PRE-OPERATIONAL TESTING PROGRAM

Kern River Eastridge CCS

Facility Information

Facility name:	Kern River Eastridge CCS MC19001INJ, ANO9004INJ, MC19002INJ, ANO9005INJ
Facility contact:	David Wessels – Project Manager 9525 Camino Media, Bakersfield, CA 93311 David.wessels@chevron.com / 661-412-6039
Well location:	Bakersfield, Kern County, CA 93308 35.4404°/-118.9983°; 35.4465°/-119.0012°; 35.4401°/-118.9981°; 35.4462°/-119.0010°

Introduction

The testing activities at the CO_2 injection, deep monitoring, shallow monitoring, and stratigraphic wells (**Table 1**) described in this document are restricted to the pre-injection phase. Testing and monitoring activities during the injection and post-injection phases are described in the Testing and Monitoring Plan and the Post Injection Site Care and Site Closure Plan, along with other non-well related pre-injection baseline activities such as geochemical monitoring.

Overall Strategy and Approach for Pre-Operational Testing

Testing Selection Strategy

Chevron U.S.A., Inc. (Chevron) plans to collect data during the pre-injection phase of the project from two (2) CO_2 injection wells, four (4) deep monitoring wells, six (6) shallow monitoring wells, and one (1) stratigraphic well. A summary of the CO_2 injection wells, shallow monitoring wells, and deep monitoring wells is provided in **Table 1.** The specific tests and test intervals were selected to address uncertainties and data gaps discussed in the Site Characterization section of the Project Narrative and the Area of Review (AoR) and Corrective Action Plan. For a list of testing activities see **Table 2**. Chevron plans to collect a robust suite of data including (1) whole core across both the Vedder Sand injection zone and the Freeman-Jewett Silt confining zone, (2) formation pressures (Reservoir Description Tool [RDT]) from the Vedder Sand and the Santa Margarita (i.e., the lowermost Underground Source of Drinking Water [USDW]), (3) fluid samples (modular formation dynamics tool [MDT]) from the Vedder Sand, (4) a wireline stress test (stress test) in the Freeman Jewett Silt, (5) a pressure transient analysis (PTA) in the Vedder Sand, (6) a basic logging suite (e.g., Gamma Ray [GR], Resistivity [RES], Spontaneous Potential [SP], Bulk Density [RHOB], Neutron Density [NPHI], Dielectric, and Caliper), and (7) an advanced logging suite (e.g., Nuclear Magnetic Resonance [NMR], Formation Imaging [FMI], and Dipole Sonic) across all zones of interest. In addition to the tests listed below, all wells will run a cement bond log (CBL) and a variable density log (VDL) to assess mechanical integrity,

and the injectors will additionally run a casing inspection log (CIL) to establish a corrosion baseline.

The tests outlined above provide a wide range of information that Chevron plans to use to refine and enhance the site characterization, reservoir modeling, and dynamic simulation of the project. Specifically, the tests can inform the stratigraphic and structural framework (e.g., GR, RES, SP), reservoir properties such as porosity and permeability (e.g., whole core, PTA, NMR, RHOB, NPHI), the presence and analysis of faults and fractures in the injection and confining zone (e.g., whole core, PTA, FMI), geomechanical evaluation (e.g., whole core, stress test, FMI, Dipole Sonic, RHOB, RDT), geophysical evaluation (e.g., Dipole Sonic), and updates to the critical pressure calculation (e.g., RDT, MDT).

Testing Strategy and Design by Well Type

The stratigraphic well data collection strategy was designed (1) to provide information on the Vedder Sand injection zone, (2) to test the fracture gradient of both the Freeman-Jewett Silt confining zone and the Vedder Sand injection zone, and (3) to assess and calibrate the sealing capacity of faults within the Area of Interest (AoI). The well (KC20050X_ST1) was located outside of the AoR near the Apollo Jr. Fault to limit the number of artificial penetrations in the AoR, to facilitate a whole core through the fault zone, and to be close enough to a fault to measure its properties in a pressure transient analysis. Core analysis includes (1) core description and photographs, (2) routine core analysis (e.g., porosity and permeability plugs), (3) special core analysis (e.g., X-ray diffraction [XRD], thin sections, mercury injection capillary pressure [MICP], scanning electron microscope images [SEM], capillary pressure [air brine porous plate]), (4) relative permeability values in a CO_2/brine system, (5) core nuclear magnetic resonance (NMR), (6) X-ray fluorescence (XRF) across the fault zone, and (7) a full suite of geomechanical analyses in the sandstone, shale, and fault zone intervals. In addition to collecting and analyzing core, Chevron performed a pressure transient analysis (PTA) and step rate test in the Vedder Sand along with an extended leak off test (LOT) in the Freeman-Jewett Silt.

The CO_2 injection well data collection strategy was designed (1) to address uncertainties and data gaps in the Freeman-Jewett Silt, (2) assess local reservoir conditions including reservoir injectivity at the injection wells, and (3) to minimize any damage to the formation or near-wellbore conditions that might affect injectivity. To address uncertainties and data gaps in the Freeman-Jewett Silt, Chevron plans to collect NMR and FMI logs across the Freeman-Jewett Silt in the CO_2 injection wells. Due to CO_2 injector wellbore deviation in the Freeman-Jewett Silt, which significantly complicates coring operations, Chevon plans to collect two Freeman-Jewett Silt cores in the two of the four deep monitoring wells and calibrate the core properties to the CO_2 injection wells using NMR and FMI logs collected in both the CO_2 injection and deep monitoring wells. NMR and FMI logs in conjunction with a standard logging suite will provide information on local reservoir conditions at the CO_2 injection wells. To minimize near-wellbore damage to the formation from drilling fluids designed to improve core recovery, Chevron plans to collect Vedder Sand core in the stratigraphic well instead of in the CO_2 injection wells. This Vedder Core will supplement the other seven (7) legacy cores across the AoI.

The deep monitoring well data collection strategy was designed (1) to address uncertainties and data gaps in the Freeman-Jewett Silt, (2) to provide additional data points across the AoR and AoI, and (3) to reduce uncertainty in the variability in permeability across the AoR and AoI. To

address uncertainties and data gaps in the Freeman-Jewett Silt, Chevron plans to collect whole cores and perform wireline stress tests in the Freeman-Jewett Silt in the two of the four deep monitoring wells. These data will be calibrated to properties at the CO_2 injection wells using NMR and FMI logs collected in both the CO_2 injection and deep monitoring wells. A standard logging suite will supplement the 70+ well penetrations from legacy and project wells and NMR logs will provide information on the variability of permeability within the Vedder Sand. The shallow monitoring well data collection strategy was designed to provide the information required to select the perforated intervals for above zone fluid sampling.

Pre-Operation Data Collection Timing and Zonal Coverage

Chevron plans to drill injectors MC19001INJ and ANO9004INJ as well as all monitoring wells at approximately the same time after receiving the authorization to construct the CO_2 injection wells. The stratigraphic well was drilled in late 2022 to provide enough time to complete and incorporate extensive core analysis with the other data collected from the CO_2 injection and monitoring wells during the pre-operational phase of the project. **Figure 1** below shows the relative locations of the CO_2 injection wells, the deep and shallow monitoring wells, the stratigraphic well, mapped faults within the Vedder Sand, the AoR, and the AoI.

Chevron plans to drill the two (2) CO_2 injection wells and the four (4) deep monitoring wells to the base of the Vedder Sand (i.e., the injection zone). Chevron plans to drill two (2) of the six (6) shallow monitoring wells to the base of the Olcese Sand (i.e., the first permeable zone) and four (4) of the six shallow monitoring wells to the base of the Santa Margarita Sand (i.e., the lowermost USDW). The stratigraphic well was drilled outside of the AoR through the base of the Vedder Sand. Exact depths will depend on logging, drilling conditions and other drilling data. Wireline logs will be run to the total depth (TD) of the well, or as deep as possible.

Testing and Monitoring Baseline Data

Chevron will conduct several baseline tests prior to injection to help determine if there are significant changes after CO_2 injection begins. These baseline tests will help decrease errors in the repeatability of future data. A cement bond log and variable density log will be run after each string of casing is installed to verify cement placement. A casing inspection log will be run after the installation of the injection string of casing on the injection wells to evaluate initial casing conditions and provide a baseline for further corrosion related logs. To calibrate CO_2 plume monitoring techniques, a cased hole pulsed neutron log (PNL) will be run in all project wells (i.e., CO_2 injection wells, deep monitoring wells, and shallow monitoring wells). Distributed acoustic sensing fiber optic (DAS) vertical seismic profiles (VSPs) or equivalent technologies will be performed to establish a baseline survey. An oxygen activation log will generate a baseline for external mechanical integrity. A baseline injectivity and pressure fall-off test will also be performed for each CO_2 injection well prior to injection.

Baseline fluid sampling & analysis will be conducted quarterly on the first permeable zone above the caprock (i.e., Olcese) and the lowermost USDW (i.e., Santa Margarita) for a year prior to injection to assess initial water quality. Additionally, baseline wireline fluid samples will be taken in the Vedder Sand Injection Zone prior to injection. Baseline fluid samples will collect data across a wide range of parameters. For a full list of baseline fluid sample parameters, see the Testing and Monitoring Plan.

Existing Data

Chevron has a robust dataset that complements the pre-operational data collection program that includes seventy (70) wells. In addition to the proposed coring program, there are seven (7) wells with whole-core data in the Vedder Sand, twenty-nine (29) wells with sidewall core data in the Vedder Sand, and seven (7) wells with sidewall core data in the Freeman-Jewett Silt.

Table 1. Summary of monitoring wells.

Well Types	Well Name	Monitoring Zone	Formation	Top Zone Depth (ft TVDSS)	Quantity
Shallow Observation	IR_9001OB KER9001OB ANO9003OB GW_9001OB	Lowermost USDW	Santa Margarita	-810 to -1350	4
	ANO9001OB GW_9002OB	1st Permeable Zone	Olcese	-1840 to -2420	2
Deep Observation	HK_9001OB COR9001OB	1st Permeable & Injection Zone	Olcese & Vedder	-1840 to -2420 -3690 to -4230	2
	RCA9001OB DDA9001OB	Injection Zone	Vedder	-3690 to -4230	2
CO_2 Injection	ANO9004INJ MC19001INJ	Injection Zone	Vedder	-3690 to -4230	2

Table 2. Summary of pre-operational testing program. All wireline logs, denoted by an "X", will be run as deep as possible in the open hole section of the deepest string. Whole core, formation pressures (RDT), fluid samples (MDT), stress tests, pressure transient analysis (PTA, and injectivity/pressure fall off tests (Inj Test) will be collected for specific zones (SM = Santa Margarita Sandstone, OL = Olcese Sand, FJ = Freeman-Jewett Silt, V = Vedder Sand). For more information on the stratigraphic intervals see the Site Characterization Section of the Project Narrative.

Well Information			Core	Formation Testing					Basic Logging Suite							Advanced Logging Suite		
Well Name	**Well Type**	**Deepest Zone**	**Whole Core**	**RDT (Pressure)**	**MDT (Samples)**	**Stress Test**	**PTA**	**Inj Test**	**GR**	**RES**	**SP**	**RHOB**	**NPHI**	**Dielectric**	**Caliper**	**NMR**	**FMI**	**Dipole Sonic**
KC20050X_ST1	Stratigraphic	Famoso	V	V			V	V	X	X	X	X	X	X	X	X	X	X
ANO9004INJ	CO_2 Injector	Vedder		SM, V	SM, V			V	X	X	X	X	X	X	X	X	X	X
MC19001INJ	CO_2 Injector	Vedder		SM, V	SM, V			V	X	X	X	X	X	X	X	X	X	X
RCA9001OB	Deep Monitoring	Vedder							X	X	X	X	X	X	X			
COR9001OB	Deep Monitoring	Vedder	FJ			FJ			X	X	X	X	X	X	X	X	X	X
HK_9001OB	Deep Monitoring	Vedder	FJ			FJ			X	X	X	X	X	X	X	X	X	X
DDA9001OB	Deep Monitoring	Vedder							X	X	X	X	X	X	X			
ANO9001B	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			
ANO9003OB	Shallow Monitoring	Olcese							X	X	X	X	X	X	X			
GW_9001OB	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			
GW_9002OB	Shallow Monitoring	Olcese							X	X	X	X	X	X	X			
KER9001OB	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			
IR_9001OB	Shallow Monitoring	St. Margarita							X	X	X	X	X	X	X			

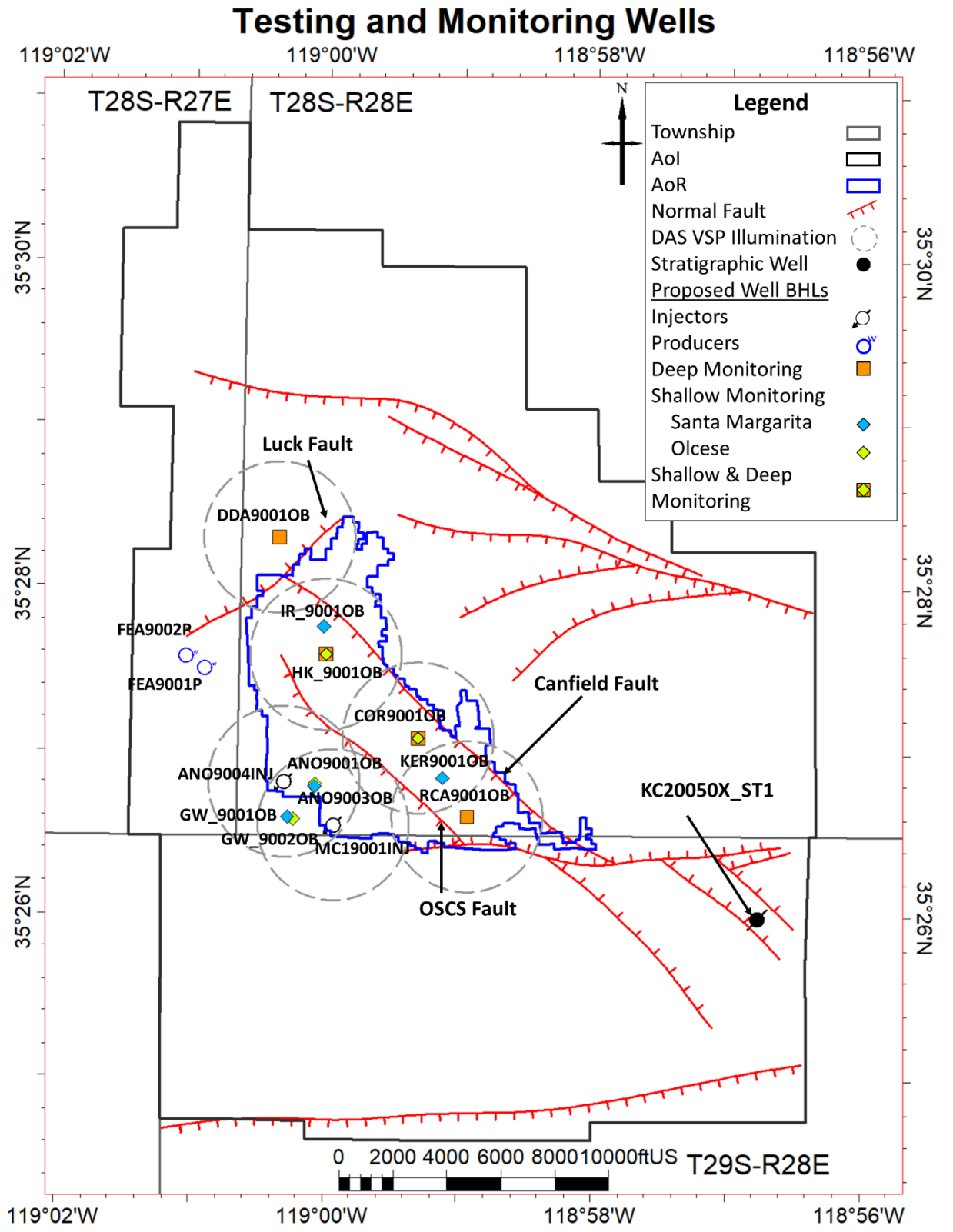

Figure 1. Locations of the CO_2 injection wells, the deep and shallow monitoring wells, the stratigraphic well, mapped faults within the Vedder Sand, the AoR, and the AoI.

Pre-Injection Testing Plan – Injection Wells

The following tests and logs will be conducted during drilling and after casing installation in accordance with the testing required under 40 CFR 146.87(a), (b), (c), and (d). The tests and procedures are described below and in the Proposed Injection Well Construction Information section of the permit application.

Deviation Checks

Deviation measurements will be conducted approximately every 90 feet during construction of the well.

Tests and Logs

To be performed during the drilling phase, prior to running casing. The basic logging suite will be run prior to each string of casing. The advanced logging suite and pressures and samples will be run prior to running the second surface casing and injection casing.

- Basic Logging Suite:
    - Gamma Ray
    - Resistivity
    - Spontaneous Potential
    - Bulk Density
    - Neutron porosity
    - Dielectric
    - Caliper Logs
- Advanced Logging Suite
    - Nuclear Magnetic Resonance (NMR)
    - Formation Imaging (FMI)
    - Dipole Sonic
- Pressures and Samples
    - Formation Pressure (RDT)
    - Fluid Samples (MDT)

To be performed after casing installation for each string of casing.

As outlined by 40 CFR § 146.87(a)(2) and 40 CFR § 146.87(a)(3), the following tests demonstrate zonal isolation and the integrity of the cement job to casing and to the formation. Additionally, when the Variable Density Log and Cement Bond Log are run in combination, they offer insights into possible microannulus/fluid migration paths in cement.

- Cement Bond Log
- Variable Density Log
- Temperature Log

The following test measures casing thickness, internal and external diameters. Run to establish a corrosion baseline.

- Casing Inspection Log

To be performed after casing installation of the injection string of casing prior to CO_2 injection.

The following tests estimate the injection pressure as a function of injection rate and provide information on the near wellbore environment and bulk permeability that could impact injectivity.

- Injectivity Test
- Pressure Fall Off Test

Demonstration of mechanical integrity

Below is a summary of the mechanical integrity tests (MITs) and pressure fall-off tests to be performed prior to injection:

Table 3. Pre-Operational Testing Schedule

Class VI Rule Citation	Rule Description	Test Description	Program Period
40 CFR 146.89(a)(1)	MIT - Internal	Standard Annulus Pressure Test	1 test within 3 months pre-injection
40 CFR 146.87(a)(4)	MIT - External	Oxygen Activation Log	1 test within 3 months pre-injection
40 CFR 146.87(e)(1)	Reservoir Test	Pressure Fall-Off Test	1 test prior to Operation
40 CFR 146.87(e)(3)	Reservoir Test	Injectivity Test	1 test prior to Operation

Chevron will notify Environmental Protection Agency (EPA) at least 30 days prior to conducting the test and provide a detailed description of the testing procedure. Notice and the opportunity to witness these tests/logs will be provided to EPA at least 48 hours in advance of a given test/log.

Pre-Injection Testing Plan – Deep Monitoring Wells

Deviation Checks

Deviation measurements will be conducted approximately every 90 feet during construction of the well.

Tests and Logs

To be performed during the drilling phase, prior to running casing. The basic logging suite will be run prior to each string of casing. The advanced logging suite and pressures and samples will be run prior to running the second surface casing and injection casing.

- Basic Logging Suite (All Deep Monitoring Wells):
  - Gamma Ray
  - Resistivity
  - Spontaneous Potential
  - Bulk Density
  - Neutron porosity
  - Dielectric
  - Caliper Logs
- Advanced Logging Suite (COR9001OB and HK_9001OB)
  - Nuclear Magnetic Resonance (NMR)
  - Formation Imaging (FMI)
  - Dipole Sonic
- Stress Test (COR9001OB and HK_9001OB)
  - Stress Test
- Whole Core (COR9001OB and HK_9001OB)
  - Whole Core

To be performed during and after casing installation for each string of casing.

The following tests demonstrate zonal isolation and the integrity of the cement job to casing and to the formation. Additionally, when the Variable Density Log and Cement Bond Log are run in combination, they offer insights into possible microannulus/fluid migration paths in cement.

- Cement Bond Log
- Variable Density Log

Demonstration of mechanical integrity

Below is a summary of the MITs to be performed on the deep monitoring well(s), RCA9001OB, COR9001OB, HK_9001OB, DDA9001OB, after installation and prior to commencing CO_2 injection operations. External mechanical integrity will be demonstrated with a cement bond log and variable density log:

Table 4. MITs

Test Name	Test Description	Program Period
MIT - Internal	Standard Annulus Pressure Test	Prior to Operation
MIT - External	CBL and VDL	Prior to Operation

Notice and the opportunity to witness the test/log will be provided to EPA at least 48 hours in advance of a given test/log.

Standard Annulus Pressure Test Procedures (Internal MIT):

Injection Wells

1. Fill the tubing/casing annulus with fluid and allow well to stabilize.
2. Increase annular pressure to the maximum surface injection pressure plus a safety factor. Once pressurized, isolate the annulus from the pressure source.
3. Keep the annulus isolated throughout the 30-minute testing period. Monitor and record pressure measurements continuously.

Monitoring Wells

1. Fill the casing with fluid and allowed the well to stabilize.
2. Increase casing pressure to a minimum of 200 psi. Once pressurized, isolate the well from the pressure source.
3. Keep the well isolated throughout the 30 minutes testing period. Monitor and record pressure measurements continuously.

Pressure Fall-Off Test Procedures:

A pressure fall-off test will be completed on each injection well after construction but prior to operation. Results of the pressure fall-off tests will be submitted to the Underground Injection Control (UIC) Program Director electronically within thirty (30) days of the test. The pressure fall-off testing procedure is described below.

1. Hold injection rate constant while maintaining as stable operating conditions as possible prior to the fall-off test shut in period. Do not exceed the maximum operating pressure.
2. Shut in well at the wellhead, or as near to the wellhead as is safely feasible. For offset injectors in the Vedder Sand that are operated by Chevron, maintain a constant injection rate and continuously record injection rates for the duration of the test.
3. Continuously measure pressure and temperature using downhole pressure gauges for the duration of the test. Conduct the test over a sufficient time period in which pressure is no longer influenced by wellbore storage or skin.