



**HRL**  
COMPLIANCE  
SOLUTIONS

April 6, 2020

RE: Foundation Energy Management LLC  
Waste Management & Landfarming Plan  
Location: Federal 23-4  
Pit Facility ID: 119476  
REM#: 13414

Foundation Energy Management LLC (Foundation) is submitting this waste management and landfarming operations plan as outlined in Colorado Oil & Gas Conservation Commission (COGCC) Rule 907.a.(3) *Waste Reuse & Recycling* and Rule 907.e.(1).B *Oily waste* to manage hydrocarbon impacted soils associated with the production pit.

As outlined in the Site Investigation and Remediation Workplan (Form 27), impacted soils will be excavated from within the pit and placed within a landfarm and managed on-site until the soils satisfy COGCC Table 910-1 thresholds and can be beneficially reused onsite.

### **LANDFARM CELL CONSTRUCTION**

Landfarm will be constructed on the cutslope or portion of the pad that provides the most support and leveling to prevent sloughing and/or runoff drainage of the applied products.

The surface area outlined in the landfarm site map will be scraped ~4-6 inches with heavy equipment, removing the loose soil and providing a hard surface for operations. Soil will then be compacted utilizing heavy tractor equipment to ensure an impervious surface layer is obtained, preventing cross contamination of soils.

Earthen berms constructed out of the native soil from the surrounding pad will be constructed around the landfarm cell as outlined in the landfarm site diagram. Berm will be 1 ½ the depth of the soil to be landfarmed, but not to exceed 20". Berms will be compacted to ensure they are sufficiently impervious to contain the fluids and bioremediation products applied, as well as during precipitation events.

The landfarm will be constructed to allow for turning & maintenance to occur from outside the cell berming to prevent any additional compaction. Should space constraints or pad layout prevent landfarm construction to allow for turning and maintenance outside of the berms, sloped entrance will be constructed on opposite ends of the cell to allow for equipment to enter and exit without compacting the newly turned area.

## **LANDFARM SOIL**

Impacted soils excavated from within the production pits will be placed within the compacted portion of the landfarm cell with a depth of 12-18” to allow for sufficient aeration and contact with bioremediation product.

Once all of the impacted soils have been excavated from within the pit and spread within the landfarm cell, a layout diagram will be generated to illustrate landfarm cell(s) and sampling points identified. Baseline samples will be collected to determine the contaminants of concern (COC) and aid in the formulation of bioremediation products and conditioners that will be utilized to target the specific COC’s exceeding COGCC Table 910-1. Note that baseline sampling analysis is for the purposes of establishing soil conditions and will include other analytes not outlined in COGCC Table 910-1.

## **TREATMENT**

Soils within the landfarm will be treated utilizing a combination of the following:

- Aeration
- Solarization .
- Soil Conditioners
- Bioremediation Product(s)

Landfarmed soil will be tilled/turned monthly or bi-monthly when conditions are favorable and conducive to break down the light end hydrocarbons through exposure to air and sunlight (UV), which allows for the natural degradation of hydrocarbons.

Soil conditioners will be applied during the initial stages of landfarming, to allow for an environment that is favorable and a habitat that will sustain biological breakdown of hydrocarbons, as well as accelerating the microbes currently within the soil that naturally breakdown carbon chains associated with hydrocarbons.

Bioremediation product application will occur once soil conditions are optimal and its established that the soil environment is conducive to sustain biological activity. Product(s) that have been engineered to target specific constituents will be applied in a concentrated liquid form and activated with the required nutrient and water that has been calculated based off the existing soil conditions obtained from baseline sampling analysis.

Ongoing monitoring of the soil conditions with monthly field screening and/or sampling analysis will be performed to determine the success rate of the treatment process. Follow-up applications of the soil conditioners and bioremediation product will be applied as necessary. Turning/tilling will continue bi-monthly during the active bioremediation months and switching to monthly when bioremediation conditions are less favorable (fall/early spring). Active bioremediation treatment and maintenance will stop once winter weather prevents access or temperatures drop below the ideal conditions, making the bioremediation activity dormant.

The timing of treatment in conjunction with application and tilling/turning is all based on the weather conditions at the site. As bioremediation activity is based on temperature, soil moisture, nutrient levels and sunlight exposure, the weather and timing of the project has a direct effect on the landfarming schedule.

### **SAMPLING & ANALYSIS**

Initial landfarm baseline composite samples will be collected from the landfarm for full COGCC Table 910-1. One (1) sample will be collected per 250 yards landfarmed and noted in the final landfarm construction layout diagram with sampling points identified.

Follow-up monitoring will consist of both discrete and composite sampling from one of the established composite sample points. Analysis for the follow-up sampling will only consist of the constituents that were identified as exceeding within the baseline sampling results, including the individual Polyaromatic Hydrocarbon (PAH) constituents.

Final confirmation sampling of the landfarming soil will consist of a final composite sample(s) collected from the same sample locations as the initial baseline sampling and analyzed for the following:

- Total Petroleum Hydrocarbons (TPH) – DRO & GRO
- Benzene, Toluene, Ethylbenzene, Xylene (BTEX)
- Other constituents identified as exceeding from the initial baseline sampling

Background samples will also be collected from three to five (3-5) locations off-site in an undisturbed area and analyzed for arsenic and inorganic parameters (SAR/EC/pH). If it is determined that concentrations within the landfarm are comparable or below background, Foundation Energy will be request relief to arsenic and inorganic exceedances in accordance with COGCC FAQ's #31 and #32. All landfarmed soil will be placed back within the excavated pit bottom, which are greater than 3ft. Additionally, clean native fill material will be used to cap the backfilled area.

### **BENEFICIAL RESUE CONSIDERATION**

As mentioned in the section above, soils treated and successfully landfarmed will be beneficially reused back within the excavated pit area and capped with 3ft of native cover.

Reclamation of the pit area will be conducted in accordance with the COGCC 1000 series rules and upon approval from the Bureau of Land Management (BLM) or other applicable landowner.

### **STATUS UPDATES**

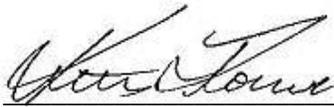
Updates will be provided on a monthly or quarterly basis during the active landfarming periods (late spring, summer, fall) with no updates being submitted once winter weather prevents active landfarming operations.

**CONCLUSION**

Attached to this landfarm operations plan is a landfarm site layout diagram (Figure 1) with the proposed area to construct the associated landfarm. As mentioned earlier in this plan, a revised landfarm diagram will be generated to account for the actual layout once all of the impacted soils have been excavated and placed within the landfarm cell.

Additionally, attached is the BLM Sundry Notice (Figure 2) approval stating that the surface owner (BLM) has provided approval to conduct landfarming on-site of the hydrocarbon impacts soil associated with the production pit.

Upon approval of this landfarming operations plan, Foundation Energy and HRL will proceed with the construction of the landfarm cell and excavation of the impacted soils within the production pit. Once sampling and analysis of the pit area indicate compliance with COGCC Table 910-1, landfarming operations will occur as outlined in this plan.



Date: \_\_\_\_\_

Kris Rowe  
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HRL Compliance Solutions

Date: \_\_\_\_\_

Alyssa Beard  
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Figure 1: Landfarm Site Layout

## Figure 2: BLM Landfarm Approval