

# Mind the Gap

Documentation of the seminar Mind the Gap at Svenska Mässan Conference Center, Gothenburg, 3 May 2006. Moderator was the excellent Jakob Lagercrantz, Equest and documentalist Lennart Mossberg, LM Bild och Bokstav AB. Photo of Per Holmström by Lennart Fogelberg.





## *A Swedish Strategy to Protect the Marine Environment*

*Lena Sommestad, Swedish Minister of Environment*

– This conference, Mind the Gap, will deal with questions of great importance for the marine environment in the North Sea and the Baltic Sea. It's clear that the marine environment has deteriorated for a long period of time due to lack of implementation of the best available environmental solutions in the shipping and fishery industries.

Lena Sommestad was in Gothenburg also to attend the sixth North Sea Conference, held 4-5 May, at which representatives for governments for all countries around the North Sea were to discuss the marine environment.

– If nothing is done, the emissions from ships, for example NO<sub>x</sub> and SO<sub>x</sub>, will become one of our major environmental problems. While emissions from land based transport are on its way down, they are increasing from shipping. The North Sea Conference will address these problems and take measures. The marine environment is an international concern and therefore international regulations are needed.

– There are a lot of techniques and concepts available. “The Clean Ship” concept sets out a way to move forward and the Swedish government is committed to argue for this.

In the harbours many ships use diesel or oil to run their auxiliary engines which causes harmful emissions. Lena Sommestad made clear that the Swedish government will propose a tax exemption for shore-side electricity and hopefully the other countries around the North Sea will agree to implement this measure.



## *From Ideas to Results*

*Kristina Jonäng, Chairman of the Environmental Committee, Region Västra Götaland*

Kristina Jonäng greeted the seminar participants welcome to Region Västra Götaland.

– Region Västra Götaland is since 1999 responsible for issues concerning sustainable development in the region. As a part of this we finance projects like the Grön Kemi (Green Chemistry) and Mind the Gap which are important to address environmental problems.

– To reduce the gap between available solutions and the present ones, we need to improve the quality of the marine fuels, improve the cleaning measures, reduce air pollution in harbours and, in the long run, find alternative renewable fuels. All this calls for international agreements and regulations and we will be very active in advocating such measures and financing projects aimed to achieve this.

After her speech, moderator Jakob Lagercrantz asked: “When do you think we will have a non-fossil fuel available for ships?” “In five years and in this region”, was Kristina Jonängs optimistic answer.



## *Examples from the Port of Gothenburg*

*Ulf Duus, project Grön Kemi (Green Chemistry)*

There are already lots of environmentally adapted solutions for ships implemented in several ships regularly calling the port of Gothenburg. That's what toxicologist Ulf Duus found out when he, together with Jan Ahlbom in the Green Chemistry project, examined five good examples. The examples are presented in a printed matter available at the seminar, fresh from the press.

– In fact I was astonished that so many good things were implemented going far beyond the regulated standards. It was also encouraging to find out that the gap we're talking about here can be reduced very much simply by applying existing technologies, Ulf Duus stated.

Among the good examples, Ulf Duus mentioned:

- Two techniques for NO<sub>x</sub> emission abatement.
- Use of low sulphur fuels.
- Active bilge water treatment.
- Implementation of biodegradable, non-toxic stern tube oils.
- Environmentally adapted cleaning agents.
- New methods for boiler water treatment.
- Use of shore-side electricity to reduce air pollution and noise in the harbours.
- Energy saving measures.

Regarding anti-fouling coatings Ulf Duus concluded that there are some interesting ideas, but more research is needed.



## *Controlling emissions in a combustion engine*

*Thomas Stenhede, Wärtsilä*

As an introduction to his speech on controlling emissions in combustion engines, Thomas Stenhede from Wärtsilä, made clear what kind of emissions we are dealing with:

NO<sub>x</sub> – causing acidification, ozone/smog formation in the lower atmosphere and damage on vegetation and human health.

CO – detrimental to health.

CO<sub>2</sub> – contribution to the greenhouse effect.

Total hydrocarbons/VOC – contribution to the greenhouse effect and ozone/smog formation in the lower atmosphere.

SO<sub>x</sub> – acidification and causing erosion and corrosion.

Particulates – detrimental to lungs.

In general terms the NO<sub>x</sub> emissions are addressed with engine modifications, water treatment (WetPac) and after treatment with selective catalytic reduction system (SCR). CO emissions can be reduced with oxidation catalysts, VOC with improved combustion and also oxidation catalysts. The emissions of particulates, sulphur and CO<sub>2</sub> are related to the choice of fuel and the amount of fuel consumed in the combustion process.

As the NO<sub>x</sub> emissions are concerned, there are new tougher emissions limits proposed from 2007 by EPA and EU. If all three measures mentioned above to reduce NO<sub>x</sub> emissions are in effect, these new demands will easily be fulfilled. Wärtsilä is working with two different ways of controlling NO<sub>x</sub> emissions, the “dry technology” and the “wet technology”. The dry technology includes miller timing, retarded start of injection, common rail and exhaust gas recirculation. The wet technology consists of fuel/water emulsions, humidification of combustion air (WetPac) and direct water injection (DWI).

Low sulphur oil reduces the emissions of particulates (PM) and, of course, SO<sub>x</sub>. The PM emissions can be reduced furthermore if common rail injection is used instead of a conventional injection system.

As the CO<sub>2</sub> emissions are concerned, the choice of fuel is very important. Gas driven DF engines give the lowest CO<sub>2</sub> emissions of the engines in present use.

Thomas Stenhede was rather optimistic about the future, he meant that emissions can be reduced more and more when research makes progress and when best available solutions become implemented in the shipping industry.



## *Selective Catalytic Reduction*

*Per Holmström, Munters*

The NO<sub>x</sub> and VOC emissions from marine diesel engines have historically been very large compared to land based means of transport and industries. However, Per Holmström from Munters, presented a selective catalytic reduction system (SCR) which very dramatically reduces these emissions.

First of all he made a revealing comparison between NO<sub>x</sub> emissions from a paper mill and a paper carrier at sea without SCR. The emissions from the paper mill was 3,5 kg NO<sub>x</sub>/ton fuel while the paper carrier let out 100 (!) kg NO<sub>x</sub>/ton fuel.

But here comes the good news: When the paper carrier in 2004 was equipped with SCR the NO<sub>x</sub> emissions dropped to 5 kg NO<sub>x</sub>/ton fuel!

The NO<sub>x</sub> emission can be reduced up to 99% with the SCR-technique and the VOC (volatile organic compounds) can be reduced 70-90%. Munters have installed more than 200 marine SCR-systems since the first one in 1992. The system meets the NO<sub>x</sub> regulations enforced in Sweden in 1998 and 2004. Some more milestones:

In 1996: First installation for operation on marine HFO.

In 1999: First installations for large bore slow speed engines. As an option, an oxidation catalyst can be installed, which further oxidises VOC and CO to CO<sub>2</sub>. This will result in a 50-90% reduction of CO emissions and also eliminate the typical diesel odour from the exhaust gases.

The total cost for this technique is 268 Euros annually for each tonne reduced NO<sub>x</sub> emissions for ferries and 255 Euros for cargo vessels. The example uses a ten years write off period.



## *Bilge water treatment*

*Benny Carlson, MarinFloc*

The bilge water on ships is a mixture of oils, cleaning agents and other chemical substances, which is complicated to separate into oil and water in traditional gravimetric bilge water separators. To solve this problem, Marinfloc has developed a system based on adding a flocculating agent for emulsion breaking and oil separation. The system also includes activated carbon and sand filtering. Testing has shown that, once the Marinfloc system is implemented, the oil levels in the bilge water has dropped dramatically, far below 15 ppm.

Benny Carlson from Marinfloc pointed out some of the reasons why many ships have a bilge water treatment that is not in line with today's best available technique. Important factors are company policies and regulations, old-fashioned tank layouts and piping arrangements, structures and in-sufficient education for the staff. The use of new chemicals has also grown for a number of years, causing greater problems dealing with the waste water from engine rooms.

Several hundred of ships of various types and sizes have installed Marinfloc solutions with good results.



## *Stern tube bio-oils*

*Chris Wholley, Vickers Oil*

Leakage of stern tube oil can be very harmful for the marine environment. Chris Wholley from the company Vickers Oil, mentioned four causes of seal leakage: debris, vibration, misalignment and pressure differences.

Seal leakage can cause a number of problems for the environment in the first place, but also for the equipment such as salt water corrosion and poor bearing lubrication. If toxic oil causes environmental damage it can also lead to port bans, impounding, heavy fines and bad operator image.

Chris Wholley mentioned some national and international standards relevant for this issue and among them the Gothenburg Harbour “Clean Ship” approach. According to this only environmentally adapted oil may be used in the stern tube. The base oil shall rapidly degrade in the environment, the additives must not have high toxicity and they are not persistent nor are they bio accumulating.

The biodegradability is a key criterion. Chris Wholley showed that the bio oils from Vickers oils meet this demand. The lubricant is in the marine environment exposed to micro-organisms, oxygen, water and nutrients. Together they transform the lubricant into carbon dioxide, water and biomass. In ten days 60% of the Hydrox Bio 68 is biodegraded and the ultimate biodegradability, 92.5%, is reached within 30 days.

The second criterion is acute aquatic toxicity. Hydrox Bio 68 has shown to be non-toxic regarding different kinds of species such as fish (vertebrates), crustacean (invertebrates) and algae (plants).

Finally, as the bioaccumulation potential is concerned, the product showed low potential for bioaccumulation.

The Hydrox Bio oils have been in the market since 2003 and are supplied to more than 165 vessels so far.



## *R&D for future environmental solutions* *Håkan Friberg, Swedish Ship-owners' Association (SSA)*

Håkan Friberg declared that the shipping industry has a positive development trend all over the world at present. Transport by sea is growing, driven by globalisation and increased world-wide trading. But this also calls for increased responsibility for the environmental impact of the business.

Håkan Friberg said that ship-owners are investing very heavily in new modern ships with better environmental standards. The investments in R&D in order to reduce environmental impact are also growing rapidly.

The three key areas for this research are:

Decrease fuel consumption

Further development of cleaning techniques

Decrease risk for accidents and accidental

– But we will also need financial and social incentives for environmental investments. It is important that skills from different sectors, such as shipping, economy, logistics and technique, cooperate to achieve this, Håkan Friberg declared, and mentioned especially the Lighthouse Project, a cooperation between SSA, Chalmers University of Technology and School of Business, Economics and Law in Gothenburg.

– A key future challenge for the shipping industry is to attract young people to the shipping sector and to do this we need awareness and determination in our environmental work, Håkan Friberg concluded.



## *Port support for sustainable solutions*

*Åsa Wilske, Port of Gothenburg*

International trade and shipping has always been very important for Gothenburg, situated as it is at the Swedish west coast. Åsa Wilske, responsible for environmental issues at the Port of Gothenburg, showed the audience a map which made clear what an important hub for shipping the port is.

– And we are determined to be known as “the green hub” of transport in northern Europe, because our targets concerning environmental issues are very high, she stated.

The port of Gothenburg has taken some measures to improve the environmental performance. One important measure is offer shore-side electricity to ships at berth, which reduces air pollution and noise in the harbour. There are already three quays that can offer this and there will be more when new investments in facilities are done.

But the shipping companies must demand this, so far only a few companies are using the possibility for shore-side electricity. Åsa Wilske was very pleased to here that the Swedish minister for environment, Lena Sommestad, will propose at tax exemption for shore-side electricity, which might create incentives for the development.

Another measure in the Gothenburg harbour is the investment in a gas recovery plant. It has a high degree of cleaning which has made it possible to reduce emissions from ships loading from approximately 450 tonnes to 25 tonnes a year.

The port of Gothenburg has implemented a differentiated fee system comprising NO<sub>x</sub>-rebates and SO<sub>x</sub>-fees in order to stimulate the development towards more environmentally adapted solutions in the shipping industry.

The port of Gothenburg takes active part in environmental cooperation networks, with companies, other authorities, NGOs and so forth.

– Because there are still very much to be done to “reduce the gap”. For instance, when will we have the first non-fossil fuel in ships? Perhaps someone can answer to that question here today.

## *European Climate Exchange*

*Neil Eckert, Chairman*

European Climate Exchange (ECX) is a pan-European platform for carbon emission trading with standard contracts and clearing guarantees provided by LCH.Clearnet. It's a wholly owned subsidiary to The Chicago Climate Exchange (CCX) that administers the world's first multi-national and multi-sector marketplace for trading (and thereby reducing) greenhouse gas emissions.

More than 60 leading businesses, including global companies such as ABN AMRO, Barclays, BP, Calyon, E.ON UK, Fortis, Morgan Stanley and Shell have signed up to trade ECX products. In his introduction, the ECX chairman Neil Eckert informed the audience that 85% of the European CO<sub>2</sub> emission trade volumes were traded by the ECX.

Some important milestones in the development of this trade are:

1992: In UN Framework Convention of Climate Change industrialised countries called upon to reduce greenhouse gas (GHG) emissions.

1997: The Kyoto Protocol called for a 5% reduction (relative to 1990 baseline) in net GHG emissions by industrialised countries by 2012. Some in this respect very important countries, among them United States, did not ratify The Kyoto Protocol but the Bush administration called for a voluntary approach to reduce GHG emissions.

Late 2004: Russia agreed to become a participant in the Kyoto Protocol, thereby achieving the required global commitment to ensure ratification.

The idea to trade with emission licenses is in fact a brilliant one, according to Neil Eckert's opinion.

– It works, the emissions in total are reduced and as an individual emitter you are rewarded for doing the right thing, he said.



The trade with emissions works like this: An overall emission reduction target is set for a group of emitters. Individual emitters can choose to reduce their emissions and sell the emission licenses not used to others. Thereby they can get paid for reducing their emissions.

Neil Eckert presented some figures from USA showing that the trade method has produced good results. The annual ambient sulphur dioxide (SO<sub>2</sub>) concentrations in rural eastern United States dropped dramatically between 1990 and 2000.

Since 2000, the traded volumes of SO<sub>2</sub> emissions allowances have dropped each year in United States. According to the laws of demand-and-supply this has led to a dramatic increase in prices for emission allowances. In other words, it's becoming more expensive to "buy yourself free" from your emission problems.

Neil Eckert pointed out that ECX is the best host for the exchange of emission allowances and it can help companies to monetise reductions.

He concluded that voluntary exchange is better than law regulations to achieve emission reductions.

– A voluntary system needs buyers and sellers. Financial markets will invest in credits up to the "marginal cost of abatement". At this price all industries invest in technology that can achieve substantial reductions in SO<sub>x</sub> and NO<sub>x</sub>.



*Emission trading will make it happen*  
*Bertil Arvidsson, Swedish Shipowners' Association*

Bertil Arvidsson presented a proposal from the Swedish Shipowners' Association on how to reduce NO<sub>x</sub> and SO<sub>2</sub> emissions by implementing emissions trading schemes for both land based industry and shipping in Europe.

The trend is that shipping will increase its transport volumes very much which may lead to a situation where the SO<sub>2</sub> and NO<sub>x</sub> emissions from ships will surpass the ones from land based industry in 2020. This will happen if no incentives and no reductions for waterborne transport are implemented. But there are ways to prevent this from happen, Bertil Arvidsson, pointed out. With current available technique, a 95% NO<sub>x</sub> emission reduction can be achieved by using SCR Converter systems.

With this background Swedish Ship-owners' Association (SSA), proposes a scheme with the scope to create emission reductions to the lowest economic cost for society as a whole and at the same time introduce financial incentives for the shipping sector to reduce emissions. The proposal is to let ships participate in emission trading schemes together with land based emitters.

The benefits would, according to Bertil Arvidsson, be that it creates fast emission reductions in a cost-effective way and great opportunities for enhanced competitiveness for ship-owners in Europe, because the scheme wouldn't increase cost-burden of waterborne transports.



*Implementing the Clean Ship Approach:  
Closing the gap between what is possible  
and what is required by law*

*Eelco Leemans, Seas at Risk*

Eelco Leemans talked as a representative for Seas at Risk, an independent non-governmental federation concerned with the protection and restoration of the marine environment. The federation consists of organisations from Belgium, Denmark, Germany, Ireland, The Netherlands, Norway, Portugal, Sweden and the United Kingdom. Seas at Risk has been involved in the North Sea Conference since 1984 and is involved in the work with EMS/EU maritime policy.

The overall objective for Seas at Risk (SAR) is to implement the clean ship approach, which is to eliminate harmful discharges and emissions from vessels. To achieve this, Eelco Leemans stressed, you need stricter regulations, but also economic incentives, improved education and the development of new technologies.

Eelco Leemans presented an overview of the North Sea Conference process.

One important milestone was the Esbjerg Declaration in 2001, at which ministers recognised that the existing regulatory standards were difficult to enforce. They agreed to pursue further research aimed at the complete elimination of intentional pollution of the marine environment by oil and other harmful substances. The ministers also agreed to study the possibilities of a zero discharge regime, improved enforcements in ports, mandatory disposal of wastes in the case of excessive waste stocks and the financing of such disposal.

The next milestone was the Bergen Declaration in 2002, where ministers agreed “to explore and develop the concept of vessels designed, constructed and operated in an integrated manner to eliminate harmful discharges and emissions throughout their working life (the Clean Ship Approach).

Next, Eelco Leemans presented an overview of the current shipping regulations, regarding marine litter, air pollution, oil pollution and tanker safety.

As marine litter is concerned, the Annex V of Marpol 73/78 prohibits the dumping of litter in the North Sea, but nevertheless 20,000 tonnes of marine litter are dumped by shipping annually. The ships have in fact economic incentives to dump their waste at sea to avoid fees in the EU ports.

The average sulphur content of ship's bunker oil is 2.7%. The sulphur content leads to air and marine pollution. Eelco Leemans put the question whether it would be possible to enforce a 1.5% sulphur limit.

As oil pollution is concerned, the levels of fines for discharges are so low that it is considered a "calculated risk". (This doesn't apply to the US.)

Tanker safety calls for a phase-out of all single hull tankers, but the implementation of double-hull tankers must be followed up by enhanced maintenance and control.

Another big problem is that it takes so long for international legal instruments to be ratified by all countries and enforced. It took 30 years for Annex IV of MARPOL 73/78 to enter into force.

Eelco Leemans pointed out some necessary measures to implement the clean ship approach:

- Regulators must close the gap between regulatory standards and existing best available technologies and practices.
- The regulations must be target driven (i.e. 1.5% global SOx cap), simple to understand and simple to enforce.
- Economic incentives and financing innovation can be a powerful force for change.
- Seafarer training and awareness building must increase.

Eelco Leemans expressed a hope that the ministerial meeting in Gothenburg would include a clear strategy for implementation.

– Seas at Risk calls on the NSC ministers to conduct a study to identify the gaps between best available technology and current regulatory standards and follow up this study with proposals for the tightening of regulations to take full advantage of best available solutions, Eelco Leemans concluded.

