

**Remedial Action Work Plan/Cost Estimate  
Caerus Piceance Riley 1 Remote Tank Battery  
Dump-line Release  
Garfield County, Colorado**

Prepared for:



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Prepared by:

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## Introduction

HRL Compliance Solutions, Inc. (HCSI) has prepared this Remedial Action Cost Estimate for Caerus Piceance, LLC (Caerus) for the cleanup of soil associated with the Riley 1 Remote Tank Battery dump-line release which occurred in 2011. The Riley 1 remote tank battery is located in Garfield County, Colorado. The objective of this remedial action cost estimate is to provide a Scope of Work and an estimate of the costs required to remediate probable hydrocarbon impacted groundwater at the Riley 1 site location.

## Scope of Work

The scope of work is based on information collected during assessments, groundwater sampling well data, remediation efforts and site characterizations conducted between 2011-2014. The objectives and tasks are summarized below.

- Utilize a CME 55 Track Rig to advance three (3) forty (40) foot deep groundwater wells to develop a potentiometric map of groundwater flow at the site location;
- Determine if groundwater has been impacted in the immediate area of the dump-line spill location;
- Determine if there is hydrocarbon influence from a historical reserve pit at the dump-line spill location;
- Excavate soil to a depth of approximately twenty-five (25) feet within the impacted area to extract hydrocarbon impacted soil between ten (10) and twenty-five (25) feet bgs and stockpile the soil on site (separating impacted soil from non-impacted soil);
- Bioremediation application to open excavation area;
- Backfill excavation with clean soil;
- Utilize a CME 55 Track Rig to advance approximately twelve (16) soil borings and install a series of *Barometric Assisted Remediation Technology* (BART) valves;
- Installation of three (3) solar powered SVE micro blowers;
- If groundwater is impacted, install a single (1) *Pump On Demand* skimmer system device for the recovery and collection of free product (if present) from the groundwater;
- Spread and treat impacted soil on site for land farm bioremediation procedures;
- Sample groundwater monitor wells for approximately two years; and,
- Provide monthly maintenance, monitoring and reporting to detail activities completed on site for the duration of the project.

The remediation project will require approximately twenty-four (24) to thirty-six (36) months. The phases of the remediation project are outlined below. However, not all phases may be required for completion of the remediation project, but are outlined if they are necessary.

### Phase 1: Groundwater Potentiometric Determination

There are currently four (4) groundwater monitor wells located west of the impacted area on site. However, no groundwater wells are located within the immediate area of impacted soil, nor are there wells located north or east of the impacted soil. In order to provide a groundwater potentiometric map of the site location wells need to be installed in these locations. Once installed, a potentiometric map of the site location can be adequately developed to investigate groundwater flow direction and whether or not a historical reserve pit is influencing soil and groundwater within the area of the dump-line spill location.

The newly installed groundwater monitor wells will require surveying as will the older wells in order to determine elevations.

### **Phase 2: Excavation of Impacted Soil**

Soil be excavated within the immediate area of the dump-line spill to a total depth not to exceed twenty-five (25) feet bgs. Based on soil boring data collected at the site impacted soil has been identified between ten (10) feet bgs and thirty-one (31) feet bgs. By excavating the soil between the ten (10) to twenty-five (25) feet depths a majority of impacted soil will be removed, thereby reducing the influence of the petroleum hydrocarbons on surrounding soil and groundwater at the site. Impacted excavated soil will be separated from non-impacted soil on site. Once the soil has been excavated and separated, non-impacted soil and clean fill will be used to backfill the excavation.

### **Phase 3: In-situ Bioremediation Application**

Once excavation has been completed bioremediation products, nutrients and soil conditioners will be applied to the excavation area using 2,500 gallons of water each week to saturate the hydrocarbons remaining in the impacted soil for a total of thirty (30) days. This application will be employed to assist in reducing the total concentration of petroleum hydrocarbons that may require an SVE system. The SVE system will be installed after the excavation is backfilled. The soil will be sampled at the end of the thirty (30) day period.

### **Phase 4: Soil Vapor Extraction**

HCSI proposes to install three (3) solar powered soil vapor extraction wells within the targeted impact area. Three (3) two (2) inch slotted PVC pipes will be installed to a total depth of thirty-five (35) feet bgs. These vapor extraction wells will be used to push or pull air to and from the impacted soil. Each of the four wells will have a solar powered *micro blower motor* to remove VOC's and GRO constituents from the soil which will then be evacuated into ambient air.

A total of thirteen (13) soil borings will also be drilled to varying depths for the installation of slotted PVC pipes and surface mounted barometric valves. The barometric valves will allow for the movement of air and vapor through the soil and escape to the atmosphere based upon changing daily barometric pressures at the site. HCSI will provide operation, maintenance and service on the SVE system. HCSI may construct a small utility building on site to house the SVE equipment.

All borings will be logged and recorded, including analyses for TPH (DRO, GRO and BTEX) in order to define the vertical and lateral extent of hydrocarbons in the boring locations.

### **Phase 5: Groundwater Free Product Recovery**

If hydrocarbon impacted groundwater is encountered at the site, as well as free product, a single (1) *Pump On Demand* skimmer system device will be installed and strategically placed and rotated in groundwater monitor wells for the recovery and collection of free product. Free product recovered will be monitored weekly by HCSI personnel during equipment maintenance procedures. Once the 55-gallon free product containment barrel is full the product will be collected by Caerus for sales.

### **Phase 6: Ex-situ Bioremediation Application**

Impacted soil which was stockpiled on site will be spread into a land treatment unit (LTU) which will be constructed on site. The LTU will have berms and constructed in a manner as to not affect on-going oil and gas operations at the Riley 1 site location. The excavated soil will be spread to a depth not to exceed twelve (12) inches. The soil will be tilled using a tractor mounted tiller and treated weekly with bioremediation products via a water truck for a total of three (3) months. Caerus will provide water for the project weekly.

### **Phase 7: Remediation Monitoring**

The remediation project will be monitored using an electronic soil vapor monitor in order to determine the time required for active remediation at the site. Once low TPH concentrations are observed, HCSI will recommend that drilling procedures at the site be completed in order to sample soil for petroleum hydrocarbons.

A series of sampling events will be conducted annually at previously pre-determined locations and depths at the site. For each monitoring/sampling event a total of six (6) boreholes will be drilled to a total depth of thirty-five (35) feet bgs using a CME 55 Track Rig. Soil samples will be collected at five (5) foot intervals using standard split-spoon or solid core sampling procedures. Soil samples will be assigned a sample identification number consisting of the initials "BH" for Borehole, followed by the number and date for the order in which the boring was completed, and then followed by the depth interval sampled in parentheses. The samples will be field-screened using a Photoionization Detector (PID) prior to sample preparation. Soil samples collected for standard chemical analysis will be placed in laboratory-provided containers, preserved on ice, and shipped by overnight carrier to ALS Environmental in Holland, Michigan for analysis. The soil sample from each borehole location will be analyzed for BTEX, DRO, GRO, moisture, pH, bacterial plate counts and soil nutrients (i.e., nitrogen, phosphorous, potassium, etc.).

### **Phase 8: In-Situ Remediation Project Closure**

When field screen readings indicate that hydrocarbon impacts are below COGCC Table 910.1 allowable standards, confirmation soil samples will be collected and submitted to ALS Environmental for analysis. Upon completion of the remediation project closure reports will be compiled and submitted to Caerus. All sampling activities will be completed in accordance with the recommended protocol specified by ALS Environmental, HCSI, Caerus and EPA sampling criteria.

### **Health, Safety and Documentation**

Field work will be performed in OSHA Level D and FRC personal protective gear. All safety measures will be taken to ensure the work is completed in accordance with safety protocol specified by federal, county, or private requirements. All activities conducted in the field will be documented. Documentation will include quarterly reports, written records and photographs documenting the activities being performed. GPS mapping will be used when applicable.

**Remediation Cost Estimate**

The following information outlines the estimated costs associated with the phased remediation approach for hydrocarbon impacted soil and potentially associated groundwater based on thirty-six (36) months of active treatment as previously described. However, not all phases may be required for completion of the remediation project, but are outlined if they are necessary. Alterations of the project plan may occur but will not deviate from the proposed budget.

**Project Administration Pre-Field Work**

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- *Project Management*..... \$ **1,200.00**

**Phase 1: Groundwater Monitor Wells and Potentiometric Determination**

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- *Drill Rig Mob/Demob*..... \$ 400.00
- *Drilling (3 boreholes to 50 feet)*..... \$ 2,250.00
- *Crew Travel*..... \$ 340.00
- *Staff Engineer/Scientist* ..... \$ 1,560.00
- *Remediation Project Manager*..... \$ 840.00
- *Field Equipment (PID, soil vapor monitor)*..... \$ 300.00
- *Injection Port Materials (piping, bentonite, cement, sand)*..... \$ 2,800.00
- *Mileage*..... \$ 198.00
- *Communication and Reproduction*..... \$ 80.00
  
- Subtotal**..... \$ **8,768.00**

**Phase 2: Excavation of Impacted Soil**

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- *Staff Engineer/Scientist* ..... \$ 1,950.00
- *Project Manager* ..... \$ 840.00
- *Mileage*..... \$ 264.00
- *Field equipment(PID, Petro-Flag)*..... \$ 400.00
- *Communication and Reproduction*..... \$ 139.50
- *Sampling/Analytical (billed directly to client)* ..... \$ 1,000.00
- *Excavation contractor provided by Caerus*..... \$ TBD\*
  
- Subtotal**..... \$ **4,593.50\***

**Phase 3: In-situ Bioremediation Application**

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- *Staff Engineer/Scientist* ..... \$ 2,080.00
- *Project Manager* ..... \$ 840.00
- *Mileage*..... \$ 330.00
- *Bioremediation Product*..... \$ 5,000.00
- *Water and delivery supplied by Caerus* ..... \$ TBD\*
  
- Subtotal**..... \$ **8,250.00\***

**Phase 4: Soil Vapor Extraction**

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**Project Field Work (Drilling and Installation of Passive SVE Piping)**

- *Drill Rig Mob/Demob*..... \$ 400.00
- *Drilling (16 boreholes to 35 feet)*..... \$ 5,460.00
- *Crew Travel*..... \$ 340.00
- *Staff Engineer/Scientist* ..... \$ 1,560.00
- *Remediation Project Manager*..... \$ 840.00
- *Field Equipment (PID, soil vapor monitor)* ..... \$ 300.00
- *Injection Port Materials (piping, bentonite, cement, sand)*..... \$ 2,800.00
- *Mileage*..... \$ 198.00
- *Communication and Reproduction*..... \$ 140.00
- *Sampling/Analytical (billed directly to client)* ..... \$ 4,000.00

**Subtotal..... \$ 16,038.00**

**Project Field Work (SVE Equipment and Installation)**

- *Staff Engineer/Scientist* ..... \$ 1,040.00
- *Project Manager* ..... \$ 1,680.00
- *SVE Motors/Equipment (3 pumps, solar systems, etc.)* ..... \$ 21,375.00
- *Barometric valves (13)*..... \$ 2,925.00
- *Mileage*..... \$ 264.00
- *Communication and Reproduction*..... \$ 60.00

**Subtotal..... \$ 27,344 .00**

**Phase 5: Groundwater Free Product Recovery**

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- *CO<sub>2</sub> POD systems*..... \$ 5,000.00
- *CO<sub>2</sub> refills* ..... \$ 200.00
- *Project Manager* ..... \$ 1,680.00
- *Geologist* ..... \$ 2,280.00

**Subtotal..... \$ 9,160 .00**

**Phase 6: Ex-Situ Bioremediation**

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- *Staff Engineer/Scientist* ..... \$ 4,680.00
- *Project Manager* ..... \$ 1,680.00
- *Tractor/Tiller*..... \$ 2,400.00
- *Mileage*..... \$ 792.00
- *Bioremediation Product*..... \$ 5,000.00
- *Water and delivery supplied by Caerus* ..... \$ TBD\*
- *Sampling/Analytical (billed directly to client)* ..... \$ 2,000.00

**Subtotal.....\$ 16,552.00\***

**Phases 7 and 8: Remediation Monitoring and Project Closure**

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**Monthly Monitoring and Equipment Servicing (36 months)**

- *Staff Engineer/Scientist* ..... \$ 600.00
- *Project Manager* ..... \$ 300.00
- *Field Equipment (soil vapor monitor)*..... \$ 100.00
- *Mileage*..... \$ 66.00
- *Communication and Reproduction*..... \$ 45.00
- Subtotal (Monthly)..... \$ 1,111.00**

**Total (\$1,111.00 x 36 months).....\$ 39,996.00**

**Analytical Field Work (Annually)**

- *Project Manager* ..... \$ 200.00
- *Drilling (6 borings to 45 feet)* ..... \$ 3,000.00
- *Drill Rig Mo/Demob* ..... \$ 400.00
- *Crew Travel*..... \$ 170.00
- *Staff Engineer/Scientist* ..... \$ 1,560.00
- *Sampling/Analytical (billed directly to client)* ..... \$ 1,800.00
- *Communication/Reproduction* ..... \$ 97.00
- Subtotal (Yearly) ..... \$ 7,227.00**

**Total (\$,227.00 x 3 years) .....\$ 21,681.00**

**Post Field Work**

- *Project Manager* ..... \$ 200.00
- *Staff Engineer/Scientist* ..... \$ 520.00
- *Communication/Reproduction* ..... \$ 37.00

**Subtotal.....\$ 757.00**

**Grand Total.....\$ 154,339.50**

*The above estimates are a Time and Materials quote. The 36 month time requirement is an estimate. Actual time required for remediation may be less. Caerus will only be billed for actual hours worked and materials used. Analytical costs will be directly billed to Caerus.*

If you have any questions, please do not hesitate to call our office at 970.243.3271.

*Sincerely,*

**HRL Compliance Solutions, Inc.**

**Proceed As Indicated Above**



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Maurice Foye  
Vice President, HCSI



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Mr. Ed Winters  
Managing Principal Caerus Piceance, LLC