

Heli Source

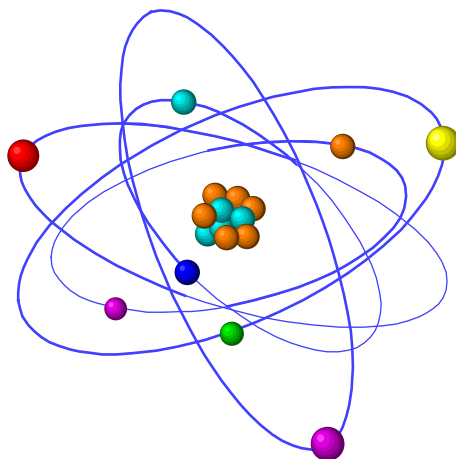
Work Order-Ref #: 21270

Vapor Intrusion Assessment (VIA)

Surface Casing Vent (SCV) Flow Test

Cameron Hills N-28

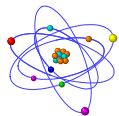
October 30, 2021



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FORENSIC SOLUTIONS FOR ENERGY CHALLENGES

**1.0 Vapor Intrusions Assessment (VIA) Summary**

Operating Company: Strategic Oil and Gas Ltd.
Well Name: Paramount et al Cameron Hills N-28
UWI: 60-10N 117-30W

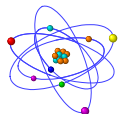
License Number: 1753
Test Date: October 30, 2021
GCHEM Project Number: 21270

1.1 Production Casing Assessment Summary Table

Combustible Gas (CH ₄) (%LEL)	nm		
Hydrogen Sulphide (H ₂ S) Gas (ppm v/v)	nm		
PC Flow Rate (m ³ /day)	nm		
P-T Date Logger Installed	nm		
P-T Data Logger Removed	nm		
P-T Data Logger Test Duration	nm		
MAX Pressure (kPa)	nm		
Gas Spl. Collection-Measurement	Total Collected	Analysis Requested*	Classification**
PC Samples (Total)	0		
PC Combustible Gas Class. Level-1 (Chemical)		NA	NA
PC Combustible Gas Class. Level-2 (δ ¹³ C)		NA	NA
PC Combustible Gas Class. Level-3 (δD)		NA	NA
PC Combustible Gas Class. Level-4 (¹⁴ C)		NA	NA

1.2 Surface Casing Vent Flow (SCVF) Assessment Summary Table

SCV Ten-Minute Bubble Test Result	PASS		
SCV Flow Rate (m ³ /day)	0		
SCV Pressure-Temp Logger Installed	NA		
SCV Pressure-Temp Data Logger Removed	NA		
SCV Shut-In Time (hrs)	NA		
SCV MAX-Recorded Build Up Pressure (kPa)	NA		
SCV Stabilized Build-up Pressure (kPa):	NA		
SCV Stabilized Build-up Time (hours)	NA		
SCV Standpipe Max CH ₄ Content (ppm v/v):	1		
SCV Standpipe Max H ₂ S Content	<1		
SCV Gas Spl. Collection-Measurement	Total Collected	Analysis Requested*	Classification**
SCV Samples (Total)	1		
SCV Combustible Gas Class. Level-1 (Chemical)		1	NON-IMPACTED
SCV Combustible Gas Class. Level-2 (δ ¹³ C)		NA	NA
SCV Combustible Gas Class. Level-3 (δD)		NA	NA
SCV Combustible Gas Class. Level-4 (¹⁴ C)		NA	NA



1.3 Soils Outside Casing (AGM) Assessment Summary Tables

A) Non-Intrusive CH₄ Surface Soil Scan (PMD) (Figure-1 and Table-1)

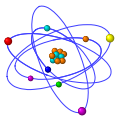
Well Casing Surface CH ₄ Test Sites	28
MAX Surface CH ₄ Reading	1 ppm v/v
MAX H ₂ S Well Soil Reading (ppm v/v)	<1
Number of Background Sites	1
MAX Background CH ₄ (ppm v/v)	1
Max H ₂ S BKG Soil Reading (ppm v/v)	<1
Surface CH ₄ -PMD Gas Classification	NON-IMPACTED

B) Non-Intrusive Surface Enclosed Soil Vapor FLUX Chamber Test

Surface SV-FC CH ₄ Test Sites	nm		
MAX SV-FC CH ₄ Reading	nm		
SV-FC Gas Spl. Collection-Measurement	Total Collected	Analysis Requested*	Test Site
SV-FC Samples (Total)	0		
SV-FC & Sites Requested for Level-1 Analysis		NA	NA
Combustible Gas Classification Level-1 (Chem.)		NA	
SV-FC & Sites Requested for Level-2 Analysis		NA	NA
Combustible Gas Classification Level-2 (δ ¹³ C)		NA	
SV-FC & Sites Requested for Level-3 Analysis		NA	NA
Combustible Gas Classification Level-3 (δD)		NA	
SV-FC & Sites Requested for Level-4 Analysis		NA	NA
Combustible Gas Classification Level-4 (¹⁴ C)		NA	

C) Intrusive Auger Test Holes with Soil Vapor Probes (Figure 2 and Table 2)

Number Soil Vapor Probe (SVP) Test Sites	0		
MAX SVP CH ₄ Reading (ppm v/v)	NA		
Max H ₂ S SVP Field Reading (ppm v/v)	NA		
Number SVP BKG Test Sites	NA		
MAX SVP CH ₄ BKG Test Sites (ppm v/v)	NA		
SVPs Gas Spl. Collection & Measurement	Total Collected	Analysis Requested*	Test Site
Soil Vapor Probes (SVPs) AGM (Total)	0		
SVP & Sites Requested for Level-1 Analysis		0	NA
Combustible Gas Classification Level-1 (Chem.)		NA	
SVP & Sites Requested for Level-2 Analysis		0	NA
Combustible Gas Classification Level-2 (δ ¹³ C)		NA	
SVP & Sites Requested for Level-3 Analysis		0	NA
Combustible Gas Classification Level-3 (δD)		NA	
SVP & Sites Requested for Level-4 Analysis		0	NA
Combustible Gas Classification Level-4 (¹⁴ C)		NA	



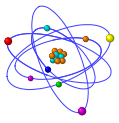
BKG Gas Spl. Collection-Measurement	Total Collected	Analysis Requested*	Test Site
BKG Soil Vapor Probe (SVPs) (Total)	0		
BKG & Sites Requested for Level-1 Analysis		0	NA
Combustible Gas Classification Level-1 (Chem.)			NA
BKG & Sites Requested for Level-2 Analysis		0	NA
Combustible Gas Classification Level-2 ($\delta^{13}\text{C}$)			NA
BKG & Sites Requested for Level-3 Analysis		0	NA
Combustible Gas Classification Level-3 (δD)			NA
BKG & Sites Requested for Level-4 Analysis		0	NA
Combustible Gas Classification Level-4 (^{14}C)			NA

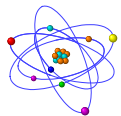
* Sample selection for chemical and isotope analysis (geochemical analytical suite) selected by client/operator.

1.4 Interpreted Source of Migrating Gases

Sample Point	Geologic Formation	Depth Range	Source Depth
No samples submitted for stable isotope composition analysis.			



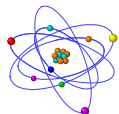




3.0 Vapor Intrusion and Surface Casing Vent Flow Testing and Sampling Comments

Assessment-Collection Date: October 30, 2021

- 1) The Surface Casing Vent passed the ten-minute bubble test (1 ppm v/v methane).
- 2) A surface combustible gas scan was performed near the wellbore using a Sensit Portable Methane Detector (PMD). All readings were low (1 ppm v/v methane).
- 3) The soils were water saturated and an intrusive soil gas migration test could not be completed. No soil gas samples could be collected for analysis.
- 4) Methane and C₂ + light alkane gas levels in SCV are low, comparable to expected background. (Figure 1).
- 5) C₆₊ contents in the SCV are low and comparable to background levels (Figure 2).
- 6) This well does not contain evidence of SCVF or gas migration at the time of this investigation.

**Table 1. High resolution molecular compositions of gas samples collected as part of the VIA Heli Source N-28.**

Gas Component	Sample Point Date Collected	SCV Oct. 30-21 ppm v/v
Neon		<0.50
Hydrogen		306.9
Helium		<0.50
Nitrogen		780688
Oxygen		217466
Carbon Dioxide		1521
Methane		14.26
Ethane		2.71
Ethene		<0.01
Propane		0.89
Propene		<0.01
iso-Butane		0.62
n-Butane		0.25
iso-Pentane		0.13
n-Pentane		<0.01
C6+		<0.01
C1 Index (C1/ΣC2+)		3.70
C2 Index (C2/ΣC3+)		2.38
C3 Index (C3/ΣC4+)		3.62
C4 Index (C4/C5)		N/A
ΣC2+		3.86
ATM Ratio (N2/O2)		3.59
Vol % CO2 of TG		0.15
Vol % Lt. Alk. of TG		0.00
Vol % Lt. Alk. CH4		75.59
Vol % Lt. Alk. C2+		24.41
Vol % C2+ of TG		0.00
Stable Carbon Isotope Compositions (‰ VPDB)		
d13C CH4		nm
d13C C2H6		nm
d13C C2H4		nm
d13C C3H8		nm
d13C C3H6		nm
d13C i-C4H10		nm
d13C n-C4H10		nm
d13C i-C5H12		nm
d13C n-C5H12		nm
d13C CO2		nm
Stable Hydrogen Isotopic Compositions (‰ VSMOW)		
dD H2		nm
dD CH4		nm
dD C2H6		nm
dD C3H8		nm
dD i-C4H10		nm
dD n-C4H10		nm
14C Concentration (pMC)		nm

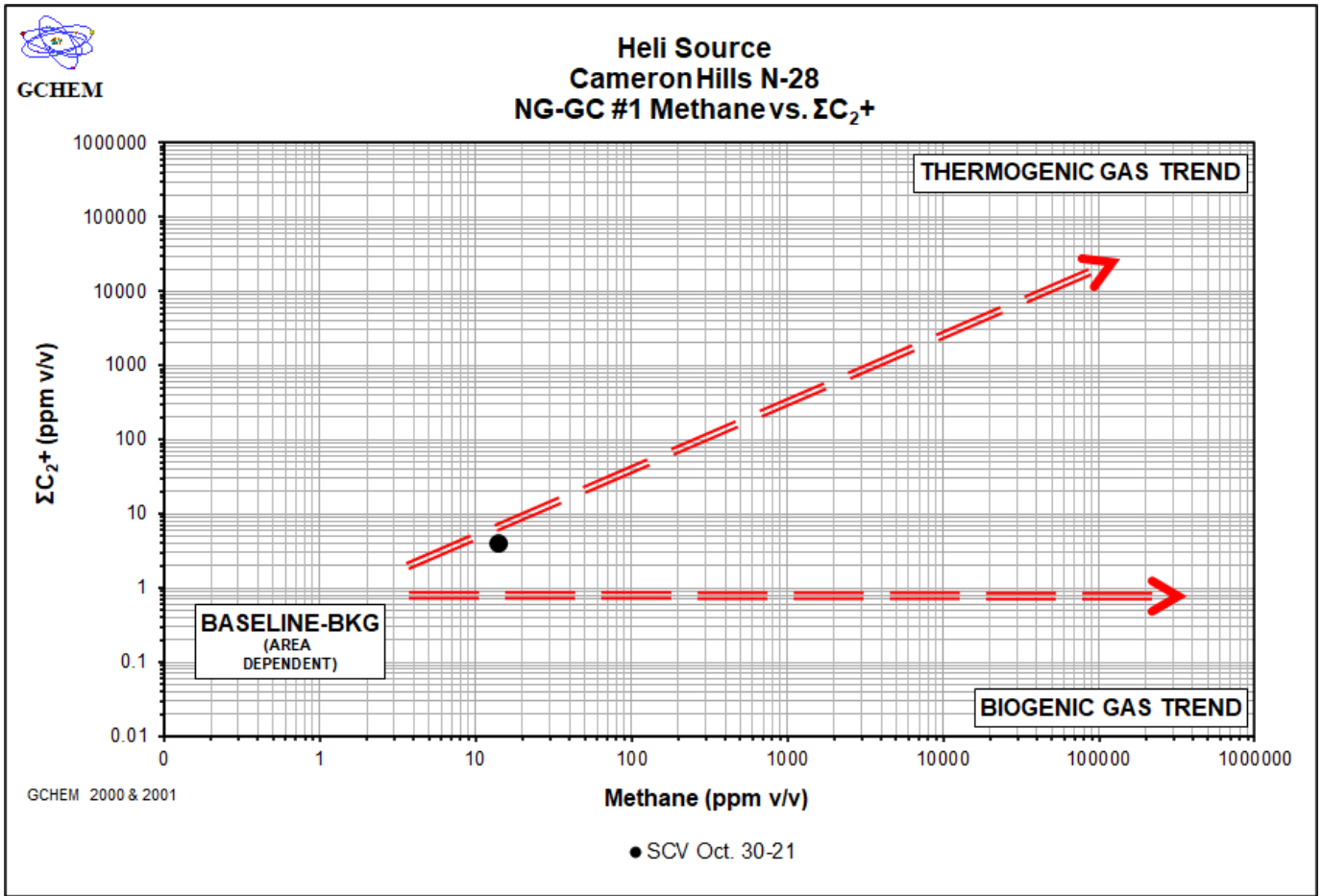
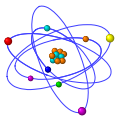


Figure 1: ΣC_2+ vs Methane. Combustible gases detected in soils and SCVs at a wellhead may result from several origins. Natural gases indicative of SCVF or AGM are thermogenic in origin (natural gas in deep reservoirs), contain high methane and C_2+ contents and plot in the Upper RH Quadrant. Low natural gas levels in background, off lease areas are naturally present in soils, vary from region to region and plot in the Lower LH Quadrant. Biogenic gases (swamp-gas) are produced by bacteria, are comprised of predominantly methane and plot in Lower RH Quadrant. Samples plotting in the Lower LH and RH do not contain SCVF or AGM and would not require down-hole remediation

NG-GC-1 Comments

- 1) Natural gases in the SCV contain low levels of C_2+ gases indicating that this well is not impacted with leaking thermogenic natural gases.

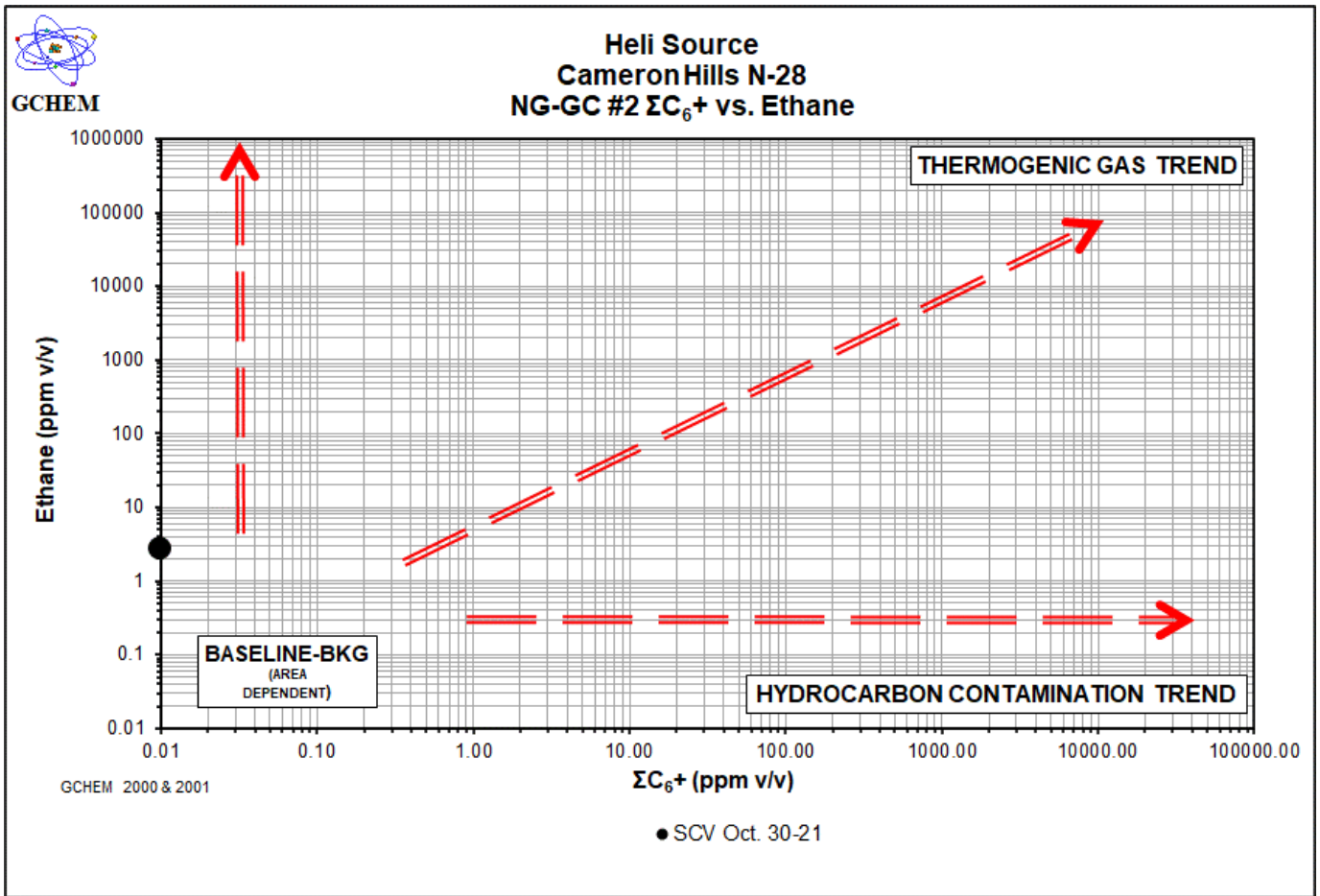
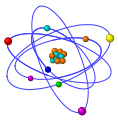


Figure 2: ΣC_6+ vs Ethane. C_6+ gases are relatively large molecules that do not readily or easily migrate in large quantities from depth upwards through subsurface fractures or micro-fractures to surface. Contamination by oil spills, fuels, and solvents is indicated by soil vapor samples that have high contents of C_6+ compounds and plot in the Lower RH Quadrant. Samples plotting in the Lower LH and RH Quadrants do not contain evidence of either SCVF or AGM and would not require downhole repair operations.

NG-GC-2 Comments

- 1) C_6+ contents of the SCV are low and are similar to expected baseline readings. Measured combustible gas levels are not the result of near surface hydrocarbon or chemical contamination.