STATEMENT OF BASIS

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 9
DRAFT CLASS V EXPERIMENTAL
UNDERGROUND INJECTION CONTROL PERMIT
 # R9UIC- CA5-FY09-1

C6 Resources, LLC
(An affiliate of Shell Oil Company)

Location:

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I. Purpose of the Statement of Basis

The U.S. Environmental Protection Agency, Region 9 (EPA) has prepared this Statement of Basis for the draft permit to be issued to the C6 Resources, LLC. (C6 Resources). Pursuant to the Underground Injection Control (UIC) regulations in Title 40, §124.7 of the Code of Federal Regulations (CFR), the purpose of the Statement of Basis is to briefly describe the derivation of the draft permit conditions and the reasons for them. To meet these objectives, this Statement of

Basis contains background information on the permit process, a description of the project, a brief discussion of the permit conditions, and the reasons for these permit conditions.

II. Permit Process

The EPA Water Division Director (Director) has authority to issue permits for underground injection activities under 40 CFR §144.31. C6 Resources submitted an application to the EPA dated August 10, 2009 for a UIC permit. C6 Resources' application proposed to construct and operate a Class V Experimental injection well facility consisting of one (1) injection well, known as C6-1, and one (1) monitoring well, known as C6-2 to be located in Section 11, Township 3N, Range 1E, on CoCo Property, LLC land in Solano County, CA,

On September 9, 2009, EPA notified C6 Resources that their application was administratively complete. Following this, EPA conducted a technical review of the application. Based on the technical review, EPA drafted a Class V Experimental UIC permit that would authorize one injection well and one monitoring well at the Solano County location. The draft permit contains construction, operation, maintenance, monitoring, reporting, and abandonment requirements.

Based on our review of the proposed well construction, operation standards, monitoring requirements, and the existing geologic setting, EPA believes the activities allowed under the proposed draft permit are protective of Underground Sources of Drinking Water (USDW) as required by the Safe Drinking Water Act.

Public Participation

The public has thirty (30) days to review and comment on the draft Class V Experimental UIC permit (40 CFR §124.10). The draft permit, this Statement of Basis, and C6 Resource's permit application are available at the following locations:

Fairfield Civic Center Library
1150 Kentucky St
Fairfield, CA 94533
1-866-57-ASKUS

U.S. Environmental Protection Agency Environmental Information Center/Library
75 Hawthorne Street
San Francisco, CA 94105
Telephone: (415) 947-4406
Library-reg9@epa.gov

These documents are also available on the EPA Region 9 web page:

http://www.epa.gov/region09/water/groundwater/uic-permits.html

The public comment period begins on July 25, 2010 and ends on August 24, 2010. During this period, all written comments on the draft permit should be mailed, faxed, or e-mailed to Michele

Dermer using the contact information listed above. Ms. Dermer is also available by phone to address any questions regarding the permit process or the draft permit.

During the public comment period, any interested person may submit written comments on the draft permit and may request a public hearing. All persons, including the applicant, who object to any condition of the draft permit or EPA's decision to prepare a draft permit must raise all reasonably ascertainable issues and submit all reasonably available arguments supporting their position by the close of the comment period. Further information regarding the raising of issues during the public comment period may be found at 40 CFR §124.13. Any request for a public hearing shall be in writing and shall state the nature of the issues proposed to be raised in the hearing. If EPA determines a public hearing will be scheduled, the hearing will be the subject of a thirty (30) day public notice, and the public comment period will be extended.

After the close of the public comment period, EPA will review and consider all comments relevant to the UIC draft permit and application. EPA will send a response to comments to the applicant and each person who has submitted written comments or requested notice of the final permit decision. EPA will also post the response to comments document on our website. The response to comments will contain: a response to all significant comments on the draft permit; EPA's final permitting decision; any permit conditions that are changed and the reasons for the changes; and procedures for appealing the decision. The final decision shall be to either issue or deny the permit. The final decision shall become effective no sooner than thirty (30) days after the service of the notice of decision. Within thirty (30) days after the final permit decision has been issued, any person who filed comments on the draft permit, participated in any Public Hearing on this matter, or takes issue with any changes in the draft permit, may petition the Environmental Appeals Board to review any condition of the permit decision. Commenters are referred to 40 CFR §124.19 for procedural requirements of the appeal process. If no comments request a change in the draft permit, the permit shall become effective immediately upon issuance (40 CFR §124.15).

III. Description of Project

C6 Resources in collaboration with the West Coast Regional Carbon Sequestration Partnership (WESTCARB) proposes to evaluate the characteristics of geologic formations in southern Solano County to determine their capacity to store carbon dioxide (CO_2). WESTCARB, led by the California Energy Commission, is one of seven regional partnerships sponsored by the U.S. Department of Energy's Regional Carbon Sequestration Partnership Program, and is managed by Lawrence Berkeley National Laboratory. Members of WESTCARB include the Natural Resources Defense Council, Environmental Defense Fund, Stanford University and the University of California, Berkeley, among others.

The UIC permit would authorize C6 Resources to drill two wells which would reach approximately two miles below the ground surface to a saline formation. One well would be used for CO_2 injection and the other well would be used for monitoring. The proposed project is a pilot program to allow C6 Resources and WESTCARB to gather information on the geology and suitability of the location for sequestration of CO_2. The injection of CO_2 is one step in

"Carbon Capture and Storage (CCS)," an experimental technology being evaluated as a method to reduce emissions of greenhouse gases into the atmosphere. The project site is on private property that is zoned for agricultural use and is currently used for dry farming and grazing, as well as wind power generation.

For the proposed test, 2,000 to 6000 metric tons of CO_2 (at least 99.5% pure) at supercritical conditions (under pressure CO_2 is present as a liquid rather than a gas) will be injected into the injection well. The target injection zone is at an approximate depth of 11,000 feet below ground surface (BGS), and is expected to contain highly saline formation water. The CO_2 will be trucked to the site; C6 Resources estimates this at approximately 300 truck trips, about 10 per day, over the course of a two month period. The actual injection duration is expected to be between one and two months, with monitoring of the CO_2 in the formation continuing for six months after the end of CO_2 injection.

For reference, 6,000 metric tons of CO_2 is the amount of CO_2 generated by a typical 1,000-megawatt coal-fired power plant in approximately 6.5 hours. The pilot-scale project will test the injectivity of this relatively small amount of CO_2 into the geologic formation, measure changes in water chemistry within the formation, and test methods for monitoring the location of the CO_2 plume to demonstrate and estimate the amount of the injected CO_2 that dissolves in the reservoir water or becomes immobilized in the formation.

Research results of this small-scale project will add critical data to our scientific understanding and help to more accurately predict the effectiveness of large-volume CO_2 sequestration. In addition, it is expected that the results will promote greater public awareness and understanding of future full-scale projects. An important goal of pilot projects such as this one is to gather, evaluate, and share data on appropriate technologies and approaches for CO_2 injection. The capture and injection of CO_2 produced by human activities for long-term storage is one of a portfolio of options that can reduce CO_2 emissions to the atmosphere and help to mitigate climate change.

IV. Brief Summary of Specific Permit Conditions

The conditions specified in the draft permit are for the construction and operation of the injection well, monitoring, reporting, and plugging and abandonment of the well. The following summary briefly describes the permit conditions and the reasons for them. These conditions will ensure the protection of USDWs, while advancing the experimental project's research objectives.

Well Construction and Site Geology

The draft permit allows well drilling, testing, construction, and operation to commence only after specific written approval is granted by EPA. Five injection zones are identified in the permit application as possible injection targets, a primary target and four alternate targets, in case the primary target does not meet project objectives. The Anderson Sandstone (at approximtely 11,000 bgs and providing a 700-foot injection interval) will be tested first, and if this zone meets operational requirements, the injection well will be completed in that formation. Alternatively,

the Hamilton Sandstone formation is the secondary target. Above the Hamilton Sandstone are the Domengine Sandstone, Martinez123 Sandstone and the Upper Martinez Sandstone. Each of these formations is included in this permit, and may be authorized for injection depending on test results.

The monitoring well shall be completed in the same zone as the target injection zone, and will be located approximately 150 feet away from the injection well, at depth. The monitoring well will be used to observe the CO_2 by crosswell tomography and other monitoring surveys.
The completed well schematics for the injection well and the monitoring well are included in Appendix B of the draft permit. The Permittee will follow this planned construction to case and cement the wells in order to provide several layers of protection to prevent the movement of fluids into or between any USDW. EPA also includes in the draft permit procedures for drilling, work-over, and plugging that will assure compliance with EPA's UIC regulations as well as appropriate state requirements for well drilling operations.

EPA's draft permit also requires logs and other tests to be conducted during drilling and construction to document information on the geologic formations encountered while drilling, as well as documenting the actual well construction details. These include, at a minimum, deviation checks, cased-hole logs, and injection formation tests. The draft permit also requires open hole logs, including mud cuttings logs over the entire open hole sequence.

EPA will require injection formation information to be determined through well logs and tests and shall include a characterization of porosity, permeability, static formation pressure, and effective thickness of the injection zone. C6 Resources will conduct additional formation testing before CO_2 injection is authorized; including tests that will help determine the maximum allowable injection pressure. A step-rate test (SRT) will be conducted using formation water before injection is authorized, to establish maximum injection pressure.

Formation water testing will be required during construction of the wells and shall include analysis of Total Dissolved Solids (TDS) to demonstrate either the presence, characteristics of, or the lack of, any USDW. The Permittee shall provide well logs and representative water sample analyses from the targeted injection zone using method(s) approved by EPA as evidence.

The draft permit requires C6 Resources to collect field information on the confining layer for the Anderson Sandstone, the Meganos Shale, such as its characteristics, its thickness and its local structure to be obtained during drilling of the injection and monitoring wells. Based on existing geological data, the Meganos Shale is expected to be approximately 900 feet thick where the wells are drilled. Field information will be used to confirm that the confining layer is an effective seal that will prevent upward migration of the CO_2 injection fluids. Details regarding the confinings layers related to the alternate injection zones is included in the draft permit.

Corrective Action

Corrective action in accordance with 40 CFR §§144.55 and 146.7 is a consideration for existing wells in the Area of Review (AOR) around the proposed site, that penetrate the injection zone, or which may otherwise cause movement of fluids into USDWs. Based on information provided in C6 Resources' application, EPA determined that no corrective action plan is necessary, because no known wells located within the AOR penetrate the proposed zones of injection or are otherwise potential conduits for fluid movement into USDWs.

Well Operation

After the casing is set and cementing is complete, the draft permit requires a spherically focused cement bond evaluation log to be run over the course of the entire cased-hole sequence to check for adequate cement bonding. Prior to receiving authorization to inject, the draft permit requires that C6 Resources conduct mechanical integrity (MI) testing. Mechanical integrity must be demonstrated by means of a pressure test in the tubing/casing annulus, and from continuous pressure monitoring, or other procedures as approved by EPA.

The draft permit notes that maximum allowable injection rate and injection pressure limitations will be established based upon results of testing required under the permit. Once established, the permit will contain a maximum injection pressure to ensure that the injection well will be operated below fracture pressure so as to not initiate or propagate physical fractures in the rock formation. A maximum injection pressure as measured at the bottom of the well or at the surface will be calculated based on the formation test data and incorporated into the proposed permit.

Injection fluids authorized by the draft permit will be limited to only food-grade CO_2. In addition, a small quantity of fluorescein (a fluorescent, organic dye used in medicine for diagnostic testing) is allowed to be added to the injected CO_2 as a tracer for the study of the movement of the CO_2.

Monitoring, Record Keeping, and Reporting

The draft permit requires C6 Resources to continuously monitor injection rate, daily and total injection volume, wellhead injection pressure, wellhead injection fluid temperature, bottom-hole injection pressure, and annular pressure, as well as to keep various records and provide quarterly monitoring reports to EPA.

The draft permit also requires that C6 Resources take samples of the injectate at or before the wellhead for analysis and submit these results to EPA. Tests include Inorganic Constituents; Total Dissolved Solids and Total Suspended Solids; general and physical parameters including temperature, turbidity, pH, conductivity, hardness, specific gravity, alkalinity, and biological oxygen demand, density and viscosity; trace metals; volatile organic compounds; and semi-volatile organic compounds.

As a part of this project, Lawrence Berkeley National Laboratory (LBNL) will install a microseismic network to monitor any seismicity, either naturally occurring or human induced that may occur during the injection period. The results of the seismic study will be prepared by LBNL for C6 Resources, and will be submitted to EPA.

All active and post-injection phase data collected during this small-scale study will be evaluated in order to provide an analysis of both the mechanical operations and the subsurface processes related to the injection of CO_2. Reports summarizing the findings of these studies will be submitted to EPA.

Financial Responsibility

C6 Resources is required to demonstrate and maintain financial responsibility and resources sufficient to close, plug, and abandon the underground injection operation as provided in the Plugging and Abandonment Plans and consistent with 40 CFR §144 Subpart D.

C6 Resources shall post an approved financial instrument such as a surety bond with a standby trust agreement, in the amount of $2,502,000 to guarantee closure of the two wells. EPA will authorize drilling of C6-1 and C6-2 only after the financial instrument has been submitted to and approved by EPA.

Well Plugging and Abandonment

The Permittee will actively monitor the injected CO_2 for at least six months post-injection. Following this period, the Permittee will temporarily abandon the wells in accordance with the plan included in Appendix F of the draft permit. The temporary abandonment procedures will be reviewed and approved by EPA before implementation. If the project site is deemed unsuitable as a location for sequestration of CO_2, the wells will be permanently plugged and abandoned as provided in Appendix F of the permit, and consistent with the requirements of 40 CFR §146.10. EPA reserves the right to change the manner in which the well will be plugged if the well is modified during its permitted life or if the well is not consistent with EPA requirements for construction or mechanical integrity. EPA may require C6 Resources to update the estimated plugging cost periodically. Such estimates shall be based upon costs which a third party would incur to plug the wells, including mud and disposal costs, with appropriate contingencies.

Duration of Permit

The permit and the authorization to inject would be issued for a period of two (2) years unless terminated under the conditions set forth in Part III, Section B.1 of the draft permit. EPA considers the duration of the permit to be set at a reasonable amount of time necessary to cover the estimated timetable of the research goals of the project.