Crude Quality and Quantity Issues

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Outline of Presentation

Introduction

Issues of Quality and Quantity

Safety

Sampling
An Extensive Global Network

- Founded as Caleb Brett 1885
- Stock Floated 2002 London Exchange
- FTSE 100 company in the Support Services sector 2009
- Market Capitalization £5 billion (USD 7.5 billion)

More than 110 countries
More than 1,000 laboratories and offices
37,000 people
Major Locations & Coordination Centers

**Americas**
Houston
135 Offices
85 Labs

**EAME**
London & Geneva
133 Offices
68 Labs

**ASIA**
Singapore
94 Offices
42 Labs
Services in the Shale Supply Chain

**Exploration & Production**
- Training: Well Control, Drilling Competence
- Geological Services
- Oil Condition Monitoring (equipment)
- Emission Studies (Stack / Generator)
- Electrical Certification (Rig & Equipment)

**Gathering & Processing**
- Consulting: HSE, Behavioural Safety
- Production Geochemistry
- Additives (well site dosing)
- Sampling Services
- Tank & Meter Calibrations

**Primary Logistics**
- Cargo Inspection
- Analytical Testing & Crude Assay
- Metering & Calibration Services
- Contamination Investigations
- Additive Treatments

**Refining / Plants**
- Supplier & 2nd Party Audits
- Systems Certification
- Engineering Consultancy
- Technical Inspections
- Corrosion Services

**Open Market**
- Crude Trading
- Secondary Logistics Product Trading

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Transportation of Crude

Traditional Mature Crude Supply Chain

Wellhead → Gathering Lines → Pipeline → Storage → Vessel/Barge → Refinery

Crude in the Changing Landscape

Wellhead → Trucks → Rail Cars → Pipeline → Storage → Vessel/Barge → Refinery

OR
A Changing Landscape for Testing, Inspection & Certification

• Safety
• Quality
• Quantity
Safety

- Higher Volumes of Truck and Rail Car Usage Requires:
  - Heightened Focus on Safety Precautions and Training:
    - Hydrogen Sulfide (H2S)
    - Rail Car Safety Awareness
Alternate Method of Measurement for consideration:

- Consider collecting samples in evacuated glass bottles
- Glass evacuated bottles contain Silica gel
- Eliminates hydrocarbon interferences
- Analyze onsite using Micro GC
Quality Matters
Internal Controls / External Challenges

- Internal Laboratory Quality Controls Managed through ISO 9000 and HSE Systems:
  - Calibration of Apparatus
  - Technician Training
  - Equipment Maintenance
  - Proper Standards
  - Sample Handling
Quality External Challenges

• Obtaining Representative Samples & Maintaining Sample Integrity

• Key Factors Affecting Quality of Data

Poor Sample = Unreliable Results
Sample Quality
BAD SAMPLES = BAD DATA

- Decisions are made and enormous dollars are spent on laboratory data
- Accurate, Quality data begins with the sample procurement process
- Understanding the effects on data is a priority
- Vapor Pressure data can be easily affected by the loss of light end materials during sampling process
- Loss or distortion of Sulfur data during sampling and shipment of sample
- Under or Over stating water volumes
REVIEW TEST METHOD
CHOOSE SAMPLE METHOD

• Each test method references the proper sample procurement method
• Manual Sampling of Petroleum and Petroleum Products
  • ASTM D-4057 / API Chapter 8.1
• Automated Sampling of Petroleum and Petroleum Products
  • ASTM D-4177 / API Chapter 8.2
• Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
  • ASTM D-5854 / API Chapter 8.3
• Sampling and Handling of Fuels for Volatility Measurement
  • ASTM D-5842 / API Chapter 8.4
VAPOR PRESSURE

- Vapor pressure data is critical to the production and movement of crude oil
- Light Volatile products produced in the Shale Regions can create issues with production, storage, loading, unloading and sales agreements
- Understanding and choosing the correct test method is a priority
- Choose the procurement method and protocol based on the analysis run
- ASTM D-323 Section 2.0 Referenced Methods refers to D-4057 and API Chapter 8.1 “Manual Sampling of Petroleum Products”
- ASTM D-323 section 8.3, details proper containers size, filling volume and best practices techniques
VAPOR PRESSURE

- ASTM D-4057 and API Chapter 8.1 provide details and recommended protocol based on the sample source and sample point.
- D-4057, section 10.3 “Vapor Pressure” recommends the use of practice D-5842.
- Provide tables, diagrams and step by step procedures to ensure quality sample submissions.
VAPOR PRESSURE

- ASTM D-6377 Section 2.0 references both D-4057 and D-4177
- “Automatic Sampling of Petroleum and Petroleum Products”
- D-6377, Section 8.1 and 8.2 reference both D-4057 and D-4177 as well as D-3700 which describes the proper use of Piston Cylinders
- Piston Cylinders can greatly reduce the loss of Light End Volatiles that can be entrained in the crude oil
- High API Gravity Volatile Condensates produced in the Shale regions demand attention to detail when choosing the sample procurement protocol
H2S AND SULFUR TESTING

- Hydrogen Sulfide (H2S) and Sulfur Compounds are easily affected during sample procurement.
- Losses can occur if the proper sample container is not used.
- Pressurized samples require lined or treated sample cylinders.
- Untreated cylinders will readily absorb sulfur compounds and thus alter the laboratory data generated.
- The cylinder, valves, relief device and all parts of the cylinder must be treated.

[Image of a pressurized sample cylinder]
• Atmospheric Crude Oils also require special attention
• ASTM D-4294, Section 2.0 and Section 11.0 both refer to D-4057 and D-4177 as well as API Chapters 8.1 and 8.2
• Selection of proper containers, materials and sample protocol are described and illustrated
• ASTM D-6021, Section 8.3 advises on sample delivery time to lab and suggests 1 to 4 hours with 24 hr maximum
DETERMINATION OF WATER

- Determination of Water is required for both Allocation and Quality
- ASTM D-4057, D-4177, D-5854 and API Chapters 8.1, 8.2 and 8.3 are commonly referenced
- D-4057, Section 9.1.2 D-4177 Automatic Sampling procedure is recommended whenever samples are required for Custody Transfer
- Containers used should be clean and free of contamination and should have an opening that allows for a homogenizer apparatus in the lab
- Sample point should provide a representative portion of the product
- If taking from a Composite System or Sample Pot, the fluids should be mixed prior to any removal of sample
DETERMINATION OF WATER

• Review the sampling method and choose the proper protocol using published tables and diagrams

• What is the source of the crude oil (tank, barge, trucks, cars, packaged lots etc…)

• ASTM D-4057 Section 11.0 “Specific Instructions for Specific Applications. (MPMS Chapter 17 Marine Vessels and 18 Crude from Tanks and Trucks)

• ASTM D-5854 Table X1.1 - 4 Lists the Summary of Containers for Crude Oils, Gasoline, Kerosene and Fuel Oils
SAMPLE DOCUMENTATION

• Each sample should have an individual tag or label
• Labeling of Hazardous Materials on bottles or containers used to carry or ship samples in accordance with regulatory agencies
• Chain of Custody with signatures, dates and times
• MSDS for the product should accompany the samples
• Bill of Lading with number of samples, sizes/volumes and Hazardous shipping information
• Anyone handling the samples should be familiar with regulations, company policies and procedures

• Analysis is only as Good as the Sample collected !!!
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