Biodiesel Working Group Meeting

Wednesday, June 8, 2005
10AM-3:00 PM

Conference Call Access (877) 939-8827
Pass Code 17341#
Web Cast: http://www.arb.ca.gov
Agenda

• Introductions
• Background
• Production and Distribution
• Costs and Incentives
• Emission Evaluations
• ASTM Efforts
• Verification
• Presentations by Others
• Open Discussions
Introductions

Gary M. Yee, Manager
Industrial Section
Robert Okamoto,
Air Pollution Specialist
Background
Current Use of Biodiesel in California

• Biodiesel: Users--CA*
  – Federal government: 29 Palms, Travis AFB; Barstow Marine Corps Station, Vandenberg AFT; Port Hueneme Naval Base; Channel Islands Nat’l Park
  – Utilities: PG&E; SoCal Edison; SDG&E
  – Municipalities: City of Berkeley; Alameda Co.
  – Private companies: Fetzer Winery;, Thanksgiving Coffee Co.; JR Cardenas Construction
  – Individuals: Fuel cooperatives; card lock stations

ARB Programs Applicable to Biodiesel

• Diesel Fuel Regulations
• Diesel In-Use Strategies
Diesel Fuel Regulations

• Biodiesel must meet current 500 ppm sulfur and 10 percent aromatic specifications
• In 2006, sulfur limit is 15 ppm
  – Generally biodiesel is less than 15 ppm sulfur
  – However levels in excess of 15 ppm sulfur have been reported*

*Bob McCormick, Biodiesel Research Update, US DOE 10th Annual Diesel Engine Emissions Reduction Conference, Coronado, California, August 30, 2004
Diesel In-use Strategies

• Biodiesel must be verified to be used as an In-use Strategy
• Currently, biodiesel cannot be used with a verified control device
  – Compatibility evaluation
Division of Measurement Standards (DMS)

• DMS regulates the sale of commercial motor vehicle fuels
• DMS adopted biodiesel regulations
  – Fuel specifications
  – Advertising
  – Labeling
Division of Measurement Standards (Cont)

• Conditions for selling biodiesel blends
  – Biodiesel feedstock must meet D6751 and the finished fuel must meet D975
  – Specification in ASTM D975 virtually limit biodiesel blends to B20 and lower

• Conditions for selling B100 in CA
  – B100 cannot be legally sold to the public as a neat fuel
  – B100 may be sold as a blending stock if it meets ASTM D6751 specifications
  – Can be sold as a neat fuel under the Developmental Engine Fuel Variance
Production and Distribution
Potential Annual Biodiesel Volume Produced from Available Feedstocks

- 2001 US total annual capacity 1.6 billion gallons
  - Greases, animal fats, vegetable oils
- 2015 annual capacity 3.5 billion gallons
  - New animal fats, new vegetable oil, corn oil, mustard, other oilseed crops
- 2030 annual capacity 10 billion gallons annual

Availability of Biodiesel Feedstocks in CA

• Sources are recycled grease, animal fats, and trap grease.
• Limited vegetable oil based feedstocks are used in CA
CA Biodiesel Production and Distribution Facilities

• 4 Production Facilities
• 29 Distributors
• 23 Retail Outlets

*Report of Biodiesel Workgroup, CA Energy Commission
Oct. 12, 2004
Biodiesel Production in California

• Current CA production capacity
  – 2005 5-16 million gallons/year*

• Future CA production capacity**
  – Baseline: 2010 10-30 million gallons/year
    2020 40-80 million gallons/year
  – Aggressive: 2010 35-63 million gallons/year,
    2020 300-700 million gallons/year

*Email Fred Wellons

Costs and Incentives
Cost of Biodiesel Fuel*

<table>
<thead>
<tr>
<th>Fuel</th>
<th>L.A.</th>
<th>S. F.</th>
<th>U.S. Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>B100</td>
<td>$2.79/gal</td>
<td>$2.77/gal</td>
<td>$2.65/gal</td>
</tr>
<tr>
<td>B20</td>
<td>$1.82/gal</td>
<td>$1.81/gal</td>
<td>$1.77/gal</td>
</tr>
<tr>
<td>Diesel #2</td>
<td>$1.57/gal</td>
<td>$1.59/gal</td>
<td>$1.55/gal</td>
</tr>
</tbody>
</table>

Source: Alternative Fuels Index May 12, 2005

*Does not include taxes and may not be net of certain subsidies
Tax Credit: Incentivized Programs

• Production Level: Bioenergy Program Tax Credit, New Gallons Produced

• Blenders Level: Biodiesel Tax Credit
  – $1.00/gal credit for agri-biodiesel
  – $0.50/gal credit for biodiesel (recycled)
  – starts 1/1/2005 sunsets 12/31/05
  – Efforts to Extend to 2010
Emissions

- Based on available open literature
- Valid engine dynamometer studies
- Does not include newer engines (Post 1997) and new emission control studies
- Comparison of B20, B100, national and CA diesel
Criteria Pollutants

- Biodiesel Reduces Emissions of PM, CO, HC
- Less Benefit for PM, CO, HC when biodiesel is compared to a CleanFuel such as CARB Diesel

NOx Emissions

• B20 average NOx increase is 1-2 %
• B100 average NOx increase is 10 %
• Feedstock dependence-soybased highest NOx
• When compared to clean fuels such as CARB fuel the NOx increase can be higher: B20 5%, B100 28%
Toxics Studies

- US EPA draft Technical Report,
- US EPA Tier 1 Study
- Montreal Biobus Study
- Little data available on newer engines and control technologies
US EPA Draft Technical Report

• B100 showed a decrease of 15% for volatile toxic emissions
  – Decrease in volatile toxic emissions much less than for Total HC emissions
US EPA Tier 1 Study

• B100 fuel compared to No. 2 diesel
• 1997 Cummins N14 diesel engine
• Reduces formaldehyde and acetaldehyde by 30%
• Reduces ozone potential by 50%
• Reduces PAH and nitro-PAHs by 75-85%
Toxics Emissions

• Montreal Biobus Study
  – Studied 1 vegetable, 1 restaurant grease, 3 animal fat feedstocks in comparison to 500 ppm sulfur diesel.
  – Electronic and Mechanical Cummins Engine
  – Tested emissions of aldehydes, VOCs, and PAHs, generally lower however restaurant grease B20 showed aldehyde emissions higher than diesel baseline for the mechanical injection engine

Source: SAE: 2004-01-1861
Greenhouse Gases

• NREL Transit Bus Study Lifecycle Emissions Assessment*
  – B100 reduces net CO$_2$, a greenhouse gas, by 78% and B20 reduces net CO$_2$ by 16% 
  – Certain agricultural practices can potentially increase greenhouse gas emissions**

*NREL/SR-580-24089 UC Category 1503 Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus

**Mark A Deluchi, A Lifecycle Emissions Model (LEM): Lifecycle Emissions from Transportation Fuels, Motor Vehicles, Transportation Modes, Electricity, Heating and Cooking Fuels, and Materials, UCD ITS-RR-03-17
Renewable Fuel

• Energy Balance (Life Cycle Energy Efficiency)
  – Energy consumed to produce an energy equivalent of biodiesel and diesel are about the same

• Fossil Fuel Inputs
  – Biodiesel yields 3.2 units of fuel product energy for every unit of fossil fuel consumed versus
  – Diesel yield of 0.82 units of fuel product energy for every unit of fossil fuel consumed
An Investigation into the Causes of Increased NOx Emissions with Biodiesel Fueling

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Effects of Biodiesel on NO$_x$ Emissions

Bob McCormick, PhD
Senior Engineer
Advanced Fuels R&D Group
National Renewable Energy Laboratories
Summary of Issues Raised by Recent Studies

• Greater NOx increases and less PM benefits in newer engines based on engine dynamometer tests
• Differences in engine dyno and chassis dyno test results
• Toxics tests on newer engine and technologies?
ASTM Efforts
ASTM Biodiesel Update

Steve Howell
Marc-IV Consulting
Verification
Verification under “In-Use Strategies Verification” of B20

• Compatibility demonstration of B20
  – Would allow verified devices to use B20
  – No additional emissions credits

• Full verification required when used as a verified emission reduction strategy
  – Requires a multimedia assessment H&S Code 43830.8
Presentation by Others
Open Discussion

• Limitations in shipping biodiesel through pipelines due to possible contamination of jet fuel result in additional Infrastructure at the Terminal?
  • Install pumps, tanks, meters, etc.
  • Associated cost?
• How do the CARB regulations flange up to the federal regulations -- e.g., 1992 EPACT and 1998 ECRA acts -- as they relate to the vehicle and fuel requirements?
• Any OEM/engine warranty issues when using biodiesel fuel?
• Discussion of "Tax Credit" for both vehicle and fuel tax credits, as well as both California and federal tax credits?