

IUMI Webinar

IUMI Webinar - London, 7th May 2019

The **New** **Low Sulphur**
Marine Fuels

for **Compliance** with

the **2020 IMO Emission**
Control Regulations

&

the **Impact** to

Insurance Market & Machinery Claims

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MANAGING DIRECTOR – ASSOCIATE MEMBER OF THE ASSOCIATION OF
AVERAGE ADJUSTERS

Piraeus - Istanbul - Montenegro - Houston - Split - Shanghai - Dubai - Singapore - India



We remain up to speed..

1. International Marine Claims Conference (IMCC),
Dublin, Sept. 2018
2. Asian Maritime Law & Insurance Conference
(AMLIC), Singapore, Oct. 2018
3. Luncheon Presentation Event by MMC,
London, Nov. 2018
4. Lloyd's Asia Marine Development Group,
Singapore, April 2019



Low Sulphur Fuels ?



- The 2020 Regulations are all about reducing Sulphur (SO_x)
- The whole process commenced about a decade ago
- But it peaks in 2020

Can anyone recall, what happened when SO_x were initially reduced, some 10 years ago?

Beware...

Catalytic Fines!

The Outline



- What is it all about – The punch line
- Compliant fuel oils – Primary Solution
- Scrubbers – Secondary Solution
- Marine Claims Consequences
- Remedies
- Conclusions

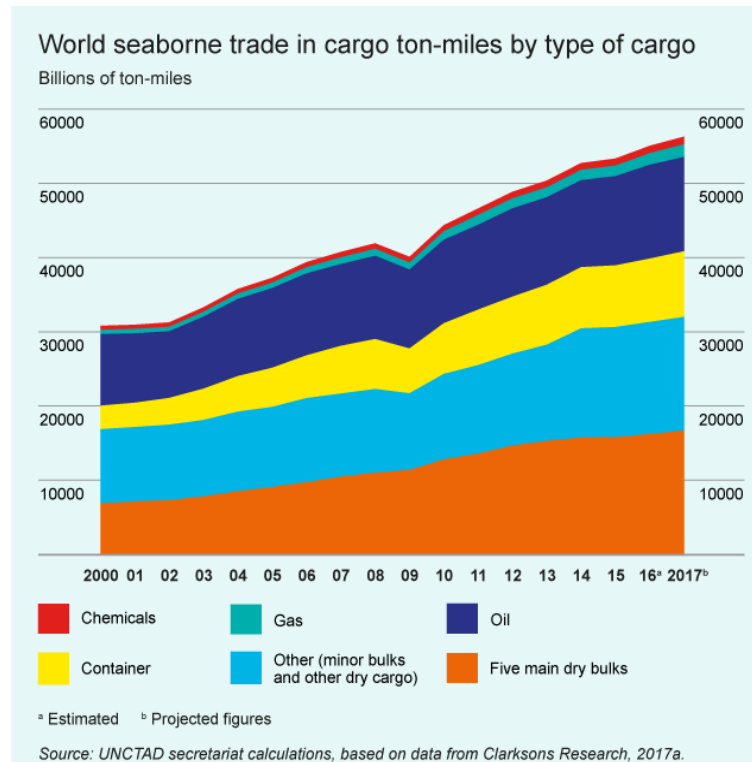
The Outline



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Why Shipborne Air Emissions were adopted?



- Diesel engines 90% of the world's ocean going ships
→ heavy fuel oils practical and cheap

BUT contain

- sulphur oxides (SO_x)
 - nitrogen oxides (NO_x)
 - carbon dioxide (CO₂)
 - particulate matter (PM)
-
- Chemical reactions in the atmosphere → SO_x and NO_x converted into fine particles (sulphate and nitrate aerosols) with significant health impacts

Some statistics...



Air pollution from international shipping accounts approximately for **50,000 premature deaths per year** in Europe, at an annual cost to society of more than **€58 billion**

International ship traffic is responsible for an estimated 7% of the total health effects in Europe due to air pollution in the year 2000, increasing to **12% in the year 2020**

Some statistics...



IMO 2020
Taking bold action to clean up shipping emissions by reducing sulphur

+ HEALTH & ENVIRONMENT - THE FACTS

- More than **570,000** premature deaths avoided (2020-2025)
- **68%** overall reduction in shipping's negative effect on human health through air pollution

Significant reductions in:

- stroke
- asthma
- cardiovascular disease
- lung cancer
- pulmonary disease

Cutting sulphur emissions helps prevent acid rain, which means:

- **less** harm to crops, forests and aquatic species
- **tackling** ocean acidification

WHERE?

- Health benefits felt globally
- Strongest in coastal communities
- Major impact in vulnerable areas: Asia-Pacific, Africa and Latin America

HOW?

- **0.50%** reduced from 3.50% - significantly less sulphur permitted in ships' fuel
- **77%** drop in overall SOx emissions from ships (2020-2025)

WHEN?

- From **1 January 2020**

#IMOSulphurLimit #BreatheLife #BeatAirPollution

IMO SUSTAINABLE DEVELOPMENT GOALS

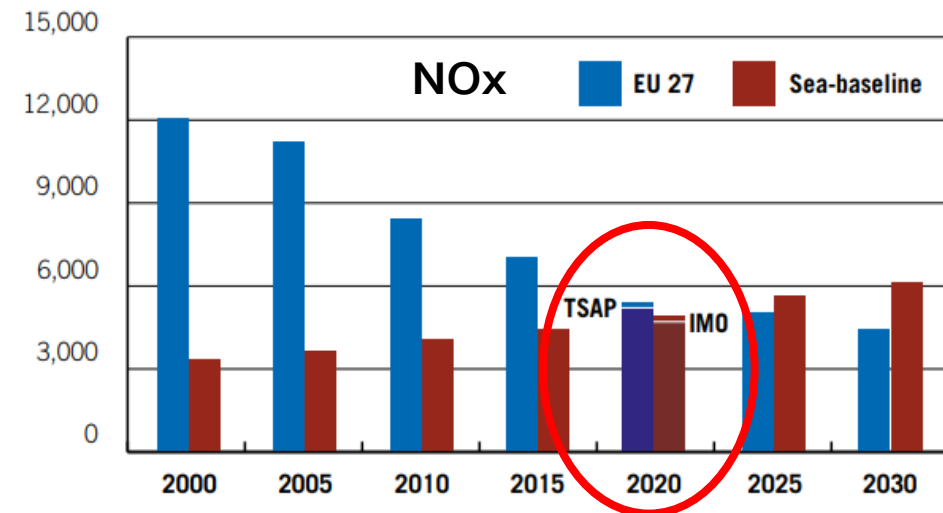
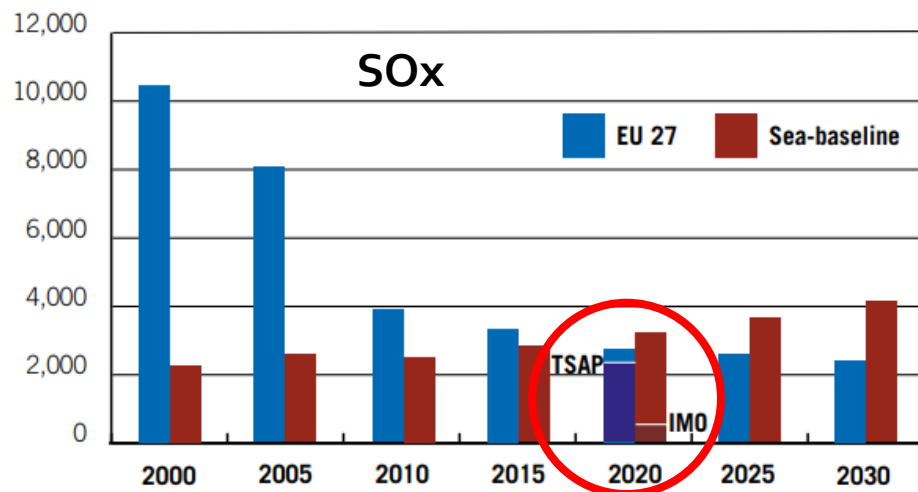


• More than **570,000** premature deaths avoided (2020-2025)

• **68%** overall reduction in shipping's negative effect on human health through air pollution

How are shipping emissions compared to land based emissions?

Pollutant emissions from land-based sources gradually coming down **BUT** those from shipping show a continuous increase



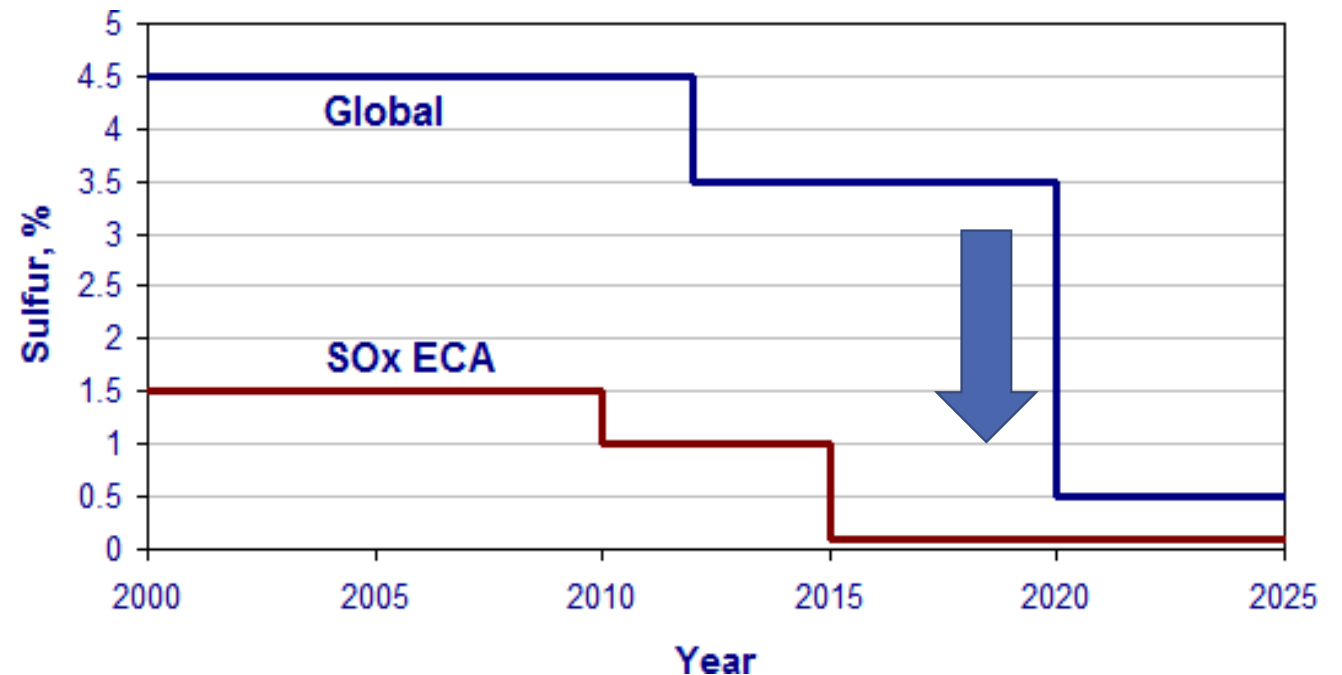
EU27 = Emissions from land-based sources (incl. domestic shipping)
Sea = Emissions from international shipping in European sea areas
TSAP = Target in line with the EU's Thematic Strategy on Air Pollution
IMO = Expected outcome from implementing the revised IMO MARPOL Annex VI

Source: Air Pollution & Climate Secretariat

Which are these regulations?

MARPOL Annex VI Regulations for the Prevention of Air Pollution from Ships

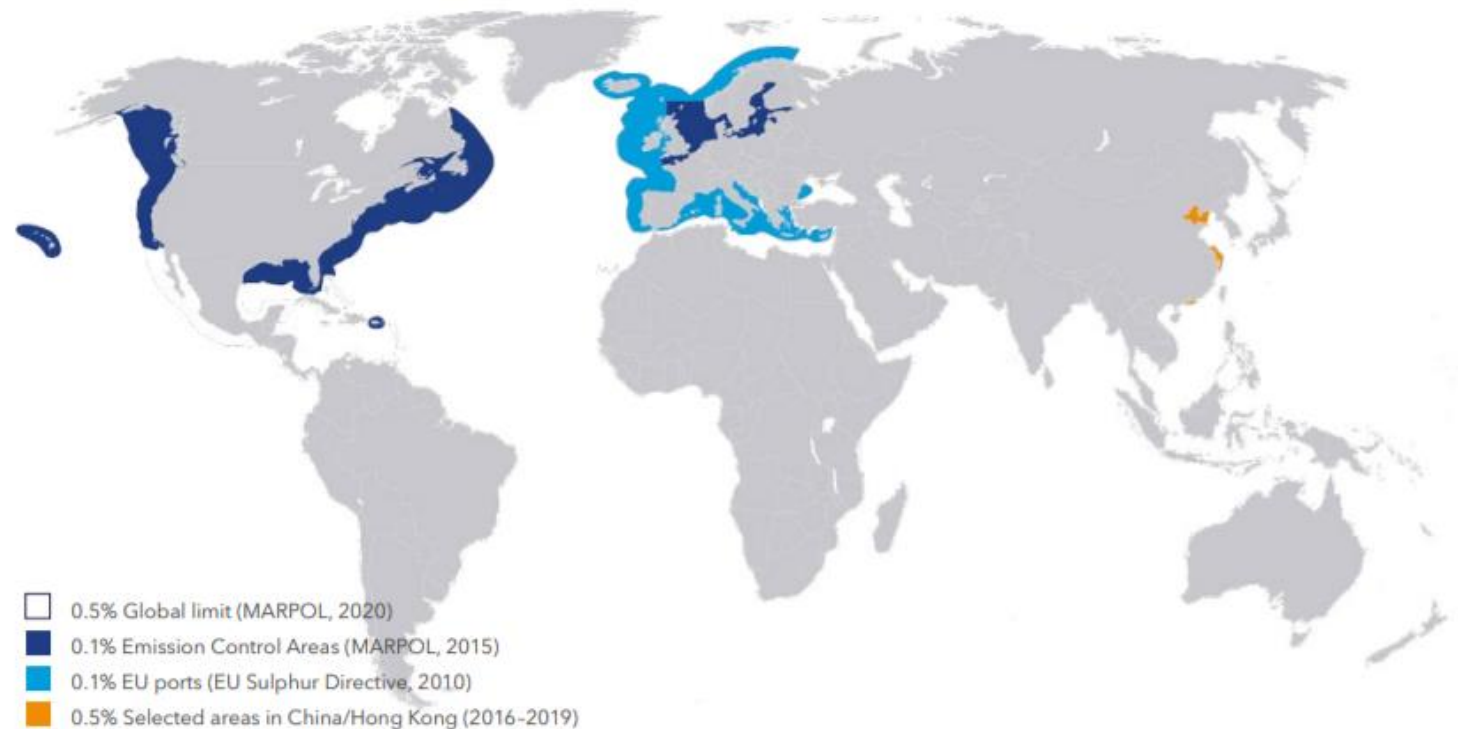
- Sulphur oxide (SOX) from **3.5% to 0.5%** in 2020 globally
- Emission Control Areas (ECAs) from **1% to 0.1%** in 2015
- ❑ Crude oil sulphur ranging from **0.1% to 4.1%**
- ❑ As per IMO MEPC 72 committee, annual average in 2017 around **2.6%** → well above 2020 limits



ECAs

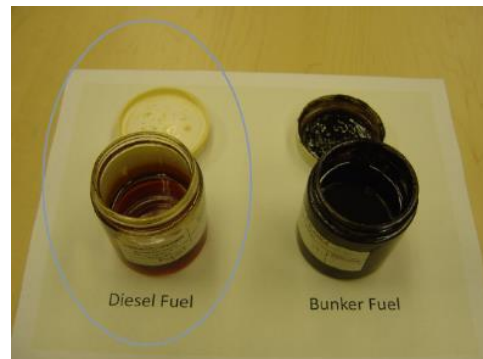
MARPOL Annex VI Regulations for the Prevention of Air Pollution from Ships

- **Baltic Sea area (SO_x only);**
- **North Sea area (SO_x only);**
- **North American area (entered into effect 1 August 2012 SO_x, NO_x and PM);**
- **United States Caribbean Sea area (entered into effect 1 January 2014 SO_x, NO_x and PM)**



Fueling the solution: there is no one-size-fits-all!

Primary Methods



☐ Low-sulphur fuels

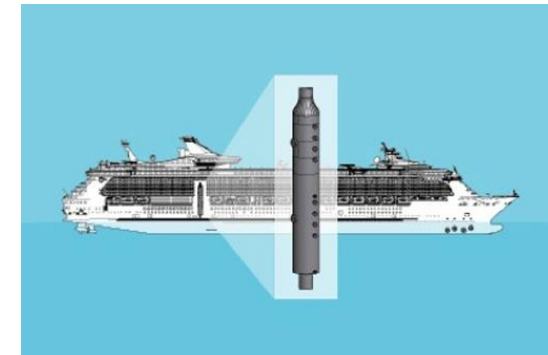
- Using low-sulphur FO or MGO (max 0.5%) globally and ultra-low-sulphur FO or low sulphur MGO (max 0.1%) in ECAs



☐ Gas or dual-fuel engines

- Using Liquefied Natural Gas (LNG) as fuel

Secondary Method



☐ Exhaust Gas Cleaning Systems

- Burning HFO (3.5%) with scrubber installed

But there is something in common... high cost!

Cost
of Measures about
50 billion USA dollars / per year



The Outline



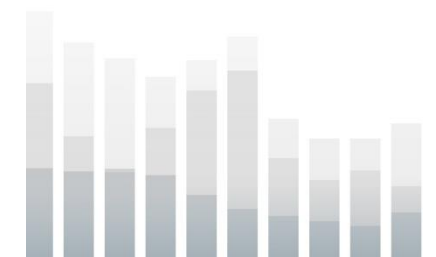
- What is it all about – The punch line

Compliant fuel oils – Primary Solution

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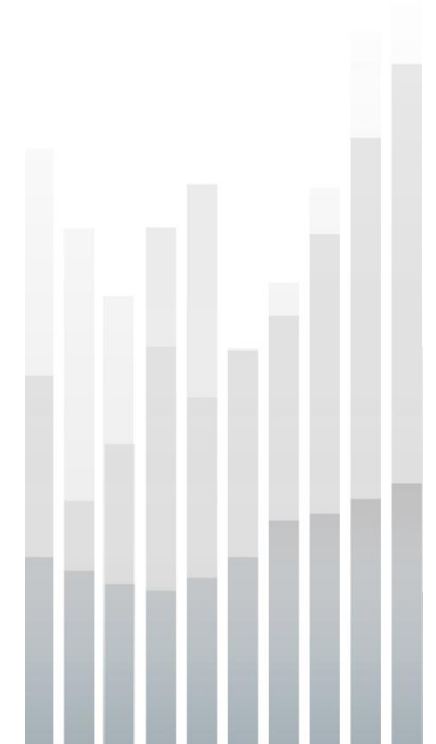
Refineries are adopting and evolving...

Fuel Types	Category	Viscosity Range (cSt)	Sulphur Content Range (%)	Price Range (\$)
IFO 180	Residual	180	1.0 – 3.5	470
HFO 380	Residual	380	1.0 – 3.5	435



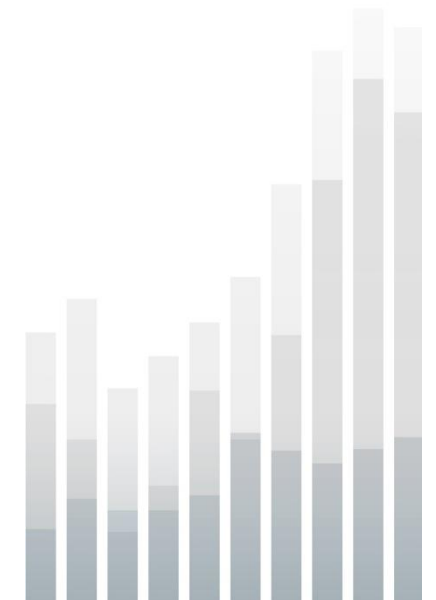
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Fuel Types	Category	Viscosity Range (cSt)	Sulphur Content Range (%)	Price Range (\$)
MDO	Distillate	10	0.1 – 1.5	630
MGO	Distillate	5	0.1 – 1	630
IFO 180	Residual	180	1.0 – 3.5	470
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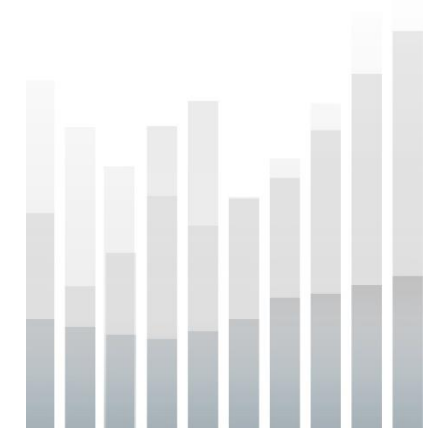
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MDO	Distillate	10	0.1 – 1.5	630
MGO	Distillate	5	0.1 – 1	630
0.1% HFO	Not standardized	70	< 0.1	610
0.5% HFO	Not standardized	70	< 0.5	6??
IFO 180	Residual	180	1.0 – 3.5	470
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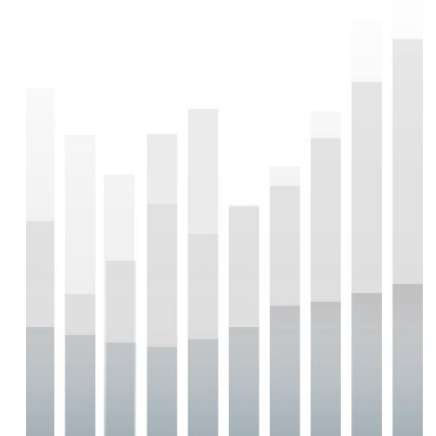
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Prices Fluctuate (July 2018 to March 2019)

Fuel Types	Category	Viscosity Range (cSt)	Sulphur Content Range (%)	Price Range (\$)
MDO	Distillate	10	0.1 – 1.5	630 / 580
MGO	Distillate	5	0.1 – 1	630 / 580
0.1% HFO	Not standardized	70	< 0.1	5?? / 570
0.5% HFO	Not standardized	70	< 0.5	5?? / 5??
IFO 180	Residual	180	1.0 – 3.5	470 / 450
HFO 380	Residual	380	1.0 – 3.5	435 / 410

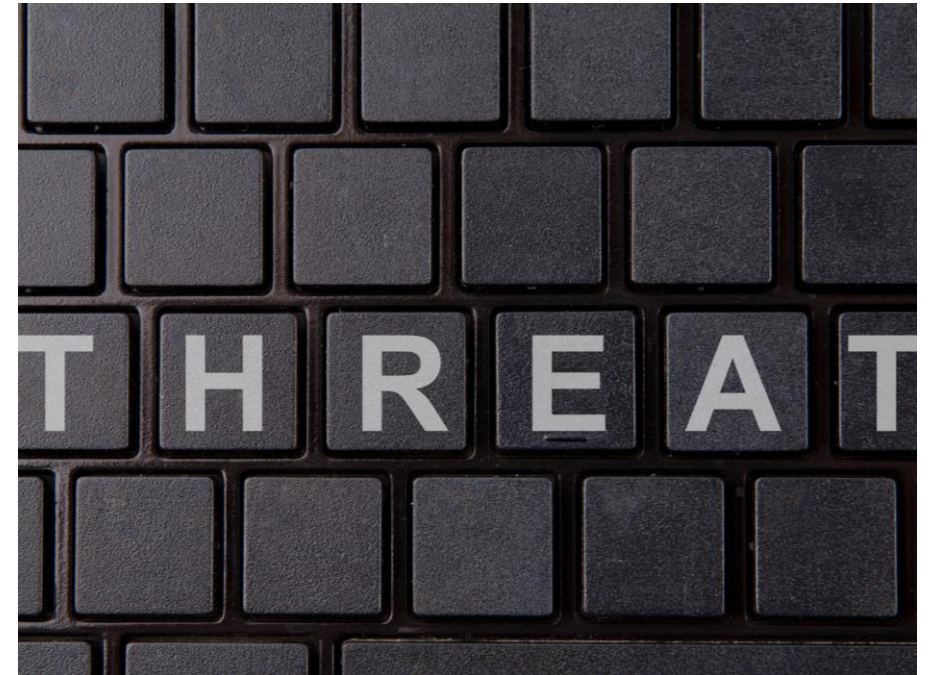


Beware...

Higher Cost of Fuel!

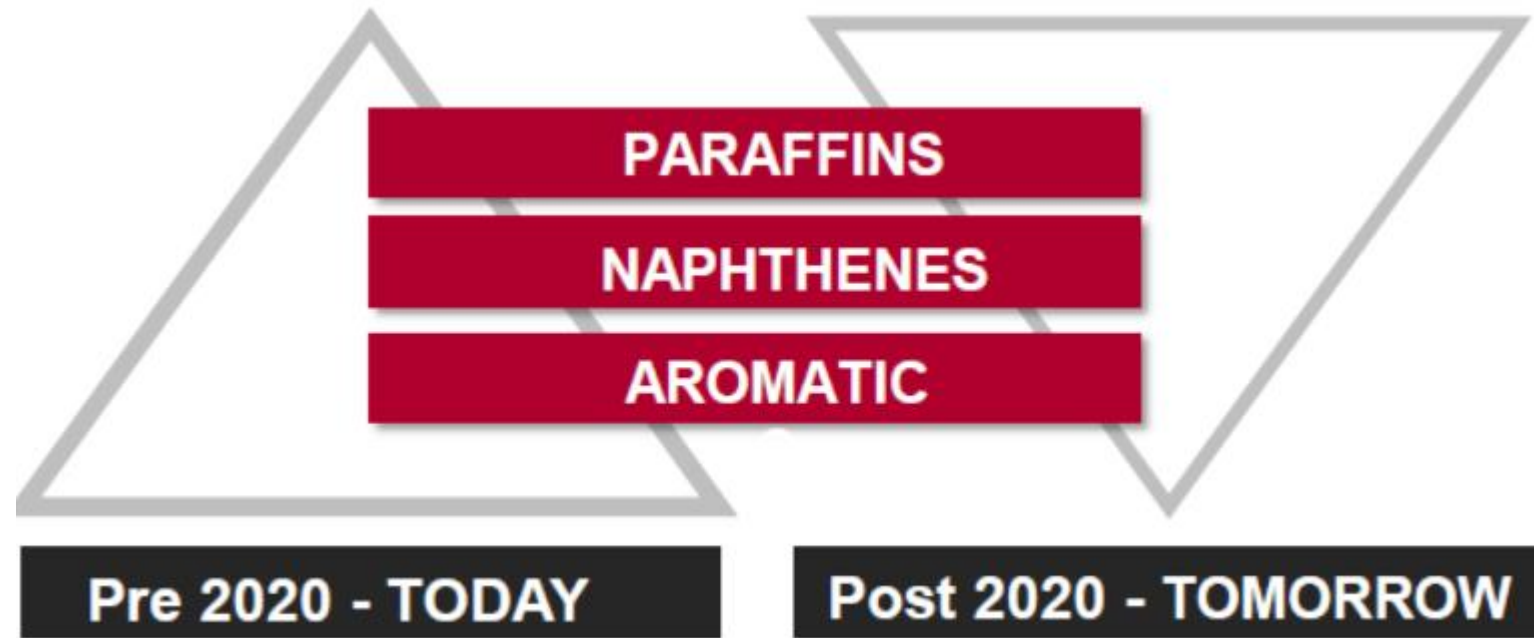
Threats due to...

- Instability
- Incompatibility
- Comingling of Fuels
- Cat Fines
- Cold Flow Properties - Pour Point
- Combustion Issues
- Flash Point



New fuels do not fit fully into either the Residual or Distillates grades of the ISO 8217 specification!

What will happen after 2020...



*Special to **thanks to Bill Stamatopoulos**, Business Development Manager South Europe, VeriFuel*

Incompatibility – Instability

- ❖ Refineries: Blending fuels for producing a **compliant** blend may sacrifice final product stability!
- ❖ Also final products with varying properties...

Huge variations in viscosity, density and cold flow properties

PRODUCTS	A	B	C	D	E
Density (kg/m ³)	911.6	955.2	942.3	920.5	950.4
Viscosity (cSt)	35.4	72.0	232	13	327.8
Pour Point (°C)	24	15	9	<21	<21
Min Storage temp (°C) for 800 cSt or lower	34	30	35	30	40
Temp (°C) separator	60	98	98	40	98
Temp (°C) for 12.5 cSt injection viscosity	82	100	126	51	133

Comingling of fuels

- ❖ When blending compliant **BUT** incompatible fuels with very different properties
- ❖ Lack of homogeneity
- ❖ As if mixing oil and water!
 - Excessive sludge formation
 - Stick fuel pumps
 - Centrifuges blocked
 - Clogged up filters
 - Reduce flow rate or even cut off fuel supply to engine



Cat Fines

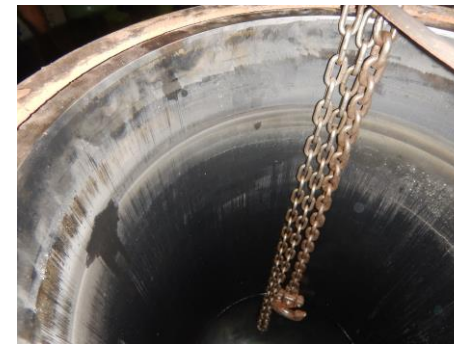
Small, hard, diamond-like particles in fuel, embedded in
Piston rings and cylinder liners

Accelerated wear in combustion chamber components:

- Cylinder liners
- Piston grooves
- Piston rings

Accelerated wear in fuel injection components:

- Fuel pumps (plunger and barrel)
- Fuel injection valves



Cold flow properties - Pour point Issues

Definition:

- The **Pour Point** is the **temperature** at which the paraffin in the fuel has crystallized to the **point** where the fuel gels and becomes resistant to flow

2020 fuels tend to have higher Pour Point:

- Wax formation
- Filters and equipment blocking
- Solid fuel

If heated, lower viscosity:

- Poor combustion
- Deposit formation
- Boiler damages
- Loss or engine power



Flash Point

Definition

- ❖ The lowest temperature at which Diesel vapors would ignite given an ignition source
- ❖ The lower the Flash Point, the easier to ignite!

Flash points below 60°C:

- The International Standard Organisation (ISO), warns that present Flash Point test for new 2020 fuels (especially BLENDS) could be UNRELIABLE!
- Increased fire / explosion risk



The Outline



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What is a scrubber?

- Main principle → **washing** the exhausts prior releasing to the atmosphere
- Converts SO_x to harmless sodium sulphate

3 Main Types:

- ❖ Open Loop
- ❖ Close Loop
- ❖ Hybrid

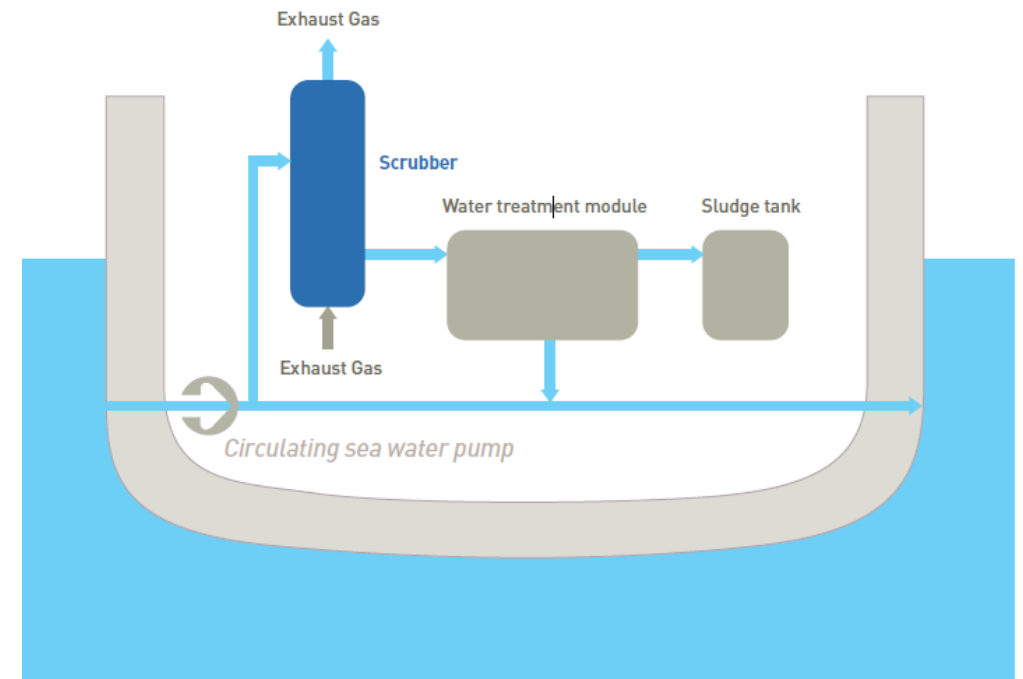


Open Loop: Uses untreated seawater and washwater is discharged at sea

- ✓ Untreated seawater of natural alkalinity (no need for chemical additives)
- ✓ Quite high pumping capability required
- ✓ Efficiency increases in higher alkalinity waters
- ✓ Washwater discharged into the sea after being treated

BUT

- ❖ Greater energy consumption compared to a close loop system
- ❖ Not permitted to discharge washwater everywhere

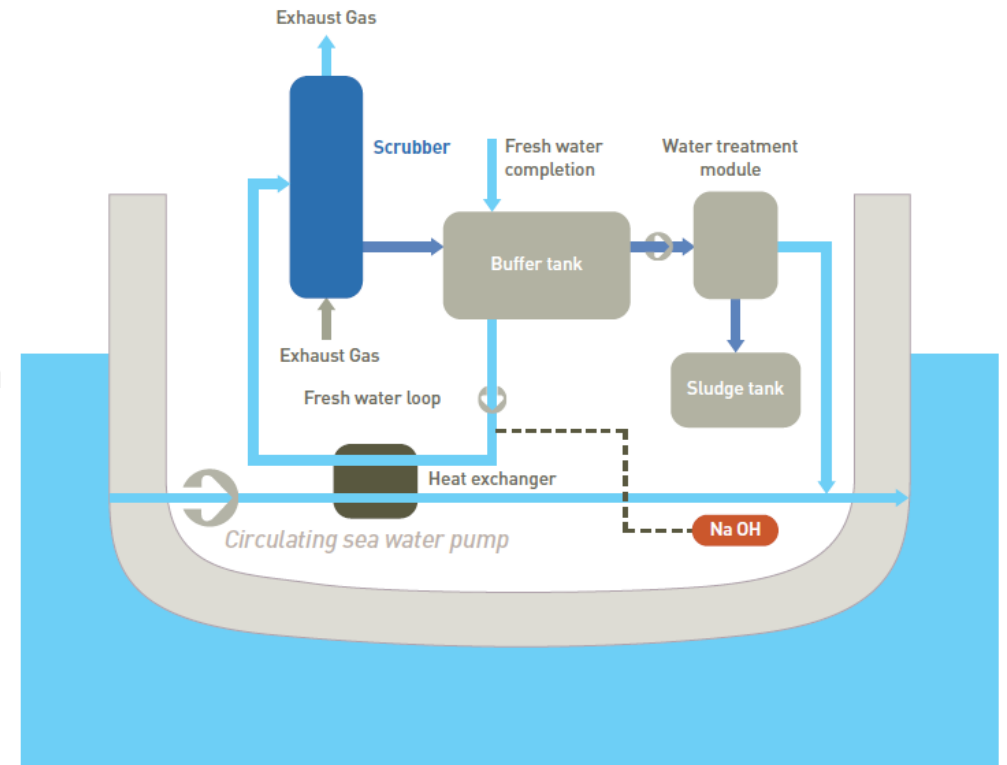


Closed Loop: Uses caustic soda and washwater is not discharged at sea

- ✓ Caustic soda added to fresh or sea water in a closed system (not dependent on the type of the water/alkalinity levels)
- ✓ Wash water passes into a process tank where it is cleaned before being recirculated with a small discharge overboard
- ✓ The amount of the water needed is about half of the flow in an open loop system

BUT

- ❖ More tanks are required and system is more complex than open

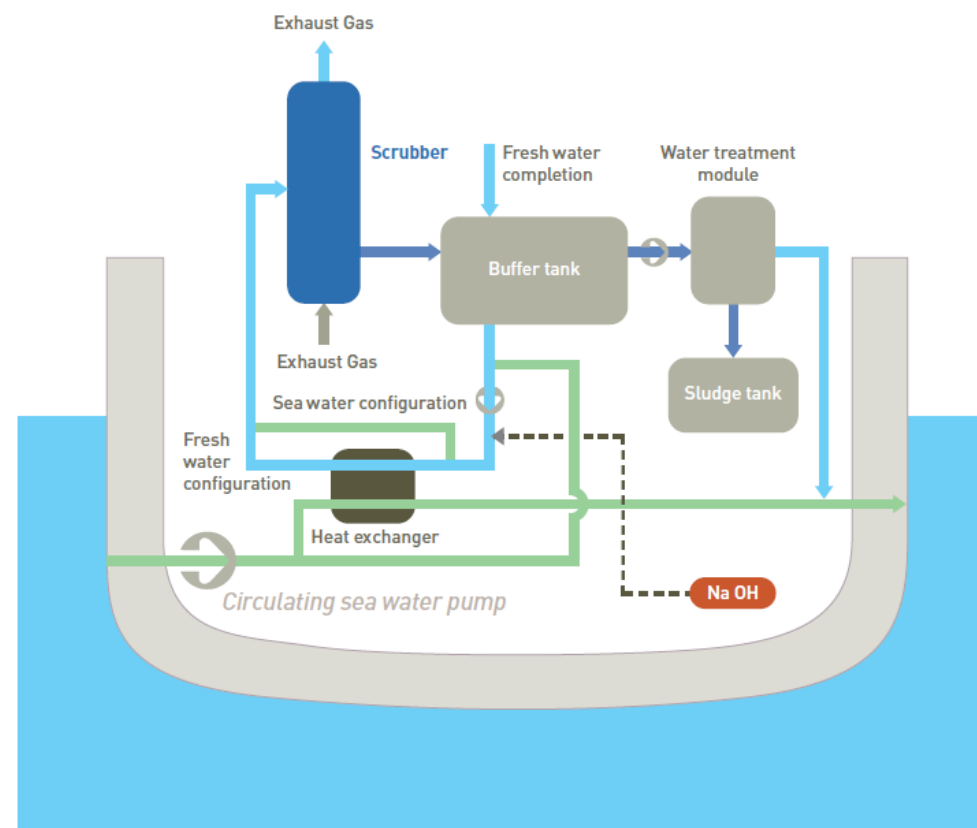


Hybrid: Combined open and closed loop

- ✓ Flexibility to either use closed loop or open loop technology
- ✓ Used as an open loop system when in open sea and as a closed loop system when in harbour
- ✓ Increasingly preferred given its flexibility

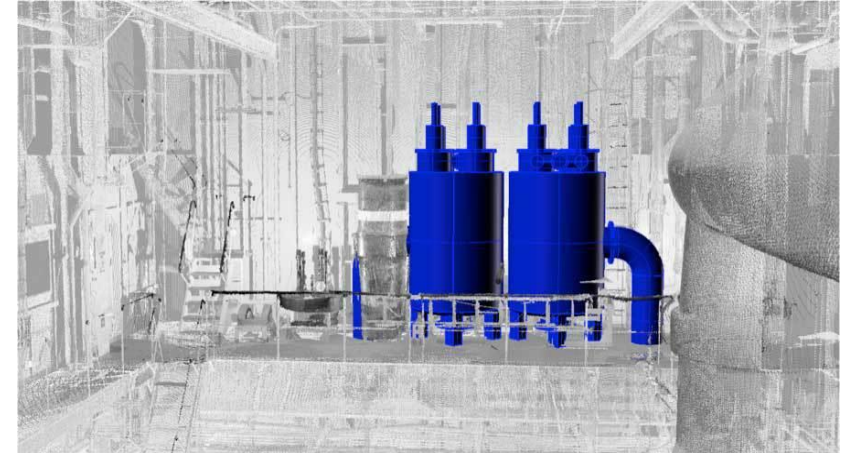
BUT

- ❖ Increased cost and more complex system than open & closed loop

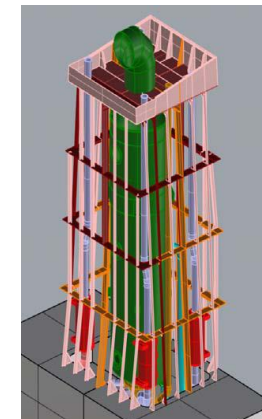


Which are the main parameters to consider when choosing system?

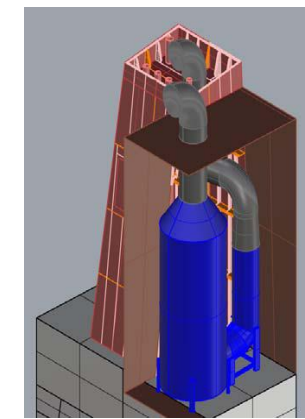
- ✓ Newbuilding vs retrofit
- ✓ Operating route
- ✓ Space availability onboard
- ✓ Capital vs operational costs
- ✓ Price differential between low sulphur and heavy fuel
- ✓ Sludge handling and disposal
- ✓ Availability of heavy fuel oil



In Line



U type



BUREAU
VERITAS

A prediction...



As per Wood MacKenzie,
by 2020 only 2-3% of
total fleet will have
installed scrubbers...

63% of Installed Scrubbers
are OPEN Loop...

Food for thought...

- If only 2-3% of vessels will have scrubbers, **will there be HFO readily available worldwide?**
 - ✓ Imagine a terminal having to maintain a bunkering barge only for such a small amount of clients for HFO
 - ✓ Big players with scrubbers will have contracts with terminals for HFO at a pre-agreed price
- If majority of scrubbers are open loop how can we ensure that **disposal will not be prohibited in the future** in areas, such as the Baltic, North Sea etc. ?

Port restrictions apply....

Ports or countries that ban open-loop scrubbers

- Singapore
- China
- Fujairah
- Norway
- Belgium (ports and inland waters)
- Dublin, Ireland
- Waterford Ireland
- Germany (inland waterways, canals and ports in inland waters)
- Californian ports and waters
- Connecticut ports and waters

On the other hand...

- Japan has ruled out open-loop scrubber ban

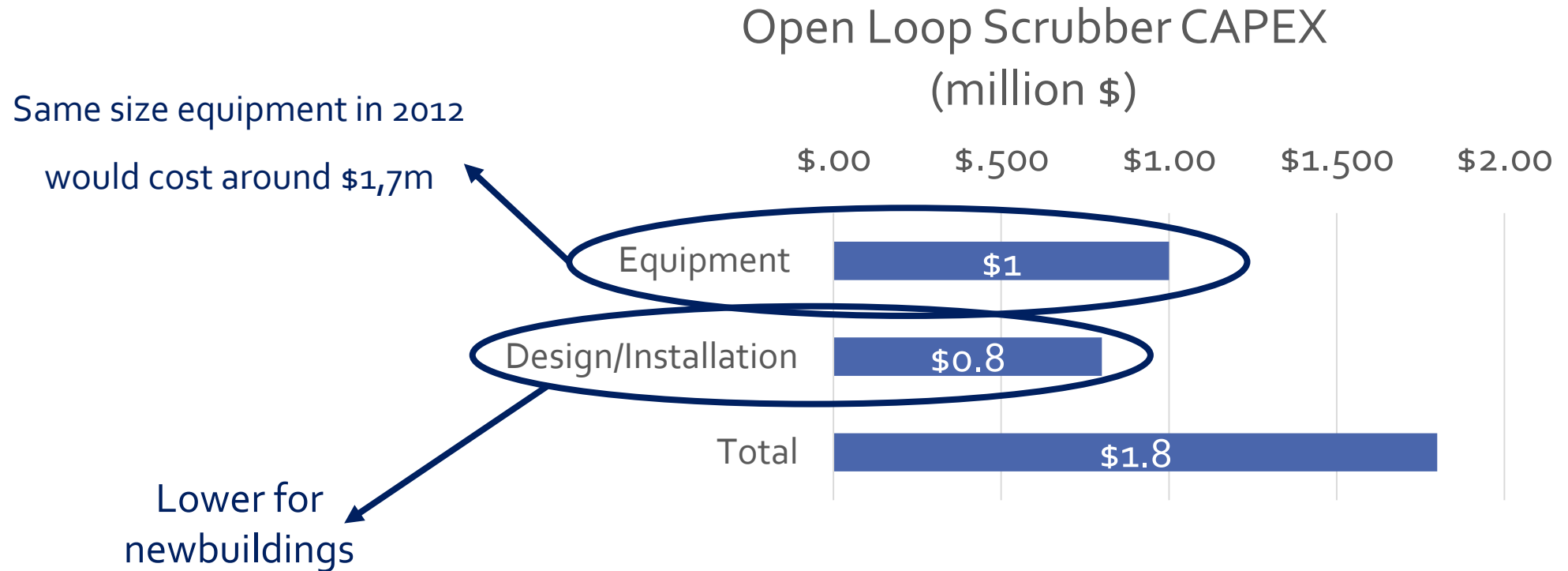
Port restrictions apply... things are VERY fluid

Singapore
ban imposed
end November 2018



Scrubbers Installation Costs

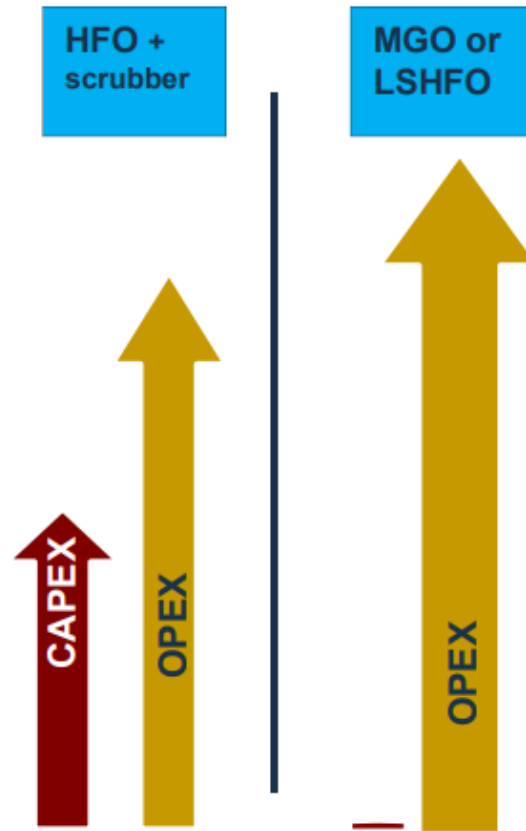
- ❖ Equipment prices have dropped significantly from the previous years
- ❖ Example for a Panamax Bulk Carrier **retrofit**



Case Study for MGO and Scrubbers

Reference vessel	Panamax Bulk Carrier		
Average Percentage Spent in SECA	20%		
Average Percentage Spent outside SECA	80%		
Fuel Cost Differential	\$150.00	\$200.00	\$250.00
Additional Yearly Costs if NO technology installed	\$759,000	\$1,012,000	\$1,265,000
Yearly Savings if Scrubber installed	\$938,750	\$1,255,000	\$1,571,250
Return period (years)	2	1.4	1

Overall Solutions Comparison



Source: Bureau Veritas

Companies are divided....

In favor of scrubbers



Still thinking about it...



The Outline



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Marine Claims Consequences

- Remedies
- Conclusions

Impact to the insurance market

Scrubbers

- **New machinery**
- **Water** in engine combustion chamber
- **LOH** for complex damages

- overheating damages similar to boilers
- machinery malfunction/damages
- idle vs expensive low sulphur fuels

Impact to the insurance market

MGO/MDO Advantages:

- ❖ Convenient and widely available
- ❖ Operational experience in industry
- ❖ Cleaner fuel – less machinery related malfunctions

vs

Compliant fuel oil blends:

- ❖ Low quality/out of spec bunker
- ❖ May contain cat fines as products of refinery streams
- ❖ Compatibility and stability issues
- ❖ Lubricity issues

Compliant low sulphur fuels

- Cat fines
- New blend of fuels / uncertainties
- Fuel incompatibility
- Different properties (viscosity, pour point etc.)

- main cause of machinery failures
- combustion issues
- sludge accumulation, dedicated tanks
- overheating, delicate changeover procedures

Beware...

More Combustion Related Claims!

The Outline

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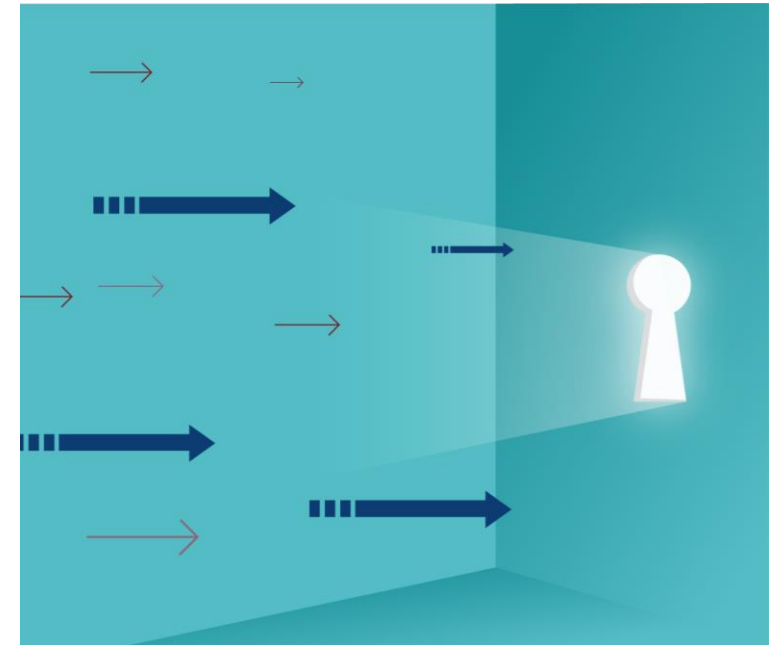
Remedies

- Conclusions



Are there any remedies?

- ❑ **Incompatibility – instability from supply**
 - Burn MGO only – cost issue!
 - Bunker from reputable bunker suppliers
 - Include detailed fuel specification, handling and sampling requirements in Charterparty Fuel clause
 - Always sample bunkers and assess lab results before using fuel



Are there any remedies?

- ❑ Incompatibility – resulting from comingling of fuels onboard
- ❑ Improper onboard handling – setting of combustion parameters

Fuel suppliers responsible for the stability of the delivered fuels

BUT

competency of the crew when mixing incompatible fuels from different suppliers/locations

or

not handling the fuel according to its specific parameters

- Increased bunker segregation – avoid mixing fuels from different suppliers in same tanks – always check compatibility before doing so
- Never mix at a ratio 50-50% - preferred ratio at least 3:1
- Develop specific onboard plans and procedures for fuel segregation, compatibility testing and handling

Are there any remedies?

❑ Cat Fines

- Appropriate settling at required temperatures
- Settling tanks drain / cleaning
- Efficient purification at correct temperatures / feed rate
- Appropriate selection of purifier disc based on fuel density
- Extra care with purification after encountering bad weather
- Careful monitoring of fuel filters
- Bunkers analysis in lab and analysis before and after purifier every 6 months or for elevated cat fines levels

Conclusion - Are there any remedies?

- Gas Oil
- Bunker suppliers
- F.O. sample testing
- Avoid mixing of bunkers
- Ultra-Correct Onboard Fuel Management Plan



Ultra-Correct Onboard Fuel Management Plan

- The Principle of “Safety Factor” in Engineering
- The Example of the Elevator Capacity Limit
- The “Safety Factor” will “excuse” human error (“Negligence”), misuse or abuse of the machinery
- Before 2020 – Safety Factor for errors / omissions in Fuel Management Plan was HIGH
- With “2020 Low Sulphur Fuels” the Safety Factor DECREASES – **Every mistake will hurt !!!**

Beware...

More Crew Negligence Claims!

The Outline



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Conclusions

Let's revisit this question...



To what extent do you consider that the 2020 IMO regulations will affect machinery related claims?

1. Reduce
2. Not Affect
3. Insignificant Increase
4. Considerable Increase

The MARGETIS MARITIME CONSULTING Guidelines



2020 Regulations for the Prevention of Air Pollution from Ships
 IMO MARPOL Annex VI
New Low Sulphur Fuel Oils Threats
 From a Surveyor's Perspective




Piraeus, 8th October 2018

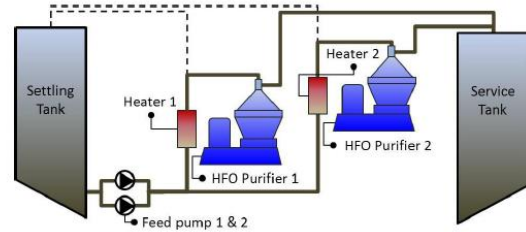
by
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On Board Fuel Oil Treatment Scheme
General Guidelines & Recommendations



Piraeus, 20th November 2018

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Some reading suggestions

Some conclusions and further food for thought...

1. Gas Oil versus New Very Low Sulphur Fuel Oil (0.5%)

- Big quality difference
- Currently moderate price difference
- Owners / Charterer will go for the less expensive
- Delicate handling required – New fuels still not categorized according to ISO 8217

2. Problems

- Cat Fines and extraordinary / accelerated wear
- Inappropriate onboard handling (combustion issues)
- Fires / explosions (flash point issues)
- Clogged injectors / pumps & engine stoppages (blends and comingling of fuels)

3. Remedies

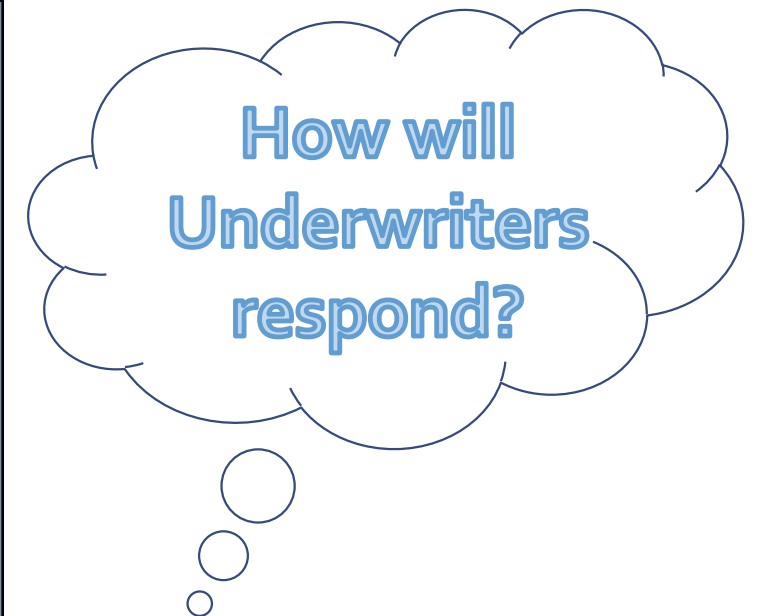
- Nothing entirely new, however necessity for Ultra-Correct Onboard Fuel Management Plan
- Delicate Procedures and Every Mistake will HURT!!

Further food for thought...

AFRAMAX TANKERS - SISTERSHIPS (10 YEARS OLD)

AFTER 1ST JANUARY 2020

<u>No Scrubber – Low Sulphur Fuels</u>	<u>Fitted with Scrubber – HFO</u>
Value: 20 Mil USD	Value: 23 Mil USD
<u>Issues Raising Risk</u> *Uncertainties with burning new Low Sulphur Fuels	<u>Issues Raising Risk</u> *New operational hazards / new piece of machinery equipment *Higher Insurance Value
<u>Issues Reducing Risk</u> *Lower Value *No New Machinery	<u>Issues Reducing Risk</u> *Experience / stability of old fashion fuels

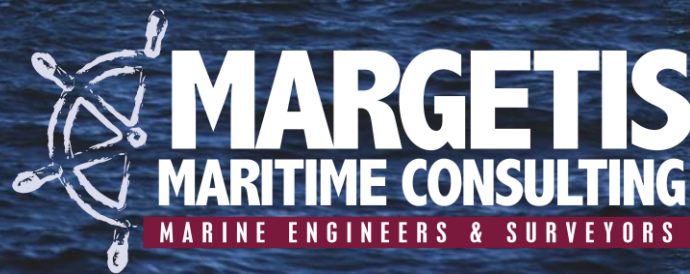


Our final word...

More Combustion Related Claims!

More Crew Negligence Claims!

Thank you!



GEORGE D. MARGETIS | Naval Architect & Marine Engineer *B.S.E., M.S.E. (MIT)*
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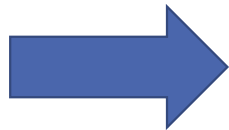
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