

**Remedial Action Summary
Vega 4 Well Pad Remediation Project
Mesa County, Colorado**

Prepared for:

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Introduction

HRL Compliance Solutions, Inc. (HCSI) has completed the successful remediation of soil generated from a leaking pipeline at the Piceance Energy Vega 4 well pad location. HCSI was contacted by Piceance Energy, LLC to conduct a remedial action for the cleanup of hydrocarbon impacted soil at the Vega 4 well pad site (COGCC ID # 283070). The project was started on June 13, 2013 and completed on July 31, 2013.

Background

In the Fall/Winter of 2012 a leak resulting from an underground pipe rupture was detected at the Vega 4 well pad site. Soil was impacted at the release location with TPH concentrations at 1,988 ppm. pH and arsenic were also reported above COGCC Table 910-1 allowable standards. The location of the release was excavated and approximately 700 cubic yards of soil was excavated. Approximately four hundred fifty (450) cubic yards of soil was stockpiled on the site location. Because of limited space on the Vega 4 well pad location, approximately two hundred fifty (250) cubic yards of soil was transferred to the Buzzard Creek Compressor Station location and stockpiled in a PVC plastic lined storage cell. Total petroleum hydrocarbon concentrations in both stockpiled locations exceeded COGCC Table 910-1 standards.

Soil Remediation Procedures

On June 11-13, 2013 the stockpiled soil at the Vega 4 well pad was moved from its stockpiled locations and transferred into three (3) small land treatment units (LTUs). On June 27, 2013 a single LTU was constructed at the Buzzard Creek location for treatment of the stockpiled soil. Earthen berms were constructed around each LTU at both locations. Impacted soil was then spread within the LTU's to a total depth of twelve (12) inches. All transfer of the impacted soil and the construction of the LTU's were completed by HCSI. The transfer and LTU construction was supervised, monitored and directed by HCSI project management with the approval of Piceance Energy.

Treatment Procedures

The soil in each LTU was tilled once a week using a tractor mounted heavy-duty tiller. Bioremediation products and soil additives were applied to the soil once a week, while water was applied twice a week. Potable water was delivered to the site location twice a week by a water contractor. Approximately 1,500 gallons of water was applied bi-weekly to each soil LTU location. Heavy rain at each location prevented tilling and watering on several occasions.

Monitoring

An initial baseline composite sample was collected by HCSI once the soil was spread in each LTU. A composite background sample was also collected from the well pad surface prior to the placement of the cuttings into the LTU. A final monitoring/sampling event was completed on July 31, 2013 in which a composite sample was analyzed for complete COGCC Table 910-1 constituents for soil at each location. Composite soil samples were collected and placed in laboratory-provided containers, preserved on ice, and shipped by overnight carrier to ALS Environmental in Holland, Michigan for analysis.

Analytical Results

Final analytical results for both locations reported all constituents below allowable COGCC Table 910-1 standards with the exception of Arsenic. However, arsenic levels are consistent with the samples collected at the site location determined by Piceance Energy in their sampling event dated April 8, 2013. However, Piceance Energy may have to request an allowance for the arsenic levels for final closure of the remediation project. pH levels of the soil were reduced during remediation efforts to 7.5 s.u. The following table reports analytical data reported by ALS Environmental, Holland, MI for both soil treatment locations.

Soil at Vega 4 Analytical Results July 31, 2013			
Analysis	Concentration	Results	COGCC Table 910-1
DRO (C10-C28)	mg/Kg-dry	37	500
GRO (C6-C10)	mg/Kg-dry	<2.8	
pH	S U	7.4	6-9 s.u.
Moisture	% sample	11	-
Electrical Conductivity (SAR)	EC @ Saturation	6.2	< 4mmhos/cm or 2x background
Benzene	mg/Kg-dry	<0.034	0.17
Ethylbenzene	mg/Kg-dry	<0.034	100
m,p-Xylene	mg/Kg-dry	<0.067	-
o-Xylene	mg/Kg-dry	<0.034	-
Toluene	mg/Kg-dry	<0.034	85
Total Xylenes	mg/Kg-dry	<0.100	175
Acenaphthene	mg/Kg-dry	<0.017	1,000
Anthracene	mg/Kg-dry	<0.017	1,000
Benzo(a)anthracene	mg/Kg-dry	<0.019	0.220
Benzo(a)pyrene	mg/Kg-dry	<0.019	0.022
Benzo(b)fluoranthene	mg/Kg-dry	<0.020	0.220
Benzo(g,h,i)perylene	mg/Kg-dry	<0.031	-
Benzo(k)fluoranthene	mg/Kg-dry	<0.020	2.20
Chrysene	mg/Kg-dry	<0.017	22
Dibenzo(a,h)anthracene	mg/Kg-dry	<0.020	0.022
Fluoranthene	mg/Kg-dry	<0.017	1,000
Fluorene	mg/Kg-dry	<0.017	1,000
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	<0.022	0.220
Naphthalene	mg/Kg-dry	<0.017	23
Pyrene	mg/Kg-dry	<0.017	1,000
Chromium, Hexavalent	mg/Kg-dry	<0.56	23
Chromium, Trivalent	mg/Kg-dry	14	120
Mercury	mg/Kg-dry	0.064	23
Arsenic	mg/Kg-dry	6.2	0.39
Barium	mg/Kg-dry	130	15,000
Cadmium	mg/L	<0.89	70

Chromium	mg/Kg-dry	14	NA
Copper	mg/Kg-dry	14	3,100
Lead	mg/Kg-dry	12	400
Nickel	mg/Kg-dry	15	1,600
Selenium	mg/Kg-dry	<2.2	390
Silver	mg/Kg-dry	<2.2	390
Zinc	mg/Kg-dry	42	23,000
Sodium Adsorption Ratio	None	8.1	<12
Calcium	mg/L	390	NA
Magnesium	mg/L	46	NA
Sodium	mg/L	630	NA

Soil at Buzzard Creek Analytical Results July 31, 2013			
Analysis	Concentration	Results	COGCC Table 910-1
DRO (C10-C28)	mg/Kg-dry	68	500
GRO (C6-C10)	mg/Kg-dry	<2.8	
pH	S U	7.5	6-9 s.u.
Moisture	% sample	12	-
Electrical Conductivity (SAR)	EC @ Saturation	3.2	< 4mmhos/cm or 2x background
Benzene	mg/Kg-dry	<0.034	0.17
Ethylbenzene	mg/Kg-dry	<0.034	100
m,p-Xylene	mg/Kg-dry	<0.067	-
o-Xylene	mg/Kg-dry	<0.034	-
Toluene	mg/Kg-dry	<0.034	85
Total Xylenes	mg/Kg-dry	<0.100	175
Acenaphthene	mg/Kg-dry	<0.017	1,000
Anthracene	mg/Kg-dry	<0.017	1,000
Benzo(a)anthracene	mg/Kg-dry	<0.019	0.220
Benzo(a)pyrene	mg/Kg-dry	<0.019	0.022
Benzo(b)fluoranthene	mg/Kg-dry	<0.020	0.220
Benzo(g,h,i)perylene	mg/Kg-dry	<0.031	-
Benzo(k)fluoranthene	mg/Kg-dry	<0.020	2.20
Chrysene	mg/Kg-dry	<0.017	22
Dibenzo(a,h)anthracene	mg/Kg-dry	<0.020	0.022
Fluoranthene	mg/Kg-dry	<0.017	1,000
Fluorene	mg/Kg-dry	<0.017	1,000
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	<0.022	0.220
Naphthalene	mg/Kg-dry	<0.017	23
Pyrene	mg/Kg-dry	<0.017	1,000
Chromium, Hexavalent	mg/Kg-dry	<0.57	23
Chromium, Trivalent	mg/Kg-dry	12	120

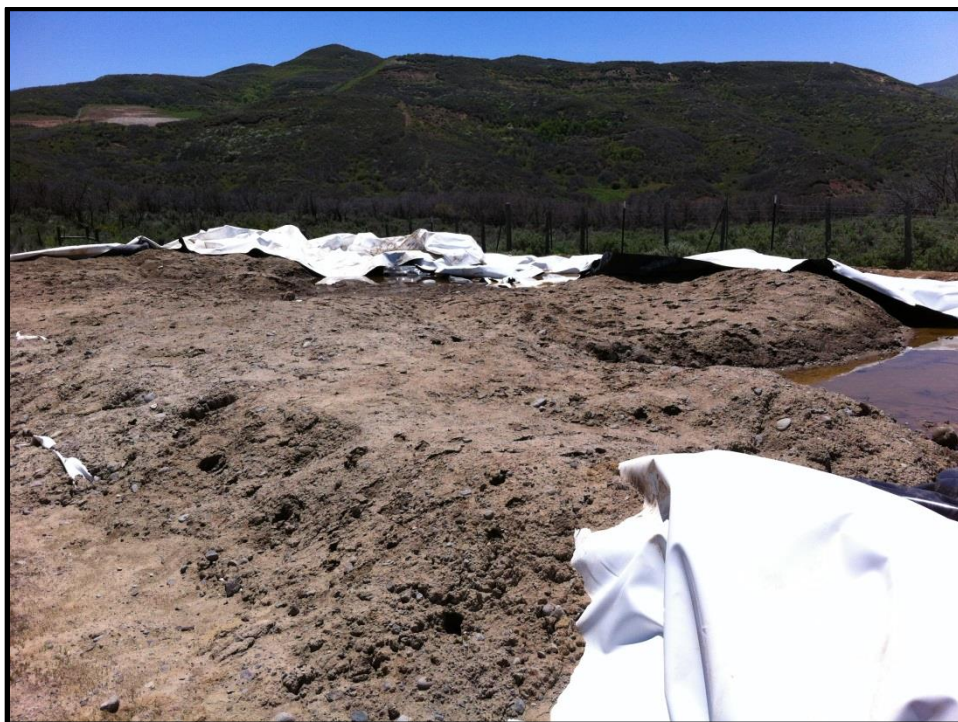
Mercury	mg/Kg-dry	0.060	23
Arsenic	mg/Kg-dry	7.2	0.39
Barium	mg/Kg-dry	200	15,000
Cadmium	mg/L	<0.80	70
Chromium	mg/Kg-dry	12	NA
Copper	mg/Kg-dry	17	3,100
Lead	mg/Kg-dry	12	400
Nickel	mg/Kg-dry	18	1,600
Selenium	mg/Kg-dry	<2.0	390
Silver	mg/Kg-dry	<2.0	390
Zinc	mg/Kg-dry	47	23,000
Sodium Adsorption Ratio	None	5.6	<12
Calcium	mg/L	220	NA
Magnesium	mg/L	24	NA
Sodium	mg/L	330	NA

Conclusion

HRL Compliance Solutions, Inc. has successfully remediated approximately 700 cubic yards of soil generated from a leaking pipeline at the Piceance Energy Vega 4 well pad location. TPH concentrations were reduced from a high of 1,980 ppm to less than 70 ppm in approximately forty five (45) days of bioremediation treatment. The project was started on June 13, 2013 and completed on July 31, 2013.



Soil excavation and stockpiles at the Vega 4 well pad prior to transfer into three (3) separate Land Treatment Units.



Soil stockpile at the Buzzard Creek Compressor location.



Impacted soil spread within Land Treatment Unit A constructed at the Vega 4 well pad location.



Impacted soil spread within Land Treatment Unit B constructed at the Vega 4 well pad location.



Impacted soil spread within Land Treatment Unit C constructed at the Vega 4 well pad location.



Impacted soil spread within the Land treatment unit at the Buzzard Creek Compressor facility. Light colored soil in the foreground is not a part of the remediation of the Vega 4 well pad.



Tilling of the impacted soil at the Vega 4 pad location.



Application of bioremediation products and nutrients at the Vega 4 pad location.



After planting and two weeks of watering, wheat grass grows in Land Treatment Unit C at the Vega 4 well pad site.

