FACTSHEET FOR PARTNERSHIP FIELD VALIDATION TEST

Partnership Name	Big Sky Carbon Sequestration Partnership		
Contacts:	Name	Organization	E-Mail
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Principal Investigator	Lee Spangler		
Field Test Information Field Test Name	Montana Phase II Characterization Study		
Test Location	Kevin Dome, Sweetgrass Arch, northcentral Montana		
Amount and Source of CO_2	Tons 0	Source NA	
Field Test Partners (Primary Sponsors)	Montana State University		

Summary of Field Test Site and Operations:
Kevin Dome is a large anticlinal structural culmination located along the Sweetgrass Arch in northcentral Montana (Figure 1). The dome is defined by surface geologic relationships as well as hundreds of wells that have been drilled for oil and gas on the structure (Figure 2). Deeper and stratigraphically lower from the oil and gas production, the Duperow Formation traps CO_2 naturally on part of this geologic feature and contains saline water structurally downdip from the trapped CO_2 (Figure 3). Approximately 50 wells have penetrated the Duperow Formation on Kevin Dome, an area of approximately 650 square miles having 700 feet of structural relief. The dome is significant in that it is a natural analog for sequestration and has the potential to store additional large volumes of CO_2 in a proven static trap. It is located in a key area of proposed power generation plants and is analogous to similar large geologic structures in other parts of the Big Sky Carbon Sequestration Partnership Region close to additional CO_2 sources.

Figure 1: Location map of Kevin Dome.

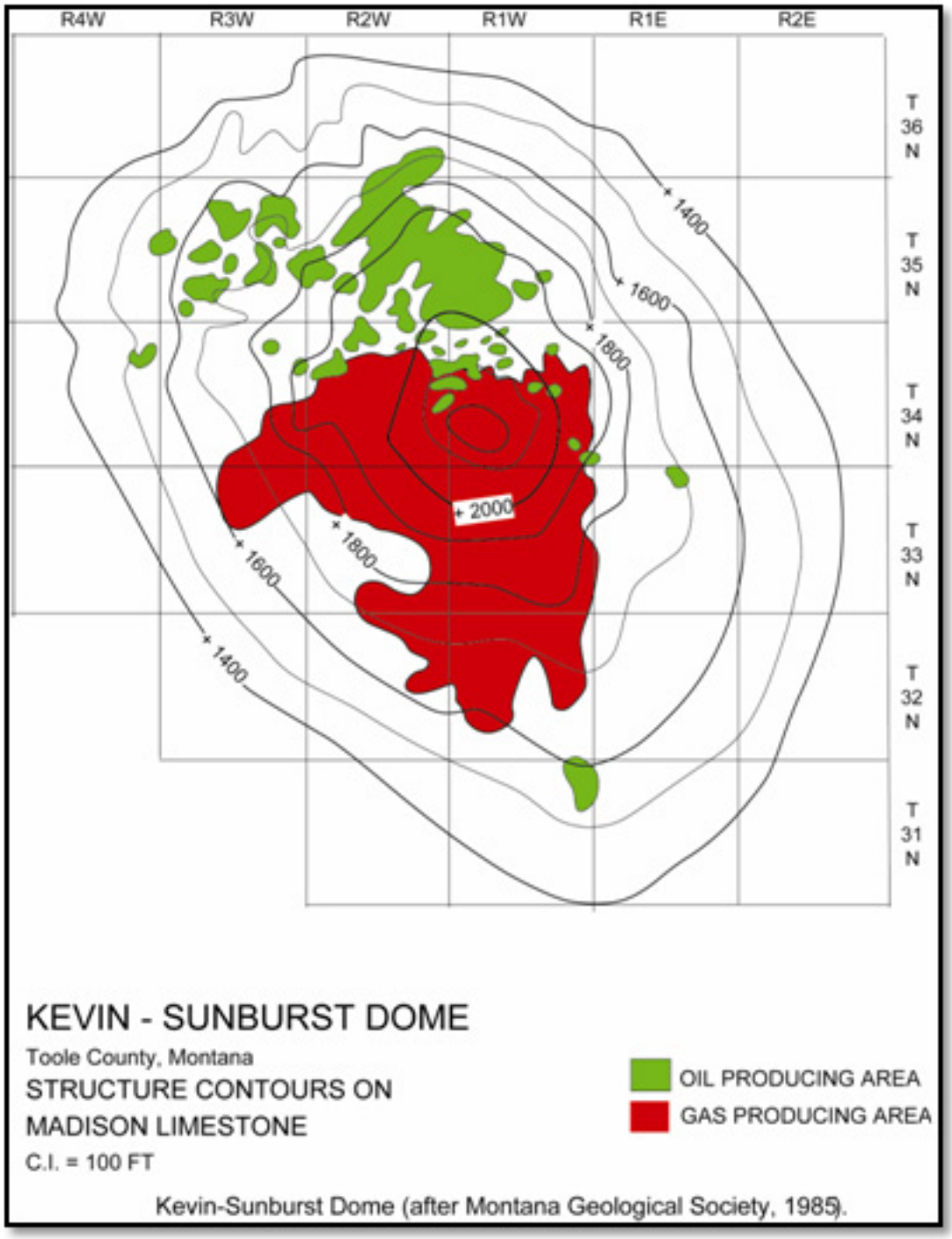

Figure 2: Structure contour map of Kevin Dome.

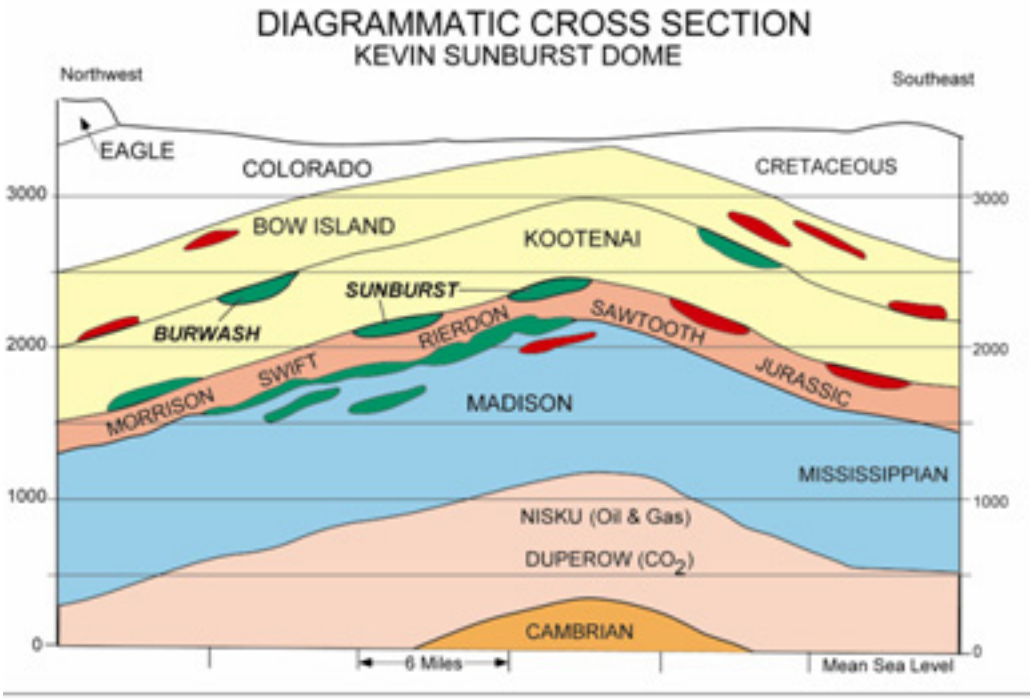

Figure 3: Schematic cross-section through Kevin Dome (modified from Montana Geologic Society, 1985).

Research Objectives:

The overall objective of the Kevin Dome characterization is to assess the viability and capacity of the Duperow Formation on Kevin Dome as a deep *saline* aquifer for large-scale geologic sequestration. The specific technical objectives are: 1) to characterize the local/larger-scale potential of the Duperow Formation on Kevin Dome to determine the potential for injection of supercritical CO_2; 2) to determine more accurately the capacity of the Duperow Formation to sequester CO_2 both on Kevin Dome and in the greater region; and 3) to use the characterization results from Kevin Dome to compare to other analog structures in the Big Sky Carbon Sequestration Partnership region. This activity will utilize public-domain information from existing boreholes, raster log images from all wells drilled on Kevin Dome, cuttings and core data from wells on the dome and in the vicinity, seismic data available for purchase from Seismic Exchange, Inc., and comparisons of the target formation and caprock on the dome to outcrops exposed to the south along the south flank of the Big Belt Mountains, to the west in the Disturbed Belt, and to the northeast in the Sweetgrass Hills.

Summary of Modeling and MMV Activities:
Existing subsurface data, including wireline well logs, cores, cuttings, and 2-d seismic data is being used to construct geologic static model of Kevin Dome. The sequestration targets at Kevin Dome are between 3,500 feet and 4,500 feet deep. Quantitative reservoir characteristics such as porosity, permeability, thickness, areal extent, and structural datums are being determined from well logs, seismic, cuttings samples and available core samples taken on and near the dome. BSCSP is performing a detailed survey of this existing data and building a static geologic model of Kevin Dome to assess its potential and capacity for sequestration. Petrographic and descriptive analysis of cores and cuttings from wells drilled in the Kevin Dome area and outcrops where the Duperow Formation and overlying caprock are exposed are being examined to determine vertical and lateral relationships that control reservoir heterogeneity and help determine the distribution of quantitative properties to cells in the static geologic model. This static model includes isopach maps of the Duperow Formation and subintervals within the Duperow Formation that are important as internal flow units, porosity thickness maps of the Duperow evaluating reservoir heterogeneity, structure contour maps of significant internal datums of the Duperow Formation and the interface between the Duperow Reservoir and caprock that predict directions of fluid flow within the reservoir and trapping geometries, fault plane maps of the Kevin Dome that verify potential fluid pathways and barriers, and a cross-section correlation grid that demonstrates mapped relationships.

Field Accomplishments to Date:
All well logs have been acquired for the Kevin Dome region. All subsurface data including drill stem tests, production data, bottom hole temperature data, and reservoir pressure data has been identified and acquired. All wells that have cut cores from zones of interest in the region of Kevin Dome have been identified. Those wells that have cores available for description at the United States Geological Survey Core Storage facility have been delineated for further detailed analysis. Two initial field surveys have been undertaken to identify outcrops and begin sampling and describing the Devonian Duperow Formation. These trips focused on the outcrops along the northern plunge of the Little Belt Mountains where outcrops of equivalent rocks to those trapping CO_2 at Kevin Dome are exposed. Additional outcrop work and description of cores and cuttings samples will continue in the second half of the year. Formation tops from rock units intersected by wells drilled for oil and gas at Kevin Dome are in the process of being picked and interpreted. Seismic sections shot across Kevin Dome have been identified. An analysis is being undertaken to determine whether this data set or a data set of gravity and magnetic data would be most useful for understanding structural complexities at Kevin Dome. Pressure data, temperature data, and formation fluid data are currently being integrated into the geologic interpretation. The construction of a 3-dimensional reservoir model of Kevin Dome is currently underway. An initial set of structural contour maps, isopach maps, and cross-sections have been completed to date.

Summarize Target Sink Storage Opportunities and Benefits to the Region:
Kevin Dome has naturally occurring CO_2 in the Duperow Formation but the volume, continuity of the trapped gas, and circumstances of its entrapment are poorly understood. The Duperow Formation is also a saline aquifer having very poor water quality (greater than 10,000 ppm TDS). The combination of a natural trap ensuring caprock efficacy and formation compatibility with CO_2, the large volume of this static trap that has additional sequestration potential because it is only partially filled with CO_2, the poor quality contained water, the proximity to present and future sources of anthropogenic CO_2, and the similarity of this feature to other large domes in Montana (Figure 4), and the entire BSCSP region, determine this geologic feature to have great regional significance for understanding

sequestration potential and capacity.

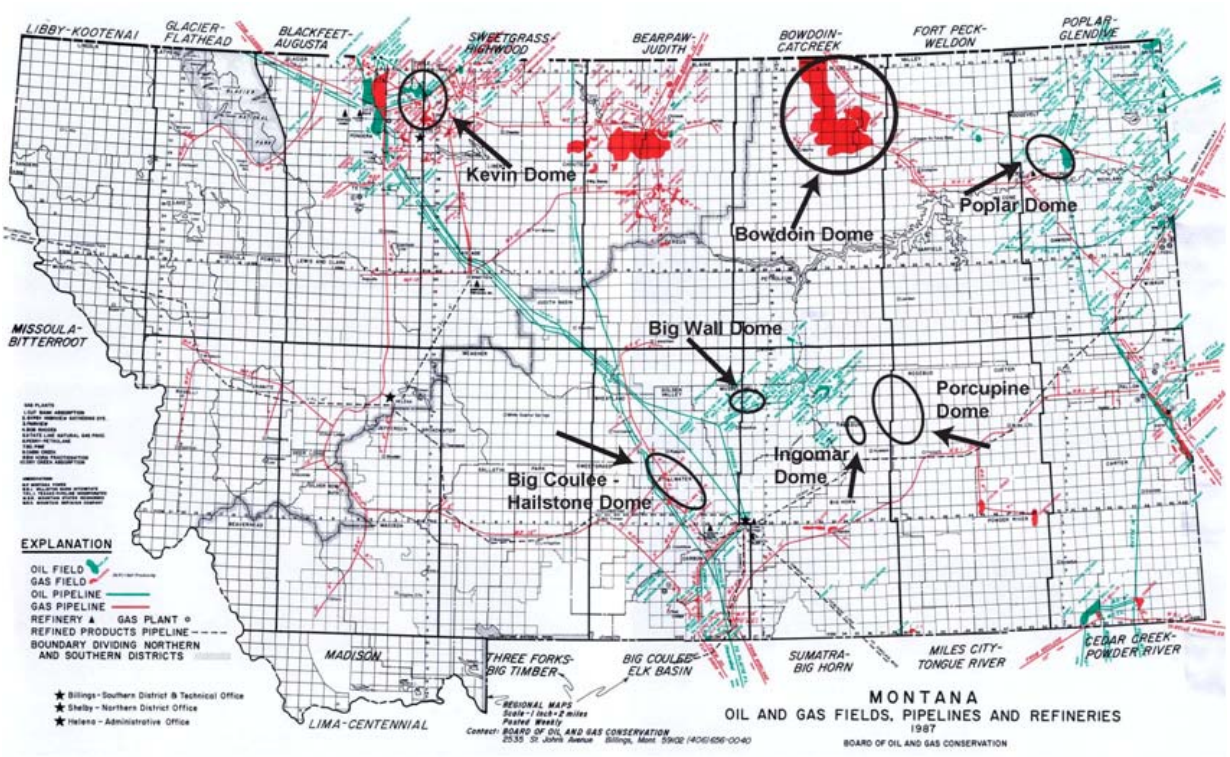

Figure 4: Location map of Kevin Dome, similar structural features, and oil and gas production and infrastructure in Montana.

Cost:

Total Field Project Cost: $927,622

DOE Share:	**$770,869**	**83.1%**
Non-Doe Share:	**$156,753**	**16.9%**

Field Project Key Dates:

Baseline Completed: 3/31/09

Drilling Operations Begin: NA

Injection Operations Begin: NA

MMV Events: NA

Field Test Schedule and Milestones (Gantt Chart):

Task 15.0	Q1-06	Q2	Q3	Q4	Q1-07	Q2	Q3	Q4	Q1-08	Q2	Q3	Q4	Q1-09	Q2	Q3	Q4	Q1-10	Q2
Task 15.1 Site Characterization																		
Construct Static Model															Gm28			
Task 15.2 Comparisons to Analog Structures																		
Cross Section, Structure Contour and Isopach Maps																	Gm29	
Task 15.3 Reporting																		
Comprehensive Report																		Gm30