



MEMORANDUM

To: Antelope 1-17 Well File, API 05-123-09510

CC: Greg Deranleau, COGCC Environmental Manager
John Axelson, COGCC East Environmental Supervisor

From: Rick Allison, Environmental Protection Specialist

Subject: Antelope 1-17 Soil Impacts around well casing

Date: April 20, 2018

The Antelope 1-17 was spud on October 1, 1978, tested in the Sussex and Lyons, and abandoned November 4, 1978 as a dry hole. The location is in irrigated cropland and passed reclamation inspections in 1997 and 2005.

SRC Energy, Inc. (Operator #10311) conducted re-entry and plugging operations of the Antelope 1-17 well (05-123-09510) on March 12, 2018, in accordance with the COGCC DJ Basin Horizontal Offset Policy. Upon excavation of the well, SRC Energy discovered historical petroleum impacts to soil and notified COGCC Environmental Staff on March 27, 2018.

COGCC Environmental Staff conducted an inspection (Inspection #679700832) of the open excavation around the well, and conducted a desktop evaluation of the threat to groundwater. During the site inspection, COGCC observed petroleum hydrocarbon staining in the sidewalls and floor of the excavation around the well. The material was composed of very fine grained to fine grained weathered sandstone. The excavation was approximately 10 feet deep and no groundwater was encountered. COGCC collected a soil sample for laboratory analysis from the base of the excavation, which appeared to be equally or more impacted than the excavation sidewalls. COGCC delivered the soil sample to ALS Environmental in Fort Collins for analysis for total petroleum hydrocarbons - diesel range organics (TPH-GRO), total petroleum hydrocarbons - gasoline range organics (TPH-GRO), benzene, toluene, ethylbenzene and total xylenes (BTEX). BTEX compounds were not detected at concentrations above the laboratory reporting limit of 0.024 milligrams per kilogram. TPH-GRO were detected at 5.9 mg/kg, and TPH-DRO were detected at 600 mg/kg. The combined TPH concentration of 605.9 mg/kg exceeds the current Table 910-1 Concentration Level of 500 mg/kg; however, the concentration of TPH is below the required regulatory thresholds in effect prior to 2008.

Table 1 summarizes the water well records existing in the Division of Water Resources database within 1 mile of the Antelope 1-17 location. One water well permit is present within ½ mile of the location. Permit 206379-A was issued to replace an existing 70 foot water well approximately 600 feet west of the Antelope 1-17 location. The new water well

was drilled to 60 feet and was abandoned as a dry hole. Shale was encountered in the water well borehole at 16 feet below ground surface.

Additional water wells are present between ½ mile and 1 mile from the Antelope 1-17 location (Table 1). Shallow groundwater appears to be present at locations south and east from the Antelope 1-17 location. COGCC Remediation Projects 9752, and 9872, 11234 all provide evidence for a shallow water table at depths of 10-12 feet below ground surface, but these Remediation Project locations are also over ½ mile east and south from the Antelope 1-17 location.

The Antelope 1-17 location is present on a topographic high point with shallow bedrock present (as observed in the excavation). The location also lies between two paleovalleys that are present west and east of the Antelope 1-17 location and contain useable quantities of shallow groundwater (Robson et al, 2000). It appears that the Antelope 1-17 is located on a bedrock divide between these paleovalleys, where the unconfined water table at the Antelope 1-17 location is greater than 20 feet deep and beneath the surface of the bedrock.

No BTEX compounds were detected in the soil sample collected from the excavation. Groundwater is likely deeper than 20 feet below ground at the location. The concentrations of TPH detected in the soil sample comply with the COGCC Rules in effect at the time of abandonment and reclamation of the Antelope 1-17 well. Therefore, COGCC Environmental Staff recommends no action be taken for further remediation of the Antelope 1-17 location. However, if additional evidence is uncovered that indicates a significant threat or actual impacts to groundwater exist, COGCC may pursue the Operator of record for further investigation and remediation of the location.

Attachments

1. Table 1 Summary of Water Wells within 1 mile of Antelope 1-17 location
2. Topographic map of Antelope 1-17 with water well locations
3. ALS Environmental Laboratory Analytical Report

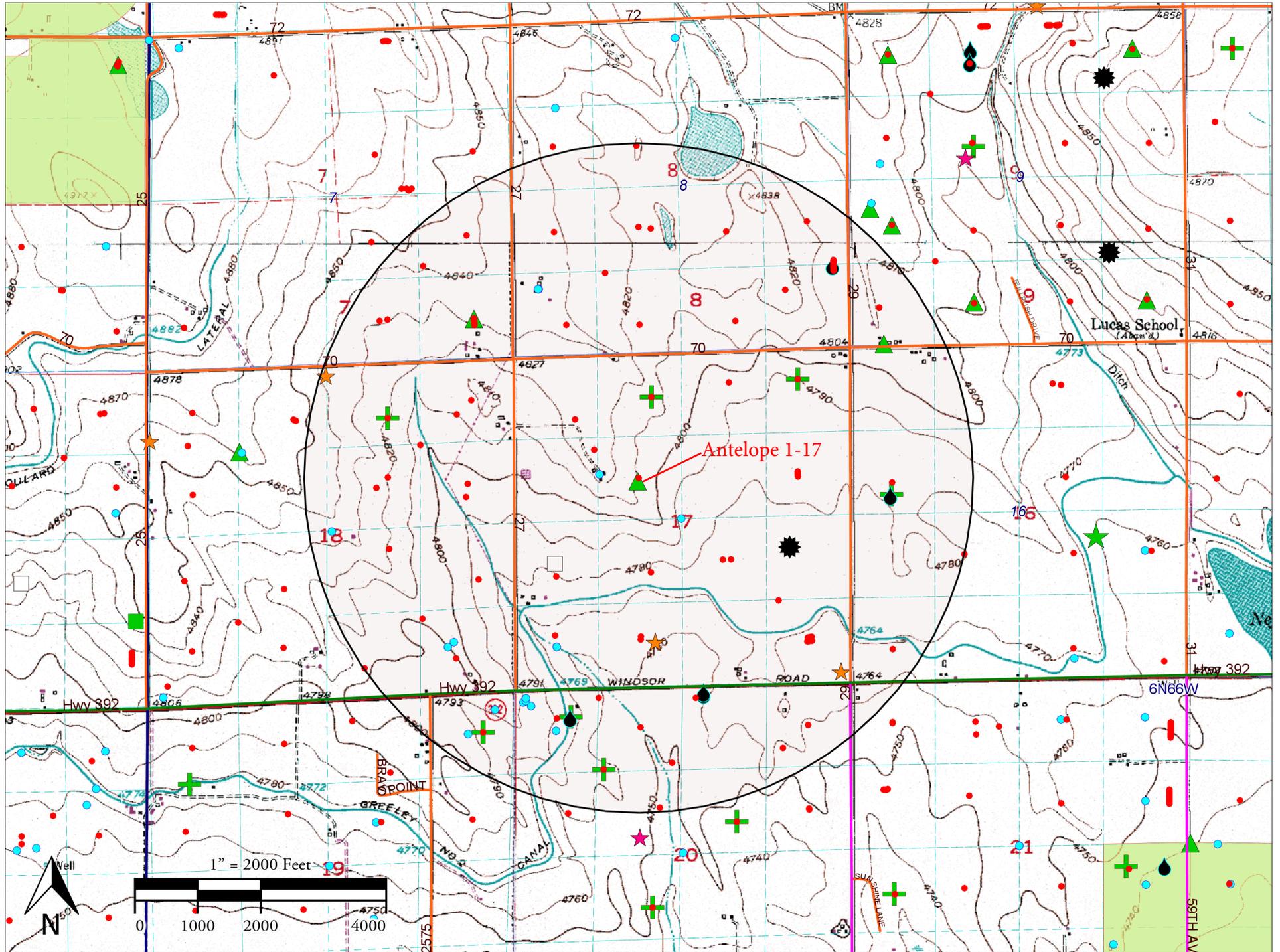
Reference

Robson, S.G., Arnold, L.R., and Heiny, J.S., 1987, Geohydrology of the shallow aquifers in the Greeley-Nunn area Colorado, U.S. Geological Survey Hydrologic Atlas 746-A, 5 plates., <https://pubs.er.usgs.gov/publication/ha746A>

TABLE 1 - WATER WELLS WITHIN 1 MILE OF ANTELOPE 1-17

WELL DESCRIPTION	LOCATION	WELL INFORMATION				COGCC REVIEW
		Depth	Top Perf	Bottom Perf	Aquifer	
WATER WELL PERMITS WITHIN 1/2 MILE OF ANTELOPE 1-17						
Receipt=0419937A, Permit=0206379-- HERGERT LAND & CATTLE CO	SENE 17 6 N-66W	70	0	0	GW	Original well, replaced by 206379-A
Receipt=0419937B, Permit=0206379--A HERGERT LAND & CATTLE CO	SWNW 17 6 N-66W	60	0	0	GW	Abandoned as dry hole
WATER WELL PERMITS WITHIN 1 MILE OF ANTELOPE 1-17						
Receipt=0508066, Permit=0206961--A HERGERT LAND & CATTLE CO	SWSW 8 6 N-66W	575	95	575	GW	3400 feet northwest
Receipt=0422867, Permit=0206961-- HERGERT LAND & CATTLE	SWSW 8 6 N-66W	150	0	0	GW	Replaced by 206961-A
Receipt=9062139, Permit=0015059-R- FRITZLER FARMS LLC	SESE 17 6 N-66W	28	0	0	GW	3500 feet southeast
Receipt=9064560, Permit=0047605-- BAILEY RAY W	NWNE 18 6 N-66W	60	0	0	GW	4520 feet northwest
Receipt=0485336, Permit=0238820-- ARMSTRONG CUSTOM DESIGNERS	SESE 18 6 N-66W	600	540	580	GW	3900 feet southwest
Receipt=3663532R, Permit=0000091-GX- KERR SCOTT	SESE 18 6 N-66W	300	0	0	GW	Geothermal well
Receipt=9059230, Permit=0004498-R- STANLEY ARTHUR E	NENE 19 6 N-66W	56	0	0	GW	4200 feet southwest
Receipt=0357546, Permit=0172400-- MORRIS GRANT L	NENE 19 6 N-66W	0	0	0	GW	4200 feet southwest
Receipt=0042493, Permit=0042493-MH- CONOCO PHILLIPS COMPANY	NWNW 20 6 N-66W	0	0	0	GW	Monitoring wells 3900 feet southwest
Receipt=0519377F, Permit=0254856-- CONOCO PHILLIPS CO	NWNW 20 6 N-66W	15	5	15	GW	Monitoring wells 3900 feet southwest
Receipt=0519377G, Permit=0254857-- CONOCO PHILLIPS CO	NWNW 20 6 N-66W	20	10	20	GW	Monitoring wells 3900 feet southwest
Receipt=0519377H, Permit=0254858-- CONOCO PHILLIPS CO	NWNW 20 6 N-66W	20	10	20	GW	Monitoring wells 3900 feet southwest
Receipt=0519377I, Permit=0254859-- CONOCO PHILLIPS CO	NWNW 20 6 N-66W	20	10	20	GW	Monitoring wells 3900 feet southwest

Topographic Map of Antelope 1-17 Location





Tuesday, April 10, 2018

Rick Allison
COGCC
1120 Lincoln St. #801
Denver, CO 80203

Re: ALS Workorder: 1803546
Project Name: Antelope 1-17
Project Number:

Dear Mr. Allison:

One soil sample was received from COGCC, on 3/29/2018. The sample was scheduled for the following analyses:

GC/MS Volatiles

Total Extractable Petroleum Hydrocarbons (Diesel)

The results for these analyses are contained in the enclosed reports.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Thank you for your confidence in ALS Environmental. Should you have any questions, please call.

Sincerely,

ALS Environmental
Katie M. OBrien
Project Manager

ALS Environmental – Fort Collins is accredited by the following accreditation bodies for various testing scopes in accordance with requirements of each accreditation body. All testing is performed under the laboratory management system, which is maintained to meet these requirement and regulations. Please contact the laboratory or accreditation body for the current scope testing parameters.

ALS Environmental – Fort Collins	
Accreditation Body	License or Certification Number
AIHA	214884
Alaska (AK)	UST-086
Alaska (AK)	CO01099
Arizona (AZ)	AZ0742
California (CA)	06251CA
Colorado (CO)	CO01099
Connecticut (CT)	PH-0232
Florida (FL)	E87914
Idaho (ID)	CO01099
Kansas (KS)	E-10381
Kentucky (KY)	90137
L-A-B (DoD ELAP/ISO 170250)	L2257
Louisiana (LA)	05057
Maryland (MD)	285
Missouri (MO)	175
Nebraska(NE)	NE-OS-24-13
Nevada (NV)	CO000782008A
New York (NY)	12036
North Dakota (ND)	R-057
Oklahoma (OK)	1301
Pennsylvania (PA)	68-03116
Tennessee (TN)	2976
Texas (TX)	T104704241
Utah (UT)	CO01099
Washington (WA)	C1280



1803546

GC/MS Volatiles:

The sample was analyzed using GC/MS following the current revision of SOP 525 based on SW-846 Method 8260C. The sample was also analyzed for Gasoline Range Organics (GRO).

All acceptance criteria were met.

DRO:

The sample was analyzed following the current revision of SOP 406 generally based on SW-846 Methods 8000C and 8015D. TEPH is a multicomponent mixture and is quantitated by summing the entire carbon range, rather than individual peaks. The carbon range integrated in this test extends from C10 to C28.

All acceptance criteria were met.

ALS -- Fort Collins

Sample Number(s) Cross-Reference Table

OrderNum: 1803546

Client Name: COGCC

Client Project Name: Antelope 1-17

Client Project Number:

Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
BASE	1803546-1		SOIL	28-Mar-18	8:40



ALS Environmental - Fort Collins
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: COGCC-3

Workorder No: 1503544

Project Manager: KMO

Initials: [Signature] Date: 3-29-18

1. Does this project require any special handling in addition to standard ALS procedures?			YES	<input checked="" type="radio"/> NO			
2. Are custody seals on shipping containers intact?		<input checked="" type="radio"/> NONE	YES	NO			
3. Are Custody seals on sample containers intact?		<input checked="" type="radio"/> NONE	YES	NO			
4. Is there a COC (Chain-of-Custody) present or other representative documents?			<input checked="" type="radio"/> YES	NO			
5. Are the COC and bottle labels complete and legible?			<input checked="" type="radio"/> YES	NO			
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)			<input checked="" type="radio"/> YES	NO			
7. Were airbills / shipping documents present and/or removable?		<input checked="" type="radio"/> DROP OFF	YES	NO			
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)		<input checked="" type="radio"/> N/A	YES	NO			
9. Are all aqueous non-preserved samples pH 4-9?		<input checked="" type="radio"/> N/A	YES	NO			
10. Is there sufficient sample for the requested analyses?			<input checked="" type="radio"/> YES	NO			
11. Were all samples placed in the proper containers for the requested analyses?			<input checked="" type="radio"/> YES	NO			
12. Are all samples within holding times for the requested analyses?			<input checked="" type="radio"/> YES	NO			
13. Were all sample containers received intact? (not broken or leaking, etc.)			<input checked="" type="radio"/> YES	NO			
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea		<input checked="" type="radio"/> N/A	YES	NO			
15. Do any water samples contain sediment? Amount of sediment: ___ dusting ___ moderate ___ heavy	Amount	<input checked="" type="radio"/> N/A	YES	NO			
16. Were the samples shipped on ice?			<input checked="" type="radio"/> YES	NO			
17. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*:	#1	<input checked="" type="radio"/> #3	#4	RAD ONLY	<input checked="" type="radio"/> YES	NO
Cooler #: <u>1</u>							
Temperature (°C): <u>2.5</u>							
No. of custody seals on cooler: <u>0</u>							
External µR/hr reading: <u>N/A</u>							
Background µR/hr reading: <u>9</u>							
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)							

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

If applicable, was the client contacted? YES / NO / NA Contact: _____ Date/Time: _____

Project Manager Signature / Date: [Signature] 3/30/18

Client: COGCC
 Project: Antelope 1-17
 Sample ID: BASE
 Legal Location:
 Collection Date: 3/28/2018 08:40

Date: 10-Apr-18
 Work Order: 1803546
 Lab ID: 1803546-1
 Matrix: SOIL
 Percent Moisture: 14.9

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
Diesel Range Organics			SW8015M		Prep Date: 4/5/2018	PrepBy: LML
Diesel Range Organics	600	LDMH	5.7	MG/KG	1	4/5/2018 22:03
Surr: O-TERPHENYL	65		49-114	%REC	1	4/5/2018 22:03
GC/MS Volatiles			SW8260		Prep Date: 3/29/2018	PrepBy: JJK
BENZENE	ND		24	UG/KG	1	3/29/2018 15:19
TOLUENE	ND		24	UG/KG	1	3/29/2018 15:19
ETHYLBENZENE	ND		24	UG/KG	1	3/29/2018 15:19
M+P-XYLENE	18	J	24	UG/KG	1	3/29/2018 15:19
O-XYLENE	ND		24	UG/KG	1	3/29/2018 15:19
Surr: DIBROMOFLUOROMETHANE	109		61-134	%REC	1	3/29/2018 15:19
Surr: TOLUENE-D8	103		57-135	%REC	1	3/29/2018 15:19
Surr: 4-BROMOFLUOROBENZENE	98		52-151	%REC	1	3/29/2018 15:19
GASOLINE RANGE ORGANICS	5900		2400	UG/KG	1	3/29/2018 15:19

Client: COGCC
Project: Antelope 1-17
Sample ID: BASE
Legal Location:
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Matrix: SOIL
Percent Moisture: 14.9

Analyses	Result	Qual	Report Limit	Units	Dilution Factor	Date Analyzed
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Explanation of Qualifiers

Radiochemistry:

- "Report Limit" is the MDC
- U or ND - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- * - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'.
- G - Sample density differs by more than 15% of LCS density.
- D - DER is greater than Control Limit
- M - Requested MDC not met.
- LT - Result is less than requested MDC but greater than achieved MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

Inorganics:

- B - Result is less than the requested reporting limit but greater than the instrument method detection limit (MDL).
- U or ND - Indicates that the compound was analyzed for but not detected.
- E - The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.
- M - Duplicate injection precision was not met.
- N - Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.
- Z - Spiked recovery not within control limits. An explanatory note may be included in the narrative.
- * - Duplicate analysis (relative percent difference) not within control limits.
- S - SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

Organics:

- U or ND - Indicates that the compound was analyzed for but not detected.
- B - Analyte is detected in the associated method blank as well as in the sample. It indicates probable blank contamination and warns the data user.
- E - Analyte concentration exceeds the upper level of the calibration range.
- J - Estimated value. The result is less than the reporting limit but greater than the instrument method detection limit (MDL).
- A - A tentatively identified compound is a suspected aldol-condensation product.
- X - The analyte was diluted below an accurate quantitation level.
- * - The spike recovery is equal to or outside the control criteria used.
- + - The relative percent difference (RPD) equals or exceeds the control criteria.
- G - A pattern resembling gasoline was detected in this sample.
- D - A pattern resembling diesel was detected in this sample.
- M - A pattern resembling motor oil was detected in this sample.
- C - A pattern resembling crude oil was detected in this sample.
- 4 - A pattern resembling JP-4 was detected in this sample.
- 5 - A pattern resembling JP-5 was detected in this sample.
- H - Indicates that the fuel pattern was in the heavier end of the retention time window for the analyte of interest.
- L - Indicates that the fuel pattern was in the lighter end of the retention time window for the analyte of interest.
- Z - This flag indicates that a significant fraction of the reported result did not resemble the patterns of any of the following petroleum hydrocarbon products:
 - gasoline
 - JP-8
 - diesel
 - mineral spirits
 - motor oil
 - Stoddard solvent
 - bunker C

ALS -- Fort Collins
 Client: COGCC
 Work Order: 1803546
 Project: Antelope 1-17

Date: 4/10/2018 10:58
QC BATCH REPORT

Batch ID: **HC180405-81-1** Instrument ID **FUELS-1** Method: **SW8015M**

LCS		Sample ID: HC180405-81		Units: MG/KG		Analysis Date: 4/5/2018 22:25					
Client ID:		Run ID: HC180405-8A		Prep Date: 4/5/2018		DF: 1					
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
Diesel Range Organics	71.5	5	62.5		114	81-129				20	
Surr: O-TERPHENYL	9.87		12.5		79	49-114					

LCSD		Sample ID: HC180405-81		Units: MG/KG		Analysis Date: 4/5/2018 22:47					
Client ID:		Run ID: HC180405-8A		Prep Date: 4/5/2018		DF: 1					
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
Diesel Range Organics	71.7	5	62.5		115	81-129		71.5	0	20	
Surr: O-TERPHENYL	9.96		12.5		80	49-114			1		

MB		Sample ID: HC180405-81		Units: MG/KG		Analysis Date: 4/5/2018 16:13					
Client ID:		Run ID: HC180405-8A		Prep Date: 4/5/2018		DF: 1					
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
Diesel Range Organics	ND	5									
Surr: O-TERPHENYL	10				80	49-114					

The following samples were analyzed in this batch:

Client: COGCC
 Work Order: 1803546
 Project: Antelope 1-17

QC BATCH REPORT

Batch ID: VL180329-2-1 Instrument ID: HPV2 Method: SW8260

LCS		Sample ID: VL180329-2			Units: UG/KG		Analysis Date: 3/29/2018 11:10				
Client ID:		Run ID: VL180329-2A			Prep Date: 3/29/2018		DF: 1				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
BENZENE	41.1	5	40		103	73-126				30	
TOLUENE	40.1	5	40		100	71-127				30	
ETHYLBENZENE	41	5	40		103	74-127				30	
M+P-XYLENE	77.3	5	80		97	79-126				30	
O-XYLENE	38.6	5	40		97	77-125				30	
Surr: DIBROMOFLUOROMETHANE	55.5		50		111	61-134					
Surr: TOLUENE-D8	51.5		50		103	57-135					
Surr: 4-BROMOFLUOROBENZENE	52.6		50		105	52-151					

LCSD		Sample ID: VL180329-2			Units: UG/KG		Analysis Date: 3/29/2018 11:33				
Client ID:		Run ID: VL180329-2A			Prep Date: 3/29/2018		DF: 1				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
BENZENE	46.6	5	40		117	73-126		41.1	13	30	
TOLUENE	43.4	5	40		108	71-127		40.1	8	30	
ETHYLBENZENE	45.5	5	40		114	74-127		41	10	30	
M+P-XYLENE	84.8	5	80		106	79-126		77.3	9	30	
O-XYLENE	42.6	5	40		106	77-125		38.6	10	30	
Surr: DIBROMOFLUOROMETHANE	56.6		50		113	61-134				2	
Surr: TOLUENE-D8	51.9		50		104	57-135				1	
Surr: 4-BROMOFLUOROBENZENE	51		50		102	52-151				3	

MB		Sample ID: VL180329-2			Units: UG/KG		Analysis Date: 3/29/2018 13:27				
Client ID:		Run ID: VL180329-2A			Prep Date: 3/29/2018		DF: 1				
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
BENZENE	ND	5									
TOLUENE	ND	5									
ETHYLBENZENE	ND	5									
M+P-XYLENE	ND	5									
O-XYLENE	ND	5									
Surr: DIBROMOFLUOROMETHANE	53.1				106	61-134					
Surr: TOLUENE-D8	51.2				102	57-135					
Surr: 4-BROMOFLUOROBENZENE	49.9				100	52-151					

The following samples were analyzed in this batch:

1803546-1

Client: COGCC
 Work Order: 1803546
 Project: Antelope 1-17

QC BATCH REPORT

Batch ID: VL180329-2-3 Instrument ID HPV2 Method: SW8260

LCS		Sample ID: VL180329-5			Units: UG/KG			Analysis Date: 3/29/2018 12:19			
Client ID:		Run ID: VL180329-2A			Prep Date: 3/29/2018			DF: 1			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
GASOLINE RANGE ORGANICS	1920	500	2000		96	80-120				20	

LCSD		Sample ID: VL180329-5			Units: UG/KG			Analysis Date: 3/29/2018 12:42			
Client ID:		Run ID: VL180329-2A			Prep Date: 3/29/2018			DF: 1			
Analyte	Result	ReportLimit	SPK Val	SPK Ref Value	%REC	Control Limit	Decision Level	RPD Ref	RPD	RPD Limit	Qual
GASOLINE RANGE ORGANICS	1910	500	2000		95	80-120		1920	1	20	

MB		Sample ID: VL180329-2			Units: UG/KG			Analysis Date: 3/29/2018 13:27				
Client ID:		Run ID: VL180329-2A			Prep Date: 3/29/2018			DF: 1				
Analyte	Result	ReportLimit										Qual
GASOLINE RANGE ORGANICS	ND	500										

The following samples were analyzed in this batch: