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Weyburn-Midale CO_2 Project

Best Practices Manual

[illegible] Weyburn-Midale [illegible] understanding of CO_2 geological storage [illegible] data set in the world.

The Best Practices Manual will guide all aspects of future CO_2 geological storage projects including:

Technical Components

- Site Characterization
- Monitoring and Verification
- Wellbore Integrity
- Performance Assessment

Policy Components

- Regulatory Issues
- Public Communication and Outreach
- Business Environment

Industry Participation Key to Success

Continued funding from industry partners will result in scientific and policy/regulatory guidance for CO_2 geological storage projects anywhere they are being considered.

Cost to Buy In

Participation in this 4-year multi-million dollar project secures access to world-leading results and produces tremendous leverage regarding all aspects of CO_2 geological storage.

$200,000 one-time fee for new members. Includes full access to previous reports and databases.

$100,000 per year active membership cost.

"Phase I of the IEA Weyburn Project subjected EnCana's Weyburn Project to a world-class, independent external audit of our storage operation."

Gerry Protti, Executive Vice-President
EnCana

"Technology offers great promise to significantly reduce [greenhouse gas] emissions - especially carbon capture, storage and sequestration technologies."

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Internationally recognized leader

in CO_2 geological storage research

Research from the Weyburn-Midale CO_2 Project, conducted in the world's largest natural laboratory, is leading the global development of CO_2 geological storage as an economically viable climate change strategy.

Key Contacts:

The Project Integrator, on behalf of the Leading Sponsors, will ensure integration between the Project's Technical and Policy Research activities. For more information, please contact:

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"Partnering with the PTRC allows Apache to stay focused on our core business, leveraging the research and knowledge this not-for-profit organization has amassed in the area of CO_2 geological storage."

Paul Griffith, Manager
Apache Corporation

IEA GHG WEYBURN-MIDALE CO_2 MONITORING AND STORAGE PROJECT

World's First CO_2 Measurement, Monitoring & Verification Initiative

"The continued success of this Project will have incredible implications for reducing CO_2 emissions throughout the world."

John Gale, International Energy Agency
Greenhouse Gas R&D Programme

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IEA GHG WEYBURN-MIDALE CO_2 MONITORING AND STORAGE PROJECT

Recognized and endorsed by:

- The International Energy Agency Greenhouse Gas R&D Programme (ensuring technical excellence)
- The Carbon Sequestration Leadership Forum (ensuring sound policy and regulation development)

Launched in 2000, this 8-year, $80 million initiative studies carbon dioxide (CO_2) injection and storage underground in depleted oil fields.

World's Largest Natural Laboratory

The Weyburn-Midale CO_2 Project is operated in conjunction with two billion-dollar commercial CO_2 floods in Saskatchewan, Canada, where huge volumes of the gas are injected to revive oil production.

- More than 7 million tonnes of CO_2 have been injected and stored to-date
- Phase 1 (2000-2004) results indicate the natural geological setting is highly suitable for long-term CO_2 storage

Addressing Climate Change

The effects of climate change are becoming all too evident. That's why it is crucial to validate the potential of CO_2 geological storage technology to reduce global atmospheric greenhouse gas concentrations right now.

- In one oilfield alone, the Weyburn CO_2 flood operated by EnCana will store 30 million tonnes of CO_2
  - Equivalent to removing 6.8 million cars off the road for a year
- 10,000 billion tonnes* of CO_2 could potentially be kept out of the atmosphere if the technology proven in this project is applied on a worldwide scale
  - That's like eliminating 425 years of global CO_2 emissions

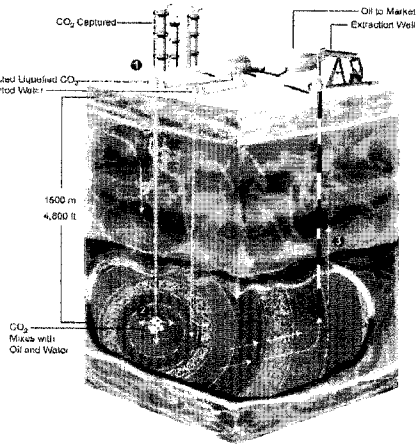
* Intergovernmental Panel on Climate Change (includes saline aquifer storage potentials)

Profit Boosting Technology

The Weyburn-Midale CO_2 Project is applying a rigorous scientific approach to the injection and storage of CO_2 from industrial sources - *a technique that's proving to be good for both the environment and the bottom line.*

- 18,000 incremental barrels of oil per day produced in EnCana's Weyburn field as a direct result of CO_2 injection
  - 60 % increase in oil production
  - 155 million incremental barrels of oil expected by end of CO_2 flood
- Apache's Midale field is also anticipating an increase in production as their CO_2 flood gets underway
- 3.8 billion incremental barrels of oil potential in western Canada using CO_2 injection technology
  - The worldwide potential: huge

How Does Enhanced Oil Recovery by CO_2 Injection Work?



1) CO_2 is injected, along with water, deep underground (1,500 metres at the Weyburn field) into a depleted oil field. The CO_2 used at Weyburn and Midale comes from the Dakota Gasification Plant in Beulah, North Dakota. There, the gas is captured after coal gasification (rather than vented to the atmosphere), liquefied by compression and pipelined 320 km north to the oil fields. It is the first man-made source of CO_2 being used for enhanced oil recovery.

2) In an operating strategy that alternates gas and water injection, CO_2 injection increases reservoir pressure and oil fluidity, enabling oil to escape from rock pores and flow more readily toward production wells.

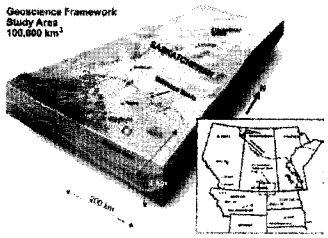
3) Much of the injected CO_2 is pumped to the surface together with oil and water, then separated and re-injected. At the end of the enhanced oil recovery period, virtually all injected and recycled CO_2 is permanently stored.

"The Weyburn-Midale Project will provide policymakers, the energy industry, and the general public with reliable information about industrial carbon sequestration and enhanced oil recovery."

Samuel Bodman, Secretary of Energy
United States of America

Final Phase* (2005-2009)

An integrated approach between technical and non-technical research will bring the Weyburn-Midale CO_2 Project's Final Phase to a successful conclusion.



Extensive historical field and well datasets make EnCana's Weyburn field and Apache's Midale field, located in southeast Saskatchewan, Canada, ideal natural laboratories for CO_2 geological storage research.

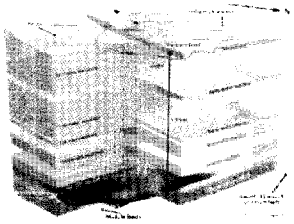
4 Technical Themes

Theme 1: Site Characterization

Develop a model protocol for selection of suitable CO_2 geological storage sites, incorporating learnings from Phase 1 to develop more universal guidelines.

Theme 2: Wellbore Integrity

Increase knowledge and assessment of risks associated with leakage from abandoned wells caused by material and cement degradation.



A 3D geological model has been constructed from ~1000 wells for an area extending 10 km beyond the limits of the Weyburn field CO_2 injection area.

Business Environment

Work with key stakeholders and policymakers to influence the development of a large, economic, anthropogenic CO_2 supply and infrastructure, along with a mechanism for monetizing credits for CO_2 geological storage.

Theme 3: Monitoring and Verification

Assess techniques to quantify CO_2 volume and distribution.

Theme 4: Performance Assessment

Build a reliable integrated simulation model (incorporating hydrogeological-geochemical-geomechanical techniques) to predict long-term storage performance accurately, and develop reliable probabilistic methods for predicting leakage rates from storage sites.

Policy Research

Regulatory Issues

Engage key regulatory bodies and stakeholders to identify and address any enhancements to existing regulatory frameworks necessary to ensure long term safety and security of geologically stored CO_2.

Public Communications and Outreach

With key stakeholders, develop and deliver a communications strategy based on the Weyburn-Midale experience and other major international projects to ensure a more common understanding of CO_2 geological storage and associated issues.

* Final Phase project deliverables subject to change