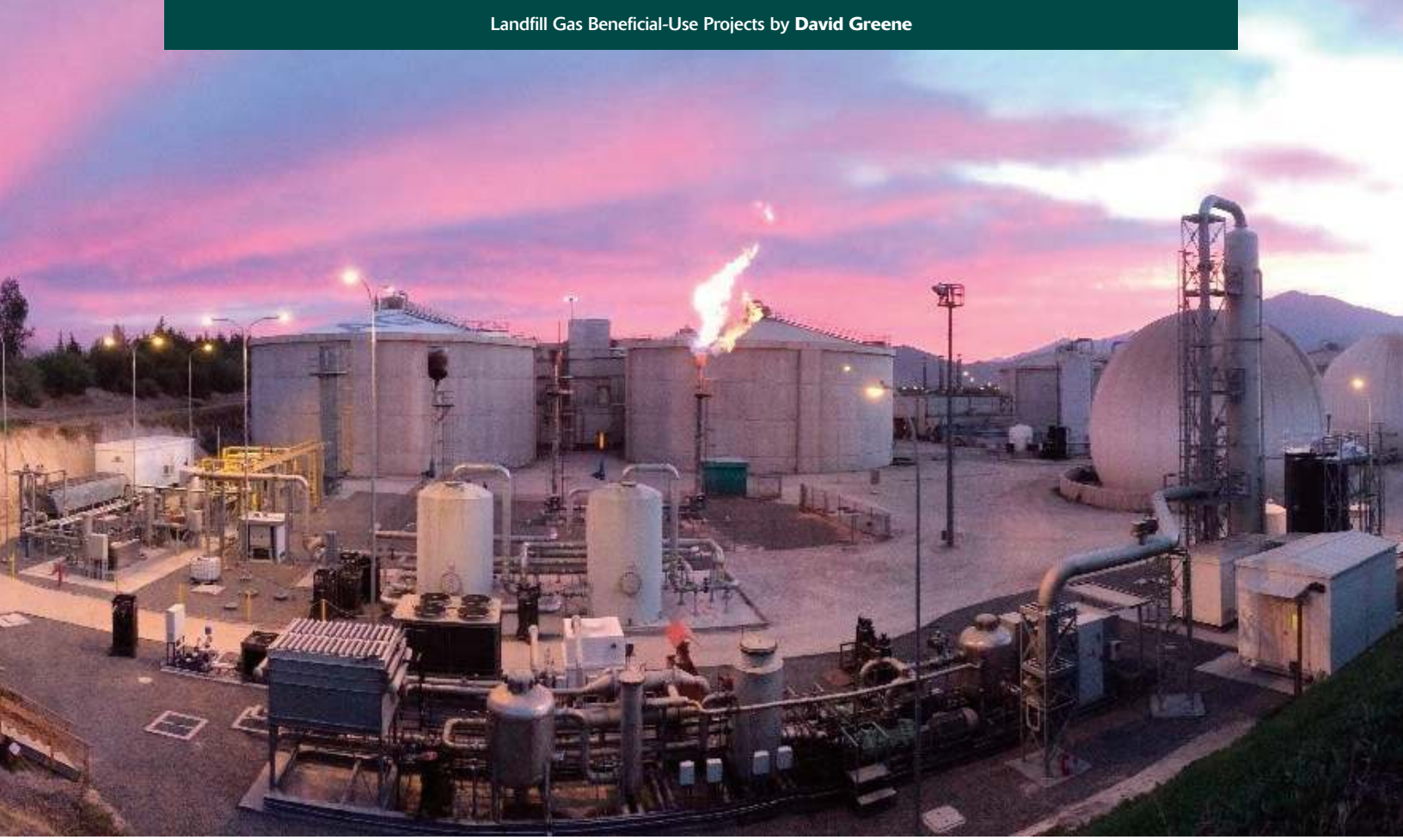

Permitting Landfill Gas Beneficial-Use Projects:

Clear the Fog

by David Greene

An overview of air permitting considerations that arise and issues to keep in mind when planning for a beneficial-use energy project using landfill gas.

Landfills that accept municipal solid waste (MSW) generate landfill gas (LFG) as the disposed organic material decomposes; about half of the LFG by volume is methane. For decades, LFG has been productively channeled into beneficial use projects at many sites, serving as a fuel to produce renewable energy, adding renewable natural gas to pipelines, and in many cases, directly reducing atmospheric emissions of methane, a potent greenhouse gas (GHG).

Such beneficial uses can generate needed electric power, create revenue for the landfill, offset fossil fuel use, and provide opportunity for carbon credits—all from the energy content contained in methane. Collection of landfill gas is a critical means of controlling fugitive landfill emissions that comprise a variety of compounds—besides the high methane fraction—and strong odorants. Methane is a particularly significant GHG and is some 25+ times more potent than carbon dioxide. Methane's potency as a GHG, and the potential for methane emissions reduction, drew special scrutiny during the 2021 Conference of the Parties COP26 meetings in Glasgow.

While LFG beneficial use projects for energy generation have financial and technical considerations, another critical aspect is compliance with applicable air quality rules. This can leave the landfill confronted with a number of important questions, some of which may be challenging:

- Who will hold the air quality permit for the landfill?
- Is the landfill subject to U.S. Environmental Protection Agency (EPA) rules that mandate LFG control?
- If so, who is responsible for operating the LFG control and treatment systems required by the EPA rules, i.e.; the New Source Performance Standards (NSPS)?
- Could the LFG energy project possibly push the landfill into compliance difficulties?

Landfill Gas Generation

MSW contains organic material that degrades over time. When a truckload of MSW is deposited in a landfill, the waste is typically placed in an engineered cell with other MSW already there. The waste is then spread in the cell and compacted to increase structural integrity and to minimize in-place volume, thus extending the lifetime storage capacity of the landfill. Then a daily cover, typically soil, is placed on top of the waste. Following these steps, the truckload of waste is now, assuming typical moisture and pH levels, in a favorable environment for anaerobic bacteria to degrade the organic portion of the waste and generate LFG. At a certain point, methane production within the landfill cell reaches a steady state and will continue until the organic waste is sufficiently degraded to the level that methane generation is greatly reduced. As long as the landfill is actively receiving MSW, LFG will be produced, but when the landfill reaches the end of its waste acceptance life, and is closed to new waste, LFG production begins to sharply decline.

If not sufficiently captured, LFG generated in high quantities can create problems, including unacceptable odor for landfill neighbors, high fugitive emissions of air pollutants, physically debilitating stresses on the landfill cover, and pressure on the landfill's subsurface liner that could cause LFG to migrate to the surrounding soil. Therefore, landfills that produce a sufficient amount of LFG are required to control their LFG emission using a designed gas collection and control system (GCCS).

However, not all of LFG that is generated is collected; some gas escapes as a "fugitive" emission to the air. Factors explaining this include the diffuse nature of gas generation within the landfill, efficiency limitations of gas collection systems, variation of waste types in the landfill, as well as waste settlement dynamics and leachate movement within the landfill. In its reference compilation of air-pollutant emission factors, AP-42, EPA suggests that 75% collection efficiency is typical of an effective GCCS. In practice, efficiency may be higher at many landfills. Successful LFG recovery depends on a variety of factors, including design and maintenance of the gas system, landfill operations, type of waste disposed, and liquid content (from waste or precipitation) that may be retained in the waste mass. An estimate merely of LFG potential generation is not an effective approach to calculating the size of a potential LFG beneficial-use project.

Permitting Questions

For most landfills, air permitting is seldom simple, and discussion at a general level is further complicated due to the variety of site-specific, state-level, and local regulations that apply in addition to the federal EPA regulations. However, there are some common aspects that allow the use of six fundamental questions to guide project planning from a permitting perspective and in obtaining a permit that allows the project to meet it design goals. Please note that these questions are not necessarily sequential. And, of course, applying for an air permit is far more involved than merely answering a handful of questions. However, these questions point to considerations that are critical steps in approaching the development of an effective air-permitting strategy.

Question 1: Who will own and operate the project?

LFG beneficial-use energy projects are often located on-site at the landfill from which LFG is obtained, or near the landfill (see Figure 1). If the owner of the LFG beneficial-use project is also the owner of the landfill, then air emissions from the energy project will be aggregated with the fugitive air emissions from the landfill itself under that one owner's EPA air quality operating permit (i.e., Title V permit). In addition, that owner will be responsible for operating the control system for fugitive emissions of LFG at the landfill, as required

Figure 1. Energy Project Using Landfill Gas.
Photo courtesy of SCS Engineers.

under the New Source Performance Standards (NSPS). However, if the beneficial-use project and the landfill are under separate ownership, then, in many instances, only the air emissions from the beneficial-use project would appear on that owner's Title V operating permit, and that owner would have no responsibility for control of the landfill's fugitive emissions.

Question 2: Will the project be considered 'collocated'?

Under EPA's Title V operating permit program (as well as the agency's construction air-permitting program for new projects), multiple, different air emissions sources in proximity might be considered a single emissions source for purposes of permitting and regulation. For example, suppose an engine-generator unit operates next to the landfill from which it receives LFG as the fuel to generate electric power. Do the engine-generator and its emissions belong on the landfill's Title V operating permit, or on its own separate permit? What about the same question if the LFG energy project is located at an independent manufacturing plant several miles from the landfill?

What constitutes a single, combined emissions source versus separate sources for permitting purposes? The issue can be complicated and the answer dependent on local regulator interpretation and discretion. However, EPA has provided guidance in the form of the so-called three factor test: Separate emission sources can be considered collocated and aggregated for permitting purpose if the sources are (1) located on one or more contiguous or adjacent properties; (2) share the same two-digit (major group) Standard Industrial Classification (SIC); and (3) are under common control. Despite this guidance addressing multiple, collocated sources, EPA nonetheless requires that compliance responsibility be vested in a single individual, a "Responsible Official."

EPA has issued further guidance, in part, due to conflicting interpretations of common control and practical difficulties of separate entities trying to cooperate in complying under a single, common Title V permit. EPA issued a letter in April 2018 pertaining to landfill gas energy projects that limits the determination of common control to "the power or authority to dictate decisions." This, for example, in the case of an LFG energy project sited adjacent to a landfill, might allow separate air operating permits to be issued to the energy project and the landfill in some cases where the two entities have distinctly separate owners.

Question 3: What emissions are produced and how much?

Typical of most permitting exercises, the key question to always ask is, "what will be emitted and in what quantities?" The bulk of LFG energy project emissions arise from combustion of landfill gas as a fuel. Because those emissions are produced, an air quality permit is required to build and operate such a project and emissions will largely determine the type of permit.

To determine and calculate project emissions, confer with the equipment vendor for equipment-specific emissions factors. In addition, both EPA's AP-42 and WebFire databases can be useful sources for emissions factors, and there are other sources available. In addition to emission factors, equipment characteristics and an understanding of operational plans are critical to determining emission rates. Calculation of potential-to-emit for LFG energy generation equipment means alculating the maximum possible emissions, assuming operation at the extremes for emissions production (e.g., nonstop operation, 8,760 hours per year; constant operation at full design capacity of the engine generator). Calculating zpotential-to-emit conservatively like this can result in a permit that allows the site ample latitude to comply while operating effectively and flexibly. While basing the potential-to-emit on the maximum possible emissions is ideal and the norm, there are exceptions. One must sometimes base the potential-to-emit at a lower emission level if the project is proposed at a location where air quality does not meet the air quality standards (i.e., a "nonattainment area"). Another circumstance favoring a lowered potential-to-emit would be to avoid becoming subject to very complex permitting. This circumstance can potentially arise when a new project has multiple new emissions sources at the site, which when aggregated, would be large enough to trigger a much more

complex level of air permitting (i.e., EPA's Prevention of Significant Deterioration [PSD] permitting).

Regulated air pollutants for which emissions must be estimated include the pollutants having EPA air quality standards (for criteria pollutants), EPA-designated hazardous air pollutants (HAPs), state-defined toxic air pollutants, and GHG compounds. Each of these pollutant categories could trigger applicability of specific regulations, result in permit conditions being imposed, and push the site into a different EPA permitting category (e.g., Title V vs. Small Source operating permit; PSD permit to construct vs. Minor-Source permitting). Certain emissions from LFG energy generators, such as formaldehyde, may be high enough to change the project from being classified a minor HAPs emitter to a major emitter. This alone can require permitting the project under major emission-source permitting requirements, rather than under simpler, minor source permitting. Calculate emissions carefully, conservatively, and be mindful of the emission-level based rules and their meaning for the project operations and future expansion plans.

Question 4: Does the project trigger PSD permitting thresholds?

Following emissions calculation and the evaluation of other emissions that might need to be aggregated, compare the projected, maximum emission rates (potentials-to-emit) of EPA-regulated air pollutants to EPA's emission thresholds that trigger PSD construction permitting for major, new emission sources (for more detail, refer to 40 CFR §51.166; also check state regulatory listing). Exceeding these thresholds can drastically complicate permitting and limit future expansion plans for the site. PSD permitting is filled with complex issues and considerations beyond the scope of this overview article, but its applicability is a key consideration in permitting.

Figure 2. Landfill gas extraction well and pump for liquids removal.
Photo courtesy of SCS Engineers.

Question 5: Does the beneficial use of landfill gas conform with the applicable EPA regulations—NSPS Subpart XXX/ Part 62 Subpart OOO?

Typically, U.S. landfills fall into one of three overarching air regulatory applicability categories: either NSPS Subpart XXX, or the Part 62 Subpart OOO Rule, or an EPA-approved state rule. These rules can impose a variety of strict requirements on landfills, including the obligation to control landfill gas. For purposes of project permitting, check to see which of these rules apply and if the gas used by the project is "treated" as defined by the applicable rule.

NSPS Subpart XXX applies to landfills with a design capacity of 2.5 million tons and 2.5 million cubic meters of waste and which were "constructed, reconstruction, or modified" after July 17, 2014. Part 62 Subpart OOO applies to landfill " constructed, reconstruction, or modified" before July 17, 2014. State plans, if approved by EPA, take the place of Part 62 Subpart OOO in those jurisdictions. When a landfill, subject to one of these rules, reaches a calculated NMOC emission rate (by a procedure described in the rule) of at least 34 Megagrams per year, it must design and install an active gas system to collect LFG and route it to a control device. It can send LFG to a beneficial-use project if the gas is treated as specified in the rule (see below).

Importantly, these federal rules governing LFG emission control at landfills (state rules may differ) include a special provision for LFG beneficial-use projects regarding the control of landfill gas. The regulations noted previously above that a landfill operation must follow to show effective LFG emissions control are not required of LFG beneficial-use projects, if the LFG is treated, as specified in the rule, prior to its combustion as a fuel. LFG treatment in this context is defined in the rule as a system that filters, de-waters, and compresses landfill gas for sale or beneficial use (see Figure 2). The specific requirement can be found at one of the following:

- Part 60 Subpart XXX: 60.762(b)(2)(iii)(c)
- Under Part 62 Subpart OOO: 62. 16714(c)(3)
- EPA-approved state rule if applicable

LFG must be treated according to the applicable regulation and a gas treatment-system plan must be implemented in order for a project to be properly permitted.

Question 6: Are there special issues?

Consider other issues that can affect permitting of the LFG beneficial-use project or questions that may arise during the regulatory review period. Some examples include: Do people occupying neighboring properties view the project negatively? If so, a public outreach effort may be needed. Does the applicability of certain air regulations affect the project's eligibility for a potential carbon credit project that is available

Figure 3. Maintenance on a landfill gas-fired engine.

Photo courtesy of SCS Engineers.

only if the gas control project is voluntary and not required by a regulation? Is air dispersion modeling required to demonstrate that air quality impacts from project emissions comply with air quality standards? In addition to these questions, ask if technology-specific air rules apply that, for example, require good combustion efficiency and limit fzormaldehyde emissions from stationary engines in general, including those combusting LFG (e.g., per the engine-related air rules under NSPS JJJJ/NESHAP ZZZZ). If those engine-related rules apply, ask the engine's supplier if their technology's emission guarantees conform to applicable limits. Figure 3 shows routine maintenance on a landfill gas-fired engine.

Ask the regulatory agency if an application pre-meeting is required or advisable before submittal of the permit application. Ask also whether application fees apply, and about the proper application forms to use, as well the appropriate regulatory staff to work with. And finally, ask about whether, after the permit is granted, there are formal notifications that must be made to the regulatory agency of construction and/or startup, and if so, when?

As one of the last steps, after the regulatory agency has prepared a draft permit, review it carefully to confirm that the rules are being appropriately applied and the project can live with the permit conditions. Although the prospect of permitting a LFG beneficial use project can appear daunting, keeping these questions in mind can help clarify complicating issues and simplify others, allowing you to undertake the permitting effort on a solid foundation. Air permitting can be a challenge but asking the right questions at the beginning can avoid headaches and missteps during the permitting effort and avoid show-stopper problems later. **em**

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