



Vision

We envision a world where legacy emissions are eliminated, and our neighbors' lands are restored through responsible, market-based solutions.

Mission

Our mission is to stop methane emissions from orphan oil and gas wells, returning healthy, revived land back to the communities who count on it.

Core Values

We reach genuine solutions by living our values of having a rebellious spirit, engaging in authentic communication, collaborating expansively and practicing creative thinking.

Methane Abatement: Orphan Oil and Gas Well Plugging

The ACR Orphan Oil and Gas Well Methodology (OOG v1.0), published in May 2023, established the first scalable, quantifiable framework, and financing pathway, for plugging orphan wells, a practice previously limited to underfunded state and federal programs. It was based on then-prevailing academic assumptions that orphan wells emitted low, stable methane volumes over short periods, reflected in an arbitrary 20-year crediting period using exponential extrapolation. While appropriate for many low-impact wells near the end of their productive life, research and the inclusion of oil and gas industry experts over the past three years has revealed a distinct subset of orphan wells with higher pressures, larger emissions, and far greater near-term climate significance. As oil and gas industry expertise has entered the VCM and academic research has evolved, clear gaps have emerged in OOG v1.0's treatment of the full orphan-well population, underscoring the need for methodological improvements.

Rebellion, founded by oil and gas industry experts, evolved the application of ACR v1.0 pre-issuance (E&C's that Rebellion played a leading role in) and post-issuance applications to bring to market high-certainty, high-integrity, transparent credits that move this market's sector in a critical direction.

ACR Methodology's Baseline	Rebellion's Additions
Lacks proper forecasting over crediting period	Uses industry standard conservative modelling to predict with certainty forecast over crediting period
Lacks understanding of when the leak started or where it was in its lifecycle	Deploys industry norm models to identify when a measured leak would occur, starts it at day zero, and can model in what year of the crediting period the peak of the leak



	would occur before applying a decline curve
Lacks detailed plugging policy for permanence	Federal and State plugging requirements center on plugging practices to protect groundwater, not preventing the travel of methane to the surface. Rebellion’s patent pending Rebellion Method of Plugging goes above and beyond API RP’s to protect groundwater and ensure permanent cessation of methane
Lacks buffer pool to reduce risk should a reversal occur	Rebellion applies a 5% buffer pool across the enterprise, up to the 5 th year of the project’s credits, once the first 5 years show zero leakage
Lacks post plugging MRV plan	Rebellion monitors each well that issues credits at days 30 and 90 post-plugging, and annually up to the 5 th year, and every 5 years throughout the 20-year crediting period to ensure permanence.
Lacks Health, Safety and Environment Policy	As Industry Experts who spent decades in Oil and Gas before founding Rebellion, unless the project developer and preferably protocol have an HSE Policy, the risk exposed to the market and buyer, more specifically, is significant.

Below we detail the **Critical Elements of Measurement to Quantify Emissions Volume** as carbon accounting is the core pillar of crediting and has the most room for improvement in a methodology, while additionality and permanence are confirmed as high-standards of excellence for orphaned oil and gas wells.

1. Measurement Method

More so than operated oil and gas wells, orphaned wells can be incredibly dangerous given their lack of maintenance (years to decades), often de-rated equipment, and little historical context. Per OSHA (general duty clause), field crews must first secure those wells meeting any of the four conditions for enforcement before any further work (i.e. prolonged measurement) can be undertaken. Once a well has been secured (not necessarily fully ‘shut in’ but secured enough to safely approach the well) and its leak altered, the most appropriate measurement method is a direct connection to the wellhead and the data gathered is a stable rate at a fixed choke setting rather than the current leak.



The direct connect method is the only safe way to take a measurement under these conditions, control of the “breach” provides valuable data about the leak at a point in time.

Why this is important: Safety + Data Quality

While the stereotypical orphan well is low energy, there are a subset of the orphan well population that are high-energy and require additional consideration. These wells often have the greatest associated emissions over time and pose the largest threat to human health and well-being.

2. Measurement Stability

Both flow rate and flowing pressure must be within the stability window for that measurement to be considered eligible. While a flow rate may appear stable, if pressure is increasing, it is an indicator of buildup; alternatively, if pressure is decreasing, it is an indicator of depletion. Specifically for a direct connect measurement method, which uses a choke to control flow, the choke setting must remain fixed for the entirety of the measurement. Often Rebellion’s fixed choke settings are between 1-4/64ths with 1/64th representing a .3mm leak, often representing a smaller orifice than may have been present in the unaltered state.

Why this is important: Avoidance of Flush Production and/or Data Manipulation

After a well has been shut-in for some time, hydrocarbons may build up near the wellbore and a large near-term flush of production (accompanied by a depleting pressure profile) may occur upon opening the well to a pressure sink. This is not a stable state nor do measurements taken during flush production provide representative data or predictive tools. Additionally, adjusting the choke setting during a measurement may provide stable data but under varying conditions.

3. Measurement Time

While it is feasible that some, low energy orphan wells may display long-term stability over a 2-hour period, as wells increase in energy (indicated by measured rate), those time frames must also increase to ensure steady state results are achieved. An iterative process balancing increasing (stable) rates with increasing (stable) time requirements introduces certainty of achieving truly predictive data. While Rebellion has done as much as a 48-hour measurement, most common is 4, 6, and 8-hour tests. Two of these tests must be completed at a minimum 30 days apart and provide consistent results to ensure external environmental conditions are not a factor.

Why this is important: Confirmation of Boundary Dominated Flow

Boundary dominated flow (aka Pseudo-steady state flow) occurs when the pressure



transient reaches all boundaries of the reservoir. This is an important phase in a wells life as it indicates a less dynamic and more predictable system. While most orphan wells are assumed to be within boundary dominated flow, it must be confirmed through direct measurements to assure the market of reliable and conservative crediting.

4. Data Usage

The “path” of a leak over time begins at zero, increases logarithmically as the breach(s) continues to corrode, stabilizes, and then decreases as the reservoirs energy is depleted. This means that a measurement taken may occur at multiple points (likely 2) along that path. A leak measurement taken in its unaltered state should be assumed to exist on the decreasing portion of the leak path given its low (depleted) energy. However, that same conclusion cannot be drawn for a well with significant energy (pressure) and additional data must be gathered.

Additionally, it is important to use all available data when analyzing a well however not all data is equally valuable, particularly if taken out of context. While many orphan wells have historic production data, the operational context for that data is almost completely unknown. For example, graphical noise may be due to an operational challenge or stratigraphically separate producing zones may be open at different times. These pieces of information, when available, can be used as a reference point but should not be trusted as the sole source of truth.

Why this is important: Decline Curve Analysis

While many project developers are rightly applying a declining forecast to their point in time measurements, that is likely an overly simplified approach on its own. First, depending on the measurement used as the start of the decline, this may be a partial analysis. Second, basing that rate of decline on limited historic production is imprecise at best without operational context, which is why Rebellion used all vertical onshore U.S. wells (1.8 million) to type-graph decline profiles based on well type and applies a decline curve at the well level post-issuance, resulting in about 40% of issued credits never being made available to the market.

5. Placement of Measured Emissions in Time

When using the direct connect method, the measured (stable) rate must be placed along the leak path (as a starting point for terminal decline) in time. This is done using an industry standard corrosion model, using data gathered throughout the test period to calculate how long it will take to move from time zero (a conservative assumption given the well was leaking greater than zero in its unaltered state) to the breach size associated with the fixed choke (measured in 64th mm).



Why this is important: Measured Rate ≠ Current Leak

The (stable) rate measured using the direct connect method may be higher or lower than the current leak. In order to accurately and conservatively estimate the remaining emissions volume within a crediting period (i.e. 20 years), it must be confirmed that the measured rate would occur within that crediting period.

Rebellion uses industry standard modeling to understand at what year (starting at zero) the well would reach its measured rate, with high accuracy, and a terminal decline is applied post-issuance to secure the well's measured rate in both time and highly certain subsurface behavior of the well.

6. Terminal Decline

While there may be instances of nominal emissions decline in very low energy wells, or wells with steady-state inducing drive mechanism (i.e. water drive), for wells with meaningful energy, it is almost certain that the reservoir powering those emissions will deplete of energy and the emissions themselves will decline over time. If boundary dominated flow has been confirmed (see measurement time), then an exponential terminal decline is industry standard conservative practice. There are over a million vertical gas production profiles and both internal and published research that empirically confirms a rate of decline between 4 – 6%, depending on well type . Increasing rates of decline are applied with increasing stable rate measurements.

Why this is important: Accounting for Reservoir Depletion

It is inappropriate and not industry standard to assume a flat profile in nearly all well scenarios. Because the drive mechanism for production is the same as the drive mechanism for emissions, the profile (exponential terminal decline) is the same (although the production rates will likely vary from the emissions rates).

Rebellion will bring forward all elements of carbon accounting that reflect critical measurement methods and quantification to the Isometric-Rebellion developed protocol for orphan oil and gas wells for rigorous science underpinning the measurement and verification of every credit.



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