STIMULATION PROGRAM
40 CFR 146.82(a)(9)

Project Name: Buckeye III CCS

Facility Information

Facility contact: Buckeye III CCS, LLC
14302 FNB Parkway
Omaha, NE 68154
402-691-9500

Well location: Coshocton County, Ohio

Well Name	Latitude (WGS84)	Longitude (WGS84)
Bellflower 1	40.215516	-81.864158

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List of Acronyms

BHA	Bottom-Hole Assembly
BIC	Basal Sandstone Injection Complex
CCS	Carbon Capture and Storage
CO_2	Carbon Dioxide
N_2	Nitrogen Gas
PBTD	Plug Back Total Depth
RIH	Run In Hole
TD	Total Depth
UIC	Underground Injection Control

Buckeye III CCS, LLC recognizes that stimulation to enhance the injectivity potential of the injection zone in the Bellflower 1 injection well at Buckeye III CCS in Coshocton County, Ohio (the "project") may be necessary. Stimulation may involve, but is not limited to, flowing fluids into or out of the well, increasing or connecting pore spaces in the injection formation, or other activities that are intended to allow the injectate to move more readily into the injection formation. Advance notice of all proposed stimulation activities will be provided to the UIC Program Director, as detailed below, prior to conducting the stimulation. Buckeye III CCS, LLC will describe any fluids to be utilized for stimulation activities and demonstrate that the stimulation will not interfere with containment. Buckeye III CCS, LLC will submit proposed procedures for all stimulation activities to the UIC Program Director in writing at least 30 days in advance, per 40 CFR 146.91(d)(2). Within the 30-day notice period, the UIC Program Director may: deny the stimulation; approve the stimulation as proposed; or approve the stimulation with conditions. Buckeye III CCS, LLC will carry out the stimulation procedures, including any conditions, as approved or set forth by the UIC Program Director.

1. Introduction/Purpose

Stimulation measures may be required for this project to mitigate drilling-induced damage near the wellbore. It is expected to effectively clear the perforated interval of fines, perforation charge residue, and debris from cement or casing. Additionally, stimulation serves to eliminate drilling mud filtrate and dissolved minerals present in the formation. This process is common, as the untreated presence of these elements can lead to elevated downhole injection pressures and diminished injectivity, underscoring the significance of thorough treatment.

Additionally, treatment may be necessary to mitigate the precipitation of evaporite minerals in and near the well bore due to the high salinity of the injection formation fluids (see fluid composition details discussed in subsection 2.8.1 of the Application Narrative). The precipitation of evaporite minerals reduces well injectivity and impacts pressure buildup by blocking pore space near the wellbore and reducing reservoir porosity and permeability. The current simulation data suggest that salt precipitation is not a problem for CO_2 injection planned over 30 years into the Basal Sandstone injection complex. However, further modeling will be performed if required with the additional data collection planned during the pre-operational testing (see Pre-Operational Testing Program). The necessity for mitigation efforts will be re-evaluated at that time, prior to seeking authorization to inject.

2. Stimulation Fluids

Matrix stimulation utilizing acid will be planned based on reservoir minerology, depth of damage, fluid invasion, temperature, and connate fluid properties. The exact composition of stimulation fluids, including the volumes and concentrations, will be determined after completion of the pre-operational testing and determination that stimulation is needed and will consider well and surface conditions. Carbon Dioxide (CO_2) or Nitrogen (N_2) may be blended with acid and other aqueous based fluids during pumping and displacement to facilitate better treatment placement and recovery (foamed acid stimulation). Diverting agents may be used to ensure the treatment is placed into the highest priority perforations.

Evaporite mitigation treatment will be designed based on a variety of factors including, but not limited to, brine fluid chemistry, rate of skin buildup, temperature, construction materials, and in-situ mineralogy. Well and surface conditions, along with updated experimental and simulation modeling from pre-operational testing data, will be used to determine the composition, volume, and concentration of any fluids used in the treatment. Batch or continuous treatment might be required depending on the rate of skin buildup at the injection site.

The purpose of stimulation, stimulation fluids to be used, and anticipated volumes and concentrations of stimulation fluids, will be provided to the UIC Program Director in the proposed stimulation procedures in the 30-day advance notification described above.

3. Additives

The specific additives to be employed will be contingent upon the prevailing well conditions, and their selection remains to be determined, dependent on compatibility testing. An example of typical additives includes the following:

- Corrosion inhibitors: serve to mitigate the corrosive impact of treatment chemicals on both surface and downhole metals and alloys;
- Surfactants: aid in the efficient removal of drilling mud from the formation, alleviate incompatibility issues, and enhance fluid recovery during flowback;
- Iron control agents: contribute to stabilization, thereby preventing the precipitation of iron, which could otherwise impair formation permeability;
- Non-emulsifiers: play a crucial role in averting emulsion formation by regulating interfacial tension between acid treatment and formation fluid;
- Clay stabilizers: reduce the likelihood of clay streaks swelling; and
- Biocides: assist in controlling sulfate-reducing or iron-oxidizing bacteria.

If it is determined that an additive is needed for stimulation, the purpose of the additive, additive to be used, and anticipated volume and concentration of additive will be provided to the UIC Program Director in the proposed stimulation procedures in the 30-day advance notification described above.

4. Diverters

Diverters may be used to ensure acid treatment is uniformly distributed along the targeted interval, though the specific types will be evaluated based on the conditions of the well prior to injection. A formalized diversion plan will be finalized based on the well conditions.

If it is determined that a diverter is needed for stimulation, the purpose of the diverter, diverter to be used, and anticipated volume and concentration of diverter will be provided to the UIC Program Director in the proposed stimulation procedures in the 30-day advance notification described above.

5. Stimulation Procedures

A multi-step evaluation process will be used prior to the actual stimulation and/or treatment program.

1. Determine effect and nature of damage.
2. Select fluid chemistry, volume, treatment schedule, and pressure.
3. Determine a proper treatment additive program.
4. Determine a treatment placement method.
5. Recover treatment fluids and any reaction products.
6. Analyze treatment effectiveness and additional treatment design as required.

5.1 Matrix Stimulation

The stimulation process will involve spotting and placing an acid treatment across the injection interval and allowing for adequate soak time. The well will then be flowed back to recover the treatment slurry and fines. Buckeye III CCS, LLC will make sure that the treating pressure is maintained below the maximum permitted pressure. Specifically, the anticipated steps include:

1. Move in Rig Up (MIRU).
2. Hold and document safety meeting.
3. Run in hole (RIH) to total depth (TD) or plug back total depth (PBTD) with bit and casing scraper, working across any suspected obstructions and across perforated interval.
4. Circulate or reverse clean with working fluid. Utilize viscous pill if needed.
5. Retrieve scraper assembly from well and RIH with tailpipe and retrievable packer.
6. Spot lead stimulation fluid across perforations and set packer.
7. Inject treatment and flow back after soak time. Repeat with additional treatments if necessary.
8. Release packer and reverse spent acid and any solids from wellbore. If reverse circulation is not possible, lay down packer and circulate clean with bit and slick bottom-hole assembly (BHA).

5.2 Evaporite Mitigation Treatment

Evaporite precipitation may lead to skin build up and may require continuous or batch treatment. Laboratory testing, simulation modeling, and real-time injection well conditions will dictate the methodology and frequency of treatment. Current model simulation indicates no need for mitigation. Appropriate measures will be determined after gathering additional characterization data from the pre-operational testing for the injection well. Proposed procedures for evaporite mitigation treatment will be submitted to the UIC Program Director in writing at least 30 days in advance, per 40 CFR 146.91(d)(2).