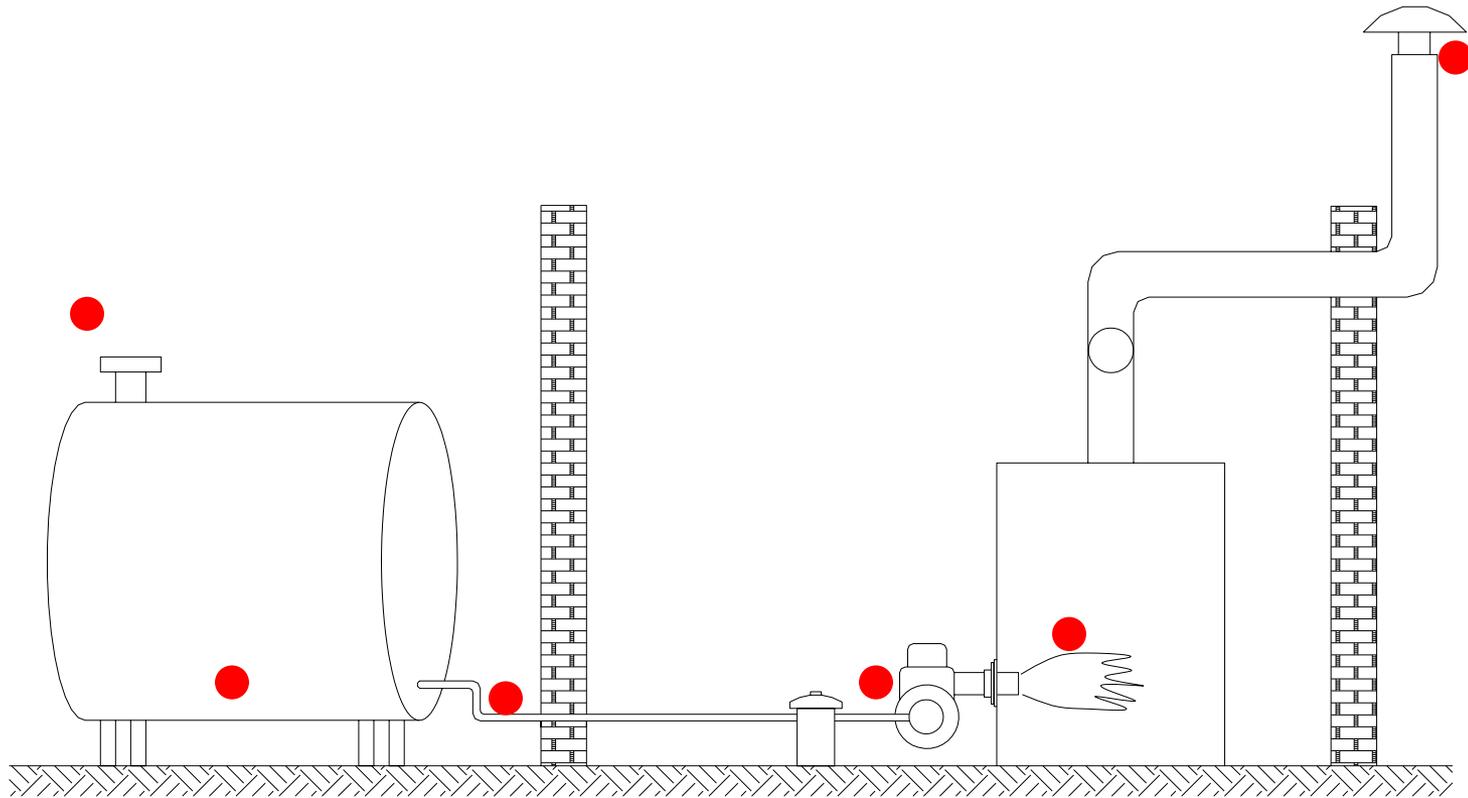


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Biodiesel for Heating in Connecticut
September 26, 2005
C.R. (Krish) Krishna
Energy Resources Division
Brookhaven National Laboratory

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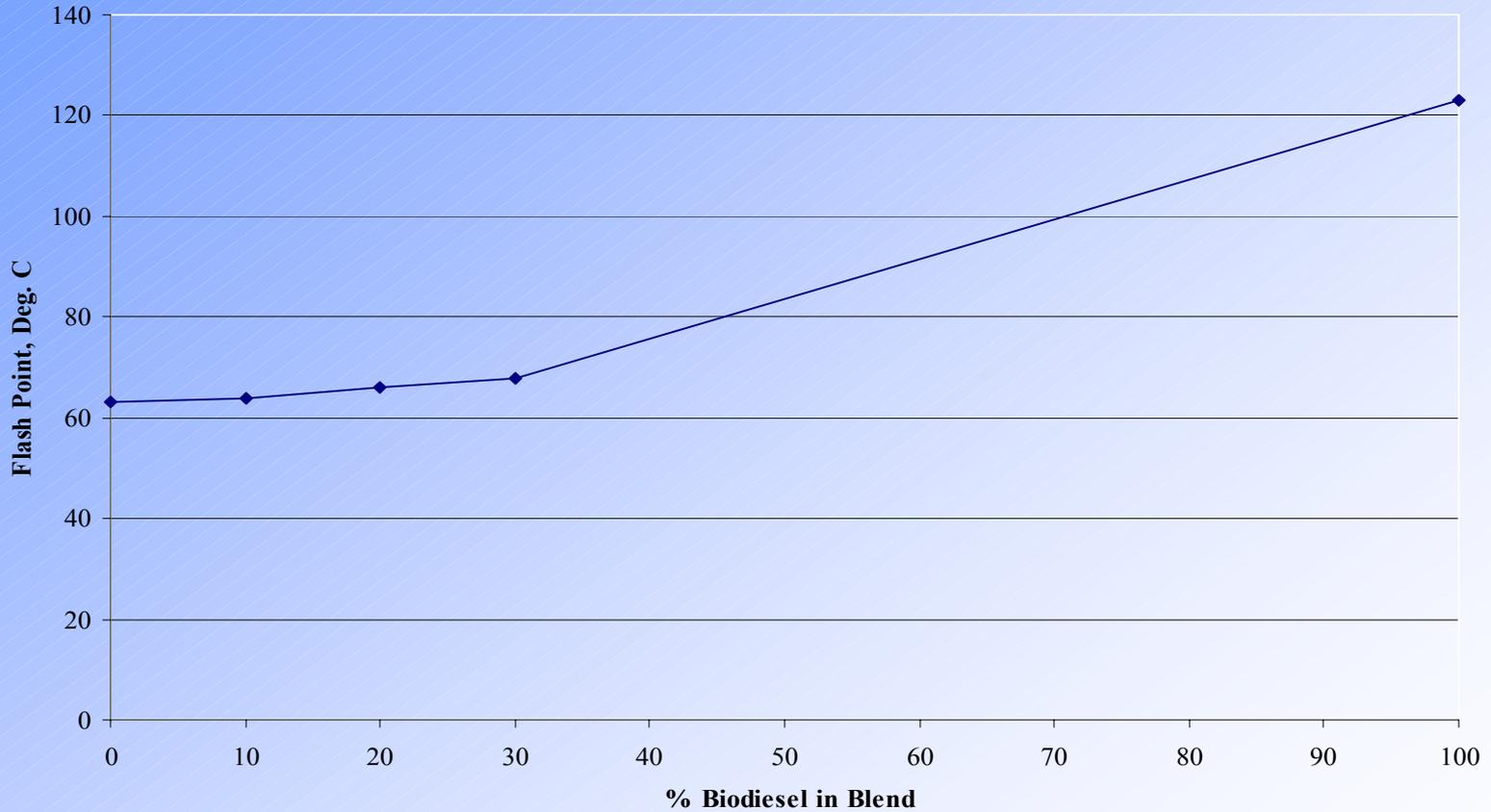
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- Some Fuel Properties of Biodiesel blends in ASTM #2 heating oil

	ASTM	No. 2	B 10	B20	B30	B 100
Flash Point °C	38 min	63	64	66	68	123
Pour Point °C, max	-6	-24	-21	-18	-15	0
Viscosity at 40°C, mm ² /s	1.9/3.4	2.67	2.90	2.95	3.1	4.4
Heating Value, Btu/gal	140,000					126,000-130,000
Specific gravity	0.85					0.885

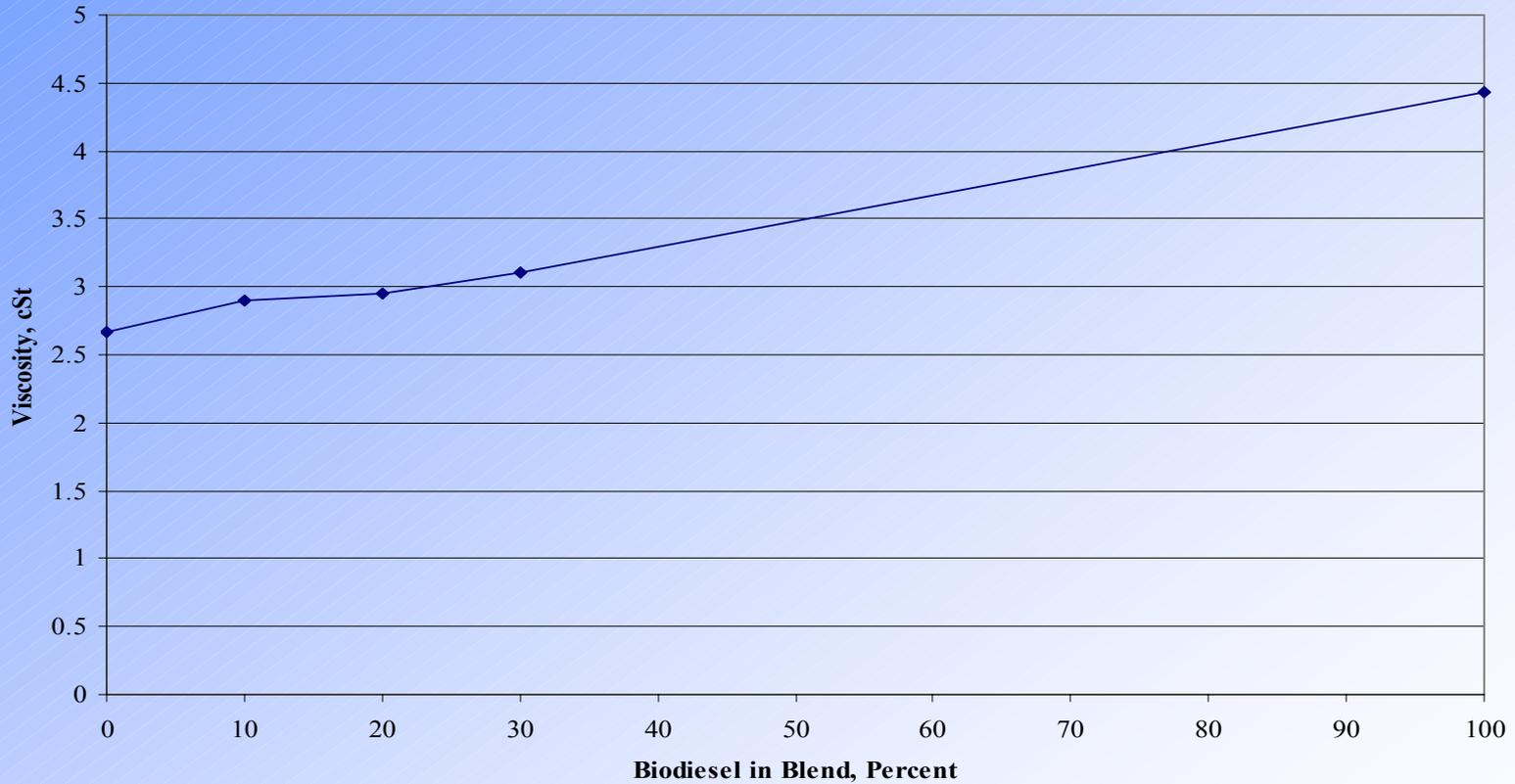
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Flash Point of Heating Oil Blends



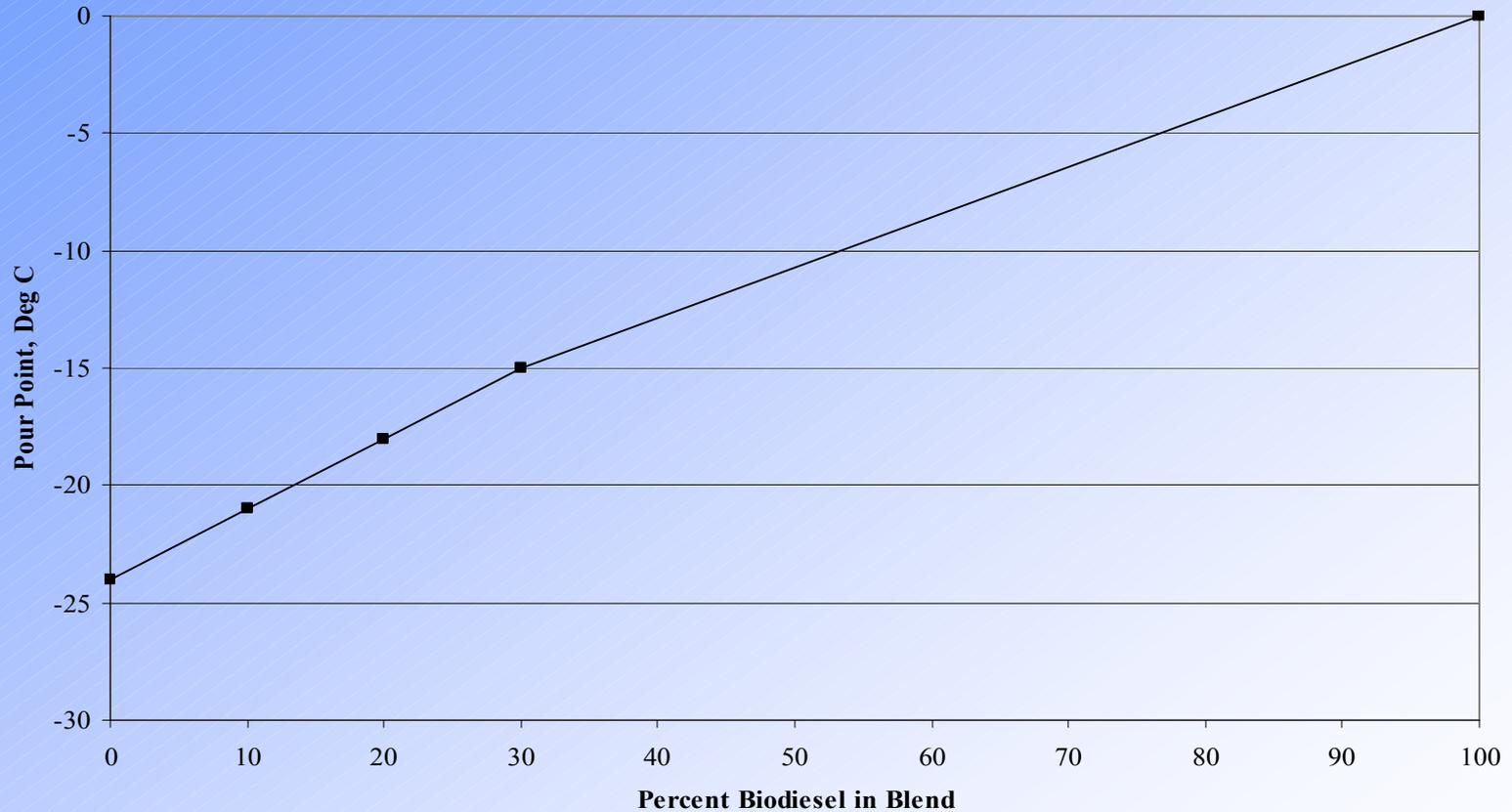
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Viscosity of Biodiesel Blends



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Pour Point of Heating Oil Blends



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- Adding biodiesel to # 2 increases flash point making it safer to store B 100
- Viscosity of B 100 exceeds the ASTM # 2 maximum
- Volumetric Heating value is ~10% lower and density is ~ 4% greater
- Clearly cold temperature storage/use is problematic

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- Broad Conclusions
 - Blends up to B 50 of these specific base fuels meet ASTM # 2 requirements (probably generally true)
 - Btu input to a residential boiler is nearly the same at similar settings
 - Pour point decreases almost linearly with amount of biodiesel in blend
 - Caution in cold weather transport, blending, storage, use

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- Blending
 - Both the biodiesel and the petroleum fuel must be ‘warm’
 - How ‘warm’?
 - Just released NBB report on cold flow testing
 - Lab tests for ‘Minnesota conditions’
 - Three samples of biodiesel and B2 blend
 - Recommends 10⁰ F above biodiesel cloud point for B2 blends
 - Abbott and Mills successful with ‘warm’ splash blending in tanker

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- Storage
 - BIOSTAB study relevant to residential storage of B 100
 - 11 samples, B 100 tested, but no Soy oil derived biodiesel
 - Stored in 200 liter drums for one year
 - *Eur. J. Lipid Sci. Technol.* **105** (2003) 735–741
 - No change was detected in 15 monitored Characteristics. All samples met the specification limits at the end of storage except for RIP
 - One test with simple and occasional agitation of product in presence of air affected stability

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- Storage (Contd)
 - Clearly it is important to prevent ingress of water
 - Recent incident in Maine for example
 - Biological growth may be more significant especially with water present
 - No data I could find
 - Biocides could take care of this?
 - Temperature above the cloud point of the mixture
 - Abbott and Mills field test report no problems in about 100 tanks of all types (Indoor, below ground, outdoor) with B 20

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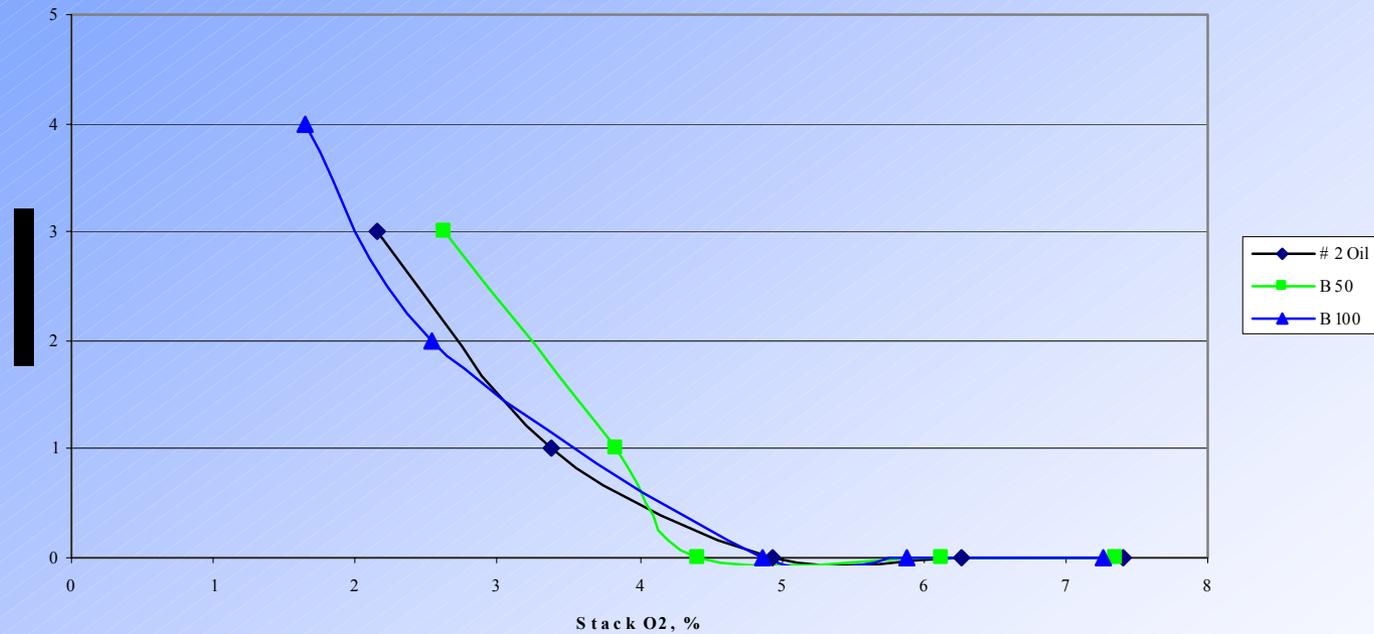
- Ongoing work funded by NYSERDA
 - Field demonstration of Biodiesel blends at National Park Site in Oyster Bay on Long Island
 - Fractionation of biodiesel to improve cold flow with AAF, LLC
 - Develop a burner system for burning B 100 with Heat Wise, Inc
 - Low wattage burner tested with blends
 - Demonstrate use of biodiesel in apartment buildings
 - Jointly with Cornell University Cooperative Extension and NYC College of Technology

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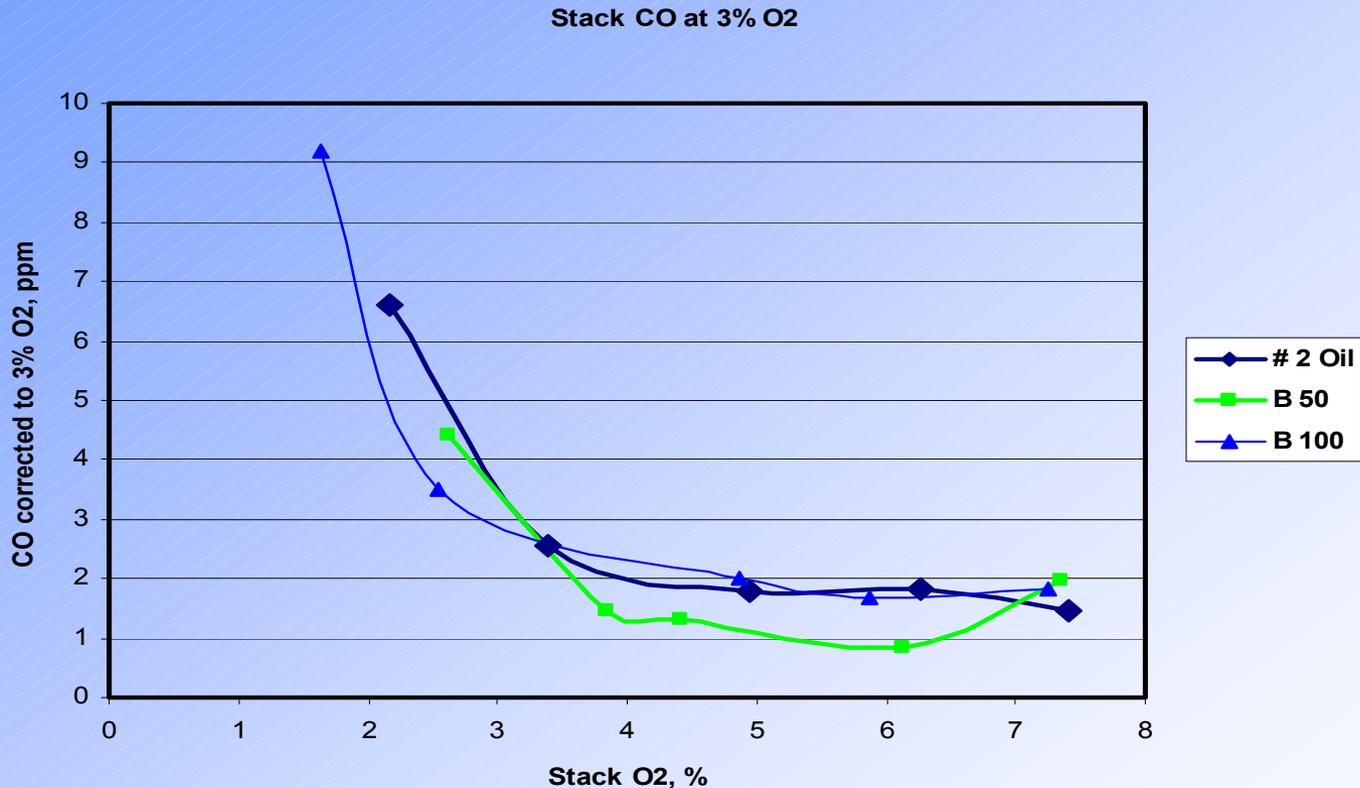


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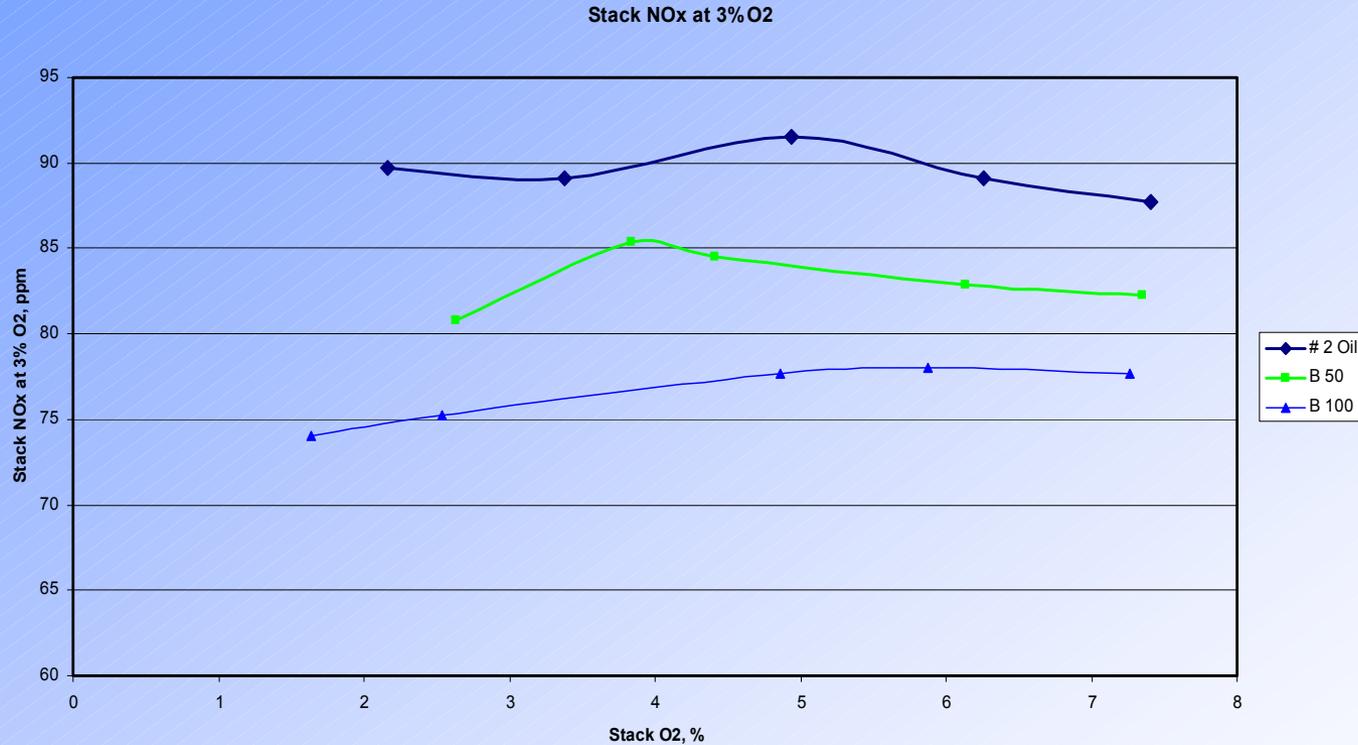
Smoke numbers



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Fuel	Cd. Cell Resistance (Ohms)
No.2 Oil	750
B-10	750
B-20	750
B-50	810
B-100	3000

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- Ralph Mills Presentation at the BNL workshop at
 - <http://intranet.bnl.gov/video/colloquia.asp>
- BNL BIODIESEL reports at
 - <http://www.osti.gov/bridge/basicsearch.jsp>
 - Search for 'Krishna' under author field