From Capture to Containment: The Safe Journey of CO2 for a Sustainable Future

Carbon Capture, Transport and Storage (CCTS) Safety Considerations

Mahsa Zeinolabedini 15 May 2024



Introduction

Global leader in professional services for

energy, chemicals, and resources sectors

- Over a century of expertise
- Commitment to innovative solutions

addressing global challenges



Introduction

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- Delivering sustainable change
- Reaching at zero emissions
- Deriving 75% of revenue from sustainability-related projects by FY2026

CO2 Role in Climate Change



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A Toolbox of Solutions for Reducing CO2 Emissions

- Renewable energy sources
- Changing to lower carbon intensive fuels



CCTS: A Powerful Tool for Cutting Emissions



Source: https://www.dnv.com/focus-areas/ccs/co2riskman/

CO2 Properties

- Denser than Air
- Colorless & Odorless
- Liquefies at Low Temperatures & High Pressure



Potential Hazards During Transport and Storage

Loss of Containment (LOC)



Accident Related to CO2 Pipeline

Satartia, Mississippi, 22 Feb 2020



Accidents Related to CO2 Tank Explosion

Location	Year	Summary	Consequences
Hungary	1969	Two vessels containing liquefied CO2 exploded due to the presence of residual water and improper construction material	9 deaths and 15 injuries
Japan	1969	Rupture of cryogenic tank due to a sequence of errors that happened during a repair work	3 deaths and 38 severe injuries
Germany	1976	Rail car carrying CO ₂ exploded	1 death
Germany	1988	Tank containing liquefied CO ₂ exploded	3 deaths and 10 injuries

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Safety Measures for CCTS





European Regulations

- **CO2 Capture and Storage Directive (CCS Directive)** (2009/31/EC).
- Industrial Emissions Directive (2010/75/EU)
- Seveso Directive (2012/18/EU)



Relevant Standards for CCTS

- ISO 27913:2016
- DNVGL-RP-F104
- CSN EN 14161
- ISO/TR 27921:2020



LOC risks

(Toxic cloud, Cold vapor cloud, CO2 BLEVE)

CO2 cloud behavior

□ Safety measures

Source: https://www.dnv.com/focus-areas/ccs/co2riskman/

CO2 Transportation

- Transportation Methods
- Design Constraints



Source: https://www.aiche.org/resources/publications/cep/2023/june/carbon-dioxidemajor-accident-hazards-awareness

CO2 Storage

- Site Selection
- Well Design
- Monitoring



Balance between sustainability and safety in CCTS

- Importance of CO2 capture
- Priority of safety

Environmental

- Avoid GHG emissions
- Improve air quality
- Mitigate of climate change
- Improve aquatic life
- Reduce acidification and toxicity
- Reduce product carbon footprint
- Decarbonize energy



Economical

- Adding value to the waste
- Increasing the Gross National Product (GNP)
- Reducing the fuel cost and electricity in long term
- Reducing the impact of climate change





Conclusion: A Sustainable Future Secured Through Safe CCTS

By working together and prioritizing **both sustainability and safety**, CCS can be a powerful weapon in our fight against climate change. Let's continue to innovate and collaborate to secure a cleaner, greener future for all.



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