

Alan R. Langenfeld
1308 Parkland Ct.
Champaign, IL 61821
7/22/2019

Brent Pooler
Senior Hydrogeologist
PO Box 60295
Lafayette, LA 70596-0295

Dear Brent Pooler :

On behalf of everyone at Isotech Laboratories, thank you for choosing us for your analytical needs. Attached with this document are the reports you requested. These documents relate to project Indigo / 8060.00 (Job 42052). We will hold your sample material until 8/21/2019. If you would like us to hold it longer please let us know.

Note that we were unable to obtain some requested isotopic values due to insufficient concentration.

We are committed to providing you with the highest level of customer satisfaction possible. If for any reason you have questions or comments, we are delighted to hear from you.

Again, thank you for your patronage. We look forward to serving you again in the future.

Best Regards,



Alan R. Langenfeld
Lab Manager

Isotech Gas Data

Job 42052

CoreTrac 15-78329

Isotech Lab No.	Sample Name	Sample Date	Sample Time	Field Name	Location	GC Date	He %	H ₂ %	Ar %	O ₂ %	CO ₂ %	N ₂ %	CO %	C ₁ %	C ₂ %	C ₂ -C ₆ %	C ₇ %	C ₈ %	iC ₉ %	nC ₉ %	iC ₁₀ %	nC ₁₀ %	C ₁₁ %	C ₁₂ %	MS Date	iD H ₂ O %	d ¹⁸ O H ₂ O ‰	Dissolved CH ₄ cc/L	Dissolved CH ₄ mg/L	Dissolved C ₂ H ₆ cc/L	Dissolved C ₂ H ₆ mg/L	Dissolved C ₃ H ₈ cc/L	Dissolved C ₃ H ₈ mg/L	Dissolved N ₂ cc/L	Dissolved N ₂ mg/L	Dissolved Ar cc/L	Dissolved Ar mg/L	Dissolved O ₂ cc/L	Dissolved O ₂ mg/L	Helium dilution factor *	Headspace Volume (mL)	Weight of Water (g)	Atmospheric Pressure (atm)	Sample Temperature (°C)	Comments	
725107	031-98432 (Paul Davis Water Well)	6/25/2019	9:20	Indigo / 80660.00	DeSoto Parish, Louisiana	7/16/2019	na	nd	1.82	7.97	0.60	89.52	nd	0.0934	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	7/7/2019	-26.7	-4.88	0.023	0.016	< 0.0002	< 0.0002	< 0.0002	< 0.0003	20	23	0.45	0.75	1.9	2.6	0.84	44	361	0.973	21.8	Insufficient hydrocarbon concentrations for isotopic analysis.

nd = not detected, na = not analyzed

* Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace.

** Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

Samples without He dilution factor had sufficient headspace to be extracted directly.

** Indicates if vacuum distillation was utilized for hydrogen and oxygen isotopic analysis of water

Lowest Quantifiable limits		
C ₁	2 ppm	0.0002%
C ₂ -C ₆ **	1 ppm	0.0001%
Ar	50 ppm	0.0050%
O ₂	100 ppm	0.0100%
N ₂	100 ppm	0.0100%
He	50 ppm	0.0050%
H ₂	100 ppm	0.0100%
CO ₂	50 ppm	0.0050%
CO	100 ppm	0.0100%

Lab #: 725107 Job #: 42052 IS-78329 Co. Job#: _____
 Sample Name: 031-9843Z (Paul Davis Water Well) Co. Lab#: _____
 Company: Hydro-Environmental Technology, Inc.
 API/Well: _____
 Container: Isoflask & 250ml bottle
 Field/Site Name: Indigo / 8060.00
 Location: DeSoto Parish, Louisiana
 Formation/Depth: _____
 Sampling Point: _____
 Date Sampled: 6/25/2019 9:20 Date Received: 6/28/2019 Date Reported: 7/22/2019

Component	Chemical mol. %	$\delta^{13}\text{C}$ ‰	δD ‰	$\delta^{18}\text{O}$ ‰	Dissolved gas cc/L	Dissolved gas ppm
Carbon Monoxide -----	nd					
Helium -----	na					
Hydrogen -----	nd					
Argon -----	1.82				0.45	0.75
Oxygen -----	7.97				1.9	2.6
Nitrogen -----	89.52				20	23
Carbon Dioxide -----	0.60					
Methane -----	0.0934				0.023	0.016
Ethane -----	nd				< 0.0002	< 0.0002
Ethylene -----	nd					
Propane -----	nd				< 0.0002	< 0.0003
Propylene -----	nd					
Iso-butane -----	nd					
N-butane -----	nd					
Iso-pentane -----	nd					
N-pentane -----	nd					
Hexanes + -----	nd					
Water -----			-26.7	-4.88		

Vacuum Distilled? ----- No

Remarks:

Analysis is of gas extracted from water by headspace equilibration. Analysis has been corrected for helium added to create headspace. Helium dilution factor = 0.84
 *Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.
 Insufficient hydrocarbon concentrations for isotopic analysis.

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Isotopic composition of oxygen is relative to VSMOW, except for carbon dioxide which is relative to VPDB. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.

Isotech QA/QC Data

42052 HYE

Calibration Standards

Check Standards

Date Ran	DI-5		LT-2		MID	
	$\delta^{18}\text{O H}_2\text{O}$ ‰	$\delta\text{D H}_2\text{O}$ ‰	$\delta^{18}\text{O H}_2\text{O}$ ‰	$\delta\text{D H}_2\text{O}$ ‰	$\delta^{18}\text{O H}_2\text{O}$ ‰	$\delta\text{D H}_2\text{O}$ ‰
2019/07/05 13:46:02	-6.736	-40.996	-18.946	-142.146	-12.081	-90.630
2019/07/05 23:57:49	-6.741	-41.550	-18.986	-142.328	-12.105	-91.705
2019/07/06 09:29:14	-6.689	-41.074	-18.925	-141.917	-12.016	-90.501
2019/07/06 19:03:46	-6.698	-41.205	-18.866	-141.622	-12.000	-90.760
2019/07/07 04:41:33	-6.812	-42.780	-18.818	-141.739	-11.966	-91.029
2019/07/07 14:22:15	-6.808	-42.897	-18.796	-141.763	-12.039	-91.062
2019/07/07 19:36:20	-6.840	-43.567	-18.818	-141.716	-11.979	-91.576
Average	-6.76	-42.0	-18.88	-141.9	-12.03	-91.0
Standard Deviation	0.06	1.0	0.07	0.3	0.05	0.5
Lit (MS) Value	-6.76	-42.0	-18.88	-141.9	-11.99	-90.9

Duplicates

I-Number	Sample ID	$\delta^{18}\text{O}$	$\delta^2\text{H}$
725107	031-9843Z (Paul Davis Water Well)	-4.894	-26.935
725107	dup	-4.874	-26.486

Job	Lab	Sample Name	Company Lab	Weather ID	Depth	GU	Analysis Order	Instrument	Run Time	Raw Total	C1	C2	C3	IC4	nC4	ICS	nCS	C5+	C2H4	C2H2	C3H6	Ar	O2	N2	CO2	H2	He	CO	H2S					
42052	7E+05	031-9843Z (Paul Davis Water Well)					1882703	Shimadzu34	7/16/2019 12:36	99.4565	0.02333	0	0	0	0	0	0	0	0	0	0	0.4534	1.84746	19.8819	0.0954	0	0.84046	0	0					
							1882006	Shimadzu34	7/15/2019 11:12	99.3837	18.9657	0.15	0.282	-0.13	0.0002	-0.08	0	0	0	0	0	0	0.7744	0.48	17.9657	0.53	62.8075	-0.1	0.1699	-3.16	0	0.03555	-0.07	0
							1881822	Shimadzu34	7/15/2019 10:53	99.2196	18.9214	0.15	0.2828	0.13	0.0002	0.08	0	0	0	0	0	0	0.7671	-0.48	16.8873	-0.53	62.936	0.1	0.1697	0.16	0	0.0356	0.07	0
							Reference Values				18.8936	0.2824	0.0002	0	0	0	0	0	0	0	0	0	0.7707	16.9765	62.8717	0.1694	0	0.03557	0	0	0	0		
Standards																																		
	6E+05	highchkstd					1881826	Shimadzu34	7/15/2019 13:45	99.1676	89.9554	0.36	0	0	0	0	0	0	0	0	0	0	0.00476	-8.32	10.0399	0.43	0	0	0	0	0	0	0	
							1881962	Shimadzu34	7/16/2019 6:13	99.6981	50.0161	0.43	0	0	0	0	0	0	0	0	0	0	0.00504	-0.9	9.97884	-0.18	0	0	0	0	0	0	0	
							1882704	Shimadzu34	7/16/2019 12:13	99.2832	89.9823	0.36	0	0	0	0	0	0	0	0	0	0	0.00486	-8.22	10.019	0.16	0	0	0	0	0	0	0	
							1883133	Shimadzu34	7/16/2019 14:07	98.9958	89.9377	0.34	0	0	0	0	0	0	0	0	0	0	0.005	-1.56	10.0574	0.6	0	0	0	0	0	0	0	
							Reference Values				89.6309	0	0	0	0	0	0	0	0	0	0	0	0.0002	0.00508	9.997	2E-05	0	0.00009	0	0	0	0	0	



HYDRO-ENVIRONMENTAL TECHNOLOGY, INC.
 Environmental Consultants
 P.O. Box 60295
 Lafayette, LA 70596-0295
 Phone (337) 261-1963 FAX (337) 261-1953

SAMPLE CHAIN-OF-CUSTODY RECORD

Project Name: Indigo Laboratory: Isotech
 Project Number: 8060.00 Collected By: LV
 Project Location: DeSoto Parish, Louisiana Company: Hydro-Environmental Technology, Inc.
 Date: 6/25/2019

Sample I.D.	Type	Date/Time Sampled		Containers	Analysis Requested/Method	Comments
031-9843Z (Paul Davis Water Well)	AQ	6/25/2019	9:20	(1) Isoflask (1) 250mL Plastic	Dissolved Gases DG-2 Hydrogen (2H/1H), Oxygen-18O/16O	

Note: Report concentrations of all fixed gases & where possible both mol ratios & concentrations of all gases.
 For the DG2 analyses, please include δD for C2 and C3 gases.

Relinquished By: <i>[Signature]</i>	Received By: Abby L. Skube / Isotech Laboratories
Date/Time: <i>6/27/19 1400</i>	Date/Time: JUN 28 2019 0855
Relinquished By:	Received By:
Date/Time:	Date/Time:
Analysis Due: Verbal:	Written: