Field Trial Implementation Proposal

Brickhaven Structural Fill Facility

Leachate Evaporation System Evaluation

Moncure, North Carolina

Date: 06/08/2017
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Introduction

Problem Statement
Charah, LLC (Charah) is the operator of the Brickhaven structural fill facility (Brickhaven) in Moncure, North Carolina. Charah's Brickhaven facility has historically generated on average between 600,000 - 3,000,000 gallons of leachate per month during the historical operation of the facility since October 2015. Leachate is generated from residual, free draining water that is present in the CCP material upon excavation; operational waters applied for dust suppression during general site operations and precipitation that contacts the placed CCP material in the structural fill cells. Leachate generation has been documented to be highly variable based on several factors including (but not limited to) precipitation volume, precipitation frequency, and open surface area of the active structural fill working face. All leachate generated at the Brickhaven facility is required by regulation and site-specific permitting to be transported to one of several disposal facilities permitted to accept industrial waste for final treatment and disposal.

Leachate generated at the Brickhaven facility requires significant operational and financial resources to manage. An economical and efficient manner of on-site disposal is required to dispose of leachate at the Brickhaven facility. Charah has evaluated the resource requirements for several other means of leachate disposal including, but not limited to, treatment utilizing an on-site wastewater pre-treatment system, treatment and disposal utilizing an on-site wastewater treatment system and solar/direct heat evaporation systems. All of these technologies were determined to be operationally limiting or cost prohibitive.

Field Trial
Charah proposes to conduct a field trial of a Leachate Evaluation System (LES) at the Brickhaven facility to assess the suitability and efficiency of this technology. Charah plans to operate the equipment in the field up to ninety (90) days.

During this field trial, the effectiveness, both in terms of disposal efficiency and the cost will be evaluated. Upon completion of the field trial, Charah will evaluate the results to determine next steps.

General Explanation of Evaporative Methodology
Evaporation of water is a natural process that involves the combination of several environmental conditions. The rate of evaporation is dependent upon the amount of UV radiation (sunlight), relative humidity, wind speed and the size of water droplets introduced into the atmosphere. As water droplets are introduced into the ambient air, water vapor will enter the vapor phase (evaporate) at a rate dependent upon natural processes and conditions.

General Assumptions
The following general assumptions were considered in the development of the field trial proposal:

(1) Leachate from the Brickhaven structural fill does not contain constituents of concern present in MSW leachate. VOCs, landfill gasses, and SVOCs common to MSW leachate can be released due to volatilization induced during leachate evaporation.
These constituents are not present in CCP generated leachate. Leachate generated at the Brickhaven project has trace amounts of heavy metals as constituents of concern. Heavy metals would be separated, in theory, from the water portion of leachate during the evaporation process and returned by gravity to the lined structural fill area.

(2) The implementation of an LES for on-site disposal of leachate at Brickhaven will continue to require reduced use of off-site transport and disposal of leachate. The ability of an LES to operate properly is 100% dependent on favorable environmental conditions. An LES should not be operated during cold and freezing conditions due to the risk of catastrophic system failure caused by the freezing of leachate. It is expected an LES could operate efficiently for six to eight months during an operational year depending on seasonal weather patterns.

(3) The location of the LES will be lined to ensure proper containment and all applicable requirements associated with compliance boundaries will be adhered to.

(4) The effectiveness of an LES is highly dependent on the following atmospheric conditions:

- Relative Humidity
- Wind Speed
- Wind Direction
- Ambient Temperature
- Solar Radiation

Description of Proposed Evaporation Equipment
A 3rd Party vendor will provide an LES with the following system components:

- Leachate pump and temporary storage tank connected to existing leachate collection and conveyance system.
- One or more booster pumps, as needed, to provide sufficient pressure to the evaporation nozzles.
- Evaporation nozzle headworks to atomize the leachate.
- High powered fan to direct the evaporate into the atmosphere.
- Lined evaporation “alleyway”.
- Perimeter berms and single row mesh netting to control evaporate migration and residual condensate.

A proposed system overview and construction layout are provided as Figures 1 and 2 in Attachment A.

Field Trial Objectives

Evaluation Criteria
The following criteria will be evaluated during the field trial:

(1) Reliability of LES System
(a) Maintenance required to operate an LES system on a continual basis.

(b) Operational efficiency (fuel consumption) per volume of leachate disposed of.

(2) Efficiency of LES System

(a) Volume of leachate disposed of during evaporation versus volume of leachate returned as condensate.

(b) The impact of atmospheric conditions on evaporation efficiency.

(c) Evaluation of perimeter controls to ensure no migration of evaporate occurs during varying atmospheric conditions.

Field Trial Implementation Plan

Field Trial Design

Proposed Evaporation Equipment Setup

The previously described LES system will be provided by a 3rd Party vendor for use during the proposed field trial. A conceptual schematic is provided in Figure 2 as Attachment A. The proposed LES will be positioned to provide adequate separation from all compliance and property boundaries in accordance with the current permits and regulations governing the Brickhaven structural fill project.

A leachate evaporation “alleyway” will be constructed on top of structural fill Cells 1/2. The LES alleyway will be constructed with approximate dimensions of 100 feet in width by 300 feet length with a sloping gradient back towards the evaporation unit. The alleyway will be constructed with an HDPE liner to collect any residual condensate that does not evaporate into the atmosphere. Diversion swales and/or ditches will be installed along the down-gradient side of the alleyway to divert all condensate into a sump and pump that will convey condensate to an existing leachate cleanout point to return leachate into the leachate collection system for recycling. The possible locations of the evaporation alleyway is provided as Figure 1 in Attachment A.

Field Trial Environmental and Engineering Controls

A perimeter soil berm approximately 4 feet high will be constructed around the perimeter of the alleyway to contain any residual evaporate that condenses and falls back to the ground surface. A single row of mesh fencing will be installed in the top of the perimeter berm to contain evaporate. Secondary mesh fencing will be placed near areas such as compliance and property boundaries nearby the LES. Details on the proposed perimeter controls are provided as Figure 5 in Attachment A.

Data Collection Means and Methods

During the trial, both field and laboratory data will be collected. Field data will be collected using automated field sampling equipment, 3rd Party vendors or Charah personnel. Laboratory sampling and analysis will be provided by an NC certified laboratory for the appropriate mediate tested (air, water, or soil). All data will be compiled and analyzed to determine if the field trial evaluation and success criteria are met during the field trial period.
Field-Colllected Data:
The following field data and frequencies of data collection will be collected during the proposed field trial:

<table>
<thead>
<tr>
<th>Field Parameter</th>
<th>Method</th>
<th>Frequency</th>
<th>Collection Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature</td>
<td>Automated Instrumentation on LES; On-site weather station; KTTA weather station data</td>
<td>Minimum – Hourly Optimum - Minute</td>
<td>LES Equipment or Vendor; Verification by Charah</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Automated Instrumentation on LES; On-site weather station; KTTA weather station data</td>
<td>Minimum – Daily Optimum - Hourly</td>
<td>LES Equipment or Vendor; Verification by Charah</td>
</tr>
<tr>
<td>Wind Speed</td>
<td>Automated Instrumentation on LES; On-site weather station; KTTA weather station data</td>
<td>Minimum – Daily Optimum - Hourly</td>
<td>LES Equipment or Vendor; Verification by Charah</td>
</tr>
<tr>
<td>Wind Direction</td>
<td>Automated Instrumentation on LES; On-site weather station; KTTA weather station data</td>
<td>Minimum – Daily Optimum - Hourly</td>
<td>LES Equipment or Vendor; Verification by Charah</td>
</tr>
<tr>
<td>Solar Radiation</td>
<td>Astronomical data collected from Moncure, NC site via weatherunderground.com website</td>
<td>Daily</td>
<td>Charah</td>
</tr>
<tr>
<td>Barometric Pressure</td>
<td>Access Weather Station Data at site and/or KTTA weather station via Internet</td>
<td>Hourly</td>
<td>Charah</td>
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Laboratory-Derived Data
The following laboratory data and frequencies of data collection will be collected during the proposed field trial:

<table>
<thead>
<tr>
<th>Field Parameter</th>
<th>Method</th>
<th>Frequency</th>
<th>Sampling Location</th>
<th>Collection Agent</th>
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<tbody>
<tr>
<td>Soil Sampling</td>
<td>EPA Method 6010 for CCP Metals</td>
<td>Pre-Field Trial for Baseline; Post-field trial</td>
<td>Sample Points as shown on Figure 3 provided as Attachment A.</td>
<td>3rd Party testing firm qualified to conduct soil sampling; samples to be submitted to an NC certified laboratory qualified and experienced in the specified testing methods</td>
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Brickhaven Structural Fill Facility
Leachate Evaporation System Evaluation

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<tr>
<td>Condensate</td>
<td>EPA Method</td>
<td>Weekly during LES Operation at a minimum</td>
<td>3rd Party testing firm qualified to conduct water sampling; samples to be submitted to an NC certified laboratory qualified and experienced in the specified testing methods</td>
</tr>
<tr>
<td></td>
<td>6010 for CCP</td>
<td>Operation at a minimum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>metals</td>
<td>LES condensate return sump</td>
<td></td>
</tr>
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<td></td>
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<td></td>
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<tr>
<td>Airborne Metals</td>
<td>EPA 6010C m,</td>
<td>Minimum: Two (2) representative tests a minimum of one week apart pre-field trial; One (1) test per 7 days of operation during field trial; Two (2) tests at one week intervals after field trial</td>
<td>3rd Party testing firm qualified to conduct ambient air sampling; samples to be submitted to an NC certified laboratory qualified and experienced in the specified testing methods</td>
</tr>
<tr>
<td></td>
<td>Total metals</td>
<td>Sample Points as shown on Figure 4 provided as Attachment A. Samples to be collected at 50 foot. 100’ setback, 200’ setback, and compliance/property boundary at a minimum</td>
<td></td>
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<tr>
<td></td>
<td>(including CCP</td>
<td></td>
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<td>metals) on high-volume Filter; collected at a flow rate required by sampling equipment</td>
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Proposed sampling locations are provided as Figure 3, and Figure 4 in Attachment A. Sampling locations can be amended based on the review and response of NC DEQ and the third-party testing service provider.

Field Trial Management and Data Evaluation

Proposed Schedule
The proposed field trial would be conducted during ideal operating conditions within the months of June, July, and August of 2017. The field trial will run for the maximum ninety (90) day period or as directed by NC DEQ.

Final Report
All data collected during the field trial will be compiled, reviewed, and presented by Charah to NC DEQ in a final report within ninety (90) days of completing the trial. The final report will contain all field and laboratory data as well as findings and recommendations. If warranted, Charah will provide a request for a permit for a permanent LES after the issuance of the final report and review by NC DEQ.
Attachments:
POTENTIAL LEACHATE EVAPORATION ALLEYWAY LOCATIONS. 100' WIDE X 300' LONG

PROPERTY LINE PROJECT BOUNDARY COMPLIANCE BOUNDARY

CELL 1 LIMITS

APPROXIMATE LIMIT OF CCP MATERIAL

SUB-CELLS 2C/2D LIMITS

SLEEVED LEACHATE SUPPLY PIPE FROM LEACHATE STORAGE AREA

PROPERTY LINE PROJECT BOUNDARY COMPLIANCE BOUNDARY

LEACHATE STORAGE AREA

BRICKHAVEN LEACHATE EVAPORATION FIELD TRIAL PROPOSAL
MONCURE, NORTH CAROLINA
FIG 1: PROPOSED EVAPORATION SYSTEM GENERAL LOCATION MAP
GENERAL NOTES:

(1) FINAL COVER GRADES SHOWN. SYSTEM MAY BE PLACED ON TOP OF INTERIM SOIL COVER. IT IS ASSUMED THAT INTERIM COVER GRADES WOULD REFLECT FINAL SURFACE GRADES AT A LOWER ELEVATION.

(2) EVAPORATION ALLEYWAY TO BE LEFT AS BARE LINER OR VEGETATED IF SOIL COVER APPLIED. FINAL COVER OR INTERIM SOIL COVER MUST BE AMENDED TO PROMOTE VEGETATIVE GROWTH PRIOR TO SYSTEM OPERATION.

(3) CONTINGENT FENCING LAYOUT MAY BE RECONSIDERED BASED ON PREDOMINANT WIND DIRECTION.

(4) PROPOSED ALLEYWAY MAY BE CONSTRUCTED ON CELL 1 OR SUBCELLS 2C/2D. LAYOUT WILL BE FOLLOWED AT EITHER LOCATION.
FIG 3: PROPOSED SOIL SAMPLING LOCATION MAP

BRICKHAVEN LEACHATE EVAPORATION FIELD TRIAL PROPOSAL
MONCURE, NORTH CAROLINA
FIG 4: PROPOSED AIR SAMPLING LOCATION MAP

BRICKHAVEN LEACHATE EVAPORATION FIELD TRIAL PROPOSAL
MONCURE, NORTH CAROLINA
GENERAL NOTES:

(1) EXISTING SOIL COVER MATERIAL OVER CELL 1 CCP STRUCTURAL FILL HAS AN AVERAGE DEPTH OF 2 FOOT
(2) FML LINER TO BE KEYED INTO ADDED SOIL TO EXISTING COVER LAYER OVER CELL 1 OR AS NEEDED TO SECURE THE LINER PROPERLY.
(3) LINER AND DRAINAGE COLLECTION PIPING WILL BE PLACED AT A MINIMUM OF 1% SLOPE TO FML TO PROMOTE DRAINAGE TO COLLECTION PIPE

PERIMETER SOIL BERM. FML TO BE PLACED BELOW EXCAVATION DEPTH OF PERIMETER FENCING SUPPORT POLES

FML BETWEEN EXISTING SOIL CAP AND DRAINAGE LAYER.

PERFORATED HDPE DRAIN PIPE TO COLLECT ANY DRAINAGE LAYER FLOW. MINIMUM SLOPE 1%

2 FOOT PROTECTIVE SOIL COVER

PERIMETER SOIL BERM. FML TO BE PLACED BELOW EXCAVATION DEPTH OF PERIMETER FENCING SUPPORT POLES

VEGETATIVE COVER

2 FOOT DRAINAGE LAYER

PERIMETER SOIL BERM. FML TO BE PLACED BELOW EXCAVATION DEPTH OF PERIMETER FENCING SUPPORT POLES

EXISTING SOIL CAP MATERIAL OVER CELL 1 CCP STRUCTURAL FILL

CROSS SECTION A - A' NOT TO SCALE

CROSS SECTION B - B' NOT TO SCALE

CROSS SECTION B - B' - DETAIL 1 NOT TO SCALE

CROSS SECTION B - B' - DETAIL 2 NOT TO SCALE