Introduction to Ethanol Fuel Blends
Ethanol Fuel Blends

• Most common blends:
  – Ethanol as a fuel additive
    • E10
    • Mid-Level Ethanol Blends: E20, E30
  – Ethanol as the primary fuel
    • E85
Historical Ethanol Demand Drivers

- **Fuel Performance**
  - Ethanol a primary Octane booster
  - Blending octane of 112.5 at 10%

- **Environmental Goals**
  - Clean Air Act Amendments 1990
  - RFG & Oxy Fuel Program

- **Energy Security**
  - Clean Air Act
  - Energy Policy Act 2005
    - Renewable Fuels Standard
  - 20 in 10 Presidential Initiative
Ethanol as a Fuel & Fuel Additive

E10 (10% ethanol by volume)
- Approved for use in all vehicles and engines
- ~98% of ethanol consumed as E10
- 80% of U.S. gasoline blended with ethanol

E85 (70-85% ethanol by volume)
- For use in flex-fuel vehicles (FFVs) only
- <2% of ethanol consumed as E85

Mid-level blends (20, 30, 40% ethanol by volume)
- For use in FFVs only
- Dispensed by “blender pumps”
- Specifications under development
Ethanol as a Fuel Additive

• Most common fuel quality specification: ASTM D 4806 Standard Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark Ignition Engine Fuel
  • Includes performance parameters, fuel expectations and analytical test methods used in the evaluation
  • Available from www.astm.org
ASTM D 4806 Standard

- Ethanol
- Methanol
- Solvent Washed Gum
- Water content
- Denaturant
- Inorganic Chlorides
- Acidity as Acetic Acid
- Copper
- pH
- Sulfur
- Sulfate
- Appearance, visibly free of suspended contaminants (clear and bright)
ASTM D 4806 Other Properties

• Limits types of Denaturants
  – Listed in Section 5 of specification
  – Also regulated by TTB (formerly the ATF)

• Workmanship clause
E0- E10 Fuel Quality

- Most common fuel quality specification:
  

- Includes performance parameters, fuel expectations and analytical test methods used in the evaluation

- Available from www.astm.org
ASTM D 4814 Standard

- Volatility
  - Vapor Pressure
  - Distillation
  - Vapor Lock Protection Class
  - Drivability Index
- All adjusted Seasonally

- Silver Strip Corrosion Test
- Solvent Washed Gums
- Sulfur Limits
- Oxidation Stability
- Water Tolerance
Federal Regulations for Motor Fuel

- Gasohol Waiver
- Phase II Volatility Control
- Anti Dumping Requirements
- Reformulated Gasoline (RFG) Requirements
Ethanol as the Primary Fuel

• Most common fuel quality specification:
  – Includes performance parameters, fuel expectations and analytical test methods used in the evaluation. Varying ethanol content due to ethanol’s low vapor pressure.
  – Available from www.astm.org
ASTM D 5798 Seasonal Changes

- Class 1 Summer Grade
  - Minimum 79% Ethanol
  - VP= 5.5 to 8.5 psi
- Class 2 Spring/ Fall Grade
  - Minimum 74% Ethanol
  - VP= 7.0 to 9.5 psi
- Class 3 Winter Grade
  - Minimum 70% Ethanol
  - VP= 9.5 to 12.0 psi
Comparison of Ethanol Specifications

• D 4806 (Ethanol as a fuel additive)
• D 5798 (Ethanol as the primary fuel)
• Specifications are similar EXCEPT:
  – Inorganic Chloride
  – Copper content
  – Higher Alcohols (C3-C8)
  – Acidity as Acetic Acid
• Ethanol made to ASTM D 4806 expectations may or may not be suitable for blending to meet D 5798 (E85.)