Southeast Regional CO₂ Sequestration Technology Training Program (SECARB-Ed)

Report Type: Final Progress Report

Reporting Period Start Date: November 16, 2009
Reporting Period End Date: November 15, 2012

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Report Issue Date: February 2013

DOE Award Number: DE-FE0001930

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Abstract

Carbon capture and storage (CCS) technologies have tremendous potential for reducing carbon dioxide (CO₂) emissions and mitigating global climate change. These technologies encourage economic growth and have manageable influence on energy use. Deploying these technologies on a commercial scale will require expanding the workforce, including geologists, engineers, scientists and technicians, trained in CCS specialties.

In 2009, the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) selected seven projects to help develop regional sequestration technology training centers in the United States. The "Southeast Regional CO₂ Sequestration Technology Training Program" (SECARB-Ed) was managed and administered by the Southern States Energy Board (SSEB) from November 16, 2009, to November 15, 2012. During this performance period, the SECARB-Ed partners were successful in achieving their primary objective of developing a self-sustaining regional CO₂ sequestration training program to facilitate the transfer of knowledge and technologies required for site development, operations and monitoring of commercial CCS projects. An experienced team of professionals participated in the SECARB-Ed program, with skills and competencies in geosciences, reservoir engineering and CCS related capture/separation, transportation, legal and regulatory disciplines. The SECARB-Ed Advisory Board included representatives from SSEB, Clemson University, GERALD R HILL PHD, Inc. (HILL), EnTech Strategies, LLC- Research Experience in Carbon Sequestration (RECS), Virginia Tech (VAT), Geological Survey of Alabama (GSA) at The University of Alabama and the Bureau of Economic Geology (BEG) at The University of Texas at Austin. The program encompasses fifteen of SSEB's member states, including: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.

The SECARB-Ed partners implemented an organized sponsorship development program, developed short courses on CCS technologies, participated in regional training and other activities through outreach and networking and performed internet-based and electronic regional/basin technology transfer services. The partners addressed the most promising sequestration options in the region; the mix of industry and power plant sources of CO₂; regional transportation infrastructure; and the legal, regulatory, and institutional frameworks that exist in the southeast. As a result, SECARB-Ed fostered the development of a future workforce with disciplines specific to applied engineering and CCS science and technologies and advance the United States in its position as the leader in addressing climate change, near-zero emissions technologies and geologic sequestration technologies. The educational and training opportunities detailed in this Final Report demonstrate an effective means of disseminating a broad base of such knowledge and skills to a variety of students and professionals who are interested in the area of CCS technologies. The efforts of the SECARB-Ed Advisory Board and partners have resulted in a total of 1,951 professional development hours (PDHs) awarded to 1,131 participants.

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Executive Summary

The Southern States Energy Board (SSEB), an interstate compact organization, has been engaged in climate change, carbon management and carbon capture and storage (CCS) research and development (R&D) programs for over a decade. Since 2003, SSEB has managed the Southeast Regional Carbon Sequestration Partnership program. A key element of SSEB's carbon management effort has been CCS outreach and education. Over the past three years, SSEB has strengthened its outreach and education efforts under a U.S. Department of Energy grant creating the "Southeast Regional CO₂ Sequestration Technology Training Program" (SECARB-Ed). The objective of SECARB-Ed is to develop a self-sustaining regional carbon dioxide (CO₂) sequestration training program. This program will facilitate the transfer of knowledge and technologies required for site development, operations and monitoring of commercial CCS projects. As a result, SECARB-Ed fosters the development of a future workforce with disciplines that are specific to applied engineering and CCS science and technologies, thus advancing the United States in its position as the leader in addressing climate change, near-zero emissions technologies and geologic sequestration technologies.

Key personnel from each SECARB-Ed participating organization were appointed to the Advisory Board to provide direction for the business model and to guide the development of high quality training materials and an effective outreach and education program. A Technology Training Plan and a Sponsorship and Marketing Plan (SMP) were formed and implemented.

SECARB-Ed team members identified topics and developed materials and course content related to the specific expertise of the university/recipient members for a variety of settings and audiences, including course/seminar talks, presentations to professional societies, workshops, and short courses. Twenty training events (short courses / workshops), including two flagship events, were conducted at various venues. One of the CCS webinar products is maintained in the American Institute of Chemical Engineers online library and is accessed periodically on a pay-for-use basis.

The initial SMP was revised due to uncertainty in the timing of any CO₂ reduction programs in the United States. Potential sponsors that were identified for SECARB-Ed delayed investment decisions related to carbon management. The plan continued to evolve throughout the project and a final amendment was added on September 18, 2012.

A SECARB-Ed website, Facebook page, Training Newsletters and E-Alerts were developed and distributed in which information on upcoming meetings of SECARB-Ed, upcoming CCS events, upcoming training opportunities, material of a technical nature relevant to the SECARB-Ed region, results from on-going CCS research, public policy updates related to CCS and alerts to forthcoming R&D solicitations were conveyed.

The efforts of the SECARB-Ed Advisory Board and partners have resulted in a total of 1,951 professional development hours awarded to 1,131 participants. In addition to meeting training objectives, the SECARB-Ed team has implemented its revised SMP, thus extending training opportunities over time and expanding the training focus to a global platform designed to be self-sustaining.

Experimental Methods / Approach

The Southern States Energy Board (SSEB) and GERALD R HILL PHD, Inc (HILL) developed a Southeast Regional CO₂ Sequestration Technology Training Program (SECARB-Ed) Technology Training Plan that identified and defined training goals and objectives, training initiatives, groups served, training resources, types of training, methods of delivery, funding, implementation responsibilities and evaluation of courses.

A major activity was the construction of short courses on carbon capture and storage (CCS) technologies. A modular approach to course development and delivery was employed, which enabled a high degree of flexibility in presentation. Using this approach, individual courses or course clusters could be selected so that activities are tailored for groups with different educational, technical and professional backgrounds. These courses could further be tailored for different venues, such as stand-alone professional courses, courses at professional society meetings, college seminars and K-12 outreach activities.

Figure 1 is an organization chart of SECARB-Ed. Each of the SECARB-Ed team members worked with their respective professional associations to get short courses approved for the award of professional development hours (PDHs) or continuing education units (CEUs). Verification of certification and courses held in conjunction with professional society meetings were particularly successful. Examples of societies and associations identified for short course approval include the American Institute of Chemical Engineers (AIChE), the Society for Mining, Metallurgy, and Exploration (SME); the American Association of Petroleum Geologists (AAPG); and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME); the West Virginia Coal Association; the Kentucky Coal Association; and the Gulf Coast Association of Geological Societies.

Figure 1 SECARB-Ed organization chart

A Sponsorship and Marketing Plan (SMP) was also developed. The original SMP focused on providing CCS content and working with others who have existing and well developed outreach networks. It was based upon supplementing the three-year federal funding program with an additional two to three years of funding from outside sponsors willing to invest in CCS training. The additional two to three years of funding was intended to provide the SECARB-Ed Advisory Board with sufficient time and resources to establish a mature training program that would transition to a self-sustaining program over the course of five or six years.

Due to uncertainty in the timing of CO₂ reduction programs in the United States, potential sponsors that were identified for SECARB-Ed delayed investment decisions related to carbon management. The decisions of companies to delay CCS investments had a direct impact on the SECARB-Ed SMP. In response to the changes, the SECARB-Ed approach was modified. Instead of focusing on two to three years of stand-alone funding for SECARB-Ed, the SMP strategy shifted focus towards finding opportunities to add SECARB-Ed's CCS training elements into existing programs/organizations. Two initiatives have been undertaken to meet the SMP objectives.

In the first initiative, HILL and SSEB brought together the Global CCS Institute and AIChE as partners for the continuation of CCS webinar training after the conclusion of the SECARB-Ed funding period. Prior to the efforts by HILL and SSEB, the Global CCS Institute and AIChE were unaware of potential opportunities to work with one another and with SECARB-Ed. SSEB is a founding member of the Global CCS Institute, and Dr. Gerald Hill has been active with the institute since its inception. The Global CCS Institute has substantial funding from the government of Australia that supports its activities through 2015. GCCSI is interested in implementing the SECARB-Ed training programs as part of an overall strategy that will enable the institute to generate income after 2015. Dr. Gerald Hill has been a member of the AIChE for over 20 years and has been active in the Founder Societies' carbon management activities, which is lead by AIChE on behalf of its membership. Founder Societies is a joint effort of professional associations for engineers (chemical, civil, mechanical, electrical and electronics) for the purpose of organizing and conducting topical training programs. During 2011 and 2012, HILL organized CCS training modules for regional meetings of AIChE and joint meetings under the Founder Societies. Dr. Hill also conducted an on-line training webinar for AIChE. Beginning in 2013, GCCSI and AIChE will begin joint CCS webinar sessions. GCCSI and AIChE have agreed to recognize the efforts of SECARB-Ed in webinars that will be produced in relation to the original AIChE/SECARB-Ed webinar.

In a second initiative, SSEB proposed continuing its in-house elements of the SECARB-Ed program (website, Facebook page, Training Newsletters and E-Alerts) under the U.S. Department of Energy's (DOE) Office of Clean Coal and its Office of Clean Energy Collaboration. On August 30, 2012, Mr. Gene Kight of DOE approved funding for the SECARB-Ed program as part of SSEB's Committee on Clean Coal and Energy Technologies Collaboration. The scope of work of the training and education effort under the Clean Coal Collaboration initiative includes:

- **Develop and Hold Training Events:** SSEB/SECARB-Ed shall identify topics for short courses and assist in the development of training materials for co-sponsored training events. SSEB/SECARB-Ed will collaborate with experts to develop short courses and other planned carbon capture, utilization and storage (CCUS) events. Course development includes content of short courses and other events, as well as plans for revisions of courses based on feedback from participants. SSEB/SECARB-Ed will assist co-sponsors with travel and other direct costs associated with the preparation and delivery of training events.
- **Organize, Prioritize and Participate in CCS Events:** SSEB/SECARB-Ed shall provide speakers and/or organize lectures, seminars, workshops and conferences in the region to facilitate CCUS outreach and networking.
- **Website:** SSEB/SECARB-Ed shall maintain a website for education and outreach. The website shall contain information on upcoming meetings of SECARB-Ed, SECARB-Ed membership/corporate sponsors, newsroom on issues facing CCUS

such as public policy (state and national) and recent CCS publications. A link on the webpage shall relay training information and a calendar schedule on CCS courses and webinars that SECARB-Ed and other CCUS trainers are providing.

- **Newsletters:** SSEB/SECARB-Ed shall publish a newsletter that contains a summary of upcoming training opportunities, material of a technical nature relevant to the SECARB-Ed region, results from on-going CCUS research, public policy updates related to CCUS, alerts to forthcoming R&D solicitations and review, summarize and comment on CCUS technical papers published by others.

Results and Discussion

Schedule/Milestone Status

Task 1.0: Project Management, Planning, and Reporting

Task 1.1: Project Management Plan (SSEB)

The SECARB-Ed program was managed in accordance with the current and approved Project Management Plan (PMP) on file with DOE/NETL. The PMP is a living document that outlines the project organization and structure, PMP implementation and coordination strategy, and potential risks to the project. It also provides a resource loaded schedule and Gantt chart, work breakdown structure, funding and costing profiles, milestone log, success criteria and decision points and the current Statement of Project Objectives (SOPO).

The initial PMP was prepared and submitted to NETL on December 16, 2009 and revised on February 25, 2010. It was further updated and sent to NETL for approval on July 5, 2011. HILL assisted SSEB with developing and updating the PMP (Appendix 1).

Task 1.2: Planning and Reporting (SSEB)

The SECARB-Ed Principal Investigator (PI), Ms. Kathryn Baskin of SSEB, was responsible for the overall project management. This included execution of each phase of the project, subcontractor procurement and management, coordinating university staff and outside resources, maintenance of the project budget and collaborating with individual stakeholders and DOE. Ms. Baskin and her appointed colleagues at SSEB compiled and submitted reports to DOE in accordance with the Federal Assistance Reporting Checklist. Reporting templates were prepared for the subcontractors to facilitate the submittal of required content from each entity and to streamline the editing and formatting process. The SF425, the PI workbook and the quarterly and semiannual progress reports were updated and submitted as required. The Annual Inventory Report of Federally Owned Property and the Annual Indirect Cost Proposal were also submitted. A list of all SECARB-Ed milestones and deliverables submitted to NETL is provided in Table 2 and Table 2, respectively. Documentation of the deliverables described above is provided in (Appendix 2).

Ms. Baskin and the SECARB-Ed partners delivered formal presentations to DOE and other entities as required and also participated in annual project review meetings with the DOE. SSEB staff participated in the HQ Milestone Project Kick-off Meeting on November 18, 2009. SSEB participated in an annual project review meeting with the DOE during 2010, 2011 and 2012 in Pittsburgh, Pennsylvania. A SECARB-Ed presentation was presented by Kathryn Baskin at the Regional Carbon Sequestration Partnership (RCSP) Annual Meeting

on October 6, 2010. Kathryn Baskin and Kimberly participated in the RCSP Annual Meeting and a SECARB-Ed poster was presented during the poster session on November 15-17, 2011. Patricia Berry, Kimberly Sams and Kathryn Baskin represented SECARB-Ed at the Technology Training Center Poster Sessions held during the RCSP Annual Meeting on August 21-22, 2012 (Appendix 3).

SSEB staff organized and participated in the SECARB-Ed team meetings March 2010 and March 2011 in Atlanta, Georgia. The planning and organization of short courses and other training events, including sponsors and topics were discussed. SSEB coordinated multiple conference calls with the partners to discuss the progress of the project. Additionally, SECARB-Ed materials were presented at the Annual SECARB Stakeholder's Briefing in Mobile, Alabama, in March 2012.

Several education and outreach materials were developed throughout the performance period. A tensioned fabric display was designed and utilized as a backdrop during poster sessions and/or trade shows. A SECARB-Ed fact sheet was created and frequently updated. Bookmarks and postcards were often distributed as well.

Two plans were developed to support SECARB-Ed's goal of becoming a self-sustaining training program; the Sponsorship and Marketing Plan and the Technology Training Plan. SSEB and HILL worked together to create and implement both documents and to modify them as the project evolved. Regular conference calls for the Training Centers were facilitated by NETL to share experiences, both successes and hardships, in an effort to assist the teams in achieving programmatic objectives. Patricia Berry participated in these calls and updated the training course calendar NETL SharePoint site as requested.

A total of 1,951 PDHs were awarded to 1,131 participants.

Table 1 List of milestones with completion dates as reported in the PI Workbook

Task	Milestone	Planned Completion Date	Actual Completion Date	Validation
1.0: Project Management, Planning, and Reporting	Initial Project Management Plan Complete	02/25/10	02/25/10	Emailed to NETL COR
2.0: Implement an Organized Sponsorship Development Program	Form Advisory Board	03/31/10	03/30/10	Emailed to NETL COR

Task	Milestone	Planned Completion Date	Actual Completion Date	Validation
HQ Milestone	HQ Milestone: Project Kick-off Meeting	03/31/10	11/18/09	All project participated in the official kick-off meeting on November 18, 2009, Pittsburgh Hilton. Projects presented during the Regional Sequestration Technology Training Session held during the Annual Regional Partnership Meeting, Pittsburgh Hilton.
HQ Milestone	HQ Milestone: Program Instituted-Initial Tech Training Plan Completed and Submitted	06/30/10	06/22/10	Emailed to NETL COR
2.0: Implement an Organized Sponsorship Development Program	Develop Sponsorship/Marketing Plan Complete	07/15/10	06/30/10	Emailed to NETL COR
HQ Milestone	HQ Milestone: One Training Event (webinar, short course, seminar, brown bag, etc.)	09/30/10	05/07/10	Emailed to NETL COR
HQ Milestone	HQ Milestone: Semi-Annual Progress Report	09/30/10	07/20/10	Emailed to NETL COR
5.0: Perform Regional/Basin Technology Transfer Services	Initial Regional Technology Training Services Complete (Develop and initiate a training newsletter, website, email alert system, and technical inquiry response system)	11/30/10	11/19/10	Emailed to NETL COR
HQ Milestone	HQ Milestone: Final Tech Training Plan Completed and Submitted	12/31/10	12/24/10	Emailed to NETL COR
HQ Milestone	HQ Milestone: Trainers visit one field site	12/31/10	04/14/10	Emailed to NETL COR

Task	Milestone	Planned Completion Date	Actual Completion Date	Validation
3.0: Development of Short Courses on CCS Technologies	Regional Technology Training Plan Implementation	01/31/11	01/04/11	Emailed to NETL COR
HQ Milestone	HQ Milestone: Yearly Review Meeting	03/31/11	10/06/10	Projects presented during the Regional Sequestration Technology Training Session held during the Annual Regional Partnership Meeting, Pittsburgh PA.
4.0: Regional Training and Other Activities Through Outreach and Networking	Develop and Hold Flagship Training Event	09/30/11	03/10/11	Course presented in conjunction with SECARB annual stakeholdre's briefing. NETL COR was present.
4.0: Regional Training and Other Activities Through Outreach and Networking	Develop and Hold Flagship Training Event	09/30/12	06/05/11	Research Experience in Carbon Sequestration (RECS)
1.0: Project Management, Planning, and Reporting	Semi-Annual Progress Report	10/31/12	NA	Included in Final Report per NETL PM

Table 2 List of deliverables with completion dates as reported in the PI Workbook

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Reporting, FARC	SF-425, Federal Financial Report, FY10Q1	01/31/10	02/24/10	Emailed to FITS@NETL.DOE.GOV
1.0: Project Management, Planning, and Reporting	Initial Project Management Plan	02/25/10	02/25/10	Emailed to NETL COR
2.0: Implement an Organized Sponsorship Development Program	Advisory Board Roster	03/31/10	03/30/10	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY10Q2	04/07/10	04/06/10	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Reporting, FARC	Quarterly Progress Report, FY10Q2	04/30/10	04/27/10	Emailed to NETL COR
Reporting, HQ	Semi-Annual Progress Report, SA01	04/30/10	04/27/10	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY10Q2	04/30/10	04/20/10	Emailed to FITS@NETL.DOE.GOV
2.0: Implement an Organized Sponsorship Development Program	Sponsorship Development and Marketing Plan	06/30/10	06/30/10	Emailed to NETL COR
3.0: Development of Short Courses on CCS Technologies	Initial Regional Technology Training Plan	06/30/10	06/22/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY10Q3	06/30/10	06/04/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY10Q3	06/30/10	05/14/10	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY10Q3	07/07/10	06/30/10	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY10Q3	07/31/10	07/20/10	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY10Q3	07/31/10	08/02/10	Emailed to FITS@NETL.DOE.GOV
Reporting, HQ Milestone Deliverable	Semi-Annual Progress Report, SA02	09/30/10	07/20/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY10Q4	09/30/10	09/24/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY10Q4	09/30/10	09/09/10	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Reporting, FARC	Annual Inventory Report of Federally Owned Property, if any (2010)	10/01/10	02/02/11	Emailed to FITS@NETL.DOE.GOV
Reporting, ARRA	PI Workbook, FY10Q4	10/07/10	09/20/10	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY10Q4	10/31/10	10/26/10	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY10Q4	10/31/10	10/26/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Website Launch	11/15/10	11/15/10	Emailed to NETL COR
Reporting, FARC	Annual Indirect Cost Proposal, 2010	12/31/10	02/02/11	Emailed to FITS@NETL.DOE.GOV
3.0: Development of Short Courses on CCS Technologies	Final Regional Technology Training Plan	12/31/10	12/24/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY11Q1	12/31/10	12/13/10	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY11Q1	12/31/10	12/06/10	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY11Q1	01/07/11	01/03/11	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY11Q1	01/31/11	01/21/11	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Reporting, FARC	SF-425, Federal Financial Report, FY11Q1	01/31/11	01/31/11	Emailed to FITS@NETL.DOE.GOV
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY11Q2	03/31/11	02/25/11	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY11Q2	03/31/11	01/13/11	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY11Q2	04/07/11	03/31/11	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY11Q2	04/30/11	04/29/11	Emailed to NETL COR
Reporting, HQ	Semi-Annual Progress Report, SA03	04/30/11	04/29/11	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY11Q2	04/30/11	04/29/11	Emailed to FITS@NETL.DOE.GOV
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY11Q3	06/30/11	06/21/11	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY11Q3	06/30/11	06/21/11	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY11Q3	07/07/11	07/05/11	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY11Q3	07/31/11	07/27/11	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY11Q3	07/31/11	08/01/11	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY11Q4	09/30/11	09/23/11	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY11Q4	09/30/11	07/06/11	Emailed to NETL COR
Reporting, FARC	Annual Inventory Report of Federally Owned Property, if any (2011)	10/01/11	11/18/11	Emailed to FITS@NETL.DOE.GOV
Reporting, ARRA	PI Workbook, FY11Q4	10/07/11	10/03/11	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY11Q4	10/31/11	10/31/11	Emailed to NETL COR
Reporting, HQ	Semi-Annual Progress Report, SA04	10/31/11	10/31/11	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY11Q4	10/31/11	10/31/11	Emailed to NETL COR
Reporting, FARC	Annual Indirect Cost Proposal, 2011	12/31/11		
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY12Q1	12/31/11	12/30/11	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY12Q1	12/31/11	11/17/11	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY12Q1	01/07/12	12/15/11	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY12Q1	01/31/12	01/29/12	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY12Q1	01/31/12	01/29/12	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY12Q2	03/31/12	03/22/12	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY12Q2	03/31/12	03/22/12	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY12Q2	04/07/12	04/02/12	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY12Q2	04/30/12	04/30/12	Emailed to NETL COR
Reporting, HQ	Semi-Annual Progress Report, SA05	04/30/12	04/30/12	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY12Q2	04/30/12	04/30/12	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY12Q3	06/30/12	06/18/12	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY12Q3	06/30/12	06/29/12	Emailed to NETL COR
Reporting, ARRA	PI Workbook, FY12Q3	07/16/12	07/09/12	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY12Q3	07/31/12	07/31/12	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY12Q3	07/31/12	07/31/12	Emailed to FITS@NETL.DOE.GOV
2.0: Implement an Organized Sponsorship Development Program	Update Sponsorship Development and Marketing Plan	09/30/12	09/18/12	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY12Q4	09/30/12	09/27/12	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY12Q4	09/30/12	08/22/12	Emailed to NETL COR
Reporting, FARC	Annual Inventory Report of Federally Owned Property, if any (2012)	10/01/12		
Reporting, ARRA	PI Workbook, FY12Q4	10/07/12	10/02/12	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY12Q4	10/31/12	10/24/12	Emailed to NETL COR
Reporting, HQ	Semi-Annual Progress Report, SA06	10/31/12	10/25/12	Emailed to NETL COR
Reporting, FARC	SF-425, Federal Financial Report, FY12Q4	10/31/12	10/30/12	Emailed to NETL COR
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.1 Training Newsletter)	Training Newsletter, FY13Q1	12/31/12	NA	Not required per NETL PM
Task 5.0: Perform Regional/Basin Technology Transfer Services (Task 5.2 Leveraged Regional Website, Email Alerts, and Technical Inquiries)	Email Tech Alert, FY13Q1	12/31/12	NA	Not required per NETL PM
Reporting, ARRA	PI Workbook, FY13Q1	01/07/13	01/07/13	Emailed to NETL COR
Reporting, FARC	Quarterly Progress Report, FY13Q1	01/31/13	NA	Not required per NETL PM-See Final Report
Reporting, FARC	SF-425, Federal Financial Report, FY13Q1	01/31/13	01/31/13	Emailed to NETL COR
Reporting, FARC	Final Scientific/Technical Report	02/13/13		
Reporting, FARC	Patent Certification	02/13/13	12/11/12	Emailed to NETL COR

Task	Deliverable	Planned Completion Date	Actual Completion Date	Validation
Reporting, FARC	Property Certificate	02/13/13	12/11/12	Emailed to NETL COR

Task 2.0: Implement an Organized Sponsorship Development Program

Task 2.1: SECARB-Ed Sponsorship Development Program

HILL assisted SSEB with the creation and implementation of the Sponsorship and Marketing Plan. During the March 8, 2011 SECARB-Ed meeting in Atlanta, Georgia, it was agreed that the SMP would be modified to facilitate working with organizations with existing avenues to deliver content. The plan continued to evolve throughout the project and a final amendment was added on September 18, 2012 (Appendix 4).

HILL led the development of a modified sponsorship development program. Because of uncertainty in the timing of any CO₂ reduction programs in the United States, potential sponsors that were identified for SECARB-Ed are delaying investment decisions related to carbon management.

SECARB-Ed worked with organizations with existing training capabilities and infrastructure such as the Founder Societies and its five engineering trade associations. Dr. Gerald Hill and SSEB conducted a one-hour live webinar for AIChE on November 30, 2011 that is available on-demand. The webinar continues to receive views and generate revenue for AIChE.

HILL worked with the North American coordinator for the Global CCS Institute to determine roles and relationships for possible continuation of webinars and training. HILL held several phone conversations with AIChE and the Global CCS Institute. SSEB and HILL organized conference calls with AIChE and the Global CCS Institute to discuss the sponsorship and continuation of technology training programs. On October 2, 2012 a conference call between HILL, AIChE, GCCSI and SSEB began the sponsorship transition.

In a separate sponsorship effort, EnTech targeted corporate sponsorship for the Research Experience in Carbon Sequestration (RECS) program and was successful in securing in-kind support. Southern Company provided the highest level of corporate support by providing access to power plants, demonstration projects and field sites. The company also arranged for communications training through its corporate communications team who offered individual and team coaching and video feedback. Thunderbird Engineering and Computer Modeling Group Ltd. offered free trial software licenses for the RECS group, and LICOR Biosciences conducted field training on its instrument systems at no cost. Denbury Resources provided in-kind field site access and faculty support. Additional corporate sponsorship through faculty in-kind participation included: ALSTOM, Summit Power Group, C12 Energy, Schlumberger Carbon Services, Praxair, Blue Strategies, Advanced Resources International, Inc. and Cimarron Engineering, Ltd.

Task 2.2: Establish an Advisory Board (SSEB/HILL)

The recipient's key project participants and existing SECARB partners identified, recruited and established an Advisory Board comprised of key sponsors and recognized CCS authorities, to provide direction for the recipient's business model and to guide the development of high quality training materials and an effective outreach and education program. The recipient provided an Advisory Board Roster to DOE that includes the list of personnel, title, area of expertise, role of each member and a short biography (Appendix 5). The members are identified in Table 3.

Table 3 SECARB-Ed Advisory Board members

Name (Last, First)	Organization	Telephone Number
Baskin, Kathryn	SSEB	770-242-7712
Brown, Bruce	NETL	412-386-5534
Castle, Jim	Clemson University	864-656-5015
Duncan, Ian	TX BEG	512-471-5117
Hill, Gerald	HILL - SSEB Sr. Tech Advisor	770-894-4709
Karmis, Michael	Virginia Tech	540-231-5273
Pashin, Jack	GSA	205-247-3558
Sams, Kimberly	SSEB	770-242-7712
Tomski, Pamela	EnTech Strategies	202-390-8896

Task 2.3: Establish a List of Revenue Generating Products

HILL assisted SSEB in establishing its initial products with revenue generating potential. One of the SECARB-Ed CCS webinar products is maintained in the AIChE on-line library and is accessed periodically on a pay-for-use basis.

The Virginia Center for Coal and Energy Research (VCCER) planned a webinar as an opportunity for revenue generating products. This was not possible under the current Virginia Tech webinar service. However, Nino Ripepi gave a free webinar in September 2010 to over 50 students at Virginia Tech, the University of Pittsburgh and the University of British Columbia and to professionals at Alpha Natural Resources.

Task 2.4: Develop and Implement a Marketing Strategy (SSEB/Hill)

Due to uncertainty in the timing of any CO₂ reduction programs in the United States, potential sponsors that were identified for SECARB-Ed indefinitely delayed investment decisions related to carbon management. In response to the changes, the SECARB-Ed SMP was modified. The original marketing plan focused on providing CCS content and working with others who have existing and well developed outreach networks. Two of the key organizations working with SECARB-Ed on this approach are the Global CCS Institute and the AIChE. The Global CCS Institute has also changed its operating strategy and, as part of a new five-year plan (developed in 2012 and scheduled for release in March 2013); the institute will be adding CCS programs in 2013 and 2014 that have the potential for generating revenues within the next two to three years.

Currently, the AIChE is generating a small amount of revenue from a SECARB-Ed webinar that has been maintained in the AIChE training library. AIChE contacted SSEB expressing interest in conducting additional CCS training programs. The ongoing dialogue with AIChE has led to the continuation of SECARB-Ed training efforts, through a joint agreement of AIChE and the Global CCS Institute, that was facilitated by team member HILL.

HILL and SSEB worked with the Global CCS Institute and AIChE and its Founder Societies in the implementation of the SECARB-Ed marketing strategy's plan for continuation. During a conference call on October 2, 2012, SSEB formally transitioned its SECARB-Ed CCS training activities to the Global CCS Institute and AIChE. The Global CCS Institute and AIChE have agreed to recognize the efforts of SECARB-Ed in webinars that will be produced in relation to the original AIChE/SECARB-Ed webinar.

In a second initiative, SSEB proposed continuing its in-house elements of the SECARB-Ed program (website, Facebook page, Training Newsletters and E-Alerts) under the U.S. Department of Energy's (DOE) Office of Clean Coal and its Office of Clean Energy Collaboration. On August 30, 2012, Mr. Gene Kight of DOE approved funding for the SECARB-Ed program as part of SSEB's Committee on Clean Coal and Energy Technologies Collaboration. The scope of work of the training and education effort under the Clean Coal Collaboration initiative includes:

- **Develop and Hold Training Events:** SSEB/SECARB-Ed shall identify topics for short courses and assist in the development of training materials for co-sponsored training events. SSEB/SECARB-Ed will collaborate with experts to develop short courses and other planned carbon capture, utilization and storage (CCUS) events. Course development includes content of short courses and other events, as well as plans for revisions of courses based on feedback from participants. SSEB/SECARB-Ed will assist co-sponsors with travel and other direct costs associated with the preparation and delivery of training events.
- **Organize, Prioritize and Participate in CCS Events:** SSEB/SECARB-Ed shall provide speakers and/or organize lectures, seminars, workshops and conferences in the region to facilitate CCUS outreach and networking.
- **Website:** SSEB/SECARB-Ed shall maintain a website for education and outreach. The website shall contain information on upcoming meetings of SECARB-Ed, SECARB-Ed membership/corporate sponsors, newsroom on issues facing CCUS such as public policy (state and national) and recent CCS publications. A link on the webpage shall relay training information and a calendar schedule on CCS courses and webinars that SECARB-Ed and other CCUS trainers are providing.
- **Newsletters:** SSEB/SECARB-Ed shall publish a newsletter that contains a summary of upcoming training opportunities, material of a technical nature relevant to the SECARB-Ed region, results from on-going CCUS research, public policy updates related to CCUS, alerts to forthcoming R&D solicitations and review, summarize and comment on CCUS technical papers published by others.

Task 3.0: Development of Short Courses on CCS Technologies

The Southern States Energy Board (SSEB) and GERALD R HILL PHD, Inc (HILL) developed a Southeast Regional CO₂ Sequestration Technology Training Program (SECARB-Ed) Technology Training Plan that identified and defined training goals and

objectives, training initiatives, groups served, training resources, types of training, methods of delivery, funding, implementation responsibilities and evaluation of courses (Appendix 6).

Task 3.1: Identify Topics for Short Courses

The SECARB-Ed Advisory Board developed CCS short courses and worked with professors/teachers to register these courses for PDHs. The team utilized their experience and academic qualifications to prepare short course lectures and materials. The topics identified by the team are described below.

HILL worked with AIChE and the Founder Societies to develop workshop training modules and a webinar on CCS. SSEB and HILL developed a training module for an AIChE webinar that was delivered live on November 30, 2011. The module contained materials related to CO₂ capture, treatment and compression. The webinar is currently available on-demand from the AIChE training library. HILL organized training modules and participated in an October 6, 2011 AIChE training event in Galveston, Texas, and a Founder Societies training session in Orlando, Florida, in February 2012.

VCCER identified course topics in the following areas and materials were developed: coal seam sequestration, shale sequestration, resource and capacity assessment, enhanced methane and shale gas recovery, pilot programs in coal seam sequestration and monitoring, verification, and accounting (MVA).

BEG developed a number of training modules related to MVA, with the majority of the focus on developing sound and effective monitoring programs for subsurface and surface change due to deep sequestration of carbon, in either saline aquifer or EOR settings; and understanding and calculating the sources of risk associated with sequestration in these deep geological settings. These modules were presented to a variety of audiences, from geologists to engineers to regulators, in classrooms, conferences and short courses.

At Clemson, topics were identified and materials were prepared for short courses and seminars pertaining to CO₂ capture, treatment and compression and produced water treatment. Information was gathered from industry reports, government documents and peer-reviewed literature.

EnTech developed RECS, an intensive, 10-day program that cuts across various aspects of CCUS and addresses science, technology and policy issues. Each course module could be utilized as a stand-alone short course.

Task 3.2: Develop Relationships with Experts to Exploit Opportunities for Presentations

The SECARB-Ed Advisory Board utilized existing and new relationships with the CCS community to match expert presenters to the course material. In many cases, the Advisory Board members and/or their colleagues presented the coursework. In other cases, the Advisory Board called upon SECARB partners to deliver specialized presentations.

In March 2011 during the 6th Annual SECARB Stakeholders' Briefing, the SECARB-Ed team partnered with Schlumberger Carbon Services to deliver a three-hour SECARB-Ed classroom training course. The intermediate-level training session on carbon sequestration technologies and applications across the Southeast was well received by participants.

Virginia Tech issued three PDHs for those who requested them. In a second SECARB-Ed training session, SSEB and HILL collaborated with Tampa Electric Company, Southern Company and American Electric Power to present “CCS Projects in the Southeast.”

The VCCER fostered relationships with a number of regional professionals in the area of CCS, including Steve Carpenter and George Koperna of Advanced Resources International, Inc., Richard Winschel and Jim Locke of CONSOL Energy, Michael Miller and Matt Conrad of Cardno Marshall Miller & Associates (formerly Marshall Miller & Associates), and Timothy Carr of West Virginia University. These individuals helped in developing materials and courses during the project.

Task 3.3: Identify and Work with Professional Societies for Short Course Approval

The SECARB-Ed partners identified and worked with professional societies to obtain short courses approved for PDHs, including verification of certification. Following is a summary of this activity. A complete listing of courses and the issuance of PDHs is provided under Task 4.3.

HILL and SSEB worked with AIChE and the Founder Societies to provide tailored training sessions and a webinar that met the standards of approval for training programs offered to chemical, civil, mechanical, electrical and electronics engineers.

Societies identified by VCCER for short course approval include the Society for Mining, Metallurgy, and Exploration (SME); the American Association of Petroleum Geologists (AAPG); and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME); the West Virginia Coal Association; the Kentucky Coal Association; the Gulf Coast Association of Geological Societies; and the Pittsburgh Coal Conference.

BEG presented modules to multiple stakeholder groups, the Society of Independent Professional Earth Scientists (SIPES), the Environmental Defense Fund, regulators at the U.S. Environmental Protection Agency (EPA) and scholarly organizations at the AIChE. Contacts with persons interested in CCS were made during preparation of these training modules and after the courses were presented. The mix of attendees provided the right balance between stakeholders, industry and regulatory groups.

Clemson presented a short course on CO₂ capture, treatment and compression and produced water treatment in conjunction with the 19th Annual Clemson Hydrogeology Symposium in April 2011. The course was approved for 3 PDHs per attendee.

Task 4.0: Regional Training and other Activities through Outreach and Networking

Task 4.1: Participate in Opportunities to Co-Sponsor Events

Opportunities for co-sponsoring courses and workshops were explored at the following: Annual Conference on Carbon Capture and Sequestration; the International Coalbed and Shale Gas Symposium; the SME Annual Meeting; the Eastern Coal Council (ECC) Annual Meeting; the Eastern Section of the AAPG Annual Meeting, the Southeastern Section of the Geological Society Annual Meeting, the RECS program, and the Pittsburgh Coal Conference.

Task 4.2: Organize, Prioritize and Participate in CCS Events

All members of the SECARB-Ed team provided speakers and/or organized lectures, seminars, workshops and conferences in the region to facilitate CCS outreach and networking. A list of presentations, posters and outreach events is provided below. Presentation materials are found in Appendix 7.

Kimberly Sams and Patricia Berry attended the Geological Society of America Annual Meeting in 2010 and 2012 as exhibitors. The SECARB-Ed and SECARB programs were discussed with visitors. SECARB-Ed fact sheets, postcards and bookmarks were distributed at the meeting, and booth visitors were added to the outreach list for e-alerts and newsletters.

Jack Pashin from GSA and Mike Karmis and Brad Kelley from VCCER participated in the Fifth Annual SECARB Stakeholder's Briefing in Atlanta, Georgia, March 9-10, 2010.

Nino Ripepi and Brad Kelley from VCCER participated in NETL's 9th Annual Conference on Carbon Capture & Sequestration in Pittsburgh, Pennsylvania, from May 10-13, 2010.

Michael Karmis and Ryan Grimm from the VCCER and Jack Pashin of the GSA participated in the NETL's Regional Carbon Sequestration Partnerships Annual Review Meeting in Pittsburgh, Pennsylvania, on October 5-7, 2010.

Michael Karmis of the VCCER gave an invited talk to a Henry Krumb guest lecture entitled: "Carbon Capture and Storage (CCS) Research: The Road to Deployment" to the Southern Californian Section of SME in Pomona, California, on February 15, 2011.

Nino Ripepi of the VCCER and Jack Pashin of the GSA gave presentations at ARI's Coal-Seq Forum as invited guest speakers on coal seam field tests on March 7, 2011 in Houston, Texas.

Jack Pashin gave an invited seminar to the Mining and Minerals Engineering and Geology departments at Virginia Tech on March 17, 2011.

In April 2011, Jack Pashin made a presentation entitled, "Clean Coal Technology Development and its Impact on the Energy Industry in the Southeastern United States," at the AAPG Annual Conference and Exposition in Houston, Texas. The presentation was made as part of a session highlighting clean coal and carbon sequestration technology.

In May 2011, Nino Ripepi of the VCCER and Dr. Pashin of the GSA attended the Tenth Annual Conference on Carbon Capture & Sequestration in Pittsburgh, Pennsylvania. There, Dr. Pashin made a presentation on the SECARB Black Warrior field test called, "CO₂ Sequestration Field Test in Mature Coalbed Methane Reservoirs of the Black Warrior Basin."

The VCCER displayed and staffed the SECARB-Ed booth at the ECC Annual Meeting in May 2011 in Kingsport, Tennessee. SECARB-Ed materials were made available to all attendees.

In June 2011, SECARB-Ed and Southern Company sponsored the Research Experience in Carbon Sequestration (RECS) program, which was held in Alabama. Participants in the program were treated to a variety of classroom, laboratory and field activities and visited many of the important project sites in Alabama, including the ARRA characterization site at Plant Gorgas, the National Carbon Capture Center at Plant Gaston, the SECARB Phase III capture plant at Plant Barry and the SECARB Phase III injection site in Citronelle Field. During the program, Kimberly Sams of SSEB provided an introductory presentation on the SECARB-Ed and SECARB programs. Dr. Jack Pashin made a presentation on regional geology and CO₂ storage opportunities in the region. Dr. Pashin and Sarah Rieboldt of GSA helped lead the discussion of geologic sinks at the Gorgas characterization site. GSA Personnel, including Jack Pashin, Sarah Rieboldt, Guohai Jin, Richard Carroll, Marcella McIntyre and Mac McKinney also led a field trip in the Birmingham area to view outcrops and cores of coal-bearing strata and saline formations.

Nino Ripepi of the VCCER discussed CCS technologies as part of the ECC's project Coal to Electricity on July 10, 2011, where 20-25 teachers from the Commonwealth of Virginia spent a week in the coalfields of southwestern Virginia.

In September 2011, Jack Pashin and Steve Carpenter chaired two Carbon Management Training Sessions for SECARB-Ed at the annual Pittsburgh Coal Conference in Pittsburgh, Pennsylvania. Eight presentations were given, to 39 attendees, who each received 2.5 PDHs.

Dr. Karmis made a presentation to the Pittsburgh Geological Society and the Society for Mining, Metallurgy and Exploration on November 16, 2011, on Carbon Capture and Storage: The Road to Deployment. One PDH was awarded to each of 45 attendees.

New SECARB-Ed materials were developed by the GSA based on the ongoing Black Warrior Site Characterization ARRA project. These materials were utilized at the RCSP meeting in Pittsburgh during November 2011.

Dr. Nino Ripepi coordinated participation in a recertification training seminar for mining engineers sponsored by the Virginia Mining Association on March 7, 2012, in Abingdon, Virginia. Dr. Ripepi's presentation was titled "Carbon Capture and Storage Opportunities in Central Appalachia." The Virginia Mining Association awarded PDHs to 137 attendees, of which one hour for each is attributable to SECARB-Ed.

On March 28, 2012, Dr. Jack Pashin was keynote lecturer at a two-day workshop organized by the U.S. Geological Survey on the assessment of geologic carbon sinks in Shepherdstown, West Virginia. His talk was entitled "Fundamentals of Sequestration in Coal and Shale." Dr. Nino Ripepi gave a presentation at the same workshop on storage issues and opportunities for CCS in Central Appalachia, on March 29, 2012.

On March 30, 2012, Dr. Jack Pashin gave a seminar, "Fundamentals of Sequestration in Coal and Shale," to the Department of Environmental and Earth Sciences at Clemson University. Dr. Jim Castle, who is also a participant in the SECARB-Ed program, organized the event, and he and Dr. Pashin met with students and faculty about a broad range of carbon sequestration and water management issues. Approximately 110 students and faculty were in attendance. Students were asked to write down a question during the presentation, and the dominant concern among the student population is long-term leakage.

The presentation was recorded, and Clemson is considering submitting the presentation to SECARB for posting on the internet.

In April 2012, Dr. Jack Pashin gave a presentation at Auburn University entitled, “Clean Coal Technology Development and its Impact on the Energy Industry in the Southeastern United States.”

In June 2012, SECARB-Ed and Southern Company sponsored the Research Experience in Carbon Sequestration (RECS) program, which was held in Alabama. Participants in the program were treated to a variety of classroom, laboratory and field activities and visited many of the important project sites in Alabama. During the program, Kimberly Sams of SSEB provided an introductory presentation on the SECARB-Ed and SECARB programs. Personnel at GSA helped host the RECS program. On June 7, 2012, GSA hosted a core workshop in which the RECS students performed a series of exercises with cores and geophysical well logs. Featured cores included a core of coal-bearing strata from the Black Warrior basin, core of the Tuscaloosa Group from the SECARB II Plant Daniel test and core of the Donovan Sand from the SECARB III test site in Citronelle field. In addition, on June 10, Dr. Pashin gave a lecture to the RECS group on carbon sequestration in unmineable coal seams. Dr. Pashin and his staff then led the group on a field trip to outcrops of Pennsylvanian strata in the Cahaba coalfield. The first stop highlighted deltaic sedimentation and a reservoir-class coal seam, and the second stop highlighted beach-barrier deposits, which constitute the best prospects for saline formation sequestration in north Alabama.

Task 4.3: Develop and Hold Training Events

Each SECARB-Ed team member developed training materials and course content related to the specific expertise of the university/recipient members. Twenty training events (short courses / workshops) were conducted at various venues. The SECARB-Ed team awarded a total of 1,951 professional development hours to 1,131 participants. Presentation materials for the modules listed below are found in Appendix 8.

GHG Fundamentals, Legal/Regulatory and Institutional, and CO₂ Transportation (SSEB/HILL)

SSEB and HILL developed a training module for an AIChE webinar that was delivered live on November 30, 2011. The module contained training materials related to CO₂ capture, treatment and compression. The webinar is currently available on-demand.

HILL and SSEB staff assisted with planning for SECARB-Ed participation in an October 6, 2011 AIChE training event in Galveston, Texas, on October 25, 2011; USCCSA training event in Charleston, West Virginia, on October 26, 2011; training event at Duke Energy, in Charlotte, North Carolina; and the Founder Societies training session in Orlando, Florida, in February 2012.

Coal, CBM, and Related MVA (VA Tech/GSA)

Dr. Michael Karmis and Nino Ripepi of the VCCER presented “Carbon Capture and Storage (CCS): The Road to Deployment,” as invited lecturers to the Virginia Tech’s Department of Geosciences Senior Seminar course on February 17, 2010. This one hour lecture to 25 geosciences students covered the basics of CCS, details on coal seam sequestration, implementation of an injection pilot test and concluded with legal and liability issues.

Dr. Michael Karmis of the VCCER presented “Carbon Capture and Storage (CCS) Research: The Road to Deployment” to the Research Council of the SME at their Annual Meeting in Phoenix, Arizona, on March 1, 2010. This presentation covered the basics of CCS and focused on CCS research and employment opportunities for the SME-represented disciplines.

Dr. Michael Karmis of the VCCER presented “Carbon Capture and Storage – The Way Ahead” at the 2010 Spring Meeting of the Central Appalachian Section of SME on May 7, 2010. 0.75 PDH’s were awarded to 41 of the 80 attendees.

The VCCER in conjunction with ECC, DOE and SECARB developed and held a successful CCS session during the Annual Meeting of ECC, in Kingsport, Tennessee, on May 24-25, 2010. The VCCER awarded 2.5 PDHs to 21 of the 68 attendees who requested them.

Dr. Nino Ripepi of the VCCER presented “Clean Coal: Carbon Capture and Storage” to over 50 students as part of a Mining Engineering Sustainable Development class offered to undergraduate and graduate students at Virginia Tech, the University of Pittsburgh and the University of British Columbia, as well as to professionals from Alpha Natural Resources. The seminar was presented on September 15, 2010 via live internet feed, complete with real-time video/audio feedback from each campus.

The VCCER and the GSA presented materials for a short course as part of the Central Appalachian Section of the SME Annual Meeting in Lexington, Kentucky, on October 15, 2010. This short course titled “Carbon Capture and Storage Fundamentals and Best Practices” was organized by Dr. Michael Karmis and Dr. Nino Ripepi of the VCCER, with assistance in developing and presenting lectures from Dr. Jack Pashin (GSA) and Dr. Tim Carr (West Virginia University). The course was conducted as a half-day or four-hour course with 20 participants attending and given PDHs. The course provided an overview of issues related to carbon capture, transportation and storage with an emphasis on storage in unmineable coal seams and shale reservoirs in Appalachia.

The GSA conducted a Technology Transfer Workshop in conjunction with the Eastern Gulf Regional Lead Organization of the Petroleum Technology Transfer Council (PTTC). The course is named “The Role of Carbon Capture and Storage in Rejuvenating the Energy Portfolio of the Southeastern United States” and was held at the Capitol Club in Jackson, Mississippi, on January 11, 2011. This workshop was designed to highlight CCS activities in the southeastern United States and to highlight the technologies that are being developed in the region. Emphasis was placed on the fundamentals of CCS and CO₂-enhanced resource recovery, as well as the CCS projects that have been performed in the region. The workshop was designed to provide an overview of CCS with emphasis on activities in Alabama and Mississippi. Students gained a fundamental understanding of CCS technology and activities in the region, and professional geologists and engineers received six PDHs.

As co-chairs of the Carbon Sequestration Session at the SME Annual Meeting, Dr. Nino Ripepi of the VCCER and Scott Keim of Marshall Miller & Associates designed a SECARB-Ed activity focused on coal seam carbon sequestration and reporting rules that affect the mining industry. Two hours of professional development hours were available for those attending this session on March 2, 2011 in Denver, Colorado. The benefit and object of this course was to engage the attendees, all who work in the mining industry, of the role that

coal seams can play in carbon sequestration activities by presenting results from three coal seam carbon sequestration tests in Appalachia.

The VCCER in conjunction with SSEB, GSA and the Texas-BEG presented materials for “CCS Technologies and Applications across the Southeast” as a SECARB-Ed Training Session coinciding with the SECARB 6th Annual Stakeholder’s Briefing in Atlanta, Georgia. The session was designed to reach out to a diversified audience with a focus on CCS fundamentals, best practices, risk assessment and commercialization. Three hours of professional development hours were available to participants for the short course on March 9, and there were 54 participants in attendance. The benefit to attendees was in depth presentations from a qualified panel on issues related to commercializing conventional CCS sinks and better understanding unconventional sinks.

A four hour training event was held immediately preceding the inaugural Carbon Management Technology Conference in Orlando, Florida, on February 6, 2012. Dr. Michael Karmis, Dr. Gerald Hill and Dr. Jack Pashin delivered training modules. A total of 56 PDHs (four per person) were awarded by Virginia Tech for this short course.

Dr. Nino Ripepi gave a presentation on CCUS to approximately 25 graduating (high school) seniors in the Student Transition Engineering Program, or STEP, on June 29, 2012, at Virginia Tech.

Dr. Ripepi and Brad Kelley of the VCCER gave four presentations on CCUS to middle school (12-13 year old) students attending an IMAGINATION summer camp at Virginia Tech on July 17, 18, 26 and 27, 2012. These presentations presented hands on exercises for the students drawn from activities and suggestions listed in the DOE Best Practices Manual for Public Outreach.

Brad Kelley gave five presentations on Carbon Capture and Storage to 2nd and 5th graders at Temple Terrace Elementary School in Tampa, Florida, in October 2012. These presentations used the exercises for students listed in the item above.

Saline, Oil and Gas, and Related MVA (UT BEG)

The entries below show dates, presenter, titles and locations of training modules performed in this project. It is important to note that BEG specializes in education and research and that modules in MVA and risk identification and quantification in CCS, similar to these, have been presented at numerous locations and venues. They were not listed here because technically they were not presented as part of SECARB-Ed.

January 2011- Dr. Ian Duncan
“Risks Associated with Geologic Sequestration in Brine Reservoirs” during the SIPES Meeting in Austin, Texas.

January 11, 2011 – Dr. Ian Duncan
“Geologic CO₂ Sequestration: Assuring Safe Effective Long Term Storage” presentation part of Short Course: “The Role of Carbon Capture and Storage in Rejuvenating the Energy Portfolio of the Southeastern United States” organized by SECARB-ED and presented in Jackson, Mississippi.

March 18, 2011 – Dr. Ian Duncan

“Performance-based Regulation of Geologic CO₂ Sequestration: Site Characterization, Monitoring and Modeling” and “Modeling Geologic Sequestration to Support Regulation: Lessons from New Field project Data” one-day short course held at EPA Region 6 in Dallas, Texas. The webinar was broadcast to EPA Regions and Headquarters staff.

September 6, 2011 – Dr. Ian Duncan

“Risks Associated with CO₂ Sequestration” presented to the World Bank during program entitled “Addressing Barriers to Carbon Capture and Storage in Developing Countries” organized by SECARB-ED.

October 6, 2011 – Dr. Michael Young

“Monitoring, Verification and Accounting (MVA) in Retention and EOR Settings” sponsored by SECARB-ED and presented at the AIChE (South Texas Section) 3rd Regional Process Technology Conference in Galveston, Texas.

December 22, 2011 – Dr. Ian Duncan

“Induced Seismology and CCS”

Two hour Webinar for Environmental Defense Fund Staff in Austin, New York, Washington D.C. and San Francisco, California.

CO₂ Capture, Treatment and Compression, and Produced Water Treatment (Clemson/HILL)

The following training events on CO₂ capture, treatment and compression and produced water treatment were developed and held:

A presentation covering the basics of CCS integrated with an overview of the activities of SECARB-Ed was delivered on April 1, 2010, at the Clemson Hydrogeology Symposium in Clemson, South Carolina. Approximately 80 professionals, mostly geologists working in the environmental consulting industry, attended the presentation. Many attendees requested to be kept current on SECARB-Ed training opportunities, and their names and contact information were forwarded to SSEB. In addition, the fact sheet on SECARB-Ed and training opportunities, produced by SSEB, was distributed to approximately 300 attendees of the Symposium.

Dr. John Rodgers and Dr. James Castle held a seminar on CCS at the Department of Biology and Geology at the University of South Carolina-Aiken on February 4, 2011. Approximately 85 participants, including personnel from the Savannah River National Laboratory, were in attendance.

Dr. James Castle presented a lecture on CCS to the Department of Forestry and Natural Resources at Clemson University on February 23. Approximately 18 participants were in attendance, and our signed up for one hour each of Continuing Forestry Education (CFE) credit offered by the Society of American Foresters. In addition, the credit applies to fulfilling the continuing education requirement to be a South Carolina Registered Forester.

Clemson personnel developed and held a short course on CO₂ capture, treatment and compression and produced water treatment in conjunction with the 19th Annual Clemson Hydrogeology Symposium in April 2011. Dr. Gerald Hill delivered a keynote address on CCS. Several other CCS modules were delivered, including: “Fundamentals of Carbon Capture and Sequestration”; “Role of Water in Carbon Capture and Sequestration”; “Behavior of CO₂, Fate & Transport”; “Applications of Modeling to Carbon Sequestration”;

and “Carbon Capture and Sequestration: Opportunities and Challenges.” Participants completed exercises on surface footprint and pressure buildup related to CCS projects. Sixteen participants attended the short course, with three PDHs awarded per attendee for a total of 48 PDHs.

Dr. John Wagner prepared and presented a lecture to educators attending Geofest 2011, a professional development conference held in Columbia, South Carolina, on September 10, 2011. The lecture covered multiple aspects of CCS and included both an overview of CCS and the importance of water in CCS.

Dr. James Castle prepared and delivered a lecture during a SECARB-ED training event at the Pittsburgh International Coal Conference in Pittsburgh, Pennsylvania, on September 14, 2011. The lecture focused on challenges and opportunities associated with water in CCS.

Dr. John Wagner prepared and presented a lecture to educators at the South Carolina Science Council annual meeting in Myrtle Beach, South Carolina, on November 3, 2011. The lecture covered various aspects of CCS including the importance of water in CCS.

Arrangements were made for holding a SECARB-ED seminar at Clemson University. The seminar was held on March 30, 2012. Dr. Jack Pashin, GSA, was the guest speaker at the event, and 102 university students, faculty and others attended.

Dr. John Wagner prepared and presented an exhibit on CCS and Water at the Environmental Education Association of South Carolina Conference in Marietta, South Carolina, on June 9, 2012.

Dr. John Wagner presented a seminar on CCS and Water at the South Carolina Upstate Regional Science Teachers Conference in Spartanburg, South Carolina, on October 13, 2012.

Dr. John Wagner presented a paper on “The Role of Water in Carbon Capture and Sequestration: Educating the Public,” at the Geological Society of America Annual National Meeting in Charlotte, North Carolina, on November 6, 2012.

Dr. John Rodgers and Dr. James Castle presented a poster on “Water in Carbon Capture and Sequestration: Opportunities and Challenges” at the Society of Environmental Toxicologists and Chemists Annual National Meeting in Long Beach, California, on November 13, 2012.

“Research Experience in Carbon Sequestration” in the Southeast (EnTech)

RECS 2011 and RECS 2012 were held in Birmingham, Alabama, with field training at various sites throughout Alabama. Additionally, EnTech recruited undergraduate students at Tuskegee University to serve as RECS interns, and hosted CCUS seminars in 2011 and 2012 for the Tuskegee University engineering departments. The RECS Field Guide Handbook was prepared to provide information on various field sites and training activities. Additional details are provided under Task 4.2.

Task 5.0: Perform Regional/Basin Technology Transfer Services

Task 5.1: Training Newsletter

An email contact list was established through networking at CCS, engineering and geologic training sessions, trade shows and national and regional meetings. SECARB-Ed directly collected contact information from 168 people. Additionally, 369 contacts were added via SECARB stakeholders. A training newsletter containing a summary of upcoming training opportunities, material of a technical nature relevant to the SECARB-Ed region, results from on-going CCS research, public policy updates related to CCS, and alerts to forthcoming R&D solicitations, were developed and emailed to recipients at least quarterly. Ten training newsletters were issued over the performance period and are compiled in Appendix 9.

Task 5.2: Leveraged Regional Website, Email Alerts, and Technical Inquires

SSEB coordinated the design, development and launch of a new, dedicated SECARB-Ed website with web designers/developers at NuSpace Media. The website, www.secarb-ed.org, was launched on November 15, 2010. SSEB maintained and updated the site regularly with information on upcoming meetings of SECARB-Ed, SECARB-Ed membership/corporate sponsorship, news regarding important issues facing CCS such as public policy (state and national) and recent CCS publications. The webpage also provided training information and a calendar schedule on CCS courses, events and webinars that SECARB-Ed and other CCS trainers were providing. Additionally, the link may contain discussions on technical issues related to CCS.

E-Alerts were developed and emailed to recipients at least quarterly. Thirteen E-Alerts and five fact sheets were issued during the performance period and are compiled in Appendix 10. A SECARB-Ed Facebook page/group was created and frequently updated with upcoming events and news to date. SECARB-Ed currently has 33 “LIKES.”

Task 5.3: Coordinate Funding Work (SSEB)

None of the co-sponsors or funding sources placed restrictions or stipulations on the work to be performed under SECARB-Ed.

CEU/PDH Award Status

Course Name	Date of Course	Number of Participants	Number of CEU or PDHs per Course	Total Number of CEU or PDHs
Carbon Capture and Storage – The Way Ahead at 2010 Spring Meeting of the Central Appalachian Section of SME	05/07/10	80	0.75	60
Clean Coal Technologies Session at the Eastern Coal Council's 31st Annual Conference and Exposition	05/25/10	68	2.50	170
Carbon Capture and Storage Fundamentals and Best Practices – Short Course; Central Appalachian Section of the Society of Mining, Metallurgy and Exploration Meeting	10/15/10	20	4.00	80
The Role of Carbon Capture and Storage in Rejuvenating the Energy Portfolio of the Southeastern United States	01/11/11	24	6.00	144
Coal and Energy: Carbon Sequestration	03/02/11	36	2.00	72
CCS Technologies and Applications across the Southeast	03/09/11	54	3.00	162
CCS Projects in the Southeast	03/10/11	60	0.00	0
CO2 Sequestration for EPA Regulators: webinar	03/18/11	65	5.00	325
Introduction to Carbon Sequestration	04/07/11	16	3.00	48
CCS Capacity Building Workshop	5/10-5/11/2011	49	0.00	0
Research Experience in Carbon Sequestration	6/5-6/15/2011	30	0.00	0
World Bank CCS Training Session	09/06/11	43	0.00	0
SECARB-Ed CCS Training Session	09/14/11	39	2.50	98
SECARB-Ed CCS Training Session- AIChE Regional	10/6-10/7/2011	68	2.00	136
SECARB-Ed CCS Training Session -USCSC	10/25/11	37	0.00	0
SECARB-Ed CCS Training Session -Duke Energy Seminar	10/26/11	81	3.50	284
Is your facility carbon capture ready? Understanding the basics of carbon capture, utilization, and storage (CCUS)	11/30/11	180	1.00	180
SECARB-Ed CCS Training Workshop	02/06/12	14	4.00	56
Virginia Mining Association, Inc. Professional Engineers in Mining, Seminar	03/07/12	137	1.00	137
Research Experience in Carbon Sequestration	6/3-6/13/2012	30		0
Total		1131	40	1951

Conference Abstracts Published:

- Castle, J. W., Wagner, J. R., Rodgers, J. H., Jr., and Hill, G. R., "Technology Training of Engineers, Geologists, and Technicians for Commercial Deployment of Carbon Capture and Sequestration: SECARB-Ed," Clemson University Eighteenth Annual Hydrogeology Symposium Abstracts with Program, p. 5, April 2010.
- Castle, J. W., Rodgers, J. H., Jr., Wagner, J. R., and Hill, G. R., "Water in Carbon Capture and Sequestration: Opportunities and Challenges," 28th Annual International Pittsburgh Coal Conference Abstracts, p. 31, September 2011.
- Wagner, J. R., Castle, J. W., Rodgers, J. H., Jr., and Falta, R. W., Jr., "The Role of Water in Carbon Capture and Sequestration: Educating the Public," Geological Society of America Abstracts with Programs, v. 44, no. 7, p. 349, November 2012.
- Rodgers, J. H., Jr., Castle, J. W., and Wagner, J. R., "Water in Carbon Capture and Sequestration: Challenges and Opportunities," Society of Environmental Toxicology and Chemistry (SETAC) North America 33rd Annual Meeting Abstract Book, p. 273, November 2012.

Conclusion

The SECARB-Ed partners implemented an organized sponsorship development program, developed short courses on CCS technologies, participated in regional training and other activities through outreach and networking and performed internet-based and electronic regional/basin technology transfer services. The partners addressed the most promising sequestration options in the region; the mix of industry and power plant sources of CO₂; regional transportation infrastructure; and the legal, regulatory, and institutional frameworks that exist in the southeast. As a result, SECARB-Ed fostered the development of a future workforce with disciplines specific to applied engineering and CCS science and technologies and advance the United States in its position as the leader in addressing climate change, near-zero emissions technologies and geologic sequestration technologies. The educational and training opportunities detailed in this Final Report demonstrate an effective means of disseminating a broad base of such knowledge and skills to a variety of students and professionals who are interested in the area of CCS technologies. The efforts of the SECARB-Ed Advisory Board and partners have resulted in a total of 1,951 professional development hours (PDHs) awarded to 1,131 participants.

List of Acronyms and Abbreviations

AAPG	American Association of Petroleum Geologists
AIChE	American Institute of Chemical Engineers
AIME	American Institute of Mining, Metallurgical, and Petroleum Engineers
BEG	Bureau of Economic Geology at The University of Texas at Austin
CCS	carbon capture and storage
CCUS	carbon capture, utilization and storage
CEU	continuing education unit
CO ₂	carbon dioxide
DOE	U.S. Department of Energy
ECC	Eastern Coal Council
GSA	Geological Survey of Alabama
HILL	GERALD R HILL PHD, Inc.
MVA	monitoring, verification and accounting
NETL	National Energy Technology Laboratory
PDH	professional development hour
PI	principal investigator
PMP	Project Management Plan
R&D	research and development
RCSP	Regional Carbon Sequestration Partnership
RECS	Research Experience in Carbon Sequestration
SSEB	Southern States Energy Board
SECARB	Southeast Regional Carbon Sequestration Partnership
SECARB-Ed	Southeast Regional CO ₂ Sequestration Technology Training Program
SIPES	Society of Independent Professional Earth Scientists
SME	Society for Mining, Metallurgy, and Exploration
SMP	Sponsorship Marketing Plan
SOPO	Statement of Project Objectives
STEP	Student Transition Engineering Program
VAT	Virginia Tech
VCCER	Virginia Center for Coal and Energy Research

Appendices