SUMMARY AND RESPONSE TO PUBLIC COMMENTS

A draft Methodology for Landfill Gas Destruction and Beneficial Use Projects, Version 2, was developed by Loci Controls and the American Carbon Registry (ACR).

All new methodologies and methodology modifications, whether developed internally or brought to ACR by external parties, undergo a process of public consultation and scientific peer review prior to approval.

The methodology was posted for public comment from July – September, 2020. Comments and responses are documented here.
If applicable, additional public comments received after the formal close of the public comment period are also documented herein and were considered in the final version of the methodology.

#	Organization	Commenter	Comment	Author Response
1	Cool Effect, Inc.	Siddharth Yadav	We believe that the question of financial additionality is key to proving the necessity of a landfill gas collection and destruction project claims to climate change funding. We would like to see disclosure of other fees, government support and local/state/federal subsidies that might be associated with community, public or private landfill gas projects. Assessment of whether the project needs revenues from the sale of carbon credits is critical, most importantly if these credits are to be used as offsets.	In the ACR Landfill Gas Destruction and Beneficial Use methodology (Methodology), projects may determine additionality by utilizing either a practice-based performance standard coupled with a regulatory surplus test or a three-prong (regulatory surplus, common practice, and financial implementation barrier) additionality test. To date, the only landfill gas project registered under the Methodology has utilized the three-prong additionality test and therefore has used a financial implementation barrier test, as required. For this project, additionality was validated by an accredited validation and verification body per the requirements of the ACR Standard and the Methodology.

				The Methodology does include a practice-based performance standard which was developed taking into consideration the size and location characteristics of a landfill. This is a stringent test and, to date, no project has attempted to utilize the performance standard. In a potential Version 2 of the Methodology, which was recently available for public comment, the performance standard was expanded to include projects that install an automated collection system (ACS). In the development of the performance standard for ACS projects, both common practice and financial considerations were analyzed to ensure that ACS projects cannot be considered business as usual and to ensure that these projects need carbon finance to achieve the promise of enhanced methane recovery in landfill applications. Details on the development of the performance standard can be found in Appendix A of the Methodology.
2	Cool Effect, Inc.	Siddharth Yadav	We recognize that LFG flaring and usage reduces odors associated with landfill gas projects. We would like to know what kind of pressure was experienced from surrounding communities and landfill gas workers that might have prompted the project to install a LFG flaring/destruction mechanism. If the equipment was installed as the result of community requirements or worker safety, the project additionality is questionable.	ACR would agree with this assessment. If a project is required, it would not pass the regulatory surplus test for additionality (which is a component of both the performance standard approach as well as the three-prong additionality approach allowed in the Methodology).
3	Cool Effect, Inc.	Siddharth Yadav	Landfill gas to Energy Projects - We believe that projects that use landfill gas for energy are extremely valuable	Again, ACR agrees with this assessment. When a project applies the three-prong additionality

			but using the gas in this way creates a financial opportunity. We believe this should be captured in the methodology. The costs of equipment, income from the sale of renewable natural gas (which is currently around $150 per tonne) maintenance, and labor for this kind of project should be included in the project review. Revenues from the sale of gas or electricity to the grid, or savings from captive consumption, gas injection or vehicle transport usage need to be declared transparently in the project documentation.	approach, the financial implementation barrier must be applied. All project costs and revenues are presented by the project proponent and validated by the validation body.
4	Cool Effect, Inc.	Siddharth Yadav	ACR has taken a similar approach to the Climate Action Reserve's US LFG Protocol Version 5 dated April 2019 for project developers adopting a performance-based additionality test option which is based on the technological penetration level. Through the review of the registries, we can attest to the fact that not a single new landfill gas project has registered under V5 of the CAR US LFG Protocol version 5 which was released in April 2019. Some of the projects have re-credited under the V5 of the CAR LFG Protocol, but we note that if a project does re-credit under CAR's LFG Protocol V5, there is no requirement for a new test for additionality if the project has issued credits before. For all projects – new or those renewing their crediting periods - we would recommend ACR adopt a crediting period of 5 years at which time additionality and baseline must be reviewed.	Please note that Version 1 of the Methodology was published in March 2017 and that the Climate Action Reserve's (CAR) Version 5 was published in April 2019. It was CAR that changed its additionality requirements when it introduced Version 5 of its protocol which was two years after ACR's Methodology was adopted. There were no projects that could qualify under CAR's Version 4. Per the ACR Standard, non-AFOLU projects are granted a 10-year crediting period. Given the timeline for project development in the landfill industry, ACR disagrees that the 10-year crediting period should be reduced for landfill projects. ACR does agree (and requires) with the comment that additionality be reassessed during a crediting period renewal process under the requirements that exist in the ACR Standard and the Methodology at the time of renewal.

			We believe one of the reasons that newly commissioned LFG projects have not registered for a GHG Program in the United States is because they are financially viable, and hence not in need of revenues from carbon credits.	Finally, the primary reasons that new landfill projects have not registered in carbon markets recently are the stringency of the additionality requirements included in landfill gas methodologies as well as requirements that prevent double counting of emission reductions (for instance, LFG projects cannot register in a voluntary carbon market and California's Low Carbon Fuel Standard program). Financial viability is not the primary reason that projects have not registered in carbon markets.
5	Cool Effect, Inc.	Siddharth Yadav	Version 2.0 of the ACR LFG Methodology adds a fifth eligible project activity i.e installation of an automated collection system that increases LFG collection efficiency above that which is obtained with standard collection methods. Section 3.1 The baseline determination states *'For projects that are or have previously employed ineligible project activities, such as a passive flare, or have an eligible project activity that was implemented prior to the specified start date, emission reductions associated with these activities shall be accounted for in the baseline emission calculations**2**.* *Project proponents shall submit a proposed method for quantifying pre-project emission reductions to ACR for approval. Emission reductions resulting from ineligible project activities shall be accounted for in Equation 2 as NEdevice.* The footnote (2) on page 15 states: ***2*** *For projects that install an automated collection system that increases landfill gas collection efficiency as*	This is a misunderstanding of the quantification requirements for projects that install an ACS as a stand-alone project activity (as indicated in the footnote). In these situations, a project only receives credit for the *increase* in gas collected due to the ACS and is not credited for landfill gas collection/destruction that would occur in the absence of the ACS. Therefore, it is not possible for a "pre-project" deduction for an ACS project which is why a pre-project deduction cannot apply, per footnote 2, in a future Version 2 of the Methodology.

			a stand-alone project activity, a landfill gas destruction device(s) may be operational prior to the start date of the automated collection system. In these situations, a deduction for baseline pre-project emission reductions is not required. We believe a deduction of actual emission reductions before installation of a more efficient automated collection system is necessary to ensure conservativeness and for the credibility and authenticity of the baseline.	
6	National Waste & Recycling Association (NWRA)	Darrell K. Smith	The EPA regulations do not specify how a landfill achieves compliance with collection system requirements so long as "owners and operators design, construct, and operate gas collection systems to *maximize collection and minimize emissions* of landfill gas." As such, automated wellheads simply are another means of ensuring compliance with the EPA regulations. It is thus unclear how the installation of this type of equipment would satisfy additionality given that EPA already requires that collection technology "handle the maximum expected gas flow rate" from the landfill and collect from all areas where initial waste placed is two to five years old.	ACR disagrees with this comment. Landfill gas collection and control systems (GCCS) at NSPS sites not utilizing automated control systems (ACS) are already deemed to comply with GCCS requirements when operated in accordance with the regulation *without* an ACS. Given that this is the case, the presumption has to be that the collection system was designed in accordance with regulatory requirements and any increase in collection efficiency through deployment of an ACS is not required by law. There is long standing precedent in emission markets to credit emission reductions beyond regulatory requirements. This is how ACR has historically operated its program but, for this point probably more importantly, it is also how the California Air Resources Board operates its compliance offset program. This is evidenced by language found in protocols for mine methane,

				anaerobic digestion at livestock facilities, and in the destruction of ozone depleting substances. All allow emission reductions in excess of regulatory requirements. Further, NWRA cites only the design considerations of a GCCS. The NSPS regulatory requirement, regarding system design, states that the LFG gas collection system "be *designed* to handle maximum expected gas flow rate from the entire area of the landfill". However, NSPS also states an operating requirement that the LFG collection system "collect gas at sufficient extraction rate". An ACS is not changing the *design* of a LFG collection system but rather the *operation*. An ACS that meets the methodology's definition will optimize operation of that system through automated feedback and control to conditions that cannot be matched by a manual process (such as manual well field tuning). Manual operations have been determined to meet the "collect gas at sufficient extraction rate" standard under NSPS. As shown below, compliance with the sufficiency standard is to "measure gauge pressure in the gas collection header applied to each individual well, monthly." ACS operations will exceed the "sufficient" standard by measuring all wells typically hourly for pressure and all the other parameters required by NSPS and more. Therefore, an ACS will optimize the operation of

				the LFG collection system which is beyond the regulatory "sufficient" requirement. *<u>From NSPS Standards for air emissions from municipal solid waste landfills at 40 CFR 60.762(b)(2)(ii)(c)(1-3):</u>* (C) An active collection system must: (*1*) Be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control system equipment; (*2*) Collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade. (*3*) Collect gas at a sufficient extraction rate; *From NSPS compliance provision at 40 CFR 60.765(a)(3):* (3) For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with §60.762(b)(2)(ii)(C)(*3*), the owner or operator

				must measure gauge pressure in the gas collection header applied to each individual well, monthly. If a positive pressure exists, action must be initiated to correct the exceedance within 5 calendar days, except for the three conditions allowed under §60.763(b). Any attempted corrective measure must not cause exceedances of other operational or performance standards. For all of the above reasons, the deployment of an ACS can be considered additional to regulatory requirements and therefore creditable for emission reductions achieved in excess of regulatory requirements. NWRA's assertion to the contrary is incorrect.
7	National Waste & Recycling Association (NWRA)	Darrell K. Smith	There are multiple challenges associated with generating emissions offsets based on modeling techniques. To the extent these models rely on assumptions that are susceptible to manipulation, a project proponent may be unable to ensure that incremental reductions in landfill biogas emissions have occurred, are measurable, are permanent, and can be quantified by an approved validation or verification body.	NWRA appears to be concerned that the use of modeling, as proposed in the revised methodology, is subject to manipulation and apparent innocent or potentially fraudulent use. ACR is unclear how such manipulation would occur but assumes that NWRA, which represents the vast majority of landfill owners in the country, is not suggesting that any of its members would undertake such manipulation. ACR does not believe that an unsubstantiated claim of potential fraud should be used to criticize the revised methodology. An advantage of the monitoring and quantification proposed in the methodology is that the underlying modeled data is required by law to be submitted to the EPA under penalty of perjury. We assume that

				NWRA is not suggesting that companies would commit a federal crime in order to take advantage of the methodology's data collection requirements. We believe that specter is unlikely. If NWRA is suggesting that a project proponent may be unaware of such manipulation and therefore could not ensure that its application were correct, we again wonder why this would be characterized as "manipulation". Under the EPA Greenhouse Gas Reporting Program (GHGRP), the landfill owner is solely in control of the data inputs to the model, and presumably takes great care to assure that the integrity of the input data reflects the specific conditions of their landfill to accurately calculate the generation of LFG. The ACR methodology is not tethered to the rules of the GHGRP but rather uses the data inputs and equations that the landfill industry has itself used well before the GHGRP was developed. Furthermore, as noted in our responses to comments 8 and 9 below, the landfill industry shaped the GHGRP methodology through articulating industry positions and comments that EPA accepted and incorporated to provide the model that is today used in the GHGRP. These factors provide support for the statement that the model is sufficiently accurate and can reasonably be utilized for the intended purpose of supporting

				the calculation of the incremental impact of the ACS system on LFG flows.
8	National Waste & Recycling Association (NWRA)	Darrell K. Smith	The methodology relies on modeled emissions which differ too significantly from actual, measured emissions to be considered genuine. Our overarching concern with the proposed quantification approach is that it is tethered to the EPA Greenhouse Gas Reporting Program (GHGRP) rules, including its equations and assumptions. Quantification based on the GHGRP modeling approach would not be an appropriate framework primarily because the significant uncertainties for gas generation and collection efficiency, which are modeled or based on assumptions. There are some sensitive variables in these equations, that can make baseline and quantification of emission reductions untenable. In the current approach the only verifiable measurement is the amount of gas collected.	Again, the ACR methodology is not tethered to the rules of the GHGRP but rather uses the data inputs and equations that the landfill industry has itself used well before the GHGRP was developed. The methodology for determining incremental methane collected from an ACS relies on measured quantities of landfill gas collected (through data collected by landfill or landfill gas utilization facility owners and operators). These measurements are typically supported by appropriate calibrations and performed at frequencies that provide accuracy of data that can be verified by third-party verifiers. The incremental methane collected is demonstrably real and permanent subject to the ACS installation and continued operation. While the EPA Landfill Gas Emissions Model (LandGEM) is used to set a basis for comparison, the accuracy of the calculation of incremental collection efficiency is based on data and calculations other than the predictive accuracy of the model. If the inputs to the model are consistent as reported by the landfill owner or operator over the relevant periods (e.g. waste additions, waste areas by type, the measured collected LFG, L_o and k), the adjusted collection efficiencies are accurately calculated by the

				methodology and the incremental collection efficiency, attributed to the ACS, is also accurate. Regardless, the landfill industry has used LandGEM as the most accurate tool in its possession to quantify total generation of LFG. The model is the standard first-order decomposition rate model that the entire landfill gas industry has used for over 30 years to permit, and to develop landfill gas utilization and control projects throughout the United States. The input parameters (e.g. L_o, and k values) to the model are adjusted to calibrate the specific conditions of the landfill (e.g. location, weather conditions and type and quantities of waste disposed, landfill area type, depth of waste) to determine an accurate quantity of total LFG generation. Most major waste companies, consultants, engineers, developers, and financers of LFG utilization projects have used this model to project landfill gas quantities for future planning considerations including compliance with regulations, sizing of LFG collection systems, and to support development of LFG utilization and control facilities. Most landfill owners take great care to assure that the data inputs and the results accurately reflect the actual performance of their landfill, especially when the data and results are reported through regulatory bodies and available to the public. We believe that the

				use of the model for the ACS system is equally supportable as is its use in all these other applications for which it is a standard tool for the industry. The industry has continued to be supportive of the method adopted which is contained in the proposed ACR methodology. For example, in 2016, NWRA member company Waste Management, Inc. submitted the following comment on proposed amendments to the GHGRP: "We first want to address this question by stating our unequivocal support for maintaining the ability for reporters to calculate a weighted-average collection efficiency value for each landfill using an area-based approach. <u>Landfill reporters have used this methodology since the inception of the GHG Reporting Program (GHGRP). EPA adopted the methodology based upon a review of substantial, peer-reviewed scientific data supporting the approach. EPA did this to enhance the accuracy of GHG emissions estimates by incorporating actual site-specific data about the type of landfill cover employed. This allows the GHGRP to go beyond simple modeling using default values, and results in improved emission estimates through use of site-specific values for calculating collection efficiency</u>." (See: Summary of Public

				Comments and Responses: 2015 Revisions and Confidentiality Determinations for Data Elements under the Greenhouse Gas Reporting Rule, Environmental Protection Agency, Dec 9, 2016.) (Emphasis Added)
9	National Waste & Recycling Association (NWRA)	Darrell K. Smith	The direct measurement of fugitive landfill methane emissions is an active and developing area of research. Implementing these measurements is challenging because landfills are dynamic biological systems covering large areas and have significant variations in topography. The field research performed to date using a variety of measurement techniques has shown significant discrepancies between measured and modeled values for gas generation, collection efficiency and fugitive emissions. On the basis of these findings it is unclear whether we can support a system of developing credits based on modeled values. For example, EPA readily admits this limitation in its AP-42 compilation of emission factors. In EPA's AP-42, a range of 60 to 85% with an average of 75% is recommended. (U.S. EPA, January 1998 page 2.4-6).	It is surprising that NWRA would cite EPA's AP-42 as evidence that the model allows such a wide variation to be reported under a default value of 75%. The actual rule provides for site specific data to be utilized. The two largest members of NWRA, Waste Management and Republic Services both provided comments to the proposed GHGRP in 2009 which was based on AP-42 and both urged EPA to adopt a method developed by the Solid Waste Industry for Climate Solutions (SWICS) which allowed site specific data to be incorporated into the model to reduce the range of uncertainty. The result was to allow reporting based on site data in lieu of using the national default value criticized by NWRA. For example, a commentator on behalf of Waste Management, Inc. stated that: "We compliment the EPA on recognizing that landfill emissions are controlled by a number of factors that vary over time and in accordance with landfill physical conditions by providing the flexibility to use

				site-specific information in developing emissions estimates…. We applaud EPA for providing opportunities to include specific determinations in the proposed rule. To prevent any risk of misunderstanding in nationwide rule implementation, we recommend that the EPA explicitly accept the procedures outlined in the document entitled Current MSW Industry Position and State-of-the-Practice on LFG Collection Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills (SWI 2009) for determining the fraction of methane oxidized, and the collection efficiency of the landfill gas collection system. SCS Engineers developed the protocol for the Solid Waste Industry for Climate Solutions (SWICS), a group representing public and private solid waste industry on climate change issues. The document, hereafter referred to as the SWICS protocol, presents the state-of-the-practice on landfill gas (LFG) collection efficiency, methane oxidation and carbon sequestration in landfills. The findings and procedures contained in the SWICS protocol are the result of a critical review of the existing peer reviewed research literature by a group of academic and industry experts. SWICS members have used the SWICS protocol for voluntary reporting of landfill methane emissions to the California

				Climate Action Registry. The Climate Registry (TCR) has also recognized the protocol as a reference for landfill emissions estimation methodology in their Solid Waste Disposal Facility Reporting Guidance available on the TCR website for use by owners and operators of MSW landfills. Waste Management intends to use the SWICS protocol for estimating our landfill emissions." (See Mandatory Greenhouse Gas Reporting Rule: EPA's Response to Public Comments Volume No.: 36 Subpart HH—Landfills, September 2009 (Hereinafter "2009 Comments"), page 59, Document Control Number: EPA -HQ-OAR-2008-0508-0376.1.) Additionally, a commentator on behalf of Republic Services, Inc. also urged the EPA to adopt the SWICS model approach: "EPA specifically requested comment on the use of models to determine a landfill's greenhouse gas emissions. The tools currently available to calculate generation and emissions from landfills have been the subject of intense scrutiny. A concern regarding the national models which are currently used is the use of generic default data that does not consider local conditions that can influence individual landfill site emissions as they would be reported under

				the proposed rule. A number of scientific advances have been published in the last ten years that require the updating of these default values. There are still issues which need to be addressed to account for site-specific collection efficiencies for landfill gas systems, CH4 oxidation in cover soils, and the importance of carbon storage in landfills. Currently the State of California under the California Energy Commission (CEC) in cooperation with the California Integrated Waste Management Board is developing a field-validated landfill CH4 emissions tool for annual site-specific emissions which will be inclusive of seasonal oxidation. This research is not completed as it was initiated in 2007 and is a 3-year project. The solid waste industry has been evaluating various methods to more accurately determine CH4 emissions from landfills. The dynamic nature of landfills given the high spatial variability of CH4 emissions has made this a difficult process. <u>However, the Solid Waste Industry for Climate Solution (SWICS) has developed guidance on the best available method for estimating greenhouse gas emissions from landfills.</u> This protocol replaces default values for landfill gas collection efficiency and methane oxidation in existing EPA models with ranges. The SWICS methodology is based on published

				literature reviews, which better account for effects of climate, landfill design and landfill cover types." (See: 2009 Comments page 60, Document Control Number EPA-HQ-OAR-2008-0508-0557.1.) (Emphasis added) In response to these requests the EPA adopted substantially all of the SWICS method. In the Preamble to the Final Rule EPA stated: "The commenters requested that the SWICS recommended defaults for gas recovery system efficiency, soil oxidation, and flare combustion efficiency be provided in the rule. They also stated that an accurate inventory should account for carbon sequestered in the landfill. Response: We again reviewed the SWICS methods in light of these comments. We agree that the SWICS default recommendations for gas recovery system efficiency (which vary from 60 to 95 percent for different types of soil covers) could provide more refined data than using the default values provided in the rule. Therefore, we have included these cover-specific gas recovery efficiencies (commensurate with the SWICS Protocol) as an alternative to the 75 percent default value for collection efficiency." (See: Federal Register / Vol. 74, No. 209 / Friday,

				October 30, 2009 / Rules and Regulations/ Page 56336) NWRA is aware that the EPA allows site specific data to be used to estimate landfill gas emissions. It is disingenuous to cite a 1998 proposal by EPA when that agency adopted the industry's requested methodology which reduced the claimed uncertainty. One aspect of the SWICS method not initially adopted in 2010 was the oxidation factor. However, in 2013, EPA amended the GHGRP and adopted the SWICS approach. Waste Management, Inc. applauded the change: "WM commends the Agency for proposing technical corrections to Subpart HH that reflect the site-specific influences affecting emissions of methane at MSW landfills. EPA's proposal to replace the default, methane oxidation fraction of 10 percent with a more refined determination using site-specific data, will improve the accuracy of landfill emissions estimates. The Agency's proposal to establish categorical values for methane oxidation based on each site's methane flux rate is well supported by the extensive peer-reviewed data provided by public and private organizations in the landfill sector. We appreciate EPA's careful review of the

				technical literature and field studies to develop and propose values for methane oxidation in landfill cover that more correctly reflect actual field measurements. This will allow for greater accuracy in estimating landfill emissions than will continued use of a national default." (See: 2013 Revisions to the Greenhouse Gas Reporting Rule and Confidentiality Determinations for New or Substantially Revised Data Elements, Revisions to oxidation fraction in Equations HH-5 through HH-8 Commenter Name: Kerry Kelly, Director, Federal Public & Regulatory Affairs Commenter Affiliation: Waste Management (WM)75 Document Control Number: EPA-HQ-OAR-2012-0934-0041-A1.) (Emphasis added) Moreover, several studies that compare measured methane emissions at landfills to first order decay rate modeled results from those landfills have been conducted. These studies typically suggest that first order decay rate models, such as LandGEM, are either statistically accurate as compared to measured methane emissions at landfills or underreport actual methane emissions at landfills. Given these results, we are confident that utilization of a model such as LandGEM will provide an accurate (and in certain instances, a conservative)

				estimation of fugitive LFG emissions. (See, for example): • Cambaliza, M., Shepson, P., Bogner, J., Caulton, D., Stirm, B., et al. 2015. Quantification and source apportionment of the methane emission flux from the city of Indianapolis. *Elementa: Science of the Anthropocene* 3:000037. doi: 10.12952/journal.elementa.000037 • Peischl, J., Ryerson, T., Brioude, J., Aikin, K., Andrews, A., et al. 2013. Quantifying sources of methane using light alkanes in the Los Angeles basin, California. *Journal of Geophysical Research: Atmospheres*, 118: 4974-4990. doi:10.1002/jgrd.50413, 2013 • Ren, X., Salmon, O., Hansford, J., Ahn, D., Hall, D., et al. 2018. Methane Emissions from the Baltimore-Washington Area Based on Airborne Observations: Comparison to Emissions Inventories. *Journal of Geophysical Research: Atmospheres*, 123: 8869-8882. doi: 10.1029/2018JD028851 • Duren, R., Thorpe, A., Foster, K., Rafiq, T., Hopkins, F., et al. 2019. California's methane super-emitters. *Nature,* 575: 180-185, doi: 10.1038/s41586-019-1720-3
9	National Waste & Recycling	Darrell K. Smith	Even when emissions are reduced at a landfill, there are too many variables to be able to attribute the reduction	We agree that many variables influence the LFG collection process and that LFG collection

	Association (NWRA)		to any one cause. Increased methane collected cannot be exclusively attributed to the automated collection system. Collection system upgrades, such as adding new or upgrading existing collection devices (e.g., installing pumps in wells, replacing/repairing well seals and piping, increasing size of gas header, etc.) significantly influence the amount of methane collected. Changes in cover area and type of cover materials also influence the methane collection. Atmospheric conditions, such as precipitation, also affect methane volume. The configuration of the landfill, including depth of waste, also influences the amount of methane collected. There currently is no valid way to measure the fraction of methane volume attributed exclusively to the automated collection system. Further, because methane generation is highly variable due to atmospheric conditions, waste type/age/placement and operational practices (waste filling/compaction, etc.) there is no guarantee of increased methane volume and in many cases, landfills experience decrease in methane volumes year over year. Landfill gas generation is not steady-state, it fluctuates. Therefore, collection will fluctuate. The proposed methodology ignores these variables for a simplified calculated increase over previous collection quantities; then attributes all increases solely to the wellheads. As described above, the increase may not have been the result of the use of the automated collection wellheads at all. If a landfill were to install the wellheads and experience a decline in collection efficiency, would this then also be attributed to the wellheads?	fluctuates based on changes to these variables. In fact, the impact of the many variables that an ACS can monitor and control in real time, but that manual adjustments address only infrequently, is precisely why the ACS results in increased collection of LFG over manual adjustments. ACS's monitor near continuously the underlying key process variables including gas composition, gas flow, gas temperature, pressures applied to the collection well, available or system vacuum, and valve position. Based on near continuous changes in these key parameters, the ACS makes frequent valve adjustments to collect the optimum levels of methane during the fluctuations. An ACS monitors collection wells near continuously and simultaneously for more variables than required by NSPS and (1) makes frequent valve adjustments to optimize gas collection system performance to respond to the fluctuations, thereby collecting LFG that would typically go uncollected with a manual system, (2) keeps the wellfield balanced on a continuous basis, which allows for more efficient collection than manual monitoring and adjustment systems (which are known to allow wellfields to drift out of balance between adjustments and that may never achieve or sustain a fully-balanced wellfield), (3) ensures that collection wells operate under negative pressure, preventing the very common occurrence of low applied vacuum collection wells to fluctuate from negative to positive

				pressure application, a situation which is only identified when near continuous measurement is used on a gas collection system, and (4) provides a powerful diagnostic tool to identify when the collection system or individual collection wells are operating outside of their target range (e.g. loss of vacuum, or air intrusion through leaking wellhead or hose), providing real time continuous wellfield data and trends that are essential to identify and allow the landfill operator to address the many variables that impact LFG collection that the infrequent periodic manual monitoring and adjustment does not provide or accomplish. Indeed, with so much additional measurement of pertinent data on field conditions, an ACS makes it possible to use data science techniques to analyze incremental impacts that the data from infrequent manual tunings are simply inadequate to support. The existence of so many variables supports the value of additional data collection and continuous response in being able to attribute changes in LFG flow rates to specific causes. Additionally, the ACS system provides electronic alerts to on site operators of the LFG collection system regarding any measurement potentially indicating operation of a collection well outside normal operating conditions. Stated simply, an ACS collects sufficient data to understand the basis for emission reductions in the way that only a data-based solution can.

				Several of the examples cited by NWRA for improvements to the collection system that result in increased gas collection, are basic and common industry practice that are typically incorporated into the basic design of modern systems today. Examples cited include removing liquids from collection wells by installing submersible pumps in collection wells, ensuring vacuum headers are properly sized to deliver required vacuum, and replacing/repairing well seals and piping. These examples are all considered standard good engineering practice to design and operate a gas collection system which meets regulatory requirements. Therefore, these improvements are not additional to regulatory requirements. During the peer review process, ACR will work with the peer review team to develop a quantification approach that will segregate potential increases in landfill gas collection that could be attributed to such improvements.