RE: Testimony in **Opposition of SB447**

02/14/2023

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Thank you for the opportunity to offer my opposition to the Anaerobic Digestion Workgroup. In my research on the comparison of Anaerobic Digestion versus Aerobic Composting, the priority of sustainably managing materials should be put on composting.

Anaerobic digesters compost (or "digest") organic waste in a machine that limits access to oxygen (hence the "anaerobic" part), encouraging the generation of methane and carbon dioxide by microbes in the waste. This digester gas (which also comes contaminated with hydrogen sulfide) is then burned as fuel to make electricity. Digesters aren't widely used yet, but tend to be used for sewage sludge at sewage treatment plants and for animal waste on farms. Digesting organic waste doesn't avoid the need to handle the digested material (a mostly solid, but wet, byproduct known as "digestate").

There are many problems with animal waste digesters, including air pollution, methane leakage, and leaching of nutrients from digestate. Digesters should not be supported with renewable energy subsidies, as they compete with solar and wind power, and could support inappropriate waste management practices, depending on the feedstock and use of the digestate.

With regard to methane leakage, methane is a serious global warming problem, since methane is 86 times worse than CO2 for the climate over a 20-year time frame. If just 2.8% of methane from a natural gas system leaks out, it's understood to be worse for the climate than coal. Anaerobic digesters are known to leak about 2-3% of the methane created by their process. (more below)

There are four main feedstocks often considered for anaerobic digestion. Here's is what they are and what we believe is the most appropriate role for them:

- **Animal waste:** For wet animal wastes (cow and pig manure), digestion can be one of the better waste management options (compared to lagoons). For poultry litter, it makes no sense, because water needs to be added to make it wet enough (sometimes, they propose sewage effluent). These are often on larger (factory) farms (a.k.a. Confined Animal Feeding Operations, or CAFOs) since they're expensive and require "renewable" energy subsidies (like being in a state Renewable Portfolio Standard). Large digesters are used to make factory farms more viable. Consequently, advocates of small family farms and of sustainable agriculture see digesters as a Trojan horse that pretends to solve a waste management problem while enabling factory farms to invade the community. Nonetheless, if the digested waste is not contaminated with toxins (such as arsenic if it's used in poultry feed), then the digestate might be acceptable for use as fertilizer or soil amendment. Read the Food and Water Watch factsheet for a strong critique of manure digesters: Hard to Digest: Greenwashing Manure into Renewable Energy

- **Sewage sludge:** Many sewage treatment plants digest their sewage sludge, then rename it "biosolids" and call it "Class A" if it passes a pathogen test, as if that makes it safe for use in gardens, soil amendment, etc. Pathogens can regrow in this heat-treated sludge, and the toxic metals and other chemicals don't vanish in the digestion process. This digested sludge does not belong being exempted from waste regulation and ought to be placed in monofills (dedicated cells at landfills), not "beneficially used" in agriculture (or in landscaping, filling strip mines, bagged and sold as fertilizer, etc.).

- **Source separated organics (SSO) [food scraps and yard waste]:** These materials ought to be aerobically composted, but anaerobic digestion could make sense in urban areas where land for aerobic composting is not available. Digested SSO could be appropriate for compost uses, but needs to be aerobically composted after digestion to condition it. Food scraps and yard waste should never be mixed with sewage sludge ("biosolids"), since they're much cleaner and shouldn't be blended with more toxic sludges. Doing so also makes it ineligible as compost under organic certification standards, which bars sewage sludge as fertilizer.

- **Municipal solid waste (MSW), or the "organic fraction" of MSW left over after efforts to remove recyclables:** The most responsible way to manage MSW is with a zero waste hierarchy that leaves little waste in the "black bin," researches what is in that waste stream, then mechanically pulls out additional recyclables before digesting and aerobically composting the remaining residual fraction prior to landfilling. This ensures that we won't have gassy, stinky landfills. However, plans for any mechanical separation and/or biological stabilization (composting or digestion) processes usually result in the digestate being burned or marketed as fuel pellets or as fertilizer. Some communities have made the mistake of trying to end source separation and have all trash, recyclables, and compostable thrown into the same bin, with the idea that machines and workers at conveyor belts will sort it all out. This idea is a terrible failure. Source separation is vital, and digestion of MSW should only be a processing step to stabilize waste before landfilling. For more info, read the reports under the "Getting the back end of the zero waste hierarchy right" section of our zero waste page and explore the detailed zero waste hierarchy we developed.

Digesters are only marginally effective at reducing problems with odors, pathogens and greenhouse gas emissions from animal waste or sewage sludge, but they are incapable of making any chemical contaminants in the wastes go away. Digesters aren't emissions-free. They are known to emit nitrogen and sulfur oxides, particulate matter, carbon monoxide and ammonia.

Living next to a digester could be unpleasant, particularly if located in a residential neighborhood or if the facility would be large -- attracting manure-hauling trucks from around the region. Some proposals for digesters have been fought off by community opposition.

Estimated air emissions data on digesters can be found here on page 3-12:

Lusk, P. (1998). Methane Recovery from Animal Manures: A Current Opportunities Casebook. (3rd Edition. NREL/SR-25145. Golden, CO: National Renewable Energy Laboratory. Work performed by Resource Development Associates, Washington, DC.

Critiques of Anaerobic Digesters:

- **Hard to Digest: Greenwashing Manure into Renewable Energy** (Food and Water Watch, Nov. 2016)
- **Methane Digesters and Concentrated Animal Feeding Operation (CAFO) Waste** (Sierra Club Guidance Oct 20, 2004)

GRACE Factory Farm Project's position on methane digesters (2003)

The GRACE viewpoint on methane digesters. The US government has started to hand out subsidies to farmers to install methane digesters--which extract methane from animal manure to create energy--as a way to deal with problems associated with factory farm waste. Digesters have greatly varying efficiencies, sometimes using all of the methane produced to sustain the production of more methane. The process is prohibitively expensive unless subsidized by taxpayer money and requires a constant supply of manure, but does not diminish the amount of manure present after methane has been extracted. Thus, methane digesters should not be viewed as a sustainable solution for factory farm waste, but rather a mechanism for perpetuating the production of excess manure...

The US Department of Agriculture (USDA) estimates animals in the US meat industry produced 1.4 billion tons of waste in 1997 -- 130 times the nation's volume of human waste and five tons of animal waste for every US citizen. The use of manure for fertilizer occurs naturally on traditional livestock farms and, assuming the manure is applied at the appropriate agronomic rates, this is good management. Production of more manure than the land on which the animals are housed can absorb is unsustainable, unless a large amount of additional land can be found for manure spreading.

The number of animals on factory farms often exceeds the ability of the factory farm operator to find enough cropland to responsibly spread the manure. This invariably leads to attempts to increase the quantity of manure spread on each plot of land by calculating the nutrient requirements using only the most generous assumptions -- or by spreading manure in excess of the legal requirements. When these practices are combined with the fact that virtually all manure spreading is calculated on nitrogen content only, even though many manures are enriched in phosphorus, the result is pollution of ground water from over application, run-off of nutrients into streams and lakes, and eutrophication of water ways.

Today's confined animal feeding operations (CAFOs) use various methods of waste disposal and storage: giant cesspools, known as lagoons; waste dispersion through injection of liquid manure into the soil; spraying the liquefied manure over the surrounding fields; or disposal of solid waste in landfills after liquid waste has evaporated from the lagoon. These practices create odor nuisances and health hazards for the neighbors of the CAFO. Pollution from animal waste can cause respiratory problems, skin infections, nausea, depression and other serious illnesses for people who live near factory farms.

Given these potential problems and the community resistance to CAFOs they have spawned, mitigating the environmental impacts of this massive amount of manure has become a major concern for CAFOs, agribusiness and the USDA. Several companies claim to have invented systems that consume parts of the manure and create valuable byproducts such as methane gas and fertilizer. One of the more popular ideas is a very old concept: the methane digester. The methane given off during the decomposition of the manure is captured and burned, providing either heat or power for electrical generation. Proponents of digesters claim they remove offensive odors from manure, while producing low-cost energy.

While the act of covering the manure used by the digester to capture the methane will reduce odors, it has no effect on the odors from manure kept in additional lagoons or on the major source of CAFO odors—the exhaust fans from the CAFO barns (these fans account for about 60% of all odors emanating from a CAFO). Further, because methane burns at such a low temperature, the digester continually emits ammonia in excess of air pollution standards unless a separate ammonia stripper is employed.

Costs such as those associated with ammonia stripping when coupled with the short life-span of digesters (usually 10 years or less) are two of the reasons that even though methane digester technology has been available for many years, it has never been shown to be an economical way to generate power. Studies show that the installation and operating costs invariably exceed the savings the digester produces by replacing other energy sources. The cost/savings differential is better for large operations, but it can never overcome the requirement that methane power must be a secondary power system. Building regulations usually require that farm-operated systems like methane digesters have a back-up system which is normally the standard electrical grid connection that the farm would use if it was not generating methane. Further, because the gasses given off by manure in the barns are so lethal, no large CAFO can allow barn ventilation systems to fail for even limited periods. As a result, the installation costs for both the electrical system and the digester must be absorbed by the owner. For these reasons, no methane digester in the United States has been an acceptable investment unless it was partially supported by a government subsidy.

Even when supported by subsidies, digesters have a high initial cost and a long payback period. They also require the waste of at least 150-200 animals to maintain efficient operation. Digester operation is labor intensive and expensive, and in the end analysis, farmers have little economic need to produce their own energy. Energy expenditures amount to only about 3-5% of total operational costs on many farms. According to California Polytechnic University, subsidies are not the make-or-break factor in the use of biomass as long as the environmental advantages can be shown to be greater than the benefit of energy production. But are the environmental benefits of digesters real?

Digesters have greatly varying efficiencies. They are unreliable and inefficient when operated at ambient temperatures. Heating the manure improves the generation of methane, but even small amounts of manure heating will consume approximately 35% of the biogas produced by the digester temperature . Heating the manure enough to speed decomposition significantly takes far more energy. For example, Big Sky Farms proposed an operation using 6 digesters in Idaho, each accommodating a 330,000-pound operating load of manure. In order to get the digesters to consume this amount of manure (from a 50,000 sow farrow-to-finish operation) as rapidly as it was produced, all the heat from the methane generated by the digesters was needed to heat the manure for digestion -- in other words, all the digester methane was used to create more digester methane. These digesters still required a huge supply of manure to be retained in the surrounding lagoons, and it did not reduce fossil fuel use at the CAFO.

Because of their excessive ammonia emissions, digesters are not likely to solve any greenhouse gas problems. A recent National Academy of Sciences report on air quality surrounding factory farms shows that ammonia released into the atmosphere, and the "nitrogen cascade" that follows this release, is the major concern for green house gasses. Air pollutants with a nitrogen base (NOx) released by a digester are similar to those from an internal combustion engine. Further, since the burning temperatures of methane are so low, the ammonia in the gasses coming from the manure will not be oxidized and will be released from the digester stacks directly into the atmosphere. In the case of Big Sky, ammonia emissions from the digesters vastly exceeded those allowed at industrial sites in Idaho. Even if the ammonia was oxidized this would simply add other Nitrogen/oxygen compounds to the waste gasses that have worse greenhouse effects than the ammonia.

Proponents of methane digesters originally touted these systems as an alternative source of energy. When it became obvious this was not the case, many proponents began to claim that the benefit of digestion was actually the reduction of odor from CAFO manure. However, while digesters mitigate some of the odor from manure, they do not make CAFOs good neighbors. In order to use a digester manure must be stored in anaerobic lagoons, which emit foul odors unless covered. Further, a study reported by the National Pork Board found that lagoon covers only reduce odor by about 45 percent. And finally, CAFO barns produce the majority of the odors at the site and this is unchanged when digesters are used.

After the methane has been produced there is still the issue of the waste that remains behind. The quantity of manure is not reduced by digestion. It still must be put somewhere, and all the chemicals and heavy metals that were in the manure prior to digestion remain after the digester has operated must be disposed of. As the National Academy of Sciences report emphasizes, the only reliable way to limit emissions to the atmosphere is to incorporate the manure into the land as rapidly as possible and to keep it covered and contained until that time. This is only possible if sufficient spreadable acreage is located adjacent to the CAFO. Obviously, to really solve the problems of odor and waste there is only one answer—never keep more animals than the available land will accommodate.

Anaerobic digesters do almost nothing to make a very serious problem less serious. Anaerobic digesters operate at temperatures too low to destroy pathogens. The concentration of oxygen-demanding carbon compounds exceeds concentrations in untreated municipal waters. Digestion converts organic forms of nitrogen to ammonia nitrogen, but it does not reduce phosphorus. And finally, the lagoons themselves continue to pose dangers to surrounding residents--leaking, emitting dangerous gases, and threatening to overflow.

Less Manure is the Solution

Manure accumulation is not the problem, it is a symptom of the real problem: CAFOs concentrate so much manure in such a small area that it cannot be realistically used for fertilizer. The GRACE Factory Farm Project does not endorse any manure treatment, recycling, or utilization technology. In our view, the solution is to allow unconfined animals to spread their own manure and to employ sustainable farming practices, not to rely on the application of endless and increasingly expensive technological fixes.

Further reading

Test and Quality Assurance Plan: Swine Waste Electric Power and Heat Production Systems: Capstone MicroTurbine and Martin Machinery Internal Combustion Engine (Prepared by Greenhouse Gas Technology Center, in cooperation with EPA. November 2002. 166pp.)

Methane Leakage from Anaerobic Digesters

Excerpted from Lifecycle Greenhouse Gas Analysis of an Anaerobic Codigestion Facility Processing Dairy Manure and Industrial Food Waste, Environmental Science & Technology, 2015, 49 (18), pp 11199–11208. DOI: 10.1021/acs.est.5b01331

Digester Operation. Digester emissions consist of direct emissions due to leaks or incomplete combustion as well as indirect emissions offset by electricity generated. Canadian and German studies reported fugitive emissions ranging from 2.1% to 3.1% of CH4 utilized.[45,46] The nominal value of 3% of gas utilized was used. However, Liebetrau et al.[46] noted that when leaks and malfunctions were eliminated, near zero fugitive emissions were measured. Conversely, releases of biogas were observed through emergency vents due to overpressure conditions in the reactor or when flaring was not possible. Therefore, a sensitivity analysis was performed using the IPCC default uncertainty range of 0–10%.[18] This range also allows for consideration of emissions due to flaring of biogas, which were minimal during the period of study due to issues related to flare operation but were reported to be on average 21% of gas produced in a study of seven NYS AD plants.[47] Site supplied measurements of gen-set exhaust reported 1314 ppmv dry CH4, which equated to 2.5% of the CH4 utilized. This was consistent with reported values for incomplete combustion, which ranged from 0.4% to 3.28%.[45, 46] N2O exhaust emissions were a smaller contribution at 0.03gN2O/m3CH4 utilized, which is also consistent with the range reported in the literature (0.02–1.75g N2O/m3 CH4 utilized).[46, 48]

References:

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[46] Liebetrau, J.; Reinelt, T.; Clemens, J.; Hafermann, C.; Friehe, J.; Weiland, P. Analysis of greenhouse gas emissions from 10 biogas plants within the agricultural sector. Water Sci. Technol. 2013, 67 (6), 1370-1379. https://www.ncbi.nlm.nih.gov/pubmed/23508164

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ASERTTI monitoring protocol: Consolidated report and findings, PRO-DAIRY Program; Department of Biological and Environmental Engineering, Cornell University: Ithaca, NY, 2011; http://nmsp.cals.cornell.edu/publications/extension/Ndoc2003.pdf.

[48] Nielsen, O. K.; Lyck, E.; Mikkelsen, M. H.; Hoffmann, L.; Gyldenkærne, S.; Winther, M.; Nielsen, M.; Fauser, P.; Thomsen, M.; Plejdrup, M. S.; Illerup, J. B.; Sørensen, P. B.; Vesterdal, L. Denmark's national inventory report 2008 − Emission inventories 1990−2006; Submitted under the United Nations Framework Convention on Climate Change; NERI Technical Report no. 667; National Environmental Research Institute, University of Aarhus: Denmark, 2008; http://www.dmu.dk/Pub/FR667.pdf.