



Nicholson GeoSolutions LLC

3433 East Lake Drive
Centennial, CO 80121

June 21, 2017

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

**Subject: Cowles “P” Landfarm Sampling Results
COGCC Remediation #9053**

Dear Terry:

Nicholson GeoSolutions LLC was retained by HRM Resources II LLC (HRM) to conduct soil sampling of the landfarm on the Cowles “P” 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 16th, 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 0.10 acres and contains an estimated 250 yards of material. A total of 3 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. All pH, SAR, and conductivity results were below the standards.

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 all three samples and ranged from 716.2 mg/kg to 9,103 mg/kg.

Table 1 Cowles No. 1 Landfarm Sample Results – May 16, 2017

	Table 910-1 Standards	Cowles LF-1	Cowles LF-2	Cowles LF-3
TVPH – gasoline range	500 ¹	0.174	273	0.233
TEPH – diesel/motor oil range		716	8,830	643
benzene	0.17	0.00214	<0.0005	0.000801
toluene	85	<0.005	<0.005	<0.005
ethylbenzene	100	<0.0005	<0.0005	<0.0005
xylenes	175	<0.0015	0.931	<0.0015

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 16th, 2017 samples and the percent difference between the two samples at each sample location. TPH ranged from 3,831 mg/kg to 43,600 mg/kg for the October 2015 samples and from 716.2 mg/kg to 9,103 mg/kg for the May 2017 samples. The TPH concentration was lower for the May 2017 samples at two sample locations and higher at the remaining location. This landfarm was recently reconstructed which may account for the erratic results.

Table 2 Comparison of TPH Results, October 18, 2015 and May 16, 2017

Sample Location	TPH (mg/kg) October 18, 2015	TPH (mg/kg) May 16, 2017	%Difference
Cowles-LF-1	7,316	716.2	-90.2
Cowles-LF-2	3,831	9,103	137.6
Cowles-LF-3	43,600	643.2	-98.5

Table 3 provides summary statistics for the two sampling events. The average TPH concentration for the three samples dropped from 18,249 mg/kg to 3,487 mg/kg between October 18th, 2015 and May 16th, 2017. The median concentration dropped from 7,316 mg/kg to 716 mg/kg. Using the results provided above in Table 2, the average %TPH reduction for the overall landfarm was -80.9%.

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

Sample Date	Minimum	Maximum	Average	Median	Average % Difference
Oct 18, 2015	3,831	43,600	18,249	7,316	
May 16, 2017	643.2	9,103	3,487	716	-80.9

Using the difference between the average TPH concentrations of 14,762 mg/kg, and the time period of 576 days, a biodegradation rate of 25.6 mg/kg-day is obtained. Using these data, and assuming a linear rate of decay, approximately 117 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 Cowles "P" lease is occurring. 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



	<p>Legend</p> <ul style="list-style-type: none"> Landfarm Sample Landfarm Cell (0.10 ac) 		<p>HRM Resources, LLC</p>	
	<p>0 25 50 Feet 1" = 50'</p>		<p>Cowles "P" Landfarm Sampling</p>	<p>Figure 1 November 2015</p>

APPENDIX A
Laboratory Report

May 30, 2017

HRM Resources, LLC - Denver, CO

Sample Delivery Group: L910024
Samples Received: 05/17/2017
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	¹Cp
Tc: Table of Contents	2	²Tc
Ss: Sample Summary	3	³Ss
Cn: Case Narrative	4	⁴Cn
Sr: Sample Results	5	⁵Sr
COWLES-LF-1 L910024-01	5	⁶Qc
COWLES-LF-2 L910024-02	6	⁷Gl
COWLES-LF-3 L910024-03	7	⁸Al
Qc: Quality Control Summary	8	⁹Sc
Volatile Organic Compounds (GC) by Method 8015/8021	8	
Semi-Volatile Organic Compounds (GC) by Method 8015	10	
Gl: Glossary of Terms	11	
Al: Accreditations & Locations	12	
Sc: Chain of Custody	13	

SAMPLE SUMMARY



COWLES-LF-1 L910024-01 Solid

Collected by
D. Nicholson
Collected date/time
05/16/17 11:40
Received date/time
05/17/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG982188	1	05/22/17 12:49	05/23/17 06:11	BMB
Semi-Volatile Organic Compounds (GC) by Method 8015	WG981861	10	05/23/17 12:32	05/24/17 01:00	LM

1
Cp

2
Tc

3
Ss

COWLES-LF-2 L910024-02 Solid

Collected by
D. Nicholson
Collected date/time
05/16/17 11:45
Received date/time
05/17/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG982188	100	05/22/17 12:49	05/26/17 08:28	LRL
Semi-Volatile Organic Compounds (GC) by Method 8015	WG981861	40	05/23/17 12:32	05/24/17 04:10	LM

4
Cn

5
Sr

6
Qc

COWLES-LF-3 L910024-03 Solid

Collected by
D. Nicholson
Collected date/time
05/16/17 11:50
Received date/time
05/17/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG982188	1	05/22/17 12:49	05/26/17 08:52	LRL
Semi-Volatile Organic Compounds (GC) by Method 8015	WG981861	5	05/23/17 12:32	05/24/17 01:14	LM

7
Gl

8
Al

9
Sc



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	Qualifier	RDL	Dilution	Analysis	Batch
	mg/kg		mg/kg		date / time	
Benzene	0.00214		0.000500	1	05/23/2017 06:11	WG982188
Toluene	ND		0.00500	1	05/23/2017 06:11	WG982188
Ethylbenzene	ND		0.000500	1	05/23/2017 06:11	WG982188
Total Xylene	ND	<u>J6</u>	0.00150	1	05/23/2017 06:11	WG982188
TPH (GC/FID) Low Fraction	0.174	<u>B</u>	0.100	1	05/23/2017 06:11	WG982188
(S) a,a,a-Trifluorotoluene(FID)	75.3	<u>J2</u>	77.0-120		05/23/2017 06:11	WG982188
(S) a,a,a-Trifluorotoluene(PID)	78.3		75.0-128		05/23/2017 06:11	WG982188

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

Sample Narrative:

8015/8021 L910024-01 WG982188: Previous run also had low IS/SURR recovery. Matrix effect.

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	559		40.0	10	05/24/2017 01:00	WG981861
C28-C40 Oil Range	157		40.0	10	05/24/2017 01:00	WG981861
(S) o-Terphenyl	93.2		18.0-148		05/24/2017 01:00	WG981861



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	ND		0.0500	100	05/26/2017 08:28	WG982188
Toluene	ND		0.500	100	05/26/2017 08:28	WG982188
Ethylbenzene	ND		0.0500	100	05/26/2017 08:28	WG982188
Total Xylene	0.931		0.150	100	05/26/2017 08:28	WG982188
TPH (GC/FID) Low Fraction	273		10.0	100	05/26/2017 08:28	WG982188
<i>(S) a,a,a-Trifluorotoluene(FID)</i>	108		77.0-120		05/26/2017 08:28	WG982188
<i>(S) a,a,a-Trifluorotoluene(PID)</i>	113		75.0-128		05/26/2017 08:28	WG982188

- 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	7750		160	40	05/24/2017 04:10	WG981861
C28-C40 Oil Range	1080		160	40	05/24/2017 04:10	WG981861
<i>(S) o-Terphenyl</i>	10.4	<u>J7</u>	18.0-148		05/24/2017 04:10	WG981861



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	0.000801		0.000500	1	05/26/2017 08:52	WG982188
Toluene	ND		0.00500	1	05/26/2017 08:52	WG982188
Ethylbenzene	ND		0.000500	1	05/26/2017 08:52	WG982188
Total Xylene	ND		0.00150	1	05/26/2017 08:52	WG982188
TPH (GC/FID) Low Fraction	0.233	<u>B</u>	0.100	1	05/26/2017 08:52	WG982188
(S) a,a,a-Trifluorotoluene(FID)	66.1	<u>J2</u>	77.0-120		05/26/2017 08:52	WG982188
(S) a,a,a-Trifluorotoluene(PID)	68.8	<u>J2</u>	75.0-128		05/26/2017 08:52	WG982188

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	491		20.0	5	05/24/2017 01:14	WG981861
C28-C40 Oil Range	152		20.0	5	05/24/2017 01:14	WG981861
(S) o-Terphenyl	106		18.0-148		05/24/2017 01:14	WG981861

6 Qc

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3221026-5 05/23/17 00:50

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/kg		mg/kg	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	0.0277	J	0.0217	0.100
(S) a,a,a-Trifluorotoluene(FID)	98.5			77.0-120
(S) a,a,a-Trifluorotoluene(PID)	95.7			75.0-128

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

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

(LCS) R3221026-1 05/22/17 22:55 • (LCSD) R3221026-2 05/22/17 23:18

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	%	%	%			%	%
Benzene	0.0500	0.0471	0.0477	94.1	95.3	71.0-121			1.28	20
Toluene	0.0500	0.0476	0.0481	95.2	96.3	72.0-120			1.18	20
Ethylbenzene	0.0500	0.0494	0.0500	98.7	100	76.0-121			1.27	20
Total Xylene	0.150	0.147	0.149	98.2	99.5	75.0-124			1.28	20
(S) a,a,a-Trifluorotoluene(FID)				97.1	97.1	77.0-120				
(S) a,a,a-Trifluorotoluene(PID)				101	101	75.0-128				

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

(LCS) R3221026-3 05/22/17 23:41 • (LCSD) R3221026-4 05/23/17 00:04

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	%	%	%			%	%
TPH (GC/FID) Low Fraction	5.50	6.08	6.38	111	116	70.0-136			4.90	20
(S) a,a,a-Trifluorotoluene(FID)				104	105	77.0-120				
(S) a,a,a-Trifluorotoluene(PID)				99.2	99.2	75.0-128				

L910024-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L910024-01 05/23/17 06:11 • (MS) R3221026-6 05/23/17 01:36 • (MSD) R3221026-7 05/23/17 01:59

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	mg/kg	%	%		%			%	%
Benzene	0.0500	0.00214	0.0312	0.0411	58.1	78.0	1	10.0-146			27.5	29
Toluene	0.0500	ND	0.0221	0.0252	42.4	48.5	1	10.0-143			12.9	30
Ethylbenzene	0.0500	ND	0.0148	0.0134	28.9	26.0	1	10.0-147			10.2	31
Total Xylene	0.150	ND	0.0408	0.0360	26.7	23.5	1	10.0-149	J6	J6	12.5	30
(S) a,a,a-Trifluorotoluene(FID)					73.6	64.7		77.0-120	J2	J2		



L910024-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L910024-01 05/23/17 06:11 • (MS) R3221026-6 05/23/17 01:36 • (MSD) R3221026-7 05/23/17 01:59

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
(S) a,a,a-Trifluorotoluene(PID)					76.2	67.4		75.0-128		<u>J2</u>		

L910024-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L910024-01 05/23/17 06:11 • (MS) R3221026-8 05/23/17 02:22 • (MSD) R3221026-9 05/23/17 02:45

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) Low Fraction	5.50	0.174	1.56	1.51	25.2	24.3	1	10.0-147			3.12	30
(S) a,a,a-Trifluorotoluene(FID)					63.3	64.5		77.0-120	<u>J2</u>	<u>J2</u>		
(S) a,a,a-Trifluorotoluene(PID)					63.2	64.6		75.0-128	<u>J2</u>	<u>J2</u>		

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Method Blank (MB)

(MB) R3220516-1 05/23/17 23:20

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/kg		mg/kg	mg/kg
C10-C28 Diesel Range	U		1.61	4.00
C28-C40 Oil Range	U		0.274	4.00
<i>(S) o-Terphenyl</i>	87.6			18.0-148

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

(LCS) R3220516-2 05/23/17 23:32 • (LCSD) R3220516-3 05/23/17 23:45

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/kg	mg/kg	mg/kg	%	%	%			%	%
C10-C28 Diesel Range	60.0	38.3	43.6	63.9	72.7	50.0-150			12.9	20
<i>(S) o-Terphenyl</i>				78.6	98.6	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.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(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
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.

- 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		

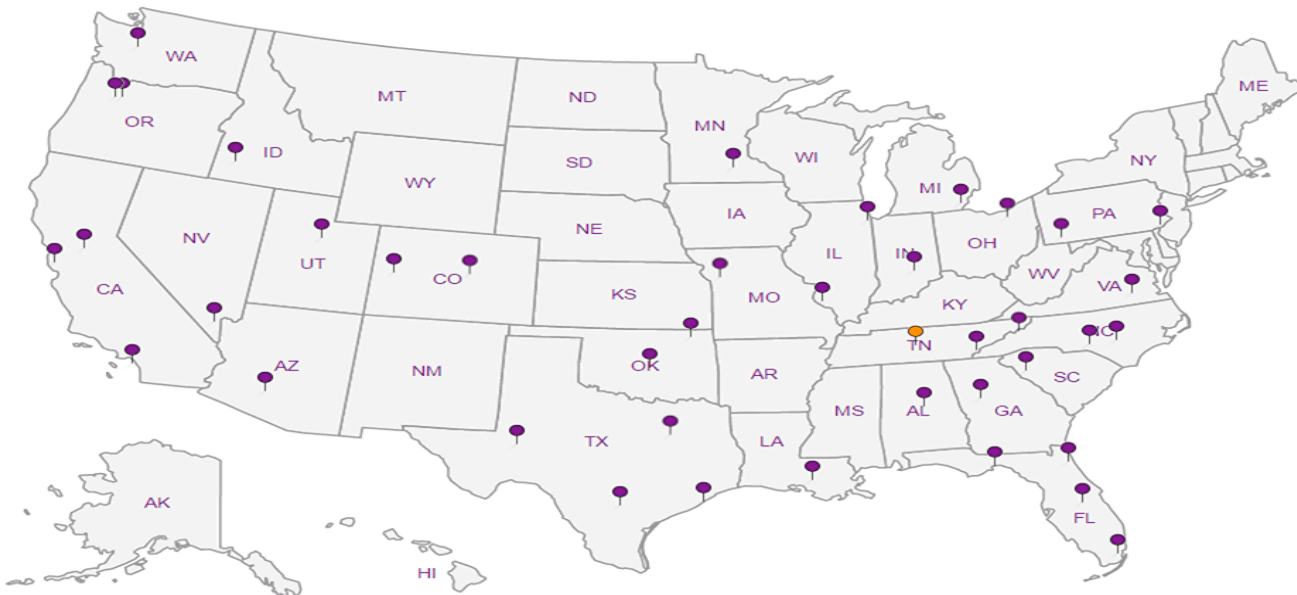
Third Party & Federal Accreditations

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>HRMRES DCO</u>	SDG# <u>1910024</u>		
Cooler Received/Opened On: <u>5/ 17 /17</u>	Temperature: <u>3.1</u>		
Received by : <u>Jon Deboard</u>			
Signature: <u>[Signature]</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?			