**ATTACHMENT J: STIMULATION PLAN**
**40 CFR 146.82(a)(9)**
**CTV II**

## Table of Contents

## Version History

| File Name | Version | Date | Description of Change |
|---|---|---|---|
| Att J – Stimulation Plan | 1 | 11/26/2024 | Original submission for CTV II project |
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## Facility Information

Facility Name: CTV II

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Well Location(s): Union Island Gas Field, San Joaquin County, CA
37.868/-121.420

## 1. Introduction

Stimulation to enhance the injectivity potential of the injection zone 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 must be provided to the Underground Injection Control (UIC) Program Director, as detailed below, prior to conducting the stimulation. CTV must describe any fluids to be used for stimulation activities and CTV must demonstrate that the stimulation will not interfere with containment. CTV must submit proposed procedures for all stimulation activities to the Director in writing at least 30 days in advance, per 40 CFR 146.91(d)(2). Within the 30-day notice period, EPA may deny the stimulation, approve the stimulation as proposed, or approve the stimulation with conditions. CTV must carry out the stimulation procedures, including any conditions, as approved or set forth by EPA.

Perforated intervals in the injection zone are expected to require stimulation. The stimulation program is necessary due to depleted reservoir pressure that may cause fluid loss during drilling and completion operations, and cement loss during primary cementing of injection liners. Stimulation to remove the near-wellbore effects of these losses will be performed after well construction is finished but prior to the start of carbon dioxide ($CO_2$) injection. Well stimulation may also be necessary on specific injectors after the start of $CO_2$ injection if injectivity is lower than expected, or if reductions in ongoing injectivity are observed due to precipitation of carbonates or other plugging materials.

## 2. Stimulation Fluids

CTV will use industry standard acid blends for matrix stimulation, including but not limited to mixtures of acetic, hydrochloric, hydrofluoric, and/or organic acids. These blends have been historically proven to remove near-wellbore damage due to carbonates, drilling muds, completion fluids, and migrating clays in sandstones while minimizing negative impacts to

permeability. CTV may energize stimulation fluids with nitrogen or $CO_2$ to protect sequestration zone permeability or to aid in recovery of the stimulation load if needed.

## 3. Additives

CTV may use combinations of the following additives to aid matrix stimulation while mitigating corrosion of tubulars and damage to the sequestration zone, including but not limited to corrosion inhibitors, clay stabilizers, biocides, demulsifiers, chelating agents, mutual solvents, iron sequestrants, retarders, and/or surfactants. Chemical additives proposed for the stimulations will be tested and confirmed to be compatible with tubulars, the injection and confining zones, and reservoir fluids prior to use.

## 4. Diverters

CTV may elect to use rubber coated nylon (RCN) or biodegradable diversion balls to effectively deliver acid to the intended perforations. The need for diverters will depend on the specific stimulation design for a given well, anticipated pump rates, the length of the perforated interval, perforation density, and the selected technique for conveying acid to the formation (e.g., pumping through regular stick tubing or pumping down coiled tubing).

## 5. Stimulation Procedures

A general matrix acidizing procedure using coiled tubing is described below. A well-specific procedure will be submitted for approval prior to actual stimulation.

1. Obtain samples (when possible) of the materials that may be impacting injectivity and test the materials with acids and additives to optimize the effectiveness of stimulation.
2. Test the selected acid blends for compatibility with well materials, reservoir rock, and fluids.
3. Design the stimulation program.
4. Provide the recommended work procedure and stimulation program to the UIC Program Director in writing at least 30-days prior to the planned date for start of the work [40 CFR 146.91(d)(2)].
5. Obtain the approval of the UIC Program Director.
6. Shut-in the injection well slowly to allow pressures to stabilize at the well, and for other wells and facilities to absorb rate and pressure changes.
7. Prep the location for rig up of subsurface equipment.
8. Move in and rig up crane and coiled tubing unit.
9. Run into the well (through tubing) with coiled tubing and wash nozzle while circulating with a compatible pre-acidizing fluid.
10. When the wash nozzle arrives at the top perforation, stop circulating and begin pumping acid stages while reciprocating up and down across the perforation interval.

- Acid blend 12 percent hydrochloric acid (HCl)/3 percent hydrofluoric acid (HF), plus appropriate additives, is an industry standard acid blend and a concentration that CTV would consider for matrix acidizing.
- Volume of pumped acid (combined stimulation fluids and additives) at each borehole will be limited to 3 feet of penetration into the pore space.
  - Total estimated volume for each well is approximately 7,000 gallons.

11. Flush acid into the perforations and attempt to recover fluids, if required in the program.
    - 5 percent ammonium chloride ($NH_4Cl$), plus appropriate additives, is an industry standard fluid that CTV would consider for displacing and flushing the acid.
12. Pull out coiled tubing out of the well.
13. Rig down and move equipment off location.
14. Return the well to injection.

CTV will ensure that no new fractures develop during stimulation by limiting pump pressures to a maximum of 90 percent of the sequestration zone fracture gradient, measured or calculated during pre-operational testing (**Attachment I: Pre-Operational Testing Plan**). Additionally, CTV will maintain at least 20 feet of separation between the base of the primary confining layer and the uppermost perforation in the injection zone.