



Nicholson GeoSolutions LLC

3433 East Lake Drive
Centennial, CO 80121

June 21, 2017

Mr. Terry Pape
HRM Resources II, LLC
410 17th Street, Suite 1600
Denver, CO 80202

**Subject: Landfarm Sampling Results for the Anderson No. 1 Lease,
COGCC Remediation #9050**

Dear Terry:

Nicholson GeoSolutions LLC was retained by HRM Resources II LLC (HRM) to conduct soil sampling of the landfarm on the Anderson No. 1 lease, Washington County, Colorado. Sampling of the landfarm was conducted at the required rate of approximately one sample per 100 yards of material on May 31st, 2017. The landfarm was previously sampled on October 18th, 2015, May 25th, 2016, and October 29th, 2016.

GPS mapping showed that the landfarm covers about 0.09 acres and contains an estimated 500 yards of material. A total of 5 discrete soil samples were collected at depths of approximately 12-16 inches. These samples were collected from approximately the same locations as those previously collected. The extent of the landfarm cell and the locations of the samples are shown on Figure 1.

All samples were analyzed for Total Volatile Petroleum Hydrocarbons (TVPH – gasoline range), Total Extractable Petroleum Hydrocarbons (TEPH – diesel and motor oil range) and BTEX (benzene, toluene, ethylbenzene, and xylenes) to evaluate compliance with the COGCC Table 910-1 standards and further treatment needs. SAR, pH, and conductivity were previously analyzed in October 2016 for the landfarm samples from this site. Conductivity was below the standard for all samples. SAR exceeded the standard for 4 of 5 samples and pH exceeded the standard for 3 of the 5 samples.

Table 1 provides a summary of the analytical results for the samples. The laboratory report is contained in Appendix A. For the May 2017 sampling event, the sum of the concentrations of gasoline, diesel, and motor oil range petroleum hydrocarbons (total petroleum hydrocarbons [TPH]) exceeded the COGCC standard of 500 mg/kg for three of the five samples and ranged from 112.5 mg/kg to 3,090 mg/kg.

Table 1 Anderson No. 1 Landfarm Sample Results – May 31, 2017

	Table 910-1 Standards	Anderson LF-1	Anderson LF-2	Anderson LF-3	Anderson LF-4	Anderson LF-5
TVPH – gasoline range	500 ¹	<0.1	<0.1	<0.1	0.151	32.2
TEPH – diesel/motor oil range		409	112.5	735	3,090	691
benzene	0.17	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
toluene	85	<0.005	<0.005	<0.005	<0.005	<0.005
ethylbenzene	100	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
xylenes	175	<0.0015	<0.0015	<0.0015	<0.0015	0.213

¹The standard is 500 for the combined total of TVPH and TEPH All units in mg/kg
Values in bold type exceed standards

Table 2 provides the TPH results for the October 18th, 2015 and May 31st, 2017 samples and the percent difference between the two samples at each sample location. TPH ranged from 368 mg/kg to 9,010 mg/kg for the October 2015 samples and from 112.5 mg/kg to 3,090 mg/kg for the May 2017 samples. The TPH concentration was lower for the October 2016 samples at four of the five sample locations and higher at the remaining location.

Table 2 Comparison of TPH Results, October 18, 2015 and May 31, 2017

Sample Location	TPH (mg/kg) October 18, 2015	TPH (mg/kg) May 31, 2017	%Difference
Anderson-LF-1	7,525	409	-94.6
Anderson-LF-2	368	112.5	-69.4
Anderson-LF-3	1,652	735	-55.5
Anderson-LF-4	1,925	3,090	60.5
Anderson-LF-5	9,010	723.2	-92.0

Table 3 provides summary statistics for the two sampling events. The average TPH concentration for the five samples decreased from 4,096 mg/kg to 1,014 mg/kg between October 18th, 2015 and May 31st, 2017. The median concentration decreased from 1,925 mg/kg to 723 mg/kg. Using the results provided above in Table 2, the average TPH decrease for the overall landfarm was -75.2%.

Table 3 Summary Statistics for the October 2015 and May 2017 Samples

Sample Date	Minimum	Maximum	Average	Median	Average % Difference
Oct 18, 2015	368	9,010	4,096	1,925	
May 31, 2017	133	3,090	1,014	723	-75.2

Using the difference between the average TPH concentrations of 3,082 mg/kg, and the time period of 591 days, a biodegradation rate of 5.21 mg/kg-day is obtained. Using these data, and assuming a linear rate of decay, about 509 days of treatment remain to reach the standard of 500 mg/kg. The actual time required to reach the standard may be more than estimated if the decay is not linear.

Based on the analytical results, bioremediation of the TPH contained in the soils in the landfarm cells at the Anderson No. 1 lease is occurring but the results so far are erratic. Tilling of the landfarm was performed on March 14th and April 25th during 2017. In addition, a nitrogen fertilizer was added during the April 2017 tilling. Additional treatment of the landfarm cells including tilling and the addition of water during dry periods will be conducted prior to the next sampling event in October 2017.

Nicholson GeoSolutions LLC

A handwritten signature in blue ink that reads "DK Nicholson". The signature is written in a cursive, flowing style.

David K. Nicholson, P.G.
Principal Geologist



GeoSolutions
NICHOLSON



HRM Resources, LLC

Anderson No. 1
Landfarm
Sampling

Figure 1
November
2015

APPENDIX A
Laboratory Report

HRM Resources, LLC - Denver, CO

Sample Delivery Group: L913041
Samples Received: 06/01/2017
Project Number:
Description: HRM Landfarm sampling

Report To: Dave Nicholson
410 17th St., Ste. 1600
Denver, CO 80202

Entire Report Reviewed By:



Mark W. Beasley
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.



Cp: Cover Page	1	
Tc: Table of Contents	2	
Ss: Sample Summary	3	
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Sr: Sample Results	5	
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Qc: Quality Control Summary	10	
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Gl: Glossary of Terms	12	
Al: Accreditations & Locations	13	
Sc: Chain of Custody	14	

SAMPLE SUMMARY



ANDERSON-LF-1 L913041-01 Solid

Collected by
Collected date/time
Received date/time

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG986439	1	06/04/17 18:25	06/08/17 00:34	LRL
Semi-Volatile Organic Compounds (GC) by Method 8015	WG986134	1	06/07/17 07:13	06/08/17 05:13	ACM

1
Cp

2
Tc

3
Ss

ANDERSON-LF-2 L913041-02 Solid

Collected by
Collected date/time
Received date/time

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG986439	1	06/04/17 18:25	06/08/17 00:57	LRL
Semi-Volatile Organic Compounds (GC) by Method 8015	WG986134	1	06/07/17 07:13	06/08/17 04:57	ACM

4
Cn

5
Sr

6
Qc

ANDERSON-LF-3 L913041-03 Solid

Collected by
Collected date/time
Received date/time

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG986439	1	06/04/17 18:25	06/08/17 01:19	LRL
Semi-Volatile Organic Compounds (GC) by Method 8015	WG986134	10	06/07/17 07:13	06/08/17 05:45	ACM

7
Gl

8
Al

9
Sc

ANDERSON-LF-4 L913041-04 Solid

Collected by
Collected date/time
Received date/time

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG986439	1	06/04/17 18:25	06/08/17 01:41	LRL
Semi-Volatile Organic Compounds (GC) by Method 8015	WG986134	10	06/07/17 07:13	06/08/17 06:02	ACM

ANDERSON-LF-5 L913041-05 Solid

Collected by
Collected date/time
Received date/time

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG986439	50	06/04/17 18:25	06/09/17 07:15	JAH
Semi-Volatile Organic Compounds (GC) by Method 8015	WG986134	10	06/07/17 07:13	06/08/17 05:29	ACM



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Mark W. Beasley
Technical Service Representative

- ¹ Cp
- ² Tc
- ³ Ss
- ⁴ Cn
- ⁵ Sr
- ⁶ Qc
- ⁷ Gl
- ⁸ Al
- ⁹ Sc



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	ND		0.000500	1	06/08/2017 00:34	WG986439
Toluene	ND		0.00500	1	06/08/2017 00:34	WG986439
Ethylbenzene	ND		0.000500	1	06/08/2017 00:34	WG986439
Total Xylene	ND		0.00150	1	06/08/2017 00:34	WG986439
TPH (GC/FID) Low Fraction	ND		0.100	1	06/08/2017 00:34	WG986439
<i>(S) a,a,a-Trifluorotoluene(FID)</i>	91.3		77.0-120		06/08/2017 00:34	WG986439
<i>(S) a,a,a-Trifluorotoluene(PID)</i>	96.4		75.0-128		06/08/2017 00:34	WG986439

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
C10-C28 Diesel Range	241		4.00	1	06/08/2017 05:13	WG986134
C28-C40 Oil Range	168		4.00	1	06/08/2017 05:13	WG986134
<i>(S) o-Terphenyl</i>	57.3		18.0-148		06/08/2017 05:13	WG986134



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	ND		0.000500	1	06/08/2017 00:57	WG986439
Toluene	ND		0.00500	1	06/08/2017 00:57	WG986439
Ethylbenzene	ND		0.000500	1	06/08/2017 00:57	WG986439
Total Xylene	ND		0.00150	1	06/08/2017 00:57	WG986439
TPH (GC/FID) Low Fraction	ND		0.100	1	06/08/2017 00:57	WG986439
<i>(S) a,a,a-Trifluorotoluene(FID)</i>	94.9		77.0-120		06/08/2017 00:57	WG986439
<i>(S) a,a,a-Trifluorotoluene(PID)</i>	99.9		75.0-128		06/08/2017 00:57	WG986439

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
C10-C28 Diesel Range	58.6		4.00	1	06/08/2017 04:57	WG986134
C28-C40 Oil Range	53.9		4.00	1	06/08/2017 04:57	WG986134
<i>(S) o-Terphenyl</i>	53.7		18.0-148		06/08/2017 04:57	WG986134



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	ND		0.000500	1	06/08/2017 01:19	WG986439
Toluene	ND		0.00500	1	06/08/2017 01:19	WG986439
Ethylbenzene	ND		0.000500	1	06/08/2017 01:19	WG986439
Total Xylene	ND		0.00150	1	06/08/2017 01:19	WG986439
TPH (GC/FID) Low Fraction	ND		0.100	1	06/08/2017 01:19	WG986439
(S) a,a,a-Trifluorotoluene(FID)	92.0		77.0-120		06/08/2017 01:19	WG986439
(S) a,a,a-Trifluorotoluene(PID)	96.9		75.0-128		06/08/2017 01:19	WG986439

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
C10-C28 Diesel Range	334		40.0	10	06/08/2017 05:45	WG986134
C28-C40 Oil Range	401		40.0	10	06/08/2017 05:45	WG986134
(S) o-Terphenyl	82.8		18.0-148		06/08/2017 05:45	WG986134

6 Qc

7 Gl

8 Al

9 Sc



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	ND		0.000500	1	06/08/2017 01:41	WG986439
Toluene	ND		0.00500	1	06/08/2017 01:41	WG986439
Ethylbenzene	ND		0.000500	1	06/08/2017 01:41	WG986439
Total Xylene	ND		0.00150	1	06/08/2017 01:41	WG986439
TPH (GC/FID) Low Fraction	0.151		0.100	1	06/08/2017 01:41	WG986439
(S) a,a,a-Trifluorotoluene(FID)	88.1		77.0-120		06/08/2017 01:41	WG986439
(S) a,a,a-Trifluorotoluene(PID)	92.8		75.0-128		06/08/2017 01:41	WG986439

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Qc
- 7 Gl
- 8 Al
- 9 Sc

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
C10-C28 Diesel Range	1980		40.0	10	06/08/2017 06:02	WG986134
C28-C40 Oil Range	1110		40.0	10	06/08/2017 06:02	WG986134
(S) o-Terphenyl	59.3		18.0-148		06/08/2017 06:02	WG986134



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/kg		mg/kg		date / time	
Benzene	ND		0.0250	50	06/09/2017 07:15	WG986439
Toluene	ND		0.250	50	06/09/2017 07:15	WG986439
Ethylbenzene	ND		0.0250	50	06/09/2017 07:15	WG986439
Total Xylene	0.213		0.0750	50	06/09/2017 07:15	WG986439
TPH (GC/FID) Low Fraction	32.2		5.00	50	06/09/2017 07:15	WG986439
(S) a,a,a-Trifluorotoluene(FID)	99.3		77.0-120		06/09/2017 07:15	WG986439
(S) a,a,a-Trifluorotoluene(PID)	104		75.0-128		06/09/2017 07:15	WG986439

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

Sample Narrative:

8015/8021 L913041-05 WG986439: Nontarget compounds are too large to run at a lower dilution.

Semi-Volatile Organic Compounds (GC) by Method 8015

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/kg		mg/kg		date / time	
C10-C28 Diesel Range	388		40.0	10	06/08/2017 05:29	WG986134
C28-C40 Oil Range	303		40.0	10	06/08/2017 05:29	WG986134
(S) o-Terphenyl	60.5		18.0-148		06/08/2017 05:29	WG986134



Method Blank (MB)

(MB) R3223911-5 06/07/17 11:32

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Benzene	U		0.000120	0.000500
Toluene	U		0.000150	0.00500
Ethylbenzene	U		0.000110	0.000500
Total Xylene	U		0.000460	0.00150
TPH (GC/FID) Low Fraction	U		0.0217	0.100
(S) a,a,a-Trifluorotoluene(FID)	98.6			77.0-120
(S) a,a,a-Trifluorotoluene(PID)	103			75.0-128

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3223911-1 06/07/17 09:41 • (LCSD) R3223911-2 06/07/17 10:04

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	0.0500	0.0485	0.0485	96.9	96.9	71.0-121			0.000	20
Toluene	0.0500	0.0479	0.0475	95.7	95.1	72.0-120			0.710	20
Ethylbenzene	0.0500	0.0480	0.0482	96.0	96.4	76.0-121			0.330	20
Total Xylene	0.150	0.139	0.140	92.7	93.1	75.0-124			0.500	20
(S) a,a,a-Trifluorotoluene(FID)				97.8	98.2	77.0-120				
(S) a,a,a-Trifluorotoluene(PID)				102	102	75.0-128				

6 Qc

7 Gl

8 Al

9 Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3223911-3 06/07/17 10:26 • (LCSD) R3223911-4 06/07/17 10:48

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) Low Fraction	5.50	5.73	5.49	104	99.8	70.0-136			4.41	20
(S) a,a,a-Trifluorotoluene(FID)				108	107	77.0-120				
(S) a,a,a-Trifluorotoluene(PID)				116	115	75.0-128				



Method Blank (MB)

(MB) R3224032-1 06/07/17 14:40

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
C10-C28 Diesel Range	U		1.61	4.00
C28-C40 Oil Range	U		0.274	4.00
(S) o-Terphenyl	103			18.0-148

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3224032-2 06/07/17 14:58 • (LCSD) R3224032-3 06/07/17 15:17

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
C10-C28 Diesel Range	60.0	44.8	44.0	74.7	73.3	50.0-150			1.87	20
(S) o-Terphenyl				83.9	93.4	18.0-148				

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.

Qualifier Description

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

⁸ Al

⁹ Sc



ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE**.
 * Not all certifications held by the laboratory are applicable to the results reported in the attached report.

State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Connecticut	PH-0197	North Carolina ¹	DW21704
Florida	E87487	North Carolina ²	41
Georgia	NELAP	North Dakota	R-140
Georgia ¹	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky ¹	90010	South Dakota	n/a
Kentucky ²	16	Tennessee ¹⁴	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC	100789
A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	S-67674
EPA–Crypto	TN00003		

¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ^{n/a} Accreditation not applicable

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



ESC LAB SCIENCES Cooler Receipt Form

Client: <u>HMR ESDCO</u>	SDG#	<u>9/13/17</u>	
Cooler Received/Opened On: <u>6/1/17</u>	Temperature:	<u>2.9</u>	
Received by : Reagan Johnson			
Signature: <u>Reagan Johnson</u>			
Receipt Check List	NP	Yes	No
COC Seal Present / Intact?	/		
COC Signed / Accurate?		/	
Bottles arrive intact?		/	
Correct bottles used?		/	
Sufficient volume sent?		/	
If Applicable			
VOA Zero headspace?			
Preservation Correct / Checked?			