SECTION F. INJECTION WELL PLUGGING PLAN
40 CFR 146.92(b)

MONTEZUMA NORCAL CARBON SEQUESTRATION HUB

Facility Information

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List of Acronyms and Abbreviations

BOP = blowout preventer	MIT = mechanical integrity test
CO_2 = carbon dioxide	NU BOP = Nipple up blowout preventer
cu ft/ft = cubic feet per foot	MC = PureField Carbon Capture, LLC
cu ft/sx = cubic feet per sack	PISC = Post-Injection Site Care
DTS = distributed temperature sensor	ppg = pounds per gallon
ft = feet	psig = pounds per square inch, gauged
ft NGVD = feet elevation referenced to the National Geodetic Vertical Datum of 1929	RU = rig up
	TIH = trip in hole
	UIC = Underground Injection Control
lb/ft = pounds per foot	USDW = Underground Source of Drinking Water
MI = move-in	

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F.1 SUMMARY

Montezuma Carbon, LLC (MC) will plug and abandon IW-A1 in accordance with 40 CFR 146.92. After serving as an injection well, IW-A1 will be re-completed as a monitoring well during the post-injection site care (PISC) period. Well plugging and abandonment of IW-A1 will occur after completion of its monitoring well service during PISC.

The essential steps for plugging and abandonment are:

1. Prior to well plugging, MC will flush the well with a buffer fluid, determine bottomhole reservoir pressure, and perform a final external mechanical integrity test per 40 CFR 146.92(a).
2. MC will prepare, maintain, and comply with this Injection Well Plugging Plan upon its acceptance of the Underground Injection Control (UIC) Program Director. This plan is submitted as part of the permit application and includes information on the following:
    a. Planned tests or measures to determine bottom-hole reservoir pressure.
    b. Planned external mechanical integrity tests (MITs).
    c. Detailed information on the plugs including:
        i. Type and number of plugs to be used.
        ii. Placement of each plug including elevations for the top and bottom.
        iii. Type, grade, and quantity of material to be used in plugging. The material must be compatible with the carbon dioxide stream.
        iv. Method of placement of the plugs.
3. MC will notify the UIC Program Director in writing 60 days before plugging (or a shorter notice period per the UIC Program Director approval). An updated plan will accompany the notification, with any amendments to the plan approved by the UIC Program Director and incorporated into the permit subject to permit modification requirements of 40 CFR 144.39 or 144.41 (as appropriate).
4. Within 60 days after plugging, MC will submit a plugging report to the UIC Program Director. The report will be certified as accurate by MC and the person who performed the plug operation (if other than MC). MC shall retain the well plugging report for 10 years following site closure.

The intention of the plugging plan is to ensure the prevention of any fluid or gas migration from the injection zone, to prevent any additional crossflow as a result of the well penetrating formations above the target zone, to resist the corrosive aspects of carbon dioxide mixed with water, and to protect Underground Sources of Drinking Water (USDWs). Any revisions to the plan due to new information collected during logging and

testing will be made after construction, logging, and testing of the well has been completed. The final injection well plugging plan will be provided to the UIC Program Director.

To prepare the well for plugging, it will first be flushed with a kill weight brine fluid. A minimum flushing of three tubing volumes will be completed without exceeding formation fracture pressure. Prior to plugging, bottom hole pressure measurements will be made, and the well will be logged and pressure tested to ensure mechanical integrity inside and outside of the casing. If mechanical integrity is determined to be lost, repairs will be made prior to continuation of plugging activities. The casing of this well was cemented during construction and will not be retrievable during abandonment. Internal tubing (if present) and packer will be removed as part of abandonment. The balanced plug placement method will be used to plug the well. Internal tubing (if present) will be removed as part of abandonment. The balanced plug placement method will be used to plug the well. If, after flushing, the tubing cannot be released, an electric line with tubing cutter will be used to cut off the tubing above the packer, and the cement retainer method will be used for plugging the injection formation below the abandoned packer.

Cement used for the lower most (roughly bottom 5,220 feet [ft]) cement plugs will be designed to resist any corrosive effects of contact with carbon dioxide (CO2), carbonic acid, or other fluids or gasses associated with or generated as a direct result of the sequestration of carbon dioxide.

F.2 PLANNED TESTS OR MEASURES TO DETERMINE BOTTOM-HOLE RESERVOIR PRESSURE

MC will record bottom hole pressure throughout the operating lifetime of the well. Kill fluid density and reservoir pressure can be determined from these measurements.

F.3 PLANNED EXTERNAL MECHANICAL INTEGRITY TEST(S)

MC will conduct at least one of the tests listed in Table F-1 to verify external mechanical integrity prior to plugging the injection well as required by 40 CFR 146.92(a).

TABLE F-1. POTENTIAL MITS

Test Description	Location
Temperature Log	Along wellbore using distributed temperature sensor (DTS) or wireline logging
Noise Log	Wireline logging

F.4 INFORMATION ON PLUGS

MC will use the materials and methods noted in Table F-2 and illustrated in Figure F-1 to plug the injection well. Plugs #1 and #2 will have multiple lifts as illustrated in Figure F-1. The volume and depth of the plug or plugs are based upon the geology and downhole conditions of the well as assessed during construction. The cement(s) formulated for plugging will be compatible with and resistant to the carbon dioxide stream. 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.

TABLE F-2. PRELIMINARY PLUGGING DETAILS FOR IW-A1

Plug Information	Plug #1	Plug #2
Diameter of boring in which plug will be placed, inches	4.670"	4.670"
Depth to bottom of tubing or drill pipe, feet	12,920'	7700
Sacks of cement to be used	594	876
Slurry volume to be pumped, cubic feet	683	1,007
Slurry weight, pounds per gallon	15.8	15.8
Calculated top of plug, feet	7700	0
Bottom of plug, feet	12,920'	7,700'
Calculated top of plug, Elevation ft NGVD	-7,690'	10
Bottom of plug, Elevation ft NGVD	-12,920	-7,690'
Type of cement or other material	CO_2 Resistant	Neat Cement Class G
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Balanced Plug	Balanced Plug

ft NGVD = feet elevation referenced to NAVD 1988

F.5 NARRATIVE DESCRIPTION OF PLUGGING PROCEDURES

F.5.1 NOTIFICATIONS, PERMITS, AND INSPECTIONS

The procedures detailed below assume tubing is present in IW-A1. If the tubing was removed from IW-A1 during the prior re-completion as a monitoring well, the procedures below will be updated accordingly and provided to the UIC Program Director for review and approval.

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

F.5.2 PLUGGING PROCEDURES

1. In compliance with 40 CFR 146.92(c), notify the regulatory agency at least 60 days before plugging the well and provide an updated plugging plan, if applicable.
2. Move-in (MI) rig onto IW-A1 and rig up (RU). All CO_2 pipelines will be marked and noted with rig supervisor prior to MI.
3. Conduct and document a safety meeting.
4. Record bottom hole pressure from down hole gauge and calculate kill fluid density.
5. Open up all valves on the vertical run of the tree and check pressures.
6. Test the pump and line to 2,500 pounds per square inch, gauged (psig). Fill tubing with kill weight brine (9.5 pounds per gallon (ppg) or as determined by bottom hole pressure measurement). Bleeding off occasionally may be necessary to remove all air from the system. Test casing annulus to 1,000 psig and monitor as in annual MIT. If there is pressure remaining on tubing rig to pump down tubing and inject three tubing volumes of kill weight brine. Monitor tubing and casing pressure for 1 hour. If both casing and tubing are dead then nipple up blowout preventers (NU BOPs). Monitor casing and tubing pressures.
7. If the well is not dead or the pressure cannot be bled off of the tubing, RU slickline and set plug in lower profile nipple below packer. Circulate tubing and annulus with kill weight fluid until well is dead. After the well is dead, nipple down tree NU BOPs, and perform a function test. Blowout preventors (BOPs) should have appropriate sized single pipe rams on top and blind rams in the bottom ram for tubing. Test pipe rams and blind rams to 250 psig low, 3,000 psig high. Test annular preventer to 250 psig low and 3,000 psig high. Test all pressure valves, lines, BOPs choke and kill lines, and choke manifold to 250 psig low and 3,000 psig high. NOTE: Make sure casing valve is open during all Blowout preventer (BOP) tests. After testing BOPs pick up tubing string and unlatch seal assembly from seal bore. Rig slick line and lubricator back to well and remove X- plug from well. Rig to pump via lubricator and circulate until well is dead.

8. If the well is not dead or the pressure cannot be bled off of the tubing, RU slickline and set plug in lower profile nipple below packer. Unseat tubing from packer, and circulate tubing and annulus with kill weight fluid until well is dead. After the well is dead, re-land tubing, nipple down tree NU BOPs, and perform a function test. BOPs should have appropriately sized single pipe rams on top and blind rams in the bottom ram for tubing. Test pipe rams and blind rams to 250 psig low, 3,000 psig high. Test annular preventer to 250 psig low and 3,000 psig high. Test all pressure valves, lines, BOPs choke and kill lines, and choke manifold to 250 psig low and 3,000 psig high. NOTE: Make sure casing valve is open during all BOP tests.
9. Pull out of hole with tubing laying it down. NOTE: Ensure that the well is over-balanced so there is no backflow due to formation pressure and there are at least two well control barriers in place at all times.
10. Confirm the well's mechanical integrity by performing one of the permitted external mechanical integrity tests presented in Table F-1.
11. Pick up workstring, and trip in hole (TIH). Sting into the packer.
12. RU Wireline Unit and Run in Hole with retrieving tool, pull X-plug out of the packer.
13. Montezuma plans to plug the well with cement from the casing shoe to the surface. The lower section of the well will be plugged using CO_2 resistant cement from total depth around 12,920 ft to a depth of approximately 7,700 ft, which corresponds to roughly 200 ft above the top of the Domengine sandstone injection formation assuming the Anderson, Hamilton and Domengine have all had CO2 injected into them. This lower plug will cover all intervals that received CO2 with CO2 resistant cement. The bottom plug will balance about 600 sx. The abandonment cement has not been designed. Actual cement volume will depend upon actual weight of the casing within the plugged zone as well as the length of plug set as determined during the plugging operation. The lower plug will be given time to set prior to tagging the top of the plug with tubing.
14. The upper plug, from 7,700' to the surface will be balanced using approximately 876 sx of cement. The design of the abandonment cement has not been prepared. If needed, a "top job" will be performed to bring the top of the plug to the surface.
15. Nipple down BOPs and cut all casing strings below plow line (minimum 3 feet below ground level or per local policies/standards). Trip in well and set final cement plug. Lay down all work string, etc. Rig down all equipment and move out. Clean cellar to where a plate can be welded with well name onto lowest casing string at a depth of roughly 3 ft, or as per permitting agency directive. (Calculations assume 23 lb/ft casing with 10% Excess)
16. The procedures described above are subject to modification during execution as necessary to ensure the plugging operation protects worker safety and is effective to protect USDWs, and any significant

modifications due to unforeseen circumstances will be described in the Plugging report. The completed plugging forms will be submitted with charts and all lab information to the regulatory agency as required by the permit. The plugging report shall be certified as accurate by MC and the plugging contractor and shall be submitted within 60 days after plugging is completed.

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FIGURE F-1. IW-A1 UIC WELL PLUGGING PLAN SCHEMATIC