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State of Louisiana

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF CONSERVATION

THOMAS F. HARRIS
SECRETARY

RICHARD P. IEYOUB
COMMISSIONER OF CONSERVATION

May 2, 2022

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DRAFT

Richard Tomaski
Hackberry Carbon Sequestration, LLC (H8907)
1500 Post Oak Blvd., Suite 1000
Houston, TX 77056

RE: Notice of Application Deficiencies
Class VI Injection Well
Hackberry Carbon Sequestration 001
Cameron, Louisiana

Application No. 43148
Serial No.

Dear Mr. Tomaski:

A technical review of the Repermit Application for the Hackberry Carbon Sequestration Injection Wells No. 1 (SN) is in progress. Based on LAC 43:XVII, Subpart 6 (Statewide Order 29-N-6) and our review, the Office of Conservation, Injection and Mining Division (IMD) is forwarding this list of deficiencies which require revisions and/or additional information. An adequate response by Hackberry to each of the listed deficiencies will be necessary in order to continue the review of the application. The submitted responses should be in a format consistent with the original application which can either replace the deficient submittals or be inserted into the original application document. Requested clarifications should be incorporated into pertinent sections of the document.

In order to keep track of the additions, modifications, etc., of the Permit to Drill Application, please submit all requested responses and clarifications in one package and include the Application Number in the upper right hand corner and the revision date on the lower right hand corner of each page submitted.

A. General

1. Requirements Matrix (Table 1) Criteria and Standards Applicable to Class VI Wells references LAC 43:XVII.Chapter 6, the reference should be made to LAC 43:XVII Subpart 6 Chapter 36. Please make the necessary revisions.

B. Form UIC-60 CCS

2. An original signature is required on the certification by operator portion of the UIC-60 CCS form; please make the necessary revisions.

C. Technical Report – Section 1: Site Characterization

3. The offset well [redacted] is referenced on p 1-2 as being "west of the proposed storage site", while on p 1-5 the well is referenced as being "drilled approximately 6 ½ miles east of the proposed storage site. Please make the necessary revisions.

4. The injection zone sands are "described from cuttings" on p 1-10, the mudlog should be provided to LDNR.

5. [redacted] p 1-10, there should be discussion to whether or not this is considered to be cement or constituents to the injection zone and any geochemical reactions that may affect the storage, confinement, and/or overall performance of the project.

6. Structural dip is stated as [redacted] p 1-17, [redacted] p 1-18, "more steeply" p 2-16. An explanation/discussion is needed for the change in dip and any possible rotation within the injection interval.

7. [redacted]

8. It is stated that "fracture orientations are unable to be determined" p 1-23 an explanation is needed as to methods expected to be used in order to obtain this information.

9. The confining fracture gradient was used with a conservative estimate of [redacted] p 1-26, an explanation is needed as to why the Poisson's Ratio for the confining layer was not calculated using the acoustic data; borehole and/or seismic.

10. [redacted] 1-31. An explanation needs to be provided as to the reason discretizing the reservoir into units was not performed.

11. The geochemical characterization p 1-38 provides no description/explanation/ stoichiometry concerning the [redacted] found within the upper and lower confining zones, or the [redacted] found within the injection zone and there anticipated reaction with the proposed CO_2 injectate and any geochemical reactions that may affect the storage, confinement, and/or overall performance of the project.

12. A discussion of the core lab analysis and test methods should be included. This discussion should include the reason test were selected, associated assumptions with analysis, conditions of any experiments or test performed, and a physical description of the core.

13. A Geomechanical discussion concerning, fractures, stress, pressure, temperature, ductility, rock strength, rock/fluid compressibility, in situ fluid pressures within the confining zones/injections zone(s), and details from log runs should be elaborated on.

14. Discussion of the 3D stress regime, determined from calipers, borehole breakouts, publications, etc. should be included.

15. The core analysis report should be provided to LNDR.

16. A discussion or explanation is not provide concerning the dip rotation of the sand beds of the [redacted]

17. The hydraulic gradient was calculated "based on historical water levels in the area dating back to the year 2000"; a reference is needed for the historical data.

18. A discussion or explanation is not provided concerning the manner in which sample preservation occurred, or the sampling equipment used to acquire the fluid samples.

19. A discussion of the sampled fluid analysis is not included.

20. The pH, and specific electrical conductance (SC) were not measured and/or tested on the fluid samples.

21. The laboratory results, including QA samples (blanks, duplicates, matrix spikes) are not included.

22. A discussion of the solids and fluids present and the affect on storage, confinement, project performance, and interactions with the CO_2 stream and what methods were used to determine affects, is not included.

23. The fluid test results have not been extrapolated for supercritical CO_2 as the non-wetting fluid.

24. A discussion of mineral dissolution in low pH conditions is not included.

25. A demonstration of whether or not the waste will adversely alter the confining capabilities of the injection and confining zones is not included.

26. A discussion and/or explanation of what elements may alter the gas compressibility is not included.

27. Potential chemical reactions that could mobilize any contaminants and potentially endanger the USDWs have not been identified or modelled.

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28. No discussion, in regards to surface air and/or soil gas data, concerning any baseline readings and variability of CO2 or parameters planned for tracking the plume front included.

D. Technical Report – Section 2: Plume Model

29. [redacted]

30. [redacted]

31. The core data from the sand interval shows a vertical permeability to be [redacted] of the horizontal permeability; while on page 1-35 it states [redacted] an explanation is needed as to why the data for this cored sand interval is valid and chosen to be applied throughout the model.

32. In order to calculate the temperature gradient, the surface temperature was assumed to be 68° F, p 2-5, an explanation is needed as to why this a reasonable assumption for surface temperature in Southwest Louisiana.

33. [redacted]

34. [redacted] p 2-8. An explanation is needed that explains why these values were utilized for the entire injection interval.

35. An explanation is needed as to the assumption that the "natural ground water movement within the AOR is assumed to be zero. p 2-9"

36. The fracture gradient is calculated using "both a step rate test and calculations using Eaton's method" p 2-9; however, previously stated "a fracture gradient was not identified, this (steprate) test was deemed inconclusive" p 1-24. Make any necessary revisions to maintain consistency.

37. [redacted] p 2-14. Make any necessary revisions to maintain consistency.

38. [redacted]

[redacted]

39. The well used to determine the thicknesses of each layer is referenced by API rather than Serial Number p 2-14. Make necessary revisions to maintain consistency.

40. The change in dip witnessed in the [redacted] sand which dips more steeply up to the West" needs to be quantified and explained.

41. A table with each sand layer and the corresponding maximum horizontal extent should be included.

42. A table with each sand layer and the corresponding maximum pressure buildup should be included.

43. Facies changes have not been identified or modelled and the implications for connectivity within the injection formation and the suitability of the confining have not been discussed.

44. Lithofacies distributions, along with porosities and permeabilities for each, within the injection and confining zone(s) have not been mapped.

45. The diagenetic processes that may affect present-day hydrogeologic properties are not included.

46. Uncertainties associated with the data and with the resulting facies model have not been included.

47. A discussion of the approach used to determine the capacity versus the planned storage is not included.

48. A description of the selected estimation method used to determine capacity, and a discussion about the suitability for the type of formation is not included.

49. The geochemical model should be provided, with the data provided in a table and the modeling parameters, including the activity coefficient model, solid phases selected, identification of thermodynamic database, kinetic data and any reactions modelled, and data used discussed.

50. A discussion about the limitations and uncertainties associated with the modelling should be included.

51. Version and build information for the modelling software used should be provided.

52. Description of file contents should be included.

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53. Total simulation time from start to finish should be included.

E. Technical Report – Section 3: Area of Review and Corrective Action Plan

54. AOR is defined as the extent of the pressure front and/or CO_2 plume, revise AOR to include the farthest extent of the pressure front and/or CO_2 plume.

F. Technical Report – Section 4: Engineering Design and Operating Strategy

55.

G. Technical Report – Section 5: Testing and Monitoring Plan

56.

H. Technical Report – Section 6: Well Plugging Plan

57.

I. Technical Report – Section 7: Post-Injection Site Care and Site Closure Plan

58.

J. Technical Report – Section 8: Emergency and Remedial Response Plan

59.

K. Technical Report – Section 9: IT Decision

L. Technical Report – Section 10: Financial Responsibility

62.

M. Technical Report – Section 11: Environmental Justice

This list of deficiencies should not necessarily be considered complete. If additional deficiencies become apparent, either in the newly submitted information or as part of the original permit application, additional information, revisions or clarifications will be requested.

Hackberry Carbon Sequestration, LLC must submit all required revisions to the Application and Attachments in order for the Geological Review of this Application to be completed. Revisions must be submitted by **December XX, 2022**.

If you have any questions, please contact the Injection & Mining Division at (225) 342-5515, Monday through Friday, between the hours of 8:00 a.m. and 5:00 p.m.

Yours very truly,

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Richard P. Ieyoub
Commissioner of Conservation

Steve H. Lee, Director
Injection and Mining Division

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