



空氣質素指標檢討 業界諮詢會議

Review of the Air Quality Objectives (AQO)
Stakeholders Engagement Meeting

非道路移動機械 Non-road Mobile Machinery (NRMM)

Environmental Protection Department

環境保護署

July 2018

2018年7月

會議議程

Agenda



1. 上次持份者會議的討論
Discussion in the previous stakeholders meeting
2. 非道路移動機械排放管制的發展
Development on emission control of regulated machines
3. 跟進兩項空氣質素改善措施的可行性
Follow up the practicability of two possible air quality improvement measures
4. 其他事項
Any other business

上次持份者會議的討論

Discussion in the previous stakeholders meeting

- 第一次業界諮詢會議於2017年8月25日舉行
The first engagement meeting was held on 25 August 2017
- 探討進一步減少非道路移動機械(包括受規管機械和非道路車輛)的排放的可行性
Explore the practicability to further reduce emissions from NRMM (both regulated machines and non-road vehicles)

上次持份者會議的討論

Discussion in the previous stakeholders meeting

兩項可行措施 Two possible measures were discussed

1. 探討收緊新供應香港的受規管機械及非道路車輛的廢氣排放標準
Explore the tightening of emission standards of regulated machines and non-road vehicles newly supplied to Hong Kong



歐盟IIIA期 → 歐盟IIIB / IV期 / 美國第4級?
Euro IIIA → Euro IIIB / Euro IV / US Tier 4?



歐盟五 → 歐盟六?
EU V → EU VI?

- 結論 Conclusion
實施的可行性 Practicability for implementation
- ✓ 受規管機械 Regulated machines – 中期可行 Medium term
- ✓ 非道路車輛 Non-road vehicles – 短期可行 Short term

上次持份者會議的討論

Discussion in the previous stakeholders meeting

2. 探討為豁免的受規管機械及非道路車輛進行改裝以改善其排放表現
Explore the feasibility of retrofitting exempted regulated machines and non-road vehicles to improve their emission performance



柴油粒子過濾器 Diesel particulate filter??
柴油氧化催化器 Diesel oxidation catalyst??
選擇性催化還原器 Selective catalytic reduction??

- **結論 Conclusion**

實施的可行性 Practicability for implementation

High back pressure and incompatible to old engines, warranty void & cost implication 高背壓及與舊引擎不相容、保用失效及成本影響

□ 不可行 Not practicable

香港現行管制措施 - 法例訂明的排放標準

Hong Kong statutory emission standards

- 《空氣污染管制(非道路移動機械)(排放)規例》已於2015年6月1日生效
Air Pollution Control (Non-road Mobile Machinery)(Emission) Regulation in effect on 1 June 2015

受規管機械排放標準 Emission standards of regulated machines

壓燃式引擎 Compression-ignition engines

額定引擎輸出功率 Rated engine power output (P) (以千瓦特作單位) kW	廢氣排放標準 Emission standards adopted
$37 \leq P \leq 560$	歐盟 IIIA期、美國第3級或日本環境省排放標準* EU Stage IIIA, US Tier 3 or Japan MoE standards*
$19 < P < 37$	歐盟 IIIA期、美國第2級或日本環境省排放標準* EU Stage IIIA, US Tier 2 or Japan MoE standards*

強制點火式引擎 Positive-ignition engines

額定引擎輸出功率(P) Rated engine power output (以千瓦特作單位) kW	廢氣排放標準 Emission standards adopted
$19 < P \leq 560$	美國第2級或日本環境省排放標準* US Tier 2 or Japan MoE standards*

*指由日本環境省於2006年作出第72公告的標準

* Standards specified in Announcement No.72 made by MoE in 2006

其他國家的現行排放準標

Prevailing emission standards in other countries

非道路壓縮點火引擎 Non-road compression ignition engines

地方 Places	引擎輸出功率 (千瓦) Power output (kW)	排放標準 Emission standards	實施年份 Implementation Year
歐盟 EU	$37 \leq P < 56$	歐盟IIIB期 EU Stage IIIB	2013
	$56 \leq P < 75$	歐盟IV期 EU Stage IV	2014
	$75 \leq P < 130$		
	$130 \leq P < 560$		
美國 US	$P < 19$	美國第4級 US Tier 4	2008
	$19 \leq P < 56$		2008
	$56 \leq P < 130$		2012
	$130 \leq P$		2011
日本* Japan	$19 \leq P < 37$	與美國第4級相近 Similar to US Tier 4	2013
	$37 \leq P < 56$	歐盟IIIB期 EU Stage IIIB	2013
	$56 \leq P < 560$	歐盟IV期 EU Stage IV	2015 / 2016

* Not applicable on generators and air compressors 不適用於發電機及空氣壓縮機

外國近期的改裝經驗

Recent overseas retrofitting experience

國家/城市 Country/ City	要求 Requirements
美國加州 California, US	<p>自2007年起，要求使用認可的排放控制裝置改裝非道路發動機，包括柴油粒子過濾器，適用於挖掘機、發電機、起重機、空氣壓縮機等。</p> <p>Starting from 2007, existing excavators, generators, cranes, air compressors, etc. have been required to retrofit with approved emission control devices such as DPFs.</p> <p>(https://www.arb.ca.gov/msprog/decsinstall/installationprocess.htm)</p>
美國紐約市 New York City, US	<p>自2003年起，要求城市建設項目中使用的非道路機械使用新機械或在現有機械加裝柴油粒子過濾器以達至最新的美國排放標準，適用於挖掘機、發電機、裝載機、空氣壓縮機等。</p> <p>Starting from 2003, non-road equipment used on city construction projects have been required to meet latest US emission standards by using new machines or retrofitting existing machines with DPFs including excavators, generators, loaders, air compressors, etc.</p> <p>(http://www.nyc.gov/html/dep/html/air/emissions_from_transportation.shtml)</p>
瑞士/德國 Switzerland/ Germany	<p>瑞士和德國分別自2002和2008年起要求施工機械使用新機械或在現有機械加裝柴油粒子過濾器以符合最新的歐盟粒子排放標準，適用於挖掘機、發電機、起重機、空氣壓縮機等。</p> <p>Starting from 2002 and 2008 respectively, Switzerland and Germany have required construction machinery to comply with latest EU particulate matters (PM) emission standards by using new machines or retrofitting existing machines with DPFs, including excavators, generators, cranes, air compressors, etc.</p> <p>(https://www.dieselnet.com/standards/ch/nonroad.php; https://www.dieselnet.com/standards/de/ohs.php)</p>

外國近期的改裝經驗

Recent overseas retrofitting experience

國家/城市 Country/ City	要求 Requirements
英國倫敦 London, UK	<ul style="list-style-type: none"><li data-bbox="369 394 1870 586">• 2008年，推出非道路移動機械改裝技術認證計劃，適用於挖掘機、發電機、起重機、推土機等。 In 2008, launched the certification scheme for retrofit technologies for non-road machinery including excavators, generators, cranes, bulldozers, etc.<li data-bbox="369 639 1870 879">• 2015年，大倫敦和倫敦中部分別要求使用符合歐盟第IIIA和IIIB階段排放標準的非道路機械。 In 2015, required non-road machinery operating in Greater London and Central London to meet Stage IIIA and Stage IIIB emission standards, respectively.<li data-bbox="369 932 1870 1076">• 2020年，這些要求分別收緊至歐盟第IIIB和IV階段。 In 2020, these requirements are tightened to Stage IIIB and Stage IV, respectively.<li data-bbox="369 1129 1870 1380">• 以上要求可以透過使用新機械或在現有機械加裝柴油粒子過濾器。 Can meet the requirements by using new machines or retrofit existing machines with DPFs. http://nrmm.london/content/cleaner-construction-machinery-london ; http://www.energysavingtrust.org.uk/transport-travel/transport/non-road-mobile-machinery-nrmm-certification)

外國認可的柴油粒子過濾器 Overseas approved DPFs

受規管機械 Regulated Machine	認可的柴油粒子過濾器* Approved DPFs*	減少粒子排放效率 PM Removal Efficiency
挖掘機 Excavators	Baumot BA / BA-B	>99%
	Caterpillar Converter GP-CGP	≥95%
	Eminox CRT System	≥98%
發電機 Generators	AIRMEEX CARMEX CSC	>95%
	Bersy BPF R620	≥98%
	Catalytic Exhaust Products Ltd.	≥85%
	Dieselytic SXS-SC DPF	
履帶式起重機 Crawler Cranes	Eminox CRT System	≥98%
	LIEBHERR R01	≥98%
	RYPOS, Inc. ActiveDPF/C3+™	≥85%
空氣壓縮機 Air Compressors	AIRMEEX CARMEX CSC	>95%
	Johnson Matthey DPF-BU	>99%
	DCL International Inc. DPF	≥85%

*以上列出的柴油粒子過濾器均獲得美國、瑞士、德國或英國倫敦的認可。

*The above listed DPFs are approved by the US, Switzerland, Germany or London, UK.

本地的改裝經驗

Local retrofitting experience

- 香港生產力促進局曾與業界合作於發電機及挖泥機加裝柴油粒子過濾器

Hong Kong Productivity Council (HKPC) has conducted a trial with the trade to retrofit DPFs on generators and excavator.

- 初步結果顯示在合適的運作溫度下，柴油粒子過濾器能減少粒子排放達90%或以上。

Preliminary results showed that DPF can remove PM over 90% if the operation temperature was appropriate.



政府新基本工程合約的要求

Requirements in Government's new capital works contracts

對獲核准受規管機械數量要求

Requirements on the number of approved regulated machines

受規管機械 Regulated machines	第一階段 Phase I 招標期 Tender to be invited between: 01/06/2015 - 31/05/2017	第二階段 Phase II 招標期 Tender to be invited between: 01/06/2017 - 31/05/2019	第三階段 Phase III 招標期 Tender to be invited: 從01/06/2019起 from 01/06/2019 onwards
發電機 Generators	ALL		
空氣壓縮機 Air compressors	ALL		
挖掘機 Excavators	> 50%	> 80%	ALL
履帶式起重機 Crawler Cranes	> 50%	> 80%	ALL

2019年起，所有新招標的政府工程下(超過2億元)，四種受監管機械須使用符合歐盟IIIA期標準的。
By 2019, in all new tenders invited for government projects exceeding \$200 millions, four types of regulated machines will be required to use EU Stage IIIA compliant models.

可能實施的措施

Possible measures

1. 探討進一步收緊新供應香港的受規管機械的廢氣排放標準
Revisit the tightening of emission standards of regulated machines newly supplied to Hong Kong



歐盟IIIA期 → 歐盟IIIB / IV期 / 美國第4級?
Euro IIIA → Euro IIIB / Euro IV / US Tier 4?

2. 探討為獲核准的受規管機械加裝柴油粒子過濾器 以提升其排放表現，並要求用於政府新工程合約

Revisit the feasibility of retrofitting approved regulated machines with DPF to improve their emission performance and require them to be used in future government' s new capital works contracts.



加裝柴油粒子過濾器在部份符合歐盟第IIIA階段的機械
Retrofit DPFs on some EU Stage IIIA machines.

考慮要點 (措施1)

Key considerations (Measure 1)

1. 國際監管的發展 International regulatory development

- 歐美及日本的廢氣排放標準較香港嚴格
Emission standards in the EU, US and Japan are more stringent than HK

2. 符合標準的機械的供應、使用趨勢

Availability of compliant machines, trend of usage

- 預期可從歐美或日本市場進口符合排放標準較嚴格的機械
It is anticipated that machines complying with stringent emission standards are available in the EU/US/Japan markets.

3. 成本影響 Cost implication

- 使用符合較嚴格排放標準的機械的成本可能較高
Greater costs may be incurred due to the use of machinery complying with stringent emission standards

4. 業界反應 Trade reaction

- 主要視乎供應及對成本的影響
Mainly subject to the cost implication and supply

考慮要點 (措施2)

Key considerations (Measure 2)

1. 外國經驗 Overseas experience

- 開始管制在用機械排放及在部份工程或地區強制使用新機械或要求改裝現有機械
Start to control emission of in-use NRMM and retrofitting some existing machines becomes mandatory in some areas or projects.

2. 技術成熟程度及限制 Technical maturity and constraints

- 改裝技術適用於較新的引擎(例如符合歐盟第IIIA階段型號), 並須有足夠空間安裝減排裝置及適當的溫度運作
Retrofit technology may be only suitable for use with some relatively new engines(e.g. EU Stage IIIA compliant model). There should be sufficient space and appropriate temperature for the retrofit device.

3. 成本影響 Cost implication

- 額外運作及維修成本 Extra costs on operation and maintenance

4. 業界反應 Trade reaction

- 主要視乎成本影響及技術可行性
Mainly subject to the cost implication and technical feasibility





謝謝
Thank You