Potential use of NSPS and GHGRP Data to Calculate GHG Reductions

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John Henkelman, Patrick S. Sullivan
SCS Engineers, Sacramento, California
Raymond H. Huff, Cassandra Drotman
SCS Engineers, Long Beach, California

INTRODUCTION

On August 29, 2016, the United States Environmental Protection Agency (EPA) published the new New Source Performance Standards (NSPS) and Emission Guidelines (EG) for municipal solid waste (MSW) landfills as 40 Code of Federal Regulations (CFR) Part 60, Subparts XXX and Cf, respectively. These new regulations iterate on the old MSW landfill NSPS and EG, 40 CFR Part 60 Subparts WWW and Cc, which had the stated goal of reducing emissions of non-methane organic compounds (NMOC) and volatile organic compounds (VOC), which can contribute to ozone formation. The new NSPS and EG regulations (Subpart XXX and Cf regulations) have the same goal of reducing NMOC and VOC emissions, but also include the goal of reducing greenhouse gas (GHG) emissions from landfills, primarily methane from landfill gas (LFG). As noted in the new NSPS and EG regulations, the reduction of methane emissions is part of the 2013 Presidential Climate Action Plan and consistent with the President's Methane Strategy. However, demonstrating the effectiveness of the new regulations in reducing emissions will pose a challenge for the EPA and other regulators.

The EPA is collecting GHG emissions data from a wide range of GHG emission sources, including landfills, as part of the federal GHG Reporting Program (GHGRP) (40 CFR Part 98). However, landfill GHG emissions include fugitive emissions and are not directly measured like GHG emissions from the majority of other stationary sources. Instead, methane generation at landfills is calculated two ways, as modeled and calculated based on measured methane recovery or an estimated methane collection efficiency. The modeled and measured recovery estimates are both reported under the GHGRP.

This extended abstract reviews and determines whether the data the EPA would need to quantify the GHG reductions achieved by the new NSPS and EG. It discusses what information is being collected by the EPA as part of either the new NSPS and EG regulation or the GHGRP, and whether that data could be used to demonstrate GHG emissions resulting from the new NSPS and EG. The extended abstract also identifies data gaps, which would need to be filled before accurate estimates of GHG reductions could be derived.

NSPS AND GHGRP BACKGROUND

The NSPS, EG, and the GHGRP are regulatory programs which apply to landfills in the United States. Applicability for the NSPS and EG are triggered by the design capacity of the landfill, and the applicability for the GHGRP is triggered by the potential methane emissions from the site.

The NSPS and EG require the quantification of NMOC emissions. Under the new landfill NSPS (40 CFR Part 60, Subparts XXX and Cf), adopted in 2016, if NMOC emissions exceed 34 megagrams per year (Mg/year), the site triggers a timeline for the installation of a LFG collection and control system (GCCS). Alternatively, the site may demonstrate that if NMOC emissions are below 50 Mg and quarterly surface emissions of methane are below 500 parts per million by volume (ppmv) on an annually may delay the installation of a GCCS.

The older NSPS and EG regulations (40 CFR Part 60 Subparts WWW and Cc) had similar NMOC quantification requirements, but the threshold for triggering the GCCS installation timeline was 50 Mg/year of NMOC emissions. The old NSPS and EG did not allow sites to demonstrate that surface emissions were below 500 ppmv to delay GCCS installation.

The GHGRP requires that landfills generating more than 25,000 Mg/year of carbon dioxide equivalent ($MTCO_2e$) of potential emissions submit annual emission reports. The GHGRP does not impose emission limits on a site. The NSPS and EG regulations do not impose emission limits either, but they do require emission reductions through LFG collection and control.

DATA COLLECTED BY THE GHGRP AND NSPS

The GHGRP collects a significant amount of data for each site reporting under the GHGRP regulation. Each site's data is reported in an eXtensible Markup Language (XML) files, which can be directly generated by the reporter or using the EPA's reporting tool. Even relatively simple sites without LFG collection can contain several hundred lines of data. More complicated sites can have over a thousand lines of data, but only a small portion of the data play part in determining GHG emission reductions due to the NSPS.

Under the GHGRP, sites report their annual waste placement and average annual rainfall which is critical for determining NMOC and GHG emission reductions. These data are themselves inputs into the methane generation model used to calculate methane generation at sites, but they also allow the EPA to create an LFG generation model for each site reporting under the GHGRP. The fact that the regulations use two different models is important for evaluating which sites are covered by the GHGRP (an Intergovernmental Panel on Climate Change [IPCC] mimic model), which sites are subject to the new NSPS (the LFG Emission Model [LandGEM]), and which sites are covered by both. While both the IPCC mimic model and LandGEM are first order decay (FOD) models, which use the mass of landfilled waste as an input, they each have different values for the methane generation potential and decay rate of the waste.

However, the data collected by the GHGRP are not perfect inputs for use in NSPS and EG emission calculations. Some waste types that are included when calculating emissions under the NSPS and EG are clearly excluded in the GHGRP. One such example is petroleum contaminated soils (PCS). PCS is inert and should be reported as inert waste under the GHGRP; however, it is likely to contain NMOC that could be emitted in LFG and should be included when evaluating NMOC emissions for NSPS applicability[1].

It may be reasonable to overlook discrepancies in waste tonnage inputs to evaluate emission reductions. The overall magnitude of the discrepancies in the waste tonnages subject to each rule are likely to be small relative to the overall magnitude of the waste stream in the United States; however, it could be relatively large for individual sites when sites take large amounts of inert waste.

The GHGRP also requires the reporting the methane oxidation rate at the landfill surface. This rate can be as low as zero (0) in the case of landfills with a geomembrane cover, to as high as 35 percent for landfills with low methane flux. This reduction in methane emissions for oxidation is potentially significant and significantly more accurate, and the ability to include the methane oxidation rate that would occur in landfill cover if the methane were not collected in calculations significantly improves the accuracy of the GHG reduction calculations.

FAILURE OF EACH SINGLE REGULATION TO COLLECT NECESSARY DATA

The data required under the NSPS and EG when reporting NMOC emissions include “all the data, calculations, sample reports, and measurements used to estimate the annual or 5-year emissions.” Data collected include annual waste placement, methane generation potential, decay rate, and default or site specific NMOC concentration, which are then input into the LandGEM to calculate the NMOC emission rate. The data could be used as model inputs to calculate the methane generation rate for a landfill, but there are deficiencies when trying to do so. The data set collected under the NSPS is insufficient for determining the GHG emissions because it is missing waste categorization, allowed under the GHGRP, and the methane oxidation rate in the landfill surface and requires default inputs to the models that may not provide accurate estimates.

Most critically, the NSPS and EG does not collect any data on LFG collection. Since the NSPS and EG achieve GHG emission reductions through the collection and destruction of methane in LFG, the only reasonable way to quantify GHG reductions based on that recovered LFG and methane data. The NSPS and EG do not collect that data, and it is impossible to quantify GHG reductions resulting from the regulation without those data inputs.

Similarly, the GHGRP fails to collect the data needed to determine which sites are impacted by the NSPS and EG because it does not collect any data on the concentration or emission rate of NMOC emissions from landfills. Without the NMOC emission rate, it is not possible to evaluate which sites are required to collect LFG by the NSPS or EG versus those collecting LFG for reasons such as energy recovery, migration control, or odor reduction.

Because neither regulation requires the necessary data to evaluate the reduction in NMOC and GHG emissions, this extended abstract evaluates whether the data from both programs is collectively sufficient to determine the NMOC and GHG emissions achieved under the NSPS and EG.

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[1] This determination was issued be the EPA based on the old landfill NSPS and EG (Subparts WWW and Cc), but the wording of the new NSPS is similar to the old NSPS. It seems likely that the determination would apply to the new NSPS as well.

EARLY GCCS INSTALLATION

The NSPS and EG have different applicability thresholds than the GHGRP. Sites with relatively high NMOC concentrations can be required by the NSPS or EG to install a GCCS before exceeding the 25,000 $MTCO_2e$ emission threshold that would trigger reporting under the GHGRP. After the GCCS is installed and operational, there is no reporting requirement under the NSPS or EG for the quantity of LFG or methane recovered to be reported. The methane reduction driven by the NSPS would not be quantifiable until the site becomes subject to the GHGRP, which requires the measurement of the quantity of methane collected.

It is likely that NSPS and EG sites with a GCCS are collecting the data required to quantify the methane recovered (LFG flow rate and methane concentration). The site may be reporting it to regulators at the local or state level as required by a permit, but that information is unlikely to be reported to the EPA where it could be used to quantify the GHG reductions caused by the NSPS and EG.

GCCS INSTALLATION DRIVER

The most significant challenge in determining GHG reductions created by the new NSPS and EG, is determining whether the new NSPS and EG are the driving factor in forcing a site to install a GCCS. The new NSPS will require the installation of a GCCS at sites generating between 34 Mg/year and 50 Mg/year of NMOC; however, the NSPS and EG are not the only factor that can drive a site to install a GCCS.

There can be several drivers of GCCS installation. Prevention of LFG migration offsite or to groundwater is one regulatory driver of GCCS installation. Some state and local regulations, such as California's Methane Emissions from Municipal Solid Waste Landfills regulation (Title 17, California Code of Regulations [CCR], Article 4, Subarticle 6, Sections 95460 to 95476), can require the installation of a GCCS ahead of the timeline created by the new NSPS and EG. Voluntary installation of gas collection could be driven by an energy recovery project where the LFG is combusted for a beneficial use like electricity generation. It is not uncommon for sites to operate a GCCS prior to triggering the regulatory GCCS installation timeline, as the aforementioned examples demonstrate, then to operate the GCCS under the requirements of the NSPS or EG when the NMOC generation threshold is exceeded, making it more difficult to attribute the GHG reductions from GCCS installation and operation to the NSPS and EG.

Neither the NSPS, EG, nor the GHGRP collect information on whether the NSPS was the cause of the GCCS installation. This data gap means that determining the GHG reductions achieved by the NSPS will require reviewing a combination of NMOC emission reports, GCCS design documents, and other reports to determine whether GCCS installation was driven by the NSPS and EG. This determination requires exercising professional judgement and has the greatest potential for introducing error, even if the professional has access to a robust set of NSPS and EG data.

The driver of GCCS installation is further complicated by the fact that sites may install partial GCCS for the reasons mentioned above prior to triggering the NSPS and EG timeline for installation. When those sites are required to install a GCCS by the NSPS or EG, they can then expand the partial system into a comprehensive NSPS and EG compliant system. Only part of the LFG recovered by such a system would be attributable to the NSPS and EG. Without sectioning the GCCS off by the requirement that drive the GCCS installation and metering each section separately, it will be impossible to separately quantify for which fraction of the collected LFG the NSPS and EG are responsible.

CONCLUSIONS

Neither the NSPS and EG nor the GHGRP require the reporting of sufficient data on their own to reasonably calculate GHG reductions resulting from the new NSPS and EG. The NSPS and EG lack data on methane collection and destruction to quantify GHG emission reductions under the regulation, and the GHGRP lacks any data on NMOC emission rates or the GCCS installation drive that could be used to determine which sites are collecting and destroying methane due to the NSPS and EG.

If the datasets are combined, it is possible that the quantity of GHG reductions could be estimated, though some data gaps will continue to exist as in the case of landfills which install a GCCS prior to entering the GHGRP or sites which expand an existing GCCS in response to the NSPS or EG. Due to these data gaps, it is not possible to provide more than an estimate of the amount of GHG reductions cause by the NSPS and EG.

Even with the data from the NSPS, EG, and the GHGRP, compiling the data across the programs will be challenging because NSPS and EG data are submitted in narrative reports and do not allow easy data extraction. This easy data extraction is possible with the GHGRP due to the use the online reporting tool and XML report format. However, this XML reporting format prevents reporters from nuanced explanations or scenarios not envisioned by the coders responsible for the format.

To improve the estimation of the GHG reductions from the NSPS and EG, the EPA would have to definitively know which sites were collecting LFG due to the NSPS and EG and how much of that collection was due to the NSPS and EG. The EPA would also have to collect methane recovery data from sites which are subject to the NSPS but not the GHGRP. With this additional information, it would be possible to create a reasonably accurate estimate of the GHG emission reductions attributable to the new NSPS. Until such data are available, EPA will continue to rely on imprecise estimates of the emission reductions attributable to the NSPS and EG. This reliance on imprecise data make it almost impossible to accurately estimate the benefits of the regulation or its cost effectiveness.

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