

**For discussion on  
21 December 2011**

**LEGISLATIVE COUNCIL  
PANEL ON ENVIRONMENTAL AFFAIRS**

**Controlling Emissions from Vessels**

**PURPOSE**

This paper seeks Members' views on a proposal to control emissions from vessels for further improvement to air quality.

**BACKGROUND**

2. Since 1990, we have taken proactive actions to reduce land-based emissions, which have a more direct impact on the general public. As a result of these efforts, the land-based emissions of sulphur dioxide (SO<sub>2</sub>), respirable suspended particulates (RSP) and nitrogen oxides (NO<sub>x</sub>) were reduced by about 61%, 64% and 52% respectively during 1990 to 2008. In the same period, these emissions from vessels increased by 54%, 41% and 4% respectively, with the maritime activities as reflected by vessel arrival numbers increased by 57% to 76%, depending on specific marine trades<sup>1</sup>. Vessels have become one of the major local air pollution sources, being the largest source of RSP, and the second largest SO<sub>2</sub> and NO<sub>x</sub> emitter after power plants.

3. These pollutants could cause a variety of health impacts, including damage to respiratory and lung functions, aggravation of existing respiratory and heart diseases and increased risk of developing chronic respiratory diseases. The emissions also contribute to visibility impairment, which is a major environmental problem overcasting Hong Kong and the Pearl River Delta (PRD) region. Moreover, the impacts of their emissions are particularly discernible at locations near the Kwai Chung container terminals where ocean going vessels (OGVs) berth and in places close to their routes. To further improve air

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<sup>1</sup> Marine trades comprise international trading and businesses involving ocean-going vessels such as fully cellular container vessels, cruises/ferries, oil tankers, cargo vessels, bulk carriers; river trading and businesses with neighbouring regions such as Hong Kong-Macao Ferries, Hong Kong-Pearl River Delta Ferries, cargo vessels, lighters, barges and cargo junks; and local marine businesses such as ferry operation, harbour craft operation, fishing and yachting.

quality and protect public health, we must reduce emissions from the marine sector.

4. OGVs run on residual oil, which is a very dirty form of fuel with sulphur content as high as 4.5% or being 2.8% on average. River-trade vessels (RTVs) plying between Hong Kong and neighbouring cities and domestic vessels (DVs) are using light diesel oil which has a nominal sulphur content of 0.5%. These sulphur contents are 2,800 times and 500 times higher than the sulphur content of motor vehicle diesel (0.001%) respectively. Hence, emissions from vessels are a significant source of air pollution. In 2008, the contribution of maritime emissions to Hong Kong's total territory-wide emission was as follows –

Pollutant	Contribution of Maritime Emissions to Total Territory-wide Emissions			
	Ocean-going Vessels	River-trade Vessels	Domestic Vessels	Total
RSP	21%	4%	5%	31%
SO <sub>2</sub>	19%	3%	2%	23%
NO <sub>x</sub>	12%	6%	8%	27%

5. To further improve air quality, we need to tackle marine emissions targeting OGVs, RTVs and DVs. Given the mobility of vessels, we have to step up regional cooperation with our PRD counterparts if we are to curb marine emissions effectively. In this regards, both the "Framework Agreement on Hong Kong/Guangdong Cooperation" (《粵港合作框架協議》) and the "Regional Cooperation Plan on Building a Quality Living Area" (《共建優質生活圈專項規劃》) have set out proposals to gradually realise fuel and emission standards for vessels in PRD which are better than the national standards.

## THE PROPOSAL

6. The Chief Executive announced in his 2011 Policy Address the following initiatives to control emissions from the marine sector –

- (a) explore with the governments of Guangdong, Shenzhen and Macao the feasibility of requiring OGVs to switch to low-sulphur fuel while berthing at ports of Hong Kong and the PRD;
- (b) explore with the governments of Guangdong, Shenzhen and Macao setting up an

Emission Control Area (ECA) in PRD waters over the longer term; and

- (c) study in collaboration with the relevant trades the feasibility of improving the quality of vessel fuels sold locally to reduce emissions from vessels.

## **CONTROLLING EMISSIONS OF OCEAN-GOING VESSELS**

7. Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL Convention)<sup>2</sup> caps the sulphur content of residual oil at 4.5% for now and at 3.5% from January 2012. To reduce emission from OGVs, controlling fuel sulphur content is a common step for overseas countries. Some examples are listed at **Annex A**. We propose taking similar steps to control the sulphur content of the fuels of OGVs.

### **Controlling Emissions of OGVs at Berth**

8. The SO<sub>2</sub> emissions from berthing amount to about 40% of the total OGVs emissions in Hong Kong. Requiring OGVs to switch to cleaner fuel while at berth would help reduce substantially the air pollution from the marine sector and the air pollution impacts on the people near to the terminals.

9. The practicability of fuel switching has been well proven. For instance, since 1 January 2010, the European Union (EU) has obliged ships (including OGVs) to use fuels with sulphur content not exceeding 0.1% when at berth in its ports, unless their auxiliary engines use onshore power supply. In Hong Kong, the Hong Kong Liner Shipping Association (HKLSA) launched in January 2011 for two years the **Fair Winds Charter** (the Charter) at **Annex B** to encourage OGVs at berth here to voluntarily use low sulphur diesel with 0.5% sulphur. A total of 17 operators have signed up to the Charter.

10. To ride on the voluntary act of the shipping industry and to ensure a level playing field to all OGVs in our drive to tackle air pollution, we are exploring with the governments of Guangdong, Shenzhen and Macao on collaborating on a proposal to require OGVs to switch to low-sulphur fuel when berthing in Hong Kong and PRD waters. The regional

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<sup>2</sup> MARPOL Annex VI sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances. The Annex VI includes a global cap of 4.5% m/m on the sulphur content of fuel oil for now and will be tightened to 3.5% in 2012. It also contains provisions for Parties to MARPOL Annex VI to apply for special SO<sub>x</sub> Emission Control Areas (SECAs). In these areas, the sulphur content of fuel oil used onboard ships must not exceed 1% m/m for now and will be tightened to 0.1% by 2015.

collaboration provides a platform for Hong Kong and other PRD cities to join hands to tackle the regional air pollution problem prevailing in the common air shed that we live under, thereby maximising the environmental benefits.

### **Setting up an ECA in PRD Waters**

11. To further control emissions from OGVs, we also propose to look into the option of setting up over the longer term an ECA to require OGVs to use cleaner fuel once they enter PRD waters. The MARPOL Annex VI of the International Maritime Organisation (IMO) provides for a mechanism to set up an ECA which requires –

- (a) all vessels to use fuel containing no more than 1% sulphur by now and 0.1% sulphur from January 2015 upon entering an ECA. As an alternative, operators may choose to equip their OGVs with approved after-treatment devices to reduce sulphur oxides (SO<sub>x</sub>) emissions; and
- (b) from 2016, for ships constructed on or after 1 January 2016 operating in ECAs, their engines must meet Tier III NO<sub>x</sub> emission standard, which means a 60% reduction compared with Tier II standards (which is globally applicable to engines of ships built after 2010).

There are three ECAs now in operation in the Baltic Sea, North Sea and North America<sup>3</sup>. Another ECA in the Caribbean Sea is expected to enter into effect in January 2013<sup>4</sup>.

12. To pursue designating an ECA within the PRD waters, we must seek the agreement of the Central People's Government (CPG) to submit the proposal to IMO under the relevant provisions of MARPOL Annex VI by virtue of China's status as a Party to the Convention. It would involve in-depth studies and extensive discussions with the relevant ministries and departments in CPG and Guangdong, stakeholders as well as the IMO. Given the enormity of the task, our immediate priority therefore would be to consider the feasibility of introducing fuel switch by OGVs while berthing in PRD ports, as we continue to pursue the establishment of ECA.

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<sup>3</sup> The North America ECA entered into effect in August 2011 and will become enforceable in August 2012.

<sup>4</sup> The US Caribbean ECA covers waters off 50 nm from the territorial sea baselines from the Puerto Rico and the US Virgin Island. It is expected to enter into effect on 1 January 2013 and become enforceable in January 2014.

## CONTROLLING EMISSIONS OF LOCAL VESSELS

### Upgrading the Standard for Local Marine Fuel Supply

13. Local marine vessels, including coastal vessels, RTVs, and DVs plying between Hong Kong and Mainland ports, poses a health impact to the population in the proximity of sea-front. These vessels currently run on light diesel oil with a nominal sulphur limit of 0.5%. According to the test results of the oil companies, the sulphur content of light diesel oil delivered to Hong Kong ranged from 0.15% to 0.49% in the period from September 2009 to September 2011.

14. Lowering the sulphur content of marine diesel is a practicable and effective means for reducing not only the SO<sub>2</sub> but also RSP emissions. In addition to the use of ultra-low sulphur diesel (ULSD), which has a sulphur content not exceeding 0.005%, in all Government's vessels, we have completed a trial of powering non-kaito local ferries with ULSD. The conclusion is that the switch is technically feasible and there are in general no major changes in fuel consumption, maintenance requirement and engine power output. The fuel cost, however, increased by \$0.93 per litre (or 21%), mainly due to the additional handling costs for supplying ULSD to only a few vessels participating in the trial. The executive summary of the trial report is at **Annex C**.

15. In light of the findings of the study and having regard to the small market of Hong Kong, we consider that any upgrading of the standard of marine fuel sold in Hong Kong should be pursued to ensure no additional handling costs would be incurred from providing different types of marine fuels to different local vessels and to maximise the environmental benefits. We thus propose capping the sulphur content of marine light diesel at 0.1%.

16. During the trial on the use of ULSD by local ferries, there were concerns that the lubricity of a fuel might drop with its sulphur content. In this regard, we have collected samples of ULSD for testing. The results show that their lubricity is comparable to that of the current marine diesel and are in line with the findings of oil companies, who also check the lubricity of the fuel that they supply to vessels. Oil companies have further advised that oil refineries will follow an international standard, ISO 8217:2010 (Petroleum Products: Fuels (class F) -- Specifications of Marine Fuels), to ensure that the lubricity of their marine diesel comply with the requirements. Given the above and the fact that local vessels in many overseas countries such as those in EU are using 0.1% sulphur diesel, switching to 0.1% sulphur diesel, which has a higher sulphur content than ULSD (0.005%), should pose no technical problem to the engines of local vessels. Nonetheless, we are prepared to

conduct a small scale demonstration trial on the use of 0.1% sulphur diesel for local vessel operators to get first-hand experience of the cleaner fuel.

## **ENVIRONMENTAL BENEFITS**

17. Implementing the proposed emission control package in paragraph 6 could bring about the following emission reduction –

<b>Reduction in Total Local Emissions (Taking 2008 as Base Year)</b>		
<b>SO<sub>2</sub></b>	<b>RSP</b>	<b>NO<sub>x</sub></b>
21%	21%	1%

18. With a full-scale switch to 0.1% sulphur diesel, we anticipate that the ambient SO<sub>2</sub> concentrations, especially in the districts close to the coasts, would be greatly reduced. As SO<sub>2</sub> is the precursor for the formation of fine sulphate particles, a general reduction of the ambient respirable and fine suspended particulates levels would also be expected.

## **COST IMPLICATIONS**

19. The proposal for mandating OGVs to switch fuel at berth should not have significant cost implications for ship liners. The Hong Kong Shipowners Association has advised that the additional fuel cost for switching to, say, 0.1% sulphur fuel at berth is about US\$1 per 40 ft container. Compared with the freight cost of around US\$2,624<sup>5</sup> per container and the total through cost of US\$3,800-4,100<sup>6</sup> for moving a container from Hong Kong to west coast of US, the additional cost is unlikely to pose a major burden to the shipping sector.

20. The proposal to mandate the standard (not higher than 0.1% sulphur) for marine diesel sold in Hong Kong to DVs and RTVs diesel to all will help obviate any extra handling costs that oil companies might otherwise incur. Therefore, any price adjustment should merely reflect the import price differential between this cleaner fuel and the current marine light diesel (maximum 0.5% sulphur). Since the average difference in Singapore

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<sup>5</sup> Shipping cost of a 40-foot container in July 2010. Source: Drewry Shipping Consultants via the Journal of Commerce in Stephanie Clifford, "Retailers Pay More to Get Cargo (No Guarantee)", New York Times, 26 July 2010. (<http://www.nytimes.com/2010/07/27/business/global/27shipping.html>)

<sup>6</sup> Study on Hong Kong Port Cargo Forecasts 2005/2006 commissioned by the Transport and Housing Bureau, April 2008, page 11

free-on board (FOB) prices<sup>7</sup> between these two fuels was only around HK\$0.02 per litre on average (0.3%), we expect that the proposal should not bring about any major changes to the retail price of marine light diesel.

## **WAY FORWARD**

21. We have started consulting stakeholders, including the shipping and logistic trade associations, ship-liners and OGV operators, ferry and cruise owners and operators, DV owners and operators, oil companies and suppliers and others, about the proposals on control of emissions of marine vessels. We will take into consideration their views when finalizing the proposal. In parallel, we are preparing for the launch of a small scale demonstration trial on the use of 0.1% sulphur diesel for DV operators.

22. We are liaising with the authorities of Guangdong, Shenzhen and Macao on the proposed initiatives to reduce marine emissions within the PRD waters set out in the 2011 Policy Address.

## **ADVICE SOUGHT**

23. Members' views are sought on the proposals set out in this paper.

**Environmental Protection Department**  
**December 2011**

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<sup>7</sup> FOB Singapore price includes the transportation costs of fuel to the port of Singapore, the loading cost and the fuel oil cost.

**Examples of Controlling Fuel Sulphur Content in Overseas Countries/Economies for Ocean-going Vessels**

Areas	Maximum fuel sulphur content
(a) Ships berthing in European Union (EU) ports	0.1% from January 2010
(b) In North America, certain ports (Vancouver, Seattle, Tacoma, New York and New Jersey) have introduced voluntary and incentivized fuel switch at berth programmes.	0.1% to 0.5% (varies with ports and incentive schemes). Once the ECA in North America is in place, the fuel sulphur content will be capped at 0.1% as from 1 January 2015. Details are in the next row of this table.
(c) Ships operating within the North Sea ECA, Baltic Sea ECA, North America ECA <sup>8</sup> and the upcoming ECA within 50 nautical miles (nm) off the coast of Commonwealth of Puerto Rico and the U.S. Virgin Island <sup>9</sup>	<ul style="list-style-type: none"><li>● 1.5% from May 2006 (for Baltic Sea), November 2007 (for North Sea)</li><li>● 1% from 1 July 2010</li><li>● 0.1% from 1 January 2015</li></ul>
(d) Ships operating in waters within 24 nm off the coastline of California	<ul style="list-style-type: none"><li>● 0.5% - 1.5% (depending on fuel types) from July 2009;</li><li>● 0.5% - 1% (depending on fuel types) from August 2012;</li><li>● 0.1% from January 2014</li></ul>

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<sup>8</sup> The North America ECA is extended 200 nm off the coast of the US and Canada. It entered into effect in August 2011 and will become enforceable in August 2012.

<sup>9</sup> The Puerto Rico and the U.S. Virgin Island ECA is known as US Caribbean ECA. It is expected to enter into force in January 2013 and become enforceable in January 2014.



**Fair Winds Charter**

# FAIR WINDS CHARTER

## VOLUNTARY CLEAN FUELS INITIATIVE FOR OCEAN-GOING VESSELS CALLING AT HONG KONG

As international carriers, we recognize the emissions from our ships affect air quality in Hong Kong and the Pearl River Delta region. As responsible businesses, **WE VOLUNTARILY COMMIT TO >>>**

low sulphur fuel

- Switching to a fuel containing 0.50% sulphur content or less (“low sulphur fuel”) while at berth (at the terminal or at anchorage) in Hong Kong, to the maximum extent possible;
- Undertaking this voluntary initiative between 1 January 2011 to 31 December 2012;
- Collaborating within our sector and with the Hong Kong SAR and Guangdong Governments to introduce regulation on ship emissions, consistent with international standards.

In support of the **FAIR WINDS CHARTER, WE >>>**

- Urge the Hong Kong SAR Government to take a lead and work with the Guangdong Government to regulate the use of low sulphur fuel in the Pearl River Delta region by 31 December 2012.
- Urge the Hong Kong SAR Government to encourage broader industry participation by providing incentives, as it has done with other transport modes.
- Encourage the container terminals to support this initiative by offering advantages to participating ships, as well as by addressing emissions from cargo handling equipment, and the trucks and local craft that service the terminals.
- Encourage ocean-going passenger liners and other maritime users of the Port of Hong Kong to use low sulphur fuel while at berth in Hong Kong.
- Encourage cargo producers and buyers to favour participating shipping lines as a way of meeting their sustainable supply chain commitments.
- Welcome the support of end consumers who purchase the goods that the shipping industry carries.

## **Trial of Local Ferries Using Ultra Low Sulphur Diesel Executive Summary**

A trial was launched in end-August 2009 to ascertain the technical feasibility of local ferries using ultra-low sulphur diesel (ULSD) and to collect essential operation data in relation to the fuel switch. The trial was completed in end-July 2010. Its findings would help the Government map out the way forward to reduce the emissions of local ferries.

Four ferry operators contributed altogether six non-kaito ferries to the trial. The participating ferries contained a mix of different engine models, engine capacity, vessel features and service modes. For some engine models of the participating ferries, their engine makers have advised that they are ULSD compatible.

The trial findings indicated that in general, there was no remarkable change in fuel consumption, maintenance requirement and engine power output. Star Ferry took exception to the generality for the reason of the unique engine model of its participating ferry – low-speed 2-stroke engines. Exhaust emission and odour were slightly reduced. The participating ferries had to pay on average an additional cost of \$0.93 per litre after switching from marine light diesel (MLD, with a maximum sulphur content of 0.5%) to ULSD (with a maximum sulphur content of 0.005%).

It is concluded that from a technical point of view, the participating ferries could generally replace MLD with ULSD for powering their engines. Star Ferry considers the trial findings inconclusive for its participating ferry due to the unique engine model of its participating ferry. The trial has also demonstrated that if ULSD is applied only to a small sector of the local vessels, a logistic overhead cost would be incurred. This would increase the fuel price differential of fuel switch, thereby raising the operating cost and imposing pressure on fare (for the case of ferry services).