

# Crude by Rail

Bob Greco, API

NCSL Task Force on Energy Supply

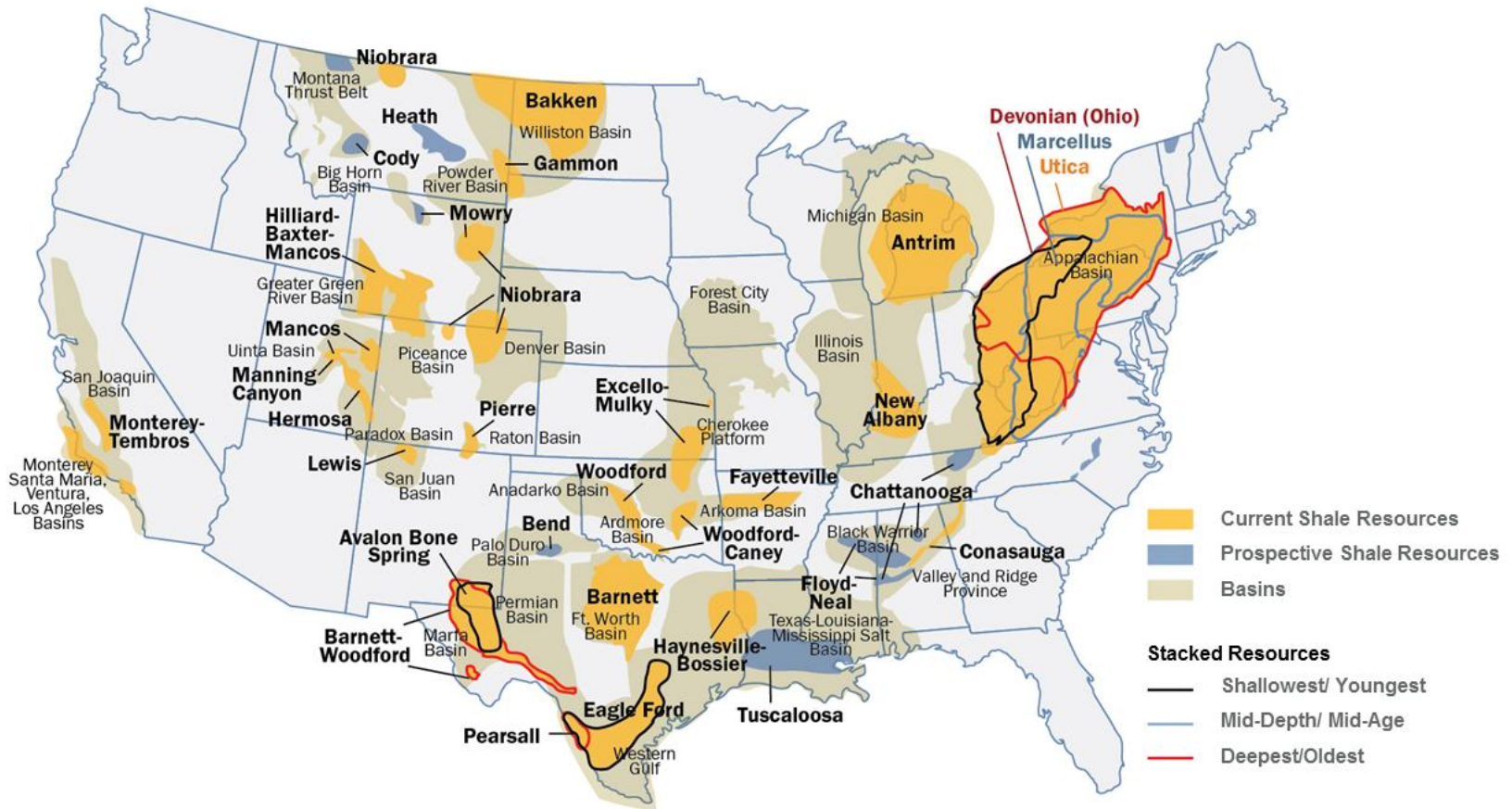
December 9, 2014

# American Petroleum Institute

- National Trade Association formed in 1919
- Only U.S. association representing entire value chain of the oil and natural gas industry: exploration, production, pipelines, refining, marketing and transportation
- More than 600 member companies
- State Petroleum Councils in 33 States

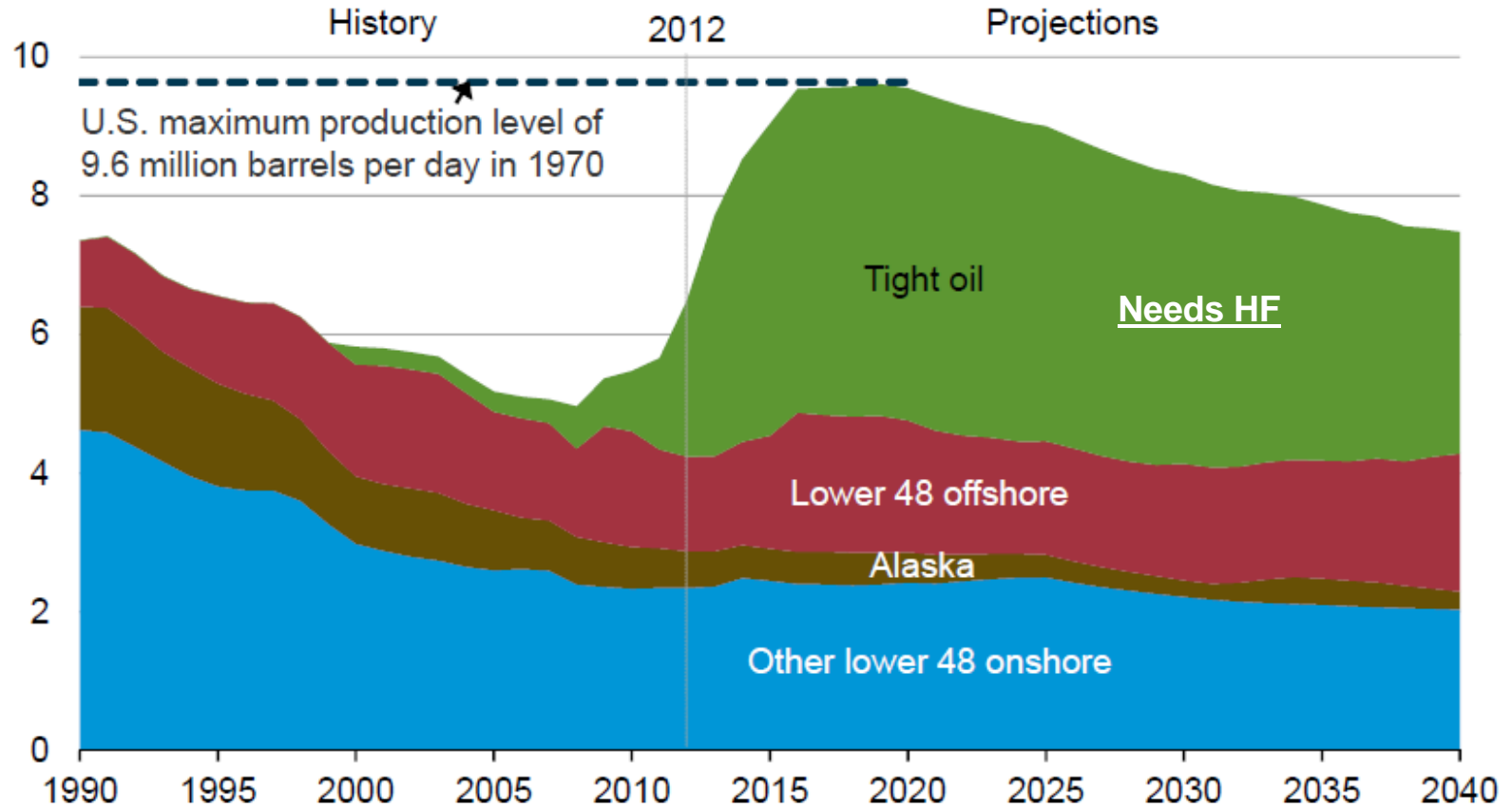
# U.S. Energy Revolution

## Shale Resources, Lower 48 States



Current and prospective resources and basins in the continental US

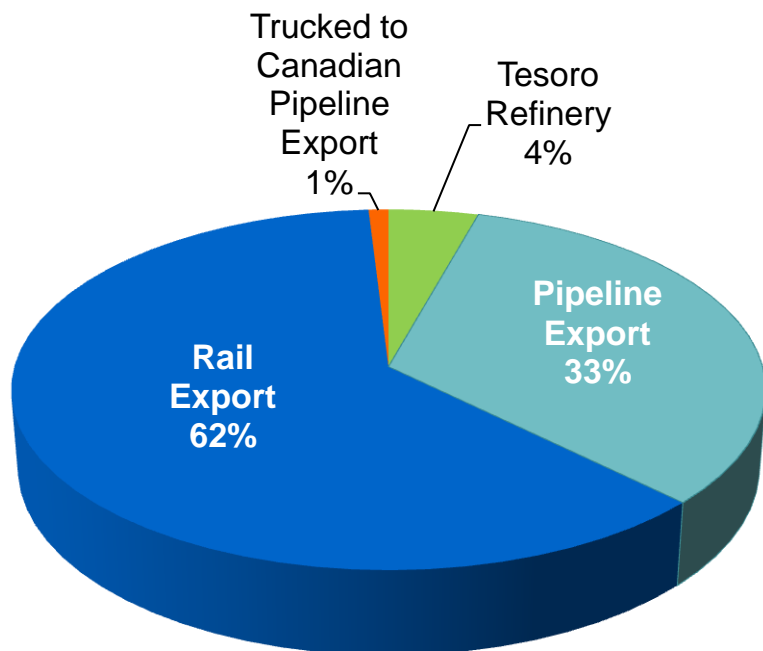
U.S. crude oil production  
million barrels per day



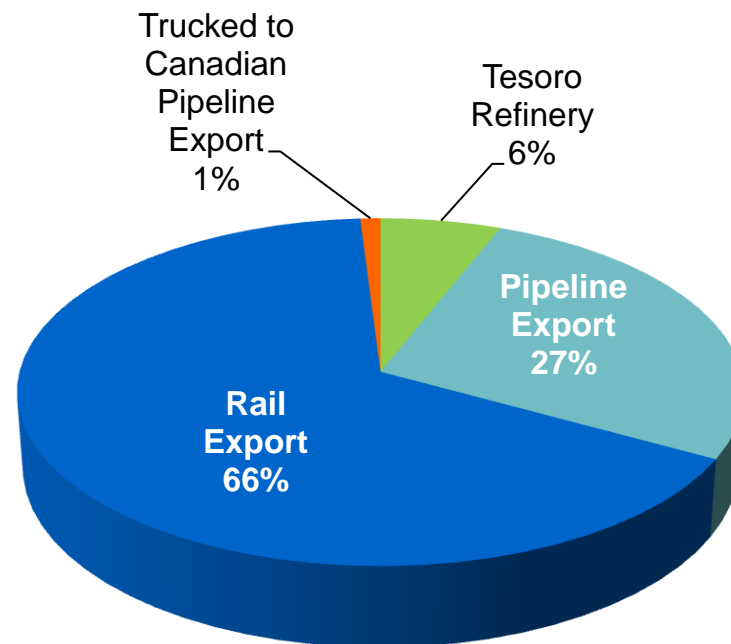
Source: EIA, Annual Energy Outlook 2014 Early Release

# Williston Basin Crude Oil Transport

**2013**



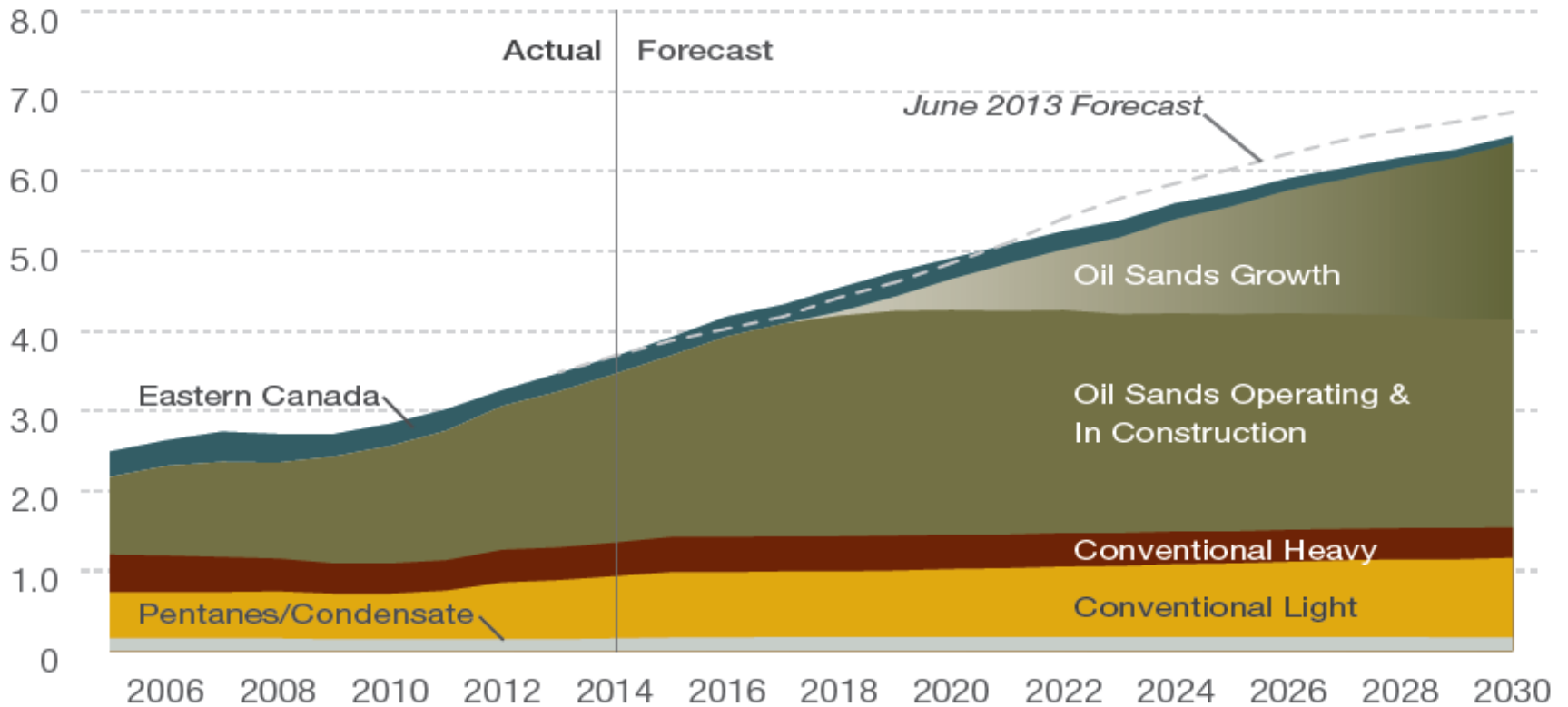
**2014**



Source: North Dakota Pipeline Authority

# Canadian Crude Oil Production

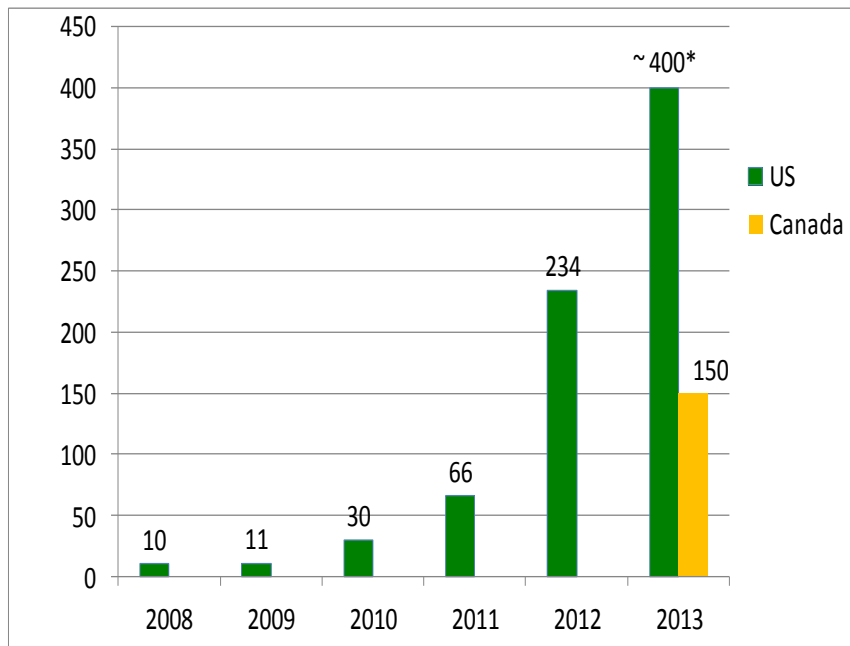
Canadian Oil Sands & Conventional Production  
million barrels per day



Source: CAPP

# Growth of Crude by Rail

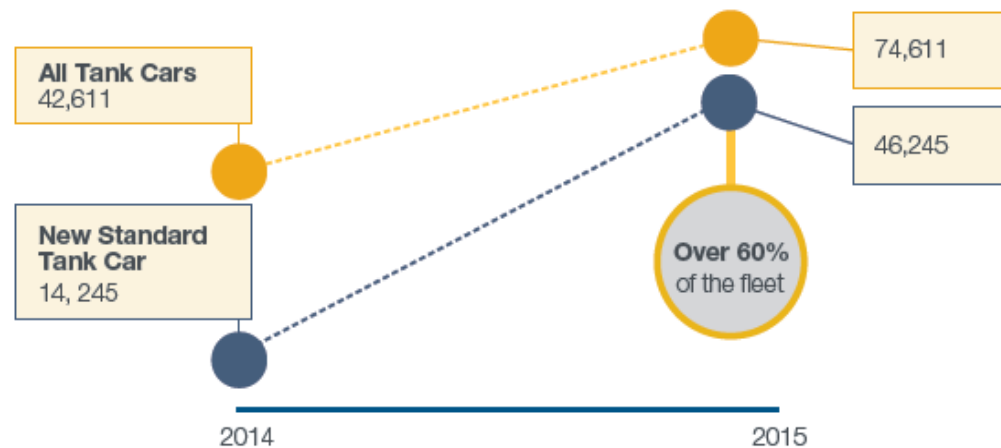
## Growth of Crude by Rail Carloads



Originated Carloads on Class I Railroads (1,000's)

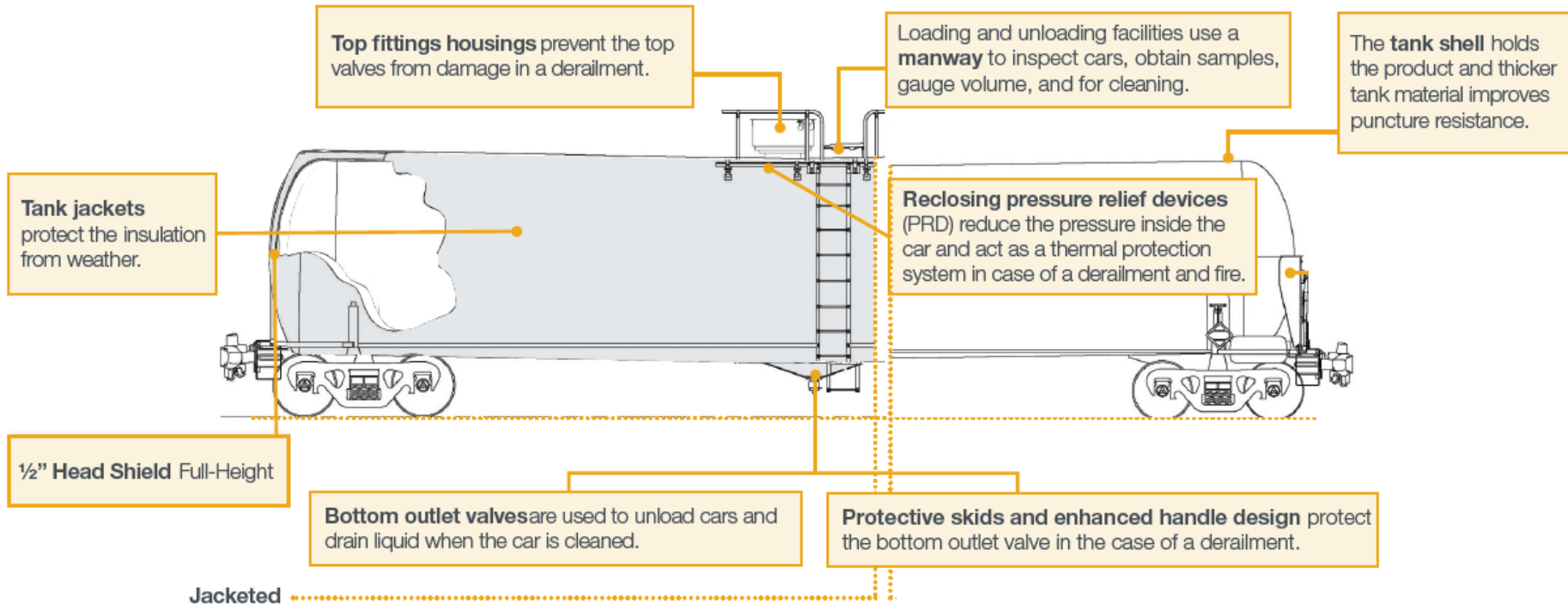
Note: 409,000 ethanol movements in 2011

## Crude Oil Tank Car Fleet



Sources: AAR & RSI Presentations to NTSB, April 2014

# Oil & Gas Industry Improvements to Rail Safety: CPC-1232 Tank Car Design





# Sustained Tank Car Supply: Critical for continued production & economic growth

- Bakken production could reach over 2 million bpd by 2020
  - ~25% of U.S. Production, 13% of U.S. consumption
- Rail movements to grow 40% over 2013 levels by 2015
- Western Canadian rail growth: ~12,000 additional railcars in the next 12 months
- U.S. requires additional rail cars AND all modes of transportation, including pipeline, rail and barge, to supply the energy our country needs
  - sustain crude oil production forecasts
  - reduce dependence on imported foreign crude oil
  - support globally competitive refining industry

# Classification Process

Hazard Classes	
<b>Class 1</b>	<b>Explosives</b>
<b>Class 2</b>	<b>Gases</b>
<b>Class 3</b>	<b>Flammable and Combustible Liquids</b>
<b>Class 4</b>	<b>Flammable Solids; Spontaneously Combustibles; Dangerous when Wet</b>
<b>Class 5</b>	<b>Oxidizers/Organic Peroxides</b>
<b>Class 6</b>	<b>Toxics; Infectious Substances</b>
<b>Class 7</b>	<b>Radioactives</b>
<b>Class 8</b>	<b>Corrosives</b>
<b>Class 9</b>	<b>Miscellaneous</b>

# Classification Process

Class 3 Packing Groups		
Packing Group	Flash Point	Initial Boiling Point
I		$\leq 95^{\circ}\text{F}$
II	$< 73^{\circ}\text{F}$	$> 95^{\circ}\text{F}$
III	$73^{\circ}\text{F}-140^{\circ}\text{F}$	$> 95^{\circ}\text{F}$

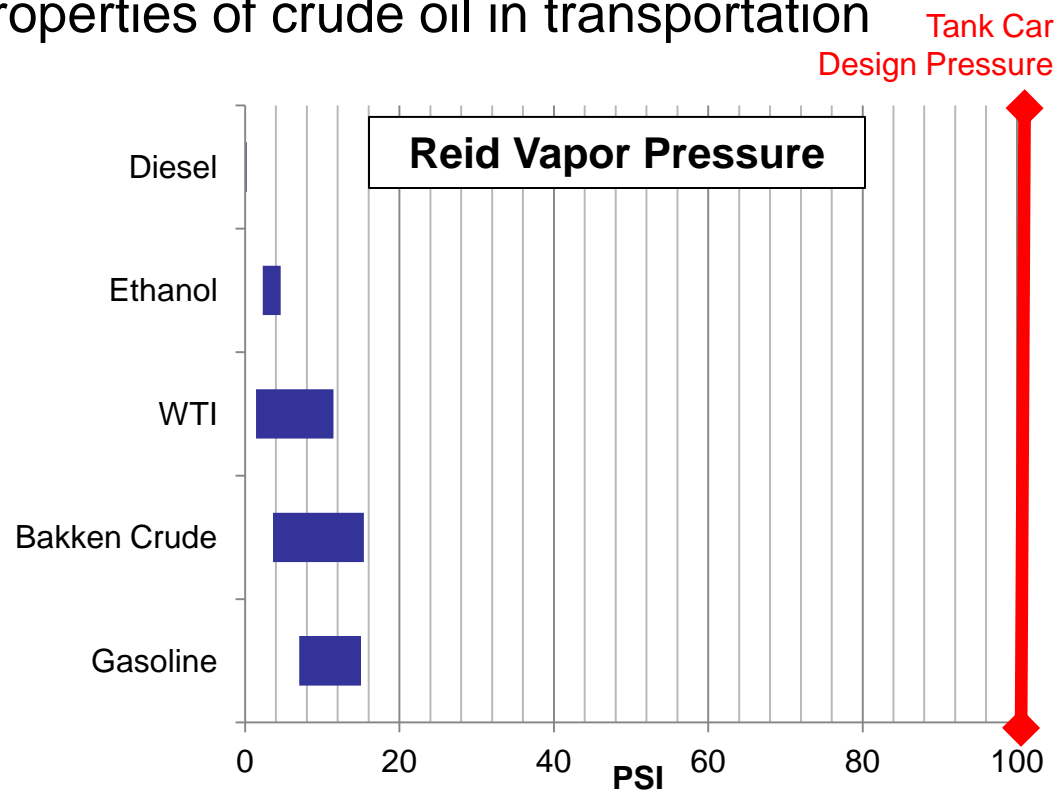
# API: Holistic Approach to Safety

**Focus on holistic and systematic approach to safety improvements: Prevention, Mitigation, and Response**

- Solutions must be data-driven with measurable improvements to safety without creating new risks or inadvertently shifting the risks to other businesses or operations
- Collaboration is needed among government, shippers, owners/lessors, railroads, and tank car builders

# Industry Action

- **New API standard (RP3000) for classifying, loading/unloading, and transporting crude oil to ensure it is moved safely**
  - Assessment of physical properties of crude oil in transportation
- **API, NDPC, AFPM have all studied the physical properties of crude oil**
  - Bakken crude is similar to other light, crude oils
  - Vapor pressure by itself is not an indicator of volatility



# DOT Statements

- Timothy Butters, PHMSA -- “Bakken crude oil’s gas content, flash point, boiling point, and vapor pressure are not outside the norm for light crude oils.”\*
- FRA noted in its study that vapor pressure was not an effective metric when considering real world accident conditions.

\* PHMSA’s Deputy Administrator, Tim Butters, testified on Sept. 9<sup>th</sup> before the Subcommittees on Energy and Oversight, Committee on Science, Space, and Technology

# Questions Answered by Research on Bakken Crude

- **Is Bakken crude different than other light crudes?**
  - No, research shows that Bakken is not materially different than other light crudes
- **Is Bakken crude more volatile than other light crudes?**
  - No, the average initial boiling point, flash point, and RVP of Bakken are similar to other light crude oils
- **What indicators are we assessing?**
  - Flash point, vapor pressure, IBP, API Gravity, light ends composition, others
- **Is Bakken crude compatible with our current rail cars?**
  - Yes, Bakken crude is currently packaged in railcars designed to carry flammable liquids at a design pressure of 100 psi

# DOT Proposed Rail Safety Rule

- Proposed rule published July 23
  - Advance Notice (ANPRM) on emergency response
  - 3800+ comments submitted by Sept 30 (deadline)
- Concerns
  - Overestimated retrofit capacity
  - Underestimated size of fleet
- Final rule: March 2015?



# API/AAR Joint Comments

- New Tank Cars
  - 1/2" shell with jacket, thermal blanket, full height head shields, pressure relief device, bottom-handle outlet protection, & top fittings protection
- **Existing** Non-Jacketed cars (DOT-111 (7/16") and CPC-1232 (1/2"))
  - Same as New Car spec (less shell thickness)
  - After retrofit – 21,000 1/2" cars meeting New Car Spec
- **Existing** jacketed cars (7/16") get BOV and PRD -- thermal blankets **not** needed
- Prioritize cars in crude oil and ethanol: most of the unit train service for flammable liquids
- Retrofit schedule must account for shop capacity and must be reviewed

# API/AAR Recommendation: Safety-Driven

- Improved puncture and spill resistance
  - University of Illinois: conditional probability of release (CPR) for cars involved in accidents - uses over 40 years of data
- Avoidance of a tank car thermal rupture
  - Predicts the time to failure for a tank car involved in a pool or torch fire - Analysis of Fire Effects on Tank Cars (AFFTAC) modeling

# Improving Response

- Oil and rail industry emergency response professionals are partnering to share expertise around crude oil spills and fires.
- Optimized positioning of assets, resources and personnel facilitates quick, effective response to rail incidents involving crude oil.
- Oil and rail industry experts are working with multiple stakeholders to develop training and exercises for first responders.

# Conclusion

- Crude-by-rail: necessary for a robust oil/gas infrastructure
  - enhances economic growth, supports jobs, and is good for the country
- The industry is using state-of-the-art tank cars and is committed to further improvements
- API and AAR: significant progress on collaborative approaches
- DOT should take a holistic approach to safety and finalize a rule grounded in science and data

Bob Greco  
Group Director, Downstream &  
Industry Operations

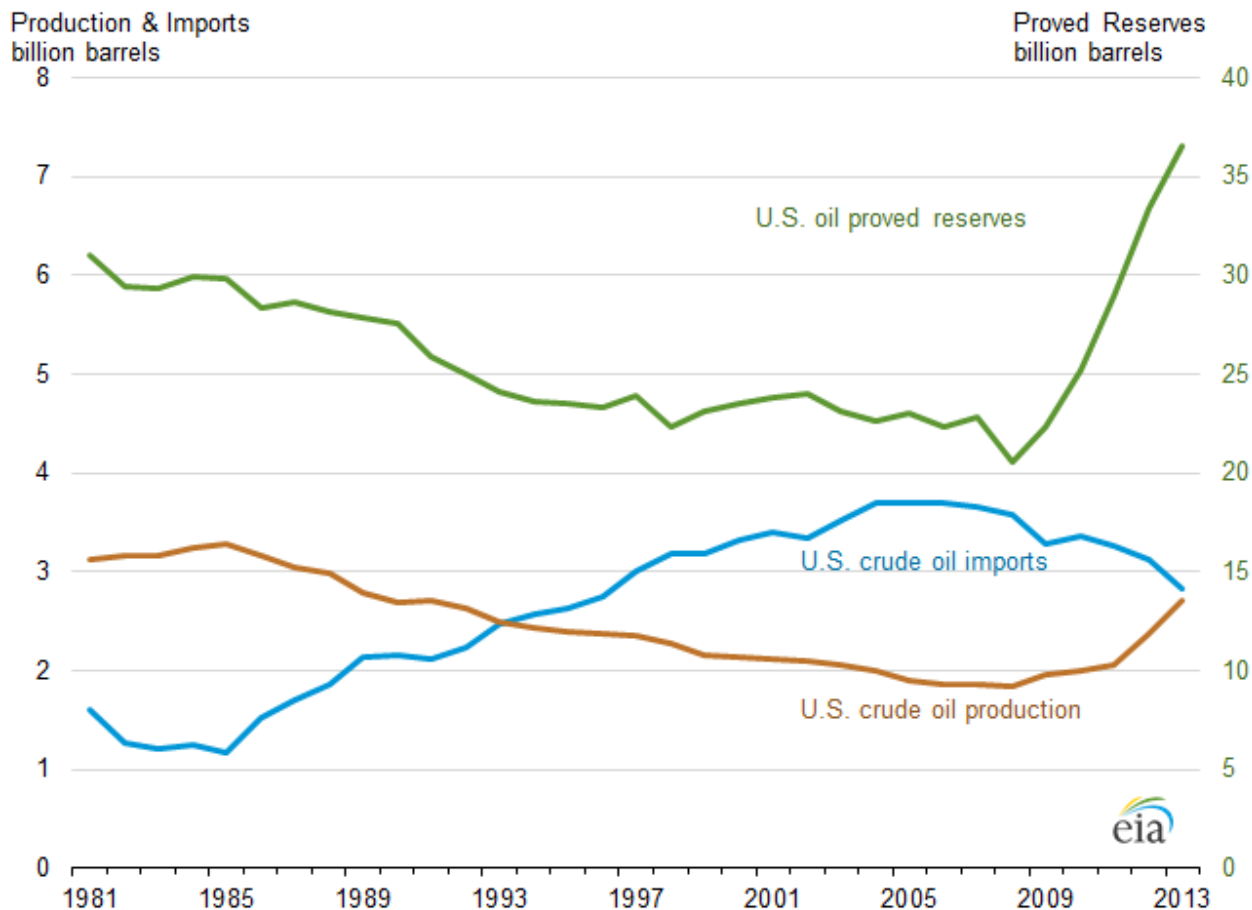
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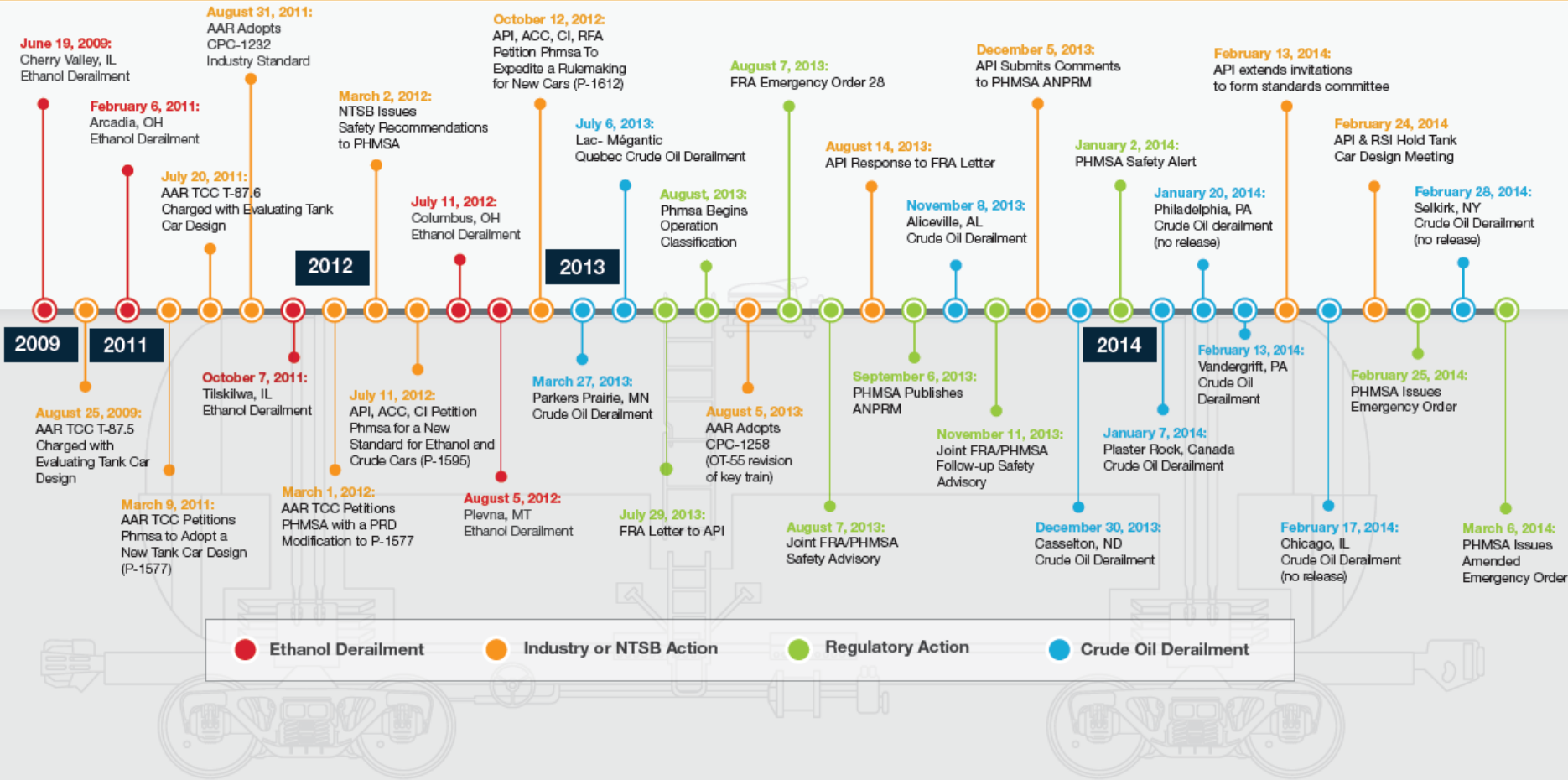
# Background slides

Figure 4. U.S. crude oil and lease condensate proved reserves, production, and imports, 1981-2013



Sources: U.S. Energy Information Administration, Form EIA-23L, Annual Survey of Domestic Oil and Gas Reserves; Form EIA-814, Monthly Imports Report; and U.S. Department of Energy, Office of Fossil Energy, Natural Gas Imports and Exports.

# Timeline of Rail Events



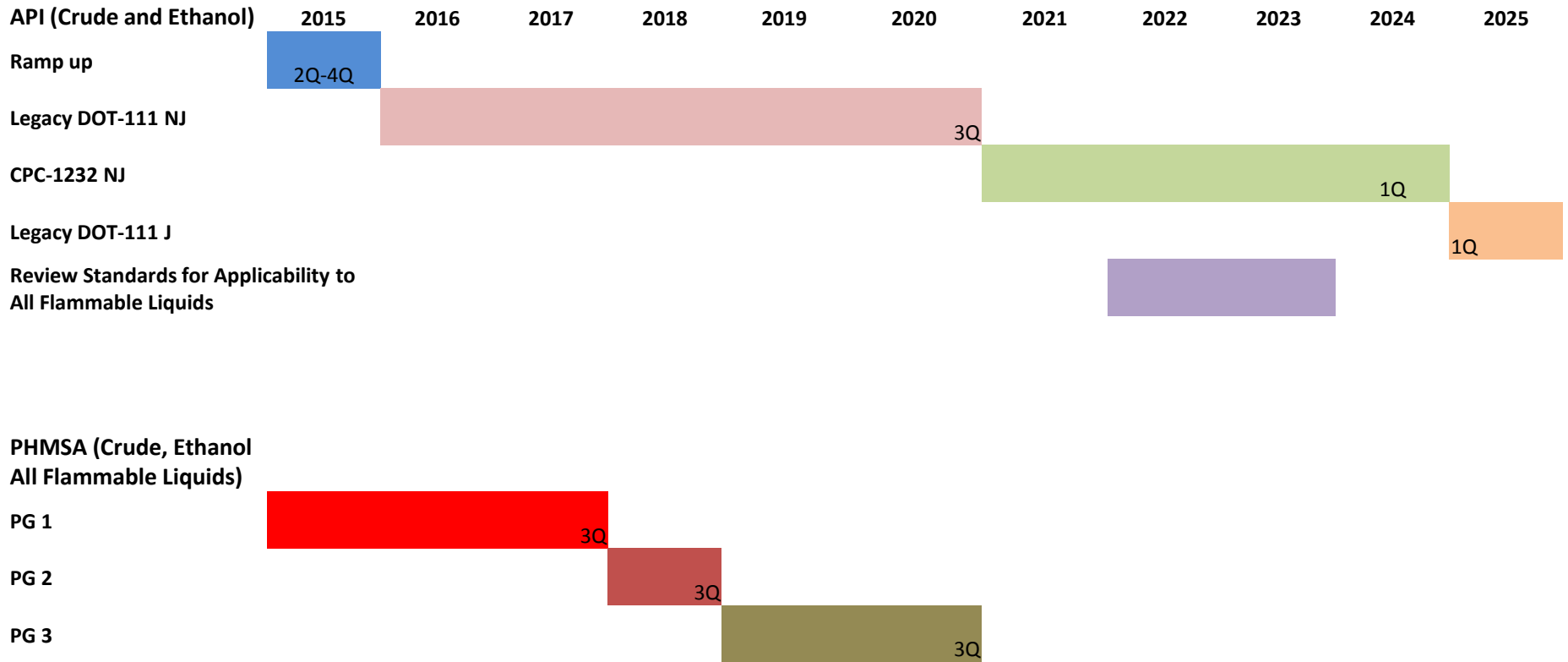


# Crude Oil and Ethanol Tank Car Fleet\*

Car Type (CPR Value)	Number as of 2013	2014 orders	2015 orders	Crude Total	Ethanol Total	Ethanol and Crude Total
CPC-1232 J (4.57%)	7,685	13,647	9,730	31,062	23	31,085
CPC-1232 NJ (10.3%)	11,364	7,481	1,180	20,025	751	20,776
Legacy-111 J (8.5%)	6,524			6,524	88	6,612
Legacy-111 NJ (19.55%)	22,930			22,930	26,983	49,913
			Total	80,541	27,845	<b>108,386*</b>
<p>* Note: Excludes 38,000 tank cars in Other Flammables service.</p>						

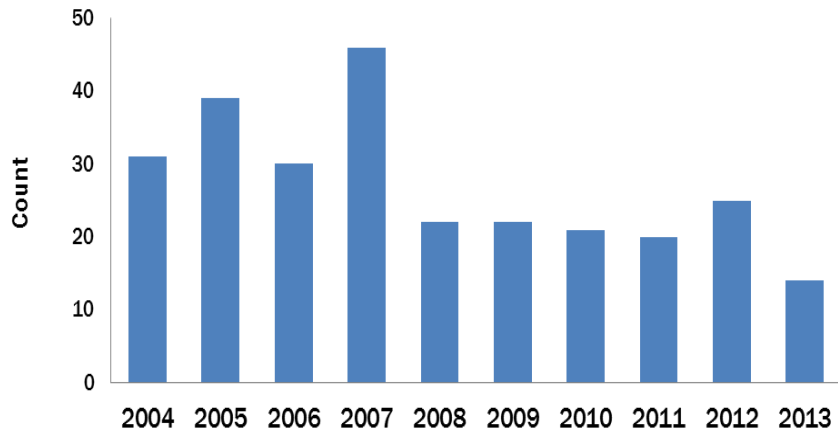
\* AAR data of existing cars. RSI data shows committed tank car orders that are contracted to be built for a specific design and will be completed by the end of 2015.

# Proposed Retrofit Schedule

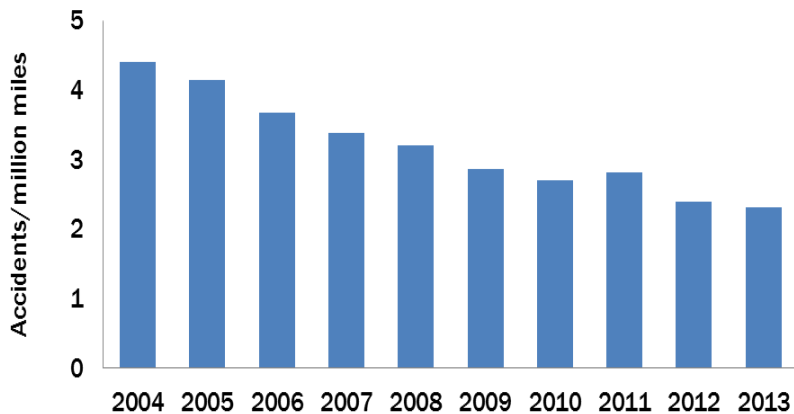


# U.S. Rail Safety Statistics

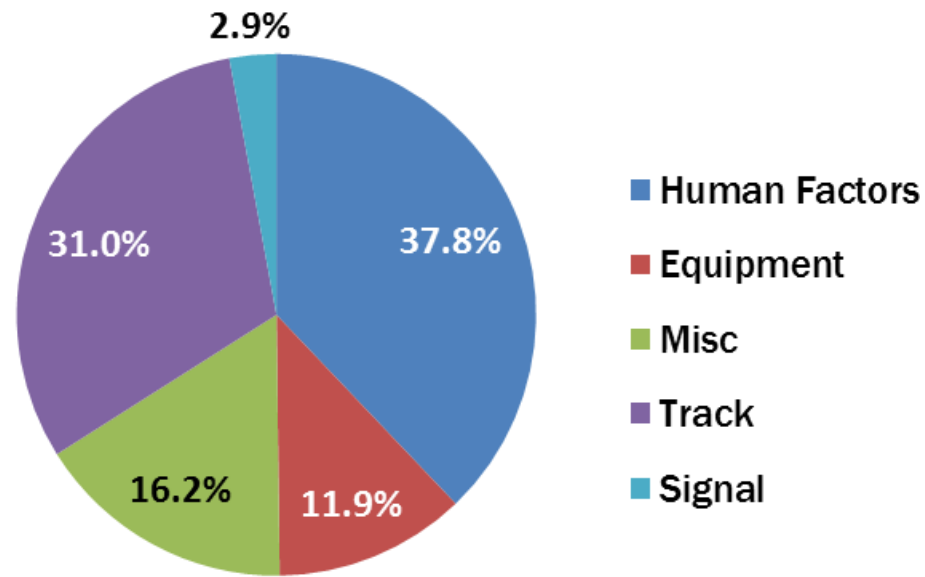
Accidents Resulting in Hazardous Materials Release



U.S. Rail Accident Rate



2012 U.S. Rail Accidents<sup>1</sup>



**69% of rail accidents are caused by operational errors and track failures**

# Industry Action - Comparison of Crude Oil Data Sets

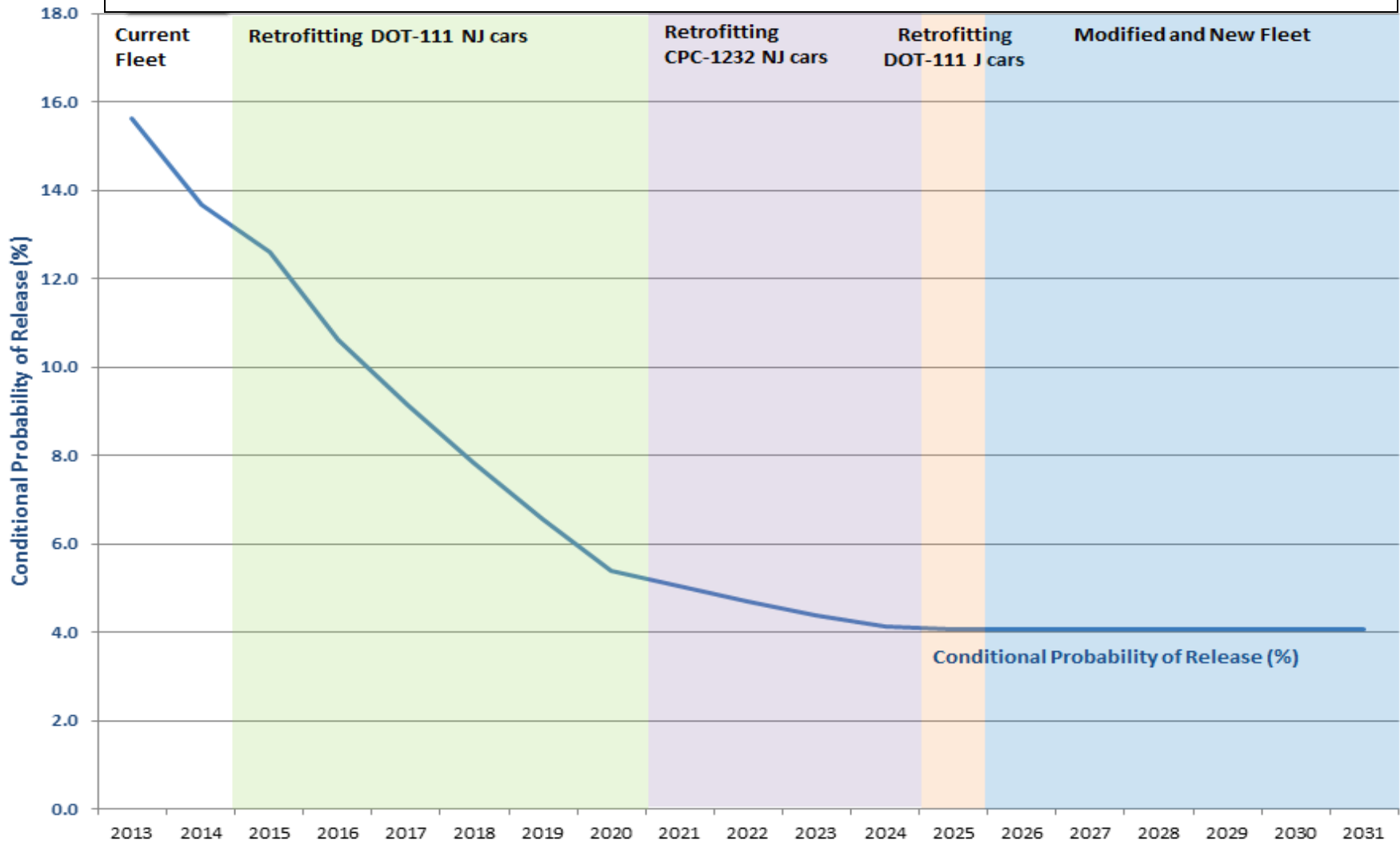
		API Other Crudes*	API Bakken*	AFPM	NDPC
Vapor Pressure PSI (ASTM D6377)	<b>Avg</b>	<b>7.24</b>	<b>11.81</b>	<b>8 - 12</b>	<b>11.7</b>
	Min	1.43	3.60	0.8	8.9
	Max	11.46	15.37	15.4	14.4
Sulfur Wt % (D4294)	Avg	0.14	0.1	Not reported	0.14
	Min	0.01	0.02		
	Max	0.64	0.25		
API Gravity (D5002)	Avg	<b>40.36</b>	<b>42.66</b>	>37	<b>41</b>
	Min	34.40	38.60		36.7
	Max	46.9	47.07		46.3
Initial Boiling Point (D86) ° F	Avg	<b>101.94 (PGII)</b>	<b>91.96 (PG I)</b>	<b>69.6 (PG I)</b>	<b>99.6 (PG II)</b>
	Min	83.40 (PG I)	79.10 (PG I)	36.0 (PG I)	91.9 (PG I)
	Max	182.80 (PGII)	150.80 (PG II)	152.4 (PG II)	107.2 (PG II)

\* API's analysis of over 200 samples submitted to PHMSA

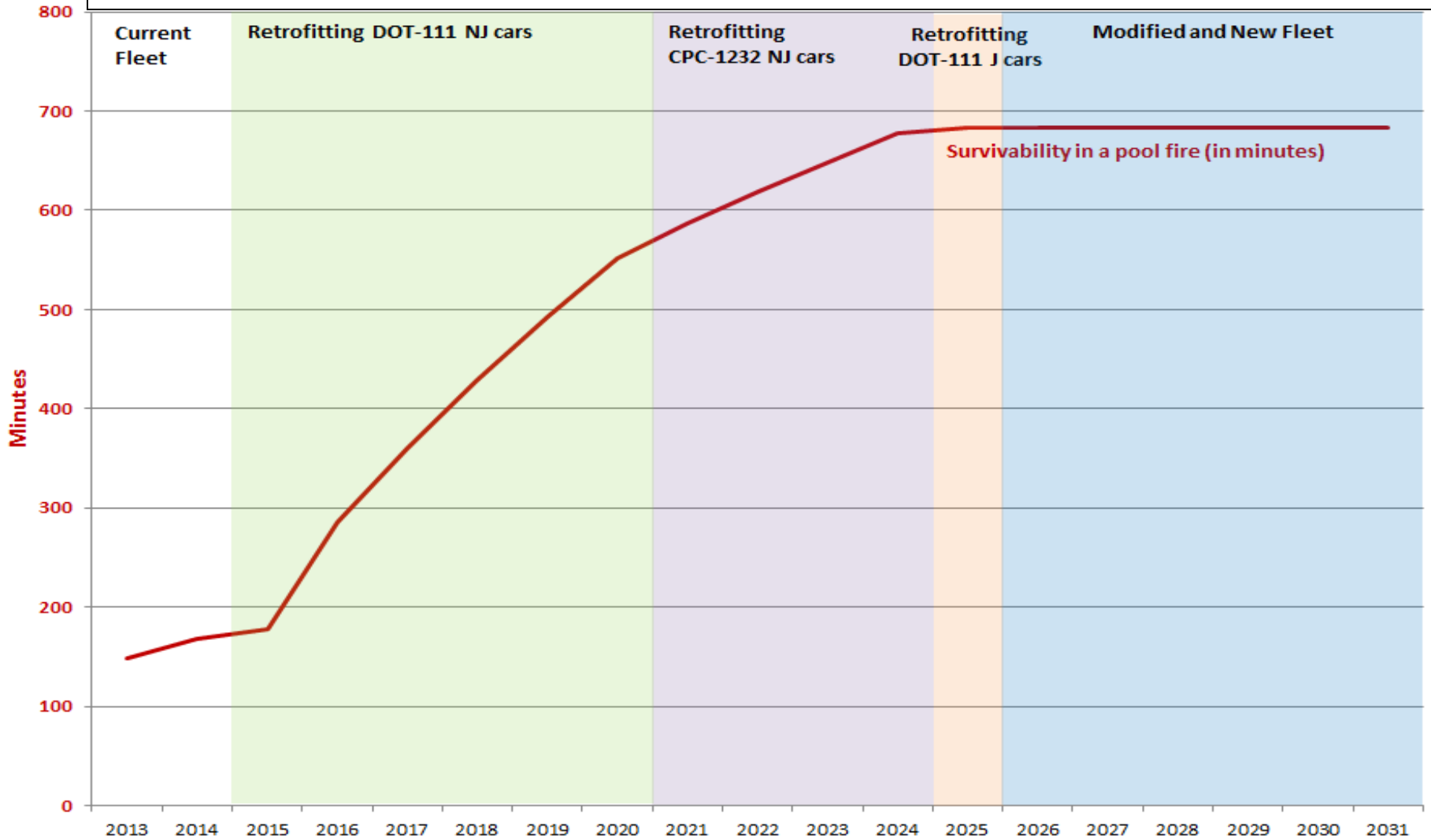
# ANSI/API RP 3000, Classifying and Loading of Crude Oil into Rail Tank Cars, Sept 2014

- Hazardous Materials Regulations cover all hazardous materials, RP 3000 provides guidance specifically for crude oil
- For rail transportation only
- Includes loading, does not cover offloading of crude oil
- PHMSA encouraged to incorporate API RP 3000 by reference into new DOT regulations
- Consideration will be given to revisiting the standard if new DOT regulations contain different requirements
- Developing training for RP 3000

## Safety: Improvements in Fleet Safety for the Crude Oil and Ethanol Cars



## Safety: Fleet Survivability in a Pool Fire Increased for Crude Oil and Ethanol Cars



# API/AAR Joint Industry Work Groups

