

Wabash Carbon Services (WCS) Class VI Project Review of Financial Responsibility Information

This financial responsibility demonstration evaluation report for the proposed Wabash Carbon Services (WCS) Class VI geologic sequestration (GS) project summarizes EPA's evaluation of the financial responsibility information that WCS submitted to the GSDT on April 28, 2021. Pursuant to 40 CFR 146.85, Class VI permit applicants must demonstrate financial responsibility 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, applicants must estimate the cost of each of these activities and provide qualifying financial instruments.

PART 1: Cost Estimate Evaluation

The WCS project consists of two injection wells (WVCCS1 and WVCCS2), which are projected to inject 20 million metric tons of CO₂ over 12 years into the Potosi Dolomite in Vigo County Indiana. According to maps and tables in the permit application, the AoRs for each plume are approximately 14 square miles (the northern plume) and 14.43 square miles (the southern plume), and an underground source of drinking water (USDW) is present within the AoRs.

To evaluate WCS's financial responsibility demonstration, EPA compared the cost estimates they provided in their Class VI 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 financial responsibility activities based on information submitted with a permit application.

These 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, and the characteristics of any deficient wells in the AoR requiring corrective action. Exhibit 1 presents the Cost Tool inputs EPA used, and Appendix A identifies the source of the inputs based on the permit application.

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 WCS will 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 WCS 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 to be appropriate for evaluation purposes. The particular activities that WCS must perform are specified in the approved project plans that will be attached to the permit.

Exhibit 1. Cost Tool Inputs.

Project Information														
Variable Name	Value													
Project Name (Corporate entity)	Wabash Valley													
Project Address/Location														
Contact Name														
Contact Information for Project Operator														
Project Data														
Variable Name	Value	Units (Click in Cell for Dropdown List)												
Size of Area of Review (AoR)	14	Square Miles												
Are There Underground Sources of Drinking Water (USDWs) in the AoR?	Yes													
Mass of CO ₂ to be Injected	20,000,000	Metric Tons												
Duration of Post-Injection Site Care	4	Years												
Depth of Injection Well	5,400	Feet												
Diameter of Injection Well	7.625	Inches												
<p><small>Information on Monitoring Wells 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).</small></p>														
<p style="text-align: center;">14 -- Number of Monitoring Wells</p> <p>Enter the names, depths (feet), and diameters (inches) of monitoring wells in the table below.</p>														
Well Name	CM1	CM2	FM1	FM2	GM1	GM2	GM3	GM4	GM5	GM6	GM7	GM8	GM9	GM10
Well Depth (feet)	2,386	2,386	4,600	4,600	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001	2,001
Well Diameter (inches)	6.25	6.25	6.25	6.25	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
<p>Information on Deficient Wells in the AoR Requiring Corrective Action</p> <p style="text-align: center;">0 -- 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>														
Well Name														
Well Depth (feet)														
Well Diameter (inches)														

--If there are no USDWs, but there are other (non-USDW) types of groundwater in the AoR that the operator would be required to remediate (if contaminated by a well failure), select 'Yes'.

Comparison of Financial Responsibility Cost Estimates

Exhibit 2 compares the financial responsibility cost estimates provided by WCS (Column A) to the estimates EPA generated using the Cost Tool (Column B).

Exhibit 2. Comparison of Cost Estimates Provided by WCS and Generated by EPA

Financial Responsibility Categories	A. WCS Submission (2020\$)	B. EPA Cost Tool Estimate (2021\$)
Corrective Action	\$0	\$0 to \$0
Injection Well Plugging	\$883,874	\$110,000 to \$293,000
PISC and Site Closure	\$3,642,656	\$4,712,000 to \$9,629,000
E&RR	\$9,378,796	\$9,934,000 to \$92,110,000
Total Amount Needed to Show Financial Responsibility	\$13,905,326	\$14,756,000 to \$102,032,000

Notes:

- (1) Numbers may not appear to add due to rounding.
- (2) WCS estimated plugging costs for both wells; EPA's Cost Tool only estimates the cost to plug one injection well.
- (3) The PISC and Site Closure estimate shown combines separate cost estimates for PISC and site closure, which are discussed below.

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

Performing Corrective Action on Deficient Wells in the AoR

WCS states in their AoR and Corrective Action Plan that there are no deficient wells in the AoR that need corrective action. Therefore, the applicant and the Cost Tool estimate that no resources are needed for this activity.

Plugging the Injection Well

WCS estimates the cost of plugging their two Class VI injection wells to be \$883,874, or \$441,937 per well. This per-well estimate is above the estimate generated by EPA's Cost Tool, which estimates the cost to be between \$110,000 and \$293,000, with a middle-range estimate of \$170,000.

The Cost Tool estimate reflects the cost of plugging only a single well, which is commensurate with the fact that financial responsibility will be permit-based, i.e., for only a single Class VI well.

Post-Injection Site Care and Site Closure

WCS estimates the costs of all PISC and site closure activities to be \$3,642,656. This is lower than the range estimated by the Cost Tool, which is from \$4,712,000 to \$9,629,000, with a middle-range estimate of \$6,801,000. The Class VI Rule, at 40 CFR 146.85(a)(2)(iii), requires permit applicants to show adequate financial coverage for PISC and site closure activities combined; the assumptions underlying the PISC and site closure cost estimates are discussed separately below.

Post-Injection Site Care

WCS's cost estimate for PISC activities is \$1,813,928. This is lower than the estimate generated by the Cost Tool, which ranges from \$3,519,000 to \$6,184,000, with a middle-range estimate of \$5,038,000.

According to WCS's PISC and Site Closure Plan, post-injection monitoring activities will include:

- Semi-annual fluid sampling in 10 shallow monitoring wells (GM1 through GM10), which will be 100 feet deep.
- Annual fluid sampling above the confining zone in two wells (CM1 and CM2), which will be about 1,742 to 2,386 feet deep.
- Annual fluid sampling of the injection zone to monitor the CO₂ plume in two wells (FM1 and FM2), which will be approximately 4,600 feet deep.
- Indirect plume monitoring using pulsed neutron capture/reservoir saturation tool logs and 3D surface seismic surveys across 16 square miles per injection well every 5 years.

The applicant provided a detailed third-party cost estimate for the monitoring that would be performed in the shallow and deep wells. The differences between the Cost Tool estimates and WCS's estimate are likely due to differences in the following assumptions:

- The third-party estimate appears to include two sampling events in deep wells each year. However, according to the PISC and Site Closure Plan, four deep-well sampling events would occur each year: a sample in each of the above confining zone wells (CM1 and CM2) and a sample in each of the injection zone monitoring wells (FM1 and FM2).
- The third-party estimate does not include operating and maintenance (O&M) costs on the monitoring wells, which could be significant, particularly in the deeper wells.
- The third-party estimate assumes 3D seismic surveys over a four square mile area, which is multiplied by 2 to account for the north and south plumes (for a total of 8 square miles).

However, Table 4 of the PISC and Site Closure Plan describes a seismic survey area of 16 square miles around each injection well. The Cost Tool assumes that the 3D seismic surveys will be performed over a 14.43 square mile area, commensurate with the size of the AoR of the South plume.

Site Closure

WCS estimates the cost of site closure to be \$1,828,728, which is the sum of their estimates for monitoring well plugging (\$1,051,728) and site remediation (\$777,000). This is fairly close to the middle-range estimate generated by the Cost Tool of \$1,763,000 (the Cost Tool estimates range from \$1,193,000 to \$3,445,000).

WCS's itemized third-party cost estimate appears to be the sum of: plugging the two FM wells, plugging the two CM wells, and well site remediation for 6 wells (which presumably accounts for the 2 injection wells and 4 deep monitoring wells). It does not appear to include the **cost** of plugging the ten shallow monitoring wells, however.

Emergency and Remedial Response¹

WCS estimates the cost of emergency and remedial response activities to be \$9,378,796, which is slightly below the range of estimates generated by the Cost Tool (between \$9,934,000 and \$92,110,000, with a middle-range estimate of \$25,634,000).

WCS's E&RR Plan provides a list of emergency scenarios that could occur during the injection and post-injection phases of the project. These scenarios include injection or monitoring well or equipment failures, CO₂ or brine leakage to a USDW or the surface, a natural disaster, or an induced or natural seismic event.

WCS provided a third-party cost estimate for groundwater remediation that included: installation and sampling of ten monitoring wells, installation and operation of water injection wells, pumping and treatment of contaminated groundwater, and removal of equipment and wells following operations.

WCS's estimate is similar to the activities assumed by the Cost Tool for projects where a USDW is present, which include activities to remediate mechanical integrity failures and USDW contamination (i.e., 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).

WCS's cost estimate does not include the cost of repairing an injection or monitoring well that loses integrity, however.

¹ Although only a small fraction of GS 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.

Questions/Requests for the Applicant:

- *Please revise the post-injection monitoring costs to address the discrepancies described above, including:*
 - *Sampling in two additional deep monitoring wells;*
 - *O&M costs for the monitoring wells; and*
 - *Performing 3D seismic surveys over a 16 square mile area around each injection well.*
- *Please include the cost of plugging the ten shallow monitoring wells in the site closure cost estimate.*
- *Please include the cost of repairing an injection or monitoring well in the emergency and remedial response cost estimate.*
- *Please update the cost estimates to 2023 dollars.*

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

- *Changes to various Cost Tool inputs (e.g., the dimensions of the injection or monitoring wells, the size of the AoR based on final modeling, the total volume of CO₂ to be injected, and corrective action needs at the time the permit is issued) may affect financial responsibility needs.*

PART 2: Financial Instrument Demonstration

WCS provided draft language for a Trust agreement (which was signed and notarized on April 26, 2021) between Wabash Carbon Services LLC and U.S. Bank National Association (the “Trustee”). The language of the draft agreement follows the EPA-developed template. Schedules A and B attached to the Trust agreement reference the third-party cost estimates (as described above).

The Trust agreement states that, because of the similarity of the two injection wells covered by the agreement the funds described in the schedules “apply [to] both injection wells as one integrated facility.” The Class VI rule allows financial responsibility instruments to cover more than one injection well as long as the amount of funds available is no less than the sum of funds that would be available if a separate instrument had been established for each injection well. EPA recommends in its Financial Responsibility Guidance that the instrument show the EPA Identification Number, name, address, and the amount of funds assured by the instrument. Schedule A includes this information (with some placeholders).

Schedule C of the Trust agreement proposes a pay-in period. WCS proposes to fund the Trust as follows:

- When the final Class VI permits are issued, fund \$1,935,602 (for plugging the injection and monitoring wells) plus \$9,378,796 (for E&RR).
- On the earlier of the one-year anniversary of permit issuance or prior to EPA authorization of injection, WCS will add \$2,590,928 to the trust to cover PISC monitoring and site closure costs.

The pay-in schedule appears to be appropriate (i.e., within the 2-3 year pay-in period recommended in EPA’s Financial Responsibility Guidance) and is commensurate with risk. Specifically, E&RR will be fully funded at the start of construction operations and post-injection site care will be fully funded before any CO₂ is injected.

Questions/Requests for the Applicant:

- *Please adjust Schedule A to reflect the emergency and remedial response cost estimate (the draft includes the total for all activities under the E&RR column).*
- *For clarity, EPA recommends that Schedule A itemize the costs associated with each well to the degree possible (i.e., \$441,937 for plugging each of WCCS1 and WCCS2, totaling \$883,874).*
- *Following issuance of draft UIC permits for the two wells, Schedule A should reference the permit numbers.*
- *Please include the Trust fund number on the agreement document.*
- *Please confirm that the monies in the Trust fund are solely to cover the financial responsibility obligations for the Class VI permits (i.e., they do not cover any other liabilities).*
- *Please be consistent in the spelling of “Grantor” in the trust documentation to avoid any legal confusion.*
- *Following EPA approval of the cost estimates for all activities, the values in Schedules A, B, and C will need to be adjusted accordingly.*

Appendix A

EPA Cost Estimation Tool Inputs¹

Parameter	EPA Input	Source/Notes
Size of Area of Review (AoR)	14.43 square mi	Table 8 of the AoR plan provides the extent in each direction of the plumes around each well. The North plume (WVCCS1) is 3.6 x 3.9 miles = 14.04 mi ² ; the South plume (WVCCS2) is 3.7 x 3.9 miles = 14.43 mi ² .
Are there USDWs in the AoR?	Yes	Narrative, pg. 3: "the Bainbridge or Salina Group...is considered to be the lowermost USDW."
Mass of CO ₂ to be Injected	20 million metric tons	Narrative, pg. 3: "The injection period is expected to last for 12 years and result in the successful sequestration of 20 Million Metric Tons of CO ₂ "
Duration of PISC	4 years	Narrative, pg. 88: "WCS will be proposing an alternative PISC timeframe of 4 years"
Depth of Injection Well	5,400 ft.	Narrative, Table 15 (the same depth is proposed for WVCCS1 and WVCCS2)
Diameter of Injection Well	7.625 in.	Narrative, Table 15 (the same diameter is proposed for proposed for WVCCS1 and WVCCS2)
Monitoring Well Plugging		
Depth of CM1	2,386 ft.	Testing and Monitoring Plan, pg. 2: "these wells will be installed at a depth of ~ 1,742 ft MD to ~2,386 ft MD." The deeper value was selected as an input to provide a conservative assumption.
Diameter of CM1	6.25 in.	None provided; diameter is assumed based on other Class VI projects.
Depth of CM2	2,386 ft.	Testing and Monitoring Plan, pg. 2: "these wells will be installed at a depth of ~ 1,742 ft MD to ~2,386 ft MD." The deeper value was selected as an input to provide a conservative assumption.
Diameter of CM2	6.25 in.	None provided; diameter is assumed based on other Class VI projects.
Depth of FM1	4,600 ft.	Testing and Monitoring Plan, pg. 2: "these wells will be installed to a depth of approximately 4,600 ft MD"
Diameter of FM1	6.25 in.	None provided; diameter is assumed based on other Class VI projects.
Depth of FM2	4,600 ft.	Testing and Monitoring Plan, pg. 2: "these wells will be installed to a depth of approximately 4,600 ft MD"
Diameter of FM2	6.25 in.	None provided; diameter is assumed based on other Class VI projects.
Depth of 10 Pennsylvanian Strata monitoring wells (GM1 through GM10)	2,001 ft.	100 ft, per Testing and Monitoring Plan, Table 6; use 2,001 ft for the Cost Tool) ²
Diameter of 10 Pennsylvanian Strata monitoring wells (GM1 through GM10)	4.5 in.	None provided; diameter is assumed based on other Class VI projects.
Wells Needing Corrective Action		
None.		Narrative, pg. 78: "Within the calculated AoR, no wells penetrate the primary seal."

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

² Note that the Cost Tool uses a regression analysis to estimate monitoring well plugging costs that is only applicable to wells that are more than 2,000 feet deep.