



IMO 2020 0.5% Sulphur

Bunker Sampling

Jörg Larink

Technical Fleetmanager

Combi Seminar 2019



What problems you have had with fuels:

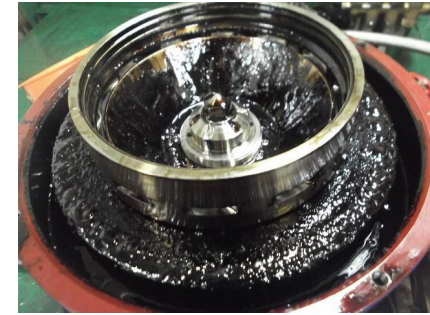
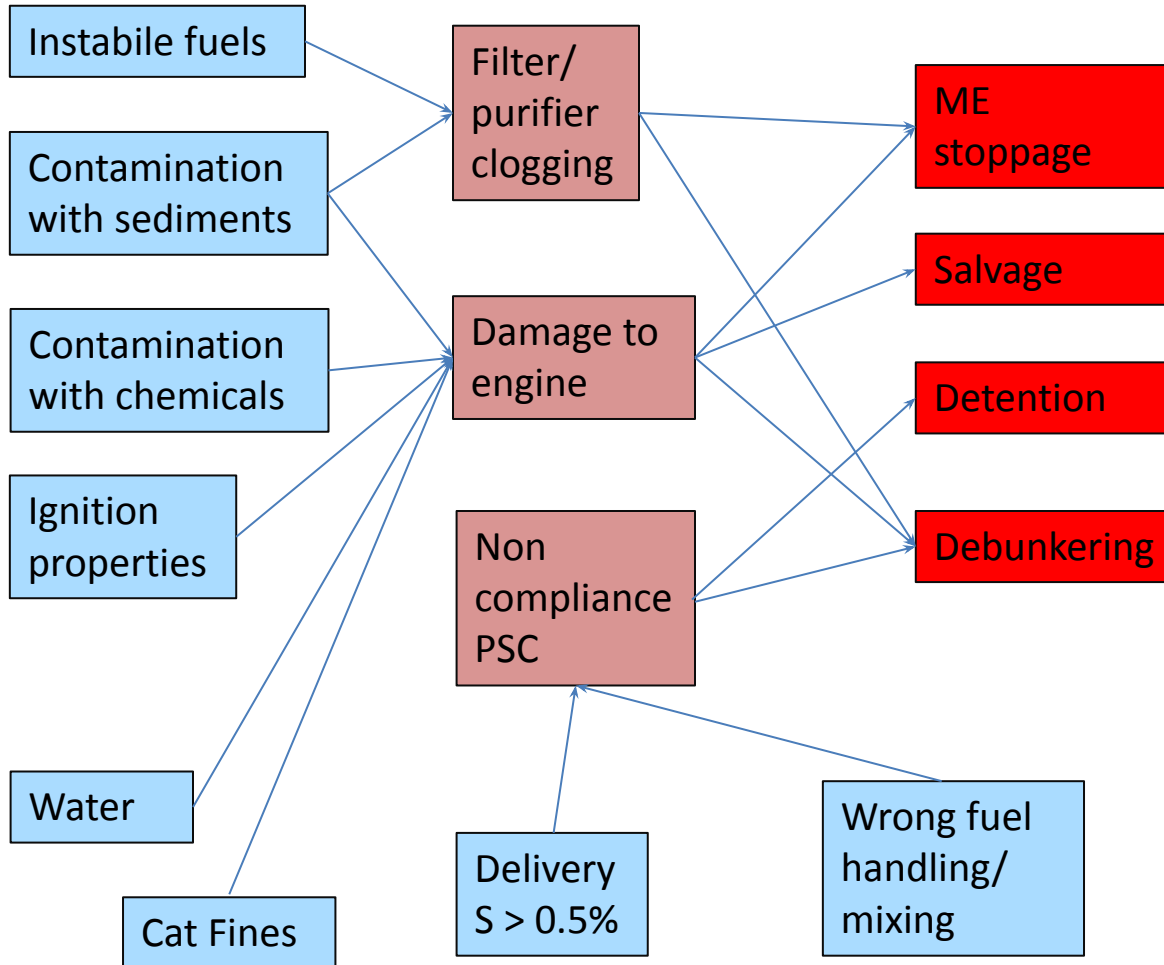
- during bunkering?
- with the quality of bunkers?
- with authorities e.g. PSC



Each participant should
fill out 2 cards



Marine Fuel a black box?

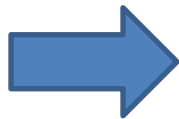




General

- From the 01.01.2020 the global sulphur limit will be 0.5% inlet engines!
- No grace periode
- No HFO can be stored on board after 01.03.2020

Dokument:



***Global Sulphur Cap 2020
Ship Implementation Plan***



IMO 2020/ Definition of fuels

ISO 8217 Specification

RM = Residual Fuels (HFO)
 DM = Distillate Fuels (MGO / MDO)

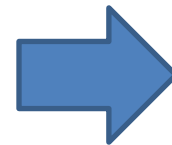
Blends = Mix of RM + DM only by supplier
Hybrids = Side product, which have either RM or DM spec

General definition

MGO = Marine Gas Oil
 MDO = Marine Diesel Oil
 HFO = Heavy Fuel Oil
 FO = Fuel Oil

Sulphur limits

HS (high sulphur) 0,5 % < 3,5 % sulphur
 VLS (very low sulphur) 0,1 % < 0,5 % sulphur
 ULS (ultra low sulphur) < 0,1 % sulphur



In future you will receive many different types of fuel!

Table 2 – Residual marine fuels

Characteristic	Unit	Limit	Category ISO-F:										Test method reference	
			RMA	RMB	RMD	RME	RMG					RMK		
			10*	30	80	180	180,0	380,0	500,0	700,0	380,0	500,0	700,0	
Kinematic viscosity at 50 °C ¹	mm ² /s	max.	10,00	30,00	80,00	180,0	180,0	380,0	500,0	700,0	380,0	500,0	700,0	ISO 3104
Density at 15 °C	kg/m ³	max.	920,0	960,0	975,0	991,0	991,0					1010,0	see 7.1 ISO 3075 or ISO 12185	
CCAI	—	max.	850	860	880	860	870					870	see 6.3 a)	
Sulfur ²	mass %	max.	Statutory requirements										see 7.2 ISO 8754 ISO 14596	
Flash point	°C	min.	60,0	60,0	60,0	60,0	60,0					60,0	see 7.3 ISO 2719	
Hydrogen sulfide ³	mg/kg	max.	2,00	2,00	2,00	2,00	2,00					2,00	IP 570	
Acid number ⁴	mg KOH/g	max.	2,5	2,5	2,5	2,5	2,5					2,5	ASTM D664	
Total sediment aged	mass %	max.	0,10	0,10	0,10	0,10	0,10					0,10	see 7.5 ISO 10307-2	
Carbon residue: micro method	mass %	max.	2,50	10,00	14,00	15,00	18,00					20,00	ISO 10370	
Pour point (pppt) ⁵	winter quality	°C	max.	0	0	30	30					30	ISO 3018	
	summer quality	°C	max.	6	6	30	30					30	ISO 3018	
Water	volume %	max.	0,30	0,50	0,50	0,50	0,50					0,50	ISO 3733	
Ash	mass %	max.	0,040	0,070	0,070	0,070	0,100					0,150	ISO 6248	
Vanadium	mg/kg	max.	50	150	150	150	350					450	see 7.7 IP 901, IP 470 or ISO 14597	
Sodium	mg/kg	max.	50	100	100	50	100					100	see 7.8 IP 501 IP 470	

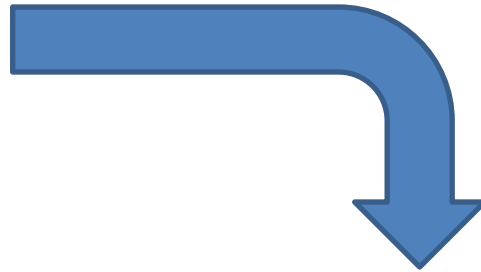


What is exactly crude oil?

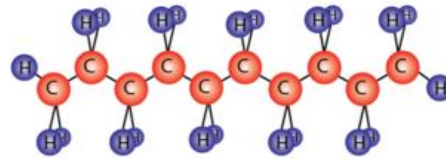
Crude oil is a mixture of organic molecules, characterized by paraffins, naphthenes, aromatics

Chemical Elements

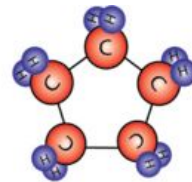
Carbon — 83 to 85%
Hydrogen — 10 to 14%
Nitrogen — 0.1 to 2%
Oxygen — 0.05 to 1.5%
Sulfur — 0.05 to 6.0%
Metals — < 0.1%



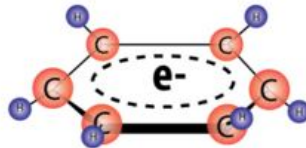
The elements are stored in different type of molecules



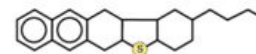
Paraffin



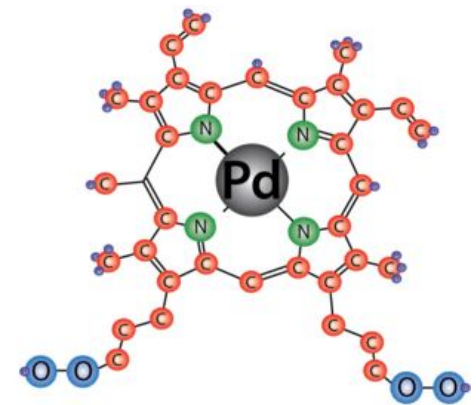
Naphthene



Aromatic



Resin

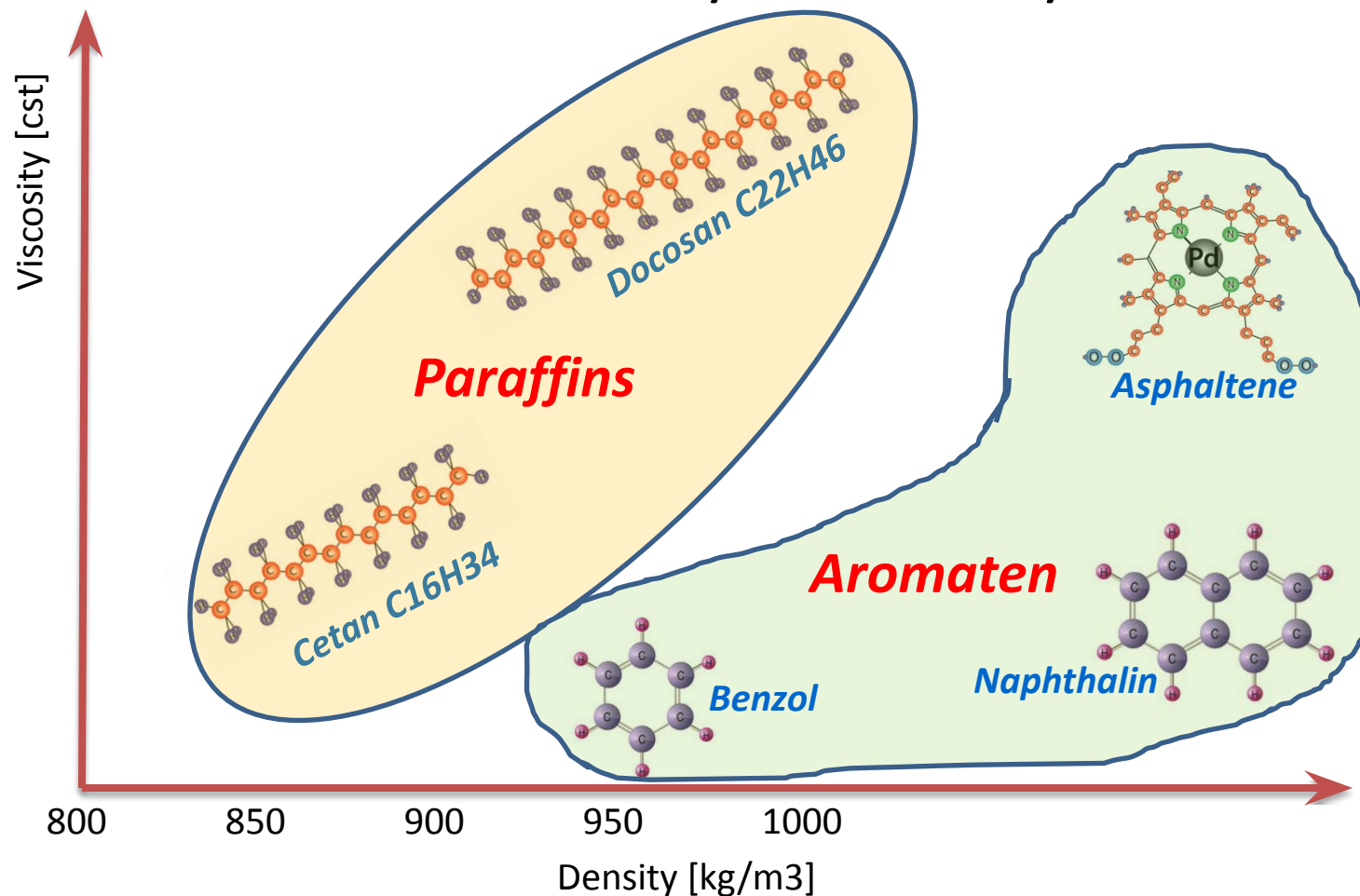


Asphaltene



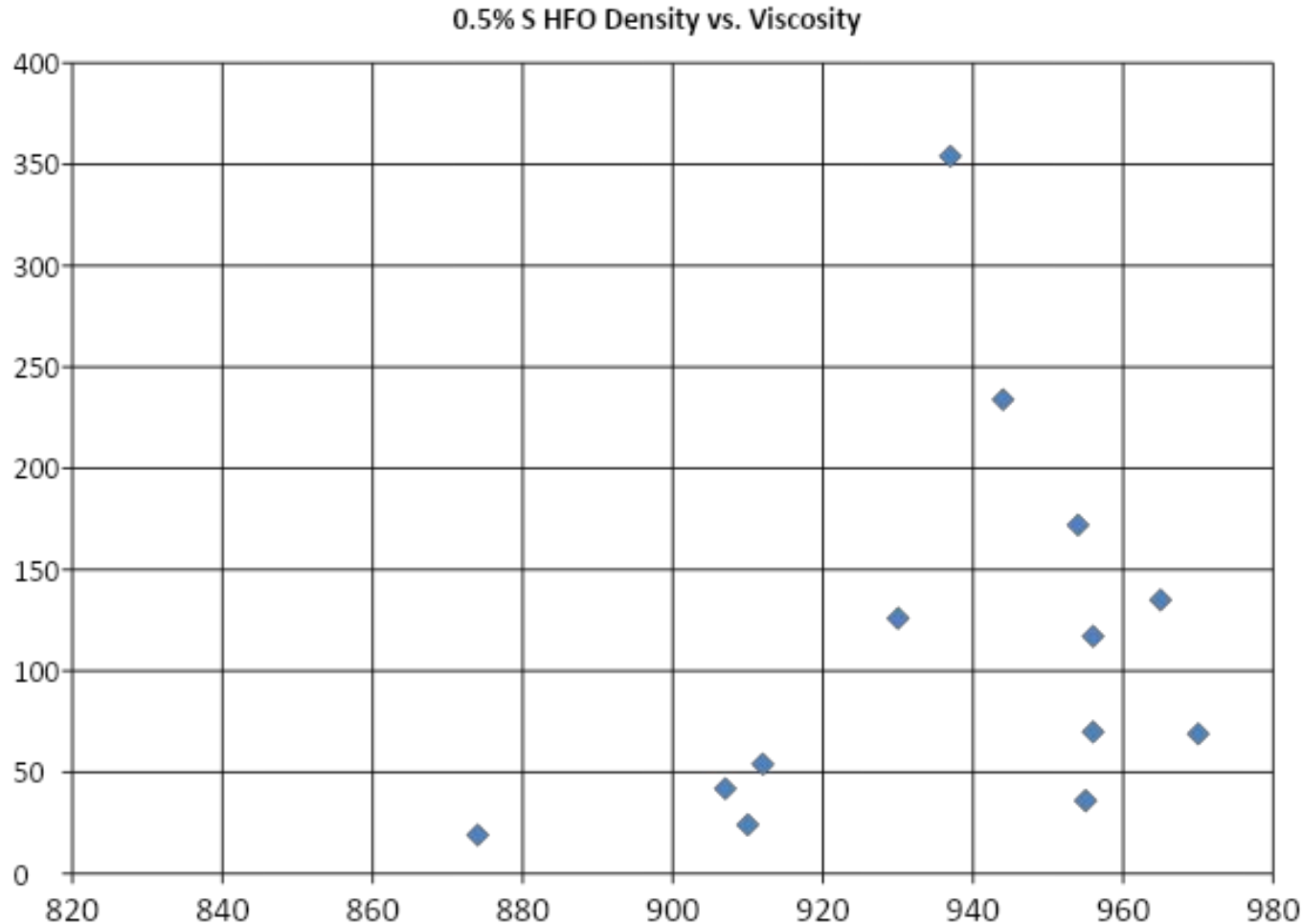
Most important parameters of 0.5% S Fuel

Density vs Viskosity





Most important parameters of 0.5% S Fuel





Best praxis categorisation of 0.5% S fuel

Class A: More Aromatics Fuels

- A blend with high content of residues from cracking
- High density and low viscosity □ High CCAI
- Potentially unstable due to high content of asphaltene
- Existence of Cat fines



Fuels with high density and low viscosity most unstable fuel!

Class B: More Paraffinic Fuels

- A blend with high content of long paraffinic chains
- Low density and higher viscosity □ Middle CCAI
- Stable fuel

Class AB: Straight Run Fuels (also called hybrid fuels)

- A the residue product of the first distillation (Atmospheric)
- The used crude oil has very low sulphur
- Medium density and medium viscosity
- Quite stable fuel



FUEL FORMULATIONS



Typical LSFO derived from a LS Crude

Parameter	Result	Units	Spec Limit
Viscosity (50°C)	301.8	cSt@50°C	380.0 max
Density	954.2	kg/m³@15°C	991.0 max
CCAI	818	Index #	
Sulphur	0.43	% mass	3.50 max
Flash Point	64.0	°C	60.0 min
Acid Number	1.03	mg KOH/g	
Total Sediment	0.03	% mass	0.10 max
Micro Carbon Residue	8.81	% mass	18.00 max
Pour Point	-9	°C	30 max
Water	0.15	% vol	0.50 max
Ash	0.021	% mass	0.150 max
Vanadium	12	mg/kg	300 max
Sodium	12	mg/kg	
Aluminium plus Silicon	44	mg/kg	80 max
Net Specific Energy	41.50	MJ/kg	
Calcium	20	mg/kg	
Zinc	1	mg/kg	

"New VLSFO"

Parameter	Result	Units	Spec Limit
Viscosity (50°C)	397.1*	cSt@50°C	380.0 max
Density	979.0	kg/m³@15°C	991.0 max
CCAI	839	Index #	
Sulphur	0.46	% mass	0.50 max
Flash Point	>70.0	°C	60.0 min
Acid Number	<0.20	mg KOH/g	
Total Sediment	0.02	% mass	0.10 max
Micro Carbon Residue	13.38	% mass	18.00 max
Pour Point	+12	°C	30 max
Water	0.10	% vol	0.50 max
Ash	0.076	% mass	0.150 max
Vanadium	24	mg/kg	300 max
Sodium	36	mg/kg	
Aluminium plus Silicon	19	mg/kg	80 max
Net Specific Energy	41.15	MJ/kg	
Calcium	15	mg/kg	
Zinc	2	mg/kg	

Source: Intertek, Mr. Green, Presentation 2020 – THE FINAL STAGES

IMO 2020/ Definition of fuels/ Examples



CHINA FUELS

0.50% M/M SULPHUR VLSFOS



Test Parameters	D@15	V@50	S%	FLASH	CCAI	ACID	TSA	MCR%	POUR	H2O%	ASH%	V	NA	AL+SI	AL	SI	CA	ZN	P	FE	NI	C/VAL
	969.2	61.35	0.42	>70.0	852	0.2	0.01	2.53	21	0.05	0.02	3	2	44	17	27	6	<1	<1	6	3	41.34
	958.4	85.87	0.51	>70.0	837	0.34	0.2	4.48	21	0.3	0.011	6	2	5	3	2	15	1	<1	3	8	41.35
	963	74.55	0.32	>70.0	843		0.02	3.25	-3	0.15	0.019	6	2	52	18	34	4	1	1	10	10	41.41
	950.3	37.94	0.5	>70.0	841	0.2	0.01	2.9	6	0.15	0.009	3	7	15	8	7	2	<1	<1	9	2	41.53
	968.9	66.09	0.35	>70.0	851		0.02	3.51	15	0.05	0.035	6	2	47	16	31	6	<1	<1	11	10	41.36
	910.6	88.58	0.42	69	789	0.28	0.01	7.64	24	0.05	0.048	9	5	58	25	33	<1	<1	2	9	108	42.11
	947.2	91.71	0.47	>70.0	825	0.2	0.01	2.95	15	0.1	0.015	4	5	22	10	12	2	<1	<1	8	3	41.6
	947.5	92.36	0.44	>70.0	825	0.2	<0.01	3.38	15	0.1	0.004	13	7	29	12	17	6	<1	<1	14	4	41.61
	968	71.83	0.38	>70.0	849		0.01	3.15	12	0.4	0.005	7	2	40	18	22	32	<1	<1	9	12	41.22
	968	72.76	0.38	>70.0	849		0.01	3.44	12	0.5	0.002	13	3	16	9	7	29	2	<1	10	7	41.18
	958.7	90.52	0.49	>70.0	836		<0.01	4.32	3	0.15	0.023	11	4	35	15	20	8	<1	<1	16	13	41.42
	960.3	129.9	0.5	>70.0	833	0.2	0.02	5.82	27	0.15	0.03	8	13	46	22	24	5	<1	<1	15	13	41.39
	961.2	105.1	0.41	>70.0	837	0.24	0.01	5.66	12	0.2	0.052	10	13	58	28	30	8	1	1	20	16	41.37
	959.6	92.88	0.49	>70.0	837	0.2	0.01	3.28	24	0.05	0.018	4	3	29	11	18	3	<1	<1	6	4	41.45
	959.2	91.62	0.49	>70.0	837		<0.01	4.06	12	0.1	0.011	9	7	34	14	20	6	<1	<1	8	6	41.44
	969.2	114.2	0.47	>70.0	844	0.2	0.01	5.52	24	0.15	0.024	4	10	49	24	25	5	<1	<1			41.28
	967.1	73.68	0.43	>70.0	848	0.2	0.02	3.37	24	0.1	0.013	6	4	30	12	18	2	<1	<1	5	3	41.35
Average Values	958.0	84.8	0.44	>70.0	837.2	0.2	0.03	4.1	15.5	0.16	0.02	7.2	5.4	35.8	15.4	20.4	8.7	1.3	1.3	9.9	13.9	41.4

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Source: Intertek, Mr. Green, Presentation 2020 – THE FINAL STAGES



Current commercially available 0.50% S Fuels

- These fuels will be Residual or Residual/Distillate Blends, Vacuum Residue/Cutter Stock blends, etc
- Some 0.5% S fuels are already being made commercially available and VPS are starting to test them:

- Ordered Grades:

- 700 CST 2%
- 500 CST 7%
- 380 CST 31%
- 180 CST 19%
- 80 CST 14%
- Unknown 27%

Parameter	Result Range
Density	909-988 kg/m ³
Viscosity	37-342 CST
Sulphur	0.27-0.62%
TSP	0.01-0.20
Al+Si	2-59 ppm
Net energy	40-42
CCAI	797-823



- 3 Marpol samples:
 - delivered sample, in-use sample, onboard sample*
- In case of testing the 95% confidence level will be used:*
 - test margin is 0.53 % and 0.11 % sulphur*

 ***Detention/ Debunkering***

- Most important document is the “Fuel Management Plan”

Fuel Management Plan - Sulphur Cap 2020

M/V: IMO No: Date:

Fuel Tanks		Current Status				Tank empty*		System fuel oil flushing		Tank inspection				First bunkering after cleaning					
No.	Tank Name	Fuel Type	actual mass in mt	K in % (Sulphur content)	Additives added before bunkering? Yes / No	Date	Tank Flushing Date	Amount fuel needed (m ³)	Date	ISM From "Permit to Work" - 12.27a filled out?	Condition of tank	Amount of sludge removed	Correct entry of sludge removal in OBS ?	Tank clean and ready for 0.5 % sulphur Yes / No	Date	Port	Fuel Type	actual mass in mt	
1																			
2																			
3																			
4																			
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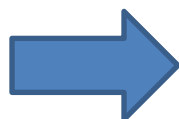
To be sent to the office monthly together with the F13a - Monthly Engine Reports or in case of any changes!

* Fuel with sulphur content > 0.5 % is not allowed to be on board after 28.02.2020!



- The plan has to be adapted to each vessel
- Definitions of fuel
- Risk assessment & mitigation plan
- Tank cleaning:
 - Empty tank
 - Flush by MGO
 - Pump to HFO day tank
 - Open tank
 - Pump out residues with diaphragm pump to sludge tank
 - Make pictures – proper documentation

Fuel Management Plan



Fuel Management Plan - Sulphur Cap 2020

M/V: _____ Date: _____
IMO No: _____

Fuel Tanks		Current Status		K in % (Sulphur content)	Additives added before bunkering? Yes / No	Tank empty* Date	System fuel oil flushing		Tank Inspection		Correct entry of sludge removed in OIB ?	Tank clean and ready for 0.5 % sulphur Yes / No	First bunkering after cleaning		actual mass in mt	
No.	Tank Name	Fuel Type	actual mass in mt				Tank Flushing Date	Additional fuel needed (m ³)	Date	IMO Form "Permit to Work" - I-37a filled out?			Condition of tank	Amount of sludge removed		Date
1																
2																
3																
4																
5																
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To be sent to the office monthly together with the F30a - Monthly Engine Reports or in case of any change!

* Fuel with sulphur content > 0.5 % is not allowed to be on board after 28.02.2020!



Storage

- Some fuels (Aromatics) might have limited storage qualities
- Heating to be done carefully
- Segregation of Sulphur (PSC detention)

Mixing

- Some fuels (Aromatics) might have limited storage qualities
- Segregation of Sulphur (PSC detention)

Treatment

- Heating in storage tank to be done carefully
- Settling tank temperature ???? □ to be confirmed from suppliers
- Purifier temperature □ to be confirmed from suppliers
- Service tank temperature

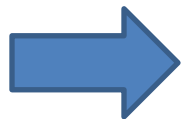
Change over from 0.5% S fuel to next 0.5% S fuel

- Settling tank must be fully empty
- Service tank as much as possible empty (in case of doubt change over to MGO and drain service tank)



Overview

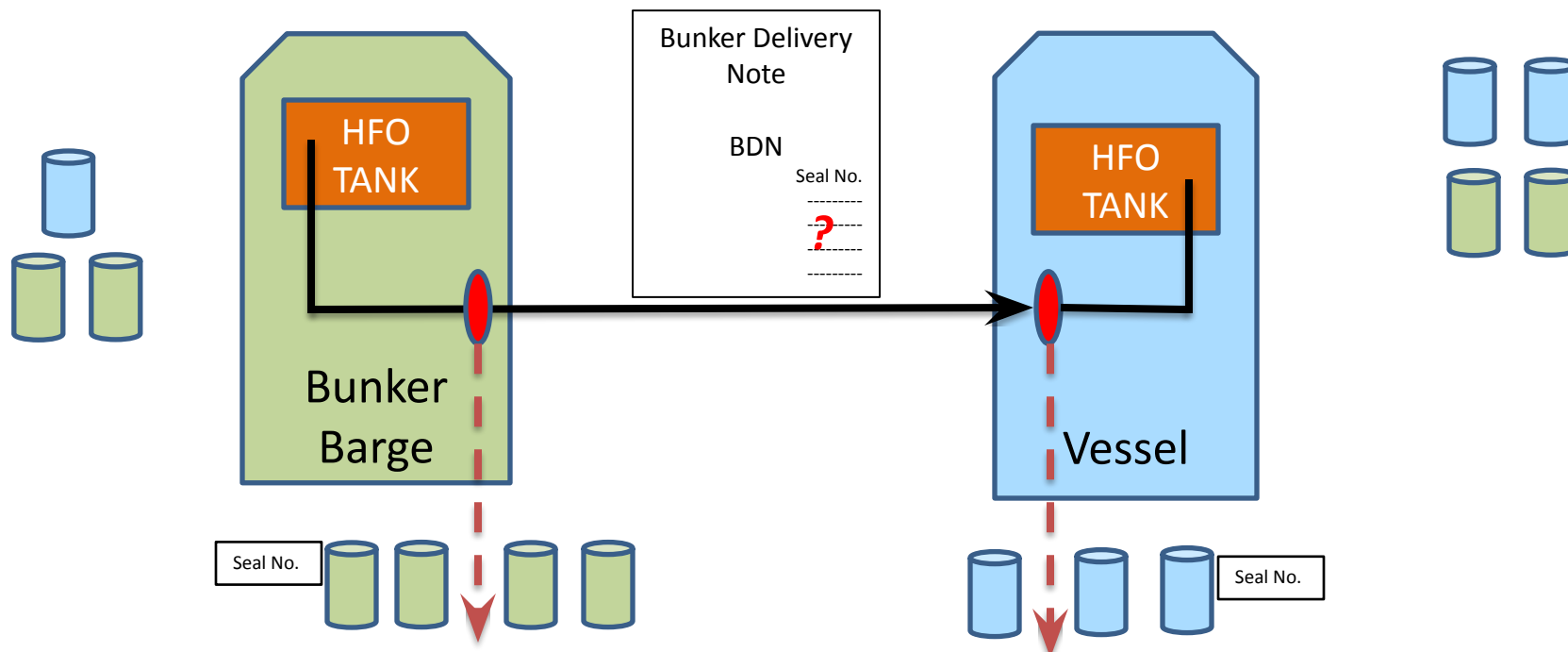
- 1. Number of samples (Supplier and Vessels Sample)
- 2. *Official Samples/ Bunker Delivery Note (BDN)*
- 3. *Continuous drip sampling as per MARPOL*
- 4. *Documentation during and after bunkering*
- 5. *Decision tree*
- 6. *Letter of protests*
- 7. *Examples for manipulation*



Technical Circular T-057



1. Number of samples (Supplier and Vessels Sample)



Usually 4 Samples are taken on barge:

- One for the vessel (handed over to vessel)
- One for Marpol (handed over to vessel)
- Two for the Barge

3 Samples are always taken on the vessel:

- One for the vessel (retained on board)
- One for the barge/supplier
- One for laboratory (e.g. VPS)



2. Official Samples/ Bunker Delivery Note (BDN)

- Only sample/ seal numbers from BDN are official in case of dispute
- We should always try to use the vessels sample on BDN, but we can not request!

If sampling will be done on barge



Always watch sampling on bunker barge!



Claim to supplier



Letter of Protest



Call Operator



After confirmation stop bunkering



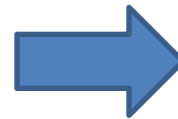
2. Examples for wrong sampling

The supplier does not agree to take official BDN samples on vessel manifold

- One crew member always monitor sampling on barge
- In any case samples to be taken on vessel manifold as well
- Double seals (from vessel and barge) to be used
- All seal numbers to be inserted into the BDN

The samples at barge manifold are not taken correctly

- Contact your operator/ stop bunkering????
- Letter of protest
- In any case samples to be taken on vessel manifold as well
- Don't sign the BDN with remark or written approval by operator



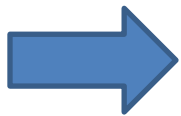
1. No drip sampler
2. Wrong adjustment of valve
3. Wrong position of sampling

Always check carefully the BDN before signature!!



3. Continuous drip sampling as per MARPOL

- As per MARPOL 73/78 Annex VI, Regulation 18, Chapter 8.1 samples to be taken as per guidelines MPEC 182(59)
- As per MPEC 182(59) the sample location *should* be the receiving vessels manifold



Due to the „should“ we can not request to take samples at the vessel manifold

- Bunker flange with adjustment valve
- End of bunker line
- Cubic container to be sealed water tight
- Correct adjustment of the adjustment valve



3. Continuous drip sampling as per MARPOL

Correct as per MARPOL



Not acceptable





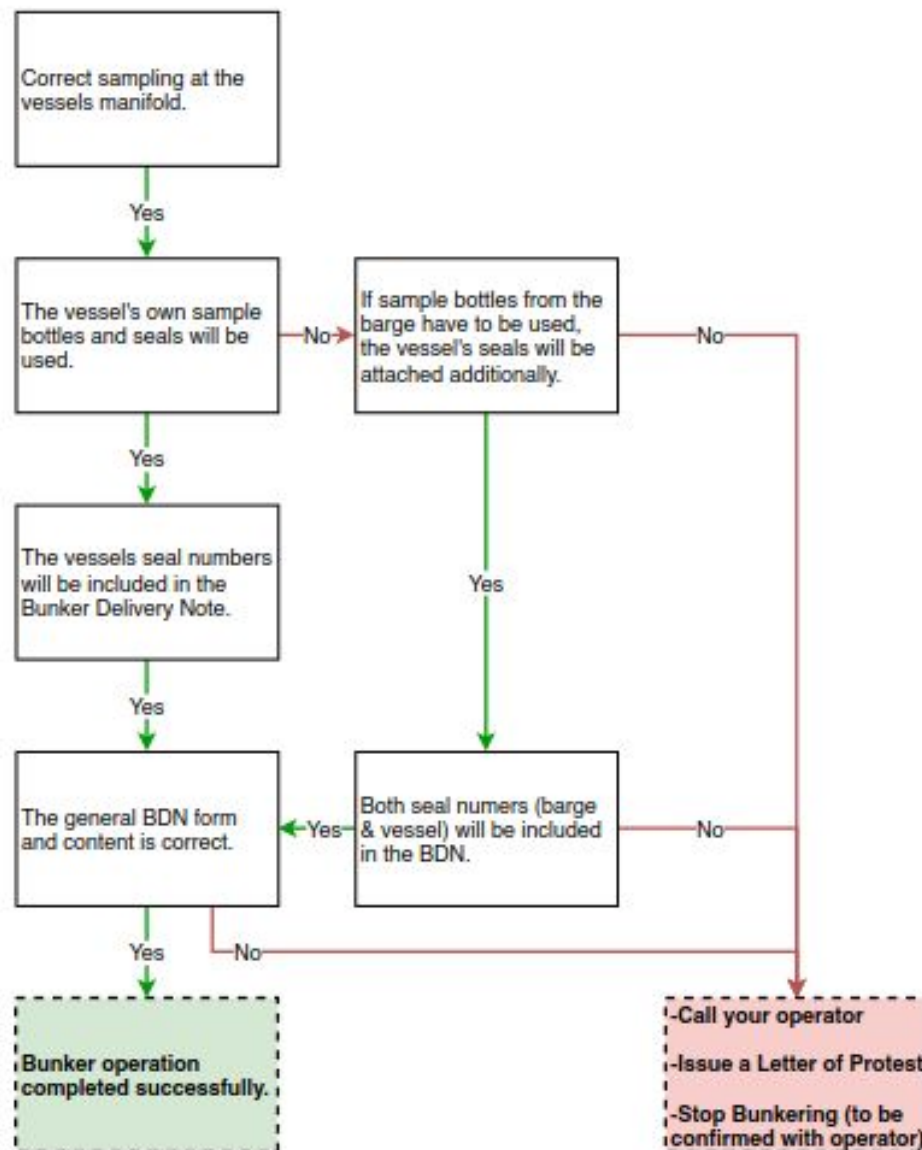
4. Documentation during and after bunkering

- The following documentations has to be done
 - Bunker Checklist Bunker Plan (F23)
 - Documents from sample kit provider e.g. “request to witness sampling”
 - Pictures of sampling
 - Bunker delivery note
 - In case needed a Letter of Protest (LOP)
- To be noted
 - F23, BDN, Pictures, LOP to be send to your inspection group
 - request witness for sampling and vessel samples to be signed by barge
 - If BDN is not correct and charterer has instructed you to sign, please sign with remarks:
 - + “for receipt only”
 - + “LOP has been issued”



5. Decision tree

A. The crew asks the supplier if the official samples can be taken at the vessel's manifold. This is confirmed by the supplier.

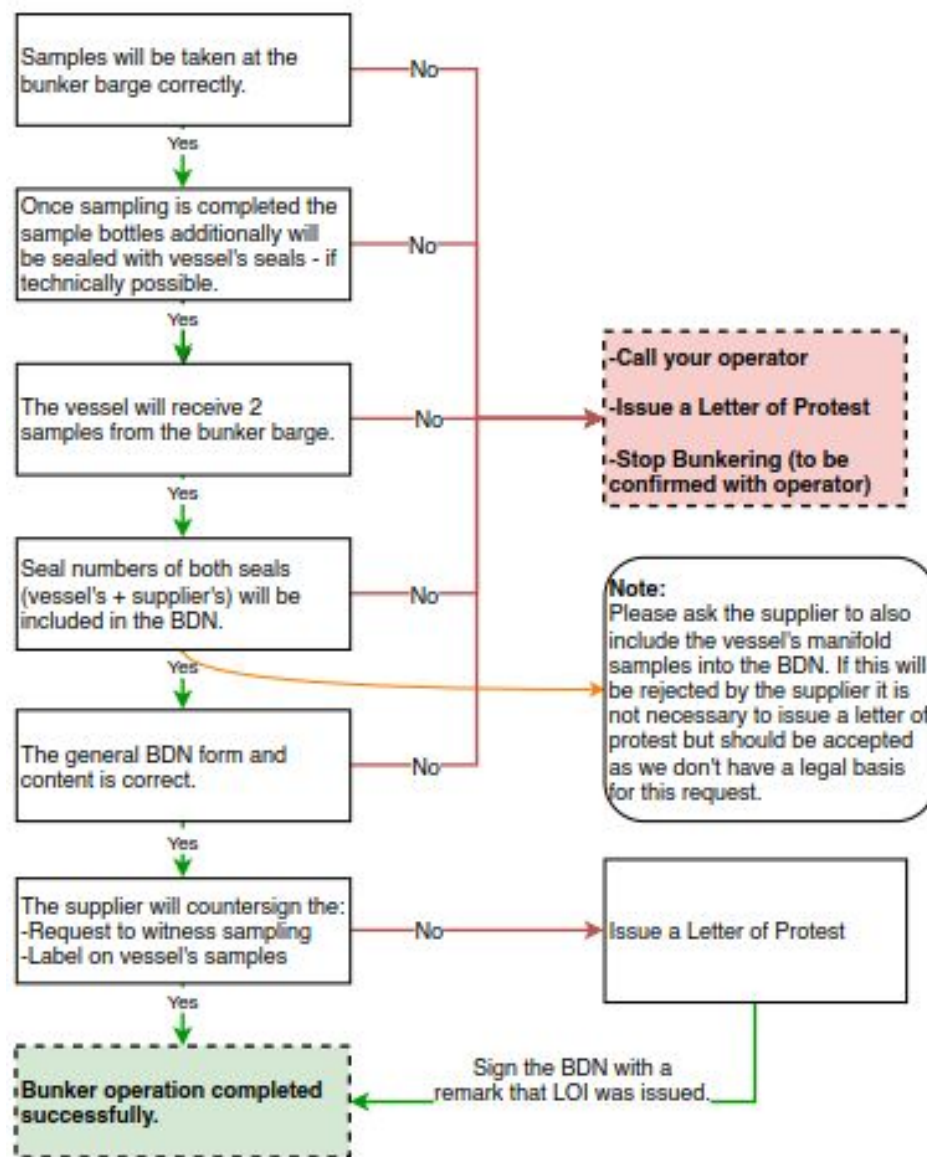




5. Decision tree

B. The crew asks the supplier if the official samples can be taken at the vessel's manifold. This has been rejected by the supplier.

Note: In any case also samples at vessels manifold to be taken and send to laboratory.






6. Letter of protest “LOP”

- Examples can be found in circular T57
- To be signed by the bunker supplier. If they refuse the BDN shall not signed unless approval by charterer.
- In case a LOP has been issued, BDN to be signed only with remark to LOP.

**Letter of Protest
for incorrect sampling during bunkering**

 BRIESE SCHIFFFAHRT

Vessel _____ Date _____
Location _____ Time _____

Name of supplier _____
Name of bunker barge / facility _____
Fuel grade & quantity _____

I beg to advise you that:

(Comment: Please delete this line and items as appropriate)

- The samples that have been taken at the supplier's bunker manifold have not been taken in a correct way as per MARPOL guideline MEPC 182(59) and do not represent the average characteristics of the total volume of bunker.
- Even though samples have been taken at the suppliers manifold the vessel did not receive a set of two samples from the supplier.
- The supplier does not agree to use the vessels seals for the bunker samples.
- The Bunker Delivery Note Form and / or content is not in accordance with The MARPOL regulation.

Hence, I have no other option but to protest against the method of sampling and request that that the samples will be taken in a proper way which is also in compliance with MARPOL Regulations.

Master: _____ Bunker supplier: _____

Chief Engineer: _____

One Original to:
- Supplier
- Vessel

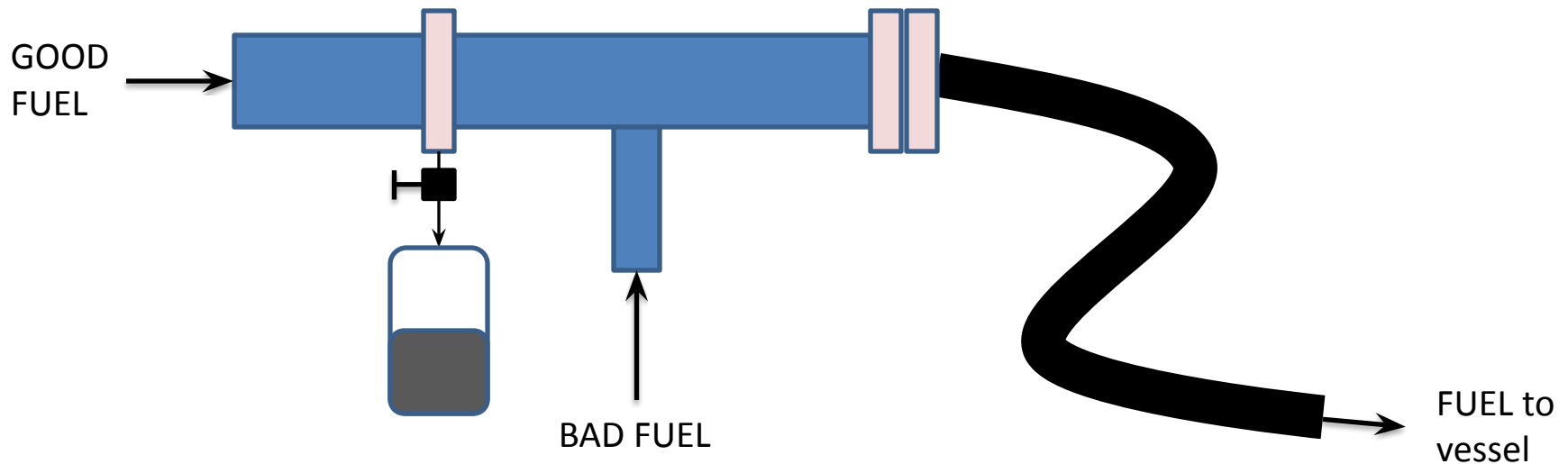
One Copy to:
- Inspection group
- Charterer / Operator

* Please insert the remark "LOP was issued" next to your signature on the Bunker Delivery Note.



6. Examples for manipulation

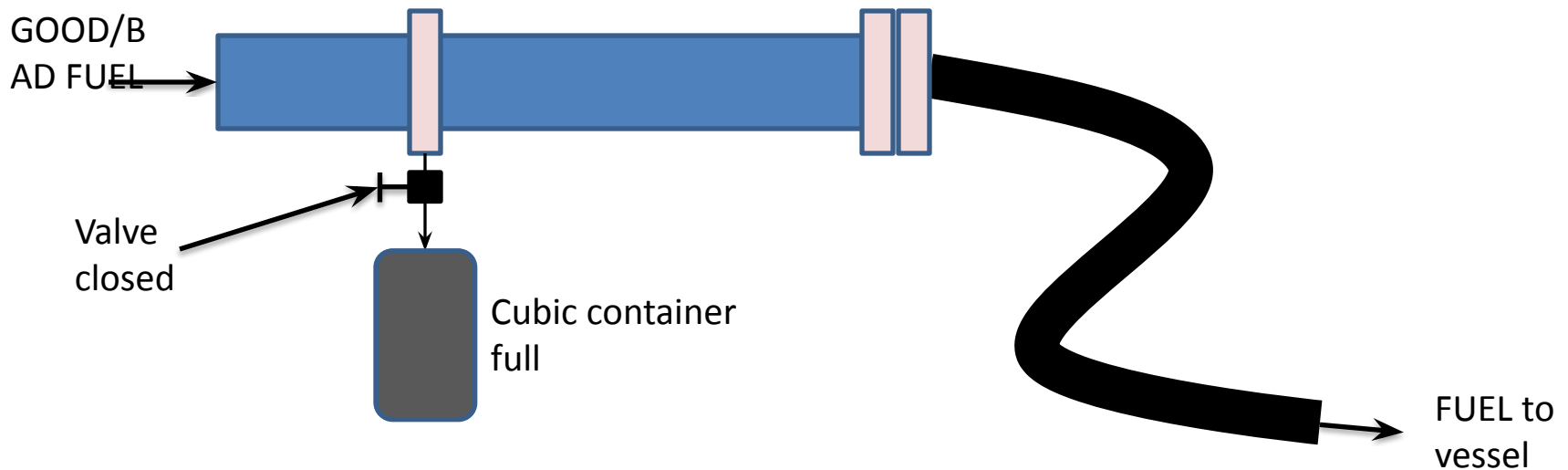
1. Bunker flange not at the end of bunker line





6. Examples for manipulation

2. Manipulation by the adjustment valve

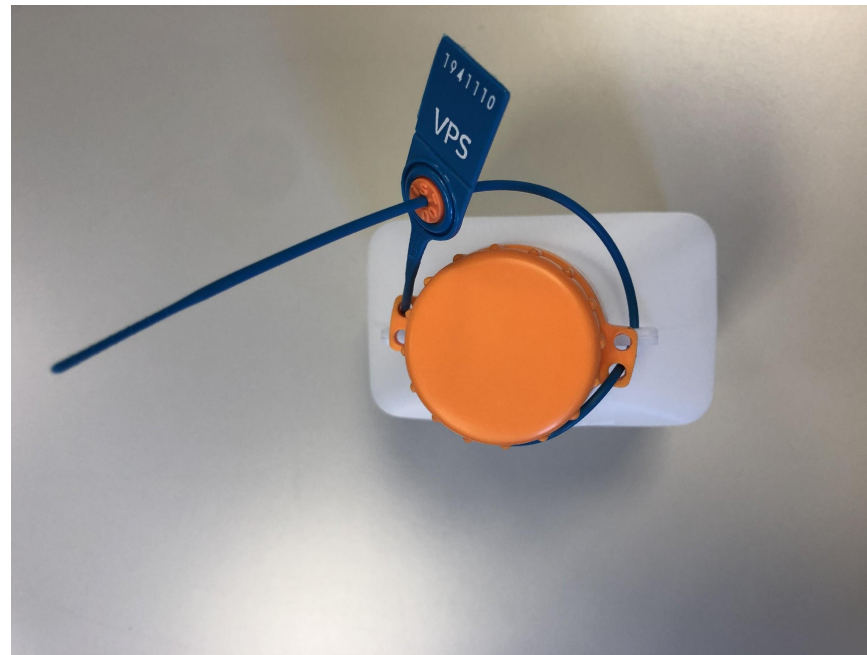




6. Examples for manipulation

3. Manipulation of the samples

- Sample bottles ready before bunkering
- The barge has double seals and don't permit to install a second seal from vessel
- Seal is not pulled fully tight and can be used a second time





Final conclusion

- New 0.5% S Fuel will be more challenging like RMG380 HFO
 - Storage
 - Fuel preparation
 - Fuel injection adjustment of viscosity
- The potential commercial loss and risk is much higher due to PSC with focus to 0.5% S
- In case of no sulphur compliance the fuel must be debunkered
- More care is needed when official (BDN) samples are drawn
- The suppliers are potentially more active with manipulation of samples!



Thank you for attention!