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MariEMS Learning Material

This is the 34th compilation by Professor Dr Reza Ziarati on the work of the EU funded Erasmus + MariEMS' partners and material extracted from the IMO TTT Course. The material is composed from Chapter 34 of the learning material. Readers are also advised to refer to the papers on IdeaPort and IdealShip projects led by C4FF and published by MariFuture.

34. Green Port Initiatives and Port Environmental Programmes

34.1 Introduction

Apart from Onshore Power Supply (OPS) that could lead to improved air quality in port areas and likely reduction of GHG emissions, various ports are promoting green initiatives that aim to reduce air emissions from ships. Green port initiatives are in place in particular in USA, Europe and to some extent Asia. In the majority of cases, reduction of air pollution and improving the port area air quality are at the core of the green port initiatives.

Green port initiatives could take many forms and shapes, but the main purpose as indicated to reduce port-area emissions. Example activities could be reduced port dues for clean ships, investment in port infrastructure to improve port operations, providing OPS facilities, reducing or exemption from taxation for clean ships, etc.

In this section, a number of port related green activities that relate to air emissions are presented and discussed.

34.2 Port Related VOC Management

Volatile Organic Compounds (VOCs) are the lighter parts of crude oil, or their products. They normally vaporise during the ship loading process in the loading tanks. This is then normally vented to the atmosphere causing air pollution in port areas.

IMO MARPOL Annex VI regulations allow the Flag state to designate ports that intend to control and reduce VOC from tankers. This is embodied in Annex VI Regulation 15 on VOC. The regulation enables ports and terminals to implement VOC controls.

For compliance purposes, these ports should be able to receive such gases and collect and safely dispose of them. Tankers that visit such ports should also have a Vapour Emissions Control System (VECS) to be compliant with IMO MSC/Circ. 585 on Standards for VECS system. Figure 34.2.1 shows a schematic of such a ship-board VECS. Further information on technical information on systems and operation to assist development of VOC management plans can be found in the relevant IMO MEPC Circular (MEPC.1/Circ.680, 27 July 2009).

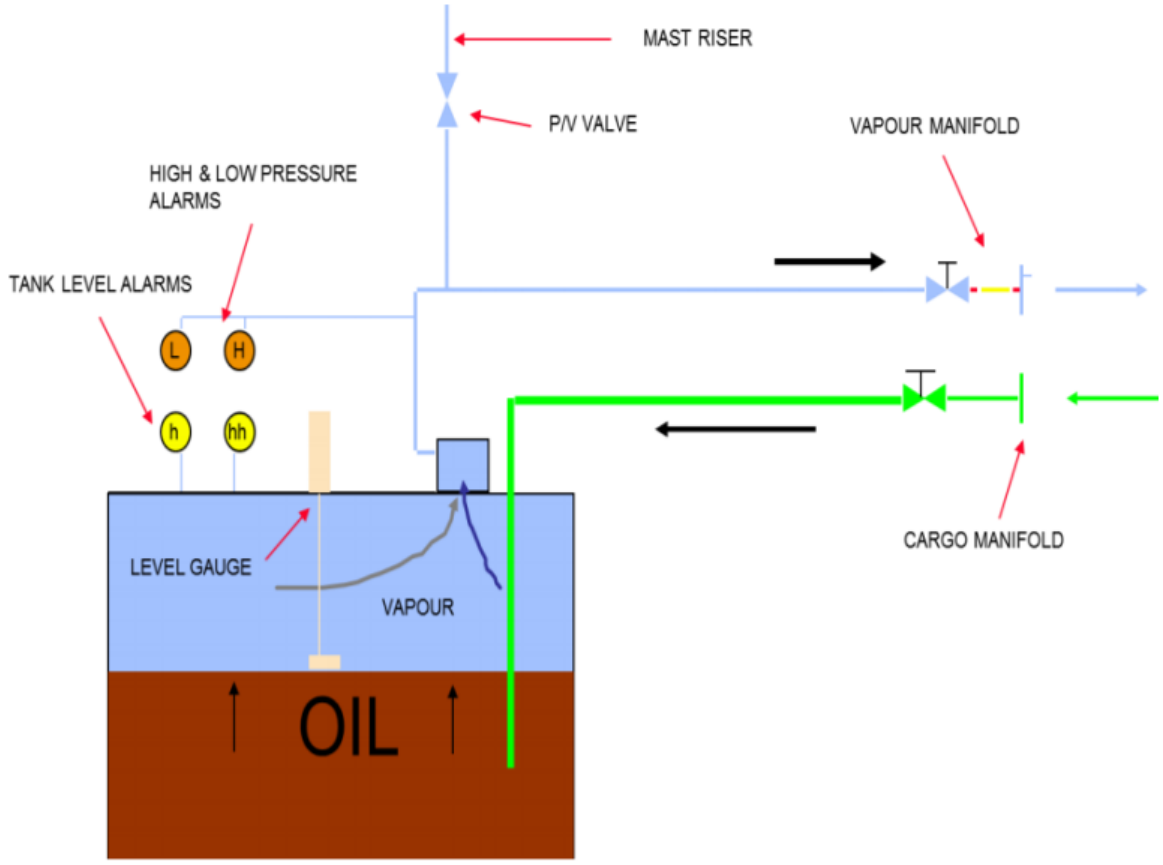

Figure 34.2.1 – Schematic of an oil tanker's VOC emissions control system

Additionally, crude oil tankers are required to have an approved VOC manual. This should contain procedures for minimizing VOC emissions during loading, sea passage and discharge and additional VOC during washing. Currently, a number of ports have been assigned as VOC control ports; see the list below (Table 34.2.1).

DESIGNATED PORTS AT WHICH VOC EMISSIONS ARE REGULATED

NAME OF PORTS, TERMINAL/FACILITY		SIZE OF TANKERS	CARGOES REQUIRING VAPOUR EMISSION CONTROL SYSTEMS	EFFECTIVE DATE
The Netherlands				
Amsterdam	All terminals	All sizes	Cargoes with VOC, with the exception of methane, with a vapour pressure of 1 kPa (10 mbar) or more at a temperature of 293.15 K (20°C) or such cargoes with an equal volatility of 10 mbar	9 November 2011
Rotterdam	Botlek Tank Terminal, Rubis, ETT, Argos	All sizes	Cargoes with VOC, with a vapour pressure of 1 kPa (10 mbar) or more at a temperature of 293.15 K (20°C). For Rubis only, substances under class LT2 are to be controlled	9 November 2011
Moerdijk	Afval Stoffen Terminal Moerdijk ATM, Shell Chemie Moerdijk, Den Hartoch Moerdijk bv	All sizes	Cargoes with VOC, smelling products and ADR Class 3 and 6	9 November 2011
Terneuzen	Dow Benelux BV Terneuzen, Oiltanking Terneuzen BV.	100,000 GT and less	Cargoes with VOC	9 November 2011
Groningen	VOPAK	All sizes	Cargoes with VOC, with the exception of methane, with a vapour pressure of 1 kPa (10 mbar) or more at a temperature of 293.15 K (20°C) or such cargoes with an equal volatility of 10 mbar	1 July 2012
Vlissingen	Zeeland refinery	9,000 GT and above	Cargoes with VOC	9 November 2011
The Republic of Korea				
Busan Incheon Pyeongtaek/Dangjin Ulsan Yeosu Kwangyang		400 GT and above	Crude oil Gasoline Naphtha	20 May 2009
Daesan		400 GT and above	Crude oil Gasoline Naphtha	20 May 2015

Table 34.2.1 – Designated ports with VOC emissions control

34.3 Differentiated Port Dues

If ports/terminals give ship owners and operators of relatively clean ships a port due advantage, they give a direct incentive for reducing ship port emissions. Thus port dues advantages for relatively clean ships can be put into practice by two options:

- Reducing port dues for relative clean ships while keeping port dues for the other ships unchanged and thus reducing a port's income.
- To apply the 'polluter pays principle', raising the port dues for those ships that have relatively high port emissions.

In the first case, where discounts are given, the funding of the incentive scheme could turn out to be a problem for a port. In the second case, where port dues are raised based on ship emission level, the port runs the risk of losing business to competing ports, which have not introduced such a penalty-based scheme. Another potential barrier in this context is the presence of privately owned quays in the port area that may hamper the introduction of the polluter pays principle, as this also may affect the level playing field within the port [MEPC 68 INF.16].

Some of the existing ports provide incentives for efficient and clean shipping via reduced port dues based on their regulated emissions levels. Examples are the Swedish ports that currently provide differentiated port dues based on environmental criteria. About 20-25 of the bigger ports in Sweden have differentiated port dues on the basis of the sulphur content of the fuel used and the NOx emissions from the engines on-board. For example, in Gothenburg, Sweden the port dues used to increase if the sulphur content of the fuel exceeded 0.2% (currently, the regulatory limits for Swedish ports are 0.1% due to the IMO Emissions Control Area regulations, thus the above is irrelevant).

For ships with a NOx emission level lower than 10 g/kWh, a discount is applied that increases progressively as shown in below Table 34.3.1.

Emission level in grams of NOx/kWh	Reduction in SEK per unit of the ship's gross tonnage (GT)
6.0–9.9	0.05 SEK/GT
2.0–5.9	0.10 SEK/GT
0–1.9	0.20 SEK/GT

Table 34.3.1 – NOx reduction incentives in port of Gothenburg

34.4 Differentiated Ship Registration Fees

The EEDI (Energy Efficiency Design Index) is part of the energy efficiency regulations under MARPOL Annex VI that aims to improve shipping CO_2 emissions via enforcing future targets for ship designs that will provide major reductions to EEDI. Some administrations have taken, or are evaluating, to use this index for differentiated registration fee or tonnage taxation. An example of such an initiative

is the one by Singapore MPA (Maritime Port Authority) in 2011 that was undertaken under the Singapore Green Ship Programme.

The Green Ship Programme targets Singapore-flagged ships. The MPA provides incentives to ship owners who adopt energy efficient ship designs that will reduce fuel consumption and carbon dioxide emissions. Accordingly, Singapore-flagged ships registered on or after 1 July 2011, which go beyond the requirements of the International Maritime Organization's EEDI, will enjoy a 50% reduction on the Initial Registration Fees under both the normal registration and the Block Transfer Scheme during the registration of the ship. They will also enjoy a 20% rebate on Annual Tonnage Tax payable every year for a number of years based on a scheme that uses EEDI.

Existing ships which utilise energy efficient ship designs that meet the requirements for the Green Ship Programme can also take part in this programme, but will only enjoy the 20% rebate on Annual Tonnage Tax payable every year until the ship ceases to exceed the requirements of IMO EEDI reference lines.

34.5 Environmental Ship Index (ESI)

A large number of the world's key ports have committed themselves to reducing the port-related GHG. This commitment is called the World Port Climate Initiative (WPCI). One aspect of this initiative is to give incentives to ships that visit such ports as a way of reducing port-related emissions.

One of the projects within WPCI is the development of an Environmental Ship Index (ESI). The ESI identifies seagoing ships that perform better in reducing air emissions than the levels required by the IMO MARPOL Annex VI. The ESI evaluates the amount of nitrogen oxide (NOx), sulphur oxide (SOx) that is released by a ship and includes a reporting scheme on the GHG emission of the ship.

The ESI aims to identify cleaner ships in a general way. The index is intended to be used by ports to reward ships when they participate in the scheme for promoting clean shipping. Also, WPCI encourages the shippers and ship owners to use the index as their own promotional instrument. ESI is a voluntary scheme designed to improve the environmental performance of sea going vessels. It can be applied to all types of seagoing ships. It is easy to calculate and simple in its approach.

ESI relies on various formulas for the calculation of various parts for NOx, SOx and CO_2. It additionally awards a bonus for the presence of OPS. The ESI Score ranges from 0 for a ship that meets the IMO environmental regulations that is already in force and 100 for a ship that emits no SOx and no NOx and reports or monitors its energy efficiency. In other words, a ship with a score of 0 point is actually in full compliance with the applicable regulations while a ship with 100 points has zero air emissions. In reality, the best performing ships currently score at around 40 points.

For further information on ESI and current ship ranking, refer to Environmental Ship Index website. For the ESI calculation formula, refer to ES web site.

34.6 Norway NOx Tax and NOx Fund

This is a NOx tax applicable mainly to national industries including shipping. The NOx tax is collected from participating industries and is fed into a NOx fund. The participating companies could include oil and gas producers, fishing and offshore supply vessels, ferries, airlines, cargo, railways, land based industry, etc. The NOx fund then provides financial incentives for those participating organisations that want to implement NOx reduction measures including shipping industry.

This incentive system in Norway is only applicable to domestic shipping around Norway. It is an example of an effective local program that tries to create a finical scheme and business case for NOx

reduction from shipping. These funds are generated by gathering revenue from companies that emit NOx emissions by making them subject to a NOx tax. On the basis of the scheme, a large number of ships have so far been equipped with NOx reduction technologies.

As for shipping, this started from 1st January 2007 and tax level is 1.9 €per kg NOx. It is applicable to propulsions engines exceeding 750 kW. This fund has so far widely funded major Norwegian initiatives such as the move to LNG as fuel for ships operating in Norwegian water.

34.7 General Discussion

IMO commissioned a study on ship-port interface in 2014 [MEPC 68/INF.16] that is widely looking at many aspects of ship-port interface including the green initiatives. Based on this study a survey of stakeholder was conducted. These stakeholders included representatives from port authorities and terminals, ship owners and operators, equipment manufacturers as well as governmental and regulatory authorities. This section mainly taken from this study discussed some the issues raised.

All stakeholders indicated that air pollution is a major environmental challenge. On international or regional regulations, these have specific and high impacts on ship owners and operators but not necessarily ports. When it comes to port-ship interface green initiatives, the lack of a sound business case was widely reported by the stakeholders as the largest barrier to the implementation of various initiatives. This lack of business case issue is closely related to the reason that regulation is reported in the survey as the most effective driver.

On the other hand, voluntary and financial instruments leave room for individual decisions and evaluations regarding the use of advanced technologies or other measures, but also require a business case to be driven by factors beyond direct return on investment.

The availability of energy infrastructure, for example with LNG bunkering or connection to OPS, was also reported as a barrier, and is closely connected to the problem of having an insufficient business case. Subsidies may be needed to address this barrier, followed by fine-tuned regulation that considers local circumstances and cost effectiveness of the measures on the basis of clear criteria.

In addition to regulations, it is cited that the number of voluntary and financial incentive schemes has grown significantly in recent years. Various schemes have been implemented in Asian ports (Hong Kong, Shenzhen, Singapore), providing discounted port dues to visiting ships using low sulphur fuel. The ESI as explained is the most widely implemented and is still growing from its current participation involving over 3,000 ships and 24 ports. However, compared to the overall number of cargo ships in operation worldwide, the share of ships joining such voluntary schemes is estimated to be around 5%. As a consequence, the effectiveness of voluntary schemes is limited on the worldwide level. It can however be effective at smaller scale, such as the port level, where a smaller portion of the overall fleet can be targeted and incentives can be tailored in a way that incrementally enhances (without entirely satisfying) the business case for adoption of measures.

Maintaining a level playing field among ports when implementing financial incentives schemes or regulations is a challenge. Partnering with other regional stakeholders by harmonizing the requirements for ships may increase the effectiveness of instruments, while the regional level playing field is maintained. There are ship owners implementing voluntary measures and participating in voluntary and incentive-based programs set up mainly by port authorities.

34.8 References and further reading

The following list provides references for this section and additional publications that may be used for more in-depth study of topics covered in this section:

1. "IMO train the trainer course material", developed by WMU, 2013.
2. IMO, MEPC 61/INF.12, full report of the work undertaken by the Expert Group on Feasibility Study and Impact Assessment of possible Market-based Measures, 13 August 2010
3. For further information on OPS refer to: http://wpci.iaphworldports.org/onshore-powersupply/environment-and-health/climate.html, cited August 2015.
4. Green Ship Programme in Singapore http://www.mpa.gov.sg/sites/maritime_singapore/msgi/green-shipping-programme.page, cited August 2015.
5. Lean Shipping Technology website, http://cleantech.cnss.no/policies-andinstruments/voluntary-instruments/clean-shipping-index/, cited August 2015.
6. "Environmental Ship Index", http://esi.wpci.nl/Public/Home, cited August 2015.
7. MEPC.1/Circ.774 on "Information on designated ports at which VOC emissions are regulated", IMO, 21 December 2011.