

**OHIO COAL DEVELOPMENT OFFICE
PROJECT ABSTRACT
as of October 1, 2010**

1. PROJECT SPONSOR:
Battelle Memorial Institute
505 King Avenue
Columbus, Ohio 43201

2. PROJECT MANAGER:
Joel Sminchak

3. OCDO GRANT NO.
CDO D-10-3

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5. PROJECT TITLE: "Simulation Framework for Regional Geologic CO₂ Storage Infrastructure along Arches Province of Midwest United States"

6. PROJECT TERM FROM: March 9, 2010 **TO:** March 8, 2012

7. PROJECT UPDATE **--OR-- FINAL REPORT** _____

8. BUDGET:

CO-SPONSOR'S NAME

COST-SHARE

OCDO	\$300,000
Battelle (DOE Funds)	\$824,173
IGS ²	\$207,313
KGS ²	\$187,474
OGS ²	\$266,710
WMU ²	\$279,394
Grand Total	\$2,065,064

² includes DOE project funding and in-kind cost share. IGS = Indiana Geological Survey, KGS = Kentucky Geological Survey, OGS = Ohio Geological Survey, WMU = Western Michigan University.

Abstract: The goal of this project is to use the available data from existing Class I and II waste injection wells, oil and gas exploration wells, and core analysis in western Ohio, and states neighboring western Ohio to develop a computer model that refines estimates of CO₂ storage capacity in this region. The work in Ohio will focus on an area from Columbus to eastern Indiana, and from Cincinnati to Toledo and include any available data that also exists from wells in the neighboring states and in the same geologic formation. . One of the focus areas for the project is to determine 'sweet-spots' for CO₂ sequestration, and thus reducing costs related to CO₂ injection operations. Project results will help determine carbon sequestration framework for coal burning power plants and Ohio industry along the Ohio River valley and western Ohio, and thus promoting continued use of Ohio coal.

The project shall be led by Battelle with subcontracts to ODNR-Geological Survey, and Geological Survey offices from Indiana, Kentucky, and Michigan. The Ohio Geological Survey is currently coordinating the geologic mapping effort of eight states in the Mid West Regional Carbon Sequestration Partnership (MRCSP) – OCDO D-05-13 and OCDO D-07-04. They will provide similar coordination with Kentucky, Indiana, and Michigan for geologic mapping, statistical analysis, and data analysis in this project.

Status: The Arches Province in the Midwestern U.S. has been identified as a major area for carbon dioxide (CO₂) sequestration because of the intersection of reservoir thickness and permeability along the province. The province includes areas of Indiana, Kentucky, Michigan, and Ohio along several arch structures between the Appalachian, Illinois, and Michigan sedimentary basins. The main injection target is the Mt. Simon Sandstone due to its depth, thickness, hydraulic properties, and brine salinity. The Arches Simulation project is designed to develop a simulation framework for regional geologic CO₂ storage infrastructure along the Arches Province through development of a geologic model for the Arches province and advanced reservoir simulations of large-scale CO₂ storage along the province.

This report presents a summary of the geological data package for the Arches region. The data package includes information on the deep wells in the region that penetrate the Eau Claire or deeper formations. In addition, deep well injection operational data are summarized for waste disposal wells into the Mt. Simon. The database will be used to make a three dimensional model of the reservoir by defining the extent and boundaries between stratigraphic and flow units, and estimating the petrophysical (fluid flow) properties of the rocks within these layers. In addition, injection test data will be used for history matching to aid the calibration of the numerical models.

The data compilation effort involved reviewing state databases for oil and gas wells and Environmental Protection Agency (EPA) records on deep well injection. Deep well data were screened for wells penetrating the Eau Claire shale or deeper. Information for the wells was then tabulated in a database summarizing well construction, owner, location, logging methods, geotechnical testing, formation depths, and status. This database facilitates development of the geological model.

Compilation of the data package for the Arches Province provided a regional depiction of the geologic framework for the area. Information was evaluated from 496 wells that penetrate the Eau Claire or deeper in the region. The wells were drilled over several decades and, consequently, quality varies. In addition, wells were not evenly distributed in the study area. Therefore, areas up to several hundred square miles have no data points. Review of the geological data helped define the limits of the model domain and understand the nature of these Cambrian rock units in the Arches Province. For example, the Mt. Simon sandstone extends well west of the Arches Province into Iowa, Minnesota, and Wisconsin. However, these areas are not qualified for CO₂ storage because the Mt. Simon is too shallow and/or contains freshwater. Therefore, model boundaries may relate to other features in these areas.

Injection data were compiled for Underground Injection (UIC) injection wells in the Arches Province. Information on injection rates, pressures, and fluids was tabulated for 30 sites in the study area. Data were available for over 20 years of operation at some sites, while other sites were never operated during injection regulations. For most sites, irregular injection operations may provide a challenge for model calibration. Information

from annual pressure fall-off tests required with mechanical integrity tests may provide a better calibration dataset for the model.