

**Finding of No Significant Impact
for
Environmental Assessment for
Supercritical Carbon Dioxide Pilot Plant Test Facility**

San Antonio, Texas

LEAD AGENCY: U.S. Department of Energy; National Energy Technology Laboratory

ACTION: Finding of No Significant Impact

SUMMARY:

Pursuant to the Council on Environmental Quality (CEQ) Regulations (40 *Code of Federal Regulations* [CFR] Parts 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (NEPA) (42 *United States Code* [U.S.C.] 4321 *et seq.*) and Department of Energy (DOE) National Environmental Policy Act (NEPA) implementing regulations (10 CFR 1021), DOE prepared an Environmental Assessment (EA) (DOE/EA-2071) to analyze the potential environmental, cultural, and socioeconomic impacts of partially funding a proposed project to design, construct, and operate a 10-megawatt-electric (MWe) Supercritical Carbon Dioxide (sCO₂) Pilot Plant Test Facility. This EA identifies, documents, and evaluates the potential environmental effects of implementing the Proposed Action to be located at and operated by the Southwest Research Institute (SwRI®). All discussions and findings related to the Proposed Action and the No-Action Alternative are presented in the attached Final EA and Appendices. The Final EA is hereby incorporated by reference.

DOE proposes to provide cost-shared funding to a project team led by Gas Technology Institute (GTI), SwRI, and General Electric Global Research (GE-GR) for the proposed sCO₂ Test Facility Project at the SwRI, an existing research facility in San Antonio, Texas. The proposed sCO₂ Test Facility Project would involve the construction and 3-year operation of a pilot plant test facility to verify the performance and integrity of the components, demonstrate a pathway toward a thermodynamic cycle efficiency greater than 50 percent, and show the potential for cost savings in electricity generation. Under the Proposed Action, DOE proposes to provide GTI with up to \$79.9 million of cost-shared financial assistance under the sCO₂ Crosscut Initiative. Composed of the DOE Offices of Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear Energy, the sCO₂ Crosscut Initiative is a collaborative program with the specific mission to reduce the technical barriers and risks to commercialization of the sCO₂ power cycle. DOE's contribution would constitute about 70 percent of the estimated \$113.3 million total project cost.

Based on the analysis in the EA, DOE finds that implementing the Proposed Action at SwRI would not constitute a major federal action that would significantly affect the quality of the physical, biological, or human environment, within the meaning of NEPA. Therefore, the preparation of an Environmental Impact Statement is not required, and DOE is issuing this Finding of No Significant Impact (FONSI).

ALTERNATIVES CONSIDERED:

PROPOSED ACTION

DOE proposes to provide cost-shared funding to a project team led by GTI, SwRI, and GE-GR for the proposed 10-MWe sCO₂ Pilot Plant Test Facility Project at the SwRI, an existing research facility in San Antonio, Texas. The proposed sCO₂ Test Facility Project would involve the construction and 3-year operation of a pilot plant test facility to verify the performance and integrity of the components, demonstrate a pathway toward a thermodynamic cycle efficiency greater than 50 percent, and show the potential for cost savings in electricity generation.

The proposed sCO₂ Test Facility Project would demonstrate the potential for higher efficiency and reduced cost-of-electricity for power cycles based on sCO₂ working fluids, compared to state-of-the-art steam cycles. Supercritical carbon dioxide is CO₂ held above its critical temperature and pressure so that it is in a fluid state. When used as a working fluid for fossil fuel based applications, sCO₂ power cycles can enable a power plant to generate the same amount of electricity from less fuel, thus decreasing CO₂ emissions. Furthermore, because sCO₂ has a high fluid density relative to steam, sCO₂ power plants may be fitted with compact turbomachinery, which would reduce capital costs.

Under the Proposed Action, DOE's sCO₂ Crosscut Initiative, composed of the DOE Offices of Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear Energy, would provide GTI with up to \$79.9 million of cost-shared financial assistance. DOE's contribution would constitute about 70 percent of the estimated \$113.3 million total project cost.

The sCO₂ Test Facility configuration would consist of a natural-gas fired process heater, compressor, turbine, recuperators, heat exchanger, cooling tower, backup generators, emissions stack, and balance of plant components. The sCO₂ Test Facility would require utility and infrastructure upgrades, including a new natural gas line to supply the fuel for the proposed project and a sanitary sewer force main. Other infrastructure upgrades within the project area would include tie-ins to the water line and electrical supply.

The sCO₂ Test Facility Project would demonstrate at least 700 degrees Celsius (°C) turbine inlet temperature or higher design point, and produce a Recompression Closed Brayton cycle (RCBC) configuration that would be used to demonstrate and evaluate system and component design and performance capabilities (including turbomachinery and recuperators in steady state, transient, load following, and limited endurance operation), and demonstrate the potential and pathway for a thermodynamic cycle efficiency greater than 50 percent. The proposed project would feature three phases including the Simple Cycle Configuration Operation, RCBC Reconfiguration, and RCBC Operation. The facility would also be capable of being reconfigured to accommodate potential future testing of system/cycle upgrades, new cycle configurations, and new or upgraded components (compressor, recuperators, and heat exchangers). Therefore, the design basis for this facility includes the flexibility (footprint accessibility considerations, standardized component flanging, standardized fittings, standardized data acquisition systems and components) to accommodate future facility utilization to support continued development of sCO₂ power cycle technologies.

NO-ACTION ALTERNATIVE

Under the No-Action Alternative, DOE would not provide cost-shared funding to the proposed project. The sCO₂ Test Facility Project would not be constructed and the sCO₂ technology would not be validated in an operational system. Consequently, the power generation and other related industries would not have access to the facility to test various component configurations. Without pilot scale validation of this technology, it is unlikely that industry would scale it for use in various applications.

ENVIRONMENTAL CONSEQUENCES:

The Final EA examined the potential effects of the Proposed Action and No-Action Alternative on the following 13 resource areas of environmental and socioeconomic concern: air quality, biological resources, community services, cultural resources, geography and soils, health and safety, infrastructure and utilities, land use and aesthetics, materials and waste, noise, socioeconomics and environmental justice, traffic and transportation, and water resources. Six of the resource areas were screened from further analysis since DOE determined they would either not be affected or would sustain negligible impacts from the Proposed Action and not require further evaluation. The following seven resource areas were analyzed in more detail: air quality, biological resources, cultural resources, geology and soils, health and safety, infrastructure and utilities, and water resources. The EA also considered cumulative impacts that might reasonably occur as a result of the Proposed Action.

Based on the analysis contained in the Final EA, DOE determined that the construction and operation of the proposed sCO₂ Test Facility, under the Proposed Action, would not have significant adverse impacts, either

individually or cumulatively, on the physical, biological, or human environments. Implementation of the Proposed Action would result in short-term and long-term negligible to minor adverse impacts, which are described in the following paragraphs. Under the No-Action Alternative, the sCO₂ Test Facility Project would not take place at SwRI, and existing conditions would remain unchanged. As such, implementation of the No-Action Alternative would not result in any impacts to considered resource areas.

Air Quality. Minor adverse impacts to air quality would be anticipated during construction and operation of the project. Construction would cause a temporary increase in emissions of criteria pollutants from construction equipment. Operation of the sCO₂ Test Facility would result in a minor impact to air quality due to direct and fugitive air emissions from the proposed project components. These emissions would be within the authorized limits and would not exceed any permit limits or federal or state regulations.

Biological Resources. Construction of the proposed project would result in overall minor adverse impacts on vegetation, wildlife, and threatened and endangered species. Long-term, minor impacts to vegetation would occur during construction of the proposed sCO₂ Test Facility Project from land clearing and ground disturbance required for construction of the proposed project as well as emplacement of proposed utilities. While the construction activities themselves would be temporary, the clearing of the existing trees in construction areas outside of the proposed operational footprint still represents a long-term impact due to the length of time required for regeneration. To limit potential impacts to migratory birds, if present within the proposed project area during construction, Texas Parks and Wildlife Department (TPWD) recommends that ground disturbance and vegetation removal occur outside of the general nesting season (i.e., March 15th through September 15th) in accordance with the Migratory Bird Treaty Act. If clearing outside this timeframe is unavoidable, the TPWD recommends a trained biologist with bird identification experience survey the proposed disturbance areas for nesting birds to avoid the inadvertent destruction of nests and eggs. Operation of the proposed sCO₂ Test Facility Project would have negligible impacts to biological resources, including federally and state-listed species and migratory birds. No land-disturbing activities are currently planned during operations. The sCO₂ Test Facility, including the 75-foot heater stack, would be consistent with the existing infrastructure within the SwRI campus, which includes tall structures associated with existing research facilities.

Cultural Resources. Construction and operation of the proposed project is not anticipated to result in adverse impacts to cultural resources. As there are no historic structures located within the area of potential effect (APE) of the proposed sCO₂ Test Facility Project, there would be no impacts. Therefore, DOE has made a determination of No Historic Properties Affected for Historic Structures and Districts. An archaeological survey was completed for the sCO₂ project area. The Final Report concluded that no significant prehistoric or historic materials were encountered within the APE. One Isolated Find was documented, but the single secondary chert flake was identified within a highly disturbed setting, heavily impacted by erosion from the existing pipeline corridor and SwRI campus to the east. It is likely that the single flake had eroded down from a higher elevation and was not *in situ*. Given this conclusion, the Final Report concludes that no significant cultural deposits would be impacted by the proposed project and recommends no further archaeological investigations for the current APE. Based on the results of the archaeological survey conducted at the sCO₂ project site, DOE has concluded that a finding of no adverse effect from the proposed project. On April 16, 2018, the Texas Historical Commission formally concurred with DOE's finding.

Geology and Soils. Construction of the proposed project would result in minor adverse impacts to geology and soils. Construction of the proposed sCO₂ Test Facility Project would disturb approximately 10.74 acres of currently undeveloped land and approximately 5.80 acres of developed land across the site, including areas for site clearing, building construction, construction laydown, and emplacement of underground utilities. Construction of the natural gas pipeline extension would require an approximately 4-foot deep trench and 30-foot wide construction ROW through developed and undeveloped land. Soil disturbance can also increase the likelihood of soil erosion and runoff, and soil compaction could occur which would decrease water infiltration and inhibit the soil's ability to support plant life as a result of vehicle traffic and heavy machinery. SwRI would implement established programs and plans (e.g., SwRI's Stormwater Pollution Prevention Plan (SWPPP) and

Spill Prevention, Control, and Countermeasure (SPCC) Plan) to minimize potential impacts to soil resources. Operation of the proposed sCO₂ Test Facility Project would have negligible impacts to soils. No land-disturbing activities are currently planned during operations.

Health and Safety. Construction and operation of the proposed sCO₂ Test Facility Project would introduce minor potential for health and safety impacts. Primary concerns to human health and safety regarding the proposed project would include accidental injuries during construction and operation; electric shock hazards related to high-voltage electrical systems; injuries related to cryogenic liquids; asphyxiation hazards from venting CO₂; exposure to aqueous ammonia through inhalation of vapors or contact with the skin or eyes; and scalding, explosive, or fire hazardous associated with the combustion of natural gas. Adherence to Occupational Safety and Health Administration (OSHA) requirements and standard safety practices would minimize these potential risks to health and safety. Detailed hazard assessments and safety procedures would be developed after the design phase and an operational analysis are completed. During operations, prevention is the first step in dealing with incidents where equipment, the environment, or personnel may be harmed by errors or accidents. For this reason, the minimum requirements of OSHA standards would be met or exceeded in the design of equipment, buildings, and access. Safety training shall be given to employees and a safety orientation to visitors. As the proposed project would implement robust safety procedures, the potential for impacts to human health and safety would be minor.

Infrastructure and Utilities. Construction and operation of the proposed project is not anticipated to result in adverse impacts to infrastructure and utilities. Negligible adverse impacts to water and wastewater are expected during construction. Once operational, the sCO₂ test turbine building would use potable water for process water and the operational employees. Operation of the sCO₂ Test Facility would require approximately 360,000 gallons per month of water for testing operations. Primary water demand during operations would be for process cooling using a cooling tower. The increase in water usage would have negligible impacts on the SwRI well system's ability to provide water for the SwRI campus. The sCO₂ Test Facility would discharge approximately 60,000 gallons per month of wastewater for testing operations. The increase in wastewater to the San Antonio Water System (SAWS) would represent a small amount of additional flow compared to the existing campus discharge and would be within the discharge limitations of the Industrial Wastewater Permit; as a result, negligible impacts are anticipated. SwRI would notify SAWS of the new source of wastewater discharge and update the Slug Control Plan.

SwRI would use their existing SWPPP for construction of the proposed project. Earth-disturbing activities during construction would be managed to reduce stormwater runoff using control measures and best management practices (BMPs) such as covering exposed soils in heavily trafficked areas; placing structural erosion controls where necessary; and designating and protecting established/existing vegetation buffer areas (i.e., trees, shrubs, and natural vegetation), to the extent practicable. During operations, stormwater would be managed and mitigated with low-impact development (LID) features incorporated into facility design. To the extent practicable, stormwater discharges from the proposed project would be retained using onsite LID features to minimize potential impacts to downstream receptors, such as the nearby tributary.

Negligible adverse impacts are expected to electrical supply during construction since it is assumed that electrical power would be provided by portable generators until construction of electrical infrastructure is completed and operational. Operation of the sCO₂ Test Facility would tie into existing SwRI electrical infrastructure at an existing manhole within the proposed project area. No significant updates to the SwRI campus electrical system outside of the proposed project footprint are anticipated.

As part of the sCO₂ Test Facility Project, SwRI would construct a new 4- or 8-inch diameter natural gas pipeline extension to connect the proposed project to an existing natural gas pipeline. Negligible impacts to natural gas usage and supply would be expected during construction. During operations, natural gas would be required to fuel the primary heater of the sCO₂ Test Facility. The demand for the sCO₂ Test Facility would represent an approximately two-fold increase over SwRI's current natural gas usage. Although this represents a significant

increase in natural gas usage at SwRI, it represents a small demand increase to CPS Energy's current capacity of natural gas. Since the proposed project would operate at the analyzed capacity for the 3-year test period, the proposed project is not expected to affect CPS Energy's ability to provide natural gas to customers.

Water Resources. Construction and operation of the proposed sCO₂ Test Facility Project would result in negligible adverse impacts to floodplains and minor adverse impacts to surface water and surface water quality. The proposed project area is adjacent to the intermittent tributary of Leon Creek, which is considered a jurisdictional water of the U.S. No other water resource features are present in the proposed project area. SwRI would maintain compliance with the existing SWPPP and implement construction BMPs for erosion control, such as covering exposed soils in heavily trafficked areas, placing structural erosion controls where necessary, and designating and protecting established/existing vegetation (i.e., trees, shrubs, and natural vegetation) buffer areas (e.g., the 100-foot buffer zone from the tributary of Leon Creek), to the extent practicable. Potential operational impacts to surface water resources would largely be limited to increases in stormwater runoff from new impervious cover. Adherence to applicable laws, regulations, and BMPs would also help to avoid or minimize potential adverse operational impacts to surface waters. BMPs would include maintaining all equipment and vehicles to reduce leakage, adhering to loading/unloading precautions, and maintaining the minimum 100-foot buffer to the adjacent tributary. With adherence to the SwRI's SWPPP and SPCC Plan, spills associated with the handling or use of hazardous materials (e.g., vehicle fuel, oils and lubricants, etc.) would be potentially avoided, or minimized and quickly contained.

Construction and operation of the proposed sCO₂ Test Facility project would result in negligible impacts to groundwater. SwRI is located outside of the regulated zone of the Edwards Aquifer. SwRI's location provides hydrological barriers to reduce the downward migration of surface water to the Edwards Aquifer. As a result, the proposed project is not anticipated to impact the Edwards Aquifer.

A *Jurisdictional Waters of the United States Wetland Determination and Delineation* was completed on October 23, 2017 and determined that there are no wetlands present within or adjacent to the proposed project area. As a result, construction and operation of the proposed sCO₂ Test Facility would have no impact on wetlands.

PUBLIC AVAILABILITY:

DOE encourages public participation in the NEPA process. This EA was released for public review and comment after publication of the Notice of Availability in the *San Antonio Express-News*. The public was invited to provide oral, written, or e-mail comments on the Draft EA to DOE during the comment period, which occurred from March 19, 2018 to April 18, 2018. Copies of this Draft EA were also distributed to cognizant agencies, Native American Tribes, and interested parties. Additionally, copies of the Draft EA were made available for review at Forest Hills Branch Library, located at 5245 Ingram Road, San Antonio, Texas, and at the SwRI Building #139, located at 6220 Culebra Road, San Antonio, Texas. Comments were received from the Texas Commission on Environmental Quality (TCEQ), Texas Historical Commission, Texas Parks and Wildlife Department (TPWD), and United States Army Corps of Engineers (USACE) – Fort Worth District and were considered during preparation of the Final EA. The Draft and Final EA are available on National Energy Technology Laboratory website at <https://www.netl.doe.gov/library/environmental-assessments> and DOE's NEPA website at <https://energy.gov/nepa/nepa-documents>.

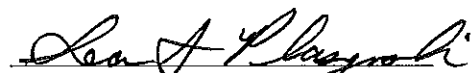
FOR FURTHER INFORMATION ON THE DOE NEPA PROCESS CONTACT:

Ms. Pierina Fayish
U.S. Department of Energy
National Energy Technology Laboratory M/S 922-1W13
P.O. Box 10940
Pittsburgh, Pennsylvania 15236
Pierina.Fayish@NETL.DOE.GOV
(412) 386-5428

DETERMINATION:

Based on the information presented in the Final EA (DOE/EA-2071), DOE finds that implementing the Proposed Action at SwRI would not constitute a major federal action that would significantly affect the quality of the physical, biological, or human environment, within the meaning of NEPA. Therefore, the preparation of an Environmental Impact Statement is not required, and DOE is issuing this FONSI.

Issued in Pittsburgh, Pennsylvania on this 22nd day of May, 2018.



Sean I. Plasynski, Director (Acting)
National Energy Technology Laboratory