

HAZARD ANALYSIS FOR ONSHORE AND OFFSHORE CARBON CAPTURE INSTALLATIONS AND PIPELINES

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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 Connolly, 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 CO₂ 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 CO₂ 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 CO₂.

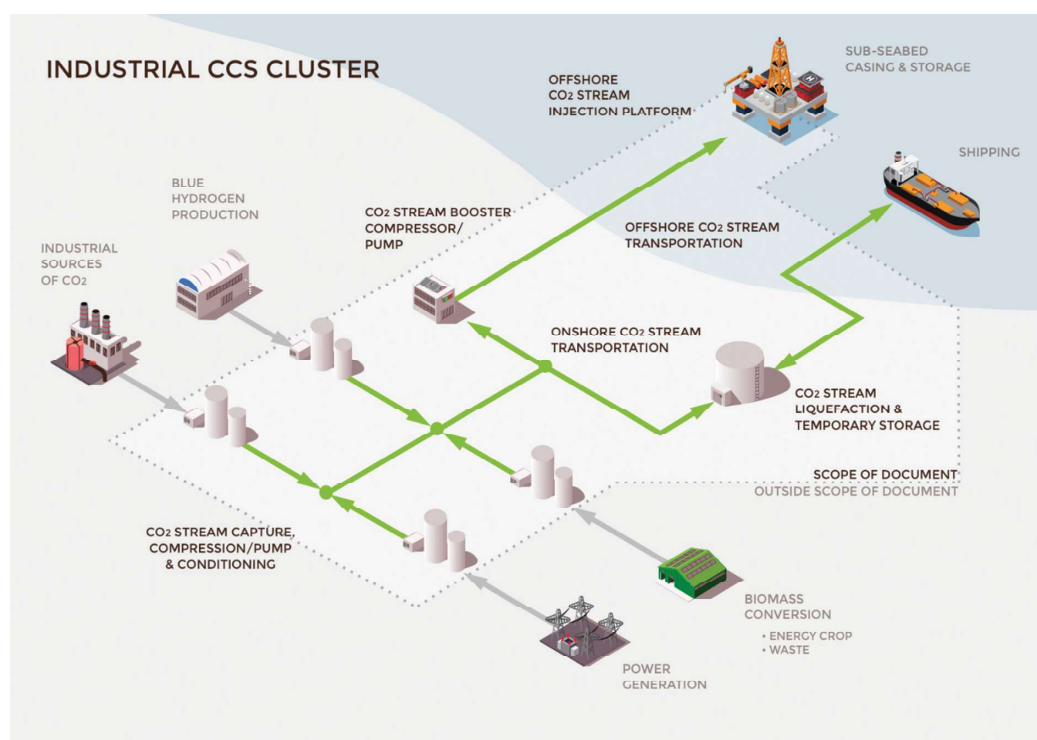


Figure 1: Scope of the CCS chain

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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