

# Errata and Clarifications

## METHODOLOGY FOR THE QUANTIFICATION, MONITORING, REPORTING AND VERIFICATION OF GREENHOUSE GAS EMISSION REDUCTIONS AND REMOVALS FROM PLUGGING ORPHANED OIL AND GAS WELLS IN THE U.S. AND CANADA

### VERSION 1.0

2024-06-13

This Errata and Clarifications document is supplemental to the ACR Methodology *Plugging Orphaned Oil and Gas wells in the U.S. and Canada, Version 1.0* (“the Methodology”) and applies to all projects registered under the Methodology. Each erratum and clarification contained herein is effective as of its posting date listed below. This document may be updated as supplemental information or clarifications are needed. Project Developers and Verification Bodies shall adhere to the errata and clarifications when implementing projects and conducting verification activities.

#### 1. Clarification: Crediting Period (2024-06-13)

Section 1.3 states: “Per the *ACR Standard* ... update the methodology.” This text is updated to: “Per the *ACR Standard*, the project Crediting Period is the length of time for which a GHG Project Plan is valid, and during which a project can generate credits against its baseline scenario. Orphaned well plugging activities developed under this methodology will have a single, non-renewable Crediting Period. Each well is eligible for crediting for 20 years based on Enverus oilfield data on wells currently classified as orphaned by states that demonstrates that the last production date was, on average, 17 years prior to that data being accessed. There is a significant population of unknown orphaned wells and projections for many additional wells to become orphaned. As additional data becomes available that defines orphaned well degradation, potentially high emission rates, and the emission decline curve, ACR will update the methodology.

The Crediting Period begins when it is first demonstrated through post-plugging measurements that there are no emissions from a well plugged as part of a project (i.e., the same date as the project start date and Reporting Period start date). The Crediting Period ends twenty years after it is demonstrated through post-plugging measurements that there

are no emissions from the final well measured in the project (i.e., the same date as the Reporting Period end date). All wells in a project must be plugged and demonstrated through post-plugging measurements that there are no emissions within 24 months of the project start date, resulting in a maximum Crediting Period duration across all wells in the project of 22 years.”

## **2. Erratum: Evidence or Attestation that an Orphaned Well is Leaking (2024-06-13)**

In Section 4, a top bullet is added which states: “Verifiable evidence that the well was found to be leaking in its original condition, or an attestation as such signed by Project Proponent (and Project Developer Account Holder, if not the same entity), must be submitted as part of the project documentation.”

## **3. Clarifications: Approval of Methane Measurement Methods (2024-06-13)**

- a. The text of first bullet of Section 4 states “Methods to measure emissions ... during GHG Project Plan preparation.” This text is updated to: “Project Proponents shall submit a [Methane Measurement Method Approval Form](#) to ACR and obtain approval prior to collection of pre-plugging methane measurements. More detail provided in Section 4.1.”
- b. Text in third paragraph of Section 4.1 states “Project proponents shall consult ... the below ACR Requirements:” This text is updated to: “Project Proponents shall submit a Methane Measurement Method Approval Form to ACR for approval. The form shall be submitted during GHG Project Plan preparation (after project listing) and approved prior to collection of pre-plugging methane measurements. This form collects information about the parties participating in the project methane measurement activities, the name and qualifications of the qualified measurement specialist(s), and the proposed method(s) and equipment. Completed forms and any supplemental documents shall be uploaded to the Project Documents section for the applicable project on the ACR Registry. ACR will assess this information for consistency with the intent of the methodology and principles of accuracy and conservativeness, but approval of the form does not guarantee a successful verification or the issuance of carbon credits. ACR will upload the reviewed form to the ACR Registry when approved. In the final GHG Project Plan, Project Proponents must provide documentation that equipment was administered correctly, including calibration; demonstrate that the flow rates measured were within the specified range for the equipment used; and that the equipment, as administered in the field, met all accuracy and precision requirements set out in this methodology and the *ACR Standard*, including:”
- c. The text in Section 4.2 that states “Measurement methods design shall ... sampling may contact ACR” is removed.

#### **4. Errata: Removal of Requirement to Measure Ambient Background Methane During Pre-plugging (2024-06-13)**

- a. Bullet 3 of Section 4 addressing ambient emissions measurements is removed.
- b. First bullet in “Before Plugging” in Section 4 addressing ambient methane concentration is removed.
- c. Bullet 1 in Section 4.2 addressing background sampling is removed.
- d. The sixth bullet of Section 5.2 states “Documented date, time and location for ambient methane concentration readings.” This text is updated to: “Documented date, time and location for post-plugging ambient methane concentration readings”.

#### **5. Clarifications: Readings Required (2024-06-13)**

- a. Bullet 3 in Section 4.1 states “Date, time, and location ... data can be verified.” This text is updated to: “Measurements of methane concentration, well gas flow rate, and wellhead pressure (if measurement equipment is directly connected to leaking well) must be measured and recorded simultaneously. Methane-specific flow rates may be collected in lieu of separate measurements for methane concentration and well gas flow rate. Each reading shall include documentation of the measurement date, time, and location so measured data can be verified.”
- b. Section 4.1.2 states “Emissions measurements, taken over ... slope of less than 1%.” This text is updated to: “Emissions measurements are required to determine pre-plugging methane flow for every well in the project boundary. Two pre-plugging sampling events, at least 30-days apart, are required at each well, as demonstrated in Figure 3.”
- c. Section 5.2, bullet 3, first sub-bullet states “Measurements of methane ... pictures or reports.” This text is updated to: “Measurements of simultaneously collected methane concentrations, well gas flow rate, and wellhead pressure (if measurement equipment is directly connected to leaking well) over reported sampling event – including time-stamped, georeferenced videos, pictures or reports”.

#### **6. Clarifications: Emissions Stabilization Requirements (2024-06-13)**

- a. Section 4.1.4 title is changed to “Stabilization Requirements for Measurements”
- b. The text states “Methane emission rates can ... not eligible for crediting.” This text is updated to: “Regardless of method, simultaneous measurements of methane concentration, well gas flow rate, (or methane emission rate if methane is measured directly) and wellhead pressure (required if measurement equipment is directly connected to leaking well) must be recorded at 10-minute intervals, or more frequently and averaged over a 10-minute period. These readings are used to determine methane emission rate stability. During each pre-plugging sampling event

described in Section 4.1.2, the methane emission rate, measured directly or calculated from simultaneously measured methane concentration and well gas flow rate, must stabilize for a minimum of two hours. If required to be measured, wellhead pressure must also be stable over the two-hour sampling period, though this data will not be used as part of the calculations. Figure 4 provides examples of methane emission rates over time considered to be constant, stabilized, and non-stabilized. To be considered stable over the minimum 2-hour period, the following criteria must be met:

- The 10-minute interval methane emission rate data points over the minimum 2-hour stability period do not vary from one another by a factor greater than 10;
- The slope of a line of best fit for the 10-minute interval methane emission rate data points must not decline or increase more than 1% from its initial rate at the start of the minimum 2-hour stability period; and
- If wellhead pressure is measured, pressure readings must be similarly assessed and also must not decline or increase more than 1% from its initial reading at the start of the minimum 2-hour stability period.

The mean of all 10-minute interval methane emission rates during the minimum 2-hour stability period will be considered the average methane emission rate for that sampling event. To demonstrate stability over time, the average methane emission rate from the second sampling event at least 30 days later must be within 10% of the average of first sampling event.

If the observed methane emission rates during initial measurement do not meet the above criteria, additional measurements may be collected.”

## 7. Errata: Equation Updates (2024-06-13)

Equations within the methodology are updated as follows:

- a. A new Equation 1 is added to Section 4.2.1 to calculate the annual emission rate for a single well.

Text is added: “The annual emission rate for each well is calculated using readings from stable periods of both pre-plugging sampling events in Equation 1.”

### Equation 1: Annual Emission Rate for a Well

$$Q_{\text{pre-plugging},p} = \frac{\sum_{i=1}^n (Q_{\text{measured},i} \times \text{Conc}_{\text{measured},i})}{n \times 1,000} \times 8,760$$

#### WHERE

$Q_{\text{pre-plugging},p}$

Methane emission rate for well,  $p$  (Kg CH<sub>4</sub>/year)

$Q_{\text{measured},i}$	Well gas flow rate for 10-minute interval, $i$ , from minimum 2-hour stable period of both pre-plugging sampling events for well $p$ (g/hour)
$\text{Conc}_{\text{measured},i}$	Concentration of methane in the well gas stream for 10-minute interval, $i$ , from minimum 2-hour stable period of both pre-plugging sampling events for well $p$ (%)
$n$	Number of 10-minute intervals, $i$ , from stable periods of both pre-plugging sampling events (minimum 2-hours each for a minimum quantity of 24 interval readings)
1,000	Conversion of g to Kg
8,760	Hours per year

- b. Equation 1 from the methodology becomes Equation 2 and is updated from calculating annual baseline emissions to baseline emissions during the Crediting Period.

The text states “The baseline (pre-plugging) emissions, BE (t CO<sub>2</sub>e/year), are computed using:” This text is updated to: “The baseline (pre-plugging) emissions over the Crediting Period for all wells in the project, BE (MT CO<sub>2</sub>e), is calculated using Equation 2.”

### Equation 2: Baseline Emissions (Pre-Plugging)

$$BE = \frac{\sum_{p=1}^w (Q_{\text{pre-plugging},p})}{1,000} \times \text{GWP}_{100\text{CH}_4} \times 20$$

#### WHERE

BE	Baseline emissions over the Crediting Period for all wells in project (MT CO <sub>2</sub> e)
$Q_{\text{pre-plugging},p}$	Methane emission rate for well, $p$ (Kg CH <sub>4</sub> /year) from Equation 1
$w$	Total number of wells to be plugged in a project
1,000	Conversion of Kg to MT
$\text{GWP}_{100\text{CH}_4}$	100-year global warming potential for methane (CH <sub>4</sub> )

**20** Years in Crediting Period

- c. Section 4.3 and Equation 2 from the methodology is removed.
- d. Equation 3 from the methodology is updated to:

**Equation 3: Project CO<sub>2</sub> Emissions from Fossil Fuel Combustion for Equipment Used at Plugging Project**

$$PE = \sum_{j=1}^y \frac{FF_j \times EF_j}{1,000}$$

**WHERE**

<b>PE</b>	Project CO <sub>2</sub> emissions from fossil fuel combustion for equipment used at plugging project (MT CO <sub>2</sub> e)
<b>FF<sub>j</sub></b>	Quantity of fossil fuel, <i>j</i> , consumed (gallons) <sup>20</sup> in all plugging activities required for project completion
<b>EF<sub>j</sub></b>	Fuel specific emission factor for fuel, <i>j</i> 10.19 Kg CO <sub>2</sub> e per gallon diesel, and 8.78 Kg CO <sub>2</sub> e per gallon of gasoline <sup>21</sup>
<b>1,000</b>	Conversion of Kg to MT
<b>y</b>	Number of fossil fuels used at plugging project

- e. Section 4.6 and Equation 4 from the methodology are removed. Uncertainty is addressed by the standard uncertainty deduction discussed in the text of Section 6.2 and applied in Equation 5.
- f. Equation 5 from the methodology is updated to:  
 Text is added: “The total GHG emission reductions achieved by the project, minus the 5% uncertainty deduction for all projects is calculated using Equation 5.”

<sup>20</sup> Plugging records that show diesel/gasoline used during plugging activities need to be shared with ACR for verification.

<sup>21</sup> [https://www.eia.gov/environment/emissions/co2\\_vol\\_mass.php](https://www.eia.gov/environment/emissions/co2_vol_mass.php)

### Equation 51: Total GHG Emission Reductions

$$\text{TotalER} = (\text{BE} - \text{PE}) \times (1 - \text{UNC})$$

**WHERE**

<b>TotalER</b>	Total emissions reductions from project (MT CO <sub>2</sub> e)
<b>BE</b>	Baseline emissions over Crediting Period for all wells in project (MT CO <sub>2</sub> e) from Equation 2
<b>PE</b>	Project CO <sub>2</sub> emissions from fossil fuel combustion for equipment used at plugging project (MT CO <sub>2</sub> e) from Equation 3
<b>UNC</b>	5% uncertainty deduction

g. Section 4.9 and Equation 6 from the methodology are removed.

### 8. Erratum: Update 5.2.1 Parameters (2024-06-13)

Table 5.2.1 is updated as follow and only reflects measured parameters:

UNIT	PARAMETER	SOURCE	BASELINE OR PROJECT	FREQUENCY OF MONITORING
(g/hour)	Q <sub>measured,i</sub>	Field measurements	Baseline	Two minimum 2-hour sampling events/well
%	ConC <sub>measured,i</sub>	Field measurements	Baseline	Two minimum 2-hour sampling events/well
PSI	Wellhead pressure	Field measurements	Baseline	Two minimum 2-hour sampling events/well
number of 10-minute intervals from pre-plugging sampling events	n	Field measurements	Baseline	Two minimum 2-hour sampling events/well

UNIT	PARAMETER	SOURCE	BASELINE OR PROJECT	FREQUENCY OF MONITORING
volume	$V_{eff}$	Field measurements (for non-steady state enclosure-based measurements)	Baseline	Two minimum 2-hour sampling events/well
$\frac{\text{mass}}{\text{volume} \times \text{time}}$	$\frac{dC}{dt}$	Field measurements (for non-steady state enclosure-based measurements)	Baseline	Two minimum 2-hour sampling events/well
$\frac{\text{volume}}{\text{time}}$	q	Field measurements (for non-steady state enclosure-based measurements)	Baseline	Two minimum 2-hour sampling events/well
$\frac{\text{mass}}{\text{volume}}$	$C_{eq}$	Field measurements (for non-steady state enclosure-based measurements)	Baseline	Two minimum 2-hour sampling events/well
$\frac{\text{mass}}{\text{volume}}$	$C_b$	Field measurements (for non-steady state enclosure-based measurements)	Baseline	Two minimum 2-hour sampling events/well
wells	w	Project documentation	Baseline and Project	1/project
gallons	$FF_j$	Fuel measurement	Project	1/fuel/plugging activity
ppm	Post-plugging methane screening	Field measurements	Project	1/well
ppm	Ambient methane emissions	Field measurements	Project	1/well

## 9. Clarification: Definitions (2024-06-13)

The following definition is added:



**Sampling Event** Refers to a single, minimum 2-hour period for the simultaneous collection of methane concentration, well gas flow rate, and wellhead pressure (required if measurement equipment is directly connected to leaking well) from an orphaned well. Methane-specific flow rates may be collected in lieu of separate measurements for methane concentration and well gas flow rate.

### **10. Clarification: Environmental Conditions (2024-06-13)**

Seventh bullet in Section 5.2 states “Environmental conditions: precipitation ... wind speed (onsite measurement required).” This text is updated to “Onsite environmental conditions must be reported in the final GHG Project Plan to confirm that the measurement equipment used is within its operational range. It is acceptable to use third party information (weather reports or apps) to collect this information. Information to be reported includes precipitation, temperature, humidity, and wind speed.”