

Southwest Regional Partnership for Carbon Sequestration

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ABSTRACT

The Southwest Partnership Region includes five states (Arizona, Colorado, New Mexico, Oklahoma, Utah) and contiguous areas from three adjacent states (west Texas, south Wyoming, and west Kansas). This energy-rich region exhibits some of the largest growth rates in the nation, and it contains two major CO₂ pipeline networks that presently tap natural subsurface CO₂ reservoirs for enhanced oil recovery at a rate of 30 million tons per year. The ten largest coal-fired power plants in the region produce 50% (140 million tons CO₂/y) of the total CO₂ from power-plant fossil fuel combustion, with power plant emissions close to half the total CO₂ emissions.

The Southwest Regional Partnership comprises a large, diverse group of expert organizations and individuals specializing in carbon sequestration science and engineering, as well as public policy and outreach. These partners include 21 state government agencies and universities, the five major electric utility industries, seven oil, gas and coal companies, three federal agencies, the Navajo Nation, several NGOs including the Western Governors Association, and data sharing agreements with four other surrounding states.

The Partnership is developing action plans for possible Phase II carbon sequestration pilot tests in the region, as well as the non-technical aspects necessary for developing and carrying out these pilot tests. The establishment of a website network to facilitate data storage and information sharing, decision-making, and future management of carbon sequestration in the region is a priority. The Southwest Partnership's approach includes (1) dissemination of existing regulatory/permitting requirements, (2) assessing and initiating public acceptance of possible sequestration approaches, and (3) evaluation and ranking of the most appropriate sequestration technologies for capture and storage of CO₂ in the Southwest Region. The Partnership will also identify potential gaps in monitoring and verification approaches needed to validate long-term storage efforts.

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INTRODUCTION

The Southwest Partnership consists of many partners, as tabulated in Table 1.

<i>Table 1: Partners in the Southwest Partnership</i>	
<p><i>State Partners</i></p> <p><i>Arizona Universities & Government</i> Arizona Geological Survey Arizona State University</p> <p><i>Colorado Universities & Government</i> Colorado Geological Survey Colorado State University</p> <p><i>New Mexico Universities & Government</i> New Mexico Oil Cons. Division New Mex. Bureau of Geology New Mexico Envir. Department NM Inst. of Mining and Technology New Mexico State University Dine College (Navajo Nation)</p> <p><i>Oklahoma Universities & Government</i> Oklahoma Geological Survey University of Oklahoma Oklahoma State University Sarkey's Energy Center</p> <p><i>Texas</i> Texas Bureau of Economic Geology Texas A&M</p> <p><i>Utah Universities & Government</i> Utah Geological Survey University of Utah Utah State University Utah AGRC Utah Division of Air Quality Utah Energy Office Utah Division of Oil Gas & Mining</p>	<p><i>Industry Partners</i></p> <p><u>Power utilities:</u> Tucson Electric Power Oklahoma Gas & Electric Intermountain Power Agency PacifiCorp Public Service Co. of New Mexico (PNM)</p> <p><u>Energy providers (oil, gas, coal):</u> Yates Petroleum, ChevronTexaco Marathon, Occidental Permian ConocoPhillips, Burlington</p> <p><u>Gas infrastructure (CO₂ pipelines):</u> Kinder Morgan</p> <p><i>U.S. Federal Government Partners</i> Los Alamos National Laboratory Sandia National Laboratory U.S. Dept. of Agriculture</p> <p><i>Various Additional Partners</i> Navajo Nation New Mexico Oil and Gas Association Gas Technology Institute Electric Power Research Institute Interstate Oil and Gas Compact Commission Center for Energy and Economic Dev. Advance Resources International Western Governors Association Petroleum Recovery Research Center Waste-management Educ. & Research</p>

The partners spent the first several months laying the groundwork for the Partnership Phase I project, and data were either collected or the best methods for collection determined. The Kickoff Meeting took place in Albuquerque on October 26, 2003, and the Partnership also held its first Outreach Workshop in Salt Lake City on March 26, followed by a Thematic Committee Project Review meeting. Many teleconferences were also held in lieu of in-person meetings (to save costs). A website was established and developed during January 2004: www.southwestcarbonpartnership.org. Please access this website for more detailed information.

EXECUTIVE SUMMARY

The Southwest Regional partnership is one of seven partnerships of state agencies, universities, and private companies that form the core of a nationwide network to help determine the best approaches for capturing and permanently storing gases that can contribute to global climate change. The Southwest Regional Partnership aims to provide the U.S. with prime regional candidate options for pilot testing of carbon sequestration technologies in the Southwest. A critical objective within these goals is to identify gaps in technology, regulatory permitting, and monitoring/verification protocols. The group will identify the most promising sequestration technologies for the region, and explicit action plans for carrying out the most promising pilot tests (Phase II) in the Southwest Region. The ultimate goal of the Partnership is to identify future large-scale carbon sequestration demonstration and deployment opportunities possible after conclusion of the Regional Partnership programs.

In the first reporting period, the Partnership has established the groundwork to proceed with its objectives. A website is now established, whose “partners-only” section includes meeting schedules, downloads, instructions, and a bimonthly newsletter. Data collection has either begun, or the best method for collecting data selected in several areas. The Partnership also held its first Outreach Workshop in Salt Lake City on March 26, followed by a Thematic Committee Project Review meeting.

EXPERIMENTAL

No experiments are associated with this project.

RESULTS AND DISCUSSION

Progress for this reporting period has been broken down by working groups, which span a number of organizations and institutions. These will have contributed to more than one group. In other words, the progress of each working group has been implemented by a number of entities in many cases.

Infra/Sep/Cap/Pt Sources (GTI)

GTI developed a spreadsheet with information on >400 gas treating plants and >1000 gas processing plants in the SW region. Where known, the tabulated information includes the Operator, State and County, flow rate of natural gas, concentration of CO₂, plant name, contact phone number, owners and other information. This was transmitted to NMIMT for posting on the partnership ftp site or other appropriate dissemination.

GTI has reviewed the Integrated Environmental Control Model developed by Carnegie Mellon University with DOE funding for application to this project. It should be useful for determining CO₂ capture costs from coal fired power plants in the region. DOE, in the February 6 conference call, has indicated they will be providing additional economic guidelines for capture costs to be used in the project.

Sinks and Distributed Sources (Texas A&M)

Terrestrial carbon sequestration in the semi-arid and arid environments of the Southwest Regional Partnership project area, which includes Arizona, Colorado, New Mexico, Oklahoma, Utah, and parts of Kansas, Nevada, Texas, and Wyoming presents a complex mix of sites that range from those with no potential for sequestration regardless of human input to those areas that can either reduce losses or actually increase sequestration

through improved management practices. To address this complexity in the terrestrial component, an extensive GIS approach is being used to first define those areas where there is no potential for intervention, and then to define those areas where carbon losses can be controlled (erosion management) or sequestered (soils and vegetation management). The following spatial data sources have been acquired: 1) historical 0.1 degree weather data (1948-present) from NOAA, 2) soils attributes for USDA-NRCS STATSGO and SSURGO soil databases, and 3) land cover analysis from USGS. We are in the process of acquiring and staging the new MODIS NPP imagery to assess the spatial distribution of aboveground carbon in the study region. In addition, over 700 literature sources have been acquired to help establish carbon relationships relative to climate, vegetation, NPP, and management practices. A protocol has been developed, using spatial stratification of the acquired data, that will identify those regions where human intervention can alleviate carbon losses through erosion management or enhance carbon through conservation practices such as revegetation, grazing management or vegetation control. Using threshold spatial characterization techniques, we can identify areas where various best management practices can be applied. A series of assumptions relative to the relationship between cover type, soil carbon, climate and net primary production will be established with the partnership collaborators to help classify the relative potential to save or increase current carbon stocks in the region. Coordination of the classification of landscape potentials and best management practices with the geologic component is being pursued to insure that terrestrial carbon stocks are represented in the totality of the analysis being pursued by the partnership.

Sinks and Distributed Sources (all state entities and national laboratories)

The Sinks and Distributed Sources Thematic Committee has been organized into three subgroups: Mineralization Engineering, Terrestrial Sinks and Distributed Sources, and Geologic Sinks subgroups..

The Mineralization Engineering subgroup. Consensus on an abstract for an overview paper for the NETL Third Annual Conference on Carbon Sequestration was obtained and

the abstract was submitted. They are in the process of organizing their initial subgroup teleconference. Data needs for this group are somewhat similar to those for saline aquifer sequestration (below) and are not anticipated to cause difficulties.

The Terrestrial Sinks and Distributed Sources subgroup has also submitted an abstract for the NETL conference and is also organizing their initial subgroup teleconference.

The Geologic Sinks subgroup has had by far the most attention due to the large number of potential sinks that are available in the region. Defining appropriate data collection resolution and data fields to collect have dominated the conversations between members thus far.

Data Collection: Each state will be defining their own data collection strategy due to the wide variation among the states of what data is publicly available and what size of sink keeps the amount of data to be collected “reasonable” within the constraints of the allotted budget. The highest resolution that the Integrated Model can handle was stated as approximately equivalent to a county and thus, “field” was suggested as the highest resolution for data collection. Within each state, this resolution has been further refined as appropriate. A database design for data collection has been developed by the Utah Geological Survey. The basis for the design was the DOE GASIS database, a database developed for gas field data. The design has added data elements for oil field, coalbed methane field and saline aquifer parameters and now has more than 250 individual data elements per field. The database is in MicroSoft Access format and distribution to the states is imminent. Each state will use the database to collect data for distribution to the Utah AGRC for implementation into the regional GIS/database.

Actual data collection, evaluation and submission to Utah AGRC for implementation into the regional GIS/database is the primary task set for the next reporting period. Plans are also evolving as to how to use the collected data in the integrated model and how to evaluate sink options consistently. In addition, evaluation of how to evaluate and imple-

ment risks and ancillary benefits from sequestration into the integrated model will be areas of discussion.

Sinks and Distributed Sources (AZ)

- Completed initial overview of potential geologic sinks for CO₂ sequestration in Arizona. Sent list to the Geologic Sink Committee.
- Finished learning basics of Arc View to start digitizing oil and gas well locations into a GIS shape file at a scale of 1:24,000.
- Purchased scanner and scanned 700 well logs into raster digital images.
- Completed initial review of database structure and input screens being prepared by AGRC of Utah.

Sinks (Utah Geological Survey)

- Reviewed existing databases on Utah's oil, gas and coal occurrences. Found the DOE-supported GASIS (Gas Information System) database provided a starting point for assembling information about potential geologic CO₂ sinks. This database incorporates information from the Rocky Mountain Gas Atlas, and is already populated with a considerable amount of relevant data.
- Imported the GASIS database in to Access and began adding data fields based on discussion with others in the Partnership on the gaps in critical data. Approximately 250 data fields are now present, and this database is being distributed to those involved in the Geologic Sinks Theme.
- Reviewed the scope of data entry for Utah; Utah has 66 oil fields and 24 gas fields, 12 coal field and 12 deep saline structures that will be entered for initial screening of "options and opportunities" as specified by the solicitation. A cutoff of 1.5 million barrels oil ultimate recoverable and 8 bcf of gas have been adopted as the thresholds for including in the database as a potential site.
- Contributed to abstract for the Third Annual Conference on Carbon Capture and Sequestration

Sinks and Distributed Sources (Utah State University)

- Contributed to geologic sinks database revisions, concentrating on potential non oil and gas sequestration structures
- Activity on terrestrial sequestration options in Utah has been slow to start, partly due to delays in getting the sub-contracts issued from the office of Sponsored Projects. An evaluation of soil carbon in Utah's agricultural soils using satellite imagery has begun.

Sinks and Distributed Sources (Utah Division of Environmental Quality)

- Work on a review of Utah's present carbon emissions inventory has just begun, in collaboration with Utah Energy Office. The Energy Office completed precise estimates of Utah's historic energy consumption-related greenhouse gas emissions for each fuel in each fossil energy sector, and for each year from 1960-2002.

University of Utah

- Coordinated with AGRC to negotiate and finalize contract for web-site design
- Completed
- Began preparing and circulating web content to theme committee members and NETL
- Began preparation for first mediated modeling workshop to be held in late March
- Work with Colorado Geological Survey to finalize partnership fact sheet
- Regular participation on NETL-sponsored conference calls

Arizona

- Reviewed partnership website and provided input as needed.
- Reviewed current regulatory and permitting requirements for CO₂ injection in Arizona.
- Completed questionnaire for the Regulatory Committee.

Utah Division of Oil Gas and Mining

- Completed initial perspective of Utah's regulatory environment

Integrated Assessment Thematic Committee (SNL)

The Integrated Assessment Thematic Committee is developing a systems-modeling decision framework that will provide a means for comparing alternate carbon sequestration technologies, sequestration sites, and sequestration rates in terms of their environmental risks, monitoring and verification requirements, life-cycle costs, and regulatory and permitting constraints. The modeling framework is being developed in large part through interactions with the other five thematic committees, which are in the process of providing subject matter expertise and data to support the modeling effort.

During the reporting period, members of the committee and the modeling team have participated in teleconferences with other committees to start to develop a common understanding of the scope of committee activities, the data and information needs of each committee, and the process of developing an integrated assessment model. In addition, the integrated assessment modeling team has been working a dynamic simulation framework as the basis of the assessment model, and will initially include characterization of the economic activity and CO₂ emissions of the Southwest Partnership region. Discussions are under way to define the aspects of the initial assessment model that will be presented at the first workshop in March.

Information, GIS / Database Committee

- (1) Contributing Geographic Information System (GIS) data layers characterizing geologic sinks in the Texas Permian Basin and Panhandle.
- (2) Participation in Southwest Regional Sequestration Partnership activities such as meetings and national CO₂ sequestration forums.

- (3) Disseminating outreach materials developed by Southwest Regional Sequestration Partnership or national organizations on the issues and opportunities surrounding CO₂ sequestration.

The major effort is being directed at providing GIS layers characterizing geologic sinks in the Texas Permian Basin and the Panhandle, at a level suitable for decision making and inclusion in the national atlas. Data sets now in preparation and to be completed in May 2004 for the Department of Energy (DOE) funded *Play analysis and digital portfolio of major oil reservoirs in the Permian Basin: application and transfer of advanced geological and engineering technologies for incremental production opportunities* will form the basis of this data set as well as past Texas oil and gas atlases.

Information, GIS / Database Committee (AGRC)

- Coordinated with other theme committees and the modeling and outreach groups on data needs.
- Worked on refining the GIS data model to include specifics based on data requirements and availability.
- Compiled a list of what geologic data each state has.
- Created a basic IMS site to demonstrate some of the general functionality that will be included on the IMS site. Only basic nationwide datasets are included at this time.
- Compiled the available large-scale land ownership layers for each state in the partnership.
- Began process of finding the economic forecast data for the states.

CONCLUSION

In sum, the Southwest Partnership is “on schedule” with respect to major goals and objectives. The following tasks and their current stage/progress are as follows:

- Characterization of sequestration options for the region
 - current stage: intrastate assessments

- Cataloging of applicable regulatory constructs in place
 - current stage: intrastate assessments
- Evaluation of current public opinion and knowledge of sequestration
 - current stage: intrastate assessments
- Open forums and other means to educate public about sequestration
- Cataloging of data / database development
 - current stage: intrastate, interstate (partnership-wide)
and inter-partnership database being developed
- Partnership has begun assessment and ranking of sequestration options
 - current stage: intrastate rankings

REFERENCES

No other documents were referenced in this report.