

SUB-COMMITTEE ON POLLUTION  
PREVENTION AND RESPONSE  
5th session  
Agenda item 23

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### ANY OTHER BUSINESS

#### **Proposed new output on development of amendments to MARPOL Annex VI and the NO<sub>x</sub> Technical Code on the use of multiple engine operating profiles (Maps) for marine diesel engines**

**Submitted by IMarEST**

#### **SUMMARY**

*Executive summary:* With regard to the request from MEPC for PPR to further consider the title and scope of this proposed new output, together with the associated definition, it is seen that the term "emission control strategy" should be applied instead of "engine operating profile". The basis of this proposal is the potential possibilities and ease of change of electronic engine management systems which now requires this overall strategy to be addressed within the NO<sub>x</sub> certification process. To do so, it would ensure that the process is sufficiently robust, appropriate and meets the challenges of modern marine diesel engines in a uniform manner consistent with the MARPOL Annex VI objectives.

*Strategic direction:* No related provisions

*High-level action:* No related provisions

*Output:* No related provisions

*Action to be taken:* Paragraph 13

*Related document:* MEPC 71/17

#### **Introduction**

1 In view of the instruction from MEPC 71 to PPR 5 to further consider the title of the proposed new output and the associated scope of work, including the definition of the term "Map", the IMarEST convened an informal workshop in order to facilitate discussion on this topic. This workshop was attended by a number of invited interested parties including Administrations, recognized organizations, engine builders and others.

## Discussion

2 At the IMarEST workshop, it was identified that the terms "Engine Operational Profile" and "Map" as used in document MEPC 69/19/1 submitted by Norway, which first proposed this new output, did not fully reflect the true scope of the core issue.

3 Marine diesel engine certification under the NO<sub>x</sub> Technical Code 2008, specifically in relation to the Engine Group concept, inherently allows for a particular engine to be fitted with a range of NO<sub>x</sub> critical components and/or NO<sub>x</sub> critical settings. The essential and fundamental point being that each allowed, as specified in the approved Technical File, combination of NO<sub>x</sub> critical components and settings is to be compliant with the tier to which that engine is to be certified. Furthermore, the particular combination of those NO<sub>x</sub> critical components and settings that results in the highest NO<sub>x</sub> emission value is applied to the Engine Group Parent Engine which is then subject to the emission test as detailed in chapter 5 of the Code. Thereafter a shipowner is at liberty to use whichever of those approved combinations of NO<sub>x</sub> critical components and settings as best meets their operating requirements.

4 In a mechanically controlled marine diesel engine, on which the Code was based, NO<sub>x</sub> critical components would typically include items such as fuel injection pumps and nozzles and fuel cams. A typical NO<sub>x</sub> critical setting would be fuel pump timing. Therefore, a change in any of those NO<sub>x</sub> critical elements would require the engine to be stopped and a potentially significant amount of time and effort to be expended in making that change across all cylinders. Furthermore, in a mechanically controlled engine the NO<sub>x</sub> emission performance between mode points may be reliably taken as being indicated by the respective mode point values – except where there are certain cut-in/cut-out features as would be described in the approved Technical File.

5 In contrast, with an electronically controlled engine the NO<sub>x</sub> emission performance characteristics can be readily changed (for example, at the touch of a button) across the entire engine. Also the range of potentially adjustable parameters is far wider than that of a mechanically controlled engine; in respect of fuel oil injection alone, both the start and end of injection can be independently altered as can the intensity and distribution of that injection. Additionally NO<sub>x</sub> performance between mode points is not necessarily indicated by the respective mode point values and indeed could potentially be substantially different. Hence, it would be considered that it is the ease of that change, the potential of that change on NO<sub>x</sub> emissions and the inter-mode point NO<sub>x</sub> performance which all now need to be addressed by the NO<sub>x</sub> Technical Code 2008, in order to have a robust and fit-for-purpose approach to modern electronically controlled marine diesel engines.

6 In order to address the particular issues identified above with regard to electronically controlled engines and the question as raised in the initial proposal together with the valid concerns expressed in a number of the subsequent commenting submissions, an outcome from the IMarEST workshop was the proposal that generally the term "emission control strategy" should be used in place of "engine operating profiles (Maps)" when referring to this topic. The basis of this being that the core issue raised by the original proposal is seen to be more than "the operational profile" itself and the term "map" is often used to describe only a detailed sub-element of the overall emission control strategy.

7 In coming to this conclusion the IMarEST workshop participants noted that the submission and review of the emission control strategies to be applied is now usual practice in other engine emission programmes, such as the EU non-road mobile machinery engine certification process. Also, while there are certain unique features of marine diesel engines and their certification in accordance with the NO<sub>x</sub> Technical Code 2008, the central focus on emission's control is common to all engine types and therefore such a requirement should be seen as being generally applicable.

8 Consequently, the key point as regards the multiple engine operating profiles (Maps) issue is in fact the particular overall "emission control strategy" to be applied in the case of an electronically controlled engine and how that, and its subsidiary parts, should be regulated under MARPOL Annex VI/NO<sub>x</sub> Technical Code 2008 – both in respect of an Engine Group as certified, in terms of capability, and the restrictions as given in the engine's Technical File, in terms of application.

9 While noting that it is generally accepted that different settings may be applied to engines which are certified to both Tier II and Tier III or to engines which operate on either liquid only or dual fuel – it remains unclear as to what extent, if at all, this should be provided for other operational modes specifically in the case of electronically controlled engines due to the relative ease in making such changes. As has been highlighted during the plenary discussions at both MEPC and PPR on this matter, there are divergent views as to whether alternative emission control strategies are currently allowed (albeit that there are marine diesel engines so fitted which have been certified in accordance with the NO<sub>x</sub> Technical Code) and what level of control could and should be applied in such cases if allowed, given that there is currently no uniformly understood interpretation of the Code that clearly prohibits such an approach.

#### **Proposals in respect of proposed new output**

10 Therefore a proposed response to the instruction from MEPC would be the general replacement of the term "engine operational profile (Map)" with the term "emission control strategy" and that this should be given against an engine, rather than engines, since it is the application of more than one strategy to a particular engine which is the point in question. In terms of the scope of work it should also recognize the existing uncertainty and the lack of uniform application in this area.

11 In respect of the draft definition of the term "Engine Operational Profile (Map)" as developed by PPR 4, it would be seen, at this stage, to be premature to use the term "definition" since that could imply that the wording of any possible addition to regulation 2 of MARPOL Annex VI or paragraph 1.3 NO<sub>x</sub> Technical Code 2008 is pre-set from the outset. Instead it is proposed that this be presented as a "description", recalling that at PPR 4 this was developed solely to guide the discussion within the working group as to the extent and depth of the topic under consideration.

12 Based on the above considerations, the proposals as presented in document MEPC 71/9/2 submitted by EUROMOT have been amended as shown in the annex.

#### **Action requested of the Sub-Committee**

13 The Sub-Committee is invited to note the information provided, the proposals made in paragraphs 10, 11 and 12 and to take action as deemed appropriate.

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## ANNEX

### PROPOSED TITLE OF THE NEW OUTPUT, SCOPE AND ASSOCIATED DEFINITION

**Title of the proposed new output:**

Development of amendments to MARPOL Annex VI and the NO<sub>x</sub> Technical Code on the use of multiple ~~engine operating profiles (Maps)~~ electronic emission control strategies for a marine diesel engines.

**Scope:**

~~Consider~~ Clarify whether multiple ~~engine operational profiles (Maps)~~ should be emission control strategies are allowed, and if so, what regulatory controls should be applied, noting these may also need to include amendments to MARPOL Annex VI and the NO<sub>x</sub> Technical Code 2008, and if not allowed, then what amendments would be necessary to MARPOL Annex VI and the NO<sub>x</sub> Technical Code 2008 to explicitly prohibit multiple ~~engine operational profiles~~ emission control strategies.

**~~Map definition~~ Emission control strategy description:**

~~A Map~~ An emission control strategy is a particular set of NO<sub>x</sub> influencing settings applied in an electronic engine management system which influences the NO<sub>x</sub> emission performance. Those settings may relate to, but are not limited to, fuel injection, inlet and exhaust valve operation, charge air, exhaust bypass/wastegate or exhaust aftertreatment controls and auxiliary control devices.

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