



Nicholson GeoSolutions LLC

3433 East Lake Drive
Centennial, CO 80121

November 6, 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 October 23rd, 2017. The landfarm was previously sampled on October 18th, 2015, May 25th, 2016, October 29th, 2016 and May 16th, 2017.

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.

Table 1 provides a summary of the analytical results for the samples. The laboratory report is contained in Appendix A. For the October 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 1,542.113 mg/kg to 3,510 mg/kg.

Table 1 Cowles No. 1 Landfarm Sample Results – October 23, 2017

	Table 910-1 Standards	Cowles LF-1	Cowles LF-2	Cowles LF-3
TVPH – gasoline range	500 ¹	<0.1	<0.1	0.113
TEPH – diesel/motor oil range		3,510	1,611	1,542
benzene	0.17	0.00056	0.0008	0.000707
toluene	85	<0.005	<0.005	<0.005
ethylbenzene	100	<0.0005	<0.0005	<0.0005
xylenes	175	<0.0015	<0.0015	<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 October 23rd, 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 1,542 mg/kg to 3,510 mg/kg for the October 2017 samples. The TPH concentration was lower for the October 2017 samples at all three sample locations.

Table 2 Comparison of TPH Results, October 18, 2015 and October 23, 2017

Sample Location	TPH (mg/kg) October 18, 2015	TPH (mg/kg) October 23, 2017	%Difference
Cowles-LF-1	7,316	3,510	-52.0
Cowles-LF-2	3,831	1,611	-57.9
Cowles-LF-3	43,600	1,542	-96.5

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 2,221 mg/kg between October 18th, 2015 and October 23rd, 2017. The median concentration dropped from 7,316 mg/kg to 1,611 mg/kg. Using the results provided above in Table 2, the average %TPH reduction for the overall landfarm was -87.8%.

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

Sample Date	Minimum	Maximum	Average	Median	Average % Difference
Oct 18, 2015	3,831	43,600	18,249	7,316	
Oct 23, 2017	1,542	3,510	2,221	1,611	-87.8

Using the difference between the average TPH concentrations of 16,028 mg/kg, and the time period of 736 days, a biodegradation rate of 21.78 mg/kg-day is obtained. Using these data, and assuming a linear rate of decay, approximately 79 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, April 25th, and September 30th 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 should be conducted prior to the next sampling event in May 2018.

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

November 03, 2017

HRM Resources, LLC - Denver, CO

Sample Delivery Group: L946582
Samples Received: 10/26/2017
Project Number:
Description: Cowles

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	
Ss: Sample Summary	3	²Tc
Cn: Case Narrative	4	
Sr: Sample Results	5	³Ss
COWLES-LF-1 L946582-01	5	
COWLES-LF-2 L946582-02	6	⁴Cn
COWLES-LF-3 L946582-03	7	⁵Sr
Qc: Quality Control Summary	8	
Volatile Organic Compounds (GC) by Method 8015/8021	8	⁶Qc
Semi-Volatile Organic Compounds (GC) by Method 8015	9	
Gl: Glossary of Terms	10	⁷Gl
Al: Accreditations & Locations	11	⁸Al
Sc: Sample Chain of Custody	12	⁹Sc

SAMPLE SUMMARY



COWLES-LF-1 L946582-01 Solid

Collected by
DK Nicholson Collected date/time
10/23/17 11:40 Received date/time
10/26/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG1036397	1	10/27/17 10:22	10/28/17 06:10	ACE
Semi-Volatile Organic Compounds (GC) by Method 8015	WG1037653	20	11/01/17 11:50	11/02/17 02:16	ACM

1
Cp

2
Tc

3
Ss

COWLES-LF-2 L946582-02 Solid

Collected by
DK Nicholson Collected date/time
10/23/17 11:45 Received date/time
10/26/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG1036397	1	10/27/17 10:22	10/28/17 06:33	ACE
Semi-Volatile Organic Compounds (GC) by Method 8015	WG1037653	20	11/01/17 11:50	11/02/17 02:33	ACM

4
Cn

5
Sr

6
Qc

COWLES-LF-3 L946582-03 Solid

Collected by
DK Nicholson Collected date/time
10/23/17 11:50 Received date/time
10/26/17 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Volatile Organic Compounds (GC) by Method 8015/8021	WG1036397	1	10/27/17 10:22	10/28/17 06:55	ACE
Semi-Volatile Organic Compounds (GC) by Method 8015	WG1037653	20	11/01/17 11:50	11/02/17 02:50	ACM

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 radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. 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	0.000560	<u>B</u>	0.000500	1	10/28/2017 06:10	WG1036397
Toluene	ND		0.00500	1	10/28/2017 06:10	WG1036397
Ethylbenzene	ND		0.000500	1	10/28/2017 06:10	WG1036397
Total Xylene	ND		0.00150	1	10/28/2017 06:10	WG1036397
TPH (GC/FID) Low Fraction	ND		0.100	1	10/28/2017 06:10	WG1036397
<i>(S) a,a,a-Trifluorotoluene(FID)</i>	84.0		77.0-120		10/28/2017 06:10	WG1036397
<i>(S) a,a,a-Trifluorotoluene(PID)</i>	91.1		75.0-128		10/28/2017 06:10	WG1036397

- 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	1850	<u>J3</u>	80.0	20	11/02/2017 02:16	WG1037653
C28-C40 Oil Range	1660		80.0	20	11/02/2017 02:16	WG1037653
<i>(S) o-Terphenyl</i>	0.000	<u>J7</u>	18.0-148		11/02/2017 02:16	WG1037653



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	0.000800	<u>B</u>	0.000500	1	10/28/2017 06:33	WG1036397
Toluene	ND		0.00500	1	10/28/2017 06:33	WG1036397
Ethylbenzene	ND		0.000500	1	10/28/2017 06:33	WG1036397
Total Xylene	ND		0.00150	1	10/28/2017 06:33	WG1036397
TPH (GC/FID) Low Fraction	ND		0.100	1	10/28/2017 06:33	WG1036397
<i>(S) a,a,a-Trifluorotoluene(FID)</i>	83.5		77.0-120		10/28/2017 06:33	WG1036397
<i>(S) a,a,a-Trifluorotoluene(PID)</i>	90.7		75.0-128		10/28/2017 06:33	WG1036397

- 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	864	<u>J3</u>	80.0	20	11/02/2017 02:33	WG1037653
C28-C40 Oil Range	747		80.0	20	11/02/2017 02:33	WG1037653
<i>(S) o-Terphenyl</i>	0.000	<u>J7</u>	18.0-148		11/02/2017 02:33	WG1037653



Volatile Organic Compounds (GC) by Method 8015/8021

Analyte	Result mg/kg	Qualifier	RDL mg/kg	Dilution	Analysis date / time	Batch
Benzene	0.000707	<u>B</u>	0.000500	1	10/28/2017 06:55	WG1036397
Toluene	ND		0.00500	1	10/28/2017 06:55	WG1036397
Ethylbenzene	ND		0.000500	1	10/28/2017 06:55	WG1036397
Total Xylene	ND		0.00150	1	10/28/2017 06:55	WG1036397
TPH (GC/FID) Low Fraction	0.113		0.100	1	10/28/2017 06:55	WG1036397
<i>(S) a,a,a-Trifluorotoluene(FID)</i>	82.3		77.0-120		10/28/2017 06:55	WG1036397
<i>(S) a,a,a-Trifluorotoluene(PID)</i>	89.2		75.0-128		10/28/2017 06:55	WG1036397

- 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	910	<u>J3</u>	80.0	20	11/02/2017 02:50	WG1037653
C28-C40 Oil Range	632		80.0	20	11/02/2017 02:50	WG1037653
<i>(S) o-Terphenyl</i>	0.000	<u>J7</u>	18.0-148		11/02/2017 02:50	WG1037653



Method Blank (MB)

(MB) R3262262-5 10/28/17 01:42

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Benzene	0.000247	↓	0.000120	0.000500
Toluene	0.000872	↓	0.000150	0.00500
Ethylbenzene	0.000203	↓	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)	94.9			77.0-120
^(S) a,a,a-Trifluorotoluene(PID)	104			75.0-128

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

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

(LCS) R3262262-1 10/27/17 23:51 • (LCSD) R3262262-2 10/28/17 00:13

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	0.0446	0.0486	89.2	97.2	71.0-121			8.57	20
Toluene	0.0500	0.0468	0.0510	93.6	102	72.0-120			8.54	20
Ethylbenzene	0.0500	0.0450	0.0492	90.1	98.4	76.0-121			8.83	20
Total Xylene	0.150	0.127	0.139	84.4	92.4	75.0-124			9.05	20
^(S) a,a,a-Trifluorotoluene(FID)				93.3	93.0	77.0-120				
^(S) a,a,a-Trifluorotoluene(PID)				100	99.8	75.0-128				

7 Gl

8 Al

9 Sc

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

(LCS) R3262262-3 10/28/17 00:35 • (LCSD) R3262262-4 10/28/17 00:58

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	5.77	5.91	105	107	70.0-136			2.39	20
^(S) a,a,a-Trifluorotoluene(FID)				107	107	77.0-120				
^(S) a,a,a-Trifluorotoluene(PID)				115	114	75.0-128				



Method Blank (MB)

(MB) R3262411-1 11/02/17 00:34

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	0.985	J	0.274	4.00
(S) o-Terphenyl	50.5			18.0-148

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

(LCS) R3262411-2 11/02/17 00:51 • (LCSD) R3262411-3 11/02/17 01:08

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	59.0	37.6	98.3	62.6	50.0-150		J3	44.4	20
(S) o-Terphenyl				66.7	63.3	18.0-148				

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(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.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

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.
J3	The associated batch QC was outside the established quality control range for precision.
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		

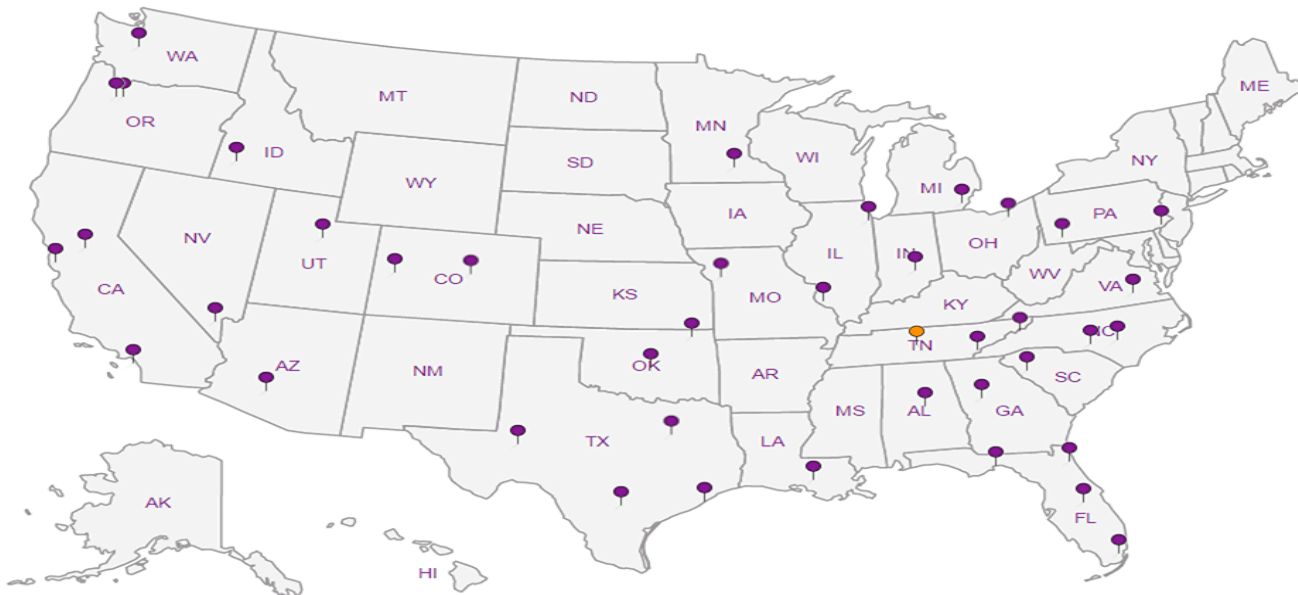
Third Party & Federal Accreditations

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:	HRMRESDCO	SDG#	L946582	
Cooler Received/Opened On:	10/26/17	Temperature:	2.3	
Received by : Christian Kacar				
Signature: <i>Christian Kacar</i>				
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?				