

Quarterly Report

Grant No. DE-SC-0001761

Report period: From June 30 through September 30, 2011

1) Project activity during this quarter

(a) Planned activities—continued to

1. Develop data archive and resource center
 - Create statewide digital databases for samples and well records for Michigan's geological formations relevant to CO₂ storage, containment and potential for enhanced oil recovery
 - Accumulate data with which to construct maps and tables of physical properties
 - Implement internal data share (intranet) to facilitate compilation of information into a digital atlas
2. Conduct technical research on CO₂ sequestration:
 - Conduct basic and applied research to characterize Michigan saline reservoirs for CO₂ storage potential volume, injectivity and containment
 - Integrate any new data from wells drilled primarily by the oil and gas industry.
3. Acquire data and implement software to conduct geologic and fluid flow modeling to address specific predictive uses of CO₂ storage and enhanced oil recovery, including:
 - Compile data for geological and fluid flow models
 - Formulate models, integrate data, and run the models
 - Apply models to specific predictive uses of CO₂ storage and enhanced oil recovery
4. Conduct technology transfer to members of industry and governmental agencies
 - Establish an Internet Website at which all data, reports and results will be accessible (site usage statistics will be maintained)
 - Introduce MICHCARB programs to industry and government at workshops and individual meetings and public groups

(b) Actual activities: All planned were conducted and good progress was made as described in detail in attachments.

2) Project problems, solutions and changes during the quarter

- For our server/dataset work, we are still addressing a few transitional details concerning software licensing keys and file redirects.
- For our archival work, we are finding that checking all original data against our datasets has proved very useful in correcting significant errors.
- Through meetings with colleagues at other research organizations, we gained insights into different approaches dealing with geomechanical aspects of carbon sequestration.

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Date: October 25, 2011

Please see Attachments

Attachment 1 Report on *Establishing the Resource Center at MGRRE*

- **Developing statewide and site-specific digital research databases—Data added this quarter:**
 - Core analysis data (largely porosity and permeability data)—hand entered from paper records for 73 wells
 - Core gammas scanned for 18 wells and added to our dataset
 - Mudlogs—117 scanned and added to dataset
 - Wireline logs—we focused on organizing, unifying, and documenting our collection of over 100,000 wireline logs. We hope to have this comprehensive listing standardized, formatted and available within the near future.
 - Cuttings—we are reinventorying our oldest cuttings collection, checking internal footages against box footages, checking the dataset against the data itself to correct earlier errors (identification, location, and footages), and bar-coding the boxes. This collection alone consists of 3316 boxes.
 - Core collection--We continue to resolve discrepancies and improve documentation for our core collection while developing guidelines for description and quantification of data.
 - We are incorporating recently donated drillers' reports and scout tickets into our permanent collections.
- **Acquiring Michigan core now archived in Texas**
 - We have again requested the transport of two truckloads of Michigan core from Texas to our facility. We expect to receive those this quarter. We plan to produce reservoir property data from these rocks to evaluate their perspective use in CO2 sequestration.
- **Compiling all information into a digital atlas**

Because our data and sample collections continue to grow and requests to access them are so rapidly increasing, we took several steps to address heavier server loads:

- We doubled the access speed for our data by increasing the capabilities of our new server.
- By increasing RAM from 4 to 16GB, we can now process information four times faster.
- We decreased potential data failure rate from 5% to 0.09%.

We took these steps to increase data storage security:

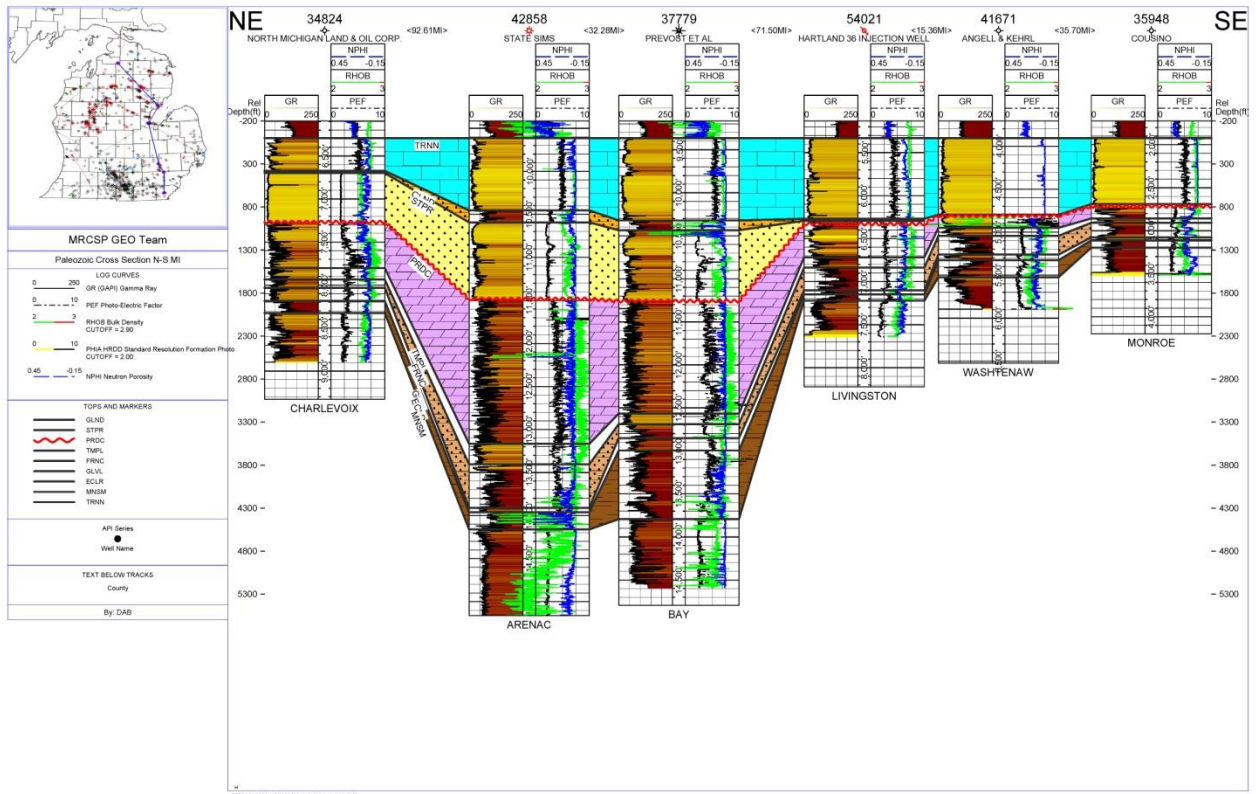
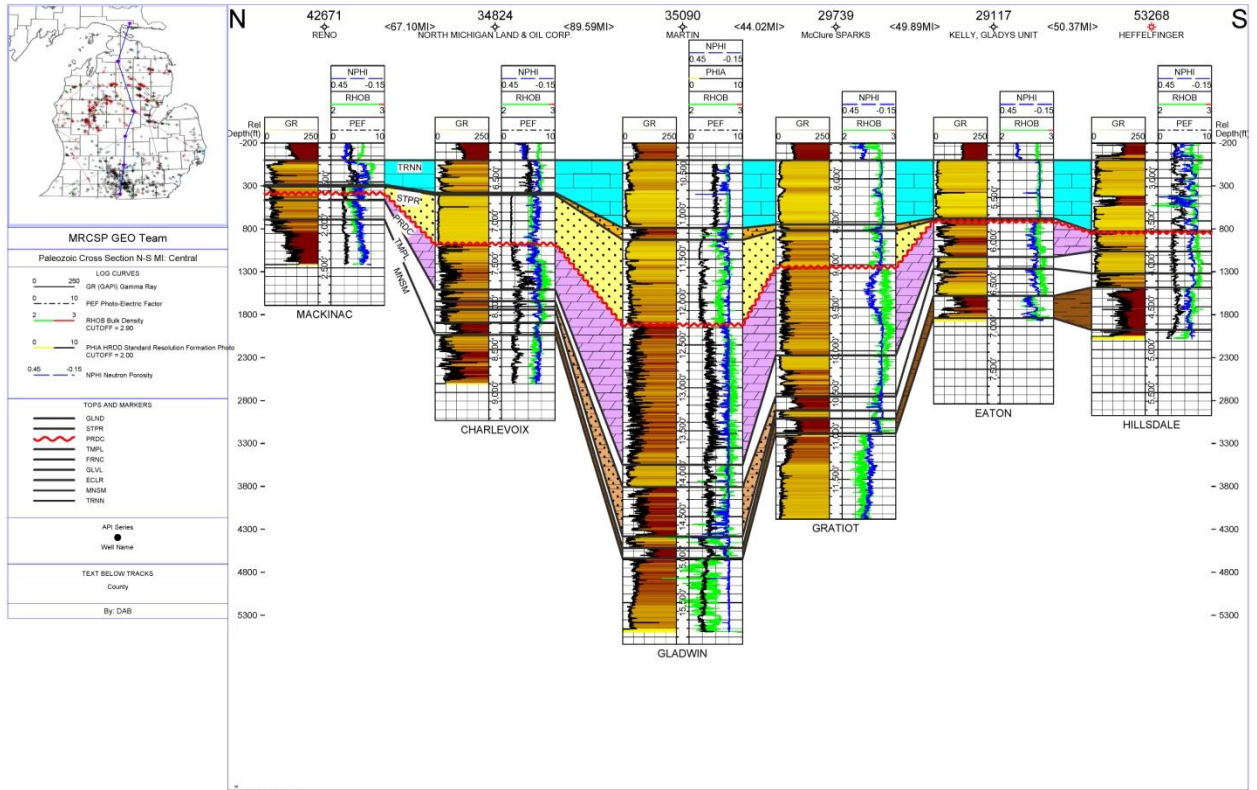
- We have incorporated into our schematics both internal and external backups, with minimum double redundancy throughout and triple redundancy on sensitive data.
- Internal backups are housed for 3 weeks in a fire-proof box. Retention time for remote backups is 30 days.

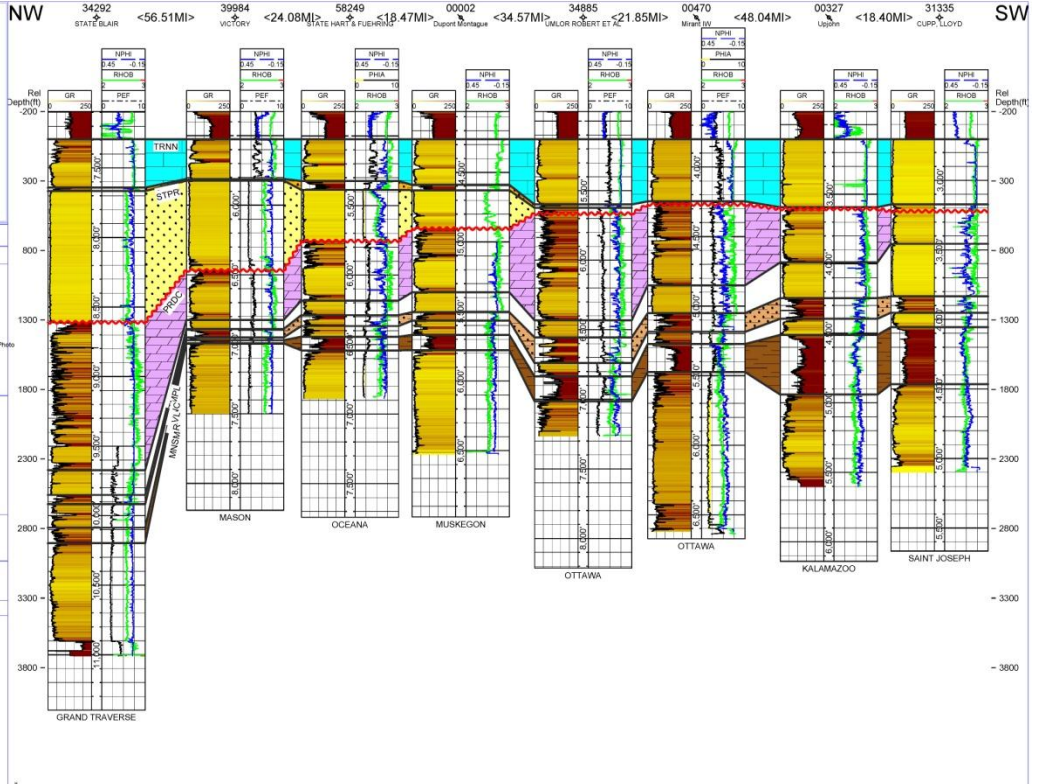
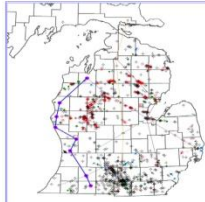
Through these efforts, we have enhanced exponentially our system performance for process-intensive geospatial software.

Attachment 2 Report on Technical Research on CO2 Sequestration and Enhanced Oil Recovery

- Technical Research on CO2 Sequestration
 - Dr. Barnes worked on regional Characterization and Geological Carbon Sequestration Storage Capacity for the Ordovician St. Peter Sandstone formation. He supervised this poster presentation (see also Attachment 4):
[Stratigraphic Controls on Diagenetic Pathways in the St. Peter Sandstone, Michigan Basin: An Investigation into Reservoir Quality Prediction for Carbon Sequestration](#)
 Stephen A. Zdan
 - He also worked on regional geology of the Lower Paleozoic of Michigan and constructed regional cross sections







- Dr. Harrison continues to build a dataset of Michigan oil and gas fields for use in evaluation of their EOR potential. The dataset includes all fields that have produced at least 250,000 bbls of oil during primary production and are at least 2500 feet deep. Also included is information on fields for which some type of secondary or enhanced oil recovery operation has previously been attempted.

Attachment 3 Report on Conducting Geologic and Fluid Flow Modeling

- Dr. Hampton continued to focus on conceptual geologic model formulation, deployment of modeling software, and general guidance and coordination.
 - He met with Dr. Ron Falta at Clemson University, where they discussed Dr. Falta's CO₂ sequestration modeling research utilizing TOUGH2 software.
 - Together with graduate students Amy Manley and Beth VandenBerg, he met with colleagues at the Indiana Geological Survey in Bloomington, Indiana. Meeting with John Rupp, Cristian Medina, Kevin Ellett, Qian Zhang, Richard Lahann, Sally Letsinger and Michael Hamburger, they learned different approaches to dealing geomechanical aspects of carbon sequestration.
 - Dr. Hampton also discussed geomechanical modeling relative to our Mount Simon work with Battelle colleagues Joel Sminchak and Neeraj Gupta, agreeing on timelines for preparing our report.
 - Dr. Hampton also attended a two-day short course in Houston, TX, taught by CMG, Computer Modeling Group, focusing on GEM's preprocessor, BUILDER, and postprocessor, RESULTS.
 - Met with graduate students Amy Manley, Beth VandenBerg, and Tony Clark to discuss course contents and relevance to our work.

Attachment 4 Report on Technology Transfer to Members of Industry and Governmental Agencies and Outreach to the general public

- **Disseminating information about MICHCARB/accelerating the deployment of CC&GS in Michigan**
 - Dr. Barnes attended EPA Region 5 Carbon Sequestration Workshop in Chicago IL
 - Dr. Barnes and Harrison and graduate students Katherine Pollard and Stephen A. Zdan attended the Eastern Section AAPG Meeting in Washington D.C.
 - Dr. Barnes co-Authored a paper for the Eastern Section AAPG meeting: [Geological Controls on Geological Carbon Storage Capacity, Efficiency, and Security in the Middle Devonian Sylvania-Bois Blanc Saline Aquifer, Central Lower Michigan, USA](#)
Farsheed Rock, Katherine Pollard, and David A. Barnes
 - Dr. Barnes also supervised this poster presentation by graduate student Stephen A. Zdan at the Eastern Section AAPG meeting:
[Stratigraphic Controls on Diagenetic Pathways in the St. Peter Sandstone, Michigan Basin: An Investigation into Reservoir Quality Prediction for Carbon Sequestration](#)
Stephen A. Zdan
 - Katherine Pollard gave an oral presentation on the Sequestration potential in the Sylvania/Bois Blanc Formation.
 - Harrison attended a Workshop on Co₂ enhanced oil recovery and had discussions with industry professionals on EOR in Michigan and elsewhere.
- **Outreach to Industry, and the General Public**

- MICHCARB's WebPages received more than 1600 visitors, up from 1300 visitors last quarter. We had 2000 specific requests for data, up from 1400 last quarter.
- We continue to review, revise, update and standardize our on-line datasets. This process is detail intensive and time consuming, but we are making headway.