Advantage Insight Group Inc.

Analysis of Blending Data Used In the Condensate EQ Model

For

Canadian Association of Petroleum Producers

By

Advantage Insight Group Inc

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www.cti-advantage.com

Suite 210, Alastair Ross Technology Centre. 3553 – 31 Street N.W. Calgary, AB T2L 2K7 Canada
Phone: 403-571-1705 - Fax: 403-571-1709

Executive Summary

The Equalization Steering Committee in their role to oversee the Condensate Equalization has requested Advantage Insight Group Inc to confirm the applicability of the current condensate equalization constants. These constants were based on analysis of blending data obtained from a series of laboratory analysis. This data has not been reviewed since 2001.

The main objective of this study is to establish whether or not the current data base should be changed or expanded.

Based on the already accepted industry methodology, two samples of heavy crude, thermal produced heavy oil sample (Cold Lake) and a conventional produced heavy oil sample (Nexen), were blended with 6 different diluents:

- Fort Saskatchewan (CFT)
- Rimbey (CRM)
- Peace River (CPR)
- Pembina (CPM)
- CRW
- PetroCanada (CPC)

Three target density blends were prepared for each of the heavy crude and diluent pairings; 912 kg/m3, 930 kg/m3 and 940 kg/m3. The viscosity for each blend density mixed was measured at 7°C, 12°C, 20°C, 30°C and 40°C.

The data was statistically analyzed. The error distribution was reviewed to assess the consistency between the predicted and the measured values. The results indicated that the 2006 data was more consistent that the data from 2001. The correlation on all of the data was good.

It was concluded that the data of 2006 is consistent with the data from 2001. Due to the scatter in the data there would have been a 6 to 8 cent reduction in the density penalty if only 2006 blend data had been used. However there would have been a change of less than 1 cent in the density penalty if a larger set of data including both 2001 and 2006 had been used.

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1 Introduction

In 2001, the Equalization Steering Committee adopted a condensate density equalization system that was based on the value of the condensate as a bitumen diluent.

When bitumen is shipped by pipeline it must meet both density and viscosity specifications. Normally diluent/bitumen blends are limited by the viscosity of the blend, not the density. However, density is easily measured and is a much more convenient proxy for the blending characteristics of a blend. To allow the use of density as a proxy for blend efficiency, blends of representative diluent and representative bitumen were prepared and the viscosity behavior of these blends was analyzed to arrive at generalized blending correlations. Using statistical techniques, this viscosity data was then merged to provide generalized relationships that were suitable for valuing each condensate's blend efficiency based on its density.

In 2006, the Equalization Steering Committee requested that the laboratory blend data be reviewed to ensure that the blending relationships that had been observed in 2001 still reflected the current diluent/bitumen blending behavior.

The scope of this report is to re-evaluate the condensate equalization constants based on a new set of laboratory blend data and the already accepted model for the industry methodology.

2 Scope and Laboratory analysis

The Equalization Steering Committee selected several condensate streams to be blended with two representative bitumen streams. A thermally produced heavy oil sample (Cold Lake) and a conventionally produced heavy oil sample (Nexen), were blended with 6 different diluents.

As in 2001, each crude was mixed with each diluent to produce three blends of approximately 940 Kg/m3, 930 Kg/m3 and 912 Kg/m3. Each blend was analyzed for viscosity (ASTM D7042) at 7°C, 12°C, 20°C, 30°C and 40°. Appendix 1 contains the Laboratory results provided for this study.

In 2006 it was concluded that the significant streams in the condensate pool had changed so a slightly revised condensate slate as examined. Table 1 summarizes the streams used in 2001 and 2006 new set of data:

Table 1 2001 and 2006 Condensate and Bitumen Sources

Condensates 2001	Density, kg/m3	Condensates 2006	Density, kg/m3
Fort Saskatchewan (CFT)	670.8	Fort Saskatchewan (CFT)	676.3
Rimbey (CRM)	682.8	Rimbey (CRM)	715.2
Peace River (CPR)	763.8	Peace River (CPR)	739.6
Pembina (CPM)	768.1	Pembina (CPM)	773.4
CRW Jun 3	730.7	CRW	727.2
Swan Hills	828.6	PetroCanada (CPC)	757.2
CRW Jun 1	720.6		
Amoco (CAM)	714.8		
West Pembina	799.7		
Total Blends	**54**	**Total Blends**	**36**
Heavy Streams			
Cold Lake Bitumen	1005.7	Cold Lake Bitumen	997.2
Lloyd Kerrobert Bitumen	976.4	Nexen Plover Lake	984.6

3 Data analysis

A linear viscosity/temperature plot was generated for each Crude/Condensate blend as per ASTM D341. Appendix 2 shows the data analysis and viscosity/temperature plot for each of the crude/condensate blends.

The blend/temperature data was linearly regressed to obtain the 350 cSt density/temperature relationship for each crude/condensate pair. The following expression is obtained:

Equation 1 $$\rho_{blend} = Slope * T_{reference} + Intercept$$

Table 2 summarizes the slope and intercept that was calculated from each of the regressions as well as the quality of the regression. The high R Square value for each of the regressions indicates that the viscosity data is linear over the range of values indicated.

Appendix 3 shows the plot of density vs. temperature for each crude/condensate blend.

Table 2 350cSt Viscosity Blends Density vs. Temperature Correlation Summary - Data 2006

Condensate		Cold Lake			Nexen Blends		
Stream	Density, Kg/m3	Slope	Intercept	R square	Slope	Intercept	R square
CFT-0488	676.3	1.38701	908.4348	0.9990	1.225389	915.4466	0.9999
CRM-0482	715.2	1.25236	914.2953	0.9999	1.168499	918.1293	1.0000
CRW-675	727.2	1.23879	914.6688	0.9984	1.170814	917.6339	0.9999
CPR-0822	739.6	1.23077	915.3531	0.9953	1.161862	918.2300	1.0000
CPC-475	757.2	1.08093	923.6149	1.0000	1.050757	924.4989	0.9999
CPM-478	773.4	1.19867	915.9908	0.9999	1.139727	919.2878	1.0000

Table 3 shows the slope and intercept that was calculated for each of the blends done in 2001 as well as the quality of those regressions. The 2001 data appears

reasonably consistent with the 2006 data considering the differences in individual stream densities.

Table 3 350cSt Viscosity Blend Density vs. Temperature Correlation Summary - Data 2001

Condensate		Cold Lake			LLK		
Stream	Density, Kg/m3	Slope	Intercept	R square	Slope	Intercept	R square
Fort Saskat.(CFT)	670.8	1.349	896.5	0.9994	1.098	920.1	0.9999
Rimbey (CRM)	682.8	1.355	900.5	0.9993	1.249	918.2	0.9979
Amoco (CAM)	714.8	1.273	906.5	0.9997	1.239	921.0	0.9984
Peace River(CPR)	764.2	1.186	910.4	0.9904	1.251	920.0	0.9994
Pembina (CPM)	768.3	1.221	908.4	0.9995	1.142	921.5	0.9989
West Pembina	799.7	1.180	908.7	1.0000	1.195	918.8	0.9991
Valhalla[1]	811.6	1.479	901.6	0.9974	1.453	914.1	0.9940
Swan Hills	828.6	1.087	913.8	0.9998	1.139	919.9	0.9976
CRW Jun 1	720.6	1.302	903.9	0.9994	1.186	919.9	0.9990
CRW Jun 3	730.7	1.268	905.4	0.9992	1.164	920.4	0.9999

Using the data presented in Table 2 and Table 3, an equation for the minimum blend density that would achieve the required viscosity at pipeline reference temperature was developed for each bitumen.

The Slopes and Intercepts from **Equation 1** were regressed vs. condensate density (Table 2 and Table 3) obtaining the following relationships:

$$Slope = a_1 * \rho_{condensate} + b_1$$
$$Intercept = a_2 * \rho_{condensate} + b_2$$

Equation 1 then takes the form of:

Equation 2
$$\rho_{blend} = (a_1 * \rho_{condensate} + b_1) * T_{reference} + (a_2 * \rho_{condensate} + b_2)$$

[1] Excluded from calculation as per analysis 2001

Where:

ρ_{blend} = the required blend density to achieve the 350 cSt blend viscosity at pipeline reference temperature expressed in kg/m3.

$\rho_{condensate}$ = the condensate density used in the blend expressed in kg/m3.

$T_{reference}$ = the pipeline reference temperature expressed in Celsius.

Four cases were analyzed:

Case 1 - Using only 2006 data.

Case 2 - Using 2006 data excluding PC.

Case 3 - Using all 2006 data and 2001 data (excluding Valhalla condensate).

Case 4 - Using 2006 data excluding PC 2001 data (excluding Valhalla condensate).

Appendix 4 shows with more detail the calculation of the coefficient values for each of the cases. The following figure shows the comparison of the effect on the Condensate density penalty for each of the cases.

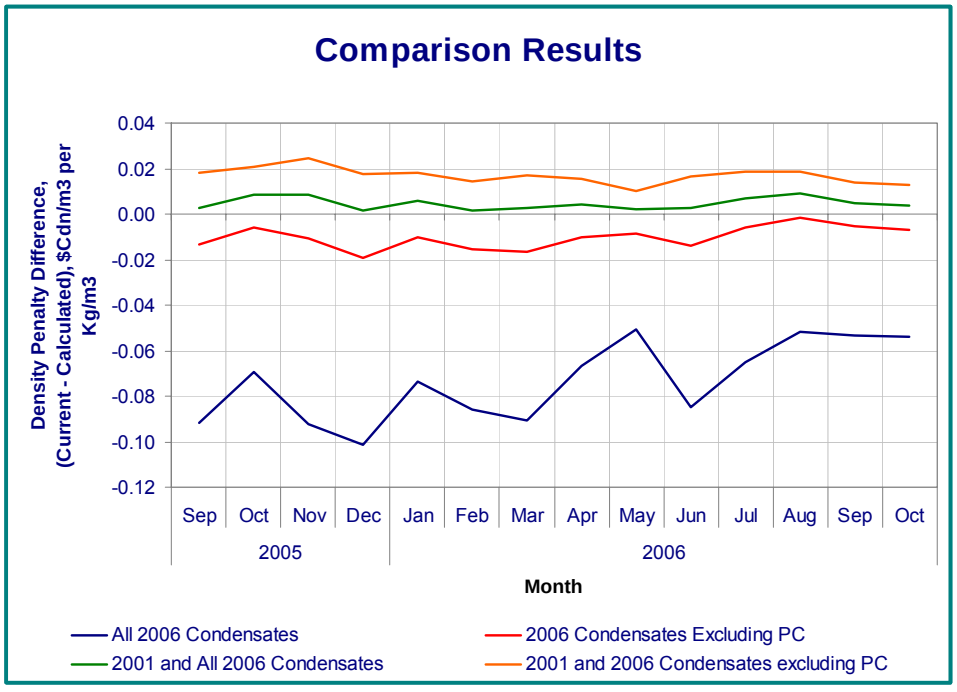

Figure 1 Comparison Cases – Effect of Coefficients in Condensate Density Penalty

It is possible to predict the blend density using Equation 2 with the laboratory information and compare it with the measured density at 15 °C using the coefficients calculated for each case. R square or coefficient of determination can be calculated with the following expression:

Equation 3

$$r^2 = 1 - \frac{\sum(\rho_{measured} - \rho_{predicted})^2}{\sum(\rho_{measured} - \bar{\rho})^2}$$

Where

$\rho_{measured}$= Measured density, kg/m3

$\rho_{predicted}$ = Predicted density, kg/m3

$\bar{\rho}$ = Mean density

Table 4 presents the summary of coefficient of determination or R square obtained for each of the studied cases. More detail is presented in Appendix 4

Table 4 Density prediction Summary of R square

Case	R square
2001 Data	0.8487
Case 1: Only 2006 data	0.7820
Case 2: Using 2006 data excluding PC	0.8217
Case 3:Using all 2006 data and 2001 data	**0.9041**
Case 4: Using 2006 data excluding PC 2001 data	0.8994

From the above table, it was concluded that the coefficients obtained when using all 2006 and 2001 data provide a better representation of the data.

Table 5 Model coefficients using 2001 and 2006 Data

	Slope vs. Condensate Density			Intercept vs. Condensate Density		
	a1	b1	R square	a2	b2	R square
Cold Lake Blends	-0.00174	2.52645	0.77947	0.08222	849.09899	0.29120
LLK Blends	-0.00058	1.60790	0.20725	0.02055	904.23302	0.16961

4 Conclusions

- The data of 2006 appears to be consistent with the data from 2001
- Because of the scatter in the data there would be a 6 to 8 cent reduction in the density penalty if only 2006 blend data were used
- There would have be a change of less than 1 cent in the density penalty if a larger set of data including both 2001 and 2006 were used.
- The sets of coefficients obtained when including 2006 data provide an improved estimate of the blend density that satisfies the viscosity of 350 cSt.

5 Appendices

5.1 Appendix 1 Laboratory results

Petroleum Services Division
Core Laboratories Canada, Ltd.
2810 - 12 Street N.E.
Calgary, Alberta, Canada T2E 7P7
Tel: (403) 250-4000
Fax: (403) 250-5120
www.corelab.com

Core Laboratories Reservoir Fluids Report - Calgary

Diluent Blending Project
for
CAPP / Advantage Insight Group

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APPROVED BY:

Eric MacDonald, B.Sc.
Team Lead, Technical Services Group
Phone # 403-250-4082
Email Eric.Macdonald@corelab.com

Please contact the above person should there be any questions concerning the contents of this report. Atmospheric samples will be kept a maximum of 30 days.

COMPANY	CAPP / Advantage Insight Group.	PAGE	1
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Scope of Test

CAPP / Advantage Insight group requested Core Laboratories prepare various diluent – bitumen blends to target densities. The bitumen, diluent and prepared blends were subject to density and viscosity characterization.

Sample Descriptions

Sample	Description
Bitumen	Imperial Cold Lake
Bitumen	Nexen Plover Lake 16-9 Battery
Diluent	CRW-675 June 8th 2006
Diluent	CPC-475 Petro Canada Condensate, June 8th 2006
Diluent	CPR-0822 Peace Condensate, June 9th 2006
Diluent	CFT-0488 Fort Saskatchewan Condensate, June 8th 2006
Diluent	CRM- 0482 Rimbey Condensate, June 8th 2006
Diluent	CPM-478 Pembina Condensate, June 8th 2006

Procedure

The bitumen was characterized by measuring density, total sulphur and viscosity at 30°C, 40°C and 50°C. Each diluent was characterized by measuring its density, Reid Vapour Pressure, C30+ Hydrocarbon Composition, Boiling Range Distribution by Gas Chromatography (Simulated Distillation), and viscosity at 7°C, 12°C, 20°C, 30°C, 40°C. Diluents were kept in a freezer (- 12 °C) until needed. Blends were prepared by accurately weighing the bitumen and diluent on an analytical balance. The masses of each component required to achieve a target densities were calculated utilizing API 2509C and API 12.3 shrinkage methodologies, each blend was vigorously agitated on a paint shaker for 15 minutes. The blends were then allowed to settle for 4 hours prior to density and viscosity measurements. The time between preparation and analysis was kept constant at 4 to 6 hours to reduce aging effects.

The industry standard procedures utilized for characterization are listed below.

Test	Method
Density	ASTM D-5002 / ASTM D-4052 / ASTM D-7042
Sulfur	ASTM D-4294
Viscosity	ASTM D-445 / ASTM D-7042 / ASTM D-341
RVP	ASTM D-5191

Bitumen Characterization

Imperial Cold Lake Bitumen
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
30	18642	18870
40	6082	6195
50	2328	2386
7 (Extrapolated)	525000	524000
12 (Extrapolated	227800	228000
20 (Extrapolated)	58190	69000

Measured Density @ 15.0°C..... 997.2 kg/m^3

API Gravity @ 15.6°C..... 10.3

Total Sulfur ..... 3.97 Wt%

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Nexen Plover Lake 16-9 Battery Sales Oil
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
30	4217	4324
40	1613	1665
50	735.4	764.0
7 (Extrapolated)	67900	68600
12 (Extrapolated	33800	34300
20 (Extrapolated)	12400	12600

Measured Density @ 15.0°C..... 984.6 kg/m^3

API Gravity @ 15.6°C..... 12.1

Total Sulfur ..... 3.05 Wt%

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Diluent Characterization

CRW-675 June 8th , 2006
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	0.6759	0.9221
12	0.6344	0.8698
20	0.5619	0.7774

Measured Density @ 15.0°C (on July 11th, 2006)..... 727.2 kg/m^3

API Gravity @ 15.6°C..... 62.9

RVP ..... 72 kPa

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CPC-475 PetroCanada Condensate June 8th , 2006
Viscosity

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	0.7133	0.7627
12	0.6675	0.7591
20	0.6054	0.7524

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CPR 0822 Peace Condensate June 8th , 2006
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	0.7756	1.0411
12	0.7219	0.9737
20	0.6063	0.8262

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CFT 0488 Fort Saskatchewan Condensate June 8th , 2006
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	0.3745	0.5495
12	0.3464	0.5114
20	0.3117	0.4653

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CRM-0482 Rimby Condensate June 8th , 2006
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	0.5388	0.7472
12	0.5029	0.7009
20	0.4467	0.6295

Measured Density @ 15.0°C (on July 11th, 2006)..... 715.2 kg/m^3

API Gravity @ 15.6°C..... 66.2

RVP ..... 71 kPa

Simulated Distillation.....Page 18

Hydrocarbon Composition.....Page 19

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PROJECT	Diluent Blending Study	DATE	12/13/2006

CPM-478 Condensate June 8th , 2006
Viscosity

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	1.3210	1.6933
12	1.2161	1.5669
20	1.0637	1.3818

Core Lab
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LABORATORY TEST RESULTS

JOB NUMBER: 52137-2006-4335 **CUSTOMER: CAPP / Advantage Insight Group**

SAMPLE I.D: **CRW - 675** LABORATORY I.D.: 52137-06-4335-1

DATE SAMPLED: June 8, 2006

TEST DESCRIPTION	RESULT	LIMITS	UNITS	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-2887	06/11/02	BH
I.B.P.	**-3.4**					
5% Off	**26.1**					
10% Off	**30.0**					
15% Off	**35.0**					
20% Off	**35.9**					
25% Off	**58.2**					
30% Off	**63.4**					
35% Off	**69.3**					
40% Off	**83.1**					
45% Off	**90.1**					
50% Off	**98.1**					
55% Off	**103.9**					
60% Off	**115.8**					
65% Off	**126.0**					
70% Off	**140.7**					
75% Off	**159.9**					
80% Off	**187.9**					
85% Off	**235.2**					
90% Off	**302.1**					
95% Off	**391.4**					
F.B.P.	**512.3**					

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2810 - 12th Street N.E.
CALGARY, ALBERTA T2E 7P7

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HYDROCARBON LIQUID ANALYSIS

Operator: EnCana Resources
Well: CRW - 675
Sample Point: Spot Sample

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File: 52137-2006-4335-1-276
Date: 2006 11 07

Analysis of C_{30+} Fraction

Boiling Point: Range (° C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
-161.7	Methane	C_1	Trace	Trace	Trace
- 88.9	Ethane	C_2	0.0003	0.0001	0.0002
- 42.2	Propane	C_3	0.0041	0.0018	0.0025
- 11.7	Iso Butane	C_4	0.0061	0.0035	0.0045
- 0.6	Normal Butane	C_4	0.0428	0.0245	0.0301
27.8	Iso Pentane	C_5	0.1397	0.0992	0.1142
36.1	Normal Pentane	C_5	0.1504	0.1068	0.1217
36.1- 68.9	Hexanes	C_6	0.1382	0.1172	0.1269
68.9- 98.3	Heptanes	C_7	0.0902	0.0889	0.0930
98.3-125.6	Octanes	C_8	0.0664	0.0746	0.0760
125.6-150.6	Nonanes	C_9	0.0394	0.0497	0.0496
150.6-173.9	Decanes	C_{10}	0.0268	0.0375	0.0368
173.9-196.1	Undecanes	C_{11}	0.0218	0.0316	0.0288
196.1-215.0	Dodecanes	C_{12}	0.0139	0.0221	0.0198
215.0-235.0	Tridecanes	C_{13}	0.0099	0.0170	0.0151
235.0-252.2	Tetradecanes	C_{14}	0.0085	0.0158	0.0139
252.2-270.6	Pentadecanes	C_{15}	0.0070	0.0141	0.0123
270.6-287.8	Hexadecanes	C_{16}	0.0052	0.0113	0.0097
287.8-302.8	Heptadecanes	C_{17}	0.0042	0.0097	0.0083
302.8-317.2	Octadecanes	C_{18}	0.0038	0.0095	0.0079
317.2-330.0	Nonadecanes	C_{19}	0.0032	0.0083	0.0070
330.0-344.4	Eicosanes	C_{20}	0.0026	0.0070	0.0059
344.4-357.2	Heneicosanes	C_{21}	0.0027	0.0077	0.0064
357.2-369.4	Docosanes	C_{22}	0.0020	0.0061	0.0050
369.4-380.0	Tricosanes	C_{23}	0.0019	0.0060	0.0049
380.0-391.1	Tetracosanes	C_{24}	0.0016	0.0052	0.0043
391.1-401.7	Pentacosanes	C_{25}	0.0014	0.0049	0.0039
401.7-412.2	Hexacosanes	C_{26}	0.0013	0.0046	0.0037
412.2-422.2	Heptacosanes	C_{27}	0.0012	0.0043	0.0036
422.2-431.7	Octacosanes	C_{28}	0.0010	0.0038	0.0031
431.7-441.1	Nonacosanes	C_{29}	0.0009	0.0037	0.0028
441.1 PLUS	Triacontanes Plus	C_{30+}	0.0070	0.0293	0.0231
80.0	Benzene	C_6H_6	0.0144	0.0111	0.0090
110.6	Toluene	C_7H_8	0.0277	0.0251	0.0207
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	0.0225	0.0235	0.0195
144.4	o-Xylene	C_8H_{10}	0.0045	0.0047	0.0038
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	0.0061	0.0072	0.0058
48.9	Cyclopentane	C_5H_{10}	0.0151	0.0104	0.0100
72.2	Methylcyclopentane	C_6H_{12}	0.0320	0.0265	0.0253
81.1	Cyclohexane	C_6H_{12}	0.0290	0.0240	0.0221
101.1	Methylcyclohexane	C_7H_{14}	0.0432	0.0417	0.0388
	TOTAL		1.0000	1.0000	1.0000

Core Lab
PETROLEUM SERVICES

LABORATORY TEST RESULTS

JOB NUMBER: 52137-2006-4335 **CUSTOMER: CAPP / Advantage Insight Group**

SAMPLE I.D: **CPC - 475 Petro Canada Condensate** LABORATORY I.D.: 52137-06-4335-2

DATE SAMPLED: June 8, 2006

TEST DESCRIPTION	RESULT	LIMITS	UNITS	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-2887	06/11/02	BH
I.B.P.	**69.1**					
5% Off	**85.8**					
10% Off	**91.0**					
15% Off	**94.0**					
20% Off	**98.2**					
25% Off	**103.1**					
30% Off	**103.8**					
35% Off	**107.1**					
40% Off	**113.2**					
45% Off	**117.0**					
50% Off	**119.4**					
55% Off	**123.4**					
60% Off	**126.3**					
65% Off	**132.7**					
70% Off	**135.2**					
75% Off	**140.2**					
80% Off	**143.1**					
85% Off	**147.3**					
90% Off	**151.8**					
95% Off	**162.4**					
F.B.P.	**206.3**					

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HYDROCARBON LIQUID ANALYSIS

Operator: EnCana Resources
Well: CPC - 475
Sample Point: Spot Sample

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File: 52137-2006-4335-2-277
Date: 2006 11 07

Analysis of C_{30+} Fraction

Boiling Point: Range (° C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
-161.7	Methane	C_1	0.0000	0.0000	0.0000
- 88.9	Ethane	C_2	0.0000	0.0000	0.0000
- 42.2	Propane	C_3	0.0000	0.0000	0.0000
- 11.7	Iso Butane	C_4	0.0000	0.0000	0.0000
- 0.6	Normal Butane	C_4	0.0000	0.0000	0.0000
27.8	Iso Pentane	C_5	Trace	Trace	Trace
36.1	Normal Pentane	C_5	0.0002	0.0001	0.0002
36.1- 68.9	Hexanes	C_6	0.0112	0.0088	0.0097
68.9- 98.3	Heptanes	C_7	0.2003	0.1822	0.1952
98.3-125.6	Octanes	C_8	0.2504	0.2597	0.2707
125.6-150.6	Nonanes	C_9	0.1653	0.1925	0.1966
150.6-173.9	Decanes	C_{10}	0.0492	0.0636	0.0638
173.9-196.1	Undecanes	C_{11}	0.0095	0.0127	0.0118
196.1-215.0	Dodecanes	C_{12}	0.0044	0.0064	0.0059
215.0-235.0	Tridecanes	C_{13}	0.0014	0.0022	0.0020
235.0-252.2	Tetradecanes	C_{14}	0.0003	0.0006	0.0005
252.2-270.6	Pentadecanes	C_{15}	Trace	Trace	Trace
270.6-287.8	Hexadecanes	C_{16}	0.0000	0.0000	0.0000
287.8-302.8	Heptadecanes	C_{17}	0.0000	0.0000	0.0000
302.8-317.2	Octadecanes	C_{18}	0.0000	0.0000	0.0000
317.2-330.0	Nonadecanes	C_{19}	0.0000	0.0000	0.0000
330.0-344.4	Eicosanes	C_{20}	0.0000	0.0000	0.0000
344.4-357.2	Heneicosanes	C_{21}	0.0000	0.0000	0.0000
357.2-369.4	Docosanes	C_{22}	0.0000	0.0000	0.0000
369.4-380.0	Tricosanes	C_{23}	0.0000	0.0000	0.0000
380.0-391.1	Tetracosanes	C_{24}	0.0000	0.0000	0.0000
391.1-401.7	Pentacosanes	C_{25}	0.0000	0.0000	0.0000
401.7-412.2	Hexacosanes	C_{26}	0.0000	0.0000	0.0000
412.2-422.2	Heptacosanes	C_{27}	0.0000	0.0000	0.0000
422.2-431.7	Octacosanes	C_{28}	0.0000	0.0000	0.0000
431.7-441.1	Nonacosanes	C_{29}	0.0000	0.0000	0.0000
441.1 PLUS	Triacontanes Plus	C_{30+}	0.0000	0.0000	0.0000
80.0	Benzene	C_6H_6	0.0058	0.0041	0.0034
110.6	Toluene	C_7H_8	0.0503	0.0421	0.0356
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	0.0648	0.0625	0.0530
144.4	o-Xylene	C_8H_{10}	0.0230	0.0222	0.0185
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	0.0063	0.0069	0.0057
48.9	Cyclopentane	C_5H_{10}	Trace	Trace	Trace
72.2	Methylcyclopentane	C_6H_{12}	0.0292	0.0223	0.0218
81.1	Cyclohexane	C_6H_{12}	0.0262	0.0200	0.0188
101.1	Methylcyclohexane	C_7H_{14}	0.1022	0.0911	0.0868
	TOTAL		1.0000	1.0000	1.0000

Core Lab
PETROLEUM SERVICES

LABORATORY TEST RESULTS

JOB NUMBER: 52137-2006-4335 **CUSTOMER: CAPP / Advantage Insight Group**

SAMPLE I.D: **CPR - 0488 Peace Condensate** LABORATORY I.D.: 52137-06-4335-3

DATE SAMPLED: June 9, 2006

TEST DESCRIPTION	RESULT	LIMITS	UNITS	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-2887	06/11/02	BH
I.B.P.	**-4.7**					
5% Off	**25.8**					
10% Off	**27.3**					
15% Off	**35.5**					
20% Off	**58.6**					
25% Off	**68.3**					
30% Off	**75.3**					
35% Off	**85.7**					
40% Off	**93.2**					
45% Off	**102.7**					
50% Off	**108.1**					
55% Off	**118.4**					
60% Off	**128.2**					
65% Off	**142.4**					
70% Off	**161.2**					
75% Off	**182.8**					
80% Off	**220.2**					
85% Off	**271.0**					
90% Off	**331.1**					
95% Off	**411.8**					
F.B.P.	**507.8**					

CORE LABORATORIES
2810 - 12th Street N.E.
CALGARY, ALBERTA T2E 7P7

HYDROCARBON LIQUID ANALYSIS

Operator: EnCana Resources
Well: CPR - 0822
Sample Point: Spot Sample

Page:15
File: 52137-2006-4335-3-278
Date: 2006 11 07

Analysis of C_{30+} Fraction

Boiling Point: Range (° C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
-161.7	Methane	C_1	0.0007	0.0001	0.0003
- 88.9	Ethane	C_2	0.0007	0.0002	0.0004
- 42.2	Propane	C_3	0.0102	0.0042	0.0061
- 11.7	Iso Butane	C_4	0.0092	0.0050	0.0065
- 0.6	Normal Butane	C_4	0.0601	0.0327	0.0409
27.8	Iso Pentane	C_5	0.0949	0.0641	0.0750
36.1	Normal Pentane	C_5	0.1157	0.0782	0.0905
36.1- 68.9	Hexanes	C_6	0.1295	0.1043	0.1149
68.9- 98.3	Heptanes	C_7	0.0936	0.0878	0.0933
98.3-125.6	Octanes	C_8	0.0724	0.0775	0.0800
125.6-150.6	Nonanes	C_9	0.0447	0.0537	0.0543
150.6-173.9	Decanes	C_{10}	0.0329	0.0439	0.0436
173.9-196.1	Undecanes	C_{11}	0.0267	0.0368	0.0340
196.1-215.0	Dodecanes	C_{12}	0.0168	0.0254	0.0231
215.0-235.0	Tridecanes	C_{13}	0.0125	0.0205	0.0185
235.0-252.2	Tetradecanes	C_{14}	0.0107	0.0190	0.0169
252.2-270.6	Pentadecanes	C_{15}	0.0089	0.0172	0.0151
270.6-287.8	Hexadecanes	C_{16}	0.0066	0.0138	0.0119
287.8-302.8	Heptadecanes	C_{17}	0.0053	0.0118	0.0101
302.8-317.2	Octadecanes	C_{18}	0.0050	0.0118	0.0101
317.2-330.0	Nonadecanes	C_{19}	0.0042	0.0104	0.0088
330.0-344.4	Eicosanes	C_{20}	0.0034	0.0087	0.0074
344.4-357.2	Heneicosanes	C_{21}	0.0035	0.0095	0.0080
357.2-369.4	Docosanes	C_{22}	0.0027	0.0076	0.0065
369.4-380.0	Tricosanes	C_{23}	0.0025	0.0075	0.0062
380.0-391.1	Tetracosanes	C_{24}	0.0021	0.0065	0.0054
391.1-401.7	Pentacosanes	C_{25}	0.0019	0.0063	0.0051
401.7-412.2	Hexacosanes	C_{26}	0.0018	0.0059	0.0050
412.2-422.2	Heptacosanes	C_{27}	0.0016	0.0055	0.0046
422.2-431.7	Octacosanes	C_{28}	0.0013	0.0049	0.0039
431.7-441.1	Nonacosanes	C_{29}	0.0013	0.0048	0.0040
441.1 PLUS	Triacontanes Plus	C_{30+}	0.0087	0.0347	0.0278
80.0	Benzene	C_6H_6	0.0131	0.0096	0.0079
110.6	Toluene	C_7H_8	0.0295	0.0255	0.0213
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	0.0273	0.0271	0.0228
144.4	o-Xylene	C_8H_{10}	0.0050	0.0050	0.0041
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	0.0078	0.0088	0.0072
48.9	Cyclopentane	C_5H_{10}	0.0126	0.0083	0.0081
72.2	Methylcyclopentane	C_6H_{12}	0.0327	0.0258	0.0250
81.1	Cyclohexane	C_6H_{12}	0.0299	0.0236	0.0220
101.1	Methylcyclohexane	C_7H_{14}	0.0500	0.0460	0.0434
	TOTAL		1.0000	1.0000	1.0000

Core Lab
PETROLEUM SERVICES

LABORATORY TEST RESULTS

JOB NUMBER: 52137-2006-4335 **CUSTOMER: CAPP / Advantage Insight Group**

SAMPLE I.D: **CFT - 0488 Fort Saskatchewan Condensate** LABORATORY I.D.: 52137-06-4335-4

DATE SAMPLED: June 8, 2006

TEST DESCRIPTION	RESULT	LIMITS	UNITS	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-2887	06/11/02	BH
I.B.P.	**4.4**					
5% Off	**26.0**					
10% Off	**26.6**					
15% Off	**26.9**					
20% Off	**27.3**					
25% Off	**28.2**					
30% Off	**35.3**					
35% Off	**35.7**					
40% Off	**36.1**					
45% Off	**36.5**					
50% Off	**56.8**					
55% Off	**59.4**					
60% Off	**68.2**					
65% Off	**69.5**					
70% Off	**82.6**					
75% Off	**88.1**					
80% Off	**98.0**					
85% Off	**106.2**					
90% Off	**125.6**					
95% Off	**164.5**					
F.B.P.	**339.6**					

CORE LABORATORIES
2810 - 12th Street N.E.
CALGARY, ALBERTA T2E 7P7

HYDROCARBON LIQUID ANALYSIS

Operator: EnCana Resources
Well: CFT - 0488
Sample Point: Spot Sample

File: 52137-2006-4335-4-279
Date: 2006 11 07

Analysis of C_{30+} Fraction

Boiling Point: Range (° C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
-161.7	Methane	C_1	0.0000	0.0000	0.0000
- 88.9	Ethane	C_2	Trace	Trace	Trace
- 42.2	Propane	C_3	Trace	Trace	Trace
- 11.7	Iso Butane	C_4	0.0006	0.0004	0.0005
- 0.6	Normal Butane	C_4	0.0417	0.0296	0.0341
27.8	Iso Pentane	C_5	0.2553	0.2248	0.2425
36.1	Normal Pentane	C_5	0.2762	0.2431	0.2593
36.1- 68.9	Hexanes	C_6	0.1414	0.1487	0.1509
68.9- 98.3	Heptanes	C_7	0.0545	0.0667	0.0653
98.3-125.6	Octanes	C_8	0.0261	0.0364	0.0347
125.6-150.6	Nonanes	C_9	0.0125	0.0196	0.0183
150.6-173.9	Decanes	C_{10}	0.0080	0.0139	0.0128
173.9-196.1	Undecanes	C_{11}	0.0083	0.0149	0.0127
196.1-215.0	Dodecanes	C_{12}	0.0033	0.0065	0.0055
215.0-235.0	Tridecanes	C_{13}	0.0021	0.0044	0.0037
235.0-252.2	Tetradecanes	C_{14}	0.0016	0.0037	0.0030
252.2-270.6	Pentadecanes	C_{15}	0.0011	0.0028	0.0022
270.6-287.8	Hexadecanes	C_{16}	0.0007	0.0019	0.0015
287.8-302.8	Heptadecanes	C_{17}	0.0005	0.0014	0.0012
302.8-317.2	Octadecanes	C_{18}	0.0004	0.0012	0.0010
317.2-330.0	Nonadecanes	C_{19}	0.0003	0.0009	0.0008
330.0-344.4	Eicosanes	C_{20}	0.0002	0.0006	0.0005
344.4-357.2	Heneicosanes	C_{21}	0.0002	0.0007	0.0006
357.2-369.4	Docosanes	C_{22}	0.0001	0.0005	0.0003
369.4-380.0	Tricosanes	C_{23}	0.0001	0.0004	0.0003
380.0-391.1	Tetracosanes	C_{24}	0.0001	0.0003	0.0003
391.1-401.7	Pentacosanes	C_{25}	0.0001	0.0003	0.0003
401.7-412.2	Hexacosanes	C_{26}	0.0001	0.0003	0.0003
412.2-422.2	Heptacosanes	C_{27}	Trace	Trace	Trace
422.2-431.7	Octacosanes	C_{28}	Trace	Trace	Trace
431.7-441.1	Nonacosanes	C_{29}	Trace	Trace	Trace
441.1 PLUS	Triacontanes Plus	C_{30+}	0.0003	0.0017	0.0012
80.0	Benzene	C_6H_6	0.0220	0.0210	0.0160
110.6	Toluene	C_7H_8	0.0188	0.0211	0.0163
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	0.0094	0.0122	0.0094
144.4	o-Xylene	C_8H_{10}	0.0017	0.0022	0.0017
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	0.0016	0.0024	0.0018
48.9	Cyclopentane	C_5H_{10}	0.0229	0.0196	0.0176
72.2	Methylcyclopentane	C_6H_{12}	0.0307	0.0315	0.0282
81.1	Cyclohexane	C_6H_{12}	0.0275	0.0282	0.0243
101.1	Methylcyclohexane	C_7H_{14}	0.0296	0.0355	0.0309
	TOTAL		1.0000	1.0000	1.0000

Core Lab
PETROLEUM SERVICES

LABORATORY TEST RESULTS

JOB NUMBER: 52137-2006-4335 **CUSTOMER: CAPP / Advantage Insight Group**

SAMPLE I.D: **CRM - 0482 Rimbey Condensate** LABORATORY I.D.: 52137-06-4335-5

DATE SAMPLED: June 8, 2006

TEST DESCRIPTION	RESULT	LIMITS	UNITS	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-2887	06/11/02	BH
I.B.P.	**4.1**					
5% Off	**26.3**					
10% Off	**27.1**					
15% Off	**35.0**					
20% Off	**36.1**					
25% Off	**57.3**					
30% Off	**60.0**					
35% Off	**68.9**					
40% Off	**69.7**					
45% Off	**83.5**					
50% Off	**89.2**					
55% Off	**97.9**					
60% Off	**103.5**					
65% Off	**113.0**					
70% Off	**119.4**					
75% Off	**134.9**					
80% Off	**146.0**					
85% Off	**169.7**					
90% Off	**214.0**					
95% Off	**305.2**					
F.B.P.	**493.0**					

CORE LABORATORIES
2810 - 12th Street N.E.
CALGARY, ALBERTA T2E 7P7

HYDROCARBON LIQUID ANALYSIS

Operator: EnCana Resources
Well: CRM - 0482
Sample Point: Spot Sample

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File: 52137-2006-4335-5-280
Date: 2006 11 07

Analysis of C_{30+} Fraction

Boiling Point: Range (° C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
-161.7	Methane	C_1	Trace	Trace	Trace
- 88.9	Ethane	C_2	0.0003	0.0001	0.0002
- 42.2	Propane	C_3	0.0024	0.0011	0.0015
- 11.7	Iso Butane	C_4	0.0031	0.0019	0.0024
- 0.6	Normal Butane	C_4	0.0440	0.0267	0.0324
27.8	Iso Pentane	C_5	0.1477	0.1113	0.1263
36.1	Normal Pentane	C_5	0.1378	0.1038	0.1166
36.1- 68.9	Hexanes	C_6	0.1693	0.1522	0.1628
68.9- 98.3	Heptanes	C_7	0.1011	0.1058	0.1090
98.3-125.6	Octanes	C_8	0.0649	0.0774	0.0777
125.6-150.6	Nonanes	C_9	0.0373	0.0500	0.0491
150.6-173.9	Decanes	C_{10}	0.0233	0.0346	0.0334
173.9-196.1	Undecanes	C_{11}	0.0174	0.0267	0.0240
196.1-215.0	Dodecanes	C_{12}	0.0102	0.0171	0.0152
215.0-235.0	Tridecanes	C_{13}	0.0066	0.0120	0.0105
235.0-252.2	Tetradecanes	C_{14}	0.0055	0.0109	0.0094
252.2-270.6	Pentadecanes	C_{15}	0.0043	0.0092	0.0079
270.6-287.8	Hexadecanes	C_{16}	0.0031	0.0073	0.0061
287.8-302.8	Heptadecanes	C_{17}	0.0025	0.0061	0.0052
302.8-317.2	Octadecanes	C_{18}	0.0022	0.0057	0.0048
317.2-330.0	Nonadecanes	C_{19}	0.0018	0.0050	0.0041
330.0-344.4	Eicosanes	C_{20}	0.0015	0.0042	0.0035
344.4-357.2	Heneicosanes	C_{21}	0.0014	0.0043	0.0035
357.2-369.4	Docosanes	C_{22}	0.0010	0.0033	0.0026
369.4-380.0	Tricosanes	C_{23}	0.0009	0.0031	0.0024
380.0-391.1	Tetracosanes	C_{24}	0.0008	0.0026	0.0022
391.1-401.7	Pentacosanes	C_{25}	0.0007	0.0025	0.0020
401.7-412.2	Hexacosanes	C_{26}	0.0006	0.0023	0.0018
412.2-422.2	Heptacosanes	C_{27}	0.0005	0.0021	0.0016
422.2-431.7	Octacosanes	C_{28}	0.0004	0.0018	0.0013
431.7-441.1	Nonacosanes	C_{29}	0.0004	0.0017	0.0013
441.1 PLUS	Triacontanes Plus	C_{30+}	0.0030	0.0133	0.0104
80.0	Benzene	C_6H_6	0.0175	0.0143	0.0114
110.6	Toluene	C_7H_8	0.0353	0.0340	0.0276
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	0.0269	0.0298	0.0244
144.4	o-Xylene	C_8H_{10}	0.0034	0.0038	0.0030
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	0.0063	0.0079	0.0063
48.9	Cyclopentane	C_5H_{10}	0.0163	0.0119	0.0113
72.2	Methylcyclopentane	C_6H_{12}	0.0296	0.0260	0.0244
81.1	Cyclohexane	C_6H_{12}	0.0290	0.0255	0.0231
101.1	Methylcyclohexane	C_7H_{14}	0.0397	0.0407	0.0373
	TOTAL		1.0000	1.0000	1.0000

Core Lab
PETROLEUM SERVICES

LABORATORY TEST RESULTS

JOB NUMBER: 52137-2006-4335 **CUSTOMER: CAPP / Advantage Insight Group**

SAMPLE I.D: **CPM - 478 Pembina Condensate** LABORATORY I.D.: 52137-06-4335-7

DATE SAMPLED: June 8, 2006

TEST DESCRIPTION	RESULT	LIMITS	UNITS	TEST METHOD	DATE	TECH
Simulated Distillation			°C	ASTM D-2887	06/11/02	BH
I.B.P.	**-3.1**					
5% Off	**27.5**					
10% Off	**57.3**					
15% Off	**68.7**					
20% Off	**77.3**					
25% Off	**90.7**					
30% Off	**98.4**					
35% Off	**109.3**					
40% Off	**118.9**					
45% Off	**133.7**					
50% Off	**144.3**					
55% Off	**162.0**					
60% Off	**178.5**					
65% Off	**204.5**					
70% Off	**234.9**					
75% Off	**266.4**					
80% Off	**302.6**					
85% Off	**344.1**					
90% Off	**393.4**					
95% Off	**454.6**					
F.B.P.	**543.2**					

CORE LABORATORIES
2810 - 12th Street N.E.
CALGARY, ALBERTA T2E 7P7

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HYDROCARBON LIQUID ANALYSIS

Operator: EnCana Resources
Well: CPM - 478
Sample Point: Spot Sample

Page: 21
File: 52137-2006-4335-7-282
Date: 2006 11 07

Analysis of C_{30+} Fraction

Boiling Point: Range (° C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
-161.7	Methane	C_1	Trace	Trace	Trace
- 88.9	Ethane	C_2	0.0004	0.0001	0.0002
- 42.2	Propane	C_3	0.0060	0.0021	0.0032
- 11.7	Iso Butane	C_4	0.0065	0.0030	0.0041
- 0.6	Normal Butane	C_4	0.0328	0.0152	0.0198
27.8	Iso Pentane	C_5	0.0591	0.0340	0.0414
36.1	Normal Pentane	C_5	0.0728	0.0419	0.0505
36.1- 68.9	Hexanes	C_6	0.1129	0.0777	0.0890
68.9- 98.3	Heptanes	C_7	0.0965	0.0771	0.0853
98.3-125.6	Octanes	C_8	0.0805	0.0733	0.0789
125.6-150.6	Nonanes	C_9	0.0553	0.0566	0.0596
150.6-173.9	Decanes	C_{10}	0.0449	0.0510	0.0528
173.9-196.1	Undecanes	C_{11}	0.0403	0.0473	0.0455
196.1-215.0	Dodecanes	C_{12}	0.0279	0.0358	0.0341
215.0-235.0	Tridecanes	C_{13}	0.0219	0.0305	0.0287
235.0-252.2	Tetradecanes	C_{14}	0.0197	0.0299	0.0276
252.2-270.6	Pentadecanes	C_{15}	0.0165	0.0271	0.0248
270.6-287.8	Hexadecanes	C_{16}	0.0126	0.0223	0.0202
287.8-302.8	Heptadecanes	C_{17}	0.0102	0.0192	0.0173
302.8-317.2	Octadecanes	C_{18}	0.0094	0.0188	0.0168
317.2-330.0	Nonadecanes	C_{19}	0.0079	0.0166	0.0147
330.0-344.4	Eicosanes	C_{20}	0.0064	0.0140	0.0124
344.4-357.2	Heneicosanes	C_{21}	0.0067	0.0155	0.0136
357.2-369.4	Docosanes	C_{22}	0.0050	0.0122	0.0106
369.4-380.0	Tricosanes	C_{23}	0.0047	0.0119	0.0103
380.0-391.1	Tetracosanes	C_{24}	0.0039	0.0102	0.0089
391.1-401.7	Pentacosanes	C_{25}	0.0035	0.0097	0.0083
401.7-412.2	Hexacosanes	C_{26}	0.0031	0.0090	0.0076
412.2-422.2	Heptacosanes	C_{27}	0.0028	0.0084	0.0071
422.2-431.7	Octacosanes	C_{28}	0.0024	0.0075	0.0063
431.7-441.1	Nonacosanes	C_{29}	0.0023	0.0074	0.0062
441.1 PLUS	Triacontanes Plus	C_{30+}	0.0178	0.0603	0.0504
80.0	Benzene	C_6H_6	0.0130	0.0081	0.0070
110.6	Toluene	C_7H_8	0.0318	0.0234	0.0204
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	0.0321	0.0272	0.0238
144.4	o-Xylene	C_8H_{10}	0.0061	0.0052	0.0044
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	0.0113	0.0108	0.0093
48.9	Cyclopentane	C_5H_{10}	0.0113	0.0063	0.0064
72.2	Methylcyclopentane	C_6H_{12}	0.0288	0.0193	0.0195
81.1	Cyclohexane	C_6H_{12}	0.0264	0.0177	0.0172
101.1	Methylcyclohexane	C_7H_{14}	0.0465	0.0364	0.0358
	TOTAL		1.0000	1.0000	1.0000
			125.4	0.7606	

COMPANY	CAPP / Advantage Insight Group.	PAGE	22
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CRW-675 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....17.89 Mass %

.....23.00 Volume %

Measured Density @ 15.0°C..... 939.7 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	925.4	979.5
12	612.8	650.8
20	336.0	358.8
30	176.5	489.8
40	101.3	109.8

Target Density 930 kg/m^3

Diluent Concentration.....20.87 Mass %

.....26.56 Volume %

Measured Density @ 15.0°C..... 930.3 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	481.6	514.9
12	331.3	335.3
20	190.9	206.0
30	106.9	116.2
40	64.23	70.32

COMPANY	CAPP / Advantage Insight Group.	PAGE	23
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CRW-675 Blend Characterization

Target Density 912 kg/m^3

Diluent Concentration.....26.89 Mass %

.....33.53 Volume %

Measured Density @ 15.0°C..... 911.1 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	155.9	170.2
12	114.3	125.1
20	71.37	78.66
30	44.66	49.94
40	29.16	32.74

Cold Lake – CPC-475 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....20.36 Mass %

.....25.19 Volume %

Measured Density @ 15.0°C..... 939.6 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	579.5	613.6
12	396.6	421.2
20	226.1	241.5
30	125.0	134.4
40	74.22	80.44

COMPANY	CAPP / Advantage Insight Group.	PAGE	24
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CPC-475 Blend Characterization

Target Density 930 kg/m^3

Diluent Concentration.....24.33 Mass %

.....29.75 Volume %

Measured Density @ 15.0°C..... 928.0 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	265.1	284.2
12	189.3	203.6
20	114.3	123.7
30	68.34	74.46
40	43.11	47.32

Target Density 912 kg/m^3

Diluent Concentration.....31.20 Mass %

.....37.39 Volume %

Measured Density @ 15.0°C..... 909.2 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	83.96	91.83
12	63.97	70.21
20	42.46	46.90
30	28.02	31.19
40	19.22	21.56

COMPANY	CAPP / Advantage Insight Group.	PAGE	25
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CFT-0488 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....14.11 Mass %

.....19.50 Volume %

Measured Density @ 15.0°C..... 940.4 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	1117	1182
12	753.8	799.8
20	405.2	432.4
30	208.4	224.0
40	117.2	128.0

Target Density 930 kg/m^3

Diluent Concentration.....16.73 Mass %

.....22.86 Volume %

Measured Density @ 15.0°C..... 927.6 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	517.2	554.5
12	353.6	380.4
20	202.2	218.8
30	112.1	122.2
40	66.70	73.51

COMPANY	CAPP / Advantage Insight Group.	PAGE	26
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CFT-0488 Blend Characterization

Target Density 912 kg/m^3

Diluent Concentration.....21.61 Mass %

.....28.90 Volume %

Measured Density @ 15.0°C..... 907.8 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	180.5	197.7
12	130.5	143.4
20	80.17	88.68
30	49.04	55.23
40	31.68	35.58

Cold Lake – CPR-0822 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....18.76 Mass %

.....23.74 Volume %

Measured Density @ 15.0°C..... 940.5 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	926.0	979.4
12	614.2	651.7
20	337.2	359.9
30	177.2	190.5
40	101.2	109.6

COMPANY	CAPP / Advantage Insight Group.	PAGE	27
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CPR-0822 Blend Characterization

Target Density 930 kg/m^3

Diluent Concentration.....22.08 Mass %

.....27.65 Volume %

Measured Density @ 15.0°C..... 930.6 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	469.2	501.6
12	323.8	347.2
20	186.9	201.6
30	105.1	114.2
40	63.23	69.21

Target Density 912 kg/m^3

Diluent Concentration.....28.63 Mass %

.....35.11 Volume %

Measured Density @ 15.0°C..... 911.2 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	146.9	160.3
12	108.1	118.4
20	67.97	74.89
30	42.77	47.49
40	28.00	31.33

COMPANY	CAPP / Advantage Insight Group.	PAGE	28
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CRM-0482 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....16.70 Mass %

.....21.84 Volume %

Measured Density @ 15.0°C..... 939.5 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	879.4	931.1
12	585.1	621.5
20	322.5	344.6
30	170.2	183.1
40	98.04	106.3

Target Density 930 kg/m^3

Diluent Concentration.....19.73 Mass %

.....25.52 Volume %

Measured Density @ 15.0°C..... 927.5 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	424.7	455.3
12	293.5	315.7
20	170.3	184.3
30	96.35	105.1
40	58.29	64.05

COMPANY	CAPP / Advantage Insight Group.	PAGE	29
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CRM-0482 Blend Characterization

Target Density 912 kg/m^3

Diluent Concentration.....25.44 Mass %

.....32.24 Volume %

Measured Density @ 15.0°C..... 908.2 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	139.8	153.1
12	102.9	113.1
20	64.83	71.68
30	40.79	45.45
40	26.76	30.06

Cold Lake – CMP-478 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....22.30 Mass %

.....27.01Volume %

Measured Density @ 15.0°C..... 937.5 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	758.6	804.8
12	507.4	540.0
20	281.8	301.7
30	150.3	162.1
40	86.73	94.22

COMPANY	CAPP / Advantage Insight Group.	PAGE	30
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Cold Lake – CMP-478 Blend Characterization

Target Density 930 kg/m^3

Diluent Concentration.....26.43 Mass %

.....31.65 Volume %

Measured Density @ 15.0°C..... 926.9 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	375.6	402.9
12	261.4	281.4
20	153.0	165.7
30	87.48	95.44
40	53.19	58.46

Target Density 912 kg/m^3

Diluent Concentration.....34.04 Mass %

.....39.96 Volume %

Measured Density @ 15.0°C..... 910.9 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	135.4	147.8
12	100.6	110.3
20	64.53	71.20
30	41.56	46.78
40	26.68	29.92

COMPANY	CAPP / Advantage Insight Group.	PAGE	31
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CRW-675 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....14.75 Mass %

.....18.99 Volume %

Measured Density @ 15.0°C..... 939.2 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	796.6	843.5
12	530.4	563.5
20	292.5	316.6
30	154.0	165.9
40	88.10	95.52

Target Density 930 kg/m^3

Diluent Concentration.....17.77 Mass %

.....22.64 Volume %

Measured Density @ 15.0°C..... 930.6 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	439.0	469.2
12	302.0	323.8
20	173.7	187.4
30	97.30	105.7
40	58.26	63.77

COMPANY	CAPP / Advantage Insight Group.	PAGE	32
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CRW-675 Blend Characterization

Target Density 912 kg/m^3

Diluent Concentration.....23.56 Mass %

.....29.45 Volume %

Measured Density @ 15.0°C..... 913.5 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	153.0	166.6
12	112.1	122.4
20	69.88	76.80
30	43.38	48.04
40	28.11	31.37

Nexen Plover Lake – CPC-475 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....16.45 Mass %

.....20.38 Volume %

Measured Density @ 15.0°C..... 940.7 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	625.9	661.8
12	421.9	447.6
20	236.8	252.7
30	128.1	137.6
40	74.73	80.91

COMPANY	CAPP / Advantage Insight Group.	PAGE	33
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CPC-475 Blend Characterization

Target Density 930 kg/m^3

Diluent Concentration.....20.55 Mass %

.....25.16 Volume %

Measured Density @ 15.0°C..... 929.9 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	280.3	299.8
12	198.3	212.8
20	118.2	127.6
30	69.51	75.60
40	43.23	47.36

Target Density 912 kg/m^3

Diluent Concentration.....28.00 Mass %

.....33.59 Volume %

Measured Density @ 15.0°C..... 911.1 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	85.45	93.27
12	64.84	71.02
20	42.76	47.12
30	27.91	31.00
40	19.00	21.26

COMPANY	CAPP / Advantage Insight Group.	PAGE	34
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CFT-0488 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....11.42 Mass %

.....15.80 Volume %

Measured Density @ 15.0°C..... 940.2 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	923.0	976.3
12	608.2	645.5
20	330.8	353.1
30	171.6	184.5
40	96.89	105.0

Target Density 930 kg/m^3

Diluent Concentration.....14.13 Mass %

.....19.32 Volume %

Measured Density @ 15.0°C..... 929.9 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	458.7	490.6
12	314.8	337.8
20	180.8	195.2
30	100.6	109.5
40	60.06	65.80

COMPANY	CAPP / Advantage Insight Group.	PAGE	35
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CFT-0488 Blend Characterization

Target Density 912 kg/m^3

Diluent Concentration.....19.08 Mass %

.....25.55 Volume %

Measured Density @ 15.0°C..... 911.9 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	159.0	173.4
12	116.0	127.0
20	72.00	79.29
30	44.60	49.49
40	28.81	32.23

Nexen Plover Lake – CPR-0822 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....15.29 Mass %

.....19.37 Volume %

Measured Density @ 15.0°C..... 941.1 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	887.0	937.3
12	584.9	620.2
20	318.8	340.0
30	166.1	178.4
40	94.09	101.8

COMPANY	CAPP / Advantage Insight Group.	PAGE	36
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CPR-0822 Blend Characterization

Target Density 930 kg/m^3

Diluent Concentration.....18.81 Mass %

.....23.57 Volume %

Measured Density @ 15.0°C..... 931.1 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	436.7	466.5
12	300.7	322.2
20	173.2	186.8
30	96.90	105.2
40	58.04	63.50

Target Density 912 kg/m^3

Diluent Concentration.....25.54 Mass %

.....31.35 Volume %

Measured Density @ 15.0°C..... 912.7 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	141.1	153.7
12	103.8	113.5
20	65.05	71.55
30	40.74	45.16
40	26.57	29.67

COMPANY	CAPP / Advantage Insight Group.	PAGE	37
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CRM-0482 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....13.57 Mass %

.....17.77 Volume %

Measured Density @ 15.0°C..... 940.4 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	834.4	882.5
12	553.0	586.8
20	303.1	323.5
30	159.0	170.9
40	90.55	98.07

Target Density 930 kg/m^3

Diluent Concentration.....16.77 Mass %

.....21.72 Volume %

Measured Density @ 15.0°C..... 929.1 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	406.6	434.8
12	281.1	301.5
20	162.9	175.8
30	91.78	99.79
40	55.31	60.58

COMPANY	CAPP / Advantage Insight Group.	PAGE	38
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CRM-0482 Blend Characterization

Target Density 912 kg/m^3

Diluent Concentration.....22.68 Mass %

.....28.76 Volume %

Measured Density @ 15.0°C..... 911.9 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	134.7	147.0
12	99.39	108.8
20	62.64	68.97
30	39.34	43.65
40	25.76	28.80

Nexen Plover Lake – CMP-478 Blend Characterization

Target Density 940 kg/m^3

Diluent Concentration.....18.32 Mass %

.....22.21 Volume %

Measured Density @ 15.0°C..... 940.4 kg/m^3

Temperature (°C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	806.5	852.9
12	534.8	567.4
20	293.2	312.9
30	154.3	165.9
40	87.83	95.10

COMPANY	CAPP / Advantage Insight Group.	PAGE	39
SAMPLE ID	Various	FILE	52137-06-4335
PROJECT	Diluent Blending Study	DATE	12/13/2006

Nexen Plover Lake – CMP-478 Blend Characterization

Target Density 930 kg/m^3

Diluent Concentration.....20.40 Mass %

.....24.60 Volume %

Measured Density @ 15.0°C..... 930.1 kg/m^3

Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	388.9	415.9
12	269.4	289.0
20	156.2	168.6
30	88.57	96.29
40	53.32	58.40

Target Density 912 kg/m^3

Diluent Concentration.....30.62 Mass %

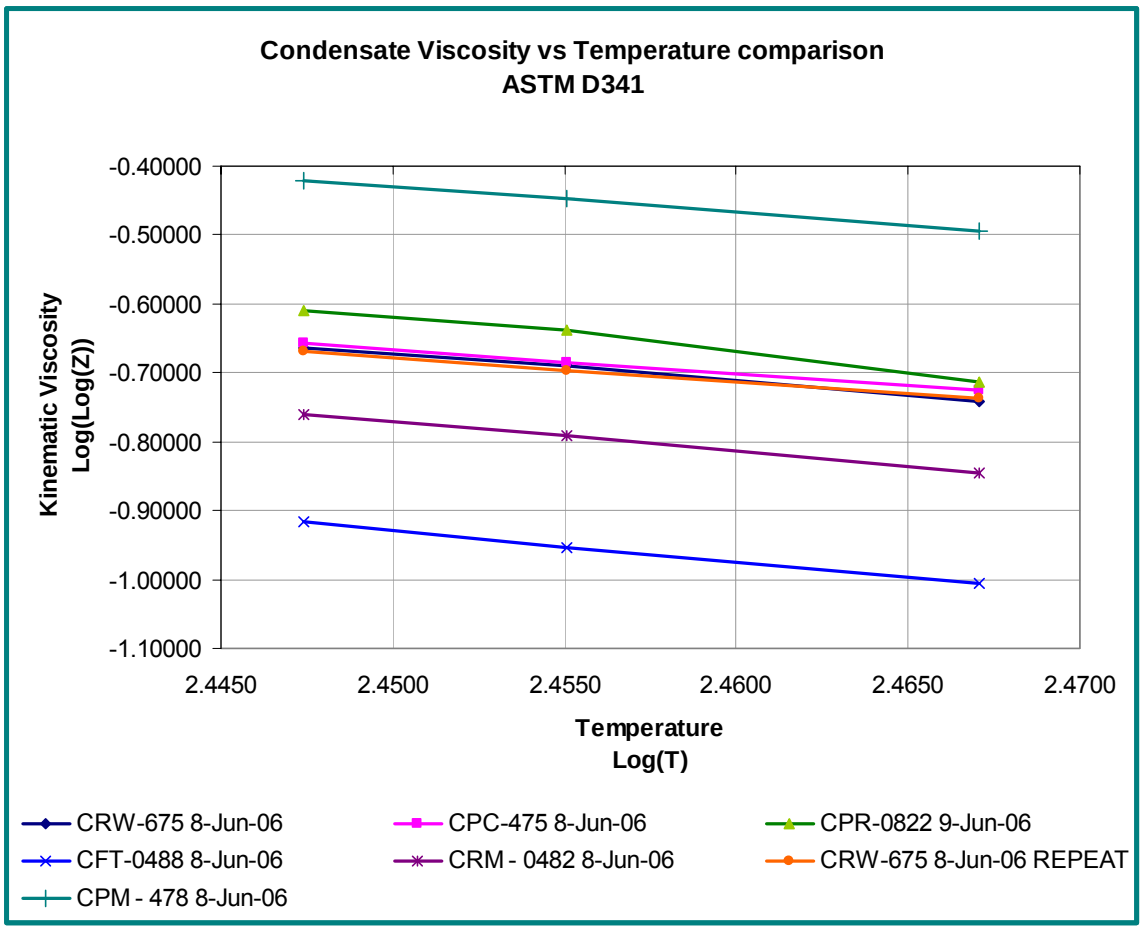
.....35.97 Volume %

Measured Density @ 15.0°C..... 912.0 kg/m^3

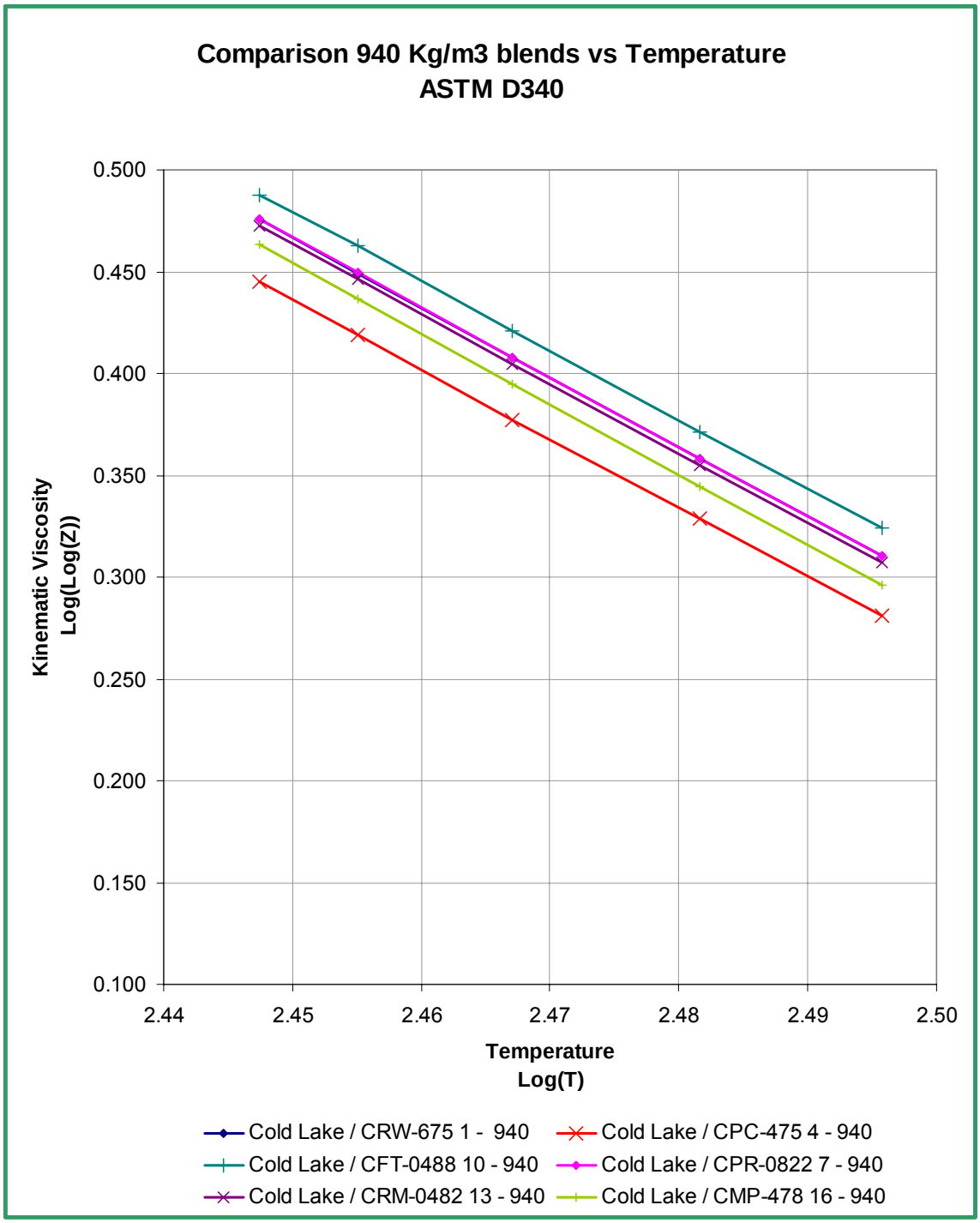
Temperature (^{o}C)	Dynamic Viscosity (cP.)	Kinematic Viscosity (cSt.)
7	125.7	137.1
12	93.03	101.8
20	58.86	64.80
30	37.23	41.30
40	24.42	27.30

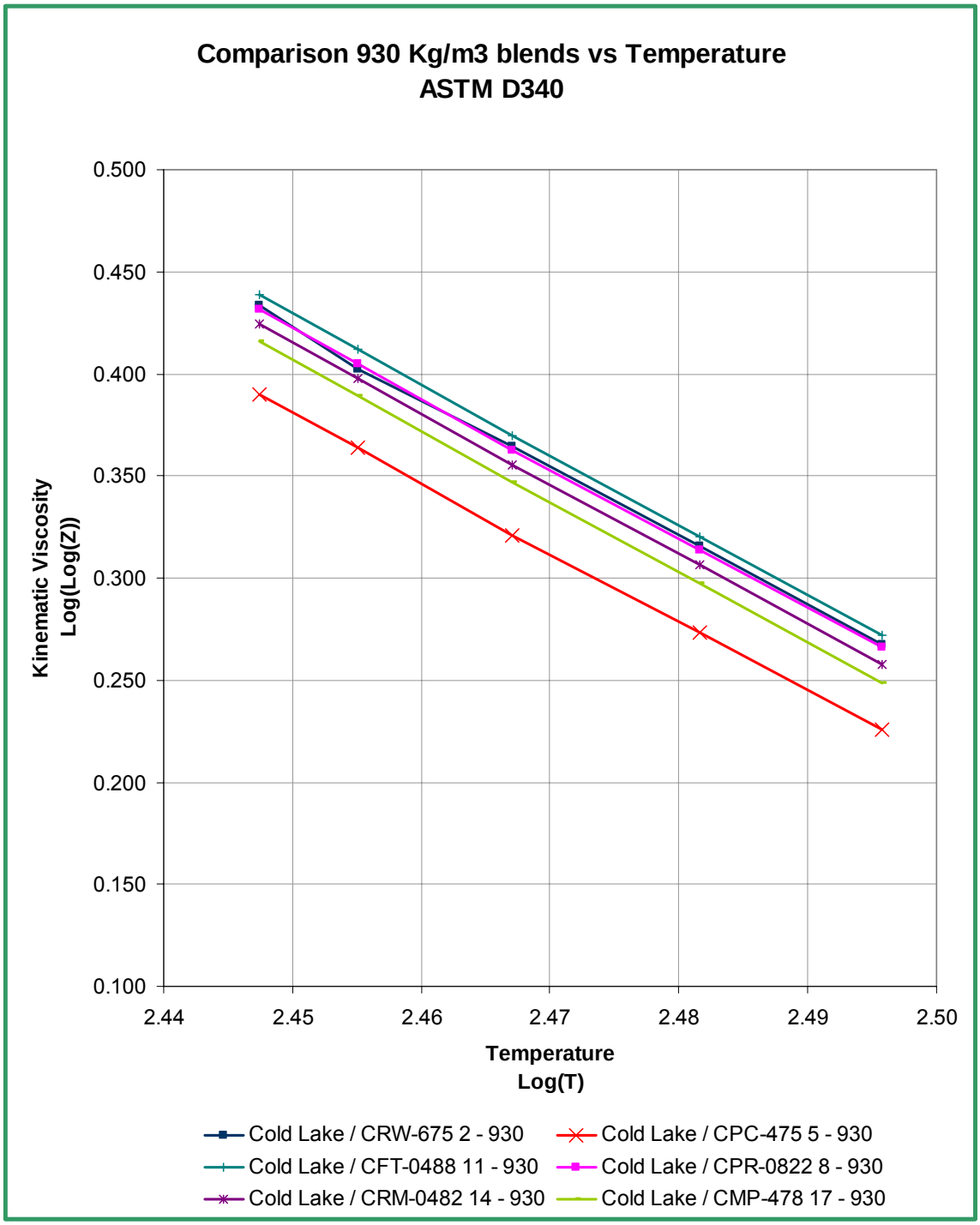
5.2 Appendix 2 Data Analysis – Viscosity vs. Temperature

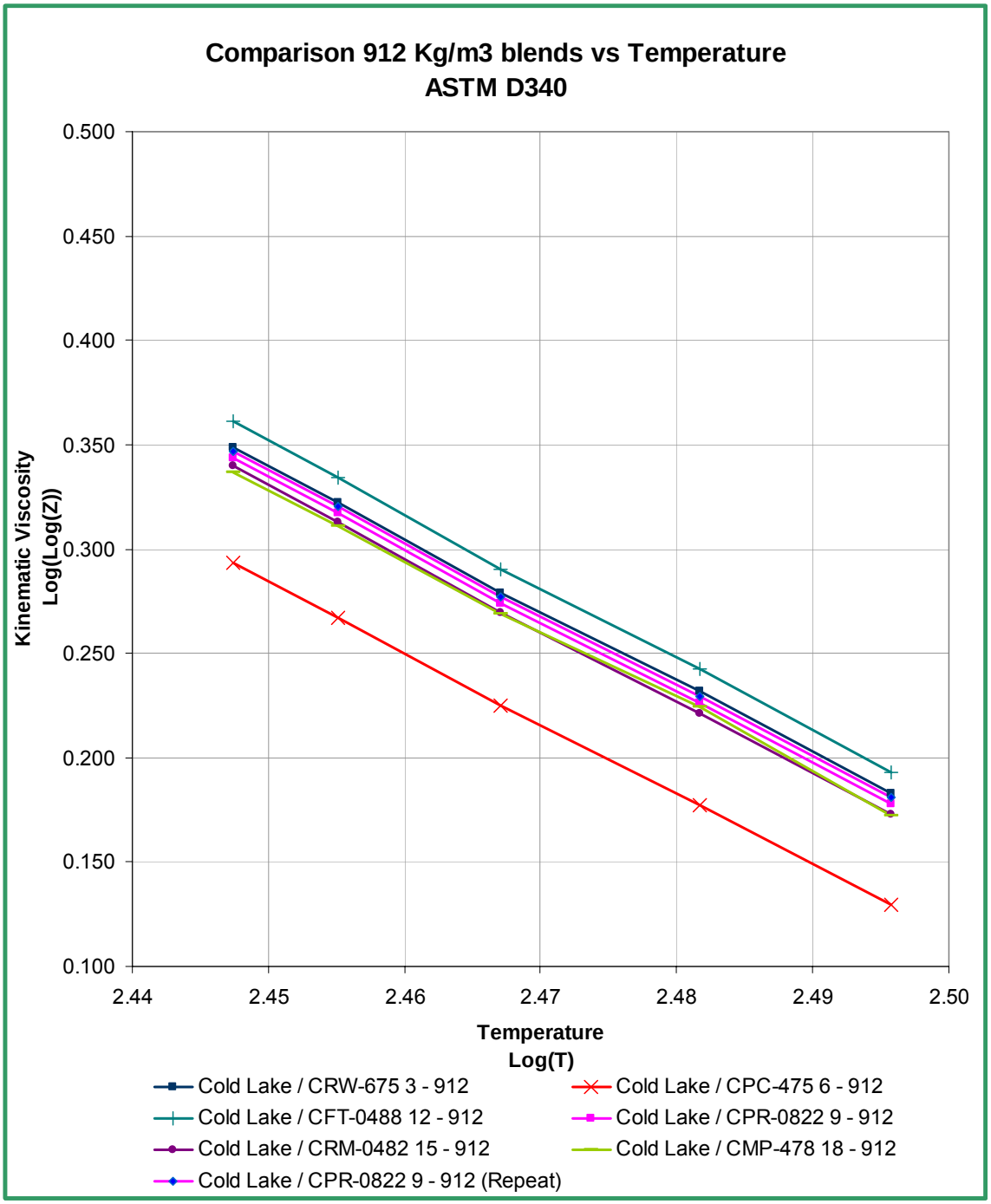
As per ASTM D341, the following plot compares viscosity vs. temperature for each of the condensates that were used. The value of Z corresponds to a series of calculations based on Kinematic viscosity. ASTM D341 contains further details about this calculation. Linear behaviour is observed.

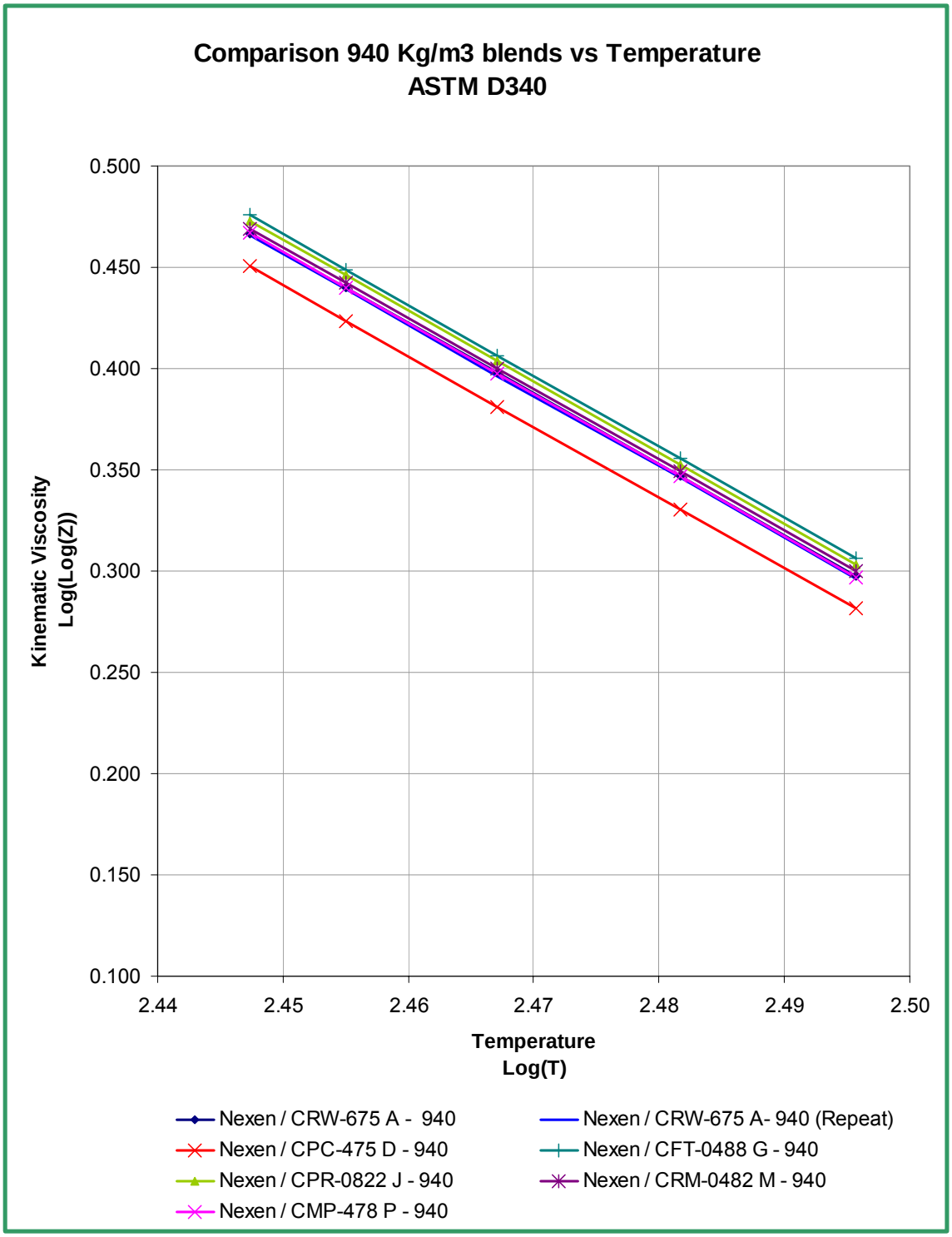


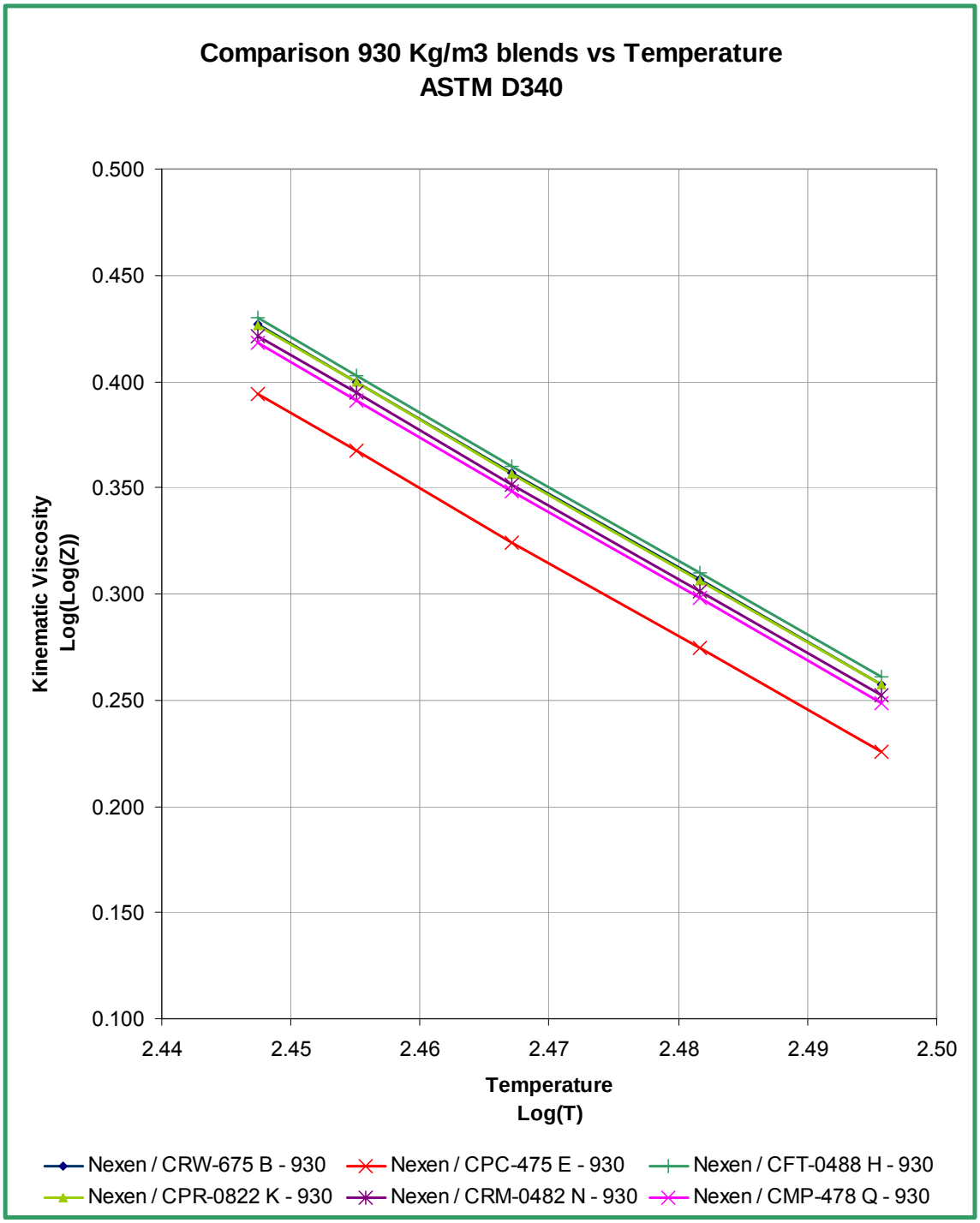
For each of the blends the viscosity vs. temperature was plotted as per ASTM D341. The following figures compare the results for each of the blends.

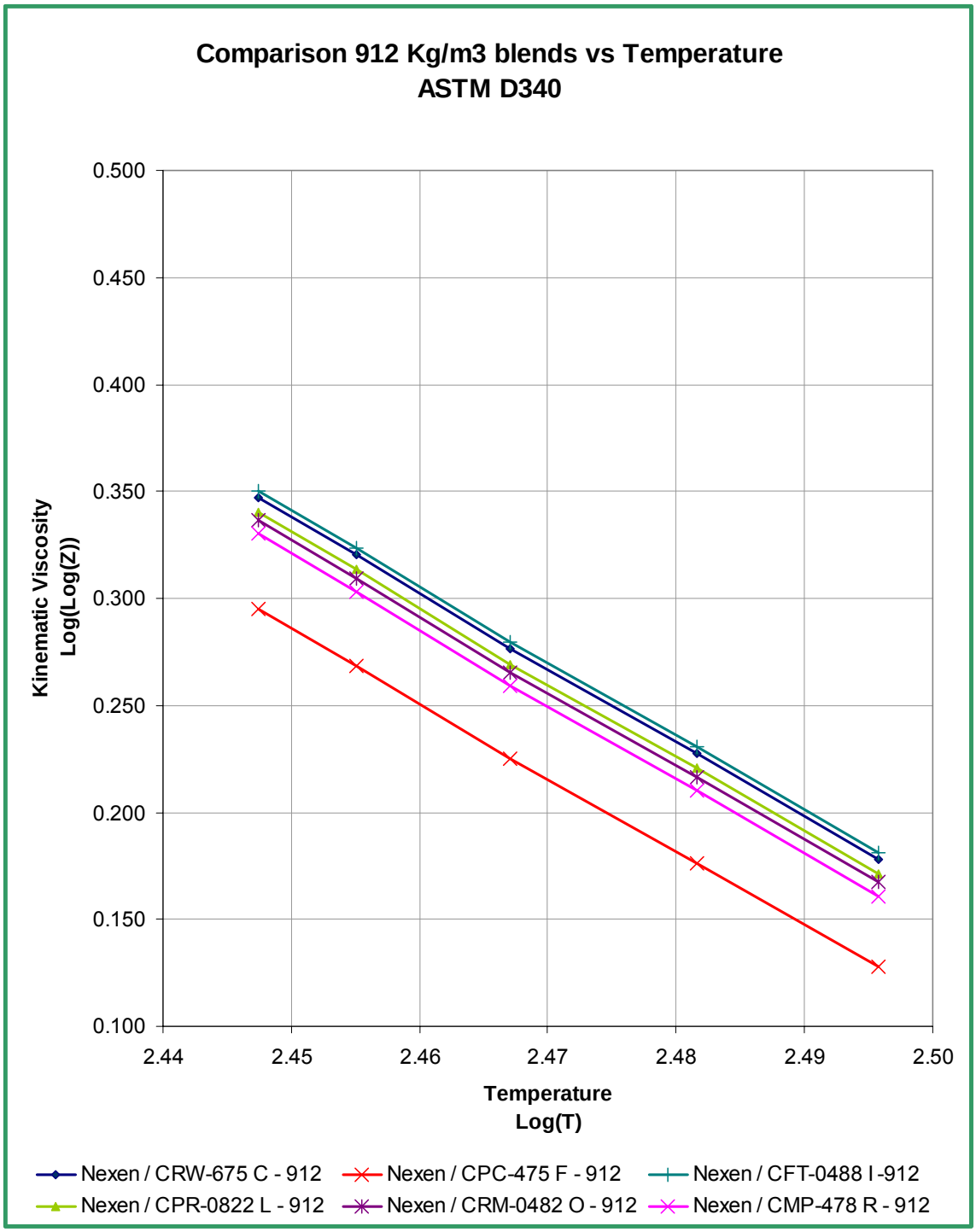

Comparison 940 Kg/m3 blends vs Temperature
ASTM D340
Kinematic Viscosity
Log(Log(Z))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
2.44
2.45
2.46
2.47
2.48
2.49
2.50
Temperature
Log(T)
Cold Lake / CRW-675 1 - 940
Cold Lake / CPC-475 4 - 940
Cold Lake / CFT-0488 10 - 940
Cold Lake / CPR-0822 7 - 940
Cold Lake / CRM-0482 13 - 940
Cold Lake / CMP-478 16 - 940


Comparison 930 Kg/m3 blends vs Temperature
ASTM D340
Kinematic Viscosity
Log(Log(Z))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
2.44
2.45
2.46
2.47
2.48
2.49
2.50
Temperature
Log(T)
Cold Lake / CRW-675 2 - 930
Cold Lake / CPC-475 5 - 930
Cold Lake / CFT-0488 11 - 930
Cold Lake / CPR-0822 8 - 930
Cold Lake / CRM-0482 14 - 930
Cold Lake / CMP-478 17 - 930


Comparison 912 Kg/m3 blends vs Temperature
ASTM D340
Kinematic Viscosity
Log(Log(Z))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
2.44
2.45
2.46
2.47
2.48
2.49
2.50
Temperature
Log(T)
Cold Lake / CRW-675 3 - 912
Cold Lake / CPC-475 6 - 912
Cold Lake / CFT-0488 12 - 912
Cold Lake / CPR-0822 9 - 912
Cold Lake / CRM-0482 15 - 912
Cold Lake / CMP-478 18 - 912
Cold Lake / CPR-0822 9 - 912 (Repeat)

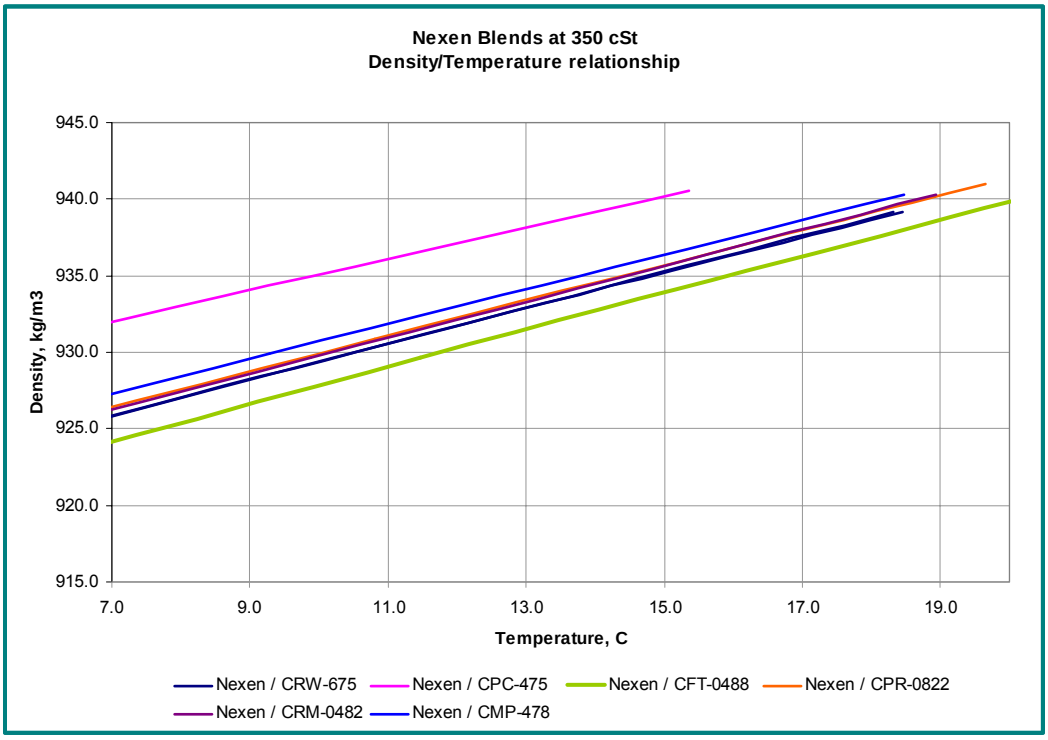

Comparison 940 Kg/m3 blends vs Temperature
ASTM D340
Kinematic Viscosity
Log(Log(Z))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
2.44
2.45
2.46
2.47
2.48
2.49
2.50
Temperature
Log(T)
Nexen / CRW-675 A - 940
Nexen / CRW-675 A- 940 (Repeat)
Nexen / CPC-475 D - 940
Nexen / CFT-0488 G - 940
Nexen / CPR-0822 J - 940
Nexen / CRM-0482 M - 940
Nexen / CMP-478 P - 940


Comparison 930 Kg/m3 blends vs Temperature
ASTM D340
Kinematic Viscosity
Log(Log(Z))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
2.44
2.45
2.46
2.47
2.48
2.49
2.50
Temperature
Log(T)
Nexen / CRW-675 B - 930
Nexen / CPC-475 E - 930
Nexen / CFT-0488 H - 930
Nexen / CPR-0822 K - 930
Nexen / CRM-0482 N - 930
Nexen / CMP-478 Q - 930

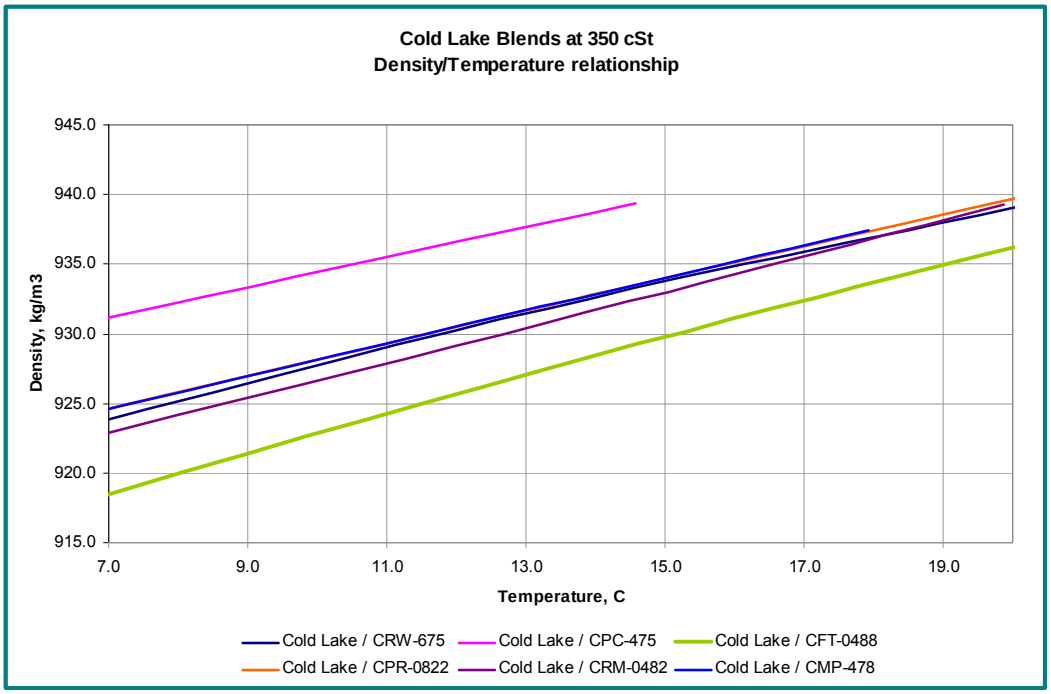

Comparison 912 Kg/m3 blends vs Temperature
ASTM D340
Kinematic Viscosity
Log(Log(Z))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
2.44
2.45
2.46
2.47
2.48
2.49
2.50
Temperature
Log(T)
Nexen / CRW-675 C - 912
Nexen / CPC-475 F - 912
Nexen / CFT-0488 I -912
Nexen / CPR-0822 L - 912
Nexen / CRM-0482 O - 912
Nexen / CMP-478 R - 912

5.3 Appendix 3 Data Analysis – Density vs. Temperature

The 350 cSt Viscosity Blends Density[2] vs. Temperature for the Cold Lake and LLK plots are shown in the following figures.



[2] Blend density @ 15°C, was interpolated based on laboratory information received.



The following table summarizes the regression results for the 350 cSt viscosity blends density vs. temperature. A general equation is obtained:

Equation 4

$$\rho_{blend} = Slope * T_{reference} + Intercept$$

The following table summarizes the slopes and intercepts obtained for each pair of Heavy/Condensate.

Table 350cSt Viscosity Blends Density vs. Temperature Correlation Summary - Data 2006

Condensate		Cold Lake			Nexen Blends		
Stream	Density, Kg/m3	Slope	Intercept	R square	Slope	Intercept	R square
CFT-0488	676.3	1.38701	908.4348	0.9990	1.225389	915.4466	0.9999
CRM-0482	715.2	1.25236	914.2953	0.9999	1.168499	918.1293	1.0000
CRW-675	727.2	1.23879	914.6688	0.9984	1.170814	917.6339	0.9999
CPR-0822	739.6	1.23077	915.3531	0.9953	1.161862	918.2300	1.0000
CPC-475	757.2	1.08093	923.6149	1.0000	1.050757	924.4989	0.9999
CMP-478	773.4	1.19867	915.9908	0.9999	1.139727	919.2878	1.0000

5.4 Appendix 4 Model coefficients

As shown in Appendix 3 a 350cSt density/temperature relationship for each crude/condensate was obtained:

Equation 5 $$\rho_{blend} = Slope * T_{reference} + Intercept$$

The Slopes and Intercepts from the 350 cSt viscosity blends density vs. temperature (slope and intercept) were regressed vs. the condensate density obtaining an equation for each bitumen that relates the target density required to meet the 350 cSt pipeline specification with reference temperature and diluent density.

$$Slope = a_1 * \rho_{condensate} + b_1$$
$$Intercept = a_2 * \rho_{condensate} + b_2$$

Equation 5 takes the form of:

Equation 6 $$\rho_{blend} = (a_1 * \rho_{condensate} + b_1) * T_{reference} + (a_2 * \rho_{condensate} + b_2)$$

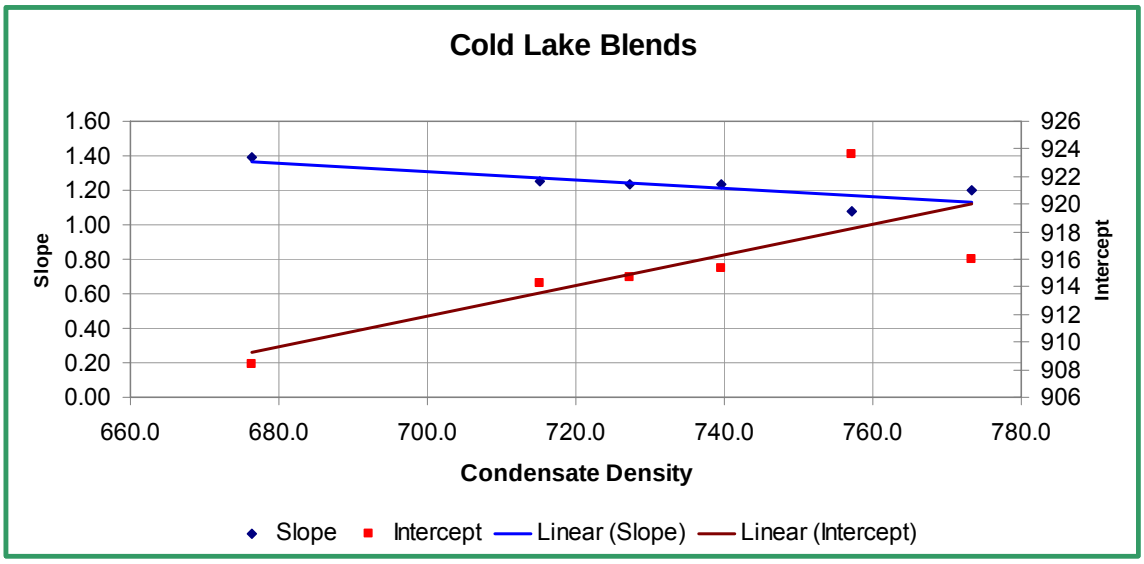
Coefficients a1, b1, a2 and b2 are input in the Condensate EQ model.

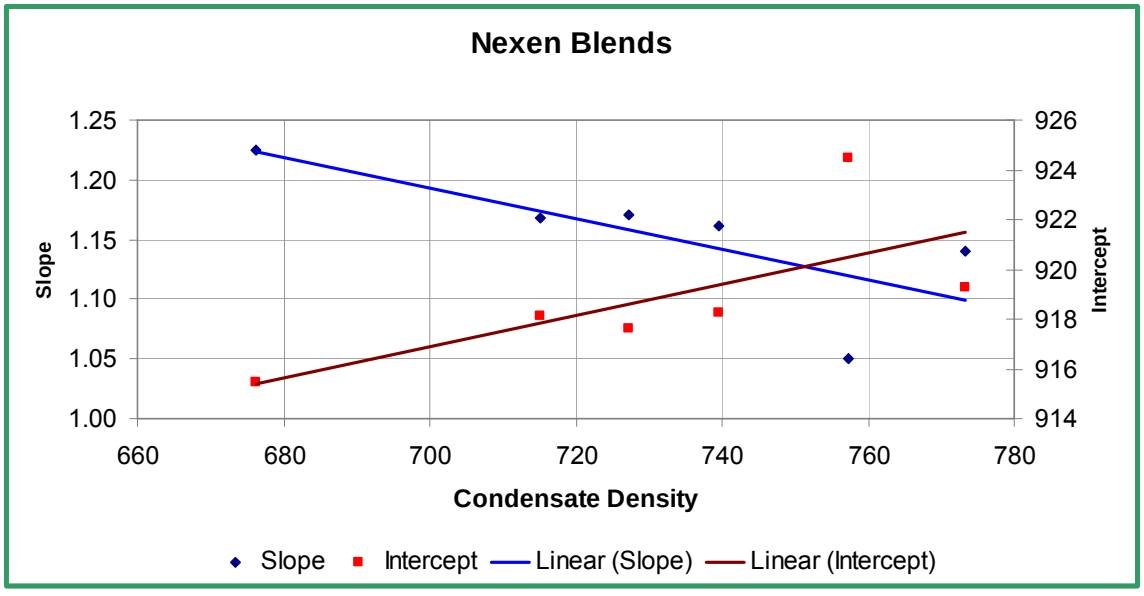
Calculation of coefficients was done according to the following cases:

- Case 1 – Using only 2006 data.
- Case 2- Using 2006 data excluding PC.
- Case 3 - Using all 2006 data and 2001 data (excluding Valhalla condensate).
- Case 4 - Using 2006 data excluding PC 2001 data (excluding Valhalla condensate).

Case 1 – Using only 2006 data.

The following figures show the value of the slope and intercept vs. condensate density for Cold Lake and LLK blends.



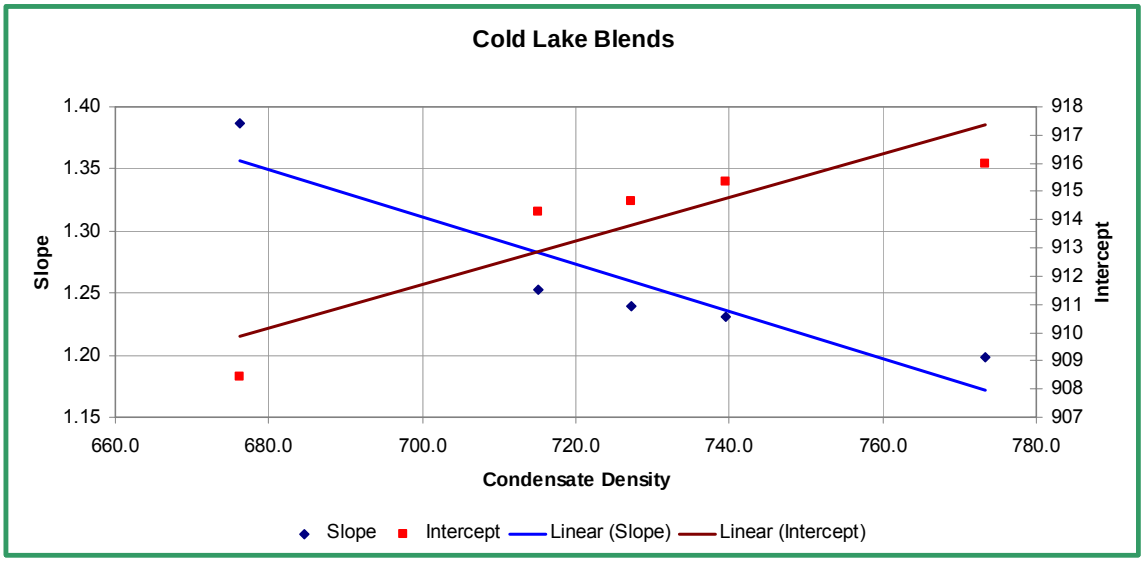


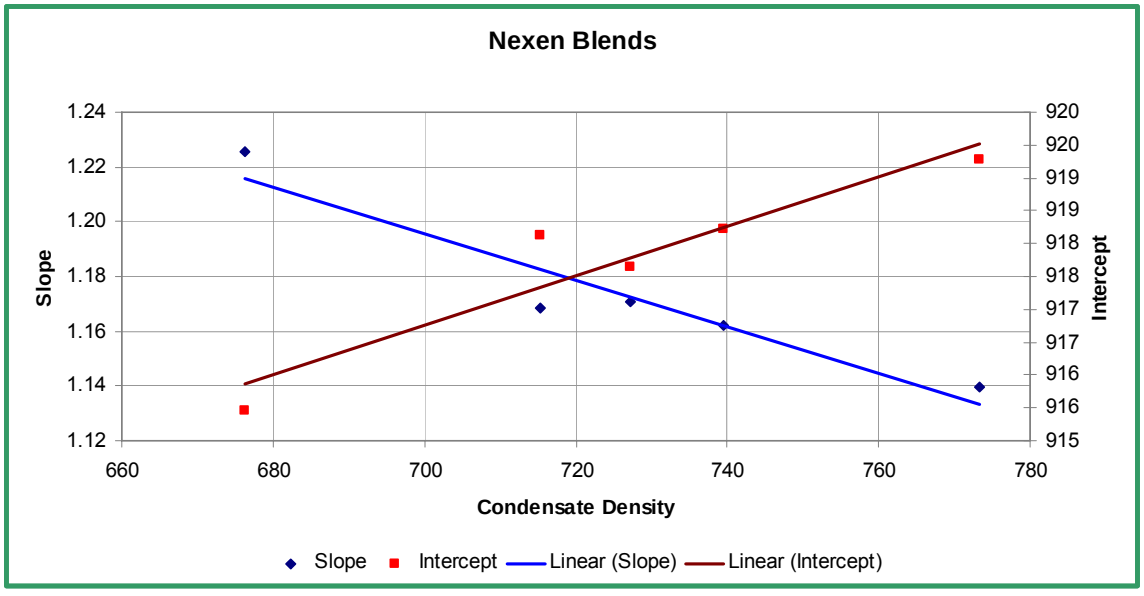
The following table summarizes the values of a1, b1, a2, b2 calculated for each of the bitumen using only 2006 data.

	Slope vs. Condensate Density			Intercept vs. Condensate Density		
	a1	b1	R square	a2	b2	R square
Cold Lake Blends	-0.00244	3.01910	0.71705	0.11029	834.71530	0.59872
LLK Blends	-0.00128	2.08871	0.57647	0.06251	873.14887	0.49303

Case 2- Using 2006 data excluding PC.

The following figures show the value of the slope and intercept vs. condensate density for Cold Lake and LLK blends for this case.



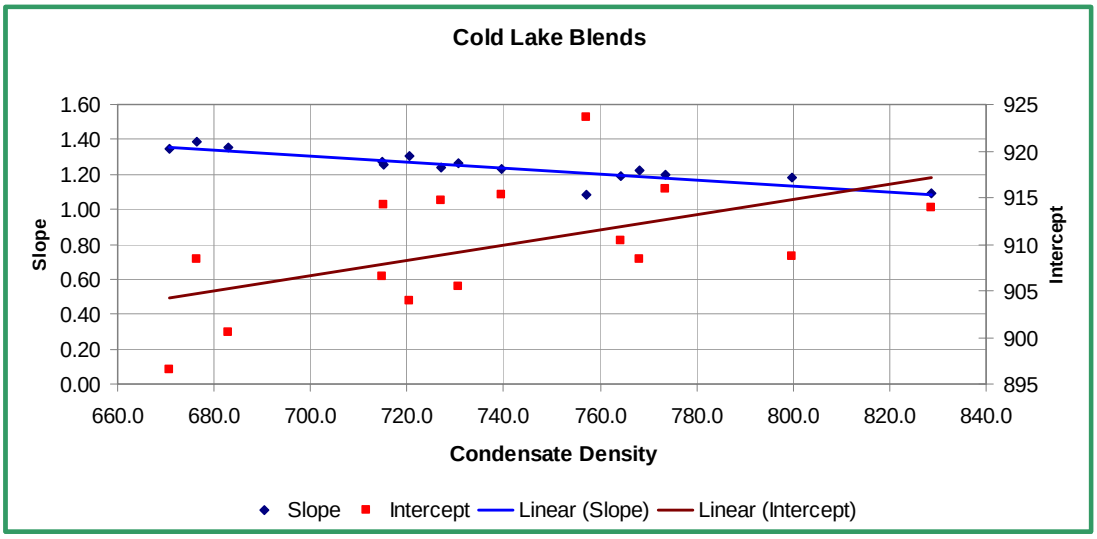


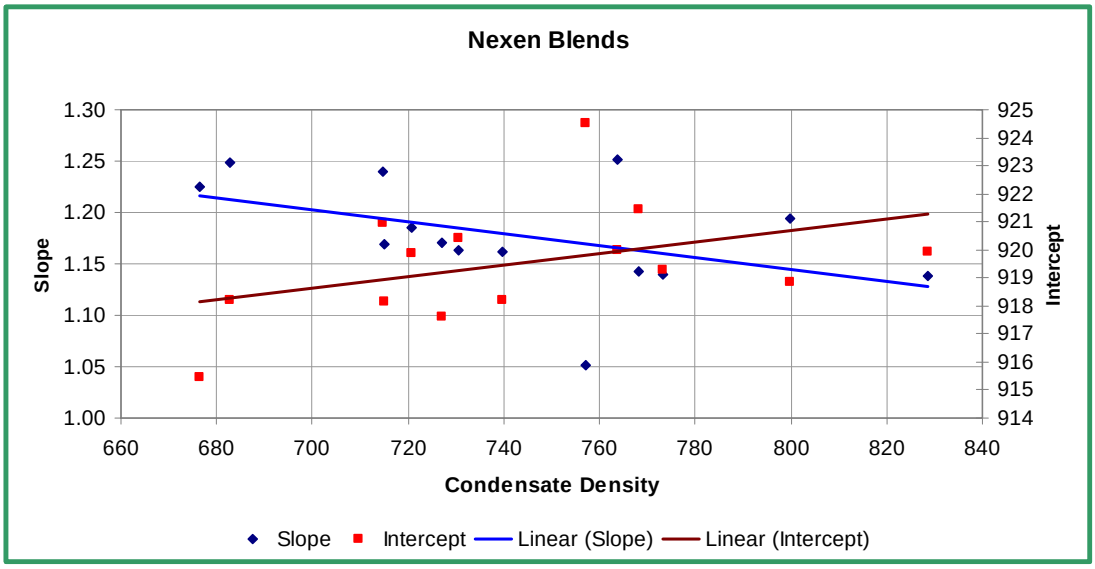
The following table summarizes the values of a1, b1, a2, b2 calculated for each of the bitumen using 2006 data and excluding the PC stream.

	Slope vs. Condensate Density			Intercept vs. Condensate Density		
	a1	b1	R square	a2	b2	R square
Cold Lake Blends	-0.00191	2.64525	0.85756	0.07718	857.68864	0.80846
LLK Blends	-0.00085	1.79360	0.91519	0.03779	890.29871	0.88945

Case 3 - Using all 2006 data and 2001 data (excluding Valhalla condensate).

The values of the slope and intercept vs. condensate density for Cold Lake and LLK blends are shown in the following figures.



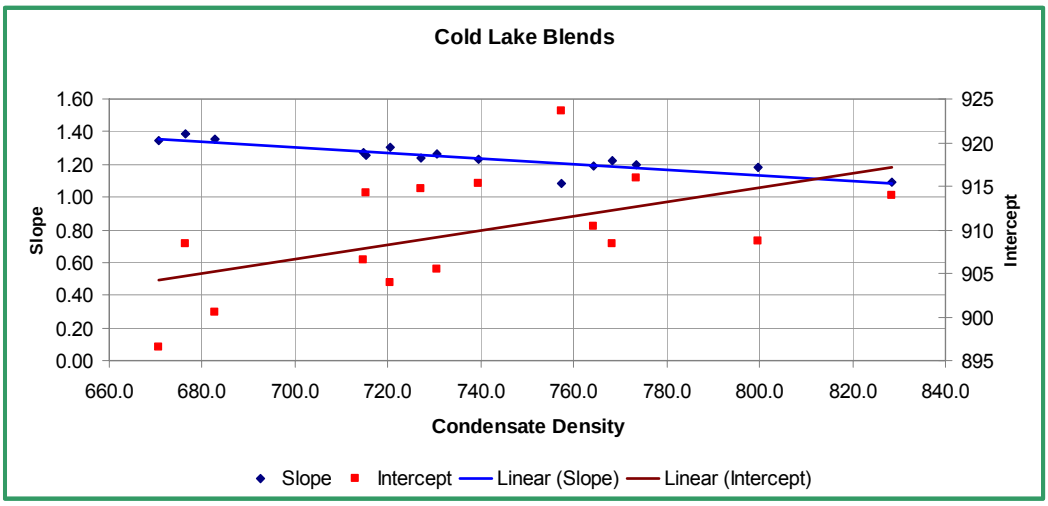


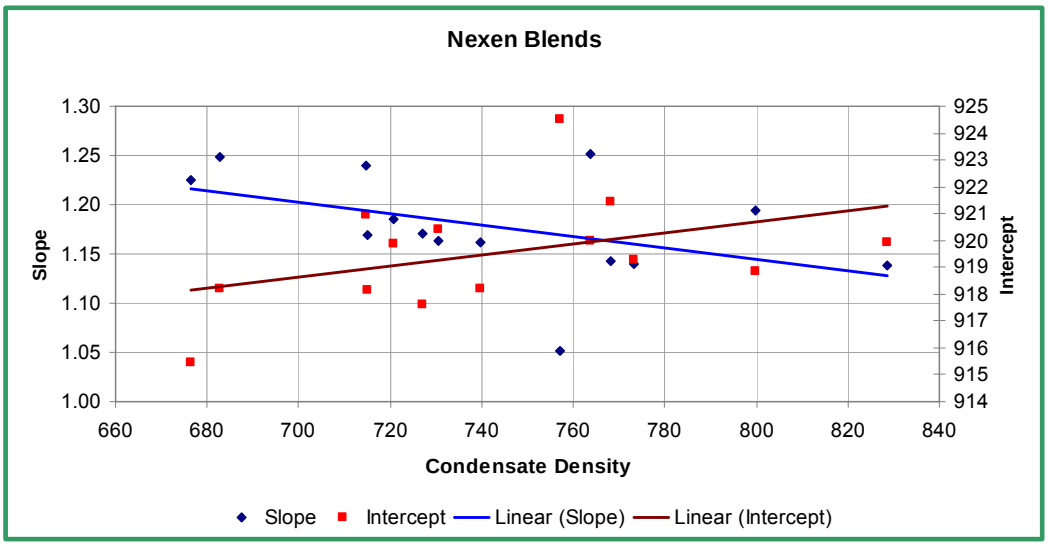
The following table summarizes the values of a1, b1, a2, b2 calculated for each of the bitumen using all 2006 data and 2001 data excluding the Valhalla stream as concluded in the 2001 report.

	Slope vs. Condensate Density			Intercept vs. Condensate Density		
	a1	b1	R square	a2	b2	R square
Cold Lake Blends	-0.00174	2.52645	0.77947	0.08222	849.09899	0.29120
LLK Blends	-0.00058	1.60790	0.20725	0.02055	904.23302	0.16961

Case 4 - Using 2006 data excluding PC 2001 data (excluding Valhalla condensate).

The values of the slope and intercept vs. condensate density for Cold Lake and LLK blends are shown in the following figures.



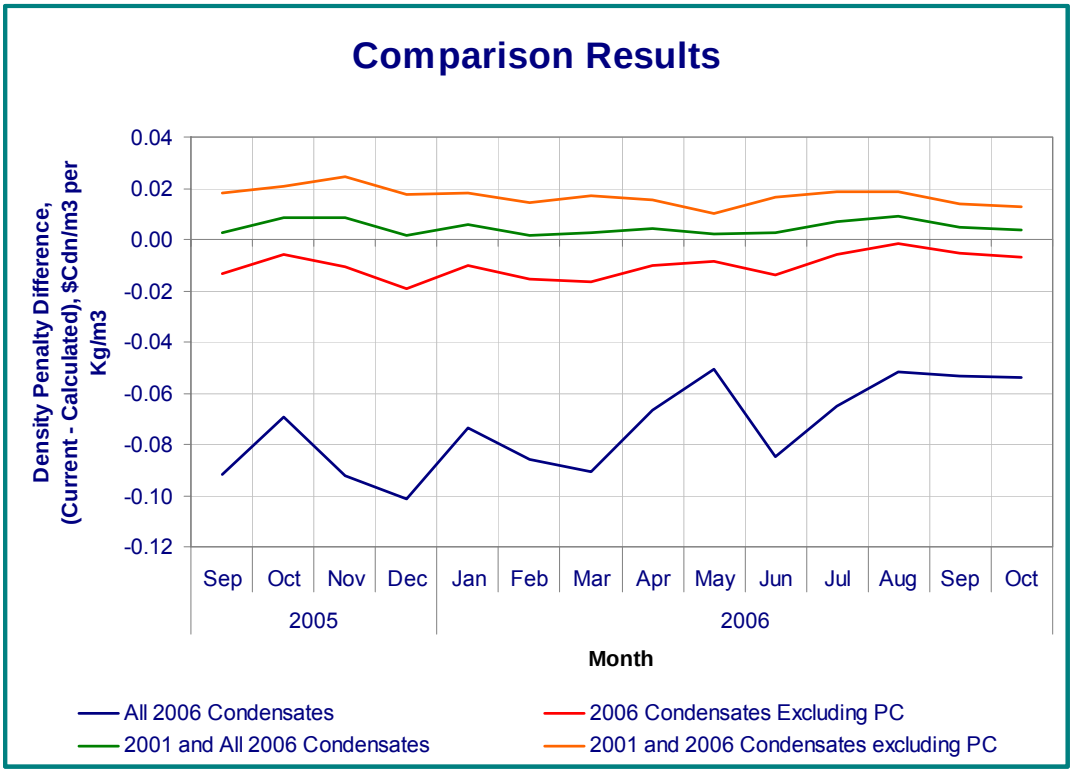


The following table summarizes the values of a1, b1, a2, b2 calculated for each of the bitumen using all 2006 excluding PC data and 2001 data excluding the Valhalla stream.

	Slope vs. Condensate Density			Intercept vs. Condensate Density		
	a1	b1	R square	a2	b2	R square
Cold Lake Blends	-0.00165	2.46643	0.91639	0.07311	854.93179	0.33101
LLK Blends	-0.00050	1.55775	0.28045	0.01737	906.23124	0.22410

Effect on Condensate Equalization

The following figure compares the effect that each of the case would have on the Condensate Equalization penalties.



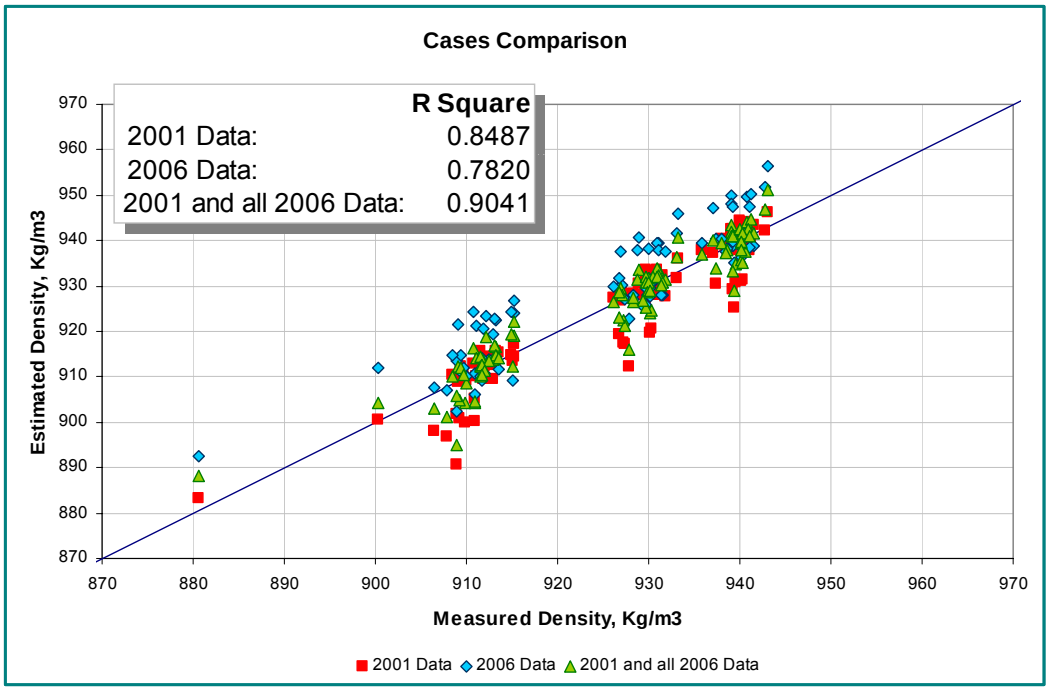
Prediction quality – Coefficient of determination

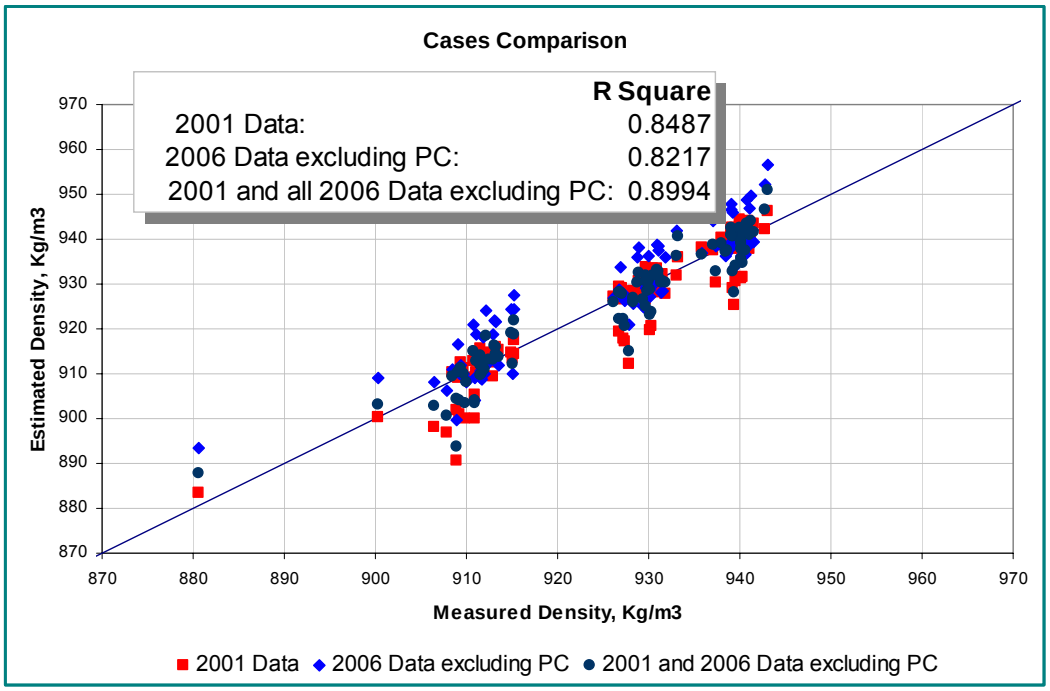
It is possible to obtain the temperature at which each blend will satisfy the 350cSt interpolating from the ASTM D341 graphics as shown in Appendix 2.

Knowing the temperature and the condensate density, the blend density is then estimated using the coefficients calculated for each case according with the following equation:

$$\rho_{blend} = (a_1 * \rho_{condensate} + b_1) * T_{reference} + (a_2 * \rho_{condensate} + b_2)$$

The following figures show the comparison of the measured density vs. the predicted density for each of the cases as well as with the actual set of coefficients (obtained from 2001 data excluding Valhalla).





2001 and 2006 data offers a better representation of the data. The following figure compares shows the effect of the Petro-Canada stream will make on the predictions.