Methane to Markets

Leakage from Anaerobic Digestion Systems

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Overview

- Background

- Current Status

- Other Findings

- Conclusions

Background

- IPCC guidelines provided no guidance on leakage rates from AD systems, indicating a range of 0 to 100 percent

- In response the Subcommittee first discussed addressing leakage estimates in Beijing in November 2007

  - An engineering approach for improving leakage estimates was envisioned as a credible approach

  - The approach was based on the factors which effect leakage rate

Components Contributing to Leakage

- Leakage from AD systems varies based on:

  - *Type of system*: covered lagoon, tank, fixed dome, etc.
  - *Physical Design*: floating cover, bank-to-bank cover, rigid cover, etc.
  - *Design Parameters*: Hydraulic retention time (HRT), Solids retention time (SRT), and organic loading rate
  - *Materials and construction quality*: gas permeability
  - *Gas handling and transmission*: materials, seals
  - *Method of combustion*: flares, IC engines, or boilers
  - *System age*: weathering, corrosion, and maintenace

Action Taken

- In Mexico in April 2008 the U.S. Environmental Protection Agency agreed to perform a literature search to determine if any data exist to develop credible leakage rate factors for the components contributing to leakage

- The literature search could not support the development of credible leakage rate factors within the engineering framework originally envisioned.

Other Findings

- The U.S. EPA developed a Climate Leaders Protocol to estimate emission reductions from manure AD systems.
    - http://epa.gov/climateleaders/documents/resources/ClimateLeaders_DraftManureOffsetProtocol.pdf

- This protocol includes a collection efficiency value which is used to represent gas that is not collected by the system due to leakage.

Climate Leaders Leakage Rates

System Type	Cover Type	Collection Efficiency
Covered Anaerobic Lagoon	Bank to bank, impermeable	95 to 100%
	Modular, impermeable	50 to 90%
Complete mix, fixed film, or plug-flow digester	Enclosed Vessel	98 to 100%

From the U.S. EPA's Climate Leader's Protocol for Managing Manure with Biogas Recovery Systems (2008).

These values may be appropriate for high quality engineered systems commonly found on medium to large scale commercial farms and have large investment costs

Values are derived from Sommer et al (2000), Bicudo et al. (2004), Nicolai et al. (2004) and Emission Solutions et al. (2000).

Climate Leaders Usefullness

- The U.S. EPA Climate Leader's collection efficiency values have limitations:
  - Leakage is only related to a limited set of system types and does not take into account system age, operation, etc.
  - Values are presented as ranges, so selecting the appropriate value for a system would be subjective

- However values may be representative for high quality engineered systems commonly found at medium to large scale commercial farms with large investment costs

Other Findings

- Clean Development Mechanism (CDM) uses a fixed leakage rate of 15% in PDD's developed for livestock waste methane reduction projects

- Limitations of this fixed approach may over or under predict leakage as system type, age, operation etc. are considered.

- However, this factor may be representative of systems that are designed and built with an intermediate level of engineering consideration and require lower cost.

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Conclusions

- The Agriculture Subcommittee was interested in investigating an approach to improve IPCC leakage estimates which ranged fro 0 – 100%.
  - A literature search could not support the engineered approach originally envisioned

- The search did identify other leakage rate estimates which had a comparatively narrower range than IPCC and were somewhat technology specific
  - These could be used to develop intermediate guidance based on Best Professional Judgment (BPJ)

- One possible step to increase estimate reliability could require development of a data base to develop qualitative assessments of different types of systems.

- Resource implications and value to the Subcommittee need to be considered