



**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**

**Crude Property Determination  
for**

**Canadian Natural Resources Ltd.  
CNRes Primrose 100/07-03-068-03W4/00**

**Number Of Pages ( including cover page): 8**

**File Number: 52137-2002-3589**

**Date: June 11, 2002**

**Report Distribution: Jon Dudley, Canadian Natural resources Ltd. (Calgary) - 2  
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Dave Noel, Canadian Natural Resources Ltd. (Calgary) -  
invoice**

**APPROVED BY:**

**Eric MacDonald, B.Sc.  
Technical Specialist, Technical Services Group  
Phone # 250-4082  
Email emacdonald@corelab.ca**

**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.**

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COMPANY Canadian Natural Resources Ltd.  
WELL CNRes Primrose AA/7-3-68-3  
PROJECT Crude Property Determinations

PAGE 1 of 7  
FILE 52137-02-3589  
DATE 6/11/02

### Scope

To determine the oil properties of the crude extracted from the core material.

### Sample Description

**CNRes Primrose AA/7-3-68-3  
LSD 100/07-03-068-03W4/00**

# 1	Depth 492.90 m	# 3	Depth 498.18 m
# 2	Depth 495.18 m	# 4	Depth 507.11 m

### Data

Kinematic viscosities were measured at 40°C, 50°C and 60°C (ASTM D-445), and results are recorded on pages 2 - 3 of this report. Graphical representations of the viscosity data are located on pages 4 - 7. Values for 13°C, 20°C and 250°C were extrapolated from the graphical representations and are also recorded on pages 2 - 3, along with the density, API gravity, resistivity and chloride content of each sample.

### Results and Comments

Each core was individually centrifuged at ambient temperature to extract the hydrocarbon fluid. The samples were then placed in sealed containers and immersed in a water bath (60°C) to facilitate the removal of water and sediment.

The kinematic viscosity was measured in centistokes (mm<sup>2</sup>/s) and plotted linearly utilizing ASTM D-341 methodology, in a temperature range between the fluid's cloud point (onset of wax crystallization) and its' initial boiling point. The viscosity profile permits viscosity extrapolation at temperatures within the above mentioned temperature range (ASTM D-445). Values for 13°C, 20°C and 250°C were extrapolated from the graphical representations.

The heavy nature of the fluid prevented density measurements directly at 15°C. Densities were measured at an elevated temperature (35.0°C or 60.0°C) and converted to 15.0°C using Petroleum Volume Correction Factors. An Anton Parr digital densimeter was used for this purpose (ASTM D-5002). The resistivity and chloride contents were measured on the water phase that was removed from the core material by Ultracentrifuge.



COMPANY Canadian Natural Resources Ltd.  
WELL CNRes Primrose AA/7-3-68-3  
PROJECT Crude Property Determinations

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**CNRes Primrose AA/7-3-68-3  
LSD 100/07-03-068-03W4/00**

**#1 Depth 492.90 m**

Kinematic Viscosity  
40°C..... 2 474 cSt  
50°C..... 1 162 cSt  
60°C..... 579.5 cSt  
13°C (extrapolated) ..... 39 000 cSt  
20°C (extrapolated) ..... 16 900 cSt  
250°C (extrapolated) ..... 3.46 cSt

Measured Density @ 35.0°C..... 977.2 kg/m<sup>3</sup>  
Density @ 15.0°C..... 989.7 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.4  
Resistivity @ 25.0°C..... 1.166 (Ohm-metres)  
Chloride ..... 2830 (mg/L)

**#2 Depth 495.18 m**

Kinematic Viscosity  
40°C..... 2 616 cSt  
50°C..... 1 157 cSt  
60°C..... 569.3 cSt  
13°C (extrapolated) ..... 45 000 cSt  
20°C (extrapolated) ..... 20 000 cSt  
250°C (extrapolated) ..... 3.25 cSt

Measured Density @ 35.0°C..... 977.8 kg/m<sup>3</sup>  
Density @ 15.0°C..... 990.24 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.3  
Resistivity @ 25.0°C..... 1.261 (Ohm-metres)  
Chloride ..... 2410 (mg/L)



COMPANY Canadian Natural Resources Ltd.  
WELL CNRes Primrose AA/7-3-68-3  
PROJECT Crude Property Determinations

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DATE 6/11/02

**CNRes Primrose AA/7-3-68-3  
LSD 100/07-03-068-03W4/00**

**#3 Depth 498.90 m**

Kinematic Viscosity

40°C..... 3 567 cSt  
50°C..... 1 596 cSt  
60°C..... 747.4 cSt  
13°C (extrapolated) ..... 69 000 cSt  
20°C (extrapolated) ..... 28 700 cSt  
250°C (extrapolated) ..... 3.41 cSt

Measured Density @ 60.0°C.....964.4 kg/m<sup>3</sup>  
Density @ 15.0°C.....992.5 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.0  
Resistivity @ 25.0°C.....1.257 (Ohm-metres)  
Chloride ..... 2980 (mg/L)

**#4 Depth 507.11 m**

Kinematic Viscosity

40°C..... 25 940 cSt  
50°C..... 10 370 cSt  
60°C..... 4 615 cSt  
13°C (extrapolated) ..... 614 000 cSt  
20°C (extrapolated) ..... 240 000 cSt  
250°C (extrapolated) ..... 8.07 cSt

Measured Density @ 60.0°C.....980.7 kg/m<sup>3</sup>  
Density @ 15.0°C.....1008.3 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 8.7  
Resistivity @ 25.0°C.....0.798 (Ohm-metres)  
Chloride ..... 3900 (mg/L)



Company Name: Canadian Natural Resources Limited

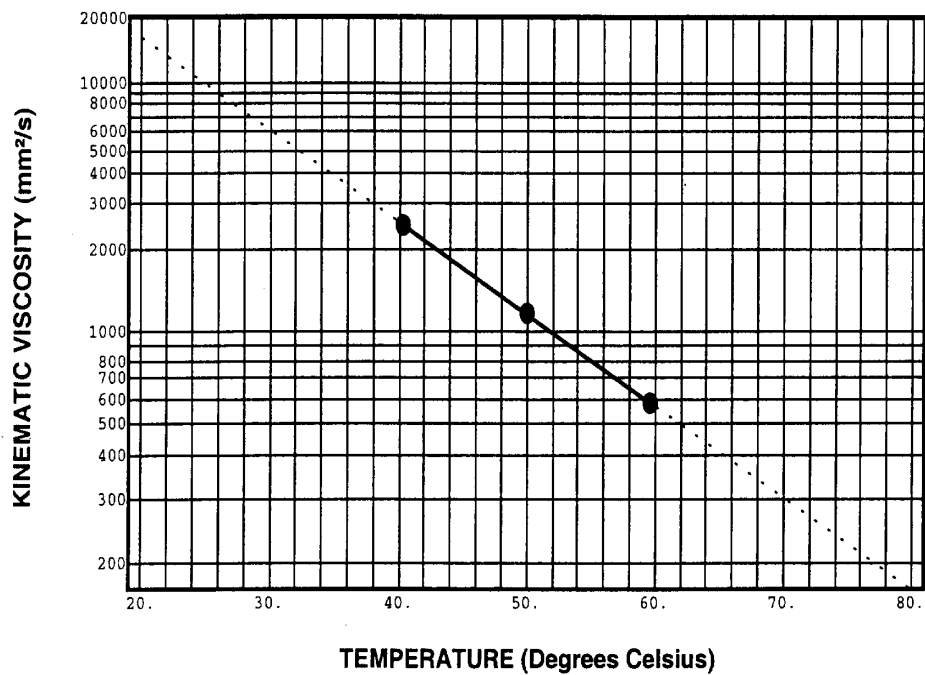
Well Name: CNRes Primrose AA/7-3-68-3

Location: 100/07-03-068-03W4/00

Sampled From: Depth 492.90 m

Sampling Date: 2002 05 30

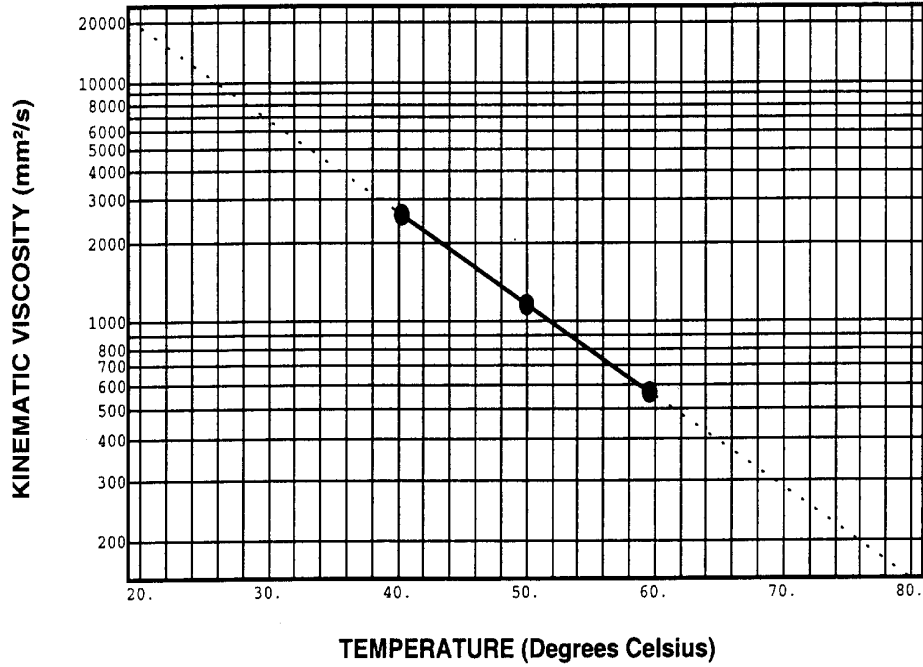
### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited  
Well Name: CNRes Primrose AA/7-3-68-3  
Location: 100/07-03-068-03W4/00  
Sampled From: Depth 495.18 m  
Sampling Date: 2002 05 31

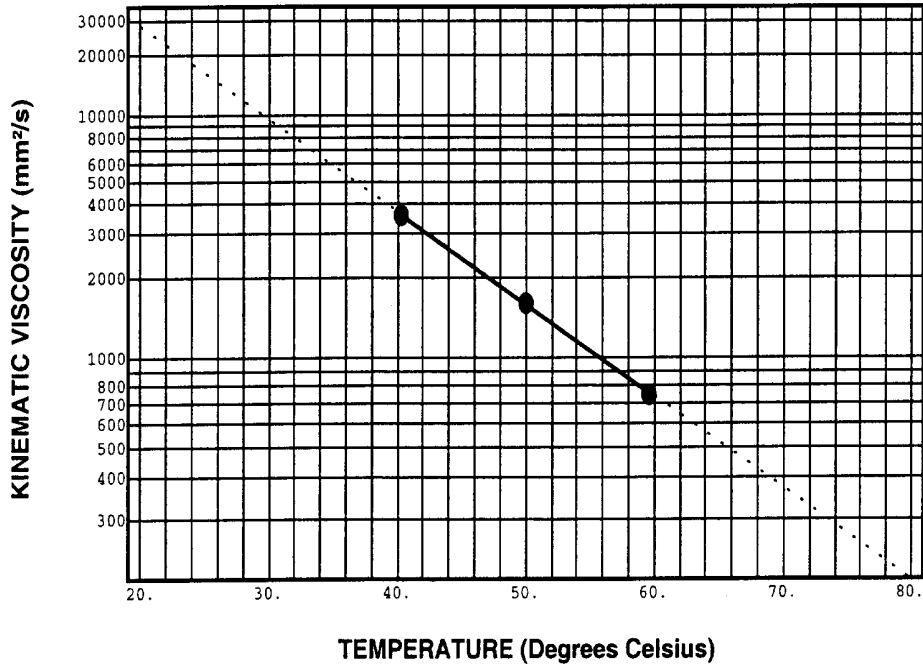
### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited  
Well Name: CNRes Primrose AA/7-3-68-3  
Location: 100/07-03-068-03W4/00  
Sampled From: Depth 498.90 m  
Sampling Date: 2002 05 31

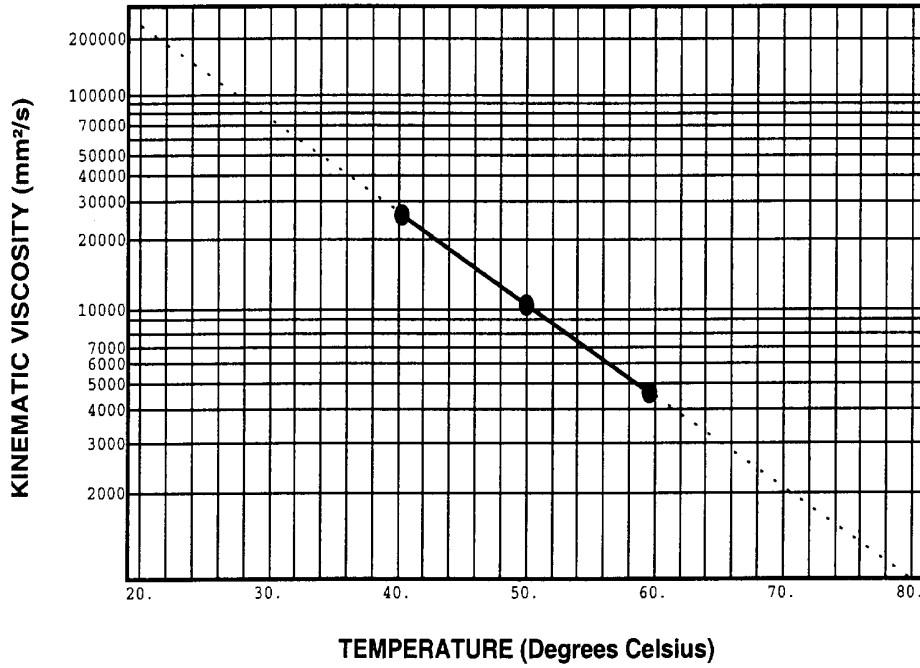
### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited  
Well Name: CNRes Primrose AA/7-3-68-3  
Location: 100/07-03-068-03W4/00  
Sampled From: Depth 507.11 m  
Sampling Date: 2002 06 04

### VISCOSITY - TEMPERATURE CHART





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

Crude Property Determination  
for  
**Canadian Natural Resources Ltd.**  
CNRes Primrose 02/09-29-067-03W4/00

Number Of Pages ( including cover page): 7

File Number: 52137-2002-3445

Date: June 11, 2002

Report Distribution: Jon Dudley, Canadian Natural Resources Ltd. (Calgary) - 2  
copies  
Dave Noel, Canadian Natural Resources Ltd. (Calgary) -  
invoice

APPROVED BY:

A handwritten signature in black ink, appearing to read 'Eric MacDonald'.

Eric MacDonald, B.Sc.  
Technical Specialist, Technical Services Group  
Phone # 250-4082  
Email [emacdonald@corelab.ca](mailto:emacdonald@corelab.ca)

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COMPANY Canadian Natural Resources Ltd.  
WELL CNRES 102 Primrose 02/9-29-67-3  
PROJECT Crude Property Determinations

PAGE 1 of 6  
FILE 52137-02-3445  
DATE 6/11/02

### Scope

To determine the oil properties of the crude extracted from the core material.

### Sample Description

**CNRES 102 Primrose 02/9-29-67-3**  
**LSD 102/09-29-067-03W4/00**

#1	Depth 437.75 m	#3	Depth 446.55 m
#2	Depth 443.47 m		

### Data

Kinematic viscosities were measured at 40°C, 50°C and 60°C (ASTM D-445), and results are recorded on pages 2 - 3 of this report. Graphical representations of the viscosity data are located on pages 4 - 6. Values for 13°C, 20°C and 250°C were extrapolated from the graphical representations and are also recorded on pages 2 - 3, along with the density, API gravity, resistivity and chloride content of each sample.

### Results and Comments

Each core was individually centrifuged at ambient temperature to extract the hydrocarbon fluid. The samples were then placed in sealed containers and immersed in a water bath (60°C) to facilitate the removal of water and sediment.

The kinematic viscosity was measured in centistokes ( $\text{mm}^2/\text{s}$ ) and plotted linearly utilizing ASTM D-341 methodology, in a temperature range between the fluid's cloud point (onset of wax crystallization) and its' initial boiling point. The viscosity profile permits viscosity extrapolation at temperatures within the above mentioned temperature range (ASTM D-445). Values for 13°C, 20°C and 250°C were extrapolated from the graphical representations.

The heavy nature of the fluid prevented density measurements directly at 15°C. Densities were measured at an elevated temperature (60.0°C) and converted to 15.0°C using Petroleum Volume Correction Factors. An Anton Parr digital densimeter was used for this purpose (ASTM D-5002). The resistivity and chloride contents were measured on the water phase that was removed from the core material by Ultracentrifuge.



COMPANY Canadian Natural Resources Ltd.  
WELL CNRES 102 Primrose 02/9-29-67-3  
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DATE 6/11/02

**CNRES 102 Primrose 02/9-29-67-3  
LSD 102/09-29-067-03W4/00**

**#1 Depth 437.75 m**

Kinematic Viscosity  
40°C..... 2 502 cSt  
50°C..... 1 112 cSt  
60°C..... 577.9 cSt  
13°C (extrapolated) ..... 38 800 cSt  
20°C (extrapolated) ..... 17 100 cSt  
250°C (extrapolated) ..... 3.36 cSt

Measured Density @ 60.0°C.....958.3 kg/m<sup>3</sup>  
Density @ 15.0°C.....986.5 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.8  
Resistivity @ 25.0°C.....0.889 (Ohm-metres)  
Chloride ..... 3600 (mg/L)

**#2 Depth 443.47 m**

Kinematic Viscosity  
40°C..... 2 684 cSt  
50°C..... 1 169 cSt  
60°C..... 596.5 cSt  
13°C (extrapolated) ..... 45 400 cSt  
20°C (extrapolated) ..... 19 500 cSt  
250°C (extrapolated) ..... 3.24 cSt

Measured Density @ 60.0°C.....960.6 kg/m<sup>3</sup>  
Density @ 15.0°C.....988.8 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.5  
Resistivity @ 25.0°C.....0.941 (Ohm-metres)  
Chloride ..... 3490 (mg/L)



COMPANY Canadian Natural Resources Ltd.  
WELL CNRES 102 Primrose 02/9-29-67-3  
PROJECT Crude Property Determinations

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DATE 6/11/02

**CNRES 102 Primrose 02/9-29-67-3  
LSD 102/09-29-067-03W4/00**

**#3 Depth 446.55 m**

Kinematic Viscosity

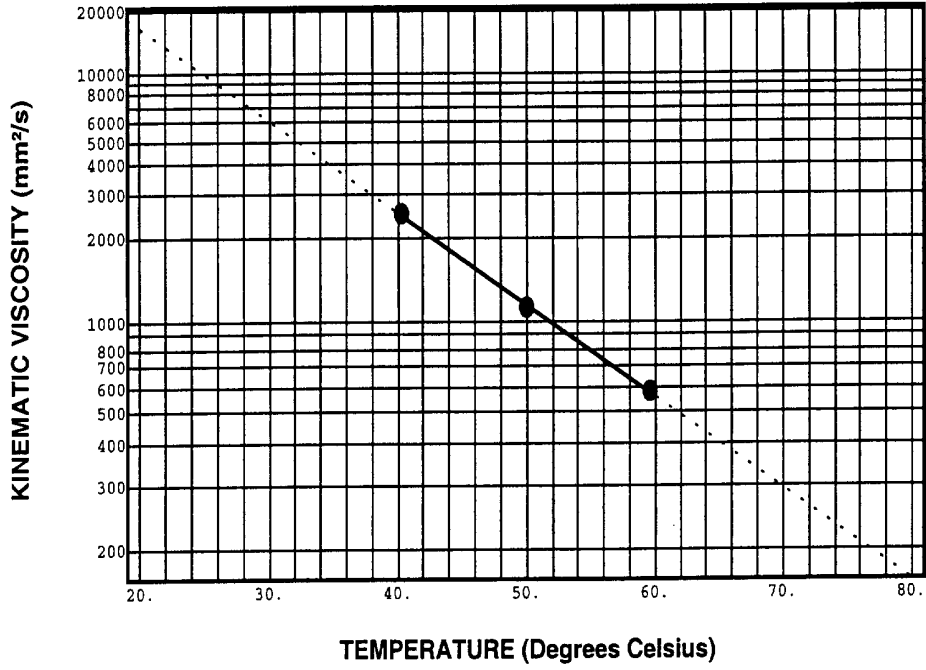
40°C..... 4 079 cSt  
50°C..... 1 778 cSt  
60°C..... 871.0 cSt  
13°C (extrapolated) ..... 73 000 cSt  
20°C (extrapolated) ..... 31 000 cSt  
250°C (extrapolated) ..... 3.80 cSt

Measured Density @ 60.0°C.....962.2 kg/m<sup>3</sup>  
Density @ 15.0°C.....990.3 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.3  
Resistivity @ 25.0°C.....0.965 (Ohm-metres)  
Chloride ..... 3180 (mg/L)



Company Name: Canadian Natural Resources Limited  
Well Name: CNRes 102 Primrose 9-29-67-3  
Location: 102/09-29-067-03W4/00  
Sampled From: Depth 437.75 m  
Sampling Date: 2002 05 27

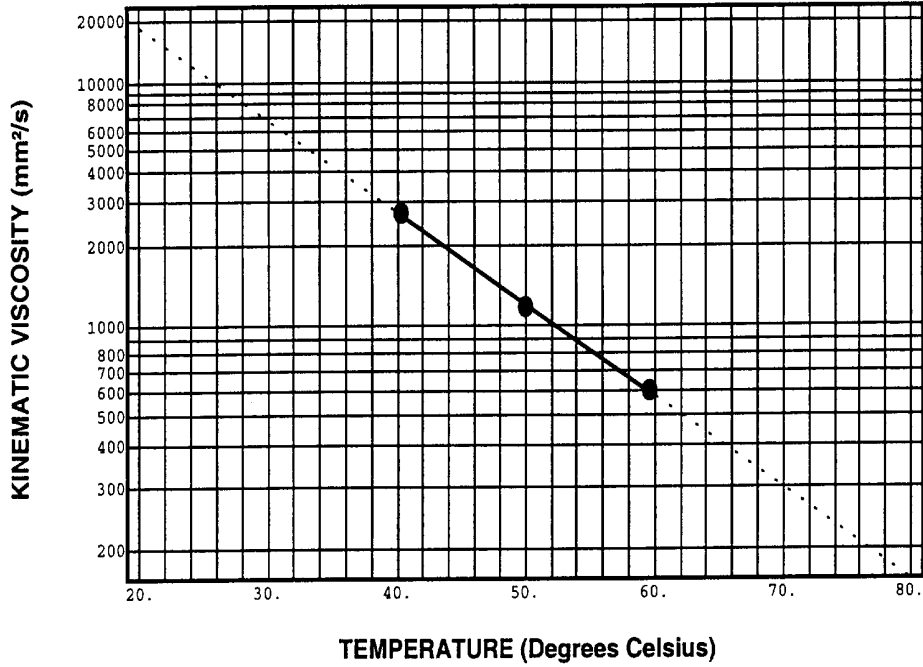
### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited  
Well Name: CNRes 102 Primrose 9-29-67-3  
Location: 102/09-29-067-03W4/00  
Sampled From: Depth 443.47 m  
Sampling Date: 2002 05 28

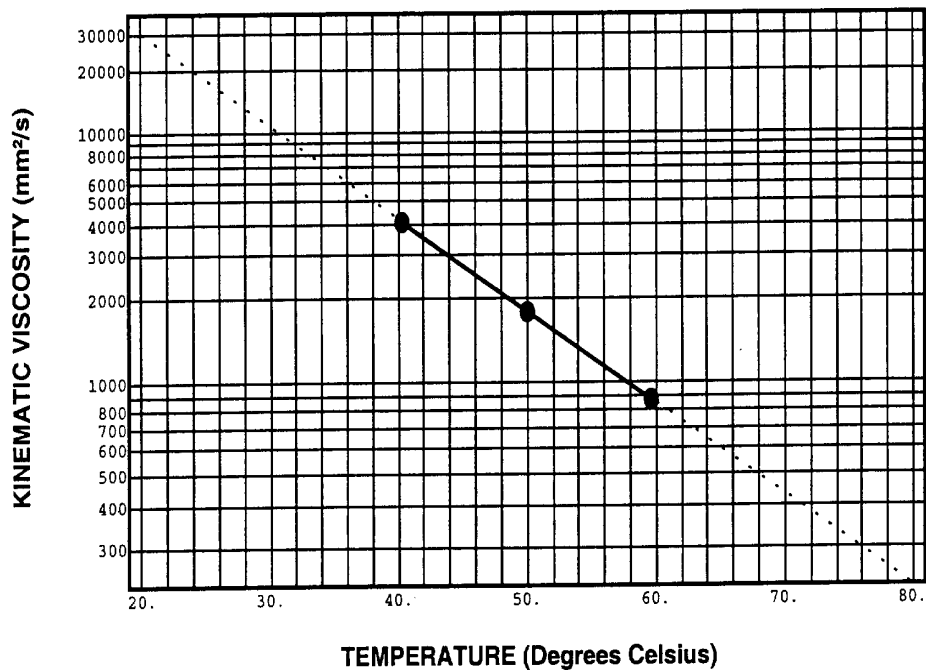
### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited  
Well Name: CNRes 102 Primrose 9-29-67-3  
Location: 102/09-29-067-03W4/00  
Sampled From: Depth 446.55 m  
Sampling Date: 2002 05 28

### VISCOSITY - TEMPERATURE CHART





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## **Core Laboratories Reservoir Fluids Report - Calgary**

**Crude Property Determination  
for**

**Canadian Natural Resources Ltd.  
CNRes Primrose 100/01-02-067-03W4/00**

**Number Of Pages ( including cover page): 7**

**File Number: 52137-2002-3540**

**Date: June 13, 2002**

**Report Distribution: Dave Noel, Canadian Natural Resources Ltd. (Calgary) - 2  
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Lowrine Hillbraned, Canadian Natural Resources Ltd.  
(Calgary) - invoice**

**APPROVED BY:**

**Eric MacDonald, B.Sc.  
Technical Specialist, Technical Services Group  
Phone # 250-4082  
Email emacdonald@corelab.ca**

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COMPANY Canadian Natural Resources Ltd  
WELL CNRes Primrose AA/1-2-67-3  
PROJECT Crude Property Determinations

PAGE 1 of 6  
FILE 52137-02-3540  
DATE 6/11/02

### Scope

To determine the oil properties of the crude extracted from the core material.

### Sample Description

**CNRes Primrose AA/1-2-67-3**  
**LSD 100/01-02-067-03W4/00**

#1	Depth 482.00 m	#3	Depth 503.76 m
#2	Depth 490.00 m		

### Data

Kinematic viscosities were measured at 40°C, 50°C and 60°C (ASTM D-445), and results are recorded on pages 2 - 3 of this report. Graphical representations of the viscosity data are located on pages 4 - 6. Values for 13°C, 20°C and 250°C were extrapolated from the graphical representations and are also recorded on pages 2 - 3, along with the density, API gravity, resistivity and chloride content of each sample.

### Results and Comments

Each core was individually centrifuged at ambient temperature to extract the hydrocarbon fluid. The samples were then placed in sealed containers and immersed in a water bath (60°C) to facilitate the removal of water and sediment.

The kinematic viscosity was measured in centistokes (mm<sup>2</sup>/s) and plotted linearly utilizing ASTM D-341 methodology, in a temperature range between the fluid's cloud point (onset of wax crystallization) and its' initial boiling point. The viscosity profile permits viscosity extrapolation at temperatures within the above mentioned temperature range (ASTM D-445). Values for 13°C, 20°C and 250°C were extrapolated from the graphical representations.

The heavy nature of the fluid prevented density measurements directly at 15°C. Densities were measured at an elevated temperature (35.0°C) and converted to 15.0°C using Petroleum Volume Correction Factors. An Anton Parr digital densimeter was used for this purpose (ASTM D-5002). The resistivity and chloride contents were measured on the water phase that was removed from the core material by Ultracentrifuge.



COMPANY Canadian Natural Resources Ltd  
WELL CNRes Primrose AA/1-2-67-3  
PROJECT Crude Property Determinations

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FILE 52137-02-3540  
DATE 6/11/02

**CNRes Primrose AA/1-2-67-3  
LSD 100/01-02-067-03W4/00**

**#1 Depth 482.00 m**

Kinematic Viscosity

40°C..... 2 618 cSt  
50°C..... 1 195 cSt  
60°C..... 594.3 cSt  
13°C (extrapolated) ..... 43 000 cSt  
20°C (extrapolated) ..... 18 600 cSt  
250°C (extrapolated) ..... 3.34 cSt

Measured Density @ 35.0°C.....977.8 kg/m<sup>3</sup>  
Density @ 15.0°C.....990.2 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.3  
Resistivity @ 25.0°C.....1.055 (Ohm-metres)  
Chloride ..... 3080 (mg/L)

**#2 Depth 490.00 m**

Kinematic Viscosity

40°C..... 3 873 cSt  
50°C..... 1 646 cSt  
60°C..... 782.6 cSt  
13°C (extrapolated) ..... 80 000 cSt  
20°C (extrapolated) ..... 32 500 cSt  
250°C (extrapolated) ..... 3.31 cSt

Measured Density @ 35.0°C.....980.2 kg/m<sup>3</sup>  
Density @ 15.0°C.....992.6 kg/m<sup>3</sup>  
API Gravity @ 15.6°C ..... 11.0  
Resistivity @ 25.0°C.....1.216 (Ohm-metres)  
Chloride ..... 2670 (mg/L)



COMPANY Canadian Natural Resources Ltd  
WELL CNRes Primrose AA/1-2-67-3  
PROJECT Crude Property Determinations

PAGE 3 of 6  
FILE 52137-02-3540  
DATE 6/11/02

**CNRes Primrose AA/1-2-67-3  
LSD 100/01-02-067-03W4/00**

**#3 Depth 503.76 m**

Kinematic Viscosity

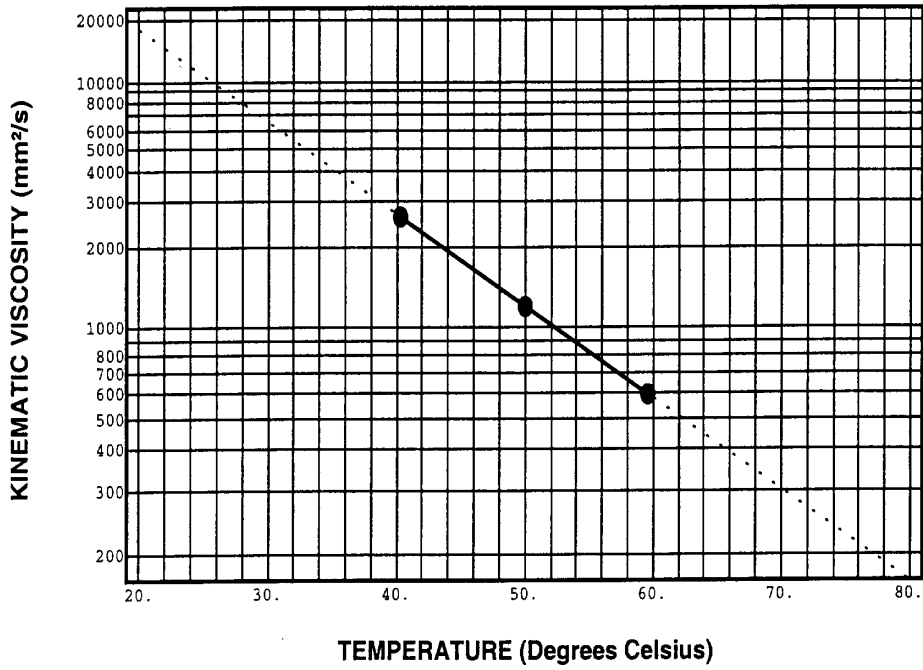
40°C.....	4 027 cSt
50°C.....	1 740 cSt
60°C.....	819.3 cSt
13°C (extrapolated) .....	83 000 cSt
20°C (extrapolated) .....	33 500 cSt
250°C (extrapolated) .....	3.45 cSt

Measured Density @ 35.0°C.....	982.3 kg/m <sup>3</sup>
Density @ 15.0°C.....	994.7 kg/m <sup>3</sup>
API Gravity @ 15.6°C .....	10.7
Resistivity @ 25.0°C.....	1.285 (Ohm-metres)
Chloride .....	2410 (mg/L)



Company Name: Canadian Natural Resources Limited  
Well Name: CNRes Primrose AA/1-2-67-3  
Location: 100/01-02-067-03W4/00  
Sampled From: Depth 482.00 m  
Sampling Date: 2002 05 28

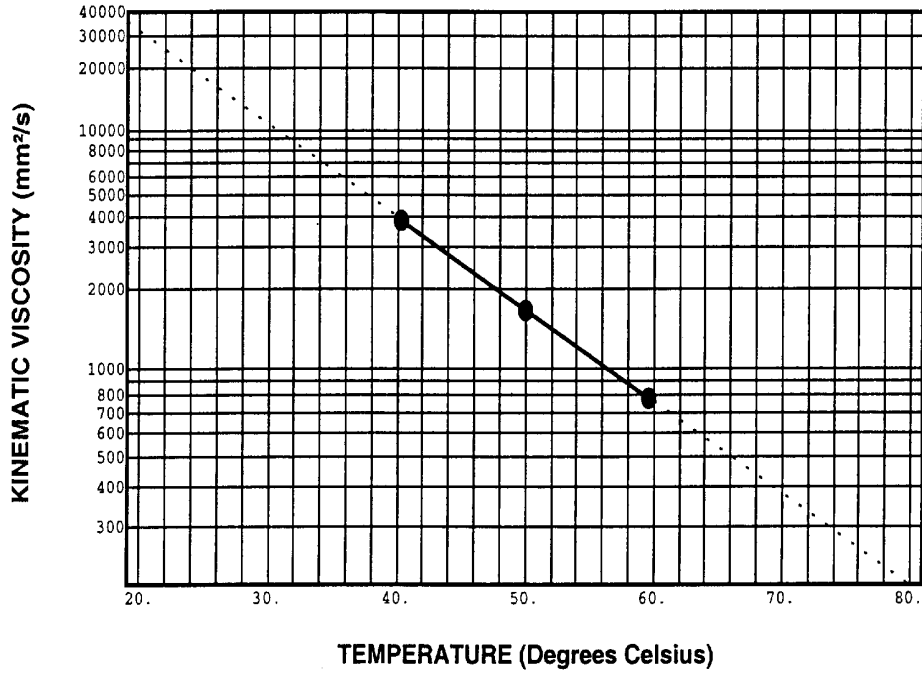
### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited  
Well Name: CNRes Primrose AA/1-2-67-3  
Location: 100/01-02-067-03W4/00  
Sampled From: Depth 490.00 m  
Sampling Date: 2002 05 29

### VISCOSITY - TEMPERATURE CHART





Company Name: Canadian Natural Resources Limited

Well Name: CNRes Primrose AA/1-2-67-3

Location: 100/01-02-067-03W4/00

Sampled From: Depth 503.76 m

Sampling Date: 2002 05 29

### VISCOSITY - TEMPERATURE CHART

