

February 16, 2018

Mr. Brett Middleton  
Caerus Oil and Gas  
143 Diamond Avenue  
Parachute, CO 81635

**RE: 2017 Annual Report of Work Completed**  
H29A – Pit Closure and Remediation System  
COGCC Location ID: 335594  
SENE, Section 29, T5S, R95W (Lat = 39.58838, Long = -108.07060)  
Garfield County, Colorado

Dear Mr. Middleton:

Rule Engineering, LLC (Rule) has prepared this report to summarize monitoring and remediation activities completed in 2017 for Caerus Oil and Gas (Caerus) at the above-reference location. This report will outline quarterly soil-vapor extraction (SVE) events conducted and in-situ soil samples collected from soil borings and bio-vent well installation activities completed in 2017.

## **Background**

Based on records acquired from the Colorado Oil & Gas Conservation Commission (COGCC) and provided by Caerus, the produced water storage pit at this location was closed in fall of 2012. Per COGCC rules the closure was documented on a Form 27. After removal of the pit liner, soil samples were collected below-liner identifying organic, inorganic, and metal constituents of concern above COGCC allowable concentrations, indicating a possible liner failure. Following laboratory analytical results from the below-liner samples, a Form 19 was submitted to document the failed liner. A subsequent site investigation with an environmental drilling rig was undertaken to determine the vertical and horizontal extent of soil impacts, and to install vertical SVE wells to augment natural attenuation, monitor subsurface conditions, and support future remediation efforts. The site investigation activities and findings were reported in a Form 4 (Report of Work Completed).

- Form 27 (Doc: 2146043) (Rem: 7966)
- Form 19 (Doc: 2231696)
- Form 4 (Doc: 400815683)

## **2017 Remediation and Monitoring Activities**

### *SVE Remediation Events*

Rule completed one quarterly SVE event on September 11<sup>th</sup>, 2017 using Caerus' SVE pilot trailer. Below please find the table outlining results from the SVE event:

Well	Time	Duration (min)	SCFM	Vacuum (inch Hg)	PID (ppm)
SVEE02	9:30	40	95	6	5.6
SVEE03					
SVEE01	10:10	40	85	10	1.6
SVEN03					
SVES02	10:50	30	25	8	2.1
SVEMID01					
SVEMID01	11:20	30	55	11	3.8
SVEN02					
SVEN01	11:50	30	100	6	4.8
SVES03					
SVEW01	12:20	30	110	7	18.5
SVEW03					
SVEW03	12:50	30	90	11	14.2
SVEW02					
SVEW03	1:20	30	50	8	26
SVEE02	2:00	30	110	6	5.1
SVEE03					

#### *Solar Powered SVE Trailer*

Rule installed a solar powered SVE trailer at the H29A well pad in October 2017. The trailer was connected to bio-vent wells SVEE01 and SVEE02 to provide additional air flow and to enhance remediation. Due to the reduced sunlight the batteries were not charging, and the system was faulting out. It was decided that over the winter months the solar system would be moved offsite.

#### *Bio-vent Well Soil Monitoring*

On June 13 and 14, 2017, Rule provided oversight and sampling for a drilling contractor using a solid-stem auger rig to advance eight soil borings to depths ranging from five to sixty feet below ground surface (bgs). Soil borings were characterized using a 2-foot split-spoon sampler every five feet bgs to determine impacted soil depths and concentrations. Of the eight soil borings, five were advanced to assess existing bio-vent wells with the remaining three soil borings being constructed into new bio-vent wells.

#### *Assessment Borings*

The bio-vent well assessment borings were located within two feet of the original bio-vent wells to assess remediation of impacted soils within the pit. Based on previous sample analytical results, soil samples were collected using a 2-foot split-spoon sampler within the hydrocarbon impacted zone.

#### *Bio-vent Well Construction*

Soil borings constructed into new bio-vent wells were sampled every five feet bgs to determine impacted soil depths and concentrations. Each new bio-vent well was drilled between 40 and 60 feet bgs and constructed with 35 to 55 feet of slotted poly-vinyl chloride (PVC) and completed with ten feet of solid PVC pipe to the surface.

Soil samples were selected from the borings for chemical analysis based on field screening and were placed into clean, laboratory provided containers and shipped under chain-of-custody procedures via FedEx to Environmental Science Corporation located in Mt. Juliet, Tennessee. Each soil sample was analyzed for gasoline range (GRO) and diesel range (DRO) total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylene (BTEX) (see attached laboratory analytical spreadsheet and laboratory reports for soil sampling results).

## Findings

### *Assessment Borings*

Five assessment borings were conducted to determine remediation progress of the current bio-vent well. The samples collected for laboratory analysis demonstrate exceedance of COGCC soil standards for TPH.

Sample Location	TPH concentration (mg/Kg)	
	2014	2017
SVEE01A (30 – 32')	<b>1,400</b>	<b>2,304</b>
SVEE02 (20 – 22')	Not analyzed	<b>2,552</b>
SVEN02 (15 – 17')	<b>1,300</b>	<b>1,892</b>
SVES03A (15 – 17')	<b>1,700</b>	<b>1,553</b>
SVEW01A (10 – 12')	Not analyzed	<b>1,262</b>

**Bold** indicates exceedance of COGCC TPH soil concentration level.

### *Bio-Vent Well Construction*

A total of three bio-vent wells were installed with soil samples collected from the borings for laboratory analysis. A summary table outlining each bio-vent well and depth of the highest TPH concentration, and any depth exceeding COGCC soil standard for benzene is outlined below:

Bio-Vent Well	Impacted soil depth (ft)	Hydrocarbon concentration (mg/Kg)
SVEE03	25 – 27	TPH = <b>2,711</b>
SVEMID01	15 – 17	TPH = <b>1,662</b>
	30 – 32	Benzene = <b>0.182</b>
SVEW03	15 – 17	Benzene = <b>2.19</b>
	20 – 22	TPH = <b>1,843</b>

**Bold** indicates exceedance of COGCC soil concentration level.

## Conclusions

Available laboratory analytical data between 2014 and present demonstrates an overall increase in hydrocarbon impacts around two of the three bio-vent wells tested. Caerus intends to continue to utilize the bio-vent wells for passive venting, quarterly enhanced powered SVE events using Caerus's SVE trailer, and continued solar powered SVE trailer activity to supplement air flow and enhance on-going remediation.

If you have any questions with the provided report, please contact me at (970) 244-8500 or at [brollins@ruleengineering.com](mailto:brollins@ruleengineering.com).

Sincerely,  
**Rule Engineering, LLC**

*Blair K. Rollins*

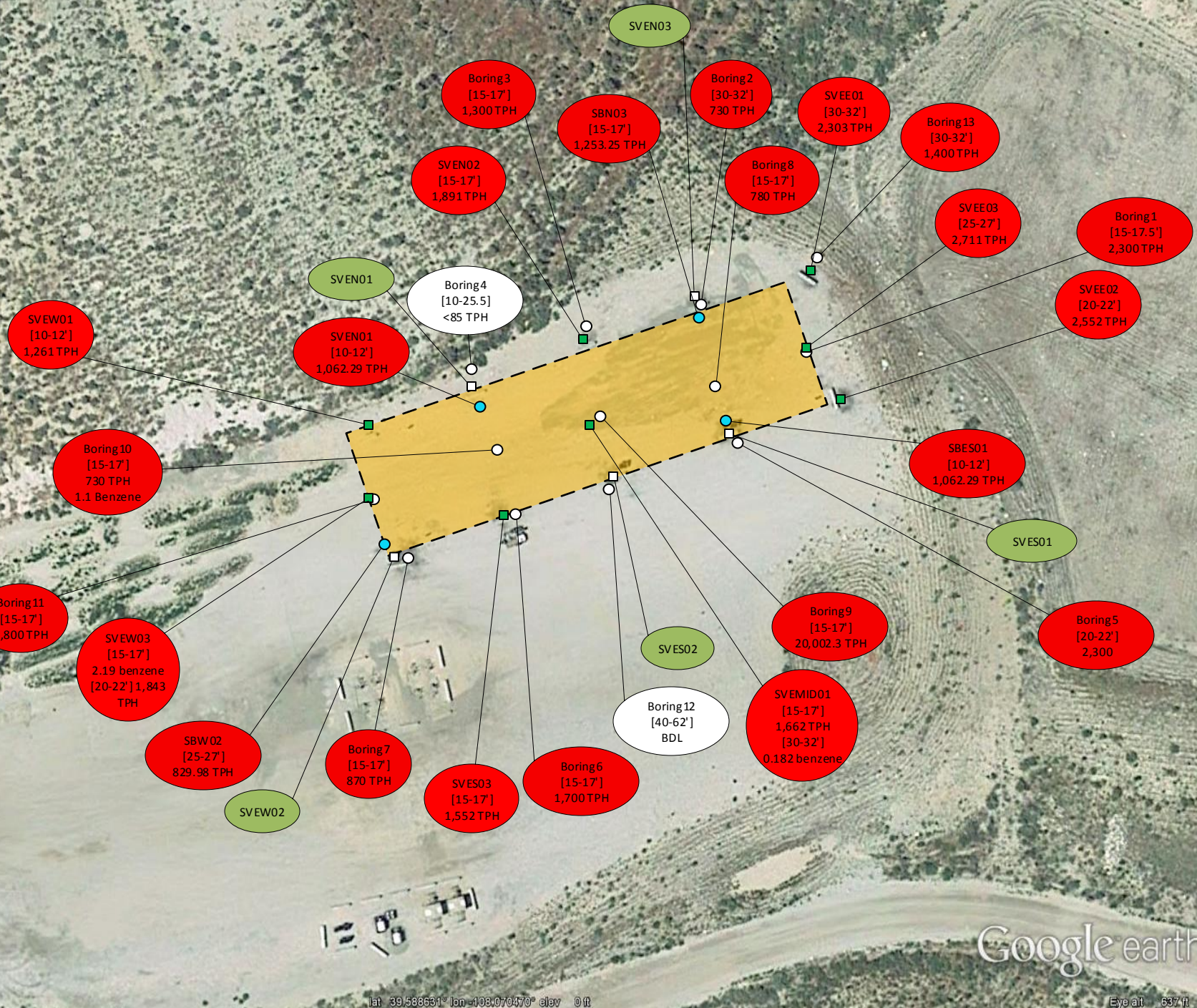
Blair K. Rollins  
Project Manager

cc: M. Brown  
R. Knight





• No Scale •



- - Sample
- - Biovent/Sample
- - Previous Pit Footprint
- - 2012 Activity
- - 2013 Activity
- - 2016 Activity
- - 2017 Activity



Pad: H29A (Location ID: 335594)

Area: North Parachute Ranch

Legal: SENE, Sec. 29, T5S, R95W, 6th PM