

**2022 MECHANICAL INTEGRITY TESTING AND
PRESSURE FALLOFF TESTING REPORT
REPUBLIC INDUSTRIAL & ENERGY SOLUTIONS, LLC**

WELL NO. 2-12

**API No. 21-163-M453
EPA Permit No. MI-163-1W-C0011
Michigan EGLE Permit No. M-453
Romulus, MI**

September 2022

Baton Rouge, LA



Project No. 192128AD

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1.0 INTRODUCTION

In accordance with the United States Environmental Protection Agency (U.S. EPA), requirements included in the Class I UIC permit number MI-163-1W-C011 granted to Republic Industrial and Energy Solutions, LLC (Republic) and with the State of Michigan Administrative Rule R299.2393 (MI Permit #M-453) the annual mechanical integrity testing was performed on Well No. 2-12 on August 15 and 16, 2022 to demonstrate the mechanical integrity of the casing, packer, and tubing.

Republic Industrial and Energy Solutions, LLC (Republic) retained WSP USA (WSP) to perform the annual mechanical integrity testing on Well No. 2-12 at Republic's facility in Romulus, MI. The mechanical integrity tests included a Temperature Survey, a Radioactive Tracer Survey and an Annulus Pressure Test. All tests were conducted in accordance with United States Environmental Protection Agency (USEPA) 40 CFR 146.8 and 146.13(b)(3), (c)(2)(i), and (d). Approved testing procedures are included as Appendix A.

In addition to the mechanical integrity testing, a bottom hole pressure falloff test (Ambient Pressure Monitoring) was run in Well No. 2-12 to assist in evaluating the injection zone. A chronology of field activities is included as Appendix B. Wellhead and wellbore schematics of Well No. 2-12 are included as Figures 1 and 2, respectively.

2.0 REPORT OF FIELD OPERATIONS

All depths in this report, unless otherwise noted, are referenced to the Kelly Bushing (KB) elevation which is 13 feet above the ground level elevation for Well No. 2-12. A wellbore schematic of Well 2-12 is presented as Figure 2. A chronological report of field activities is presented as Appendix B.

Republic performed the annulus pressure test (APT) on August 15, 2022, to demonstrate that there is no significant leak in the tubing, casing or packer. Jason Stigler with Michigan EGLE-OGMD witnessed and passed the test. The annulus pressure test results are detailed in Section 3.0.

Republic had the well shut-in for more than 36 hours prior to the beginning of the field wireline operations. Field wireline operations began on August 16, 2022, when Michigan Wireline spotted and rigged up logging equipment. Performed 2-point “bucket calibration” of the temperature logging tool using hot water and room temperature water before rigging up on the well. Then, rigged up on the well and logged with Casing Collar Locator (CCL), Temperature, and Gamma Ray Neutron (GRN) tools from surface to total depth (4336 feet). The log was correlated to the radioactive tracer survey of the previous year. Pulled logging tools out of the hole and changed out the tools for the radioactive tracer survey. Well 1-12 was shut-in throughout the temperature survey. The temperature survey results are detailed in Section 4.0.

A radioactive tracer survey (RTS) was run on August 16, 2022, after the completion of the temperature survey. A pre-survey base log and 5-minute statistical checks were ran with no injection. Injection was initiated at 42 gallons (gpm), then a slug of radioactive material was released at 3100 feet. A dissipated slug was located at approximately 4034 feet with Chase Pass No. 5. A slug of radioactive material was ejected at 3750 feet, and the lower gamma ray detector was run downhole and positioned at 3960 feet to observe the slug passing by and monitor for any upward migration. The time-drive survey was conducted for approximately 30 minutes at 42 gpm and 714 psi injection pressure. To conclude the RTS, the well was shut-in and the post-survey log was run. The radioactive tracer survey results are detailed in Section 5.0.

On August 17, 2022, J.O. Well Service & Testing spotted and rigged up slickline with memory-type bottom-hole pressure gauges. The memory gauges were run downhole and set at 3975 feet (top gauge at 3973 feet). Injection was initiated at 1419 hours. Republic began to discontinue injection of plant effluent into Well 2-12 at 0128 hours on August 18, 2022. The pressure falloff was monitored for approximately 29.03 hours and was concluded on August 19, 2022. While pulling the gauges out of the well, static pressure gradient stops were made at 3000 feet, 2000 feet, 1000 feet, and at the surface. Well 1-12 was shut-in throughout the build-up and falloff period. The falloff test and bottom hole static pressure gradient results are detailed in Sections 6.0 and 7.0, respectively.

3.0 ANNULUS PRESSURE TEST

An Annulus Pressure Test (APT) was conducted on Well #2-12 on Monday, August 15, 2022, with Jason Stigler of the Michigan EGLE-OGMD witnessing the test. Between 10:00 AM and 10:11 AM, the annulus pressure was decreased from 1128.21 psig to 1106.31 psig. The official APT was started at 10:16 AM at a pressure of 1104.92 psig. One hour later at 11:16, the annulus pressure had declined 0.72 psi to 1104.20 psig which was a decrease of 0.72 psi (-0.07%) and within the $\pm 3\%$ /hour allowed by the EPA Region 5.

A plot of the APT is provided as Figure 3, and a tabulate of the APT data is provided as Appendix C. A calibration certificate for the digital pressure gauge is included in Appendix D. Signed copy of the USEPA Standard Annular Pressure Test Form is provided as Appendix E.

4.0 DIFFERENTIAL TEMPERATURE SURVEY

A differential temperature survey was conducted in Well 2-12 on August 16, 2022, by Michigan Wireline from surface to TD at 26-29 ft/min after the well was shut-in for at least 36 hours, in accordance with US EPA Region 5 UIC Branch – Regional Guidance #5.

Before running the survey, a bucket calibration was performed using a calibrated temperature meter that recorded a temperature of 97.5 degrees Fahrenheit (°F) in a fluid where the temperature tool measured an average temperature of 97.6 °F. In a fluid where the calibrated meter read 35.0 °F, the temperature tool read 34.8 °F.

The differential temperature survey was run from the surface to 4336 feet at an average logging speed of 27.6 ft/min. The well was full of fluid and had approximately 127 psi surface pressure. The differential temperature survey shows a gradual increase in temperature, with no anomalous temperature changes, from approximately 71.3 °F near the surface to 86.9 °F at 4336 feet. From 3902 feet to 3935 feet (packer depth), the temperature gradually decreased from 82.2 °F to 80.8 °F. Below the packer, the formation temperature continued to decrease to a low of 76.3 °F at a depth of 4199 feet. TD was found at 4336 feet, indicating 214 feet of fill in the bottom of the well.

The absence of anomalous temperature changes in the differential temperature survey demonstrates that no fluid movement has occurred outside of the protection casing in Well 2-12. The differential temperature survey, therefore, demonstrated Well #2-12 has external mechanical integrity. A copy of the Temperature Survey is included as Exhibit 1, and a completed EPA Temperature Survey Form that includes background information of the survey is included as Appendix F.

5.0 RADIOACTIVE TRACER SURVEY

A Radioactive Tracer Survey was run in Well #2-12 on August 16, 2022, after running the differential temperature survey. The survey was conducted using the facility's pump and fresh water. After correlating the log with the top of the packer set at 3930 feet, the tool tagged bottom at 4335 feet which was 1 foot shallower than with the differential temperature survey.

A Base Pass was made from 4335 feet to 2989 feet, and 5-minute statistical checks were made at 3800 feet and 3855 feet. While injecting into the well at 1 bbl/min (42 gal/min), a 4-second slug of radioactive material (Iodine-131) was released at 3100 feet. Five Chase Passes were made through the radioactive slug as it traveled down the tubing and dissipated into the Injection Interval, below the 7-inch protection casing set at 3982 feet, dissipating at approximately 4034 feet. A summary of the Chase Passes with flow rate is provided as Table 1. No radioactive material was detected exiting the well above the Injection Interval, demonstrating the external mechanical integrity of the well.

The injection rate was kept at 42 gal/min, and a 4-second slug of radioactive material was released at 3750 feet. The upper and lower gamma ray detectors were then positioned at 3,955 feet and 3,960 feet, respectively. At 14:49:57 the slug passed by the upper gamma ray detector, and 17 seconds later at 14:50:14, the slug passed by the lower gamma ray detector. Approximately 35 seconds after the radioactive slug passed by each gamma ray detector, the level of radiation returned to background levels on both gamma ray detectors and remained at background levels for the duration of the time-drive survey. The time-drive survey was terminated at 15:21:59 which was 32 minutes after the radioactive slug passed by the lower gamma ray detector. No vertical migration was detected during the time-drive survey, demonstrating the base of the 7-inch protection casing cement had mechanical integrity.

A final gamma ray pass was made from 4338 feet to 2989 feet following the time-drive survey. Above approximately 4220 feet, the final pass repeated the base pass with the upper and lower gamma ray detectors. Below 4220 feet, both gamma ray detectors averaged approximately 30 counts/sec higher on the final pass, indicating residual tracer material in the borehole. Some of this small increase may have been due to residual radioactive material in the borehole getting dispersed with movement of the tool.

A copy of the Radioactive Tracer Survey is included as Exhibit 2. Appendix G provides a completed EPA Radioactive Tracer Survey Form with background information of the Well #2-12 survey.

6.0 PRESSURE FALLOFF ANALYSIS

Pressure falloff testing was conducted on Well 2-12 from August 17, 2022, through August 19, 2022. A Badger Tri Tool, Serial No. 5599 pressure gauge was utilized during the testing. The gauge calibration certificates are presented in Appendix C and show the gauges have been calibrated as specified by the gauge manufacturer.

Injection Period

The rate data used in the analysis of the falloff pressure data was the injection period on August 17, 2022, through shut-in. Well 2-12 was shut in on August 17, 2022, to run the bottom-hole pressure gauges. Injection resumed on August 17, 2022 at 1419 hours then continued for approximately 11.15 hours. General well and reservoir information is presented in Table 2. Information pertinent to the injection period is presented in Table 3.

Falloff Period

Well 2-12 was shut in at 0128 hours on August 18, 2022 and remained shut-in for approximately 29.03 hours while the bottom-hole pressure and temperature were recorded. Appendix H lists the pressure and temperature data recorded during the test. Table 4 contains information pertinent to the falloff period of the test.

Analysis of Falloff Test

The pressure data obtained during the falloff test were analyzed utilizing the commercially available pressure transient analysis software program PanSystem[®]. The PanSystem[®] output for the analysis of this test is presented in Appendix I. J.O. Well Service and Testing Inc's pressure test report is presented as Appendix J. A completed EPA Pressure Falloff Test Form is provided in Appendix K.

Figure 4 shows the pressure response recorded by the bottom-hole pressure tool from the time the tool was in place through the 29.03-hour shut-in period. Figure 5 is a Cartesian plot of the pressure data recorded during the falloff period. The superposition time function was used to account for all rate changes during the injection buildup period of the testing.

Figure 6 is a log-log diagnostic plot of the falloff data, showing change in pressure and pressure derivative versus elapsed shut-in time. Radial flow begins to appear at an elapsed time following shut-in of 7.99 hours and continues until an elapsed time following shut-in of 11.01 hours. The radial flow regime is indicated on Figure 7.

The reservoir permeability was determined from the radial flow region of the superposition Horner plot (Figure 7). The radial flow regime begins at a superposition Horner time of 2.39 and continues until 2.01. Figure 8 shows an expanded view of the superposition Horner plot. The slope of the radial flow period was determined to be 73.386 psi/cycle.

An estimate of mobility-thickness, kh/μ , for the reservoir was determined from the following equation:

$$\frac{kh}{\mu} = 162.6 \frac{q B}{m}$$

Where,

- kh/μ = formation mobility-thickness, millidarcy-feet/centipoise
- q = rate prior to shut-in, bpd
- B = formation volume factor, reservoir volume/surface volume
- m = slope radial flow period, psi/cycle

With the following values, the mobility-thickness was found to be 3,491 md-ft/cp:

- q = 1575.43 barrels/day
- m = 73.386 psi/cycle
- B = 1.0 reservoir barrel/surface barrel

$$\frac{kh}{\mu} = 162.6 \frac{(1575.43)(1.0)}{73.386}$$

$$= 3,491 \text{ md-ft/cp}$$

The permeability-thickness, kh , was determined to be 4,678 md-ft by multiplying the mobility-thickness, kh/μ , by the viscosity of the reservoir fluid, μ_{res} , of 1.34 centipoise:

$$kh = \left(\frac{kh}{\mu}\right) \mu_{res}$$

$$= (3,491) (1.34)$$

$$= 4,678 \text{ md-ft}$$

The average reservoir permeability using the total thickness of 133 feet was determined to be 35.2 md:

$$k = \frac{(kh)}{h}$$

$$= \frac{4,678}{133}$$

$$= 35.2 \text{ md}$$

To determine whether the pressure transient was indeed beyond the waste front, the travel time for the pressure transient to pass beyond the waste front was calculated. The distance to the waste front is determined from the following equation:

$$r_{waste} = \left(\frac{0.13368 V}{\pi h \phi} \right)^{1/2}$$

Where:

- r_{waste} = radius to waste front, feet
- V = total volume injected into the injection interval, gallons
- h = formation thickness, feet
- ϕ = formation porosity, fraction
- 0.13368 = constant

The time necessary for a pressure transient to travel this distance is calculated from the following equation:

$$t_{waste} = 948 \frac{\phi \mu_{waste} c_t r_{waste}^2}{k}$$

Where:

- t_{waste} = time for pressure transient to reach waste front, hours
- ϕ = formation porosity, fraction
- μ_{waste} = viscosity of the waste at reservoir conditions, centipoise
- r_{waste} = radius to waste front, feet
- c_t = total compressibility of the formation and fluid, psi
- k = formation permeability, millidarcies
- 948 = constant

Combining the previous two equations results in:

$$t_{waste} = 126.73 \frac{V \mu_{waste} c_t}{\pi k h}$$

The waste viscosity is 0.80 centipoise at reservoir conditions, while viscosity of brine in the reservoir is 1.34 centipoise. A cumulative volume of approximately 43,539,706 gallons of waste has been injected into Well 1-12 since injection began. The formation has a porosity of 0.11 and a total compressibility of 6.20×10^{-6} psi⁻¹. The time necessary for a pressure transient to traverse the distance from the wellbore to the leading edge of the waste front, would then be 1.86 hours:

$$t = 126.73 \frac{(43,539,706)(0.80)(6.20 \times 10^{-6})}{(\pi)(35.2)(133)}$$
$$= 1.86 \text{ hours}$$

Since the radial flow period occurred from 7.99 to 11.01 hours elapsed time following shut-in, the use of the injected waste viscosity for calculating permeability during the radial flow period was valid.

The skin factor was determined from the following equation:

$$s = 1.151 \left[\frac{P_{wf} - P_{1hr}}{m} - \log \left(\frac{k}{\phi \mu c_t r_w^2} \right) + 3.23 \right]$$

Where,

- s = formation skin damage at open perforations, dimensionless
- 1.151 = constant
- p_{wf} = flowing pressure immediately prior to shut-in, psia
- p_{1hr} = pressure determined by extrapolating the radial flow semi-log line to a Δt of one hour, psi
- m = slope of the radial flow semi-log line, psi/cycle
- k = permeability of the formation, md
- ϕ = porosity of the injection interval, fraction
- μ = viscosity of the fluid the pressure transient is traveling through, centipoise
- c_t = total compressibility of the formation plus fluid, psi^{-1}
- r_w = radius of the wellbore, feet
- 3.23 = constant

The final flowing pressure was 2621.50 psia. The pressure determined by extrapolating the radial flow semi-log line to a Δt of one hour, p_{1hr} , was 1947.25 psia. The porosity of the injection interval, ϕ , is 0.11 and the total compressibility, c_t , is $6.2 \times 10^{-6} \text{ psi}^{-1}$. The wellbore radius, r_w , is 0.3646 feet. Using these values in addition to the previously determined parameters, m and k, results in a skin of 4.55:

$$s = 1.151 \left[\frac{2621.50 - 1947.25}{73.386} - \log \left(\frac{35.2}{(0.11)(1.34)(6.2 \times 10^{-6})(0.3646)^2} \right) + 3.23 \right]$$

$$= 4.55$$

The change in pressure, Δp_{skin} , in the wellbore associated with the skin factor was determined to be 290.16 psi using the slope of the straight-line portion of the radial flow plot, the calculated skin factor, and the following equation:

$$\Delta p_{skin} = 0.869 ms$$

Where:

- 0.869 = constant
- m = slope from superposition plot of the well test, psi/cycle
- s = skin factor calculated from the well test

$$\Delta p_{\text{skin}} = 0.869 (73.386) (4.55)$$

$$\Delta p_{\text{skin}} = 290.16 \text{ psi}$$

The flow efficiency (E) was determined from the following equation:

$$E = \frac{p_{\text{wf}} - p^* - \Delta p_{\text{skin}}}{p_{\text{wf}} - p^*}$$

Where:

- E = flow efficiency, fraction
- p_{wf} = flowing pressure prior to shutting in the well for the falloff, 2621.50 psia
- p^* = pressure extrapolated to an infinite shut-in time from the straight-line portion of the radial flow plot, 1867.67 psia
- Δp_{skin} = pressure change due to skin damage, 290.16 psi

Substituting these values, the flow efficiency was calculated to be 0.62:

$$E = \frac{2621.50 - 1867.67 - 290.16}{2621.50 - 1867.67}$$

$$= 0.62$$

Table 5 presents a summary of calculated test data determined from the analysis.

Table 6 presents a summary of the results determined from the analysis.

7.0 BOTTOM-HOLE PRESSURE MEASUREMENT AND STATIC GRADIENT SURVEY

On August 19, 2022, a static gradient survey was performed while pulling the pressure gauges out of the well. Gradient stops were made at 3000 feet, 2000 feet, 1000 feet 500 feet, and at the surface. The bottom-hole pressure and temperature, after approximately 29.03 hours of shut-in at 3975 feet, were 1861.60 psia and 76.04 °F, respectively. The data printout for the static gradient survey is presented as Appendix L. A tabulation of the survey results is provided as Table 6. The data are depicted graphically in Figure 9.

8.0 CONCLUSIONS

In conclusion, Republic Well No. 2-12 has mechanical integrity in accordance with 40 CFR 146.08 a (1) and in accordance with U.S. EPA Permit Number MI-168-1W-C011, and in accordance with the State of Michigan administrative rule R299.2393 (Michigan Permit Number #M-453) by demonstrating that:

- There is no significant leak in the casing, tubing or packer, as evidenced by an annulus pressure test conducted on August 15, 2022.
- The August 16, 2022 differential temperature survey displayed no indication of any fluid having an upward movement, thus confirming external integrity.
- The cement at the top of the injection interval has integrity and all injected fluids exited the injection tubing below the packer and moved out into the injection zone as demonstrated by the radioactive tracer log dated August 16, 2022.

With the submittal of this report, the ambient pressure monitoring and mechanical integrity testing conducted on Well 2-12 satisfies the United States Environmental Protection agency requirements which are included in the Class I UIC well permit number MI-163-1W-C0011

TABLES

TABLE 1

RADIOACTIVE TRACER SURVEY CHASE PASS SUMMARY

Chase Pass	Time Logged	Peak Slug Depth (ft KB)	Distance Traveled (ft)	Time Between Slugs (min)	Volume Between Slugs (gal)	Flow Rate (gpm)
1	13:47:58	3150.8				
2	13:51:08	3344.8	194.0	3.2	134.4	42
3	14:01:02	3943.6	598.8	9.9	415.8	42
4	14:23:30	4019.8	76.2	22.5	945.0	42
5	14:37:38	4034.0	14.2	14.1	592.2	42

**TABLE 2
GENERAL TEST INFORMATION**

PARAMETER	VALUE	SOURCE/JUSTIFICATION
Dates of test	August 17-19, 2022	
Time since reservoir pressure was last stabilized	8/17, 2-12 inactive while running gauges for PFOT	Republic plant records
Shut-in time prior to test	96 hours	Republic plant records
Stabilized pressure and temperature prior to test	N/A	
Cumulative injection into completed interval (gallons)	#1-1249,616,461 #2-1243,539,706 Total:93,156,167	Republic plant records
Wellbore Radius (inches)	4.375	Figures 1 and 2
Completed Intervals (feet KB)	3,975 – 4,550	Figures 1 and 2
Type of Completion	Open-Hole	Figures 1 and 2
Depth to Fill (feet KB)	4,336	Temp Survey conducted 08/16/22
Interval Thickness (feet)	133	No-Migration Petition Revision, Section VI (September 2002)
Average historical waste fluid viscosity	0.80	Estimated from Waste Stream Characteristics (30K TDS)
Formation fluid viscosity (cp)	1.34	No-Migration Petition Revision, Section VI (September 2002)
Porosity	11%	No-Migration Petition Revision, Section VI (September 2002)
Total Compressibility (psi ⁻¹)	6.20 x 10 ⁻⁶	No-Migration Petition Revision, Section VI (September 2002)
Formation volume factor	1	Assumed since the dominant fluid is water
Initial formation bottom-hole pressures	1,779.5 psia @ 3,950' KB MD / 3,856' KB TVD	No-Migration Petition Revision, Section VI (September 2002)
Initial formation bottom-hole temperature	86.4 °F @ 3,950' KB MD / 3,856' KB TVD	No-Migration Petition Revision, Section VI (September 2002)

**TABLE 3
INJECTION PERIOD**

PARAMETER	VALUE	SOURCE/JUSTIFICATION
Time of injection period (hours)	11.15 hours	Appendices 2 & 6 / Figure 3
Type of test fluid	Republic Storm Water	
Final Injection rate (gpm)	45.95	Appendices 2 & 6 / Figure 3
Pumps used for test	Facility Pump	
Distance from shut-in valve to wellhead	20 feet	Measured
Injection fluid viscosity (cp)	0.95	Estimated (based on Fresh Water @ 73 °F)
Injection fluid density (gm/cc)	1.00	Measured
Method and time viscosity tested	Not measured	
Final injection pressure	2,621.50 psia	Appendix H
Gauge temperature at shut-in	67.44 °F	Appendix H
Gauge type	Cal-Scan	Appendix D
Gauge model	Badger Tri Tool, SN 5599	Appendix D
Gauge sensitivity	Accuracy: (0.024% FS) Resolution: (0.0003% FS)	Appendix D
Gauge depth (feet KB)	3,975	Appendix B
Manufacturer's recommend gauge calibration frequency	Annual	Appendix D

**TABLE 4
FALL-OFF PERIOD**

PARAMETER	VALUE
Total shut-in time	29.03 hours
Final shut-in pressure	1,876.21 psia
Final shut-in temperature	76.27 °F

**TABLE 5
CALCULATED TEST DATA**

CALCULATED PARAMETER	VALUE
Time to Waste Front (hours)	1.86
Time of Radial Flow Regime (hours)	7.99 – 11.01
Time to End of Wellbore Storage (hours)	0.1395
Radial Flow (Horner) Time at End of Wellbore Storage	94.50
Slope of Straight-Line Portion of Radial Flow Plot (psi/cycle)	73.386
Injection Reservoir Transmissibility (md-ft/cp)	3,491
Permeability (mD)	35.2
Skin Factor (dimensionless)	4.55
Pressure Loss @ 45.95 gpm Due to Skin Damage (psi)	290.16
Flow Efficiency (fraction)	0.62

**TABLE 6
SUMMARY OF PANSYSTEM FALL-OFF ANALYSIS**

SOURCE	PARAMETER	2-12 VALUE	UNITS
Log-Log and Derivative Information	Total Shut-in Time	29.03	hours
	Derivative Smoothing Factor	0.070	
	Radial Flow Period (elapsed)	7.99 – 11.01	hours
Information from Superposition Plot	Slope of Semi-Log Straight Line	73.386	psi/cycle
	Pressure at Infinite Shut-in Time	1867.67	psia
	Pressure at 1-hour from Shut-in (Extrapolation of Semi-Log Straight Line)	1947.25	psia
Semi-Log Analysis	Mobility Thickness	3,491	md-ft/cp
	Permeability Thickness	4,678	md-ft
	Permeability	35.2	md
	Formation Skin Damage	4.55	

TABLE 7

STATIC PRESSURE GRADIENT SURVEY

WELL No. 2-12

AUGUST 19, 2022

Memory Gauge Serial No. 5599			
Depth (feet)	Pressure (psig)	Pressure Gradient (psi/ft)	Temperature (°F)
0	139.18	-	63.53
1000	573.03	0.434	58.10
2000	1006.64	0.434	62.40
3000	1439.29	0.433	74.14
3975	1861.60	0.433	76.04

FIGURES

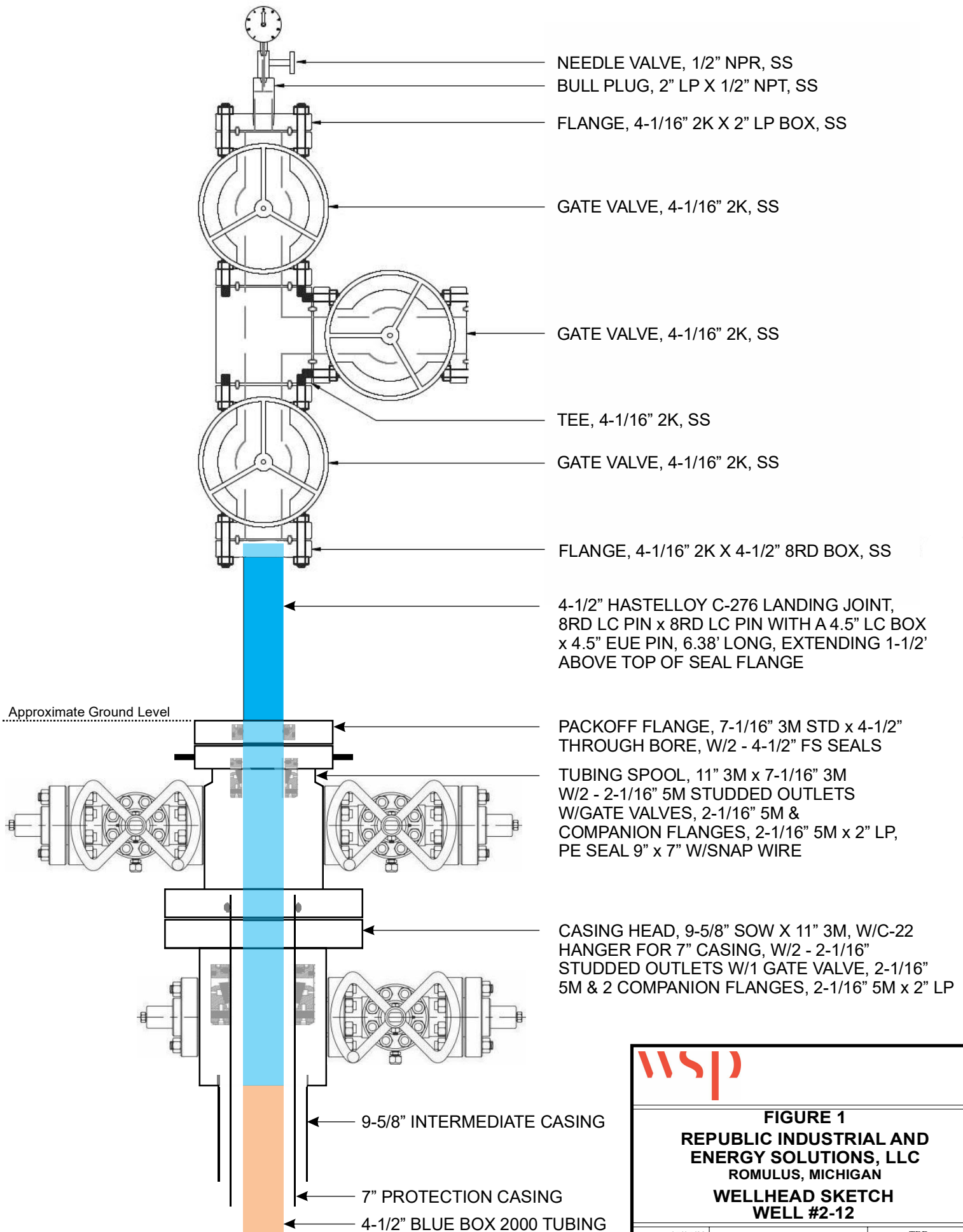
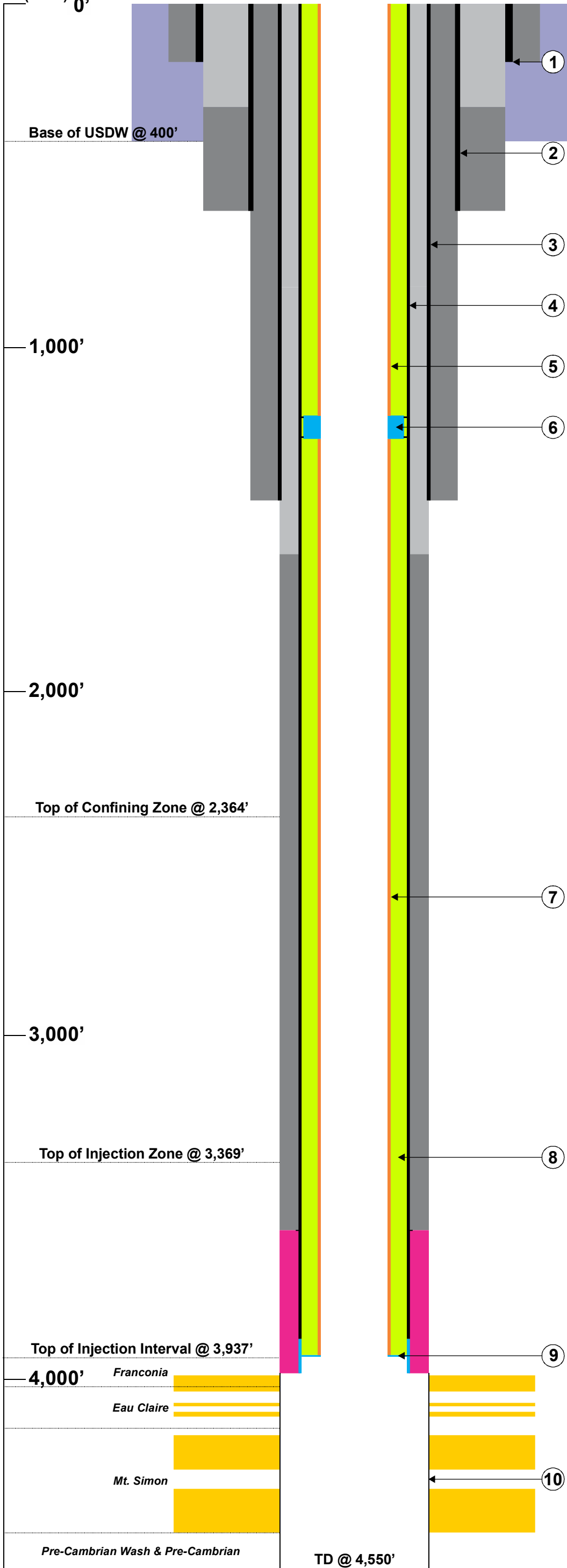


FIGURE 1
REPUBLIC INDUSTRIAL AND ENERGY SOLUTIONS, LLC
 ROMULUS, MICHIGAN
WELLHEAD SKETCH
WELL #2-12

DATE	07/05/22	CHECKED BY	JOB NO.	TBD
DRAWN BY	SLK	APPROVED BY	DWG NO.	

Depth Scale
(ft KB)



BELOW GROUND DETAILS

1. **Conductor Casing:** 16", 60 lb/ft set in a 20" borehole at 169'. Cemented with 300 sacks of Class A cement containing 3% CaCl₂ with 75% returns.
2. **Surface Casing:** 13-3/8", 48 lb/ft, H-40, ST&C set in a 17-1/2" borehole at 602'. Cemented with 350 sacks of 65/35 Pozalin with 3% CaCl₂ followed by 200 sacks of Class A tail cement with 3% CaCl₂. Top-out with 50 sacks of Class A cement with 3% CaCl₂.
3. **Intermediate Casing:** 9-5/8", 36 lb/ft set in a 12-1/4" borehole at 1,444'. Cemented with 725 sacks of Class A with 3% CaCl₂. 33 bbl of cement circulated to the surface.
4. **Protection Casing:** 7", 26 lb/ft, K-55, LT&C set in an 8-3/4" borehole to 3,882' and 7", 1/4" wall, Hastelloy C-276, STL set in 8-3/4" borehole from 3,882' to 3,979.4' with 7" float collar and float shoe set from 3,979.4' to 3,982'. Top 10' of Hastelloy coated with Teflon for galvanic corrosion inhibition. Cement diverter tool set in 7" casing from 3,565.5' to 3,568'.
 Stage I (3,568' to 3,982'):
 686 gallons (16.3 bbl) of 12.5 lb/gal EPSEAL epoxy cement.
 Stage II (Surface to 3,568'):
 310 sacks of 50/50 of Poz followed by 340 sacks of 50/50 Poz with microbond followed by 450 sacks of Standard cement with microbond. 44 bbl circulated to surface.
5. **Upper Injection Tubing:** 4-1/2", Blue Box 2000, fiberglass tubing to top of straddle packer at 1,199':
 a) 6', 4-1/2" Hastelloy C-276 landing joint top positioned ~2' above ground level with 1' of stretch. (Landing Joint base = 15.38' KB);
 b) 2 Pup Joints (5.71' + 9.73'), 4-1/2", Blue Box FRP from 15' to 31';
 c) 4-1/2", Blue Box FRP tubing (40 joints) from 31' to 1,199';
 d) Anchor Seal Assembly, 4.75" x 3.75", Hastelloy C-276, 1.64' long set in Model 12 Injection Packer PBR from 1,199' to 1,200.5'.
6. **Straddle Packer:** Model 12, Hastelloy C-276 wetted parts set from 1,199' to 1,268'. Upper Element at 1,204' and Lower Element at 1,265'.
7. **Lower Injection Tubing:** 4-1/2", Blue Box 2000, fiberglass tubing set from 1,268' to 3,930' with 2' of stretch as follows:
 a) 4-1/2", Blue Box FRP tubing (91 joints) from 1,268' to 3,930'.
 b) Anchor Seal Assembly, 4.75" x 3.75", Hastelloy C-276, 1.64' long set in Model 12 Injection Packer PBR from 3,930.0' to 3,931.5'.
8. **Annulus Fluid:** 66 bbl (2,772 gallons) of 9.7 lb/gal brine water containing a corrosion inhibitor, a bactericide and an oxygen scavenger.
9. **Injection Packer:** Model 12, Hastelloy C-276 wetted parts set from 3,930' to 3,935'.
10. **Open Hole Completion:** 8-3/4" borehole from 3,975' to 4,550'.

LEGEND

- | | | |
|----------------------|-------------------|----------------------|
| - USDW | - Fiberglass | - Standard Cement |
| - Receptive Interval | - Carbon Steel | - Lightweight Cement |
| - Annulus Fluid | - Hastelloy C-276 | - Epoxy Cement |

Vertical Scale: 1" = 300'



WSP USA INC.
8212 Kelwood Ave.
Baton Rouge LA 70806
Tel: (225) 753-2561
Fax: (225) 925-2530

FIGURE 2

REPUBLIC INDUSTRIAL AND ENERGY SOLUTIONS, LLC
ROMULUS, MICHIGAN

WELL #2-12 BELOW GROUND DETAILS AFTER PHASE II WORKOVER

DATE 07/05/22	CHECKED BY	JOB NO. TBD
DRAWN BY SLK	APPROVED BY	DWG NO.

**Annulus Pressure Test
Well 2-12
August 15, 2022**

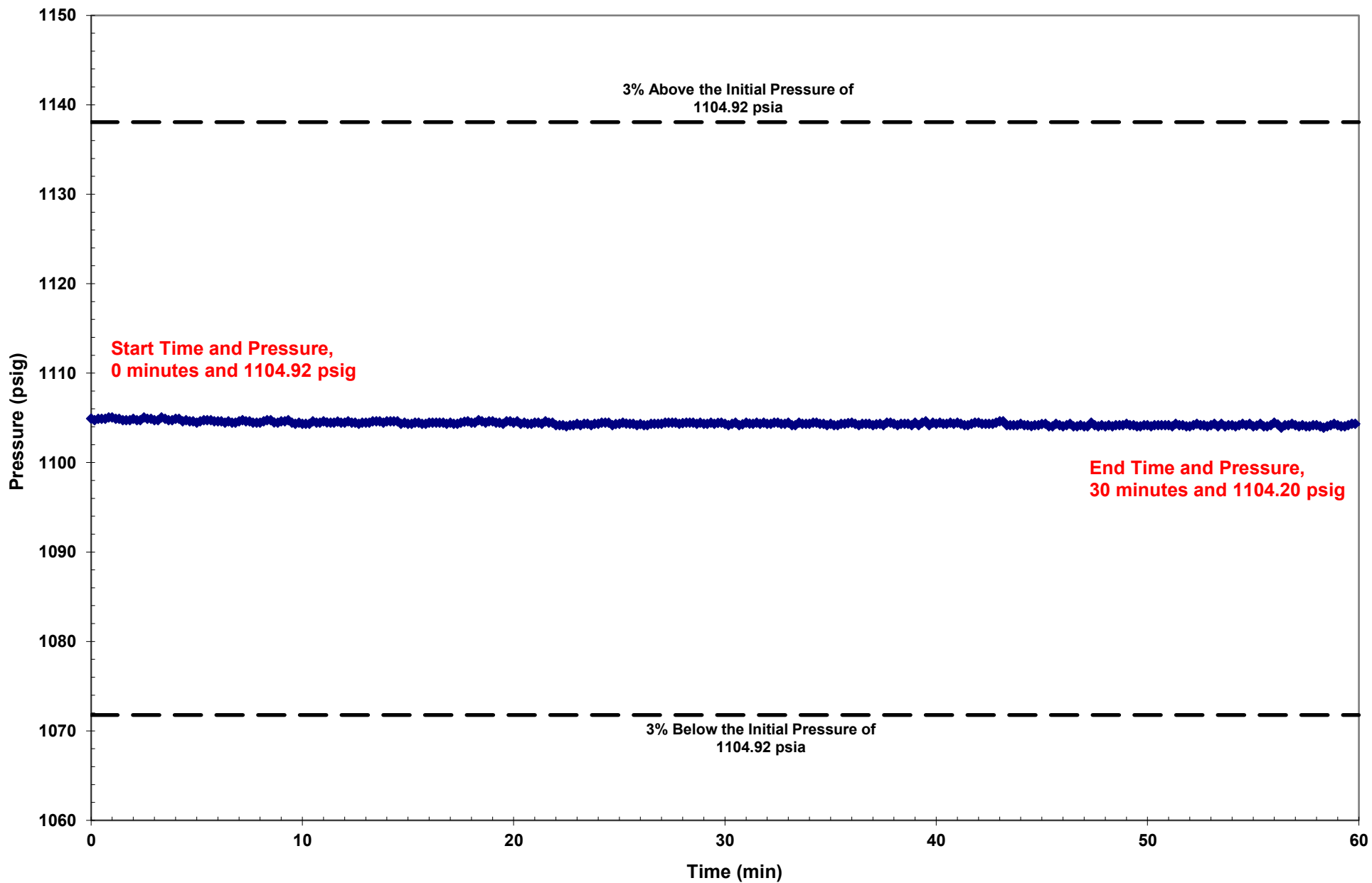


FIGURE 3

Figure 4: #2-12 2022 Test Overview Plot

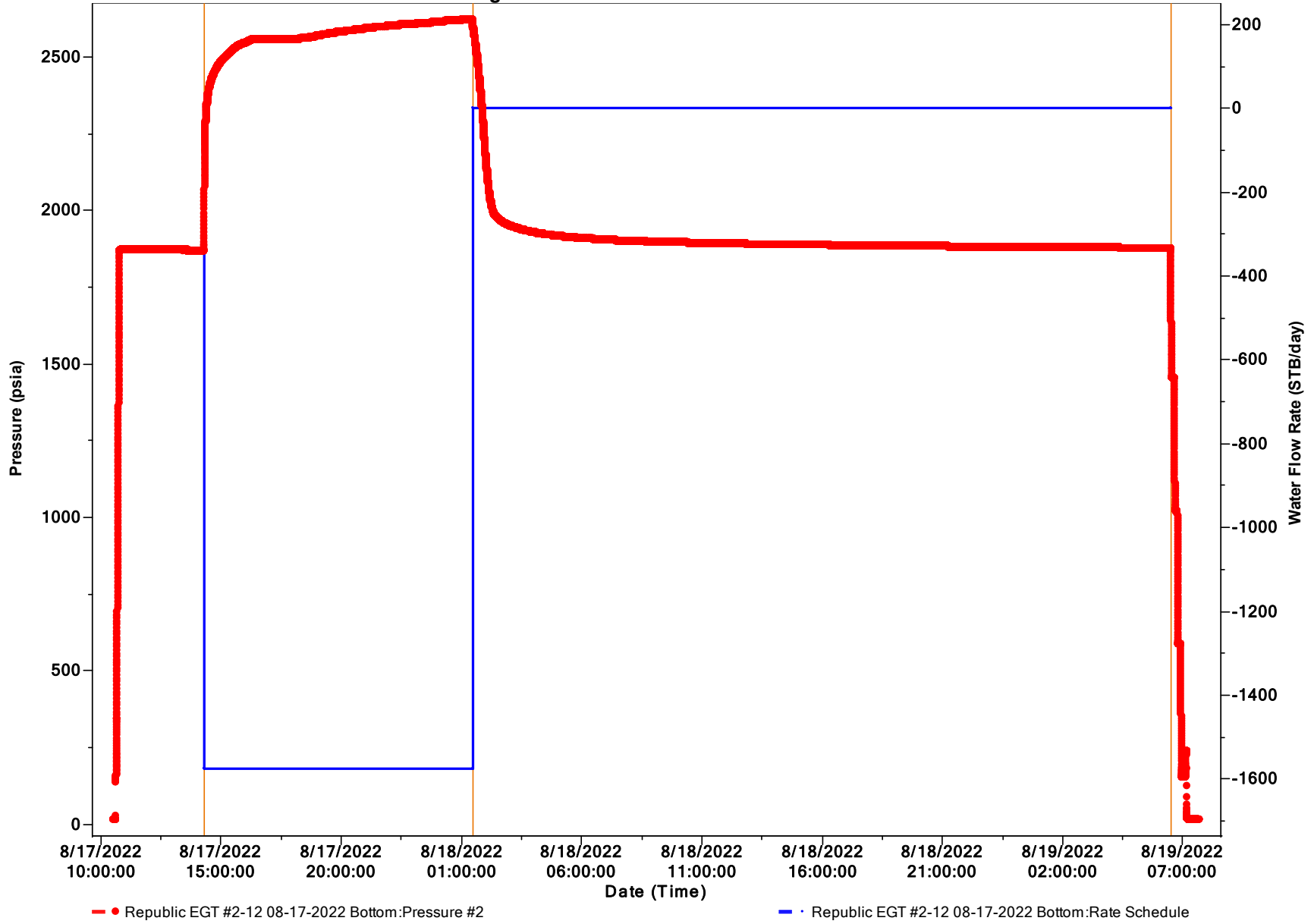


Figure 5: #2-12 2022 Cartesian Plot

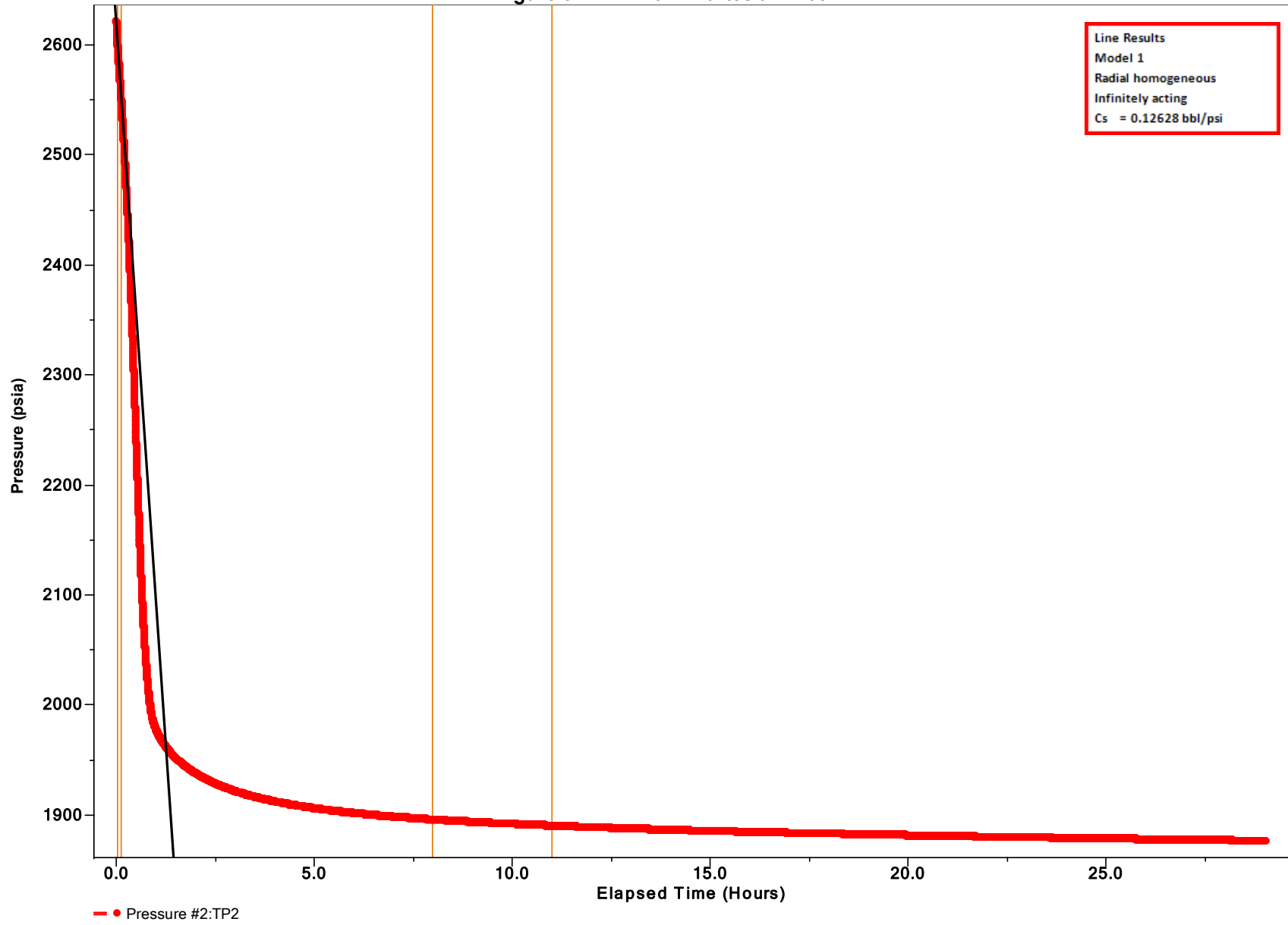


Figure 6: #2-12 2022 Log-Log Plot

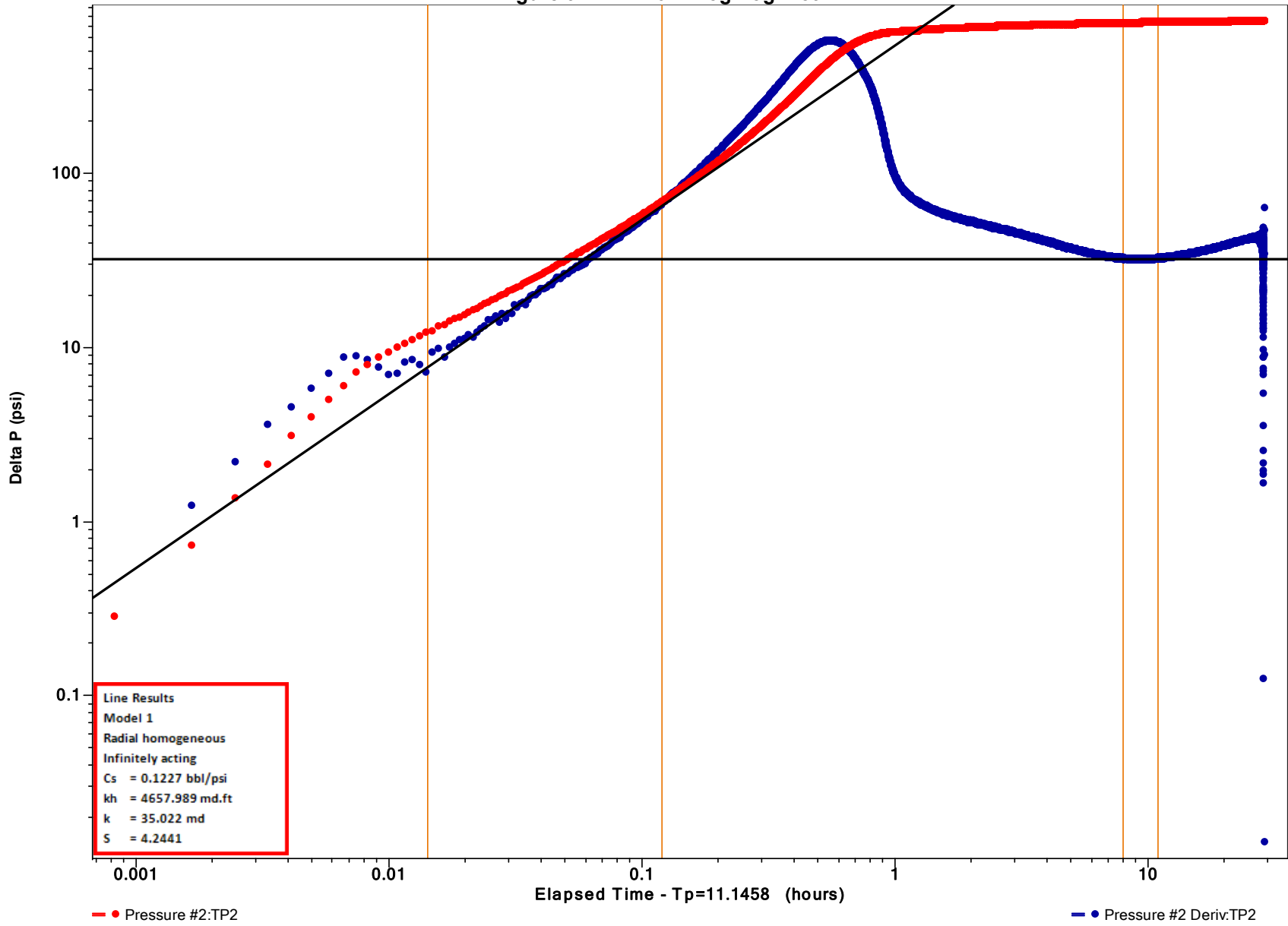


Figure 7: #2-12 2022 Radial Flow Plot

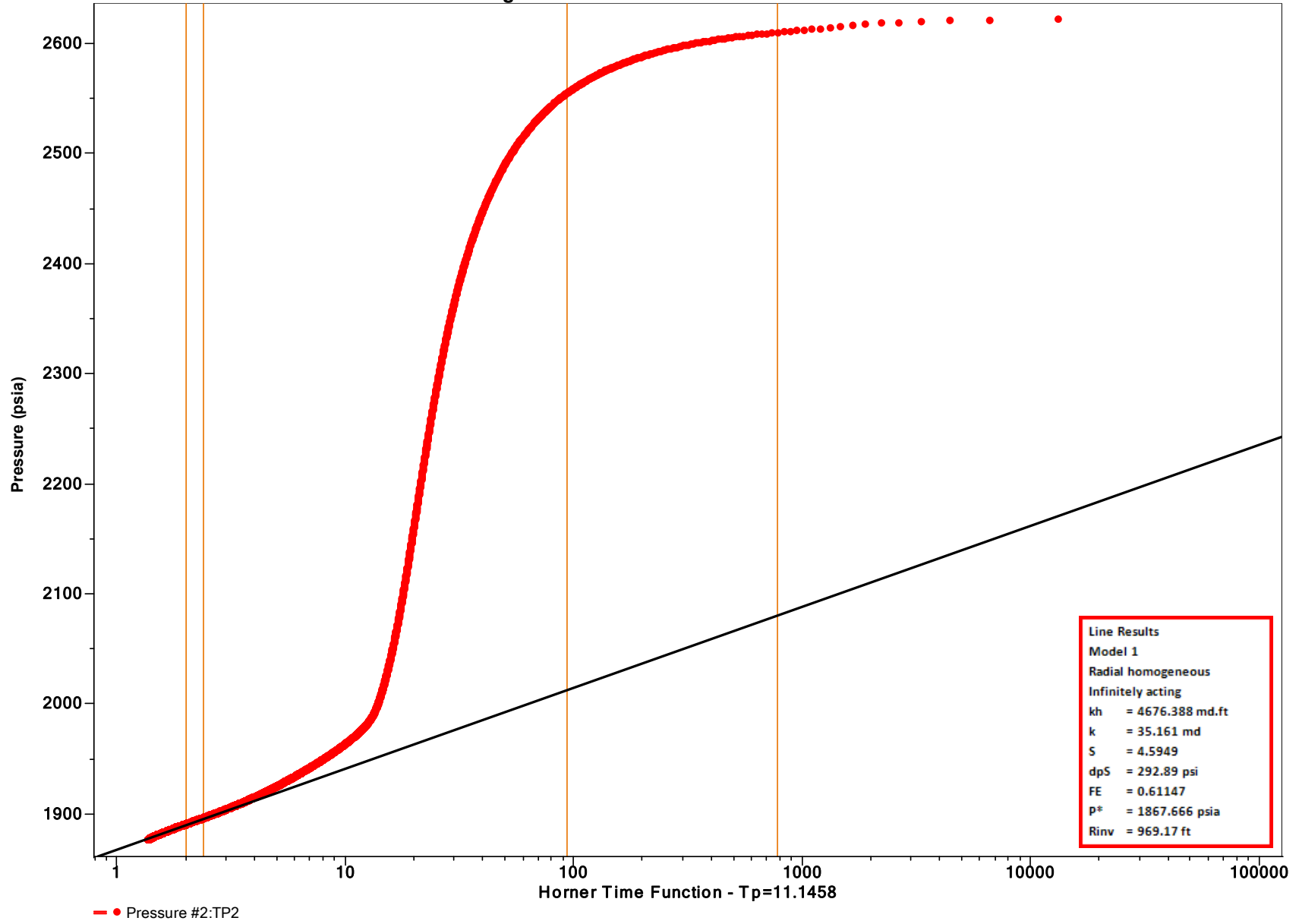
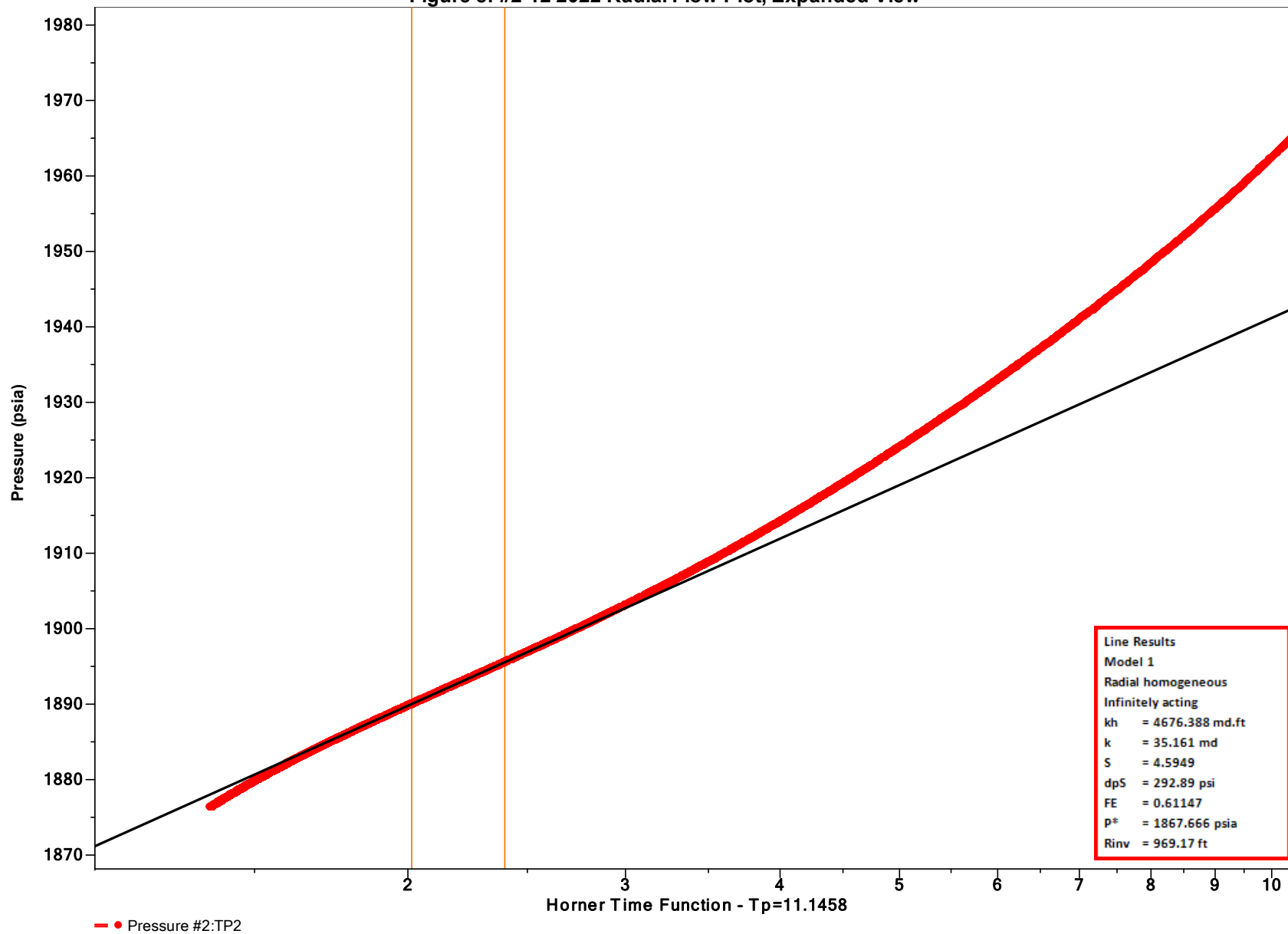


Figure 8: #2-12 2022 Radial Flow Plot, Expanded View



STATIC PRESSURE GRADIENT SURVEY
WELL No. 2-12
AUGUST 19, 2022

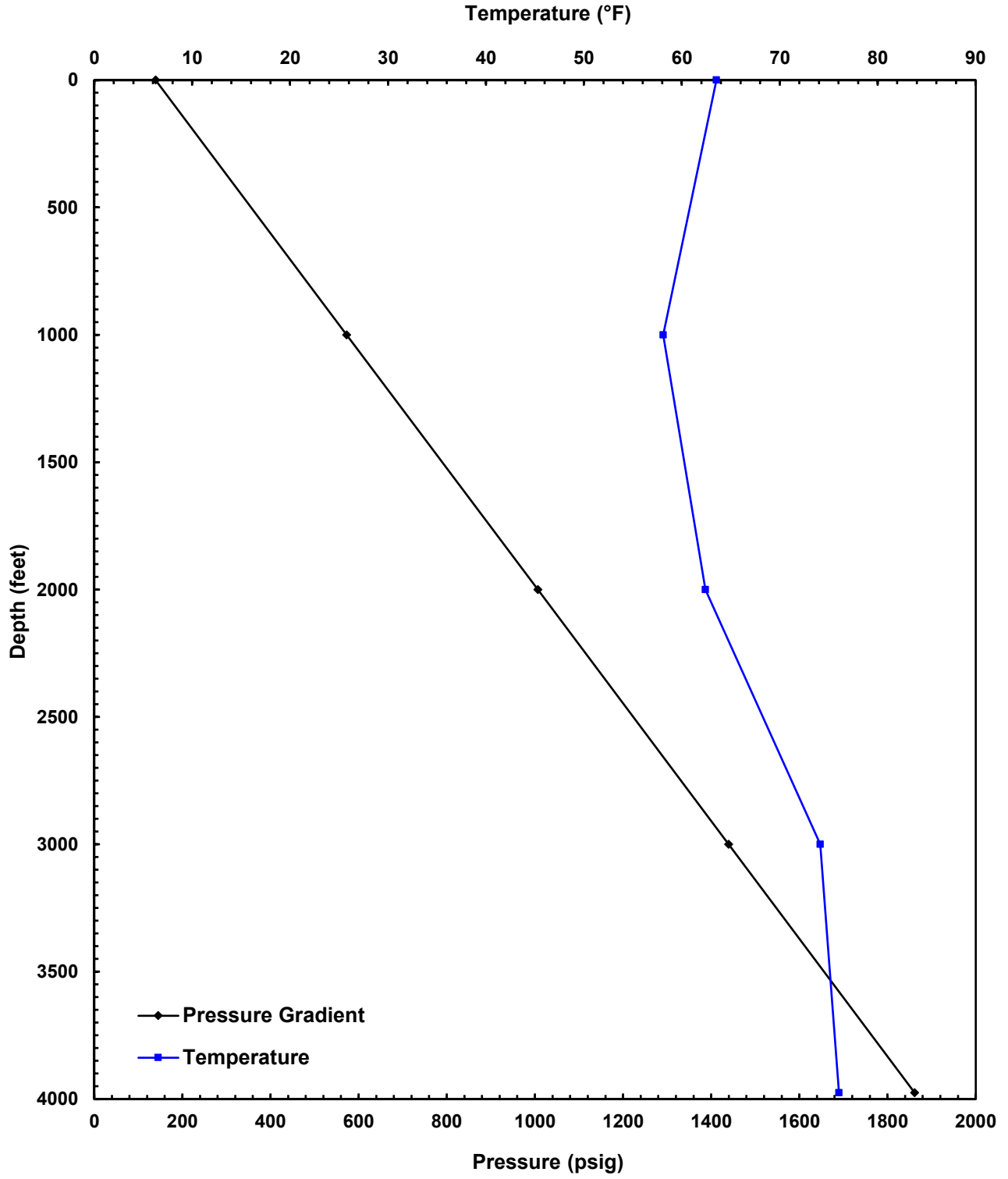


FIGURE 9

APPENDICES



APPENDIX A
REGULATORY CORRESPONDENCE



From: Kelly, Stephen L.
Sent: Friday, August 5, 2022 8:09 PM
To: Rubin, Jason; Rodriquez, Tom; John Frost; Tahtouh, Jeffry
Subject: Fwd: 2022 Annual Mechanical Integrity and Reservoir Monitoring Procedures for Republic Wells 1-12 and 2-12 (Romulus, Michigan Facility)
Attachments: image001.png; FOT.pdf; RTS.pdf; TempLog.pdf

Sent from my iPhone

Begin forwarded message:

From: "Fisher, Marc" <Fisher.Marc@epa.gov>
Date: August 5, 2022 at 6:22:34 PM CDT
To: "Kelly, Stephen L." <STEVE.KELLY@wsp.com>
Cc: "Greenhagen, Andrew" <Greenhagen.Andrew@epa.gov>, "Chase, Felicia" <chase.felicia@epa.gov>, "Roy, Stephen" <roy.stephend@epa.gov>, R5UICWellTesting <R5UICWellTesting@epa.gov>
Subject: RE: 2022 Annual Mechanical Integrity and Reservoir Monitoring Procedures for Republic Wells 1-12 and 2-12 (Romulus, Michigan Facility)

EPA has reviewed the procedures you proposed on July 7, 2022 for temperature logs, radioactive tracer surveys, and fall-off tests in Republic Wells 1-12 and 2-12, Romulus (EPA UIC Permit #MI-163-1W-C010 and MI-163-1W-C011). Your proposed procedures are hereby approved unless you receive additional email correspondence in the next three business days from Marc Fisher approving the procedures with conditions or disapproving the procedures. EPA offers the following comments on the procedures:

1. All data must be submitted with the test reports
2. For fall-off testing: EPA typically recommends a pressure build-up period of longer than 10 hours since the most reliable fall-off data occurs during only half the build-up period. A longer build-up period lends itself to more reliable data. Also, EPA requests that the raw data from the fall-off tests be submitted digitally with a link to a file exchange site. It makes the process for our review and interpretation of the data easier.

A blank test information sheet is attached to this email – please complete and return it for each test when you submit your report. Please note all the items listed under “Remember” at the bottom of the information sheet. These items will help ensure that all the information we require for interpretation of the test will be included in your submission. Please remember to submit the digital data either on CD, USB flash drive, or by email when you submit your report. If a test does not provide definitive information concerning the conditions which it is designed to ascertain, or approved procedures are not followed, you will be required to rerun the test.

It is our practice that testing be witnessed by our contract field inspector to the extent possible. If you have not already done so, please contact Felicia Chase at chase.felicia@epa.gov to schedule the witnessing of these tests. Unwitnessed tests are only acceptable if it is impossible for the field inspector to be present.

If you have any questions or if you find during a test that you are unable to follow the approved procedures, please contact Marc Fisher at (312) 886-4240 or fisher.marc@epa.gov.

Please note: We have established an additional email address of R5UICWellTesting@epa.gov. You may now send all correspondence relating to well test witness scheduling, procedure approvals, and electronic report/data submissions to this inbox. At this time, EPA still requires a copy of the test report via paper with appropriate signature for the permanent file.

Marc R. Fisher
Geologist, UIC Section
Water Division
USEPA Region V
77 West Jackson Blvd
Chicago, IL 60604
(312) 886-4240

From: Kelly, Stephen L. <STEVE.KELLY@wsp.com>
Sent: Thursday, July 07, 2022 11:08 AM
To: Greenhagen, Andrew <Greenhagen.Andrew@epa.gov>; Chase, Felicia <chase.felicia@epa.gov>; vugrinovichr@michigan.gov
Cc: Rodriquez, Tom <trodriquez@republicservices.com>; Frost, John <JFrost@republicservices.com>; Rubin, Jason <jrubin@republicservices.com>
Subject: 2022 Annual Mechanical Integrity and Reservoir Monitoring Procedures for Republic Wells 1-12 and 2-12 (Romulus, Michigan Facility)

On behalf of Republic Services, WSP is submitting for review/approval the attached Procedures for conducting annual mechanical integrity tests and annual reservoir monitoring (injection/falloff tests) on Well 1-12 (API No. 21-163-M452) and Well 2-12 (API No. 21-163-M453).

These are Commercial, Class I hazardous wells that operate at the Republic Industrial and Energy Solutions, LLC facility in Romulus, Michigan.

Let me know if you have any questions.

Steve Kelly
Senior Project Manager

Main: +1 225-753-2561
Direct: +1 225-508-3867
Mobile: +1 225-572-2511

Email: Steve.Kelly@wsp.com

WSP USA
8212 Kelwood Ave
Baton Rouge, LA 70806

wsp.com

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2022 ANNUAL MECHANICAL INTEGRITY
TEST PROCEDURES

Republic Services
Romulus, MI Facility
Well 1-12; API No. 21-163-M452

Project No. TBD

Date 07/05/22

Page 1 of 3

INTRODUCTION

The following procedures comply with the requirements of EPA, Region 5 for annual mechanical integrity tests on a Class I hazardous waste disposal well.

The following are the objectives of the 2022 Annual Mechanical Integrity Tests:

- Conduct a 1-Hour Annulus Pressure Test at a pressure of approximately 1,100 psi.
- Run a static Temperature Survey from the surface to the total depth of the well.
- Run a Radioactive Tracer Survey.
- Return well to normal service.
- Prepare a Mechanical Integrity Test Report and submit to the UIC groups of EPA, Region 5 and Michigan EGLE.

A. ANNULUS PRESSURE TEST PROCEDURE

1. Notify the EPA, Region 5 and the Michigan EGLE at least 48 hours prior to initiating the annual mechanical integrity tests on Well 1-12.
2. Shut-in Well 1-12 at least 36 hours prior to conducting an Annulus Pressure Test (APT).
3. Record the last date of injection into Well 1-12.
4. Install a certified digital pressure gauge to the annulus and have a Calibration Certificate available on site that demonstrates the pressure gauge was calibrated within the past 12 months.
5. Pressurize the annulus to approximately 1,100 psi.
6. Allow the annulus pressure to stabilize. If necessary, depressurize and bleed line to gauge to remove any trapped air and repressurize.
7. Isolate the annulus pressure on the well from the Well Annulus Monitoring System by closing the necessary valves.
8. Record the Initial Annulus Pressure to begin the 1-hour APT.
9. Continue recording the annulus pressure at 10-minute intervals for at least 60 minutes or as instructed by the regulatory agency inspector witnessing the test. A successful APT will not fluctuate more than 3% of the initial test pressure during the 1-hour test period.
10. Release the pressure from the annulus by bleeding the excess annulus fluid into the Well Annulus Monitoring System storage tank and note the change in the tank level. If requested, perform annual alarm testing.
11. Provide the regulatory agency inspector with a copy of the data recorded during the APT and the pressure gauge calibration certificate.



2022 ANNUAL MECHANICAL INTEGRITY
TEST PROCEDURES

Republic Services
Romulus, MI Facility
Well 1-12; API No. 21-163-M452

Project No. TBD

Date 07/05/22

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B. STATIC TEMPERATURE SURVEY PROCEDURE

1. Prior to commencing work, hold an initial safety meeting and site orientation with all parties. Conduct a Job Safety Analysis, as necessary.
2. Move in and rig up a wireline unit, a crane truck and pressure control lubricator with a pump-in-sub. Verify that the well has been shut-in for at least 36 hours.
3. Rig up a temperature tool and conduct a two point check of the tool calibration by immersing the temperature probe into a bucket of ice and by monitoring the ambient air temperature. Record the two temperatures with the tool and with an independent thermometer.
4. After rigging up to the well, start logging out of the lubricator with the tool zeroed at KB (13 feet above ground level). Run a Temperature Survey while going in the hole at a logging speed not to exceed 30 feet per minute.
5. Record the Temperature data on 1-inch/100 feet and 5-inch/100 feet scales.
6. After tagging bottom, pull up at least 100 feet above the packer assembly and run a Repeat Section.
7. If temperature anomalies indicate the possibility of upwards migration, run additional repeat sections across the temperature anomalies.
8. Prepare to run the Radioactive Tracer Survey.
9. Submit an interpretation of the Temperature Survey with the Mechanical Integrity Testing Report.

C. RADIOACTIVE TRACER SURVEY PROCEDURE

1. Republic will use its pump and fresh water to conduct the RAT Survey.
2. Run in the well with a dual gamma ray detector tool that has a collar locator and an ejector tool filled with Iodine₁₃₁ radioactive material positioned above the gamma ray detectors.
3. After correlating the log with previous logs run in the well, tag bottom and run a pre-survey base gamma ray log from the total depth reached to approximately 3,000 feet.
4. Run 5-minute statistical checks in the time drive logging mode at 3,955 feet and 3,802 feet.
5. Start injection into the well at approximately 42 gpm (1 bpm). This will provide a fluid velocity of 65 ft/min in the tubing and a maximum velocity of approximately 12 ft/min in the open hole completion interval.
6. Release a slug of radioactive material at 3,100 feet while continuing to inject into the well at 1 bpm.
7. Drop the tool string down and record a log through the radioactive slug as it travels downhole. Make at least two logging passes through the moving slug before it reaches the injection packer at 4,036 feet. (At an injection rate of 1 bpm, slug will take approximately 15 minutes to reach the packer after ejection.)
8. Continue logging the movement of the slug as it enters the open hole completion at a reduced velocity (maximum velocity = approximately 12 fpm at 1 bpm). Make additional logging passes through the slug until it has dissipated into the injection interval.
9. Pull the logging tool up to approximately 3,750 feet while continuing to inject at 1 bpm. Release a slug of Iodine₁₃₁ at 3,750 feet. Drop the tool downhole and position the bottom detector at approximately 4,050



2022 ANNUAL MECHANICAL INTEGRITY
TEST PROCEDURES

Republic Services
Romulus, MI Facility
Well 1-12; API No. 21-163-M452

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feet and begin recording a time drive survey. (Slug will be traveling at approximately 65 ft/min and will take about 4.6 minutes to reach tool from the time it was ejected.)

10. Record a time drive survey for at least 30 minutes while continuing to inject at approximately 1 bpm.
11. Following the time drive survey, tag bottom with the tool and run a post-survey base gamma ray log from the total depth reached to 3,000 feet.
12. Pull out of the hole with the tool and rig down and move out the wireline unit, pump truck and associated equipment.
13. Return the well to normal operation.
14. Prepare a Mechanical Integrity Report and submit to the UIC groups of the EPA, Region 5 and the Michigan EGLE.

ATTACHMENTS

- Figure 1: Wellhead Sketch
- Figure 2: Below Ground Details

PREPARED BY Steve Kelly 07-05-2022



2022 ANNUAL MECHANICAL INTEGRITY
TEST PROCEDURES

Republic Services
Romulus, MI Facility
Well 2-12; API No. 21-163-M453

Project No. TBD

Date 07/05/22

Page 1 of 3

INTRODUCTION

The following procedures comply with the requirements of EPA, Region 5 for annual mechanical integrity tests on a Class I hazardous waste disposal well.

The following are the objectives of the 2022 Annual Mechanical Integrity Tests:

- Conduct a 1-Hour Annulus Pressure Test at a pressure of approximately 1,100 psi.
- Run a static Temperature Survey from the surface to the total depth of the well.
- Run a Radioactive Tracer Survey.
- Return well to normal service.
- Prepare a Mechanical Integrity Test Report and submit to the UIC groups of EPA, Region 5 and Michigan EGLE.

A. ANNULUS PRESSURE TEST PROCEDURE

1. Notify the EPA, Region 5 and the Michigan EGLE at least 48 hours prior to initiating the annual mechanical integrity tests on Well 2-12.
2. Shut-in Well 2-12 at least 36 hours prior to conducting an Annulus Pressure Test (APT).
3. Record the last date of injection into Well 2-12.
4. Install a certified digital pressure gauge to the annulus and have a Calibration Certificate available on site that demonstrates the pressure gauge was calibrated within the past 12 months.
5. Pressurize the annulus to approximately 1,100 psi.
6. Allow the annulus pressure to stabilize. If necessary, depressurize and bleed line to gauge to remove any trapped air and repressurize.
7. Isolate the annulus pressure on the well from the Well Annulus Monitoring System by closing the necessary valves.
8. Record the Initial Annulus Pressure to begin the 1-hour APT.
9. Continue recording the annulus pressure at 10-minute intervals for at least 60 minutes or as instructed by the regulatory agency inspector witnessing the test. A successful APT will not fluctuate more than 3% of the initial test pressure during the 1-hour test period.
10. Release the pressure from the annulus by bleeding the excess annulus fluid into the Well Annulus Monitoring System storage tank and note the change in the tank level. If requested, perform annual alarm testing.
11. Provide the regulatory agency inspector with a copy of the data recorded during the APT and the pressure gauge calibration certificate.



2022 ANNUAL MECHANICAL INTEGRITY
TEST PROCEDURES

Republic Services
Romulus, MI Facility
Well 2-12; API No. 21-163-M453

Project No. TBD

Date 07/05/22

Page 2 of 3

B. STATIC TEMPERATURE SURVEY PROCEDURE

1. Prior to commencing work, hold an initial safety meeting and site orientation with all parties. Conduct a Job Safety Analysis, as necessary.
2. Move in and rig up a wireline unit, a crane truck and pressure control lubricator with a pump-in-sub. Verify that the well has been shut-in for at least 36 hours.
3. Rig up a temperature tool and conduct a two point check of the tool calibration by immersing the temperature probe into a bucket of ice and by monitoring the ambient air temperature. Record the two temperatures with the tool and with an independent thermometer.
4. After rigging up to the well, start logging out of the lubricator with the tool zeroed at KB (13 feet above ground level). Run a Temperature Survey while going in the hole at a logging speed not to exceed 30 feet per minute.
5. Record the Temperature data on 1-inch/100 feet and 5-inch/100 feet scales.
6. After tagging bottom, pull up at least 100 feet above the packer assembly and run a Repeat Section.
7. If temperature anomalies indicate the possibility of upwards migration, run additional repeat sections across the temperature anomalies.
8. Prepare to run the Radioactive Tracer Survey.
9. Submit an interpretation of the Temperature Survey with the Mechanical Integrity Testing Report.

C. RADIOACTIVE TRACER SURVEY PROCEDURE

1. Republic will use its pump and fresh water to conduct the RAT Survey.
2. Run in the well with a dual gamma ray detector tool that has a collar locator and an ejector tool filled with Iodine₁₃₁ radioactive material positioned above the gamma ray detectors.
3. After correlating the log with previous logs run in the well, tag bottom and run a pre-survey base gamma ray log from the total depth reached to approximately 3,000 feet.
4. Run 5-minute statistical checks in the time drive logging mode at 3,855 feet and 3,800 feet.
5. Start injection into the well at approximately 42 gpm (1 bpm). This will provide a fluid velocity of 65 ft/min in the tubing and a maximum velocity of approximately 12 ft/min in the open hole completion interval.
6. Release a slug of radioactive material at 3,100 feet while continuing to inject into the well at 1 bpm.
7. Drop the tool string down and record a log through the radioactive slug as it travels downhole. Make at least two logging passes through the moving slug before it reaches the injection packer at 3,934 feet. (At an injection rate of 1 bpm, slug will take approximately 13 minutes to reach the packer after ejection.)
8. Continue logging the movement of the slug as it enters the open hole completion at a reduced velocity (maximum velocity = approximately 12 fpm at 1 bpm). Make additional logging passes through the slug until it has dissipated into the injection interval.
9. Pull the logging tool up to approximately 3,750 feet while continuing to inject at 1 bpm. Release a slug of Iodine₁₃₁ at 3,750 feet. Drop the tool downhole and position the bottom detector at approximately 4,050



2022 ANNUAL MECHANICAL INTEGRITY
TEST PROCEDURES

Republic Services
Romulus, MI Facility
Well **2-12**; API No. 21-163-M45**3**

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Date 07/05/22

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feet and begin recording a time drive survey. (Slug will be traveling at approximately 65 ft/min and will take about 4.6 minutes to reach tool from the time it was ejected.)

10. Record a time drive survey for at least 30 minutes while continuing to inject at approximately 1 bpm.
11. Following the time drive survey, tag bottom with the tool and run a post-survey base gamma ray log from the total depth reached to 3,000 feet.
12. Pull out of the hole with the tool and rig down and move out the wireline unit, pump truck and associated equipment.
13. Return the well to normal operation.
14. Prepare a Mechanical Integrity Report and submit to the UIC groups of the EPA, Region 5 and the Michigan EGLE.

ATTACHMENTS

- Figure 3: Wellhead Sketch
- Figure 4: Below Ground Details

PREPARED BY Steve Kelly 07-05-2022



2022 ANNUAL RESERVOIR PRESSURE MONITORING (INJECTION - FALLOFF) TEST PROCEDURE

Project No. TBD

Republic Services
Romulus, MI Facility
Well 1-12; API No. 21-163-M452

Date 07/05/22

Page 1 of 1

INTRODUCTION

The following procedure complies with the requirements of EPA, Region 5 for an annual reservoir pressure monitoring (injection – falloff) test of a Class I hazardous waste disposal well.

The following are the objectives of the 2022 Annual Reservoir Pressure Monitoring (Injection – Falloff) Test:

- Initiate injection into Well 1-12 at a constant rate. Terminate injection into Well 2-12 prior to the injection test into Well 1-12.
- Position dual memory gauges in Well 1-12 with the bottom gauge located at 4,080 feet KB.
- Inject fresh water into Well 1-12 at a constant rate for approximately 10 hours.
- Terminate injection into Well 1-12 no sooner than 1 hour after positioning bottomhole gauges in well and record the pressure falloff for approximately 24 hours.
- Return well 1-12 to normal service.
- Prepare a Reservoir Pressure Monitoring (Injection – Falloff) Test Report and submit to the UIC groups of EPA, Region 5 and Michigan EGLE. Include the raw pressure data with the report and the pressure gauge calibration certificate.

RESERVOIR PRESSURE MONITORING (INJECTION - FALLOFF) TEST PROCEDURE

1. Rig up a calibrated digital pressure gauge with a backup gauge to the wellhead of Well 1-12. Program the gauges to record pressure and ambient temperature data at 3-second intervals. Have a copy of the calibration certificate available during the test and submit a copy with the report.
2. Move in and rig up a pump truck to Well 1-12.
3. Initiate injection into Well 1-12 at a constant rate ($\pm 5\%$) using fresh water. Record the injection data during the test.
4. After approximately 10 hours of constant injection with a constant fluid density, terminate injection and shut-in the wing-valve near the well.
5. Record the pressure falloff data for a minimum of 12 hours.
6. Remove the pressure gauges from the well and download the pressure and temperature data.
7. Return Well 1-12 after completing the falloff test on Well 2-12.
8. Analyze the data using PanSystem software and prepare a final report and submit to the UIC groups of EPA, Region 5 and Michigan EGLE. Include the raw pressure data with the report and the calibration certificate for the pressure gauges.

ATTACHMENTS

Figure 1: Wellhead Sketch

Figure 2: Below Ground Details

PREPARED BY Steve Kelly 07-05-2022



2022 ANNUAL RESERVOIR PRESSURE MONITORING (INJECTION - FALLOFF) TEST PROCEDURE

Project No. TBD

Republic Services
Romulus, MI Facility
Well 2-12; API No. 21-163-M453

Date 07/05/22

Page 1 of 1

INTRODUCTION

The following procedure complies with the requirements of EPA, Region 5 for an annual reservoir pressure monitoring (injection – falloff) test of a Class I hazardous waste disposal well.

The following are the objectives of the 2022 Annual Reservoir Pressure Monitoring (Injection – Falloff) Test:

- Initiate injection into Well 2-12 at a constant rate. Well 1-12 will be shut-in at least a few hours prior to initiating the injection test into Well 2-12.
- Position dual memory gauges in Well 2-12 with the bottom gauge located at 3,975 feet KB.
- Inject fresh water into Well 2-12 at a constant rate for approximately 10 hours.
- Terminate injection into Well 2-12 no sooner than 1 hour after positioning bottomhole gauges in well and record the pressure falloff for approximately 24 hours.
- Return well 2-12 to normal service.
- Prepare a Reservoir Pressure Monitoring (Injection – Falloff) Test Report and submit to the UIC groups of EPA, Region 5 and Michigan EGLE. Include the raw pressure data with the report and the pressure gauge calibration certificate.

RESERVOIR PRESSURE MONITORING (INJECTION - FALLOFF) TEST PROCEDURE

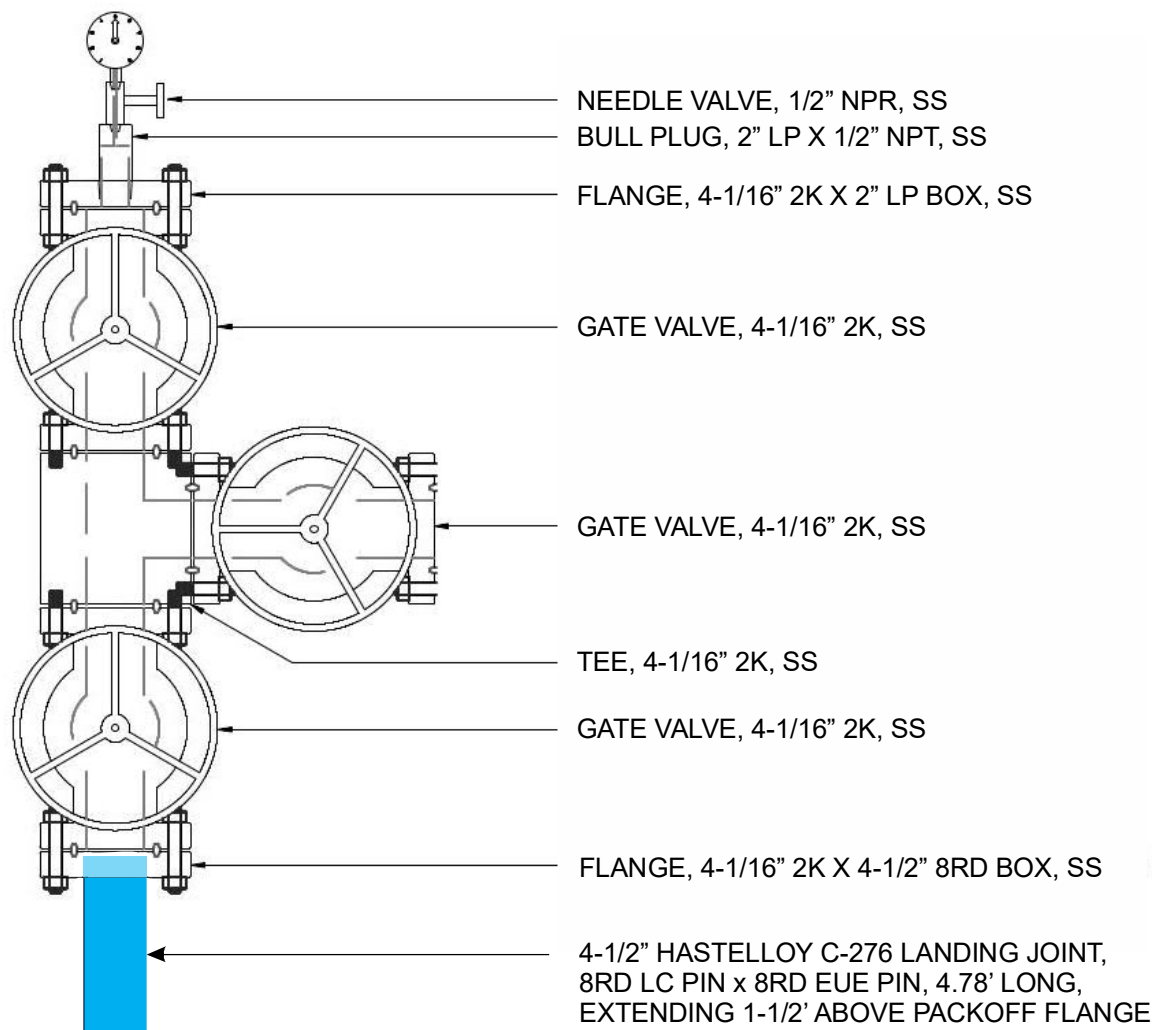
1. Rig up a calibrated digital pressure gauge with a backup gauge to the wellhead of Well 2-12. Program the gauges to record pressure and ambient temperature data at 3-second intervals. Have a copy of the calibration certificate available during the test and submit a copy with the report.
2. Move in and rig up a pump truck to Well 2-12.
3. Initiate injection into Well 2-12 at a constant rate ($\pm 5\%$) using fresh water. Record the injection data during the test.
4. After approximately 10 hours of constant injection with a constant fluid density, terminate injection to initiate the falloff test and immediately shut-in the wing-valve near the well.
5. Record the pressure falloff data for approximately 24 hours.
6. Remove the pressure gauges from the well and download the pressure and temperature data.
7. Return Wells 1-12 and 2012 to normal service after completing the falloff test on Well 2-12.
8. Analyze the data using PanSystem software and prepare a final report and submit to the UIC groups of EPA, Region 5 and Michigan EGLE. Include the raw pressure data with the report and the calibration certificate for the pressure gauges.

ATTACHMENTS

Figure 3: Well Sketch

Figure 4: Below Ground Details

PREPARED BY Steve Kelly 07-05-2022



Approximate Ground Level

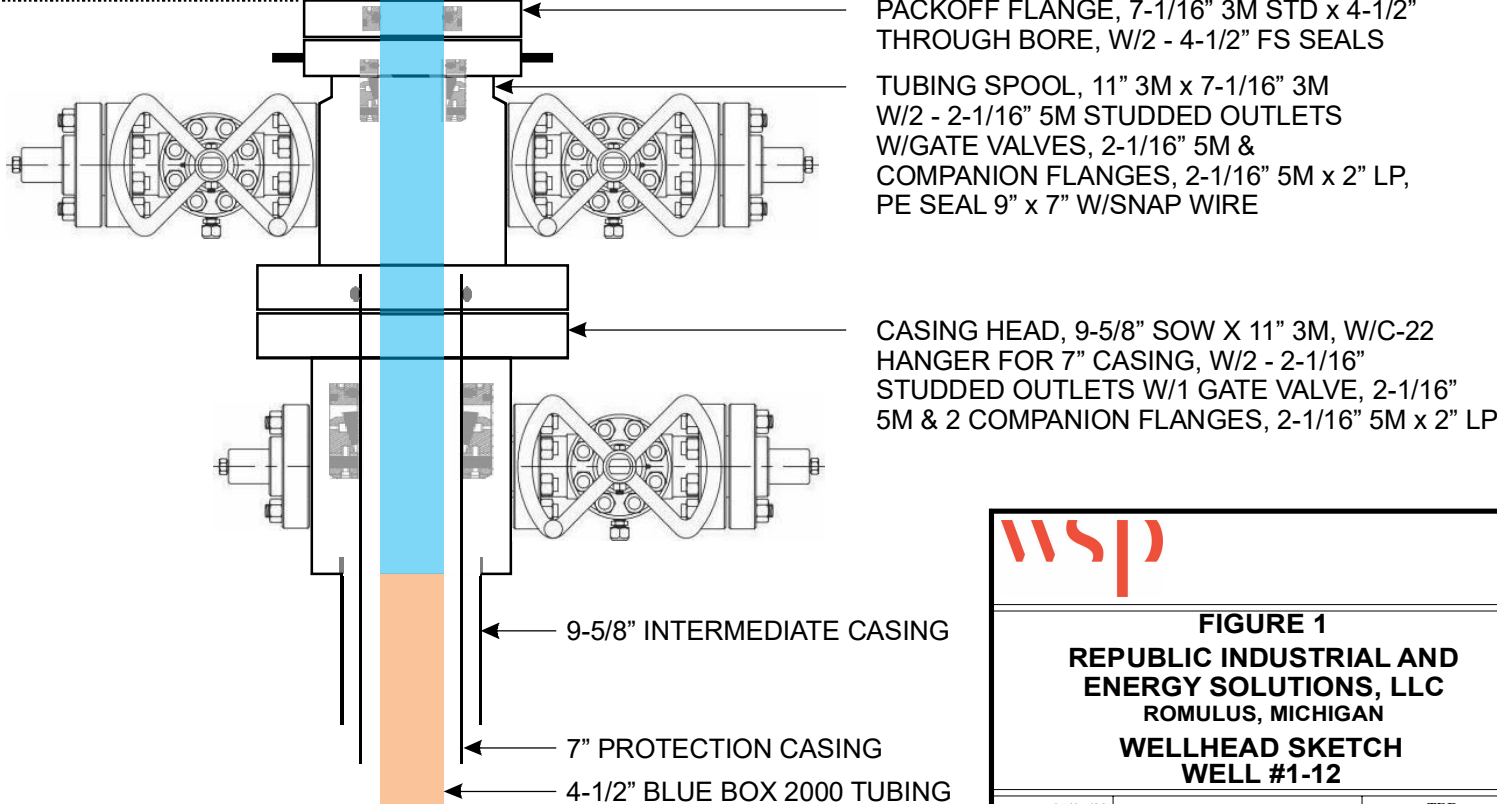

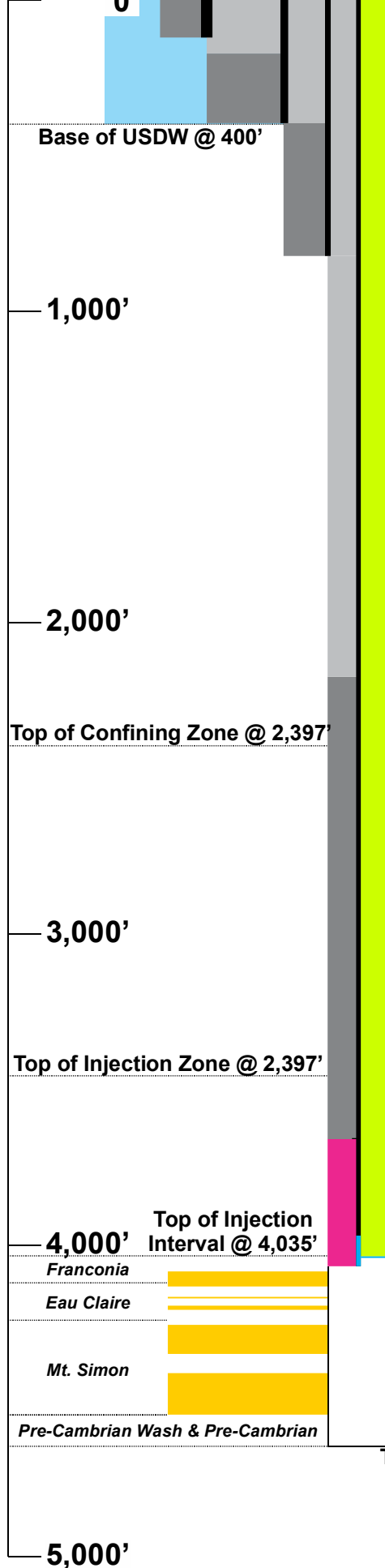



FIGURE 1
REPUBLIC INDUSTRIAL AND ENERGY SOLUTIONS, LLC
 ROMULUS, MICHIGAN
WELLHEAD SKETCH
WELL #1-12

DATE	07/05/22	CHECKED BY	JOB NO.	TBD
DRAWN BY	SLK	APPROVED BY	DWG NO.	

Depth Scale

(ft KB)



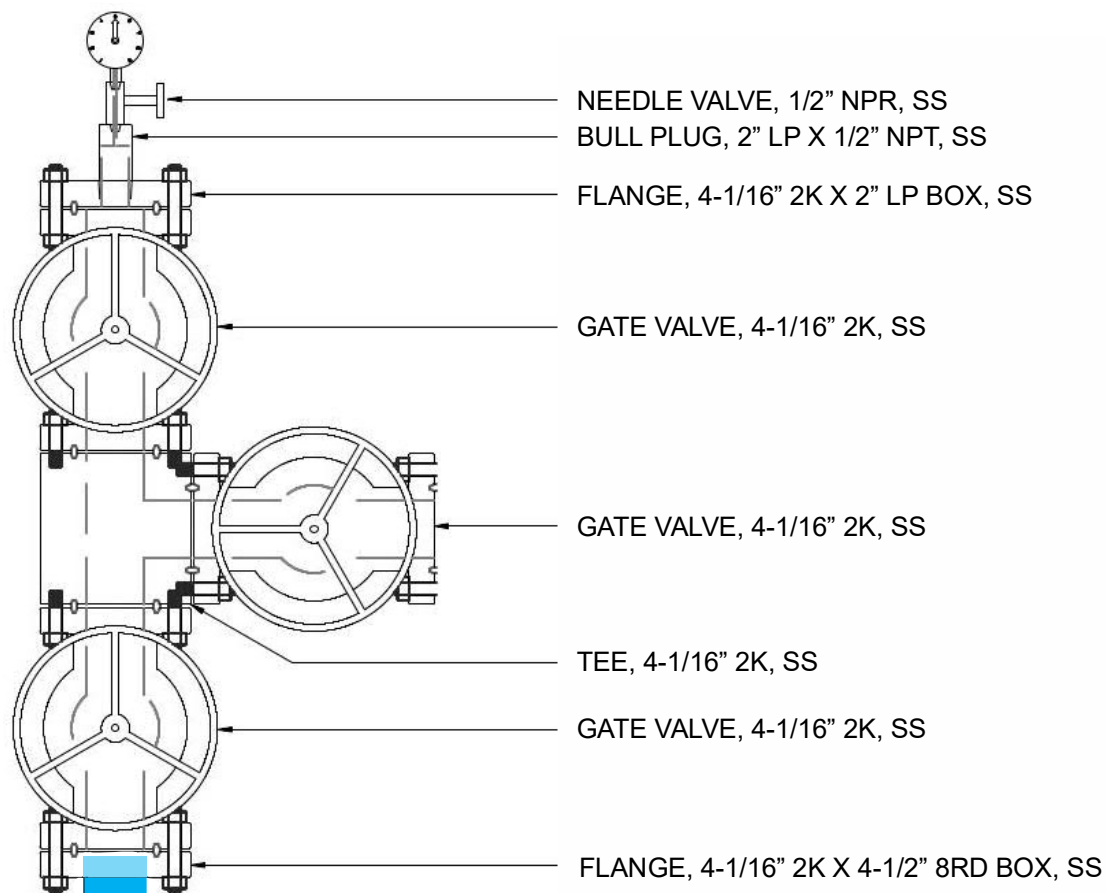
BELOW GROUND DETAILS

- Conductor Casing:** 20", H-40 set in a 24" borehole at 119'. Cemented with 200 sacks of Class A cement containing 3% CaCl₂ with 75% returns. Top 50' of annulus cemented with 50 sacks of Class A.
- Surface Casing:** 13-3/8", H-40 set in a 17-1/2" borehole at 405'. Cemented with 75 sacks of Lite lead cement with 3% CaCl₂ followed by 150 sacks of Class A tail cement with 3% CaCl₂. Top of annulus cemented with 175 sacks of Class A cement with 3% CaCl₂.
- Intermediate Casing:** 9-5/8", 36 lb/ft set in a 12-1/4" borehole at 824'. Cemented with 150 sacks of Lite lead with 3% CaCl₂ followed by 200 sacks of Class A tail with 3% CaCl₂. Approximately 10 bbl of cement circulated to the surface.
- Protection Casing:** 7", 26 lb/ft, K-55, LT&C set in an 8-3/4" borehole to 3,977' and 7", 1/4" wall, Hastelloy C-276, STL set in 8-3/4" borehole from 3,977' to 4,075' with 7" float collar and float shoe set from 4,075' to 4,080. Cement diverter tool set in 7" casing from 3,657' to 3,660'.
 Stage I (3,660' to 4,080'): 686 gallons (16.3 bbl) of EPSEAL epoxy cement.
 Stage II (Surface to 3,660'): 500 sacks of 50/50 Standard Pozmiz lead cement with 2% gel, 0.4% HALAD 344 and 3% salt followed by 450 sacks of Standard Class A tail cement containing 3% HALAD 322, 0.4% HALAD 344, 8.2% Microbond, and 2.14% salt.
- Injection Tubing:** 4-1/2", Blue Box 2000, fiberglass tubing to top of packer at 4,036' (4.78', 4-1/2" Hastelloy C-276 landing joint top positioned 1-1/2' above ground level with 4' of stretch. Landing Joint base = 16.28' KB:
 a) 3 Pup Joints (3.64' + 1.72' + 3.60' = 8.96'), 4-1/2", Blue Box FRP;
 b) 4-1/2", Blue Box FRP tubing (137 joints x 29.249'/joint = 4,007.08'
 c) Anchor Seal Assembly, 4.75" x 3.75", Hastelloy C-276, 1.64' long set in Model 12 Injection Packer PBR from 4,036.32' to 4,037.96'.
- Annulus Fluid:** 68.5 bbl (2,877 gallons) of 10 lb/gal brine water containing a corrosion inhibitor, a bactericide and an oxygen scavenger.
- Injection Packer:** Model 12, Hastelloy C-276 wetted parts set from 4,036.3' to 4,041.4'. Polished test bore = 3.50" at packer base.
- Open Hole Completion:** 8-3/4" borehole from 4,080' to 4,645' (TVD = 4,535' @ 4,645' MD).

Bottom-hole location: 211' south and 754' west of surface location (782.97, South 74° 21' 58.35" West)

	WSP USA INC. 8212 Kelwood Ave. Baton Rouge LA 70806 Tel: (225) 753-2561 Fax: (225) 925-2530		
	FIGURE 2 REPUBLIC INDUSTRIAL AND ENERGY SOLUTIONS, LLC ROMULUS, MICHIGAN WELL #1-12 BELOW GROUND SCHEMATIC		
DATE	07/05/22	CHECKED BY	JOB NO. TBD
DRAWN BY	SLK	APPROVED BY	DWG NO.

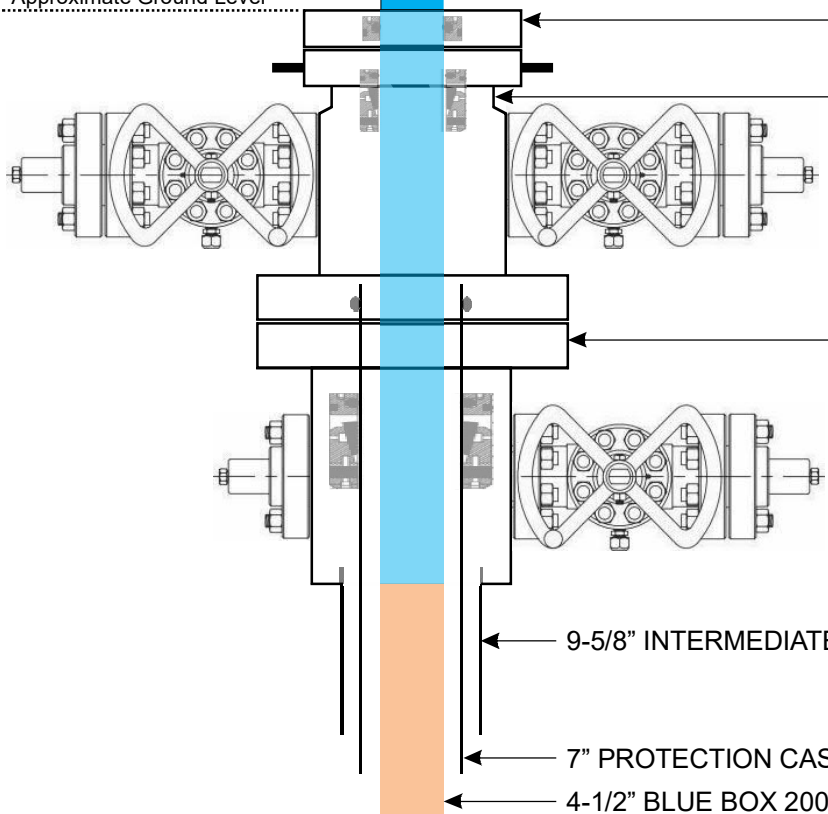
Vertical Scale: 1" = 500'



- NEEDLE VALVE, 1/2" NPR, SS
- BULL PLUG, 2" LP X 1/2" NPT, SS
- FLANGE, 4-1/16" 2K X 2" LP BOX, SS
- GATE VALVE, 4-1/16" 2K, SS
- GATE VALVE, 4-1/16" 2K, SS
- TEE, 4-1/16" 2K, SS
- GATE VALVE, 4-1/16" 2K, SS
- FLANGE, 4-1/16" 2K X 4-1/2" 8RD BOX, SS

4-1/2" HASTELLOY C-276 LANDING JOINT, 8RD LC PIN x 8RD LC PIN WITH A 4.5" LC BOX x 4.5" EUE PIN, 6.38' LONG, EXTENDING 1-1/2' ABOVE TOP OF SEAL FLANGE

Approximate Ground Level



- PACKOFF FLANGE, 7-1/16" 3M STD x 4-1/2" THROUGH BORE, W/2 - 4-1/2" FS SEALS
- TUBING SPOOL, 11" 3M x 7-1/16" 3M W/2 - 2-1/16" 5M STUDDED OUTLETS W/GATE VALVES, 2-1/16" 5M & COMPANION FLANGES, 2-1/16" 5M x 2" LP, PE SEAL 9" x 7" W/SNAP WIRE
- CASING HEAD, 9-5/8" SOW X 11" 3M, W/C-22 HANGER FOR 7" CASING, W/2 - 2-1/16" STUDDED OUTLETS W/1 GATE VALVE, 2-1/16" 5M & 2 COMPANION FLANGES, 2-1/16" 5M x 2" LP

- 9-5/8" INTERMEDIATE CASING
- 7" PROTECTION CASING
- 4-1/2" BLUE BOX 2000 TUBING


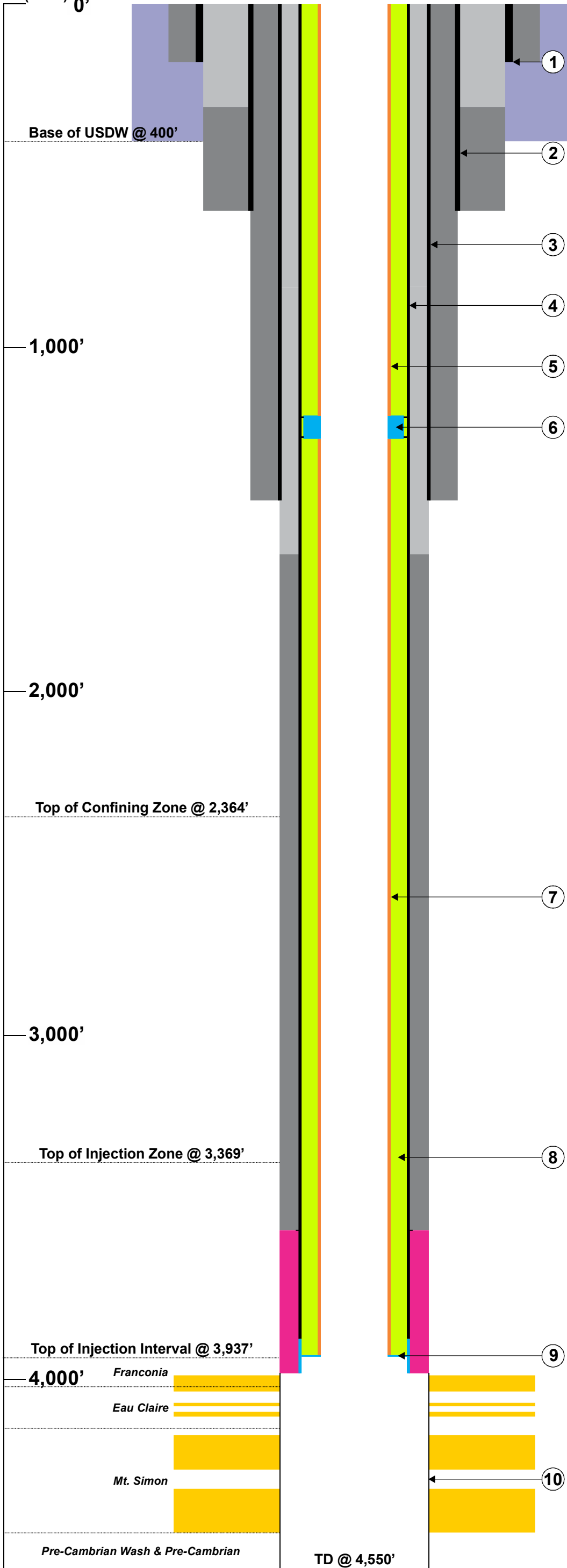


FIGURE 3
REPUBLIC INDUSTRIAL AND ENERGY SOLUTIONS, LLC
 ROMULUS, MICHIGAN
WELLHEAD SKETCH
WELL #2-12

DATE	07/05/22	CHECKED BY	JOB NO.	TBD
DRAWN BY	SLK	APPROVED BY	DWG NO.	

Depth Scale
(ft KB)



BELOW GROUND DETAILS

1. **Conductor Casing:** 16", 60 lb/ft set in a 20" borehole at 169'. Cemented with 300 sacks of Class A cement containing 3% CaCl₂ with 75% returns.
2. **Surface Casing:** 13-3/8", 48 lb/ft, H-40, ST&C set in a 17-1/2" borehole at 602'. Cemented with 350 sacks of 65/35 Pozalin with 3% CaCl₂ followed by 200 sacks of Class A tail cement with 3% CaCl₂. Top-out with 50 sacks of Class A cement with 3% CaCl₂.
3. **Intermediate Casing:** 9-5/8", 36 lb/ft set in a 12-1/4" borehole at 1,444'. Cemented with 725 sacks of Class A with 3% CaCl₂. 33 bbl of cement circulated to the surface.
4. **Protection Casing:** 7", 26 lb/ft, K-55, LT&C set in an 8-3/4" borehole to 3,882' and 7", 1/4" wall, Hastelloy C-276, STL set in 8-3/4" borehole from 3,882' to 3,979.4' with 7" float collar and float shoe set from 3,979.4' to 3,982'. Top 10' of Hastelloy coated with Teflon for galvanic corrosion inhibition. Cement diverter tool set in 7" casing from 3,565.5' to 3,568'.
 Stage I (3,568' to 3,982'):
 686 gallons (16.3 bbl) of 12.5 lb/gal EPSEAL epoxy cement.
 Stage II (Surface to 3,568'):
 310 sacks of 50/50 of Poz followed by 340 sacks of 50/50 Poz with microbond followed by 450 sacks of Standard cement with microbond. 44 bbl circulated to surface.
5. **Upper Injection Tubing:** 4-1/2", Blue Box 2000, fiberglass tubing to top of straddle packer at 1,199':
 a) 6', 4-1/2" Hastelloy C-276 landing joint top positioned ~2' above ground level with 1' of stretch. (Landing Joint base = 15.38' KB);
 b) 2 Pup Joints (5.71' + 9.73'), 4-1/2", Blue Box FRP from 15' to 31';
 c) 4-1/2", Blue Box FRP tubing (40 joints) from 31' to 1,199';
 d) Anchor Seal Assembly, 4.75" x 3.75", Hastelloy C-276, 1.64' long set in Model 12 Injection Packer PBR from 1,199' to 1,200.5'.
6. **Straddle Packer:** Model 12, Hastelloy C-276 wetted parts set from 1,199' to 1,268'. Upper Element at 1,204' and Lower Element at 1,265'.
7. **Lower Injection Tubing:** 4-1/2", Blue Box 2000, fiberglass tubing set from 1,268' to 3,930' with 2' of stretch as follows:
 a) 4-1/2", Blue Box FRP tubing (91 joints) from 1,268' to 3,930'.
 b) Anchor Seal Assembly, 4.75" x 3.75", Hastelloy C-276, 1.64' long set in Model 12 Injection Packer PBR from 3,930.0' to 3,931.5'.
8. **Annulus Fluid:** 66 bbl (2,772 gallons) of 9.7 lb/gal brine water containing a corrosion inhibitor, a bactericide and an oxygen scavenger.
9. **Injection Packer:** Model 12, Hastelloy C-276 wetted parts set from 3,930' to 3,935'.
10. **Open Hole Completion:** 8-3/4" borehole from 3,975' to 4,550'.

LEGEND

- USDW
- Fiberglass
- Standard Cement
- Receptive Interval
- Carbon Steel
- Lightweight Cement
- Annulus Fluid
- Hastelloy C-276
- Epoxy Cement

Vertical Scale: 1" = 300'

		WSP USA INC. 8212 Kelwood Ave. Baton Rouge LA 70806 Tel: (225) 753-2561 Fax: (225) 925-2530
FIGURE 4		
REPUBLIC INDUSTRIAL AND ENERGY SOLUTIONS, LLC		
ROMULUS, MICHIGAN		
WELL #2-12 BELOW GROUND DETAILS AFTER PHASE II WORKOVER		
DATE 07/05/22	CHECKED BY	JOB NO. TBD
DRAWN BY SLK	APPROVED BY	DWG NO.

APPENDIX B
CHRONOLOGY OF FIELD ACTIVITIES





16200 Park Row., Suite 200
Houston, Texas 77084
(281) 589-5900

FIELD ACTIVITY REPORT

Company:	Republic Industrial and Energy Solutions	Project No:	192128AD
Well:	EDS 1-12 and EDS 2-12	Date:	8/16/2022
City:	Romulus	FAR Report No.:	1
County/Parrish:	Wayne County	WSP Rep.:	Jeffry Tahtouh
State:	MI		
Work Performed:	<input type="checkbox"/> New Well <input type="checkbox"/> Workover <input checked="" type="checkbox"/> Wireline <input type="checkbox"/> Consulting <input type="checkbox"/> Other		

Breakdown of Operations

From	To	Hrs	
7:00	7:45	0.75	Arrive on location, held safety meeting, discussed job, and got the notice to proceed
7:45	8:15	0.50	Rig-up Wireline unit on Well 2-12 for Temperature/CCL/ GR logging AP = 1097 psi IP = 127 psi Rate= 0 gpm
8:15	8:30	0.25	Perform 2-point bucket calibration test. Confirmed tool is working good.
8:30	11:15	2.75	Run Gamma Ray/CCL/Temperature Log
8:35			Depth = 0' Temp = 72 °F
9:08			Depth = 1000' Temp = 58.1 °F
9:44			Depth = 2000' Temp = 62.8 °F
10:21			Depth = 3000' Temp = 75.3 °F
10:56			Depth = 4000' Temp = 77.4 °F
11:10			Depth TD = 4336' Temp = 86 °F
11:15	11:45	0.50	Pull out of the hole.
11:45	12:00	0.25	Change out tool to Radioactive Tracer Tool (RAT)
12:00	12:30	0.50	Run in hole with RAT
12:30	16:00	3.50	Perform Radioactive Tracer Survey on well 2-12
12:40	13:11		Run Pre base log (4335'- 3000'). Rate= 0 gpm, AP= 1376 psi IP= 110 psi.
13:17	13:29		Run 5 min stat checks at 3855' and 3000'
13:40	14:38		Initiate Injection at 42 gpm Run chase-down sequence 4 sec slug released at 3100', Rate=42 gpm, AP= 1376 psi IP= 575 psi. Three passes.
14:45	15:22		Maintain Injection at 42 gpm Run time-drive survey 30 minute time drive, Eject 4 sec slug at 3750', Run downhole to 3960' and start time drive when slug passed 3960' Rate=42 gpm, AP= 1363 psi IP= 714 psi.
15:24			Cease Injection
15:26	15:51		Run Post base log (4335'- 3000'). Rate= 0 gpm, AP= 1363 psi IP= 211 psi.
16:00	16:45	0.75	Pull out of the hole and Rig down.
16:45	17:00	0.25	Secure well and leave location
Total		10.00	

Safety Topics

Working in Republic Romulus facility, working at heights, pinch points, chemical exposure, heavy lifting



16200 Park Row., Suite 200
Houston, Texas 77084
(281) 589-5900

FIELD ACTIVITY REPORT

Company:	Republic Industrial and Energy Solutions	Project No:	192128AD
Well:	EDS 1-12 and EDS 2-12	Date:	8/17/2022
City:	Romulus	FAR Report No.:	2
County/Parrish:	Wayne County	WSP Rep.:	Jeffry Tahtouh
State:	MI		
Work Performed:	<input type="checkbox"/> New Well <input type="checkbox"/> Workover <input checked="" type="checkbox"/> X Wireline <input type="checkbox"/> Consulting <input type="checkbox"/> Other		

Breakdown of Operations

From	To	Hrs	
6:30	7:00	0.50	Arrive on location, held safety meeting, discussed job, and got the notice to proceed
7:00	7:15	0.25	Rig-up Wireline unit on Well 1-12 for Temperature/CCL/ GR logging AP = 1096 psi IP = 124 psi Rate= 0 gpm
7:15	10:00	2.75	Run Gamma Ray/CCL/Temperature Log
7:18			Depth = 0' Temp = 66 °F
7:47			Depth = 1000' Temp = 57.6 °F
8:23			Depth = 2000' Temp = 62.3 °F
8:59			Depth = 3000' Temp = 73.7 °F
9:36			Depth = 4000' Temp = 81.1 °F
9:55			Depth TD = 4518' Temp = 88.7 °F
10:00	10:45	0.75	Pull out of the hole.
8:15	10:48		JO Well Services arrived on site. Safety briefing and discuss the job, Ran Slickline unit with bottom hole pressure/temperature gauges downhole at Well 2-12 AP = 1100 psi IP = 131.84 psi Rate= 0 gpm
10:45	11:00	0.25	Change out tool to Radioactive Tracer Tool (RAT) for Well 1-12
11:00	11:15	0.25	Run in hole with RAT at Well 1-12
11:15	14:45	3.50	Perform Radioactive Tracer Survey on Well 1-12 AP = 1100 psi IP = 124 psi Rate= 0 gpm
11:23	11:56		Well 1-12 Run Pre base log (4516'- 3000'). Rate= 0 gpm, AP= 1100 psi IP= 124 psi.
12:05	12:10		Well 1-12 Run 5 min stat checks at 3955' and 3802' Rate= 0 gpm, AP= 1092 psi IP= 121 psi.
12:22	13:28		Initiate Injection at 42 gpm on Well 1-12 Run chase-down sequence 4.5 sec slug released at 3100', Rate=42 gpm, AP= 1378 psi IP= 865 psi. Five passes.
13:33	14:09		Maintain Injection at 42 gpm on Well 1-12 Run time-drive survey 30 minute time drive, Eject 4.5 sec slug at 3750', Run downhole to 4050' and start time drive when slug passed 4050' Rate=42 gpm, AP= 1431 psi IP= 874 psi.
14:10			Cease Injection on Well 1-12
14:22			Initiate Injection on Well 2-12 for the pressure buildup Rate= 50 gpm, AP= 1200 psi IP= 130 psi
14:14	14:44		Well 1-12 Run Post base log (4516'- 3000') Rate= 0 gpm, AP= 1409 psi IP= 778 psi.
14:45	16:15	1.50	Pull out of the hole and Rig down of Well 1-12
16:22			Well 2-12 pressure buildup phase Rate= 50 gpm, AP= 1418 psi IP= 817 psi
16:15	16:30	0.25	Secure wells and leave location
Total		10.00	

Safety Topics

Working in Republic Romulus facility, working at heights, pinch points, chemical exposure, radioactive material, heavy lifting



16200 Park Row., Suite 200
Houston, Texas 77084
(281) 589-5900

FIELD ACTIVITY REPORT

Company:	Republic Industrial and Energy Solutions	Project No:	192128AD
Well:	EDS 1-12 and EDS 2-12	Date:	8/19/2022
City:	Romulus	FAR Report No.:	3
County/Parrish:	Wayne County	WSP Rep.:	Jeffry Tahtouh
State:	MI		
Work Performed:	<input type="checkbox"/> New Well <input type="checkbox"/> Workover <input checked="" type="checkbox"/> Wireline <input type="checkbox"/> Consulting <input type="checkbox"/> Other		

Breakdown of Operations

From	To	Hrs	
6:00	6:15	0.25	Arrive on location, held JSA, and obtained permit
6:15	6:30	0.25	End PFO Test @ 6:25 for Well 2-12 IP = 138.5 psi AP = 1092 psi Rate = 0 GPM
6:30	7:00	0.50	Run Static Gradient Survey
6:33	6:38		5-min Stop @ 3000'
6:42	6:47		5-min Stop @ 2000'
6:50	6:55		5-min Stop @ 1000'
6:58	7:03		5-min gradient stop @ Surface (in lubricator)
7:00	7:30	0.50	Rig down from Well 2-12 . Download data from the bottom hole pressure gauges. Move to 1-12 to run gauges downhole for pressure falloff.
7:30	8:30	1.00	Rig up on Well 1-12 Ran Slickline unit with bottom hole pressure/temperature gauges downhole at Well 2-12 AP = 1100 psi IP = 131.84 psi Rate= 0 gpm
8:15			Initiate Injection on Well 1-12 for the pressure buildup Rate= 50 gpm, AP= 1088 psi IP= 500 psi
8:26			Gauges set downhole @ 4080' Rate= 50 gpm, AP= 1391 psi IP= 748 psi
8:30	9:00	0.50	Secure well and leave location
11:00			Update from operation personnel Rate= 50 gpm, AP= 1444 psi IP= 910 psi Injection Rate will gradually be decreased to achieve an equilibrium constant injection rate and an IP value to avoid pump from tripping due to MASIP being reached
Total		3.00	

Safety Topics

Working in Republic Romulus facility, ppe, pinch points, and fall protection



16200 Park Row., Suite 200
Houston, Texas 77084
(281) 589-5900

FIELD ACTIVITY REPORT

Company:	Republic Industrial and Energy Solutions	Project No:	192128AD
Well:	EDS 1-12 and EDS 2-12	Date:	8/20/2022
City:	Romulus	FAR Report No.:	4
County/Parrish:	Wayne County	WSP Rep.:	Jeffrey Tahtouh
State:	MI		
Work Performed:	<input type="checkbox"/> New Well <input type="checkbox"/> Workover <input checked="" type="checkbox"/> Wireline <input type="checkbox"/> Consulting <input type="checkbox"/> Other		

Breakdown of Operations

From	To	Hrs	
19:00	19:30	0.50	Arrive on location, held JSA, and got the notice to proceed
19:30	19:45	0.25	End PFO Test @ 19:45 for Well 1-12 IP = 138 psi AP = 1089 psi Rate = 0 GPM
19:45	20:30	0.75	Run Static Gradient Survey
19:48	19:53		5-min Stop @ 4000'
19:56	20:01		5-min Stop @ 3000'
20:05	20:10		5-min Stop @ 2000'
20:13	20:18		5-min Stop @ 1000'
20:23	20:28		5-min gradient stop @ Surface (in lubricator)
20:30	20:45	0.25	Rig down from Well 1-12 . Download data from the bottom hole pressure gauges.
20:45	21:00	0.25	Secure well and leave location
Total		2.00	

Safety Topics

Working in Republic Romulus facility, ppe, pinch points, and fall protection

APPENDIX C
ANNULUS PRESSURE TEST DATA



APPENDIX C
WELL 2-12 ANNULUS PRESSURE DATA
August 15, 2022

Time	Time (min)	Pressure (psia)	
10:16:00	0.00	1104.92	START
10:16:30	0.50	1104.89	
10:17:00	1.00	1105.03	
10:17:30	1.50	1104.75	
10:18:00	2.00	1104.89	
10:18:30	2.50	1105.03	
10:19:00	3.00	1104.75	
10:19:30	3.50	1104.89	
10:20:00	4.00	1104.89	
10:20:30	4.50	1104.75	
10:21:00	5.00	1104.47	
10:21:30	5.50	1104.75	
10:22:00	6.00	1104.61	
10:22:30	6.50	1104.61	
10:23:00	7.00	1104.61	
10:23:30	7.50	1104.61	
10:24:00	8.00	1104.47	
10:24:30	8.50	1104.75	
10:25:00	9.00	1104.61	
10:25:30	9.50	1104.47	
10:26:00	10.00	1104.33	
10:26:30	10.50	1104.61	
10:27:00	11.00	1104.61	
10:27:30	11.50	1104.47	
10:28:00	12.00	1104.47	
10:28:30	12.50	1104.47	
10:29:00	13.00	1104.47	
10:29:30	13.50	1104.61	
10:30:00	14.00	1104.61	
10:30:30	14.50	1104.61	
10:31:00	15.00	1104.34	
10:31:30	15.50	1104.47	

Time	Time (min)	Pressure (psia)	
10:32:00	16.00	1104.45	
10:32:30	16.50	1104.47	
10:33:00	17.00	1104.47	
10:33:30	17.50	1104.47	
10:34:00	18.00	1104.47	
10:34:30	18.50	1104.61	
10:35:00	19.00	1104.61	
10:35:30	19.50	1104.33	
10:36:00	20.00	1104.47	
10:36:30	20.50	1104.47	
10:37:00	21.00	1104.46	
10:37:30	21.50	1104.61	
10:38:00	22.00	1104.19	
10:38:30	22.50	1104.05	
10:39:00	23.00	1104.33	
10:39:30	23.50	1104.33	
10:40:00	24.00	1104.33	
10:40:30	24.50	1104.47	
10:41:00	25.00	1104.33	
10:41:30	25.50	1104.33	
10:42:00	26.00	1104.32	
10:42:30	26.50	1104.33	
10:43:00	27.00	1104.33	
10:43:30	27.50	1104.47	
10:44:00	28.00	1104.42	
10:44:30	28.50	1104.47	
10:45:00	29.00	1104.33	
10:45:30	29.50	1104.33	
10:46:00	30.00	1104.33	
10:46:30	30.50	1104.47	
10:47:00	31.00	1104.47	
10:47:30	31.50	1104.47	

APPENDIX C, Continued
WELL 2-12 ANNULUS PRESSURE DATA
August 15, 2022

Time	Time (min)	Pressure (psia)	
10:48:00	32.00	1104.33	
10:48:30	32.50	1104.47	
10:49:00	33.00	1104.47	
10:49:30	33.50	1104.47	
10:50:00	34.00	1104.33	
10:50:30	34.50	1104.33	
10:51:00	35.00	1104.33	
10:51:30	35.50	1104.33	
10:52:00	36.00	1104.47	
10:52:30	36.50	1104.33	
10:53:00	37.00	1104.19	
10:53:30	37.50	1104.19	
10:54:00	38.00	1104.33	
10:54:30	38.50	1104.33	
10:55:00	39.00	1104.47	
10:55:30	39.50	1104.61	
10:56:00	40.00	1104.33	
10:56:30	40.50	1104.33	
10:57:00	41.00	1104.47	
10:57:30	41.50	1104.19	
10:58:00	42.00	1104.47	
10:58:30	42.50	1104.33	
10:59:00	43.00	1104.61	
10:59:30	43.50	1104.19	
11:00:00	44.00	1104.33	
11:00:30	44.50	1104.08	
11:01:00	45.00	1104.32	
11:01:30	45.50	1104.05	
11:02:00	46.00	1104.05	

Time	Time (min)	Pressure (psia)	
11:02:30	46.50	1104.05	
11:03:00	47.00	1104.05	
11:03:30	47.50	1104.19	
11:04:00	48.00	1104.05	
11:04:30	48.50	1104.19	
11:05:00	49.00	1104.33	
11:05:30	49.50	1104.05	
11:06:00	50.00	1104.19	
11:06:30	50.50	1104.19	
11:07:00	51.00	1104.19	
11:07:30	51.50	1104.19	
11:08:00	52.00	1104.05	
11:08:30	52.50	1104.19	
11:09:00	53.00	1104.19	
11:09:30	53.50	1104.33	
11:10:00	54.00	1104.19	
11:10:30	54.50	1104.33	
11:11:00	55.00	1104.05	
11:11:30	55.50	1104.05	
11:12:00	56.00	1104.47	
11:12:30	56.50	1104.19	
11:13:00	57.00	1104.19	
11:13:30	57.50	1104.05	
11:14:00	58.00	1104.19	
11:14:30	58.50	1104.05	
11:15:00	59.00	1104.19	
11:15:30	59.50	1104.19	
11:16:00	60.00	1104.20	END

APPENDIX D
CALIBRATION CERTIFICATES





CALIBRATION CERTIFICATE

UIS SCADA
2290 Bishop Circle E.
Dexter, MI 48130
734-424-1200

CUSTOMER Republic Services CERTIFICATE # REPI228242-3, 6
 Address 28470 Citrin Drive; Romulus MI US 48174 JOB # REPI228242-3
 USER Republic Services; 28470 Citrin Drive; Romulus MI US 48174 PAGE 6
 OWNER REPRESENTATIVE John Frost TELEPHONE 734-946-1000
 Date: 7/11/2022 Temp: 75 °F Humidity: 55 %RH Equip Location: Plant
 Sub/Parent: Well 2 Position/Child: Annulus Pressure Primary

NAMEPLATE

Item Tested Pressure Transmitter
 Manufacturer Yokogaw Model Number EJA530E-JDS7N-012EL/FU1/D1/JH05
 Serial Number 91V927606 Tag Number PIT3938
 Operating Range cal 0-1000 psig Procedure/Method Fluke 754:75x_umeng0000 rev Jul 2011

As Found - Within Spec As Left - Within Spec

INPUT		OUTPUT						
Line	%	Applied	As Found	OOT	As Left	OOT	Lo Spec	Hi Spec
1		0	4.00 / 0	<input type="checkbox"/>	4.00 / 0	<input type="checkbox"/>	-2	+2
2		250	4.55 / 250	<input type="checkbox"/>	4.55 / 250	<input type="checkbox"/>	248	252
3		500	5.10 / 500	<input type="checkbox"/>	5.10 / 500	<input type="checkbox"/>	498	502
4		750	5.66 / 750	<input type="checkbox"/>	5.66 / 750	<input type="checkbox"/>	748	752
5		1000	6.22 / 1000	<input type="checkbox"/>	6.22 / 1000	<input type="checkbox"/>	998	1002
6		Hart Address	4	<input type="checkbox"/>	4	<input type="checkbox"/>		
7				<input type="checkbox"/>		<input type="checkbox"/>		

Communicator:	Hart-OEM Specific	Totalizer As Found	NA	Totalizer As Left	NA	Gal
#	Manufacturer	Model	Serial / ID Number	Calibration Date	Calibration Due	
1	Fluke	700PD5 (0-1000 psig)	SHOP-756	12/16/2021	12/31/2022	
2	Extech	RH300(Ambient)	SHOP-1773	1/11/2021	1/11/2026	
3	Fluke	754	RC-1053	4/7/2022	4/30/2023	

Comments:
 no mA output; unit comm with Hart to PLC

Deficiencies:

Traceability at UIS, Inc. is achieved through an unbroken chain of measurements with known uncertainties, to the International Systems of Units (SI) thru NIST or another Metrology Institute. The results contained within relate only to the item(s) calibrated. Pass/Fail or In/Out of tolerance statements are the opinions of UIS, Inc., decisions are based on data from measurements made, procedure utilized, professional experience. The uncertainty associated with this calibration has been included with any determination. It is the responsibility of the user of this equipment to determine if the results identified meet specific requirements for accuracy and its intended use. Due dates appearing on the certificate of calibration and label are determined by client for administrative purposes without the written approval of UIS, Inc., and do not imply continued conformance to specifications. The Confidence Factor is K=2 approx. 95% Confidence Level. All Certificates are page 1 of 1 unless otherwise specified. Page numbers at the top refer to the overall Job. This certificate shall not be reproduced except in full, without the written approval of UIS, Inc. Decision Rule 1: Measurement Uncertainty IS NOT taken into account for determining PASS or FAIL.

Cal-scan Services Ltd.

4188-93 Street
Edmonton, Alberta, Canada
T6E 5P5
Phone: (780) 944-1377 Fax: (780) 944 - 1406

Calibration Certificate

Model : Badger Tri Tool **Range :** 10,000.00 psi
Serial Number : 5599 **Last Cal. Date :** 18-February-2022

Specifications

Calibration Pressure Range: 0.00 10,000.00 psi
Calibration Temperature Range: 0.00 150.00 °C

Pressure: Accuracy ± 2.4000 psi (0.024 %FS)
Resolution ± 0.0300 psi (0.0003 %FS)

Temperature: Accuracy ± 0.40 °C
Resolution ± 0.001 °C

Calibration Summary

Pressure: Accuracy (maximum error) 0.65 psi
Temperature: Accuracy (maximum error) 0.19 °C

Traceability Statement

All working standards are traceable to national or internationally recognized standards.

Calibrated with Cal-Scan DWG # 6

Calibrated by:


Ryan Kryzanowski

Cal-scan Services Ltd.

4188-93 Street
Edmonton, Alberta, Canada
T6E 5P5
Phone: (780) 944-1377 Fax: (780) 944 - 1406

Calibration Certificate

Model : Badger Low Temp **Range :** 6,000.00 psi
Serial Number : 91885 **Last Cal. Date :** 17-February-2022

Specifications

Calibration Pressure Range: 0.00 6,000.00 psi
Calibration Temperature Range: 0.00 150.00 °C

Pressure: Accuracy ± 1.4400 psi (0.024 %FS)
Resolution ± 0.0180 psi (0.0003 %FS)

Temperature: Accuracy ± 0.40 °C
Resolution ± 0.001 °C

Calibration Summary

Pressure: Accuracy (maximum error) 0.24 psi
Temperature: Accuracy (maximum error) 0.10 °C

Traceability Statement

All working standards are traceable to national or internationally recognized standards.

Calibrated with Cal-Scan DWG # 2

Calibrated by:



Ryan Kryzanowski



APPENDIX E

EPA STANDARD ANNULAR PRESSURE TEST FORM



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
STANDARD ANNULAR PRESSURE TEST

Operator Republic Industrial and Energy Solutions, LLC

State Permit No. M-453

Address 28470 Citrin Drive Romulus, MI 48174

USEPA Permit No. MI-163-1W-C011

Date of Test 08-15-2022

Well Name Well #2-12

Well Type Waste Disposal (Class 1)

LOCATION INFORMATION SW Quarter of the NW Quarter of the SE Quarter of Section 12; Range 9E; Township 3S; County Wayne;

Company Representative John Frost; Field Inspector JASON SNLGER (EGLE)

Type of Pressure Gauge _____ inch face; 7200 psi full scale; 0.1 psi increments;

New Gauge? Yes No If no, date of calibration 07-11-22 Calibration certification submitted? Yes No

TEST RESULTS

Readings must be taken at least every 10 minutes for a minimum of 30 minutes for Class II, III and V wells and 60 minutes for Class I wells.

For Class II wells, annulus pressure should be at least 300 psig. For Class I wells, annulus pressure should be the greater of 300 psig or 100 psi above maximum permitted injection pressure.

Original chart recordings must be submitted with this form.

5-year or annual test on time? Yes No
2-year test for TA'd wells on time? Yes No
After rework? Yes No
Newly permitted well? Yes No

Time	Pressure (in psig)	
	Annulus	Tubing
<u>10:15</u>	1104.9 <u>1104.9</u>	<u>132.4</u>
<u>10:25</u>	<u>1104.3</u>	<u>132.5</u>
<u>10:35</u>	<u>1104.6</u>	<u>132.3</u>
<u>10:45</u>	<u>1104.3</u>	<u>132.3</u>
<u>10:55</u>	<u>1104.5</u>	<u>132.1</u>
<u>11:05</u>	<u>1104.0</u>	<u>132.7</u>
<u>11:15</u>	<u>1104.2</u>	<u>132.7</u>

Casing size 7"
Tubing size 4-1/2"
Packer type Model 12, Hastelloy
Packer set @ 3930
Top of Permitted Injection Zone 3973
Is packer 100 ft or less above top of Injection Zone? Yes No
If not, please submit a justification.
Fluid return (gal.) _____

Comments:

Test Pressures: Max. Allowable Pressure Change: Initial test pressure x 0.03 33.15 psi
Test Period Pressure change 0.7 psi

Test Passed Test Failed

If failed test, well must be shut in, no injection can occur, and USEPA must be contacted within 24 hours. Corrective action needs to occur, the well retested, and written authorization received before injection can recommence.

I certify under penalty of law that this document and all attachments are, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (See 40 CFR 144.32(d))

John Frost
Printed Name of Company Representative

John Frost
Signature of Company Representative

8.15.22
Date

APPENDIX F

EPA TEMPERATURE SURVEY FORM



BACKGROUND INFORMATION FOR REVIEW OF TEMPERATURE LOGS

Facility Name		Operator	
Well Name		USEPA Permit Number	State Permit Number
County, State	Test Date	Depth Reference: Kelly Bushing Ground Level	
Well and Operational Information			
Top of Open Interval, ft	Tubing Depth, ft	Date of Last Injection	Is This a Multi-Zone Facility?
Depth to Base of USDW, ft.	Name of lowermost USDW	Hour of Last Injection	Other Zones Used at Facility
Depth to Top of Permitted Int, ft	Name of Injection Interval	Volume Injected in Past Year, gal	Name of Shallower Injection Zone
Plugged Back Depth, ft.	Total Depth, ft	Injectate Temperature Variance, °F	Depth to Shallower Injection Zone, ft
Calibration Information		Logging Information	
Low Gauge Temperature, °F	High Gauge Temperature, °F	Time of Start of Logging	
Low Thermometer Temperature, °F	High Thermometer Temperature, °F	Days Since Last Injection	Maximum Log Depth, ft.
Were Log Readings Adjusted?	Gauge Calibration Date	Multiple Log Runs?	Maximum Logging Speed, ft/min

REMEMBER

1. Please fill in the above cells.
2. The well should have been shut in for at least 36 hours or until temperatures have stabilized (based on previous logs).
3. If the well cannot be shut in for 36 hours, shut in as long as possible and run two logs at least six hours apart.
4. Calibrate the temperature tool at two different temperatures immediately prior to running the test.
5. Record log data at least once per foot.
6. Record natural gamma ray activity log with temperature.
7. Log top to bottom. Keep logging speed below 30 feet per minute.
8. Log quality in air-filled holes can be improved by logging at a slower speed. Please reduce logging speed to less than 20 feet per minute in the top 1000 feet of air-filled holes.
9. The report on the test must explain any anomalies shown on the log.
10. Submit digital logging data on a CD in .las or .asc format.
11. Submit an up-to-date well schematic.

APPENDIX G

EPA RADIOACTIVE TRACER SURVEY FORM



BACKGROUND INFORMATION FOR REVIEW OF RADIOACTIVE TRACER SURVEYS FOR CEMENT INTEGRITY

Facility Name			Operator		
Well Name			USEPA Permit Number	Witness	
State	Test Date		Logging Company	Depth Reference: Kelly Bushing Ground Level	
Well and Operational Information					
Long String Casing Material	Long String Casing OD, ins	Casing weight, #/ft	Casing ID, ins.	Long String Casing Length, ft	
Tubing Material	Tubing OD, ins	Tubing weight, #/ft	Tubing ID, ins.	Tubing Length, ft	
Tail Pipe Material	Tail Pipe OD, ins	Tail Pipe, weight#/ft.	Tail Pipe ID, ins.	Tail Pipe Length, ft	Tail Pipe Depth
	Open Hole diameter, in	TD, ft	PBTD, ft	Top of Open Interval, ft	
Packer Model	Packer Type	Top of Packer, ft	Bottom of Packer, ft		
Geological Information					
Lowermost USDW Name		Fms in Confining Zone		Fms in Injection Zone	
Base of USDW, ft		Depth to top of Confinement Zone		Injection Zone Top, ft	
TOOL INFORMATION					
Ejector, ft above BDET	TDET, ft above BDET	MDET, ft above BDET			
CALIBRATION INFORMATION					
Depth BDET, ft	Depth TDET, ft	BDET CPSPI	Lithology (Warm/Cool)	Maximum Reading, LD	Minimum Reading, LD
Depth BDET, ft	Depth TDET, ft	BDET CPSPI	Lithology (Warm/Cool)	Maximum Reading, LD	Minimum Reading, LD
FIRST SLUG TRACKING SEQUENCE					
Flow Rate, gpm	Velocity in tubing, fps	Depth of deflection on 1st pass, ft	Deflection on 1st pass, LD	Deflection/Background	Passes Through Slug
Slug Split? yes or no	Depth of Split, ft	Moved up, yes or no	Minimum Slug Depth, ft	Distance above shoe, ft	Maximum Slug Depth, ft
FIRST STATIONARY TEST					
Depth of BDET, ft	Depth of TDET, ft	BDET to open interval, ft	Time at station, mins	Injection Rate, gpm	Log Divisions per Minute
Depth at Injection, ft		BDET above end of tubing or casing, ft	Reached BDET up, LD	Reached UDET up, LD	Velocity Up, ft/min
2nd Setting Depth, ft	Time of reset	Slug already passed BDET?	Reached BDET up, LD	Slug arrival time	
3rd Setting Depth	Time of reset	Slug already passed BDET?	Reached BDET up, LD	Slug arrival time	
4th setting depth, ft	Time of reset	Slug already passed BDET?	Reached BDET up, LD	Slug arrival time	Upper Limit of Movement, ft

REMEMBER

1. Please fill in the above cells.
2. Inject at highest practicable rate during the stationary test to maximize pressure difference that is the driving force for upward movement of fluid (if it occurs), but at low enough velocity during slug tracking so the slug can be followed effectively.
3. Leave the scaling at the same level for all phases. 40 counts per second per inch is usually effective. We need to be able to see evidence of variation due to lithology.
4. Use big slugs. The height of the deflection caused by the slug should be at least 50 times the difference of the high and low levels measured during logging the initial log.
5. If you record times of arrival, that should be the arrival of the leading edge.
6. The purpose is to determine the shallowest depth at which tracer material leaves the well.
7. When slug tracking, logging through the slug while the last part of the slug is leaving the deeper of the tailpipe or casing is the best way to identify a split. If there is a split, always follow the upper portion to determine the limit of its upward movement.
8. When running the stationary test, set the tool with the bottom detector five feet above the end of the deeper of the tail pipe or casing. If the slug reaches it, move it up in steps to find the shallowest extent of movement.
9. The stationary test must be run long enough to be able to detect upward motion of 2 ft/min.
10. Superimpose the traces of the initial and final base logs.
11. Please submit both the merged and unmerged slug chase records.
12. The test report must explain any anomalies in the results.
13. Please submit the digital logging data on a CD.
14. Submit an up-to-date well schematic.

APPENDIX H

**RAW PRESSURE AND TEMPERATURE DATA
(ABRIDGED)**



APPENDIX I

PANSYSTEM© ANALYSIS OF FALLOFF TEST



Well Test Analysis Report

File: RS_2-12 2022 PFO Analysis.panx

Date: 29-September-2022

Report Details :

Company	Republic Services
Location	Romulus, MI
Well	#2-12
Test	Reservoir Pressure Falloff
Date	August 17-19, 2022
Injection Interval	3,975' - 4,550' KB
Interval Completion	Open-Hole
Gauge Type	Badger Tri Tool
Gauge Serial Number	5599
Gauge Depth	3,975' KB
WSP Analyst	TG
WSP Project Number	192128AD

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Input Data

Reservoir Configuration

Fluid type	Water
Well orientation	Vertical/Slant
Number of wells	1
Number of layers	1

Layer Parameters

Parameter	Layer 1
Formation thickness (ft)	133
Average formation porosity	0.11
Water saturation	0
Gas saturation	0
Formation compressibility (psi-1)	0.0000e+000
Total system compressibility (psi-1)	6.2000e-006
Layer pressure (psia)	0
Temperature (deg F)	0

Well Parameters

Parameter	#2-12
Well radius (ft)	0.3646
Distance from observation to active well (ft)	0
Wellbore storage coefficient (bbl/psi)	0
Storage Amplitude (psi)	0
Storage Time Constant (hr)	0
Second Wellbore Storage (bbl/psi)	0
Time Change for Second Storage (hr)	0
Well offset - x direction (ft)	0
Well offset - y direction (ft)	0

Fluid Parameters

Parameter	Layer 1
Oil gravity (API)	0
Gas gravity (sp grav)	0
Gas-oil ratio (produced) (scf/STB)	0
Water cut	0
Water salinity (ppm)	0
Check Pressure (psia)	0
Check Temperature (deg F)	0
Gas-oil ratio (solution) (scf/STB)	0
Bubble-point pressure (psia)	0
Oil density (lb/ft3)	0
Oil viscosity (cp)	0
Oil formation volume factor (RB/STB)	0
Gas density (lb/ft3)	0
Gas viscosity (cp)	0
Gas formation volume factor (ft3/scf)	0
Water density (lb/ft3)	0
Water viscosity (cp)	1.34
Water formation volume factor (RB/STB)	1
Oil compressibility (psi-1)	0.0000e+000
Initial Gas compressibility (psi-1)	0.0000e+000
Water compressibility (psi-1)	0.0000e+000

Correlations

Correlation Parameters	Layer 1
Cf Correlation	Hall Correlation
Young's modulus (E) (psi)	0
Poisson's Ratio (v)	0

Layer Boundaries

Boundary Parameter	Layer 1
Boundary Type	Infinitely acting

Rate Change Data

DateTime (hh:mm:ss)	Pressure (psia)	Rate (STB/day)
8/17/2022 2:19:29 PM	1868.74	0
8/18/2022 1:28:14 AM	2621.5	-1575.43
8/19/2022 6:30:00 AM	1876.21	0

Model Data

Layer 1 Model Data

Model Parameter	Model Data
Model Name	Model 1
Model Type	Radial homogeneous
Permeability (md)	0
Skin factor	0

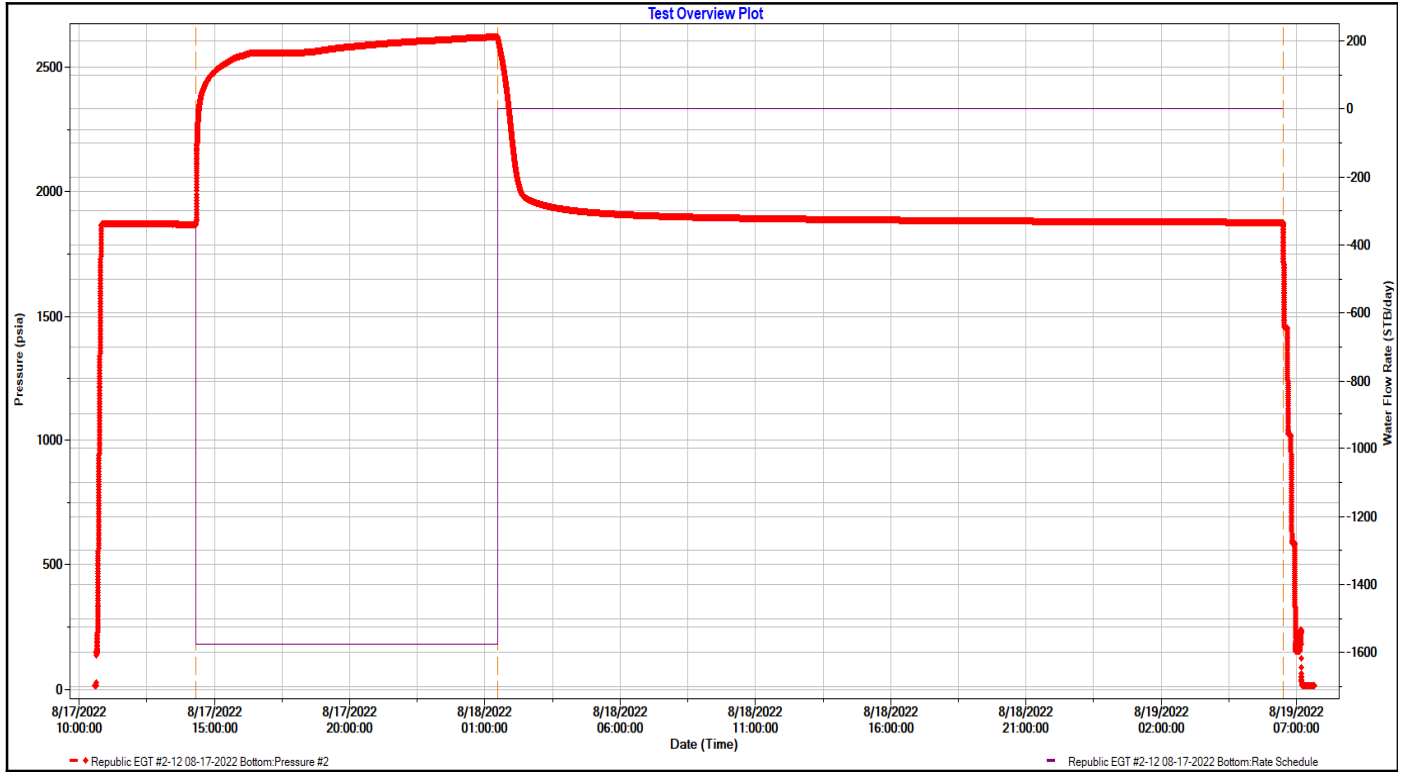
Analysis

Model - Layer 1 : Model 1

Model Detail

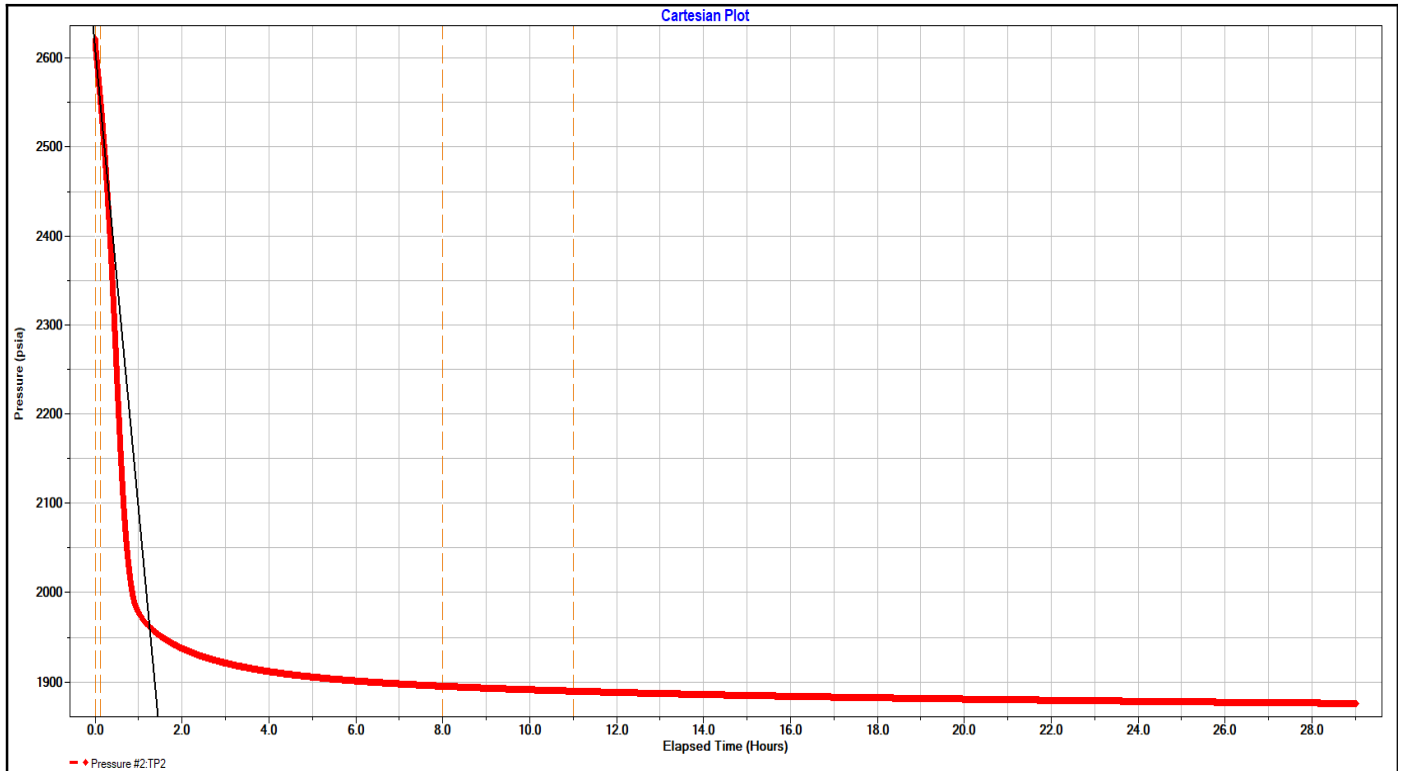
Model Parameter	Model Data
Model Name	Model 1
Model Type	Radial homogeneous
Layer	Layer 1
WellBore Storage Model	Classic Wellbore Storage

Test Overview Plot



Test Overview Plot

Cartesian Plot:TP2



Cartesian Plot

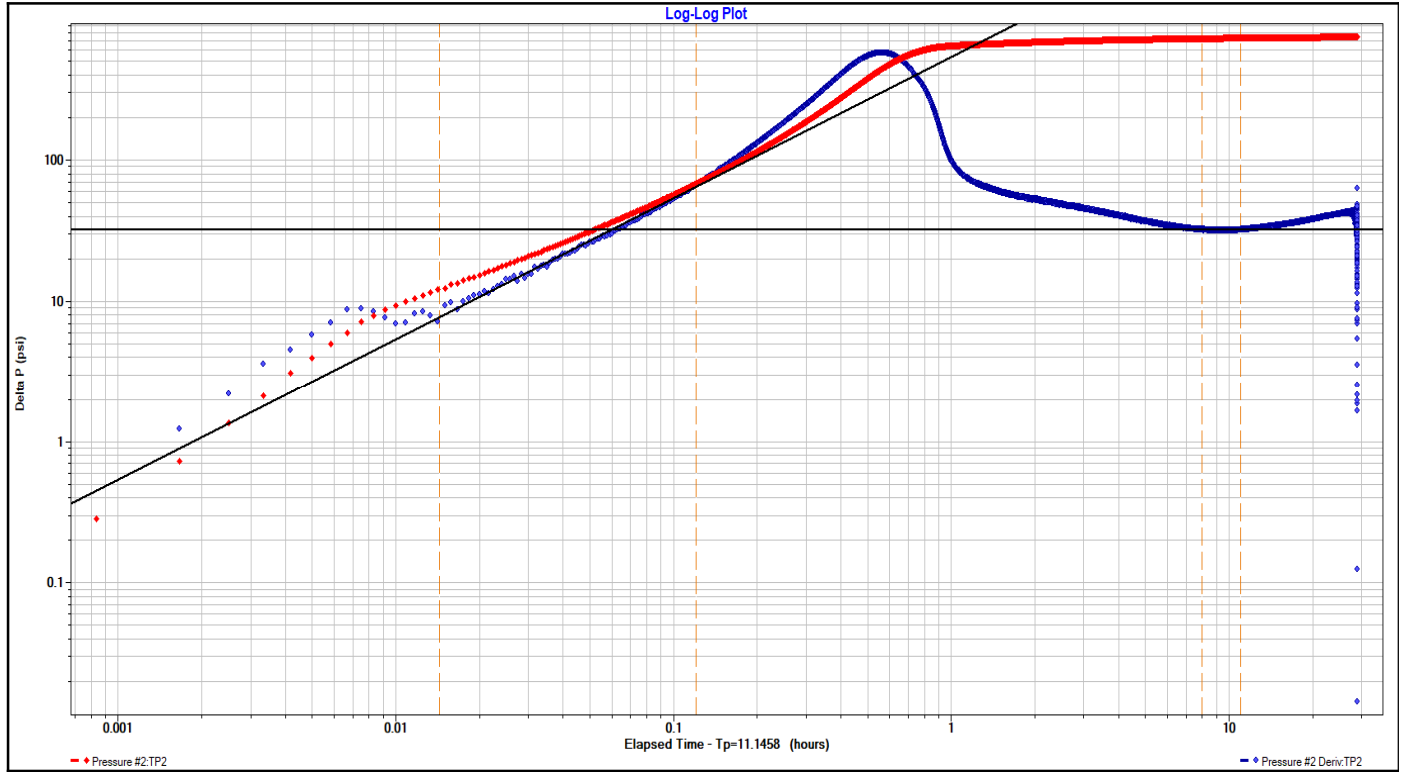
Line Results

Line Result Parameter	Value
Wellbore storage coefficient (bbl/psi)	0.126285

Line Details

Details	Value
Line type	Wellbore storage
Slope	-519.8
Intercept	2616.367
Coefficient of Determination	1

Log-Log Plot: TP2



Log-Log Plot

Line Results

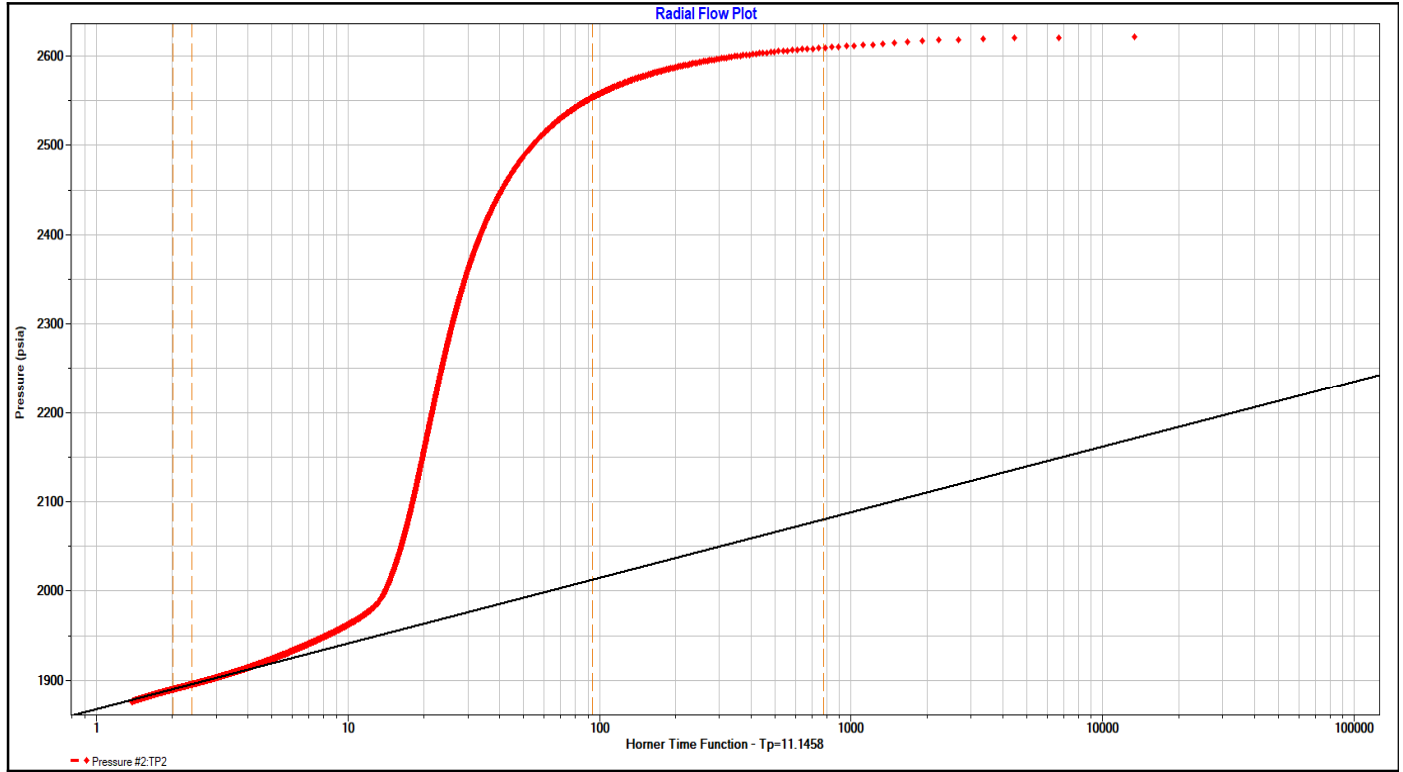
Line Result Parameter	Value
Wellbore storage coefficient (bbl/psi)	0.122696
Permeability (md)	35.0225
Permeability-thickness (md.ft)	4657.99
Skin factor	4.24406

Line Details

Details	Value
Line type	Wellbore storage
Slope	1
Intercept	535.003
Coefficient of Determination	Not Used

Details	Value
Line type	Radial flow
Slope	0
Intercept	31.997
Coefficient of Determination	Not Used

Radial Flow Plot: TP2



Radial Flow Plot

Line Results

Line Result Parameter	Value
Permeability (md)	35.1608
Permeability-thickness (md.ft)	4676.39
Extrapolated pressure (psia)	1867.666
Radius of investigation (ft)	969.17
Flow efficiency	0.611467
dP skin (constant rate) (psi)	292.89
Skin factor	4.5949

Line Details

Details	Value
Line type	Radial flow
Slope	73.386
Intercept	1867.666
Coefficient of Determination	1
Extrapolated pressure (psia)	1867.666
Pressure at dt = 1 hour (psia)	1947.247

APPENDIX J
PRESSURE TEST REPORT DATA



Pressure Test Report

COMPANY INFORMATION

Company Name Republic Services
Representative Jeffry Tahtouh with WSP
Phone 713-503-7704
Fax
Address Republic Services
28470 Citrin Drive
Romulus, MI 48174

E-Mail Address
Service Company J.O. Well Service & Testing, Inc.

WELL INFORMATION

Well Name EGT No 2-12
Well Location Romulus, MI
Field and Pool
Status (Oil, Gas, Water, Injection) Injection
Perforated Intervals
Mid-point of Perforated Intervals (MPP)
Drilling Rig Number
Elevations
 Kelly Bushing (KB)
 Casing Flange (CF)
 KB-CF
 Ground Level
Plug Back Total Depth
Total Depth
Production Casing
Production Tubing

TEST INFORMATION

Type of Test Injection/Fall-Off
Date(s) of Test August 17, 2022 thru August 19, 2022
Dead-weight Gauge Tubing Pressure
Dead-weight Gauge Casing Pressure
Shut-in Date (Duration) August 18, 2022 at 01:28:17
Date / Time on Bottom August 17, 2022 at 10:48:41
Date / Time off Bottom August 19, 2022 at 06:30:00
Probe Serial Number 5599
Probe Offset from End of Tool String
Run Depth at Probe Pressure Port

PRESSURE TEST RESULTS

Maximum Recorded Probe Pressure 2606.8 psig
Maximum Recorded Probe Temperature 81.4 deg F
Final Buildup Pressure
Gradient Survey Information
 Extrapolated Pressure to MPP
 Final Gradient at Depth
Job Number

Company Name Republic Services
Well Name EGT No 2-12
Type of Test Injection/Fall-Off
Date(s) of Test August 17, 2022 thru August 19, 2022

PROBE INFORMATION

Probe Serial Number 5599
Model Badger Tri Tool
Pressure
 Calibrated Pressure Range 0.0 - 10,000.0 psig
 Accuracy 2.40 psig (0.024% FS)
 Resolution 0.0300 psig (0.0003% FS)
Temperature
 Calibrated Temperature Range 0.00 - 150.00 deg C
 Accuracy 0.40 deg C
 Resolution 0.001 deg C
Calibration File Used for Reports February 18, 2022

PROGRAMMING DETAILS

<u>Step</u>	<u>Sample Mode</u>	<u>Period</u>	<u>Duration</u>	<u>Comment</u>
-------------	--------------------	---------------	-----------------	----------------

Program Start Time
Program End Time
Total Samples Taken
Usage for this Test
Generic Data File Name

Company Name Republic Services
Well Name EGT No 2-12
Type of Test Injection/Fall-Off
Date(s) of Test August 17, 2022 thru August 19, 2022

Pressure vs. Depth

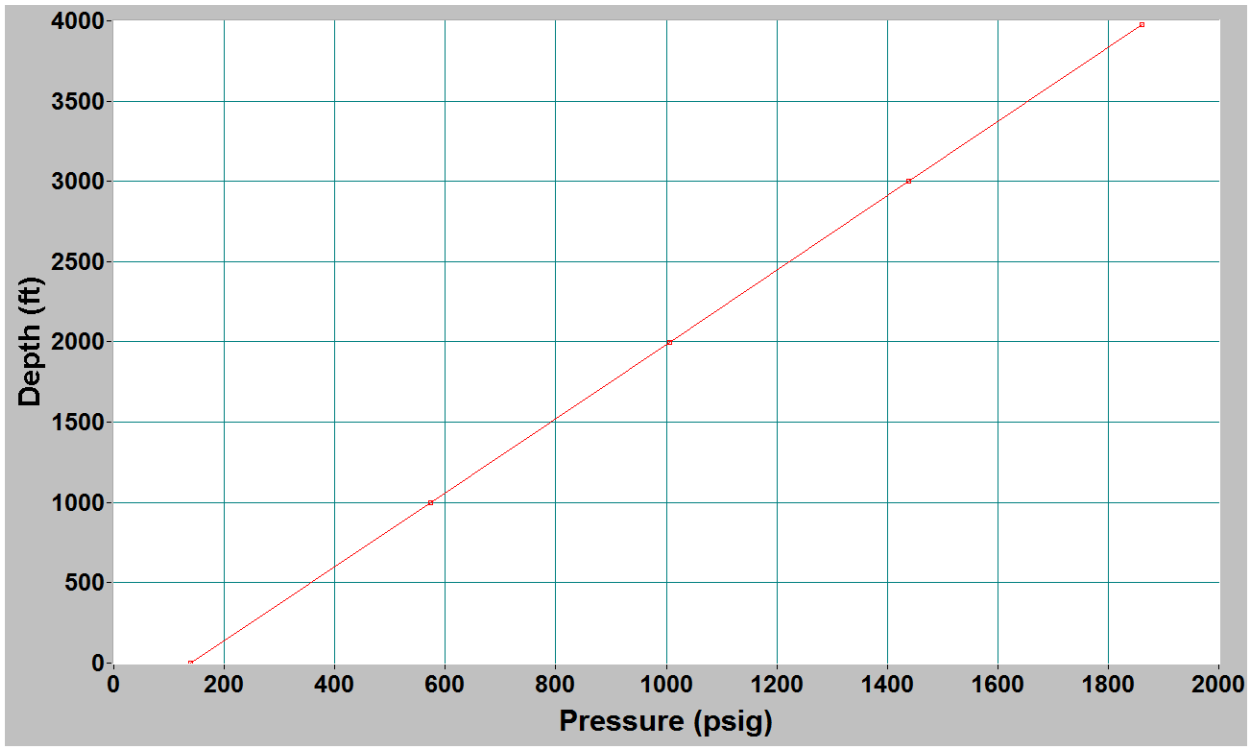
Probe Serial Number 5599

		(ft)	(psig)	(psi/ft)	(deg F)	(deg F/ft)
06:25	06:30	3975.000	1861.603	-	76.037	-
06:33	06:38	3000.000	1439.244	0.4332	74.142	0.0019
06:42	06:47	2000.000	1006.369	0.4329	62.395	0.0117
06:50	06:55	1000.000	573.020	0.4333	58.095	0.0043
06:58	07:03	0.000	139.067	0.4340	63.612	-0.0055

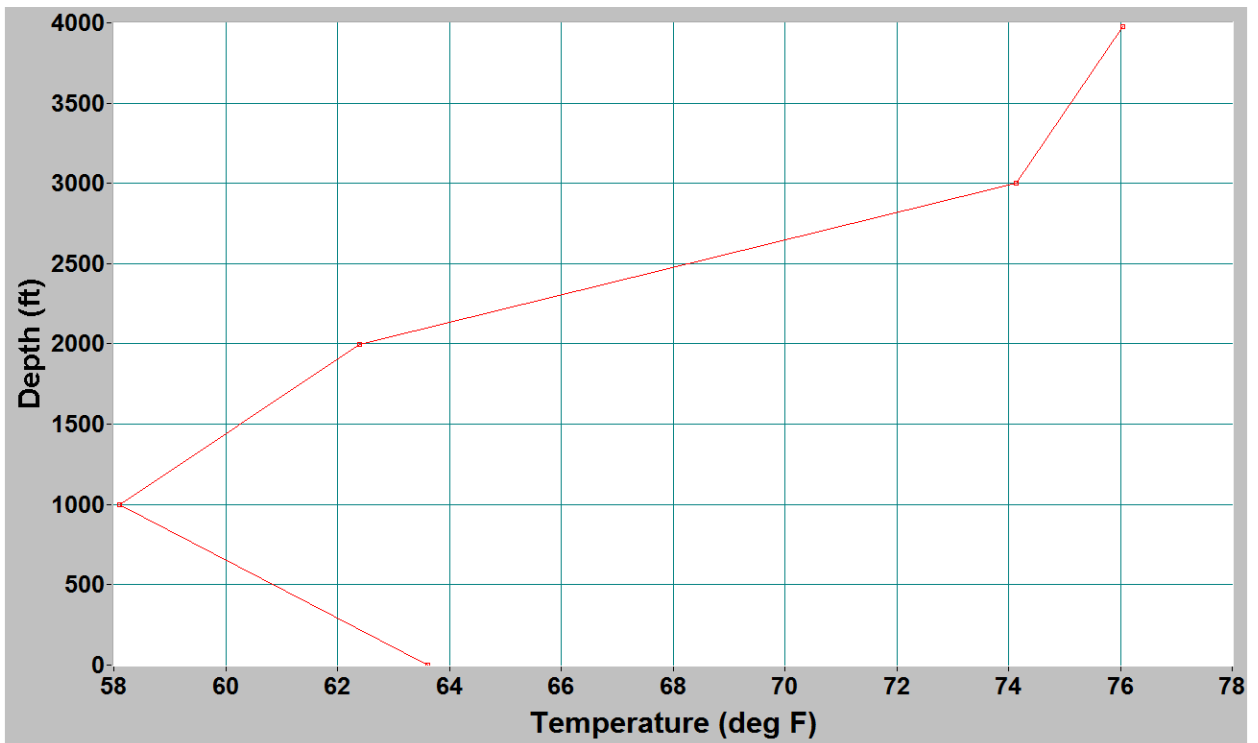
Extrapolated to MPP:

(ft)	(psig)	(deg F)
0.000		

Static Pressure Gradients

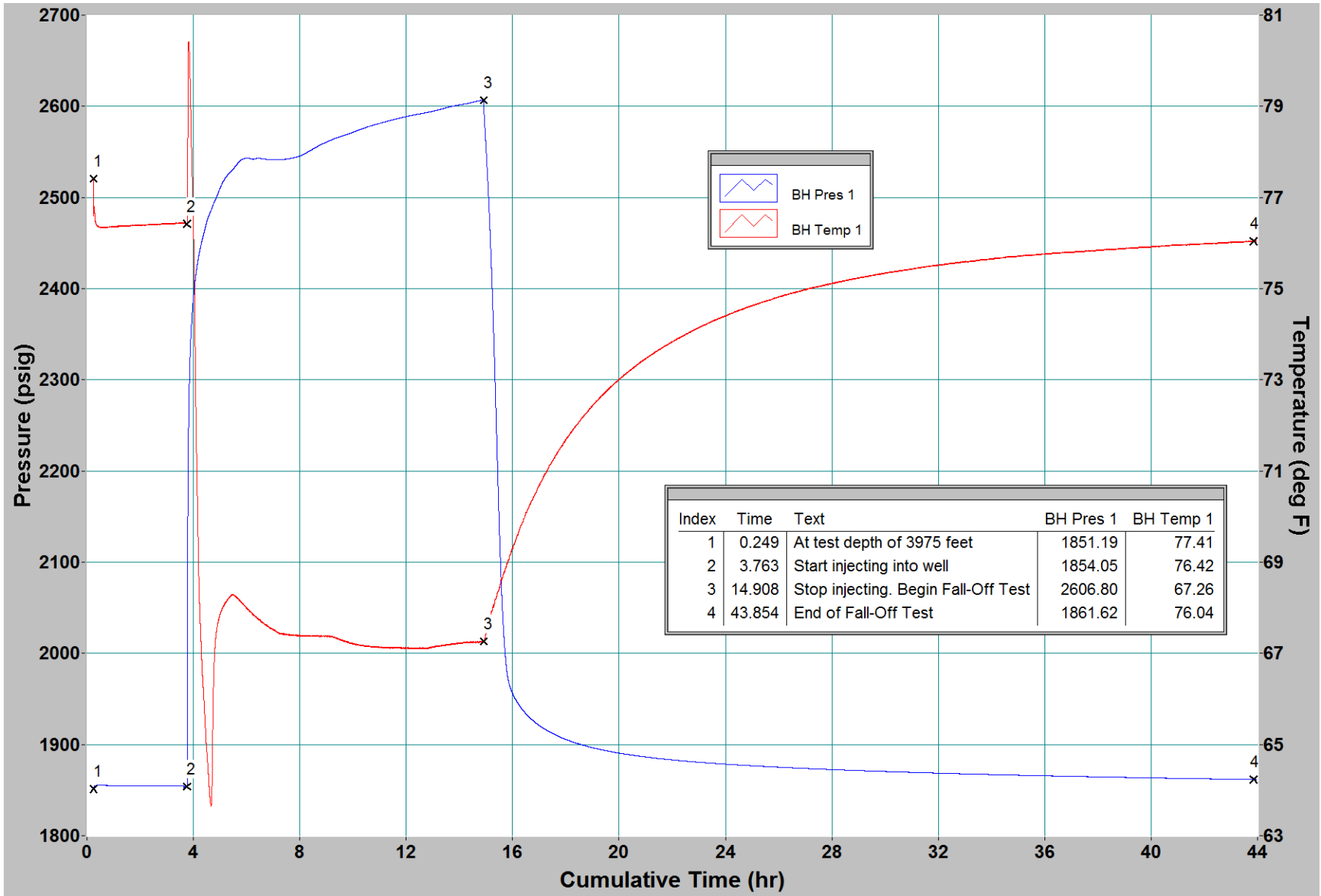


Static Temperature Gradients



Company Name Republic Services
Well Name EGT No 2-12
Type of Test Injection/Fall-Off
Date(s) of Test August 17, 2022 thru August 19, 2022

Fall-Off Test



Company Name Republic Services
Well Name EGT No 2-12
Type of Test Injection/Fall-Off
Date(s) of Test August 17, 2022 thru August 19, 2022

Date	Time	Cum. Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
Gauges on surface				
2022/08/17	10:33:44	0.0000	0.624	75.742
Gauges in lubricator				
2022/08/17	10:37:08	0.0567	1.708	80.177
Lubricator equalized				
2022/08/17	10:38:35	0.0808	134.986	77.679
R.I.H. with gauges				
2022/08/17	10:39:29	0.0958	130.957	75.018
2022/08/17	10:42:08	0.1400	459.278	57.567
At test depth of 3975 feet				
2022/08/17	10:48:41	0.2492	1851.194	77.412
2022/08/17	10:50:08	0.2733	1853.927	76.797
2022/08/17	10:58:08	0.4067	1855.211	76.374
2022/08/17	11:06:08	0.5400	1855.164	76.350
2022/08/17	11:14:08	0.6733	1855.128	76.345
2022/08/17	11:22:08	0.8067	1855.071	76.350
2022/08/17	11:30:08	0.9400	1855.034	76.356
2022/08/17	11:38:08	1.0733	1854.981	76.366
2022/08/17	11:46:08	1.2067	1854.942	76.365
2022/08/17	11:54:08	1.3400	1854.906	76.375
2022/08/17	12:02:08	1.4733	1854.850	76.383
2022/08/17	12:10:08	1.6067	1854.808	76.384
2022/08/17	12:18:08	1.7400	1854.760	76.388
2022/08/17	12:26:08	1.8733	1854.740	76.395
2022/08/17	12:34:08	2.0067	1854.679	76.386
2022/08/17	12:42:08	2.1400	1854.642	76.393
2022/08/17	12:50:08	2.2733	1854.601	76.404
2022/08/17	12:58:08	2.4067	1854.569	76.404
2022/08/17	13:06:08	2.5400	1854.542	76.413
2022/08/17	13:14:08	2.6733	1854.499	76.410
2022/08/17	13:22:08	2.8067	1854.473	76.415
2022/08/17	13:30:08	2.9400	1854.454	76.420
2022/08/17	13:38:08	3.0733	1854.403	76.422
2022/08/17	13:46:08	3.2067	1854.376	76.429
2022/08/17	13:54:08	3.3400	1854.374	76.440
2022/08/17	14:02:08	3.4733	1854.367	76.435
2022/08/17	14:10:08	3.6067	1854.349	76.442
2022/08/17	14:18:08	3.7400	1854.033	76.413
Start injecting into well				
2022/08/17	14:19:29	3.7625	1854.048	76.420
2022/08/17	14:26:08	3.8733	2324.541	79.626
2022/08/17	14:34:08	4.0067	2391.860	76.233
2022/08/17	14:42:08	4.1400	2424.691	70.763
2022/08/17	14:50:08	4.2733	2446.011	67.460
2022/08/17	14:58:08	4.4067	2462.560	65.871
2022/08/17	15:06:08	4.5400	2476.657	64.542
2022/08/17	15:14:08	4.6733	2486.504	63.687
2022/08/17	15:22:08	4.8067	2496.372	67.091
2022/08/17	15:30:08	4.9400	2505.413	67.717
2022/08/17	15:38:08	5.0733	2514.718	67.968

Date	Time	Cum. Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/17	15:46:08	5.2067	2521.582	68.108
2022/08/17	15:54:08	5.3400	2526.240	68.218
2022/08/17	16:02:08	5.4733	2530.142	68.284
2022/08/17	16:10:08	5.6067	2535.095	68.230
2022/08/17	16:18:08	5.7400	2539.680	68.157
2022/08/17	16:26:08	5.8733	2542.312	68.077
2022/08/17	16:34:08	6.0067	2543.016	67.996
2022/08/17	16:42:08	6.1400	2542.576	67.915
2022/08/17	16:50:08	6.2733	2542.021	67.834
2022/08/17	16:58:08	6.4067	2542.864	67.775
2022/08/17	17:06:08	6.5400	2542.766	67.696
2022/08/17	17:14:08	6.6733	2542.237	67.638
2022/08/17	17:22:08	6.8067	2541.621	67.584
2022/08/17	17:30:08	6.9400	2541.378	67.539
2022/08/17	17:38:08	7.0733	2541.338	67.492
2022/08/17	17:46:08	7.2067	2541.508	67.446
2022/08/17	17:54:08	7.3400	2541.772	67.422
2022/08/17	18:02:08	7.4733	2541.991	67.404
2022/08/17	18:10:08	7.6067	2542.534	67.401
2022/08/17	18:18:08	7.7400	2543.364	67.401
2022/08/17	18:26:08	7.8733	2544.303	67.383
2022/08/17	18:34:08	8.0067	2545.547	67.392
2022/08/17	18:42:08	8.1400	2547.339	67.383
2022/08/17	18:50:08	8.2733	2549.424	67.381
2022/08/17	18:58:08	8.4067	2551.635	67.384
2022/08/17	19:06:08	8.5400	2553.904	67.392
2022/08/17	19:14:08	8.6733	2556.035	67.383
2022/08/17	19:22:08	8.8067	2558.007	67.379
2022/08/17	19:30:08	8.9400	2559.907	67.381
2022/08/17	19:38:08	9.0733	2561.740	67.372
2022/08/17	19:46:08	9.2067	2563.299	67.374
2022/08/17	19:54:08	9.3400	2564.911	67.341
2022/08/17	20:02:08	9.4733	2566.224	67.311
2022/08/17	20:10:08	9.6067	2567.544	67.282
2022/08/17	20:18:08	9.7400	2568.929	67.257
2022/08/17	20:26:08	9.8733	2570.181	67.233
2022/08/17	20:34:08	10.0067	2571.584	67.217
2022/08/17	20:42:08	10.1400	2573.061	67.195
2022/08/17	20:50:08	10.2733	2574.529	67.176
2022/08/17	20:58:08	10.4067	2575.921	67.176
2022/08/17	21:06:08	10.5400	2577.334	67.165
2022/08/17	21:14:08	10.6733	2578.560	67.150
2022/08/17	21:22:08	10.8067	2579.741	67.134
2022/08/17	21:30:08	10.9400	2580.782	67.132
2022/08/17	21:38:08	11.0733	2581.905	67.129
2022/08/17	21:46:08	11.2067	2582.953	67.127
2022/08/17	21:54:08	11.3400	2584.037	67.123
2022/08/17	22:02:08	11.4733	2585.022	67.122
2022/08/17	22:10:08	11.6067	2586.023	67.118
2022/08/17	22:18:08	11.7400	2587.037	67.118

Company Name Republic Services
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Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/17	22:26:08	11.8733	2587.905	67.123
2022/08/17	22:34:08	12.0067	2588.750	67.123
2022/08/17	22:42:08	12.1400	2589.640	67.125
2022/08/17	22:50:08	12.2733	2590.409	67.109
2022/08/17	22:58:08	12.4067	2591.143	67.116
2022/08/17	23:06:08	12.5400	2591.848	67.116
2022/08/17	23:14:08	12.6733	2592.664	67.116
2022/08/17	23:22:08	12.8067	2593.414	67.114
2022/08/17	23:30:08	12.9400	2594.189	67.131
2022/08/17	23:38:08	13.0733	2595.109	67.145
2022/08/17	23:46:08	13.2067	2596.080	67.159
2022/08/17	23:54:08	13.3400	2597.116	67.174
2022/08/18	00:02:08	13.4733	2598.153	67.181
2022/08/18	00:10:08	13.6067	2599.138	67.186
2022/08/18	00:18:08	13.7400	2600.056	67.203
2022/08/18	00:26:08	13.8733	2600.901	67.213
2022/08/18	00:34:08	14.0067	2601.603	67.228
2022/08/18	00:42:08	14.1400	2602.248	67.237
2022/08/18	00:50:08	14.2733	2602.962	67.251
2022/08/18	00:58:08	14.4067	2603.805	67.240
2022/08/18	01:06:08	14.5400	2604.683	67.239
2022/08/18	01:14:08	14.6733	2605.737	67.244
2022/08/18	01:22:08	14.8067	2606.472	67.248
Stop injecting. Begin Fall-Off Test				
2022/08/18	01:28:14	14.9083	2606.800	67.260
2022/08/18	01:30:08	14.9400	2585.121	67.293
2022/08/18	01:38:08	15.0733	2513.452	67.602
2022/08/18	01:46:08	15.2067	2420.788	67.903
2022/08/18	01:54:08	15.3400	2299.606	68.162
2022/08/18	02:02:08	15.4733	2161.769	68.385
2022/08/18	02:10:08	15.6067	2053.397	68.641
2022/08/18	02:18:08	15.7400	1992.043	68.873
2022/08/18	02:26:08	15.8733	1966.243	69.087
2022/08/18	02:34:08	16.0067	1955.510	69.318
2022/08/18	02:42:08	16.1400	1947.956	69.532
2022/08/18	02:50:08	16.2733	1941.960	69.746
2022/08/18	02:58:08	16.4067	1936.902	69.915
2022/08/18	03:06:08	16.5400	1932.525	70.115
2022/08/18	03:14:08	16.6733	1928.690	70.284
2022/08/18	03:22:08	16.8067	1925.344	70.452
2022/08/18	03:30:08	16.9400	1922.210	70.619
2022/08/18	03:38:08	17.0733	1919.473	70.772
2022/08/18	03:46:08	17.2067	1916.975	70.921
2022/08/18	03:54:08	17.3400	1914.608	71.062
2022/08/18	04:02:08	17.4733	1912.533	71.197
2022/08/18	04:10:08	17.6067	1910.556	71.330
2022/08/18	04:18:08	17.7400	1908.750	71.452
2022/08/18	04:26:08	17.8733	1907.071	71.564
2022/08/18	04:34:08	18.0067	1905.519	71.695
2022/08/18	04:42:08	18.1400	1903.985	71.803

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/18	04:50:08	18.2733	1902.701	71.899
2022/08/18	04:58:08	18.4067	1901.389	72.010
2022/08/18	05:06:08	18.5400	1900.172	72.109
2022/08/18	05:14:08	18.6733	1899.074	72.210
2022/08/18	05:22:08	18.8067	1897.975	72.298
2022/08/18	05:30:08	18.9400	1897.002	72.388
2022/08/18	05:38:08	19.0733	1895.990	72.480
2022/08/18	05:46:08	19.2067	1895.147	72.559
2022/08/18	05:54:08	19.3400	1894.242	72.644
2022/08/18	06:02:08	19.4733	1893.442	72.720
2022/08/18	06:10:08	19.6067	1892.680	72.801
2022/08/18	06:18:08	19.7400	1891.925	72.876
2022/08/18	06:26:08	19.8733	1891.248	72.945
2022/08/18	06:34:08	20.0067	1890.514	73.013
2022/08/18	06:42:08	20.1400	1889.898	73.076
2022/08/18	06:50:08	20.2733	1889.288	73.146
2022/08/18	06:58:08	20.4067	1888.682	73.211
2022/08/18	07:06:08	20.5400	1888.116	73.267
2022/08/18	07:14:08	20.6733	1887.595	73.324
2022/08/18	07:22:08	20.8067	1887.068	73.382
2022/08/18	07:30:08	20.9400	1886.586	73.443
2022/08/18	07:38:08	21.0733	1886.055	73.492
2022/08/18	07:46:08	21.2067	1885.599	73.546
2022/08/18	07:54:08	21.3400	1885.161	73.603
2022/08/18	08:02:08	21.4733	1884.704	73.656
2022/08/18	08:10:08	21.6067	1884.286	73.693
2022/08/18	08:18:08	21.7400	1883.873	73.744
2022/08/18	08:26:08	21.8733	1883.506	73.794
2022/08/18	08:34:08	22.0067	1883.127	73.845
2022/08/18	08:42:08	22.1400	1882.752	73.875
2022/08/18	08:50:08	22.2733	1882.367	73.924
2022/08/18	08:58:08	22.4067	1882.035	73.963
2022/08/18	09:06:08	22.5400	1881.687	74.008
2022/08/18	09:14:08	22.6733	1881.346	74.050
2022/08/18	09:22:08	22.8067	1881.036	74.089
2022/08/18	09:30:08	22.9400	1880.701	74.129
2022/08/18	09:38:08	23.0733	1880.413	74.169
2022/08/18	09:46:08	23.2067	1880.128	74.206
2022/08/18	09:54:08	23.3400	1879.817	74.237
2022/08/18	10:02:08	23.4733	1879.540	74.273
2022/08/18	10:10:08	23.6067	1879.245	74.314
2022/08/18	10:18:08	23.7400	1878.970	74.341
2022/08/18	10:26:08	23.8733	1878.722	74.376
2022/08/18	10:34:08	24.0067	1878.457	74.401
2022/08/18	10:42:08	24.1400	1878.197	74.439
2022/08/18	10:50:08	24.2733	1877.953	74.467
2022/08/18	10:58:08	24.4067	1877.718	74.505
2022/08/18	11:06:08	24.5400	1877.469	74.530
2022/08/18	11:14:08	24.6733	1877.236	74.550
2022/08/18	11:22:08	24.8067	1877.008	74.592

Company Name Republic Services
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Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/18	11:30:08	24.9400	1876.775	74.611
2022/08/18	11:38:08	25.0733	1876.536	74.640
2022/08/18	11:46:08	25.2067	1876.366	74.667
2022/08/18	11:54:08	25.3400	1876.128	74.687
2022/08/18	12:02:08	25.4733	1875.921	74.721
2022/08/18	12:10:08	25.6067	1875.724	74.739
2022/08/18	12:18:08	25.7400	1875.526	74.761
2022/08/18	12:26:08	25.8733	1875.320	74.791
2022/08/18	12:34:08	26.0067	1875.131	74.822
2022/08/18	12:42:08	26.1400	1874.934	74.847
2022/08/18	12:50:08	26.2733	1874.744	74.863
2022/08/18	12:58:08	26.4067	1874.568	74.887
2022/08/18	13:06:08	26.5400	1874.383	74.912
2022/08/18	13:14:08	26.6733	1874.193	74.926
2022/08/18	13:22:08	26.8067	1874.001	74.941
2022/08/18	13:30:08	26.9400	1873.840	74.970
2022/08/18	13:38:08	27.0733	1873.666	74.986
2022/08/18	13:46:08	27.2067	1873.512	75.011
2022/08/18	13:54:08	27.3400	1873.317	75.027
2022/08/18	14:02:08	27.4733	1873.178	75.040
2022/08/18	14:10:08	27.6067	1872.998	75.060
2022/08/18	14:18:08	27.7400	1872.840	75.081
2022/08/18	14:26:08	27.8733	1872.686	75.094
2022/08/18	14:34:08	28.0067	1872.544	75.114
2022/08/18	14:42:08	28.1400	1872.363	75.128
2022/08/18	14:50:08	28.2733	1872.215	75.144
2022/08/18	14:58:08	28.4067	1872.081	75.164
2022/08/18	15:06:08	28.5400	1871.898	75.182
2022/08/18	15:14:08	28.6733	1871.772	75.196
2022/08/18	15:22:08	28.8067	1871.628	75.209
2022/08/18	15:30:08	28.9400	1871.473	75.227
2022/08/18	15:38:08	29.0733	1871.356	75.249
2022/08/18	15:46:08	29.2067	1871.198	75.259
2022/08/18	15:54:08	29.3400	1871.052	75.270
2022/08/18	16:02:08	29.4733	1870.926	75.283
2022/08/18	16:10:08	29.6067	1870.794	75.295
2022/08/18	16:18:08	29.7400	1870.654	75.313
2022/08/18	16:26:08	29.8733	1870.528	75.324
2022/08/18	16:34:08	30.0067	1870.397	75.342
2022/08/18	16:42:08	30.1400	1870.254	75.351
2022/08/18	16:50:08	30.2733	1870.126	75.369
2022/08/18	16:58:08	30.4067	1870.023	75.375
2022/08/18	17:06:08	30.5400	1869.888	75.391
2022/08/18	17:14:08	30.6733	1869.754	75.407
2022/08/18	17:22:08	30.8067	1869.628	75.414
2022/08/18	17:30:08	30.9400	1869.526	75.425
2022/08/18	17:38:08	31.0733	1869.402	75.441
2022/08/18	17:46:08	31.2067	1869.296	75.448
2022/08/18	17:54:08	31.3400	1869.153	75.457
2022/08/18	18:02:08	31.4733	1869.036	75.475

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/18	18:10:08	31.6067	1868.941	75.486
2022/08/18	18:18:08	31.7400	1868.817	75.499
2022/08/18	18:26:08	31.8733	1868.702	75.522
2022/08/18	18:34:08	32.0067	1868.601	75.517
2022/08/18	18:42:08	32.1400	1868.488	75.524
2022/08/18	18:50:08	32.2733	1868.386	75.529
2022/08/18	18:58:08	32.4067	1868.276	75.547
2022/08/18	19:06:08	32.5400	1868.171	75.558
2022/08/18	19:14:08	32.6733	1868.074	75.569
2022/08/18	19:22:08	32.8067	1867.940	75.576
2022/08/18	19:30:08	32.9400	1867.856	75.587
2022/08/18	19:38:08	33.0733	1867.760	75.598
2022/08/18	19:46:08	33.2067	1867.643	75.607
2022/08/18	19:54:08	33.3400	1867.556	75.616
2022/08/18	20:02:08	33.4733	1867.441	75.619
2022/08/18	20:10:08	33.6067	1867.365	75.632
2022/08/18	20:18:08	33.7400	1867.245	75.636
2022/08/18	20:26:08	33.8733	1867.154	75.646
2022/08/18	20:34:08	34.0067	1867.076	75.655
2022/08/18	20:42:08	34.1400	1866.955	75.659
2022/08/18	20:50:08	34.2733	1866.879	75.673
2022/08/18	20:58:08	34.4067	1866.772	75.673
2022/08/18	21:06:08	34.5400	1866.701	75.688
2022/08/18	21:14:08	34.6733	1866.605	75.697
2022/08/18	21:22:08	34.8067	1866.518	75.699
2022/08/18	21:30:08	34.9400	1866.426	75.706
2022/08/18	21:38:08	35.0733	1866.315	75.713
2022/08/18	21:46:08	35.2067	1866.230	75.724
2022/08/18	21:54:08	35.3400	1866.139	75.731
2022/08/18	22:02:08	35.4733	1866.070	75.740
2022/08/18	22:10:08	35.6067	1865.969	75.740
2022/08/18	22:18:08	35.7400	1865.881	75.745
2022/08/18	22:26:08	35.8733	1865.768	75.763
2022/08/18	22:34:08	36.0067	1865.697	75.751
2022/08/18	22:42:08	36.1400	1865.619	75.762
2022/08/18	22:50:08	36.2733	1865.547	75.774
2022/08/18	22:58:08	36.4067	1865.458	75.780
2022/08/18	23:06:08	36.5400	1865.379	75.785
2022/08/18	23:14:08	36.6733	1865.284	75.789
2022/08/18	23:22:08	36.8067	1865.215	75.792
2022/08/18	23:30:08	36.9400	1865.126	75.794
2022/08/18	23:38:08	37.0733	1865.064	75.805
2022/08/18	23:46:08	37.2067	1864.976	75.816
2022/08/18	23:54:08	37.3400	1864.899	75.816
2022/08/19	00:02:08	37.4733	1864.808	75.814
2022/08/19	00:10:08	37.6067	1864.728	75.817
2022/08/19	00:18:08	37.7400	1864.651	75.834
2022/08/19	00:26:08	37.8733	1864.597	75.835
2022/08/19	00:34:08	38.0067	1864.500	75.841
2022/08/19	00:42:08	38.1400	1864.445	75.843

Company Name Republic Services
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Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/19	00:50:08	38.2733	1864.360	75.852
2022/08/19	00:58:08	38.4067	1864.265	75.866
2022/08/19	01:06:08	38.5400	1864.210	75.861
2022/08/19	01:14:08	38.6733	1864.120	75.861
2022/08/19	01:22:08	38.8067	1864.061	75.873
2022/08/19	01:30:08	38.9400	1863.998	75.870
2022/08/19	01:38:08	39.0733	1863.920	75.889
2022/08/19	01:46:08	39.2067	1863.848	75.884
2022/08/19	01:54:08	39.3400	1863.770	75.893
2022/08/19	02:02:08	39.4733	1863.697	75.900
2022/08/19	02:10:08	39.6067	1863.627	75.904
2022/08/19	02:18:08	39.7400	1863.560	75.904
2022/08/19	02:26:08	39.8733	1863.504	75.913
2022/08/19	02:34:08	40.0067	1863.446	75.920
2022/08/19	02:42:08	40.1400	1863.353	75.927
2022/08/19	02:50:08	40.2733	1863.287	75.934
2022/08/19	02:58:08	40.4067	1863.226	75.940
2022/08/19	03:06:08	40.5400	1863.150	75.940
2022/08/19	03:14:08	40.6733	1863.090	75.940
2022/08/19	03:22:08	40.8067	1863.021	75.951
2022/08/19	03:30:08	40.9400	1862.948	75.949
2022/08/19	03:38:08	41.0733	1862.901	75.958
2022/08/19	03:46:08	41.2067	1862.835	75.965
2022/08/19	03:54:08	41.3400	1862.758	75.960
2022/08/19	04:02:08	41.4733	1862.699	75.969
2022/08/19	04:10:08	41.6067	1862.641	75.981
2022/08/19	04:18:08	41.7400	1862.578	75.972
2022/08/19	04:26:08	41.8733	1862.499	75.979
2022/08/19	04:34:08	42.0067	1862.443	75.987
2022/08/19	04:42:08	42.1400	1862.368	75.990
2022/08/19	04:50:08	42.2733	1862.319	76.001
2022/08/19	04:58:08	42.4067	1862.251	75.990
2022/08/19	05:06:08	42.5400	1862.195	75.997
2022/08/19	05:14:08	42.6733	1862.130	76.005
2022/08/19	05:22:08	42.8067	1862.090	76.017
2022/08/19	05:30:08	42.9400	1862.014	76.012
2022/08/19	05:38:08	43.0733	1861.949	76.017
2022/08/19	05:46:08	43.2067	1861.888	76.024
2022/08/19	05:54:08	43.3400	1861.836	76.023
2022/08/19	06:02:08	43.4733	1861.782	76.028
2022/08/19	06:10:08	43.6067	1861.725	76.032
2022/08/19	06:18:08	43.7400	1861.681	76.033
End of Fall-Off Test				
2022/08/19	06:24:59	43.8542	1861.621	76.041
Prepare to P.O.O.H. with gauges				
2022/08/19	06:25:02	43.8550	1861.622	76.042
2022/08/19	06:26:08	43.8733	1861.600	76.035
POOH Gradient: 3975.000 ft				
2022/08/19	06:29:59	43.9375	1861.603	76.037
P.O.O.H. making gradient stops				

Date	Time	Cum.Time BH1	BH Pres 1	BH Temp 1
		hr	psig	deg F
2022/08/19	06:30:02	43.9383	1861.604	76.042
Stop at 3000 feet				
2022/08/19	06:33:41	43.9992	1439.707	74.154
2022/08/19	06:34:08	44.0067	1439.703	74.138
POOH Gradient: 3000.000 ft				
2022/08/19	06:38:38	44.0817	1439.244	74.142
2022/08/19	06:42:08	44.1400	1009.502	62.449
Stop at 2000 feet				
2022/08/19	06:42:17	44.1425	1007.683	62.397
POOH Gradient: 2000.000 ft				
2022/08/19	06:47:14	44.2250	1006.369	62.395
2022/08/19	06:50:08	44.2733	573.860	58.077
Stop at 1000 feet				
2022/08/19	06:50:11	44.2742	572.809	58.082
POOH Gradient: 1000.000 ft				
2022/08/19	06:55:11	44.3575	573.020	58.095
2022/08/19	06:58:08	44.4067	156.866	59.698
Stop in lubricator				
2022/08/19	06:58:44	44.4167	138.698	64.351
POOH Gradient: 0.000 ft				
2022/08/19	07:03:44	44.5000	139.067	63.612
2022/08/19	07:06:08	44.5400	139.250	63.509
Bleed-Off Lubricator				
2022/08/19	07:11:05	44.6225	212.529	63.658
2022/08/19	07:14:08	44.6733	-0.195	63.221
2022/08/19	07:22:08	44.8067	-0.030	63.034
2022/08/19	07:30:08	44.9400	-0.030	61.790
2022/08/19	07:38:08	45.0733	-0.032	61.941

APPENDIX K

EPA PRESSURE FALLOFF TEST FORM



BACKGROUND INFORMATION FOR ANALYSIS OF PRESSURE FALL-OFF TEST

FACILITY NAME		OPERATOR	
WELL NAME		USEPA PERMIT NUMBER	STATE PERMIT NUMBER
TEST START DATE	TEST END DATE	Depth Reference: Kelly Bushing <input type="checkbox"/> Ground Level <input type="checkbox"/>	

GEOLOGICAL DATA

POROSITY, decimal	NET PERMEABLE THICKNESS, ft.	VISCOSITY, cp.	COMPRESSIBILITY, per psi
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WELL AND OPERATION DATA

LONGSTRING CASING DIAMETER, in	FINAL PRETEST FLOW RATE, gpm	INJECTATE TEMPERATURE, deg.F	KB ELEVATION, ft
OPEN HOLE DIAMTER, ins	PRETEST FLOW TIME, hrs. SEE BELOW	SPECIFIC GRAVITY OF TEST FLUID	TEST DEPTH FOR COMPARISON, ft
GAUGE DEPTH, ft		CUMULATIVE VOLUME INJECTED SINCE LAST PRESSURE EQUALIZATION,	

TEST DATA

GAUGE CALIBRATION DATE			
FLOW RATE, gpm	PRESSURE AT BEGINNING OF FALL-OFF, p	PRESSURE AT END OF FALL-OFF, ps	TO SUPPORT FULL COLUMN, psi
TEST LENGTH, hrs.	INITIAL GRADIENT, psi/ft.	FINAL GRADIENT, psi/ft.	FINAL FLUID LEVEL, ft.

REMEMBER

"Pre-test flow time" is the time since the reservoir was last in equilibrium. This may be the time since the well was last shut-in but only if the well was shut-in long enough for the pressure in the reservoir to approach equilibrium pressure.

1. Please fill in the above cells.
2. Injection of normal injectate at normal rate is preferred.
3. Submit an up-to-date well schematic.
4. The well should be shut-in as quickly as possible.
5. Data should be collected at the maximum rate for at least the first five minutes; between five and thirty minutes at no less than one reading every 30 seconds. After thirty minutes, the operator can reduce frequency as required.
6. The pressure gauge should have been calibrated no more than a year prior to the test. Submit a copy of the calibration certificate for the gauge used for pressure measurements with your report.
7. The report on the test must explain any anomalies shown in the results.
8. Submit digital logging data on a CD in .las or .asc format.

APPENDIX L

**STATIC PRESSURE GRADIENT SURVEY
(ABRIDGED)**



Static Pressure Gradient Survey Data

Well Name: Well 2-12
 Operating Company: Republic Industrial and Energy Solutions, LLC
 Well Location: Romulus, MI
 Wireline Company: J.O. Well Service & Testing, Inc.
 Downhole Data Recorder: MRO 2 Serial No. 5599

Job Number: 192128AD
 WSP Rep.: Jeffrey Tahtouh
 Data Start: 8/19/22 06:28:05
 Data End: 8/19/22 07:05:20
 Data Interval (secs): 15

Date/Time	Pressure, psig	Temperature, °F	Date/Time	Pressure, psig	Temperature, °F	Date/Time	Pressure, psig	Temperature, °F
8/19/22 06:28:05	1861.602	76.041	8/19/22 06:40:35	1240.085	67.510	8/19/22 06:53:05	573.040	58.096
8/19/22 06:28:20	1861.608	76.042	8/19/22 06:40:50	1197.503	66.386	8/19/22 06:53:20	573.030	58.098
8/19/22 06:28:35	1861.597	76.048	8/19/22 06:41:05	1155.461	65.123	8/19/22 06:53:35	573.036	58.097
8/19/22 06:28:50	1861.600	76.041	8/19/22 06:41:20	1112.350	64.297	8/19/22 06:53:50	573.028	58.094
8/19/22 06:29:05	1861.598	76.045	8/19/22 06:41:35	1069.536	63.104	8/19/22 06:54:05	573.024	58.097
8/19/22 06:29:20	1861.599	76.043	8/19/22 06:41:50	1027.557	62.744	8/19/22 06:54:20	573.018	58.095
8/19/22 06:29:35	1861.606	76.042	8/19/22 06:42:05	1011.273	62.458	8/19/22 06:54:35	573.013	58.094
8/19/22 06:29:50	1861.603	76.039	8/19/22 06:42:20	1007.565	62.385	8/19/22 06:54:50	573.014	58.092
8/19/22 06:30:05	1861.598	76.038	8/19/22 06:42:35	1007.451	62.381	8/19/22 06:55:05	573.018	58.102
8/19/22 06:30:20	1849.103	77.271	8/19/22 06:42:50	1007.363	62.385	8/19/22 06:55:20	573.019	58.099
8/19/22 06:30:35	1818.054	80.457	8/19/22 06:43:05	1007.215	62.391	8/19/22 06:55:35	554.645	58.013
8/19/22 06:30:50	1785.364	80.253	8/19/22 06:43:20	1007.162	62.390	8/19/22 06:55:50	514.603	58.216
8/19/22 06:31:05	1753.003	79.935	8/19/22 06:43:35	1007.096	62.396	8/19/22 06:56:05	474.205	57.560
8/19/22 06:31:20	1720.508	79.426	8/19/22 06:43:50	1006.945	62.394	8/19/22 06:56:20	434.547	57.251
8/19/22 06:31:35	1688.664	78.924	8/19/22 06:44:05	1006.878	62.394	8/19/22 06:56:35	393.923	56.785
8/19/22 06:31:50	1655.565	78.319	8/19/22 06:44:20	1006.808	62.397	8/19/22 06:56:50	353.267	56.188
8/19/22 06:32:05	1619.181	77.669	8/19/22 06:44:35	1006.766	62.397	8/19/22 06:57:05	312.287	55.884
8/19/22 06:32:20	1582.757	76.781	8/19/22 06:44:50	1006.700	62.400	8/19/22 06:57:20	270.971	56.271
8/19/22 06:32:35	1546.124	76.294	8/19/22 06:45:05	1006.643	62.394	8/19/22 06:57:35	230.141	56.632
8/19/22 06:32:50	1510.378	75.694	8/19/22 06:45:20	1006.590	62.396	8/19/22 06:57:50	188.574	57.594
8/19/22 06:33:05	1473.339	75.152	8/19/22 06:45:35	1006.559	62.402	8/19/22 06:58:05	159.728	59.862
8/19/22 06:33:20	1443.392	74.277	8/19/22 06:45:50	1006.536	62.400	8/19/22 06:58:20	147.157	60.487
8/19/22 06:33:35	1440.272	74.177	8/19/22 06:46:05	1006.493	62.392	8/19/22 06:58:35	140.257	65.236
8/19/22 06:33:50	1439.546	74.138	8/19/22 06:46:20	1006.440	62.391	8/19/22 06:58:50	138.639	63.991
8/19/22 06:34:05	1439.632	74.137	8/19/22 06:46:35	1006.447	62.394	8/19/22 06:59:05	138.669	63.879
8/19/22 06:34:20	1439.651	74.125	8/19/22 06:46:50	1006.417	62.388	8/19/22 06:59:20	138.711	63.846
8/19/22 06:34:35	1439.586	74.115	8/19/22 06:47:05	1006.389	62.399	8/19/22 06:59:35	138.770	63.832
8/19/22 06:34:50	1439.514	74.115	8/19/22 06:47:20	1006.358	62.384	8/19/22 06:59:50	138.816	63.813
8/19/22 06:35:05	1439.509	74.116	8/19/22 06:47:35	998.206	62.370	8/19/22 07:00:05	138.847	63.804
8/19/22 06:35:20	1439.431	74.124	8/19/22 06:47:50	956.459	62.159	8/19/22 07:00:20	138.877	63.787
8/19/22 06:35:35	1439.485	74.127	8/19/22 06:48:05	912.621	61.661	8/19/22 07:00:35	138.934	63.781
8/19/22 06:35:50	1439.479	74.134	8/19/22 06:48:20	869.689	60.937	8/19/22 07:00:50	138.954	63.770
8/19/22 06:36:05	1439.373	74.136	8/19/22 06:48:35	825.290	60.582	8/19/22 07:01:05	138.968	63.762
8/19/22 06:36:20	1439.360	74.136	8/19/22 06:48:50	781.630	60.362	8/19/22 07:01:20	138.979	63.748
8/19/22 06:36:35	1439.307	74.145	8/19/22 06:49:05	736.719	60.204	8/19/22 07:01:35	138.992	63.736
8/19/22 06:36:50	1439.316	74.142	8/19/22 06:49:20	691.595	59.500	8/19/22 07:01:50	139.009	63.724
8/19/22 06:37:05	1439.290	74.139	8/19/22 06:49:35	646.338	58.944	8/19/22 07:02:05	139.021	63.714
8/19/22 06:37:20	1439.306	74.137	8/19/22 06:49:50	600.613	58.444	8/19/22 07:02:20	139.036	63.702
8/19/22 06:37:35	1439.267	74.138	8/19/22 06:50:05	574.727	58.097	8/19/22 07:02:35	139.040	63.687
8/19/22 06:37:50	1439.259	74.138	8/19/22 06:50:20	572.732	58.070	8/19/22 07:02:50	139.042	63.680
8/19/22 06:38:05	1439.220	74.135	8/19/22 06:50:35	572.872	58.074	8/19/22 07:03:05	139.049	63.664
8/19/22 06:38:20	1439.279	74.135	8/19/22 06:50:50	572.927	58.076	8/19/22 07:03:20	139.060	63.641
8/19/22 06:38:35	1439.242	74.136	8/19/22 06:51:05	572.986	58.076	8/19/22 07:03:35	139.062	63.625
8/19/22 06:38:50	1439.215	74.141	8/19/22 06:51:20	573.037	58.080	8/19/22 07:03:50	139.064	63.606
8/19/22 06:39:05	1439.210	74.133	8/19/22 06:51:35	572.991	58.086	8/19/22 07:04:05	139.074	63.590
8/19/22 06:39:20	1438.380	74.134	8/19/22 06:51:50	573.049	58.086	8/19/22 07:04:20	139.076	63.577
8/19/22 06:39:35	1404.026	73.269	8/19/22 06:52:05	573.033	58.088	8/19/22 07:04:35	139.073	63.562
8/19/22 06:39:50	1364.255	71.674	8/19/22 06:52:20	573.039	58.085	8/19/22 07:04:50	139.106	63.554
8/19/22 06:40:05	1322.971	70.059	8/19/22 06:52:35	573.020	58.088	8/19/22 07:05:05	139.115	63.544
8/19/22 06:40:20	1281.946	68.471	8/19/22 06:52:50	573.016	58.096	8/19/22 07:05:20	139.180	63.530

ATTACHMENTS



ATTACHMENT 1

RAW PRESSURE AND TEMPERATURE DATA FROM FALLOFF AND STATIC PRESSURE GRADIENT (08-17-22 – 8-19-22)



ATTACHMENT 2

WELL 2-12 TEMPERATURE SURVEY (08-16-22).LAS



ATTACHMENT 3

WELL 2-12 RAT SURVEY - 5 CHASE PASSES (08-16-22).LAS



ATTACHMENT 4

WELL 2-12 RAT SURVEY - TIME-DRIVE (08-16-22).LAS



ATTACHMENT 5

WELL 2-12 RAT SURVEY - BASE_FINAL PASSES (08-16-22).LAS

