ATTACHMENT D

PRE-OPERATIONAL TESTING AND LOGGING PLAN [40 CFR 146.87]

1. FACILITY INFORMATION

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Well Information:

Well Number	County, State	Latitude	Longitude
CI1-64Z-27N	Kern County, CA	35°33'9.4877"N	119°48'26.3702"W
CI2-64Z-35N	Kern County, CA	35°32'32.6713"N	119°47'37.0682"W
CI3-64Z-35N	Kern County, CA	35°32'11.6457"N	119°47'7.5912"W
CI4-64Z-35N	Kern County, CA	35°31'55.4154"N	119°46'51.7864"W
27R-27N	Kern County, CA	35°33'2.4280"N	119°48'28.6103"W
55-26N	Kern County, CA	35°32'43.2520"N	119°47'32.7755"W
64-35N	Kern County, CA	35°31'44.3600"N	119°46'44.9788"W
9-1N	Kern County, CA	35°31'31.6480"N	119°46'37.0154"W
64-27N	Kern County, CA	35°32'41.1707"N	119°47'52.2726"W

Aera Energy LLC (Aera) plans to collect geologic and hydrogeologic data to demonstrate that the injection and confining layers are suitable for receiving and containing injected fluids, and to establish baseline data for time-lapse measurements, in accordance with 40 CFR 146.87. Because exploration and production activities in the 64 Zone Sandstones in the North Belridge oil field have been ongoing for the past 90 years, a substantial amount of relevant data has already been collected (**Section 2.4** of the **Application Narrative**). This attachment is the Pre-Operational Well Testing and Logging Plan for both new and repurposed injection wells that will supplement existing data and confirm conditions at the injection well locations.

2. LOGS, SURVEYS, AND TESTS DURING CONSTRUCTION [40 CFR 146.87(A)]

2.1 Logging of New Drilled Injection Wells

Deviation measurements will be conducted for newly drilled wells at a minimum of approximately every 300 feet (ft) during construction of the well. More comprehensive deviation checks will be provided at the end of each hole section at depth intervals no greater than 100 ft between checks, including inclination and azimuth. (Note: This may be done with "measurement while drilling" while drilling the hole section). A gyroscopic survey of the completed well will be done at the installation of the long string of casing for a final verification of the wellbore trajectory.

Prior to installing surface casing, a "Triple Combo" open-hole logging suite consisting of formation density, neutron porosity, resistivity, gamma ray, and spontaneous potential logs will be run from the well's present total depth (TD) to the ground surface (or base of conductor casing).

Cement bond logs, variable density logs, and a temperature log will also be performed, after the surface casing is cemented, to evaluate cement quality.

Additional logging runs will be performed, again with a Triple Combo logging suite, after surface casing is set, but before the intermediate casing, long string casing, and injection liner are installed. These logs will span from the wells TD to the base of surface casing, providing a complete log of the stratigraphic section. At this time, additional open-hole logs will be collected across the 64 Zone (injection zone), Santos Shale (primary confining layer), and Agua Sandstone (first permeable zone above the primary confining layer). Combined, these logs will provide a comprehensive evaluation of the physical and chemical properties of the injection and confining zones at the injection well locations and will serve as baseline measurements against which future measurements may be compared. Finally, additional sets of cement bond logs, variable density logs, and temperature logs will be performed to cover the entire well, after the intermediate casing, long string casing, and injection liner have been set and cemented.

A summary of proposed open-hole logs and their objectives is provided below:

- Triple Combo: correlation of formation markers, porosity, lithology, formation water salinity
- Spectral gamma ray: lithology
- Dipole sonic: compressional and shear velocity for mechanical properties and principal stress magnitude, Stoneley-wave processing for fracture identification
- Four-arm caliper: borehole shape and rugosity
- Formation micro-resistivity image: structural dip, rock texture, fracture identification, principal stress orientation

2.2 Logging of Repurposed Injection Wells

Four of the five wells proposed to be repurposed as injectors were logged when originally drilled with a suite consisting of deviation surveys, resistivity, and spontaneous potential measuring tools. There are no records of open-hole logs for well 64-27N (API: 0402935068), which is currently completed with an uncemented liner. Aera intends to remove the liner and attempt to run open-hole wireline logs from the casing shoe (in the Lower Santos) to the well's TD (covering the U and W Sandstone intervals). Log measurements include resistivity, spontaneous potential, porosity, caliper, gamma ray, and image logs (depending on borehole condition). Additionally, well 9-1N (API: 0402935107), originally drilled in 1940, was re-logged in 1986 (when the production liner was pulled) with gamma ray, formation density, thermal neutron, spontaneous potential and laterolog resistivity tools over the 64 Zone W section.

To supplement the suite of existing open-hole logs, a cased-hole logging program is proposed for repurposed wells that will be used to validate petrophysical and mechanical properties at the injection well locations. These logs will span an interval starting below the injection zone to a depth above the Agua Sandstone. The following log measurements are included in the cased-hole logging program:

- Gamma ray: correlation of formation markers
- Pulsed neutron: baseline porosity, saturation and lithology to compare against in future CO_2 saturation monitoring. Permeability will be calculated from correlations with porosity and lithology
- Dipole sonic compressional and shear velocity for mechanical properties
- Gyroscopic survey

The cased-hole environment is not conducive to downhole measurements for fracture identification; therefore, image logs are not feasible in repurposed wells. Observations made from nearby wells on fracturing trends, however, are representative of the proposed repurposed well locations. Comparison of lithology measurements from logs will be made to validate this assumption.

Cement bond logs, variable density logs, and temperature logs will be performed on the entire well, after the long-string inner casing is set and cemented.

2.3 Mechanical Integrity Tests (MIT) [40 CFR 146.87(a)(4)]

A series of MITs, selected from the list below, will be performed in the final stages of well construction to demonstrate the internal and external mechanical integrity of the injection well. Detailed testing procedures can be found in the Testing and Monitoring Plan (**Attachment E**).

- Temperature or noise log
- Oxygen activation log
- Ultrasonic image log
- Multi-finger caliper
- Annular pressure test

3. CORE FROM THE INJECTION AND CONFINING ZONES [40 CFR 146.87(B)]

3.1 Cores from Newly Drilled Wells

Pressure depletion in the 64 Zone Sandstones poses challenges to successful recovery of conventional core in present day, as experienced with the cores acquired in the 1980s. For this reason, rotary sidewall cores will be collected from the injection and confining zones. Core samples will be shipped to a laboratory and analyzed for required parameters. The existing catalog of conventional core data from seven legacy wells (**Section 2.4** of the **Application Narrative**) will be used to supplement and validate sidewall core measurements, where needed.

3.2 Core from Repurposed Injection Wells

Sidewall core samples were acquired from the injection zone and described in one of the five proposed repurposed wells, well 9-1N. While it is not feasible to collect new core samples in the remaining four repurposed wells, a robust core analysis database is available from nearby wells

and can be interpolated to the repurposed well locations by comparing log response to that of cored wells.

4. RESERVOIR PRESSURE, FRACTURE PRESSURE, AND FORMATION FLUID MEASUREMENTS [40 CFR 146.87(C)-(D)]

Fluid temperature, pH, reservoir pressure, and static fluid levels of the injection zones will be measured and recorded during and/or after construction of new and repurposed injection wells. Formation fluid samples will be collected from the injection zone using a bottom-hole sampler or by swabbing the well. These samples will be analyzed by a laboratory for salinity, pH, conductivity and other potential properties of interest in order to determine physical and chemical characteristics of the formation fluids in the injection zone.

Aera is planning to conduct step rate tests in a selection of wells in the North Belridge oil field scheduled to be either abandoned or repurposed as injection wells. This will provide data to calibrate the log-derived calculation of fracture gradient for the injection and confining zones.

A descriptive report will be prepared for each injection well summarizing observations from logs, core and other measurements. Such report will address measurements and/or estimates of fracture pressure, as well as, the physical and chemical characteristics of the injection and confining zones (including depth, thickness, porosity, permeability and lithology) and formation fluids (including temperature, salinity, conductivity).

5. HYDROGEOLOGIC CHARACTERISTICS OF THE INJECTION ZONE [40 CFR 146.87(E)]

Pressure fall-off tests and pump or injectivity tests will be performed on each injection well after construction but prior to operation. Details on the test procedures are included in the Testing and Monitoring Plan (**Attachment E**).

6. WITNESSING OF PRE-OPERATIONAL WELL TESTING [40 CFR 146.87(F)]

Aera will submit a schedule of the proposed tests and logs at least 30 days prior to conducting the first test to allow the Underground Injection Control (UIC) Program Director the opportunity to witness these tests. Changes to the testing schedule will be submitted at least 30 days prior to the next scheduled test.

7. QUALITY ASSURANCE AND SURVEILLANCE PLAN (QASP)

The Quality Assurance and Surveillance Plan is presented in the appendix of the Testing and Monitoring Plan (**Attachment E**).