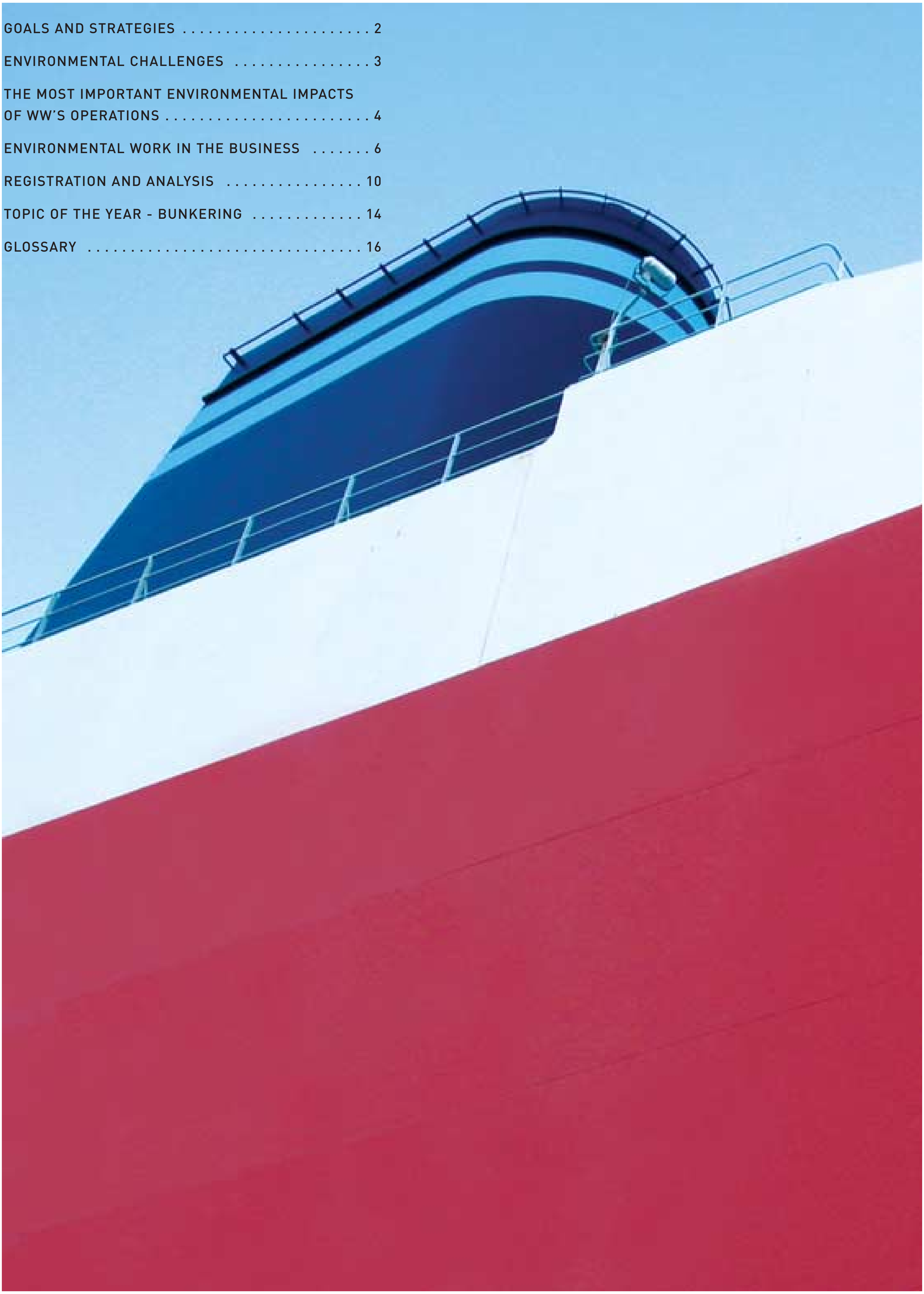
Environmental report 2003
Wilh. Wilhelmsen

CONTENT



Finding solutions to global pollution problems represents one of the biggest challenges facing the world in coming years. The WW group's area of operation — maritime transport and related services — presents several key environmental challenges. We are concerned to prevent and reduce possible unfortunate environmental consequences of our business operations. Modern society is wholly dependent on the ability to offer transport services, and in that context maritime transport provides incomparably the most energy-effective option when measured in megajoules per tonne of cargo per kilometre transported (MJ/t-km). A comparison shows that our modern ships currently use substantially less energy than road transport to move a comparable consignment. The challenges are nevertheless real enough, and we will accept our share of responsibility by ensuring that our transport services take these challenges seriously in coming years.

Shipping is an international business, and we will participate actively in efforts to establish a common international regulatory regime and environmental policy.

GOAL

Within the constraints set by technological development and economic realities, we will constantly organise our business to eliminate or minimise damage to or problems for health and the environment.

ENVIRONMENTAL STRATEGIES

One consequence of the world-wide significance of the environmental issue is that it will also be an important competitive and commercial factor. Damage to the environment is best combated through preventive measures. We will continuously evaluate our environmental risks, and analyse how the level of safety can be raised or the environmental burden reduced.

Research and technological development are essential for identifying the most appropriate and cost-effective solutions. Our ambition is to maintain a network of contacts with national and international research institutes and technical communities which can secure our access to existing expertise in the environmental field. Our contingency planning for possible environment-related incidents covers both preventive measures and crisis management. We also stage realistic exercises at regular intervals. Openness and an acceptance of the public's need for information about our attitudes and actions in the environmental field will also characterise our relations with the media in this area.

Ingar Skaug
President and group CEO

ENVIRONMENTAL CHALLENGES

The WW group takes environmental challenges seriously, and aims for a process which leads not only to increased understanding of the way its operations actually affect the environment but also to continuous improvements towards a cleaner environment.

Two areas of the business have great significance in terms of environmental challenges. One concerns the vessels owned directly by the group through its shipowning companies, and the other relates to the vessels owned by others but managed by Barber International. The group's opportunities to influence design and new investment for the latter vessels are limited.

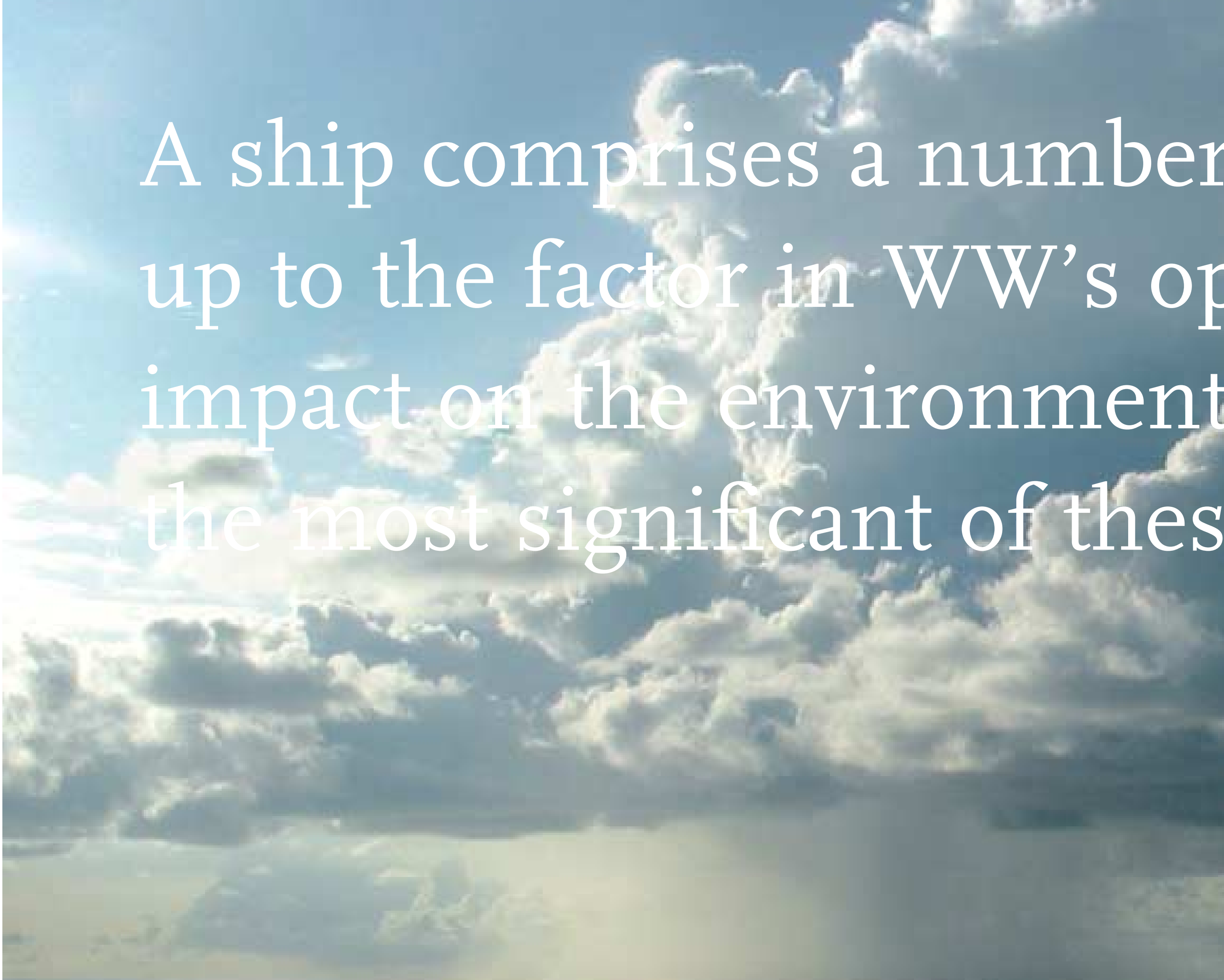
Barber International's operational offices and the ships controlled by Wilh. Wilhelmsen are certified in accordance with the ISO 14001 environmental standard. The group is thereby committed to continuous monitoring and improvement of the most significant environmental aspects it has defined.

Another goal is to encourage as many as possible of Barber's clients to opt for an environment-friendly operational profile, and to be in a position to offer environmental certification of their vessels if desired.

This report will focus primarily on the Wilhelmsen-controlled fleet. An environmental accounting has been drawn up for these vessels which critically evaluates the processes influencing emissions to the air and discharges to the sea, together with volumes delivered to land. The most important emission figures are once again compared with results in earlier years, and these comparisons will be used to evaluate environmental targets for future work.

REGULATORY REGIME

WW's efforts to limit emissions to the air and discharges to the sea are based on the international regulations in the IMO's Marpol 73/78 convention. With annexes, this regulates discharges to the sea and emissions to the air. In addition, a number of special national requirements are taken into account.



A ship comprises a number up to the factor in WW's op impact on the environment the most significant of thes

OPERATIONAL DISCHARGES TO THE SEA

This category embraces discharges of treated sewage, waste, bilge water, ballast water and toxic antifoulings.

BALLAST WATER

This subject has come into focus after the discovery that new types of algae and plants/animals are flourishing in certain areas. They appear to have been introduced in ballast water shipped from one port region to another. Their expansion could displace existing species or cause pollution at points of ballast discharge, but also cause 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 the hull as 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.

SCRAPPING

Scrapping is part of a vessel's life cycle. Growing attention is now being paid to this process, the methods used and how these contribute to polluting the environment.

OTHER DISCHARGES

Sewage, bilge water, oily sludge and waste are returned to land or treated to the standard of cleanliness defined in international regulations before being discharged.

EMISSIONS TO THE AIR

These consist primarily of exhaust fumes from the main and auxiliary engines, vaporisation from the cargo and leaks of freon and halon gases. Exhaust emissions are measured in grams per tonne cargo transported per kilometre (g/t-km).

Exhaust fumes include such components as:

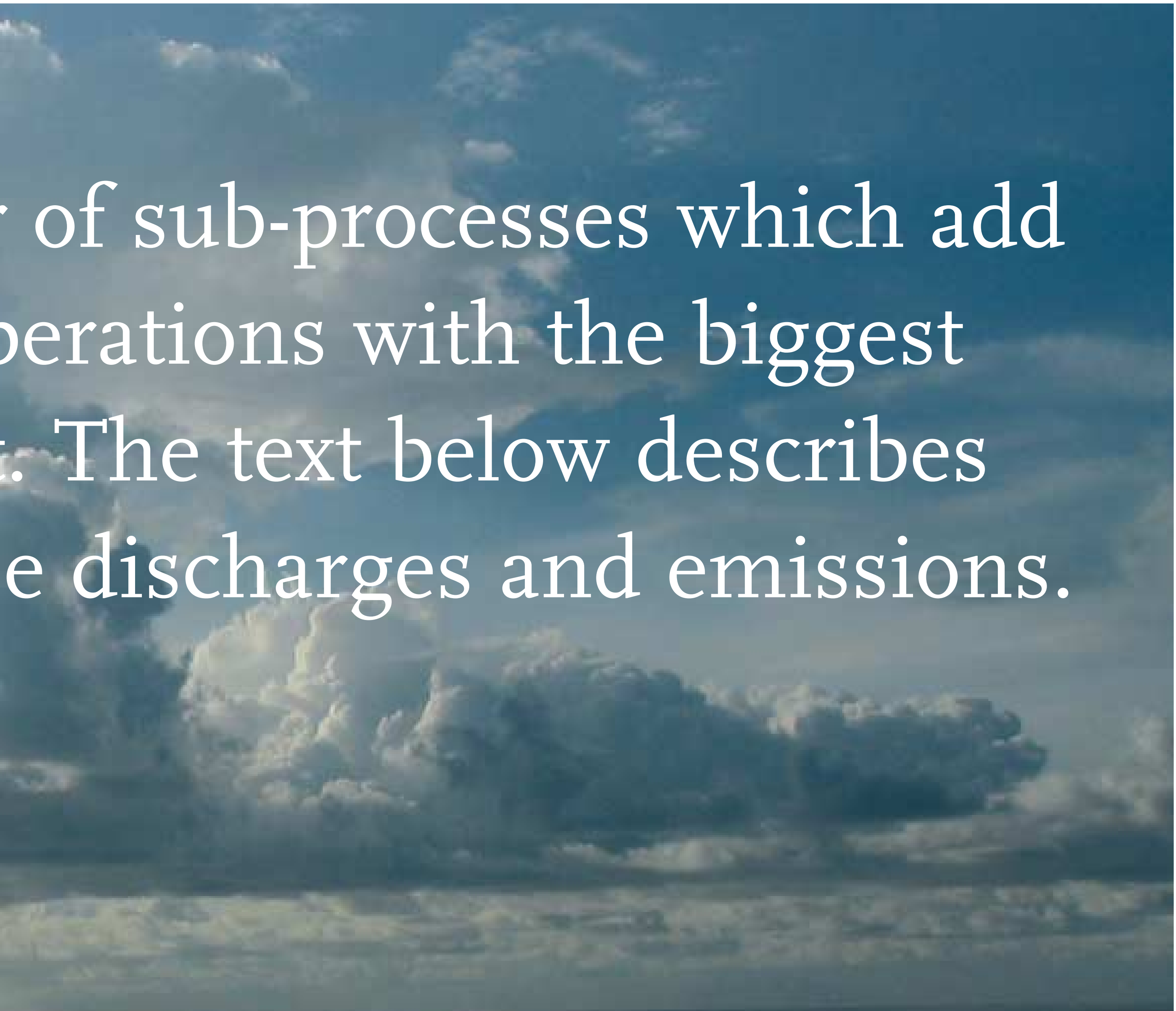
Carbon dioxide, regarded as an important greenhouse gas. High engine efficiency will reduce bunkers consumption and thereby carbon emissions. The diesel engines installed in most of WW's vessels are among the most efficient internal combustion devices available today. Maritime transport is also regarded as the most efficient existing means of moving cargo.

Nitrogen oxides contribute to acid precipitation and ground-level smog, as well as influencing the greenhouse effect, contributing to ozone depletion in the atmosphere and posing a health risk. Maritime transport is estimated to account for about seven per cent of total nitrogen oxide emissions. New IMO requirements to limit such emissions apply to vessels whose keel was laid after 2000.

Sulphur oxides contribute to acid precipitation and pose a health hazard. Estimates indicate that shipping accounts for roughly four per cent of global sulphur oxide emissions. This contribution derives directly from the sulphur content in bunkers, so that the best method of reducing it is to use fuel oil with a low sulphur content. Both the European Union and the IMO set standards for the sulphur content in bunkers.

Particulate matter (PM) in exhaust fumes comprises both organic and inorganic components. These contribute to pollution and pose a risk of cancer and other health hazards.

Vaporisation of volatile organic compounds (VOCs) from oil cargoes is particularly heavy during the loading process, when petroleum gases in the tanks are displaced by cargo



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e discharges and emissions.

being pumped aboard. It also continues throughout the voyage.

Leaks from refrigeration and fire-fighting systems emit **freon** and **halon** gases respectively 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.

The efficacy of WW's emergency response plans was amply demonstrated when the Tricolor was involved in a collision in the English Channel during the early morning of Saturday 14 December 2002. The vessel sank in just 90 minutes. Barber's emergency response team (ERT) had fully mobilised at the office within 2.5 hours of the accident and one hour after the first alarm was received. The ship's P&I underwriter, Gard, was involved from the start and has played an active role in the salvage and clean-up efforts.

Limiting the environmental consequences became an immediate priority. Apart from the vessel's own bunkers and lubricating oil, the cars making up its cargo had petrol in their tanks. The ship lay like a reef in the middle of the westbound sailing channel of one of the world's most heavily-trafficked sea areas. Although the wreck was immediately marked in accordance with the regulations, and its position reported to all maritime traffic, it was hit twice by other vessels during the first few weeks. Both of these collisions prompted a tightening in emergency response. The second also caused an oil spill. In addition, minor accidental spills were suffered while emptying the ship of bunkers under difficult conditions of weather and current. Clean-up efforts were immediately launched around the wreck and along beaches after these incidents. Smit Salvage was awarded the contract to empty the vessel of oil, began work immediately and had finished by the end of February. About two-thirds of the roughly 2 155 cubic metres of bunkers and other oil contained in the ship (or around 1 455 cubic metres) have been recovered. A further 25 per cent or so (roughly 490 cubic metres) leaked to the sea, while the remainder was left in the wreck – in small tanks, in pockets in the hull and so forth.

During the work of cutting up the hull into sections for removal, emergency oil spill response was kept in a high state of readiness to collect any residues which might have leaked into the sea. Once the wreck had been emptied of oil, a tendering round concluded with a contract being awarded to Combinatie Berging Tricolor, comprising Smit Salvage, Scaldis Salvage & Marine Contractors, URS Salvage & Maritime Contracting and Multraship Salvage. This consortium had developed the technolgy used to cut up the wreck of the Russian submarine Kursk. Work on removing the wreck began in the summer of 2003, and it had been cut into pieces by October. Most of these sections were also removed before the winter, with the remainder due to go as soon as the weather window opens.

See www.tricolorsalvage.com

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.

The captain and crew have responsibility for day-to-day monitoring on the vessel, and the captain's instructions also confer the authority to take such steps as are considered necessary to protect the marine environment.

Barber has established an environmental management system and is ISO 14001-certified. This certification includes ships controlled by Wilhelmsen Lines Shipowning AS. Its requirements include the establishment of an environmental programme and an environmental committee. Meeting at least three times a year, the latter is responsible for setting targets and for monitoring progress towards these as specified in the programme.

Personnel responsible for externally-owned vessels managed by Barber work actively in cooperation with their owners to make these ships more environment-friendly.

ENVIRONMENTAL PROGRAMME

Ship operation is constantly developing, and many of the measures currently being tried out on some 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 being reviewed at each of the three meetings of the environmental committee during the year.

The following selection from the environmental programme illustrates some of the activities being pursued to achieve WW's objectives, and thereby to 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 to be delivered from the fourth quarter of 2004, while older ships are being phased out.

SULPHUR OXIDE EMISSIONS

It was possible to reduced the average sulphur content of bunkers to below 2.2 per cent in 2003. This content is registered on a continuous basis. Some of the auxiliary engines are also being run on diesel or gas oils which contain little sulphur.

SLUDGE

The aim is to reduce the volume of oily sludge produced from preliminary treatment of fuel oil. Dewatering units have been installed on a number of ships to boil off the water in the sludge and thereby reduce its volume.

ANTIFOULING

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

ACCIDENTAL OIL SPILLS

The group aims to minimise oil pollution caused by accidents. Such spills have been very low in recent years, and as close to zero as it is practically possible to get.

FREON AND HALON GASES

Substitutes for freon have so far failed to live up to expectations, which means that efforts to phase out these gases are taking longer that earlier expected.

USE OF CHEMICALS

The use of environment-friendly chemicals is being registered. Statistics on such consumption are produced, and two vessels use only environment-friendly products. Consumption and the effects of chemicals are monitored on a continuous basis.

BILGE WATER

The aim is to work continuously on reducing the oil content in bilge water. Separators which reduce discharges will be assessed for both newbuildings and when replacing existing systems. The target is to get as low as five parts per million of oil in bilge water.

WASTE HANDLING

All the vessels have a plan for waste sorting. Some feature a separate 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.

Danilo Soriano and Pepito Rayco at work in MV Trinidad's engine room.

EXTRACT FROM THE 2003 ENVIRONMENTAL PROGRAMME

Aspect	Air	Sea	Other	Objective	Target	Measures	Status
NO_x engine operations	X			Reduce NO_x emissions	2) Reduce NO_x emissions per unit transported by 25% within eight years (2000-08).	2) Installing slide valves on Mk IV ships in 2004. 4) Studying effects of nozzles to reduce NO_x when carrying out measurements on newbuildings.	2) Regarded as solved with this new type of valve. 4) Newbuilding deliveries from the fourth quarter of 2004.
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 is an average of 1.5% for the fleet.	3) Assessing performance of auxiliary engines in low-sulphur operation. 4) Registering bunkers data.	3) Bunkering in accordance with EU directive, using marine diesel oil with 0.2% sulphur. 4) Average for the fleet in 2003 was 2.16%
Bunkers	X			Reduce sludge volume	4) Reduce water content in sludge.	4) Installing dewatering plants on the three vessels in 2003.	4) Implemented for Taiko, Tampa and Texas. Manages to boil off 6-700 litres of water per day per ship.
Antifouling		X		Extend docking intervals	4) Reduce antifouling use.	1) Planning longer intervals between dockings.	1) Four ships coated for five-year intervals in 2003. More planned in 2004.
Halon	X			Reduce pollution of the environment	1) Halon to be swapped for a less environmentally-harmful substance when replacement is necessary.	1) No ships with halon.	1) Completed.
HCFC and freon	X			Reduce pollution of the environment	1) Register the quantity used on board from 1999. 2) Start a campaign to reduce leaks. 3) Consider replacing freon in aircon units on lorries. 4) Newbuildings will be given environment-friendly plants.	1) Following up consumption in 2003 and beyond. 2) Motivating crew and assessing measures for major consumers. 3) Starting evaluation programme. 4) Installing 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. 2) Exposure occurs when equipment breaks down. 3) On hold. 4) In progress.
Chemicals and solvents		X	X	Reduce pollution from chemicals and solvents	4) Register procurement of chemicals 6) Two ships use only environment-friendly products.	4) Statistics being prepared 6) Takamine and Tamesis are test ships. Consumption and effect being evaluated.	4) In progress. 6) In progress – report under preparation.
Bilge water		X		Reduce polluting oil discharges 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.
Batteries/ fluorescent tubes			X	Reduce environmental impact	3) Evaluate receiving stations on land.	3) Memo from general manager sent on board to focus on opportunities for reception on land.	3) "Waste and sludge" manual will be an appendix to the new environmental manual.
Consumption of cylinder oil		X	X	Reduce consumption of cylinder oil	1) New lubrication system for cylinder oil to be evaluated. 2) Install SIP system for newbuildings. Slide valves on existing ships.	1) New lubrication system for cylinder oil to be installed on a selected vessel. 2) Being installed on four ships in service.	1) Done. 2) SIP = swirl injection principle. This type of fuel valve reduces afterburning and thereby the need for lubrication.

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 introduction of alien species to 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. A special training programme has been established for ship's officers in the group to enhance understanding of the problem and achieve optimum ballast water operations.

Continuous training and education will help to ensure the most environment-friendly approach in this area.

INSPECTIONS

Barber International has its own inspection programme to monitor the standards set by the group. Under this, every ship is 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 and discuss how further improvements 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 manning offices in Norway and Poland, and now in the Philippines.

In addition, 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.

All Barber's management offices are now certified and hold a document of compliance (DOC), and all group vessels have received a safety management certificate (SMC) in accordance with the ISM code.

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.

Computer-based training (CBT) modules are supplied to Barber's manning offices and vessels under management through a collaboration with Seagull. WW's Mark IV newbuildings also feature a dedicated CBT room for such training.

This page: Large deck areas need to be cleaned in preparation for a new cargo.

Far right, above: Vincie Moreno in MV Trinidad's engine room.

Far right, below: Abeh John Taniñas pursuing maintenance work on MV Trinidad.

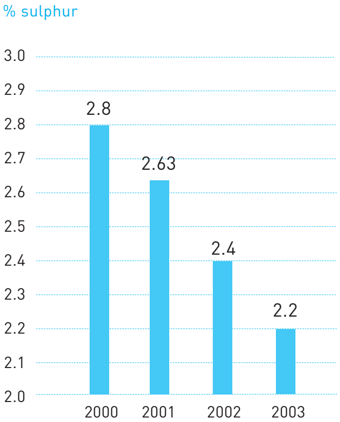
Barber has adopted a computer system developed in-house to register and analyse operational data as well as undesirable incidents and non-conformances. This information is compared with pre-defined quality parameters to ensure that levels are not unacceptably high.

Percent sulphur in bunkers, fleet

WW purchased almost 400 000 tonnes of bunkers in 2003 with an average sulphur content of about 2.2 per cent.

This means that the group reduced the sulphur content in its bunkers for the fourth year in a row.

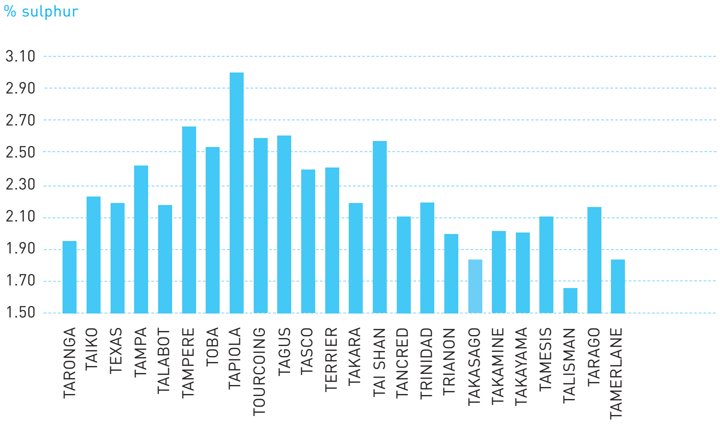
The graph below illustrates this development.



Average sulphur content in bunkers 2003

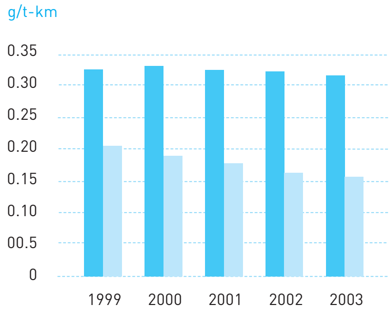
The following graph shows the percentage sulphur content in all bunkers purchased in 2003 for each of the vessels.

However, the group's total energy consumption can be 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.



NO_X and SO_X emissions

Emissions of nitrogen oxides, sulphur oxides and carbon dioxide are calculated on the basis of each ship's service speed, cargo hold volume and estimated gases released. The graph shows the average for all vessels in 1999–2003.

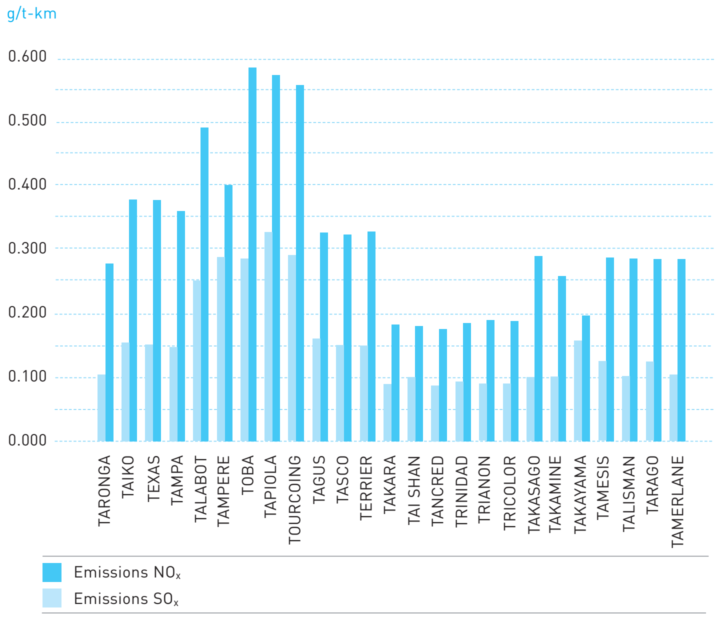


	1999	2000	2001	2002	2003
NO_x	0.331	0.340	0.332	0.332	0.326
SO_x	0.208	0.189	0.177	0.167	0.158

Exhaust fumes emitted by the ships in 2003

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).

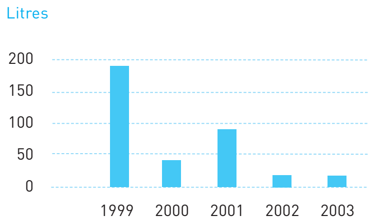
The following graph shows emissions of nitrogen and sulphur oxides for each of the group's vessels. The variations largely reflect differences in engine performance, cargo hold volume and sailing speed.



Oil spills by the fleet

Two small oil spills were recorded on the ships in 2003, with the total amount spilt amounting to no more than 20 litres.

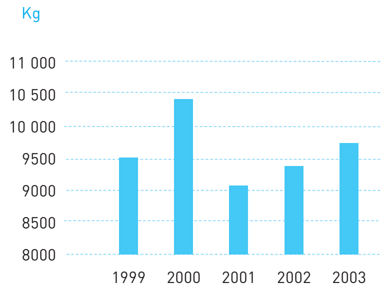
Motivational efforts and the training initiated in connection with work on ISO 14 000 are making a positive contribution through reduced oil spills. All incidents will nevertheless be analysed and necessary measures initiated to avoid repetitions.



	1999	2000	2001	2002	2003
Oil spills	190	40	90	20	20

Freon consumption

WW's long-term goal is to reduce this consumption, and measures to achieve that objective are under continuous assessment. Consumption has been virtually constant over the past few years, although rising slightly from a minimum in 2001.



	1999	2000	2001	2002	2003
Freon cons	9 549	10 419	9 036	9 417	9 747

A bunker surveyor adjusts the fuel oil sampler.

A constant watch is kept by the WW group on the status of emissions and discharges from its ships, new technology, and improvements which could reduce such emissions/discharges. The same applies to adopted or planned recommendations and requirements set by the authorities in countries where the vessels are registered or where they make port calls.

Conscious choices are made over bunkers for the ships in order to ensure a constant reduction in harmful emissions. Developments from year to year in a number of important parameters are closely monitored.

Nevertheless, bunkering a ship is not always predictable. Even if the group specifies what it wants to receive, a delivery can contain undesirable elements or risk being quite simply "off spec" in relation to the order placed. Major challenges are faced in ordering, receiving and using bunkers.

Ship's bunkers normally consist of heavy oil burnt in the propulsion machinery (main engine) and to a large extent in the generators (auxiliary engines).

Heavy oil is a residual product from the refining process, and finding applications for it can be difficult. Because crude oils and refineries differ greatly, the specifications and properties of heavy oil vary very widely. Heavy oil from the same refinery and crude may also vary over time since the overall requirements for distillates – quantity and quality – can vary.

Heavy oil has occasionally been blended with other distillates, yielding unexpected and often unfortunate results.

The International Organisation for Standardisation (ISO) has developed a standard for the most important bunkers specifications. This divides the products into classes, largely on the basis of viscosity. Each class has its specification, with maximum and minimum (limit) values for components.

Considerable variations also exist within the individual classes, and there is also a risk that oils from different sources cannot be blended even if they can be used separately. This means that they must be held on board in separate tanks.

Achieving satisfactory engine operation with such substantial variations between fuels represents a major challenge.

WW's ships are largely equipped with large slow-speed crosshead engines. These have proved for almost a century to be capable of running satisfactorily on fuels with very varying properties, and which are actually ever poorer in quality terms.

Such engines are continuously being developed and improved through a collaboration between manufacturers, shipping companies, oil companies and classification societies. The constant aim is to improve performance and reduce bunkers consumption.

The more efficient the engine, the less carbon dioxide and other harmful components it releases.

Sulphur is found in various quantities in all oil. Its volume varies with the crude and the refining method used. Since sulphur emissions are very damaging to the environment, minimising them is important. The only feasible approach today is to cut the sulphur content in bunkers. Wallenius Wilhelmsen Lines (WWL) has accordingly set a target of reaching an average sulphur content of less than 1.5 per cent for its fleet as a whole in 2004.

But low-sulphur heavy oil is still not a standard product for bunkers, and this presents a number of special challenges in both technical and commercial terms.

One is that low-sulphur bunkers often requires special lubricating oil. This calls in turn for careful planning of bunkers purchases through a close collaboration between the operations and technical departments and WW's wholly-owned bunkers broker, Wilhelmsen Bunkers.

It can also mean that two types of cylinder oil are needed in order to cover the possibility that the sulphur content in the bunkers varies from one consignment to the next.

To ensure access to products with a low sulphur content and satisfactory quality, WWL has concluded delivery agreements in the most important European and Asian ports.

At each bunkering, samples are taken of the product in accordance with a carefully planned routine. Drip sampling means that oil is allowed to drip continuously into sample flasks at the point where the hose from land or barge is flanged to the ship's piping system.

These oil sample flasks are then sent for analysis at a laboratory before the vessel begins to use the bunkers. This service is offered by the classification societies through subsidiaries, and provides the exact composition of the oil and other characteristic properties within a few days. Any treatment which might be necessary or desirable on board before using the consignment is also specified.

In the worst case, this analysis could establish that the oil must be returned to land and cannot be used as it stands. It is then important that bunkers has not been mixed with the existing fuel in the tanks, or that the vessel does not risk running out of fuel before it can re-bunker.

Engine exhaust fumes also contain other harmful substances, such as nitrogen oxides, carbon oxides and particulate matter. Work is under way to remove these substances. Carbon dioxide is a natural product of all combustion, and perhaps the most difficult to eliminate. The challenge here lies in achieving the lowest possible specific fuel consumption – in other words, optimum engine efficiency.

The actual bunkering process can present a pollution hazard in the form of oil spills and the like. Overbunkering, when oil escapes through the air vents as the tanks suddenly fill to the brim, has been the dread of many chief engineers. Good communication with the personnel running the pumps on land or in the barge is necessary, and full attention is devoted to checking the level in the ship's own bunkers tanks.

But errors can nevertheless be made, so procedures have been developed to avoid human error and to limit the damage should an accident nevertheless occur.

Possible spills on deck from overbunkering must be pumped into empty tanks before the oil can run into the sea. Manual equipment for stopping and collecting spilt oil accordingly has to be in place before bunkering begins.

Burning samples to calculate the content of ash and various metals in the fuel oil.

DEFINITIONS

Bunkers: Collective term for fuel oil used on ships. Its origin is uncertain, but may be Scottish, and a bunker originally meant a chest or box. A bunker was accordingly a storage space on vessels for sails and later for coal. The word "bunk", meaning a box-like bed, probably derives from bunker.

Heavy oil: A collective term for the residue from oil refining. It comprises a blend of substances left over from processing and necessary components which make it useful 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 ecosystems. 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.
Dewatering unit	A system which can remove water from a mix of water and oil.
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 9000	ISO standard for quality assurance.
ISO 14000	ISO standard for environment protection.
Low NO_x nozzles	Fuel valves specially developed to reduce formation of nitrogen oxides (NO_x) from combustion.
Marpol	IMO convention on the prevention of marine pollution.
Mark (Mk) I-IV	In-house WW designation for various series of ship, categorised by age.
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 (ppm = 0.000001).
SIP	Swirl injection principle. System for cylinder 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.
Volatile organic compounds (VOC)	Vapour given off from cargoes such as crude oil and refined products, and which escapes to the air during loading/ discharging and on the voyage.

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Oscar Rabino, MV Trinidad. Painting the deck.