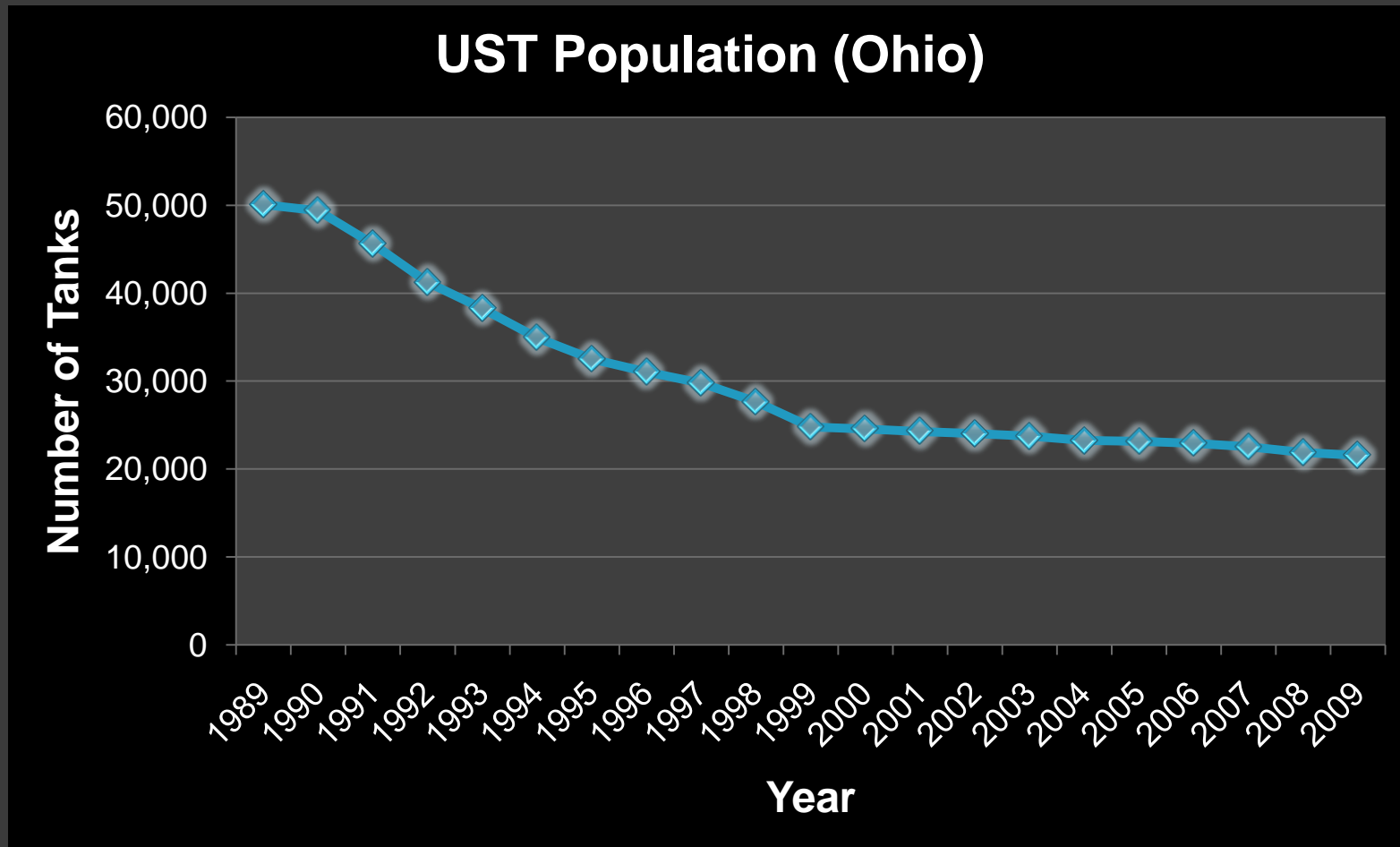


# ULTRA LOW SULFUR DIESEL AND OTHER MARKETING ISSUES

# Changing Industry



Source: Ohio Petroleum Underground Storage Tank Release Compensation Board (2010)

# Changing Industry

Facilities	Owners	Facilities per Owner	UST per Owner
1	3,117	3,117	8,277
2	289	578	1,528
3 - 5	162	600	1,601
6 - 9	50	361	1,126
10 - 19	24	296	840
20 - 49	37	1,136	3,543
50 - 99	6	414	1,299
100 - 149	4	509	1,651
150 - 199	2	346	754
>200	1	473	1,996
	<b>3,692</b>	<b>7,830</b>	<b>22,615</b>

92% (Owners: 3,117 / 3,692)

47% (Facilities per Owner: 3,117 / 7,830)

43% (UST per Owner: 8,277 / 22,615)

# Industry Challenges

- ⦿ New and alternative fuels
  - Reformulated
    - Ultra Low Sulfur Diesel (ULSD)
  - Bio-Based
    - Ethanol Blends
    - Bio-Diesel
  - Equipment compatibility
  - Fuel quality
- ⦿ Changes in UST regulations
  - Energy Act requirements
  - USEPA review of 40 CFR 280

# Ultra Low Sulfur Diesel (USLD)

# ULSD - Background

Who	What	U.S.	California
<b>Refiners &amp; Importers</b>	Import/produce at least 80% ULSD for on highway use	6/1/2006	
	Import/produce at least 100% ULSD for on highway use	6/1/2010	6/1/2006
<b>Downstream from Refineries through Fuel Terminals</b>	Facilities that choose to carry ULSD must meet 15 ppm sulfur specification	9/1/2006	
	All highway diesel must be ULSD	10/1/2010	7/15/2006
<b>Retail Outlets</b>	Facilities that choose to carry ULSD must meet 15 ppm sulfur specification	10/15/2006	
	All highway diesel must be ULSD	12/1/2010	9/1/2006

99% of highway diesel fuel dispensed as of the first quarter 2010 is ULSD (USEPA ULSD pump survey)

# ULSD - Background

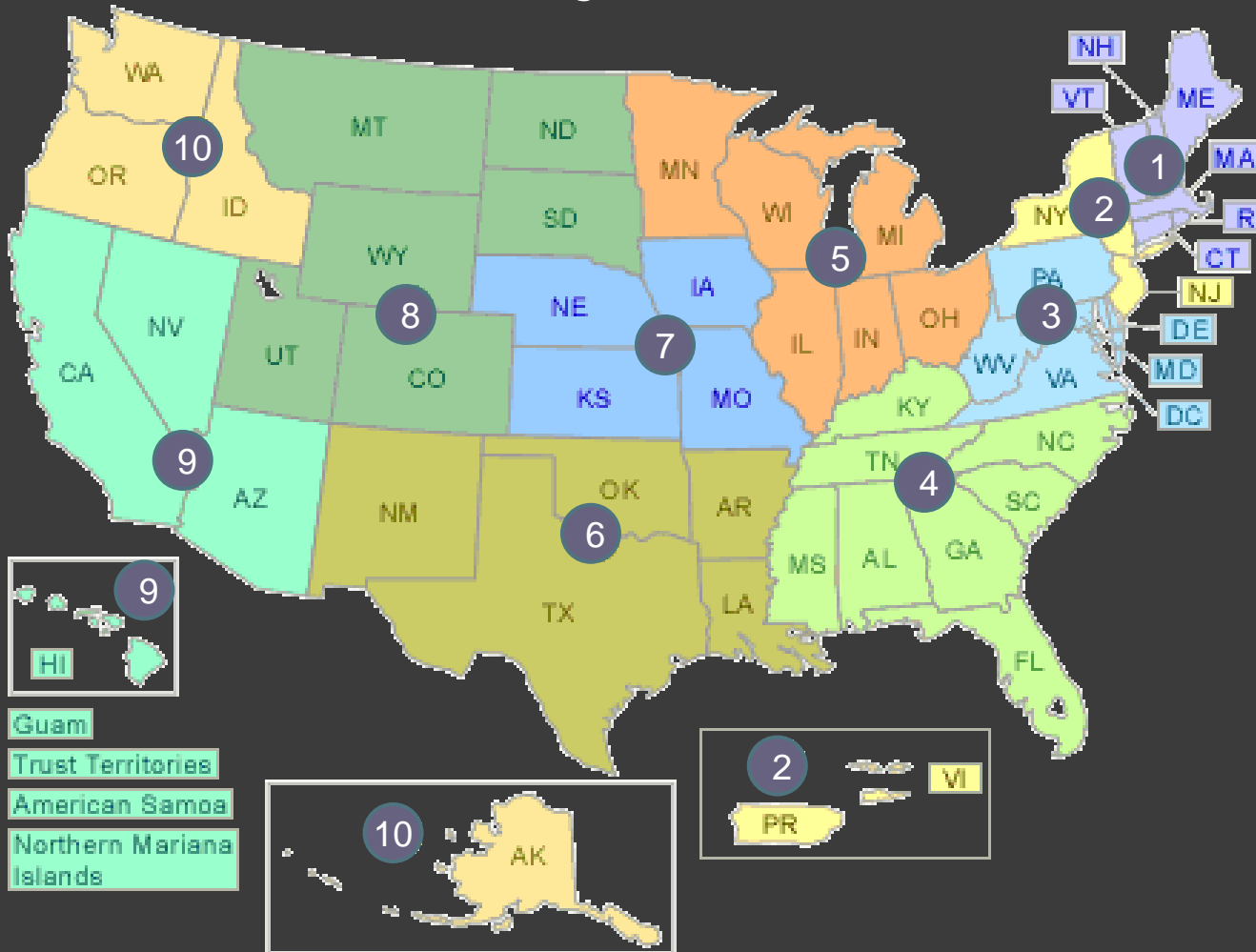
- ① Reduced sulfur
- ① Additives to inhibit biological growth
- ① Additives to increase lubricity
  - Some bio-diesel blending
- ① Additives to inhibit corrosion

# ULSD - Issues

- ⦿ Issues began surfacing in late 2008
- ⦿ Raised to national spotlight in December 2009
- ⦿ Petroleum Equipment Institute chaired a meeting of stakeholders in January 2010
  - Focus on corrosion
  - Conduct survey
- ⦿ The stakeholders group met again in April 2010
  - Review initial survey results



# ULSD - Survey



- 1192 responses
- 496 (42%) with issues
- 696 (58%) without issues
- 10.5 locations/respondent

## Distribution of locations with issues

1 –	49 (11%)
2 –	45 (10%)
3 –	65 (14%)
4 –	105 (23%)
5 –	100 (22%)
6 –	50 (11%)
7 –	58 (12%)
8 –	54 (12%)
9 –	30 (6%)
10 –	47 (10%)
Canada -	10 (2%)

464 of 496 responding  
 449 of 496 with  
 comments

# ULSD - Issues

ATG Probes



## Accelerated Corrosion?

In tanks (including vehicle tanks), tank equipment, including drop tubes, line leak detection sensors and flow meters

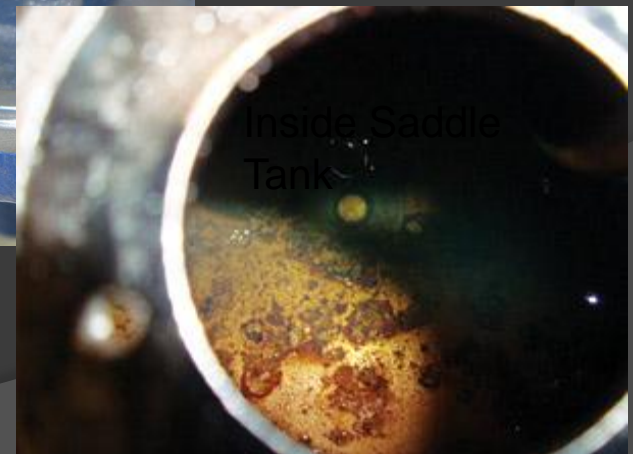


## BIO-GROWTH?

Plugged filters  
Clogged solenoid valves  
Equipment malfunctions

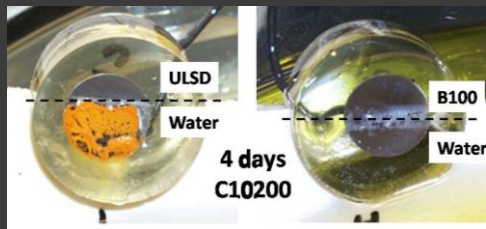
## Other Issues?

- Deteriorated gaskets and seals
- Nozzle malfunctions (failure to turn off)
- Shear and check valve malfunctions
- Seal/gasket/O-ring deterioration
- Dispenser leaks/failure/premature replacement



# ULSD - Issues

- Study conducted by the Naval Research Laboratory in 2009
  - Overall, B100 had the highest propensity for biofouling while the highest corrosion rates were measured in ULSD exposures.



Source: Microbiological and Corrosivity Characterizations of Biodiesels and Advanced Diesel Fuels , Jason S. Lee, Richard I. Ray\*, Brenda J. Little, Naval Research Laboratory, 2009

# ULSD - Causes

- ① Theories of what is causing the problem
  - Water intrusion in the tank system
    - Promotes microbial activity
  - Microbes
    - Interaction with corrosion inhibitor additives
      - Creates a diesel soap that can consume the inhibitors
    - Formation of acidic acid
  - Fuel quality/additive
  - Electrical problems (bad grounds)

# Industry Impacts

- ⦿ Dispensing system integrity
  - Replacement of dispensing system components
  - Releases to the environment
- ⦿ Slow dispensing rates
- ⦿ Fuel quality
  - Contamination control
  - Poor fuel-performance in vehicles and equipment (inefficient combustion, dark exhaust smoke)
- ⦿ Impact to vehicle and equipment fuel filters and fuel system components

# ULSD - Conclusion

- ◎ Something is up

- 58% did not experience a problem related to ULSD

BUT

- 42% reported some type of problem they believed was related to ULSD

AND

- The issue does not appear to be limited to UST

# ULSD - Conclusion

- ① The issues appear to be more than accelerated corrosion
- ① The issues need to be better defined
- ① The cause and solution needs to be identified
  - Some amount of research is needed
- ① Who's to blame?
  - Does it really matter right now?

# ULSD - Further Investigation

- ◎ More detailed survey of sites indicating corrosion
  - Detailed review of existing data
  - Gather additional data
  - Understand issues that may be associated with the storage and dispensing of ULSD
  - Clarify the relationship between ULSD and corrosion



# ULSD - In The Meantime

- ◎ Implement a tank and product quality management program
  - Be diligent in water management
    - monitor tanks on a routine basis
    - remove water when found
    - when water is found check for microbes



# ULSD - In The Meantime

- Implement a tank and product quality management program (continued)
  - Take early symptoms seriously
    - slow-flow issues, clogged filters, indications of equipment corrosion
    - Evaluate bottom sample and take appropriate actions.
  - Have the tank properly cleaned if a significant rag layer is present
  - Periodic treatment with biocide where problem may be persistent



# Bio-Based Fuels

# Biodiesel

- Biodiesel is a vegetable oil- or animal fat-based diesel fuel meant to be used in standard diesel engines.
- Can be used alone (B-100), or blended with a petroleum-based diesel (B-5, B-20).

# Bio Diesel Issues

- ⦿ Water solubility/phase separation
- ⦿ The water-fuel interface can be corrosive and promote microbial growth
- ⦿ B100 can release varnishes and gums from tank and piping walls

	Petroleum	Bio Diesel	Ethanol Blends
Dissolved Water	100	1,250 – 2,500	4,000 – 40,000
Free Water	Yes	Yes	No
Metal Corrosion	Below water line	Primarily below water line	Overall system corrosion

Source: Brief Overview to Fuels and Materials Compatibility – Presentation at 2007 National Tanks Conference by Edward W. English II, Fuels Quality Services

# Ethanol Blended Fuel

- ◎ IFC 2009 Chapter 22
  - Alcohol blended fuels, including those containing 85-per cent ethanol and 15-per cent unleaded gasoline (E85), are flammable liquids consisting of ethanol or other alcohols blended greater than 15 per cent by volume ( ).
- ◎ Proposed NFPA 30A TIA
  - Alcohol Blended Motor Fuel. Motor fuel consisting of a blend of alcohol, such as ethanol, and gasoline, with an alcohol concentration greater than 10 percent by volume, including those with nominally 85 percent ethanol /15 percent unleaded gasoline (E85).

# Ethanol Blended Fuel Issues

- ⦿ Water solubility/phase separation
  - Water saturated blends can be corrosive

	Petroleum	Bio Diesel	Ethanol Blends
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- ⦿ Fuel conductivity
  - Ethanol has a greater conductivity than petroleum fuels

# Ethanol Blended Fuel Issues

- ⦿ Solvent action
  - Can loosen rust and other materials from walls of tanks and piping and suspend sediment
- ⦿ Equipment compatibility
  - metal components due to conductivity
  - non-metal components due to solvent interaction
    - Swelling
    - Discoloration
    - Softening
    - Delaminating
    - Embrittling



# Ethanol Blended Fuel Issues

## ⦿ E-15 Waiver

- Indications are that EPA will approve E-15
  - EPA has pushed a decision to later this year
- Issues that need to be considered
  - Use in older vehicles
  - Dispenser labeling
  - Dispensing system
    - Compatibility
    - Listing requirements

# Ethanol Blended Fuel Issues

- ⦿ NFPA attempted to implement a tentative interim amendment (TIA) to address E-15 equipment issues
- ⦿ Dispenser testing for mid-level ethanol blends
  - The National Renewable Energy Laboratory (NREL) is testing E15 (15% ethanol, 85% gasoline) compatibility with regular gasoline dispenser systems
  - Publication of results is expected in the third quarter of this year

# Ethanol Blended Fuel Issues

## ⦿ Fire codes

- Motor fuel dispensing system components to be listed for the material dispensed
- Approval to change to ethanol blends (IFC 2009)

## ⦿ UST regulations

- Compatible with the material stored

# Ethanol Blended Fuel Issues

- ◎ There are three fuel dispenser certification (listing) paths for new equipment:
  - UL Standard 87 for gasoline and ethanol-gasoline blends up to E10
  - UL Subject 87A-E25 for gasoline and mid-level ethanol-gasoline blends up to E25
  - UL Subject 87A-E85 for gasoline and ethanol-gasoline fuel blends up to E85

# Ethanol Blended Fuel Issues

- ⦿ UL certified E25 dispensers (UL Subject 87A-E25)
  - Dresser Wayne Ovation Eco Fuel
  - Gilbarco Encore Flex Fuel S
  - No hanging hardware is certified for E25, which includes hoses, swivels, nozzles, and breakaways.
- ⦿ Warranty for E15 Dispenser
  - Gilbarco announced they will honor warranty for dispensers manufactured after April 1, 2008 that dispense E15

# Ethanol Blended Fuel Issues

- ◎ E85-certified equipment
  - Dispensers
    - Gilbarco Encore Series 300, 500, 550
    - Dresser Wayne G520, G610, G620, Ovation Model E
  - Hose: Veyance Flexsteel Futura Ethan-all
  - Nozzle: OPW 21GE and 21GE-A
  - Swivel: OPW 241TPS-0492
  - Breakaway: OPW 66V-0492
  - Shear valves: OPW 10P-0152E85 and 10P-4152E85
  - Submersible turbine pump: FE Petro all AG models

# UST Regulations

# Energy Act requirements

- ⦿ Secondary containment
  - New installations
  - Upgrade requirements
  - Under dispenser containment
- ⦿ Operator training
  - Turnover
  - Recordkeeping



# USEPA review of 40 CFR 280

- ① Release prevention
  - Overfill functionality testing, walk through checks, spill bucket testing and integrity testing for interstitial areas
- ① Release detection
  - walk through checks and periodic operational checks and periodic testing
- ① Address alternative fuels and compatibility

# USEPA review of 40 CFR 280

- ⦿ Fully regulate emergency generator USTs
- ⦿ Regulate
  - Airport hydrant systems with alternate release detection requirements
  - Field-constructed USTs with alternate release detection requirements
  - Regulate wastewater treatment tanks