

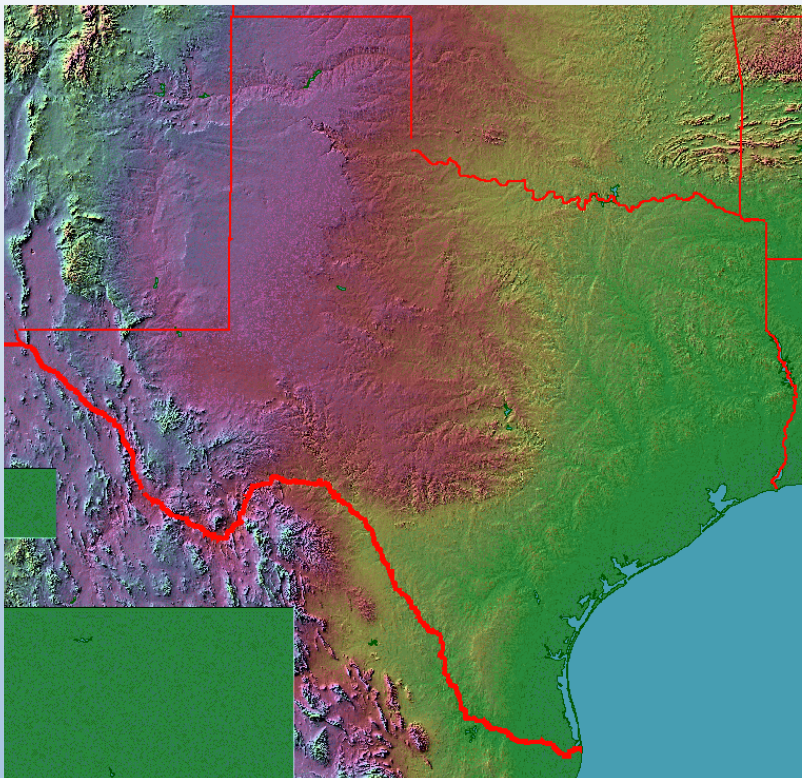
# Biodiesel and Air Quality

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October 11, 2006



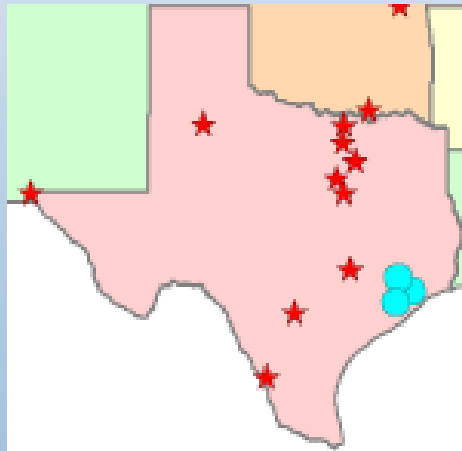
# Texas Leadership in Energy Security



- Texas produces roughly 400 million barrels of oil each year – on shore, and much more if you include offshore production
- Some of the largest ethanol production facilities in the nation are under construction

# Texas Leadership in Biodiesel Production

- Texas is also the largest producer of biodiesel in the US
- Over 100 million gallon production in place
- More than 87 million gallon capacity under construction



# Biodiesel Attributes

- *Meets requirements of Texas Low Emission Diesel*
  - High Cetane (average over 50)
  - Zero aromatics
  - Ultra Low Sulfur (average ~ 2 ppm)
- Registered with EPA under Clean Air Act 211(b)
  - As a fuel (B100) that can be blended into any other registered fuel
    - As a blending component
    - Biodiesel can be used as a pure fuel
    - Not considered an additive above 1%
  - As a fuel additive at levels below 1%

# Biodiesel Reduces Emissions of Soot and Toxic Compounds

- B20 reduces soot (or PM) emissions by 10% or more
- CO is reduced 11%
- Total hydrocarbon is reduced by more than 20%, including many toxic compounds

# Historical Overview of NO<sub>x</sub> Issue

- Up until early in 2005 it was widely accepted that B20 caused a small, 2%, increase in NO<sub>x</sub>
  - Conclusion of EPA review published in 2002
  - Based in large part on data acquired by McCormick and coworkers
- In February of 2005 we tested a group of vehicles that showed NO<sub>x</sub> reduction
- Subsequent review of EPA's analysis showed that nearly half of the data reviewed were for one engine model
- Subsequent tests with a range of engine models are finding changes in NO<sub>x</sub> that range roughly from about +4 to -4%
  - Varies with engine model
  - Average change is zero

# Recent Studies Show No Effect on NO<sub>x</sub>

***Technical data from the following independent studies completed in 2005 and 2006 show NO<sub>x</sub> neutrality without the use of additives:***

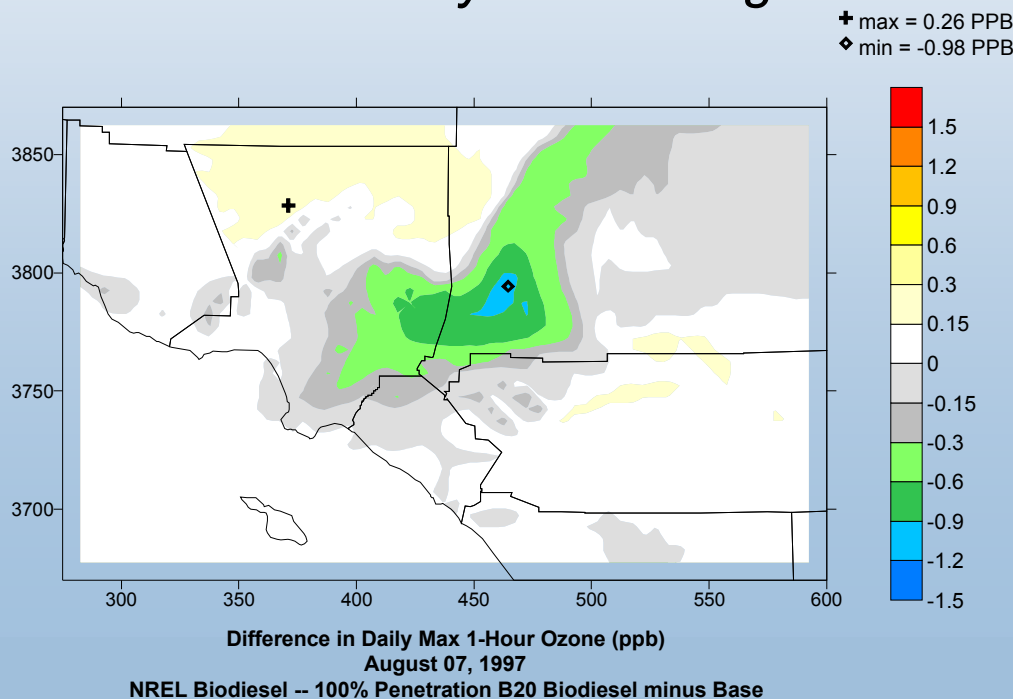
- U.S. Navy study from June 2006
  - Tested 6 on-highway vehicles, found no change in NO<sub>x</sub> on average
- Texas Transportation Institute at Texas A&M University, August 2006
  - Tested 5 school buses, found no change in NO<sub>x</sub> on average
- NREL study to be published October 2006
  - Reviewed engine and vehicle testing studies published from 2002-2006, no change in NO<sub>x</sub> on average (12 vehicles or engines)
  - Tested 8 heavy-duty vehicles, found no change in NO<sub>x</sub> on average
- North Carolina State University study from 2005
  - Tested 12 DOT dump trucks, found NO going down

# Understanding of Biodiesel and NO<sub>x</sub> Changing

- Ongoing dialogue with EPA staff
  - In Washington DC and at their emissions research lab in Ann Arbor, MI
  - EPA is currently evaluating the new data
  - EPA makes the following statements in their draft 2002 report: “
    - *While a Technical Report such as this may be a factor in such a rulemaking, the Technical Report is not intended to be a determination of SIP credits for a State fuel program.*”
    - *States to consider additional evidence on emissions effects, as it becomes available*
- Dialogue with CARB
  - CARB has explicitly allowed biodiesel since at least 1999
  - CARB has recently proposed to continue approval of biodiesel
    - Based in part on newer emission testing data showing no increase in NO<sub>x</sub>
    - To consider B20 and lower blends as California diesel fuel
    - To allow use with verified emission reduction technologies

# Air Quality Modeling for Biodiesel

- Air quality modeling performed by Environ
- Impact of 100% market penetration of B20 on air quality in Chicago area, Northeast Corridor, and South Coast Air Basin.
- Air-shed scale effects –assuming 2% increase in  $\text{NO}_x$ :
  - *$\text{NO}_x$  from B20 use has no negative air quality impact*
  - *Changes in ozone less than ~1 ppb*
  - *Ozone actually decreasing!*



Analysis from NREL/SR-540-33793, April 2003

# Conclusion

*Based on newer data for more than 43 different engines, we conclude that B20 biodiesel has, on average, no impact on emissions of NO<sub>x</sub>*