PLUGGING PLAN
40 CFR 146.92(b)

Facility Information

Facility name: Capio [redacted] Sequestration, LLC
Well Name: Capio [redacted] CCS Well No. 1

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Well location: [redacted]
Pointe Coupee Parish, Louisiana
[redacted]

Capio [redacted] Sequestration, LLC (Capio) will conduct injection well plugging and abandonment in compliance with 40 CFR 146.92 and Louisiana Administrative Code 43 Part XVII 3603. The well will be plugged to protect the USDW and prevent migration of injected carbon dioxide (CO_2) by using CO_2 resistant plugging materials. Following construction of the well, necessary revisions to the plugging plan will be completed and submitted to the UIC Program Director.

After injection has ceased, bottom-hole pressure measurements will be recorded and mechanical integrity testing will be completed to confirm the integrity of the casing and seal. The well will be flushed and filled with a brine solution to maintain pressure control of the well. If a loss of mechanical integrity is discovered, the well will be repaired and retested prior to proceeding with the plugging operations.

Planned Tests or Measures to Determine Bottom-Hole Reservoir Pressure

Bottom-hole pressure will be used to calculate the pressure required to plug the well and density of the brine to flush and fill the well. Pressures will be continuously monitored during the use of the well using the casing conveyed external bottom-hole pressure gauges. The final pressure will be recorded prior to conducting an external mechanical integrity test.

Planned External Mechanical Integrity Test(s) [MITs]

Capio will demonstrate mechanical integrity in both the injection and monitoring wells prior to operation, every five years, following corrective action, and before plugging and abandonment of the injection and monitoring wells in accordance with EPA 40 CFR 146.92 and Louisiana Administrative Code 43 Part XVII 3603. The purpose of the MIT is as follows:

1. Confirm integrity of casing (i.e., internal MIT).

2. Confirm integrity of cement seal (i.e., external MIT).

Internal Mechanical Integrity

Internal mechanical integrity will be continuously monitored in the well. An APT (annular pressure test) will be performed annually, following corrective action, prior to final plugging activities and at the request of the UIC Program Director. The APT confirms the well's ability to maintain pressure in the fluid-filled annular space between the tubing and casing. As described in EPA's guidance for standard annulus pressure tests, the annular space will be pressurized and pressure readings will be recorded for a minimum of one hour. Internal mechanical integrity will be confirmed if the pressure gain or loss does not exceed 3% of the initial test pressure.

External Mechanical Integrity

Capio will conduct one of the tests listed in Table 1 to verify external mechanical integrity prior to plugging the injection well. Temperature logs can be used to identify fluid movement through the confining zone adjacent to the well borehole and can identify casing leaks. Noise logs or radioactive tracer surveys ("RTS" s) may be used if anomalies are identified in the temperature logs.

The MIT work will be performed by Capio using experienced and licensed personnel, as applicable, and with furnished equipment that is appropriate and adequate to complete all phases of the MIT testing.

Table 9-1. Planned External MITs.

Test Description	Test Method/Deployment
Temperature Survey	Wireline Well Log
Noise Log	Wireline Well Log
Radioactive Tracer Survey ("RTS")	Wireline Well Log

Equipment

Wellhead equipment will be furnished with a stripper head (wireline packoff) assembly and used to conduct the geophysical log(s). The stripper head assembly will be securely attached to the wellhead to prevent flow from the well at the pressures observed. The stripper head assembly furnished and installed will be sized to accommodate the width and length of the longest geophysical tool or camera assembly used for conducting the tests and surveys. The wellhead will be furnished with bleed and isolation valves so the stripper head assembly can be shut-in and isolated from the wellhead equipment. The assembly will include a pressure gauge and appurtenances for monitoring the pressure in the well during the tests. A temperature survey run through the tubing will be sensitive to temperature differentials as required under the guidelines for conducting a temperature survey to determine external mechanical integrity.

Execution of External Test Logs

Capio will conduct one of the tests listed below to verify external mechanical integrity prior to plugging the injection well.

External MIT – Temperature Survey

The wellbore will be cleared of any material that would be corrosive to the logging tools or present obstructions that would prevent passage of the tools. The temperature log will be conducted through the injection tubing from surface to total depth of the well. Fluid will be injected into the well and will have a temperature differential of no less than 10º F than the wellbore temperature. The minimum volume of fluid to be injected will be based on three well volumes:

Total depth of well @ ± [redacted]
Bottom of 9 ⅝-inch long-string @ ± [redacted]
Packer set @ ± [redacted]

9 ⅝-inch long-string casing volume:
[redacted]
Three times the casing volume:
[redacted]

Following fluid injection, intermediate temperature surveys will be run from the base of the confining unit to total depth. Running the temperature log through this interval will determine temperature anomalies due to leakage behind the casing.

External MIT-RTS

Prior to proceeding with the RTS, the well will be flushed with fresh water. The RTS will be conducted with medicinal grade Iodine131 or equivalent and dynamic surveys will provide data for evaluation of external mechanical integrity.

External MIT- Noise Log

A noise log will be conducted under static conditions. The tool will record the amplitude of the reflected acoustic signal as photographic-like images, and the transit-time data will be used to generate high-resolution caliper logs within the tubing.

Should the well fail any portion of the MIT it will be subject to immediate repair. A workover procedure utilizing best industry practices at the time will be developed and submitted to the UIC Program Director for review and approval based on the anticipated technical issue to be resolved.

Information on Plugs

Following a determination of mechanical integrity, the injection tubing and packer will be removed. The well will be permanently plugged using the balanced-plug placement method

described herein and the casing string will be cut off approximately three feet below ground surface. A metal cap inscribed with the UIC permit number will be welded atop the casing.

Capio will use the materials and methods noted below to plug the injection well. The volume and depth of the plug or plugs will depend on the final geology and downhole conditions of the well assessed during construction. The cement(s) formulated for plugging will be compatible with and resistant to the injected carbon dioxide stream. The cement formulation and required certification documents will be submitted to the UIC Program Director with the well plugging plan. Capio will report the wet density and will retain duplicate samples of the cement used for each plug.

It is anticipated that throughout the operational life of the well it will be plugged back several times to allow for injection at shallower depths. The plugging plan will be revised as necessary to accommodate for these injection activities and submitted to the UIC Program Director for approval.

Table 9-2. Plugging details.

Plug Information	Plug #1	Plug #2
Diameter of boring in which plug will be placed (in.)	9 5/8	9 5/8
Depth to bottom of long-string casing (ft)	[redacted]	[redacted]
Sacks of cement to be used (each plug)	[redacted]	[redacted]
Slurry volume to be pumped (ft^3)	[redacted]	[redacted]
Slurry weight (lb./gal)	[redacted]	[redacted]
Calculated top of plug (ft)	[redacted]	[redacted]
Bottom of plug (ft)	[redacted]	[redacted]
Type of cement or other material	Class H, CO_2 resistant with latex additive	Class A/H
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Balance Method	Balance Method

(1) Sum of calculated volume for long-string casing and open hole

Narrative Description of Plugging Procedures

Notifications, Permits, and Inspections

In compliance with 40 CFR 146.92(c), Capio will notify the UIC Program Director at least 60 days before plugging the well and provide updated Injection Well Plugging Plan for approval, if applicable.

Plugging Procedures

The injection well shall be plugged and abandoned as outlined in the following steps:

1. All CO_2 pipelines will be marked and noted with rig supervisor prior to MI.

2. Conduct internal MIT.

3. Test, measure, and determine bottom-hole reservoir pressure. Calculate a kill fluid density.

4. Flush injection well with a kill weight fluid. Circulate tubing and annulus with kill weight fluid until pressure is controlled.

5. Install blowout preventers and perform a function test of the preventers.

6. Remove disposal tubing and packer.

7. Conduct an external MIT on the well as specified in 40 CFR 146.89 and described above.

8. Conduct cement bond log (CBL). Should an evaluation of the CBL indicate that remedial cementing is necessary, a plan and schedule will be submitted for review and approval. The CBL shall have the cement bond rating clearly marked on the log. Information shall be included on the log stating the criteria for various bond ratings appropriate for the casing size. In the event that remedial cementing is necessary, additional well inspections such as a caliper log may be completed to evaluate potential additional remedial procedures.

9. Deploy the first cement plug through a work-string. This procedure will be done by slowly withdrawing the work-string in stages (maximum of 500 ft). The actual volume will be based on length of the plug to be emplaced. Calculations are as follows:

   The number of sacks of CO_2 resistant cement, with a yield of 1.12 ft^3/sack, will be calculated for the 9 5/8-inch diameter long-string casing and open hole section;
   Long-string calculation
   [redacted]

   Open-hole calculation
   [redacted]

Deploy the second cement plug through a work-string. This procedure will be done by slowly withdrawing the work-string in stages (maximum of 500 ft). The actual volume will be based on length of the plug to be emplaced. The actual volume will be based on 133% of the calculated volume. Calculations are as follows:

The number of sacks of class A/H cement, with a yield of 1.18 ft^3/sack, will be calculated for the 9 5/8-inch diameter casing;

[redacted]

10. Once all cementing operations are complete, the wellhead will be removed and casing will be cut off at least three feet below ground level.

11. A metal cap will be welded onto the long-string casing inscribed with the referenced UIC permit number and the plugging date.

12. A tri-coordinate location map (including the elevation of the casing cap) will be submitted to the UIC Program Director. The map will be prepared by either a licensed professional land surveyor or professional engineer licensed to practice in Louisiana.

13. A plugging report will be submitted to the UIC Program Director within 60 days of the plugging activities.

An illustration of the plugged and abandoned well is provided in **Figure 1**.

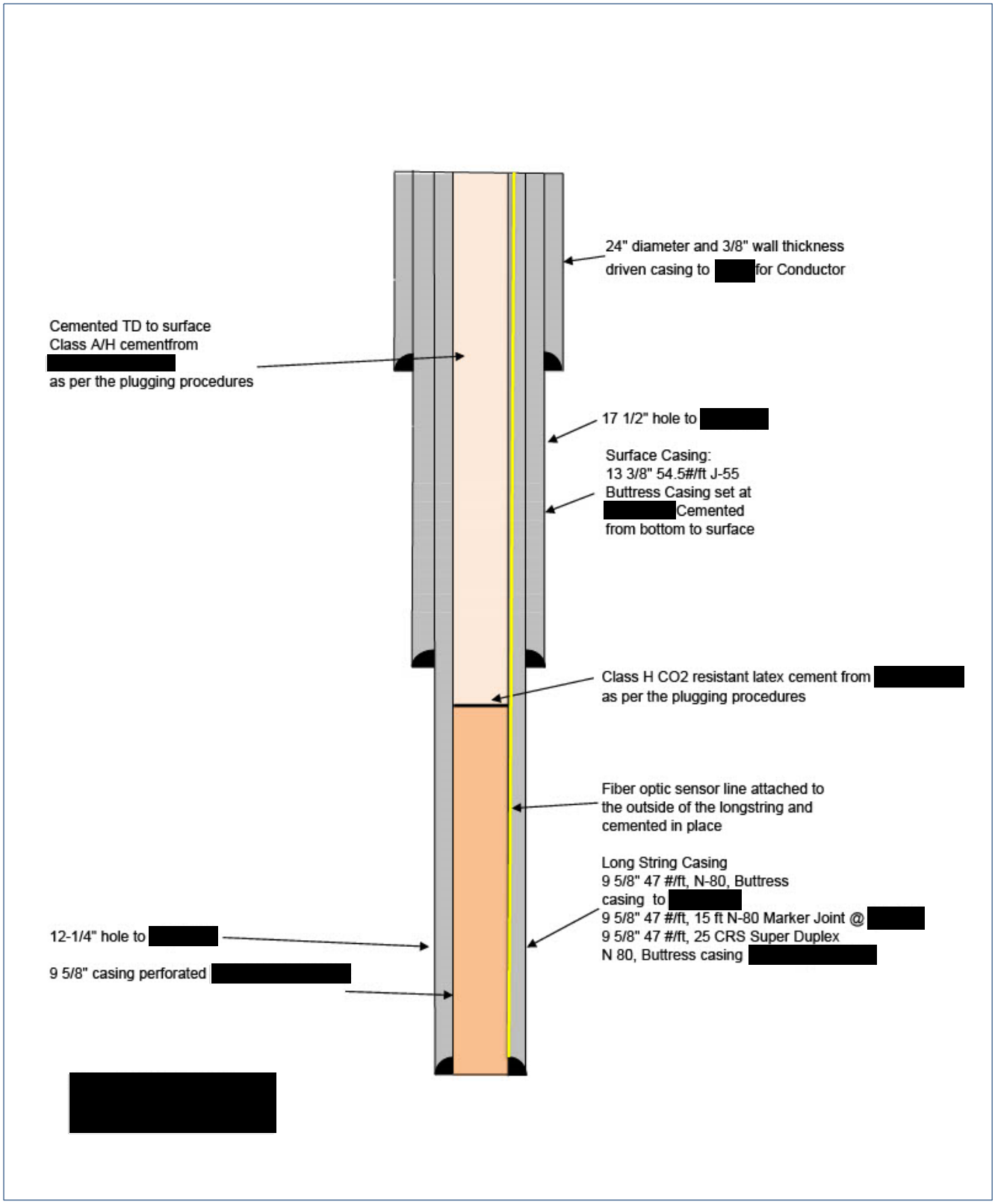

Figure 9-1. Plugged and abandoned injection well.