Landfill Project Reporting Protocol Version 2.0
ERRATA AND CLARIFICATIONS

The Climate Action Reserve (Reserve) published its Landfill Project Reporting Protocol Version 2.0 (LFPRP V2.0) in November 2008. While the Reserve intends for the LFPRP V2.0 to be a complete, transparent document, it recognizes that correction of errors and clarifications will be necessary as the protocol is implemented and issues are identified. This document is an official record of all errata and clarifications applicable to the LFPRP V2.0.[1]

Per the Reserve's Program Manual, both errata and clarifications are considered effective on the date they are first posted on the Reserve website. The effective date of each erratum or clarification is clearly designated below. All listed and registered LFPRP projects must incorporate and adhere to these errata and clarifications when they undergo verification. The Reserve will incorporate both errata and clarifications into future versions of the Landfill Project Protocol.

All project developers and verification bodies must refer to this document to ensure that the most current guidance is adhered to in project design and verification. Verification bodies shall refer to this document immediately prior to uploading any Verification Statement to assure all issues are properly addressed and incorporated into verification activities.

If you have any questions about the updates or clarifications in this document, please contact Policy at: policy@climateactionreserve.org or (213) 891-1444 x3.

[1] See Section 4.3.4 of the Climate Action Reserve Program Manual for an explanation of the Reserve's policies on protocol errata and clarifications. "Errata" are issued to correct typographical errors. "Clarifications" are issued to ensure consistent interpretation and application of the protocol. For document management and program implementation purposes, both errata and clarifications to the LFPRP are contained in this single document.

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Section 3

1. Performance Standard Scenarios (CLARIFICATION – June 25, 2010)

Section: 3.3.1 (The Performance Standard Test)

Context: Section 3.3.1 on pages 5 and 6 define the scenarios under which a landfill project may be eligible according to the protocol. In bullet (1), the protocol reads: "If the landfill is *not currently* collecting and destroying any landfill gas" (emphasis added). Bullets (2) and (3) read: "If the landfill *was previously collecting and destroying…"* (emphasis added). The language has caused confusion as to whether these scenarios are meant to reflect the circumstances directly preceding project implementation or the circumstances at any time in the past.

Clarification: All three bullets in Section 3.3.1 are intended to cover any collection or destruction that has occurred at the landfill site either directly preceding project implementation or at any time in the past. Accordingly, any destruction of landfill gas that took place at any time in the past shall be considered in assessing the project performance standard. Even in instances where destruction has not occurred for an extended period of time, it must be included in the project performance standard assessment and emission reduction calculations.

2. Attestations (CLARIFICATION – June 25, 2010)

Section: 3.3.2 (The Regulatory Test)

Context: Page 7 of LFPRP V2.0 makes reference to the Attestation of Regulatory Compliance as a requirement to meeting The Regulatory Test. As written, this form is used to attest to both the voluntary implementation of the project and the fact that it has operated in accordance with relevant regulations. However, the Reserve has subsequently divided this test into two formal protocol components for clarity: the Legal Requirement Test and Regulatory Compliance. Accordingly, project developers must execute two forms – the Attestation of Voluntary Implementation and the Attestation of Regulatory Compliance – to address The Regulatory Test. These forms are described in the Reserve Program Manual.

Clarification: The Regulatory Test requires execution of the Attestation of Voluntary Implementation and the Attestation of Regulatory Compliance.

Section 5

3. Determining OX (CLARIFICATION – July 11, 2011)

Section: 5.1 (Baseline Emissions)

Context: Footnote 15 on page 15 of LFPRP V2.0 provides guidance for determining the value of OX (used in Equation 5.1) to account for the oxidation of methane by soil bacteria. This guidance is also found in Equation 5.1 on page 18. The project is instructed to use an OX value of 0% for landfills where a synthetic liner is used as a component of the final cover system, and a value of 10% for all other landfills. It is not clear what value should be used for landfills where some portion of the final cover system uses a synthetic liner, and another portion does not.

Clarification: The first sentence of Footnote 15 on page 15 should read: "Landfill cover systems incorporating a synthetic liner throughout the entire area of the final cover system should use a default methane oxidation rate of zero." The second sentence of the guidance for OX in Equation 5.1 should read: "Equal to 0.10 for all landfills except those that incorporate a synthetic liner throughout the entire area of the final cover system, where OX = 0."

4. Equation 5.1 (ERRATUM – January 4, 2011)

Section: 5.3 (Project Emission Reductions)

Context: On page 17 of LFPRP V2.0, Equation 5.1 is used to calculate the project emission reductions. The equation printed in the protocol accounts for oxidation of methane destroyed during the project, but not to the $PRE_{discount}$ factor for pre-project destruction. The oxidation factor should be applied to all methane destruction. As written, Equation 5.1 reads as follows:

$$ER_y = [(CH_4Dest_{PR})*21*(1-OX)*(1-DF)] - FFCO_2 - ELCO_2 - PRE_{discount}$$

Correction: Equation 5.1 shall be corrected to read as follows:

$$ER_y = [(CH_4Dest_{PR})*21*(1-OX)*(1-DF)] - FFCO_2 - ELCO_2 - PRE_{discount}*(1-OX)$$

5. Quantifying Project GHG Emission Reductions (CLARIFICATION – June 18, 2015)

Section: 5.3 (Project Emission Reductions)

Context: Equation 5.1 on page 17 provides guidance for how to calculate total emission reductions during the reporting period, including discounts that must be applied to account for oxidation and uncertainties associated with monitoring equipment.

The oxidation factor (OX) accounts for the oxidation of methane by soil bacteria. The protocol requires that an OX discount be applied if the landfill does not incorporate a synthetic liner throughout the entire area of the final cover system. No guidance is provided for how to apply the OX discount factor for cover systems that were in place for less than a full reporting period.

The discount factor for uncertainties associated with monitoring equipment (DF) is applied to projects where methane concentration values were taken weekly, rather than continuously. No guidance is provided for how to apply the DF discount factor for methane concentration readings that were taken on a weekly basis using a portable gas analyzer for only part of the reporting period.

Clarification: The intent of the protocol is that both the OX discount factor and the DF discount factor shall only be applied to periods of time during the reporting period for which each factor is applicable. The OX discount factor shall only be applied for the number of days during the reporting period when the landfill did not incorporate a synthetic liner throughout the entire area of the final cover system. The DF discount factor shall only be applied for the number of days during the reporting period when methane concentration values were taken at a frequency that is less than continuous (every 15 minutes). Thus, Equation 5.1 may be calculated separately for different portions of the reporting period, with the results summed to provide total project GHG emission reductions.

6. Service Providers for Site-Specific Destruction Efficiency Testing (CLARIFICATION – January 21, 2014)

Section: 5.3 (Project Emission Reductions)

Context: Footnote 19 on page 19 states that service providers used to determine site-specific values for methane destruction efficiency must be "state or local agency accredited." It is not clear what specific options are available and permissible to projects located in a state or locality which does not have an accreditation program for source test service providers. The second to last full paragraph on page 25 in Section 6, and the comment section of Table 6.1 for parameter DE on page 28 contain similar language.

Clarification: The intent of this requirement is to ensure that any source testing conducted for the determination of a site specific value for methane destruction efficiency is of a quality that would be acceptable for compliance by a regulatory body. The following text shall be added to the end of footnote 19 on page 19, before the last paragraph of Section 6 on page 25, and to the end of the comment section of Table 6.1 for parameter DE on page 28:

> "If neither the state nor locality relevant to the project site offer accreditation for source testing service providers, projects may use an accredited service provider from another U.S. state or domestic locality. Alternatively, projects may choose a non-accredited service provider, under the following conditions: 1) the service provider must provide verifiable evidence of prior testing which was accepted for compliance by a domestic regulatory agency, and 2) the prior testing procedures must be substantially similar to the procedures used for determining methane destruction efficiency for the project destruction device(s)."

7. Determining LFG_{PP1} (CLARIFICATION – June 25, 2010)

Section: 5.3 (Project Emission Reductions)

Context: Equation 5.3 on page 21 of LFPRP V2.0 is used to calculate the pre-project adjustment associated with non-qualifying devices in the project baseline. If monitoring data is not available to estimate the term LFG_{PP1}, the maximum capacity of the pre-project device may be used, per Table 6.1. However, the protocol does not provide explicit guidance in this scenario on the appropriate PP_{CH4} value to be applied.

Clarification: If the term LFG_{PP1} in Equation 5.3 is equal to the maximum capacity of the pre-project non-qualifying device(s) because monitoring data is not available, the term PP_{CH4} shall be equal to the average monitored methane concentration over the reporting period.

6. Application of Pre-Project Destruction Adjustment (CLARIFICATION – July 11, 2011)

Section: 5.3 (Project Emission Reductions)

Context: Equation 5.3 on page 20 of LFPRP V2.0 is used to calculate the pre-project adjustment associated with LFG destruction in the project baseline. This equation collects the two potential discounts that may be calculated to account for destruction in the baseline scenario ($PRE_{discount}$): $NQ_{discount}$ and $Dest_{max}$. The protocol does not specify the time period over which this equation should be totaled. Equation 5.3 refers to time interval t as the "Time interval for which LFG flow and concentration measurements are aggregated. Equal to one day for

continuously monitored methane concentration and one week for weekly monitored methane concentration." It is not clear whether $Dest_{max}$, and thus $PRE_{discount}$, should be summed for the entire reporting period, or whether it is permissible to sum these discounts more frequently. The frequency will only affect the value of $PRE_{discount}$ during periods when the amount of methane destroyed is less than the baseline level of destruction. As shown in Box 1 on page 22, a negative value for project reductions is taken as a zero. The example in Box 1 is calculated on an annual basis, but it would also apply for sub-annual calculations.

Clarification: On page 21, the following sentence is to be added above Equation 5.3: "The time period over which the value of $PRE_{discount}$ is calculated using Equation 5.3 shall be chosen by the project developer, but cannot be less than weekly, and must be applied consistently throughout the reporting period."

7. Box 1 Generator Capacity (ERRATUM – June 25, 2010)

Section: 5.3 (Project Emission Reductions)

Context: Box 1, Applying the $Dest_{max}$ Adjustment on page 22 states that in the example there is an electric generator with a "1500 cfm capacity." However, the example calculations indicate a flow to the generator of 1800 cfm.

Correction: The generator capacity in the Box 1 example is 2000 cfm.

Section 6

8. Metering Multiple Destruction Devices (CLARIFICATION – October 26, 2011)

Section: 6 (Project Monitoring)

Context: The second paragraph and third bullet of Section 6 on page 23 state that the LFG control system "must be monitored with measurement equipment that directly meters: the continuous flow rate of landfill gas to each destruction device." On July 11, 2011, the Reserve issued a clarification to this requirement stating that: "[a] single meter may be used for multiple, identical destruction devices. In this instance, methane destruction in these units will be eligible only if both units are verified to be operational."

The Reserve has determined that in certain situations it may be acceptable for one flow meter to be used to monitor the flow of gas to multiple destruction devices without fulfilling the requirement that they be identical or that they all be operational. Such an arrangement will require extra steps for verification, depending on the situation and the monitoring data that are available.

Clarification: The following text shall replace the previously issued clarification (#9 below) as a footnote to the third bullet of Section 6:

"A single flow meter may be used for multiple destruction devices under certain conditions. If all destruction devices are of identical efficiency and verified to be operational, no additional steps are necessary for project registration. Otherwise, the destruction efficiency of the least efficient

destruction device shall be used as the destruction efficiency for all destruction devices monitored by this meter.

If there are any periods when not all destruction devices are operational, methane destruction during these periods will be eligible provided that the verifier can confirm all of the following conditions are met:

a. The destruction efficiency of the least efficient destruction device in operation shall be used as the destruction efficiency for all destruction devices monitored by this meter; and

b. All devices are either equipped with valves on the input gas line that close automatically if the device becomes non-operational (requiring no manual intervention), or designed in such a manner that it is physically impossible for gas to pass through while the device is non-operational; and

c. For any period where one or more destruction device within this arrangement is not operational, it must be documented that the remaining operational devices have the capacity to destroy the maximum gas flow recorded during the period. For devices other than flares, it must be shown that the output corresponds to the flow of gas."

9. Metering Multiple, Identical Destruction Devices (CLARIFICATION – July 11, 2011)

Section: 6 (Project Monitoring)

Context: The second paragraph and third bullet of Section 6 on page 23 state that the LFG control system "must be monitored with measurement equipment that directly meters: the continuous flow rate of landfill gas to each destruction device." There may be situations where multiple, identical destruction devices (with identical destruction efficiencies) may be operated in parallel. In this case, it is sufficiently conservative to use one meter to measure flow to all such devices, provided that they are all operational.

Clarification: The following sentence shall be considered as a footnote to the third bullet of Section 6: "A single meter may be used for multiple, identical destruction devices. In this instance, methane destruction in these units will be eligible only if both units are verified to be operational."

10. Arrangement of LFG Metering Equipment (CLARIFICATION – July 11, 2011)

Section: 6 (Project Monitoring)

Context: The first sentence of footnote 22 on page 23 states "Methane fraction of the landfill gas to be measured on a wet/dry basis (must be measured on same basis as flow, temperature, and pressure)." However, there is the alternative arrangement of measuring methane content (along with temperature and pressure) on a wet basis and flow rate on a dry basis that would result in a conservative calculation of the fraction of methane in the landfill gas. This is because after the gas is de-watered, the methane fraction will be larger, while the overall volume of gas will be smaller. If methane fraction is measured on a wet basis and flow is measured on a dry basis, the resulting figures for methane volume will always be lower than if both measurements

were taken on the same basis (both wet or both dry). The reverse situation, where methane fraction is measured on a dry basis and flow measured on a wet basis, would consistently result in over reporting, and would not be conservative.

Clarification: The following sentence shall be inserted after the first sentence of footnote 22 on page 23: "The methane analyzer and flow meter should be installed in the same relative placement to any moisture-removing components of the landfill gas system (there should not be a moisture-removing component separating the measurement of flow and methane fraction). An acceptable variation to this arrangement would be in the case where the flow meter is placed after a moisture-removing component (dry basis), while the methane analyzer is placed before this component (wet basis). The opposite arrangement is not permissible."

11. Monitoring Operational Status (CLARIFICATION – October 8, 2013)

Section: 6 (Project Monitoring)

Context: The last paragraph of page 24 in Section 6 states that "the hourly operational activity of the landfill gas collection system and the destruction devices shall be monitored and documented to ensure actual landfill gas destruction."

Certain types of destruction devices, such as internal combustion engines and most large boiler systems, are designed in such a way that gas may not flow through the device if it is not operational. It has not been clear how the requirements of Section 6 apply to these devices. There has been confusion related to the Clarification issued on October 26, 2011 regarding Metering Multiple Destruction Devices.

Clarification: The Clarification regarding Metering Multiple Destruction Devices (October 26, 2011) shall not be construed to relax the requirement for hourly operational data for all destruction devices. Rather, that clarification is allowing a specific metering arrangement during periods when one or more devices are *known* to not be operating. In order to know the operational status of a device, it must be monitored. All destruction devices must have their operational status monitored and recorded at least hourly. In other words, the project dataset will include an indication of operational status corresponding to each hour of landfill gas data. If these data are missing or never recorded for a particular device, that device will be assumed to be not operating and no emission reductions may be claimed for landfill gas destroyed by that device during the period when data are missing.

12. Verifying Off-Site Destruction in Direct Use Projects (CLARIFICATION – January 14, 2015)

Section: 6 (Project Monitoring)

Context: The protocol requires that "the hourly operational activity of the landfill gas collection system and the destruction devices shall be monitored and documented" (page 24). A clarification issued on October 8, 2013 ("Monitoring Operational Status") reiterates that this requirement applies to all destruction devices.

In scenarios where landfill gas is supplied to a third party end-user via a dedicated pipeline pursuant to a direct use agreement, the project developer may have no management control over the off-site destruction device. It has been unclear whether the operational status of those

destruction devices must be monitored, or what alternative assurance may be given to verifiers to confirm that the destruction device is operational and project biogas is being destroyed.

Clarification: The following text shall be inserted after the last paragraph of page 24 and before the first full paragraph of page 25:

> "In scenarios where landfill gas is delivered off-site to a third party end user (not to a commercial natural gas transmission and distribution system or to a facility under management control of the project operator), reasonable efforts must be made to obtain data demonstrating the operational status of the destruction device(s). If it is not possible to obtain such data, the verifier must use their professional judgment to confirm that there has been no significant release of project landfill gas and that the project developer is using the appropriate destruction efficiency value. Evidence that may assist a verifier in making a determination to that effect may include, but is not limited to, one or more of the following:
>
> - a signed attestation from the third party operator of the destruction device that no catastrophic failure of destruction or significant release of landfill gas occurred during the reporting period;
> - the verifier confirming the same via an interview with the third party operator;
> - examination of the safety features and/or design of the destruction equipment, such that the destruction device does not allow landfill gas to pass through it when non-operational and/or that the project developer is able to switch off the flow of landfill gas off-site in the event of emergencies;
> - records that can corroborate the type and level of operation of the destruction device during the reporting period, such as engine output data, etc.
>
> If the verifier is reasonably assured that no significant release of landfill gas has occurred off-site during the reporting period, the project can use the destruction efficiency appropriate to that off-site destruction device, despite the lack of hourly data from a monitoring device confirming operational status."

13. Portable Instruments QA/QC (CLARIFICATION – June 3, 2013)

Section: 6 (Project Monitoring)

Context: Section 6 (pages 24-25) states: "If a portable calibration instrument is used, such as a pitot tube or a calibrated portable gas analyzer, the portable instrument shall be calibrated at least annually at an ISO 17025 accredited laboratory."

It has been unclear what sort of portable instruments must satisfy this requirement. Some portable pieces of equipment are used in the process of the field check, but are not themselves instruments that are able to measure and produce data. The Reserve has determined that all portable instruments used for field checks and calibrations that have the ability to measure the parameter that the meter in question would normally measure must themselves be calibrated annually. Some devices however, namely those pieces of equipment that do not produce a data output that could be used in emission reduction calculations, are not considered to be "portable instruments" per the protocol requirement, and must simply be maintained and calibrated according to the manufacturer's specifications.

Clarification: The following text shall replace the final sentence of the last paragraph (cited above) on page 24 (continued onto page 25):

"If a portable calibration instrument is used to field check the calibration accuracy of equipment that acquires project data and the portable instrument produces a data output that is or could be used in emission reduction calculations (i.e., flow or concentration), the portable instrument shall be maintained and calibrated per the manufacturer's specifications, and calibrated at least annually by the manufacturer, by a laboratory approved by the manufacturer, or at an ISO 17025 accredited laboratory. Other pieces of equipment used for QA/QC of monitoring instruments shall be maintained according to the manufacturer's specifications, including calibration where specified."

14. Version 1.0 Artifact (ERRATUM – June 25, 2010)

Section: 6 (Project Monitoring)

Context: On page 25 of the protocol, the paragraph beginning "In the case where a new GHG reduction project is sited…" refers to the "effective radius-of-influence." The radius-of-influence was a term used in Version 1.0 of the LFPRP. This paragraph should have been deleted prior to publishing Version 2.0, and represents an artifact of Version 1.0

Correction: The above-referenced paragraph shall be considered deleted and shall be ignored.

15. Data Substitution (CLARIFICATION – June 25, 2010)

Section: 6 (Project Monitoring)

Context: For instances where project data is missing due to equipment failure, the protocol allows data substitution methods to be employed as contained in the U.S. EPA Acid Rain Program (40 CFR 75.33), and an additional 5% discount applied. In practice, this methodology has proven difficult to interpret and execute in the context of methane projects. Accordingly, the following clarification shall supersede the language in the protocol.

Clarification: This guidance shall be used to calculate emission reductions when data integrity has been compromised either due to missing data points or corrupt data. No data substitution is permissible for equipment such as thermocouples, which monitor the proper functioning of destruction devices. Rather, the methodologies presented below are to be used only for the methane concentration and flow metering parameters.

The Reserve expects that projects will have continuous, uninterrupted data for the entire verification period. However, the Reserve recognizes that unexpected events or occurrences may result in brief data gaps.

The following data substitution methodology may be used only for flow and methane concentration data gaps that are discrete, limited, non-chronic, and due to unforeseen circumstances. Data substitution can only be applied to methane concentration *or* flow readings, but not both simultaneously. If data is missing for both parameters, no reductions can be credited.

Further, substitution may only occur when two other monitored parameters corroborate proper functioning of the destruction device and system operation within normal ranges. These two parameters must be demonstrated as follows:

1. Proper functioning can be evidenced by thermocouple readings for flares, energy output engines, etc.
2. For methane concentration substitution, flow rates during the data gap must be consistent with normal operation.
3. For flow substitution, methane concentration rates during the data gap must be consistent with normal operations.

If corroborating parameters fail to demonstrate any of these requirements, no substitution may be employed. If the requirements above can be met, the following substitution methodology may be applied:

Duration of Missing Data	Substitution Methodology
Less than six hours	Use the average of the four hours immediately before and following the outage
Six to 24 hours	Use the 90% lower or upper confidence limit of the 24 hours prior to and after the outage, whichever results in greater conservativeness
One to seven days	Use the 95% lower or upper confidence limit of the 72 hours prior to and after the outage, whichever results in greater conservativeness
Greater than one week	No data may be substituted and no credits may be generated

The lower confidence limit should be used for both methane concentration and flow readings for landfill projects, as this will provide the greatest conservativeness.

For weekly measured methane concentration, the lower of the measurement before and the measurement after must be used. This substitution may only be used to substitute data for a one missing weekly measurement.

16. Failed Calibration (CLARIFICATION – June 25, 2010)

Section: 6 (Project Monitoring)

Context: For instances where a calibration has been failed, the protocol allows data substitution methods to be employed as contained in the U.S. EPA Acid Rain Program (40 CFR 75.33), and an additional 5% discount applied. In practice, this methodology has proven difficult to interpret and execute in the context of methane projects. Accordingly, the following clarification shall supersede the language in the protocol.

Clarification: For the interval between the last successful field check or calibration and any calibration event confirming accuracy below the +/- 5% threshold, all data from that meter or analyzer must be scaled according to the following procedure. These adjustments must be made for the entire period from the last successful field check until such time as the meter is properly calibrated.

- For calibrations that indicate under-reporting (lower flow rates or lower methane concentration), the metered values must be used without correction.
- For calibrations that indicate over-reporting (higher flow rates or higher methane concentration), the metered values must be adjusted based on the greatest calibration drift recorded at the time of calibration.

17. Meter Field Check Procedures (CLARIFICATION – January 21, 2014)

Section: 6 (Project Monitoring)

Context: On July 21, 2009 the Reserve issued a memo clarifying two issues relevant to LFPRP V2.0: data substitution and calibration practices. The memo clarifies that for landfill projects under this protocol version, a field check may be used to test the accuracy of the metering devices in lieu of a full calibration. A subsequent clarification was issued on June 25, 2010 which detailed that if a calibration event (including a field check) were to fail the +/- 5% accuracy threshold, that the data should be adjusted based on the calibration drift recorded at such time as the meter was calibrated.

Certain types of biogas flow meters and methane analyzers are susceptible to measurement drift due to buildup of moisture or contaminants on the metering sensor, even if the equipment itself is not out of calibration. If the as-found condition of the meter is outside of the accuracy threshold, but the as-left condition (after cleaning) is within the accuracy threshold, it is not clear whether a full calibration is still required for this piece of equipment. In some cases the manufacturer provides specific guidance to this effect.

Clarification: The following text shall be considered a supplement to the July 21, 2009 memo:

"The as-found condition (percent drift) of a field check must always be recorded. If the meter is found to be measuring outside of the +/- 5% threshold for accuracy, the data must be adjusted for the period beginning with the last successful field check or calibration event up until the meter is confirmed to be in calibration. If, at the time of the failed field check, the meter is cleaned and checked again, with the as-left condition found to be within the accuracy threshold, a full calibration is not required for that piece of equipment. This shall be considered a failed field check, followed by a successful field check. The data adjustment shall be based on the percent drift recorded at the time of the failed field check. However, if the as-left condition remains outside of the +/- 5% accuracy threshold, calibration is required by the manufacturer or a certified service provider for that piece of equipment."