TECHNICAL
REPORT

ISO/TR 27921

Carbon dioxide capture, transportation, and geological storage — Cross Cutting Issues — CO₂ stream composition

Captage, transport et stockage géologique du dioxyde de carbone — Questions transversales— Composition du flux de CO₂

Contents

Page

iii

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO Technical Committee (TC) 265 is developing standards and technical reports related to carbon dioxide (CO_2) capture, transportation and geological storage (CCS). This technology is a technically viable solution to reduce CO_2 emissions of large stationary point sources and therefore to limit future global temperature increases. A special report by the International Panel on Climate Change (IPCC, 2005) extensively described the fundamental technical, scientific, environmental, economic and societal dimensions of CCS and its potential role in the portfolio of climate change mitigation measures.

Depending among other things on the feedstock and the CO_2 generating and capture processes, CO_2 streams captured from industrial sources or power generation contain various impurities (that is, stream components other than CO_2). The impurities differ in their concentrations but also in their physical and chemical properties. Therefore, the composition of the originally captured CO_2 stream is a key starting point in ensuring the safety and reliability of the transport and geological storage of CO_2. Compositional information may assist operators in evaluating the need for treating a CO_2 stream, based on the intended transportation options (including mixing with other CO_2 streams), usage options (EOR or other), or dedicated storage in geologic formations.

Understanding CO_2 stream composition is also important for the commerciality of CCS activities because additional purification of the CO_2 stream increases CO_2 capture costs. In addition, CO_2 stream composition is an important input factor in quantifying the amount of CO_2 stored, for the purpose of greenhouse gas emissions reporting and crediting. Because capture and purification processes are continuously evolving, it is relevant to expose the range of impurities in CO_2 streams and their concentrations, including recent publications.

This document provides up-to-date consideration of CO_2 stream quality issues for operators, regulators and stakeholders based on research results and the experience of various pilot and industrial scale CCS projects. The first part of this report summarises existing information related to CO_2 stream composition that generally results from particular capture processes. Then this report describes possible impacts and effects of the various impurities that may occur in the CO_2 stream on various downstream elements of a CCS chain, including operational aspects, potential implications for health, safety and environmental issues, and quantification of greenhouse gas emissions.

Carbon dioxide capture, transportation, and geological storage — Cross Cutting Issues — CO₂ stream composition

1 Scope

The primary aim of this document is to describe the main compositional characteristics of the CO_2 stream downstream of the capture unit, taking into account common purification options. Accordingly, this document will characterize the different types of impurities and present examples of concentrations determined in recent capture pilot projects as well as through literature review. It identifies ranges of concentrations, giving priority to in situ measurements when available.

The second aim of this document is to identify potential impacts of impurities on all components of the CCS chain, from surface installations (including transport) to the storage complex. For example, impurities can have a significant effect on the phase behaviour of CO_2 streams in relation to their concentration. Chemical effects also include the corrosion of metals. The composition of the CO_2 stream can also influence the injectivity and the storage capacity, due to physical effects (such as density or viscosity changes) and geochemical reactions in the reservoir. In case of a leakage, toxic and ecotoxic effects of impurities contained in the leaking CO_2 stream could also impact the environment surrounding the storage complex.

In order to ensure energy efficiency, proper operation of the whole CCS chain and not to affect its surrounding environment, operators usually limit the concentrations of some impurities, which can, in-turn, influence the design of the capture equipment and purification steps. Such limits are case specific and cannot be described in this report; however, some examples of CO_2 stream specifications discussed in the literature are presented in Annex A.

The required purity of the CO_2 stream delivered from the capture plant will to a large degree depend on the impurity levels that can be accepted and managed by the transport, injection and storage operations. The capture plant operators will therefore most probably need to purify the CO_2 stream to comply with the required transport, injection, storage specifications or with legal requirements.

Monitoring of the CO_2 stream composition plays an important role in the management of the entire CCS process. Methods of measuring the composition of the CO_2 stream and in particular the concentrations of impurities are described and other parameters relevant for monitoring at the various steps of the CCS chain are described.

The interplay between the set CO_2 stream specifications and the efficiency of the entire CCS process is also explained. Finally, the mixing of CO_2 streams coming from different sources before transport or storage is addressed, and the main benefits, risks and operational constraints are presented.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

3.1
CO₂ 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.

[SOURCE: ISO 27917:2017, 3.2.10]