

National Equipment Fleet Management Conference

Mobile, Alabama

June 24-28, 2012

North Carolina Bio-Diesel Project

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Diesel Engine

- The internal combustion diesel engine was developed by Rudolph Diesel in 1893.
- It is often reported that Diesel designed his engine to run on “peanut oil”, but this is probably not the case.
- The engine was constructed for using mineral oil, and was then worked on vegetable oil without any alterations being made.

Rudolph Diesel 1912

- *“The diesel engine can be fed with vegetable oils and would help considerably in the development of agriculture of the countries which use it”*
- *“The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become in course of time as important as petroleum and the coal tar products of the present time.”*

Alternative Energy

- The Energy Policy Act (EPAct) of 1992 set goals, created mandates, and amended utility laws to increase clean energy use and improve overall energy efficiency in the United States.
- This act prompted NCDOT to enter the alternative fuel arena.

Alternative Fuel

- Biodiesel was one of the fuels of choice for many reasons.
 - Infrastructure was already in place.
 - Could make the greatest impact in a short period of time.
 - No changes needed in the engine fuel system in order to use.
- Later we were required by the legislature to reduce our petroleum by 20%.

Biodiesel

- Biodiesel has better lubricating properties and much higher cetane ratings than today's lower sulfur diesel fuels.
- Biodiesel, in addition, reduces fuel system wear, and in low levels in high pressure systems increases the life of the fuel injection equipment that relies on the fuel for its lubrication.

NCDOT and Biodiesel

- NCDOT began limited use of biodiesel in 1994.
- Transported B-100 in state owned tanker truck from Florida vendor.
- Mixed 20% biodiesel with 80% diesel fuel after arrival in NC.
- Quality probably not always up to standards.

NCDOT & Biodiesel (cont'd)

- Fuel tank management plan already in place.
- Biodiesel acts as cleaning agent in fuel tanks.
- Installed filter at dispenser to capture any material from storage tanks.
 - Use 2 micron and some cases 10 micron filters.
- Changed fuel filters on equipment more frequently than normal.

Early Lessons Learned

- Quality of utmost importance.
- Fuel needed to be turned every 120 days to avoid separation problems.
- Be aware to run engines periodically in equipment not used on regular basis.
- Prices can be much higher on occasion than regular ULSD.
 - On occasion we paid \$.50 per gallon more.

NCDOT and Biodiesel Use

- In the beginning we did not require all fourteen (14) divisions to convert to biodiesel.
- In 2006 we required all divisions to convert to B-20 with exception of one site per division.
- We reserve these sites for ULSD to be used in standby generators.
- Still have some reluctance from few divisions.

Biodiesel Use (cont'd)

- Dispensed 35 million gallons for NCDOT use since 2003.
- Volume has been steadily increasing over the years.
- Use varies depending on budget restraints.
- On track to use 7.5 million+ gallons yearly.
- Dispensed over 5 million gallons to other state agencies since 2003.

Quality Issues

- Experienced some quality issues in early years.
- Learned early on to require certain standards to insure the best quality.
- Relied on some producers and vendors for guidance.
- Realized that only way to insure consistent quality was with multi-year state wide contract.

Quality Issues (Cont'd)

- Key to quality is writing sound, detailed specifications.
- Specifications evolved over the years and changed with increased knowledge of biodiesel standards.
- Learned to place total responsibility for quality on vendor.

Partial Specifications

- Additional requirements.
 - BQ9000 Produced Product.
 - 100 Second Maximum for Cold Soak Filtration Test Year Round.
 - Feedstock Neutral April Through August.
 - Only Soy September Through March.
 - Quality Bio-Diesel Cold Weather Additive.
 - Palm or Beef Tallow Based B-100 is not allowed.

Partial Specifications (cont'd)

- The vendor agrees that **two (2) random samples** will be taken per calendar quarter for testing at a third-party lab at Vendor's expense.
- Vendor will be assessed a monetary penalty of up to **\$1,200.00** per quarterly sample if these fuel samples are found by the third-party lab to be out of specification for "B20 Parameters".

Other Experiences

- Historical static tests indicated an increase of 4%+ in NO_x.
- NCDOT decided to perform field, “real world” tests to determine the effects of B-20 as it relates to NO_x in our fleet.
- NCSU performed tests using dump trucks, wheel loaders and backhoe/loaders.
- These tests were performed during NCDOT daily operations using DOT operators.
- Determined that NO_x was reduced by 20%.

Other Experiences (cont'd)

- In the early years the manufacturer's were wary of our use of biodiesel.
- Assured vendors we were committed to the use of B-20.
- Also explained to vendors we did not require they warrant the fuel we used.
- If problems developed and were caused by our fuel we would be responsible for repairs.

What the Future Holds

- NCDOT is currently testing the feasibility of growing canola in right-of-ways.
- We are harvesting seed using the same equipment used in harvesting wild flower seed.
- NCSU is producing B-100 from the harvested canola.
- NCDOT blends 20% in diesel fuel and use in fleet.

Canola Test

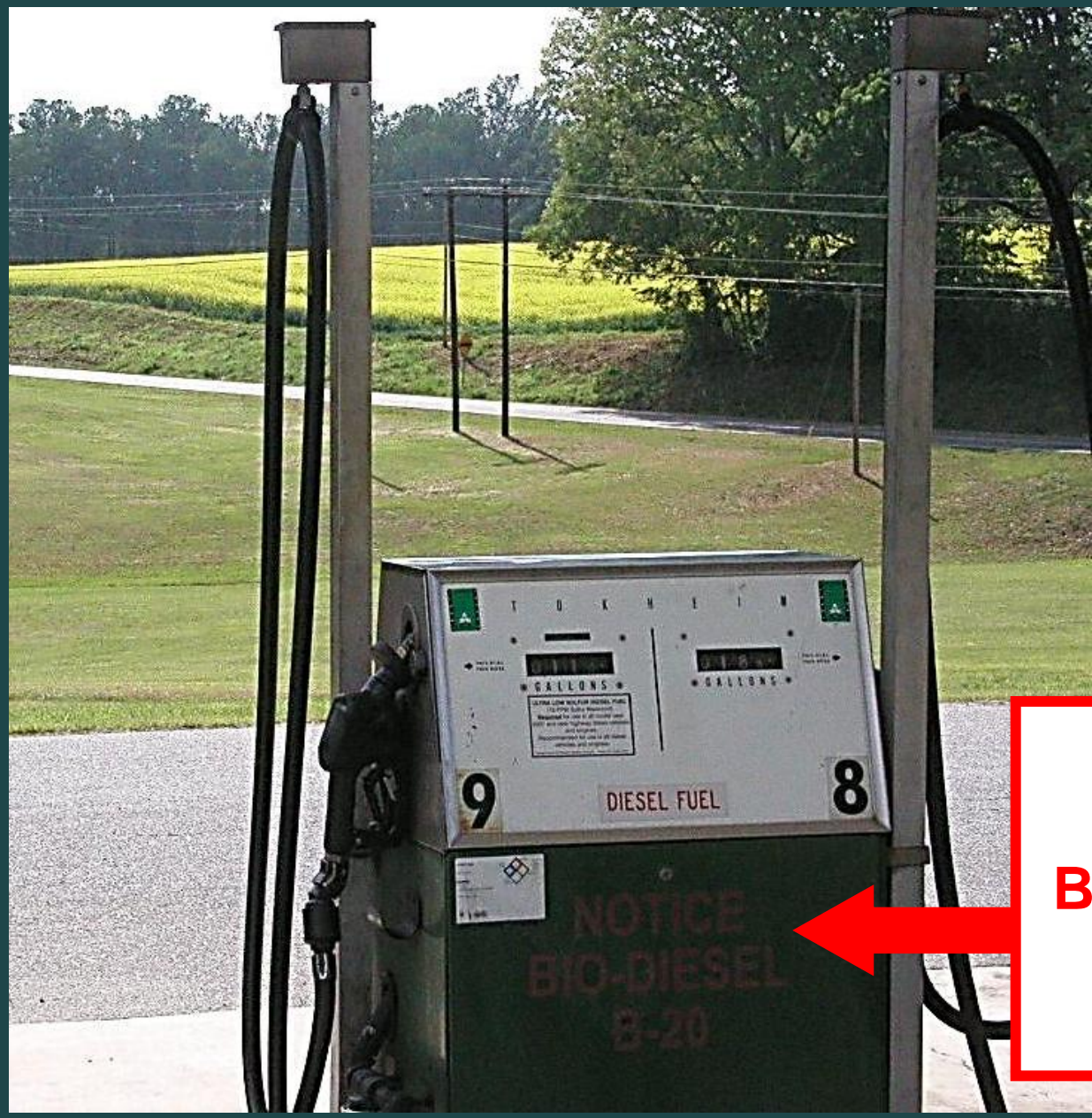








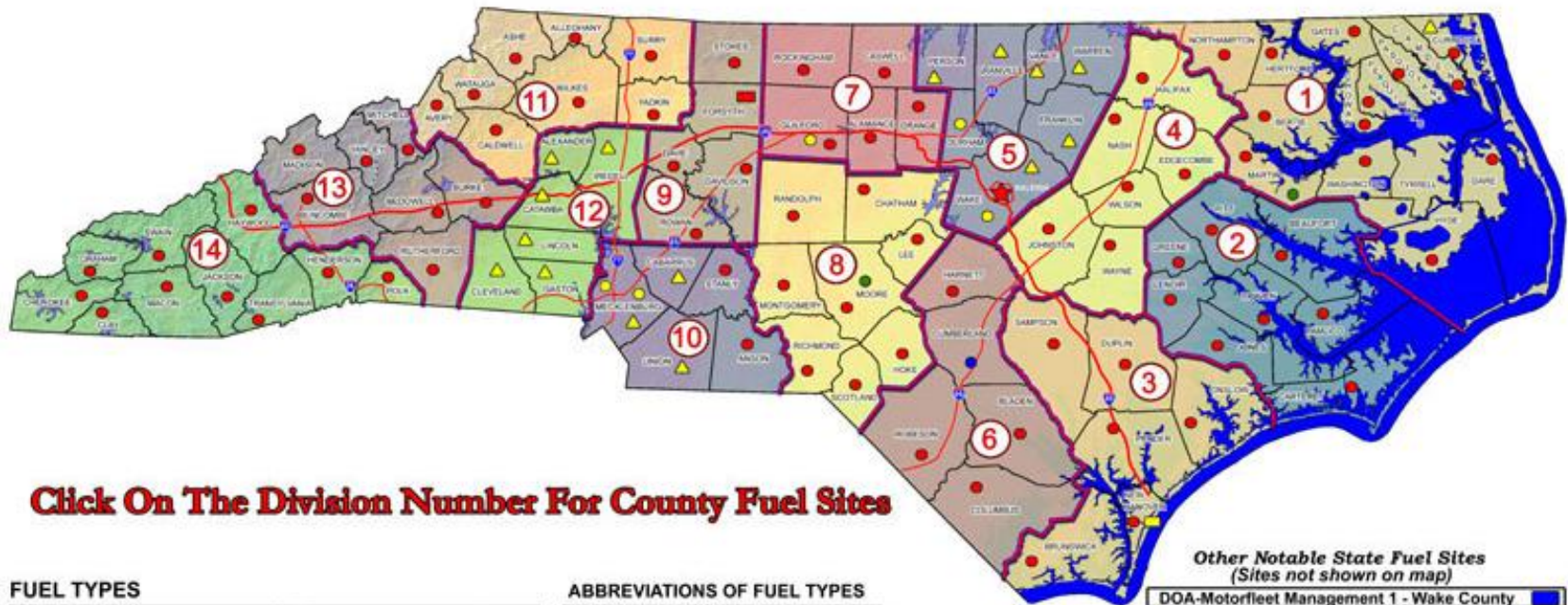




**NOTICE
BIO-DIESEL
B-20**



Automated Fuel Sites



Click On The Division Number For County Fuel Sites

FUEL TYPES

| | |
|------------------------|---------------------------|
| ● UNL ONLY | ▲ ETH, BIO-DS & PRP |
| ● UNL & DS | ▲ UNL & BIO-DS |
| ● UNL, DS & PRP | ▲ BIO-DS & GASO |
| ● UNL, DS & ETH | ▲ ETH & DS |
| ● UNL, BIO-DS & PRP | ▲ ETH & UNL |
| ▲ UNL, CNG & ETH | ▲ UNL, BIO-DS, PRP, & CNG |
| ▲ UNL, DS, PROP, & ETH | |

ABBREVIATIONS OF FUEL TYPES

| |
|------------------------------|
| GASO - GASOHOL (E-10) |
| UNL - UNLEADED |
| DS - DIESEL |
| PRP - PROPANE |
| CNG - COMPRESSED NATURAL GAS |
| ETH - ETHANOL (E-85) |
| BIO-DS - BIO-DIESEL |

Other Notable State Fuel Sites (Sites not shown on map)

| | |
|---|---|
| DOA-Motorfleet Management 1 - Wake County | ■ |
| DOA-Motorfleet Management 2 - Wake County | ▲ |
| Highway Patrol Training Center - Wake County | ● |
| Department of Corrections - Wake County | ● |
| Cherry Hospital - Wayne County | ● |
| Fayetteville Highway Patrol - Cumberland County | ● |
| John Umstead Hospital - Granville County | ● |
| UNC-Wilmington - New Hanover County | ● |

12/02/2003

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Questions?