



EERC[®]

Energy & Environmental Research Center

UNIVERSITY OF NORTH DAKOTA

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July 25, 2011

Ms. Karlene Fine
Executive Director
Renewable Energy Development Program
North Dakota Industrial Commission
State Capitol 14th Floor
600 East Boulevard Avenue
Bismarck, ND 58505-0840

Dear Ms. Fine:

Subject: Addendum to the Final Project Report Entitled “Renewable Oil Refinery Development for Commercialization”; Contract No. R004-010; EERC Fund 14560

Enclosed is an addendum to the final project report for the period of July 1, 2009 – June 30, 2011. The addendum discusses the analytical results of two jet fuel samples produced by the Energy & Environmental Research Center (EERC) that were evaluated by the Air Force Research Laboratory that were not received by the submission date of the final report. If you have any questions, please contact me by phone at (701) 777-5273, by fax at (701) 777-5181, or by e-mail at cwocken@undeerc.org.

Sincerely,

Chad A. Wocken
Senior Research Manager

CAW/cs

Enclosure

c/enc: Andrea Holl Pfennig, North Dakota Department of Commerce

**RENEWABLE OIL REFINERY DEVELOPMENT
FOR COMMERCIALIZATION ADDENDUM**

Fuel Production from North Dakota Crops

The Energy & Environmental Research Center (EERC) produced two jet fuel samples from both canola- and crambe-derived seed oil utilizing optimized conditions developed during the design effort. Each sample was submitted to the Air Force Research Laboratory (AFRL) at Wright-Patterson Air Force Base in Ohio and was evaluated for military fuel specification compliance (Military Specification MIL-DTL-83133G) and compared to a typical JP-8 fuel. The data from the specification testing is shown in Table 1. Each bio-derived fuel met all specification property limits, and all are very similar to each other and also very similar to a typical JP-8 fuel. Figure 1 shows the chromatograms of each fuel in comparison with a JP-8 fuel. The bio-derived fuels are very similar in hydrocarbon distribution and are also very similar to a JP-8 fuel. Overall, both the canola- and crambe-derived fuels exhibit very similar properties, meet all Tier 1 fuel specifications, and appear to be ideal candidates as a replacement fuel to their petroleum-derived counterparts.

Table 1. Test Results of a Canola- and Crambe-Derived Jet Fuel in Comparison with a Typical JP-8 Jet Fuel

Specification Test	MIL-DTL-83133G Specification Requirement (100% SPK ¹)	Canola Jet SPK	Crambe Jet SPK	JP-8
Aromatics, vol%	≤25	0.2	1.0	18.8
Olefins, vol%		0.2	0.5	0.8
Heat of Combustion (measured), MJ/kg	≥42.8	44.0	44.0	43.3
Distillation:				
Initial Boiling Point, °C		140	135	159
10% Recovered, °C	≤205	165	161	182
20% Recovered, °C		174	168	189
50% Recovered, °C		195	190	208
90% Recovered, °C		239	241	244
End Point, °C	≤300	267	272	265
Residue, vol%	≤1.5	1.4	1.5	1.3
Loss, vol%	≤1.5	0.6	0.7	0.8
T90-T10, °C	≥22	74	80	62
Flash Point, °C	≥38	44	41	51
Freeze Point, °C	≤-47	<-76	<-75	-50
API ² Gravity at 60°F	37.0–51.0 (52.0–57.0)	56.1 ³	56.5 ³	44.4
Density at 15°C, kg/L	0.775–0.840 (0.751–0.770)	0.754 ³	0.753 ³	0.804

¹ SPK is synthetic paraffinic kerosene.

² American Petroleum Institute.

³ The EERC fuels are 100% SPK and contain no additive aromatics; therefore, the SPK applicable specification is in parentheses.

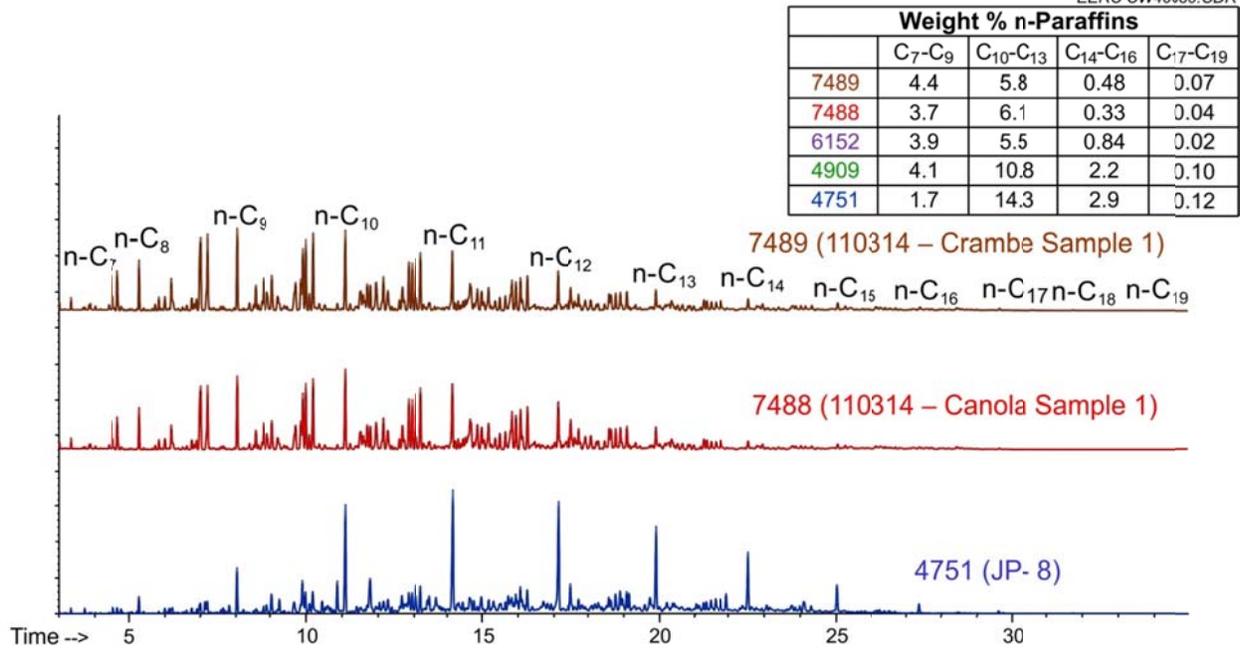


Figure 1. Chromatograms of the canola- and crambe-derived jet fuel samples and a typical JP-8 fuel.