

Quarterly Report

Grant No. DE-SC-0001761 **Report period:** From September 30, 2011 through December 31, 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: February 29, 2012

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 56 wells
 - Core gammas scanned for 53 wells and added to our dataset
 - Mudlogs—132 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.
 - Core collection--We continue to resolve discrepancies and improve documentation for our core collection while developing guidelines for description and quantification of data. We reinventoried 33 pallets of core this quarter.
 - 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 next quarter. We plan to produce reservoir property data from these rocks to evaluate their perspective use in CO2 sequestration.

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

- Technical Research on CO2 Sequestration

1) Dr. Barnes continued to work on regional Characterization and Geological Carbon Sequestration Storage Capacity for the Ordovician St. Peter Sandstone formation.

2) Dr. Harrison compiled field data from several states for screening potential oil and gas fields as candidates for enhanced recovery using CO2. The first criterion for selection of fields to be evaluated was depth to the top of the reservoir. A depth of 2600 feet or greater was selected so that CO2 would be kept in the supercritical phase and likely be miscible in most reservoir oils. Additionally, only oil fields that have already produced at least 250,000 barrels of oil were considered for this evaluation.

Data was supplied by the Geological Surveys of Kentucky, Michigan, Ohio, Pennsylvania and West Virginia. Michigan Data was derived from records at the Michigan Geological Repository for Research and Education now part of the New Michigan Geological Survey in the Geosciences Department at Western Michigan University and the Michigan Office of Oil Gas and Minerals (formerly the Michigan Geological Survey). Data for all other states was taken from the TORIS database for the Appalachian Basin.

The number of fields evaluated in this project include: 3 from Kentucky, 95 from Michigan, 19 from Ohio, 2 from Pennsylvania and 17 from West Virginia.

In addition to the 95 Michigan fields that have undergone some secondary or enhanced recovery, we have selected approximately 400 additional fields that have produced over 250,000 barrels of oil and may be candidates for enhanced recovery.

Data collected includes: *Field name, Field location, Discovery date, Number of producing wells, Number of dry holes within field area, Active wells, Abandoned wells, Producing formation(s), Lithology, Producing area, Pay thickness,*

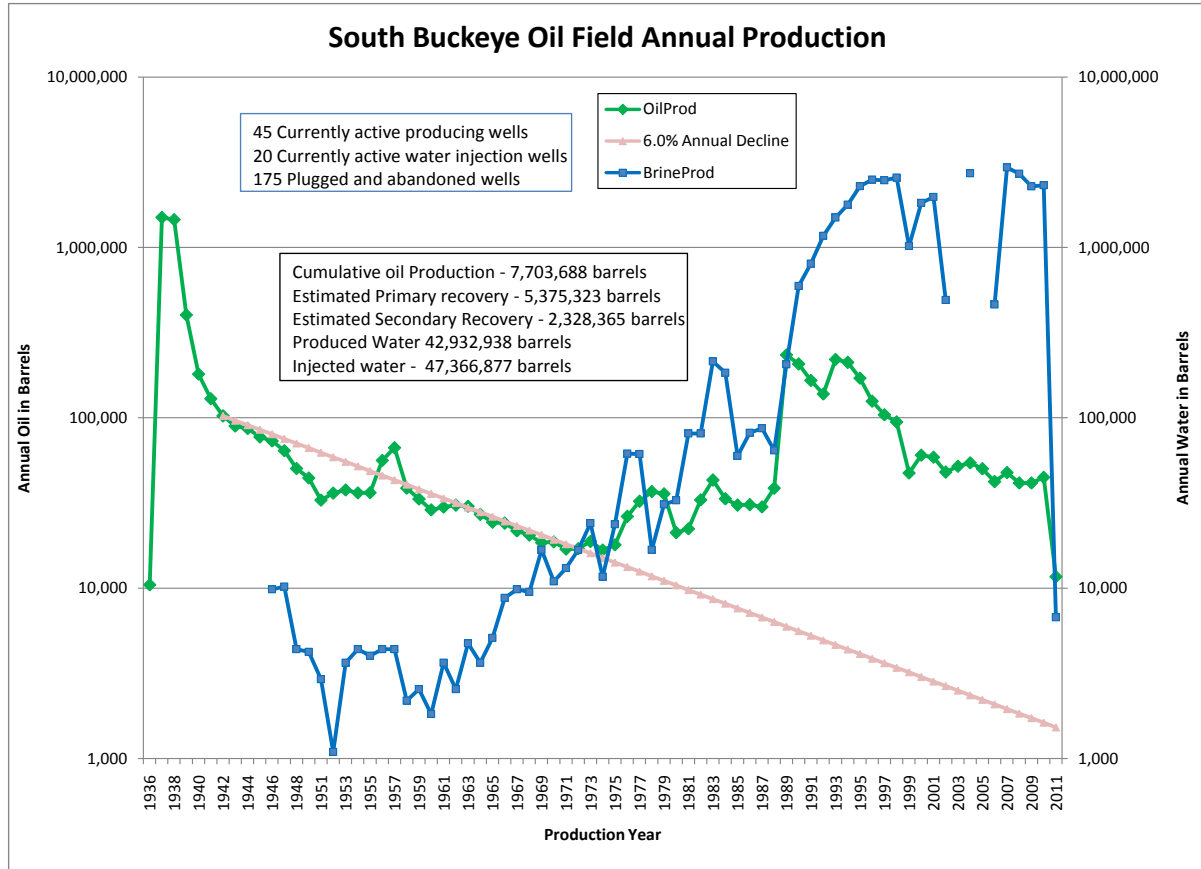
Secondary or enhanced recovery efforts, Cumulative Total oil production, Cumulative primary oil production, Cumulative Total gas production, Cumulative primary gas production, Cumulative water production, Cumulative secondary or enhanced oil production, Cumulative secondary or enhanced gas production, Original oil in place, Original gas in place, Oil recovery factor, Formation volume factor, Initial reservoir pressure, Current reservoir pressure, Reservoir temperature, Initial water saturation, Oil viscosity, Oil API gravity, Average reservoir porosity, Average reservoir permeability.

Average recoveries from fields that have undergone some secondary recovery treatment can be evaluated from the data provided for Michigan, Ohio and West Virginia. Because there is very limited available field data in Kentucky and Pennsylvania, no interpretations about average performance of secondary recovery in reservoirs was made.

Average primary recovery from oil reservoirs is: Michigan – 36.2%, Ohio – 17.0% and West Virginia – 17.9%.

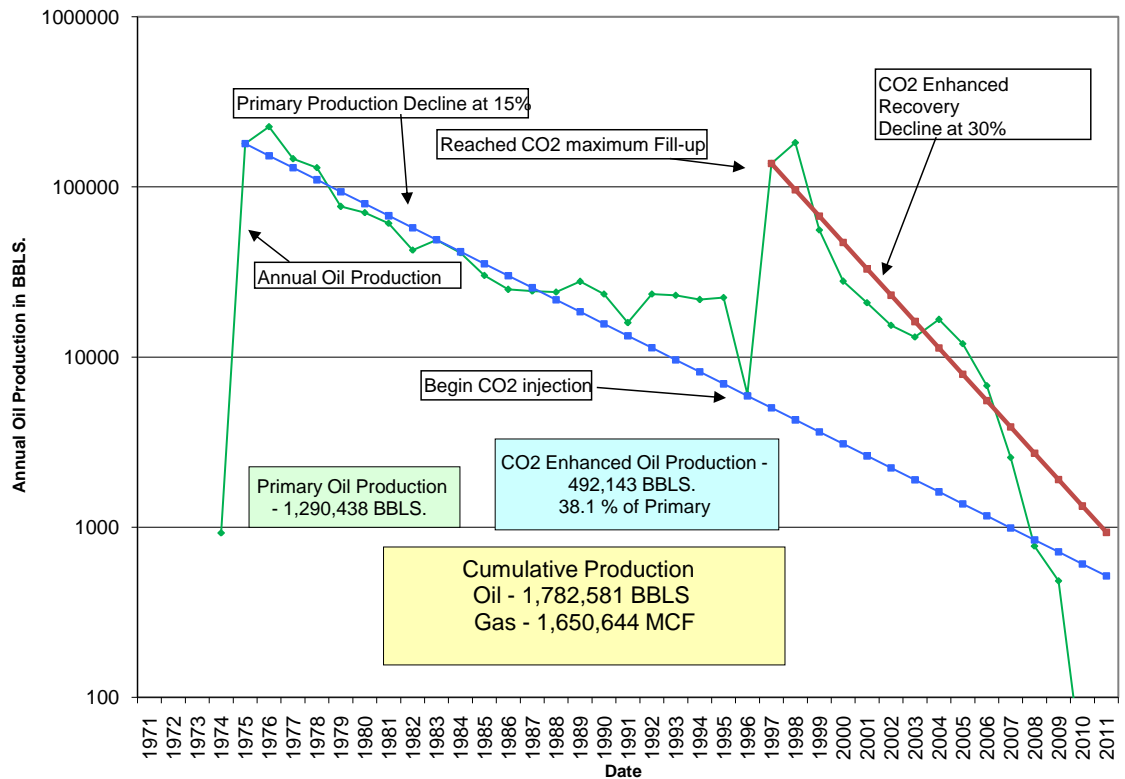
Average secondary recovery from the same reservoirs is: Michigan – 13.8%, Ohio – 5.25% and West Virginia – 14.9%

Also included in this report are a couple of examples of production history curves with secondary or enhanced recovery data presented.



South Buckeye oil field is an example of a Michigan waterflood project in the Middle Devonian Dundee Formation.

Dover 33 Niagaran Reef Field, Otsego County, Michigan Enhanced Recovery with CO2 (through 2010)



Dover 33 oil field is an example of a Michigan CO2 flood project in the Middle Silurian Niagaran Pinnacle Reef Formation.

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 attended two short courses on using CMGL (Canadian Modelling Group, Ltd) software to model carbon sequestration (Oct. 10--12 in Houston, TX) and geomechanics (Oct. 26--29 in Calgary, Alberta).
 - In December he worked with Amy Manley to apply this software as well as another program, Petrel, to model carbon sequestration in the Mt. Simon sandstone near Holland, Michigan.

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

- **Outreach to Industry, and the General Public**

- MICHCARB's WebPages served more than 1600 visitors, with over 2000 additional requests for online data.
- Our new in-house server is working nicely and nearly all bugs have been addressed. Backup procedures, both on site and off, have been nicely automated and documentation is in progress.
- We continue to resolve discrepancies in our inventory and update our metadata.