Verified Carbon Standard
A VERRA STANDARD

Procedure for Applying the GCS Non-Permanence Risk Tool

Version 5.0

16 December 2025

CONTENTS

1 INTRODUCTION AND SCOPE

This document provides the procedures for conducting the non-permanence risk and buffer determination required for geological carbon storage (GCS) projects using the digital GCS Non-Permanence Risk Tool (NPRT) available in the Verra Project Hub. The document sets out the requirements for project proponents, implementing partners, and validation/verification bodies (VVBs) to assess non-permanence risk and determine the appropriate risk rating. This procedural document should be used to understand the underlying requirements which are embedded in the tool itself.

The first version of the GCS NPRT was developed in 2022 by Verra in collaboration with the CCS+ Initiative, through a working group composed of leading experts. Tool development involved an extensive peer-review process.

Risks in GCS projects are managed through multiple approaches. Preventative approaches include setting minimum criteria for project and proponent eligibility, and mitigative approaches set project operational and closure requirements. These are provided in the *VCS Standard* and in the *GCS Requirements*. The approach for non-permanence risk of carbon known or believed to be lost due to reversal is to transfer a level of risk to the proponent through the use of a project risk analysis using the *Geological Carbon Storage Non-Permanence Risk Tool.* This is accomplished by assessing the risk of an eligible project and that project contributing proportionally to the GCS pooled buffer account to ensure that all issued Verified Carbon Units (VCUs) remain valid despite the potential for reversals. Risk ratings are based on an assessment of individual risk factors for each project, which are summed to determine the total risk rating, as set out in Section 2 for CCS projects.

This document and the GCS pooled buffer account are subject to periodic reconciliation and revision based on a review of existing GCS verification reports and an assessment of project performance, as set out in the *VCS Program Guide*.

In addition to the requirements set out in this document, GCS projects shall conform to all applicable VCS Program rules and requirements.

The material in this document has been inspired by and adapted from the following sources, with amendments made where necessary to fit the context of the VCS Program:

- United States Environmental Protection Agency (EPA). 2002. *Underground Injection Control Program Class VI Requirements (40 CFR § 146.86) – Injection Well Construction Requirements*
- US EPA Office of Water. 2013. *Underground Injection Control (UIC) Program Class VI Well Site Characterization Guidance*
- European Union. 2009. *European Parliament and the Council of the European Union (2009) Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC*

- California Air Resources Board. 2018. *Carbon Capture and Sequestration Protocol under the Low Carbon Fuel Standard*
- International Organization for Standardization. 2017. *ISO 27914:2017 – Carbon Dioxide Capture, Transportation and Geological Storage – Geological Storage*

1.1 Scope

1.1.1 This document sets out the procedure for conducting the non-permanence risk analysis for GCS projects. The non-permanence risk rating ("risk rating") is used to determine the number of buffer credits that a GCS project shall deposit into the GCS pooled buffer account. The procedure for depositing and releasing buffer credits is set out in the *Registration and Issuance Process.*

1.1.2 In the context of buffer credits for GCS projects, the principal concern for permanence is CO_2 loss from the storage zone(s) to the atmosphere. Given the VCS Program requirements to avoid or minimize negative impacts on biodiversity and ecosystems, risk mitigation in GCS projects is also concerned with unanticipated CO_2 loss from the storage reservoir to adjacent formations impacting underground sources of drinking water (USDW) and/or other subsurface resources.

1.1.3 This document applies to projects that sequester CO_2 with the intent of permanence on geologic timescales (e.g., thousands of years). Acknowledging that assessment across these timescales is not feasible, the VCS Program assesses the durability of sequestered CO_2 through the injection period and post-injection assessment period. CO_2 reductions and removals from projects that meet the eligibility conditions and operating requirements and contribute to the GCS pooled buffer account according to the risk rating prescribed in this document are considered permanent for the *VCS Standard*.

1.1.4 Section 2 of this document applies to carbon capture and storage (CCS) projects as defined in the *VCS Program Definitions*. The requirements in this section do not apply to CO_2 storage in enhanced oil recovery (EOR), geological mineralization, materials (e.g., cement, steel), fuels, or biogenic carbon sinks. Additional sections may be included in this document in subsequent revisions to assess the risk of other GCS activities.

2 CARBON CAPTURE AND STORAGE RISK ANALYSIS AND BUFFER DETERMINATION

2.1 Risk Analysis

2.1.1 The digital *GCS Non-Permanence Risk Tool,* available on the Verra Project Hub, shall be used to assess risk and complete the Non-Permanence Risk Report. This document is intended to assist project proponents in understanding and applying the digital GCS NPRT.

2.1.2 The project shall be evaluated against each category in Section 2.2 and the project proponent shall follow the calculation formulas in each table to determine the risk rating for each category.

2.1.3 Project proponents shall document and substantiate the risk analysis covering each risk factor applicable to the project.

2.1.4 The validation/verification body shall evaluate the risk analysis undertaken by the project proponent and assess all data, rationales, assumptions, justifications, and documentation provided by the project proponent to support the non-permanence risk rating.

2.1.5 The overall risk rating shall be determined by summing each of the risk category scores, following the procedure in Section 2.3.

2.2 Risk Categories

2.2.1 Regulatory framework risk (RFR) shall be assessed using Table 1, noting the following:

1) RFR refers to the rules of the jurisdiction(s) in which the project is located. Examples include rules for well licensing, well classification, casing and cementing requirements, downhole abandonment requirements, and accessibility/reliability of records of pre-existing wells in the area of review. The rules may include legislation, regulations, standards, directives, and the practices of the relevant regulator, including enforcement and guidance documents.

2) Priority refers to an explicit regulatory or legislative system that manages conflicts between competing pore space resource use in a way that protects the storage integrity and permanent storage of CO_2 in a CCS project now and in the future. Examples of competing pore space resource use include oil and gas production activities, other waste disposal activities, gas storage, geothermal energy, and mineral brine production activities.

3) Transfer of liability refers to the transfer of liability for the CCS storage site(s) from the operator of the facility to the regulating jurisdiction after the site(s) have been closed to the regulator's satisfaction.

4) The transfer of liability includes liability for any required remedial operations (remedial liability) but not liability to reconcile any loss of carbon credits resulting from the leakage of injected CO_2 to the atmosphere (climate liability). Where the transfer of liability to the jurisdiction is not specified by law or regulation, liability remains with the project proponent.

Table 1. Regulatory framework risk (RFR)

Risk Element	Description or Criteria	Score
a)	The jurisdiction has a regulatory framework that affords priority to a CO_2 storage project in the event of any competing pore space resource use.	0
	The jurisdiction does not have a regulatory framework that affords priority to a CO_2 storage project.	0.125
b)	A legislative or regulatory rule that provides for the transfer of remedial liability is in place.	0
	There is no transfer of remedial liability.	0.0625
Total Regulatory Framework Risk (RFR) = a + b		

2.2.2 Political risk (PR) shall be assessed using Table 2, noting the following:

1) A governance score of between −2.5 and 2.5 for the jurisdiction in which the storage facility is located shall be calculated from the mean of governance scores across the six indicators of the World Bank's Worldwide Governance Indicators (WGI),[1] averaged over the most recent five years of available data.

2) Governance scores shall be translated into risk scores as set out in Table 2.

3) Where a country does not have at least five years of data for any WGIs, it is not an eligible location for CCS projects registered with the VCS Program.

[1] World Bank. Worldwide Governance Indicators (annual). http://www.govindicators.org/

Table 2. Political risk (PR)

Risk Element	Description or Criteria	Score
a)	Governance score of 0.82 or higher	0
	Governance score of 0.19 to less than 0.82	0.25
	Governance score of −0.32 to less than 0.19	0.5
	Governance score of −0.79 to less than −0.32	2
	Governance score of less than −0.79	4
Total Political Risk (PR) = a		

2.2.3 Land and resource tenure risk (LRTR) shall be assessed using Table 3, noting the following:

1) Land and resource tenure refers to the exclusive right to use the storage reservoirs and pore space for the injection of CO_2, as well as the surface rights to install injection facilities, pipelines, access roads, monitoring wells, or other sensory equipment for GCS projects.

2) Reservoir and pore space rights for the injection of CO_2 and surface rights may be owned by the government, communities, or private entities.

3) Access rights mean surface access to injection facilities, monitoring wells, and other sensory equipment and may be secured through ownership, leases, rights of way, or government-issued right of entry orders.

Table 3. Land and resource tenure risk (LRTR)

Risk Element	Description or Criteria	Score
a)	All pore space within the area of review is government-owned.	0
	At least some of the pore space within the area of review is community- or privately owned.	0.125
b)	Access rights are secured for the duration of the project and the post-injection site care (PISC) period.	0

	Access rights are secured for a portion of the project and PISC period but are subject to expiry and/or conditional renewals during the injection or PISC periods.	0.25
Total Land and Resource Tenure Risk (LRTR) = a + b		

2.2.4 Closure financial risk (CFR) shall be assessed using Table 4, noting the following:

1) The CFR is based on the funds in place for post-injection site care (PISC) costs (closure and post-closure monitoring as per the GCS closure plan) at the time of evaluation (when the *GCS Non-Permanence Risk Tool is* used at validation and each verification), and on the likelihood that funding will be in place at the end of injection.

2) There are different types of funding:

   a) Secured project funding refers to dedicated, unencumbered funding such as trust funds, endowments, bonds, irrevocable letters of credit, cash on deposit with the regulator or government, and private insurance. Secured project funding shall be dedicated to PISC costs for the project and cannot be accessed for other purposes or projects by the project proponent or secured as collateral by other creditors of the project proponent. This includes any secured project funding collected or prescribed by the jurisdictional regulator that the project can access for PISC activities. It does not include regulator- or government-managed funds intended for servicing costs incurred by the jurisdiction after the transfer of liability has occurred.

   b) Unsecured funding refers to cash-in-place, corporate guarantee, self-insurance, and contractual agreements over which the project proponent has control and that can be used to service PISC costs. Unsecured funding also includes callable financial resources that are readily available to the project. The availability of such resources may be indicated through revocable letters of credit, revolving credit lines, corporate guarantees, or other financial backing, as evidenced by signed agreements that demonstrate the project's ability to access funding as needed.

3) PISC costs include monitoring program costs (from the end of injection to site closure), site closure costs, well-plugging costs, remediation costs, any corrective action costs, and post-closure monitoring costs.

4) The percentage of PISC costs covered shall be calculated by adding up all funding and revenue available according to the categories of funding described in Section 2.2.4(2) and dividing this by the PISC cost as identified in the GCS closure plan.

5) Evidence shall be provided that counterparties to funding agreements are in good financial standing and can meet the financial obligations. For example, funding may be demonstrated through financial statements, bank records, surety bonds, or private insurance agreements.

6) Project proponents with mixed funding models (including secured funding, unsecured funding, and insufficient funding) shall complete Table 4 by inputting the proportion of funding in each of the categories and shall add up the total according to the equation given. Where a jurisdiction requires a project proponent to post or otherwise maintain financial security for PISC costs to obtain regulatory approval, the project proponent may use the amounts of such financial security to meet the requirements of Table 4.

Table 4. Closure financial risk (CFR)

Risk Element	Description or Criteria
a)	The percentage of PISC costs covered by secured funding (expressed as a decimal)
b)	The percentage of PISC costs covered by unsecured funding (expressed as a decimal)
c)	The percentage of PISC costs not funded (expressed as a decimal)
Total Closure Financial Risk (CFR) = a + (1.5 × b) + (5 × c)	

2.2.5 Design risk (DR) shall be assessed using Table 5. Access to relevant well data means data as applicable for site characterization and monitoring as part of the monitoring program, such as drilling logs, seismic data, and core samples from wells that penetrate the primary or any secondary seals of the storage reservoir within the area of review.

Table 5. Design risk (DR)

Risk Element	Description or Criteria	Score
a)	All injection wells for the project meet the design guidelines in Appendix 1.	0
	Some or all injection wells for the project do not meet the design guidelines in Appendix 1.	2
b)	The project proponent has access to all relevant well data.	0
	The project proponent does not have access to all relevant well data.	1
Total Design Risk (DR) = a + b		

2.3 Overall Non-Permanence Risk Rating and Buffer Determination

2.3.1 The overall non-permanence risk rating shall be determined using Table 6.

Table 6. Overall risk rating

Risk Category		Total Risk Score
RFR	Regulatory framework risk	
PR	Political risk	
LRTR	Land and resource tenure risk	
CFR	Closure financial risk	
DR	Design risk	
Overall Risk Rating = RFR + PR + LRTR + CFR + DR		

2.3.2 The minimum risk rating shall be one, as per calculations in Tables 1–6. The maximum acceptable non-permanence risk rating for a CCS project is seven at validation and each verification.

2.3.3 To determine the number of buffer credits that shall be deposited in the GCS pooled buffer account, the overall risk rating shall be converted to a percentage (e.g., an overall risk rating of 3 converts to 3%). This percentage shall be multiplied by the tonnes of injected CO_2 (stated in the verification report), as set out in the *Registration and Issuance Process*.

2.3.4 Buffer credits shall be deposited in the GCS pooled buffer account per the procedures set out in the *Registration and Issuance Process*. The rules and requirements for the release and cancellation of buffer credits from the GCS pooled buffer account are set out in the same document.

2.3.5 Where a project has multiple storage zones and/or storage sites, the risk analysis shall be carried out for each respective storage site and/or storage zone and the highest risk rating obtained shall be applied across the entirety of the project.

APPENDIX 1: INJECTION WELL GUIDELINES

These guidelines are adapted from the US EPA *Underground Injection Control Program Class VI Requirements (40 CFR § 146.86) Injection Well Construction Requirements* and help to characterize the design risk of a GCS project (Table 5).

General: The CO_2 injection wells are constructed and completed to:

1) prevent the movement of fluids into or between USDWs or into other zones.
2) permit the use of appropriate testing devices and workover tools.
3) permit continuous monitoring of the annulus space between the injection tubing and the long string casing.

Casing and cementing of CO_2 injection wells:

1) Casing and cement or other materials used in the construction of each CO_2 injection well have sufficient structural strength and are designed for the life of the GCS project.
2) All the well materials are compatible with fluids with which the materials may be expected to come into contact and meet or exceed standards developed for such materials by the American Petroleum Institute, ASTM International, or comparable standards acceptable to the regulator of the jurisdiction in which the GCS project is located.
3) The casing and cementing programs are designed to prevent the movement of fluids into or between USDWs.
4) Surface casing extends through the base of the lowermost USDW and is cemented to the surface with single or multiple strings of casing and cement.
5) At least one long string casing, using a sufficient number of centralizers, extends to the injection zone and is cemented by circulating cement to the surface in one or more stages.
6) Cement and cement additives are compatible with the CO_2 stream and formation fluids and are of sufficient quality and quantity to maintain integrity over the design life of the GCS project. The integrity and location of the cement shall be verified using technology capable of radially evaluating cement quality and identifying the location of channels to ensure that USDWs are not endangered.

Tubing and packer:

1) Tubing and packer materials used in the construction of each CO_2 injection well are compatible with fluids with which the materials may be expected to come into contact and meet or exceed

standards developed for such materials by the American Petroleum Institute, ASTM International, or comparable standards acceptable to the regulator of the jurisdiction in which the GCS project is located.

2) All storage site operators inject fluids through tubing with a packer set at a depth opposite a cemented interval.

DOCUMENT HISTORY

Version	Date	Comment
v5.0	16 Dec 2025	Updated version released under VCS Version 5

ABOUT VERRA

Verra sets the world's leading standards for climate action and sustainable development. We build standards for activities as diverse as reducing deforestation, improving agricultural practices, addressing plastic waste, and achieving gender equality. We manage programs to certify that these activities achieve measurable high-integrity outcomes. We work with governments, businesses, and civil society to advance the use of these standards, including through the development of markets. Everything we do is in service of increasingly ambitious climate and sustainable development goals, and an accelerated transition to a sustainable future.

Verra's certification programs include the Verified Carbon Standard (VCS) Program and its Jurisdictional and Nested REDD+ (JNR) framework, the Climate, Community & Biodiversity Standards (CCBS) Program, the Sustainable Development Verified Impact Standard (SD VISta) Program, and the Plastic Waste Reduction Program.

VERRA

Standards for a
Sustainable Future

Verified Carbon
Standard

Jurisdictional and Nested
REDD+ Framework

Climate, Community
& Biodiversity Standards

Scope 3
Standard

Sustainable Development
Verified Impact Standard

Plastic Waste
Reduction Standard