

**Carbon Sequestration Leadership Forum**

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# **Final Report of the Task Force on Technical Challenges for Conversion of CO<sub>2</sub>-EOR to CCS**

Stefan Bachu, Canada, Task Force Chair

Technical Group Meeting, Washington, D.C., USA, November 5, 2013



## Origin of the Task Force

- At the CSLF Ministerial Meeting in Beijing, P.R. China, in September 2011, the CSLF Charter was amended to include CO<sub>2</sub> Utilization Technologies (the “U” in CCUS)
- On the Storage side, CO<sub>2</sub> utilization means
  - In enhanced oil recovery – **proven technology! – the objective of this Task Force**
  - In other enhanced energy recovery operations (gas, coalbed methane, shale gas and oil, geothermal) – unproven and/or untested technology
- Other forms of utilization are reviewed by another task force



## **Task Force Mandate**

- **“Review, compile and report on technical challenges that may constitute a barrier to the broad use of CO<sub>2</sub> for EOR and to the conversion of CO<sub>2</sub>-EOR operations to CCS operations”**
- **Economic and policy barriers are outside the scope of the Task Force, as these are policy matters and belong to the Policy Group**



# **Task Force Membership**

- **Canada (Chair):**     **Dr. Stefan Bachu**
- **Brazil**               **Paulo Roberto da Motta Pires**
- **China**                **Dr. Mingyuan Li**
- **Mexico**             **Dr. Francisco Guzmán**
- **Norway**             **Lars Ingolf Eide, P. Eng.**
- **Saudi Arabia**       **Dr. Ahmed Al Eidan**
- **United States**      **Stephen L. Melzer, P. Eng., Mark Ackiewicz**



# Existing CO<sub>2</sub>-EOR Projects

## ➤ Miscible CO<sub>2</sub>-EOR Projects:

112 in the United States, 5 in Canada, 3 in China, 1 in Brazil, and 1 acid gas – EOR in Canada (70% CO<sub>2</sub> and 30% H<sub>2</sub>S), for a total of 122 projects

## ➤ Immiscible CO<sub>2</sub>-EOR Projects:

6 in the United States, 5 in Trinidad, 1 in China, 1 in Brazil and 1 in Turkey, for a total of 14 projects

Total number of CO<sub>2</sub>-EOR projects worldwide: 136 (87% in the US)

- **Only one CO<sub>2</sub>-EOR operation is a recognized CCS operation!**
- **Why there is only one CO<sub>2</sub>-EOR – CCS project, are there technological barriers to deployment?**



## Report Outline

1. Executive Summary
2. Introduction (Task Force mandate, scope and objective of the report, existing CO<sub>2</sub>-EOR/CCS operations)
3. Characteristics of CO<sub>2</sub>-EOR operations (objectives, suitability, operational aspects, monitoring & surveillance, regulatory requirements)
4. Characteristics of CO<sub>2</sub> storage operations (objectives, suitability, operational aspects, monitoring & surveillance, regulatory requirements)
5. Transitioning from CO<sub>2</sub>-EOR to CCS (commonalities and differences, operational scenarios, storage integrity, monitoring and regulatory requirements)
6. Summary and Conclusions, including recommendations



## Key Findings - 1

- There is sufficient operational and regulatory experience for this technology to be considered as being mature, with an associated CO<sub>2</sub> storage rate of the purchased CO<sub>2</sub> greater than 90%.
- The main reason CO<sub>2</sub>-EOR is not applied on a large scale outside west Texas in the United States is the unavailability of high-purity CO<sub>2</sub> in the amounts and at the cost needed for this technology to be deployed on a large scale.
- The absence of infrastructure to both capture the CO<sub>2</sub> and transport it from CO<sub>2</sub> sources to oil fields suitable for CO<sub>2</sub>-EOR is also a key reason for the lack of large scale deployment of CO<sub>2</sub>-EOR.



## Key Findings - 2

- There are a number of commonalities between CO<sub>2</sub>-EOR and pure CO<sub>2</sub> storage operations, both at the operational and regulatory levels, which create a good basis for transitioning from CO<sub>2</sub>-EOR to CO<sub>2</sub> storage in oil fields.
- There are no specific technological barriers or challenges *per se* in transitioning and converting a pure CO<sub>2</sub>-EOR operation into a CO<sub>2</sub> storage operation. The main differences between the two types of operations stem from legal, regulatory and economic differences between the two.
- A challenge for CO<sub>2</sub>-EOR operations which may, in the future, convert to CO<sub>2</sub> storage operations is the lack of baseline data for monitoring.





# Message to the Policy Group

**In order to facilitate the transition of a pure CO<sub>2</sub>-EOR operation to CO<sub>2</sub> storage, operators and policy makers have to address a series of legal, regulatory and economic issues in the absence of which this transition can not take place**



# Policy Issues in CO<sub>2</sub>-EOR Transition to CCS

1. Policy and regulatory framework for CO<sub>2</sub> storage in oil reservoirs, including incidental and transitioned storage CO<sub>2</sub>-EOR operations
2. Tenure and permitting of CO<sub>2</sub>-EOR operations transitioning to CO<sub>2</sub> storage operations under mineral/oil & gas legislation or under CCS legislation.
3. Long-term liability for CO<sub>2</sub> storage in CO<sub>2</sub>-EOR operations that have transitioned to CO<sub>2</sub> storage
4. Monitoring and well status requirements for oil and gas reservoirs, particularly for CO<sub>2</sub>-EOR, including baseline conditions for CO<sub>2</sub> storage
5. Jurisdictional responsibility for pure CO<sub>2</sub> storage in oil and gas reservoirs:
  - a) In regard to national-subnational jurisdiction in federal countries, and
  - b) Organizational jurisdiction (environment versus development ministries/departments).



## Future

- The Technical Group Task Force has accomplished its mandate and, therefore, will cease to exist as of the end of this meeting
- The Task Force may write a journal paper for the International Journal of Greenhouse Gas Control, for wider dissemination
- It is suggested that the Policy Group establish a Task Force to examine and address the issues identified by this Task Force, namely:

### **“Policy, Legal and Regulatory Challenges in the Transitioning from CO<sub>2</sub>-EOR to CCS”**

- Some members of this Task Force may/should participate in the Policy Task Force, if established

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# Questions and Comments?

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