DNV Petroleum Services
230 people dedicated to fuel quality
Topic 1: New Product - Quality Review

- 2012 Cabernet ECA
Topic 2: Future Product - Quality Prediction

- 2015 Chardonnet ECA
C/E said “Slime” shut down tug’s engines”
Topic 4: ECA Compliance & Enforcement
1 August 2012

“Cabernet ECA”
Avg. Sulphur content LSFO - 2012

Geographical Region

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Consequences of reduced sulphur content

Based on number of samples

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Increased Al+Si
BUNKER ALERT, REF: 10/2013
DNV PETROLEUM SERVICES
07/MAY/2013

HIGH SEDIMENT IN LOW SULFUR FUELS OFF US GULF, USA

DNV Petroleum Services has tested three (3) fuel oil samples representing low sulfur HFO deliveries Off US Gulf, USA, with sediment content exceeding the maximum Total Sediment Potential (TSP) of 0.10% m/m stated in the ISO 8217:2005/2010/2012 specification, Table 2 requirements.

The bunker deliveries were made by one (1) supplier in the period 20-26 April 2013, with TSP levels of 0.15% m/m and 0.16% m/m.

Ships consuming these fuels might experience increased sludge formation, particularly at the centrifuges and filters, leading to possible blockages and loss of centrifuge and filter functions. Elevated sediment
# Bunker Alerts 2008-2012

## DNVPS Bunker Alerts

### 2008 - 2012 by Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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</tbody>
</table>

![Graph and Table]

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Bunker Alerts 2008-2012

DNVPS Bunker Alerts
2008 - 2012 by Country

No. of Bunker Alers

Argentina  Belgium  Brazil  Chile  China  Colombia  India  Italy  Japan  Malaysia  Malta  Panama  Russia  Singapore  Taiwan  The Netherlands  UAE  USA

2008: 0 1 2 0 1 0 1 1 0 0 1 2 3 2 2 3 1 3
2009: 1 1 2 0 0 0 1 2 0 2 0 0 0 2 2 5 1 5
2010: 1 1 2 1 0 0 0 1 0 1 1 0 0 3 0 2 1 6
2011: 0 2 2 1 1 0 1 1 0 0 4 0 1 3 1 4 2 6
2012: 1 0 2 2 1 1 1 0 1 2 3 5 5 2 0 2 3 19

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Bunker Alerts for Canada

- NONE in 2012 or 2013
1 Jan 2015
“Chardonnay ECA”
ECA sulphur limit drops down from 1.00% to 0.10%

A bright future for MGO?
Or: Blending up to max 0.10% Sulphur

ULSD (0.0015 % Sulphur) + LSFO (1.00 % Sulphur)
ISO8217 – Off specs samples 2012

Samples being off spec:

<table>
<thead>
<tr>
<th></th>
<th>HFO380</th>
<th>DMA</th>
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<tr>
<td>ISO8217:2005</td>
<td>14%</td>
<td>15%</td>
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<tr>
<td>ISO8217:2010</td>
<td>18%</td>
<td>17%</td>
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</table>

![Graphs showing HFO 380 and DMA samples](image-url)
Acidic fuels

- ISO 8217:2012 limit for Distillate fuels: 0.50 mg KOH/g
- High Acid Number can cause corrosion damage to fuel injection equipment
Lubricity / Viscosity

**Effects of low lubricity should not be confused with low viscosity!**

**Lubricity**

- Fuel oil with S >0.05% typically has sufficient lubricating properties
- Ultra Low Sulphur Fuel (S <0.05%) *can be* incapable of lubricating vital fuel system components
- Poor lubricity might result in fuel pump seizures
- Additives might be used to improve lubricity

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><em>Viscosity is increased to min 2 cSt @ 40 °C for DMA and DMB. DMZ is introduced with min 3 cSt @ 40 °C</em></td>
</tr>
</tbody>
</table>
Cloud point / Pour point

Cloud point
- The temperature below which wax form a cloudy appearance
- Indicates the tendency of the fuel to clog filters

Pour point
- The lowest temperature at which an oil will flow
- Fuels stored at temperatures below the pour point may cause filter problems and solidify completely
- Storage temperature should be at least 10°C above Pour Point
Flash Point Requirements

- Flash point is a SOLAS (Safety of Life At Sea) requirement
- Fuels with Flash Point less than 60 °C are not permitted, except for the following:
  - Ships certified for restricted service ……
  - Installations specially approved for the use of Crude oil as fuel
FAME – Fatty Acid Methyl Ester

- ISO 8217:2012 limit: “De minimis levels” set as ~0.1% (appendix A)
- FAME is potentially associated with poor oxidation stability of the fuel and may increase the risk of microbial growth, i.e. primarily an issue in case of long-term storage and/or in the presence of water

![Image of Fatty Acid Methyl Ester](image-url)
Onboard Problems with bacterial growth

- Clogged filters/nozzles
- Separator problems
- Poor combustion
- Unpleasant odors $\text{H}_2\text{S}$ – Hazards
- Reduced lubricity
- Pitting/corrosion
  - Tanks
  - Fuel system components
Recent Real Life Case – Distillate fuel challenges
Distillate fuel problem

- From Chief Eng on May 23rd:
  - “A jelly-like substance found in the fuel tanks”
  - “Samples later showed a clear, yellowish gel in the diesel - led to the failure of dozens of fuel injectors”
  - “Something appeared to be gumming up the fuel filters”
Distillate fuel problems

- Bunkering in Dutch Harbor, Alaska
- Diesel fuel causing fuel injector failure
- FAME in diesel may have oxidized into gel
- Unknown additive may have played a role
Loss of Propulsion Incidents in California

Source: USCG
Loss of Propulsion
Compliance/Enforcement
USA - ECA enforcement since Aug 2012

- Joint effort by US Coast Guard and EPA
- EPA has received approximately 750 FONARs as of Apr 2013
- USCG has issued 203 ECA deficiencies
- USCG documented 3 deficiencies as detainable
Canada – ECA enforcement – started 8th May 2013

• Delay due to parliamentary process
• Voluntary compliance after Aug 2012
• Enforced by Transport Canada as per 8th May 2013
• Similar enforcement approach as USCG/EPA
Some Good News
Global Sulphur Levels – Marine Residual Fuels

Sulphur, %

2008: 2.64
2009: 2.60
2010: 2.63
2011: 2.67
2012: 2.55

Note: Adj for BDN quantity
Clean air for our children to breath
Thank you!
Safeguarding life, property and the environment

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