

# **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

\*Report of the Biodiesel Workgroup, CA Energy Commission, Sacramento, CA, Oct 12, 2004

# **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)

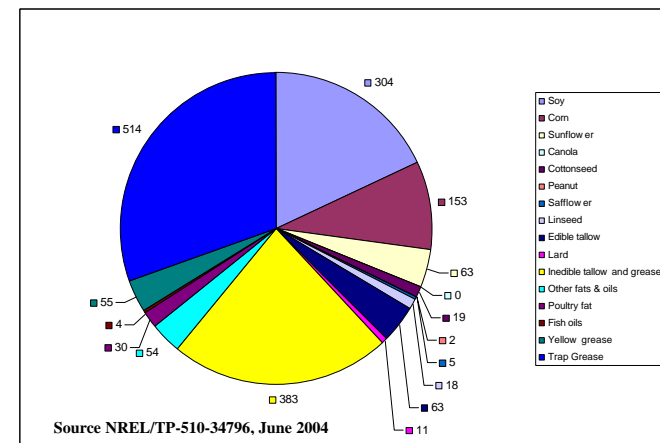
- Conditions for selling biodiesel blends
  - Biodiesel feedstock must meet D6751 and the finished fuel must meet D975
  - Specification in ASTM D975 virtually limit biodiesel blends to B20 and lower
- Conditions for selling B100 in CA
  - B100 cannot be legally sold to the public as a neat fuel
  - 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

**Biodiesel B100 Capacity in 2001  
(millions gal/yr)**



\*Source: Bob McCormick, Biodiesel Research Update, US DOE 10th Annual Diesel Emissions Reduction Conference Coronad, CA Aug 30, 2004

# **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

\*\*Report of Biodiesel Workgroup, CA Energy Commission Oct. 12, 2004

# **Costs and Incentives**



## Cost of Biodiesel Fuel\*

Fuel	L.A.	S. F.	U.S. Ave
B100	\$2.79/gal	\$2.77/gal	\$2.65/gal
B20	\$1.82/gal	\$1.81/gal	\$1.77/gal
Diesel #2	\$1.57/gal	\$1.59/gal	\$1.55/gal

Source: Alternative Fuels Index May 12, 2005

\*Does not include taxes and may not be net of certain subsidies

# Tax Credit: Incentivized Programs

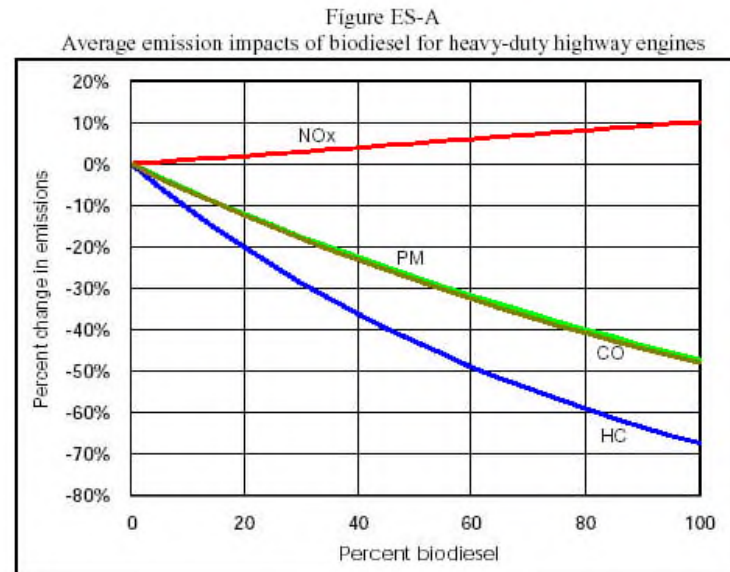
- Production Level: Bioenergy Program Tax Credit, New Gallons Produced
- Blenders Level: Biodiesel Tax Credit
  - \$1.00/gal credit for agri-biodiesel
  - \$0.50/gal credit for biodiesel (recycled)
  - starts 1/1/2005 sunsets 12/31/05
  - Efforts to Extend to 2010

# Emissions

## **US EPA Draft Technical Report, “A Comprehensive Analysis of Biodiesel Impacts on Exhaust 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

A Comprehensive Analysis of Biodiesel Impacts on Exhaust Emissions, Draft Technical Report, EPA420-P-02-001 October 2002

# NO<sub>x</sub> Emissions

- B20 average NO<sub>x</sub> increase is 1-2 %
- B100 average NO<sub>x</sub> increase is 10 %
- Feedstock dependence-soybased highest NO<sub>x</sub>
- When compared to clean fuels such as CARB fuel the NO<sub>x</sub> 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

# Greenhouse Gases

- NREL Transit Bus Study Lifecycle Emissions Assessment\*
  - B100 reduces net CO<sub>2</sub>, a greenhouse gas, by 78% and B20 reduces net CO<sub>2</sub> 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 NO<sub>x</sub> Emissions with Biodiesel Fueling**

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# Effects of Biodiesel on $\text{NO}_x$ Emissions

Bob McCormick, PhD

Senior Engineer

Advanced Fuels R&D Group

National Renewable Energy Laboratories

# Summary of Issues Raised by Recent Studies

- Greater NO<sub>x</sub> 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?