Livestock Project Reporting Protocol
Version 2.1
ERRATA AND CLARIFICATIONS

The Climate Action Reserve (Reserve) published its Livestock Project Reporting Protocol Version 2.1 (LSPRP V2.1) in August 2008. While the Reserve intends for the LSPRP V2.1 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 LSPRP V2.1.[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 livestock 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 Livestock 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 LSPRP are contained in this single document.

Errata and Clarifications (arranged by protocol section)

Section 5

1. Calculating the van't Hoff-Arrhenius Factor (ERRATUM – March 28, 2012)

Section: 5.2 (Modeled Baseline Methane Emissions Equations)

Context: The first step involved in Equation 5.3 (pages 16-17) is the calculation of the van't Hoff-Arrhenius factor (*f*). This factor estimates the percentage of volatile solids (VS) that will be biologically available for degradation in the baseline lagoon, depending on the ambient temperature. The equation is set up with a base temperature of 30°C (86°F), based on the assumption that this is the point at which biological availability will reach its maximum. One resultant outcome is that if a temperature of greater than 30°C is input for T_2, the calculated value of *f* will be greater than 100%, which is physically impossible.

Additionally, the reference source for this equation states that, under actual field conditions, the value of *f* is not likely exceed 95% (Mangino et al., 2001). Thus, the user-calculated value for *f* should never exceed 0.95 (95%), which occurs when T_2 > 29.5°C. The current calculation is taken from this specific reference, but the limit of 95% was erroneously omitted.

Correction: The following text shall be added to the definition of T_2 in Equation 5.3 on page 17:

> "If T_2 > 29.5°C then *f* = 0.95."

2. Source for VS_{table} (CLARIFICATION – March 28, 2012)

Section: 5.2 (Modeled Baseline Methane Emissions Equations)

Context: Box 5.1 on page 18 gives guidance on the calculation of VS_L for use in Equation 5.4. Users are directed to use Table B.4 to find the appropriate VS value for their animal type and reporting year. This guidance states that "[i]f the current year's table is not available, use the most current year." It is not clear that this statement is referring to the table's availability from the source (U.S. EPA), and not just the most recent table printed in the protocol appendix.

Clarification: Project developers shall use the VS value from the U.S. EPA Greenhouse Gas Inventory[2] that matches the relevant reporting year, or the most current year that is available. For convenience, the Reserve Livestock Calculation Tool[3] includes the most up-to-date tables, with units converted to match those in the protocol. The updated tables can be found in the worksheet "XIV. Reference Tables." Project developers shall refer to the tables provided in the calculation tool even if they choose not to use this tool for their project quantification.

3. Source for Typical Average Mass (TAM) (CLARIFICATION – July 19, 2012)

Section: 5.2 (Modeled Baseline Methane Emissions Equations)

Context: Box 5.1 on page 18 provides guidance on the calculation of daily volatile solids (VS) for different livestock categories. In order to adjust the VS value for each particular livestock

[2] http://epa.gov/climatechange/emissions/usgginventory.html
[3] http://www.climateactionreserve.org/how/protocols/us-livestock/

category, the average animal mass may be determined using site-specific data, or referenced from Table B.2 in Appendix B. For the VS values in Table B.4, a new table is provided in the Beta Livestock Calculation Tool with each new update of the U.S. Environmental Protection Agency (EPA) publication of the annual Inventory of GHG Sources and Sinks. However, even though many of the values for TAM in Table B.2 are referenced from the same source, an updated table has not been provided by the Reserve. Thus it has not been clear whether or not it is possible to use more current values for TAM if they are available.

Project developers who plan to submit a livestock project using the California Air Resources Board's Compliance Offset Protocol should note that the default values used in that document are static.

Clarification: Project developers shall use the TAM value from the U.S. EPA Greenhouse Gas Inventory[4] that matches the relevant reporting year, or the most current year that is available. For convenience, the Reserve Livestock Calculation Tool[5] includes the most up-to-date tables. The updated tables can be found in the worksheet "XIV. Reference Tables." Project developers shall refer to the tables provided in the calculation tool even if they choose not to use this tool for their project quantification.

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

Section: 5.4 (Project Methane Emissions Equations)

Context: Footnote 27 on page 22 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.

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 27 on page 22:

> "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)."

[4] http://epa.gov/climatechange/emissions/usgginventory.html
[5] http://www.climateactionreserve.org/how/protocols/us-livestock/

5. MCF Value for a Covered Liquid Effluent Storage System (CLARIFICATION – July 19, 2012)

Section: 5.4 (Project Methane Emissions Equations)

Context: Equation 5.7 on page 23 is used to calculate the methane emissions released from the treatment of the effluent upon leaving the anaerobic digester. To complete this calculation, the project developer must select the appropriate value for the methane conversion factor (MCF) based on the type of treatment system (usually an open effluent pond). Table B.5 in Appendix B is the source for the MCF values to be used in this equation.

In the case of a project which installs an impermeable cover on the effluent pond, effectively creating a second anaerobic digester, it is not clear how to determine the correct MCF value. Table B.5 lists the MCF value for an anaerobic digester as a range, from 0 percent to 100 percent, and directs the reader to use Formula 1 to determine the correct MCF. This formula, which was included as a footnote to the table in the original IPCC source, was omitted from the Livestock Project Protocol. In addition, it is not clear how to apply this formula for use in determining the MCF of a covered effluent pond. In the original source document, Formula 1 is not intended for determining the MCF of a covered effluent storage pond, but rather for determining the MCF of an entire digester system. Thus, the terms are not defined appropriately for this purpose.

Clarification: If the project elects to install an impermeable cover over its liquid effluent storage system, and to collect the methane gas from this covered storage and connect it to the biogas control system (BCS), it may be considered to be part of the project digester system, rather than a separate effluent treatment system. The fate of the effluent from this covered storage would then need to be quantified using Equation 5.7.

If the effluent from the project digester is directed to a covered liquid effluent storage system, and the biogas from this storage system is not collected and destroyed, then the following scenarios apply:

1) If the effluent from this system is applied directly to land, the value of $PE_{CH4,EP}$ shall be equal to the quantity of methane released directly from this storage system, divided by the biogas collection efficiency (BCE). The monitoring of biogas flow and methane concentration shall follow the requirements of Section 6. For any periods where biogas data from this system are missing or not in conformance with Section 6, Equation 5.7 shall be used to determine the quantity of methane for those periods, applying a value of 1.0 for MCF_{ep}.

2) If the effluent from the covered liquid effluent storage system is directed to another treatment system (i.e. not land-applied), the additional methane released from this further treatment must be quantified. The following adapted version of Formula 1 shall be applied to determine the MCF value for a covered liquid effluent storage system in this case. Use of this formula requires that the biogas production of the covered liquid effluent storage system be metered. If the biogas from this system is not metered, the value of MCF_{ep} shall be 1.0. For any periods when biogas from this system is not metered, the value of MCF_{ep} shall be 1.0, and these periods shall be quantified separately from the formula below.

Formula 1: MCF value for a covered liquid effluent storage system with additional effluent treatment

$$MCF_{ep} = \frac{\frac{CH_{4,meter,ep}}{BCE} + (MCF_{add} \times B_{0,ep} \times 0.3 \times VS_{ep} \times 0.68 \times d)}{B_{0,ep} \times VS_{ep} \times 0.68 \times d}$$

Where,			Units
MCF_{ep}	=	Methane conversion factor for a covered liquid effluent storage system	fraction
$CH_{4,meter,ep}$	=	Total quantity of methane released (uncombusted) from the effluent storage system. Biogas flow and methane concentration must be metered according to the requirements of Section 6	kg CH_4
BCE	=	Biogas collection efficiency (BCE) (see guidance in Equation 5.6).	fraction
MCF_{add}	=	Methane conversion factor for the additional treatment of effluent after the covered liquid effluent storage system. Project developers shall use the MCF value that corresponds to the treatment system	fraction
$B_{0,ep}$	=	Maximum methane producing capacity (of VS dry matter) (see guidance in Equation 5.7)	m^3CH_4/kg VS
0.3	=	Default value representing the amount of VS that exits the covered liquid effluent storage system as a percentage of the VS entering the covered liquid effluent storage system	fraction
VS_{ep}	=	Volatile solid to covered liquid effluent storage system (see guidance in Equation 5.7)	kg/day
0.68	=	Density of methane (1 atm, 60°F)	kg/m^3
d	=	Number of days in reporting period	days

6. Emissions from Land Application (ERRATUM – July 19, 2012)

Section: 5.4 (Project Methane Emissions Equations)

Context: Equation 5.7 on page 23 is used to quantify the methane emissions associated with the effluent pond that receives and stores the effluent from the anaerobic digester. Though the title of the equation implies that it is only to be used for quantifying the methane from an effluent pond, footnote 31 clarifies that this same equation is to be used to quantify the methane emissions from an alternative form of effluent storage or treatment. However, this footnote erroneously includes land application as a form of treatment that shall be quantified as a source of project emissions.

Methane emissions from the disposal of manure by land application are not specifically addressed in Table 4.1 on page 13. However, as evidenced by the revised Table 4.1 in Version 3.0 of the protocol, it was the intent of the Reserve that these emissions be excluded from the greenhouse gas assessment boundary for livestock projects.

Correction: Methane emissions from the disposal of manure by land application are not included within the greenhouse gas assessment boundary for livestock projects, either in the baseline or the project scenario. However, if the effluent is transported off-site for land application elsewhere, the fossil fuel emissions associated with this transportation must be quantified as project emissions (Equation 5.10).

Section 6

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

Section: 6 (Project Monitoring)

Context: Section 6 on page 26 states that the biogas control system must be "monitored with measurement equipment that directly meters: the continuous flow rate of biogas 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 (#2 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."

8. Metering Multiple, Identical Destruction Devices (CLARIFICATION – July 12, 2011)

Section: 6 (Project Monitoring)

Context: The third bullet point on page 26 of LSPRP V2.1, states that the measurement equipment must meter "[t]he continuous flow rate of biogas to each destruction device." There are instances where it would be permissible for one flow meter to be used for multiple destruction devices, so long as they had the same destruction efficiency value and were both 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."

9. Monitoring Operational Status (CLARIFICATION – October 29, 2013)

Section: 6 (Project Monitoring)

Context: The first paragraph of page 27 and the first full paragraph of page 28 in Section 6 state that "[t]he hourly operational activity of the biogas collection system and the destruction devices shall be monitored and documented to ensure actual methane destruction. … In the event that the destruction device monitoring equipment is inoperable, then all metered biogas shall be assumed to be released to atmosphere…by assuming a destruction efficiency of zero for the period of inoperability."

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 first sentence of the first paragraph on page 27 shall be read to apply to all destruction devices in use during the reporting period. 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 be not operating. All destruction devices must have their operational status monitored and recorded at least hourly. If these data are missing or never recorded for a particular device, that device will be assumed to be not operating and will be assigned a destruction efficiency of zero for all flow data that are assigned to that device.

10. Failed Calibration (CLARIFICATION – July 12, 2011)

Section: 6 (Project Monitoring)

Context: On page 27 of LSPRP V2.1, 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). 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 instances of failed calibrations, the requirements on page 27 and 28 of the LSPRP V2.1 shall be replaced with the following requirement:

1. For calibrations that indicate the flow meter was outside the +/- 5% accuracy threshold, the project developer shall estimate total emission reductions using i) the metered values without correction, and ii) the metered values adjusted based on the greatest calibration drift recorded at the time of calibration. The lower of the two emission reduction estimates shall be reported as the scaled emission reduction estimate.

11. Meter Field Check Procedures (CLARIFICATION – October 29, 2013)

Section: 6 (Project Monitoring)

Context: On July 21, 2009, the Reserve issued a memo clarifying two issues relevant to LSPRP V2.0 and 2.1: data substitution and calibration practices. The memo clarifies that for livestock projects under these protocol versions, 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 July 12, 2011 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 inserted before the first full paragraph on page 28:

"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."

12. Data Substitution (CLARIFICATION – July 12, 2011)

Section: 6 (Project Monitoring)

Context: On page 27 of LSPRP V2.1, 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). 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.

13. Data Substitution when Operational Data are Missing (ERRATUM – October 29, 2013)

Section: 6 (Project Monitoring)

Context: There are three parameters necessary for the quantification of biogas destruction: biogas flow volume, methane concentration, and operational status of the destruction device. The clarification on Data Substitution issued July 12, 2011 provides a methodology for the substitution of missing biogas flow or methane concentration data. Data on the operational status of a destruction device are not eligible for substitution. Substitution of one parameter (i.e. flow or concentration) is only allowed if both other parameters are successfully recorded during the data gap. Thus, to employ the data substitution methodology, it is required that the record of operational status be intact during the gap.

This data substitution methodology was originally developed to resolve incidents of missing methane destruction data in landfill gas projects. Under that project type, excluding the data gap entirely is equivalent to the use of a destruction efficiency (DE) value of zero, whereas the same is not true for a livestock project. In the case of the Livestock Project Protocol, there is additional guidance on page 28 of Section 6 that requires the use of a DE value of zero for periods where the destruction device is inoperable, or the operational data are missing. This procedure effectively provides substitution of missing operational data with the assumption that the device was inoperable during the data gap. The effect of this substitution is an increase in project emissions, resulting in a more conservative estimate of emission reductions, regardless of whether the ultimate estimate of emission reductions is based on the modeled baseline or the metered methane destruction.

Because of the nature of the quantification methodology for livestock projects, and the ways that it differs from that of landfill projects, it is appropriate and conservative to carry out flow or methane data substitution, even if the destruction device is inoperable. Under this protocol, the quantification of emission reductions will be more conservative than if the data substitution were not employed.

Correction: As it applies to operational status, the guidance on page 28 of Section 6 shall supersede the guidance provided in the clarification on Data Substitution (July 12, 2011). The following text shall be inserted after the third paragraph in the clarification:

“If the destruction device is inoperable, or its operational data are missing, the destruction efficiency for the device shall be zero during that period of time. Data substitution may be employed for missing biogas flow or methane concentration data during periods of missing operational data, provided the dataset is able to fulfill all other requirements of this data substitution methodology. The data substitution methodology shall be employed in the manner resulting in the greatest level of conservativeness for the quantification of emission reductions.”

14. Data Substitution for Continuous Methane Data (CLARIFICATION – October 29, 2013)

Section: 6 (Project Monitoring)

Context: The data substitution methodology provided by the clarification on Data Substitution (July 12, 2011) may not be used for data gaps that are greater than seven days. However, the minimum measurement frequency for methane concentration data is once per quarter (three months). For projects that measure methane concentration at a frequency that is greater than quarterly, it is not clear how methane values should be applied during gaps of more than one week but less than an entire quarter.

Clarification: As long as a livestock project has at least one methane concentration reading per quarter, the project may satisfy the monitoring requirements in Section 6. A livestock project may have gaps between methane concentration readings that are greater than one week without this being considered “missing data” as it is conceived in the clarification on Data Substitution (July 12, 2011). Thus, project developers may devise a reasonable approach by which to assign a value to periods of time between recorded methane concentration values. The verifier shall confirm that the value(s) applied by the project is reasonable and conservative. No data substitution may be applied if there are no methane concentration readings during an entire quarter.