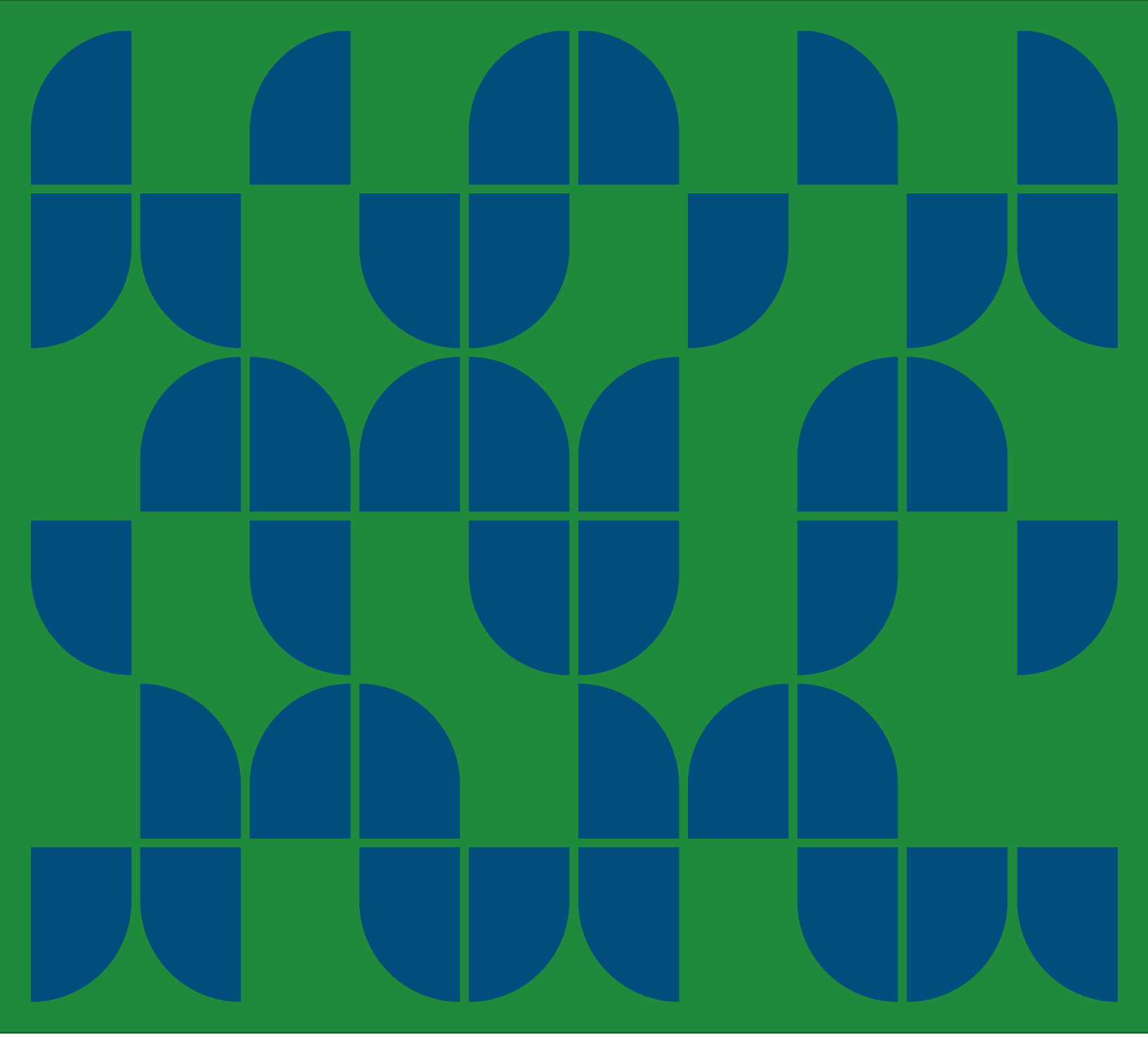

ACR VALIDATION AND VERIFICATION STANDARD

VERSION 1.1

May 2018

ACR
AT WINROCK INTERNATIONAL

ACR VALIDATION AND VERIFICATION STANDARD

VERSION 1.1

May 2018

American Carbon Registry® (ACR)

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ABOUT ACR[SM]

ACR is a leading global carbon crediting program operating in regulated and voluntary carbon markets. Founded in 1996 as the first private voluntary greenhouse gas (GHG) registry in the world, ACR creates confidence in the integrity of carbon markets to catalyze transformational climate results. ACR ensures carbon credit quality through the development of environmentally rigorous, science-based standards and methodologies as well as oversight of carbon offset project verification, registration, and credit issuance and retirement reporting through its transparent registry system. ACR is governed by Environmental Resources Trust LLC, a wholly-owned nonprofit subsidiary of Winrock International.

Acronyms

AFOLU	Agriculture, Forestry, and Other Land Use
ANSI	American National Standards Institute
ARB	Air Resources Board (California)
CH_4	Methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
ERT	Emission Reduction Ton
GHG	greenhouse gas
GIS	Geographic Information System
ISO	International Organization for Standardization
OPR	Offset Project Registry
IPCC	Intergovernmental Panel on Climate Change
IAF	International Accreditation Forum
N_2O	nitrous oxide
PDA	Programmatic Development Approach
PFC	Perfluorocarbon
QA/QC	quality assurance/quality control
SSRs	sources, sinks, and reservoirs
VVB	Validation/Verification Body

Contents

Introduction

ACR is a leading carbon offset program with two decades of unparalleled carbon market experience in the development of rigorous, science-based offset standards and methodologies as well as operational experience in the oversight of offset project verification, registration, offset issuance, and retirement reporting through ACR's online registry system. ACR is a nonprofit enterprise of Winrock International. Winrock works with people in the United States and around the world to empower the disadvantaged, increase economic opportunity, and sustain natural resources. Key to this mission is building capacity for climate change mitigation and adaptation and leveraging the power of environmental markets. Since the 1990s, Winrock has been a leader in developing science-based greenhouse gas (GHG) measurement and monitoring methods and protocols.

ACR was founded in 1996 as the GHG Registry by the Environmental Resources Trust, and joined Winrock in 2007. As the first private GHG registry in the world, ACR has set the bar for offset quality that is the market standard today and continues to lead carbon market innovation.

In 2012, ACR was approved by the California Air Resources Board (ARB) to serve as an Offset Project Registry (OPR) and Early Action Offset Program for the California cap-and-trade market. ACR's work as a California OPR is governed by the California cap-and-trade regulation and compliance offset protocols approved by the ARB.[1] The ACR Standard and the ACR Validation and Verification Standard govern only the registration of projects under ACR-approved methodologies.

The ACR Validation and Verification Standard

This document details the required validation and verification requirements that every GHG project must undergo in order for ACR to register its GHG emission reductions/removal enhancements as serialized Emission Reduction Tons (ERTs). ACR requires both validation and verification by a competent, independent, International Organization for Standardization (ISO) 14065-accredited third party that it has approved, at intervals as specified in the ACR Standard or the ACR approved methodology. This document is intended to guide validation and verification bodies (VVBs), and may also be used by Project Proponents to inform their understanding of what validation and verification will entail.

This document addresses only the validation and verification requirements for project-based GHG emission reductions and removals. It is meant to be applicable across a range of different eligible

[1] The California cap-and-trade regulation (Subchapter 10, "Climate Change," Article 5, Sections 95801 to 96022, Title 17, California Code of Regulations) and currently approved compliance offset protocols are available at http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm.

project types, rather than providing specific guidance for every type of project for which ACR has an approved methodology. Additional validation and verification guidance for specific project types is given in the relevant methodologies and guidance documents (if applicable). Definitions of terms used in this document can be found in the ACR Standard.

Last, please note that this document does not address requirements for verification of projects developed using the ARB compliance offset protocols and submitted for OPR listing on ACR. Requirements for verification of compliance offset projects are given in the Final Regulation Order: California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms (Subchapter 10, "Climate Change," Article 5, Sections 95801 to 96022, Title 17, California Code of Regulations) and in the relevant ARB Compliance Offset Protocols.[2] Verifiers of California compliance offset projects must be accredited by ARB.

Applicability

ACR-approved VVBs conducting validations and/or verifications on behalf of ACR shall include this document in addition to the ACR Standard and an ACR-approved methodology as audit criteria.

The ACR Validation and Verification Standard Version 1.1 supersedes the ACR Validation and Verification Standard, Version 1.0 (February 2018), and must be used as criteria for any project validation or verification commencing after August 1, 2018.

Project Proponents and other interested parties should refer to www.acrcarbon.org for the latest version of the ACR Standard, methodologies, tools, document templates, and other guidance.

Chapter Guide

Chapter 1 Objectives and scoping elements for validation

Chapter 2 How to validate project boundaries

Chapter 3 How to validate project baselines

Chapter 4 How to validate additionality

Chapter 5 How to validate quantification methods

Chapter 6 How to validate other eligibility criteria, such as start dates and Crediting Periods

[2] See https://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm.

Citation

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Chapter 1: Validation Overview

This chapter summarizes the objectives and scoping elements of validation necessary to list a GHG Project Plan. ACR's validation requirements are built on the foundation of *ISO 14064-3:2006, Greenhouse gases — Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions.*

1.A Definition

Validation is the systematic, independent, and documented process for the evaluation of a GHG Project Plan against applicable requirements of the ACR Standard, the applicable ACR-approved methodology, and any other applicable audit criteria.

1.B Objectives of Validation

The overall goal of third-party validation is to review impartially and objectively a GHG Project Plan against the requirements laid out in the ACR Standard and relevant methodology. The VVB must independently evaluate the project design and planning information, based on supporting documentation and GHG validation best practices.

The objectives of validation are to evaluate:

- Conformance to the ACR Standard;
- GHG emissions reduction project planning information and documentation in accordance with the applicable ACR-approved methodology, including the project description, baseline, eligibility criteria, monitoring and reporting procedures, and quality assurance/quality control (QA/QC) procedures;
- Reported GHG baseline, ex ante estimated project emissions and emission reductions/removal enhancements, leakage assessment, and impermanence risk assessment and mitigation (if applicable).

The VVB shall review any relevant additional documentation provided by the Project Proponent to confirm the project's eligibility for registration on ACR.

1.C Scope of Validation

Validation shall include examination of all of the following elements of a GHG Project Plan:

- Project boundary and procedures for establishing the project boundary;
- Physical infrastructure, activities, technologies, and processes of the project;
- GHGs, sources, and sinks within the project boundary;
- Temporal boundary;
- Description of and justification for the baseline scenario;
- Methodologies, algorithms, and calculations that will be used to generate estimates of emissions and emission reductions/removal enhancements;
- Process information, source identification/counts, and operational details;
- Data management systems;
- QA/QC procedures;
- Processes for uncertainty assessments; and
- Project-specific conformance to ACR eligibility criteria.

1.D Interval of Validation

The ACR Standard requires validation of the GHG Project Plan once per Crediting Period, because the Project Plan remains valid for the duration of the Crediting Period. The length of the Crediting Period for different eligible project types is given in the ACR Standard or applicable methodology.

If using a programmatic development approach, new sites will need to undergo validation prior to issuance of ERTs. Validations for new sites shall occur during full verifications that include a site visit.

Agriculture, Forestry, and Other Land Use (AFOLU) projects that are a result of avoided emissions (e.g., fertilizer management) and that register less than 500 metric tons of ERTs annually are not required to conduct site visits if a VVB can reach a reasonable level of assurance through alternative methods. If the VVB cannot reach a reasonable level of assurance without visiting the project site(s), then it shall conduct a site visit as deemed necessary.

Renewal for another Crediting Period and/or updating the GHG Project Plan to apply a revised version of the applicable methodology requires re-validation.

If a Project Proponent aborts a validation after validation services have begun but before the VVB is able to reach a conclusion with a reasonable level of assurance, the VVB shall inform ACR in writing of the status of the validation and reasons why the validation has been aborted.

Chapter 2: Validating Project Boundaries

The assessment of GHG project boundaries is a critical component of validation. Project boundaries must be clearly defined and transparently delineated in the GHG Project Plan. ACR defines GHG project boundaries to include the project's geographical implementation area, the types of GHG sources and sinks considered, the carbon pools considered (if applicable), and the project duration. For more information on determining and memorializing project boundaries, please refer to Chapter 2 of the ACR Standard.

2.A Physical or Geographic Boundary

To validate project boundaries, the VVB shall confirm through a field visit, visual and/or photographic evidence, maps, Geographic Information System (GIS) files, operating logs, and/or interviews with site operations personnel the accuracy of the project boundaries as defined in the GHG Project Plan.

2.B GHG Assessment Boundary

Because the project boundary includes the types of GHG sources and sinks considered and the carbon pools considered (if applicable), the VVB must evaluate the rationale presented in the GHG Project Plan for the correct inclusion/exclusion of relevant GHG sources, sinks, and reservoirs (SSRs), including the justification given for excluding particular SSRs as de minimis or conservative, and confirm that this is consistent with the GHG assessment boundary section of the chosen methodology. The VVB shall confirm that the guidance in the ACR Standard and the chosen methodology have been applied regarding significance testing, de minimis exclusions, and a priori exclusions of particular SSRs.

2.C Temporal Boundary

Because the project boundary includes the project duration, the VVB must evaluate whether the Start Date, Crediting Period, and project term proposed in the GHG Project Plan are consistent with the ACR Standard, chosen methodology and evidence presented by the Project Proponent.

Chapter 3: Validating Project Baselines

The project baseline scenario is a counterfactual scenario[3] that forecasts the likely stream of emissions expected to occur if the Project Proponent does not implement the project (i.e., the "business as usual" case).

3.A Types of Baselines

Conventionally, three distinct approaches have been taken for establishing GHG project baselines.[4] First, existing actual or historical emissions may be assumed to continue over the project lifetime or Crediting Period. This is termed the "retrofit" baseline, in which pre-retrofit measurements of actual emissions determine the project baseline. A retrofit project may involve the replacement of GHG emissions equipment/fuels with lower-emitting equipment/fuels, or the installation of GHG emissions reduction equipment. Baseline emissions are equal to historical actual GHG emissions prior to the installation of the GHG-reducing technology or change in practice.

Second, the baseline may reflect emissions and removals from a technology or practice that represents an economically attractive course of action, taking into account barriers to investment. This is termed a "project-specific" baseline approach. To determine a project-specific baseline, the Project Proponent evaluates barriers and net benefits associated with feasible alternative baseline scenarios, including the continuation of current activities, and identifies the baseline scenario with the lowest barriers and greatest benefits. The emissions/removals associated with this alternative become the baseline scenario against which emission reductions/removal enhancements in the project scenario are measured.

Third, baseline emissions may be assumed to be the average emissions of similar project activities undertaken in the recent past in similar social, economic, environmental, and technological circumstances, and whose performance is among the top specified percentage in their category. This is termed the "performance standard" approach. Project actions that, with respect to emission reductions or removal enhancements, or technologies or practices, achieve significantly better performance (e.g., lower emissions or higher removals per unit output) than the pre-established performance standard benchmark are considered additional or beyond that which would be expected under

[3] If applied to the project area, the option also exists of monitored baselines on proxy areas.

[4] See, for example World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) Greenhouse Gas Protocol Initiative: The GHG Protocol for Project Accounting (November 2005). http://www.ghgprotocol.org/files/ghg_project_protocol.pdf.

a business-as-usual scenario.[5] Provided the project action is also surplus to regulations, all emission reductions/removal enhancements relative to the baseline are creditable under this approach.

The VVB will confirm that the type of baseline used in the GHG Project Plan correctly applies the guidance in the chosen methodology.

3.B Validating Project Baselines

Project Proponents shall use appropriate methodologies and tools to estimate and update project baselines. The baseline scenario remains valid for the duration of the approved Crediting Period for that project type, and must be re-assessed in order to renew the Crediting Period.

The objective of baseline validation is to check that technically sound baseline emissions have been established and subsequently applied. To establish baseline emissions, data representative of the operations and activities must be used, either from a single year or a multi-year average.

The VVB must ensure that the selected baseline scenario is one for which verifiable data are available. Documentation should include the baseline scenario selection rationale and justification, the guidance followed for baseline emissions estimation, and consistency across post-base year project emissions calculations (to provide accurate comparisons).

Validation of the project baseline should include:

- The explanation provided for how the baseline scenario was selected, including assessment of alternative baseline scenarios and their associated barriers and benefits; and
- Data associated with the base year chosen, and consistency in implementation of emissions estimating guidance for the baseline and project emissions.

Baseline validation may include the following activities, data, and evidence sources (as informed by the VVB's professional judgment); however not all of these are required:

- Interviews with the Project Proponent to determine how baseline emissions have been quantified;
- Review of sufficient documentation for any baseline emissions sources that contribute to total emissions by more than 3% to confirm that estimates have been addressed per stated measurement and monitoring plans, and that the estimations have been applied consistently and uniformly; and
- Check consistency with the appropriate guidance, as well as consistency in applying the guidance across baseline and project activity reporting periods.

[5] Adapted from EPA Climate Leaders (2009): Using Offsets to Help Climate Leaders Achieve Their GHG Reduction Goals: Climate Leaders Offset Module Overview. See http://www.epa.gov/stateply/documents/resources/OffsetProgramOverview.pdf.

Chapter 4: Validating Additionality

Additionality is a test intended to ensure that project offsets are in addition to reductions and/or removals that would have occurred in the absence of the project activity and without carbon market incentives. Project Proponents must demonstrate that the GHG emission reductions and removals associated with an offset project are above and beyond the "business as usual" scenario. To qualify as additional, ACR requires every project to pass either an approved performance standard and a regulatory additionality test, or a three-pronged test of additionality in which projects demonstrate that the activity exceeds currently effective regulations, exceeds common practice in the relevant industry sector and geographic region, and faces at least one of three implementation barriers: financial, technological, or institutional. See the ACR Standard, Chapter 4, and relevant sector-specific requirements and methodologies. Some methodologies recommend, and some require, application of an additionality tool.

The VVB should evaluate each component of the additionality demonstration as required by the ACR Standard and chosen methodology.

4.A Regulatory Surplus Test

The regulatory surplus test involves existing laws, regulations, statutes, legal rulings, or any other regulatory frameworks that directly or indirectly affect GHG emissions associated with a project action or its baseline candidates, and that require technical, performance, or management actions. Project Proponents must provide clear evidence in the GHG Project Plan that the GHG reduction/removal activity is not required by any applicable federal, Tribal, state, or local laws, regulations, ordinances, consent decrees, or other legal arrangements. Only mandatory regulations, not voluntary guidelines, are considered in the regulatory surplus test.

To validate the results of the regulatory surplus test, the VVB shall review applicable regulations identified by the Project Proponent in the GHG Project Plan. If there are significant uncertainties associated with the regulatory requirements, the VVB shall conduct additional research and, if needed, contact the appropriate federal, state, Tribal, or local environmental compliance officer to collect additional documentation (e.g., notices of violation, consent decrees, and settlement agreements) and testimonial evidence.

Some project types may require that regulatory surplus be confirmed during every reporting period, which will be specified in the ACR approved methodology.

4.B Common Practice Test

The common practice test requires Project Proponents to evaluate the predominant technologies implemented or industry practices undertaken in a particular industry sector and/or geographic region, as determined by the degree to which those technologies/practices have penetrated the market, and demonstrate that the proposed project will reduce GHG emissions below levels produced by common technologies or practices within a comparable environment (e.g., geographic area, regulatory framework, investment climate, and access to technology/financing).

To validate the results of the common practice test, the VVB shall review the documentation provided by the Project Proponent to demonstrate that the GHG project is not common practice. In addition to this documentation, the VVB should review all original reference sources cited in the Project Proponent's documentation, such as independent consultants' reports designed to describe common practice technologies/practices, to confirm the raw data and conclusions drawn thereupon.

4.C Implementation Barriers Test

An implementation barrier represents any factor or consideration that would prevent the adoption of the project activity. Under the implementation barriers test, Project Proponents choose at least one of three barrier assessments: financial, technological, or institutional. Project Proponents may demonstrate that their project faces more than one implementation barrier, but ACR does not require more than one barrier.

4.C.1 FINANCIAL BARRIERS TEST

Financial barriers can include high costs, limited access to capital, or an internal rate of return in the absence of carbon revenues that is lower than the Project Proponent's established minimum acceptable rate. Financial barriers can also include high risks such as unproven technologies or business models, poor credit rating of project partners, and project failure risk. Carbon revenues can potentially address capital constraints, incentivize project implementation, or help to maintain the project's ongoing economic viability. If electing the financial implementation barrier test, Project Proponents shall provide solid quantitative evidence such as such as net present value and internal rate of return calculations. Use of an ACR-approved additionality tool is recommended.

The VVB shall review internal financial pro formas and historic/projected cash flow analyses prepared by the Project Proponent and/or an external party to confirm the validity of the financial barrier claim. The VVB should assess to what extent the assumptions used in the financial barriers analysis are defensible, how a variation on those assumptions (sensitivity analysis) could affect the outcome of the financial barriers test, and how likely such variations are during the project life.

4.C.2 TECHNOLOGICAL BARRIERS TEST

Technological barriers can include R&D deployment risk, uncorrected market failures, lack of trained personnel and supporting infrastructure for technology implementation, and lack of knowledge on the practice/activity. Project Proponents electing the technological implementation barrier test should provide evidence that carbon market incentives are a key element in overcoming these barriers.

The VVB shall review documentation provided by the Project Proponent to demonstrate significant carbon credit creation activities occurring either before or no later than 2 years after the project start date. In addition, the VVB shall review all documentation provided by the Project Proponent regarding the development status of the technology being implemented by the project activity, supplementing those materials as needed with publicly available demographic and characteristic information on the industry sector and technology type.

4.C.3 INSTITUTIONAL BARRIERS TEST

Institutional barriers can include institutional opposition to technology implementation, limited capacity for technology implementation, lack of management consensus, aversion to upfront costs, and lack of awareness of benefits. If electing the institutional implementation barrier test, Project Proponents shall provide documentation of the Project Proponent or project participant, management policies or guidelines that corroborate the claim of an organizational or institutional barrier, and should provide evidence that carbon market incentives are a key element in overcoming these barriers.

To validate these claims, the VVB shall collect testimonial evidence from the appropriate management personnel with purview over the GHG project's approval and implementation.

4.D Performance Standard Test

In lieu of the three-prong test to demonstrate project-level additionality, ACR also recognizes the "performance standard" approach, in which additionality is demonstrated by showing that a proposed project activity is surplus to all applicable regulations, and either is characterized by very low adoption rates in the relevant industry and geographic region, or results in lower emissions (or higher sequestration) than a benchmark established for the relevant region, industry/sector, and practice.

Performance standards vary by project type but generally include the above two components. The Project Proponent must first demonstrate in the GHG Project Plan that the project activity is not required by any applicable federal, Tribal, state, or local laws, regulations, ordinances, consent decrees, or other legal arrangements. Only mandatory regulations, not voluntary guidelines, are considered in the regulatory surplus test. The VVB shall review applicable regulations identified by the Project Proponent in the GHG Project Plan. If there are significant uncertainties associated with the regulatory

requirements, the VVB shall conduct additional research and, if needed, contact the appropriate federal, state, Tribal, or local environmental compliance officer to collect additional documentation (e.g., notices of violation, consent decrees, and settlement agreements) and testimonial evidence.

Second, the Project Proponent must demonstrate in the GHG Project Plan that the project activity achieves a level of performance with respect to emission reductions and/or removals that is significantly better than business as usual. This is done by comparing the project activity to a performance threshold specific to each project type and established by examining data from similar recently undertaken practices in the same geographic region and industry/sector. In some cases, the performance standard will establish that common practice adoption rates of a particular GHG-reducing practice or technology are very low and, therefore, the practice or technology is deemed additional. In other cases, the performance standard benchmark represents a level of emissions or sequestration per unit output to which Project Proponents compare the measured performance of their project, demonstrating that the project activity achieves lower emissions or higher sequestration per unit output than the benchmark.

Validation of the performance standard will vary somewhat depending on the project type. For performance standards in which additionality is demonstrated by comparison to common practice adoption rates of a particular GHG-reducing practice or technology, the VVB need only check that an approved methodology was applied. For performance standards in which actual project performance (e.g., emissions or sequestration per unit output) is monitored and compared to a benchmark, the VVB will review measurement and monitoring methods as described elsewhere in this Guideline, but the performance benchmark itself will be as established in the ACR-approved methodology and need not be validated.

Chapter 5: Validating Quantification Methods

ACR requires every project submitted for registration to use an ACR-approved methodology or secure ACR approval of a new methodology or methodology modification prior to validation.

This chapter addresses validation of GHG quantification methods for estimating emission reductions and removal enhancements. It includes brief descriptions of commonly used quantification methods and examples of their applicability and validation issues.

When validating quantification methods, the objective is to collect and test sufficient evidence to ensure that the methods are appropriately selected and applied to develop accurate and conservative estimates of emission reductions and removals.

Validating quantification methods requires review of four elements:

- The quantification method for each data parameter is clearly defined, and supporting documentation provided is adequate to support the level of assurance required.
- The methods are appropriate for accurately quantifying each data parameter based on the required level of assurance.
- The methods are applied consistently to develop estimates of emission reductions and removal enhancements.
- The ISO principle of conservativeness is applied (i.e., the choice of assumptions, calculation methods, parameters, data sources, and emission factors is more likely to lead to an underestimation than overestimation of net GHG emission reductions and removal enhancements).

5.A Emissions Data

Emissions data can be measured directly (e.g., with continuous emissions monitoring equipment) or indirectly estimated (e.g., by monitoring a surrogate parameter or using a predictive model). Emissions data may also be derived from activity data and emission factors, as described in later sections.

For direct emissions monitoring or process monitoring methodologies for quantifying GHG emissions, validation activities should consider the following:

- Operation and calibration of equipment;
- Existence and appropriateness of operation and maintenance standard operating procedures;
- Consistent and accurate data management;

- Representativeness of sampling for operating parameters;
- Robustness of test data to substantiate use of process parameters as "surrogates" or to substantiate use of predictive algorithms;
- Accuracy of material and energy input and output estimates;
- Appropriate operation and maintenance of instrumentation; and
- Review of calibration records, equipment manufacturer documentation, and service records.

5.B Activity Data

The accurate and conservative estimation of GHG emission reductions/removal enhancements is the key goal of quantification methodologies. Project Proponents will often estimate emissions based on activity data, which is the information that provides the magnitude of the activities that cause the emissions, emission reductions or enhancements (e.g., the amount of diesel consumed by a vehicle or pounds of nitrogen fertilizer applied to a field during a specified reporting period.)

The objective of validation is to confirm that the activity data used in the emission calculations (1) meet the requirements of the approved methodology and are appropriate for the emission sources; (2) have been correctly applied from the original documentation; and (3) is the most accurate data readily available. The VVB should confirm that the methodology accounts for all variations in activity data over the relevant Crediting Period.

5.C Emission Factors

Estimating GHG emissions using activity data requires the application of an emission factor. Emission factors are usually expressed as the ratio of the mass of GHG emitted to the unit weight, volume, distance, or duration of the activity emitting the GHG. In general, emission factors are either default or site-specific:

- **DEFAULT** emission factors taken from an external source such as the Revised 1996 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories, U.S. Energy Information Administration, or U.S. Environmental Protection Agency publications. They are specific to a given parameter, such as fuel type, electricity prime mover, production method, and geographic area. Default emission factors are readily available for many sources, and their use may reduce the time and cost of estimating emissions. However, because they are not based on the emission characteristics of specific facilities, they may produce less accurate results than site-specific factors.
- **SITE-SPECIFIC** emission factors are specific to a facility, plant, or unit, and must be developed for the facility based on historical data. They will tend to provide more facility-specific or operationally appropriate emission estimates, but their derivation and use will be more complex than default

factors. The use of site-specific factors is warranted when feasible, as they are usually more accurate than default factors. They should be used in cases where specialized equipment has been developed to fit the specific needs of the facility or project, where the pattern of use of equipment varies significantly from the manufacturer's specifications, or where operating conditions may reduce the accuracy of default factors.

The objectives of validating emission factors are to:

- Confirm that the emission factors used meet the requirements of the approved methodology and are appropriate to activity;
- Confirm that the emission factors have been correctly applied from the original documentation to the relevant activity data, and that the most appropriate factors readily available have been selected;
- Where there is a choice among equally defensible emission factors, confirm that the principle of conservativeness has informed the choice of emission factors; and
- Where site-specific emission factors have been used, examine the sampling methods and calculations used to derive them, and compare them to known and accepted default factors (when available) from independent sources to assess accuracy. The VVB should evaluate both the source data and the methodology used to derive site-specific emission factors.

Chapter 6: Validating Other Project Criteria

The VVB shall review the elements of the GHG Project Plan discussed below.

6.A Start Date

ACR defines the Start Date for all projects other than AFOLU as the date on which the project began to reduce GHG emissions against its baseline. ACR defines the Start Date for AFOLU projects as the date on which the Project Proponent began the activity on project sites, with more specific guidance in Appendix A of the ACR Standard and the applicable methodology.

To validate the Start Date, the VVB shall review documentary evidence that confirms the project Start Date as described in the GHG Project Plan. Evidence may include documentation such as construction and operating permits, contracts, lease agreements, historical operational records, and third-party reports.

For projects developed using an aggregated or programmatic development approach, the Start Date will be the first date that a project activity or technology was implemented at the first site in the entire project. Individual project participants and/or sites will have site-specific implementation dates, which cannot occur prior to the Start Date.

6.B Crediting Period

Crediting Period is the finite length of time during which the project's GHG Project Plan is valid, and during which a project can generate offsets for registration on ACR against its baseline. The Crediting Period is defined in the ACR Standard or approved methodology. It is 10 years for non-AFOLU projects, unless otherwise specified in the relevant approved methodology. Longer Crediting Periods are allowed for some project types (e.g., some AFOLU activities), while other types have shorter Crediting Periods due to triggers that make the activity no longer surplus to regulations after a certain number of years (e.g., some types of landfill gas collection).

The VVB shall confirm that the temporal boundaries of the GHG project are entirely within the approved Crediting Period timeframe.

6.C Minimum Project Term

The Minimum Project Term is the length of time for which a Project Proponent commits to project continuance, monitoring, and verification. Minimum Project Term for different project types is specified in the ACR Standard or the approved methodology. Some project types do not have a minimum term; for those that do, the Project Proponent (not necessarily the landowner) commits to continue project implementation, monitoring, and verification for the minimum term and signs agreements with ACR to this effect.[6]

The VVB shall confirm whether a Minimum Project Term commitment is required for the project type. If one is required, it shall confirm that this minimum term is documented in the GHG Project Plan and the agreement between the Project Proponent and ACR. If no Minimum Project Term is required, the VVB shall confirm that the GHG Project Plan does not incorrectly indicate a Minimum Project Term.

6.D Offset Title

The Project Proponent shall provide documentation and attestation of undisputed title to all offsets prior to registration, including chain of custody documentation if offsets have been sold in the past. Title to offsets shall be clear, unique, and uncontested.

The VVB shall review the Project Proponent's ownership attestation and supporting documentation that specifies ownership of offsets title and, if applicable, ownership of the emissions sources within the project assessment boundary. Examples of such documentation may include incorporation/joint venture agreements; financial/Securities and Exchange Commission reports; contracts; lease agreements; purchase orders, invoices, and receipts; and agreements with the landowner specifying ownership of offsets.

For some project types (e.g., AFOLU), the Project Proponent and project participant will often be different entities. The Project Proponent need not own the project lands or the GHG sources and sinks thereon, but is required to demonstrate that title to the offsets is clear, unique, and uncontested.

6.E Impermanence and Risk Mitigation

GHG reductions/removals from terrestrial sequestration or carbon storage activities are impermanent in the sense that they may be subject to some risk of future reversal, including unintentional reversals

[6] For example, ACR AFOLU Carbon Project Reversal Risk Mitigation Agreement and ACR Buffer Pool Terms and Conditions – AFOLU Carbon Projects.

(e.g., fire, flood, and insect infestation for terrestrial projects) and intentional reversals (e.g., landowners or project participants choosing to discontinue project activities).

For projects with a risk of reversal of GHG emission reductions/removals, Project Proponents must assess risk using an ACR-approved risk assessment tool and enter into a legally binding Reversal Risk Mitigation Agreement with ACR. Project Proponents must then mitigate reversal risk by contributing offsets to the ACR Buffer Pool (either from the project itself, or ERTs of any other type and vintage); by providing evidence of sufficient insurance coverage with an ACR-approved insurance product to recover any future reversal; or by using another ACR-approved risk management mechanism.

The VVB shall review the Project Proponent's project-specific risk assessment, which must be conducted using the ACR Tool for Risk Analysis and Buffer Determination, and its chosen risk mitigation mechanism, supporting documentation, and analytics. The VVB shall also review the risk reversal mitigation measures implemented to ensure they are consistent with the terms set forth in the ACR AFOLU Carbon Project Reversal Risk Mitigation Agreement.

Note that ACR requires that the risk analysis and corresponding buffer contribution (if applicable) be evaluated in the GHG Project Plan. This will be included in ACR's eligibility screening report. The VVB shall independently evaluate whether the risk assessment has been conducted correctly.

6.F Leakage

Leakage is an increase in GHG emissions or decrease in sequestration outside the project boundaries that occurs because of the project action. ACR requires Project Proponents to assess, account for, and mitigate leakage, and provide documentation to support mitigation assertions if the ACR Standard or approved methodology requires it. Project Proponents must deduct leakage that significantly reduces the GHG emissions reduction and/or removal benefit of the project. Specific leakage guidance is given in the ACR Standard, sector-specific standards, and approved methodologies.

The VVB shall confirm whether a leakage assessment is required. If one is required, it shall confirm that the leakage analysis and leakage deduction in the GHG Project Plan conforms to the requirements of the chosen methodology and the ACR Standard.

6.G Environmental and Community Impacts

GHG projects have the potential to generate both positive and negative community and environmental impacts. ACR requires that all projects develop and disclose an impact assessment to ensure compliance with environmental and community safeguards best practices. Projects' environmental and

community impacts should be net positive, and projects must "do no harm" in terms of being in violation of local, national, or international laws or regulations.

Project Proponents must identify a project's community and environmental impacts. Projects may disclose positive contributions as aligned with applicable sustainable development goals. Projects must describe the safeguard measures in place to avoid, mitigate, or compensate for potential negative impacts, and how such measures will be monitored, managed, and enforced. For more information on what the assessment should include, please refer to Section 8.A of the ACR Standard.

To examine a Project Proponent's claims of net positive community and environmental impacts, the VVB shall review publicly available information regarding the GHG project against the GHG Project Plan undergoing validation and the environmental community impact assessment; records of stakeholder consultations, if any; and results from methodologies and tools used for community and environmental impact analysis.

Net positive impacts, and the adequacy of community impact analysis and/or stakeholder consultations, are subjective criteria that are difficult to validate and verify. Therefore, the VVB is not required to provide a judgment on the adequacy of these processes or their qualitative results. However, it must confirm that the Project Proponent has evaluated community and environmental impacts, documented a mitigation plan for any foreseen negative community or environmental impacts, and disclosed any prior negative environmental or community impacts or claims of thereof.

6.H Double Issuance, Double Selling, and Double Use of Offsets

The VVB shall confirm that projects undergoing validation are not claiming emission reductions for the same project and reporting period on any other GHG registry or platform. This shall be confirmed during every reporting period throughout the project's Crediting Period. For more information on ACR's policies regarding double issuance, double selling, and double use, please refer to Chapter 10 of the ACR Standard.

6.I Projects Participating in Other Asset Programs

The VVB shall confirm if projects undergoing validation are enrolled in other asset programs (e.g., water quality trading). The VVB shall ensure that projects claiming other environmental assets have done so in accordance with the ACR Standard and the chosen methodology, and that the attributes quantified are for non-carbon benefits. This shall be confirmed during every reporting period throughout the

project's Crediting Period. For more information on ACR's policies regarding participation in other asset programs, please refer to Chapter 2 of the ACR Standard.

Chapter 7: Validation Report

The product of validation is a Validation Report, which is posted publicly by ACR. The Validation Report is a detailed description of the validation activities and conclusions. This report shall:

- Provide the name, address, and contact information of the VVB;
- Identify the GHG project by name and Crediting Period covered;
- Reference the ACR Standard, and approved methodology against which validation was conducted;
- Describe the validation objectives, scope, and activities, including but not limited to evaluation of:
  - Project boundary and procedures for establishing it;
  - Physical infrastructure, activities, technologies, and processes of the GHG project;
  - GHGs, sources, and sinks within the project boundary;
  - Temporal boundary;
  - Description of and justification for the baseline scenario;
  - Methods, algorithms, and calculations that will be used to generate estimates of emissions and emission reductions/removal enhancements;
  - Process information, source identification/counts, and operational details;
  - Data management systems;
  - QA/QC) procedures;
  - Processes for uncertainty assessments; and
  - Project-specific conformance to ACR eligibility criteria, including additionality.
- Describe any findings, including opportunities for improvement raised during the validation and their resolutions, including issues that required consultation with ACR and ACR's determinations on these issues, citing the specific communication and date;
- State the VVB's conclusion on the conformance of the GHG Project Plan to the ACR Standard and methodology chosen; and
- Be signed and dated by the lead validator and internal reviewer.

Note that validation and the first verification may be conducted simultaneously, and may be conducted by the same approved VVB. Therefore, it is acceptable to combine the Validation Report and Verification Report (see Chapter 12 for contents) into a single report which should also include the above information.

Chapter 8: Verification Overview

This chapter summarizes the objectives and scoping elements of verification necessary to register GHG project net emissions reductions/removals as ERTs. ACR's verification requirements are built on the foundation of the ISO 14064-3:2006, *Greenhouse gases — Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions*.

8.A Definition

Verification is the systematic, independent, and documented process for the evaluation of a GHG assertion against specific criteria. The verification process is intended to assess the degree to which a project has correctly quantified net GHG reductions or removals per the validated GHG Project Plan and correctly utilizes ACR methodologies and tools. A successful verification provides reasonable assurance that the GHG assertion is without material misstatement.

8.B Objectives of Verification

The overall goal of third-party verification is to review impartially and objectively a Project Proponent's claimed GHG emission reductions/removal enhancements against relevant ACR standards and the approved methodology. The VVB must independently evaluate the GHG assertion, based on supporting evidence and GHG verification best practice.

The objectives of verification are to evaluate the following:

- Reported GHG baseline, project emissions and emission reductions/removal enhancements, leakage assessment, and impermanence risk assessment and mitigation (if applicable);
- Any significant changes to the project procedures or criteria since the last verification; and
- Any significant changes in the GHG project's baseline emissions and emission reductions/removal enhancements since the last verification.

The VVB shall review the GHG Project Plan, GHG assertion, and any additional relevant documentation provided by the Project Proponent to determine:

- That the reported emissions reductions and/or removal enhancements are real;
- Degree of confidence in and completeness of the GHG assertion;

- That project implementation is consistent with the GHG Project Plan;
- Eligibility for registration on ACR; and
- Sources and magnitude of potential errors, omissions, and misrepresentations, including:
  - Inherent risk of material misstatement; and
  - Risk that the existing controls of the GHG project will not prevent or detect a material misstatement.

8.C Scope of Verification

Verification shall include examination of some or all of the following elements of a GHG Project Plan:

- Physical infrastructure, activities, technologies, and processes of the GHG project;
- GHG SSRs within the project boundary;
- Temporal boundary;
- Baseline scenarios;
- Methods and calculations used to generate estimates of emissions and emission reductions/removal enhancements;
- Original underlying data and documentation as relevant and required to evaluate the GHG assertion;
- Process information, source identification/counts, and operational details;
- Data management systems;
- Roles and responsibilities of project participants or project proponent staff;
- QA/QC procedures and results;
- Processes for and results from uncertainty assessments; and
- Project-specific conformance to ACR eligibility criteria.

The VVB shall examine the reported data, quantification methodologies, calculation spreadsheets or databases, source data, project data management systems, data quality controls in place, measurement and monitoring systems, and records pertaining to emissions quantification. Calculation and error checks, site inspections, interviews with project participants, an iterative risk assessment, sampling plan, and audit checklist shall be performed to the extent necessary for the VVB to develop an understanding of how data are collected, handled, and stored for a specific project.

8.D Interval of Verification

The ACR Standard generally requires:

- A desk-based verification audit at each request for issuance of new ERTs. This is usually conducted annually, but may be more or less frequent at the discretion of the Project Proponent.
- A full verification including a field visit at the first verification and again at least every 5 years. Field verifications may be conducted more frequently (e.g., in the case of changes in monitoring and data management practices, or for particular project types with material parameters that can only be verified on site). Generally, for most project types, field verification is required at minimum every 5 years.[7]
- Following any reversal of sequestration that requires updating the project baseline.

If the Project Proponent selects a different VVB in the interval between field verifications, the new VVB shall continue desk audits until the next required field verification.

Please note that some ACR methodologies may not require additional site visits during a full verification after the initial verification if no significant changes have occurred to the project since successfully undergoing validation. If no additional site visits are necessary, it shall be specified in the methodology, along with what constitutes a significant change and how to fulfill the requirements of a remote full verification. All other projects must meet the full site visit requirement specified in the ACR Standard.

8.E Level of Assurance

ACR considers verification to be a risk-based process in which the VVB conducts an iterative risk assessment that shall inform the sampling plan, allowing the VVB to provide a reasonable level of assurance that the GHG assertion is free of material misstatement and provides a true and fair representation of the project's net GHG emission reductions/removal enhancements.

ACR requires all Verification Statements to provide a reasonable (as opposed to absolute or limited) level of assurance. Chapter 11 includes the required wording of Verification Statements. Under this level of assurance, a GHG assertion is deemed materially correct, and a fair representation of the GHG data and information. This also indicates that the GHG assertion is prepared in accordance with the ACR Standard and the ACR-approved methodology.

[7] Subject to the clarification that verification is required only prior to issuance of ERTs. If the Project Proponent (e.g., of an afforestation/reforestation project) does not seek ERT issuance for longer than 5 years after the Start Date, it is not required to verify until the first request for ERT issuance. Once this first verification takes place, subsequent field verifications must occur at least every 5 years. Additional rules regarding the field visits during a full verification is provided in Section 9.C and Appendix A of the ACR Standard.

8.F Materiality

A material misstatement is an inaccurate assertion of an offset project's GHG emission reductions/removals, which may reasonably be expected to influence decisions or actions taken by the users of the GHG project information. To accept a Verification Statement, ACR requires that discrepancies between the emission reductions/removal enhancements claimed by the Project Proponent and estimated by the VVB be immaterial (i.e., less than ACR's materiality threshold of ±5%).

Individual or aggregation of errors or omissions greater than the ACR materiality threshold of ±5% require restating before a Verification Statements will be accepted. Individual and aggregation of errors or omissions greater than ±1% but less than ±5% must be qualified in the Verification Statement but do not require restating.

8.G Materiality vs. Precision

The precision of GHG estimates is distinct from the concept of materiality. Materiality dictates that the individual or aggregation of errors and omissions exceeding the ±5% materiality threshold requires restatement (i.e., correcting of material errors) prior to ERT issuance.

For precision, ACR prescribes a target for the final calculation of GHG emission reductions/removal enhancements, and requires an uncertainty deduction if this target is not achieved. This is to provide flexibility to the Project Proponent, in the case that the costs of additional sampling to achieve the precision target outweigh the benefits of not having to take a deduction. The relevant text is:[8]

ACR sets a precision target of ±10% of the mean at 90% confidence, applied to the final calculation of emission reductions/sequestration. If the Project Proponent cannot achieve precision of ±10% of the mean at 90% confidence, then the reportable amount shall be the mean minus the lower bound of the 90% confidence interval, applied to the final calculation of emission reductions/removal enhancements.

The conservativeness principle dictates that if projects cannot achieve the precision target, then:

- For activities reducing emissions, proponents should report the lower bound of the confidence interval on baseline emissions and the upper bound of the confidence interval on project emissions.
- For activities enhancing terrestrial sequestration, proponents should report the upper bound of the confidence interval on baseline sequestration and the lower bound of confidence interval on project sequestration.

[8] See the ACR Standard.

This approach will minimize the potential that measurement uncertainty causes an overestimation of net emission reductions/removals.

Thus, uncertainty may be greater than ±5%, and may not be possible to reduce in a cost-effective manner. In such cases, provided there are no material errors or misstatements exceeding the ACR materiality threshold, the project may be registered but with the uncertainty deduction applied.

Because ACR requires all projects to use an approved methodology and meet the requirements of the ACR Standard, all projects must adhere to these uncertainty requirements (achieve precision of ±10% of the mean at 90% confidence, or else report the mean minus the lower bound of the 90% confidence interval). Any required uncertainty calculations or deductions will be outlined in the applicable approved methodology.

8.H Procedure for Verification Discrepancies

If the verification requirements are not met, then a project will not be eligible to generate ERTs during that reporting period. However, if a Project Proponent believes that the verification requirements were adequately met and the VVB does not agree, the Project Participant may choose to initiate ACR's Complaints and Appeals Procedure. For more information on this process, please refer to Chapter 11 of the ACR Standard.

If a Project Proponent aborts a verification after verification services have begun but before the VVB is able to reach a conclusion with a reasonable level of assurance, the VVB shall inform ACR in writing of the status of the verification and reasons why the verification has been aborted.

Chapter 9: Verification Activities

This chapter provides an overview of the activities the VVB shall perform, and the information and documentation it shall review.

9.A Information/Records to Be Reviewed

The GHG information and records the VVB shall review include, but are not limited to:

- GHG Project Plan;
- GHG assertion;
- Previous Verification Statements;
- Operational and control procedures and records for ensuring GHG data quality;
- Documentation of GHG SSRs;
- Documentation of quantification methodologies; and
- Documentation of monitoring and measurement systems.

Verification of source-level data and records shall include the following activities:

- Determine whether the data used are appropriate and sufficient to allow for the accurate calculation or estimation of GHG emission reductions and/or removals;
- Confirm that appropriate calculation methodology was used for data that were estimated as indicated in the GHG Project Plan;
- Confirm that the units of measure used are correct, appropriate, internally consistent, and consistent with the ACR Standard, including raw data recorded in the data collection process and data stored in the project spreadsheet or database/management system and used in calculations;
- Confirm that any unit conversions have been made correctly; and
- Confirm that there are no missing data unaccounted for and that all data have been entered properly.

9.B Data Assessment and Management Systems

It is important for the VVB to develop an understanding of the GHG project data collection and management system and processes. The VVB should examine the process flow for collecting and processing activity or monitoring data. This will enable the tracing of data or references from their original root source to the final emissions data entered into the GHG assertion.

The VVB shall assess the project GHG data management system and its controls for sources of potential errors and omissions, including the following:

- Selection and management of GHG data and information;
- Processes for collecting, processing, aggregating, and reporting;
- Systems and processes to ensure accuracy; and
- Design and maintenance of the GHG data management system, including systems and processes that support it.

The VVB shall use the results of this GHG data management system assessment and its controls to modify the sampling plan, as needed.

The VVB shall review data management system documentation that describes the process of data collection, entry, calculation, and management. This will allow evaluation and cross-checking of factors, activity data, calculations, and estimates in the data system. Such data management system elements to review may include:

- Competency of data managers or employees responsible for collecting data;
- Emissions source type;
- Units of measure;
- Periodicity of data monitoring/collection;
- Data granularity and degree of aggregation;
- File type/format;
- Method of transfer;
- Assumptions; and
- Calibration records.

The VVB should assess the effectiveness of methods for data collection and processing, identify likely areas for data corruption or potential errors, and characterize GHG data collection and management system integration weaknesses.

9.C Collection of Evidence

Verification of GHG projects shall involve collecting the following types of evidence:

- Physical evidence: direct observation of equipment or processes to demonstrate that the Project Proponent is collecting relevant data;
- Documentary evidence: paper or electronic records, which may include procedures, logs, invoices, and analytical results;
- Testimonial evidence: interviews with key personnel (e.g., technical, operations, managerial).

9.D Data Sampling Plans; Risk-Based Approach

Because it is generally impractical to assess in detail all GHG information the Project Proponent collects, especially when the project assessment boundary may include many different sites, only a subset of the operations will be under the VVB's scrutiny. Thus, a key element of a successful verification is the sampling and examination of the sites/operations and sources that are chosen to undergo only a desktop review and not a full field audit.[9]

A risk-based approach, based on considerations of inherent, control, and detection risks, should be used to determine the intensity of sampling needed to collect adequate evidence to support the required level of assurance. Sampling plans shall take into account the following:

- Level of assurance targeted;
- Verification scope and criteria;
- Amount and type of evidence necessary to achieve the required level of assurance;
- Availability of evidence;
- Materiality threshold;
- Complexity of quantification methodologies;
- Quality and completeness of emissions factors and activity data;
- Method for determining representative data samples; and
- Risks of material errors, omissions, or other discrepancies.

[9] Even at intervals when verification includes a field visit, it may be impractical to review all sites, landholdings, operations, and data. In all cases, a risk-based approach as described in this section should be applied. Additional guidance is provided in sector-specific requirements for cases in which the VVB may visit only a subset of project sites (e.g., in the ACR AFOLU Appendix, with regard to verification of aggregated land-based projects).

The implementation of a verification plan should be treated as an iterative process, as the sampling plan or other aspects may need to be modified when weaknesses in controls, GHG information, and materiality issues are identified during the verification. Revisions to the verification plan should consider the sufficiency and appropriateness of evidence from testing whether any errors or inconsistencies are systematic or anomalous, together with any control evidence to support the project's GHG assertions.

Regardless of the type of verification to be performed, in nearly all cases the VVB will examine only a subset of the entire population of project data. The total amount of data available will often be too large to allow for a complete and comprehensive examination of all data. An exhaustive review of all supporting data may also be unnecessary for verification. For example, a Project Proponent may utilize summary data that have been aggregated, in which case the review of data management procedures and systems may be more important than the examination of all of the original unprocessed data. These concerns are particularly significant in the case of activity data, which may encompass hundreds or thousands of records for a wide range of sources over multiple years.

The design of a sampling plan typically involves three steps: (1) the selection of risk parameters that present a higher risk of misstatement and should be reviewed in further detail; (2) the selection of an appropriate subset of data or sites to be visited, and issues to be examined during the field audit; and (3) the selection of issues and data to examine from sites that are not selected for a focused field audit.

The proper selection of the sample of data to be examined is a crucial step in preparing a verification plan. The amount and types of data selected for examination is ultimately at the professional judgment of the VVB. Sufficient information must be examined for the VVB to make a credible statement about the quality of the project's data, data collection and management procedures, quantification methods, and related processes, balanced with considerations of time and cost. It is important for the VVB to prioritize and carefully select sample data and other issues with a medium to high risk of misstatement to investigate further. This can be done through data sampling, a process that allows the VVB to form an opinion on the data as a whole. To draw reasonable conclusions, the sample data must be representative of the total data.

9.E Field and Desktop Data Audits

During the verification planning process, the VVB must identify the key variables with the potential to cause a material misstatement in the GHG assertion. The VVB should seek to understand what types of emission SSRs are present, what types of data management systems are used, and what types of management structures are present in the Project Proponent's company and at the project site/facility. The purpose of this profile analysis is to identify and characterize individual sources of emissions project-wide, and to categorize emissions at the facility level according to the key verification parameters. After the emission sources have been characterized, the VVB shall assess the types of data management systems and management systems the Project Proponent uses.

The selection of data to be reviewed in a desktop audit shall be based upon the following:

- The assigned risk rating;
- The number of data points or facilities within the database;
- The degree of data variability; and
- The degree of missing/estimated data.

VVBs should not be limited to these criteria when selecting different parameters for field and desktop audits. Expert judgment should be exercised to ensure that a representative sample of data sets is selected and reviewed.

9.F Error Checking/Testing

Methods for checking for potential errors associated with GHG information can be categorized into input, transformation, and output controls. Each is described below, with the applicable error checking tests to be used by the VVB.

INPUT CONTROLS. Procedures for checking the data from the measured or quantified values to a project database, and to original records. Tests for accuracy include:

- Record count: ensuring the number of data entries matches the number of units/sites reported in the GHG Project Plan;
- Valid character tests: ensuring the data entered are in a relevant format and checking for improperly entered data;
- Missing data tests: scanning for empty cells in the GHG database that are not accounted for; and
- Limits and reasonableness tests: comparing the data with predetermined limits as a reasonable test.

TRANSFORMATION CONTROLS. Checking for errors during the process of collating, transferring, processing, calculating, estimating, aggregating, disaggregating, or adjusting input data. Tests for accuracy include:

- Consistency tests: ensuring the methodologies and data handing process are consistent throughout project reporting;
- Re-computation tests: recalculating conversions, estimations, etc. using the same data and methodology provided in the database output; and
- Cross-checking tests: comparing reported results with other known results and alternative quantification methodologies.

OUTPUT CONTROLS. Controls surrounding the distribution of GHG information and comparisons between input and output information. Tests for accuracy include:

- Matching input with output: verifying that the data entered into the GHG database match the results in the GHG report.

Where applicable and available, the following types of cross-checking procedures will provide greater assurance that the reported GHG information is within the expected range. Significant departures should be investigated fully so the VVB can obtain a reasonable level of assurance.

- Internal checks within a process: compare current-year emission reductions with previous years, noting any changes to the size or usage capacity of the site;
- Checks within a sector/national grid (e.g., check if the sites' emission rates are comparable with the regional average emission rates published by the applicable regional grid authority); and
- Checks against international information (e.g., IPCC's typical emission intensity figures for different technologies in different countries).

9.G Verification of Quantification Methods and Data Sources

The objectives for verification of quantification methods are to:

- Identify quantification errors in overall GHG project emissions, identify any outliers in facility-level and temporal boundaries results, and detect any methodological inconsistencies;
- Ensure the appropriateness of the estimation methods applied to the GHG project-specific situation, based on size of the sources, data availability, and associated levels of uncertainties;
- Review calculations and quantification methods used in the GHG Project Plan and/or GHG assertion to determine if results reported reflect emission estimation approach and supporting data;
- Examine quantification method documentation at the facility/source level, reviewing key facility-specific results, calculations, emission factors, and assumptions to determine validity of the quantification method;
- Examine the reported levels of accuracy and uncertainty of the emission estimates;
- Verify application of the quantification methodology by examining supporting evidence for key selected sites and major sources;
- Review methods, underlying data/assumptions, reference citations, and data management systems, from project roll-up to individual source root data, with field audits and use of external data and third-party records to confirm reported GHG emissions and reductions results;

- Determine accuracy of quantification data and whether metering and monitoring equipment operate within acceptable limits; and
- Conduct desk audits of data and calculations for a select number of sites or landholdings not included in field verification.

The process for verification of quantification methods may include the following activities, data, and, evidence (as informed by the VVB's professional judgment; not all are required):

- Review spreadsheets and aggregated data used to create estimates of GHG emission reductions and removal enhancements.
- Review raw or source data and emission factors to evaluate whether the data used are appropriate for the associated activities and sufficient to provide a reasonable estimate of the emissions from the source category.
- Identify any missing or incomplete data. In cases where a large number of data records exist and have been aggregated, the VVB should review data management practices used to compile final aggregated data.
- Evaluate trends in calculated GHG emissions over multiple data collection and reporting periods, including comparison against relevant production data at the facility-, field-, forest- or parcel-level.
- Evaluate how data are collected and aggregated, including desktop data reviews of some key individual source data at select sites, comparing against aggregated totals.
- Perform field audit verification activities, potentially including:
  - Key personnel interviews (e.g., data management specialists, process engineers, and monitoring maintenance personnel);
  - Raw data recording, daily/monthly rollups, and data transfer practices;
  - Meter calibration, maintenance records, and frequency; and
  - Root data, quantification methods, and analytical results.
- Review key meter/instrument calibration and maintenance logs to determine adherence to QA/QC procedures.
- Perform re-computation checks for accuracy of calculations and algorithms.
- Check validity of detailed calculations, assumptions, and emission factors.
- Check spreadsheet and database calculations.
- Cross-check monitoring data with site-specific emission factors, fuel use data, and material/energy balance engineering calculations. Databases, reports, and other information systems should be checked, and manually recorded data logs, hand calculations, and spreadsheets checked in the field and compared against inventory data.
- Review original data records, identify errors and omissions in reported GHG data, and ensure accurate reporting (e.g., energy use verified by energy supplier data such as fuel shipment bills of lading, invoices, utility bills, and fuel analysis reports).

- In cases where data values can be expected to vary or be updated over the project Crediting Period, confirm that data have been adjusted accordingly.
- In cases where a single category of a data parameter has been estimated using several different sources, confirm that double counting or omission has been avoided.
- When data calculations incorporate several interrelated parameters, review to ensure that they have been calculated appropriately.
- Evaluate whether the most accurate and appropriate data parameters readily available were used, which may be affected by factors such as facility location, ambient operating conditions, and choice of measure (e.g., default vs. specific factors); identify and evaluate notable outlier data.
- Compare data to known and accepted external sources to assess accuracy and appropriateness.
- Evaluate whether the ISO principle of conservativeness has been applied in the choice of assumptions, calculation methods, emission factors, etc.

9.H Verification of Leakage Assessments

Leakage is a decrease in sequestration or increase in emissions outside project boundaries as a result of project implementation. Leakage may be caused by shifting of the activities of people in the project area or by market effects whereby emission reductions are countered by emissions created by shifts in supply of and demand for the products and services affected by the project.

Some ACR-eligible project types require leakage to be assessed and, if deemed significant, deducted from the calculation of net emission reductions. Requirements to assess and deduct leakage will be included in the ACR-approved methodology.

Verification of estimates of leakage as part of a GHG project verification is integrally related to the validation of project assessment boundaries per Chapter 3. The VVB shall use the results of the project assessment boundaries validation, the Project Proponent's estimation of the GHG project leakage, leakage guidance in the approved methodology, and the VVB's sectoral knowledge to make an independent assessment of leakage. If there is a material discrepancy between the leakage assessment and deduction included in the GHG Project Plan or GHG assertion and the VVB's independent assessment, this discrepancy must be resolved with the Project Proponent and corrected prior to ERT issuance.

9.I Verification of Permanence and Risk Reversals

GHG reductions/removals from terrestrial sequestration or carbon storage activities are impermanent in the sense that they are subject to some risk of future reversal, including unintentional reversals (e.g., fire, flood, and insect infestation for terrestrial projects) and intentional reversals (e.g., landowners or project participants choosing to discontinue project activities).

For sequestration or carbon storage projects, the VVB shall confirm that the project has conformed with the monitoring requirements for reversals and whether any reversals have occurred during the reporting period. If a reversal has occurred, the VVB shall confirm that the reversal was reported in accordance with the Reversal Risk Mitigation Agreement, the ACR Standard, and the ACR approved methodology.

Chapter 10: Verifying Aggregated Projects

Aggregation—the pooling of activities at more than one project site into a single GHG project—is an important mechanism to make it feasible for smaller project participants to participate in carbon markets. Aggregation may provide transaction cost efficiencies for initial inventory, monitoring, and verification, and may also diversify risk. ACR does not require aggregation or discourage any project participants from bringing a project to ACR directly; however, recognizing the increasing prevalence of aggregated projects, ACR provides guidelines to Project Proponents aggregating multiple project participants.

Additional requirements for aggregated projects are provided in ACR program documents. This chapter reiterates the portions relevant to verifying aggregated carbon offset projects. Other aggregated projects may be treated similarly from a verification perspective.

10.A Verification of Aggregated Projects

ACR applies its requirements for initial baseline assessments, monitoring, and verification at the level of the overall project, whether it is a single large project participant or an aggregated group of smaller project participants.

Aggregated projects require that all project participants and sites be identified in the GHG Project Plan at the time of validation, as well as a single Start Date, Crediting Period, and verification schedule.

The field verification every 5 years should include such measurements as the VVB requires to provide a reasonable level of assurance that the GHG assertion is without material discrepancy as defined by ACR. ACR expects the VVB to conduct a risk-based assessment of the probability that verified GHG reductions/removals will be materially different from those reported by the Project Proponent. For aggregated projects, an initial random sample may be sufficient to detect whether more intensive sampling is required to verify the GHG assertion at the ACR materiality threshold. The VVB may randomly select a subset of the project for field verification; if any discrepancies are discovered in the initial selection, the VVB shall visit additional sites to investigate further. ACR does not require the VVB to visit every site or to conduct a minimum number of measurements, provided the GHG assertion for the overall project can be verified at a reasonable level of assurance and the Verification Statement worded accordingly.

10.B Programmatic Development Approach

Related to but distinct from aggregation is the concept of a Programmatic Development Approach (PDA) to project development. While an aggregated project may include a variety of sites all with the same overall baseline and Start Date, a programmatic approach adds the further nuance of incrementally adding sites into the project over time through the use of cohorts. This is important for flexibility but makes project design, baseline definition, Start Date, Crediting Period, monitoring, and verification more complex.

A PDA project is treated as a single project with an overall baseline and monitoring/verification plan. The methodology for such projects will need to establish applicability conditions and procedures for the addition of new cohorts to the project, so that it does not become necessary to redefine the baseline each time a new site is added. Individual sites within the programmatic project may have different dates of initial implementation but maintain a single start date. This will require the Project Proponent to design a clear plan and schedule for project accounting, monitoring, and verification. Practical and cost considerations may dictate that each cohort be limited to a single geographic region and relatively similar land types, and that new cohorts be added at the required verification interval every 5 years.

For verification purposes, programmatic projects are treated like an aggregated project with the Start Date corresponding to the 5-year full verification interval. A field verification should occur no less frequently than 5 years after the Start Date, as defined in the validated GHG Project Plan, and will need to occur for each cohort's validation.

The VVB should conduct such measurements as it requires to provide a reasonable level of assurance that the GHG assertion is without material discrepancy. The VVB may randomly select a subset of the project for field verification; if any discrepancies are discovered in the initial selection, the VVB shall visit additional sites to investigate further. Sites in new cohorts that have yet to be validated must be included in the VVB sampling plan during full verifications. ACR does not require the VVB to visit every site or to conduct any minimum number of measurements, provided the GHG assertion for the overall project can be verified at a reasonable level of assurance and the Verification Statement worded accordingly.

During verification of a PDA project, the VVB shall:

- Ensure that the project meets the requirements for a PDA project as specified in the ACR Standard.
- Select a subset of sites for in-depth review and site visits in lieu of 100% sampling of all sites, at the VVB's discretion. The VVB is not required to visit each site during a full verification, but site visits should include a mix of new sites and sites from previously validated cohorts.

- Review any revisions to previously validated cohort design documents, monitoring reports, and any other supporting documentation that memorializes project updates from all participating sites. This information can be compiled and presented in a single document at the project proponents discretion.
- Provide to ACR its opinion on inclusion of the cohort, prior to registration or issuance of ERTs by way of a validation assessment that can be included in the relevant Verification Report.

Chapter 11: Quality Assurance and Quality Control

The Project Proponent shall establish and apply QA/QC procedures to manage data and information, including the assessment of uncertainty, relevant to the baseline and project scenarios. QA/QC procedures and the minimization of overall uncertainty are integrally related to the level of assurance required for verification, the materiality of sources included in the GHG assessment boundary, and the risk of material misstatements.

11.A Sources of Uncertainty

Assessment of uncertainty is a key element of a GHG emission reduction project QA/QC program. Significant sources with the largest uncertainty in their emission estimates should be targeted for improvements. The goal of this iterative QA/QC process is to minimize overall uncertainty in the reported GHG information.

Uncertainty is defined as a statistical parameter associated with the result of a direct measurement or indirect quantitative estimate that characterizes the dispersion of the values that could be reasonably attributed to the measured/estimated quantity (e.g., the sample variance or coefficient of variation). For GHG emissions and reductions estimates, it refers to the lack of certainty in emissions-related data resulting from factors such as:

- Application of non-representative or inaccurate quantification methodologies or emission factors;
- Incomplete data on, or omission of, material sources;
- Lack of transparency;
- Measurement accuracy or error; and
- Weaknesses in data management systems in place to control data quality.

Reported uncertainty typically specifies a quantitative estimate of the likely difference between or dispersion among reported values, and a qualitative description of the likely causes of said differences. Quantitative uncertainty estimates performed according to the "Guide to the Expression of Uncertainty in Measurement (GUM)" (ISO 1995; updated 2008) or a similar methodology are recommended for those GHG emission reductions/removal enhancements whose estimation methodologies do not include multiple measurements that allow quantification of confidence intervals. These quantitative uncertainty estimates are an integral component of the ACR verification process.

The major sources of uncertainty associated with GHG emissions estimates include:

- Estimation or model: quantification methods and mathematical equations;
- Parameter: quantifying parameters in method (emission factor, activity data);
- Systematic: estimation bias (e.g., non-representative data, faulty equipment);
- Statistical: random variability of sample data; and
- Project baseline: associated with assumptions used in development of baseline scenarios, projecting a set of circumstances possibly not likely to occur (e.g., technology, performance, timing, equivalent services uncertainties).

If adequate data are not available to quantify these uncertainties, expert judgment is often used to estimate them. GHG data uncertainties should be addressed in the QA/QC procedures and assessed by the VVB for adequacy and implementation results. Methods for estimating GHG emissions uncertainty to be assessed by the VVB may include:

- Qualitative discussion: sources listed and relative magnitude of uncertainties discussed;
- Subjective data quality rankings: rankings based on professional judgment assigned to each key emission factor and activity parameter;
- Data attribute ranking system: relative uncertainty numerical value criteria;
- Expert estimation used to estimate uncertainty;
- Propagation of errors: statistical techniques applied to expert estimates; and
- Direct simulation: Monte Carlo or other numerical modeling methods.

It is the VVB's role to assess which GHG uncertainty analysis method was utilized in the project's QA/QC program, its appropriateness for data quality objectives and end use, and its results. In all cases, the VVB should confirm that the appropriate uncertainty assessment procedures have been used.

11.B QA/QC Procedures

QA/QC procedures are critical to estimating GHG reductions over time. The nature and extent of QA/QC activities, and whether the Project Proponent implements a formal QA/QC plan, will vary depending on the end uses of the reported GHG data. It is not the VVB's role to develop a GHG emissions reductions QA/QC plan as part of the verification, but rather to verify:

- The existence of QA/QC procedures for each of the major data gathering and processing steps, and general areas of conformance and non-conformance with said QA/QC procedures;
- The appropriateness of the QA/QC procedures or plan, with respect to its design and elements, and their relationship to the GHG project applications for the reported GHG emissions data;

- The existence of a QA/QC plan and/or documented QA/QC procedures, either developed specifically for the GHG project or developed for more general environmental or financial programs and applied to the GHG project; and
- The actual application of QA/QC procedures as part of the GHG project emissions reduction activities, and availability of QA/QC results for review by the VVB.

A primary objective of QA/QC procedures is to identify the sources of error or uncertainty in both the data and data management system(s), and to reduce uncertainty and improve data quality. Verification activities should take advantage of any available results from the Project Proponent's ongoing QA/QC program, as it relates to emission reductions/removal data. QA/QC activities performed by the Project Proponent should provide reference data against which the VVB can check results of the verification and use as input to help plan for and guide execution of the verification activities.

QA/QC activities should be designed to address emissions estimation uncertainty and data quality. The uncertainty associated with the VVB's assessment of risk is reflected in the degree of confidence stated in its assertion: the greater the uncertainty, the lower degree of confidence in the reported results and, hence, a higher concern about risk.

QA/QC procedures for GHG projects will vary, ranging from institutional knowledge of the Project Proponent and documented general QA/QC procedures to a formal written QA/QC plan. Elements of a reporting party's QA/QC program that may be assessed include (as informed by the VVB's professional judgment; not all are required):

- Identify whether definitions of data quality objectives exist and are consistent with end uses of the reported GHG data;
- Determine if major sources of uncertainty have been identified, and whether an approach to reduce uncertainty and improve the quality of reported results has been developed and implemented;
- Confirm that applicable QC and independent QA activities have been performed;
- Confirm that data collection and management processes, and QA/QC procedures have been properly implemented;
- Confirm that QA/QC results and resolution of problems have been adequately documented, and results communicated to the GHG project team;
- Determine the degree to which any existing data quality objectives have been met, including assessments of accuracy (or uncertainty) of estimates, data completeness, representativeness, aggregation/disaggregation, comparability/consistency, and documentation; and
- Ensure the reasonableness of data and emissions estimates, validity of assumptions, methodology, and data used, and algorithmic correctness.

The QA/QC methods and results the VVB assesses may include (as informed by the VVB's professional judgment; not all are required):

- Reality checks: compare data or estimates to a standard reference value, estimates for similar sources, and expert judgment on reasonableness of value;
- Peer review: checklist of elements covered by peer review and written reviewer comments identifying issues;
- Sample calculations: replication of a complete calculation set, hand replication of the most complex calculations, and recalculation using a different method;
- Computerized checks: review built-in QA/QC functions, variable type and value range checks, lookup tables, cell dependency, cell precedence, and error identification;
- Sensitivity analysis: focus on key variables and effects on results of emissions models and previous inventories/sensitivity analyses;
- Statistical checks: descriptive statistics and outlier detection for range checks;
- Independent internal reviews: evaluation to determine data quality, confidence in accuracy and completeness of results, and QC effectiveness; and
- Emission estimation comparisons: comparison of estimated emissions to real-world measurements (or their surrogates).

Chapter 12: Verification Statement and Verification Report

The end products of verification are a Verification Statement and Verification Report. ACR posts both publicly.

The Verification Statement is a brief statement of the VVB's opinion of the GHG assertion. This statement shall:

- Be addressed to ACR.
- Provide the VVB's name, address, and other contact information.
- Include an introductory paragraph that:
  - Identifies the project name and the project proponent;
  - Describes the level of assurance, objectives, and scope;
  - Identifies the reporting period covered by the verification; and
  - References the ACR Standard and approved methodology against which the verification was conducted.
- State the quantity of GHG emission reductions or removal enhancements in the GHG assertion for the reporting period.
- State the VVB's conclusion on the GHG assertion, including any qualifications or limitations. For acceptance by ACR, the Verification Statement shall confirm that the GHG assertion is without material discrepancy, as defined by ACR, and that the verification activities provide a reasonable level of assurance.
- Be signed by the lead verifier and internal reviewer.

The Verification Report is a more detailed description of the verification activities, corrective actions, and conclusions. This report shall:

- Provide the VVB's name, address, and other contact information.
- Include the date of report issue.
- Identify the GHG assertion verified and reporting period covered.
- Reference the ACR Standard and approved methodology against which the verification was conducted.
- Describe the verification objectives, scope, and activities, including:

- GHG information or performance data verified (e.g., baseline GHG emissions, project GHG emissions, GHG emissions reductions and/or removal enhancements);
- Project personnel interviewed;
- Techniques and processes used to test the GHG information and associated GHG assertion;
- The results of quantitative uncertainty assessment and analysis of the quantification methodologies and applicable data sets and sources;
- Whether the data and information supporting the GHG assertion were based on assumptions and industry defaults, future projections, and/or actual historical records;
- Describe the leakage assessment, if required; and
- Describe any findings, including opportunities for improvement raised during the verification and their resolutions, including issues that required consultation with ACR and ACR's determinations on these issues, citing the specific communication and date.

- Include dates for any site visits, which sites were visited, and any onsite activities conducted.
- For projects requiring Project Proponents to assess risk of reversal and apply an ACR-approved risk reversal mechanism, include the VVB's opinion on the risk assessment.
- Describe the level of assurance.
- State the VVB's conclusion on the GHG assertion, including any qualifications or limitations. For acceptance by ACR, the Verification Statement shall confirm that the GHG assertion is without material discrepancy, as defined by ACR, and that the verification activities provide a reasonable level of assurance.
- Be signed and dated by the lead verifier and internal reviewer.

Note that validation and the first verification may be conducted simultaneously, and may be conducted by the same approved VVB. Therefore, it is acceptable to combine the Validation Report (see Chapter 7 for contents) and Verification Report into a single report.

Chapter 13: Requirements for VVBs

This chapter reiterates information about current requirements for ACR-approved validators and verifiers provided on www.acrcarbon.org. The information on the ACR Web site—the current list of approved VVBs, accreditation and other requirements of VVBs, VVB application process and fees, and conflict of interest requirements—supersedes the information in this chapter in the case of any conflicts.

13.A Requirements of Project Validators and Verifiers

VVBs shall be accredited for project validation and verification in the scope of the applicable methodology, and VVB teams shall meet the competence requirements as set out in ISO 14065:2013. All ACR validators and verifiers must be accredited, by an accreditation body that is a member of the IAF and with which ACR has a Memorandum of Understanding (MoU), to ISO 14065:2013 (or the latest version of the standard) in the applicable sectoral scope to conduct validation(s) and/or verification(s).[10, 11] All entities must submit required documentation and evidence of accreditation for ACR approval prior to conducting work for any project registered or seeking registration on ACR.

ANSI accredits VVBs separately for validation and verification of assertions related to GHG emission reductions and removals at the project level.

ACR requires that all VVBs submit an application and verifier attestation, which defines the VVB role and responsibilities, ensuring technical capabilities and no conflicts of interest. Validation and verification activities may not be conducted until the VVB has received approval from ACR. Once approved, it is the VVB's responsibility to update ACR immediately about any changes in accreditation status or scope, enforcement activities, investigations, revocations or suspensions of the body itself, or any verifiers working on the VVB's behalf.

[10] ACR will consider, on a case-by-case basis, VVBs pursuing accreditation to perform validations or verifications on behalf of ACR.

[11] As of May 2018, ACR has an MoU with the ANSI. ACR may, in the future, enter into MoUs with other IAF member accreditation bodies.

VVBs must also complete a project-specific conflict of interest form prior to initiating any validation or verification work. VVBs must complete the conflict-of-interest form for each reporting period, regardless of prior approval.

The VVB application process is detailed at www.acrcarbon.org.

13.B Approved VVBs

See www.acrcarbon.org.

13.C Rotation Requirement for VVBs

Projects may elect to contract with the same VVB for both validation and the first verification. ACR requires that Project Proponents utilize a different VVB at a minimum of every 5 years or five verifications, whichever comes first. For Crediting Period renewals, a different VVB than conducted the initial project validation must be chosen.

13.D VVB Oversight

In addition to the accreditation processes to which all VVBs must adhere, ACR reserves the right to conduct oversight activities during validation and/or verification performance by the VVBs operating under the ACR program. Oversight activities are conducted to ensure an adequate level of quality control, and are intended to supplement accreditation body oversight and audit processes. Oversight activities conducted by ACR representatives include the following:

- Review of information and supplementary documentation submitted by VVBs regarding project-specific conflict of interest determinations;
- Review of VVB documentation such as verification and sampling plans;
- Review of Validation Reports, Verification Reports, and Verification Statements; and
- Participation during project-level audits.

13.D.1 OVERSIGHT OF IAF MEMBER-ACCREDITED VVBS

Should ACR select an IAF member-accredited VVB for a project-level audit, the VVB must include ACR on communications with the Project Proponent, include ACR in substantive meetings with the Project Proponent, and make project-level data and information subject to validation and/or verification

available to ACR for review. During a project-level audit, ACR may choose to send, at its own expense, a representative to the validation and/or verification site visit to observe on-site verification activities. After a project-level audit is complete, ACR will communicate its observations via written report directly to the VVB, which may also be made available to the accreditation body. The report will document, as applicable, any items of concern noted during validation and/or verification performance, including areas for improvement and nonconformities with ACR validation and verification procedures.

Appendix A: References

ACR. 2018. The ACR Standard, version 7.0. Winrock International, North Little Rock, Arkansas.

Environmental Resources Trust (ERT). 2005. Corporate Greenhouse Gas Verification Guideline, prepared for the U.S. Environmental Protection Agency's Climate Leaders Program, Washington, DC.

International Standards Organization (ISO) 14064-2:2006(E) - Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

International Standards Organization (ISO) 14064-3:2006(E) - Greenhouse gases — Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions.

International Standards Organization (ISO) 14065:2013(E) - Greenhouse gases — Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition.

International Standards Organization (ISO) 14066:2011(E) - Greenhouse gases — Competence requirements for greenhouse gas validation teams and verification teams.

International Standards Organization (ISO). Guide 98-3:2008 Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement.

United States Environmental Protection Agency (USEPA) Climate Leaders Program, GHG Inventory Protocol (May 2005). http://www.epa.gov/climateleaders/resources/inventory-guidance.html.

United States Environmental Protection Agency (USEPA). 2009. Using Offsets to Help Climate Leaders Achieve Their GHG Reduction Goals: Climate Leaders Offset Module Overview. EPA-430-F-09-046. http://www.epa.gov/stateply/documents/resources/OffsetProgramOverview.pdf.

World Resources Institute and World Business Council for Sustainable Development (WRI/WBCSD). 2005. Greenhouse Gas Protocol Initiative, The GHG protocol for project accounting. http://www.ghgprotocol.org/standards/project-standard.