

Emulsified Fuel Technology for Boilers, Engines, Turbines



ALTERNATIVE
PETROLEUM
TECHNOLOGIES



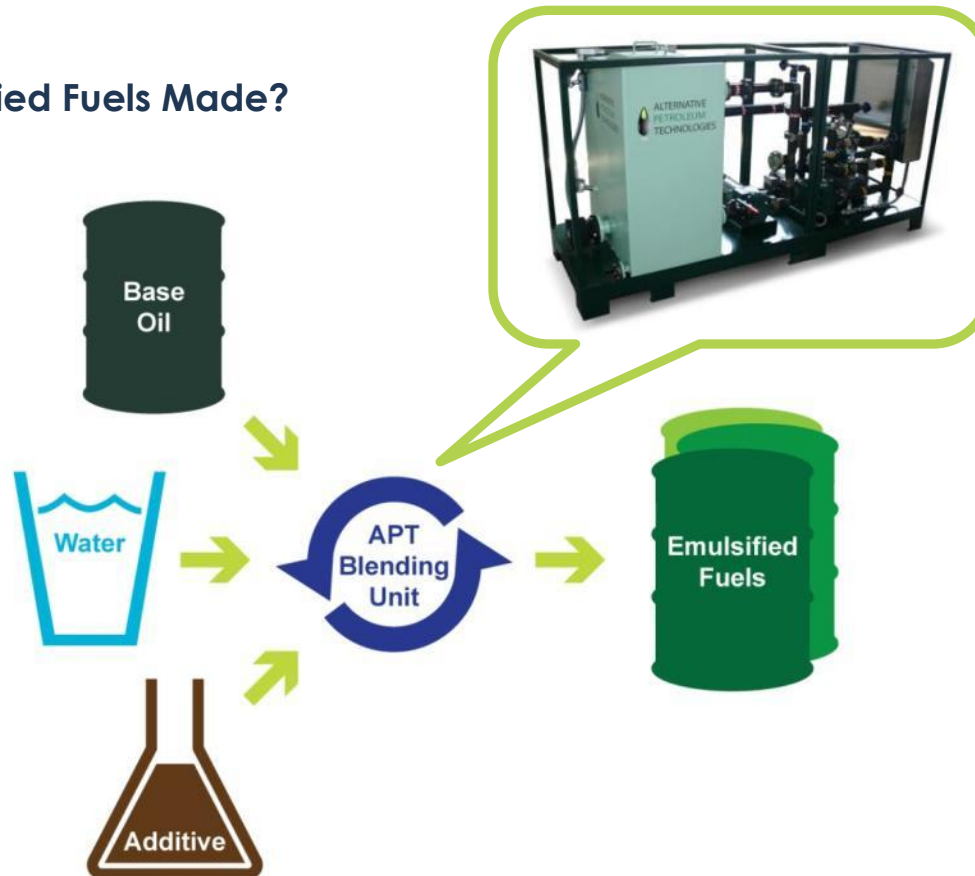
Helping to save the planet - one drop at a time

What are Emulsified Fuels?

- **Emulsified Fuels** contain microscopic water droplets that are encased by an emulsion surfactant and remain in stable suspension within petroleum products:

- Diesel Oils, Fuel Oils, **Biodiesel** Fuels, Residuals

- How are Emulsified Fuels Made?



Stationary DOE Blending Units in Refinery, Italy

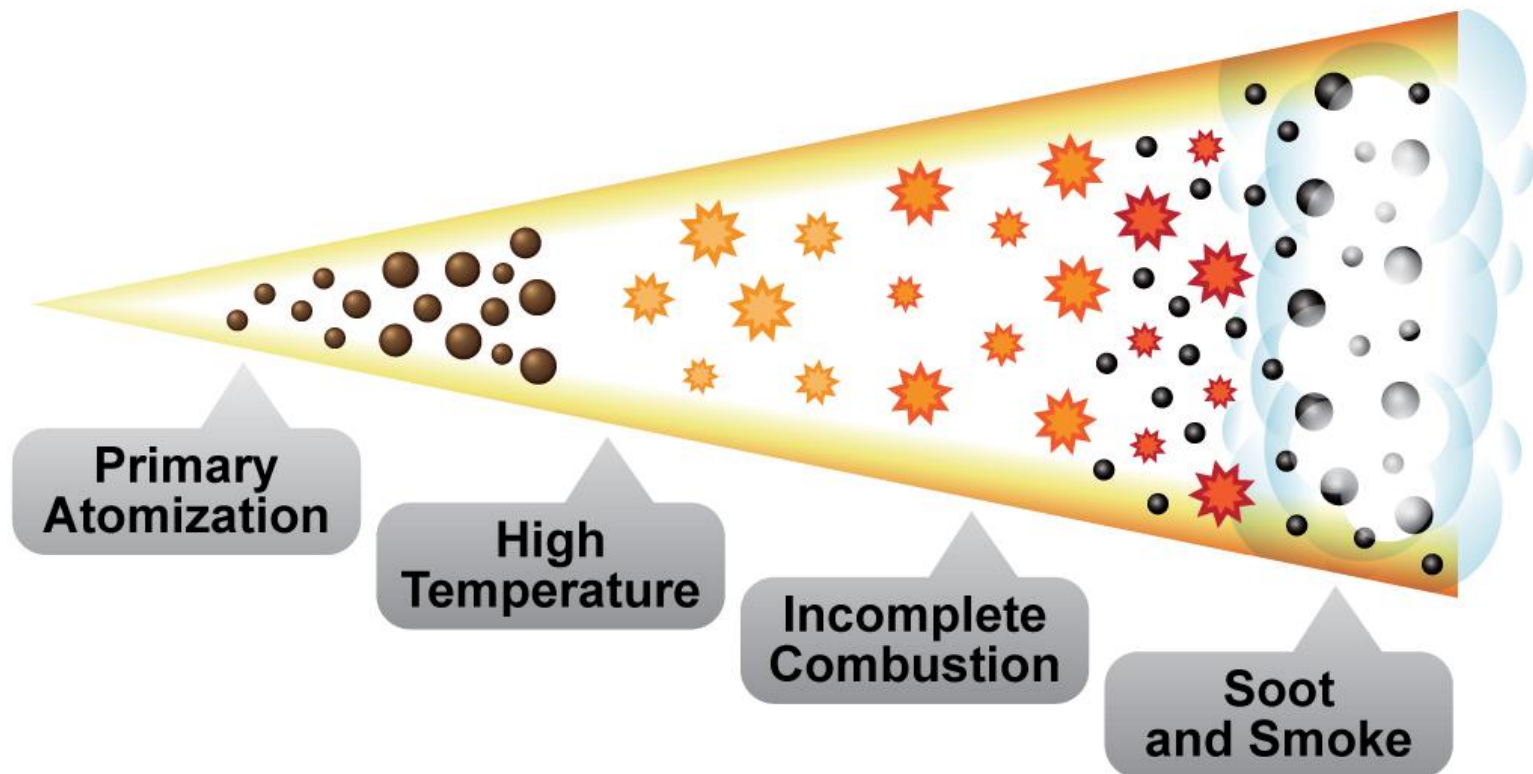


Mobile FOE Blending Unit at Daesang Plant, Korea



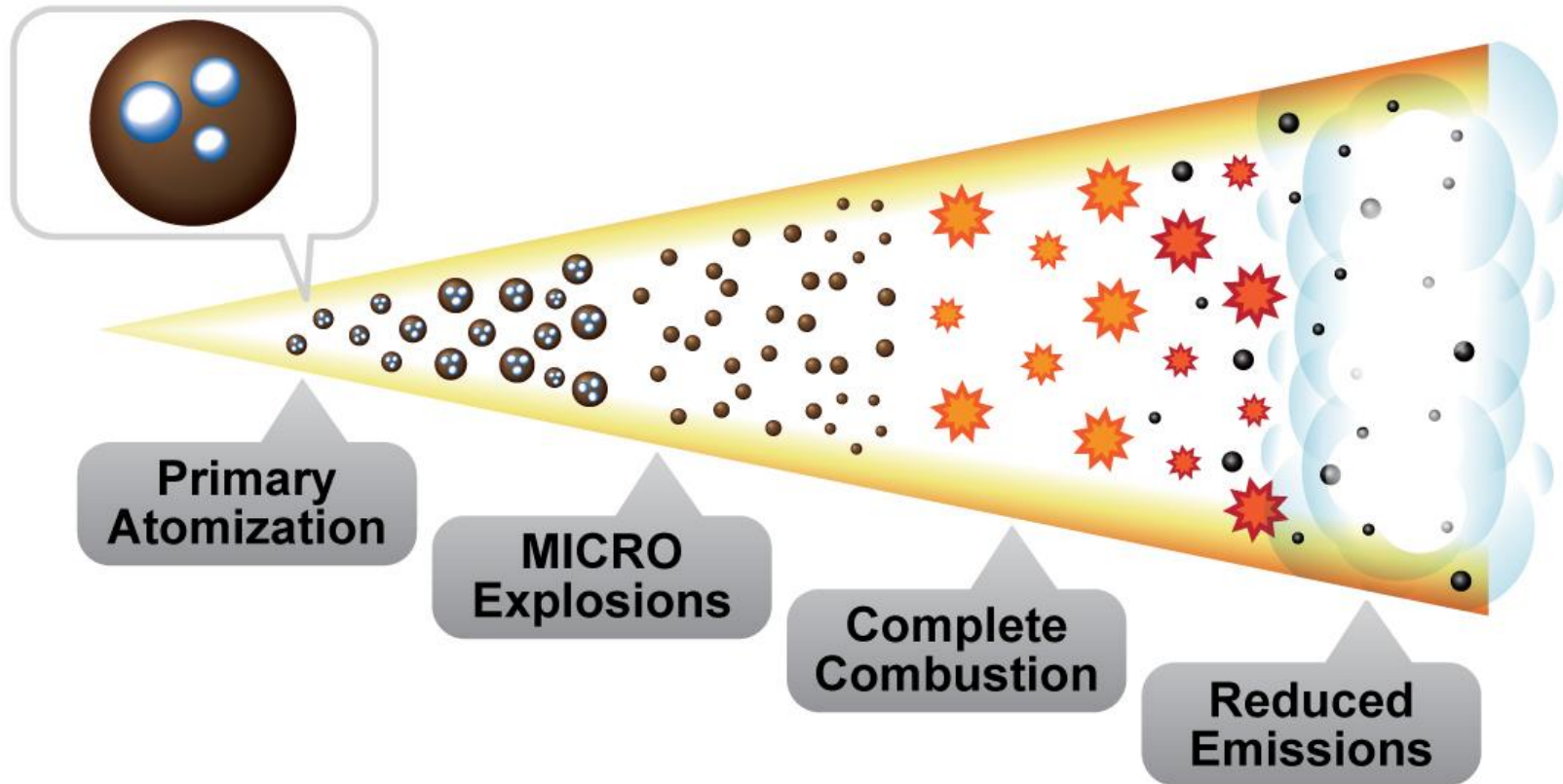
How do Fuels Burn?

- *Traditional Fuels Combustion*



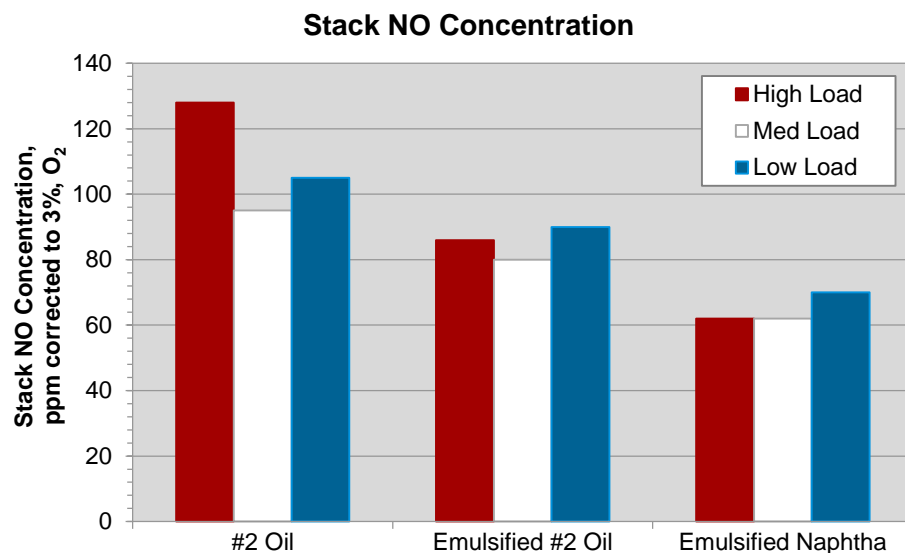
How do Fuels Burn?

- *Emulsified Fuels Combustion*



Past Applications of Emulsified Fuels

- Heating Sector – Commercial Boilers



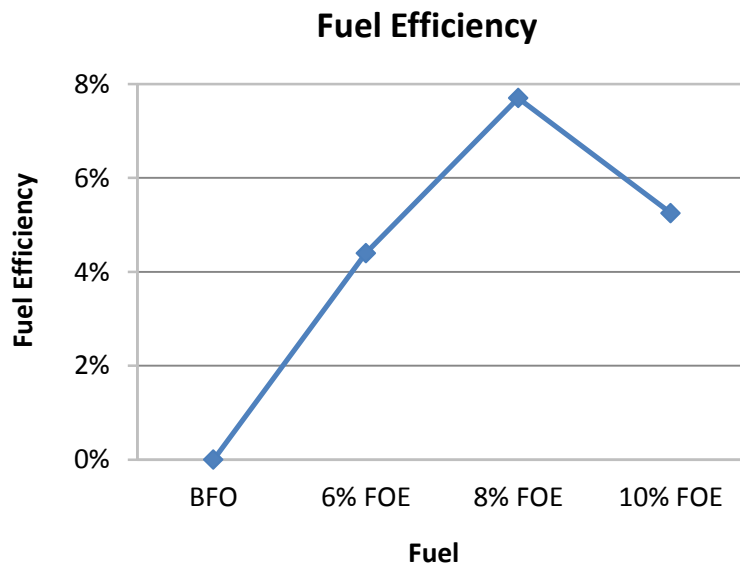
EPA Testing – Research Triangle Park, NC - 1998

Emulsified Fuel Oil	Emulsified Naphtha
NO_x ↓ 34% - High Load	NO_x ↓ 51% - High Load
NO_x ↓ 17% - Med Load	NO_x ↓ 35% - Med Load
NO_x ↓ 15% - Low Load	NO_x ↓ 33% - Low Load

Past Applications of Emulsified Fuels

- **Process Sector – Industrial Boilers**

- **APT Tests – CRYSEL PLANT – Guadalajara, Mexico - 2004**
- **Max ↑ Fuel Eff – Tons (Steam) / Gal (Fuel) @ 8% H₂O Content**
- **Steam Flow = 40 Mt/Hr Press = 263 Lb/In² Temp = 473 F**
(Press = 18.5 Kg/Cm³ Temp = 245 C)

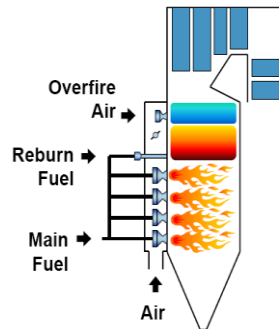


Past Applications of Emulsified Fuels

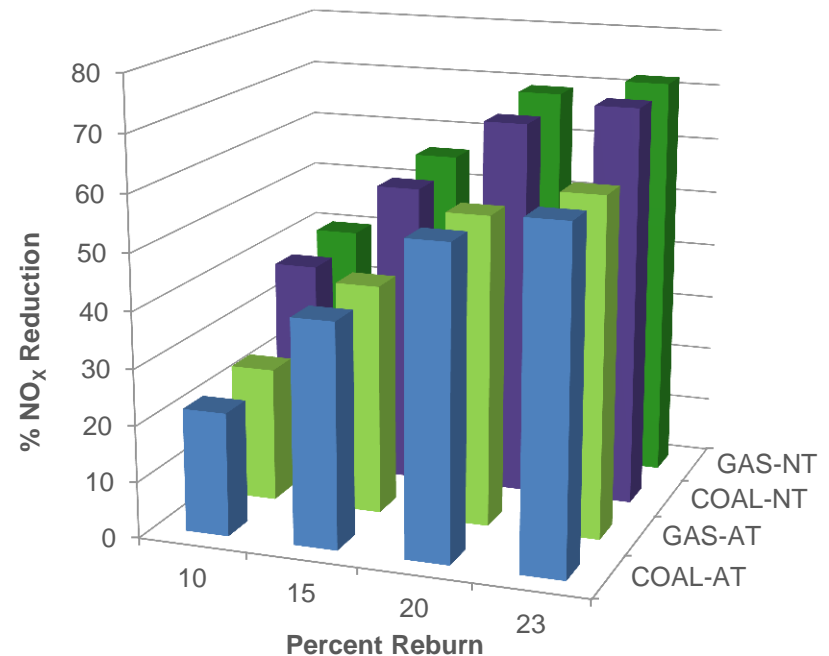
• Process Sector – Industrial Boilers

- APT Coal Boiler Reburn Tests – EER Labs, Irvine, CA - August, 1998
- Model Coal Plant - TVA Allen Plant 1 – 300 MW – 2475 PSI, 1053 °F
- NO_x Reductions = 70% with EMULSIFIED #6 Fuel Oil = 20% Heat In
- PM Reductions & CO₂ Credits Possible with Emulsified BIOFUELS!

Reburning process includes fuel and air staging to reduce NO_x emissions



NO_x generated in the **main combustion zone** reacts with fuel fragments injected into the **reburn zone** reducing it to molecular nitrogen. Overfire air addition completes combustion in the **burn-out zone**.



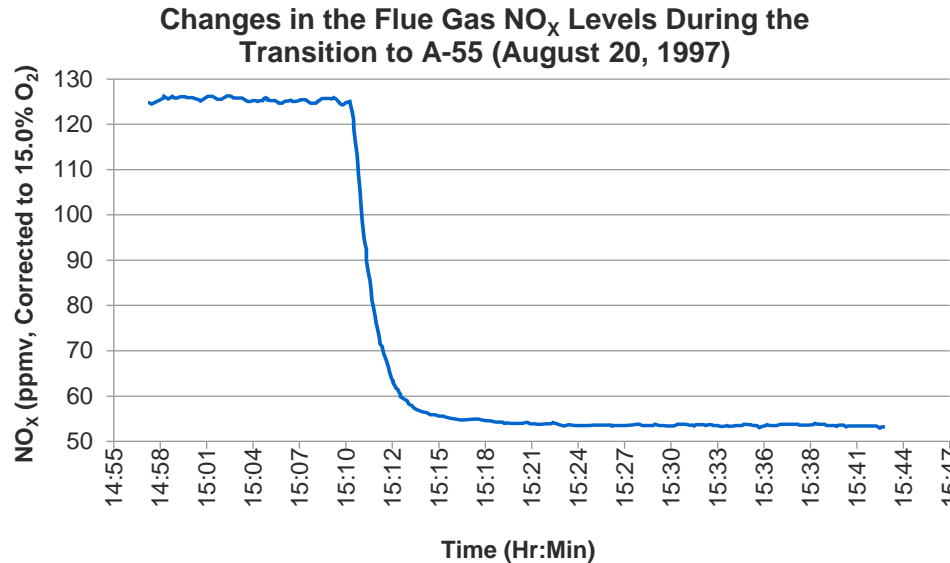
Past Applications of Emulsified Fuels

- Transport Sector – Diesel Engines
 - CARB (2003) Verified Emissions Performance for Diesel Oil Emulsion Fuels:
 - NO_x Emissions ↓ 15%
 - PM Emissions ↓ 53%
 - With Diesel Engine Tuning :
 - NO_x Emissions ↓ **48%**
 - PM Emissions ↓ **83%**



Past Applications of Emulsified Fuels

- Electric Sector – GE Power Turbine



NO_x ↓ 55%



TVA Colbert Power Plant
Huntsville, AL - DEC 1998

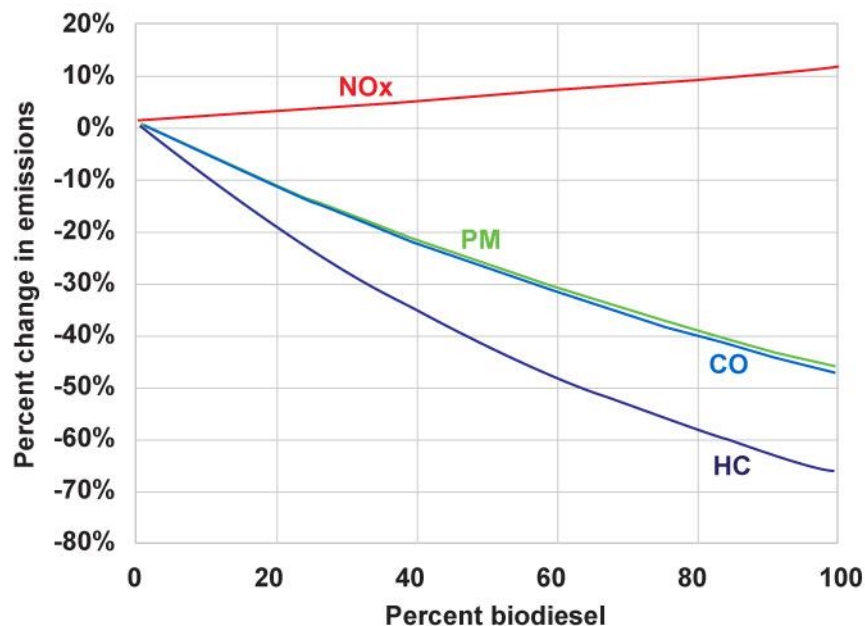
Corrected Gross Output

Load	Baseline kW	A-55 with 30% Water kW	A-55 with 35% Water kW
Base Load	44,665	46,711	46,868

Compared to Base Load, Power ↑ 5%

Future Applications of Emulsified Fuels

- Transport & Power Sectors – [Biofuels](#)

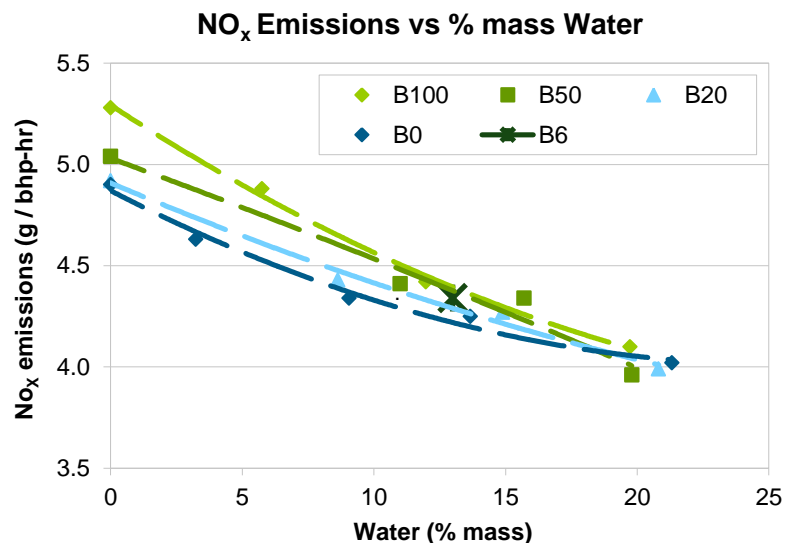


**Biodiesel Fuels
increase
NO_x Emissions**

USEPA Report 420-P-02-00 October 2002

Future Applications of Emulsified Fuels

- Transport & Power Sectors – Biofuels



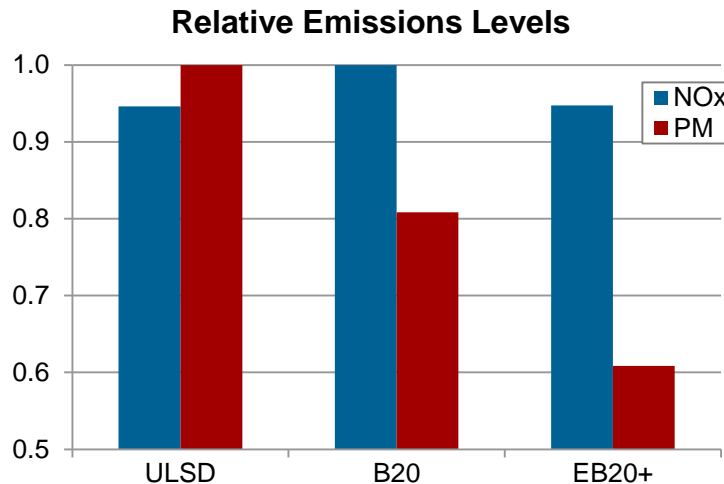
EMULSIFIED BIODIESEL FUELS

NEUTRALIZE NO_x EMISSIONS

SWRI RPT 03.13948 – SEPT 2008

Future Applications of Emulsified Fuels

- Transport & Power Sectors – [Biofuels](#)



Emulsified Biofuels Neutralize NO_x Emissions

And Reduce Particulate Matter (PM) Emissions

(Olson Ecologic Report – Oct 2009)

ULSD-Diesel Fuel

B20-Biodiesel Fuel

EB20+ = Emulsified B20 + Diesel OXY CAT (doc)

Technology Application Project – Port of Los Angeles

- Application of **Emulsified Biodiesel (EB20) Fuel**
- **Waterfront Operations – Ports America Company**



Top handler on EB20 Fuel at Port of LA

Technology Application Project – Port of Los Angeles

- Waterfront Operations – Ports America Company



Date: January 26, 2011

From: Ken Pope
Area Equipment Manager
Ports of America
2050 John S. Gibson Boulevard
San Pedro, California 90731

To: Port of Los Angeles

Ref: Agreement No. E6535 between The City of Los Angeles and Alternative Petroleum technologies, Inc.

To whom it may concern,

From September 2, 2010 to January 21, 2011, Ports America used Alternative Petroleum Technologies emulsified biodiesel fuel on Top Handlers. During the trial period (4 months) the operators did not report any operational issues with the fuel and its use in the top Handlers.

Kenton R. Pope

Area Equipment Services MGR.

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Technology Application Project – Port of Los Angeles

- CO₂ Emissions Reductions

Carbon Dioxide (CO₂) Emissions Table

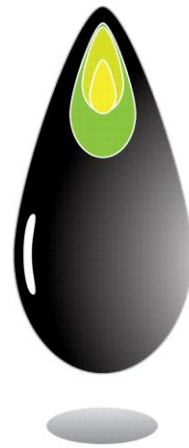
1. The actual EBIOD fuel consumption for 3 top handlers during 118 days of activity was 12,300 GAL
Entering this value of fuel usage into the NBB computer model gives CO₂ reduction of **36,485 L**
2. Annualized EBIOD fuel consumption for 3 top handlers is: $12,300 \times (365/118) = 38,047$ GAL
Entering this value of fuel usage into the NBB computer model gives CO₂ reduction of **112,857 LBS**
3. Annualized EBIOD fuel consumption for 100 top handlers is: $38,047 \times (33) = 1,255,538$ GAL
Entering this value of fuel usage into the NBB computer model gives CO₂ reduction of **3,724,228 LBS**

Note: CO₂ reductions demonstrated here can be realized along with reductions in NO_x & PM emissions.
(<http://www.Biodiesel.Org/tools/calculator/default.aspx?Aspxautodetectcookiesupport=1>)

Summary of Emulsified Fuel Technology

- EFT presents a significant opportunity to fully utilize hydrocarbon fuels – in all “flavors” – to their maximum operational potential without contributing to harmful gaseous (NO_x) & particulate matter (PM) emission levels.
- EFT is an enabling technology with significant potential for economic operations in:
 - Commercial, industrial boilers
 - Engines – trains, trucks, ports
 - Electric power plants

Contact Information



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