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

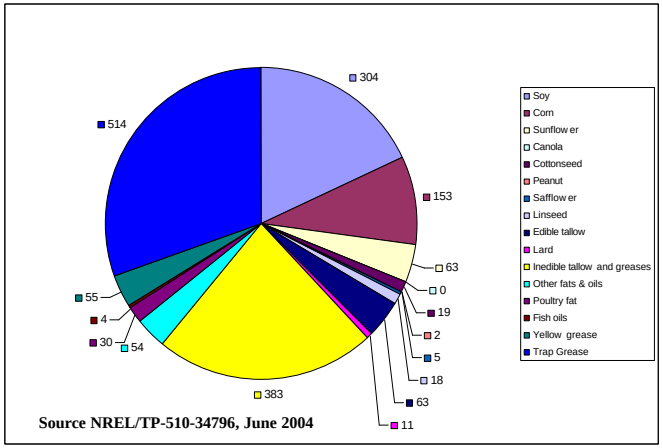
Production and Distribution

Prod&Dist

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 vegatable oil, corn oil, mustard, other oilseed crops
- 2030 annual capacity10 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

Prod&Dist

CA Biodiesel Production and Distribution Facilities

- 4 Production Facilities
- 29 Distributors
- 23 Retail Outlets

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

Prod&Dist

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

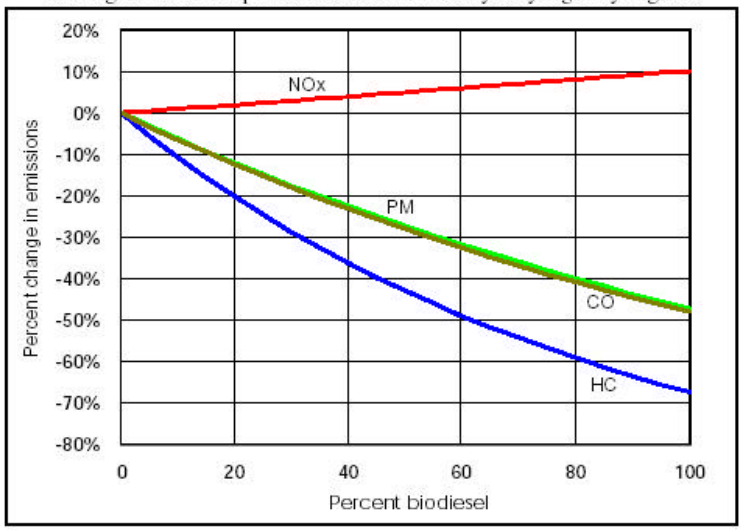
Emissions

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

Figure ES-A
Average emission impacts of biodiesel for heavy-duty highway engines



- 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-02-001October 2002

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 us 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?