



Environmental report 2004 Wilh. Wilhelmsen





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Ship's engineer **Oscar G Sabado** carries out maintenance on m/v Talisman's main engine.



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Shipping is an international business, and Wilh. Wilhelmsen (WW) will participate actively in efforts to establish a common international regulatory regime. We believe that international regulations administered by a collective body will provide better overall environmental protection than a number of regional and national requirements. International regulations in

are certified to the ISO 14001 environmental management standard, which helps to ensure continuous improvement and provides a means of determining that environmental work is pursued in line with the plans we have defined.

Under ISO 14001, we are required to keep updated on all environmental requirements in our business and to conduct our busi-

ness within these limits. Discharging illegal quantities of waste oil from ships has long been a known problem. Heavy fines and in some cases prison sentences have been imposed in recent years on people who have been linked to such illegal discharges. We have called attention to this environmental problem, in part by organising an international conference on the issue during 2004 together with the International Maritime Training Centre in India. Preventing illegal discharges of waste oil to the sea is also an important topic in training for seagoing personnel by our group.

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Shipping has always been regarded as an environment-friend-

ly mode of transport when measured in energy units per quantity of cargo carried. As a result, much of the environmental attention has earlier been directed at land transport, with the development of more energy-efficient engines and reductions in polluting fumes. Ships use far more energy viewed overall, however, which in turn generates environmentally-harmful emissions

and discharges. Through our environmental efforts, we will seek to reduce energy consumption as well as environmentally-harmful emissions or discharges where we can influence these. We will actively strive to ensure that new vessels ordered by our group consume less energy than existing ships. One example is provided by our series of newbuildings under construction in Japan. Their bunkers consumption will be far lower than for earlier carriers. The result is not only a substantial environmental gain but also good transport economics.

concentrating strongly on reducing emissions of sulphurous exhaust fumes from ship propulsion machinery. This has been a priority area since WWL was created in 1999. Sulphur dioxide emissions are most easily reduced by using bunkers oil with a low sulphur content. The drawback is that such fuel has poor availability and costs considerably more than conventional

bunkers. Running engines on low-sulphur bunkers also presents technical and operational challenges. The international standard for sulphur in exhaust fumes is 4.5 per cent, while our average for 2004 was 1.76 per cent. Active efforts are being made to reduce this proportion even further in coming years.

We have focused considerable attention on the sulphur issue in this report, and describe the challenges and measures related to using low-sulphur bunkers on our ships.

In cooperation with our partners in Wallenius Wilhelmsen Lines (WWL) and EUKOR, we are con-



Ingar Skaug,
President and group CEO

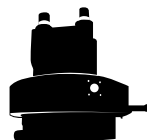


our business are established by the UN's International Maritime Organisation (IMO), which has its headquarters in London. We can influence its environmental work through active contact with international organisations, shipowners' associations and national governments represented in the IMO.

Our ambition is to take environmental challenges seriously, and we aim for a process which leads not only to increased understanding of the way our operations actually affect the environment but also to continuous improvement towards a cleaner environment. We study the environmental impacts of our activities and seek to identify which are the most significant before laying plans to reduce them. Our opera-



Second engineer Amarante S Carvalho (left) and chief engineer Arild Husøy lead maintenance work on m/v Talisman's main engine. This unit is an 8L70MC from Burmeister & Wain, developing 28 400 bhp. The vessel has a service speed of 20 knots.



Chief engineer Arild Husøy.

Replacing liners in several of the cylinders on m/v Talisman's main engine.





Ship operation comprises a number of sub-processes which collectively represent a process with a substantial impact on the natural environment.

An overview of the most significant of these discharges and emissions is provided here.

OPERATIONAL DISCHARGES TO THE SEA

This category embraces discharges of treated sewage, waste, bilge water, ballast water and toxic antifoulings, as well as some minor risk of oil spills in the event of accidents, excess bunkering and so forth.

BALLAST WATER

This issue has attracted attention after the registration of the undesirable spread of new types of algae and plants/animals in certain areas. These appear to have been introduced in ballast water shipped

smooth as possible reduces fuel consumption, and thereby exhaust fumes. The drawback with traditional antifoulings is that they not only kill weeds and other foulings but also add toxins to the sea. This applies particularly to the tin-based TBT coatings. All of the WW group's ships are coated with tin-free antifouling.

OTHER DISCHARGES

Sewage, bilge water, oily sludge and waste are treated to the standard of cleanliness defined in international regulations.

EMISSIONS TO THE AIR

These consist primarily of combustion gases from the main and auxil-

Maritime transport is also regarded as the most efficient existing means of moving cargo.

NITROGEN OXIDES

These are considered to be highly damaging in a pollution context because they form a photochemical smog which falls as acid precipitation. They influence the greenhouse effect and contribute to ozone depletion in the atmosphere. Maritime transport is estimated to account for about seven per cent of total nitrogen oxide emissions. New IMO requirements to limit such emissions, which come into force on 19 May 2005, apply to vessels whose keel was laid after 2000.

SULPHUR OXIDES

These contribute to acid precipitation, one effect of which can be to cause respiratory problems. Estimates indicate that marine transport accounts for roughly four per cent of global sulphur oxide emissions. Since this contribution derives directly from the sulphur content in bunkers, the best method of reducing it is to use fuel oil with a low sulphur content. Both the European Union and the IMO have standards for the sulphur content in bunkers.

PARTICULATE MATTER (PM)

Particulates in exhaust fumes comprise elements of various materials and derive from unburnt fuel. They largely account for the diesel smell associated with such fumes.

FREON/HALON

Leaks from refrigeration and fire-fighting systems release freon and halon gases to the air, where they help to deplete the ozone layer.

ACCIDENTAL DISCHARGES TO THE SEA

Accidental discharges pose a constant risk, including during routine work such as bunkering or the use of hydraulic equipment.

Good procedures and responsible personnel will reduce the risk. A high level of emergency response and well-established routines can limit the scope of a possible accident.

Accidents and wrecks unfortunately occur. Good routines, procedures and emergency response plans reduce the risk and limit the environmental consequences.

By analysing and learning lessons from such accidents, new vessel types can be developed which are better able to withstand collision and wreck. ■



from one port region to another. Their expansion could not only displace existing species or cause pollution at points of ballast discharge, but also lead to fouling of seawater intakes and filters where the new species become established.

ANTIFOULINGS

Antifouling coatings are intended to prevent marine growth on the vessel hull. Keeping a hull as

primary engines as well as refrigeration plants, vaporisation from the cargo and leaks of freon and halon gases. An internationally-accepted standard is used to measure combustion gases in grams per tonne cargo transported per kilometre (g/t-km).

Combustion gases include such components as:

CARBON DIOXIDE

is regarded as an important greenhouse gas. High combustion efficiency will reduce bunkers consumption and thereby carbon emissions. The diesel engines installed in most of WW's vessels are among the most efficient internal combustion devices available today.



Engineer Oscar G Sabado cleans the engine room after the maintenance work has been completed.

ENVIRONMENTAL WORK IN THE BUSINESS

Environmental work in the WW organisation is stratified. The management of each company bases its environmental policy on the company's quality assurance system.

Environmental targets for vessel operation have been developed jointly by Wilhelmsen Lines Shipowning and Barber Ship Management. The management organisation for each ship is responsible for technical monitoring and for recommending environmental measures which should be implemented on board.

In close cooperation with Wallenius Wilhelmsen Lines, WW works continuously on environmental issues. Common goals and status are discussed at annual environment meetings.

WW has established an environmental management system and is ISO 14001 certified. This certification includes vessels controlled by Wilhelmsen Lines Shipowning, which means in part that an environmental programme has been drawn up and an environmental committee established. The latter meets at least three times a year, and is responsible for setting targets and monitoring progress for the programme. This work was further improved in 2004 through the creation of a special post devoted primarily to the assessment of technical and financial measures which provide environmental gains.

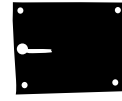
The WW group has a dedicated project department in Barber Marine Consultants which provides

assessments in design and conversion projects of all the consequences of operating a ship.

This unit maintains continuous contact with the yards responsible for newbuilding, conversion or repair of the vessels. Specifications pass back and forth between the project department and the yard several times before a contract is awarded. This process leads to ships which are safer to operate

and better able to withstand collisions. WW goes further than the regulations require, for instance, by installing an additional watertight deck on all its new vessels. Two newbuildings have now been delivered and four are still under construction by Mitsubishi Heavy Industries in Japan. Their fuel consumption is greatly reduced through an improved hull configuration which lowers its water resist-

Engineer cadet Christopher Garcia burns waste paper in an incinerator.



Engineer cadet Christopher Garcia on m/v Talisman checks that the process for incinerating sludge (water/oil mix created when treating heavy oil) is going as it should.



EXTRACT FROM THE 2004 ENVIRONMENTAL PROGRAMME

Aspect	Air	Sea	Other	Objective	Target	Measures	Status
NO _x , main engine operations	X			Reduce NO _x emissions	2) Reduce NO _x emissions per unit transported by 25% within eight years (2000-08)	2) Install slide valves on Mk IV ships in 2004 4) Study effects of nozzles to reduce NO _x when carrying out measurements on newbuildings	2) Not fully implemented. Continuing in 2005 4) Measurements carried out on m/v Torrens
SO ₂ , main and auxiliary engine operations	X			Reduce sulphur emissions	3) Reduce emissions by using low-sulphur bunkers 4) WWL's bunkers instruction is observed, the goal for 2004 was an average of 1.5% for the fleet	3) Assess performance of auxiliary engines in low-sulphur operation. Exchange experience with other operators 4) Register bunkers data	3) Bunkering in accordance with EU directive, using marine diesel oil with 0.2% sulphur 4) Average for the fleet in 2004 was 1.76%
Antifouling		X		Extend docking intervals	1) Reduce antifouling use 2) Evaluate results	1) Plan longer intervals between dockings 2) Follow up at next environment meeting	1) Four ships coated for five-year intervals in 2003. M/v Talbot docked in 2004 2) Done
HCFC & Freon	X			Reduce pollution of the environment	1) Register the quantity used on board from 1999 4) Newbuildings will be provided with environment-friendly plants	1) Follow up consumption in 2003 and beyond 4) Install products expected to yield an improvement	1) Freon consumption: 1999 = 9 549 kg; 2000 = 10 419 kg; 2001 = 9 300 kg; 2002 = 9 417 kg; 2003 = 9 747 kg; 2004 = 6 327 kg 4) Freon R-404A utilised on the three first newbuildings
Bilge water		X		Reduce polluting discharges of oily water to the sea	2) Evaluate results from the newbuildings in order to set targets for existing ships	2) Evaluation report under preparation	2) Process under way. Separator which will give 5 ppm oil in bilge water discharged overboard has been installed on three ships plus newbuildings
Painting		X	X	Use environment-friendly paint on board	1) Evaluate environment-friendly paint 2) Keep updated on new products 3) Return empty paint containers to the supplier	1) Seek advice from paint suppliers 2) Constantly follow up new products 3) Cooperate with suppliers over measures	1) Few viable alternatives 2) Few viable alternatives 3) Keeping developments under review
Paper, plastic and wood			X	Reduce paper flow and transport	6) Installing EasyInfo/Safir	6) No paper reports to and from the vessels	6) Continue development. 18 ships completed
Ballast water		X		Eliminate micro-organisms in ballast water	2) Reduce pumping of ballast water in port 3) Further develop understanding of micro-organisms in ballast water among ship's officers	2) Enhance understanding of the need to develop better plans for ballast water treatment 3) Develop an expertise programme at officer seminars and through visits to the shipping company	2) Done 3) Done
Consumption of cylinder oil		X	X	Reduce consumption of cylinder oil	2) Install slide valves on four ships 3) Install SIP system for newbuildings	2) Being installed on four ships in service 3) Installed on ships delivered in 2004	2) Not yet completed 3) Done
Environmental training	X	X	X	Enhance understanding of environmental protection	2) Enhance understanding	2) Refresher courses for officers and crew	2) Not yet completed



ance. A patented stator fin installed on the rudder and an advanced propeller design complete the picture. Cargo capacity has also been increased by design measures which yield better utilisation of the cargo holds. The result is good transport economics combined with environmental benefits in the form of reduced emissions.

To prevent oil pollution in the event of a collision, the bunkers

tanks are placed as close as possible to the vessel's centre line.

The volume of these tanks has also been increased in order to reduced the number of bunkering operations and thereby minimise the risk of oil leaks.

These developments are regarded by the WW group as part of a continual improvement in vessel types and a reduction of the risk of major environmental disasters.

Other examples of environment-friendly measures include:

- only environment-friendly, biochemically-degradable products and chemicals are used in day-to-day operations
- materials are returned to suitable ports for recycling, including medicines past their expiry date, used lightbulbs and fluorescent tubes, fuses, batteries and so forth
- reduced use of plastics
- sorting and treatment of ship's waste
- involving, updating and training ship's officers to think

environment-friendly products and measures at all times.

ENVIRONMENTAL PROGRAMME

Ship operation is constantly developing, and many of the measures currently being tried out on some of the group's vessels aim to reduce emissions of polluting substances. If these efforts yield successful results, the relevant measures will be extended to other vessels in coming years.

Procedures and long-term targets have been established for the most significant environmental aspects, with measures and status ▶

Bosun Raut V Badtles sorts ship's waste, which is placed in containers labelled for the different categories of refuse in Bremerhaven.



All waste on m/v Talisman, like these containers of food scraps, is sorted and sent ashore when the vessel has berthed.

being reviewed at three meetings of the environmental committee per year.

The following extract from the environmental programme illustrates some of the activities being pursued to achieve WW's objectives, and thereby accept its share of responsibility for reducing the environmental impact of its operations.

This environmental programme has been applied on all Wilhelmsen-controlled vessels in connection with ISO 14001 certification. The most important targets being pursued are:

NITROGEN OXIDE EMISSIONS

The engines on the latest newbuildings delivered to the group have nitrogen oxide emissions below the IMO ceiling. Further improvements are expected with the series of six ships, of which two have been delivered.

SULPHUR OXIDE EMISSIONS

It was possible to reduce the average sulphur content of bunkers to below 1.8 per cent in 2004. That represents an improvement of about 20 per cent from the year before. This content is registered on a continuous basis. Some of the auxiliary engines are also being run on diesel or gas oils which contain around 0.2 per cent sulphur on average.

ANTIFOULING

All the vessels are now coated with tin-free antifoulings. The next step is to extend docking intervals in order to achieve a reduction in the total quantity of antifouling used over time.

FREON AND HALON GASES

WW has succeeded in reducing leaks of these gases to the air by more than 32 per cent since 2002, which is in line with the group's in-house targets.

BILGE WATER

The aim is to work continuously on reducing the oil content in bilge water. Separators which can further reduce discharges are assessed by WW both for newbuildings and when replacing existing systems. The target is to get as low as five parts per million (five mg/kg) of oil in bilge water, which compares with an international requirement of 15 ppm.

WW strives to enhance awareness, knowledge and qualifications of both seagoing personnel and office staff regarding bilge water treatment. As part of these efforts, a special bilge water seminar was held in Mumbai, India, with participation by senior management from WW and about 15 other shipping companies. The principal topics were existing and future legislation, how to relate to these provisions and the consequences of failing to observe them.

BALLAST WATER

The aim is to reduce the volume of micro-organisms in ballast water, and to limit the intake and discharge of such water where possible. Preventing the expansion of alien species in new environments is desirable.

A ballast management system has been implemented in the fleet, along with a plan for internal transfers of ballast between the tanks. Ballast water is replaced when the ships are on the high seas in order to have the cleanest possible seawater in the tanks when arriving in port.

A special training programme has been established for ship's offi-

biochemically-degradable waste is discharged overboard, and then only in accordance with the international Marpol regulations.

INSPECTIONS

Barber International has its own inspection programme to monitor the standards set by the group, with every ship visited once a year by the company's safety inspectors. A special safety, health and environmental (SHE) group has been established to follow up this work. The SHE inspectors check the vessel's condition, interview the crew, organise emergency response exercises, hold courses on board and discuss how further improve-



cers in the group to enhance understanding of the problem and achieve optimum ballast water operations.

WASTE HANDLING

All the vessels have established a plan for waste sorting. Some are also equipped with a recycling station. Experience with such units will be assessed for possible retrofitting of similar installations on all the ships.

Vessels are required to return hazardous products to land whenever possible. Meeting this target will be hampered in certain ports by the lack of reception facilities.

A survey shows that vessels of around 55 000 gross tons generate roughly 7 000 cubic metres of waste per year. These materials are handled on board in the most environment-friendly way possible. Some is burnt in suitable incinerators and some sent ashore. Only

ments in safety and environmental protection could be achieved.

TRAINING

Barber has its own maritime training and educational centre at Mumbai in India. Specially-tailored training programmes are also run in cooperation with the company's crewing offices in Norway, Poland and the Philippines.

Barber cooperates closely with the Vestfold Regional College in Norway to hold regular seminars on safety training in critical conditions. This programme has been specially developed for WW officers, and feedback from participants is very positive. Emergency response exercises for handling oil spills are staged regularly both at sea and on land. Environmental work is also a topic at the conferences organised regularly for ship's officers. ■



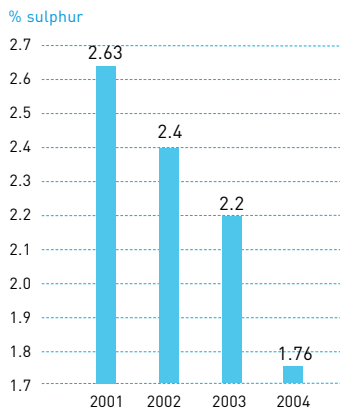


Barber has adopted a computer system developed in-house to register and analyse operational data as well as undesirable incidents and non-conformances. This information is compared with pre-defined quality parameters to ensure that levels are not unacceptably high.

Consumption

WW purchased about 348 000 tonnes of bunkers in 2004, with an average sulphur content of roughly 1.76 per cent.

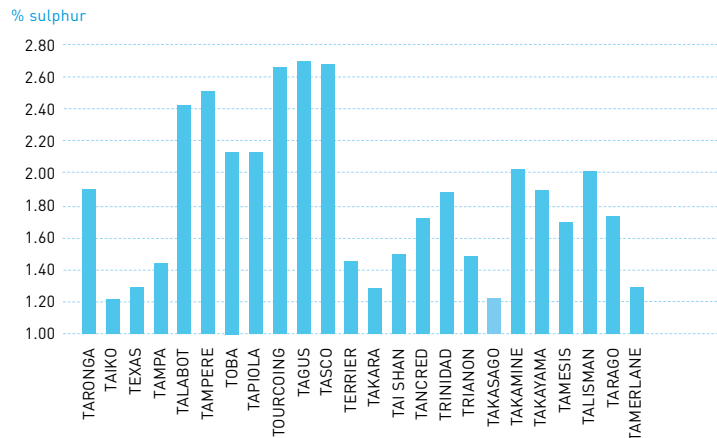
This means that the fleet reduced the sulphur content in its bunkers for the fifth year in a row, thereby making a further contribution to reducing sulphur emissions.



Average sulphur content in bunkers 2004

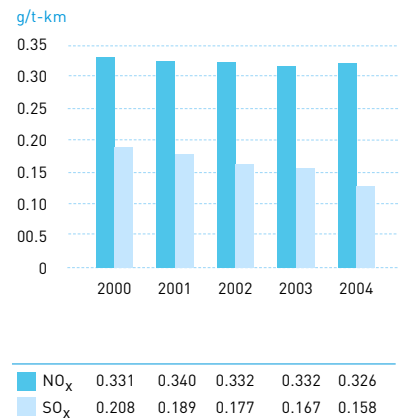
The graph below shows the percentage sulphur content in all bunkers purchased in 2004 for each of the vessels.

However, the group's total energy consumption is a misleading parameter for measuring how well its ships are being operated. The most interesting comparison is between consumption and emissions per gram of cargo transported per tonne-kilometre (g/t-km). These data are now calculated for all WW ships and presented in the environmental accounting.



Fleet's total NO_x and SO_x emissions

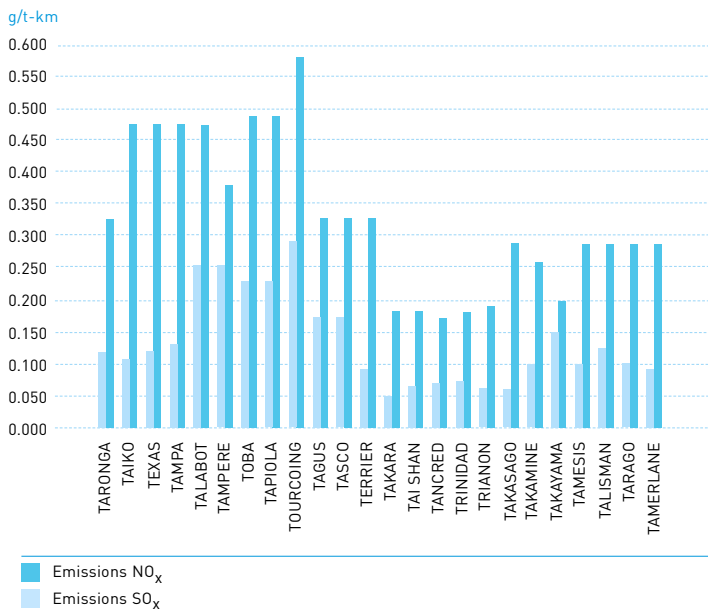
Emissions of nitrogen and sulphur oxides and carbon dioxide relate to vessel service speeds, cargo hold volumes and calculated releases of gases. The graph below shows the average for all ships in 1999–2004.



Exhaust fumes emitted by the ships in 2004

Because the fleet composition was virtually unchanged, total nitrogen oxide emissions were the same. Sulphur oxide emissions declined somewhat, as explained above (reduced sulphur content in bunkers). In line with the goal of steadily reducing the sulphur content in bunkers, WW is hoping for a further reduction in sulphur oxide emissions for 2005.

The graph below shows emissions of nitrogen and sulphur oxides for each of the group's vessels. The variations largely reflect differences in engine performance, cargo hold volume and sailing speed.



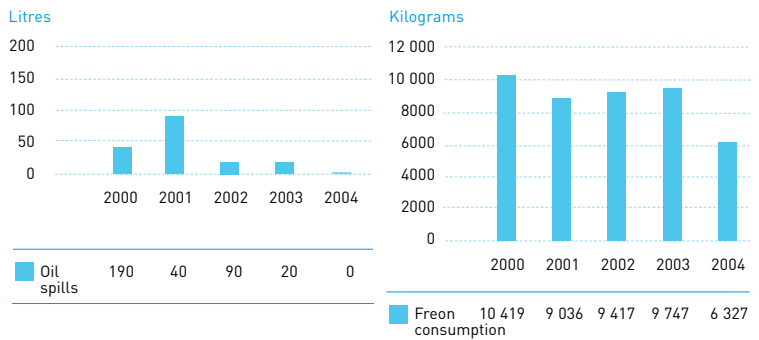
Oil spills by the fleet

No incidents involving oil spills or pollution were recorded on the ships in 2004 as a result of accidents.

Good seamanship and routines have yielded results. The group seeks to prevent such incidents through training and motivational efforts. Should one occur, it will be analysed and the necessary measures initiated to avoid repetitions.

Consumption of freon by the fleet

WW's long-term goal is to reduce freon usage, and measures to achieve that objective are under continuous assessment. Consumption has been virtually constant over the past few years, but with a marked decline in 2004.



TOPIC OF THE YEAR: LOW-SULPHUR OIL

This year's topic focuses on reducing the sulphur content of bunkers oil. Sulphur emissions influence acid precipitation, which is why this subject has been chosen for 2005.

ACID PRECIPITATION EXPLAINED

Gases such as sulphur dioxide (SO₂) and nitrogen oxides (NO_x) are by-products of burning coal or oil, for instance. After a time, sulphur dioxide usually oxidises further to form sulphur trioxide (SO₃). This combines in turn with water droplets (H₂O) in the atmosphere to produce sulphuric acid (H₂SO₄). Nitrogen oxides consist primarily of nitrogen oxide (NO) and nitrogen dioxide (NO₂). These compounds react with water droplets in the atmosphere to create nitric acid (HNO₃). Both sulphuric and nitric acid are strongly acidic. Rain or snow containing a high proportion of H⁺ ions give acid water – in other words, with a low pH.

EFFECTS OF ACID PRECIPITATION

Acid precipitation affects both animals and plants in various ways:

- acidification of lakes
- leaching of nutrients from the soil
- dissolution of toxic metals.

The effect on plants is therefore:

- reduced nutrition
- poisoning or reduced resistance to bacteria, fungi and insects.

High atmospheric concentrations of sulphur dioxide can arise over certain cities and built-up areas, causing respiratory ailments as well as corrosion or deterioration of structures and buildings.

The transport sector releases both sulphur dioxide and nitrogen oxides by burning fuel. Already present in the fuel, the sulphur binds with oxygen (O₂) in the combustion air. The amount of sulphur dioxide which forms depends entirely on the sulphur content of the fuel.

A different process is involved in nitrogen oxide formation, where

nitrogen (N₂) binds to oxygen in the combustion air under high pressure and temperature. Combustion must also continue for some time. These conditions all occur in engine cylinders. In other words, the quantity of nitrogen oxides formed is not solely dependent on the fuel. Nitrogen oxides can be treated in a catalytic converter, but sulphur dioxide would destroy such a device.

THE CHALLENGE

The challenge now and in the future is to produce sufficient low-sulphur oil for the world market. Oil companies also warn that this product will cost more to produce. Together with Wallenius, WW has taken a lead in using low-sulphur heavy oil on its vessels. This increased costs for its fleet by about USD 3.3 million in 2004. No international regulations require the use of low-sulphur oil outside the sulphur oxide emission control area (Seca), which embraces the Baltic, the English Channel and parts of the North Sea. In other words, this is an in-house requirement.

Operating with low-sulphur fuel in large ship's engines is not without its technical problems. Certain engine types require both conversion and the replacement of equipment, such as lubrication systems and nozzles for cylinder oil, extra



rings on the piston head, special slide valves for fuel, or the use of other types of cylinder oil than with high-sulphur fuels.

Ships operating in and out of the Seca normally carry two types of bunkers with different sulphur content, and two types of cylinder oils. That in turn calls for ▶

M/V Talisman takes on 2 300 tonnes of low-sulphur bunkers oil in Bremerhaven. Such fuel must contain no more than one per cent of sulphur – in this case, the content is 0.87 per cent.



Fourth engineer Arvin P Salgado supervises the bunkering operation. The oil has reached Bremerhaven on a bunkers barge from Hamburg, and is checked by chief engineer Arild Husøy and surveyor Peter van den Boomgaard from Det Norske Veritas.







attention by engine room personnel. For technical reasons, they must also make sure that the cylinder oil is changed when shifting to low-sulphur oil. Forgetting to do so could lead in the worst case to engine failure.

Heavy oil contains about 4.5 per cent sulphur, or 45 000 ppm. Sulphur is found to varying degrees in all oil, depending on the type of crude and the refining method.

Another problem is the mixing



of bunkers and variations in bunkers quality. Samples of the product are taken every time a ship loads bunkers, and are sent for analysis by an oil laboratory. After a few days, the ship receives exact details about the composition and properties of the fuel. Until then, the crew will know nothing about the product they have received. In the worst case, the oil has to be returned to land. It is important in such cases that the oil has not been mixed with the fuel previously in the tanks.

OFFICIAL MEASURES

International measures taken to reduce emissions include:

- The EU's environmental council resolved in June 2004 to reduce sulphur dioxide emissions from ships by more than 500 000 tones every year until 2007.
- The IMO's aim is primarily to improve safety at sea and prevent pollution of the marine environment. Its Marpol Annex VI directive has created and defined a Seca where, from 19 May 2005, the sulphur content in bunkers must be below a ceiling of 1.5 per cent. The directive also permits the installation of combustion gas treatment plants which emit a maximum of six grams of sulphur oxides per kWh. This

provision will apply in the Baltic from 19 May 2006, and in the English Channel and the North Sea from the summer of 2007. Outside the Seca, the global sulphur ceiling is set at

4.5 per cent.

- From the date the Marpol Annex VI is ratified, all vessels of 4 500 gross tons and above must satisfy the requirements for an international air pollution prevention certificate (IAPP). This is the highest level of certification and is issued by the classification societies on behalf of the authorities. It shows that the ship satisfies the Annex VI regulations.
- Several countries, including Sweden and Norway, have introduced environmentally-differentiated duties to encourage the use of low-sulphur fuel oil.

HOW WW IS MEETING THE CHALLENGES

The group's targets for 2004 were:

- All WW ships would bunker an average of 1.5 per cent sulphur.
- Take on bunkers in ports which could deliver predictable and satisfactory quality.
- Contract for bunkers delivery with one per cent sulphur in Europe.
- Two different cylinder oil types on board.
- Satisfy the EU's requirement for 0.2 per cent sulphur in marine diesel oil.

The global shortage of oil with one per cent sulphur meant that bunkers with 2.5 per cent sulphur and higher had to be taken on in some ports. Ships have therefore had to shift between low- and high-

sulphur bunkers. The contract for bunkers with one per cent sulphur in Europe functioned satisfactorily. WW also succeeded in satisfying the EU's requirement for 0.2 per cent sulphur in marine diesel oil.

WW is represented in a forum on reducing sulphur emissions from oil organised by the Norwegian Shipowners Association. This body comprises about 20 Norwegian shipping companies together with representatives from engine manufacturers, oil producers, consultants and research communities. The group devotes considerable resources to the forum through its own commitment and financing. WW is represented on all five of the forum's action groups.

GROUP 1 EXHAUST GAS TREATMENT

The action group assessing technology for exhaust gas treatment is looking at various ways to optimise cleaning of fumes from engines, boilers and incinerators. Two types of treatment systems stand out today – scrubbers and catalytic converters. A scrubber is a wet-wash plant which treats the gases with the aid of seawater. This can be done either by spraying seawater into the exhaust gas under pres-

sure, or by passing the gases through a water bath which removes particles and sulphur oxides. A catalytic converter turns nitrogen oxides into nitrogen (N₂) under high temperatures.

GROUP 2 TRIBOLOGY

This group is looking at various experiences with low-sulphur operation. These include problems related to mixing cylinder oils, the lubricating qualities of low-sulphur

oil and engine wear. The group studies and analyses available information, and considers what should be studied next, causal relationships and hypotheses. Engine industry representatives are also actively involved in this work.

GROUP 3 REGULATORY REGIME

The regulatory regime group is looking at the regulations and seeking to keep updated internationally. It will be a resource for the authorities, the classification societies and organisations involved in preparing and maintaining regulations in the maritime sector.

GROUPS 4 AND 5 BUNKERS AVAILABILITY AND QUALITY

As their names indicate, these groups work with bunkers suppliers and producers not only to identify availability but also to highlight the issue of varying bunkers quality. Representatives of the oil producers are also involved in these bodies. ■

M/V Talisman's funnel with its With. Wilhelmsen identity – two light-blue stripes on a black background.



Superintendent Asle R Olsen in Barber Ship Management is responsible for technical management of m/v Talisman. This includes supervising maintenance work on the main engine.

DEFINITIONS

Bunkers: Collective term for fuel oil used on ships. Its origin is uncertain, but could derive from the English word “bunk” – a storage space on vessels for sails and in times past for coal (or for people – bunk = bed). Steamers stored their coal in a coal bunker.

Heavy oil: A collective term for residues from oil refining. It comprises a blend of substances left over from processing and necessary components which make it useable as fuel.

GLOSSARY

Antifouling	Coating for a vessel's bottom which contains toxic components to prevent fouling.
Barnacles	Organisms which stick to the submerged parts of a vessel and increase its resistance to the water.
Ballast water	Contains micro-organisms which can cause environmental problems if introduced to alien eco systems. Ballast water is taken on board during the discharge of a cargo, and pumped to the sea when the next cargo is loaded.
Bilge water	Dirty water, possibly from leaking pipes or the like, which collects in a ship's bilges and may be contaminated with oil, etc.
Boost, booster	Pumps, for instance, working in series to increase volume and discharge pressure.
Bow thrusters	Usually denotes a propeller with drive installed in a transverse tunnel.
CFC	Chlorofluorocarbons – compounds containing chlorine and fluorine, which include freon. Harmful to the ozone layer. See HCFC.
CO, CO ₂	Carbon monoxide, carbon dioxide – combustion products. The amount of carbon dioxide in the atmosphere may increase the temperature at the Earth's surface – known as the greenhouse effect.
Cooling agents	Used in cooling and freezing plants.
Dehumidifier unit	A unit for removing humidity from the air.
Dewatering unit	A system which can remove water from a mix of water and oil.
g/t-kg	Grams per tonne per kilometre. Denotes emissions in grams per tonne of cargo shipped over a given distance.
Halon	Hydrocarbons in a gaseous phase, harmful to the ozone layer in the atmosphere.
HCFC	Hydrogen-rich chlorofluorocarbon compounds, such as freon 22 (R22).
HFC	Hydrofluorocarbon – a fluorinated hydrocarbon which can substitute for CFCs without harming the ozone layer.
HFO	Heavy fuel oil.
IMO	International Maritime Organisation. International body created to regulate maritime trade.
ISM code	International Safety Management code. A standard for safe and environmentally-conscious vessel operation.
ISO	International Organisation for Standardisation.
ISO 14000	ISO standard for environmental management.
ISO 9000	ISO standard for quality assurance.
Low NO _x nozzles	Fuel valves specially developed to reduce formation of nitrogen oxides (NO _x) from combustion.
Mark (Mk) I-IV	In-house WW designation for various series of ship, categorised by age.
Marpol	IMO convention on the prevention of marine pollution.
MDO/MGO	Marine diesel oil/marine gas oil.
Nitrogen oxides (NO _x)	React with moisture in the air to form nitric acid.
ppm	Parts per million (1 ppm = 0.000001). For example, one weight unit ppm = 1 mg/kg
Seca	Sulphur oxide emission control area – a sea area defined in IMO Marpol Annex VI, which includes restrictions on emitting sulphur oxides
SIP	Swirl injection principle. Special type of fuel valve which reduces afterburning and thereby the need for engine lubrication.
Slide valve	Fuel valves which are fully emptied on each stroke, and thereby counteract afterburning.
Sludge	Mixture of water and oil formed during shipboard treatment of heavy fuel oil.
Sulphur oxides (SO _x)	React with moisture in the air to form sulphuric acid.
TBT	Tributyltin, used in tin-based antifouling.
Viscosity	A liquid's resistance to flow.



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