Hot Topics: Alternative Fuels: Ethanol & Bio Diesel
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The Problem

• January 2009 (RFA Statistics)
  – 10.6 Billion Gallons
  – 170 Plants in 26 states
  – 24 Plants under construction

• January 2004
  – 3.1 Billion Gallons

• #1 Haz Mat Transported by rail
Fixed Facility & Transportation Issues

• Refineries have added large haz mat issues
  – Corrosives, peroxides, poison/corrosive gases, flammables, monomers

• Current transport is by rail and highway
  – Numerous Transportation incidents
  – DOT 111 and MC 306/ DOT 406;MC 307/DOT407
Current Trends

• #1 NAR haz mat for rail. (FRA)
• E15 and E20
  – Pending passage by EPA
  – Auto industry adapting engines for the future
• Pipelines
  – Plans for Magellan Pipeline: Midwest to NE
  – Kinder Morgan Local Pipelines in Florida, Texas
**Release Information**

- Ethanol is now **12% of all rail releases**
- Other materials release numbers are going down
- Ethanol is replacing the void left by the reduction in other commodities
- This increases the notoriety of fuel ethanol as a source of public and environmental danger

<table>
<thead>
<tr>
<th>Year</th>
<th>All</th>
<th>Ethanol</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>899</td>
<td>17</td>
<td>1.9</td>
</tr>
<tr>
<td>2002</td>
<td>870</td>
<td>40</td>
<td>4.6</td>
</tr>
<tr>
<td>2003</td>
<td>802</td>
<td>54</td>
<td>6.7</td>
</tr>
<tr>
<td>2004</td>
<td>765</td>
<td>60</td>
<td>7.8</td>
</tr>
<tr>
<td>2005</td>
<td>745</td>
<td>67</td>
<td>9.0</td>
</tr>
<tr>
<td>2006</td>
<td>704</td>
<td>87</td>
<td>12.4</td>
</tr>
<tr>
<td>2007</td>
<td>709</td>
<td>86</td>
<td>12.1</td>
</tr>
</tbody>
</table>
Response Issues

• Alcohol Resistant Foam
  – How does it work?
  – Application techniques.
  – How application equipment works?

• Properties = HAZARDS

• Placards
Ethanol
Ethanol Properties

• Ethanol (Ethyl Alcohol)

• Denatured Alcohol (98%/2%)

• E-85

• E10
Ethanol Hazards

- Ethanol
  - Flammable/Toxic
  - CGI
  - PID
  - FID
  - Temp Gun
  - Tube/CHIP
  - Turn Out/SCBA
  - 10% LEL Red Light
**Ethyl alcohol**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formula:</strong></td>
<td>CH\textsubscript{3}CH\textsubscript{2}OH</td>
</tr>
<tr>
<td><strong>CAS#:</strong></td>
<td>64-17-5</td>
</tr>
<tr>
<td><strong>RTECS#:</strong></td>
<td>KQ6300000</td>
</tr>
<tr>
<td><strong>IDLH:</strong></td>
<td>3300 ppm [10% LEL]</td>
</tr>
<tr>
<td><strong>DOT:</strong></td>
<td>1170 127</td>
</tr>
</tbody>
</table>

**Conversion:** 1 ppm = 1.89 mg/m\textsuperscript{3}

**Synonyms/Trade Names:** Alcohol, Cologne spirit, Ethanol, EtOH, Grain alcohol

**Exposure Limits:**
- NIOSH REL: TWA 1000 ppm (1900 mg/m\textsuperscript{3})
- OSHA PEL: TWA 1000 ppm (1900 mg/m\textsuperscript{3})

**Physical Description:** Clear, colorless liquid with a weak, ethereal, vinous odor.

**Chemical & Physical Properties:**
- **MW:** 46.1
- **BP:** 173°F
- **Sol:** Miscible
- **Fl.P.:** 55°F
- **IP:** 10.47 eV
- **Sp.Gr.:** 0.79
- **VP:** 44 mmHg
- **FRZ:** -173°F
- **UEL:** 19%
- **LEL:** 3.3%
- Class IB Flammable Liquid

**Flash Point:**

**PID-PPM:**

**Incompatibilities and Reactivities:** Strong oxidizers, potassium dioxide, bromine pentafluoride, acetyl bromide, acetyl chloride, platinum, sodium

**Exposure Routes, Symptoms, Target Organs:**
- **ER:** Inh, Ing, Con
- **SY:** Irrit eyes, skin, nose; head, drow, lass, narco; cough; liver damage; anemia; repro, terato effects
- **TO:** Eyes, skin, resp sys, CNS, liver, blood, repro sys

**Personal Protection/Sanitation:**
- **Skin:** Prevent skin contact
- **Eyes:** Prevent eye contact
- **Wash skin:** When contam
- **Remove:** When wet (flamm)
- **Change:** N.R.

**Respirator Recommendations:**
- **NIOSH/OSHA: 3300 ppm:** Sa/ScbaF
- **Escape:** ScbaE

**Measurement Methods:**
- (see Table 1):
  - NIOSH 1400
  - OSHA 100

**First Aid:**
- **Eye:** Irr immed
- **Skin:** Water flush prompt
- **Breath:** Fresh air
- **Swallow:** Medical attention immed
Denatured Ethanol 5% MSDS
Poet Biofuels

- **SECTION IV – Fire and Explosion Hazard Data**
- **Flash Point (Method Used):** 49 degrees F
  (Tag Open Cup ASTM D-1310)
- **Flammable Limits**
  - **LEL** 3.3%
  - **UEL** 19.0%
- **Class IB Flammable liquid**
Flash Point of Denatured ETOH
<table>
<thead>
<tr>
<th></th>
<th>Gasoline</th>
<th>E-10 Blended Fuel</th>
<th>E-85 Blended Fuel</th>
<th>E-95 / E – 98 Fuel Grade Ethanol / Denatured Ethanol</th>
<th>E-100 Pure Ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flash Point</strong></td>
<td>-45°F</td>
<td>-45°F</td>
<td>-20° - -5°F</td>
<td>-5°F</td>
<td>54°F</td>
</tr>
<tr>
<td><strong>Auto Ignition Temperature</strong></td>
<td>Highly Variable; &gt;530°F</td>
<td>Highly Variable; &gt;530°F</td>
<td>&gt;790°F</td>
<td>&gt;689°F</td>
<td>685°F</td>
</tr>
<tr>
<td><strong>Specific Gravity @ 60°F</strong></td>
<td>0.70 – 0.78</td>
<td>0.70 – 0.78</td>
<td>0.79</td>
<td>0.79</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Vapor Density Air = 1</strong></td>
<td>3.0 – 4.0</td>
<td>3.0 – 4.0</td>
<td>2.0 - 4.0</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Vapor Pressure</strong></td>
<td>275 – 475 mmHg @ 68°F</td>
<td>275 – 475 mmHg @ 68°F</td>
<td>340 – 560 mmHg @ 68°F</td>
<td>181 mmHg @ 32°F</td>
<td>44mmHg @ 68°F</td>
</tr>
<tr>
<td><strong>Boiling Point</strong></td>
<td>85 - 437°F</td>
<td>85 - 437°F</td>
<td>96 - 170°F</td>
<td>165 - 175°F</td>
<td>173°F</td>
</tr>
<tr>
<td><strong>Flammable Range (LEL-UEL)</strong></td>
<td>1.4% - 7.6%</td>
<td>1.4% – 7.6%</td>
<td>1.4% - 19.0%</td>
<td>3.3% – 19.0%</td>
<td>3.3% – 19.0%</td>
</tr>
<tr>
<td><strong>Conductivity</strong></td>
<td>None</td>
<td>No Information Found (Consider as Possible)</td>
<td>No Information Found (Consider as Possible)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Smoke Character</strong></td>
<td>Black</td>
<td>Black</td>
<td>Slight to None</td>
<td>Slight to None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Solubility (In Water)</strong></td>
<td>Immiscible</td>
<td>Partially miscible (gasoline immiscible)</td>
<td>Highly miscible (gasoline immiscible)</td>
<td>Highly miscible (gasoline immiscible)</td>
<td>Totally miscible</td>
</tr>
</tbody>
</table>
AR - AFFF

• Application techniques/rates.
  – NFPA 11 or 1,000 sq’ = 200 gpm solution
  – Roll On or Bank Down

• How does it work?
  – Polar Solvent – Polymer film

• How application equipment works?
  – Eductors
  – On Board Systems
Treat It Like Latex Paint
CO Sensor Cross Interference

• Sensors currently do have some filters on them, but the ethanol quickly saturates these and once that happens the sensors begin to respond to ethanol. (Raymond Berg, Technical Support Specialist, Industrial Scientific Corporation)

• False CO readings are not immediate
  – Length of detection time
  – Age of sensor
Derailment Jan 2006

Old placard UN 1993
## Regulatory Change

**HM-218D-Final Rule – January 28, 2008**

- **Effective Date** – October 1, 2008
- **Effective Date for Ethanol changes delayed Until** October 1, 2010
- **Voluntary Compliance** – January 28, 2008

<table>
<thead>
<tr>
<th>Ethanol Concentration</th>
<th>Preferred Proper Shipping Name and Identification Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 - E10</td>
<td>Gasohol, NA1203 or Gasoline, UN1203</td>
</tr>
<tr>
<td>E11 - E94</td>
<td>Ethanol and gasoline mixture, UN 3475</td>
</tr>
<tr>
<td>E95 - E99</td>
<td>Denatured alcohol, NA1987 or Alcohols, n.o.s., UN 1987</td>
</tr>
<tr>
<td>E100</td>
<td>Ethanol, or Ethyl alcohol, UN 1170</td>
</tr>
</tbody>
</table>
Current DOT Placards

- E10
  - 1203
- E85
  - 3475
- E95
  - 1987
  - OR
  - 3475
- E100
  - 1170
Biodiesel

- A vegetable oil- or animal fat-based diesel fuel consisting of high M.W. esters (C\textsubscript{18}H\textsubscript{32}CO\textsubscript{2}C\textsubscript{6}H\textsubscript{14}). Biodiesel is typically made by chemically reacting lipids with an alcohol.

A common methyl ester produced from soybean or canola oil and methanol.
Bio Diesel Continuous Flow Plants

[Map showing 176 Bio Diesel Continuous Flow Plants across the United States]
Home and CO-OP Production
Home/CO-OP Issues

• Residential locations
• Lack of codes and ordinances
• Safety Issues
  – Lack of complete understanding of the hazards
  – Non intrinsically safe equipment
  – Lack of ventilation
  – Lack of PPE
Hazards From Production Materials

• Methanol
  – Flammable/Toxic
  – CGI; PID (10.84eV); FID; Temp Gun; Tube; Turn Out/SCBA
  – 150’; 10% LEL

• Sodium or Potassium Hydroxide
  – Strong Corrosive/Toxic
  – 150’; pH; TO-Rescue; Plastic-Plumbing

• Hydrochloric Acid
  - Corrosive/Toxic
  – 150’; pH (Red Light); TO/SCBA-Rescue; Plastic-Plumbing
Blends

• B10 – B100
• Bio diesel blended with petroleum diesel
Biodiesel Training

• Cooperative agreement with the National Biodiesel Board

• Biodiesel Emergency Response training package
  – Basics of Biodiesel
  – Hazards at biodiesel manufacturing facilities
  – Response techniques for biodiesel incidents
Ethanol Training

USFA Partnership
• Response to Ethanol Incidents training package
• Ethanol Fixed Facilities: Assessment & Guide

PHMSA Partnership

Responding to Ethanol Incidents

Instructor Guide
Contact Information
National Hazardous Materials Fusion Center

www.hazmatfc.com

Email – hazmatfusion@iafc.org

IAFC – www.iafc.org/hazmatfusion