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Carbon dioxide capture, transportation and geological storage — Vocabulary — Cross cutting terms

Captage, transport et stockage géologique du dioxyde de carbone — Vocabulaire — Termes transversaux

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Foreword

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This document was prepared by Technical Committee ISO/TC 265, *Carbon dioxide capture, transportation and geological storage*.

Introduction

The objectives of the document are the following:

— to provide a comprehensive list of terms and their definitions for carbon dioxide capture, transportation and geological storage including through EOR operation in order to facilitate communication among:

  — experts involved in the development of ISO standards on carbon dioxide capture, transportation and geological storage;

  — other carbon dioxide capture, transportation and geological storage stakeholders;

— to provide the basis for common understanding for all future ISO standards for carbon dioxide capture, transportation and geological storage.

Carbon dioxide capture, transportation and geological storage — Vocabulary — Cross cutting terms

1 Scope

This document defines a list of cross-cutting terms commonly used in the field of carbon dioxide capture, transportation and geological sub-surface storage including through storage in association with enhanced oil recovery (EOR) operations.

This document only deals with CO_2 geological sub-surface storage.

The terms are classified as follows:

— general terms and definitions relating to carbon dioxide;

— general terms and definitions relating to carbon dioxide capture, transportation and storage;

— general terms and definitions relating to monitoring and measuring performance in carbon dioxide capture, transportation and geological storage;

— general terms and definitions relating to risk;

— general terms and definitions relating to relationships with stakeholders;

A list of the main acronyms used is given in Annex A.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 General terms and definitions relating to carbon dioxide capture, transportation and storage

3.1.1
carbon dioxide capture and storage
CCS
process consisting of the separation of CO_2 from industrial and energy-related sources, transportation and injection into a geological formation, resulting in long term isolation from the atmosphere

Note 1 to entry: CCS is often referred to as Carbon Capture and Storage. This terminology is not encouraged because it is inaccurate: the objective is the capture of carbon dioxide and not the capture of carbon. Tree plantation is another form of carbon capture that does not describe precisely the physical process of removing CO_2 from industrial emission sources.

Note 2 to entry: The term "sequestration" is also used alternatively to "storage". The term "storage" is preferred since “sequestration” is more generic and can also refer to biological processes (absorption of carbon by living organisms).

Note 3 to entry: Long term means the minimum period necessary for geological storage of CO_2 to be considered an effective and environmentally safe climate change mitigation option.

Note 4 to entry: The term Carbon dioxide Capture, Utilization (or use) and Storage (CCUS) includes the concept that isolation from the atmosphere could be associated with a beneficial outcome. CCUS is embodied within the definition of CCS to the extent that long term isolation of the CO_2 occurs through storage within geological formations. CCU is Carbon Capture and Utilization (or use) without storage within geological formations.

Note 5 to entry: CCS should also ensure long term isolation of CO_2 from oceans, lakes, potable water supplies and other natural resources.

3.1.2
CCS project life cycle
entirety of phases of a CCS project from concept through to post-closure

Note 1 to entry: The CCS project life cycle includes mainly concept, design, obtaining permit, construction, operation, monitoring, measurement and verification, decommissioning, closure and post-closure (see Annex B).

3.1.3
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental and health impacts of a CCS project or a component part throughout its life cycle

[SOURCE: ISO 14040:2006, 3.2 modified — “and health” and “a CCS project or a component part” have been added and “of a product system” has been deleted. The Note 1 to entry has been added.]

Note 1 to entry: Boundaries of the assessment include all equipment and processes necessary to evaluate a CCS project or component part. The main input and output flows may include raw materials, process gases, electricity, fossil fuels, water, CO_2, emission in air and water, solid and liquid waste, co-products, etc.

3.1.4
value chain
entire sequence of activities or parties that provide or receive value in the form of products or services

[SOURCE: ISO 26000:2010, 2.25]

3.1.5
CCS energy consumption
total energy used within defined boundaries of a CCS project

Note 1 to entry: It could be expressed in gigajoules.

3.1.6
intermittency
lack of continuity in operation, as measured by the frequency or extent to which a process or installation is stopped or unavailable

Note 1 to entry: Intermittency includes variable CO_2 flows among project components.

3.1.7
closure period
period between the cessation of CO_2 injection and the demonstration of compliance with the criteria for site closure

3.1.8
post–closure period
period that begins after the demonstration of compliance with the criteria for site closure

Note 1 to entry: In some countries, demonstration of compliance may need approval from a third party.

3.1.9
geological storage complex
subsurface geological system extending vertically to comprise storage unit(s) and primary and secondary seals, and extending laterally to the defined limits of the CO_2 storage project

Note 1 to entry: Limits can be defined by natural geological boundaries, regulation or legal rights.

3.2 General terms and definitions relating to CO_2

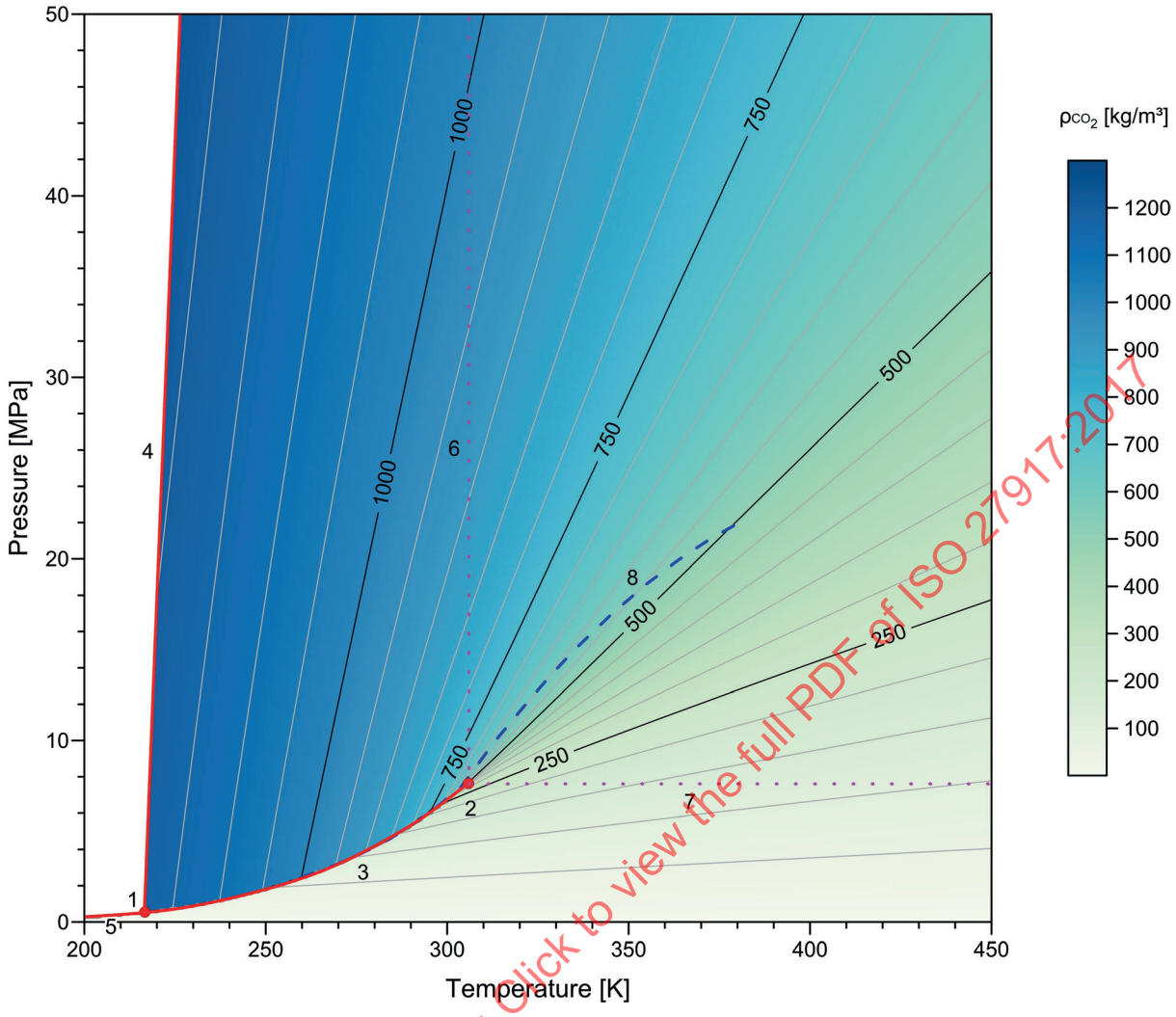
3.2.1
supercritical CO_2
CO_2 at pressures and temperatures above both the critical pressure and critical temperature

3.2.2
dense phase CO_2
CO_2 in its liquid or supercritical phases

Note 1 to entry: Compression and transport of dense phase CO_2 are commonly achieved using pumps. Compression and transport at lower densities are commonly achieved with turbo-compressors.

Note 2 to entry: Not all supercritical CO_2 is in a dense phase and not all dense phase CO_2 is supercritical.

Note 3 to entry: Figure 1 illustrates pure CO_2 phase diagram and density plots, calculated according to Reference [16], and plotted as a function of temperature and pressure.



Key

1 triple point
2 critical point
3 liquid-gas phase boundary
4 solid-(dense) fluid phase boundary
5 solid-(gaseous) fluid phase boundary
6 critical temperature
7 critical pressure
8 lower operation limit for radial pumps

Figure 1 — Pure CO_2 phase diagram and density plots

Note 4 to entry: The curve defined by Key number 8 is shown as an example illustrating typical operation limits specific to individual pumps, according to Reference [17].

— Fluid CO_2 in the p-T-range between lines 3, 4 and 6 is often named liquid CO_2.

— Fluid CO_2 in the p-T-range between lines 3, 5 and 7 is often named gaseous CO_2.

— Fluid CO_2 in the p-T-range between lines 6 and 7 is often named supercritical CO_2.

— Solid CO_2 in the p-T-range between lines 4 and 5 is often named dry ice.

— Fluid CO_2 in the p-T-range above lines 3 and 8 is often named dense phase CO_2.

Note 5 to entry: In thermodynamic equilibrium, liquid and gaseous CO_2 do only coexist at p-T-values specified by line 3 between points 1 and 2.

3.2.3
critical point
highest temperature and pressure at which a pure substance (e.g. CO_2) can exist as a gas and a liquid in equilibrium

Note 1 to entry: For a multicomponent fluid mixture of a given composition, the critical point is the intersection of the bubble and the dew point curves.

3.2.4
critical pressure
vapour pressure at the critical temperature

Note 1 to entry: According to Reference [16], the critical pressure for pure CO_2 is expressed in absolute pressure as 7,3773 MPa (gauge pressure 7,28 MPag).

3.2.5
critical temperature
temperature above which liquid cannot be formed simply by increasing the pressure

Note 1 to entry: According to Reference [16], the critical temperature for pure CO_2 is 304,1282 K.

3.2.6
CO_2 equivalent
unit for comparing the radiative forcing of a GHG to carbon dioxide

Note 1 to entry: The carbon dioxide equivalent is calculated using the mass of a given GHG multiplied by its global warming potential.

[SOURCE: ISO 14064-2:2006, 2.21]

3.2.7
global warming potential
GWP
factor describing the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a specified period of time

[SOURCE: adapted from ISO 14064-2:2006, 2.20]

3.2.8
CO_2 emission reduction
calculated net decrease of CO_2 emissions between a baseline scenario and the CCS project output

Note 1 to entry: In most cases, a CO_2 emission reduction may be referred to as "CO_2 avoided". CO_2 avoided may also refer to CO_2 removals from the atmosphere.

[SOURCE: ISO 14064-2:2006, 2.7 modified — "greenhouse gas" and "GHG" have been replaced by "CO_2" in the term and the definition. "project" has been replaced by "CCS project output".]

3.2.9
abatement
reduction in the amount, degree or intensity of emissions of CO_2 or other pollutants

[SOURCE: IPCC:2005 modified]

3.2.10
CO_2 stream
stream consisting overwhelmingly of carbon dioxide

Note 1 to entry: the CO_2 stream typically includes impurities and may include substances added to the stream to improve performance of CCS and/or to enable CO_2 detection.

3.2.11
CO_2 stream phase state
thermodynamic state of CO_2 stream, which is a function of the composition of the stream (the chemical characteristics and proportions of the components), and the physical state of the stream (temperature, pressure and volume)

3.2.12
impurities
non-CO_2 substances that are part of the CO_2 stream that may be derived from the source materials or the capture process, or added as a result of commingling for transportation, or released or formed as a result of sub-surface storage and/or leakage of CO_2

Note 1 to entry: As a subset of impurities, contaminants are non-CO_2 substances whose presence in the CO_2 stream is generally unwanted.

Note 2 to entry: As a subset of impurities, additives are substances added to the stream for the purposes of managing its physical or chemical behaviour (e.g., hydrate and corrosion inhibitors), for or from interaction with equipment (e.g., lubricants), and to track its distribution in the subsurface after injection (geochemical tracers).

3.2.13
pressure limit
pre-defined extrema of pressure for safe and effective operation of components of a CCS project

3.2.14
CO_2 leakage
unintended release of CO_2 out of a pre-defined containment

Note 1 to entry: Containments can include both surface containers (e.g. compressors, pipelines, trucks, ships, trains) and subsurface containments (e.g. storage complex).

3.3 General terms and definitions relating to monitoring and measuring performance in CCS

3.3.1
monitoring
continuous or repeated checking, supervising, critically observing, measuring or determining the status of a system to identify change from a baseline or variance from an expected performance level

Note 1 to entry: In case of geological storage, monitoring is not restricted to the technical infrastructure of an operator, it also includes the wider surroundings of the surface and/or subsurface storage site.

3.3.2
baseline
reference basis for comparison against which project status or performance is monitored or measured

3.3.3
detection limit
smallest value of a property of a substance that can be reliably detected by a specified measuring method in a specific context

3.3.4
threshold
limit value, which can be a function of time, space or other variables, beyond which an action or frame of reference is triggered

3.3.5
verification
confirmation by examination and provision of objective evidence that specified criteria are met

Note 1 to entry: In the context of the Clean Development Mechanism (CDM), the independent review by a designated operational entity of monitored reductions in anthropogenic emissions.

3.3.6
validation
confirmation that the system under consideration meets in all respects the specification of that system

3.3.7
uncertainty (of measurement)
parameter, associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measured property

[SOURCE: ISO 20988:2007, 3.1]

3.3.8
uncertainty analysis
process that leads to qualitative and/or quantitative statement on the uncertainty of the data and/or the assumptions that contribute to the assessment

3.3.9
certification
third-party attestation related to products, processes, systems or persons

[SOURCE: ISO 17000:2004, 5.5]

3.3.10
area of review
AOR
geographical area(s) of a CCS project or part of it, designated for assessment of the extent to which a CCS project, or part of it, could affect life and human health, the environment, competitive development of other resources, or infrastructure

Note 1 to entry: The delineation of an area of review defines the outer perimeters on the land surface or seabed and water surface within which assessments will be conducted as may be required by regulatory authorities.

3.3.11
sampling strategy
set of technical principles or steps that aim to establish, depending on the objectives and the site considered, the sampling density, distribution location(s) and frequency for each sampling area

3.4 General terms and definitions relating to risk

NOTE Some definitions in this clause relating to risk have been adapted from ISO Guide 73 and from CSA Z 741 for the context of CCS.

3.4.1
risk
effect of uncertainty on project objectives (e.g. on performance metrics for an element of concern)

Note 1 to entry: An effect is a deviation from the expected — positive and/or negative.

Note 2 to entry: Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3 to entry: Risk is expressed in terms of a combination of the severity of consequences (negative impacts) of an event and the associated likelihood of their occurrence.

[SOURCE: ISO Guide 73:2009, 1.1 modified — "(e.g. on performance metrics for an element of concern)" has been added. Note 4 to entry has been deleted and Note 3 to entry modified.]

3.4.2
overarching risk
risk that affects a CCS project as a whole or CCS projects in general

3.4.3
cross-cutting risk
risk that affects one or more part(s) of a CCS project and has an impact or effect on other parts

3.4.4
risk treatment
process to reduce a specified risk through implementation of risk controls

3.4.5
risk control
measure whose purpose is to reduce a specific risk or avoid escalation of risk

3.4.6
risk scenario
combination or chain of circumstances through which a threat can cause an event to occur and through which the consequences of an event can have a negative impact on elements of concern

3.4.7
acceptable risk
risk borne by the project operator and others having regard to legal obligations and management policies

Note 1 to entry: A tolerable risk is a risk of significant level considered as temporarily or conditionally acceptable. It is tolerated in order to facilitate a gradual response (e.g. monitoring of risk treatment) until the risk has been reduced.

[SOURCE: ISO 27914:2017, 3.2]

3.4.8
unacceptable risk
risk of a nature and level that is regarded as unacceptable by the project operator and others or by an authority whose approval is required for the project to proceed

3.4.9
preventive measures
measures that aim to reduce the likelihood that a specific event occurs

Note 1 to entry: These measures are thus implemented before a hazardous event has occurred or before a process has led to unwanted impacts (e.g. exceeded predefined thresholds)

3.4.10
mitigation
limitation or reduction of actual or potential undesirable effects of a particular event or process

3.4.11
remediation
process of correcting a failure or impacts on affected elements of concern

3.4.12
emergency response plan
systematic procedures that clearly detail what is to be done, how, when, and by whom before, during and after the time an emergency occurs

Note 1 to entry: In some jurisdictions, it can be called “emergency and remedial response plan”, “contingency plan”, etc.

Note 2 to entry: Emergency response plans often also cite preparations to be completed before an emergency occurs

3.4.13
environmental impact
change, which may be adverse or beneficial, to the environment, wholly or partially resulting from CCS project activities

3.4.14
expert elicitation
structured process for obtaining expert opinion

Note 1 to entry: Structured discussions, interviews, questionnaires, and polling or voting are among the methods used for expert elicitation.

Note 2 to entry: Expert opinions may be needed to assess quantities, consequences, probabilities, etc.

3.4.15
elements of concern
valued elements or objectives for which risk is evaluated and managed

3.5 General terms and definitions relating to relationship with stakeholders

3.5.1
stakeholder(s)
individual, group of individuals, or organization whose interests are or could be affected by a CCS project

3.5.2
operator
entity legally responsible for all or part of the CCS operations

3.5.3
regulator
entity or entities that have the authority to permit, approve, and/or otherwise authorize one or more CCS project activities, and/or monitor compliance with the terms of a permit

[SOURCE: CSA Z741-12 modified]

3.5.4
communication plan
document describing when, what and how to communicate with project stakeholders

Note 1 to entry: A communication plan may provide information relating to issues such as monitoring and verification, environmental impacts, risk treatment.

3.5.5
stakeholder engagement
consultation process that involves stakeholders identifying and addressing issues of common importance and sharing information on CCS projects

3.5.6
third party
entity that is independent of the parties involved with the issues in question

Annex A
(informative)

List of acronyms

CCS	Carbon Dioxide Capture and Storage
CCU	Carbon Dioxide Capture, Utilization (or use)
CCUS	Carbon Dioxide Capture, Utilization (or use) and Storage
LCA	Life Cycle Assessment
CDM	Clean Development Mechanism
EOR	Enhanced Oil Recovery
GHG	Greenhouse Gases
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change

Annex B
(informative)

CCS project life cycle

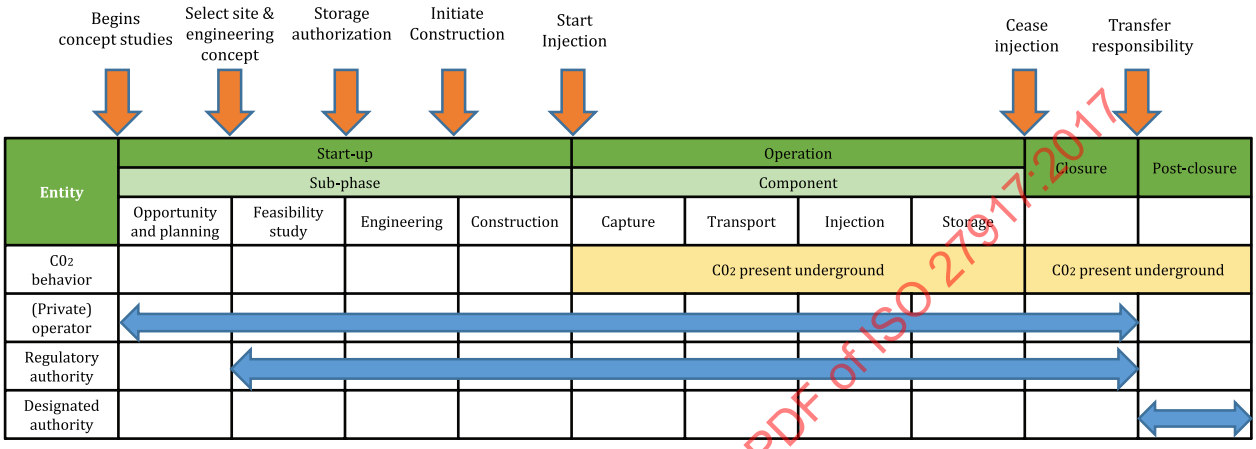


Figure B.1 — CCS project life cycle[1)]

1) From ISO/TR 27918.