



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Sent via email only

October 1, 2020

Rebecca Hollis
Clean Energy Systems
3035 Prospect Park Dr., Suite 120
Rancho Cordova, California 95670

Re: Technical Evaluation Comments and Information Request #2 for
Underground Injection Control (UIC) Permit Application
Class VI Pre-Construction Permit Application No. R9UIC-CA6-FY20-1

Dear Ms. Hollis:

The United States Environmental Protection Agency, Region 9 (EPA) has conducted a technical evaluation of the proposed Emergency and Remedial Response Plan and financial responsibility demonstration provided in Attachments F and H of the subject permit application, respectively. Based on this evaluation, we have identified additional information or clarification needed for EPA's continued evaluation of the permit application.

Please submit the requested information in the Enclosures by October 31, 2020. If you have any questions about this letter and the Enclosures, please contact me at (415) 972-3971 or call Calvin Ho at (415) 972-3262.

Sincerely,

David Albright
Manager, Groundwater Protection Section

Enclosures

cc (via email): Chris Jones, CalGEM Inland District
Clay Rodgers, Central Valley Regional Water Quality Control Board
John Borkovich, CA State Water Resources Control Board
Amit Garg, CalGEM
Vincent Agusiegbe, CalGEM

ENCLOSURE 1

Evaluation of the Proposed Emergency and Remedial Response Plan for the CES-Mendota Class VI Project

EPA reviewed the proposed Emergency and Remedial Response Plan for the Clean Energy Systems (CES)-Mendota Class VI project (Attachment F of the permit application). EPA has the following questions and recommendations for CES.

Emergency Identification and Response Actions

For a holistic documentation of the response, EPA recommends that, for each scenario, the following be identified: severity of the impact: (i.e., high, medium, low); likelihood of the event; timing of the event (i.e., project phase); avoidance measures in place to reduce the likelihood of the event (e.g., maintenance or monitoring); detection methods that reflect planned testing and monitoring; response personnel; and equipment.

EPA also recommends some additions/revisions to the descriptions of response actions for the specific scenarios identified in the plan. These are summarized in the table below:

Event/Scenario	EPA Comment/Recommendation
All	Add: "Limit access to wellhead to authorized personnel only."
Well Integrity Failure	Response actions could also include: "If a shut off is triggered by mechanical or electrical malfunctions without endangering a USDW, repair faulty components."
Injection Well Monitoring Equipment Failure	Expand this scenario to include other equipment failures and damage to the wellhead.
Injection Well Monitoring Equipment Failure	Response actions could also include: <ul style="list-style-type: none"> • Evaluate the cause of the failure, and mitigate if necessary (i.e., repair equipment). • If there is damage to the wellhead, repair the damage and conduct a survey to ensure wellhead leakage has ceased. • Confirm well integrity prior to restarting injection (upon approval of the UIC Program Director).
Injection Well Monitoring Equipment Failure	Response actions for a Major or Serious emergency could also include: <ul style="list-style-type: none"> • Review downhole, wellhead, and annulus pressure data. • Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor. • Perform a well log/MIT to detect CO₂ movement outside of the casing.
Potential Brine or CO ₂ Leakage to USDW	This scenario should encompass: any evidence of CO ₂ or fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address unanticipated events associated with faults or other pathways; any potential USDW endangerment/unacceptable changes in water quality; and CO ₂ leakage to the land surface.
Potential Brine or CO ₂ Leakage to USDW	CES should identify what types of activities they plan to perform to determine the severity of the event, e.g., sampling, pressure falloff test, Hall Plot analysis.

Event/Scenario	EPA Comment/Recommendation
Potential Brine or CO ₂ Leakage to USDW	Other appropriate steps may include: <ul style="list-style-type: none"> • Address a well integrity issue, including taking specific steps to identify the location of the failure/leak, affect repairs, and demonstrate MI. • Isolate the nearby area, if needed; establish a safe distance and perimeter using a hand-held air-quality monitor.
Natural Disaster	Add to the responses to a minor emergency: “If there has not been a loss of mechanical integrity, initiate gradual shutdown.”
Induced Seismic Event	This section and the title should refer to induced <u>or natural</u> seismic events.
Induced Seismic Event	Please explain how the selected seismic thresholds (i.e., magnitude, distance from the project) are considered to be protective of USDWs.
Induced Seismic Event	In the green operating state: add “Document the event for reporting to EPA in semi-annual reports.”
Induced Seismic Event	At the yellow, orange, and magenta operating states, add: “Initiate gradual shutdown of the well if it is determined to be appropriate.”
Induced Seismic Event	Recommended edits to item 6 of the magenta and red operating states: <ul style="list-style-type: none"> • Determine if leaks to ground water or surface water <u>or a CO₂ leak to the surface</u> occurred. • If a <u>CO₂ leak or USDW contamination/</u>endangerment is detected: <ol style="list-style-type: none"> a. Notify the UIC Program Director within 24 hours of the determination <u>and implement appropriate remedial actions in consultation with the Director.</u>
Induced Seismic Event	Please describe the “rate reduction plan” in the response to the magenta operating state. Does this refer to gradual shutdown?
Induced Seismic Event	In the red operating state, item 1: “Initiate <u>immediate</u> shutdown plan.”

Response Personnel and Equipment

- Is the phone number for the control room technician on duty a 24-hour number? If not, please provide one.
- Please include contact information (name, 24-hour number, and email address) for the plant manager.

Staff Training and Exercise Procedures

- Please provide a copy of CES’s site specific standard operating procedures and training program.
- Will the ERRP be incorporated into a site safety plan as well? If so, please include.

ENCLOSURE 2

Evaluation of Financial Responsibility Demonstration Provided for the CES-Mendota Class VI Site

This financial responsibility demonstration evaluation report for the proposed Clean Energy Systems (CES)-Mendota Class VI geologic sequestration project summarizes EPA's evaluation of the cost estimates provided in Attachment H of the CES-Mendota Class VI permit application. Pursuant to 40 CFR 146.85, Class VI permit applicants must demonstrate financial responsibility (FR) for performing corrective action on deficient wells in the area of review (AoR), plugging the injection well, post-injection site care (PISC) and site closure, and emergency and remedial response (E&RR). To make this demonstration, they must 1) estimate the cost of each of these activities, and 2) provide qualifying financial instruments.

PART 1: Cost Estimate Evaluation

The CES-Mendota project consists of one injection well, into which 350,000 tons of carbon dioxide (CO₂) are proposed to be injected annually for 12 to 20 years (up to 7,000,000 tons total). According to the permit application, the AoR for the project is 2.2 square miles and there is an underground source of drinking water (USDW) within the AoR.

To evaluate CES's FR demonstration, EPA compared the cost estimates provided by CES in their permit application to those generated by EPA's Cost Estimation Tool for Class VI Financial Responsibility Demonstrations (the Cost Tool). EPA developed the Cost Tool to provide an "acceptable range of costs" (including a high-end, middle range, and low-end cost estimate) for Class VI FR activities based on information submitted with a permit application.

For this analysis, EPA determined the Cost Tool inputs based on project data in the permit application. EPA calculated estimates in 2015 dollars to facilitate comparison with the CES estimates, however, as noted below, the cost estimates will ultimately need to be inflated to 2020 dollars for final determination of the specific financial responsibility requirement. Inputs include the size of the AoR, the presence/absence of USDWs in the AoR, the amount of CO₂ to be injected, the duration of the PISC period, the depths and diameters of the injection and monitoring wells in the AoR, and the characteristics of any deficient wells in the AoR requiring corrective action. Exhibit 1 presents the Cost Tool inputs EPA used.

As noted below, the specific activities that the Cost Tool assumes will be employed may differ from those in the approved project plans that describe specific activities that CES must perform. However, because the goal of the financial responsibility requirements is to ensure that sufficient resources are available to cover the costs of EPA engaging a third party to complete the activities (i.e., if CES were to become financially insolvent), the activities do not need to be identical. Where they differ, the ranges of estimates generated by the Cost Tool can be considered appropriate for evaluation purposes. The particular activities that CES must perform will be specified in the approved project plans.

Exhibit 1. Cost Tool Inputs.

Project Information																																																							
Variable Name	Value																																																						
Project Name (Corporate entity)	CES-Mendota																																																						
Project Address/Location	Mendota, California																																																						
Contact Name	Rebecca Hollis																																																						
Contact Information for Project Operator	916 638-7967																																																						
Project Data																																																							
Variable Name	Value	Units (Click in Cell for Dropdown List)																																																					
Size of Area of Review (AoR)	2.2	Square Miles																																																					
Are There Underground Sources of Drinking Water (USDWs) in the AoR?	Yes																																																						
Mass of CO ₂ to be Injected	7,000,000	Tons																																																					
Duration of Post-Injection Site Care	10	Years																																																					
Depth of Injection Well	10,412	Feet																																																					
Diameter of Injection Well	9.63	inches																																																					
<p>Information on Monitoring Wells <i>Note: Cost to clean out monitoring wells is based on a regression equation that is only valid for well depths greater than 2,000 ft. Model is run for all monitoring wells (where the shallow wells are conservatively assumed to be 2,001 ft deep).</i></p> <p style="background-color: #e0e0e0;">7</p> <p>←Number of Monitoring Wells</p> <p>Enter the names, depths (feet), and diameters (inches) of monitoring wells in the table below.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #e0e0e0;"> <th style="width: 15%;">Well Name</th> <th>OBS 1</th> <th>ACZ 1</th> <th>USDW1</th> <th>GW1</th> <th>GW2</th> <th>GW3</th> <th>GW4</th> </tr> </thead> <tbody> <tr> <td>Well Depth (feet)</td> <td>10,412</td> <td>7,302</td> <td>2,001</td> <td>2,001</td> <td>2,001</td> <td>2,001</td> <td>2,001</td> </tr> <tr> <td>Well Diameter (inches)</td> <td>8.75</td> <td>8.75</td> <td>8.75</td> <td>8.75</td> <td>8.75</td> <td>8.75</td> <td>8.75</td> </tr> </tbody> </table> <p>Information on Deficient Wells in the AoR Requiring Corrective Action</p> <p style="background-color: #e0e0e0;">2</p> <p>←Number of Deficient Wells in the AoR that will be Remediated</p> <p>Enter in the names, depths (feet), and diameters (inches) of deficient wells in the aor requiring corrective action in the table below.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #e0e0e0;"> <th style="width: 15%;">Well Name</th> <th>Amstar 1</th> <th>BB Co 1</th> <th>[Well Name]</th> <th>[Well Name]</th> <th>[Well Name]</th> <th>[Well Name]</th> <th>[Well Name]</th> </tr> </thead> <tbody> <tr> <td>Well Depth (feet)</td> <td>8,587</td> <td>11,567</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Well Diameter (inches)</td> <td>9.625</td> <td>9.625</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>								Well Name	OBS 1	ACZ 1	USDW1	GW1	GW2	GW3	GW4	Well Depth (feet)	10,412	7,302	2,001	2,001	2,001	2,001	2,001	Well Diameter (inches)	8.75	8.75	8.75	8.75	8.75	8.75	8.75	Well Name	Amstar 1	BB Co 1	[Well Name]	Well Depth (feet)	8,587	11,567						Well Diameter (inches)	9.625	9.625									
Well Name	OBS 1	ACZ 1	USDW1	GW1	GW2	GW3	GW4																																																
Well Depth (feet)	10,412	7,302	2,001	2,001	2,001	2,001	2,001																																																
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Comparison of Financial Responsibility Cost Estimates

Exhibit 2 compares the FR cost estimates provided by CES (Column A) to the estimates EPA generated using the Cost Tool (Column B). It appears that CES used EPA's Cost Tool to develop their cost estimates, using slightly different assumptions from EPA's in this evaluation; the specific differences (and their implications for setting the value of financial instruments) are discussed below. Appendix B compares the inputs EPA used to those used by CES. However, the cost estimates for each FR category are intended to be accurate enough for the UIC Program Director to assess whether or not the cost estimate provided by CES is likely to be adequate and to serve as a point of discussion between the UIC Program Director and the permit applicant in the FR demonstration review process.

Exhibit 2. Comparison of FR Cost Estimates Provided by CES and Generated by the Cost Tool.

Financial Responsibility Categories	A. CES Submission (2015\$)	B. EPA Cost Tool Estimate (2015\$)
Corrective Action	\$110,000 to \$438,000	\$111,000 To \$456,000
Injection Well Plugging	\$124,000 to \$304,000	\$125,000 To \$313,000
PISC and Site Closure	\$6,970,000 to \$12,641,000	\$3,818,000 To \$7,209,000
E&RR	\$13,096,000 to \$80,925,000	\$13,096,000 To \$80,925,000

Notes:

- (1) CES’s permit application assumed a PISC timeframe of 10 years; approval of this timeframe is pending.
- (2) The PISC and Site Closure estimate shown combines separate cost estimates for post-injection site care and site closure, which are discussed below.
- (3) A detailed table showing individual cost estimates EPA generated using the Cost Tool is presented in Appendix A.
- (4) The estimates generated by EPA and CES are in 2015 dollars; these will need to be inflated to current year (i.e., 2020) dollars to determine the appropriate value of the financial instruments. (Based on the online [Consumer Price Index inflation calculator](#), this will likely inflate the cost estimates by approximately 10 percent.)

The following subsections discuss assumptions that may contribute to differences between these FR estimates.

Performing Corrective Action on Deficient Wells in AoR

CES estimates the cost of performing corrective action on wells in the AoR to be \$110,000 to \$438,000, with a middle estimate of \$212,000. This is similar to the estimates generated by the Cost Tool, which range from \$111,000 to \$456,000, with a middle estimate of \$215,000.

CES’s AoR and Corrective Action Plan (Attachment B of the permit application) identifies two wells in the AoR that penetrate the confining zone and will be plugged. These include the Amstar 1 well (which is 8,587 feet deep) and the B.B. Co 1 well (which is 11,567 feet deep). These wells are described in Attachment B.

Based on plugging schematics in Attachment B, these wells appear to have a diameter of 9⁵/₈ (9.625) inches. However, CES assumed a diameter of 8.75 inches. This would result in a slight underestimate of the well plugging cost estimate (between \$1,000 and \$18,000).

Plugging the Injection Well

CES estimates the cost of plugging the injection well to be \$124,000 to \$304,000, with a middle estimate of \$187,000; this is slightly below the estimate generated by EPA using the Cost Tool of \$125,000 to \$313,000, with a middle estimate of \$188,000.

Both EPA and CES based their estimate on a well depth of 10,412 feet, which is the total depth of the proposed injection well, as shown on the well plugging plan schematic in CES’s Well Plugging Plan (Attachment D of the permit application). However, CES assumed a well diameter of 8.75 inches, and EPA’s estimate assumes a well diameter of 9.625 inches, which is the inside diameter of the hole cemented to surface per Attachment D.

Post-Injection Site Care and Site Closure

EPA estimates the costs of all PISC and site closure activities to range from \$3,818,000 to \$7,209,000, with a middle estimate of \$5,392,000. This is lower than the sum of CES's estimate for these activities (which ranges from \$6,970,000 to \$12,641,000, with a middle estimate of \$9,798,000). 40 CFR 146.85(a)(2)(iii) requires permit applicants to show adequate financial coverage for PISC and site closure activities combined; for ease of discussion, the assumptions underlying PISC and site closure cost estimates are discussed separately below.

Post-Injection Site Care

CES's cost estimate for post-injection site care activities ranges from \$6,400,000 to \$11,057,000, with a middle estimate of \$8,938,000. This is about double the estimate EPA generated using the Cost Tool, which ranges from \$3,248,000 to \$5,625,000, with a middle estimate of \$4,541,000.

The Cost Tool estimates costs associated with conducting groundwater monitoring and performing seismic surveys for the duration of the PISC timeframe. CES's cost estimate does not appear to be directly based on the activities in their Post-Injection Site Care Plan (Attachment E of the permit application); however, the post-injection monitoring activities that CES proposes to perform are similar to those assumed by the Cost Tool estimates. CES proposes to perform ground water monitoring (including fluid sampling in all monitoring wells and logging and continuous pressure monitoring in the deep monitoring wells), and CO₂ plume and pressure front tracking (via fluid and neutron logging, 3D surface, or combination of borehole and surface seismic; and direct pressure/temperature monitoring).

Below is a discussion of how the differences in the assumptions used by EPA and CES affect the estimates generated by the Cost Tool:

- PISC timeframe: EPA's estimate assumes 10 years of post-injection site care based on the alternative timeframe proposed in the Post-Injection Site Care Plan (Attachment E); however, CES based their cost estimate on a 20-year PISC duration. This longer PISC timeframe would increase CES's cost estimate by \$3,249,000 to \$5,626,000 relative to EPA's Cost Tool estimates.
- The size of the AoR: EPA's estimate assumes that the AoR is 2.2 square miles, based on information in the AoR and Corrective Action Plan (Attachment B), while CES assumed an AoR of 2 square miles. The size of the AoR affects cost estimates associated with project-wide surveys to monitor the extent of the CO₂ plume (such as a seismic survey); and a smaller AoR would reduce CES's cost estimate by \$48,000 to \$96,000 relative to EPA's Cost Tool estimates.

Further, because there is currently no information about the depth and diameter of the above confining zone monitoring well (ACZ_1), EPA used the same assumptions as CES. CES expects to complete this well at about 4,500 feet in the Garzas Formation which appears, based on cross sections in the permit application, to be significantly shallower than the 7,302 feet CES assumes. The final construction of this well may impact the post-injection site care cost estimate. (The depth of the monitoring well is a factor in the calculation of O&M costs.)

Site Closure

CES estimates the cost of site closure to be \$570,000 to \$1,584,000, with a middle estimate of \$851,000; this is the same as EPA's Cost Tool estimate. Because there is currently no information about the depth and diameter of monitoring wells OBS_1, ACZ_1, USDW1, GW1, GW2, GW3, and GW4, EPA assumed the same depth and diameter for these wells as CES used in their cost estimate. Because the final cost estimate will need to be based on the actual well specifications, EPA will need to revisit the cost estimates based on the final specifications for these wells.

In the Cost Tool, the cost to clean out monitoring wells is based on a regression equation that is only valid for well depths greater than 2,000 feet. At the CES project, five of the seven monitoring wells are proposed to be shallow wells, with depths of 50 to about 1,400 feet. To understand the potential impacts on the cost estimates of conservatively assuming the shallow wells to be 2,001 feet, EPA ran the Cost Tool assuming two shallow monitoring wells (as proxies for the USDW1 well and one of the very shallow monitoring wells); this reduced the overall cost estimate for site closure by \$51,000 to \$113,000.

Emergency and Remedial Response¹

CES's emergency and remedial response cost estimate ranges from \$13,096,000 to \$80,925,000, with a middle estimate of \$25,603,000; this is the same as EPA's Cost Tool estimate.

CES's E&RR Plan provides a list of possible emergency scenarios that could occur during the injection and post-injection phases of the project. These scenarios include:

- Over-pressurized fluid (blowout) during well construction;
- Injection or monitoring well integrity failure;
- Injection well monitoring equipment failure;
- A natural disaster;
- Fluid (e.g., brine) leakage to a USDW;
- CO₂ leakage to a USDW or the land surface; or
- An induced seismic event.

The Cost Tool develops E&RR cost estimates based on a scenario that includes activities to remediate USDW contamination, including ceasing injection, creating a hydraulic barrier to contain fluid movement upward and/or laterally, installing chemical sealant to stop the CO₂ leak, and treating contaminated water. The Cost Tool estimates also account for the fact that there is a USDW in the AoR of the project.

Questions/Requests for CES:

- *It appears that CES's cost estimates were generated using the EPA FR Cost Estimation Tool; if this is the case, can CES confirm that all of the activities planned for post-injection site care and site closure, and emergency response are addressed in the cost estimate? (It is assumed that corrective action and injection and monitoring well plugging activities will be similar to the activities on which the Cost Tool assumptions are based.)*
- *The cost estimates should represent costs for an independent third party to perform each activity (i.e., not a "discounted" rate provided to CES or its consultants). Please confirm that the cost estimates provided are for an independent third party to conduct the activities described in the corrective action, plugging, post-injection site care and site closure, and emergency and remedial response plans of the permit application. Alternatively, if the estimates provided do not represent costs for an independent third party to conduct these activities, please revise and re-submit the estimates accordingly.*
- *Please provide the date of the cost estimate and revise the cost estimates to reflect current year (i.e., 2020) dollars.*

¹ Although only a small fraction of geologic sequestration sites are expected to require E&RR, all sites need to be financially capable of facing an emergency (40 CFR 146.84(a)(2)(iv)). As such, the Cost Tool will overestimate the actual E&RR costs incurred by most sites, but not overestimate the funds required for financial responsibility for E&RR.

Future Considerations Based on the Results of Pre-Operational Testing/Modeling Updates:

- *Confirm assumptions about the depth and diameters of the injection well and monitoring wells based on final plans/as-built specifications.*
- *Changes to various Cost Tool inputs (e.g., the size of the AoR based on final modeling, the total volume of CO₂ to be injected, corrective action needs at the time the permit is issued, and the approved post-injection site care timeframe) will affect the estimates generated by the Cost Tool.*
- *Although CES provided ranges of cost estimates, the selected financial instrument(s) (see Part 2 below) will need to have a specific face value that is proposed to, and approved by, EPA.*

PART 2: Financial Instrument Demonstration

CES plans to use a single financial instrument to cover the costs of corrective action, injection well plugging, PISC and site closure, and emergency and remedial response. Financial instruments that CES identifies as under consideration include a trust agreement, escrow agreement, or certificate of insurance.

CES must provide acceptable FR instrument(s) listed under 40 CFR 146.85(a)(1) prior to the issuance of a permit for the construction of a new Class VI well. If CES elects to use a trust fund or escrow account, the EPA Director may allow phased pay-in for these two instruments. However, CES must submit a pay-in schedule for the Director's review and approval.

Appendix A
EPA's Output tables for CES-Mendota Cost Estimates
Amount Needed to Show Financial Responsibility (2015\$)

Project Task	Low End Cost Estimate (\$/Project; includes 20% G&A)	Middle Cost Estimate (\$/Project; includes 20% G&A)	High End Cost Estimate (\$/Project; includes 20% G&A)
Performing Corrective Action on Deficient Well(s) in AoR			
Maintenance Rig Rental (Clean Out Deficient Wells)	\$ 70,000	\$ 154,000	\$ 175,000
Flush Deficient Wells	\$ 1,000	\$ 7,000	\$ 17,000
Plug Deficient Wells	\$ 33,000	\$ 46,000	\$ 228,000
Log Deficient Wells	\$ 7,000	\$ 9,000	\$ 36,000
Subtotal: Corrective Action Cost	\$ 111,000	\$ 215,000	\$ 456,000
Plugging Injection Well			
Maintenance Rig Rental (Clean Out Injection Well)	\$ 45,000	\$ 98,000	\$ 111,000
Perform Mechanical Integrity Test Before Plugging Injection Well	\$ 60,000	\$ 60,000	\$ 60,000
Flush Injection Well with a Buffer Fluid Before Plugging	\$ 400	\$ 3,300	\$ 9,000
Plug Injection Well	\$ 16,000	\$ 23,000	\$ 116,000
Log Injection Well	\$ 4,000	\$ 4,000	\$ 18,000
Subtotal: Injection Well Plugging Cost	\$ 125,000	\$ 188,000	\$ 313,000
Post-Injection Site Care (assume 0% discount rate)			
Post-Injection O&M for Monitoring Wells			
Post-Injection Seismic Survey	\$ 3,248,000	\$ 4,541,000	\$ 5,625,000
Post-Injection Groundwater Monitoring			
Post-Injection Monitoring Reports to Regulators			
Site Closure			
Maintenance Rig Rental (Clean Out Monitoring Wells)	\$ 90,000	\$ 198,000	\$ 225,000
Perform MIT Before Plugging Monitoring Wells	\$ 171,000	\$ 171,000	\$ 171,000
Flush Monitoring Wells	\$ 2,000	\$ 19,000	\$ 50,000
Plug Monitoring Wells (occurs at end of PISC; use 0% discounting)	\$ 105,000	\$ 136,000	\$ 595,000
Log Monitoring Wells (occurs at end of PISC; use 0% discounting)	\$ 25,000	\$ 31,000	\$ 125,000
Remove Injection Well Surface Equipment and Restore Vegetation at Injection Well	\$ 19,000	\$ 35,000	\$ 50,000
Remove Monitoring Well Surface Equipment and Restore Vegetation (occurs at end of PISC; use 0% discounting)	\$ 136,000	\$ 242,000	\$ 348,000
Document Plugging and Site Closure Process	\$ 19,000	\$ 19,000	\$ 19,000
Subtotal: Site Closure Cost	\$ 570,000	\$ 851,000	\$ 1,584,000
Emergency and Remedial Response, Scenario B: Remediate Underground Source of Drinking Water (USDW) Contamination			
Stop CO2 Injection	\$ 1,000	\$ 1,000	\$ 3,000
Create Hydraulic Barrier	\$ 9,830,000	\$ 11,159,000	\$ 18,049,000
Install Chemical Sealant to Stop CO2 Leaks	\$ 11,000	\$ 24,000	\$ 32,000
Treat Contaminated Water from USDW	\$ 3,254,000	\$ 14,419,000	\$ 62,841,000
Subtotal: Scenario B	\$ 13,096,000	\$ 25,603,000	\$ 80,925,000
Total Amount Needed to Show Financial Responsibility	\$ 17,149,000	\$ 31,398,000	\$ 88,903,000

Note: Results may not add due to independent rounding.

Appendix B
Comparison of EPA and CES-Mendota Cost Estimation Inputs
Differences are shaded

Parameter	EPA Input	CES Input	Source/Notes for EPA Inputs¹
Size of the AoR	2.2 square miles	2.0 square miles	Attachment B, p.17
Are there USDWs in the AoR?	Yes	Yes	Based on cross sections in the narrative
Mass of CO ₂ to be Injected	7,000,000 tons	7,000,000 tons	Narrative, p. 11: “350,000 tons/year for 12 (4,200,000 tons total) to 20 years (7,000,000 tons total)”
Duration of Post-Injection Site Care	10 years	20 years	Attachment E, p. 15
Depth of Injection Well	10,412 feet	10,412 feet	Total depth per schematic in Attachment D
Diameter of Injection Well	9.625 inches	8.75 inches	Attachment D; page 10, “hole cemented to surface”
Monitoring Well Plugging			
ACZ_1 depth	7,302 feet	7,302 feet	EPA used CES input (which appears to be slightly shallower than the Moreno); note the well could be shallower if it is in the Garzas
ACZ_1 diameter	8.75 inches	8.75 inches	No information about the well was available, so EPA used CES input
Depth of GW1, GW2, GW3, GW4	2,001 feet	2,001 feet	Range = 50-500 feet (Attachment C, p. 7); 2,001 feet is minimum depth for Cost Tool calculations
Diameter of GW1, GW2, GW3, GW4	8.75 inches	8.75 inches	No information about the well was available, so EPA used CES input
OBS_1 depth	10,412 feet	10,412 feet	Same depth as CES used; would be in the injection zone, per injection well specs
OBS_1 diameter	8.75 inches	8.75 inches	No information about the well was available, so EPA used CES input
USDW1 depth	2,001 feet	2,001 feet	Depth of deepest USDW = 1,450; 2,001 feet is minimum depth for Cost Tool calculations
USDW1 diameter	8.75 inches	8.75 inches	No information about the well was available, so EPA used CES input
Wells Needing Corrective Action			
Amstar 1 depth	8,587 feet	8,587 feet	Attachment B, p. 23
Amstar 1 diameter	9.625 inches	8.75 inches	Attachment B, Figure 13
BB Co. 1 depth	11,567 feet	11,567 feet	Attachment B, p. 23
BB Co. 1 diameter	9.625 inches	8.75 inches	Attachment B, Figure 13

¹ All Cost Tool inputs are based on the permit application and are preliminary; the final cost estimates will reflect the UIC permit conditions.