# IMO 2020
## JUNE 2019 UPDATE

National Oil Recyclers Association (NORA)

Denver Mid-Year Meeting

June 13, 2019

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MODERN FUELS

# IMO 2020 Imminent Market Shift

## "Largest shift in fuels since the change from coal to fuel oil" (Exxon – Mobil)

- Global rule set by International Maritime Organization in October 2016 stipulating a maximum of 0.5% sulfur fuels on high seas (for ships without scrubbers) as of 1/1/2020; it will not be delayed

- Creating "massive" demand shift to "cleaner" fuels over next 5 months

**OUT** High Sulfur Fuel Oil (HSFO 3.5%S, *aka* IFO 380, Bunker C, No. 6 Oil)

*Most ship owners not opting to install scrubbers yet (scrubbers utilize HSFO)*

**IN** Marine Gas Oil (MGO 0.1%S) *and* Very Low Sulfur Fuel Oil (VLSFO 0.5%S)

*Ship owners nervous about VLSFO product quality and compatibility*

*Many will opt for MGO, despite its higher cost*

- Limited Tankage

Many storage tanks will be re-purposed from dirty to clean over next 5 months

Tanks must be cleaned and bottom layer (heel) in tanks will require disposal

Musical chairs: *Who will utilize HSFO?*

# Demand for Higher Product Quality Changes Share

## Flight to highest product quality likely as market transitions

| *(millions of barrels per day)* | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| ***1. Demand*** | | | | | | | |
| (A) Marine high sulphur fuel oil | 3.4 | 3.5 | 1.4 | 1.2 | 1.1 | 1.1 | 1.1 |
| Of which: Scrubbers | 0.2 | 0.3 | 0.7 | 0.9 | 1.0 | 1.0 | 1.0 |
| Of which: Non-compliance | - | - | 0.7 | 0.3 | 0.1 | 0.1 | 0.1 |
| (B) Very low sulphur fuel oil | 0.0 | 0.0 | 1.0 | 1.4 | 1.6 | 1.7 | 1.8 |
| (C) Marine gasoil | 0.9 | 0.9 | 2.0 | 1.9 | 1.9 | 1.8 | 1.8 |
| (D) Inland fuel oil | 3.6 | 3.5 | 3.8 | 4.0 | 4.0 | 4.0 | 4.0 |
| (E) Inland gasoil | 27.7 | 27.9 | 27.9 | 28.0 | 28.1 | 28.2 | 28.4 |

*Source: IEA Oil 2019, Table 4.1, p. 118, released Market 12, 2019*

| Product | Sulfur Maximum % | millions of barrels per day | | Change 2020 VS 2019 | |
|---|---|---|---|---|---|
| | | Estimated 2019 | Forecasted 2020 | % Change | billions of gallons per year |
| High Sulfur Fuel Oil (HSFO) | <3.5% | 3.5 | 1.4 | **-60%** | -32.2 |
| Low Sulfur Fuel Oil (LSFO) | <1.0% | N/A | N/A | N/A | N/A |
| Very Low Sulfur Fuel Oil (VLSFO) | <0.5% | 0 | 1.0 | *inifinite* | 15.3 |
| Ultra Low Sulfur Fuel Oil (MGO*) | <0.1% | 0.9 | 2.0 | 122% | 16.9 |

* Generally targeted to <0.5% Emission Control Areas (ECA)

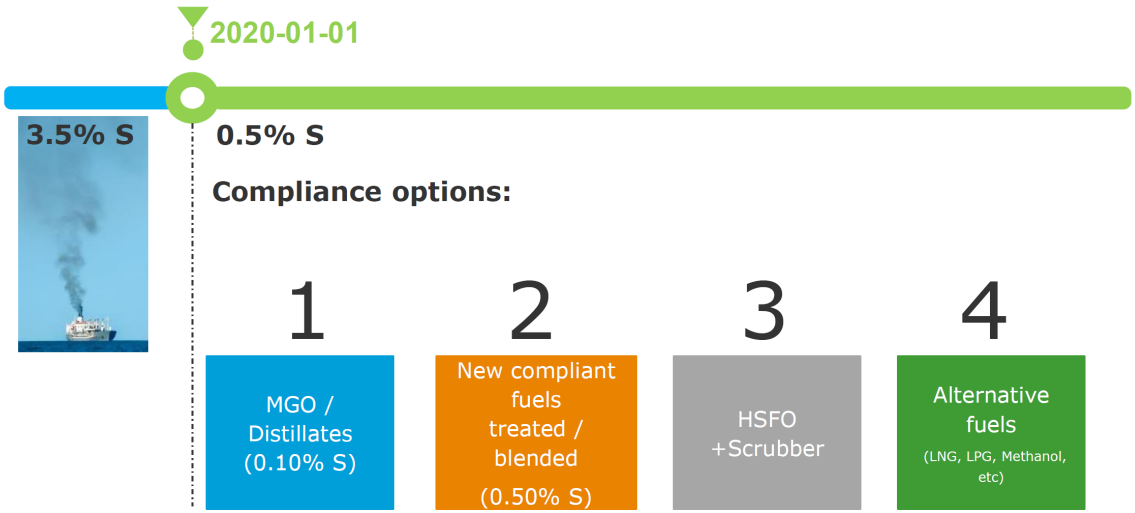
*Source: derived from IEA table above*

*Total used oil available worldwide is ~8.6 billion gallons per year (assumes ULO = 50% of base oil market). But demand decline for HSFO is forecasted to be about 4x the entire volume of available used oil.*

# Ship Owner / Operator Options

## Short-term and long-term decision making

- Which fuel option to choose to comply with IMO 2020?




- Vast majority of market has not chosen to add scrubbers (yet), and it is now too late for 2020

Ship owners and operators have choices, but still face extreme pricing, volume (availability), and regulatory uncertainty

# Product quality affects product value (June 3, 2019)

## MGO shows high premiums even to ULSD, whereas HSFO is valued below Brent

| Product & Region | $ | Spread Vs. WTI | | Spread Vs. Brent | |
|---|---|---|---|---|---|
| | | $ | % | $ | % |
| *MGO* | | | | | |
| MGO East Coast (7 ports) | $1.97 | $0.69 | 53% | $0.46 | 31% |
| MGO USGC (3 ports) | $1.92 | $0.63 | 49% | $0.41 | 27% |
| MGO West Coast (5 ports) | $2.11 | $0.82 | 64% | $0.60 | 40% |
| Average MGO | $2.00 | $0.71 | 56% | $0.49 | 33% |
| *ULSD* | | | | | |
| ULSD - NYH | $1.82 | $0.53 | 42% | $0.31 | 21% |
| ULSD - USGC | $1.75 | $0.46 | 36% | $0.24 | 16% |
| USLD - CARB CA | $1.88 | $0.59 | 46% | $0.37 | 25% |
| Average ULSD | $1.82 | $0.53 | 41% | $0.31 | 21% |
| *HSFO* | | | | | |
| HSFO/IFO 380 East Coast (7 Ports) | $1.54 | $0.25 | 19% | $0.03 | 2% |
| HSFO/IFO 380 USGC (3 ports) | $1.37 | $0.09 | 7% | -$0.14 | -9% |
| HSFO/IFO 380 West Coast (5 ports) | $1.43 | $0.14 | 11% | -$0.08 | -5% |
| Average HSFO/IFO 380 | $1.44 | $0.16 | 12% | -$0.06 | -4% |

| | | | | |
|---|---|---|---|---|
| MGO conversion ratio | 311 | gallons per metric ton | | |
| IFO 380 conversion ratio | 281 | gallons per metric ton | | |
| WTI Crude Oil | $1.29 | price per gallon or | $53.99 | per barrel |
| Brent Crude Oil | $1.51 | price per gallon or | $63.29 | per barrel |

Price Sources:

MGO & HSFO Prices: S&P Global/Platts

USGC & NYH ULSD Prices: CME Group Front Month

ULSD CARB CA price estimated at 13 cpg average premium to USGC ULSD from January 2 to June 3, 2019: US EIA

# HSFO still trades above historical levels because…

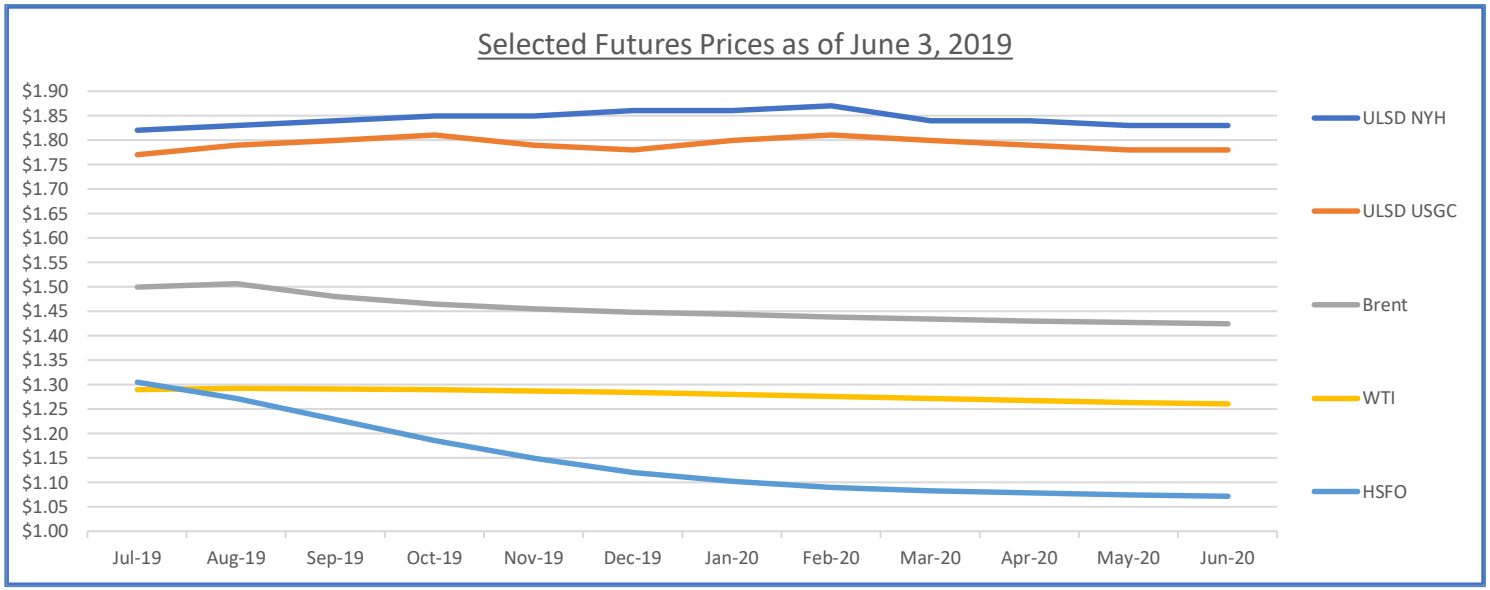
## 1. Crude oil slate is getting lighter and 2. Less heavy crude production from Venezuela

- Refineries shifting to lighter crude oil slates and producing less HSFO
- Venezuelan crude oil is heavy. Production decline driven by political and economic mismanagement
- Shipping demand for HSFO has not yet declined. So less supply and constant demand = higher prices
- HSFO demand will decline rapidly in later Q3 and Q4 2019 => producing *sharp* value drop near term
- As HSFO's value declines, traders and shippers will avoid holding HSFO inventory
- HSFO supply and availability may become spotty, especially in smaller ports (each port different)
- Some HSFO may be absorbed by power and asphalt markets – but markets are already in balance

*Who will hold inventories of HSFO or used oil targeted to HSFO market?*

# Futures prices indicate HSFO value is heading…. *down*

## CME Group futures price for HSFO 3% Fuel Oil versus crude oil moving down




| | Jul-19 | Aug-19 | Sep-19 | Oct-19 | Nov-19 | Dec-19 | Jan-20 | Feb-20 | Mar-20 | Apr-20 | May-20 | Jun-20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ULSD NYH | 1.82 | 1.83 | 1.84 | 1.85 | 1.85 | 1.86 | 1.86 | 1.87 | 1.84 | 1.84 | 1.83 | 1.83 |
| ULSD USGC | 1.77 | 1.79 | 1.80 | 1.81 | 1.79 | 1.78 | 1.80 | 1.81 | 1.80 | 1.79 | 1.78 | 1.78 |
| Brent | 1.50 | 1.51 | 1.48 | 1.46 | 1.46 | 1.45 | 1.44 | 1.44 | 1.43 | 1.43 | 1.43 | 1.42 |
| WTI | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.28 | 1.28 | 1.28 | 1.27 | 1.27 | 1.26 | 1.26 |
| HSFO | 1.30 | 1.27 | 1.23 | 1.19 | 1.15 | 1.12 | 1.10 | 1.09 | 1.08 | 1.08 | 1.07 | 1.07 |
| HSFO % of Brent | 87% | 84% | 83% | 81% | 79% | 77% | 76% | 76% | 76% | 75% | 75% | 75% |
| HSFO % of WTI | 101% | 98% | 95% | 92% | 89% | 87% | 86% | 85% | 85% | 85% | 85% | 85% |

Source: CME Group

ULO discounts to HSFO typically move inversely with HSFO prices. Lower HSFO prices = bigger ULO discounts to HSFO.

HSFO futures pricing indicates an 18% drop over next year (and from 87% to 75% of Brent)

But 60% drop in demand volume likely to have far greater impact on ULO

# Where *can* used oil go?

## Destination product quality and supply/demand balance contribute to used oil value pickup

1: These are relative values only, and it assumes ULO = 0
2: Relative values will vary over time and by geographic region
3: Regulatory factors often impact relative values over time
4: Technology selection can materially affect relative product values

| Hypothetical Example of Value Chain | | | | |
|---|---|---|---|---|
| Stage | Product | Points | Pickup | Source Basis |
| 1 | Used Lube Oil (ULO) Street Pickup | 0 | | 50 points off RFO |
| 2 | RFO (aggregated DW/DA ULO) | 50 | 50 | 60% to 80% of HSFO |
| 3 | High Sulfur Fuel Oil (HSFO) | 75 | 25 | 60% to 80% of Brent |
| **4** | **Very Low Sulfur Fuel Oil (VLSFO)** | **114** | **39** | **7:1 VGO/HSFO** |
| 5 | Vacuum Gas Oil (VGO 0.5%) | 120 | 6 | Argus |
| 6 | Ultra Low Sulfur Diesel Oil (ULSD) | 149 | 29 | Argus |
| **7** | **Marine Gas Oil (MGO)** | **150** | **1** | **Platts** |
| WTI | 83 | | | |
| Brent | 105 | *Pickup value from ULO street value to MGO = 150* | | |

Current processing by geographic locale also affects value pickup

# Assessing Prospective ULO Outlets

## Answers are becoming more clear

- Which product markets will have growing demand?

  *MGO and VLSFO*

- What product characteristics are necessary to meet the growing markets' requirements?
  *MGO specs are known, VLSFO specs will be coming soon*

- How can the target markets be accessed (directly or indirectly)?

  *ULO's traditional HSFO blend outlet forecasts imminent sharp decline, so what to do?*

| Stage | Product | Volume Change | Volume Direction | Price Direction (b) | ULO Suitability as Blendstock |
|---|---|---|---|---|---|
| 1 | Used Lube Oil (ULO) Street Pickup | small | steady | down | yes |
| 2 | RFO (aggregated DW/DA ULO) | small | steady | down | yes |
| 3 | High Sulfur Fuel Oil (HSFO) | huge | down | down | yes |
| 4 | Very Low Sulfur Fuel Oil (VLSFO) | huge | up | up | no |
| 5 | Vacuum Gas Oil (VGO 0.5%) (a) | small | up | tbd | no |
| 5 | Ultra Low Sulfur Diesel Oil (ULSD) | moderate | up | up | no |
| 6 | Marine Gas Oil (MGO) | huge | up | up | no |

(a) Assumes VGO derived from ULO.

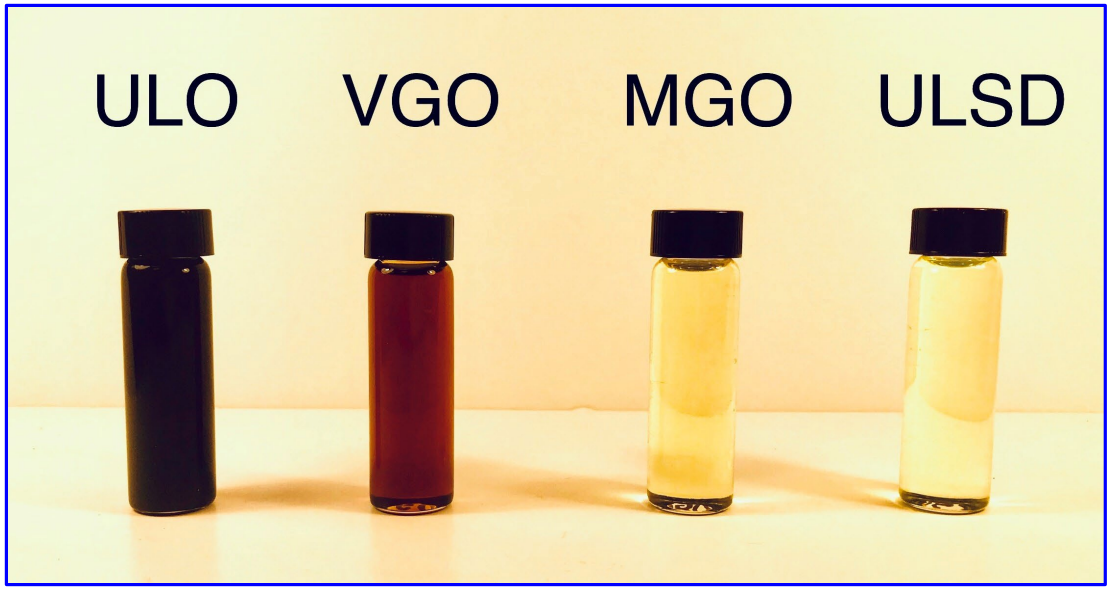
(b) Assuming crude oil prices are held constant.

*ULO needs to access upgrading capability to tap into high growth, high value markets*

# Product Visuals: ULO => VGO => MGO and ULSD

## Bright and clear product is often a proxy for higher quality

- Used Lube Oil (ULO) used for blending into HSFO. ULO typically sold as Recycled Fuel Oil (RFO)
- Vacuum Gas Oil (VGO) can be made from ULO via vacuum distillation
- Marine Gas Oil (MGO) quality far above VGO (color, chlorides, clarity, oxidation stability, TAN, etc.), with many properties similar to USLD, although higher in viscosity and sulfur
- Markets will seek lowest priced blend stocks, but will be very quality sensitive (especially initially)

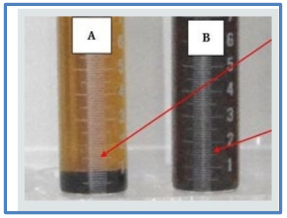


# Very Low Sulfur Fuel Oil (VLSFO)

## VLSFO is IMO 2020's target 0.5% product

- VLSFO will be derived from Straight Run Products or blends of VGO, residuals, and other streams

- Ship owners want straight run products. Many VLSFO blends will likely include "cats & dogs" (Bad Bunkers)




*Left sample shows separation, creating sludge and risking loss of engine power*

- Compatibility is king. Blending rule is "*like likes like*". <u>Many blend stocks will be "unlike"</u> Contrasting: residual vs. distillate, aromatic vs paraffinic, lower vs. higher viscosity and/or density

- Majors (Ex-Mo, Shell, BP, Chevron) leveraging brand names, global footprint, and balance sheets to gain share versus "risky independents" - ship owners fearful. ***Whose fuel do you trust in your ship?***

- VSLFO specs not yet released, and may be "loose" but for clause 5 ("fit for use" catch-all provision)

> **5.2** The fuel shall be free from any material at a concentration that causes the fuel to be unacceptable for use in accordance with Clause 1 (i.e. material not at a concentration that is harmful to personnel, jeopardizes the safety of the ship, or adversely affects the performance of the machinery).

*Source: ISO 8217:2017(E) Sixth edition 2017-03*

*VLSFO is a major unknown but uncertainty will drop quickly in 2020*

# VLSFO Blend Component Compatibility – Wild Wild West

## Compatibilities between components and stability of components are key

| | |
|---|---|
| straight run atmopsheric residue (HS or LS) | Residues from crude atmospheric distillation with no further processing |
| straight run vacuum residue (HS or LS) | Residues from crude vacuum distillation with no further processing |
| thermally cracked residues (HS or LS) | Residues from thermal cracking units (e.g. visbreaker unit, thermal gasoil unit) |
| catalytically cracked residues (HS or LS) | Residues from Fluid Catalytic Cracker (e.g. slurry oil) |
| hydroprocessed residues | Residues subject to sulfur reduction via hydrogenation |
| hydrocracker bottoms | Waxy residual stream from hydrocracker unit, coming from distillate feeds (e.g. VGO) |
| straight run atmosperic distillates | Distillate fractions from crude atmospheric distillation (e.g. straight run gasoil) |
| straight run vacuum distillates | Vacuum Gasoil from crude vacuum distillation (VGO) - also after mild hydrotreatment |
| thermally cracked distillates | Distillate fractions from thermal cracking units (e.g. VBU, TGU) |
| catalytically cracked distillates | Distillate fractions from Fluid Catalytic Cracker (e.g. LCO) |
| hydrocracked distillates | Distillate fractions from hydrocracker unit (no residues as feed) |
| hydrotreated distillates | Distillate fractions from hydrotreating unit |
| Pyrolysis Fuel Oil | Residue from ethylene cracker |
| Pyrolysis Gasoil | Gasoil fraction from ethylene cracker |
| Biocomponents | components coming from biomass processing (e.g. FAMEs, HVO, pyrolysed bio-oil) |
| Other | streams that do not fit the descriptions above |

Source: Concawe Blend Study

Blenders incur risk on each stream's affect on compatibility in making VLSFO

Small, inconsistent streams will be tested with respect to their suitability ***and*** economics

VGO's made from ULO must prove up ***both*** their compatibility ***and*** lack of contaminants

# Fuel Oil Contaminants! (example 1 Bad Bunkers)

## Know your supplier, know your constituents

- Fuel Oil Bunker Advisory Service (FOBAS) incidents expected to increase dramatically in near term
- Product liability risks are material as VLSFO will include a wide variety of blend stocks
- Retaining samples, testing, and good recordkeeping are all critical to reduce risks (CYA)
- Lawsuits and reputation risk
- Contaminants include chlorides, acidity, metals, FAME, etc.

### Glencore to Blame for San Antonio Bad Bunkers, says NuStar

Monday April 29, 2019

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**NuStar Energy** says **Glencore PLC** is to blame for alleged bad bunkers supplied last year to **Centurion Bulk Pte Ltd** (Centurion) chartered vessel *m/v San Antonio*.

NuStar says Glencore is to blame for bad bunkers. File Image/ Pixabay

As Ship & Bunker previously reported, earlier this month Centurion Bulk took legal action against NuStar for the March 15, 2018 stem, including in its claim a **FOBAS** Fuel Quality Investigation Report that opinioned the fuel did not meet ISO 8217 Clause 5 for being fit for purpose.

"On March 15, 2018, NuStar delivered **540.86 metric tons** of bunker fuel to the vessel *M/V SAN ANTONIO*. The fuel delivered by NuStar to that vessel was part of the fuel delivered by Glencore to NuStar," NuStar said in court documents filed last week.

*Source: shipandbunker.com*

*Full adherence to "common sense" practices key to managing new era risks*

# Fuel Oil Contaminants! (example 2 high acidity)

## Fuel Oil Bunker Advisory Service (FOBAS) - Lloyd's Register watchdog service

- Fujairah 3rd largest marine fuel port
- Recent acid testing on a number of fuels conveys acid test (TAN) levels higher than 0.12 (mg KOH/gram)
- ISO 8217 spec limit is max TAN 0.25, but…
- *"Past experience has shown some [high acid] components linked to severe operational problems, particularly around filters, injections pumps, and fuel injectors"*
- *"Vessels [should] test for…acid number … and confirm with suppliers they are supplying fuel in compliance with MARPOL Annex VI Reg 18.3 and ISO 8217 general requirements Clause 5.*

*Source for article and quotes: shipandbunker.com*

### FOBAS Alert: High Acid Number and Possible Contamination of Fuels in Fujairah

by FOBAS

Friday April 12, 2019

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Over recent weeks FOBAS has tested a number of fuels from **Fujairah** with elevated acid number (TAN). The tested TAN values were all well above the average for the port (0.12mgKOH/g).

Acid number can be a reflection of naturally occurring naphthenic acids in the fuel from the crude source or a reflection of contamination with acidic compounds. High acid number fuel due to naphthenic acids are common in certain parts of the world (although not previously Fujairah) and are not considered problematic during use. Fuels contaminated with extraneous acidic compounds however have been linked to many operational problems in the past. ISO 8217 recognises that presence of acids even if within the specified limits of ISO 8217:2010 i.e. 2.5 mg KOH/g, can cause operational problems if the acids present in fuels are not naturally occurring Naphthenic acids.

Investigative analysis using FTIR and GCMS test methods has been carried out on a selection of these fuels and the results show a mixed picture of contamination with low levels of certain fatty acids and phenols. Some of the specific compounds detected include 4 cumyl phenol, Bisphenol and commonly found fatty acids Palmitic and Stearic acids. All individual components have been found at low levels but in combination with a number of unidentified components the total concentration in some cases is much higher.

Past experience has shown some of these components have been linked with severe operational problems, particularly around filters, fuel injection pumps and fuel injectors. We would like to reiterate that any such contaminants even at low levels contravenes the stipulations of Revised MARPOL Annex VI regulation 18.3 and International Marine Fuel Standard ISO 8217, Clause 5.

Further to this for vessels bunkering at this port we would recommend as a precaution to test any HFO for its acid number if not already doing so as standard and confirm with suppliers that they are supplying fuel in compliance with MARPOL Annex VI Reg 18.3 and ISO8217 general requirements clause 5.

# MGO and VLSFO Product Quality

## Product must meet market requirements or it will take discounts or be non-marketable

- High volume & value IMO 2020 markets are MGO (near term) and VLSFO (long term)
- MGO's product quality very difficult to achieve (color, chlorides, oxidation stability, etc.)
- VLSFO may be blended product comprised of many and varied streams (very risky)
- VLSFO blending tests for compatibility, stability, sediment, and other qualities are key

| | | | | SELECTED MGO PROPERTIES | | | | | | SELECTED VLSFO PROPERTIES | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Stage | Category | Product | Color | Chlorides | Clarity | Compatibility <0.1% (ECA) | Compatibility <0.5% (2020) | Oxidation Stability | Ash | Metals | Sediment | Sulfur | TAN |
| ULO street => | 1 | Residual | Used Lube Oil (ULO) Street Pickup | - - - | - - - | - - - | nm | nm | nm | - - - | - - - | nm | + + | - - |
| | 2 | | RFO (aggregated DW/DA ULO) | - - - | - - - | - - - | nm | nm | nm | - - - | - - - | nm | + + | - - |
| | 3 | | High Sulfur Fuel Oil (HSFO) | - - - | - | - - - | nm | nm | nm | - | - | nm | - - - | - - |
| Objective => | 4 | Both | Very Low Sulfur Fuel Oil (VLSFO) | nm | tbd | nm | this is the standard | | nm | tbd | tbd | tbd | + + + | tbd |
| | 5 | Distilled | Vacuum Gas Oil (VGO 0.5%) (a) | + | - - | - - - | - - - | - - - | - - - | + + + | + + | + + | + + + | + |
| | 6 | | Ultra Low Sulfur Diesel Oil (ULSD) | + + + | + + + | + + + | varies * | varies * | + + + | + + + | + + + | varies * | + + + | + + + |
| Stop gap => | 7 | | Marine Gas Oil (MGO) | + + | + + + | + + + | varies * | varies * | + + + | + + + | + + + | varies * | + + + | + + + |

(a) Assumes VGO derived from ULO.

(b) Assuming crude oil prices are held constant.

** Compatibility and Sediment characteristics of ULSD and MGO vary with respect to their suitability with other VLSFO blend stocks*

Key: + is good, + + + is best
- is bad, - - - is worst
nm is not meaningful
"varies" means VLSFO blend dependent
"tbd" means standard or guideline is unknown

# Singapore – Reading the Tea Leaves

## Singapore is where IMO 2020 is heading as Singapore already trading 0.5% sulfur product

- Singapore consumes as much fuel oil as the next 8 largest ports combined
- China already implemented 0.5% limit on 1/1/2019 so Singapore has a 0.5% VLSFO market today
- Singapore has banned open loop scrubbers, thus prohibiting scrubber waste water discharge (many other ports may follow suit)
- Singapore imprisons regulation violators (often)
- Many port authorities worldwide collaborating on compliance procedures and tracking violators
- Many port authorities happy to allow US Coast Guard to police compliance (radio ahead to place BOLOs on inbound cheaters)

| Rank | Port | Volume mm mt/y | Cumulative Non-Singapore |
|---|---|---|---|
| 1 | Singapore | 50.0 | |
| 2 | ARA | 18.5 | 18.5 |
| 3 | Fujairah | 9.0 | 27.5 |
| 4 | Algeciras & Gibralter | 7.2 | 34.7 |
| 5 | Busan | 4.0 | 38.7 |
| 6 | Zhousan | 3.6 | 42.3 |
| 7 | Panama | 3.5 | 45.8 |
| 8 | Hong Kong | 2.5 | 48.3 |
| 9 | Houston | 2.2 | 50.5 |
| 10 | LA/Long Beach | 2.0 | 52.5 |
| 11 | Shanghai | 1.8 | 54.3 |
| | Total | 104.3 | |

Source: Argus Estimate

| Singapore Values (June 7, 2019) | | | |
|---|---|---|---|
| Product | $ / MT | $ / Gal. | Conversion * |
| MGO | $557 | $1.79 | 311 |
| VLSFO * | $510 | $1.66 | 307 |
| IFO 380 | $390 | $1.39 | 281 |
| Brent | n/m | $1.51 | n/m |
| WTI | n/m | $1.29 | n/m |
| * Assumed VLSFO MGO:IFO 380 Blend Ratio: 6 | | | |
| *VLSFO premium to WTI is* | *$15.78* | *per barrel.* | |

Source: S&P Global/Platts

# Non-compliance *(new US Government revenue source)*

## Cheating is unlikely to succeed, and carries very high costs for failure

- Bunker Records Requirements: Oil Transfer Process (33 CFR 155,750), Technical Files, Engine Book of Parameters, Bunker Delivery Notice (18.3 of MARPOL Annex VI) w/3 years retention, Fuel Changeover Plan

- EPA and US Coast Guard MOU: Active collaboration with civil penalties of $25,000 per day plus criminal liabilities under Act for the Prevention of Pollution from Ships (APPS) under 33 USC Sec §§ 1901 *et seq*

- Criminal Statutes: APPS (33 USC Sec §§ 1901), False Statement Act (18 USC §1001), Conspiracy (18 USC §371), Obstruction of Justice (18 USC §371), Tampering with Witnesses (18 USC §1512), Sarbanes-Oxley Act of 2002 (18 USC §1519)

- US Enforcement Tactics: Hardnose interviews, indefinite detention, delay of crewmembers' parole

- Whistleblower Rewards: Under 33 USC 1908(a), court discretion allows for up to ½ of fine to be paid to providers of information leading to conviction

- Very hard not to know of fuel violations. For violators who know, cost of non-compliance skyrockets

*Fuel violations have already been settled at $3 million and $40 million*

# Ship Owner and Ship Operator Decision Challenges

## A number of major concerns all hitting at once

- How do I transition out of existing HSFO inventory (de-bunker) during changeover?
- Where can I source IMO 2020 compliant fuel in each port of call?
- How can my ship be operated safely using the available IMO 2020 compliant fuel at each port of call?
- What testing and personnel training procedures must be implemented to operate safely?
- How do I document sourcing only IMO 2020 compliant fuel?
- Can I absorb or pass on a massive increase in fuel costs (applies only to ships without scrubbers)?
- Should I add scrubbers?

Owning and operating ships is about to change *drastically* and many uncertainties still remain

# Wild Cards (exogenous factors)

## Marine fuels affected by wide variety of variables

- Global economic growth – changes in Gross Domestic Product (GDP of China and US key drivers)
- Crude oil prices – supply and demand balance (fracking vs. new/restored supply)
- Trade wars – effect on shipping and global GDP growth
- Shooting wars – constraints on Middle East (Iran, Strait of Hormuz)
- Regulatory Change – open loop scrubber bans, outright scrubber bans, future $NO_x$, $SO_x$, $PM_{(2.5?)}$, $CO_2$
- Acts of Terror – pipelines, ships, and ports, attempts to destroy infrastructure and/or political stability
- Strategic Plays – China's "Belt & Road" initiative (new economic corridors), Northwest (Arctic) passage
- Venezuela – restored production will eventually increase heavy crude oil supply (leads to more HSFO)
- Financial Markets – ship owner / operator access to capital as fuel costs skyrocket

*Current range of uncertainties may mitigate or enhance IMO 2020's effect on marine fuels*

# Strategies and Comments

## ~6 months to D-day for Marine Fuels, with less than 4 months for changeovers to start

- Seek higher valued outlets, preferably long term and sustainable (improved distillates)
- Minimize exposure to HSFO outlets or to blenders utilizing ULO to make HSFO
- Be very careful about ULO based VLSFO traders – ULO contaminants could cause skittish buyers and product liability risks are enormous
- Educate the generators (quick lube shops, etc.) that "*Winter is coming*"
  - IMO 2020 will bring very cold winds with a Tsunami of HSFO oversupply
  - Where will ULO even be placed in the future?
  - ULO street pricing must adjust rapidly to allow gatherers to survive
- Can large aggregators pick up slack? Will large fuel oil traders create cargos of ULO/RFO?

*Nature abhors a vacuum and markets will adjust*

*New solutions will emerge over time*