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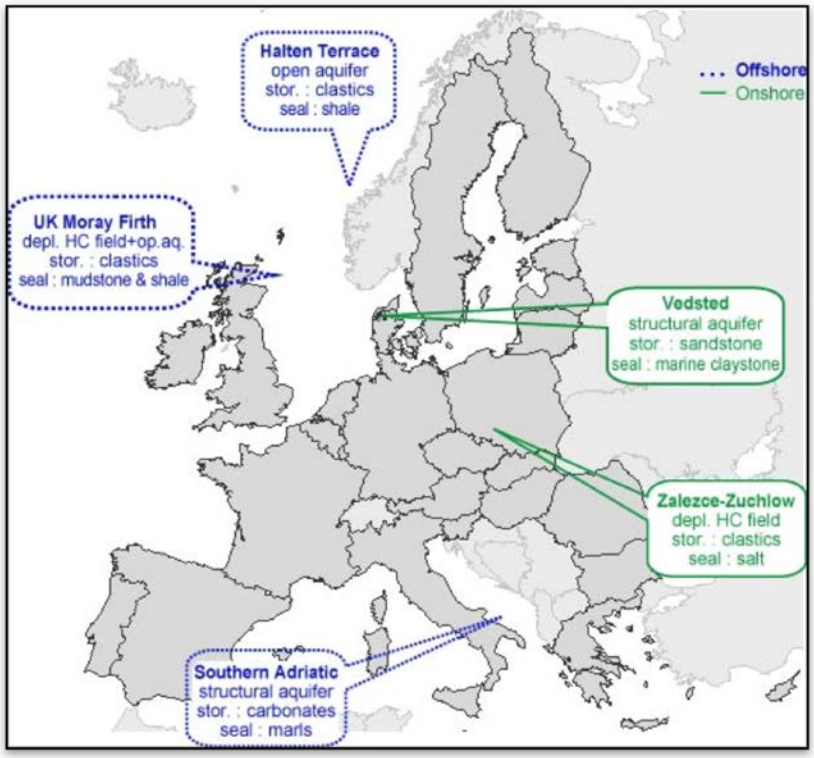
SiteChar is a three year European Union funded project to determine the criteria for CO_2 storage site characterisation. The conclusions from the project, which is now drawing to a close, were presented at a one day conference on 28th November and summarised in this Information Paper.

SiteChar examined the whole site characterisation process integrating technical detail, risk assessment and the development of monitoring plans. Consent for CO_2 storage means that site characterisation must comply with the EC Storage Directive. The process was tested at a range of onshore and offshore sites located across Europe that included saline aquifers and depleted hydrocarbon reservoirs. Detailed evaluation of site-specific techno-economic factors and injection strategies were performed. Public engagement activities were also conducted. All these activities culminated in the development of "dry-run" licence applications. The production of these applications has provided a valuable prelude to potential geological storage on an industrial scale in Europe.



SiteChar was coordinated by IFP Energies nouvelles, with sixteen other partners from research, industry, and the consultancy sector, from ten EU countries: AGH, BGS, ECN, ENEL, GEUS, GFZ, IMPERIAL, OGS, PGNiG, SINTEF-PR, Statoil, TNO, UfU, UniRoma1-CERI, Vattenfall and the Scottish Government. SiteChar is also supported by Veolia Environment.

Two potential onshore sites were selected: Vedsted in Denmark; and Zalecze & Zuchlow in Poland. Vedsted was supposed to be a demonstration by Vattenfall for an industrial CCS scheme but it has now been shelved. The Polish site is a depleted gas reservoir. There are also three offshore sites: one is a deep saline aquifer the Trondelag platform in the Norwegian sector of the North Sea; another is in a carbonate saline aquifer in the southern Adriatic; and a third is a multi compartment reservoir, the Blake oil field in the Moray Firth, in the UK North Sea.

The BGS assessed the Blake oil field. This is a depleted reservoir penetrated by 36 wells. The organisation modelled the pressure regime, seal integrity and post closure plan. Geomechanical modelling was used to determine the fracture threshold of the caprock set at a 80 bar maximum limit. Modelling included the impact of CO_2 migration and the concomitant pressure footprint on adjacent fields. It did not include an injection optimisation plan. Saline production would need to be implemented to ensure that the reservoir could be maintained within the pressure limits imposed by the caprock properties. To put saline discharges into context 175 M m^3 of water was produced and discharged into the UK North Sea in 2011.

Site characterisation has also been completed at the onshore Vedsted storage. Both static and dynamic modelling has been performed to simulate reservoir pressure and determine the boundary conditions. Pressure management would need to be implemented through saline production from four production wells. This would lead to an inevitable predicament because of the onshore location. Baseline surveys included a comprehensive assessment and monitoring of natural seismicity, to delineate any induced seismicity, and measurement of CO_2 soil fluxes.

Delegates elaborated on some of the challenges that licensing procedures could present particularly when the demands of technical site characterisation and long-term storage are considered.

Experience from the oil industry shows that the understanding of each new field will inevitably change as development proceeds and more detailed site-specific data becomes available. Consequently, pre-production assumptions need to be modified once production begins. The same philosophy needs to be applied to CO_2 storage reservoirs. Models need to be modified following the acquisition of field data. In the future the permit process might need to recognise that initial submissions may need to be modified as new data becomes available.

Estimating storage capacity needs to include:

- CO_2 retention for 10,000s of years
- Storage security
- Leakage routes
- Trapping mechanisms
- Evaluating the migration paths & behaviour of injected CO_2

Up-scaling from single wells to basin scale, taking account of facies distribution and fault status with limited data, can be a challenge. Heterogeneities can be important as they influence pressure communication, injectivity and dissolution rates. For example low permeability zones can lead to pressure build up. A comparison of different CO_2 migration routes needs to be investigated especially if there are faults present. These features can acts as seals or conduits.

Evaluating geomechanical stability and related storage implications is another integral part of site characterisation and needs to include:

- Threshold overpressure as determined by caprock fracture limit

- Fault-related geomechanical risk especially the relationship with fluid flow
- Seabed/topographical surface displacement
- Potential migration pathways

Challenges need to be assessed by applying uncertainty analysis assuming best and worst case scenarios. Modelling is a key part of this site characterisation but it is essential that:

- Model software and compatibility must be assured at the start.
- The model extent and resolution as well as boundary conditions need to be defined.

The meeting concluded that several Competent Authorities might be involved in the control and authorisation of consents. Such authorities will need significant resources and expertise to assess applications and monitor activities during and after injection. They will also need to understand specific features of site characterisation such as plume migration behaviour. Permits and any liabilities might also need to be transferred with changes of ownership.

There was general agreement that demonstration sites can provide good opportunities for understanding and resolving permit issues for all stakeholders including the degree of acceptance by the general public. There needs to be a clear and unambiguous format for public consultation. Demonstration projects can also be used to build a dialogue with regulators and show how liability can be transferred. The Lacq storage site in the south of France is a good example of a facility that was operated by an oil company, Total, which has now been transferred to the French Government.

A key aspect of the consenting process will be public engagement. One contributor stressed the necessity for a rigorous Environmental Impact Assessment to persuade local communities to accept facilities near to them. He commented that local concerns need to be addressed to reassure local communities and therefore dialogue with them is essential. Listening as well as informing is an integral part of the consultation process.

For further information about this project, including the Closing Conference, please visit: *http://www.sitechar-co2.eu/NewsData.aspx?IdNews=93&ViewType=Actual&IdType=534*

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