Puro.earth Certification Framework

Puro.earth CCS+ Program Annex

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1. Overview of Puro.earth CCS+ Program

Program official name:	Puro.earth CCS+ Program
Unit name:	CCS+ Carbon Removal Certificate (CRC); CCS+ Emission Reduction Certificate (ERC) (see Puro.earth Certification Procedures, Table 2)
Supported Methodologies:	Puro.earth CCS+ Program Carbon Capture and Storage Methodology and associated modules and tools, co-branded CCS+ & Puro.earth (see Section 2.2)
Registry:	Puro Registry

The CCS+ Initiative is a collaboration of companies and organisations that developed the CCS+ Carbon Capture and Storage Methodology and its associated modules and tools. Puro.earth has licensed these documents and integrated them into the Puro.earth Certification Framework as the Puro.earth CCS+ methodology suite.

The Puro.earth CCS+ Program enables project activities certified under the Puro.earth CCS+ methodology suite to issue two credit types through the Puro Registry, in accordance with Table 2 of the Puro.earth Certification Procedures: CCS+ Carbon Removal Certificates (CRCs), issued for verified carbon dioxide removals and CCS+ Emission Reduction Certificates (ERCs), issued for verified reductions arising from avoided point-source emissions as differentiated in accordance with the Differentiating Reductions and Removals in CCS Projects tool.

2. Normative Framework for the Puro.earth CCS+ Program

2.1. Purpose and document hierarchy

2.1.1. This Annex sets out the additional Program-specific requirements and adaptations applicable to the Puro.earth CCS+ Program.

2.1.2. This Annex shall be read together with the Puro.earth Certification Procedures and the applicable Puro.earth CCS+ methodology documents, including the applicable Methodology and supporting tools set out in Section 2.2 of this Annex.

2.1.3. This Annex shall also be read together with the Puro.earth Common Criteria where this Annex or an applicable methodology expressly references them. The Puro.earth Common Criteria are a shared normative resource. They do not govern CCS+ activities directly unless this Annex or an applicable methodology makes them applicable. Where applicable, they apply only to the extent and in the manner specified by the relevant reference.

2.1.4. This Annex establishes in Section 2.3 which Common Criteria apply at CCS+ Program level, i.e. for all activities included in the CCS+ Program. Common Criteria not referenced in this Annex do not apply automatically at Program level, but may apply to a CCS+ activity if expressly referenced in the associated methodology.

2.1.5. In the event of any inconsistency between this Annex and the Puro.earth Certification Procedures or Common Criteria, the requirements of this Annex shall prevail for CCS+ Program execution.

2.2. Normative Documents

2.2.1. The Puro.earth CCS+ Program specific rules are defined in the following normative documents. The latest approved valid versions are published on the Puro.earth website document library (Puro.earth/document-library).

- *Puro.earth Certification Procedures*
- *Puro.earth Common Criteria*
- *Puro.earth List of Definitions and Abbreviations*
- *Puro.earth Article 6 Procedures*
- *Puro.earth Audit Guidance*
- *Puro.earth CCS+ Program Annex*
- *Puro.earth CCS+ Program Emissions from Electricity Consumption*
- *Puro.earth CCS+ Program Carbon Capture and Storage Methodology*
- *CCS+ Module A - CO_2 Capture from Air (Direct Air Capture)*
- *CCS+ Module C - CO_2 Transport for CCS Projects*
- *CCS+ Module D - CO_2 Storage in Saline Aquifers and Depleted Hydrocarbon Reservoirs*
- *CCS+ Tool E - Differentiating Reductions and Removals in CCS Projects*
- *CCS+ Tool F - Accounting CO_2 in CCS Projects Using Shared Infrastructure*

2.2.2. Where Puro.earth publishes updated versions of any of the documents listed above, the applicable version for a project activity is the version current at the date of validation. Crediting period renewals shall apply the most recent approved version in force at the time of renewal, in accordance with the Puro.earth Certification Procedures.

2.3. Applicability of Common Criteria

This section identifies the Common Criteria that apply at Puro.earth CCS+ Program level and specifies any Program-specific modifications to their application.

2.3.1. The Common Criteria identified in rules 2.3.2 to 2.3.9 apply under the CCS+ Program, subject to any limitation or modification stated for the specific Common Criterion:

2.3.2. Principle 1: Transparency and Documentation

- CC1.1 Project Activity Description *applies alongside any methodology requirements.*
- CC1.2 Monitoring Plan *applies alongside any methodology requirements. The Monitoring Plan shall incorporate a storage monitoring plan, as set out in Section 9.5 of this Annex.*
- CC1.3 Monitoring Report *applies alongside any methodology requirements, as set out in Sections 9.5 to 9.8 of this Annex.*
- CC1.4 Crediting Period Renewal Assessment *applies alongside any methodology requirements*

2.3.3. Principle 2: No double counting

- CC2.1 No Double Issuance *applies alongside any methodology requirements*
- CC2.2 No Double Claiming with Mandatory Domestic Mitigation Schemes *applies alongside any methodology requirements*
- CC2.3 No Double Claiming from Other Environmental Credits *applies alongside any methodology requirements*
- CC2.4 Article 6 Authorization *applies where the Operator seeks Article 6 authorized use for CRCs or ERCs; Puro.earth Article 6 Procedures govern. Where a project activity crosses jurisdictional boundaries (e.g. capture in one country, storage in another), the Operator shall obtain authorizations from each relevant host country National Designated Authority*

2.3.4. Principle 3: Additionality

- No Common Criteria under this Principle apply at CCS+ Program level because requirements related to additionality are addressed directly within the applicable Methodology.

2.3.5. Principle 4: Net GHG Quantification

- No Common Criteria under this Principle apply at CCS+ Program level because requirements related to quantification are addressed directly within the applicable Methodology.

2.3.6. Principle 5: Permanence and Reversal Risk

- CC5.1 Reversal Risk Assessment applies alongside any methodology requirements. *The permanence framework for CCS+ activities is governed in full by Section 8 of this Annex*.
- CC5.2 Reversal Risk Monitoring applies alongside any methodology requirements, as set out in full in Section 9.8 of this Annex.
- CC5.3 Reversal Event Reporting and Compensation *applies alongside any methodology requirements,* as set out in full in Section 9.9 of this Annex.

2.3.7. Principle 6: Environmental and Social Safeguards

- No Common Criteria under this Principle apply at CCS+ Program level because requirements related to environmental and social safeguards are addressed directly within the applicable Methodology.

2.3.8. Principle 7: SDG and Co-benefits

- CC7.1 SDG 13 Climate Action *applies alongside any methodology requirements*

2.3.9. Principle 8: Contributions to Net-Zero Transitions

- No Common Criteria under this Principle apply at CCS+ Program level because requirements related to contributions to net-zero transitions are addressed directly within the applicable Methodology.

2.3.10. An Operator may choose to comply with requirements additional to those specified in the applicable methodology, such as additional Common Criteria, provided that doing so does not modify or conflict with the applicable rules in a manner that results in non-compliance with the methodology, Program requirements, or Certification Procedures.

3. Definitions and Terminology Alignment

3.1.1. All definitions contained in the Puro.earth List of Definitions and Abbreviations shall apply to CCS+ Program activities.

3.1.2. For the purposes of CCS+ Program certification, the following additional definitions shall apply:

- **CCS+ Carbon Removal Certificate (CRC):** the verified unit issued under the Puro.earth CCS+ Program for verified removals, representing one tonne of CO_2e of verified net carbon dioxide removal from the atmosphere, quantified in accordance with the applicable Methodology and differentiated as a CDR removal in accordance with CCS+ Tool E – Differentiating Reductions and Removals in CCS Projects. CRCs are issued by Puro.earth and recorded in the Puro Registry, in accordance with Table 2 of the Puro.earth Certification Procedures.
- **CCS+ Emission Reduction Certificate (ERC):** the verified unit issued under the Puro.earth CCS+ Program for verified reductions, representing one tonne of CO_2e of verified GHG emission reduction arising from avoided point-source emissions, quantified in accordance with the applicable Methodology and differentiated in accordance with CCS+ Tool E – Differentiating Reductions and Removals in CCS Projects. ERCs are issued by Puro.earth and recorded in the Puro Registry, in accordance with Table 2 of the Puro.earth Certification Procedures.
- **CCS+ Buffer Pool:** the pooled buffer account maintained by Puro.earth under the CCS+ Program into which all CCS+ project activities collectively deposit buffer credits in proportion to their non-permanence risk rating.

4. Crediting Period

4.1.1. The project crediting period shall be 5 years, renewable 4 times.

5. Additionality

5.1.1. Additionality for Activities certified under this Program is assessed in accordance with the three-step approach set out in the applicable Methodology (Regulatory Analysis, Implementation Barrier, and Common Practice). Step 1 (Regulatory Analysis) and Step 3 (Common Practice) apply as set out in the applicable Methodology, without modification by this Annex.

5.1.2. This Section modifies Step 2 (Implementation Barrier) only. Where the applicable Methodology requires an investment analysis under Step 2, that analysis shall be conducted in accordance with the Puro.earth Common Criteria (CC 3.3), and not CDM TOOL01 (Tool for the Demonstration and Assessment of Additionality) or CDM TOOL27 (Investment Analysis) as referenced in the applicable Methodology.

5.1.3. In addition to the requirements of CC 3.3, the assessment shall be conducted from the perspective of the capture activity. Transport and storage activities shall be treated as costs to the capture activity, whether those costs are incurred as fees paid to separate transport and storage site operators, or accounted for internally by a vertically integrated project proponent.

5.1.4. Revenues from capture, transport, and storage activities (e.g., a fee per tonne of CO2 transported and/or stored) shall be incorporated into the investment analysis regardless of the ownership or operatorship of the transport facilities and storage site(s). This does not apply to payments between capture, transport, and storage activities that form part of the same Activity.

5.1.5. Where shared infrastructure is relevant to the economics of an Activity, costs and revenues shall reflect the estimated or contracted usage rate of the transport and storage infrastructure by each capture activity, prorated accordingly and not reflecting the cost of the entire shared capacity.

5.1.6. Where an Activity comprises multiple capture activities, the investment analysis shall consider all capture activities within the Activity when demonstrating the existence of an investment barrier.

5.1.7. Where an Activity has undersubscribed transport or storage capacity at the time of the investment analysis, the expected usage rate, fee structure, and resulting return on investment shall be used as inputs to the analysis.

5.1.8. Payments from a capture activity to a CO2 source facility for the CO2 captured shall not be treated as a cost in the investment analysis.

6. Validation and Verification Body (VVB) Requirements

6.1.1. By way of derogation from rule 7.1.1 of the Puro.earth Certification Procedures, VVBs conducting validation and verification under the Puro.earth CCS+ Program shall be accredited under EN ISO/IEC 14065 or EN ISO/IEC 17020.

6.1.2. VVBs shall additionally demonstrate that the audit team includes personnel with documented competence in:

i. geological CO_2 storage site assessment;

ii. CCS monitoring, reporting, and verification;

6.1.3. The verification report shall additionally include:

i. the verified non-permanence risk rating for the Monitoring Period;

ii. the verified buffer deposit volume to the CCS+ Buffer Pool for the Monitoring period.

7. CCS+ Certificate Issuance

7.1.1. CCS+ Carbon Removal Certificates (CRCs) shall be issued for verified removals, and CCS+ Emission Reduction Certificates (ERCs) shall be issued for verified reductions, of a CCS+ project activity, in accordance with Table 2 of the Puro.earth Certification Procedures.

7.1.2. For activities with mixed CO2 streams (i.e. containing fossil CO2), for each issuance request, the Operator shall submit to the VVB a calculation differentiating removals and reductions prepared in accordance with CCS+ Tool E – Differentiating Reductions and Removals in CCS Projects. The VVB shall confirm this differentiation in the verification report.

7.1.3. Puro.earth shall issue CRCs and, where applicable, ERCs following:

a) receipt of a positive verification report from a Puro.earth-approved VVB confirming the verified net CDR removals and, where applicable, verified emission reductions for the monitoring period, and the differentiation between the two; and
b) completion of Puro.earth's internal review in accordance with the Certification Procedures.

7.1.4. Each CRC and ERC shall be assigned a unique serial number and recorded in the Puro Registry. The Registry record shall include the project activity identifier, the monitoring period and a reference to the verification report.

8. Permanence Framework

8.1. Non-permanence risk assessment

In general, geological storage of CO_2 is considered a secure, resilient action to mitigate climate change and to restore the rise in global mean temperature to below 2 °C.

All CCS+ projects for geological storage of CO_2 certified under the Puro.earth CCS+ Program shall apply this non-permanence risk assessment for rating loss of containment risks at the storage sites.

The non-permanence risk elements in this document have been adapted from the following sources:

- ICAO Document Chapter 11 Requirements for Geological Carbon Capture and Sequestration Monitoring, Mitigation, and Compensation of Impermanence (Link)
- Alcalde, J., Flude, S., Wilkinson, M. et al. Estimating geological CO_2 storage security to deliver on climate mitigation. Nat Commun 9, 2201 (2018). DOI: 10.1038/s41467-018-04423-1 (Link)

8.1.1. The project activity shall assess the non-permanence risk at each validation of the project.

8.1.2. The Project proponent shall update the assessment of the non-permanence risk at each verification of the project.

8.1.3. The risk assessment shall be carried out for each storage site. If a project has multiple storage sites, each site shall be assessed separately, resulting in a storage site specific non-permanence risk rating.

8.1.4. The validation and verification body shall, at each validation and at each verification, evaluate the non-permanence risk assessment conducted by the Project proponent.

8.1.5. The overall non-permanence risk rating shall be determined as a sum of risk element scores R1 to R4.

8.1.6. The minimum non-permanence risk rating shall be one (1). The maximum acceptable non-permanence risk rating for a CCS project is seven (7).

8.1.7. The non-permanence risk rating is expressed in percentage by converting the overall non-permanence rating score to equal percentage, such that rating 1 is expressed as 1% and rating 7 is expressed as 7%.

Risk Element		Score
R1	**Regulatory framework risk** Regulatory Framework risk element (R1) requires assessment of the rules of the jurisdiction(s) in which the project is located including legislation, regulations, standards, directives, enforcement and guidance of the relevant regulator. Risk element R1 is related to ICAO requirements 1-9.	0 – 2
R2	**Closure financial risk** Closure Financial risk element (R2) requires assessment of sufficient financing to cover the estimated costs of emergency and remedial response, corrective action, injection well plugging, and post-injection site care and through closure, and the likelihood that funding will be in place at the end of the injection period. Post-Injection Site Care (PISC) costs include monitoring (end of injection to closure), site closure, well-plugging, remediation, corrective action, and post-closure monitoring. Risk element R2 is related to ICAO requirements 10-14.	1 – 5

Risk Element		Score
R3	**Reservoir containment modelling risk** Reservoir containment modelling risk element (R3) requires assessment of fluid-modelling and behaviour of the CO2 plume and a comprehensive understanding of its behaviour throughout the injection and post-injection periods. Risk element R3 is related to ICAO requirements 5, 6, 9-13.	0 – 5
R4	**Legacy wells risk** Legacy wells risk element (R4) requires assessment of legacy wells that may provide a pathway for the migration of CO_2 out of the storage complex. Risk element R4 is related to ICAO requirement 6 and the research article "Estimating geological CO_2 storage security to deliver on climate mitigation" (Alcalde et al., 2018).	0 – 5
Non-permanence risk rating (NPRR)	***Overall non-permanence Risk Rating,* Storage site specific**	***Sum of R1 to R4 (1 – 17)***

8.1.8. The Project proponent shall assess Regulatory Framework risk element (R1) in the jurisdiction(s) where the geological storage is located according to Table 1.

Table 1. Regulatory framework risk (R1)

Risk Element	Description or Criteria	Score
R1.0	The jurisdiction does not have a regulatory framework for Geological CO_2 storages.	Not eligible
R1.1	The jurisdiction has a regulatory framework in place for the geological storage of CO_2.	2
R1.2	R1.1 is met and a legislative or regulatory framework is in place that provides for clear remedial liability obligation after the post-injection and post-closure period.	1
R1.3	R1.1 and R1.2 are met and a legislative or regulatory framework is in place that provides neutralising the adverse climate impact in case of a CO_2 reversal from a storage, such that the storage operator is obliged to surrender emissions allowances equivalent to the released CO_2 amount, or by other means effectively neutralize the adverse climate impact of released CO_2.	0
Regulatory framework risk score (R1)		*0 – 2*

8.1.9. The Project proponent shall assess Closure financial risk element (R2) in the jurisdiction(s) where the geological storage is located according to Table 2.

TABLE 2. CLOSURE FINANCIAL RISK (R2)

Risk Element	Description or Criteria	Score
R2.1	The Post-Injection Site Care (PISC) costs are not funded.	**5**
R2.2	The Post-Injection Site Care (PISC) costs are at least 50% funded with secure funds or financial resources that are readily available to the project	**2**
R2.3	The Post-Injection Site Care (PISC) costs are considered fully funded with secure funds or financial resources that are readily available to the project	**1**
Closure financial risk score (R2)		**1 – 5**

NOTE: Because R2.3 = 1 (fully funded), the minimum overall risk rating is 1.

8.1.10. The Project proponent shall assess Reservoir containment modelling risk element (R3) in the jurisdiction(s) where the geological storage is located according to Table 3.

TABLE 3. RESERVOIR CONTAINMENT MODELLING RISK (R3)

Risk Element	Description or Criteria	Score
R3.1	No modelling and monitoring is performed or planned to identify migration of CO2 streams and potential leakage pathways.	**5**
R3.2	Partial fluid-modelling has been performed to gain an understanding of the site and CO2 plume behaviour.	**2**
R3.3	Comprehensive fluid-flow modelling has been performed, based on available geologic and monitoring data including risk assessment of potential containment loss . The modelling predicts the behaviour of the CO2 plume and demonstrates that it will stay within the target reservoir. Storage operator will conduct monitoring, conformance assessments and history matching to maintain the modelling. Storage operator has emergency and remedial response plan in place.	**0**
Reservoir containment modelling risk score (R3)		**0 – 5**

8.1.11. The Project proponent shall assess Legacy wells risk element (R4) in the jurisdiction(s) where the geological storage is located according to Table 4.

Table 4. Legacy wells risk (R4)

Risk Element	Description or Criteria	Score
R4.1	There is high likelihood that not all legacy wells have been identified.	**5**
R4.2	Legacy wells have been identified and all legacy wells have a traceable (decommissioning) history, with limited unknowns.	**2**
R4.3	R4.2 and all legacy wells are plugged and abandoned properly, and the risk for loss of containment of CO_2 through legacy wells has been modelled and the risk is considered low.	**0**
Legacy wells risk score (R4)		***0 – 5***

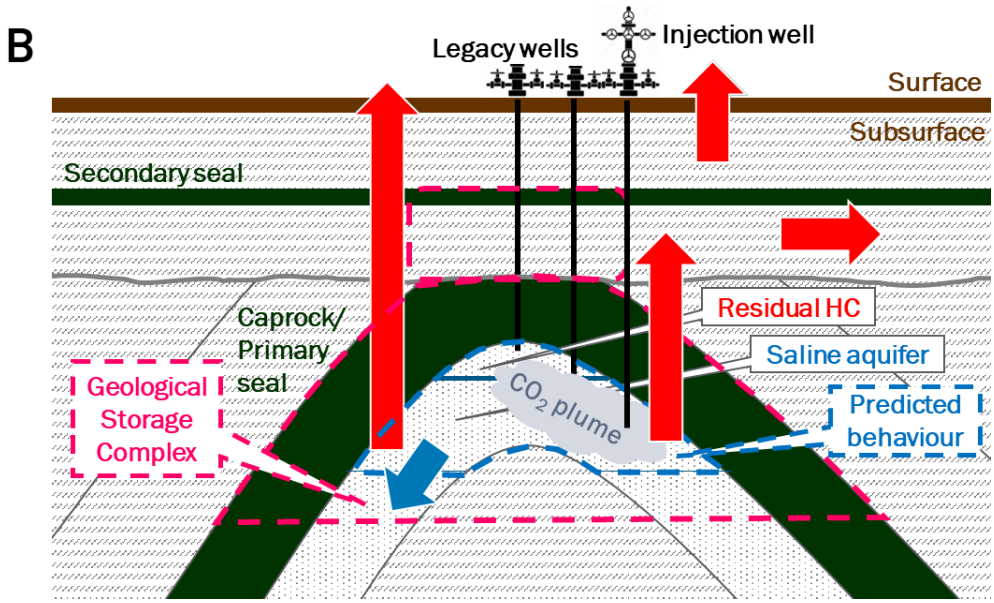


FIGURE 1: POTENTIAL LEAKAGE PATHWAYS (SOURCE: CCS+ MODULE D)

8.2. CCS+ Buffer Pool

8.2.1. The CCS+ Buffer Pool is a credit account maintained by Puro.earth within the Puro Registry accessible only by Puro.earth. Buffer credits are held in the CCS+ Buffer Pool as part of a collective insurance mechanism for non-permanence of CO2 covering all CCS+ activities certified under this Program.

8.2.2. At each issuance, Puro.earth shall deposit into the CCS+ Buffer Pool the buffer deposit volume confirmed in the verification report under rule 6.1.3, and shall issue CRCs and ERCs for the balance.

8.2.3. The buffer deposit volume for a given verification period shall be calculated as non-permanence risk rating percentage (%) multiplied by verified removals and reductions for that period.

8.2.4. The project proponent shall submit a reversal event report in accordance with rules 9.9.2 and 9.9.3.

8.2.5. Upon receipt of a reversal event report, Puro.earth shall place on hold within the CCS+ Buffer Pool a volume of buffer credits equivalent to the estimated loss, pending confirmation at the project activity next verification.

8.2.6. Where no reversal is confirmed at the subsequent verification, the buffer credits placed on hold shall be released from hold status in the CCS+ Buffer Pool.

8.2.7. Where reversal volume is confirmed at the subsequent verification, Puro.earth shall withdraw buffer credits equal to the confirmed reversal volume.

i. Where the confirmed reversal volume exceeds the volume of buffer credits placed on hold, Puro.earth shall withdraw the full volume placed on hold and shall withdraw additional buffer credits from the CCS+ Buffer Pool to fully account for the reversal.

ii. Where the confirmed reversal volume is less than the volume of buffer credits placed on hold, the remaining held credits shall be released from hold status in the CCS+ Buffer Pool.

8.2.8. Where reversal volume is confirmed at the subsequent verification, the project proponent shall replenish the CCS+ Buffer Pool and deposit new credits equivalent to the full reversal volume. Until the full reversal volume has been deposited, all issued CRC or ERC credits issued to this project activity shall be used for replenishing the CCS+ Buffer Pool.

8.2.9. Where the risk rating changes between verification periods, the new rating applies to the cumulative CRC and ERC credit Volume from the beginning of the Crediting Period. Volume of deposited buffer credits are recalculated retrospectively from the beginning of the Crediting Period.

i. Where the updated buffer deposit volume exceeds the volume of buffer credits deposited, the project proponent shall deposit additional buffer credits to the CCS+ Buffer Pool equal to recalculated buffer deposit volume.

ii. Where the updated buffer deposit volume is less than the buffer credits deposited, the difference shall be released to the project proponent's Puro Registry account from the CCS+ Buffer Pool.

8.2.10. Upon completion of the post-injection site care period, confirmed by the regulator, Puro.earth shall release the remaining buffer credits deposited for the project activity to the project proponent's Puro Registry account.

8.2.11. Where a project activity is no longer eligible due to the quantity of CO2 lost is more than 10% of the total CO2 injected during the Crediting Period, the remaining buffer credits deposited for this project activity in the CCS+ Buffer Pool shall be withdrawn. Any part of the confirmed reversal volume not covered by the withdrawn buffer credits shall be borne by the pooled buffer credits in the CCS+ Buffer Pool. The non-eligible project activity shall be Withdrawn from the CCS+ Program in accordance with Table 4 of the Certification Procedures, and no further credits shall be issued to that project activity.

9.Requirements for geological storage

9.1. Project Location

9.1.1. The Project Activity Description shall specify the project location, comprising:

i. the planned CO_2 transport network, the transport modes to be used, and the transport distance for each mode;
ii. the injection and monitoring well locations, and bottom-hole locations for deviated or horizontal wells, specified by geodetic coordinates;
iii. a vertical surface projection of the storage reservoir area of review, provided as a KML file; and
iv. the total area of the storage reservoir surface footprint.

9.2. Regulatory Framework requirements

9.2.1. Regulatory oversight is provided by a government or government agency, and the regulatory framework requires that regulators have evaluated and found adequate for the Activity:

i. storage site selection and reservoir characterization;
ii. well design, construction, and operating limits;
iii. a monitoring plans covering the injection and closure period with clear assigned monitoring responsibility for each period;
iv. storage site closure plans with defined closure conditions Post-Injection Site Care (PISC) funding, and assigned responsibility for closure, and post-closure liabilities;
v. emergency and remedial response plan for post-injection CO_2 releases

9.3. Geological Storage Site Operator and Design

9.3.1. The project activity description shall describe the operator for the geological storage site(s) and transportation system(s).

9.3.2. The geological storage operator shall demonstrate to have a valid licenses, permits, or other authorizations issued by the regulating authority in the jurisdiction to operate the storage site(s) for injection and permanent storage of CO_2.

9.3.3. The geological storage operator shall demonstrate access rights to relevant locations for the operation of the storage site through land title(s), land tenure or other granted access rights.

9.3.4. Where the storage operator is separate entity from the capture facility project proponent, the storage site operator shall demonstrate an enforceable and irrevocable agreement with the capture facility project proponent for CO_2 storage services. Such agreement shall include clauses assigning responsibility, at the storage site, for:

i. storage site closure and post-closure procedures, including remedial liability for the release of injected CO_2; and
ii. funding for post-injection site care (PISC) operations.
iii. Where the storage operatorship or ownership is transferred to a new party the obligations in (i) and (ii) above shall transfer to new storage operator or owner

9.3.5. Where an Activity comprises more than one storage site, all storage sites shall share a common storage site operator, interconnected surface infrastructure, located within the same jurisdictional boundary, and shall be overseen by the same regulatory authorities.

9.3.6. The storage site operator shall manage reservoir pressure such that it does not reactivate faults or fracture the confining zone(s) at any point in time. For saline aquifers, reservoir pressure shall always remain below the fracture pressure of the confining zone, and for depleted hydrocarbon reservoirs, reservoir pressure shall not exceed the original virgin reservoir pressure, other than locally around injection wells during injection or well stimulation.

9.3.7. For CO_2 injection in saline aquifers, the storage reservoir(s) shall have a sufficient temperature and pressure to maintain the CO_2 in liquid, supercritical, or dense phase.

9.4. Expansion of Activities

9.4.1. Where an Activity is expanded through the addition of further capture, transport, or storage elements after Validation, the expansion must be documented and approved as a post-certification change in accordance with Section 5.8 of the Puro.earth Certification Procedures. An expansion is not a standalone Activity, a grouped Activity, or a new instance of the Activity; it is restricted to the addition of capture, transport, or storage elements to the existing value chain.

9.4.2. An expansion is eligible only where it has a dedicated CO_2 flow connection to the (original) validated Activity before expansion, such as a pipeline connection, or a CO_2 receiving terminal or intermediate storage.

9.4.3. The post-certification change submission for an expansion must additionally include:

i. a description of the expansion;

ii. a demonstration of expansion conformance with the relevant applicability criteria
iii. a description of any additional methodology modules used, where applicable;
iv. the location of the expansion area and connection points for the flow of CO_2 between the added project activities and the previous project areas,
v. description of new project proponents or entities involved; and
vi. the expansion impacts to additionality or the baseline scenario, assessed in accordance with the Puro.earth Common Criteria (CC 3.1–3.5).

9.5. Storage Site Modelling and Monitoring

9.5.1. The storage site operator shall develop and maintain a reservoir model based on numerical simulation, incorporating geological and geophysical data from storage site selection, reservoir characterization, and the ongoing monitoring data (e.g., well-log data, petrophysical analysis, core data, pressure and saturation data, and seismic or other geophysical surveys), comprising at minimum a geostatic representation of the geological storage complex and a flow model of CO_2 and reservoir-fluid behavior over time.

9.5.2. Where dynamic data limitations or uncertainties exist, the reservoir model shall be supplemented by a geologic evaluation addressing geochemical interactions between the CO_2, the storage reservoir rock, and the confining zone, and geomechanical risk, including induced seismicity and stress or deformation.

9.5.3. The reservoir model and geologic evaluation shall be used to:
i. assess the risk of CO_2 loss from the storage complex;
ii. evaluate the conformance of the CO_2 plume to expectations as the Activity progresses;
iii. estimate the pressure differential between pre-injection and post-injection conditions in the injection zone;
iv. and forecast the CO_2 plume extent and pressure front at the anticipated time of storage-site closure.

9.5.4. The storage site operator shall create and maintain a Storage Monitoring Plan for the geological storage complex. The Storage Monitoring Plan shall include:
i. monitoring objectives and performance metrics based on a systematic risk analysis identifying potential CO2 leakage pathways;
ii. a description of the methods used to assess the movement of the injected CO2 plume or change in saturation, characterise the conformance of CO2 behaviour to expectations, and confirm containment; and
iii. for each monitoring technique applied:
    a. the instruments and equipment used;
    b. its contribution to the monitoring objectives and performance metrics;
    c. its application to the near-surface (including around any existing or abandoned wellbores) and subsurface;
    d. its application during the pre-injection, injection, closure, and post-closure phases;
    e. and its technical specifications, including sensitivity, range, depth, detection thresholds, detection frequencies, and vertical and spatial resolution.
    f. the responsibilities and roles of personnel involved in implementing

9.5.5. The Storage Monitoring Plan shall include a discussion of

i. any non-negligible CO2 containment loss indicated by the reservoir model or geologic evaluation,

ii. concerns and vulnerabilities, comprising the highest risks to permanent containment identified by the risk analysis above,

9.5.6. The Storage Monitoring Plan shall be updated, at a minimum, on each of the following:

i. a Crediting Period renewal;
ii. an expansion of the Activity;
iii. an identified and confirmed CO2 containment loss;
iv. prediction of a non-negligible risk of CO2 containment loss indicated by the updates to reservoir model or geologic evaluation

9.5.7. The storage site operator shall implement monitoring activities described in the Storage Monitoring Plan for the duration of the injection period, the post-injection period until storage-site closure, and post-closure monitoring period.

9.5.8. The results of monitoring activities shall be submitted in a Storage Monitoring Report. The Storage Monitoring Report shall summarize for each monitoring period

i. confirmation of CO2 containment or declaration of CO2 loss and volume;
ii. results of monitoring activities, performance metrics, uncertainties in measured data;
iii. a description of deviations from the Storage Monitoring Plan;
iv. updated results from the reservoir model and geologic evaluation;
v. modifications to the Storage Monitoring Plan going forward, with justification;
vi. commentary on concerns and vulnerabilities identified in the Storage Monitoring Plan or the reservoir model
vii. for monitoring periods covering closure, the storage site closure conditions that have been met.

9.6. Storage Site Closure

9.6.1. The storage site operator shall create and maintain a closure plan document, which shall include:

i. the conditions required for successful storage-site closure;
ii. the duration of the post-injection site care (PISC) period; and
iii. a description of the activities to be undertaken during the PISC period (e.g., monitoring, well and facility abandonment, corrective actions, site remediation).

9.6.2. The closure plan shall be updated, at a minimum, upon each of the following:

i. a Crediting Period renewal;
ii. an expansion of the Activity;
iii. an identified and confirmed CO2 containment loss;
iv. prediction of a non-negligible risk of CO2 containment loss indicated by the updates to reservoir model or geologic evaluation

9.6.3. The closure plan shall include cost estimates for activities during the PISC period, discounted to present value, comprising monitoring costs from the end of injection to storage-site closure, closure costs, storage site remediation costs, corrective action costs, and post-closure monitoring costs.

9.6.4. Storage-site closure shall not occur until each of the following is confirmed and documented in the Monitoring Report for the relevant reporting periods:

i. CO2 containment at the storage site is confirmed;

ii. all storage-site closure conditions defined in the closure plan are verified to be met;
iii. and the future CO2 plume extent and pressure-front evolution through the post-injection assessment period has been predicted using the reservoir model and geologic evaluation and does not indicate an increasing risk of CO2 containment loss.

9.7. Post-injection monitoring obligations

9.7.1. During the post-injection site care (PISC) period, the Operator shall:
i. notify Puro.earth immediately of any event that is likely to qualify as a loss event, in accordance with CC5.3.
ii. submit PISC Monitoring Reports at the intervals required by the local authority and as defined in the Storage Monitoring Plan, covering post-injection CO2 containment or declaration of CO2 loss volume; any corrective actions or site remediations actions performed
iii. accompany each PISC Monitoring Report with a verification report from a Puro.earth-approved VVB

9.7.2. Post-Injection site care (PISC) period ends when the following is confirmed and documented in the Monitoring Report for the relevant reporting periods:
i. CO2 containment at the storage site is confirmed using the reservoir model and geologic evaluation
ii. all storage-site PISC conditions defined by the regulatory regime in this jurisdiction are met to the satisfaction of the authority
iii. The authority has confirmed post-injection site care (PISC) period termination.

9.8. Reversal Risk Monitoring

9.8.1. The Storage operator shall include a dedicated section of the Monitoring Plan for reversal risk monitoring, in accordance with CC5.2.

9.8.2. The reversal risk monitoring period shall start at the first injection and continue until termination of the post-injection site care (PISC) period.

9.8.3. The reversal risk monitoring section shall specify, for each reversal risk identified in the reversal risk assessment: the parameters to be monitored; the monitoring methods and measurement frequencies; the specific detection threshold to detect a loss of containment that would trigger reporting of a reversal event.

9.8.4. The reversal risk monitoring section shall specify roles, responsibilities, expected time to detection, and a contingency plan for actions to be taken upon trigger exceedance or detection of a reversal event. The approaches used to localize and quantify the loss of containment shall be specified.

9.8.5. The storage operator shall maintain records of all trigger condition assessments, including assessments where the trigger was not exceeded, in a form and at a level of detail that enables the VVB to independently determine whether any trigger condition was exceeded during the monitoring period, regardless of whether a reversal event was reported by the storage operator.

9.9. Reversal Events

9.9.1. Upon detecting a loss of containment, the storage operator shall act according to Module D section 6.3.1. The storage operator shall halt injections at the affected storage site and shall not resume injections until containment has been fully re-established.

9.9.2. Upon detecting a loss of containment, the storage operator shall notify Puro.earth of any Reversal event within 5 days of detection in accordance with rule 9.10.3 of the Certification Procedures and submit a reversal event report.

9.9.3. A reversal event report shall contain the date of detection; the cause or causes of the reversal event; an estimate of the quantity of carbon re-released to the atmosphere in tCO_2e; and a description of the containment actions taken immediately following detection in accordance with CC5.3.

9.9.4. Upon receipt of a reversal event report Puro.earth shall initiate the procedures defined in rules 8.2.5 - 8.2.8 in this Annex.

9.9.5. For unintentional discharges of CO2 from the subsurface (CO2 leaks) during the injection period, the storage operator shall report and quantify those as UD_Subsurface according to Module D equation (9) and deduct that as project emissions according to Module D equation (1) in the Monitoring Period when it was detected.

Document History

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