# Southeast Regional Carbon Sequestration Partnership Phase III Early Test

**AGENCY:** U.S. Department of Energy (DOE)

**ACTION:** Finding of No Significant Impact (FONSI)

SUMMARY: DOE has prepared an Environmental Assessment (EA), DOE/EA-1625, titled "Southeast Regional Carbon Sequestration Partnership (SECARB) Phase III Early Test" for a proposed project in which DOE would provide co-funding. The project would inject and closely monitor the flow of approximately 1.7 million short tons (1.5 million metric tons) of supercritical carbon dioxide (CO<sub>2</sub>) into the brine-bearing Tuscaloosa Formation in an area within the lease boundaries of the Cranfield Unit oilfield, about 12 miles (19 kilometers (km)) east of Natchez, Mississippi. The project team would be led by the Southern States Energy Board (SSEB) and include the Texas Bureau of Economic Geology (BEG) at the University of Texas at Austin as a subcontractor. The host site for the proposed project is owned by Denbury Resources International Company (Denbury). This field experiment is known as the SECARB Phase III Early Test Project. The proposed injection period for this Phase III Early Test is 18 months, followed by at least one year of post-injection monitoring.

The Proposed Action will require four CO<sub>2</sub> injection wells directionally drilled to targets within the Tuscaloosa formation. Three of these wells have been drilled and are currently being used for enhanced oil recovery (EOR) operations. A fourth well will be required to be drilled from one of two existing well pads used during previous production at the Cranfield Unit and directionally drilled to the desired down-hole locations in the saline portion of the formation below the oil-brine interface. Two observation wells would also be drilled from one of the reconditioned well pads and would be dedicated full-time to continuous monitoring of the formation response to the CO<sub>2</sub> flood. Two water wells would be drilled to approximately 200 feet (61 meters (m)) to evaluate the performance of shallow groundwater and soil-gas monitoring strategies.

Based on the analyses documented in the Final EA, DOE has concluded that the SECARB Phase III Early Test Project would have no significant consequences to the human environment. Thus, DOE considers that the Proposed Action, providing cost-shared funding for the project, is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969, 42 United States Code 4321, et seq. Therefore, in accordance with 10 CFR Part 1021.322, DOE has concluded that preparation of an Environmental Impact Statement is not required, and DOE is issuing this FONSI.

#### COPIES OF THE EA ARE AVAILABLE FROM:

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### FOR FURTHER INFORMATION ON THE DOE NEPA PROCESS, CONTACT:

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BACKGROUND: In one of many governmental efforts to address global climate change concerns, the Department of Energy (DOE) established the Carbon Sequestration Program in 1997 with the focus of conducting research and development activities to evaluate and develop carbon sequestration technologies. Carbon sequestration involves capturing and storing carbon dioxide (CO<sub>2</sub>) emissions prior to release into the atmosphere as well as enhancing natural carbon uptake and storage processes. Geologic sequestration involves the permanent storage of CO<sub>2</sub> in deep unmineable coal seams, depleted oil and gas reservoirs, or saline (saltwater-filled) formations. Impermeable caprocks and/or geologic structural or stratigraphic traps retain the CO<sub>2</sub> in the formation similar to natural gas storage trapping mechanisms.

Public Participation: On August 25, 2008, DOE released a Draft Environmental Assessment (EA) for review and comment. Public notices announcing the availability of the Draft EA were placed in <u>The Natchez Democrat</u> newspaper in Natchez, Mississippi. Hardcopies of the Draft EA were made available in the Natchez Library, which is the nearest public building to the site. Following a 30-day review and comment period, no substantive comments were received. The Final EA was completed in October 2008.

DESCRIPTION OF THE PROPOSED ACTION: The Proposed Action is for the DOE to provide 69 percent of the funds necessary to complete the project to inject and closely monitor the flow of approximately 1.7 million short tons (1.5 million metric tons) of supercritical CO<sub>2</sub> into the brine-bearing Tuscaloosa Formation on the flank of the structure, downdip of the oil-bearing zone. The proposed injection period for the Phase III Early Test is 18 months followed by at least one year of post-injection monitoring.

The Proposed Action calls for the use of four injection wells. Three of these wells have already been drilled by Denbury Resources International Company (Denbury) as a part of ongoing enhanced oil recovery (EOR) operations. These three wells extend below the oil-brine interface into the deeper brine-bearing Tuscaloosa formation below 10,000 feet (approximately 3,000 meters (m)). An additional injection well will be drilled to the same depth. These four primary injection wells would use existing well pads used during the previous production at the Cranfield Unit and directionally drilled to the desired down-hole locations. The fourth well will be drilled from one of two previously disturbed well pad sites. The selection of the well pad for this fourth well would be determined by Denbury based on cost, accessibility, and other factors unrelated to the study.

Since the well pads were abandoned in the mid-1960s, Denbury will recondition them to support drilling operations. Site reconditioning will include land clearing of approximately one acre or

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less (0.4 hectare), leveling and fill activities, rebuilding access roads, laying connector pipelines, and extending other infrastructure services as needed. The drilling, site preparation, and infrastructure construction must be permitted by the Mississippi Oil and Gas Board (MSOGB) and conducted in compliance with all applicable federal and state regulations and acceptable industry practices for environmental protection. All planned well pad, pipeline, and road construction activities will be conducted as part of the EOR activity planned at the site and will occur whether DOE funds the Proposed Action or not; however, these activities were considered as connected actions for the purpose of the EA.

**ENVIRONMENTAL CONSEQUENCES:** The Final EA included analyses of the potential impacts of the proposed *SECARB Phase III Early Test Project* on the following elements of the human and natural environment: air quality; geology and soils; water resources; wetlands and floodplains; terrestrial vegetation; wildlife; land use and visual resources; socioeconomic resources; human health and safety; cultural resources; and waste management. No substantive adverse impacts were identified from analyzing the effects of the proposed project on the human and natural environment.

### **AIR QUALITY:**

The State of Mississippi takes into account the effects of all past, present, and reasonably foreseeable emissions during the development of the State Implementation Plan. The State of Mississippi accounts for all significant stationary, area, and mobile emission sources in the development of this plan. Estimated emissions generated by the Proposed Action, including temporary diesel emissions from drilling equipment during well development and drilling of the observation and groundwater monitoring wells, would be minimal and would occur without the Proposed Action. Further, the increase in air emissions from an additional compressor for the Proposed Action added to the existing station would be minimal. Direct and indirect air emissions would not exceed applicability thresholds, be "regionally significant," or contribute to a violation of any federal, state, or local air regulation. Therefore, it is anticipated that the Proposed Action would not impede the area's conformity with the state's air emissions standards and is not expected to exceed the impact significance threshold established in the body of the EA.

### GEOLOGY AND SOILS:

The main potential negative effects of the Proposed Action (injection of approximately 1.7 million short tons (1.5 million metric tons) of supercritical CO<sub>2</sub> over an 18 month period into the brine-bearing Tuscaloosa formation) are identified in the following paragraphs with accompanying notations regarding their likelihood of occurrence.

Some long-term increased Tuscaloosa formation pressure gradients due to CO<sub>2</sub> injection would be expected resulting in the movement of multi-phase fluids. The increased pressure gradients will not, however, exceed the current EOR pressure gradients within the field. Increasing formation pressures could enhance the likelihood of well casing failures and gas migration resulting in potential leakage from aging abandoned wells. However, current EOR operations are being performed at or near these increased pressure gradients, and it is not anticipated that

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the increased pressure gradients will have any additional impacts on wellbore integrity.

CO<sub>2</sub> injection rates and pressure will be regulated at the surface by controlling pressure and volume of injection using standard industry practices. Preliminary modeling shows that the footprint (maximum horizontal extent in the subsurface), as well as maximum pressure buildup of the CO<sub>2</sub> plume, will be controlled by pressure drawdown at production wells in the oil-producing rim. Down-dip spread of the plume will be limited with most of the plume migrating up-dip to the oil-producing area. While some long-term increase in subsurface pressures due to CO<sub>2</sub> injection may occur, only an imperceptible risk exists of inducing seismic events due to the controlled pressure drawdown at the producing wells. Existing production without any indication of pressure loss would suggest no faults are present penetrating the stratigraphic cap in the proposed injection area. Structural closure in the area of the gas cap will be the ultimate trap for any CO<sub>2</sub> migrating out of the flank area, since the producing formation is a domal structure capped by impermeable shale units.

Hydrocarbon recovery brought on by implementation of the Proposed Action could develop additional emulsions of hydrocarbons, saline water, and gasses including CO<sub>2</sub>. Although the collection and disposal of saline water and gasses increases the likelihood of accidental releases, it is highly unlikely as the increased production of one or more of these parameters would be handled by the existing on-site containment in use as part of the current EOR operations.

Increased traffic due to establishment of groundwater monitoring wells and implementation of soil and geological monitoring programs will result in soil compaction and disturbance. This disturbance will be limited to constructed roadways and reconditioned drill pad areas and would be a minimal impact.

Drilling mud (30,000 to 50,000 pounds (lbs.) or 13,608 to 22,680 kilograms (kg)) used to drill and deepen injection, deep monitoring, and shallow water monitoring wells as well as associated produced formation water and wellbore cuttings may be able to be buried on-site. Laboratory analyses will be conducted to determine the presence of any contaminants that would prohibit on-site burial. If contaminants are present, spent drilling mud, formation water, and/or associated cutting will be hauled off-site for proper disposal at an approved disposal site.

All activities by Denbury and SECARB, including the construction, operation, maintenance, and closure of wells, compressors, and related facilities, would be required to meet all MSOGB requirements. Existing MSOGB regulations adequately protect the environment with strict standards to prevent and contain spills, erosion, waste, and release of other materials; provide for penalties; and appropriate remedial actions for failure to comply.

Due to the highly unlikely nature of the above-described effects, the conclusion is that there would be no measurable leakage of CO<sub>2</sub> from the storage formation to the surface or into another area in the subsurface. Since there are no expected substantial impacts to geological and soil resources from the Proposed Action alternative, it should not substantially contribute to the cumulative impacts to these resources in the project area or its vicinity. Thus, impacts from the Proposed Action would not be expected to exceed the significance threshold established in the body of the EA or contribute substantially to the cumulative impacts of past, current, and

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reasonably foreseeable activities, including injections related to other Cranfield Oil and Gas Field EOR activities.

### WATER RESOURCES:

Other than observation well water samples, the SECARB project would produce negligible quantities of produced water. Any soil erosion occurring as a result of field re-development would be minimal. The incremental impact of the SECARB project would have a negligible influence on overall soil erosion and potential surface water impacts. Operationally, SECARB would not need any make up water. Further, as described in the previous section, groundwater contamination is not likely and would be easily detected and remediated by the proposed monitoring plan.

The cumulative impact to the surface and groundwater of the Cranfield Oil and Gas Field development would be negligible and, therefore, is not expected to exceed the impact significance threshold established in the body of the EA.

## WETLANDS AND FLOODPLAINS:

No jurisdictional wetlands have been recorded in the National Wetlands Inventory within the project boundaries, and the elevation of the project site is well above the 100 year flood profile of the floodplain associated with nearby Coles Creek. However, past oil and gas development in the Cranfield Unit has likely resulted in previous impacts to the area's wetlands and floodplains. Wetlands and floodplains are subject to damage from ongoing activities in the area including hunting, cattle grazing, and timber harvest operations; these activities are likely to continue in the future, along with Denbury's commercial EOR operations. The proposed project could pose some threats to wetlands and floodplains identified at the site, including soil erosion and sediment delivery, destruction of some wetland surface area, and risk of accidental fuel spills. It is also possible that an unlikely leakage of CO<sub>2</sub> to the surface would have more widespread consequences on wetlands and floodplains. However, given the larger impacts to wetlands and floodplains from past, present, and future activities, cumulative impacts contributed by the proposed project would not exceed the significance threshold established in the body of the EA.

### TERRESTRIAL VEGETATION:

Vegetation in the Cranfield Unit has been previously cleared for construction of wells, roads, and related infrastructure as part of past oil and gas operations. The area has and continues to be used for hunting, cattle grazing, and timber harvest. Each of these activities involves removal, trampling, or destruction of vegetation and disturbance of ground cover. Land clearing as part of the proposed project would be limited to well pad sites of one acre or less, associated road construction or reconditioning necessary to provide access to the sites, and pipeline construction for CO<sub>2</sub> and product recovery. Most of this activity would occur on property already disturbed by prior drilling and other activities and would be conducted as part of Denbury's commercial EOR operations. It is also possible that an unlikely leakage of CO<sub>2</sub> to the surface would have more widespread consequences on vegetation. The potential for leakage is minimal, based upon the geology of the target formation and well construction, operation, and closure standards.

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Overall, cumulative impacts from the proposed project, when added to other past, present, and reasonably foreseeable future actions, would not exceed the significance threshold established in the body of the EA.

### WILDLIFE:

Wildlife and habitat in the Cranfield Unit have been, and continue to be, subject to disturbance and damage from hunting, timber harvest, traffic, Denbury's commercial EOR operations, and past oil and gas operations. Additional habitat disturbance associated with infrastructure as part of the proposed project would be limited, and wildlife displacement and disturbance would be temporary, lasting only for the duration of the construction, injection, and monitoring period. Similar impacts could occur to any threatened and endangered (T&E) species if they are present in the area. Consultation with the United States Fish and Wildlife Service (USFWS) indicates that there are two T&E species and one recently delisted species that could be found in the immediate area; however, if habitat for species of interest, such as bear den trees were discovered, work would be halted and additional consultation with the appropriate state and federal wildlife agencies would be made. It is also possible that an unlikely leakage of CO<sub>2</sub> to the surface would have more widespread consequences on wildlife and habitat. Cumulative impacts from the proposed project when added to other past, present, and reasonably foreseeable future actions would be limited to a small portion of the wildlife population and would not affect the viability of the resource. Recovery of this resource from any temporary change would occur in a reasonable period of time and not exceed the impact significance threshold established in the body of the EA.

### LAND USE:

Because of the project area's historical use as an oil and gas field within the Cranfield Unit, as well as Denbury's ongoing commercial EOR efforts, the effects of the Proposed Action would be limited to a small area and would not likely alter any particular land use at the project site or in adjacent areas, which would not be expected to exceed the significance threshold. As the Proposed Action does not represent a substantial land use change from the historic and current use for oil and gas exploration, any cumulative effects to land use within the project area as a result of implementation of the Proposed Action is not expected to exceed the significance threshold. Because land clearing activities associated with the Phase III Early Test project is a component of Denbury's current commercial operations and are a small spatial percentage of the overall study area, cumulative impacts to other adjacent land uses (such as timber production, farming, and recreation) would not likely exceed the significance threshold established in the body of the EA as a result of implementation of Proposed Action.

### SOCIOECONOMIC RESOURCES:

The cumulative effects resulting from the addition of the Proposed Action to ongoing Denbury commercial activities would be limited to the additional temporary workforce required during the drilling phase and some minimal addition of labor during the operation and maintenance phase. These requirements are minimal and would not be expected to stress local resources and accommodations. The proposed activity is in character with existing operations at the site and

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would add only minimally to existing conditions in the study area. None of these impacts could be expected to exceed the significance threshold.

The area and its associated road network have been part of ongoing oil and gas field operations for several decades. There are no planned or reasonably foreseeable actions proposed for the area that may affect local road use or traffic patterns. The introduction of a temporary increase in traffic during construction operations can be easily accommodated by the existing road system with only minor disruptions. The project would not noticeably affect or disrupt the normal or routine functions of public institutions, roads, electricity, and other public utilities and services in the project area. Continuing operations of the SECARB wells following construction would have no additional impact.

The addition of the proposed SECARB action to ongoing activities at the Cranfield Unit and in the surrounding area would have no significant impact to the use of national forest lands, state parks, or other recreational opportunities in the two-county area.

Visual quality at the Cranfield Unit has been predominantly altered by the past oil and gas operation under which drilling rigs and wells were installed and then abandoned, land was cleared, and gravel roads were constructed. Other ongoing activities that have affected the visual quality of the area are hunting camps and removal of trees as part of timber harvest operations. Additionally, Denbury's current commercial EOR operations could potentially further alter the visual elements of the area. Given the larger impacts to visual resources from past, present, and future activities, cumulative impacts added from the proposed project would not change the visual resource classification of the affected area.

The Proposed Action would introduce long-term incremental increases to the noise environment. All noise associated with the project would be in addition to Denbury's on-going commercial operations in the area. These increases would be relatively small and have a minor cumulative effect on the overall noise environment but would not be expected to exceed ambient noise standards beyond the proposed project boundary.

The proposed activity considered by this assessment would add only minimally to existing conditions in the study area and surrounding communities. As a result, any incremental impact would not be sufficient to constitute a significant impact and would most likely be experienced evenly across all populations. Therefore, neither minority nor low-income groups within the affected community will experience proportionately greater adverse effects than other members of the community. Therefore, impacts to socioeconomic resources, as well as cumulative impacts, from implementing the Proposed Action are not expected to exceed the significance threshold established in the body of the EA.

### HUMAN HEALTH AND SAFETY:

Since CO<sub>2</sub> is neither explosive nor toxic, the main human health and safety risk is from a rapid release that displaces air, which can cause frostbite from contact or asphyxiation. Such a rapid release, e.g., from pipe failure or wellhead being removed, generally also causes dry ice formation. Since CO<sub>2</sub> will dilute to safe levels with proper ventilation, the largest potential risk

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is to the site workers and not the general public due to the remoteness of the site allowing for adequate dispersion of the CO<sub>2</sub> and increases the available response time to any problems that might occur. Warning systems, proper safety gear, and ventilation will reduce impacts from the displaced air. Hence, while the risk of CO<sub>2</sub> leaks from the pipes or other components exists, the impacts to human health and safety would also be minimized by the Safety Training Program Denbury has in place that provides safety, training, and response procedures. Further, CO<sub>2</sub> injection with EOR has occurred for over 20 years safely. With all of these considerations, the impacts to human health and safety are expected to be minimal.

Because of the overlying impervious seams above the injection zone, it is not likely that injected CO<sub>2</sub> would find its way to the surface or into freshwater aquifers after sequestration at greater than 10,000 feet (approximately 3,000 m). The main issues concerning human health and safety from EOR (whether the Proposed Action or No-Action alternative were chosen) are operational integrity ones, such as ensuring high quality cement work in the wells. The only reasonable manner in which CO<sub>2</sub> could escape back to surface and/or affect potable water resources is by way of operational error or inadequacy, such as flow of gas behind cement or poor well abandonment, exceedance of fracture pressures or fracture gradients, or overpressuring of flowlines. With the low failure rate of CO<sub>2</sub> pipelines, proper siting, and the monitoring involved, the overall risk to human health and safety is not expected to exceed the significance threshold.

The cumulative impacts of existing activities in and around the project area with the implementation of the Proposed Action does not represent a significant risk to human health and safety with existing and upcoming mitigation and safety procedures in place. Therefore, the cumulative impacts to human health and safety are not expected to exceed the significance threshold established in the body of the EA.

### **CULTURAL RESOURCES:**

The project site has already been disturbed from previous industrial activities, and since no cultural resources have been found with the previous disturbances, there would be less of a probability of discovering unknown cultural resources during the Proposed Action. Consultation with the State Historic Preservation Office (SHPO) did occur. They voiced concern about two cultural sites in the area, but these sites are over 6 miles from the Proposed Action location. No Tribal concerns were voiced from the consultation with Tribes and the Bureau of Indian Affairs. Thus, it was determined that there were no cultural resource issues at the site. However, if cultural resources were found during the Proposed Action, the activities would be stopped and SHPO and other proper authorities contacted. As impacts to cultural resources are generally local (heavy machinery crushing resources, etc.), the Proposed Action and the No-Action alternative both are unlikely to contribute to impacts to cultural resources outside the vicinity of the project area. Further, due to lack of known cultural resources, the impacts of the Proposed Action on cultural resources are not expected to exceed the significance threshold. Currently, the only projected types of activities in the project area will be other oil and gas activities; therefore, the Proposed Action and the No-Action alternative will be only a small component to potential cumulative impacts. Since there are no significant impacts to cultural resources, the Proposed Action and the No-Action alternative do not substantially contribute to the cumulative impacts to cultural resources in the vicinity of the project area. Therefore, the impacts to cultural

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resources of implementing either alternative are not expected to exceed the significance threshold established in the body of the EA.

### WASTE MANAGEMENT:

Potential cumulative impacts related to drilling the observation wells include disposal of produced brines in permitted Class II injection wells and the handling and management of additional drilling muds. Provided all regulatory requirements are met, the cumulative waste impacts, related to the drilling requirements of the SECARB project, would not be significant.

There are potential cumulative impacts related to the waste products from the compression and injection of additional CO<sub>2</sub> for the SECARB project including increased volumes of lube oil and wastewater generated. Due to the Denbury's commercial EOR infrastructure and other resources available to handle these waste streams, it is not anticipated that these waste streams would have any significant cumulative effects. Therefore, the impacts to waste management are not expected to exceed the significance threshold established in the body of the EA.

There are likely to be negligible cumulative impacts regarding wastes related to sampling and monitoring of the wells due to the small volumes of waste generated.

Overall, the proposed SECARB project would not cause air, water, or soil to be contaminated with hazardous materials (assuming appropriate drilling waste management and compressor waste containment strategies are in place) to a degree that would pose a threat to human or ecological health and safety.

ALTERNATIVES CONSIDERED: DOE's role in the project is limited to deciding whether or not to co-fund the project; thus, the alternative actions considered were also limited. The alternatives considered in the Final EA consisted of: (1) a No-Action Alternative, under which DOE would not provide cost-shared funding for the project and the SECARB Phase III Early Test would cease operations; and (2) co-fund the project.

The No-Action alternative means that DOE funds would not be used to support the proposed data collection at the target site. Without DOE funds, the data collection proposed would not occur because such data collection is unnecessary for the purposes of EOR at this site. With no intent to collect the proposed data set, those wells specific to such data collection would be unnecessary. Not conducting such tests would delay by several years the development of information needed to assess technological options for geologic carbon sequestration. From an overall perspective, therefore, the No-Action alternative within the SECARB region would adversely affect the ability to provide options to help meet national objectives for greenhouse gas emission reductions by using sequestration as a mitigation option. Also, increased understanding of subsurface behavior of CO<sub>2</sub> would not be gained, and the possibility of an example of successful and safe sequestration within the SECARB region could not be offered for consideration by the public, policy makers, and regulators during any future consideration of regional CO<sub>2</sub> sequestration proposals. In the absence of an adequate base of knowledge, the complexities of future projects could result in long delays for public and regulatory approval, thereby jeopardizing goals for action on climate change issues.

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The Proposed Action would be conducted in an oilfield in association with an ongoing EOR program by Denbury. The proposed Cranfield Unit site was drilled and oil and gas extracted beginning in the 1940s and running through the 1960s. The proposed site is in an area where drilling and other subsurface activities familiar to the surrounding communities have occurred for many decades in a mature oilfield setting that provides abundant subsurface data. It is the intention of Denbury to implement oil and gas removal at this site using CO<sub>2</sub> injection, with or without the data collection proposed by DOE. In other words, those potential environmental impacts associated with this EOR project would occur even if DOE were not involved. In fact, one of the primary reasons for selecting this site for the Proposed Action was to take advantage of the infrastructure developed for CO<sub>2</sub>-EOR efforts by the field operator. This presents SECARB with the opportunity to inject approximately 1.7 million short tons (1.5 million metric tons) of CO<sub>2</sub> over 1.5 years in the down-dip leg of an oil reservoir in order to test a number of commercial and experimental monitoring protocols for carbon sequestration. Thus, the No-Action alternative represents a lost opportunity to utilize the cost-savings, background data, and limited additional environmental impacts associated with using the established oilfield. Choosing the No-Action alternative would delay development of technological options for geological CO<sub>2</sub> sequestration and possibly result in increased CO<sub>2</sub> emissions before any stabilization efforts could be started.

**FINDING:** Based on the information and data contained in the Final EA, which analyzes the relevant environmental issues and concerns of stakeholders, DOE finds that no significant impact would result from implementing the proposed Federal action, to provide cost-shared funding for the design, construction, and operation of the SECARB Phase III Early Test Project.

This Finding of No Significant Impact (FONSI) is made pursuant to the National Environmental Policy Act (NEPA) of 1969 [42 U.S. Code 4321 *et seq.*]; the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of NEPA, Title 40 CFR, Part 1500-1508; and the DOE's NEPA Implementing Procedures, Title 10 CFR, Part 1021. The Proposed Action does not constitute a major Federal action that would significantly affect the quality of the human environment within the meaning of NEPA. Therefore, an Environmental Impact Statement is not required, and DOE is issuing this FONSI.

ISSUED IN PITTSBURGH, PENNSYLVANIA, this 26 day of Nov. 2008.

Carl O. Bauer

Director

National Energy Technology Laboratory