



# *Pipelines: The Underground Pathway to National Supply Assurance?*

**National Biodiesel Conference & Expo**

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# Agenda

- ◆ Buckeye Background
- ◆ Logistics of the Northeast
- ◆ Pipeline Concerns
- ◆ Trial Movements
- ◆ ASTM D975 vs. Pipeline Specs
- ◆ Biodiesel vs. Ethanol
- ◆ Path to Overcome
- ◆ Past Success Stories



# Who is Buckeye?

- ◆ One of Largest Independent Pipeline Systems in United States (Volumes Delivered)
- ◆ Owns & Operates:
  - 5,400 miles of pipeline
  - 51 product terminals
    - 21.0 million barrels of aggregate storage
- ◆ Operates:
  - 2,700 miles of pipeline for oil and chemical companies



# Buckeye Logistics

## ◆ Major Receipt Locations

- Linden, NJ (New York Harbor)
- Boothwyn, PA (Philadelphia)
- New Haven, CT
- Toledo & Lima, OH
- Detroit, MI
- East Chicago, Hammond & Hartsdale, IN
- St. Louis, MO





# Buckeye System

- ◆ Multi-Product Systems
  - Gasoline
  - Diesel Fuel
  - Jet Fuel
  - LPG's
- ◆ Fungible System
  - Product commingles with other like product
    - Maximizes tank utilization
  - Intense product scrutiny
    - Must protect other product in tankage



# Northeast Logistics

- ◆ Supplied from Local Refining, Barge Movements into NY Harbor, and Other Pipelines
  - Colonial, Explorer, Sunoco Logistics, Teppco,
- ◆ Deliveries to Terminals and Other Pipelines
  - BP Inland, Marathon, Sunoco Logistics, Teppco, West Shore, Wolverine
- ◆ Multiple Handoffs Requires Coordination Between All Parties Involved



# Pipeline Transportation Concerns



# Pipeline Transportation Concern: *Trailback into Jet Fuel*

- ◆ Multi-Product Systems
  - Impact on other products, specifically jet fuel
- ◆ Biodiesel is Surface Active
  - Propensity to adhere to surfaces, including pipe walls
- ◆ Product Sequencing – Segregation of Jet Fuel from Biodiesel Batches
  - Some systems only move diesel and jet fuel
  - Limits flexibility of pipeline, which limits capacity



# Pipeline Transportation Concern: *Trailback into Jet Fuel*

- ◆ Definition of “0” FAME
  - Will determine what is considered contamination
  - Lowest detectable limit?
  - JIG 11/07 Bulletin – up to 5 ppm considered no-FAME
- ◆ Allowable FAME Levels in Jet Fuel
  - Aero-engine OEM Approval of higher concentrations
  - JIG P.Q. Committee – formal report to OEM’s
  - Data Shared with OEM’s at IASH 10/7/07 Meeting
    - FAME levels up to 400 ppm - properties unaffected
    - Even if properties unaffected, fuel must be “Fit For Purpose”



# Pipeline Transportation Concern: *Increased Interface Generation*

- ◆ Volume Settlement Process
  - Customers made whole for interface downgrades
  - When jet fuel is cut short, pipeline compensates those customers for shortfall
  - Increased shortages means increased payments to customers
- ◆ Settlement Process Would Change for Biodiesel
  - Biodiesel shippers would be responsible for the additional downgrades
- ◆ Alternative – Non-Biodiesel Buffer Material
  - Limits Flexibility/Capacity

# Batch Sequencing - Interface

NO BIODIESEL



Flow 

WITH BIODIESEL



*Larger Interface Due to FAME Contamination*

# Buffer Material

NO BIODIESEL



Flow 

WITH BIODIESEL (USING BUFFER)





# Pipeline Transportation Concern: *Lack of Additional Tankage*

- ◆ Already Multiple Grades of Diesel
  - ULSD (<15 ppm)
  - Low Sulfur Diesel (<500 ppm)
  - High Sulfur Diesel (>500 ppm)
- ◆ Tankage Constraints
  - Incapable of moving multiple blend percentages
  - Move one biodiesel blend AT MOST
    - Blending at rack if additional biodiesel required
    - May have to commingle with non-blended product



# Pipeline Transportation Concern: *Tracking Biodiesel Content*

- ◆ Scenario #1: All Product is 5% Blend
  - Downstream customers all get 5% biodiesel
  - Additional blending at the rack based on 5%
- ◆ Scenario #2: Mixture of Blends & Non-Blends
  - Segregation of blends & non-blends requires tankage
  - Commingling of blends & non-blends likely
  - Biodiesel content uncertain after commingling
    - Affects additional rack blending, as well as additives
  - Requires downstream testing to determine blend content



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# Pipeline Transportation Concern: *Lack of Low-Level FAME Test*

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- ◆ Test for Identifying Contamination
  - Must be capable of testing to the maximum allowable limit in jet fuel
- ◆ Must be Applicable in Field Environment
  - Can't send samples to lab during batch change
  - Require fast, accurate results



# Pipeline Transportation Concern: *Cold Flow in Pipeline*

- ◆ Concern with Pure Biodiesel (B100)
  - Higher pour point than refined petroleum products
  - Low-level blends should have sufficient cold flow properties to avoid gelling
- ◆ Underground Exposure
  - Long transit times
  - Cooling effects
- ◆ Dependent on Biodiesel Source
  - Rape seed, tallow, soy, palm, etc.
    - Varying cold flow properties
    - Monitoring biodiesel source is not feasible for pipeline



# Pipeline Trial



# Test Movement – Trapil, France

- ◆ Test Protocol
  - 150 km (93 mile) transfer through 20” pipeline
  - Two pipeline runs
    - Referee Case – Jet Following Non-Biodiesel
    - Test Case – Jet Following 10% Bio-blend
  - Jet Fuel for referee and test case from same batch
- ◆ Results
  - Interface Increased by 20%
  - Detected FAME in the Jet
    - Performance Properties of the Jet Not Affected

*Info from presentation to IASH Conference, Oct. '07*



# Pipeline Specifications



# Specification Comparisons: *ASTM vs. States vs. Pipeline*

- ◆ Pipeline Specifications Developed Based On ASTM and State Requirements
  - Some additional specs for pipeline (ex.: corrosion)
- ◆ Not All Specs are Identical
  - States typically adopt ASTM standards
  - Pipelines must ensure that product meets ASTM and state specifications at point of retail
- ◆ Inclusion of Biodiesel Blends in D975 Does NOT Guarantee Pipeline Acceptance
  - Must be capable of moving safely without impact to other products

# Pipeline Comparison: *Biodiesel vs. Ethanol*

	<b>Biodiesel</b>	<b>Ethanol</b>
<b>Metallurgical Issues</b>	None	Stress Corrosion Cracking (SCC)
<b>Operational Concerns</b>	Trailback	System Cleanliness
<b>Solvency</b>	Stronger solvency than typical diesel fuel	Pick up <i>all</i> dirt and contaminants in pipeline
<b>Water</b>	Accelerates degradation and corrosion	Miscible in water – separation difficult
<b>Air Interaction</b>	Stability Issues	Component of SCC



# Additional Concerns

- ◆ Phase Separation
  - Product will sit in breakout tankage
  - One tank will likely supply multiple customers
  - Can't rely on product mixing at delivery
- ◆ Compatibility of Drag Reducing Agent (DRA)
  - DRA is essential in many systems for additional capacity
  - Movement of products without DRA slows the line
  - Pure Biodiesel – will DRA work?



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# Where Do We Go From Here?

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# Path to Overcome

- ◆ More Pipeline Trials
  - Additional information to make better decisions
- ◆ Better Testing Capabilities
  - Testing at low levels is imperative to identifying contamination
- ◆ Get Jet Fuel Experts Involved
  - Express desire to move biodiesel via pipelines
    - If no reason to investigate higher levels of FAME in jet fuel, it will never be approved
  - Establish acceptable FAME levels
    - Must come from OEM's



# Path to Overcome

- ◆ Discuss Changing Pipeline Logistics
  - Modified Interface Cutting
    - Downgrades will be at the expense of the biodiesel shipper
  - Controlled Product Sequencing
    - Jet fuel moving around gasoline or other non-bio blends
  - Non-FAME Buffers
    - Buffer size sufficient enough to remove FAME from pipe
  - Minimum Jet Fuel Batch Sizes
    - Dilution of FAME impact
    - *Assuming FAME is acceptable at some concentration*



# Success Story



# Past Challenges – Red Dye

- ◆ Concerns When Dye Introduced in Pipeline Movements
  - Trailback concern with jet fuel
- ◆ Changes to Product Movements
  - Product sequencing (where available)
  - Changed product cut criteria
  - Testing equipment
- ◆ Minimal Red Dye Issues with Jet Fuel
  - Contamination easily identified visually and quantified with field equipment



## Other Sources of Information...

- IASH Conference – Trapil Trial April 2007  
October 2007  
<http://iash.net>
- IATA Aviation Fuel Forum  
Istanbul, Turkey 11/5/07-11/8/07  
[www.iata.org](http://www.iata.org)
- JIG Bulletin No. 15  
November 2007  
[www.jointinspectiongroup.org](http://www.jointinspectiongroup.org)



Questions???