U.S. Environmental Protection Agency
Environmental Technology Verification Program
ETV
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Environmental and Sustainable Technology Evaluation (ESTE)
Manure Treatment by Anaerobic Digester Technology to Recover Energy and Reduce Pollutants
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Impact Statement

Anaerobic digestion of animal manures at large scale animal feeding operations has the potential to reduce waste loads, control microorganisms, and generate energy and salable products. Any or all of these potentials can benefit agriculture in the United States because waste management at large scale feeding operations has become an issue of importance to local communities. Verification of the performance of digesters will help to develop and broaden the appeal of digesters to more farms.

Background

The U.S. Environmental Protection Agency's Office of Research and Development (EPA-ORD) supports Environmental and Sustainable Technology Evaluation (ESTE) to facilitate the development and commercialization of innovative technologies through performance verification and information transfer. In part, ESTE is intended to increase the relevance of Environmental Technology Verification (ETV) program (www.epa.gov/etv) projects to U.S. EPA program offices and regional offices. These performance verifications will serve the public by demonstrating performance of commercial technologies in operation. Stringent quality control measures will be taken to gain credible performance data. Potential customers will be able to refer to reports of verification to help make decisions regarding purchase and use of these technologies.

Large scale animal feeding operations commonly known as concentrated animal feeding operations (CAFOs) generate very large quantities of manure. Most of the manure is spread on farm land both as a fertilizer and as a disposal mechanism. The major problems associated with manure relate to odor production and nutrient content. Many soils of the US are overloaded with phosphorus and adding more from animal manure only makes the problem worse. Similarly, large scale operations have the potential for generating odors that degrade the quality of life in nearby areas. There are also questions about the transport of pathogenic organisms and harmful gases such as hydrogen sulfide from large scale animal waste facilities. Anaerobic digesters operate in the absence of oxygen and can not be open to the atmosphere. In the process, degradable organic matter is converted to methane and carbon dioxide. The methane can be recovered and used to power generators or water heaters on the farm to reduce the farm's dependence on fossil fuel generated electricity. In most cases, a good digester can provide enough methane to generate excess electricity that can be sold to the grid, further reducing the cost of operating a digester. After the digestion process is completed the residual material has much less odor potential and is reduced in total mass. This material can be further composted or dried for other uses, thereby making better overall use of the material. Further processing of the liquid waste stream can recover phosphorus, preventing application of excess phosphorus to farm fields. These factors can combine to make anaerobic digestion of animal waste an attractive waste management practice.

Objective

The objective of this project is to verify the performance of an anaerobic digester in use on a large scale farm. The work planned will examine several reactor performance parameters. Reduction of organic solids, methane generation, energy generation, and reduction of potentially pathogenic microorganisms are included in the measurements planned.

Study Description

Sample collection and analysis will be conducted in accordance with the procedures identified in the approved Test/QA plan. No less than 12 or no more than 52 sample events will be performed. The parameters of interest include but are not limited to influent and effluent analysis of the waste stream for total solids, volatile solids, pH, nitrogen, phosphorus, fecal coliforms, *Escherichia coli*, COD, and gas production from the reactor. Gas analysis may be done to provide gas quality estimation. The content of methane, CO_2 and H_2S may be measured. Evaluation of generator performance will be conducted. QA audits will be included in this part of the work. Planned QA audits will occur before starting the sampling, at the midpoint and at the end of the sample collection and analysis period. The test site and the analytical laboratory(ies) will be audited.

An ETV report and verification statement of the evaluation of the anaerobic digester will be completed after the data are analyzed statistically for the report and statement. A draft report and statement will be produced for review by the stakeholders group and the QA office. Comments from the reviewers will be addressed in the final report and statement. Writing the final report and statement will entail a description of the work performed, a description of the digester operation, samples analyzed, analytical results, statistical analysis, and estimates of the value of the methane produced in the digester. The value of the gas produced can be derived from electrical energy generated during operation and calculation of the cost of an equivalent amount of natural gas supplied by a natural gas utility. The ETV report and verification statement will detail operation and maintenance requirements of the system and energy requirements of the system. The ETV report and verification statement should also estimate the quantity of phosphorus reduction obtained and how this will impact the ability to land apply digester waste.

Status

The digester to be evaluated has been selected and a contractor to conduct the sample collection, analysis, and report writing has been chosen. The actual sample collection should begin in late June or early July.

Next Step

A conference call with stakeholders, digester operator, and contractor will be convened prior to beginning sample collection. The plan will be reviewed and final concurrences gathered for the work.

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