

Class VI UIC Area of Review and Corrective Action

This submission is for:

- Project ID: R09-CA-0017
- Project Name: Carbon Terravault VI
- Project Phase: Pre-Injection Prior to Construction

Check box if asserting a PBI claim. Provided information, where indicated, is being claimed as PBI.

Overview

- Simulator Used for AoR delineation modeling: GEM
- Version Used: 2024.20
- Simulator Description/Documentation: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CMG_GEM_Simulator_Documentation.pdf
- Total Simulation Time From Start of Injection: PBI Redacted
- Additional AoR Delineation Information: [PBI Redacted File](#)

Model Domain

- Coordinate System: PBI Redacted
 - Horizontal Datum: PBI Redacted
 - Coordinate System Units: ft
 - Vertical Datum: PBI Redacted
 - Describe Vertical Datum: PBI Redacted
 - Zone: PBI Redacted
 - FIPZONE: PBI Redacted ADSZONE: PBI Redacted
- Mesh Type: PBI Redacted
 - Describe Mesh Type: PBI Redacted
- Domain Size in Global Units Specified Above
 - Domain Coordinates File: [PBI Redacted File](#)
- Grid Size
 - Number of Nodes in x: PBI Redacted y: PBI Redacted z: PBI Redacted
- Grid Spacing: PBI Redacted
- Grid File Format: PBI Redacted
 - Grid File Description: [PBI Redacted File](#)
 - Grid Data File: [PBI Redacted File](#)
- Faults Modeled: No
- Caprock Modeled: No
- Image File(s) for Model Domain Grid: [PBI Redacted File](#)

Processes Modeled by Simulator

- Reservoir Conditions:
 - PBI Redacted Checkbox
- Phases Modeled:
 - PBI Redacted Checkbox PBI Redacted Checkbox
- Aqueous Phase:
 - Phase Compressibility: PBI Redacted
 - Compressibility Value: PBI Redacted
 - Phase Composition: PBI Redacted
- Supercritical CO2 Phase:
 - Phase Compressibility: PBI Redacted
 - Phase Composition: PBI Redacted
 - Supercritical CO2 Phase Components:
 - PBI Redacted Checkbox Water Methane
- Equation of State Description Including Reference: PBI Redacted

File with EOS Reference or Documentation: [PBI Redacted File](#)

Multifluid Flow Processes:

[PBI Redacted Checkbox](#) [PBI Redacted Checkbox](#) [PBI Redacted Checkbox](#) [PBI Redacted Checkbox](#)

[PBI Redacted Checkbox](#) [PBI Redacted Checkbox](#)

Thermal Conditions: [PBI Redacted](#)

Heat Transport Processes:

Geochemistry Modeled: [PBI Redacted](#)

Geomechanical/Structural Deformations Modeled: [PBI Redacted](#)

Modeled Processes Comments: [PBI Redacted](#)

Rock Properties and Constitutive Relationships

Porosity/Permeability Model

[PBI Redacted Checkbox](#)

Porosity Distribution: [PBI Redacted](#)

Spatially Variable Porosity File: [PBI Redacted File](#)

File Describing how Porosity was Determined and Assigned to Numerical Model: [PBI Redacted File](#)

Image Files for Porosity Distributions: [PBI Redacted File](#)

Permeability Distribution: [PBI Redacted](#)

Spatially Variable Permeability File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV_VI_Confidentiality_SpatialPermeability.pdf [PBI Redacted Units](#)

File Describing how Permeability was Determined and Assigned to Numerical Model: [PBI Redacted File](#)

Image Files for Permeability Distributions: [PBI Redacted File](#)

Number of Rock Types Modeled: [PBI Redacted](#)

Description of Rock Type Selection and Assignment: [PBI Redacted File](#)

Rock Type Distribution Data File: [PBI Redacted File](#)

Image Files for Rock Type Distribution: [PBI Redacted File](#)

Rock Type #1

Rock Compressibility: [PBI Redacted](#)

Rock Compressibility Distribution: [PBI Redacted](#)

Compressibility Value: [PBI Redacted](#)

Constitutive Relationships

Aqueous Saturation vs. Capillary Pressure: [PBI Redacted](#)

File Describing Functional Form Used for Aqueous Saturation vs Capillary Pressure: [PBI Redacted File](#)

Aqueous Trapped Gas Modeled: [PBI Redacted](#)

Hysteresis other than non-wetting fluid trapping: [PBI Redacted](#)

Aqueous Relative Permeability: [PBI Redacted](#)

File Describing Functional Form Used for Aqueous Relative Permeability: [PBI Redacted File](#)

Hysteresis other than non-wetting fluid trapping: [PBI Redacted](#)

Gas Relative Permeability: Functional Form

File Describing Functional Form Used for Gas Relative Permeability: [PBI Redacted File](#)

Hysteresis other than non-wetting fluid trapping: No

Porosity and Permeability Reduction Due to Salt Precipitation

Boundary Conditions

Attach Boundary Conditions Description File: [PBI Redacted File](#)

Initial Conditions

Initial Phases in Domain: [PBI Redacted Checkbox](#)

Initial Aqueous Pressure: [PBI Redacted](#)

Initial Aqueous Pressure: [PBI Redacted](#) at Reference Elevation: [PBI Redacted](#)

Initial Temperature: [PBI Redacted](#)

Initial Temperature: [PBI Redacted](#) at Reference Elevation: [PBI Redacted](#) Gradient: [PBI Redacted](#)

Initial Salinity: Spatially Constant

Initial Salinity: PBI Redacted

Operational Information

Number of Injection Wells: PBI Redacted

Injection Well #1

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV_VI_AoR_CA_Inj_1_wellbore_dia.pdf

Well Screen Interval Provided as: PBI Redacted

Elevation of Top of Screened Interval: PBI Redacted Elevation of Bottom of Screened Interval: PBI Redacted

Mass Rate of Injection: PBI Redacted

Total Mass of Injection: PBI Redacted

Fracture Gradient: PBI Redacted PBI Redacted Units

Maximum Injection Pressure: PBI Redacted Elevation Corresponding to Pressure: PBI Redacted

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: PBI Redacted

Injection Schedule Provided as: PBI Redacted

Injection Start Date: PBI Redacted Stop Date: PBI Redacted

Injection Well #2

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV_VI_AoR_CA_Inj_2_wellbore_dia.pdf

Well Screen Interval Provided as: PBI Redacted

Elevation of Top of Screened Interval: PBI Redacted Elevation of Bottom of Screened Interval: PBI Redacted

Mass Rate of Injection: PBI Redacted

Total Mass of Injection: PBI Redacted

Fracture Gradient: PBI Redacted PBI Redacted Units

Maximum Injection Pressure: PBI Redacted Elevation Corresponding to Pressure: PBI Redacted

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: PBI Redacted

Injection Schedule Provided as: PBI Redacted

Injection Start Date: PBI Redacted Stop Date: PBI Redacted

Injection Well #3

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV_VI_AoR_CA_Inj_3_wellbore_dia.pdf

Well Screen Interval Provided as: PBI Redacted

Elevation of Top of Screened Interval: PBI Redacted Elevation of Bottom of Screened Interval: PBI Redacted

Mass Rate of Injection: PBI Redacted

Total Mass of Injection: PBI Redacted

Fracture Gradient: PBI Redacted PBI Redacted Units

Maximum Injection Pressure: PBI Redacted Elevation Corresponding to Pressure: PBI Redacted

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: PBI Redacted

Injection Schedule Provided as: PBI Redacted

Injection Start Date: PBI Redacted Stop Date: PBI Redacted

Injection Well #4

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV VI AoR CA Inj 4 wellbore dia.pdf

Well Screen Interval Provided as: Single Interval

Elevation of Top of Screened Interval: PBI Redacted Elevation of Bottom of Screened Interval: PBI Redacted

Mass Rate of Injection: PBI Redacted

Total Mass of Injection: PBI Redacted

Fracture Gradient: PBI Redacted PBI Redacted Units

Maximum Injection Pressure: PBI Redacted Elevation Corresponding to Pressure: PBI Redacted

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: PBI Redacted

Injection Schedule Provided as: PBI Redacted

Injection Start Date: PBI Redacted Stop Date: PBI Redacted

Injection Well #5

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV VI AoR CA Inj 5 wellbore dia.pdf

Well Screen Interval Provided as: Single Interval

Elevation of Top of Screened Interval: PBI Redacted Elevation of Bottom of Screened Interval: PBI Redacted

Mass Rate of Injection: PBI Redacted

Total Mass of Injection: PBI Redacted

Fracture Gradient: PBI Redacted PBI Redacted Units

Maximum Injection Pressure: PBI Redacted Elevation Corresponding to Pressure: PBI Redacted

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: PBI Redacted

Injection Schedule Provided as: PBI Redacted

Injection Start Date: PBI Redacted Stop Date: PBI Redacted

Injection Well #6

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV VI AoR CA Inj 6 wellbore dia.pdf

Well Screen Interval Provided as: PBI Redacted

Elevation of Top of Screened Interval: PBI Redacted Elevation of Bottom of Screened Interval: PBI Redacted

Mass Rate of Injection: PBI Redacted

Total Mass of Injection: PBI Redacted

Fracture Gradient: PBI Redacted PBI Redacted Units

Maximum Injection Pressure: PBI Redacted Elevation Corresponding to Pressure: PBI Redacted

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: PBI Redacted

Injection Schedule Provided as: PBI Redacted

Injection Start Date: PBI Redacted Stop Date: PBI Redacted

Injection Well #7

Well Direction: PBI Redacted

Location: X: PBI Redacted Y: PBI Redacted

Wellbore Diameter: PBI Redacted

Wellbore Diameter File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/Shared/Submissions/R09-CA-0017/Phase1-PreConstruction/AoRModeling-07-30-2024-2009/CTV VI AoR CA Inj 7 wellbore dia.pdf

Well Screen Interval Provided as: **PBI Redacted**

Elevation of Top of Screened Interval: **PBI Redacted** Elevation of Bottom of Screened Interval: **PBI Redacted**

Mass Rate of Injection: **PBI Redacted**

Total Mass of Injection: **PBI Redacted**

Fracture Gradient: **PBI Redacted** **PBI Redacted Units**

Maximum Injection Pressure: **PBI Redacted** Elevation Corresponding to Pressure: **PBI Redacted**

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: [PBI Redacted File](#)

Composition of Injectate: **PBI Redacted**

Injection Schedule Provided as: **PBI Redacted**

Injection Start Date: **PBI Redacted** Stop Date: **PBI Redacted**

Number of Production/Withdrawal Wells: 0

Model Output/Results

Provide file name and corresponding spatial location for each file: **PBI Redacted**

Time-Series File: [PBI Redacted File](#)

Provide file name and corresponding variable and time stamp for each file: **PBI Redacted**

Snapshot File: [PBI Redacted File](#)

Provide file name and corresponding description of surface for each file: **PBI Redacted**

Surface Flux File: [PBI Redacted File](#)

AoR Pressure Front Delineation

Lowermost USDW:

Name of Lowermost USDW: **PBI Redacted**

Water Density: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement for Density: **PBI Redacted**

Temperature: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: **PBI Redacted**

Pressure: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: Reservoir condition

Salinity: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: **PBI Redacted**

Elevation of bottom of USDW: **PBI Redacted**

Injection Zone:

Name of Injection Zone: **PBI Redacted**

Water Density: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: **PBI Redacted**

Temperature: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: **PBI Redacted**

Pressure: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: **PBI Redacted**

Salinity: **PBI Redacted** at Elevation: **PBI Redacted**

Location of Measurement: **PBI Redacted**

Elevation of top of Injection Zone: **PBI Redacted**

Method of Estimating Critical Pressure: **PBI Redacted**

File Describing Critical Pressure Estimation: [PBI Redacted File](#)

Estimated Critical Pressure: **PBI Redacted**

Delineated AoR:

Shapefile or KML File Showing Delineated AoR: [PBI Redacted File](#)

Corrective Action

Supporting Documentation: [PBI Redacted File](#)

Area of Review and Corrective Action Plan [40 CFR 146.82(a)(13) and 146.84(b) or applicable state

requirements]

Are you making an Area of Review and Corrective Action Plan submission at this time?: **PBI Redacted**

Reason for Project Plan Submission: **PBI Redacted**

Project Plan Upload

Attach the Area of Review and Corrective Action Plan: [PBI Redacted File](#)

Appendices and Supporting Materials Upload

Attach Any Supporting Documentation for the AoR and Corrective Action Plan: [PBI Redacted File](#)

Area of Review Reevaluation [40 CFR 146.84(e) or applicable state requirements]

Minimum fixed frequency of AoR reevaluation: **PBI Redacted**

Are you making an Area of Review reevaluation submission at this time?: **PBI Redacted**

Reevaluation Background

Reevaluation Materials

Please upload your amended AoR and Corrective Action Plan on the previous tab.

Complete Submission

Authorized submission made by: Faisal Latif

I agree to the terms in the preceding paragraph for submitting information

I have reviewed EPA's PBI submission guidelines:

I understand that I may be required to substantiate this confidentiality claim for which I will bear the burden on substantiating

The information subject to these confidentiality claims is not, and has not been, reasonably attainable without my consent by use of legitimate means

I have taken reasonable measures to protect the confidentiality of this information

All information covered by this confidentiality claim has been indicated via the PBI checkboxes and PBI statements where applicable

PBI contained within documents submitted has been clearly indicated to be distinguishable from non-PBI information

In the event that a state where my GS project is located gets Class VI primacy after I submit my PBI to EPA, I understand, acknowledge, and hereby consent for said PBI to be shared with that state

All redactions have been clearly labeled as "Claimed as PBI"

All redacted files have been correctly redacted and sanitized

For confirmation a read-only copy of your submission will be emailed to: Faisal.Latif@crc.com