

OROGO use only

The details of this document have been examined and verified by:

Job Designation _____

Well Identifier _____

Signature _____

Approval Authority

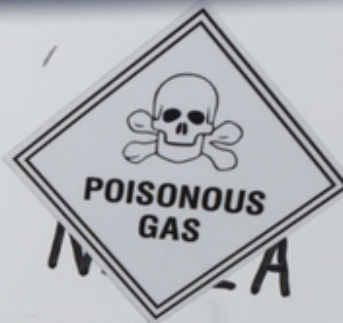
Unique Well Identifier 30 / _____ - _____ - _____ / _____
(eg. 300 / A01 60-00 120-00 / 0)

Date _____





Canadian Natural



A-77

60-50-122-30/00

LA

NO SMOKING

NO UNAUTHORIZED PERSONNEL

PH: 1-888

THE LOBERT GROUP







GAS MIGRATION ANALYSIS

C053681:YE3967-01

Laboratory Number

MaxID

Client ID

Meter Number

CANADIAN NATURAL RESOURCES LTD.

Operator Name

LSD

Well ID

ANADARKO EMILE LAKE A-77

DJ

CNRL

Well Name

Initials of Sampler

Sampling Company

FT LIARD

SLAVE POINT

SURFACE CASING VENT

11110,15204

Field or Area

Pool or Zone

Sample Point

Container Identity

Percent Full

Test Recovery

Interval

Elevations (m)

Sample Gathering Point

Solution Gas

Test Type

No.

Multiple Recovery

From:

630.80

624.70

To:

KB

GRD

N 0.000000

W 0.000000

Production Rates

Gauge Pressures kPa

Temperature °C

GPS

GPS

Water m³/d

Oil m³/d

Gas 1000m³/d

1240

1118

9

23

Source

As Received

Source

As Received

Well Fluid Type

NT004090

Licence No.

2020/07/30 14:15

2020/07/31

2020/08/10

AT3,GM1

Date Sampled Start

Date Sampled End

Date Received

Date Reported

Date Reissued

Analyst

COMPOSITION

Component	Mole Fraction		δ ¹³ C ‰
	As Rec'd*	ppm (v/v)	
H2	0.0067		
He	0.0046		
O2	0.0001		
N2	0.1454		
CO2	0.0000		
H2S	0.0000		
C1	0.8326		-44.29
C2	0.0091		-34.40
C3	0.0013		-34.53
IC4	0.0001	110	-30.91
NC4	0.0001	140	-33.24
IC5	Trace	20	
NC5	Trace	10	
C6	Trace	Trace	
C7+	Trace	Trace	
TOTAL	1.0000		

PROPERTIES

Calculated Molar Mass
Moisture Free as Sampled

Total

Calculated Gross Heating Value (MJ/m3)
@ 101.325 kPa & 15°C

GPA 2172

Calculated Relative Densities
Relative to Air @15°C

Moisture Free as Sampled

Hydrogen Sulphide

On Site

In Lab

Gastec (ppm v/v)

Tutweiler (mole%)

Gastec (ppm v/v)

Tutweiler (mole%)

H2S from GC (mole%)

Onsite analysis is required for accurate source H2S content.

H2S degrades variably in all sample containers and is also matrix dependent.

$$\delta^{13}C \text{ ‰} = \left[\left(\frac{^{13}C / ^{12}C_{\text{sample}}}{^{13}C / ^{12}C_{\text{standard}}} \right) - 1 \right] \times 1000$$

INTERPRETATION

QC Check Std # 0415/5010 Date 2020/07/31 QC Passed Yes

*per Method GPA 2286-M

Results relate only to items tested

Remarks:

UWI: 300/A-77-60.50-122.30/00

NO ONSITE H2S CONTENT RECORDED ON THE SAMPLING TAG.

NO PROTREND CODE PROVIDED.



Surface Casing Vent Gas Summary

Bureau Veritas File #: C053681 – YE3967
Date Sampled: 2020/07/30 @ 14:15

Well Name: ANADARKO EMILE LAKE A-77
UWI: 300/A-77-60.50-122.30/00
SH LOC: N/A
License #: NT004090

Interpretation:

Surface Casing Vent Gas **1997 – 2010**
Possible Depth (m KB):

Surface Casing Vent Gas **Slave Point**
Possible Geologic Formation:

Bureau Veritas's Remarks:

- ◆ The collected gas was found to contain C1 – C7 hydrocarbons (HCs) that were of thermogenic origin and migrated from a deep source / formation. Based on the gas composition and carbon stable isotope analysis data, the source of those HCs was located within the Slave Point formation at a depth of 1997 to 2010 m (KB).
- ◆ Carbon isotopic signatures of methane (C1), ethane (C2), propane (C3), and butane isomers (iC4 and nC4) were found to have values very similar to those observed previously for C1 – C4 alkanes present in SCV gas sample, which was collected at the subject well on Oct. 18th, 2017 (B792558 – SG6477). Hydrocarbon concentration patterns of both SCV gases appeared almost identical, too. All those findings suggested that since October 2017 the hydrocarbon gas migration into SCV space had continued to occur out of the same source / formation.

- ◆ Bureau Veritas Canada's interpretation and remarks were made by Andrey Tsyganok
- ◆ Email: Andrey.Tsyganok@bvlabs.com