

Carbon dioxide vessel failures: a review of relevant incidents, models and experiments

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There is growing interest in non-pipeline transport of carbon dioxide (CO₂) in the UK and Europe to support Carbon Capture Utilisation and Storage (CCUS) infrastructure projects. This often involves large-scale CO₂ buffer storage at ports, for onwards transport of CO₂ by ship. The Northern Lights and Greensand projects provide an indication of the potential scales of CO₂ inventories involved. Typically, the ports have plans to use a cluster of vessels, where each vessel has a capacity of around 700 m³ to 2,000 m³, and the total inventory is around 5,000 m³ to 20,000 m³ of refrigerated CO₂. When considering the safety aspects of such large-scale onshore CO₂ storage, it is useful to review relevant historical incidents and to assess the potential hazards, using consequence models. It is also important to understand the capabilities and limitations of these models, and the extent to which they have been validated. The aim of this presentation at the IChemE Hazards conference is to review relevant CO₂ vessel failure incidents, models and the experiments that can be used for model validation. The focus is on catastrophic vessel failure, rather than smaller leaks. The models include those used for simulating blast effects from Boiling Liquid Expanding Vapour Explosions (BLEVEs) and source models for CO₂ dispersion simulations. Some indicative results from models are presented. A key issue is identified, namely, the lack of relevant data for model validation. Outline plans are presented for a future collaborative research project to address this need.

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