# ENVIRONMENTAL TOXICITY AND FAITH OF LIGHT- AND INTERMEDIATE FUEL OILS WHEN SPILT ON A COLD WATER SURFACE

Norwegian Coastal Administration

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# Changes in fuel Sulphur content regulation

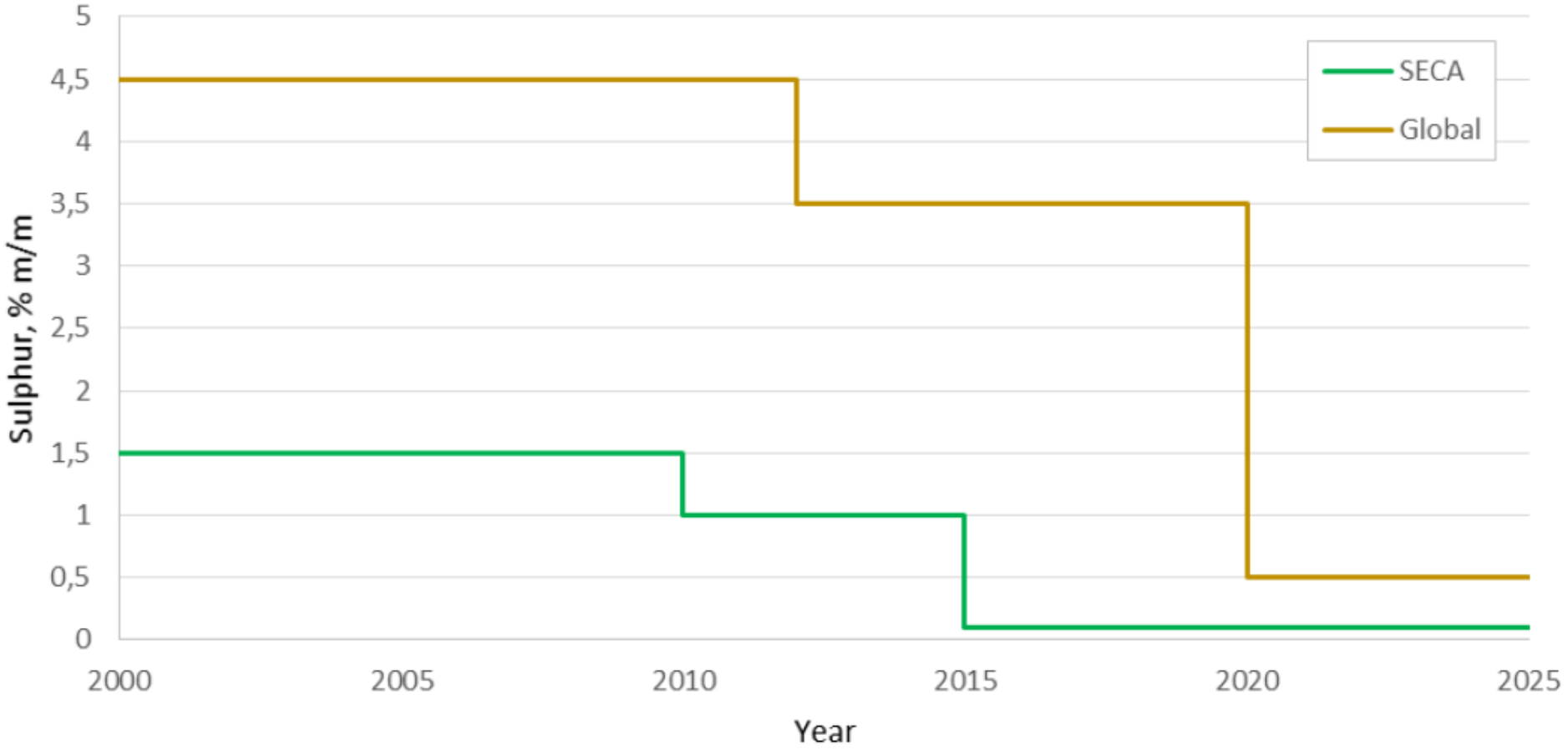


**Figure 1-1: Previous and future changes in regulations regarding sulphur content in marine fuel oils within SECA and globally**

# RELEVANT BUNKER OPTIONS IN 2020

0.5% Sulfur fuel Globally and 0.1% Sulfur fuel in ECA's

- Continue to use Heavy Fuel with Scrubbers for Exhaust
- Use MGO (Marine Diesel)
- Use Hybrid Fuels (like Exxon HDME50, Shell ULSFO)
- Use LNG (for the ships with new dual engine and space)
- Desulfurize Heavy fuels at liquid fuel level

# Background for the suggested project

- Basis for this proposal is a project funded by the Norwegian Coastal Administration (NCA, 2016-2017) that studied 3 hybrid/LSFO-fuels and 5 marine diesel oils
- The three hybrid oils had a wide span in properties, and two of them had highly solidifying properties in cold water
  - reduced the effectiveness of dispersants
  - Reduced effectiveness, or more accurately oil skimmers failed to work
  - http://www.kystverket.no/Beredskap/forskning-og-utvikling/diesel--og-hybridoljer/forskningsresultater/
- A Wide span in toxicity / chemical composition were also reviled in the study
  - Some fuels are highly toxic
  - Others are acceptable or even “clean”

# Hybrid fuel oil samples

# Hybrid fuel Shell ULFSO when spilt on a cold sea surface

## Weathering in meso-scale flume basins

Example ULFSO at 2°C, (pour-point = +24°C)

Just after release (0 hr)
→ immediately solidified lumps
(5000 mPas)

After 72 hours:
Stable emulsion
(75 -80 % water)
(25000 mPas)

After 72 hours weathering, and just after dispersant treatment:

- Low effectiveness: < 20 % disp.
- Surface: 25000 → 14000 m Pas

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*Bilde 3 viser at Shell ULSFO ikke flyter sammen og tetter hullene med vann*

# Weathering in meso-scale flume basins

Example HDME 50, at 2°C, (Pour-point = +12°C)

Low spreading properties
→ solidified lumps
(50000mPas)

After 4 hours:
Emulsification on the solidified lumps
(20000 / 50000mPas)

After 72 hours weathering, and just after dispersant treatment:

- 50% of the emulsion dispersed
- Solidified lumps: not dispersible



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# Differences in environmental toxicity

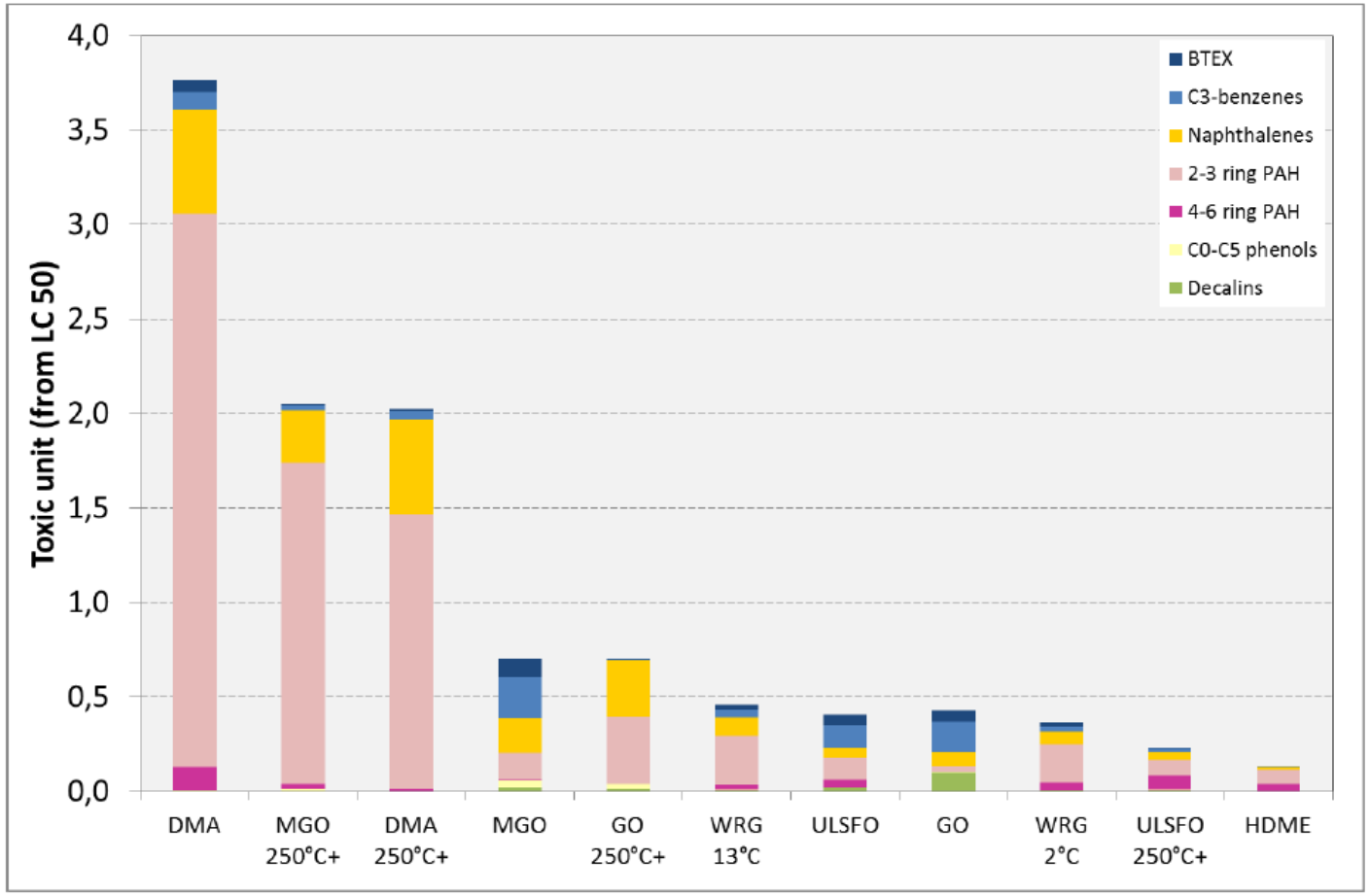


**Figure 7-8: Toxic Unit calculated for WAFs of 1:40 loading for the tested oils and weathered residues. TU > 1 indicate that 50 % of the test organisms dies. DMA = Rotterdam diesel**

# Norway want to solder the interest for a joint project between EPPR and PAME

***Environmental toxicity of light- and intermediate fuel oils (PAME)***

- Fuel samples from different batches of the same product may vary considerable in relation to toxicity
- Equivalent products (substitutes/competitors) vary greatly in relation to toxicity levels?
- Why is it so?
  - Is it the crude oil used in the refinery as an input that is decisive for the toxicity level?
  - Or the refinery technology or processes?
  - Or is the toxic substances added for other reasons by the refinery, or by the oil blenders?

***The fate of hybrid- and intermediate fuel oil when spilled at a cold sea surface (EPPR)***

- Fuel oil from the same viscosity and ISO class behave so differently when spilt on a cold sea surface
- Some Hybrid oils become very stiff and greasy and they may be difficult to remove mechanically with skimmers or other oil uptake methodologies
- While other hybrid oils on the other hand, will be in a liquid form even at a cold sea surface and hence much easier to remove.

# Project goals

**Environmental toxicity**

- Gather knowledge and describe facts accurately about the reasons for the large variation in environmental toxicity
- What measures can be taken to avoid high toxicity levels in oils in arctic waters and in other sea areas?
- Industry involvement will be required for this task.

***The fate of hybrid- and intermediate fuel oil when spilled at a cold sea surface***

- Describe why fuel oil from the same viscosity and ISO class behave so differently when spilt on a cold sea surface
- What measures can be taken to optimize intermediate and hybrid fuel oil to have the best possible oil uptake properties when spilt in cold water and in ice

***"The most effective blender is one who meets the fuel specification limit while using the lowest cost blend stock"***

***- Quote from a Senior Blending expert***

# Thank You!