Class VI UIC Area of Review and Corrective Action

This submission is for:

Project ID: R06-LA-0007

Project Name: Hackberry Sequestration Project

Current Project Phase: Pre-Injection Prior to Construction

Overview

Simulator Used for AoR delineation modeling: GEM

Version Used: 2020.11

Simulator Description/Documentation: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--1.pdf

Total Simulation Time From Start of Injection: 120 yrs

Additional AoR Delineation Information: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--2.pdf

Model Domain

Coordinate System: State Plane

Horizontal Datum: NAD83

Coordinate System Units: ft

Vertical Datum: Ground Surface

Describe Vertical Datum: Measured in feet, positive in downward direction with zero at surface

Zone: -999

FIPSZONE: -999 ADSZONE: -999

Mesh Type: Hexahedral Cartesian

Domain Size in Global Units Specified Above

Hexahedral Cartesian

Domain Coordinates File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--3.pdf

Angle of Inclination in X Direction: -999 Dips in the Direction of: increasing x

Angle of Inclination in Y Direction: -999 Dips in the Direction of: decreasing y

Grid Size

Number of Nodes in x: -999 y: -999 z: -999

Grid Spacing: Constant

Grid Spacing in x: -999 y: -999 z: -999

Grid File Format: ASCII file containing vertices and elements

Grid File Description: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--4.pdf

Grid Data File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--5.pdf

Faults Modeled: Yes

Fault Coordinates File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--6.pdf

Caprock Modeled: No

Image File(s) for Model Domain Grid: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--7.pdf

Processes Modeled by Simulator

Reservoir Conditions:

Supercritical CO_2 Conditions

Phases Modeled:

Aqueous Supercritical CO_2

Aqueous Phase:

Phase Compressibility: Compressible

Compressibility Value: -999 1/psi

Phase Composition: Compositional

Aqueous Phase Components:

CO_2 Water

Supercritical CO_2 Phase:

Phase Compressibility: Compressible

Phase Composition: Compositional

Supercritical CO_2 Phase Components:

CO_2 Water

Equation of State Description Including Reference: Peng-Robinson (1978)

File with EOS Reference or Documentation: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--8.pdf

Multifluid Flow Processes:

Advection Dispersion Diffusion Buoyancy

Non-wetting Fluid Trapping Mixed Wettability Pore Compressibility

Thermal Conditions: Isothermal

Heat Transport Processes:

Geochemistry Modeled: Yes

File Describing Geochemistry Modeling: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--9.pdf

Geomechanical/Structural Deformations Modeled: No

Rock Properties and Constitutive Relationships

Porosity/Permeability Model

Single Porosity

Porosity Distribution: Heterogeneous

Spatially Variable Porosity File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--10.pdf

File Describing how Porosity was Determined and Assigned to Numerical Model: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--11.pdf

Image Files for Porosity Distributions: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--12.pdf

Permeability Distribution: Heterogeneous

Spatially Variable Permeability File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--13.pdf mD

File Describing how Permeability was Determined and Assigned to Numerical Model: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--14.pdf

Image Files for Permeability Distributions: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--15.pdf

Number of Rock Types Modeled: -999

Description of Rock Type Selection and Assignment: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--16.pdf

Rock Type Distribution Data File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--17.pdf

Image Files for Rock Type Distribution: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--18.pdf

Boundary Conditions

Attach Boundary Conditions Description File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--19.pdf

Initial Conditions

Initial Phases in Domain: Aqueous

Initial Aqueous Pressure: Varying with Depth, Temperature, and Salinity

Initial Aqueous Pressure: -999 MPa at Reference Elevation: -999 m

at Reference Elevation: -999 m

Initial Temperature: Varying with Depth

Initial Temperature: -999 C at Reference Elevation: -999 m Gradient: -999 deg C/m

Initial Salinity: Spatially Constant

Initial Salinity: -999 mg/L

Operational Information

Number of Injection Wells: 3

Injection Well #1

Well Direction: Vertical

Location: X: -999 Model Units Y: -999 Model Units

Wellbore Diameter: Constant

Wellbore Diameter: -999 cm

Well Screen Interval Provided as: Multiple Intervals

Screened Interval File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--26.pdf

Mass Rate of Injection: -999 MMT/yr

Total Mass of Injection: -999 MMT

Actual Injection Temperature: -999 C

Modeled Injection Temperature: -999 C

Fracture Gradient: -999 psi/ft

Maximum Injection Pressure: -999 Pa Elevation Corresponding to Pressure: -999 m

Description of How Fracture Gradient and Maximum Injection Pressure were Determined: -999

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--27.pdf

Composition of Injectate: Mixture

List Each Injectate Component with Percentage: -999

Injection Schedule Provided as: Single Injection Period

Injection Start Date: -999 Stop Date: -999

Injection Well #2

Well Direction: Vertical

Location: X: -999 Model Units Y: -999 Model Units

Wellbore Diameter: Constant

Wellbore Diameter: -999 cm

Well Screen Interval Provided as: Multiple Intervals

Screened Interval File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--28.pdf

Mass Rate of Injection: -999 MMT/yr

Total Mass of Injection: -999 MMT

Actual Injection Temperature: -999 C

Modeled Injection Temperature: -999 C

Fracture Gradient: -999 psi/ft

Maximum Injection Pressure: -999 Pa Elevation Corresponding to Pressure: -999 m

Description of How Fracture Gradient and Maximum Injection Pressure were Determined: -999

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--29.pdf

Composition of Injectate: Mixture

List Each Injectate Component with Percentage: -999

Injection Schedule Provided as: Single Injection Period

Injection Start Date: -999 Stop Date: -999

Injection Well #3

Well Direction: Vertical

Location: X: -999 Model Units Y: -999 Model Units

Wellbore Diameter: Constant

Wellbore Diameter: -999 cm

Well Screen Interval Provided as: Multiple Intervals

Screened Interval File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--30.pdf

Mass Rate of Injection: -999 MMT/yr

Total Mass of Injection: -999 MMT

Actual Injection Temperature: -999 C

Modeled Injection Temperature: -999 C

Fracture Gradient: -999 psi/ft

Maximum Injection Pressure: -999 Pa Elevation Corresponding to Pressure: -999 m

Description of How Fracture Gradient and Maximum Injection Pressure were Determined: -999

Description of How Fracture Gradient and Maximum Injection Pressure were Determined File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--31.pdf

Composition of Injectate: Mixture

List Each Injectate Component with Percentage: -999

Injection Schedule Provided as: Single Injection Period

Injection Start Date: -999 Stop Date: -999

Number of Production/Withdrawal Wells: 0

Model Output/Results

Provide file name and corresponding spatial location for each file: -999

Time-Series File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--20.pdf

Provide file name and corresponding variable and time stamp for each file: -999

Snapshot File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--23.pdf

Provide file name and corresponding description of surface for each file: -999

Surface Flux File: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--24.pdf

Sensitivity Analysis Description/Results: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--25.pdf

AoR Pressure Front Delineation

Lowermost USDW:

Name of Lowermost USDW: -999

Water Density: -999 kg/m^3 at Elevation: -999 m

Location of Measurement for Density: -999

Temperature: -999 C at Elevation: -999 m

Location of Measurement: -999

Pressure: -999 MPa at Elevation: -999 m

Location of Measurement: -999

Salinity: -999 mg/L at Elevation: -999 m

Location of Measurement: -999

Elevation of bottom of USDW: -999 m

Injection Zone:

Name of Injection Zone: Lower Miocene

Water Density: -999 kg/m^3 at Elevation: -999 ft

Location of Measurement: -999

Temperature: -999 F at Elevation: -999 ft

Location of Measurement: -999

Pressure: -999 psi at Elevation: -999 ft

Location of Measurement: -999

Salinity: -999 mg/L at Elevation: -999 ft

Location of Measurement: -999

Elevation of top of Injection Zone: -999 ft

Method of Estimating Critical Pressure: Other

File Describing Critical Pressure Estimation: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--21.pdf

Estimated Critical Pressure: -999 psi

Delineated AoR:

Shapefile or KML File Showing Delineated AoR: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/CBI--Page--22.pdf

Corrective Action

Corrective Action Comments: No corrective action plans needed.

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?: Yes

Reason for Project Plan Submission: Other (specify):

Updated plume model discussion.

Project Plan Upload

Attach the Area of Review and Corrective Action Plan: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/3_AOR_CBI.pdf

Appendices and Supporting Materials Upload

Attach Any Supporting Documentation for the AoR and Corrective Action Plan: https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/2_Plume_Model_CBI.pdf

https://gsdt.pnnl.gov/alfresco/service/velo/getFile/no_wiki/shared/Submissions/R06-LA-0007/Phase1-PreConstruction/AoRModeling-01-03-2023-1554/2_Plume--Model_CBI_12.22.2022.pdf

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

Minimum fixed frequency of AoR reevaluation: 1 Years

Are you making an Area of Review reevaluation submission at this time?: No

Reevaluation Background

Reevaluation Materials

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

Complete Submission

Authorized submission made by: William Gurrola

For confirmation a read-only copy of your submission will be emailed to: theresa.cu@lonquist.com