail Extensions through to 2004. In addition, DNV has provided safety training to all of Westrail's Construction Safety Department. The contract requires a digital camera to record physical conditions, and a digital projector to present the audit findings, including photos.

DNV and KCRC jointly developed a definition of 'acceptable' performance for the contractors. The penalty for not achieving acceptable performance is for a milestone payment to be withheld. The ultimate target (after 18 months) is to achieve an average score of at least 40% overall scoring over 16 elements specified by KCRC, a minimum of 20 % individual element scoring and a minimum of 65% physical conditions, with continuous improvement in the meantime. This performance standard is approximately equivalent to a Level Five rating of the ISRS. The elements and sub-elements included were based on legal requirements, contractual requirements, requirements in the safety auditing systems, international safety performance levels and the local construction safety performance level.

CONSTRUCTION

The contract has benefited from two 3-4 week visits from an auditor and trainer from the U.K., highly experienced in contractor auditing, who has led some of the early training courses and audits, and subsequently from a highly experienced safety professional and auditor familiar with Hong Kong and the construction industry in Asia.



Photo: Milepost 92 1/2

Mass Transit, Kowloon-Canton and Lightrail systems are all seeing new investment as Hong Kong continues to expand.

Rapid provision of audit reports

Morale on the project has been excellent, with high scores being achieved by KCRC personnel in course tests, training audits and in their own divisional audit. Reporting is greatly streamlined by use of DNV Summit, computerised report-writing software for which a customised audit question set uses just the 16 relevant elements and sub-elements. A special report template has been developed to meet the requirements of the brief. We are able to conduct an audit, prepare the report and QA the work in just over a week. This means that the audit is still fresh in the contractor's mind when he receives the report. The report also contains photographs of physical conditions observed by the auditor. Examples of non-conformities include incorrect or non-use of personal safety equipment, and dangerous practices such as welding near inflammable materials.

As the former tiger economies of Asia emerge from financial turmoil, big infrastructure projects are starting up again, as with the monorail in Kuala Lumpur, and the Taiwan High Speed Rail project, where DNV is to carry out systems assurance for the only underground station on the line.

There is great potential for DNV gaining similar contracts for new railway construction throughout Asia.

Dudley.Tait@dnv.com

About 40% of the world's population live in water-polluted areas or have inadequate access to water. Rapid population growth combined with industrialisation and water-intensive lifestyles could result in global water crises. 'There simply isn't enough water for everyone; we have to share what's left and make use of all technology available to improve its quality,' says Shafqat Kakakhel, Deputy Executive Director of the UN's Environment Programme.

CLEAN WATER FOR ALL

Global freshwater consumption rose at more than double the rate of population growth from 1900 to 1995, according to statistics from the United Nations Environmental Programme (UNEP). Says Kakakhel, 'If present consumption patterns continue, two out of every three people on earth will live in water-stressed conditions by the year 2025. Urban air pollution is another threat to fresh water, reaching crisis dimensions in most large cities of the developing world. Road traffic, burning of high-sulphur coal and oil, and forest fires are the major causes of such pollution.'

Cleaner production

UNEP has been a driving force to create the International Declaration on Cleaner Production. It is a voluntary, public statement focusing on clean production as a main goal to eliminate pollution. Clean production means a preventive environmental management strategy towards eliminating pollution before it is created, rather than using end-of-pipe solutions.



Kakakhel explains, 'UNEP and the International Fertiliser Industry Association, representing 460 companies worldwide, have recently signed the declaration. The fertiliser industry accounts for two percent of world energy consumption and emissions of key greenhouse gases. The declaration outlines a set of principles encouraging fertiliser manufacturers to introduce preventive strategies and innovative solutions in order to implement cleaner production practices on sites all over the world.'

Nitrate pollution

The intensive use of pesticides and fertilisers has led to chemicals being leached into fresh-water supplies. Nitrate pollution from excess fertiliser use is now one of the most serious water quality problems. In the U.S.A. more than 40 million people obtained their drinking water in 1994 from a system in which there were violations of health-based standards, mainly those relating to nitrates. In some parts of Africa, nitrate loads in some suburban groundwater wells are 6-8 times levels acceptable to the World Health Organisation.

Alleviating scarcity

By 2025, 1.8 billion people will live in countries or regions of serious water scarcity, according to the International Water Management Institute (IWMI). Most countries in the Middle East and North Africa can be classified as having water scarcity today. By 2025, these countries will be joined by Pakistan, South Africa, and large parts of India and China. This means that they will not have sufficient water resources to maintain their current level of per capita food production from irrigated agriculture, and to meet reasonable water needs for domestic, industrial, and environmental purposes.

Globally, IWMI predicts that, to meet the 2025 water needs, the world must develop 22% more primary water supply. The irrigation sector—by far the largest water user today—will still account for 69% of the total primary water demand. To meet food needs, the primary water supply to irrigation must be increased by 17%. IWMI's conclusion is that, while the world must continue investing in water development projects to meet future food demands, investments in research to improve crop water productivity could be a cost-effective means to limit the requirement for new dams.

Concludes Kakakhel, 'Water security, like food security, will become a major priority in many areas of the world in the future. The declining state of the world's freshwater resources in terms of quantity and quality may prove to be the dominant issue on the environmental and development agenda of the coming century.'



'If present consumption patterns continue, two out of every three people on earth will live in water-stressed conditions by the year 2025,' says Shafqat Kakakhel.

Photo: André Meling

Photo: NPS/Jim Cummins

Beate.v.orbeck@dnv.com

Oil-industry work for DNV UK

DNV UK has secured new contracts at BP, and is now assisting the oil major with combined risk assessments, management system development, and technical safety support services.

The BP facilities at Grangemouth in Scotland are one of the largest petro-chemical complexes in the UK; historically they consisted of 34 individual sites. With the help of DNV, these sites are presently being integrated into one establishment, according to project manager Angus Lyon.

Says Lyon, 'The integration process plus the requirement to meet the Seveso II (COMAH) regulations has created new opportunities for DNV. We are now assisting BP with the preparation of COMAH submissions for all sites which were originally part of the Chemical Group. We are also assisting BP with HSE management system development and technical safety support services for the operational sites.'

The COMAH work entails a qualitative risk assessment of all potential hazards onsite. The task will run until April 2001 and is currently keeping three DNV staff fully occupied there. The HSE work is expected to run for the rest of this year, with two senior DNV staff onsite.



BP's Grangemouth facilities: one of the largest petro-chemical complexes in the UK

DNV India secures space research project

DNV India has secured a contract to carry out quality assurance work for the Indian Space Research Organisation.

The Indian Space Research Organisation (ISRO) has chosen DNV to carry out quality assurance services for its second launch pad project, and associated facilities. DNV's task is to provide design reviews, develop and monitor quality plans, and ensure surveillance at equipment manufacturing sites and at the rocket launch facility at Sriharikota. The project will commence later this year and is expected to run until 2002. ISRO provides space research facilities for India and has ambitions to become a third party service provider for satellite launching.

Risk and feasibility studies in Dutch ports

DNV has been commissioned to carry out risk analyses and feasibility studies of the ports of Rotterdam and Amsterdam.

DNV is to carry out quantitative risk analyses of the port of Amsterdam for ship movements in the entrance to the sea locks. The analyses comprise estimation of the consequences of collisions in terms of human safety and oil spills, and economic consequences of removing a part of the present peninsular at the entrance to the locks.

At the port of Rotterdam a qualitative risk analysis will be carried out, resulting in a disturbance model indicating harbour processes, possible disturbances, root causes and controlling remedies. The Harbour Development Department of the port of Rotterdam has commissioned DNV to carry out a feasibility study for its MultiCore project. The project is to operate a set of underground pipelines in a bundle that can carry a wide range of products for different users; the feasibility study will focus on the legislative aspects of this approach.



Major tunnel project

DNV has concluded a contract with Spanish and Moroccan interests to evaluate a multi-tube tunnel to be built under the Strait of Gibraltar.

The tunnel, scheduled for completion around the year 2015, is to be located at a depth of approximately 800 metres below the water surface, making it the deepest underwater tunnel in the world. It will provide public transport services between Spain and Morocco. DNV has primarily been given the task of evaluating the technological approaches relating to offshore geological coring activities.



Members of the joint-industry project.

Joint industry projects launched in Azerbaijan

The Government of Azerbaijan has launched, with the help of DNV, two initiatives to enhance safety operations in its oil and gas sector.

A meeting was recently held in Baku to launch a new joint initiative between the Azerbaijan Government and the oil industry. According to DNV's Nils Andreas Masvie, this initiative is aimed at developing state-of-the-art safety regulations for Azerbaijan's upstream oil and gas exploration and production industry. The project, which was recently endorsed by Government authorities, is being funded by industry majors Agip, BP, Exxon, Mobil, Statoil and DNV, supported by the Norwegian Government. Chevron has also expressed an interest to join the project.

The second initiative, Oil Spill Contingency Project, is another joint industry effort which addresses oil spill combat in the Caspian Sea. DNV recently won a World Bank tender to study and develop oil spill contingency plans. The work will involve oil industry majors and authorities in Azerbaijan, Iran, Turkmenistan, Kazakhstan and Russia.

Virgin Trains on track

DNV Consulting in the UK has carried out a Management Systems Audit of Virgin Trains, using the Train Operating Companies Customised Profile (ROARS).



Virgin Trains' Chris Green and DNV's Louise Smail holding the Management Systems certificate.

'Virgin Trains aims to become a world class railway by the year 2003, and we see this process as key to insuring that we move towards this goal,' states Virgin Trains managing director Chris Green.

Louise Smail, DNV project manager, says 'This project was particularly gratifying as it allowed DNV to develop a close working relationship with the company at Board level and down.'

The type of work carried out by DNV for Virgin, Great North Eastern Railway and First Group is in line with the thinking of the Cullen Inquiry which is currently looking at how the rail industry needs to change following the Paddington accident.

Infostrada gets ISO 9001

The Italian telecommunications giant, Infostrada, has received ISO 9001 certification by DNV.

Infostrada, a subsidiary of the Mannesmann Group, has received ISO 9001 certification. The certificate was recently awarded by DNV Italy at Infostrada's head office in Milan. The implementation process took approximately 10 months to complete and involved a redefinition and consolidation of existing company processes, encompassing network design infrastructures and the provision of telecommunication services.

According to Infostrada's CEO Riccardo Ruggiero, the certificate is a 'milestone in the company's quality management work, and confirms that Infostrada is at the forefront in the telecommunications sector. The certification will help increase our competitiveness, both in Italy and abroad.' Infostrada provides fixed telecommunication services to 4 million customers, in the public and private sectors.

ERIKA SAW THE TURN OF THE TIDE

The sinking of *Erika* and loss of her cargo of heavy fuel resulted in an environmental catastrophe in one of the most sensitive areas of the European continent. It raised searching questions affecting those across the industry. At the core of the call for change lie the European Commission proposals for a post-*Erika* safety package which, if adopted, will have a far-reaching effect on all players in the maritime sector. Paal Frisvold, at the EFTA Secretariat in Brussels, shares his thoughts with Stuart Brewer, editor of *DNV Forum*.

Loss of the tanker *Erika* last year highlighted the deficiencies of today's Rules in maritime safety. Once again a serious accident at sea occurred, and the centuries-old international legislative framework once again, in the public's eyes, proved irresponsible and lacking in justice.

Neither the flag state, the classification society, the shipowner nor the cargo owner admitted (some didn't even respond to) the accusations from a shocked public opinion and a determined French Government. Politics prevailed, and in addition to the payments guaranteed through the IOPC fund, the French cargo owner ended up paying up under public pressure.

This time, however, the maritime players can no longer stick their heads in the sand. Having caused devastating damage to the French tourist industry, the umbilical cord of the French economy, and France's beloved natural pearl the beaches of Brittany, time has been called. On strict orders from the incoming French Presidency of the EU, the Commission has drawn up legislative proposals that could drastically alter each maritime player's responsibilities and, most importantly, financial liabilities.

A few examples of what can be expected: Controls and inspections of ships in ports will be extended and considerably tightened, particularly for tankers over 15 years old. Companies chartering substandard ships that are detained will be listed and exposed. There will be faster phasing out of single-hull tankers, in line with the previously much-criticised U.S. Oil Pollution Act. And in the longer term, financial liabilities might be substantially increased and a European Maritime Safety Agency might be established primarily in order to supervise the performance of the classification societies.

Unlimited liability on Class

The role of class has come under particular scrutiny, and some of the more innovative initiatives concern the classification societies. From being able to shrug off most of the responsibility for malfunction once class has been issued, the Commission has suggested the classification societies be made financially liable for the work they do for EU flag states for up to 5 million euro. The main EU countries, however, are not satisfied and want the societies to be liable for a minimum of 5 million euro and up to an unlimited amount, should their quality control prove unreliable. Moreover, through a revised Directive on Classification Societies, Flag States will have to gain acceptance from the European Commission before they delegate authority to the societies.

'Maritime players can no longer stick their heads in the sand'
- Paal Frisvold



Obviously the tide has turned. Europe is today dominated by 'host states' as opposed to 'flag states', countries whose prime concern is the conservation of the environment, and whose maritime fleet and interests have declined drastically over the past 30 years. These countries will no longer accept a system where all participants, including shipowning companies, charterers, cargo owners, insurers, classification societies and flag states, can hide behind walls of secrecy, and sometimes not even pay for the damage done due to insufficient liability coverage. The current system is obviously flawed and outdated. The industry has closed its eyes for too long, and the old habit of not wanting to wake up sleeping dogs has proved to be counterproductive. The dogs are awake, and they will bite if the industry and maritime authorities don't hurry to put their house in order and profoundly change the system. As Phil Loree, Head of the Federation of American Controlled Shipping said during the fierce debate in Congress on the Oil Pollution Act in 1989, 'If the industry doesn't hang together, they will hang separately.'

This article expresses the personal views of Paal Frisvold, and should not be construed to reflect in any way the views of the EFTA Secretariat.

DNV WORLDWIDE

Corporate

Headquarters

Høvik (Oslo)

N-1322 Høvik, Norway

Tel: +47 67 57 99 00

Fax: +47 67 57 99 11

Division Technology

Høvik (Oslo)

Veritasveien 1,

N-1322 Høvik, Norway

Tel: +47 67 57 99 00

Fax: +47 67 57 99 11

Copenhagen

Region Denmark and Poland

Tuborg Parkvej 8, 3rd floor,

DK-2900 Hellerup, Denmark

Tel: +45 39 45 48 00

Fax: +45 39 45 48 01

Dubai

Region Middle East

P.O. Box 11539, Jumeirah, Dubai,

United Arab Emirates

Tel: +971 43 526626

Fax: +971 43 520524

Essen

Region Germany and Central Europe

Businesspark Essen - Nord,

Schnieringshof 14,

45329 Essen, Germany

Tel: +49 201 7296 0

Fax: +49 201 7296 102/103

Helsinki

Region East Baltic

Nahkahousuntie 3,

FIN-00210 Helsinki, Finland

Tel: +358 9 681 691

Fax: +358 9 692 6827

Shanghai

Region Greater China

House No.9, 1591 Hong Qiao Road

Shanghai 200336

Tel: +86 21 6278 8086

Fax: +86 21 6278 8090

Houston

Region North America

16340 Park Ten Place, Suite 100,

Houston, Texas 77084, USA

Tel: +1 281 721 6600

+1 281 721 6998 (night line)

Fax: +1 281 721 6900

Kobe

Region Japan

Sannomiya Chuo Bldg., 9th floor,

4-2-20, Goko-Dori,

Chuo-Ku, Kobe 651-0087, Japan

Tel: +81 78 291 1302

Fax: +81 78 291 1330

London

Region Great Britain,

Ireland and Africa

Palace House, 3 Cathedral Street,

London SE1 9DE, UK

Tel: +44 171 357 6080

Fax: +44 171 357 6048

Madrid

Region Iberia

Campus Empresarial Jose M.

de Churrucá, Edificio III, C/Almansa,

105-1, Pta. Oficina 2, 28040 Madrid,

Spain

Tel: +34 91 456 16 00

Fax: +34 91 456 15 99

Mumbai

Region India

Emgeen Chambers, 10

C.S.T. Road, Vidyavanagari,

Kalina, Mumbai 400 098, India

Tel: +91 22 616 0909

Fax: +91 22 619 1380

Oslo

Region Norway

N-1322 Høvik, Norway

Tel: +47 67 57 99 00

Fax: +47 67 57 99 11

Paris

Region Mid Mediterranean

10 Rue Lionel Terray,

92508 Rueil Malmaison, Paris, France

Tel: +33 (0)1 41 96 87 87

Fax: +33 (0)1 47 08 42 94

Piraeus

Region East Mediterranean

and Black Sea

26-28 Akti Kondyli, Piraeus 185 45,

P.O. Box 80 199, Greece

Tel: +30 1 41 00 200

Fax: +30 1 42 23 059

Rio de Janeiro

Region South America

Rua Sete de Setembro,

55/17 floor, CEP 20050-004,

Rio de Janeiro RJ, Brazil

Tel: +55 21 509 7232

Fax: +55 21 221 8758

Rotterdam

Region Benelux

Haastrechtstraat 7,

3079 DC Rotterdam,

P.O.Box 9599,

3007 AN Rotterdam, The Netherlands

Tel: +31 10 2922 600

Fax: +31 10 4797 141

Seoul

Region Korea

Room 2110, Kyobo Bldg., 1,

1-Ka, Jongro, Jongro-Ku,

Seoul (110-121), Republic of Korea,

Tel: +82 2 734 7327

Fax: +82 2 739 9069

Singapore

Region South East Asia

DNV Technology Centre,

10 Science Park Drive,

Singapore 118224,

Tel: +65 779 1266 (24 hours)

Fax: +65 779 7949

Stockholm

Region Sweden

Warfsvingsväg 25,

112 51 Stockholm, Sweden

Tel: +46 86 19 46 00

Fax: +46 86 19 46 60

Sydney

Region Australia and New Zealand

Level 19, Northpoint,

100 Miller Street,

North Sydney NSW 2060, Australia

Tel: +61 2 9922 1966

Fax: +61 2 9929 8792

DNVPS Singapore

DNV Petroleum Services

10 Science Park Drive,

Singapore 118224

Tel: +65 779 1266 (24 hours)

Fax: +65 779 7949

DNV Internet home page

www.dnv.com