HAZARD ANALYSIS FOR ONSHORE AND OFFSHORE CARBON CAPTURE INSTALLATIONS AND PIPELINES

Second edition

April 2024

Published by
Energy Institute, London
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Registered charity number 1097899

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This publication has been produced as a result of work carried out within the Technical Team of the EI, funded by the EI's Technical Partners. The EI's Technical Work Programme provides industry with cost-effective, value-adding knowledge on key current and future issues affecting those operating in the energy sector, both in the UK and internationally.

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The EI gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies:

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ISBN 978 1 78725 416 9

Published by the Energy Institute

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ACKNOWLEDGMENTS

This project was commissioned by the Energy Institute's Carbon Capture Usage and Storage Committee and steered by the EI's CCS2004 Working Group Chaired by Prakash Patel from Marsh (Energy and Power). The research and update of the guideline were carried by Katherine Knight and her team from PACE CCS, with contributions and guidance from the following Steering Group members and section authors:

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Andy Brown	Progressive Energy
Arthur Delargy	Liberty Global Group
John Entwistle	Eni
Vincent Ganthy	RSSB
Hamish Holt	Independent Consultant
Sabina Housez	BP
Sivaneswaran Kannan	ADNOC
David Kelly	ExxonMobil
Graeme Laughland	TUV Industrial Services Limited
Toby St Leger	Harbour Energy
Prakash Patel	Marsh (Energy and Power)

Affiliations refer to the time of participation.

Further contributions were provided by the EI CCS2004 Working Group and others. This is not a complete list of all contributions.

The Energy Institute (EI) wishes to record its appreciation of the work carried out by the authors and its gratitude for the valuable contributions made by the CCS2004 Working Group and CCUS Committee during the course of the project.

A draft version was distributed to industry stakeholders for technical review. Members from the following organisations generously gave their time to provide feedback which is greatly appreciated:

Carbon Capture and Storage Association (CCSA)

DNV
ERM
Equinor
Health and Safety Executive
International Association of Oil and Gas Producers (IOGP)
Kent Plc
Shell
Uniper

Project coordination and technical editing was carried out by Marcela Betancur-Diaz and Eva Leinwather (Energy Institute).

FOREWORD

In 2006, the then Department of Business, Enterprise, and Regulatory Reform (responsibilities now allocated to the Department for Energy Security and Net Zero (DESNZ)) asked the UK Health and Safety Executive (HSE) to determine if there were any health and safety concerns relating to the deployment of large-scale carbon capture and storage (CCS) technology in the UK.

The HSE carried out a significant review of all aspects of the carbon capture and storage chain from the various capture technologies through to the injection points on the offshore platforms. Part of this process involved approaching the Energy Institute (EI) and the Carbon Capture and Storage Association (CCSA), who jointly organised a number of workshops to identify the key areas for development. The workshops specifically identified a number of areas which it believed merited greater attention.

The concerns were split into two broad subject areas:

1. Modelling the dispersion of any leak of carbon dioxide appropriately, and
2. Ensuring good practices from industrial gases sectors are fed into the UK CCS industry and are adequate and appropriate for this new industry.

Modelling the dispersion of carbon dioxide

The HSE was concerned that, whilst commercial models were available to model the dispersion of gases, including carbon dioxide, because they were unable to model solids, assumptions had to be made.[1] As a result, any dispersion modelling using these may not be accurate, less so for impure carbon dioxide. Without a model revision, coupled with validation testing, it would be difficult to use them with any confidence. In identifying this as a need for development, the HSE and EI set about establishing a joint industry group to develop guidelines on 'Hazard analysis for onshore carbon capture installations and onshore pipelines'.

Ensuring good practices are used in the CCS industry

Carbon dioxide has particular properties which affect the choice of materials of construction and plant design and the way that plants are operated and maintained, due to solid formation and low temperatures. Although many of these issues are well understood by the industrial gases sector, they are not 'business as usual' for the CCS industry. In response to the concerns raised by the HSE, the EI formed an industry group to work with the HSE to resolve the issues raised. The work formed three discrete documents:

The first document was titled *Technical guidance on hazard analysis for onshore carbon capture installations and onshore pipelines*; the second, *Good plant design and operation for onshore carbon capture installations and onshore pipelines*. The third (which is now incorporated into the other two revisions), was published three years later, was called *Hazard analysis for offshore carbon capture platforms and offshore pipelines,* and complemented the first document.

The documents, which proved to be a well-used resource, were intended for guidance only and to improve the industry's knowledge, to assist developers and operators to carry out hazard analysis

1 Connoly, S. and Cusco, L. Hazards from high pressure carbon dioxide releases during carbon dioxide sequestration processes. International Symposium Loss Prevention and Safety Promotion in the Process Industries. IChemE Symposium Series 153.

and procure and manage their plant safely. It was accepted when producing the documents that it would be necessary, at some point in the future, to review the documents. A decade after their publication, recognising both increased interest in CO_2 capture and storage and the work that has been undertaken in the meantime, the EI organised a series of workshops which identified the need to update the earlier documents.

The opportunity was taken to restructure the two documents. All aspects relating to the hazards associated with CO_2 have been drawn together into a single document, to include approaches to ensuring that hazards are appropriately identified, quantified, and mitigated. A second document, drawing on experiences from many countries, provides not only guidance on the various elements that make up a chain (omitting geological storage), but also gives assistance on what is currently perceived as good practice in design and operation.

The scope of the CCS chain covered by both of the new documents is shown here in Figure 1. In addition to the scope shown below, both documents will be of value to projects utilising CO_2.

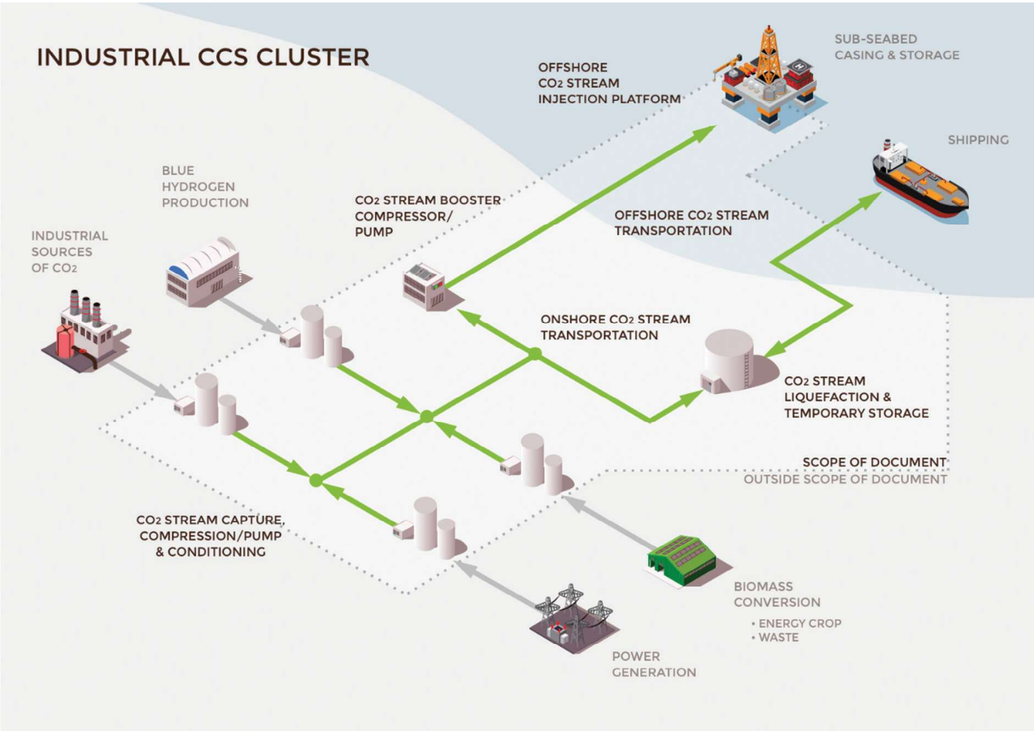

Figure 1: Scope of the CCS chain

This scope is a reflection of the expertise available to the CCUS Committee at the time of writing.

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Please note that not all sections from the original guidance documents have been updated. This publication will be further reviewed in the future, and it would be of considerable assistance for any subsequent revision if users would send comments or suggestions for improvements to:

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