



## **The corrosion and coatings challenges of carbon capture transport**

**By Dr Chris Fowler, Exova**

I, like many of my peers, continue to look at the main issues we face in the industry and what can be done to minimise corrosion's effect.

Without a shadow of a doubt, the industry is much more in a hurry than it used to be. An increasing proportion of short term project schedules simply don't allow room for any problems in material qualification because everything is wanted yesterday. Ultimately corrosion management translates directly into asset integrity and extension of useful life – in other words operational effectiveness and cost efficiency.

If equipment can be made to last longer as a result of good corrosion management techniques, then this will create greater profitability for the operator. The application of current technology can reduce corrosion losses by 30 per cent, which feeds back into an organisation's bottom line performance and boosts productivity. However, this is a view we all know well and accept.

One of the biggest challenges which the corrosion and coatings professionals and the industry faces today is how to transport sequestered (Dense Phase) Carbon Dioxide. It contains impurities such as Nitrogen Oxides (NO<sub>x</sub>) and Sulphur Oxides (SO<sub>x</sub>) which increase significantly the corrosion rate.

To bring the impurities down to levels below which they have a negligible effect on corrosion is currently not cost effective. However considerable research is being conducted into managing this issue throughout Europe.

Carbon Capture and subsequent storage is a European Union driven initiative, but compared to the United States we are somewhat lagging given that the transportation of Dense Phase CO<sub>2</sub> has been undertaken for some years however even though the CO<sub>2</sub> contains some water it has been undertaken successfully. The difference in the UK and Europe is that the product contains acidic gas impurities, which increase the corrosion rate of carbon steel substantially.

One industry concept was to use existing pipelines to transport the CO<sub>2</sub> into spent aquifers, these existing pipelines are made of carbon steel. Recent research undertaken in laboratories around Europe has highlighted an important point in that the Carbon Steel will require some form protection, probably a new form of coating. Of course the alternative could be to lay new corrosion resistant pipelines, but probably at huge cost and who would sanction that? As the European Union has reportedly said any solution must be carbon neutral, laying new CRA pipelines is certainly not that.

So what is the solution? For existing pipelines could an in-situ lining, which is resistant to the product being transported be installed? To my knowledge no such system has been used that, to date, can line an old pipeline which may be 10 or more kilometres in length. The liner would likely be in sections, which then poses the question how are the sections joined remotely?

In addition the diameters of the pipelines vary, so any system has to be truly flexible, a remote cleaning pig system would also be required, as any coating system would require a clean surface to bond to – unless a new state of the art coating was developed.

This is a cross industry technical challenge, where coating manufacturers, applicators and the users need to join forces and pool knowledge to develop a solution. In my opinion it is a priority.

Both NACE International and the European Federation of Corrosion have set up working parties/groups to provide forums for discussion and exchange of information. The industry needs to engage and move swiftly forward, perhaps a European Joint Industry Project could be the solution.

The BSI, which I am a member of and represent NACE Europe, has recently formed a Carbon Capture, Transport and Storage Committee. ISO has a similar committee which the BSI group will interface with, but ultimately the intention is to producing a report outlining the way forward, which I hope is published sooner rather than later and share with the industry a much needed road map to challenge this issue.

A further even more demanding challenge is the development of pre-salt Oil and Gas this is the development of ultra-high pressure high temperature wells, which produce dense phase hydrogen sulphide, similar to the dense phase carbon dioxide the water dissolves in the dense phase, currently we have difficulties in qualifying materials for such environments even the test methods are not standardized, undoubtedly these are exciting times for the industry with immense technical challenges. The question is are we up to the challenge?