Summary of major events that affected long-term circulation test data

**March 27, 2019**

Largely continuous injection started.

P Bot was measuring total flow from P.

P Collar measuring OT flow.

PNNL 13 measuring P interval flow

**April 2, 2019**

Replaced PNNL05 with production upper packer temperature. Replaced PNNL06 with production lower packer temperature.

**April 3, 2019**

Manually measuring the outflow from the Triplex pump, found that there was (and has been

since testing started) a constant offset in flow, troubleshooting elucidated a programming offset on the flow meter, the offset was ~ +0.032 m/s (55 +/- 0.5 mL/min higher than reported). This

means that if we reported flows of 400 mL/min out of the Triplex, they were really 345 mL/min. The programming offset was removed and the flows are now accurate within the normal error

bands.

The upper packer element on the injection string failed, flow stopped

Production packer was inflated but there was no flow

**April 4, 2019**

Flowing on the 164’ notch to check outflows in the production well was resumed – the team will remotely monitor this progress to see if the test should continue. Flow continued thereafter. P bot and P int separated since then.

**April 12, 2019**

Remotely stopped testing due to E1-I anomaly. Packer failure.

At ~02:00, the remote operations system sent alerts that the injection rate increased and the interval pressure abruptly decreased. The Triplex pump was remotely shut off. Crew arrived on site. Attempted to reinitiate flow test, flow/pressure could not be stabilized. Stopped flow, verified E1-I packer had failed. Shut down entire stim/flow system to reconfigure plumbing and circuitry. Flow relaxation following packer failure and then pump shutdown, then system was disengaged by field crew.

Cleaned out blockage of flow collection/measurement system at well E1-OT, upgraded collar flow collection systems at wells E1-PST & E1-PDT.

Performed upgrades to flow meters and associated DAQ modifications

Verified the range settings on each of the flow meters to make sure they were in-spec.

**April 15, 2019**

Installed OB and OT flowmeter (replaced OTT and OTB channels), completed flowmeter reconfiguration.

**April 16, 2019**

Quizix troubleshooting, E1-I packer replacement.

**April 17, 2019**

Quizix flow started

**April 18, 2019**

550 L was injected with the Quizix before we had to shut it down. The other cylinder failed.

Switched back to Triplex

**April 24, 2019**

OT collar flow is plugged, no longer able to make this measurement because it is plugging too rapidly

We shut in the injection interval to change the oil in the triplex pump; short interruption to the flow.

After the oil change, the flow resumed, and the system is running.

**April 25, 2019**

Erratic flow caused by collection of tracer samples from well collars

**May 7, 2019**

Repairs to PDT flow meter, disregard flow measurements. Manual measurement shows about 100 mL/min

**May 8, 2019**

Started pumping chilled water

Data file opened as being written, flow and pressure dropped off temporarily as a result

**May 30, 2019**

Switched to quizix pump

**May 31, 2019**

Noted injection packer failure

**June 4, 2019**

Some signal from testing the packers, not real testing. Shut pressure in the injection interval.

**June 5, 2019**

Reinitiated flow test using a rate-step up.

**June 7, 2019**

Noise in P Collar.

**Mid-June**

Microbiology sample collection only

**July 18, 2019**

A power spike caused a fault in the charge pump VFD. Triplex pump shut down, then restarted

**August 1 - August 5, 2019**

Troubleshooting chiller and Kloehn pump

**August 6, 2019**

Chiller back on again.

**August 19, 2019**

Stopped and restarted injection.

**October 9, 2019**

PST funnel maintenance caused sudden change of PST flow.

**October 12, 2019**

Test stopped. System went down over the weekend (Oct. 12 was Saturday)

**October 15, 2019**

Triplex pump restart

**October 22-29, 2019**

Thermistor resistance checks and tests

**October 25, 2019**

Funnel on injection well was overflowing. Rock clogged line to flowmeter.

**November 5, 2019**

Removed injection packer and production packer.

**November 7, 2019**

New thermistors installed. PNNL 05 is now production interval temperature. PNNL 06 is now production below interval temperature (P bottom). LBNL 08 is now chiller return temperature. LBNL 04 is now chiller inlet temperature.

**November 8, 2019**

Pressure surge in production bottomhole. Discovered mistakenly closed valve. Injection restarted.

**November 16, 2019**

Chiller stopped due to issues with the pressure transducer.

**November 21, 2019**

Chiller repaired.

**December 17, 2019**

P packer deflated for thermistor repair. Injection continued. Switched thermistors back to previous configuration.

**December 19, 2019**

Thermistor repair finished.

**January 13, 2020**

Injection stopped to fix the packer. LBNL 04 and LBNL 08 swapped, so LBNL 08= P interval temperature, LBNL 04 = P below interval temperature.

**January 15, 2020**

Test restarted Jan 15.

**February 3, 2020**

Shut-in tests started. Flow meter for OT replaced and reconnected.