SUMMARY AND RESPONSE TO PEER REVIEW COMMENTS

A new methodology entitled **Methodology for the Quantification, Monitoring, Reporting, and Verification of Greenhouse Gas Emissions Reductions from Plugging Abandoned and Orphaned Oil and Gas Wells** was developed by the American Carbon Registry in partnership with Dr. Mary Kang at McGill University.

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.

This methodology was open for public comment from September 27-October 31, 2021. Public comments and author 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. Section or line numbers as referenced by the public in the following table refer to the document version as posted for public comment.

The updated methodology was reviewed by an independent panel of experts beginning in April 2022.

#	Citation Reference	Comment	Commenter	Authors
Chapter 1 – Methodology Background and Applicability				
1	Applicability Pages 13-14	Stipulating that the well is emitting CH4 with "no regulatory requirement to prevent the release" may be a tall order, or a difficult thing to ask for. As documented elsewhere in the methodology document, the existence of regulatory requirements is in some cases insufficient to "prevent the release" or may in other cases allow for significant delays in getting wells plugged. Suggest re-wording or deleting this sentence to prevent confusion. Numbers 3 and 4 are mutually exclusive ("either/or") which should be made more explicit – as written it could be implied that proponents must satisfy both. The inclusion of "Abandoned" wells may be problematic, suggest improving clarity of their regulatory additionality if they remain included. We suggest limiting eligibility in the initial version of the methodology to "orphaned" wells only. Suggest re-wording to use a word like 'category' rather than 'buckets.' Reference to 'Regulatory Surplus Test' makes the definition circular because the Regulatory Surplus Test states that any well that meets the definition	Radicle Canada	We agree that enforcement can be inconsistent. Project proponents will need to interface with regulators throughput the plugging process and at that point the well will come under scrutiny, and it can be determined if it is in compliance. Terminology varies across jurisdiction. We are defining the term "abandoned" for consistency in the methodology. There are a significant number of wells that are "abandoned" and leaking methane and the methodology seeks to incentivize the plugging of these wells, with the strict standard of demonstration of regulatory compliance to ensure additionality. Done. If a well is not required to be remediated or plugged, preventing emissions is considered additional. TO meet criteria for Category #1, wells spudded prior to

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		of Abandoned is considered additional, but to pass the test it must meet the definition. As per comments above - the description of the methodology for "Abandoned" will refer back to regulatory surplus which is circular or at least unclear. Further, per comments above, does regulatory surplus refer to "no" regulatory requirement, or for example to insufficient funds available from state bonds? The last paragraph on page 14: Putting this comment in this location implies that it only applies to Abandoned Wells and not Orphaned Wells: is that the intent?		1950 are considered surplus due to the lack of regulation. Regulatory surplus refers to wells with responsible operators who may have a regulatory requirement to plug or remediate wells that are leaking. If state funds are used to plug these wells and the operator is not required to contribute, plugging would be considered additional. Removed.
2	Applicability Pages 13-14	Well candidate eligibility – can this be expanded? Rather than only listing candidate wells as those that have been shut in/nonproductive for a period of time – can we include stripper wells (wells with marginal production; in WY, these wells are defined as producing less than 10 bbls/oil/day)	Kimmeridge	Wells that have been nonproductive for 6 months are now eligible. This may be demonstrated through production logs or regulatory classification, depending on jurisdiction.
3	Applicability Pages 13-14	Recommendation - Remove the language "no reported production for the last 12 consecutive months to the state/providence" for well qualification under the Protocol. Reasoning- 10% to 20% of active wells in the United States are operated at extremely low volumes and produce economic losses for their	Darrin Prescott-Grenian	As above.

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		owners ("losing wells"). These wells are generally at the end of their lives and have material methane leakage issues that are directly related to the age of their equipment and the lack of maintenance and care. The primary reason why these wells are poorly maintained and operated at a loss is that the cost of operating the losing well is less than the cost of going through the process of properly plugging the losing well. If this recommended language is removed from the Protocol, project proponents will have an opportunity to partner with these well owners to expand the scope of economically viable projects by 25% to 50%. Further, the integrity of the Protocol is not affected by this recommendation and the goals, and the objectives of the Protocol are greatly enhanced.		
4	Reporting Period Page 15	Since projects are only allowed one reporting period, is the maximum length 5 years (per the ACR Standard)? It might be helpful to clearly state the maximum as project might aggregate multiple wells and associated testing events together into one project.	Ruby Canyon Environmental	The reporting period begins with the measurement of methane emissions and ends when project proponents confirm that there are no post-plugging emissions. Each well within a project will have its own reporting period. For aggregated wells in a single project, the reporting period starts with the first methane measurements and ends with the confirmation sampling on the last well that is plugged. Validation must be completed within 12 months of the plugging of the last well in the project. For orphan wells, crediting period is 20 years and for

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				abandoned wells, crediting period is five years with one renewal.
5	Crediting Period Page 15	a) 10-year period plus a 10-year extension. Our question is do the single batch of credits based on the formulas only get granted once in year 1 or every year or split over 10 years? Then if extended, over another 10 years? We don't think it's clear that if for example, 10 metric tons of CO2 equivalent have been saved by plugging a well, does that mean 10 credits every year, or 1 credit per year for 10 years? b) Does the fact that the well would vent methane into the atmosphere for many decades going forward get accounted for in these measurements or it is just the emissions the well would have over the 10-year period? We feel it is not a point-in-time/one-time emission that is being stopped but an ongoing emitter that will continue to emit methane for many years that is being plugged. So, the question becomes is there any value to the savings in the future? c)	Four Elements Consulting	Credits will be issued in the year that the project is completed and approved. Clarification added. We are giving the option of up to 20 years of credits. After 10 years, we will reevaluate the regulatory requirements and inventory of plugged and orphan wells to determine if another ten years of credits is appropriate. There are many factors that will impact the number of wells needing to be plugged including state/provincial and federal investment, regulatory changes, and fossil fuel demand.
6	Crediting Period Page 15	Credit Issuance Timeline: The timeline for credit issuance is unclear. Projects "will have a crediting period of ten years," and "can only have a single reporting period per crediting period" (Sections 1.3 & 1.4). It is implied (but not specified) that the reporting period will occur after the three months of post-	Yale Carbon Contentment Lab	Credits will be issued after plugging is complete and it is confirmed that there are no emissions. A 5% leakage deduction will be taken from all credits to account for any potential future emissions from plugged well and the unlikely event that the plugging impacts emissions from nearby wells. Ten-years' worth of emissions credit will be issued.

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		plugging monitoring. Are all credits associated with the ten-year crediting period issued at once following the reporting period, or are they awarded incrementally over time? • Recommendation: Revise the methodology to stipulate all eligible credits be rewarded after the three-month monitoring period. A portion of eligible credits may be siphoned to a "buffer pool" account for each developer to compensate for a credit's invalidation if a leak is later discovered. A project-developer-specific buffer pool has the advantage of concentrating risk to a single developer rather than distributing risk to developers who may not be at all responsible for a future leak. • Midpoint Monitoring and Crediting Timeline Inconsistencies: If all credits are issued at once following the three-month post-plugging monitoring period (see above), the project risks over-crediting if a leak is discovered during assessments five or ten years after plugging (Sections 1.3 & 4.1.1). The project proponent is required to fix the well plug (5.1 "Permanence and Reversal Risk"), but there is no 'claw back' provision on how or if credits may be invalidated or paid back. • Recommendation: Include a provision that invalidates previously awarded credits in		Addressed. Changed to confirm no emissions post-plugging with 5% leakage deduction.

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		the event a developer is financially or otherwise unable to plug a leak that is later discovered. Replacement credits from the developer's buffer pool may be used to compensate for any resulting losses. If no leak is discovered, the buffer pool credits should be released to the project developer to be sold on the market.		Addressed by leakage deduction.
7	Crediting Period Page 15	Montrose suggests clarification of the guidance for project renewal requirements. After the first crediting period, the methodology requires the wells to be screened again for methane emissions. Additional information should be provided to clarify the methane measurement procedures for the screening of wells and the additional project actions required for eligibility of a project renewal.	Montrose Environmental	Requirement changed to confirmation sampling immediately after plugging well and 5% leakage detection.
8	Crediting Period Page 15	Credit period of 10 years Is there a process to test periodically to confirm the abandonment remains effective? Change post-sampling to less, return ~6-18 months. If the wells are found to still be emitting, do the credits need to be returned retroactively? Address!	Kimmeridge	Leakage deduction will address low risk of methane leaks post-plugging.
9	Crediting Period Page 15	The 10-year crediting period that the ACR uses is arbitrary. It could be less than 10 or greater than 10. ACR should be amenable to augmenting the initial crediting period, while still limiting the overall combined crediting period to 20 years. Increasing the initial crediting period would prime	Michael Martin	The ten-year crediting period balances the need to issue multiple years of credits quickly, potential regulatory changes, and the need to reconfirm the lack of emissions.

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		a nascent market, as expected value economics would improve, as the severity or impact of an unmanageable, policy related risk that mitigates the earning period would decline. ACR could state upfront that the augmentation will be reduced or eliminated at a defined point in the future to further stimulate the private sector to act in the here and now; thereby, overcoming the valley of death because even if policy were to change securing the government significant funding to plug all of the super emitting orphans is unlikely based on precedents.		
10	Applicability Conditions Page 14	"The well is emitting CH_4 with no regulatory requirement to prevent the release." This is a requirement for regulatory surplus which is part of the additionality and not applicability conditions. These two sections should not be mixed.	South Pole	This provides clarification that there must be no regulatory requirements that prevent release, regardless of the terminology of the jurisdiction.
11	Applicability Conditions Page 14	ACR should allow for a period of longer than 12 months between an operator acquiring title to an orphaned well and the completion of well plugging. ACR's draft methodology states: If an operator takes title of an orphaned well with the intent of performing plugging operations, that well must be plugged within 12 months of transfer of [sic] operator in order to be eligible to participate in this methodology. XMC advocates for a period longer than 12 months for several reasons: · The methodology requires at least three months of testing prior to plugging.	X Machine Capital Strategies LP ("XMC")	Requirement removed. The project proponent must demonstrate their intent to plug adopted wells by listing their project within 12 months. Listing a project does not require taking emissions measurements or plugging the well.

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		· The methodology requires that significant work be done to study the hydraulic connection between hydrocarbon reservoirs. · The methodology recognizes that plugging may not be successful initially and should allow ample time for testing and repair as necessary; and · In the case of an operator who has acquired a few wells in a producing basin, a plugging program may take several months or years to complete. XMC suggests two changes to this requirement: · The 12-month period should be extended to 24 months; and · The methodology should require that the operator commence a plugging program within the required time period and continue the program until all acquired wells in the basin are plugged.		Once a project is listed, project proponent will have 24 months to plug and additional 12 months verify emissions reductions.
12	Applicability Conditions (Title) Page 14	OFFSET OWNERSHIP – We believe that providing additional guidance on minimum requirements for offset/project ownership would be helpful to project developers and verifiers. Ownership could be complicated for abandoned wells with multiple parties involved (mineral owners, surface owners, well owners, operators, plugging companies).	Ruby Canyon Environmental	Requirement to plug AWoR removed. Project proponents only need to demonstrate access to wells being plugged.
13	Applicability Conditions (Title) Page 14	Clarity around credit validity if the plugging activity was already required by the state? Currently it appears that if an operator were to take ownership of orphaned wells, and the state/federal rules already require the plugging, that operator would not be eligible for carbon credits even though they abandoned the well. How	Kimmeridge	If plugging is required by state, no credits can be issued. If operators demonstrate that a well was orphaned and they took ownership with the intent to plug, that well is eligible.

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		can we be sure that taking on orphan wells will actually be valid for carbon credit opportunities?		
14	Applicability Conditions (Title) Page 14	Although the title of the methodology addresses all Greenhouse Gas (GHG) emissions, the methodology itself discusses methane (CH_4) specifically. Because methane is the most potent GHG, it is appropriate to concentrate efforts on CH_4 however it is our belief given the above as well as our comments under bullet #2 – Eligibility, we would propose the following: "Methodology for the Quantification, Monitoring, Reporting, and Verification of Methane Reductions achieved by Plugging Oil and Gas Wells" that the title should reflect that same specificity.	Rebellion Energy	Title is standard ACR language and, though the methodology focuses on methane emissions for wells, other GHGs are considered.
15	Periodic Reviews and Revisions Page 15	Clarification: for projects-in-progress, when revisions are published, at what stage would they need to apply? In other words, do these revisions apply retroactively to completed or registered projects, are current projects able to select which revision to use, or would ACR reserve discretion to apply revisions as it sees fit? Suggest clarifying (or referencing which section of the ACR Standard governs this).	Radicle Canada	The methodology used is whichever version is active on a project's start date. If, during the course of a project, another methodology becomes active, the project proponent may decide which methodology to use.
Chapter 2 – Project Boundaries				
16	Geographic Boundaries Page 16	"Wells that are within the methane drainage pattern of the emitter well and are hydraulically connected will need to be plugged as part of the project."	South Pole	NWoR requirements removed.

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		ACR must define minimum requirements to demonstrate as to what all wells fell within the drainage pattern. These requirements must be in the main methodology section. Similarly, there should be appropriate requirements to select NWoR and their monitoring in appropriate sections		
17	Geographic Boundaries Page 16, and 49 (A.5)	The wording is a bit confusing but should confirm that a single Proponent can list multiple project aggregations/pools. Recommend adding "within a single project" Regarding the statement: "The proponent must demonstrate to ACR's satisfaction…" how would this satisfaction be acquired and documented? Suggest clarifying that this is part of project listing documentation (or otherwise). The term "methane drainage pattern" is not (to our knowledge) a recognized technical term and should either be replaced or defined.	Radicle Canada	NWoR requirements removed. Removed. Removed.
18	Geographic Boundaries	It is understandable that well data must be required by ACR to catalogue and administer credits effectively – specifically avoiding redundant credit offerings. Well location (GPS, lat/long, S-T-R-Qtr, Qtr) and Well ID (API #) are sufficient to accomplish this task and no well attributes are needed. Our recommendation is to remove language requiring well attributes with the exception of location and identification in order to ease the administrative burden on behalf of both operators and ACR.	Rebellion Energy	Well data requirements reduced.

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19	Chapter 2 Table 1 Page 17	"GHG included in cement transportation and plugging operations" CH_4 and N_2O can be omitted. Simpler explanation for omissions can include reference to CDM tool 12 and, CDM Tool 03 and CDM Tool 05 respectively.	South Pole	CO_2, CH_4, and NO_2 included in cement transportation calculations.
20	Chapter 2 Table 1 Page 17	There are additional SSRs in the full process of plugging and reclaiming a well. I am curious whether these emissions should be included in the formulae or, at a minimum, acknowledged as to why they are excluded. Some examples of possible, additional emissions are those from mobile mechanical equipment for, or transportation of: • location rebuild (import of gravel), if the area around the wellhead needs improvement to support the weight of a plugging rig; • sale or disposal of any remaining oil products in tanks; • pressure bleed to "kill" a well prior to plugging; • plugging of on-location fresh water wells; • waste disposal – TENORM, impacted soils and water, asbestos, etc.; • disposal or repurpose of above-ground and below-ground facilities and flowlines/pipelines; • hydrovac identification/preparation of flowlines/pipelines and purging of those lines for abandonment; • import of topsoil and dirt work for surface reclamation; etc. (This isn't required for plugging the well and preventing emissions).	Joey McKenley	Different jurisdictions have different remediation requirements. These activities would also occur at the time of future well plugging. This methodology incentivizes plugging the wells sooner and preventing the interim emissions.

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21	Chapter 2 Table 1 Page 17	Same comments as above for Page 17 – Table 1: Sources, Sinks and Reservoirs. Consider acknowledging or including the additional emissions SSRs involved in the entire plugging/reclamation process than seemingly focusing only on the plugging phase of the process.	Joey McKenley	As above.
22	Chapter 2 Table 1 Page 17	SSR's – ACR is requiring the cement transportation (SSR2) and plugging mobilization (SSR3) be subtracted from the credit offering, this is appropriate only if all associated methane reductions are being captured, which is not the case. Reduction in pumper transportation, onsite, connected equipment that is also potentially leaking methane, etc…. must also be incorporated in order to capture the full scale of both sides of the equation. For simplicity, we recommend excluding SSR's beyond SSR 1 and considering the extraneous emissions a wash. We are open to including ALL SSR's as an alternative.	Rebellion Energy	All emissions associated with the well, including from surface equipment, can be quantified and included in the emissions reductions. Clarity added in methodology.
23	Chapter 2 Boundaries	The term "boundary" here may be difficult to reconcile with the use of the same term above. The term above refers to a number of wells. Here it would seem that it should include transportation from the cement production facility as well. Suggest reviewing or perhaps using two distinct terms.	Radicle Canada	Clarity added.
24	Chapter 2 Table 1	Provide additional information for quantifying nitrous oxide (N_2O) emissions.	ClimeCo Corporation	Updated formulas and Appendix F to clarify emissions from CO_2, CH_4, and N_2O all included.

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	Page 17	In the methodology, Table 1 identifies the inclusion of N_2O emissions for quantifying project emissions. However, it appears that sections 4.2 (Project Emissions) and 6.3 (Parameters) solely include GHG emission specific parameters for CO_2 and CH_4. The source and quantification for N_2O emissions is currently unclear. We would like a better understanding on how to account for N_2O in project emissions.		
Chapter 3 – Baseline Determination and Additionality				
25	Additionality Page 19	3.2 Additionality Assessment - The term "effectively" does some heavy lifting in this sentence, and it might be good to clarify further per comments above – regulations may not be clear, black and white, and in many cases effectiveness can be argued both ways. 3.2.2 Regulatory Surplus Test - This is circular because the definition of Abandoned, within section 1.2, refers to this regulatory surplus test as being a requirement of the definition. Per above. 3.2.2 Performance Standard - Might prefer "and/or" enforcement, in cases where the regulations exist but are insufficient.	Radicle Canada	Term "effectively" removed.
26	Regulatory Surplus Test	P&A process to use? Requirement that proponent followed the state's rules. P&A process to use?	Kimmeridge	Plugging will require approval from responsible agency, generally state or province. Language added to provide clarity.

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	Page 19	Requirement that proponent followed the state's rules. Assuming we defer to the local guidelines (whichever is most stringent) for plugging? Does the process need to be reviewed and authorized by ACR before plugging?		In the unlikely event that there is conflict or question regarding plugging requirements, consult ACR. Language added in section 7.3.
Chapter 4 – Quantification of GHG Emissions Reductions				
27	Baseline Emissions Page 21	It is common for methane emissions to leak from various production facilities associated with an oil & gas well. The leaks can come from tanks, flowlines, heater treaters, meter runs, various piping, valves, etc. Satellite spectrometer surveys confirm that methane plumes are more often sourced from production equipment than the actual wellhead itself. These facilities are commonly constructed with steel and degrade over time thus becoming conduits for methane leaks. The methodology currently allows for the sampling of the wellhead and a 10cm to 1m area of immediately adjacent soils. Since methane often leaks from the associated production facilities of a well, and not just the wellhead itself, would it be possible to include the associated production facilities into the Baseline Emission scenario and Project Boundary to ensure all methane sources are included?	The McDaniel Company	Leaks from associated equipment can be included in project emissions if proponent can clearly demonstrate direct connectivity to the wellhead. Emissions from additional equipment must be demonstrated to no longer be leaking immediately following plugging. Emissions of residual materials from tanks is not included because that is not related to the plugging of the well.
28	Baseline Emissions	Recommendation - Add the ability for the project proponent to increase the measurement space to include the well, related infrastructure, and	Darrin Prescott - Grenian	Leaks from associated equipment can be included in project emissions if proponent can clearly demonstrate direct connectivity to the wellhead.

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	Page 21	surrounding soils when performing Baseline Emissions testing. Reasoning - The total methane emissions from a well include its related infrastructure and adjacent soils. Once a well is plugged, these emissions from related infrastructure and adjacent soils will also be eliminated. If the activities of plugging the well eliminate the emissions from the well's related infrastructure and adjacent soils, then these emissions should be included in the Baseline Emissions quantities.		Emissions from additional equipment must be demonstrated to no longer be leaking immediately following plugging. Emissions of residual materials from tanks is not included because that is not related to the plugging of the well.
29	Baseline Emissions Page 21	ACR should allow for alternatives to chamber-based testing. ACR's draft methodology states: Measuring these emissions shall be done using a calibrated methane-specific gas detector and a tested enclosure-based (also referred to as chamber-based) method. Chamber design shall be approved by ACR, or other experts, during project review – project proponents who wish to consult with experts prior to sampling may contact ACR. XMC advocates for the allowance of additional types of baseline gas detection. Just as ACR must approve the chamber design in the draft methodology, ACR will also have to approve the alternative testing method. However, ACR should not rule out alternative testing procedures in the methodology.	X Machine Capital Strategies LP ("XMC")	Other quantification methods may be used provided that they can demonstrate detections limits at or below 1.0 g/hour of methane.

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30	Baseline Emissions Page 21	"One additional methane assessment is required approximately five years after plugging. This can be done with a handheld sensor or multi-gas sensor with a lower detection limit of 2 ppmv methane. If methane concentrations exceeding 3 ppmv are detected during the test, methane flow rate using a chamber-based method shall be used. This test is to ensure plugged well is not emitting." Plugging process is similar to what happens in case of closure of wells in the CCS projects. Continuous monitoring, at least every 6 months (2x24) should be there to take into consideration various aspects in the Crediting period. The methodology's requirements of monitoring seem to be too relaxed. If only one additional assessment is required after 5 years, there should be at least a proper justification (and reference to international/national regulations or best practices)	South Pole	Requirement replaced with leakage deduction.
31	Temporal variation Page 21	Additional information is needed regarding the well testing to be completed approximately 5 years after plugging. Some questions include: • Why is it "approximately"? For clarity, it would be helpful to require the testing to occur by a certain time. • What happens if the testing shows the well is leaking? There is no process listed on next steps and accounting for potential over-crediting or a "reversal".	Ruby Canyon Environmental	Requirement replaced with leakage deduction.

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		• What is the process for submitting this testing to ACR? Does this need to be reviewed by VVB?		
32	Temporal variation Page 21	I take no issue with the proposed measurement requirements and timing of those measurements. I wish to comment on state/BLM requirements, surface owner relations, and weather, which may complicate scheduling for the party completing plugging/reclamation: • State/BLM requirements – Some states and the BLM have timing requirements for completing certain phases of the abandonment and reclamation process. The pre-plugging emissions measurements may extend those timelines. As indicated elsewhere in the document, the plugging/reclamation party shall conduct their work in accordance with regulations. Regulatory entity approval of any timing delays for pre-plugging emissions measurements are anticipated to be automatic but should not be taken for granted. • Surface owners – It should be acknowledged that access to the well for plugging/reclamation activities, including pre- and post-plugging emissions measurements, requires notification and potential compensation to surface owners for access to the well. In addition, the plugging/reclamation party should set	Joei McKinley	Measurement requirements have changed. Measurement is required only immediately after plugging. Site remediation activities can proceed as required. Surface owners may need to grant permissions to access well for measurements and plugging. Last site visit required is emissions measurements immediately following plugging.

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		expectations with the surface owner for timing in the emissions measurement and plugging/reclamation processes. Surface owners in some areas are known to halt new well or pipeline projects until older wells are plugged and reclaimed. Delay for the sake of emissions measurements may not be satisfactory to these surface owners. • Weather – It should be acknowledged that weather for approximately six-to-nine months of the year in northern US states and presumably Canada complicates scheduling, cost, and execution of plugging/reclamation activities. Adding three months for pre-plugging emissions measurements may push a well beyond an executable weather window in a given year, deferring the work to the following year. This may require the plugging/reclamation party to weigh benefits of immediate plugging/reclamation or delay to the following year with emissions measurements.		Requirements have been reduced. Plugging need not immediately follow emissions measurement.
33	Temporal variation Pages 21-22	What is the impact of this screening? Is there any prescribed methodology? With respect to its impact on credits that are already issued, there is no mention of insurance or buffer pool requirements, so the purpose of the screening is unclear. Is it to inform future methodology	Radicle Canada	Post-plugging requirements changed to measurements post-plugging and leakage deduction to address the low likelihood of leaks.

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		revisions? Does it even need to be reported to ACR? Also, as above, there is reference to a screening at the 10-year mark in order to enable a second crediting period; suggest that both of these should either be addressed in terms of their impact on existing registered offsets, reporting requirements and methodologies or, otherwise, removed for clarity. Regarding "diurnal variations": Even if the variations exceed 10x per above? Is this separate limit/guidance needed? In general, the 10x variance is very helpful because visual comparison to a graph could be highly subjective.		There is no requirement to sample at 10-year renewal, that is an evaluation of a jurisdiction's orphan well inventory to confirm additionality. The time required for sampling has been reduced and is specific to the equipment used, however in rare cases there may be measurements that take long enough to stabilize that some cycling is observed.
34	Temporal variation Pages 21-22	4.1.1 'Emissions measurements, taken over a three-month period, are required for both. 6.3 1 / well, and "continuous in time measurement" without referencing section 4.1.1 could lead to significant confusion here. pre-plugging and post-plugging conditions for every well in the project boundary." 3 - month is not a universally known measurement of time period as there can be variations in the number of days. Example 1: Jan - Feb - March: Can have 90 days or 91 days depending upon the fact it is leap year or not. Example 1: 3 months may correspond either to 92 days or 91 days depending upon which month you	South Pole	Measurement requirements have been updated.

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		start baseline calculation. It is better to explicitly say 90 days to avoid confusion.		
35	Steady-State and Non-Steady-State Chambers Page 23	Please clarify whether both steady-state and non-steady state are considered static chambers. The terms are used throughout the Methodology, and it is not clear how they relate. Consider adding terms to definition section.	Ruby Canyon Environmental	Clarified.
36	Chapter 4 Pages 21- 28	Not all carbon offsets are created equally; there are deltas in additionality, enforceability, verifiability, counting, leakage, or a combination thereof. Like other products and services, one should expect the market to demand more information to better implement pricing discrimination. It is imperative that ACR ensure that the carbon offsets generated by the AOOG well plugging methodology be clearly labelled as being affiliated with methane given the fact that the GHG is 84-86 times as potent as CO_2 from a 20-year global warming potential perspective.	Michael Martin	Language added in intro.
37	Chapter 4 Pages 21- 28	There is no mention of leakage. While it may be correct that there is no leakage (emissions increase outside of project boundary due to project) where NWoR are appropriately considered and there are, there should be a mention that LE and how it is addressed.	South Pole	Wells plugged through this methodology are non-productive. Language added in section 2.2
38	Chapter 4	Emissions produced by plugging operations – who validates this calculation?	Kimmeridge	These calculations will be examined during review and validation.

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	Pages 21- 28	Have any theoretical numbers been put to these calculations? Range of emissions being produced? Estimation of emissions produced to plug the well? Are some of these plugging operations effectively net-negative to the operator? What about emissions created during the plugging work (not just mileage to/from location)? How are these calculated?		No, this can vary widely. It is possible. These emissions are included.
39	Pre-plugging and post-plugging Emissions Calculation Page 24	4.1.4 Equation 3 PPE - PPE is a part of project emissions.	South Pole	Correct- hopefully PPE=0.
40	Pre-plugging and post-plugging Emissions Calculation Equation 3 Page 24	ACR should credit reductions utilizing a GWP10 or GWP20. Equation 3 of ACR's draft methodology utilizes the term GWP100(CH4) 100-year global warming potential for methane (CH_4). The proper rate for converting methane volumes into CO_2 equivalent will likely be a hot topic of discussion. Presumably, ACR has developed this new AOOG methodology because of the opportunity to promote the remediation of unaddressed methane emissions that are extremely potent in the short term. Adopting a GWP10 factor would simply be consistent with this vision. Further, the incorporation of a GWP10 factor would both	X Machine Capital Strategy LP	ACR Standard specifies which GWP value to use.

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		accelerate the development of AOOG remediation projects and provide the economic incentive to plug a wider universe of target wells.		
41	Pre-plugging and post-plugging Emissions Calculation Equation 3 Page 24	The intent seems to credit avoided emissions over the 10-year crediting period, but it is not clear in the equations where the multiplication of the annual emissions rates by 10 years occurs. Is the annual emission rate (tCH_4/year) determined in Equation 6 used for all 10 years of the crediting period?	Ruby Canyon Environmental	Added to Equation 11.
42	Pre-plugging and post-plugging Emissions Calculation Equation 3 Page 24	Regarding the "Total post-plugging annual emission rate of all plugged wells in the project boundary": Would it be possible to measure and not plug within NWoR? What might be considered de minimis level to exclude emissions? Elsewhere in the methodology there is reference to 3 ppmv but this is an exceedingly low concentration for background in many regions (e.g. agricultural). Suggest that post-plugging, a simple screening to determine methane is not above background should prevent the need to conduct chamber-based measurements. If screening shows emissions above background it should trigger chamber measurements. Per above - discussion of the term 'stabilize' are relatively qualitative and based on visual representation, which could be subjective.	Radicle Canada	NWoR requirements replaced with leakage deduction. Stabilization defined in 4.1.1.

#	Citation Reference	Comment	Commenter	Authors
		Presumably over a long enough time period/enough measurement it could be captured. Better defining this term might help.		
43	Pre & Post Plugging Emissions Calculation Page 24	1. Both pre and post plugging monitoring requirements seem to be too lax. In addition, the equipment used to measure are mentioned and/or introduced in the baseline sections, they should have been kept for monitoring section. 2. Emissions from post plugging should be in project emissions and not in baseline emissions as they are happening after the implementation of the project (plugging). 3. Determination of baseline emissions seems to be insufficient. The methodology should justify how this (sampling and forecasting) removes any uncertainty around emission from wells with a confidence of at least 90% 4. Though there is no evidence that seasonal changes does or does not impact methane emissions, some studies have found variations in the control systems (https://doi.org/10.1073/pnas.1408315111). 2x24 hour measurements for both unplugged and plugged wells may not be enough. 5. In most project types data is collected by project proponents, such as a forest inventory for instance or some production indicators. Typically, such factors are quite robust, and the plausibility can be checked via other indicators and over time. The difference in this project type is that the baseline	South Pole	Chamber method is used as an example. Technique is aligned with academic research. Additional equipment and technologies can be reviewed and approved by ACR. Post-plugging emissions, if detected, must be quantified in the same manner as pre-plugging emissions. They are then subtracted from the total credits (Equation 10). Research by Dr. Mary Kang has shown that higher emitting wells are not impacted by seasonal changes, though the controls can be (Kang et al 2014, Kang et al 2016). Proponents will be required to use approved technologies, this will include understanding the limitations of those methods and recording pertinent data (wind speed, temperature, weather conditions, if applicable).

#	Citation Reference	Comment	Commenter	Authors
		emission is just measured 2x 24h pre-plugging, with a method that can have different errors. Once the well is plugged, however, it is impossible to check the plausibility of the value. So it would be impossible to tell if the baseline was actually 5000 tCO_2eq or 50 tCO_2eq once it is plugged. At the same time many options are given in terms of frequency and total sample collections. This might lead to a kind of "confirmation bias" with the sampler. Therefore, it may be worth considering requiring project proponents to engage an independent entity do the measurement plan and measurement to increase trustworthiness in this methodology. Or (perhaps less onerous), requiring that the measurement plan be submitted / reviewed by ACR in advance of the measurement, to reduce risks of (unconscious or conscious) biases.		
44	Cement Emissions Equation 8 Page 27	Regarding EF_{transC} are there standard factors or equations available for this? Could they be added here?	Radicle Canada	Emission factors are shown in Appendix F.
45	Project Emissions Page 27	In section 4.2 (Project Emissions), equations 7 and 8 use the parameter "FF_{ef}" in the equation, though parameter "EE_{ef}" is listed in the description tables. Please clarify the correct parameter for each equation.	ClimateCo Corporation	FF= volume of fuel consumed EF= emissions factor as described in Appendix F

#	Citation Reference	Comment	Commenter	Authors
46	Project Emissions	GWP - What value will ACR use in this methodology?	Rebellion Energy	ACR Standard specifies which GWP value to use.
47	Project Emissions Page 27	In section 4.2 (Project Emissions), the parameters EQ_{CO2} (equation 7) and $Trans_{CCO2}$ (equation 8) have the same description ("CO_2 emissions from fossil fuel used in equipment at plugging project (t CO_2)"). It appears that $Trans_{CCO2}$ pertains to transportation emissions and was incorrectly identified. We request clarification on the difference between these two parameters	ClimateCo Corporation	Updated.
48	Project Emissions Page 27	4a. Carbon Intensity of Cement Production: When determining the project boundary, certain emissions sources will be subtracted from total project emission reductions. "This includes emissions from plugging activities at the well site and transportation of materials, including cement," but excludes GHG emissions related to the production of cement, which can be significant (4.2 "Project Emissions"). The Methodology therefore overestimates the emissions reductions resulting from well-plugging on a life cycle basis. 4a. Recommendation: Stipulate a credit deduction for emissions generated from cement production based on standard emissions factors. If 900 kg of CO_2 is emitted for every 1000 kg of cement produced, 2 then the Methodology should stipulate a corresponding credit deduction for the tonnage of cement used. Alternatively, the Methodology could inspire innovation in the field by creating a crediting	Yale Carbon Contentment Lab	It is assumed that the wells would eventually be plugged using cement and that those emissions are equivalent.

#	Citation Reference	Comment	Commenter	Authors
		incentive for project proponents to experiment with, utilize, and share information on less carbon-intensive plugging materials than cement.		
Chapter 5 – Permanence				
49	Permanence & Reversal Risk Page 30	Per above (reference elsewhere to 5 year and 10-year screening): How do those reconcile with this section? Suggest removing the 5-year screening if it has no impact on project/credits. Regarding the "3 ppmy": In some settings this could be background. Could consider developing a method for establishing background concentration in a region? Anecdotally, from post-closing monitoring this could be as high as 160+ (down from 525,000 pre-plugging). One of the reasons is that the soils themselves often contaminated with hydrocarbons that produce temporary off gassing, where the methane is not originating from the well/downhole.	Radicle Canada	Leakage deduction added to replace 5-year sampling. Background sampling requirement added.
50	Permanence & Reversal Risk Page 30	"Project proponents must monitor all wells plugged a minimum of 3 months after the completion of plugging" 1. This requirement implies continuous monitoring, which does not seem to be the case, according to section 4.1.1, where a number of continuous in time	South Pole	Leakage deduction added to replace post-plugging measurement and 5-year sampling. Proponent must complete methane detection to ensure no leaks. If no methane is detected, no further action is needed.

#	Citation Reference	Comment	Commenter	Authors
		measurements are taken for periods of 24 hours at a time (not continuously) 2. Since this is under the permanence section, there should be a mention of the period for which permanence is conformed to (100 years?). Additionally, 3 months monitoring may not be sufficient to ensure long term permanence. There should be guidance for longer term monitoring.		
51	Neighboring Wells of Review Page 30-31	The requirement to identify Neighboring Wells of Review, determine their hydraulic connectivity, and plug them, should be removed from the methodology: The plugging of a methane-emitting well would not impact the leak rate of other nearby wells and is highly unlikely to result in differences in emissions of these wells over the crediting period. The plugging of a methane-emitting well would not impact the leak rate of other nearby wells and is highly unlikely to result in differences in emissions of these wells over the crediting period.	Tradewater	NWoR requirement removed.
52	Neighboring Wells of Review Page 30-31	Seem to have a large number of ways to document whether NWoR are “in communication” or not. While a project developer generally welcomes flexibility here, ensuring that neighboring wells don’t simply allow methane leakage is quite important to the environmental rigor of this protocol. The question arises of whether the protocol is too flexible. Are all of the options sufficiently rigorous?	South Pole	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
53	Neighboring Wells of Review Page 30-31	"To be eligible, an AOOG well plugging project must plug all these wells within the area of review or demonstrate that wells are not be [sic] in communication with the plugged wells (i.e., no credits will be granted to any well plugged as part of a project until all wells with the NWoR are addressed). … Reservoir geology, structure, and other factors can be used to demonstrate lack of communication." I see benefits and drawbacks to the vagueness of the above requirements, and I have not yet settled on whether I believe more clearly defined standards should be set forth. I have seen operators arguably abuse reservoir and geologic data to gain competitive drilling permits or obtain increased density approvals to extract more oil and gas volumes at today's prices whilst potentially sacrificing maximum long-term reservoir depletion. Therefore, I am mistrustful of how data can be manipulated to avoid plugging responsibilities. However, vagueness and flexibility in this realm may help foster project participation.	Joei McKenley	NWoR requirement removed, it is unlikely that plugging a well will increase emissions from a neighboring well. The 5% leakage deduction will cover that rare possibility.
54	Neighboring Wells of Review Page 30-31	Greater clarity is needed on how NWoR can be determined and what processes/procedures may be acceptable to ACR. Additional questions/comments include: • Will ACR approve the NWoR prior to validation or will it be the responsibility of	Ruby Canyon Environmental	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		the VVB to confirm the NWoR during the validation process? • It would be helpful to provide examples of the types of reports, studies or evidence that is sufficient to prove lack of connectivity/influence between wells. • How will horizontal wells be addressed should they exist in the O&G pool? Figure 4 doesn't have examples of horizontal wells. • Are there specific databases or resources that ACR expects to be reviewed or utilized to determine all potential wells in a pool or field?		
55	Neighboring Wells of Review Page 30-31	Regarding the statement: "If the NWoR can be shown to not be leaking, they do not need to be plugged." This is a helpful clarification if it is true. In entirety, the NWoR concept is not very clearly laid out. It should be considered carefully against the literature as it risks introducing a disproportionate burden on project proponents relative to the additional confidence it might provide around permanence of emission reductions. Consider the scenario where the plugging of an emitting well results in an economically feasible emissions reduction project; however, due to the NWoR requirements, multiple other non-emitting or low-emitting wells (that are not economically feasible) must be plugged along with the primary well. In many cases, this scenario	Radicle Canada	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		would not result in the plugging of any wells if the overall project is then uneconomical. For context and comparison, CO_2 sequestration projects require confirmation of much longer-term permanence in order to be eligible (100+ years) as they involve injection of GHG - as opposed to limiting orphan well emissions, which requires only 10 years permanence as proposed, though hopefully and likely will have longer-term ancillary benefits. CO_2 sequestration (including in oil/gas bearing formations via CO_2-EOR) has been extensively studied and simulated for long term permanence, leakage, and migration. Specifically, DOE NETL (2010, 2013), Cooney et al (2015), and Azzolina et al (2016) suggest 100-year leakage rates between 0% and 1% (including in the presence of 'pathways to surface' e.g. wells). If similar rates hold for NWoR's over the proposed crediting period of 10 years, it would not seem to warrant project costs increasing by 100% or greater. The statement about the project proponent demonstrating that wells penetrating the reservoir are not hydraulically connected, and the statement "If the NWoR can be shown to not be leaking, they do not need to be plugged." seem to encapsulate a workable solution for NWoR: • if not connected, no need to sample or plug • if connected, must sample		It is unlikely that plugging a well will increase emissions from a neighboring well. The 5% leakage deduction will cover that rare possibility.

#	Citation Reference	Comment	Commenter	Authors
		• if not “leaking” no need to plug. Of course, leaks could develop after plugging activities but as per above, gas migration risks should be considered in context. To our knowledge there are only a handful (or fewer) examples of significant gas migration as a result of plugging that resulted in incremental release to atmosphere. In these examples attribution to plugging activities was weak or non-existent. Beyond the commercial implications of potentially requiring many wells to be plugged where only one of them is economical, there are logistical and regulatory considerations. Keeping in mind that project proponents are required to effectively take ownership over a well prior to plugging, they would likely need to establish many more commercial agreements with more leaseholders, landowners, those who own or deal with access roads, etc. Further, this concept effectively precludes any plugging from happening in regions where there are still actively producing wells since they clearly won’t be plugged. If we assume that any methane migrating to a producing well is going to end up in a sales pipeline, we could allow this – but what if the well stops producing in the next 10 years? Does it become an NWoR retroactively and thereby obligate the project proponent to plug wells into the future? As you can see, from a commercial, logistical and regulatory standpoint the NWoR concept is entirely unworkable in a large proportion of cases. If ACR		

#	Citation Reference	Comment	Commenter	Authors
		truly intends to enable proponents to address the orphan well emissions problem at scale, it must revisit the concept and produce a solution that is proportional to the risk. Regarding the "NWoR that are hydraulically connected": Could this be a spectrum, e.g. define a rate of hydraulic connectivity as opposed to yes/no? The NWoR will present significant validation and verification risk and so we suggest that ACR specifically incorporate it into project listing procedure for ACR review and sign-off, to remove the selection of wells in NWoR from VVB scope. Regarding "are not be": this is either a Typo; or needs more clarity. They are not, or they cannot be? Per above. Can these characterizations be established by conducting a geo/engineering risk assessment? If so, suspect they would be more likely to characterize conductivity as "low" than "no".		Removed.
56	Neighboring Wells of Review Page 30-31	Require that the project proponent prove that a plugged well will not increase drilling in nearby wells. Multiple reports show that well owners are disincentivized from properly plugging AOOG wells due to financial burdens and a lack of adequate	ClimeCo Corporation	Project proponents may not be operators in nearby parts of the field and should not be limited in plugging leaking wells. Plugging activities will be taking place in depleted fields and the risk of another well being drilled to replace a poorly

#	Citation Reference	Comment	Commenter	Authors
		regulation.1,2 However, a recent report shows that well owners may be financially incentivized to plug a well to increase pressure and promote drilling in nearby wells.3 We believe that this issue may be technically addressed in section 5.2 (Neighboring Wells of Review). However, as currently written it is unclear how producing wells or potential future producing wells are addressed. To avoid allowing for projects that support additional or future drilling, the methodology should include a clearly stated requirement that the project proponent must prove that they are not plugging a well to maintain or increase pressure to drill nearby wells. To ensure permanence, the methodology should also include a monitoring requirement to prove that nearby wells do not start producing in the future due to the plugging of the project well.		performing well is low. Plugging a well will not increase pressure in the formation.
57	Neighboring Wells of Review Page 30-31	Neighboring Well of Review (NWoR) – It seems like it's a total unknown until you get far down the road of measuring/evaluating a well or group of wells for potential plugging. In our case, we want to hit the highest emitters, which will already be somewhat difficult to pinpoint. Then without significant work ahead of time on the drilling records, etc., It seems like it would be difficult to determine how many other wells are part of what will need to be plugged. We may end up having to plug 20 wells just to get the credits for the one high emitter we want. We see the point in having this	Four Elements Consulting	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		as part of the standards and it makes sense, but is there any way to know the total potential exposure?		
58	Neighboring Wells of Review Page 30-31	2a. Legitimacy of NWoR Proofing: The procedure for identifying NWoR, determining communication between wells and reporting to ACR is open-ended and leaves room for confusion (5.2 “Neighboring Wells of Review”). It is unclear what level of proof is sufficient to demonstrate that wells are not communicating. It is also unclear what types of geological survey maps or other documents would be considered sufficient to prove wells do not communicate. 2a. Recommendation: Clarify the reporting requirements for NWoR and communications between wells. Include a standard list of required documents or examples of approved data sources to provide guidance. 2b. Title Issues & NWoR: As written, the project proponent must either prove that neighboring wells of review (NWoR) are not communicating with the target well, or otherwise plug all NWoR (5.2 “Neighboring Wells of Review”). However, the project proponent must hold the title or “demonstrate to ACR’s satisfaction that they are eligible to plug a well, monitor for emissions, and receive credits” for all wells associated with the project (A.5 “Timing Requirements for Abandoned Wells”). If the project proponent cannot obtain the title or access to plug all NWoR, it may be impossible to obtain credits for plugging the target	Yale Carbon Contentment Lab	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		well. Similarly, proximity of the target well to an active well may also disqualify an otherwise legitimate project. 2b. Recommendation: Allow project proponents to plug the target well and all accessible NWoR. The project proponent should first demonstrate to ACR why any NWoR would be deemed inaccessible to plug beyond reasonable doubt. Adding this provision may allow more project developers to plug problematic wells.		
59	Neighboring Wells of Review Page 30-31	Connectivity of Wells: Section 2 Project Boundaries and Section 5.2 Neighboring Wells of Review Montrose is concerned about the requirement to demonstrate that neighboring wells are not in communication with the well to be plugged. Due to the probable lack of precise, available data of abandoned and orphaned wells, determination of the connectivity could be economically prohibitive as current evaluation methods are time consuming and costly. The costs and timeframes of this type of evaluation would vary significantly depending on the number of wells in proximity of the target wells to be closed and the number of formation layers being intercepted by the target wells. Montrose suggests clarification to allow for additional methods to identify well connectivity. As an example, a lack of connectivity can be demonstrated by robustly monitoring NWoR emissions before and after the plugging project, in cases when data is unavailable, and a physical	Montrose Environmental	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		geologic investigation of older wells is impractical or cost prohibitive. No increase of emissions with the NWoR would be a sufficient determinant that there is no connectivity with the NWoR.		
60	Neighboring Wells of Review Page 30-31	Regarding plugging all wells within a 'pool' How do you validate/confirm that these wells are communicating? Are local commission spacing orders/requirements sufficient proof of drainage area and determination of whether or not wells are in communication? Why is communication relevant to plugging all wells? What if the operator is not the owner of all the wells and/or does not have authority to access/plug the other wells?	Kimmeridge	NWoR requirement removed.
61	Neighboring Wells of Review Page 30	The Neighboring Wells of Review (NWoR) methodology is onerous, and positioned to antagonize American Carbon Registry's ability and desire to reduce emissions. The certain cost associated with the review itself will impact any and all project economics. If the added cost associated with complying with Section 5.2 of the methodology results in the project falling below the private sector's hurdle rate the well emitting GHG will remain unplugged in a properly functioning market. As Kang et al. note in Energy Policy (132 (2019) 594–601), "[m]ethane emissions from AOG wells follow extreme distributions with the largest 16% of leaks (> 0.09 tonne yr−-1 well−-1	Michael Martin	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		or > 104 mg h−-1 well−-1) accounting for 98% of the total leakage volume." The primary focus and goal of the AOOG well plugging methodology must be to reduce emissions from high methane emitting AOOG wells. Such a focus, as Kang et al. note, will "lead to cost-effective environmental benefits". A more prudent approach than the NWoR would be to institute a monitoring requirement using a scalable overhead technology. If cost-effective monitoring highlights that the methane emissions at a neighboring well have increased by a statistically significant amount the carbon offsets in forward years could then be held until the neighboring well is plugged, and once plugged, the released carbon offsets could be reduced to account for the temporary increase in neighboring well emissions. NOTE: GHGSat, is one company that has multiple satellites in orbit that are able to detect methane emissions from sources 100 times smaller than any other satellite, but with a resolution 100 times higher such that methane emissions from point sources as small as oil & gas wells can be detected & quantified at concentrations 12 ppb or less. (source, source).		
62	Neighboring Wells of Review Page 30-31	We're thinking about this in terms of actual work/boots on the ground, and the physical steps to identify NWoR's, and the obstacles/challenges that would be associated with doing so to be in compliance with the methodology. Based on that we have the following questions	The McDaniel Company	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
		• How would one demonstrate to ACR's satisfaction that any wells within the surface projection of the pool are not leaking and in communication with the emitter well? • In practice in the field, how would a project proponent physically go about doing this? • What is a methane drainage pattern and who or what will establish that? • How close is a NWoR? Is it feet, miles, etc. • How can one identify whether a well is a NWoR or not? • How can a project proponent prove, or disprove hydraulic connectivity to ACR? • What variables will ACR use to make a determination as to whether or not a well is a NWoR?		
63	Neighboring Wells of Review Page 30-31	Regarding the statement about emitter wells penetrating or being perforated in multiple pools, this is an interesting point about where the methane emissions are originating from; is this difficult? What methods or techniques are recommended for fingerprinting a specific methane source?	Radicle Canada	NWoR requirement removed.
64	Neighboring Wells of Review Page 30-31	What is project proposal? This word is not defined in the Standard. I assume this means Project Plan, or is it GHG Project Listing Form? Or is there a separate step proposed for this project type that involves a project proposal?	Radicle Canada	Changed proposal to plan.
65	Neighboring Wells of Review	NWoR – This concept in the document is overly cumbersome and will have the opposing effect of delaying plugging of individual offenders in order	Rebellion Energy	NWoR requirement removed.

#	Citation Reference	Comment	Commenter	Authors
	Page 30-31	to include NWoR wells at a later date (upon the end of their economic life). It is also irrelevant as the oil and gas industry itself already has processes in place to avoid fluid migration via potential subsurface conduits. We recommend striking the NWoR concept completely from the document and including the following sentence from Section 7.2: "Project proponents must demonstrate that their plugging activities will not exacerbate emissions and that plugging will result in no post-plugging emissions from an individual pool."		
Chapter 6 – Monitoring and Data Collection				
66	Chamber Specifications Page 34-35	Sample specifications - Suggest that ACR provide an affirmative list of approved materials, where any materials not on the list need to be "tested" and, or otherwise, describe how this testing could be completed.	Radicle Canada	Methane quantification technology is evolving. Chamber method is detailed in methodology as an example. Other equipment can be approved.
67	Chamber Specifications Page 34-35	Testing details – equipment requirements Does ACR have examples of non-steady state chambers? Only steady state were shown Are both steady and non-steady state measurement methods viewed with the same level of validity? What is the process to authorize operator-build chambers for testing? Do they need to be authorized by ACR before testing? i.e. does our system for testing the CBM wells work in this system/process?	Kimmeridge	Chamber method is detailed in methodology as an example, further resources are available in literature cited. Other equipment can be approved prior to use.

#	Citation Reference	Comment	Commenter	Authors
68	Chamber Specifications Page 34-35	The technology for measuring fugitive emissions, specifically CH_4 are quickly evolving. The chamber method described in this methodology is one means of analyzing emissions that exist today however the methodology should avoid such specifics and leave space to encourage growth in this field. Some level of sophistication must be required however that may be captured in a pre-approval of the GHG monitoring plan by ACR. The methodology is long and outlines overly complex analysis that will deter project proponents from participating. This section is a great example (as well as redundant to a previous section) Our recommendation is to streamline the document by removing all of the specific chamber design and associated analysis and continue to require that discussion in the GHG monitoring plan with a pre-approval step.	Rebellion Energy	Chamber method is detailed in methodology as an example. Other equipment can be approved prior to use. Language updated to clarify other technologies are available.
69	Chamber and Methane Analyzer Specifications	Provide details on measuring and monitoring standards. We support the methodology's inclusion of standards on how to measure and monitor emissions as described in section 6. However, we would like clarification around the source or methods used to create these standards (e.g., measuring tool, length of time, distance around well). We request that the methodology provide details and sources to clarify how the monitoring standards required in the methodology meet industry and scientific best-practices.	ClimeCo Corporation	Chamber method is detailed in methodology as an example, further resources are available in literature cited.

#	Citation Reference	Comment	Commenter	Authors
70	Methane Analyzer Specifications Page 34	Montrose disagrees with the stated methane analyzer specifications. The specification that the analyzer "provides a measurement frequency of 1 Hz and a precision of 1 ppmv" excludes the use of hi-flow samplers. Hi-flow samplers currently on the market are accepted for use in federal EPA regulations Greenhouse Gas Reporting Program 40 CFR 98 Subpart W. These hi-flow samplers do not have a sensitivity as low as 1 ppmv. Additionally, hi-flow sampler technology is recommended for use in the enclosure apparatus; benefits include greater flow capacity and the ability to create negative pressure to pull air into the manufactured chamber. We would be happy to provide additional information regarding these sampling devices.	Montrose Environmental	Chamber method is detailed in methodology as an example. Other equipment can be approved prior to use. Thresholds for analyzers updated.
71	Data Collection and Parameters to be Monitored Page 33	1. Both pre and post plugging monitoring requirements seem to be too lax. In addition, the equipment used to measure are mentioned/introduced in the baseline sections, they should have been kept for monitoring section. 2. Emissions from post plugging should be in project emissions and not in baseline emissions as they are happening after the implementation of the project (plugging). 3. Determination of baseline emissions seems to be insufficient. The methodology should justify how this (sampling and forecasting) removes any uncertainty around emission from wells with a confidence of at least 90%	South Pole	Chamber method is used as an example. Technique is aligned with academic research. Additional equipment and technologies can be reviewed and approved by ACR. Post-plugging emissions, if detected, must be quantified in the same manner as pre-plugging emissions. They are then subtracted from the total credits (Equation 10).

#	Citation Reference	Comment	Commenter	Authors
		4. Though there is no evidence that seasonal changes do or does not impact methane emissions, some studies have found variations in the control systems (https://doi.org/10.1073/pnas.140 8315111). 2x24 hour measurements for both unplugged and plugged wells may not be enough. 5. In most project types data is collected by project proponents, such as a forest inventory for instance or some production indicators. Typically, such factors are quite robust, and the plausibility can be checked via other indicators and over time. The difference in this project type is that the baseline emission is just measured 2x 24h pre-plugging, with a method that can have different errors. Once the well is plugged, however, it is impossible to check the plausibility of the value. So it would be impossible to tell if the baseline was actually 5000 tCO_2eq or 50 tCO_2eq once it is plugged. At the same time many options are given in terms of frequency and total sample collections. This might lead to a kind of "confirmation bias" with the sampler. Therefore, it may be worth considering requiring project proponents to engage an independent entity do the measurement plan and measurement to increase trustworthiness in this methodology. Or (perhaps less onerous), requiring that the measurement plan be submitted / reviewed by ACR in advance of the measurement, to reduce risks of (unconscious or conscious) biases		Research by Dr, Mary Kang has shown that higher emitting wells are not impacted by seasonal changes, though the controls can be: Kang et al 2014, Kang et al 2016. Proponents will be required to use approved technologies, this will include understanding the limitations of those methods and recording pertinent data (wind speed, temperature, weather conditions, if applicable),

#	Citation Reference	Comment	Commenter	Authors
72	Chamber Specifications Pages 34-35	Where ACR review and/or approval are required, such as for the design and methodology of chamber-based methane emission measurements, we request that ACR clearly identify the timeline and process for these reviews. The timeline should include both relative timeframes (e.g., prior to project listing, between project listing and the beginning of the reporting period) and absolute timeframes (e.g., ACR will review chamber designs within 2 weeks of receipt of design documents).	Tradewater	We are unable to provide timelines due to the potential need for additional research and meetings to address concerns.
73	Data Collection and Parameters to be Monitored Pages 33-36	Given the importance of the well testing in determining the emissions reductions, this activity will be considered an area of high risk by verification bodies (VVBs). RCE suggests adding safeguards or guidance into the Methodology to ensure that the testing is done competently, truthfully and accurately. Without any 3rd party oversight or involvement required, RCE believes there is a risk of inaccurate measurements or potential for biased baseline values. Some comments and questions include: • Has ACR considered some type of 3rd party involvement in the well testing? • Providing more detailed information, guidance, templates on what is needed and expected for well testing would be helpful. This is an area where it could be unclear what type of evidence or documentation is expected for the VVB to reach a reasonable level of assurance	Ruby Canyon Environmental	Methane measurements will be completed with approved technologies and calibration procedures. The approval processes for each technology will include a review of the limitations (temperature, windspeed, resolution, etc). Due to these strict requirements, ACR is confident that equipment will be deployed properly and that emission rates cannot be overestimated.

#	Citation Reference	Comment	Commenter	Authors
		that the Methodology requirements were followed.		
74	Chamber Specifications Page 34	How can this chamber design/function be validated/verified? Can you provide guidance for verification?	Ruby Canyon Environmental	Chamber specifications are detailed in the methodology. Logs will be included in the GHG Plan. Other approved measurement techniques will require comparable logs and calibration.
75	Data Collection and Parameters to be Monitored Pages 33-36	In addition to those noted above, RCE has the following general questions and comments: • Does ACR have an expectation on how many wells need to be visited by the VVB as part of the site visit? • Would be possible for the VVB to visit well testing during the validation (and pre-plugging activities)? • Does the Methodology allow one project to be located across multiple states, basins, and pools? • Is there any limitations on the project boundary? • What are ACR's expectations for the VVB to confirm regulatory compliance? With multiple different requirements across various states for well plugging and reclamation, some guidance on the scope of regulatory compliance would be helpful.	Ruby Canyon Environmental	With appropriate documentation and equipment, including georeferenced methane measurements, it is possible that limited or no field visits will be necessary. If needed. It may also be possible to review georeferenced, timed data or verify activities and equipment via video or video calls. Yes, project developers may aggregate wells across geographical areas. No. Boundary for projects is temporal, as credits will not be issued until the wells in a project are plugged. Project proponent must supply proof of regulatory compliance from the responsible agency.
76	Data Collection and Parameters	6.2 Data Collection and Parameters to be Monitored - Regarding "Well Attributes": What is the purpose of each of these being submitted? GOR for example is known to be very poorly	Radicle Canada	Well attribute requirements reduced.

#	Citation Reference	Comment	Commenter	Authors
	Pages 33-34	estimated, and proponents are directly measuring flow rate anyway. We support the included flexibility language as there are known to be significant data gaps especially with orphaned wells. 6.3 parameters - Majority of the "evidence" is "measurements" which seems more like an activity than evidence. This may be defined in the Standard but could ACR provide guidance on what is acceptable documentation (evidence) to support measurements? Spreadsheet, photos, operator log, etc.? Also, the parameter table seems to be missing everything to do with transport/equipment fuel use on site, chamber and analyzer specifications, lots of parameters relating to establishing NWoR, well parameters, etc. What is Astate, rstate, f, N, Af? All terms should be defined.		Need to determine how proponents satisfy that they are collecting the measurements correctly (and without bias) in the field N= Number of emission rate over specified time period. Other parameters removed.
77	Chamber Specifications Page 35	Baseline - Regarding the 10 cm to 1 m of immediately adjacent soils, Minimum makes sense, why a maximum of 1 m? We don't see a problem with this just wonder why the methodology would disqualify a project for e.g. 1.5 m? Baseline - Regarding the statement "two types of chamber measurements required by this methodology", this makes it sound like both types are required, I think it is actually that chamber	Radicle Canada	Maximum removed. Language clarified.

#	Citation Reference	Comment	Commenter	Authors
		measurements are required, and either of two types are allowed. Suggest clarifying the language.		
Chapter 7 – Conservative Approach and Uncertainty				
78	Conservative Approach and Uncertainty Pages 40-41	CONSERVATIVE APPROACH AND UNCERTAINTY It seems as though this section implies that all projects must take a 20% discount to baseline emissions to ensure conservativeness. To make this clearer, this discount should be applied in the Baseline Emissions equation. Also, the 20% cited is based on static chambers – should this % be applied to both steady and non-steady state chambers?	Ruby Canyon Environmental	Clarification added.
79	Conservative Approach and Uncertainty Pages 40-41	Section 7.2 Conservative Approach and Uncertainty Montrose suggests clarification on the application of the proposed 20% error estimate. The methods of how to utilize the 20% error require additional direction.	Montrose Environmental	Clarification added.
Definitions, Appendix, and General Comments				
80		The Well-Done Foundation (WDF) continues to reinforce our position firmly against the inclusion of any well or wells that are not clearly designated as being "Orphaned" by the appropriate regulatory body having direct jurisdiction and responsibility thereof. The AOOG Well Methodology is sure to draw scrutiny and criticism as is to be expected and therefore, the hurdle of additionality needs to be held as a bright line that is straight forward, defensible and crystal clear. The American Carbon	The Well-Done Foundation	It is ACR's position that preventing methane leaks from both orphan and abandoned, operated wells have benefits to the climate. If a project proponent can demonstrate that they are in regulatory compliance, they are eligible to participate.

#	Citation Reference	Comment	Commenter	Authors
		Registry's (ACR) continued insistence of expanding the scope of this methodology and lowering the bar to include "Marginal Wells, Idled Wells, Shut-In Wells" that have a direct connection to any current Oil & Gas Operator, regardless of that operator's financial or technical condition, only threatens to weaken the potential impact of this methodology and jeopardizes all of the credits developed thereunder, regardless of their origin. Allowing credits to be generated from operator wells, regardless of the length of time that those wells have been idled or shut in, and regardless of the potential emissions, will only discredit the legitimately developed offsets from orphaned well projects by painting them with the same brush. Orphaned well credits delivered under an ACR methodology that does not offer a clear and defined distinction between the two very different programs will likely be forced to face discounts in the marketplace if they are even deemed to be desirable at all. WDF's question continues to be simply "WHY"? WHY risk tarnishing the perception of this important work and muddy the waters unnecessarily? WHY lead with including operators wells in the initial version of the methodology instead of getting a very clear category of "orphan wells" across the finish line with a defensible and charismatic narrative? WHY subject the ACR and project proponents to having to accept a discounted rate or worse yet, a market		

#	Citation Reference	Comment	Commenter	Authors
		disinterested in these offsets because of their questionable origin? WDF feels that ACR's continued pursuit of including operator wells in this methodology completely deflates the "Charismatic" nature of our orphan well projects and can result in measurable damages to the WDF.		
81	US State Plugging Funds Page 47	I have seen the average cost of the full plugging/reclamation process for an asset retirement program of more than 500 wells at approximately $250,000 per well, excluding a few extreme outliers of less than $0 (meaning the well only needed to be released from bond) and approximately $2 million. I believe cost efficiencies can be found in strategic execution and that costs will vary by region. However, I think the US GAO's cost estimates are low. Major cost impacts, in addition to well complexity are: identification of legacy flowlines/pipelines, remediation of any discovered hydrocarbon impacted soils and water, waste disposal (asbestos, TENORM), topsoil import, etc. These issues may not be as problematic or prevalent on BLM locations as they may be on private well locations. I am curious whether any of the BLM proofs of claim filed with the Justice Department for operator bankruptcy consider these costs.	Joei McKenley	Costs can range significantly for plugging a well based on numerous factors. With this methodology, ACR seeks to prioritize wells that are causing the most environmental harm with the limited plugging budget available.
82		"Poorly Plugged" Missing from the defined terms list.	Radicle Canada	Updated.

#	Citation Reference	Comment	Commenter	Authors
		Regarding “High Emitter”: I think this was defined in-text as “Poorly Plugged” Regarding “Inactive Wells”: Only true in some jurisdictions		
83	Appendix F Page 55	Montrose suggests utilizing emission factors that are more accurately representative of the type of transportation and mobile source operations that will occur. The primary and most common types of fuel for transportation, including diesel, are not listed in the proposed emission factor table. Additionally, the provided web links to EPA emissions factors are broken preventing review of the reference tables.	Montrose Environmental	Updated.
84		Acknowledging post-plugging work of surface reclamation should be included when speaking about plugging a well. My impression of the oil and gas industry is that many folks are not aware of the extent of post-plugging work. Including “reclamation” when speaking about “plugging” helps educate folks on the additional work.	Joei McKenley	Site reclamation is required in some jurisdictions. This methodology will not address as it is not tied directly to emissions.
85		The flow of the methodology is not adequate. For instance, applicability conditions mentions regulatory surplus, baseline emissions also has a part of project emissions. The requirements around determination of baseline scenario and monitoring of project as a	South Pole	Baseline emissions are determined by methane measurements at the well.

#	Citation Reference	Comment	Commenter	Authors
		whole may be cost effective but may not be sufficient and robust enough. ACR must see that cost of plugging the wells is anyway too less (around 20,000 USD - https://pubs.acs.org/doi/10.1021/acs.est.1c02234) and at least robustness of monitoring should be such that it can be justified that the project is additional. Clear definition for orphaned and abandoned wells and other relevant eligibility criteria (e.g. non-producing for 12 months) should be fully included in Section 1.2 (not Appendix A). Appendix A can certainly provide extra clarification and nuance, but eligibility definition should ideally be clearly defined within the body of the methodology.		Definitions are defined in the methodology. Jurisdictions have varying terminology that may conflict with ACR's terminology.