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Monitoring of CO2 Storage for the Meota East Carbon Capture and Storage Project

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Outline



1. Introduction and History
2. MMV (Measurement Monitoring and Verification) Process
3. MMV Plan
4. Current Status
5. Summary

Project Overview and Scope

The most practical approach for significantly reducing Strathcona's CO₂ emissions in the near term is Carbon Capture and Sequestration (CCS).

- Reduce CO₂ emissions from 30,000 bbl/d of thermal oil production across our four Saskatchewan SAGD facilities
- Use three wells to store 1.1 MM tonnes/year of CO₂
- Sequestered in a local, deep saline aquifer
- Strathcona will be the first to materially reduce emissions from thermal oil production
- Meota East CCS will be the first of these projects

Project Timelines



- Nov. 2019 Serafina started technology evaluation and site selection process
- Aug-Sep 2021 drilled two wells, sampled and tested extensively, fully cored one well
- Conducted G&G, Laboratory, Reservoir, Geochemical, Fault Reactivation, Geomechanics, Hydrogeology and MMV studies
- Aug. 2022 Serafina is acquired by Strathcona Resources Ltd.
- ✓ Mar. 2023 submit, Oct. 2023 receive subsurface Regulatory Approval
- ✓ Jul. 2024 received \$1 Billion partnership commitment from Canada Growth Fund towards our CCS projects in Saskatchewan and Alberta: 1st project is Meota East CCS
- Current: FEED followed by detailed engineering and design

Well Data Acquisition

Extensive testing and data gathering program :

- Sidewall Core: 15 plugs in caprocks
- Conventional Core: 230.5 m of core - reservoir and caprock
- 59 caprock samples have been preserved @ wellhead
- Pressurized bottom hole fluid samples and P&T data
- 6 Mini-frac tests
- Injection, fall off, pressure interference (Vert & Hz) tests

Caprock Integrity



Critical for success in any CCS project :

- High resolution 3D seismic
- Sonic and image logs
- Core caprock, preserve at wellhead, lab analysis including capillary threshold pressure, rock strength, etc.
- Mini-frac tests in caprock and reservoir
 - Analytical study of capillary and mechanical integrity failure, fault reactivation
 - Coupled numerical geomechanical modelling

MMV Program Development

- Review & develop best practices based on 4 Western Canadian projects:
Shell Quest, SaskPower Boundary Dam, White Cap Weyburn, Enhance Energy Clive
- Completed a comprehensive Risk Assessment Study following Canadian Standards Association Z741-12 “Geological Storage of Carbon Dioxide”
- Bow Tie Method
- Identified monitoring tasks and “long list” of potential technologies for each exposure pathway identified in the Risk Assessment and created a “short list”
- Initiated baseline to collect sufficient information for future phases
- Living document: finalize the list of technologies and schedule

Existing Wells



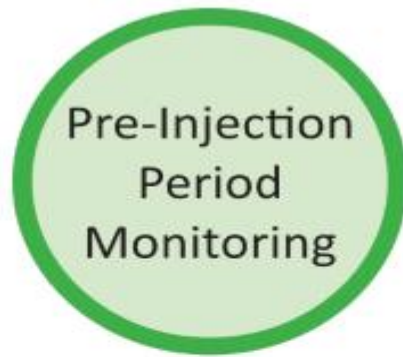
- Two appraisal wells were drilled (suspended)
- Plan to use both wells as in zone observation wells
- Both wells will be abandoned after CO2 arrival with cement plug across and above storage complex
- Future observation wells will be drilled to just above storage complex with DAS, DTS, etc.

Future Injection Wells



- Downhole pressure & temperature measurements
- Injection through tubing, zone isolated by packer
- CO2 compatible: metallurgy, casing connections, cement
- DAS, DTS

Monitoring Periods



- Period prior to onset of injection
- Project vulnerabilities to be identified
- Mitigation solutions to be proposed
- Monitoring tasks to be defined
- Baseline monitoring data to be acquired



- Operational period, including pilot injection tests
- Implementation of monitoring tasks to manage containment risks and storage injection performance
- Monitoring practices to be evaluated and adapted throughout to ensure they continue to be appropriate and effective



- Monitoring activities to provide sufficient information for managing containment risk, determining whether conformance with predictions has been attained, and for demonstrating the long-term integrity of the storage complex

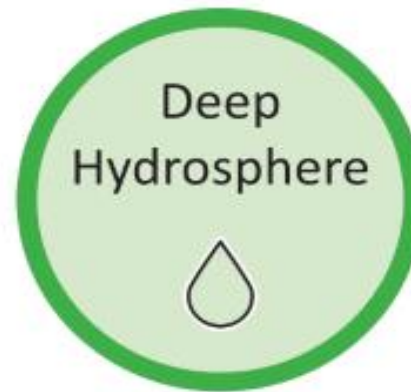


- Limited monitoring, as required, to verify that the storage complex is performing as predicted
- Eventually, to demonstrate that the containment risk has been reduced to a level where the need for further monitoring is eliminated

Monitoring Spheres



The deep subsurface domain comprising the stratigraphy of the entire storage complex, from the top of the Prairie Evaporite to the base of the Basal Sandstone Unit



The subsurface domain below the BGWP consisting of saline waters with concentrations of TDS greater than 3000 mg/l, i.e., unfit for human consumption, and the lower limit of being acceptable for agricultural purposes as defined by the Saskatchewan Government



The regions of the near-surface and surface of the earth extending downwards to the depth of the BGWP, consisting of groundwaters suitable for drinking or agricultural use, and/or regions occupied by living organisms



The local gaseous environmental domain above the ground surface within the limits of the study area surrounding the CO₂ storage site.

Atmosphere, Hydrosphere, Biosphere Monitoring



CO2 Plume (15 years injection + 35 years shut in)

- CO2 plume radius < 2.5 km after 50 years
- Monitoring area adds a buffer of ~1 section = 4 km radius

Baseline Surface Monitoring

Establish a baseline for at least 2 years in monitoring area

- 12 groundwater wells
- 6 soil vapour probe locations
- Atmospheric eddy covariant analysis
- InSAR satellite ground level monitoring
- LiDAR base line

Baseline Subsurface Monitoring



A partial list:

- 3D Seismic
- Reservoir Pressure
- Reservoir Temperature
- CO2 arrival
- DTS (stops above caprock)
- DAS (stops above caprock)
- VSP

Summary



- Meota East will be the first of its kind in the world to capture CO₂ at commercial scale (200K tonne/y) from a thermal oil facility
- Our best assurance for safe storage:
 - ✓ 6 (8) cap rocks above the storage zone(s)
 - ✓ Very large margin of safety for caprock integrity
 - ✓ Injection and deep observation well design
- Surface and subsurface monitoring for containment and conformance for verification



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