

IMPACTS Information Workshop GHGT

October 7th, 2014, 14:15-15:55

Summary by Marit Mazzetti, SINTEF ER

IMPACTS GOAL: To develop the CO₂ quality knowledge base required for defining norms and regulations to ensure safe and reliable design, construction and operation of CO₂ pipelines and injection equipment, and safe long-term geological storage of CO₂

An IMPACTS informational workshop was held during the GHGT 12 meeting in Austin on October 7th, 2014. Marit Mazzetti gave an overview presentation of IMPACTS. Marie Bysveen also from SINTEF gave an overview of the EERA CCS project. Then all the work packages gave a presentation Jacob Stang from SINTEF represented WP1 talking about impact of impurities in CO₂ transport. And Sebastian Fischer from GFZ showed results from the important CO₂/N₂ injection experiments at Ketzin.

Filip Neele presented the work to be performed in WP3 as that has just now started. There was great interest in the techno economic assessment and the tools that are under development in WP3. The techno-economic tool aims to study the relation between CO₂ quality and the cost of constructing and operating a CCS system (including capture, transport and storage).

There was also a very interesting guest lecture by Rebecca Hollins from CO₂ Global, USA. As Texas has the longest experience with operating CO₂ pipelines in the world, it was interesting to learn from the US Experience of impact of impurities in CO₂ pipelines.

The US has an extensive network of CO₂ pipelines as can be seen from the picture from Dr. Hollis's presentation shown below. The US pipelines are regulated by the US Department of Transportation. The CO₂ pipelines are not hazardous. A 90% molar purity is required for supercritical. Pressure rating is 2-3000 psig, about 3 times that of natural gas pipelines.

The standard in the US has been CO₂ for use in EOR. The CO₂ quality is therefore all about corrosion and MMP (Minimum Miscibility Pressure) which impacts total oil recovered and project valuation. The CO₂ is set to 95% purity. The nitrogen is limited to 4 % as it usually has a detrimental impact on MMP depending on reservoir depth and conditions.

Oxygen is set at 10 ppm max. It is a major concern for the field operator. It needs to be better evaluated to assess impact on both the reservoir and sub-surface corrosion/metallurgy. There is a H₂S requirement set at 10-200ppm (max.). It is a safety issue. It can be re-injected however.

Points brought up for further consideration was:

- *There is extensive experience with CO₂ for EOR, however there is little compatibility with this and the requirements for storage in Deep Saline Formations (DSF)
 - *DSF is more related to criteria for environment and safe drinking water**
- *There also remains challenges for defining CO₂ quality criteria with various capture technologies that require differing downstream CO₂ processing and clean-up.*

Overall it was an interesting workshop with great interaction and discussions among the participants.



IMPACTS Information workshop, GHGT12

CO₂ Quality – The Typical U.S. Standard
CO₂-EOR quality is all about MMP and corrosion

Attribute	Typical Standard	Reason
Carbon Dioxide (CO ₂)	95% (min)	CO ₂ is critical for the reservoir Minimum Miscibility Pressure (MMP) – impacts total oil recovered and project valuation
Nitrogen (N ₂)	4% (max)	N ₂ usually has a detrimental impact on MMP depending on reservoir depth and conditions
Hydrocarbons (HC)	5% (max)	Again MMP considerations. Typically C ₁₄ is detrimental; however C ₂₊ can also improve performance w/rt. recovered oil
Water (H ₂ O)	480 mg/Nm ³ (max)	Reacts with CO ₂ to form carbonic acid. Mainly a concern for well-bore integrity
Oxygen (O ₂)	10 ppm (max)	O ₂ is a major concern for the field operator. Needs to be better evaluated to assess impact on both the reservoir and sub-surface corrosion/metallurgy
Hydrogen Sulfide (H ₂ S)	10 – 200 ppm (max)	H ₂ S is mainly a safety issue. Often occurs in the recycled CO ₂ (termed "sour gas"). Can be re-injected
Glycol	0.04 ml/Nm ³ (max)	Triethylene glycol (TEG) is most common dehydration process in oilfield operation
Temperature	65 °C (max)	Material integrity

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Summary of the US Standard for CO₂ Quality by Rebecca Hollins, Clean Energy Systems, USA

Impacts Informational Workshop Programme

14:15-14:30: Welcome and Introduction to the IMPACTS project

Marit Mazzetti, SINTEF

14:30-14:40: The EERA CCS project

Marie Bysveen, SINTEF

14:40-15:00: EOR requirements for CO₂ quality and composition- Experience from US Projects

Rebecca Hollis, Clean Energy Systems

15:00-15:15: Impact of impurities on CO₂ transport

Jacob Stang, SINTEF

15:15-15:30: Results from CO₂/N₂ injection experiment

Sebastian Fischer, GFZ

15:30-15:45 Techno-economic evaluation in Impacts

Filip Neele, TNO

15:45-15:55: Discussion and Wrap-Up