

Challenges in the Evolving Crude Oil Landscape from Shale Plays

EPA-NEMC 2014

Kesavalu M. Bagawandoss, Ph.D., J.D.

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Outline

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- ❖ Introduction
- ❖ Hydraulic Fracturing
- ❖ Shale Oil & Gas Resources
- ❖ Transportation, Quantity, Quality & Safety - Current Landscape
- ❖ Summary
- ❖ References

Introduction

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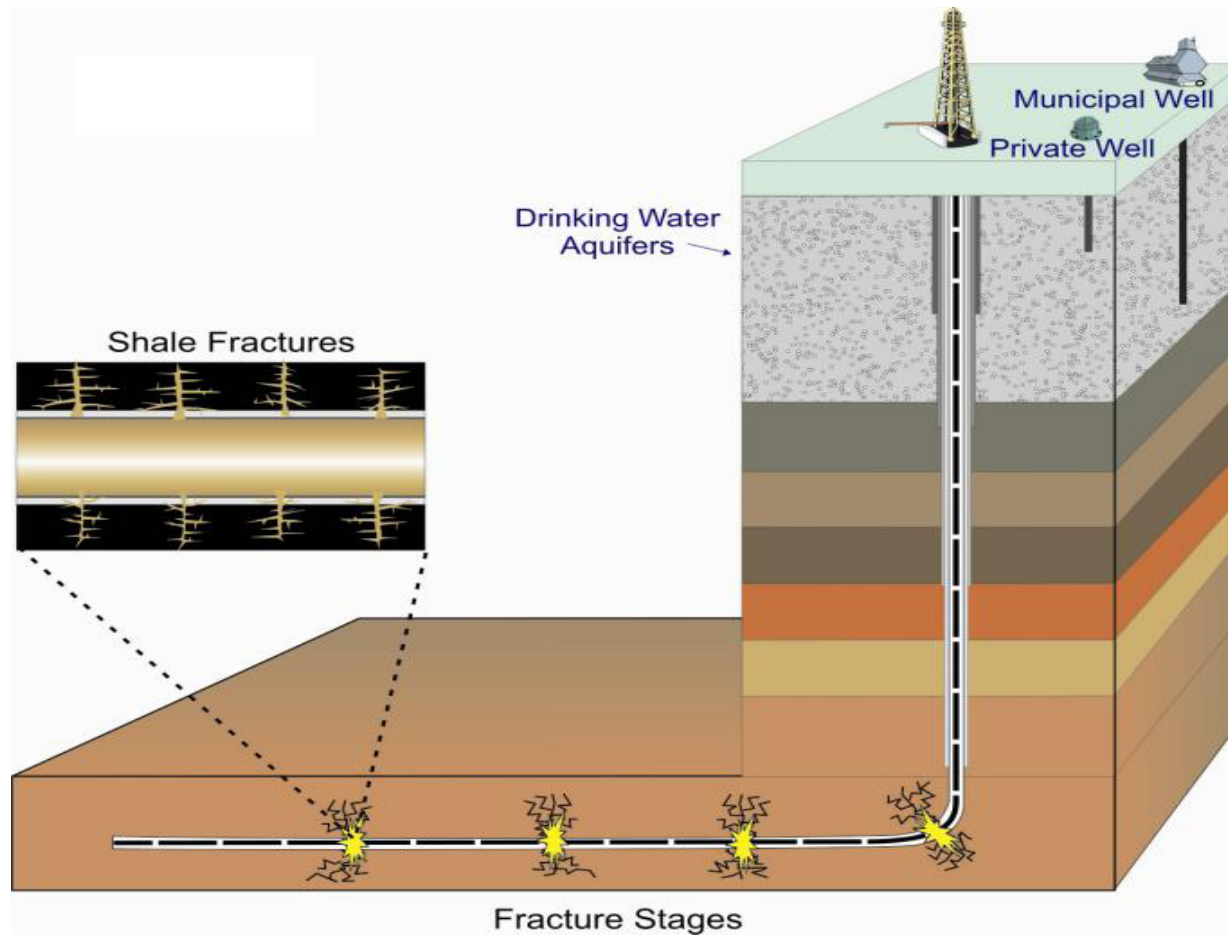
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- Well Stimulation by Hydraulic Fracturing and Horizontal Drilling
- O & G Exploration has created more than 1 million new jobs
- More than 1 million HF jobs have been completed
- Production of Crude Oil Growing (Self Sufficient and Exporting Natural Gas)
- Transportation Infrastructure
- We must, at the same time, harness our Natural Resources in a safe manner and protect our environment, health and welfare of our citizens

Hydraulic Fracturing

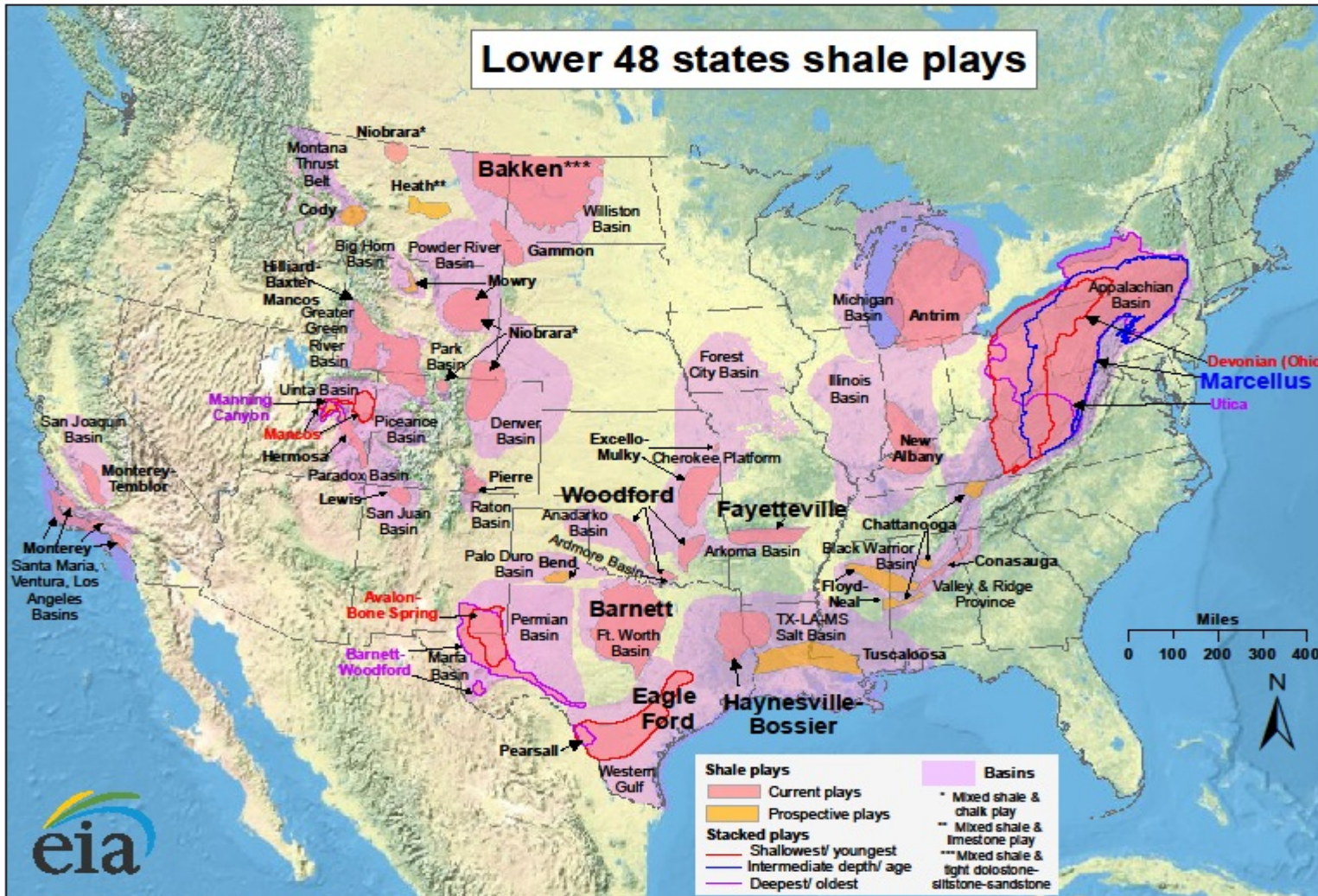
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Courtesy of EPA

Major Shale Plays and their locations



Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

Shale Supply Chain

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Exploration & Production



Gathering & Processing



Primary Logistics



Refining / Plants



Open Market

Secondary
Logistics
Product
Trading

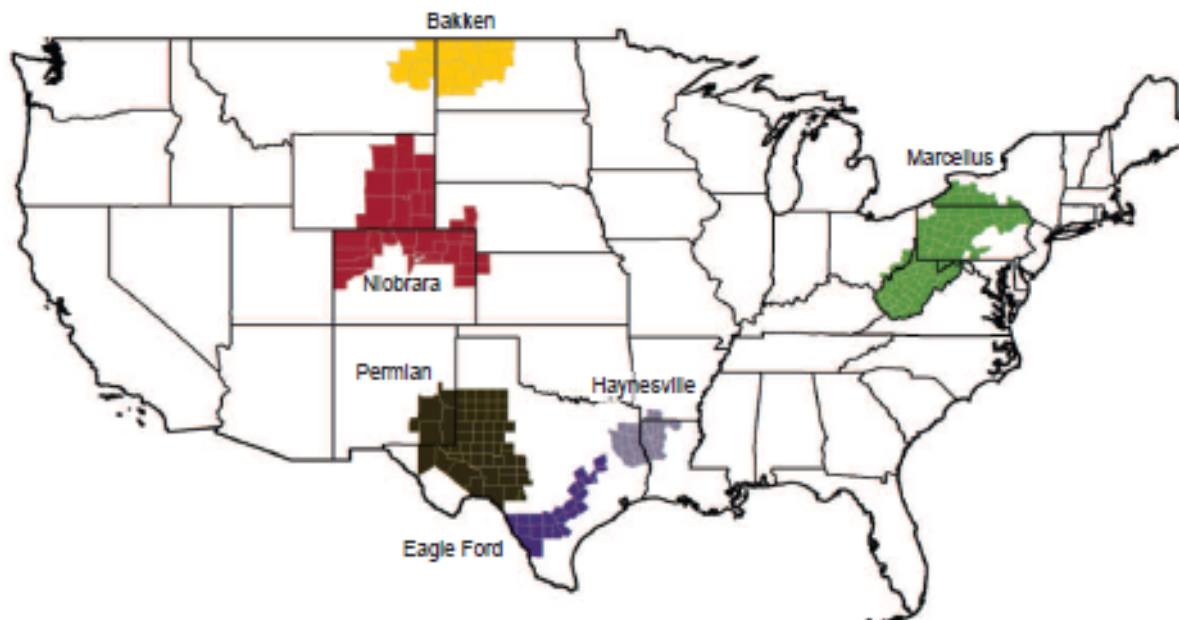
Oil and Gas Production

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Drilling Productivity Report

For key tight oil and shale gas regions



The six regions analyzed in this report accounted for nearly 90% of domestic oil production growth and virtually all domestic natural gas production growth during 2011-12.

Courtesy of US EIA

Current Production



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Oil ~ 8.4 MBPD

Gas ~ 78.1 BCFPD

Exports – Natural Gas – LNG terminals
- Crude (2 permits in US)

Crude Oil Issues - Current Landscape

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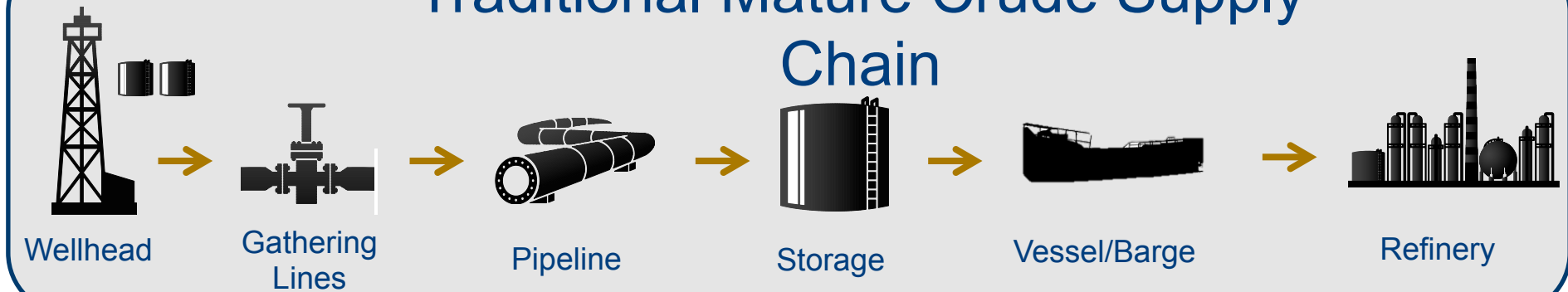
Issues

- Transportation
- Quantity
- Quality
- Safety

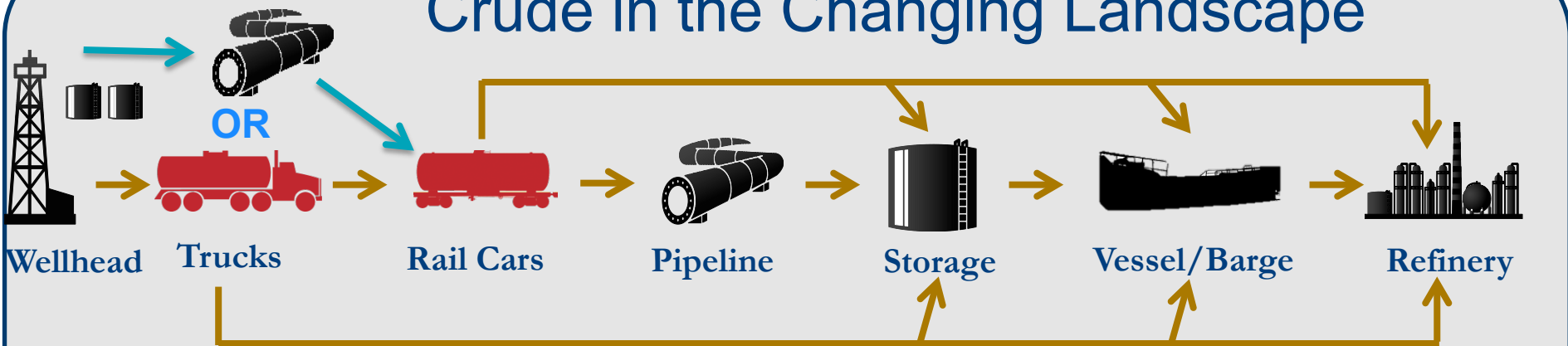


Transportation of Crude By Rail

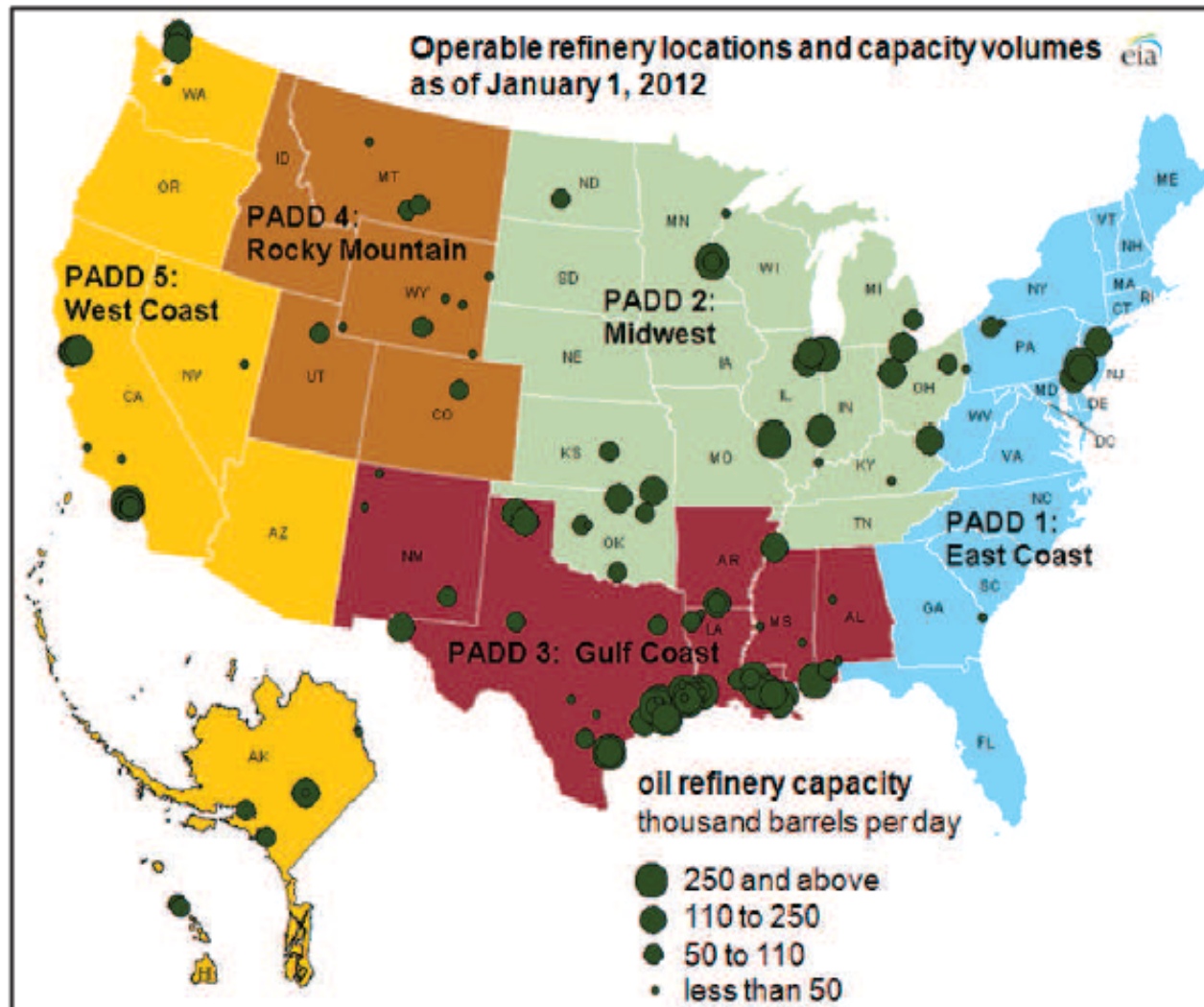
Traditional Mature Crude Supply Chain



Crude in the Changing Landscape



Transportation of Crude by Rail



The Petroleum Administration for Defense Districts (PADDs) are geographic aggregations of the 50 States & DC

Crude Oil Types are Evolving

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A Diverse and Growing Range:

- **Conventional Crudes**
- Virgin Crudes
- “Dumb-Bell Crudes” (Blended)
- **Unconventional Crudes**
- **Tight Sands aka Shale Plays**



Example Shale Crude Oils



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Bubbling Crude



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<http://www.intertek.com/ngl-condensate-boiling-video/>

Crude Oil Issues - Current Landscape

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Transportation Issues

- Pipeline Infrastructure is Scarce
- Crude transported from Well Head to Rail Cars by Trucks (traffic issues on the road)
- Quantity of Rail Cars
- Rail Car Safety
- DOT Emergency Order
- Packing Group determinations
- Risk Communications
- New DOT NPRM – July 23, 2014
- HHFT (“high-hazard flammable train”)

(20 or more carloads containing a Class 3 flammable liquid)



Crude Oil Issues - Current Landscape

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- New DOT NPRM – July 23, 2014
 1. Rail Routing
 2. Classification of mined Gas and Liquids
 3. Notification to Emergency Responders
 4. Speed Restrictions
 5. Braking
 6. Tank Car Specifications



Crude By Rail Slate

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- **Classification Tests**
- IBP & Flash Point
- **Additional Tests** (if offeror doesn't have sufficient knowledge of composition)
- Light Ends, Vapor Pressure, Sulfur components/H₂S, Corrosivity
- Corrosivity – UN, NACE
- Optional SIM DIS (DOT/Operator)
- Sampling
- Frequency of Analysis (composition)



Crude Oil Issues - Current Landscape

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Quantity Issues

- Measurements at points of Sale and Receipt
- Meters Calibrated



Pipe Prover



LACT

Crude Oil Issues - Current Landscape

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Quality Issues

- Quality checks at Origination
- Quality at the point of Delivery
- Effects of Transport
- Sampling



Safety Issues

- Volatility (analytical & sampling methods)
- H₂S issues (analytical & sampling methods)
- Classification of Crude per DOT codes



Rail Car Safety

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- DOT Specifications
- Corrosion



Summary

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- Energy Production is proliferating
- Petrochemical Industry is enjoying benefits of NG
- Benefits in both jobs and local economies
- Technological advancements
- Need Transportation Infrastructure
- Safety
- Energy Independence - sooner than predicted or anticipated

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Contact Details

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Kesavalu M. Bagawandoss, Ph.D., J.D.

Corporate Technical Director

801 Travis St., Suite 1500

Houston, TX 77001

Phone: (713) 407-3500

Email: dr.doss@intertek.com

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