ATTACHMENT J STIMULATION PROGRAM
40 CFR 146.82(a)(9)

DONALDSONVILLE SITE

Facility Information

Facility name: Ciel
CIEL NO.1

Facility contact: Lauren Read –Vice President BKVerde, LLC
1200 17th St, Suite 2100, Denver, CO 80202
Ph: +1 (720)375-9680; email: laurenread@bkvcorp.com

Well location: Donaldsonville, Ascension, Louisiana
NAD 1927 (Louisiana South Zone) X: 2,114,245.33′; Y: 511,857.41′

Stimulation to enhance the injectivity potential of the injection interval 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 EPA or the Underground Injection Control (UIC) Director, as detailed below, prior to conducting the stimulation. The permittee must describe any fluids to be utilized for stimulation activities and the permittee must demonstrate that the stimulation will not interfere with containment. The permittee must submit proposed procedures for all stimulation activities to EPA or the UIC 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. The permittee must carry out the stimulation procedures, including any conditions, as approved or set forth by EPA.

Introduction/Purpose

The purpose of well stimulation on the proposed injection well, Ciel No.1 is to reduce or remove near-wellbore skin damage created by operations such as drilling, workover, and perforating. The treatment will be performed below fracturing pressure to remove damage from the near-wellbore region and restore injectivity. The matrix stimulation for the injection well may be carried out more than once—prior to the start of CO_2 injection and during the injection period based on the injectivity and well performance.

Stimulation Fluids

Stimulation programs may include treatment with acid and/or non-acid-based systems depending on the nature and extent of the damage. A description of the fluid systems is provided below:

(1) Non-acid stimulation: Non-acid fluid systems containing dispersant-type surfactants and chelating agents can effectively reduce drilling and completion damage in the critical matrix region, thereby restoring natural permeability and injectivity. Pre- and post-treatment testing will be conducted to determine the effectiveness of the treatment. If the process is unsuccessful and/or additional treatment is required, acid-based fluid treatments will be performed to remove additional damage.
(2) Acid stimulation:
    a. Hydrochloric acid (HCl): 7–15% HCl may be pumped to remove formation skin damage due to invasion of solids and fluids during operations such as drilling, workovers, and perforating.
    b. Mud acid: Hydrofluoric (HF) combined with HCl and a buffered brine solution may be pumped to remove formation skin damage due to invasion of solids and fluids during operations such as drilling, workovers, and perforating. Mud acid is a ratio of HCl to HF, with regular mud acid being 12% HCl + 1.5-3% HF. The strength of mud acid will be determined following laboratory tests conducted on the core samples to determine the stability of the cementing material and identify the potential of fines migration.

Additives

Additives may be added to the stimulation fluids to improve the effectiveness of the treatment and/or prevent additional damage. Additives and their concentration will be determined during the fluid selection and treatment design phase. A list of common additives that may be added to the stimulation fluids include the following:

- Corrosion inhibitor
- Inhibitor aid
- Chelating agent
- Surfactant
- Mutual solvent
- Clay stabilizer

Diverters

Well test data will be analyzed to determine the nature and extent of formation damage. If necessary, diverting agents may be utilized to improve the effectiveness of the matrix stimulation treatment. Diversion techniques may be provided by mechanical means or chemical products. Diverter material will be determined during stimulation treatment fluid selection and design phase.

Stimulation Procedures

Well test data will be analyzed to determine the extent of damage (skin) and design a methodology using matrix stimulation engineering (MSE), as detailed below:

- Formation damage determination
- Fluid selection
- Treatment design
- Execution
- Treatment evaluation

Matrix stimulation designs:

(1) Flow or swab well back to tank. Remove any formation skin damage from the injection perforations and near-wellbore area.

(2) Utilize nitrogen to back wash sand and fluids from perforations and near-wellbore area to remove formation skin damage.

(3) Non-acid stimulation: Design of the stimulation involving the volumes to be pumped and the order in which volumes will be pumped will be determined from core and wireline log data prior to pumping operations at the time of placement and by formation characteristics determined from core, wireline-log evaluation, and onsite information.

(4) Acid stimulation:

a. Acid treatment design: Design of the stimulation involving the volumes to be pumped and the order in which volumes will be pumped will be determined from core and wireline log data prior to pumping operations at the time of placement and by formation characteristics determined from core, wireline-log evaluation, and onsite information.

i. Chemicals may be added to the acid treatment design to limit clay swelling, reduce emulsions, control pH, and inhibit reaction to the corrosion-resistant steel completion tubulars and cement. The type and quantity of these chemicals will be determined based on formation characteristics determined from core information, fluid sampling, and wireline-log evaluation.

ii. The acid fluids will be displaced from the wellbore and near-wellbore area by either pumping them into the formation or backflowing the fluids following stimulation.