June 24, 2024
Submitted to:
James Clark, Public Works Director
235 E Henri De Tonti Blvd Tontitown, AR 72770

Submitted by:
Richard Ims, richard@carbonchicken.com
COO, Carbon Chicken Project
13893 White Oak Road
Fayetteville, AR 72704

Subject: Proposal for Odor and Emission Mitigation at Tontitown Lift Station – Trial and Pilot Project

Dear Mr. Clark,

Carbon Chicken Project is pleased to submit this proposal to secure a contract for the mitigation of odors and harmful emissions emanating from the Tontitown Lift Station, which handles runoff leachate from the EcoVista landfill. We understand that local residents have raised concerns regarding the deteriorating air quality in the area, aligning with the air quality assessments recently conducted near the Waste Management (WM) landfill on Arbor Acres Avenue and the Public Works Lift Station on Pianalto Road in Tontitown, Arkansas.

Problem Statement: Recent air quality assessments in Tontitown, conducted from April 28 to May 1, 2024, for the Arkansas Department of Energy and Environment (ADEE), have detected several volatile organic compounds (VOCs) at concentrations exceeding their respective USEPA Resident Air Regional Screening Levels (RSLs). Specifically, **acrolein**, **benzene**, **carbon tetrachloride**, and **naphthalene** were noted above RSLs. Acrolein was detected at all ten locations surrounding the WM landfill, with concentrations averaging 0.13 ppb against an RSL of 0.009 ppb. Benzene was also detected at all ten locations, averaging 0.15 ppb against an RSL of 0.11 ppb. Carbon tetrachloride exceeded its RSL at four landfill locations and three background sites. These VOCs, along with other potential landfill gas emissions, contribute to environmental and health concerns, including respiratory irritation, and are often associated with unpleasant odors. While hydrogen sulfide (H2S), another common odorant, was not detected during the April 28 – May 1, 2024 sampling event near the landfill or at background locations, addressing

overall odorous and harmful VOCs remains crucial. Biochars are recognized for their efficacy in removing various gaseous chemical contaminants, including **volatile organic compounds (VOCs)**, **odorous substances**, and **acidic gases**.

Proposed Solution: Biochar Air Filtration Trial and Pilot Project at the Public Works Lift Station

Our engineers propose a trial and pilot project focused on replacing the current media in your air scrubber at the Tontitown Lift Station with our specialized biochar. Biochars are **low-cost**, **renewable**, and **sustainable biomaterials** produced via pyrolysis of biomass under high temperature and low/no oxygen. They are capable of removing various gaseous chemical contaminants such as **volatile organic compounds (VOCs)**, **odorous substances**, and **acidic gases (e.g., H2S, SO2, CO2)** through mechanisms such as **adsorption, precipitation, and size exclusion**. Biochars have been specifically applied for the removal of VOCs in gaseous streams.

The trial will proceed as follows:

- **Baseline Air Quality Assessment:** Carbon Chicken Project would initially require a current/up-to-date test by GTS to record a baseline reading of the airborne contaminants and odors emanating from the lift station. This pre-application monitoring will help assess current levels of VOCs, which include potential odorous compounds.
- **Biochar Media Replacement:** Our engineers will then replace the existing media in the air scrubber with our specifically selected biochar. Biochar air filters can be customized to different air duct systems, offering a **"plug-and-play" solution**.
- **Post-Application Re-testing:** Following the media replacement, we will require a re-test of the air readings to record the drop in emissions and consequently, the odors emanating from the lift station.

The benefits of utilizing biochar in your air filtration system include:

- **Reduced Pressure Drop:** Biochar air filters are known to **reduce pressure drop** of air flowing through the filter. Conventional fabric-based air filters can worsen pressure drop when pores are blocked by pollutants.
- **Improved Air Flow:** Air speed can actually **increase and stabilize** after passage through a biochar air filter, a result of flow straightening and reduction of air turbulence.
- **Particulate Matter Reduction:** Biochar air filters are able to remove about **12.2% of PM10 and 32.9% of PM2.5** from external air. This capability improves community health by significantly reducing PM levels in the fresh air taken into the air duct. During periods of very high PM levels, such as haze incidents, biochar air filters can remove even higher percentages of PMs.
- **Low Cost and Sustainability:** Biochar is a **low-cost**, **renewable**, and **sustainable biomaterial** made from the recycling of biomass waste.

Ongoing Service and Cost: After evaluating the positive effects demonstrated by the trial, we propose to replace the biochar media on a **monthly basis** to retain the effectiveness of the filtration system. This is important as biochar-based fixed filter columns (BFCs) can exhibit a decline in treatment efficiency over time, similar to other biofiltration technologies, due to alterations in functional groups within biochar's pores and changes in microbial communities' activity on its surface. Our proposed cost for this service is **$2400 per month** for the first 3 months, using 3 biochar formulation to test the most effective. We would continue the process thereafter on a monthly basis at a reduced rate of **$1900 per month** with the formulation that tested with the highest adsorption rate.

Future Considerations: Direct Leachate Treatment We will further evaluate the overall effectiveness of the air scrubbing system and may propose a subsequent phase involving the use of biochar directly in the liquid leachate as an adsorbent to further reduce toxins and harmful emissions. Biochar has garnered significant attention for its capabilities in **wastewater treatment**, including the removal of pollutants such as **organic compounds, nutrients, heavy**

metals, and pathogens. It can serve as a structural substrate, filtration medium, and catalyst in water management. When used as a filtration material, biochar serves as a carrier for microorganisms to attach to, allowing them to develop and break down pollutants. Therefore, as a medium in biofiltration systems, biochar combines microbial degradation of pollutants with its adsorbent properties, rendering it an attractive option for biologically mediated water treatment. This approach is likely out-of-scope and can be significantly more expensive. The more likely and reasonable next phase approach will be using biochar with the landfill solid waste Daily Top Cover to mitigate off-gassing of the emissions that far exceed EPA levels tested by ADEQ.

Based on the leachate sample results from the Tontitown Lift Station, key contaminants that biochar-based systems can effectively treat include:

- **High BOD (Biochemical Oxygen Demand)**: The leachate samples show high BOD values, for example, 1156.0, 1323.0, 2177.0, 3275.0, and 3629.0. Biochar has shown **high Chemical Oxygen Demand (COD) removal, with a mean of 80%** (95% CI: 72%, 86%), which is indicative of its ability to remove organic compounds.
- **Nitrogen Compounds (Ammonia-N, TKN, Nitrate-N, Nitrite)**: The leachate samples show significant levels of Ammonia-N, Total TKN, Nitrate-N, and Nitrite. Biochar-based systems can achieve **significant NH4+-N removal, averaging 71%** (95% CI: 60%, 80%), and nutrient removal generally.
- **Phosphorus**: The leachate samples indicate phosphorus levels. **Phosphorus removal averages 57%** (95% CI: 41%, 74%) when using biochar in fixed filter columns.
- **Heavy Metals (Mercury, Arsenic, Barium, Chromium, Lead, Selenium, Silver)**: The leachate results include these heavy metals with various concentrations. Biochar is effective in the **removal of heavy metals from wastewater**.

The effectiveness of biochar in wastewater treatment is influenced by biochemical characteristics, pollutant concentrations, and operational conditions, including hydraulic loading rate and retention time. The pyrolysis temperature (typically 300 to 800 °C) and duration (1.0 to 4.0 h) influence biochar's specific surface area (SSA), with higher temperatures generally increasing SSA, which impacts its adsorption capacity.

We are confident that our biochar air filtration solution offers a sustainable, low-cost, and effective approach to addressing the air quality concerns at the Tontitown Lift Station. We look forward to the approval of this proposal and demonstrate the benefits of biochar for your community.