Advanced Resources International, Inc.

June 6, 2013

Mr. Richard Rhudy, Technical Executive
EPRI
3420 Hillview Avenue
Palo Alto, California 94304

RE: Completed and Interpreted Baseline Seismic Survey Report
SECARB Phase III Work Product 4.2.2.b

Dear Mr. Rhudy,

Attached please find Advanced Resources' presentation of the results of the seismic survey performed at the SECARB Citronelle project in Alabama. The CO_2 monitoring effort for the Anthropogenic Test includes two wellbore seismic methods, specifically time-lapse crosswell seismic and vertical seismic profiles (VSP). Due to the unique challenges presented by this test (injection depth of 9,500+ ft. into thin, stacked reservoir sands and limited injection volumes) surface seismic was eliminated as a Monitoring, Verification, and Accounting (MVA) tool. However, the newly drilled project wells provided ample casing diameters (prior to running tubing) to accommodate wellbore seismic receivers (wireline and tubing deployed) and a crosswell source.

Baseline surveys were conducted in 2012 prior to the onset of CO_2 injection operations. Attached to this letter are two reports documenting the results from the baseline vertical seismic profile (VSP) and crosswell seismic surveys performed by SR2020 and Schlumberger Carbon Services, respectively. A summary of the surveys is provided below.

Baseline Vertical Seismic Profile

SR2020 acquired a baseline VSP survey for the Project at the Anthropogenic Test Site in early February 2012. Two wells, the D-9-7#2 (injection well) and the D-9-8#2 well (observation well), were populated with SR2020's three component (3C) geophone arrays. Data was acquired in several phases:

- Zero-offset data were acquired from the surface locations of the two receiver wells,
- Offset shots were acquired at seven locations around the injection well on existing Citronelle oilfield locations, and
- Two walkaway VSP lines were acquired:
    - Walkaway Line #1 on the lease road between the two receiver wells, and
    - Walkaway line #2 in the power line clear-cut between the two receiver wells.

The data acquisition locations are identified in **Figure 1**.

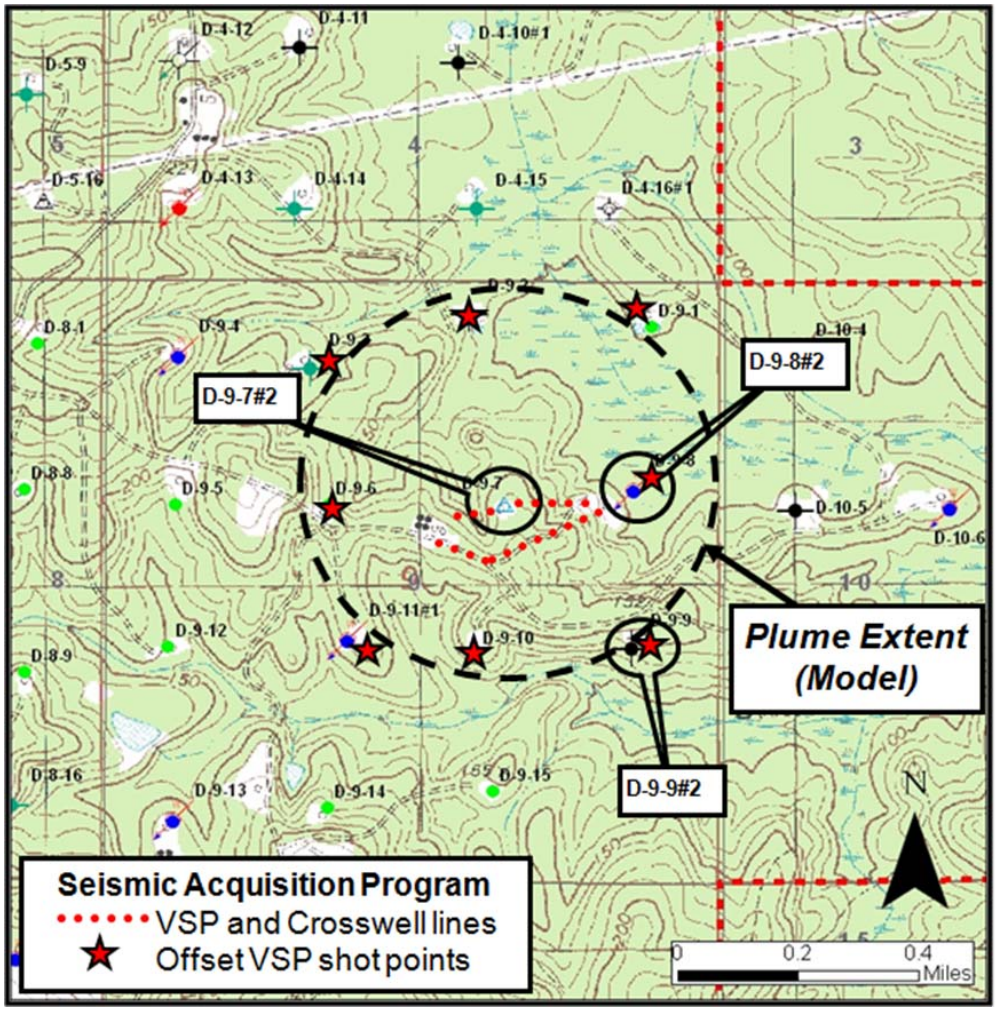

Figure 1. Location of Seismic Data Acquisition Points

The receiver array in well D-9-7#2 had 25 ft. receiver spacing (-5,366 ft. to -7,113 ft. below GL). The receiver array in well D-9-8#2 had 50 ft. receiver spacing (-4,863 to -8,810 ft. below GL).

The data processing included the following steps:

- Geometry assignment – source and receiver locations, taking into account well deviation,
- Three component (3C) rotation to True XYZ – rotate the data into a true Z, EW, NS system,
- Deconvolution – remove seismic source effects (i.e. downgoing source energy reverberations),
- Three Component (3C) Wavefield Separation – Amplify the upgoing reflections and separate P and S waves, and
- Depth Migration – migrate upgoing wavefield from time into depth.

Based on spectral analysis, usable data were acquired from 12 -140 Hz. The processed images capture reservoir images and the injection zone was imaged from both geophone arrays. Vertical resolution of the images appears to be 30-50 ft. and should be of sufficient quality to monitor the CO_2 migration after time-lapse comparison with the post injection VSP.

Baseline Crosswell Seismic

Schlumberger's DeepLook-CS group acquired a single baseline crosswell seismic survey for the Project at the Anthropogenic Test Site in January of 2012. Two wells, the D-9-7#2 (injection well) and the D-9-8#2 well (observation well), were used to deploy the receivers (D9-8#2) and the source (D9-7#2). The receiver array contained 10 geophone levels (at 10 ft. spacing). The piezoelectric source was swept at 100-1,200 Hz as it was raised in the well while the receiver array stayed stationary and recorded seismic data. Once the source reached the top of the pre-determined survey interval, data acquisition stopped, the source was lowered to the bottom of the interval, the receiver array was raised 100 ft and the process was repeated again. The resulting

source-receiver combinations covered the depth range (8,160-10,500 ft), which includes the CO_2 injection interval (9,436 to 9,800 ft).

The crosswell seismic data processing included the following steps:

- Data preparation – data stacking and correlation,
- Tomographic (velocity) processing –correct p-wave first arrival times based on receiver and source locations and a reservoir structural model, and
- Reflection imaging (transform the time domain data into data volume in depth),
    - Remove tube wave, direct arrival and down-going reflection data, and
    - Deconvolution (remove source effects) and amplitude normalization
- Depth Migration – migrate wavefield from time into depth.

Based on spectral analysis, the seismic vendor believes usable data were acquired from 100-1,200 Hz. The processed image captures a high resolution reservoir image between the injection well and the observation well. No structural anomalies (i.e. small scale faults) were observed in the image. Vertical resolution of the images appears to be about 10 ft. and should be of excellent quality in order to monitor the CO_2 migration using time-lapse comparison techniques.

Should you have any questions or require any additional information, please feel free to contact me at your convenience.

Sincerely,

Advanced Resources International, Inc.

Steven M. Carpenter
Vice President

Attachments: Baseline VSP Seismic Report (SR2020)
Crosswell Seismic Report (Schlumberger Carbon Services)

pc: Rob Trautz, EPRI w/attachments
George Koperna, ARI w/attachments