STATE OF CALIFORNIA

# CONTRACT REQUESTS FORM (CRF)

CEC-94 (Revised 5/11) CALIFORNIA ENERGY COMMISSION

500-11-024

☒ New Contract ☐ Amendment to Existing Contract: _____ Amendment Number: _____

| Division | Contract Manager: | MS- | Phone | CM Training Date |
|---|---|---|---|---|
| Energy Research and Development | Joe O`Hagan | 43 | 916-327-1368 | 11/14/2007 |

| Contractor's Legal Name | Federal ID Number |
|---|---|
| DOE- Lawrence Berkeley National Laboratory | 94-2951741 |

| Title of Project |
|---|
| Assessment of Potentially Deleterious Effect of Geologic Carbon Sequestration Operations on Groundwater Quality |

| Term | Start Date | End Date | Amount |
|---|---|---|---|
| New/Original Contract | 6/25/2012 | 3/31/2015 | $ 600,000 |

*Line up the Amendment information as best as possible within the following table.*

| Amendment # | End Date *(mm/dd/yy)* | Amount |
|---|---|---|
| | | |

| Business Meeting Information | | | |
|---|---|---|---|
| Proposed Business Meeting Date | 5/9/2012 | ☐ Consent | ☒ Discussion |
| Business Meeting Presenter | Joe O`Hagan | Time Needed: | 5 minutes |

**Agenda Item Subject and Description**

Possible approval of Contract 500-11-xxx for $600,000 with Lawrence Berkeley National Laboratory for 33 months to evaluate the potential for geologic carbon sequestration in California's Central Valley to adversely affect groundwater quality. This project is considered match funding for a $16 million federal WESTCARB award. (PIER natural gas funding.) Contact: Joe O'Hagan. (5 minutes)

**Business Meeting approval is not required for the following types of contracts:** *Executive Director's signature is required in all cases.*

☐ Contracts less than $10k *(Policy Committee's signature is also required)*

☐ Amendment for a no-cost time extension. Must be first extension, less than one year and original contract less than $100k.

☐ Contracts less than $25k for Expert Witness in Energy Facility licensing cases and amendments.

**Purpose of Contract or Purpose of Amendment, if applicable**

The purpose of the agreement is to evaluate the potential for geologic carbon sequestration in California's Central Valley to adversely affect groundwater quality.

**California Environmental Quality Act (CEQA) Compliance**

1. Is Contract considered a "Project" under CEQA?
   ☒ Yes: skip to question 2 ☐ No: complete the following (PRC 21065 and 14 CCR 15378):
   Explain why contract is not considered a "Project":

2. If contract is considered a "Project" under CEQA:
   ☒ a) Contract **IS** exempt. (Draft NOE required)
   ☐ Statutory Exemption. List PRC and/or CCR section number: _____
   ☐ Categorical Exemption. List CCR section number: _____
   ☒ Common Sense Exemption. 14 CCR 15061 (b) (3)
   Explain reason why contract is exempt under the above section:
   The activity is covered by the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA.

   ☐ b) Contract **IS NOT** exempt. The Contract Manager needs to consult with the Energy Commission attorney assigned to their division and the Siting Office regarding a possible Initial Study.

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APR 9 2012
CONTRACTS, GRANTS & LOANS

## Budgets Information

| Contract Amount Funded | | Breakdown by FY | | | Funding Sources | | | |
|---|---|---|---|---|---|---|---|---|
| Funding Source | Amount | FY | Amount | Approved? | Funding Source | FY | Budget List No. | Amount |
| ARFVTF | $ | 11-12 | $600,000 | Yes | NG Subaccount, PIERDD | 10-11 | 501.001E | $600,000 |
| ECAA | $ | | $ | | | | | $ |
| State- ERPA | $ | | $ | | | | | $ |
| Federal | $ | | $ | | | | | $ |
| PIER - E | $ | | $ | | | | | $ |
| PIER - NG | $600,000 | | $ | | | | | $ |
| Reimbursement | $ | | $ | | | | | $ |
| Other | $ | | $ | | | | | $ |
| TOTAL: | $600,000 | TOTAL: | $600,000 | | | | TOTAL: | $600,000 |
| Reimbursement Contract #: | | | | | Federal Agreement | | | |

| Contractor's Administrator/ Officer | | Contractor's Project Manager | |
|---|---|---|---|
| Name: | David Garcia | Name: | Peter Nico |
| Address: | 1 CYCLOTRON RD # 90R31 | Address: | 1 CYCLOTRON RD # 90R31 |
| City, State, Zip: | BERKELEY, CA 94720-8099 | City, State, Zip: | BERKELEY, CA 94720-8099 |
| Phone/ Fax: | (510) 486-7283 / (510) 486-4386 | Phone/ Fax: | (510) 486-7718 / (510) 486-5686 |
| E-Mail: | dagarcia@lbl.gov | E-Mail: | psnico@lbl.gov |

## Contractor Is

- ☐ Private Company *(including non-profits)*
- ☐ CA State Agency *(including UC and CSU)*
- ☒ Government Entity *(i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)*

## Selection Process Used

- ☐ Solicitation Select Type Solicitation #: _____ # of Bids: _____ Low Bid? ☐ No ☐ Yes
- ☐ Non Competitive Bid *(Attach CEC 96)*
- ☒ Exempt Other Government Entity

## Civil Service Considerations

- ☐ Not Applicable (Contract is with a CA State Entity or a membership/co-sponsorship)
- ☒ Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)
- ☐ The Services Contracted:
  - ☐ are not available within civil service
  - ☐ cannot be performed satisfactorily by civil service employees
  - ☐ are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system.
- ☐ The Services are of such an:
  - ☐ urgent
  - ☐ temporary, or
  - ☐ occasional nature

  that the delay to implement under civil service would frustrate their very purpose.

**Justification**:
Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)

Department of Energy

**Funds-In Agreement for Research and Development**

**Appendix A—California Energy Commission**

**Exhibit A - Statement of Work**
**Exhibit B - Task Deliverables, Schedule,**
**Exhibit C - Budget**
**Exhibit D - List of Contacts And Addresses**
**Exhibit E - Confidential Deliverables and Intellectual Property Lists**

Prepared by the Lawrence Berkeley National Laboratory
2/8/2012

## I. Title of project

Assessment of Potentially Deleterious Effect of Geologic Carbon Sequestration Operations on Groundwater Quality

## II. Energy Commission RFP identification

N/A

## III. Background

The U.S. Department of Energy (DOE) has directed the University of California to perform the work stated in this Appendix A for the Energy Commission. Lawrence Berkeley National Laboratory (LBNL), a laboratory owned by the Department of Energy, is located at One Cyclotron Road, Berkeley CA, 94720. The University of California, a not-for-profit corporation organized under the laws of the State of California, with its principal place of business at 1111 Franklin St, Oakland, CA 94607-5200, manages and operates Lawrence Berkeley National Laboratory under DOE Contract No. DE-AC02-05CH11231.

The California Energy Resources Conservation and Development Commission (Energy Commission) is an agency organized under the laws of the State of California with a principal place of business at 1516 Ninth Street, Sacramento, California 95814.

## IV. Project Goals and Objectives

### Problem Statement

A promising measure for mitigating climate change is to store large volumes of Carbon Dioxide ($CO_2$) in deep saline aquifers. In California, the thick marine sediments of the Central and Salinas Valleys have been identified as prime targets for future $CO_2$ storage. However, any water resources impacts of large-scale $CO_2$ storage need to be evaluated before industrial-size storage projects get underway.

The Agreement describes research to assess the potential water quality impacts of $CO_2$ leakage from deep storage aquifers into shallow potable aquifers. It will focus on issues specific to California by selected research materials from field sites in California's San Joaquin Valley. There are no other groups evaluating the potential impacts on California groundwater resources of elevated $CO_2$ as a result of $CO_2$ storage activities.

LBNL has specialized experimental and modeling expertise which will allow them to accomplish the research in this Agreement in a particularly efficient and effective manner. Specifically, LBNL has two ongoing projects addressing the impact of elevated $CO_2$ on groundwater quality; one funded by the Electrical Power Research Institute and the second by the United States Environmental Protection Agency. Through these previous projects LBNL has developed a unique flow through system for evaluating the impact of elevated $CO_2$ on aquifer sediments. They have also characterized the mineral-trace metal interactions in an aquifer sediment from Mississippi State and incorporated those findings into a reactive transport model. The results from this model are compared against the results of a large scale field test of $CO_2$ injection. The learnings from these previous and ongoing activities will be applied to the work herein.

The principal barriers that hinder the ability to predict the impact on water quality from potential $CO_2$ leakage are insufficient scientific understanding of:

- The nature and quantity of organic matter potentially leached during a leakage event.
- Typical mineral-trace metal associations present in California sediments in the regions where $CO_2$ storage activities are most likely.
- The chemistry of elevated $CO_2$ groundwater with those trace metals.
- The impact of organic matter on the metal mobilization and microbial activity in California aquifers.
- The reversibility of these impacts with off gassing of $CO_2$.
- The existence of reactive transport models parameterized with high quality experimental data from California aquifer materials.

These barriers have not been addressed by other institutions due to the absence of funding for research on materials and conditions specific to California. As large scale field tests of $CO_2$ storage are being conducted or proposed it is important to simultaneously evaluate the potential risks of these activities. The overall project goal is to provide laboratory and computer modeling results that will support effective decision making regarding the risk of water resource degradation due to long-term $CO_2$ storage activities.

## V. Technical and economic/cost performance objectives

The overall goal of this Agreement is to provide laboratory and computer modeling results that will support effective decision making regarding the risk of water

resource degradation due to long-term $CO_2$ storage activities.

The specific technical objectives upon which this Agreement's success will be evaluated are:

- Assess the quantity and quality of supercritical $CO_2$ leachable organic material from a typical reservoir cap.
- Assess mineral-trace metal associations in typical aquifers near areas deemed most suitable for Carbon Capture and Storage (CCS) operations in California.
- Determine the impact of elevated $CO_2$ ground water on metal within aquifers.
- Determine the impact of organic material on metal mobilization and microbial activity within aquifers.
- Evaluate the extent to which these impacts reverse themselves upon depressurization during transport to the surface.
- Incorporate results from tasks 1-5 into improved reactive transport models that can be applied to further evaluate the mobilization, fate and transport of trace metals in groundwater by $CO_2$ leaks from CCS operations in California.
- Determine the most probable mechanisms of water quality impacts as a result of $CO_2$ leaks.

## VI. Preliminary Activities

### 1.1 Attend Kick Off Meeting

The Facility Operator's Project Manager (Principal Investigator) shall attend a "kick off" meeting with the Commission Contract Manager to review the Energy Commission's expectations for: accomplishing tasks described in the work statement; administrative requirements in the terms and conditions of the contract (e.g., invoicing, statements vesting title, prior approvals, data disclosure limitations, monthly progress reporting format and content, etc.); and the Energy Commission's roles and responsibilities. The location of this meeting shall be designated by the Commission Contract Manager.

### 1.2 Describe Synergistic Projects

Documentation of synergistic project value assessments will be received, reviewed and approved in writing by the Commission Contract Manager before: 1) any Public Interest Energy Research (PIER) funds under this contract are disbursed, and 2) PIER-funded work on Technical Tasks may begin.

Provide the following information about the synergistic projects that will enhance information and technology exchanges with this project:

- Assessed value of each synergistic project.

- Title, contact name, address and telephone number for each identified synergistic project.
- Written concurrence from each technical manager of the identified synergistic projects that information and technology derived from the synergistic project is unrestricted and available for exchange and collaboration in conjunction with this project.

There are three synergistic projects that will enhance the value of the current proposed work. They are described briefly below.

1) **$CO_2$ Field Experiment with Injection into Fresh Water Aquifer - Geochemical Interpretations and Modeling:**
   Value: $450,000, Years 2010-2012
   Funded by: Electrical Power Research Institute
   Contacts: Jens Birkholzer (510-486-7134) and
   Nic Spycher (510-495-2388)
   Lawrence Berkeley National Laboratory
   One Cyclotron Rd.
   Berkeley CA 94720

   This is a large scale field experiment examining the impacts of an injection of high dissolved $CO_2$ (i.e. carbonated) water on trace metal mobility in a US Gulf Coast drinking water aquifer. As part of this activity we have conducted detailed spectroscopic and wet chemical characterization of aquifer sediments. The expertise we have gained and the experimental approaches developed through this program will facilitate similar investigations using California specific groundwater aquifer materials. In these investigations we have learned the iron sulfide minerals are likely particularly important in controlling trace metal mobility and will therefore be able to pay particular attention to these phases during our CEC funded investigations. In addition, as part of the EPRI project our team has developed reactive transport models to predict the movement of the field experiment $CO_2$ plume. These models will be available for the evaluation of the experimental results proposed herein.

2) **Evaluating the Consequences of $CO_2$ Intrusion into Groundwater: Laboratory Experiments, Microspectroscopy, and Associated Geochemical Modeling:**
   Value: $750,000, Years 2010-2012
   Funded by: United States Environmental Protection Agency
   Contacts: Jens Birkholzer (510-486-7134) and
   Nic Spycher (510-495-2388)
   Lawrence Berkeley National Laboratory
   One Cyclotron Rd.
   Berkeley CA 94720

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As part of this project we are evaluating the sensitivity of trace metals in several aquifer sediments from around the country to elevated dissolved $CO_2$ concentrations. As part of this project we have developed a unique flow through experimental system for testing the interaction of elevated $CO_2$ groundwater and aquifer sediments. This experimental system is available for use for the activities proposed herein. The development of this flow system has been resource intensive, but it is now a unique system for examining the release of trace metals under realistic $CO_2$ pressures and flow rates. It is also amenable to performing stop-flow experiments which will augment our experimental results. It should be noted that our EPA project was not specifically targeting any sites within California.

**3) WESTCARB New Geologic Characterization Well:**

Value: $750,000, Years 2010-2012
Funded by: United States Environmental Protection Agency
Contacts: John Beyer (510)486-7954)
Lawrence Berkeley National Laboratory
One Cyclotron Rd.
Berkeley CA 94720

In December 2011, WESTCARB drilled a geologic characterization well in the Central Valley of California, in the southwestern Sacramento Basin in proximity to major population centers and $CO_2$ sources. The well is in northern California's Rio Vista gas province, where the penetrated formations are known to host natural gas reservoirs, now largely depleted. Geologic characterization of these formations will be a first step in evaluating, not only the potential for $CO_2$ sequestration in saline reservoirs, but also, future possibilities for $CO_2$ storage in depleted gas reservoirs, and enhanced gas recovery using $CO_2$.

The well reached a vertical depth of 2109 meters (6920 feet) and penetrated three potential sandstone reservoir formations with overlying shale caprocks, and at total depth had penetrated 76 m (250 ft) of a fourth shale formation overlying deeper sandstones. A total of 44 sidewall cores were recovered from all of these formations, plus 6 m of whole core from one confining unit and 15 m from a massive sandstone formation with high porosity and permeability. Schlumberger ran a full suite of logs (Platform Express, Elemental Capture Sonde, Sonic Scanner, FMI Microimager, and Combinable Magnetic Resonance), which will provide constraints on stratigraphy, transport properties, and geochemistry.

On-going research at Lawrence Berkeley National Laboratory includes:

- chemical (XRD & ICP-MS) and isotopic analyses of core samples to constrain laboratory experiments and modeling,
- petrophysical analyses to determine porosity, permeability, mineralogy,

grain size distribution, relative permeability of $CO_2$ at reservoir temperature and pressure, and changes in seismic properties and electrical resistivity with varying $CO_2$ saturation,

- quantitative imaging (synchrotron micro-CT, SEM, & FIB) to improve understanding of rock structure, transport properties, and seismic response,
- geochemical experiments to assess the long-term fate of $CO_2$ as it interacts with reservoir rock and brine,
- modeling of geochemical interactions among reservoir rock, formation brine, and $CO_2$, and
- dynamic modeling of the hydrology and reactive transport of $CO_2$ into potential reservoir formations
- Results from this work will be available for the research activities proposed herein.

### 1.3 Identify Required Permits

No permits are required to conduct this project.

### 1.4 Obtain Required Permits

N/A

### 1.5 Prepare Production Readiness Plan

N/A

## VII. Description of tasks to be performed

### TECHNICAL TASKS

### *GLOSSARY*

*Specific terms and acronyms used throughout this work statement are defined as follows:*

| | |
|---|---|
| CCS | Carbon Capture and Storage |
| $CO_2$ | Carbon Dioxide |
| CPR | Critical Project Review |
| DOE | United States Department of Energy |
| LBNL | Lawrence Berkeley National Laboratory |
| PIER | Public Interest Energy Research |

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## SCOPE OF WORK

This agreement includes a set of administrative tasks and a set of Technical Tasks. The remainder of this work statement defines these Technical Tasks. Task descriptions include goals, Contractor activities, and deliverables. The deliverables, such as test plans, technical reports and other interim deliverables, for each task are defined to the extent possible, but are subject to change based on recommendations from the Project Manager and the approval of the Commission Contract Manager. The Contractor shall submit a draft of each deliverable, unless described differently in the Technical Tasks, to the Commission Contract Manager for review and comment in accordance with the approved Schedule of Deliverables. Deliverables not requiring a draft version are indicated by marking "(no draft)" after the deliverable name.

The Commission Contract Manager will provide written comments back to the Contractor on the draft deliverable within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

When creating technical deliverables, the Facility Operator shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

### Technical Task List

| | |
|---|---|
| Task 2.1 | Assess the Quantity and Quality of Supercritical $CO_2$ Leachable Organic Material from a Typical Reservoir Cap |
| Task 2.2 | Assess Mineral-Trace Metal Associations in Typical Aquifers near Areas Deemed Most Suitable for CCS Operations in California |
| Task 2.3 | Determine the Impact of Elevated $CO_2$ Ground Water on Metal within Aquifers |
| Task 2.4 | Determine the Impact of Organic Material on Metal Mobilization and Microbial Activity within Aquifers |
| Task 2.5 | Evaluate the Extent to Which These Impacts Reverse Themselves upon Depressurization during Transport to the Surface |
| Task 2.6 | Incorporate Results from Tasks 2.2-2.5 into Improved Reactive Transport Models That Can Be Applied to Further Evaluate the Mobilization, Fate and Transport of Trace Metals in Groundwater by $CO_2$ Leaks from CCS Operations in California |

| | |
|---|---|
| Task 2.7 | Determine the Most Probable Mechanisms of Water Quality Impacts as a Result of $CO_2$ Leaks |

**Task 2.1 Assess the Quantity and Quality of Supercritical $CO_2$ Leachable Organic Material from a Typical Reservoir Cap**

The goal of this task is to evaluate the quantity and quality of organic matter likely to be carried upwards into a drinking water aquifer by a supercritical $CO_2$ leak passing through organic rich cap rock.

**The Contractor shall:**

- Review current literature with regards to organic mobilization from natural rocks via supercritical $CO_2$.
- Contact research groups conducting experimental extractions of non-California sample reservoir cap rock in order to be aware of latest results.
- Conduct spectroscopic evaluation of organic material in samples of recovered reservoir cap rock if suitably uncontaminated material can be collected.
- Prepare a technical memo on recommendations for types of organics to be tested in Task 2.4 based on the findings within this task.
- Prepare a technical memo on spectroscopic data findings discovered in this task.

**Deliverables:**

- Technical memo on recommendations for types of organics to be tested in Task 2.4 (no draft)
- Technical memo on spectroscopic data findings discovered in this task (no draft)

**Task 2.2 Assess Mineral-Trace Metal Associations in Typical Aquifers near Areas Deemed Most Suitable for CCS Operations in California**

The goal of this task is to evaluate the chemical and physical associations of potentially mobilized trace metals in typical California aquifer material.

**The Contractor shall:**

- Conduct chemical extractions and spectroscopic evaluations of typical California aquifer sediments in order to estimate mineral-metal associations, with particular emphases on Uranium-mineral associations.
- Prepare a technical memo on the spectroscopic and chemical extraction data findings discovered in this task.
- Prepare a technical memo on recommendations for metal-mineral associations in order to populate model development in Task 2.6.

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**Deliverables:**

- Technical memo on the spectroscopic and chemical extraction data findings discovered in this task (no draft)
- Technical memo on recommendations for metal-mineral associations to populate model development in Task 2.6

**Task 2.3 Determine the Impact of Elevated $CO_2$ Ground Water on Metal within Aquifers**

The goal of this task is to measure the mobilization of metals from typical California aquifer sediments as a result of exposure to simulated groundwater containing elevated concentrations of $CO_2$.

**The Contractor shall:**

- Conduct flow and batch extraction experiments using the Contractors $CO_2$ extraction apparatus and sediment samples from typical California aquifers.
- Prepare a technical memo on solution state metal concentration data findings discovered in this task.
- Prepare a technical memo on data for calibration of models in Task 2.6.

**Deliverables:**

- Technical memo on solution state metal concentration data (no draft)
- Technical memo on data for calibration of models in Task 2.6 (no draft)

**Task 2.4 Determine the Impact of Organic Material on Metal Mobilization and Microbial Activity within Aquifers**

The goal of this task is to evaluate the impact of added organic matter on the mobilization of metals from typical California aquifer sediments as a result of exposure to simulated groundwater containing elevated concentrations of $CO_2$.

**The Contractor shall:**

- Conduct flow and batch extraction experiments with added organic matter as recommended from Task 2.1 using the Contractors $CO_2$ extraction apparatus and sediment samples from typical California aquifers.
- Prepare a technical memo on solution state metal concentration data findings discovered in this task.
- Prepare a technical memo on data for calibration of models in Task 2.6.

**Deliverables:**

- Technical memo on solution state metal concentration data (no draft)
- Technical memo for calibration of models in Task 2.6 (no draft)

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**Task 2.5 Evaluate the Extent to Which These Impacts Reverse Themselves upon Depressurization during Transport to the Surface**

The goal of this task is to determine the degree to which metals mobilized under elevated $CO_2$ conditions are removed from solution as pressure is reduced and $CO_2$ released.

**The Contractor shall:**

- Modify the existing $CO_2$ extraction apparatus in order to allow for controlled depressurization of samples and analysis as a result of the changes in metal concentration.
- Conduct experiments using modified apparatus and typical California aquifer sediments measuring the concentrations of metals in the solution state before and after depressurization events.
- Prepare plans for modified experimental apparatus.
- Prepare a technical memo on solution state metal concentration data.
- Prepare a technical memo on data for calibration of models in Task 2.6.

**Deliverables:**

- Plans for modified experimental apparatus
- Technical memo on solution state metal concentration data (no draft)
- Technical memo on data for calibration of models in Task 2.6 (no draft)

**Task 2.6 Incorporate Results from Tasks 2.2-2.5 into Improved Reactive Transport Models That Can Be Applied to Further Evaluate the Mobilization, Fate and Transport of Trace Metals in Groundwater by $CO_2$ Leaks from CCS Operations in California**

The goal of this task is to incorporate the experimental data derived in tasks 2.1 to 2.5 into a refined reactive transport model.

**The Contractor shall:**

- Incorporate the results from Tasks 2.2 and 2.3 into an existing reactive transport model in order to make that model more relevant to typical California aquifer conditions.
- Test and calibrate the reactive transport model against the experimental results obtained in tasks 2.4 and 2.5.
- Prepare a technical memo on comparisons between the new reactive transport model and the experimental results.

**Deliverables:**

- Technical memo on comparisons between the new reactive transport model and the experimental results (no draft)

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**Task 2.7 Determine the Most Probable Mechanisms of Water Quality Impacts as a Result of $CO_2$ Leaks**

The goal of this task is to synthesize, to the extent possible, the experimental and modeling results from tasks 2.1 to 2.6 into recommendations for probable impacts on groundwater quality as a result of elevated $CO_2$ intrusions into groundwater California aquifers.

**The Contractor shall:**

- Integrate the results from Tasks 2.1 through 2.6 in order to assess the most probable impacts on California groundwater quality as a result of $CO_2$ leakage from deep underground storage activities. Recommendations will be as extensive as possible on the experimental results but will not be compressive with regards to all $CO_2$ related activities and potential groundwater quality impacts.
- Prepare a Synthesis Report integrating the results from Tasks 2.1 through 2.6

**Deliverables:**

- Synthesis Report

**Task 3.0 Reporting Tasks**

All reports shall be delivered to:

Accounting Office, MS-2
California Energy Commission
1516 9th Street, 1st Floor
Sacramento, CA 95814

**Task 3.1 *Quarterly* Progress Reports**

The Contractor shall prepare *written Quarterly* Progress Reports to the Commission Contract Manager by the 30th of the following month, starting after the Department of General Service's contract approval date and shall continue each month until the Final Report has been accepted by the Commission Contract Manager. Attachment A-2 provides a recommended format and content requirements for the Monthly Progress Report.

**Task 3.2 Final Report**

The Final Report shall be a public document. If the Contractor will be preparing a confidential version of the final report as well, the Contractor shall perform the following tasks for both the public and confidential versions of the Final Report. When creating the Final Report, the Facility Operator shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

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http://www.energy.ca.gov/contracts/pier/contractors/index.html

**Subtask 3.2.1 Final Report Outline**

- Contractor shall prepare and submit to the Commission Contract Manager for review an outline of the Final Report describing the original purpose, approach and results of the project.

- The outline shall be submitted to the Commission Contract Manager for review. The Commission Contract Manager shall determine if the outline is satisfactory. If the Commission Contract Manager determines that the outline is unsatisfactory, he or she will, in a timely manner, provide to the Contractor written comments, which indicate how the outline can be improved. The Contractor shall revise the outline to meet the Commission Contract Manager's requirements. Upon finding the final report outline satisfactory, the Commission Contract Manager shall provide to the Contractor written approval of it.

**Subtask 3.2.2 Draft Final Report for Comment**

- The Contractor shall prepare and submit to the Commission Contract Manager a draft Final Report on the project. The format of the report shall follow the approved outline.
-
- The draft final report shall be submitted to the Commission Contract Manager for review and to determine, in a timely manner, if it is satisfactory. If the Commission Contract Manager determines that it is unsatisfactory, he or she will, provide to the Contractor written comments, which indicate how it can be improved. The Contractor shall revise the draft final report incorporating the Commission Contract Manager's corrections and required changes. Upon finding the revised draft to be satisfactory, the Commission Contract Manager shall provide to the Contractor written approval of it.

**Subtask 3.2.3 Final Report**

- The Contractor shall prepare Final Report and submit it to the Commission Contract Manager after receiving the Commission Contract Manager's written approval of the draft Final Report. This task shall be deemed complete and accepted by the Commission only when the Commission Contract Manager approves the Final Report in writing. Upon approval, the Contractor shall submit two unbound copies of the Final Report to the Commission Contract Manager.

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### Task 3.3 Final Meeting

Contractor shall meet with the Commission Contract Manager to present findings, conclusions, and recommended next steps (if any) for the project.

Contractor will also discuss with the Commission Contract Manager the following contract close-out items:

- What to do with any state-owned equipment (Options), if applicable
- Commission's request for specific "generated" data (not already provided in contract deliverables)
- Need to document Contractor's disclosure of "subject inventions" developed under the contract
- Need to file UCC-1 form re: Commission's interest in patented technology
- Other "surviving" contracts provisions.

## VIII. Critical Project Reviews

The Energy Commission will conduct critical project reviews at the conclusion of the following tasks:

- TBD

***(Note: Critical project reviews are meetings between the Facility Operator, the Energy Commission Contract Manager and other individuals selected by the Commission Contract Manager to provide objective, technical support to the Energy Commission. The purpose of these meetings to discuss with the Facility Operator the status of the project and its progress toward achieving its goals and objectives. These meetings may take place at the Energy Commission offices in Sacramento, or at another, reasonable location determined by the Commission Contract Manager.)***

***(Note: Prior to the critical project review meeting, the Facility Operator will provide the task deliverable(s) to the Commission Contract Manager sufficiently in advance to allow the Contract Manager's review of the deliverable document(s) before the review meeting. If not already defined in the Work Statement, the Commission Contract Manager shall specify the contents of the deliverable document(s).)***

***(Note: At the project review meeting, the Facility Operator shall present the required technical information and participate in a discussion about the project with the Commission Contract Manager and other meeting attendees, if any.***

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***(Note: Following the project review meeting, the Energy Commission will determine whether the Facility Operator is complying satisfactorily with the Work Statement and whether the project is demonstrating sufficient progress toward achieving its goals and objectives to warrant continued PIER financial support for the project.)***

## IX. Sponsor's Key personnel and Agreement Management

A. The name and area code/phone number of the California Energy Commission's Contract Manager is listed on Exhibit D and is the official technical contact for the Energy Commission.

The Sponsor's Contract Manager is responsible for the day to day project status, decisions and communications with the Facility Operator Project Manager (Principal Investigator). The Commission Contract Manager will review and approve all project deliverables, reports, and invoices.

The Sponsor may change the Contract Manager by notice given to the Facility Operator at any time signed by the Contract Officer of the Energy Commission.

B. The name and area code/phone number of the California Energy Commission's Contract Officer is listed on Exhibit D and will be the Contract Officer for the Agreement and is the official administrative contact for the Energy Commission.

## X. Facility Operator's Key Personnel and Agreement Administration

The Facility Operator is obligated to comply with the terms and conditions of its Management and Operating (M&O) Contract with the DOE when performing work under this agreement. The DOE may require substitution of the named "key personnel" under this agreement should the DOE determine that the services of the Project Manager (Principal Investigator) or other named key personnel are necessary to meet the Facility Operator's M&O Contract obligations to the DOE. Should the DOE direct the Facility Operator to substitute the named key personnel under this agreement, the Facility Operator shall inform the Energy Commission of the directed substitution in accordance with paragraphs A and B below. In the event that the Energy Commission does not concur with the substitution of named key personnel as directed by the DOE, this agreement shall be terminated under Article XX, Termination, of the modified terms and conditions.

A. The name and area code/phone number of the National Laboratory's Project Manager (Principal Investigator) is on Exhibit D and will be the Project Manager (Principal Investigator) for this project and is the official technical contact for Lawrence Berkeley National Laboratory.

The Facility Operator's Project Manager (Principal Investigator) is responsible for the day to day project status, decisions, and communications with the Sponsor's Contract Manager. The Facility Operator's Project Manager (Principal Investigator) will review and approve all project deliverables and reports.

The Facility Operator's Project Manager (Principal Investigator) is designated as "key personnel" under the Agreement. The Energy Commission reserves the right to prior written concurrence of any substitution of the Project Manager (Principal Investigator).

B. The key personnel are listed on Exhibit D in this agreement.

Facility Operator's key personnel may not be substituted without the Commission Contract Manager's prior written concurrence. Such concurrence shall not be unreasonably withheld. All other personnel may be substituted by Facility Operator, with written notification made to the Commission Contract Manager.

C. The name and area code/phone number of National Laboratory Agreement Administrator is on Exhibit D and will be the Agreement Administrator for this Agreement and is the official administrative contact for Lawrence Berkeley National Laboratory.

## XI. Facility Operator's key subcontractors

The Facility Operator's key subcontractors are listed on Exhibit D in this agreement.

Facility Operator's key subcontractors may not be substituted without the Commission Contract Manager's prior written concurrence. Such concurrence shall be timely provided and not unreasonably withheld. Delay in written concurrence may result in a work stoppage of subcontract work. All other subcontractors may be substituted by Facility Operator, with written notification made to the Commission Contract Manager.

## XII. Report standards

A. The report outline and format will be provided by the Sponsor's Contract Manager to the Facility Operator's Project Manager (Principal Investigator).

B. All reports shall be delivered to the Accounting address shown on Exhibit D.

C. Progress Reports. The Facility Operator shall prepare a Progress Report that summarizes all Agreement activities conducted by the Facility Operator to date, with an assessment of ability to complete the project within the current budget and any anticipated cost overruns. Each Progress Report is due to the Commission

Contract Manager within 30 days after the end of the reporting period. The Commission Contract Manager will specify the report format and contents and the number of copies to be submitted.

D. Final Report and Final Meeting. At the conclusion of the Agreement's technical work as provided for this Appendix A Statement and revised project plan, Facility Operator shall prepare a comprehensive written Final Report, including an Executive Summary. The Commission Contract Manager will review and approve the Final Report.

***(Note: Facility Operator will also participate in a Final Meeting with the Energy Commission to present the findings, conclusions, and recommendations. Both the Final Meeting and the Final Report must be consummated on or before the termination date of the Agreement.)***

## XIII. Schedule

The program will continue for 33 months after advance funding is received by M&O of Lawrence Berkeley National Laboratory. This Agreement is effective the later date of (1) the date on which it is signed by the last of the parties thereto, or (2) the date on which it is approved by the California Department of General Services as noted on the Standard Agreement, or (3) the date on which the Facility Operator receives advance funding from the Sponsor.

## XIV. Budget

SOW Appendix A, Exhibit C shows Energy Commission's Reimbursable Budget.

SOW Appendix A, Exhibit C shows the assessed value of the Federal Administrative Charge not charged to this project.

SOW Appendix A, Attachment A-2 shows assessed value of synergistic projects. The assessed value of such synergistic projects does not constitute a funding contribution or obligation (either cash or in-kind) on the part of the DOE or the Facility Operator.

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