

# Biofuel: NOx and MARPOL Annex VI compliance

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# Biofuel within MARPOL Annex VI

MARPOL Annex VI sets limits for emissions of SO<sub>x</sub> and NO<sub>x</sub> for “fuel oil for combustion purposes” – where does this leave biofuel?

- Regulation 13 of Annex VI sets out NO<sub>x</sub> limits
- Compliance with NO<sub>x</sub> limits determined through the NO<sub>x</sub> Technical Code – very different from determining SO<sub>x</sub> compliance!
- **Regulation 18.3 of Annex VI – Fuel oil quality** differentiates between **18.3.1**: “blends of hydrocarbons derived from petroleum refining” and **18.3.2**: “*fuel oil for combustion purposes derived by methods other than petroleum refining*” – with a caveat that it “*shall not cause an engine to exceed the applicable NO<sub>x</sub> emission limit set forth in ... regulation 13*”.



# Regulation 13 - NO<sub>x</sub> emission limits

- Tier I – Ships constructed on or after 1 Jan 2000
- Tier II – Ships constructed on or after 1 Jan 2011
- Tier III – Ships constructed 1 Jan 2016 onwards when in NO<sub>x</sub> ECAs

Tier	n < 130 rpm	n = 130 – 1999 rpm	n ≥ 2000 rpm
Tier I	17.0 g/kWh	$45.0 \cdot n^{(-0.2)}$ g/kWh	9.8 g/kWh
Tier II	14.4 g/kWh	$44.0 \cdot n^{(-0.23)}$ g/kWh	7.7 g/kWh
Tier III	3.4 g/kWh	$9.0 \cdot n^{(-0.2)}$ g/kWh	2.0 g/kWh

- Compliance demonstrated through survey and **certification of the engine** in accordance with the NO<sub>x</sub> Technical Code leading to:
  - Engine International Air Pollution Prevention (EIAPP) Certificate
  - EIAPP based on specific Test fuel oil: ISO 8217:2005 DM-grade
  - Existing engine using biofuel or biofuel blend **may have to demonstrate compliance**

# Biofuel & NOx – problem/solutions?



- **The problem:**
- How to prove that the engine does not “*exceed the applicable NOx emission limit*” when the EIAPP Certificate is based on DM-grade oil-based fuel?
- May require onboard emissions testing for fuel from non-petroleum sources where the results should be presented in g/kWh – impractical and unreliable
- **Proposed solutions:**
- MEPC 70/7/2 (IMarEST, 2016) – allow Regulation 18.3.1 to cover all fuel oils, deleting Regulation 18.3.2
- MEPC 76/7/22 – (DE, FR, GR, JPN, SGP, ICS) - invite Administrations of Parties to MARPOL Annex VI to issue temporary exemptions for ships conducting biofuel trials for GHG reduction purposes
- MEPC 76/7/22 (India) - consider amendments to MARPOL Annex VI and the NOx Technical Code to clarify the regulatory requirement for the use of biofuel and biofuel blends on board

# Biofuel emission reduction potential

## How does biofuel and biofuel blends compared to DM-grade MGO?

- Less SO<sub>x</sub> but similar for CO<sub>2</sub> and NO<sub>x</sub> - though some evidence of higher NO<sub>x</sub>
- Significant potential for reduction in carbon intensity if taking well to wake lifecycle emissions into account (as opposed to tank to wake)
- IMO's initial GHG Strategy adopted in 2018 identifies among the 'candidate short-term measures':
  - *develop robust lifecycle GHG/carbon intensity guidelines for all types of fuels, in order to prepare for an implementation programme for effective uptake of alternative low-carbon and zero-carbon fuels*

# Sea trials of a B20 MGO/biodiesel blend



- Sea trials conducted on two ships for a duration of three months under all sea conditions at both loaded and ballast passages (MEPC 76/7/32)
- Emission measurements conducted at different engine loads by a certified Flue gas analyser and NOx analyser in line with NOx Technical Code

Ship 1 certified for NOx Tier-I Ship 2 pre-dates NOx Tier requirements	NOx when using B20 biodiesel blend compared to LSHSD	CO2 when using B20 biodiesel blend compared to LSHSD
Main engine: 2 x 969 kW @ 1200 rpm Auxiliary engine: 2 x 189 kW @ 1500 rpm	Approximately 2% reduction	Approximately 7% reduction (21% if considering LCA)
Main engine: 2 x 596.8 kW @ 1400 rpm Auxiliary engine: 2 x 125 kW @ 1500 rpm	Minimum 6% reduction Maximum 28% reduction	Approximately 7% reduction (21% if considering LCA)

# Concluding observations

- Biofuel and biofuel blends can meet NOx emission limits, the question is how to prove compliance
- There is growing recognition that development of low-carbon or carbon neutral biofuels may be hindered by the current text of MARPOL Annex VI and the NOx Technical Code
- MARPOL Annex VI amendment requires broad support at IMO and would need to be taken forward under a 'new output' under IMO procedures







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**Thank you for your attention!**

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