Principles of representative sampling and monitoring

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Workshop on Microbial Growth in Fuel Supply and Distribution

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Disclaimer

This presentation does not address health and safety or any regulatory issues. Further guidance is available in some of the publications listed. Reference should also be made to appropriate national safety regulations and guidance provided by relevant petroleum industry codes.

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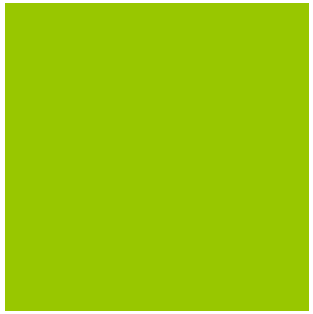
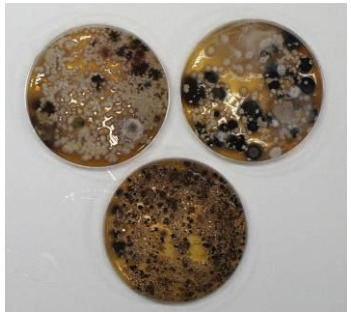




1 Sampling: what and why

Are you assessing:

1.Condition of fuel?

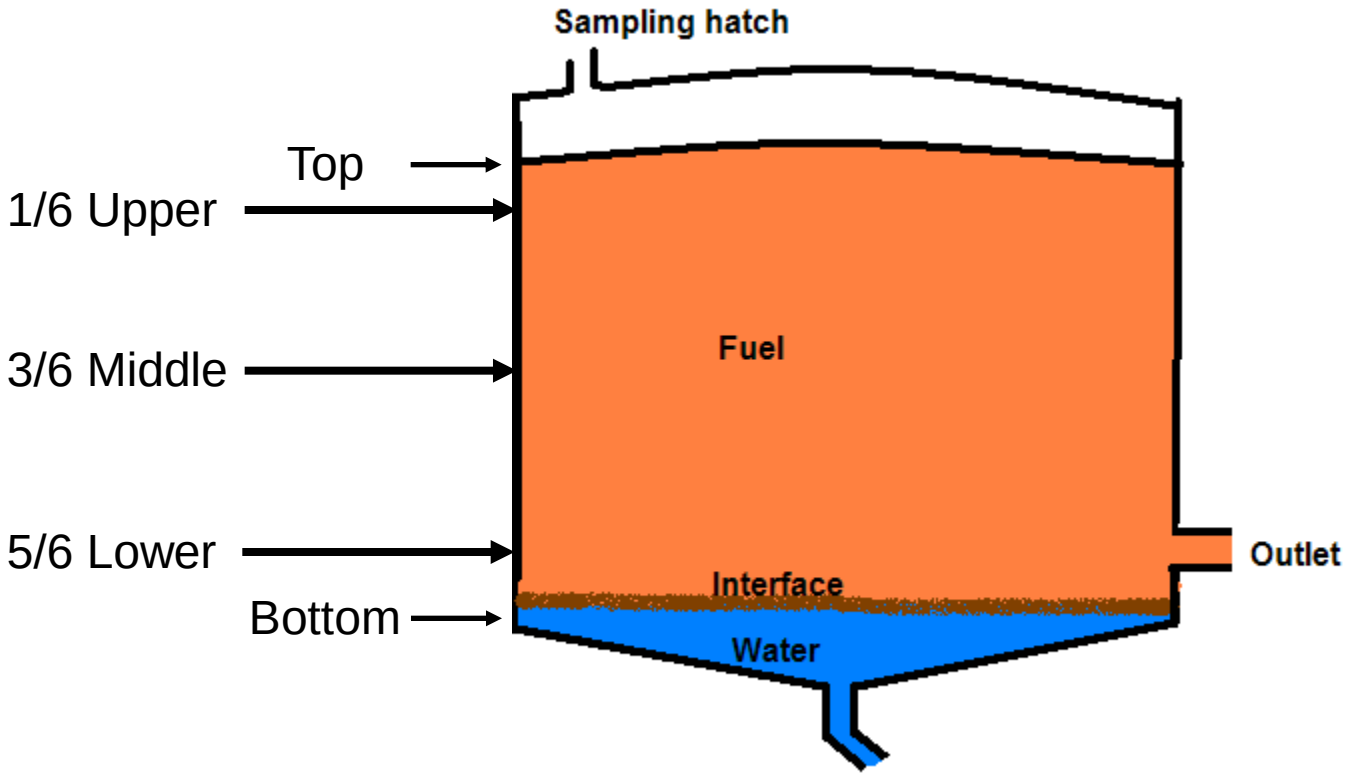
or

2.Condition of the fuel system?

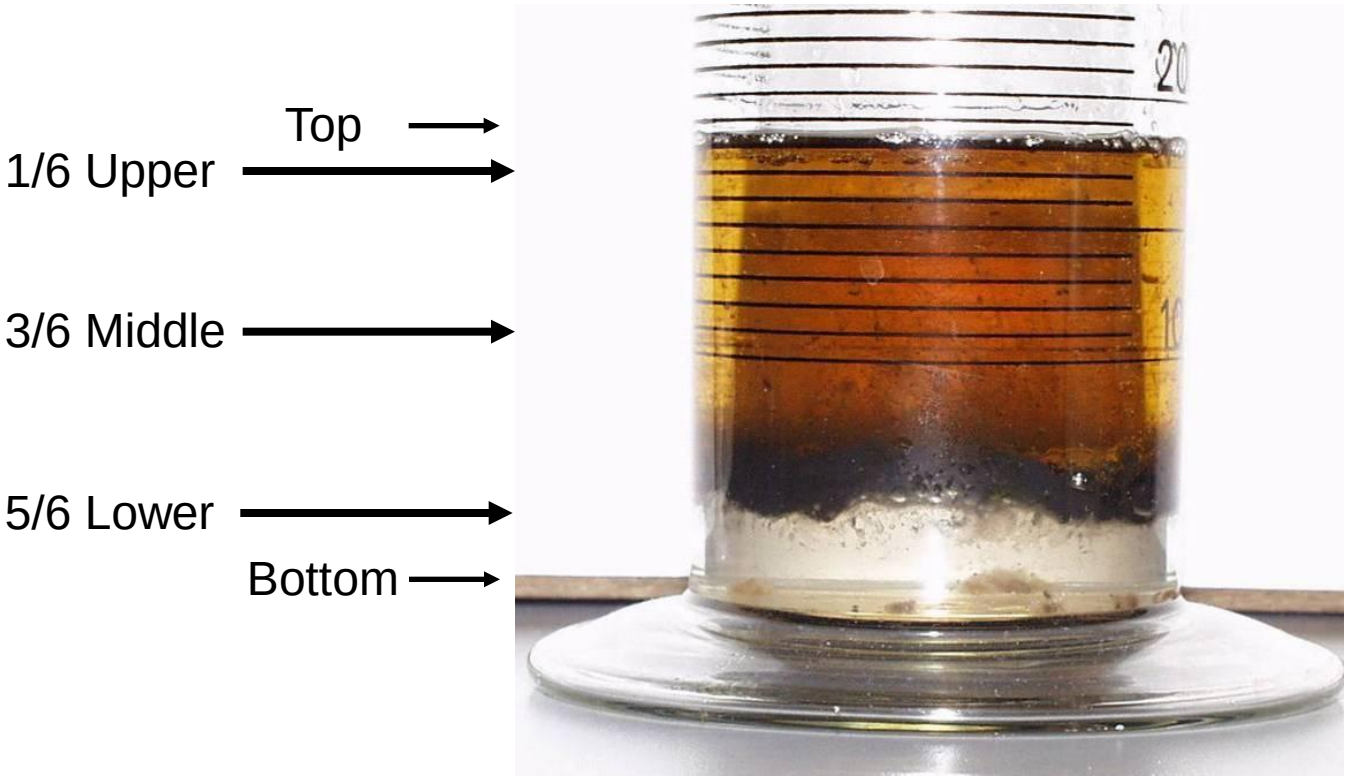
-Important to understand the distinction.

Sampling points

There are several potential sampling points in most systems.

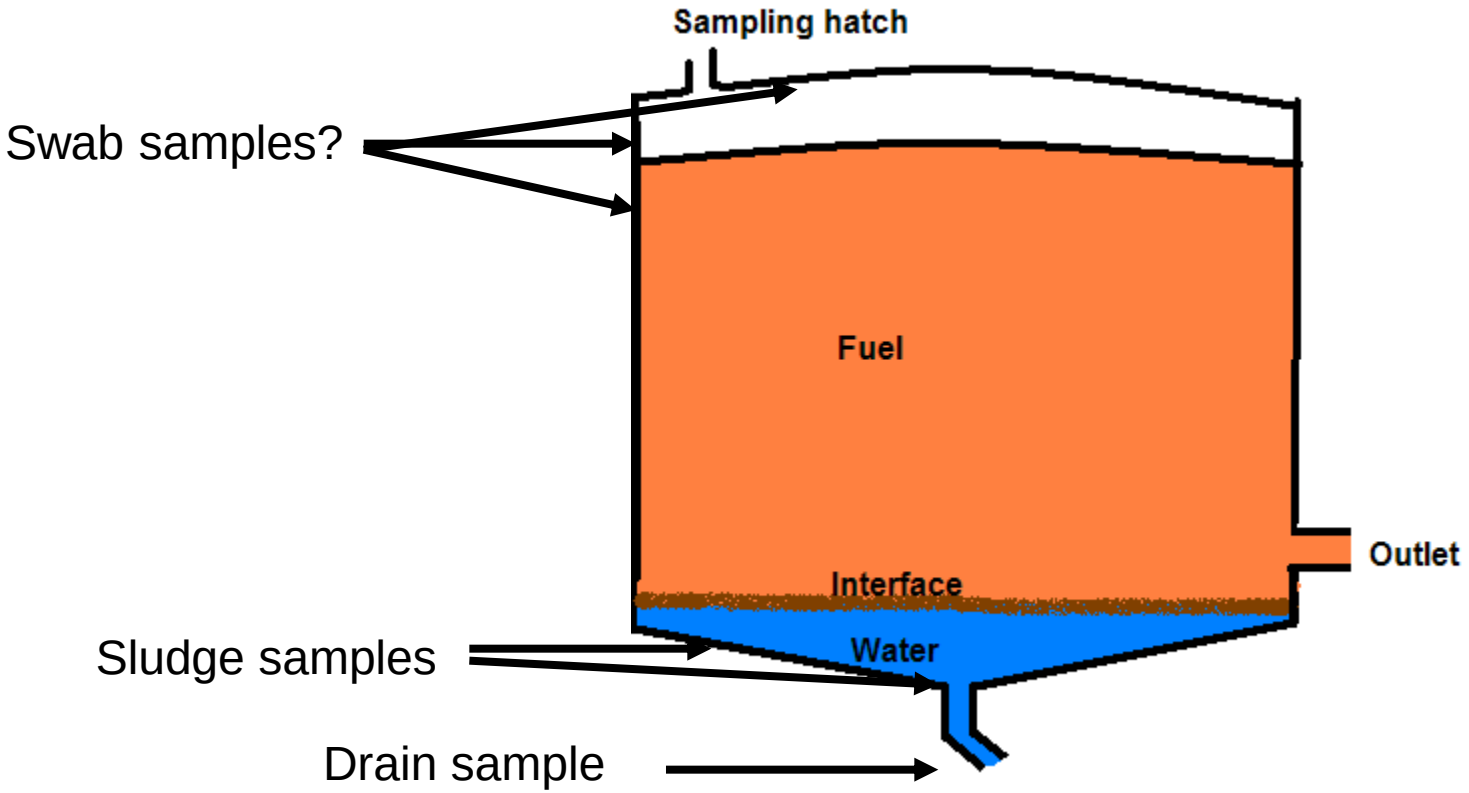


Inside a contaminated tank?



Sampling points - cont

Swab and scraping samples can be taken from where slimes may accumulate.



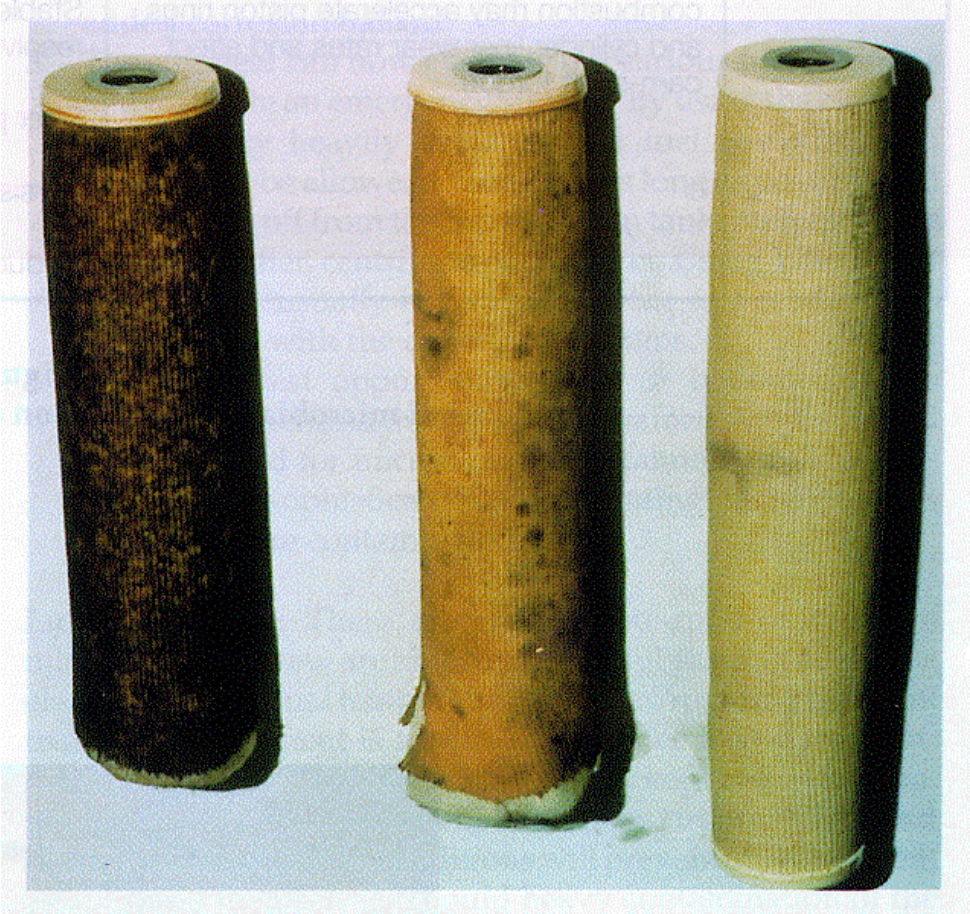
Filters

Filter water separators

- Vulnerable to MBC

Evidence:

- Increased dp
- Spotting on sock

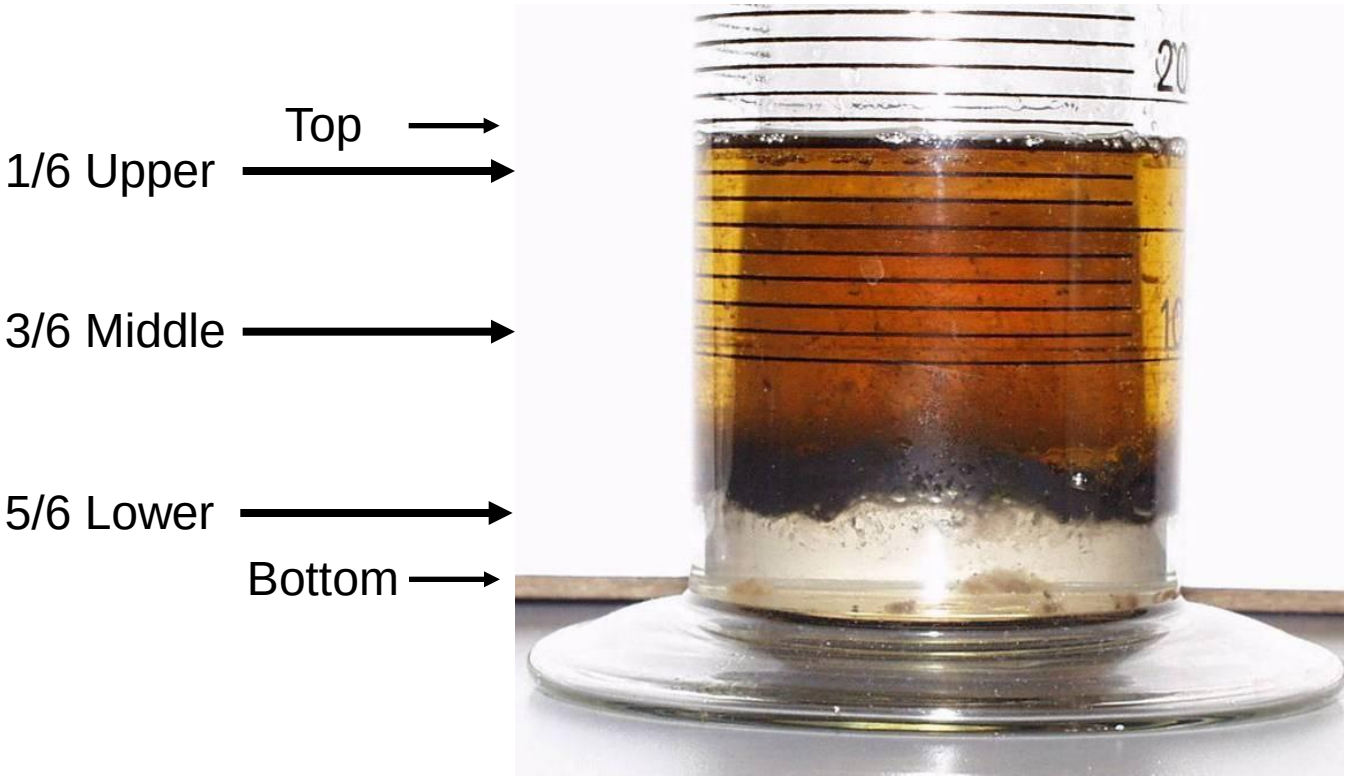


2
Sampling: where and how

Fuel/interface/water

Sample from top to bottom

- To reduce potential contamination



Sampling devices

Bacon Bomb

Bottom sampling

All level sampling

Any level sampler

Bottom sampling

All level sampling

Interface sampling?

Thief sampler

For sampling drums and cans

Brass sampling devices

Brass not recommended as copper affects test results.

- Thermal stability
- Oxidation /storage stability
- Antimicrobial

Avoid cork/porous materials as they may host microbes from previous samples.

Sample containers

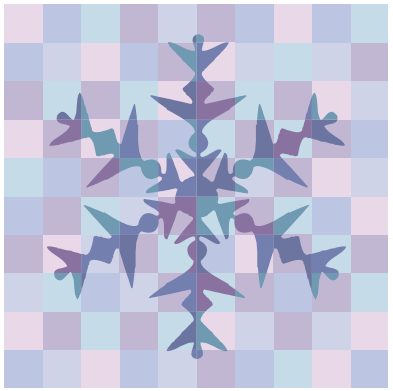
Glass and (clear) plastic preferred

Sample containers - cont

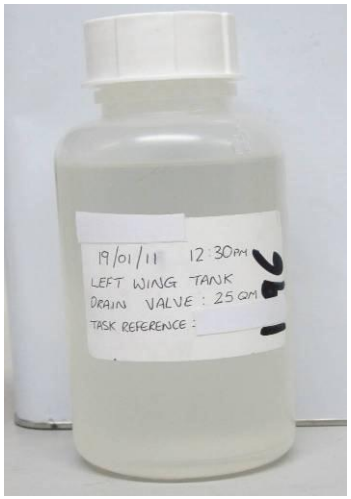
Clean (unused) containers preferred

Sample storage

Time, temperature and other storage conditions all affect the microbial population in a sample…



Samples should be tested within 24 hours.
Samples should be kept at around 4 °C.
Leave some headspace (ullage), preferably 20 -30% to avoid oxygen deficient conditions - unless testing for sulphate reducing bacteria.



3
Monitoring (when)

Monitoring programme

Inspection period
– suitable for product/system

Visual inspection
-Limited information
- -Water
- -Haze
- -Particulate
- -Slimes

Bacteria: Typically 1-5 micron.
Fungi: Moulds. Can be several mm long 1-5 micron across.
Fungi: Yeasts:
spherical (5-10 micron across)
filamentous (1-5 micron across).

Particulate contamination

IP 387 filter porosity 1.6 micron

Note: Filter blockage most commonly due to fuel-derived particulates.

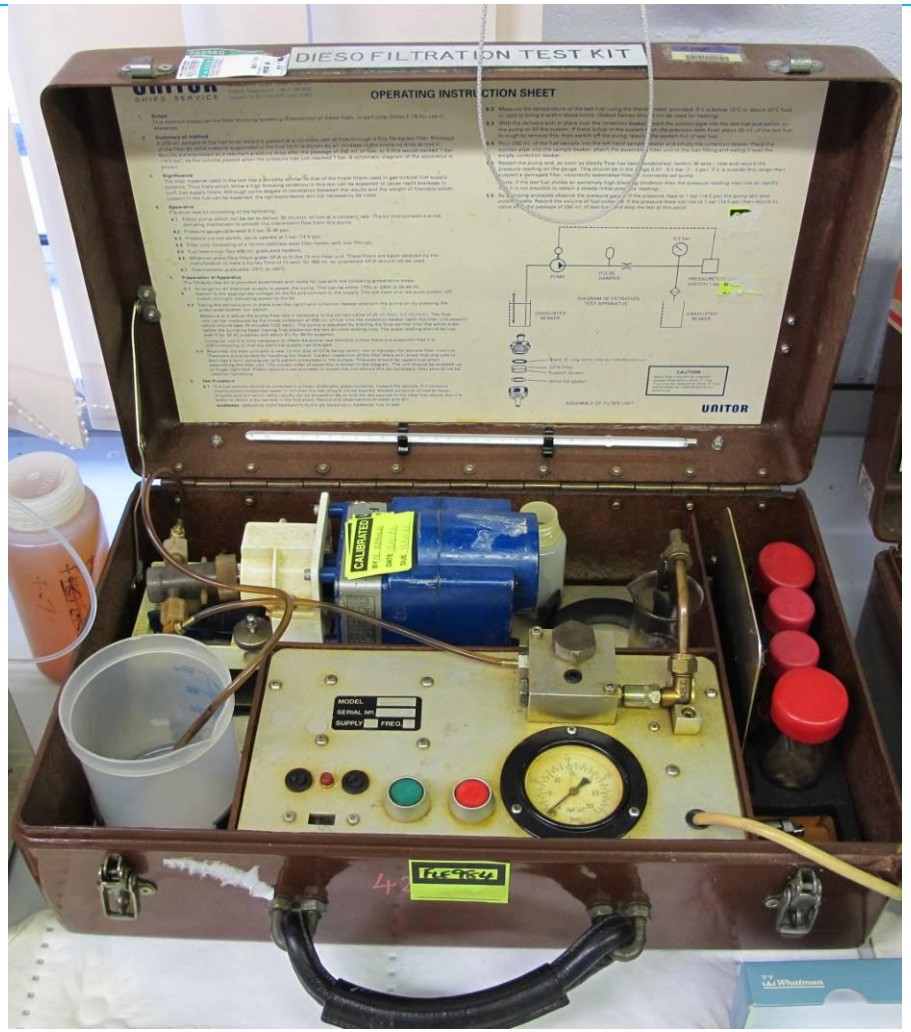
Particle counting may be used:

Typical channels sizes

>4µ, >6µ, >14µ and larger.

Gravimetric or timed filtration:

Filter sizes typically 0.45µ, 0.80µ



Water samples

Routinely check for:

- Fuel degrading organisms

and/or

- Sulphate reducing bacteria
- Hydrogen sulphide
- pH
- Dissolved metals
- Iron sulphide

Other properties: hardness, dissolved oxygen, nitrite, nitrate, ammonia nitrogen.

(See ASTM Manual 47)

Evidence of srb corrosion

Monitoring programme - cont

Microbiological testing

- -Apply suitable tests
- -Develop suitable action/warning limits
- -Develop suitable action plan

Guidance may be available from:

- •Equipment manufacturer
- •EI Guidelines
- •IATA (aircraft fuel tanks)

Biofuels may require increased vigilance

4

Useful publications

Useful Publications - Sampling

- *IP 475, EN ISO 3170, Petroleum liquids – Manual sampling (ISO 3170:2004)*
- *ASTM D4057 - 06 Standard Practice for Manual Sampling of Petroleum and Petroleum Products*
- *IP 476, EN ISO 3171 Petroleum liquids – Automatic pipeline sampling (ISO 3171:1988).*
- *ASTM D4177 - 95(2010) Standard Practice for Automatic Sampling of Petroleum and Petroleum Products.*

- ***ASTM D7464 - 08 Standard Practice for Manual Sampling of Liquid Fuels, Associated Materials and Fuel System Components for Microbiological Testing.***

Useful Publications - microbiological testing and control

- *ASTM D6469 - 08e1 Standard Guide for Microbial Contamination in Fuels and Fuel Systems.*
- *ASTM D5245 - 92(2005) Standard Practice for Cleaning Laboratory Glassware, Plasticware, and Equipment Used in Microbiological Analyses.*
- *Determination of the viable aerobic microbial content of fuels and fuel components boiling below 390°C - Filtration and culture method 1999*
- *IP 472 Determination of fungal fragment content of fuels boiling below 390°C 2002*
- ***Fuel and fuel system microbiology- Fundamentals, diagnosis and contamination control. ASTM Manual 47, 2003***
- ***Guidelines for the investigation of the microbial content of petroleum fuels and for the implementation of avoidance and remedial strategies. Energy Institute 2008***
- ***IATA Guidance Material on Microbiological Contamination in Aircraft Fuel Tanks, Edition 3, 2009.***

5 Summary

Summary

Need to be clear on why samples are being taken: system health, fuel condition and tests to be applied.

Take appropriate samples: i.e. water bottoms, fuel, swabs, scrapings, filters.

Use appropriate sampling devices.

Ensure that sampling practice, devices and containers do not introduce contamination but maintain sample condition as far as reasonably practical.

Apply/develop suitable action/warning limits and action plan

Sampling and testing frequency must be appropriate to prevent problems arising.

Thank – you for your attention.

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