WELL PLUGGING PLAN
ELK HILLS A1-A2 STORAGE PROJECT
INJECTION WELL 357-7R

Facility Information

Facility Name: Elk Hills A1-A2 Storage Project
357-7R

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Well Location: Elk Hills Oil Field, Kern County, CA
35.3280 / -119.5450

Version History

File Name	Version	Date	Description of Change
COP_357-7R_v1	1	5/16/2022	Combines documents, incorporates corrections and EPA feedback dated 04/25/22
COP_357-7R_v2	2	11/1/2022	Revisions based on EPA feedback dated 8/17/22
Attachment D2_Plugging Plan_357-7R_v3	3	4/24/2024	Splitting COP_357-7R_v2 into Att. G2 and Att. D2

1. Introduction

CTV plans to use existing injectors 357-7R and 355-7R for the Elk Hills A1-A2 Storage project. The wells are in Section 7R within the unit boundary of the Elk Hills Oil Field (Figure 1). 357-7R and 355-7R surface elevations are 792 feet and 714 feet above mean sea level, respectively. These injectors are currently approved by CalGEM for Class II injection of up to 50 million cubic feet per day gas (up to 44% carbon dioxide [CO_2]) for the purpose of reservoir pressure maintenance. The wells have been engineered for the injection of CO_2 with appropriate materials able to minimize corrosion and to ensure that the wellbore stresses are within specifications and standards given the planned operating conditions. Previous and current injectors used to maintain reservoir pressure injected 175 billion cubic feet of natural gas with injection rates as high as 30 million cubic feet per day for individual wells.

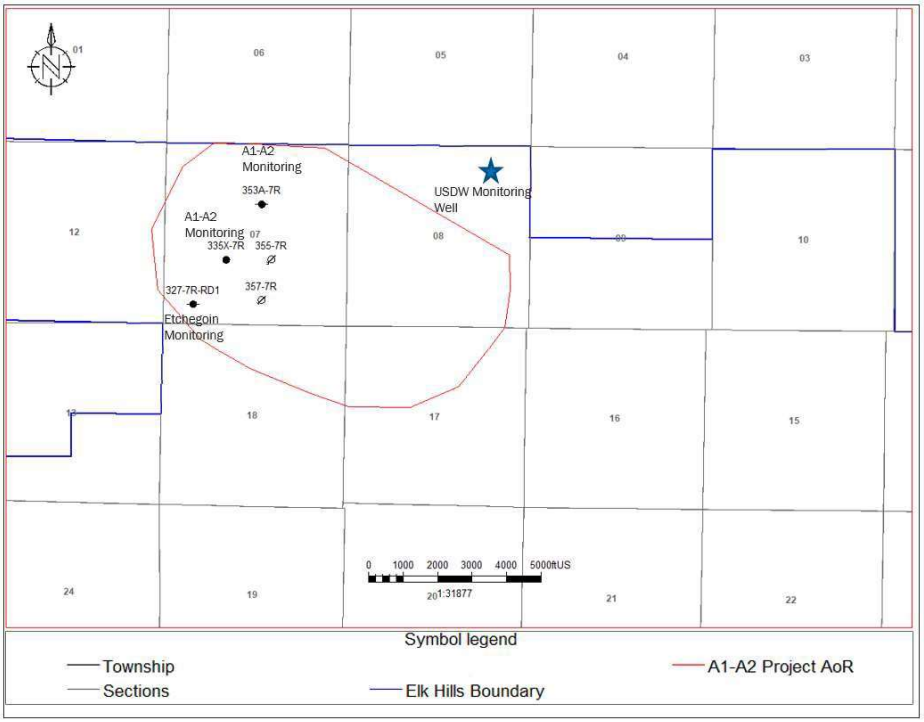


Figure 1. Map showing the location of injection wells and monitoring wells at A1-A2.

2. Injection Well Plugging

CTV's Injection Well Plugging Plan pursuant to 40 CFR 146.92 describes the process, materials and methodology for injection well plugging.

Planned Tests or Measures to Determine Bottomhole Pressure

Before beginning the plugging and abandonment process, the pressure used to squeeze the cement will be determined from the bottomhole pressure gauge. During plugging operations, the heavy-weighted cement slurry, as well as properly weighted displacement fluids, will be over-balanced, ensuring that no reservoir fluids will be able to enter the wellbore during cementing operations.

Planned External Mechanical Integrity Test(s)

CTV will conduct at least one external mechanical test integrity prior to plugging the injection well as required by 40 CFR 146.92(a). A temperature log will be run over the entire depth of each sequestration well. Data from the logging runs will be evaluated for anomalies in the temperature profile, which could be indicative of fluid migration out of the injection zone. Data will be compared to the data from temperature logs performed prior to injection of CO_2. Deviations between the temperature log performed before, after, and during injection may indicate issues related to the integrity of the well casing or cement.

Information on Plugs

CTV will use the materials and methods noted in Table 1 to plug the injection well. The cement formulation and required certification documents will be submitted to the agency with the well

plugging plan. The owner or operator will report the wet density and will retain duplicate samples of the cement used for each plug.

A standard Portland cement blend with specifications consistent with API Spec 10A will be designed with a minimum 1,000 pounds per square inch (psi) compressive strength and a maximum liquid permeability of 0.1 millidarcy (mD). The properties of this cement blend will be consistent with the properties of Class G Portland cement used in well construction, and the cement plug will provide an effective, long-term barrier to prevent migration of CO_2 into and within the wellbore. This cement is widely used in CO_2-enhanced oil recovery (EOR) wells and has been demonstrated to have properties that are not deleterious with CO_2. The wells will have this cement placed as detailed in Table 1, and all portions of the wellbore that are not plugged with cement will be filled with sufficiently weighted abandonment mud (Figure 2). The cement will be set in plug segments per CTV's standard procedures. Note that ground level corresponds to 20 feet measured depth (MD) due to the depth reference to the kelly bushing 20 feet above ground level during drilling.

Table 1: Plugging details

Plug Information	Plug #1	Plug #2	Plug #3	Plug #4
Diameter of boring in which plug will be placed (inches)	6.184	6.366	6.366	6.184
Depth to bottom of tubing or drill pipe (feet)	8,794	2,970	1,447	45
Sacks of cement to be used (each plug)	70	24	143	5
Slurry volume to be pumped (ft^3)	80	28	164	6
Slurry weight (lb/gal)	15.8	15.8	15.8	15.8
Calculated top of plug (feet)	8,411	2,845	706	20
Bottom of plug (feet)	8,794	2,970	1,447	45
Type of cement or other material	Class G	Class G	Class G	Class G
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Balanced Plug, Retainer, or Coiled-Tubing Plug			

Notifications, Permits, and Inspections

In compliance with 40 CFR 146.92(c), CTV will notify the regulatory agency at least 60 days before plugging the well and provide an updated Injection Well Plugging Plan, if applicable.

Plugging Procedures

The following plugging procedures are planned assuming a coiled tubing unit (CTU) is used for cement plug placement after all completion equipment is removed. The placement method may vary depending on the type of service equipment used. For instance, a maintenance rig may place the cement plug of same specification at same depths using jointed pipe and achieve the same result.

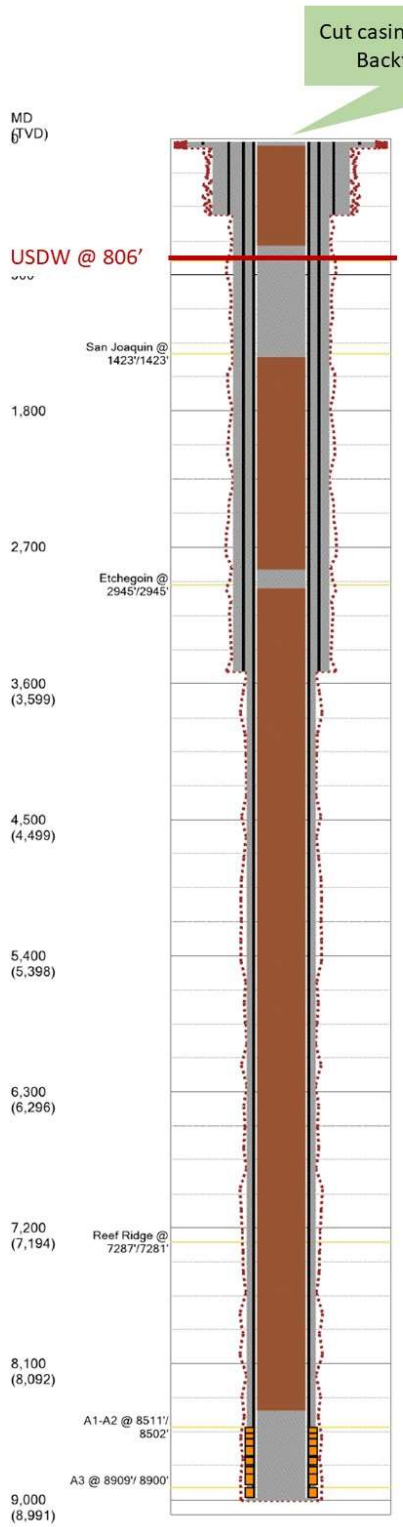
1. Bottomhole pressure from downhole pressure gauge is recorded and kill fluid density is calculated.
2. Kill fluid of appropriate density is bullheaded into the wellbore to prevent reservoir fluid inflow and acts as a buffer fluid to flush the wellbore. After at least one wellbore volume of fluid is pumped, the well is observed to ensure static conditions, which is an indication that (1) the weighted fluid is preventing fluid migration into the wellbore and (2) that there is no CO_2 in the wellbore. If CO_2 were present in the wellbore, it would migrate to surface due to density difference and expand in volume under decreasing hydrostatic pressure, resulting in non-static (flowing) conditions at surface.
3. Tubulars and downhole equipment are removed from the casing, and the well is cleaned out to total depth (TD) during rig operations. Subsequent operations are carried out using a CTU.
4. The CTU runs in the hole to TD and begins placing cement in the casing. The coiled tubing is kept about 100 feet inside of the cement plug and is pulled uphole while cementing operations continue.
5. Once the full plug is placed, the coiled tubing is pulled above the plug and the well is circulated to ensure the depth of the top of the plug. The tubing is then pulled uphole while operations are paused to wait on cement.
6. Once the cement has set, the coiled tubing is run back in the hole to witness the depth and hardness of the plug before initiating the next cemented plug interval.
7. Abandonment mud is placed between cement plugs while pulling the coiled tubing uphole to the base of the next plug.
8. This process, beginning with step 4, is repeated for each cement plug until cement is placed to surface.

CRC follows the following standards for plugging operations:

- Bottomhole plug: All perforations shall be plugged with cement, and the plug shall extend at least 100 feet above the top of a landed liner, the uppermost perforations, the casing cementing point, the water shut-off holes, or the oil or gas zone, whichever is highest.
- Base of underground source of drinking water (USDW) plug (USDW is defined as a non-exempt aquifer that has <10,000 milligrams per liter [mg/L] total dissolved solids [TDS]):
    - If there is cement behind the casing across the base of USDW, a 100-foot cement plug shall be placed inside the casing across the interface.

- ◇ If the top of the cement behind the casing is below the base of the USDW, squeeze-cementing shall be required through perforations to protect the freshwater deposits. In addition, a 100-foot cement plug shall be placed inside the casing across the fresh-saltwater interface.

- Surface Plug: The casing and all annuli shall be plugged at the surface with at least a 25-foot cement plug.



Well	357-7R			
Plugs	**Plug 1**	**Plug 2**	**Plug 3**	**Plug 4**
Hole Size (in.)	6.184	6.366	6.366	6.184
Bottom of tubing (ft)	8794	2970	1447	45
Cement Volume (sacks)	70	25	143	5
Slurry Volume (bbl)	14.34	5.12	29.29	1.02
Slurry Weight (lb/gal)	15.8	15.8	15.8	15.8
Top of plug (ft)	8411	2845	706	20
Bottom of Plug (ft)	8794	2970	1447	45
Type of Cement	Class G	Class G	Class G	Class G
Method of placement	Balanced Plug, Retainer, or CT Plug			

Figure 2. Injection Well 357-7R, Abandonment Schematic