Cleanup Plan

UDEX Feed Underground Line Release

Former Philadelphia Energy Solutions Refinery
3144 West Passyunk Avenue
Philadelphia, Pennsylvania
PADEP Facility ID No. 856431

Stantec

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c/o HRP Group

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1 Introduction

On behalf of Bellwether District Holdings, LLC (BDH), formerly known as Philadelphia Energy Solutions Refining and Marketing LLC (PESRM), Stantec Consulting Services Inc. (Stantec) has prepared this Cleanup Plan (CUP) to document the remedial goals, remediation history, and transition to post-remediation monitoring of the underground petroleum release that occurred from an UDEX feed line (UDEX release) at a portion of the former Philadelphia Energy Solutions (PES) Refinery (facility). The facility is located at 3144 West Passyunk Avenue, Philadelphia, Pennsylvania.

Remediation activities are being conducted at the facility under the Pennsylvania Land Recycling and Environmental Remediation Standards Act (Act 2) by both BDH and Evergreen Resources Group, LLC (Evergreen)[1] in accordance with the Consent Order and Agreement (CO&A) among Pennsylvania Department of Environmental Protection (PADEP), Sunoco, Inc. (R&M) n/k/a Sunoco (R&M), LLC, and PESRM, now BDH, dated August 14, 2012 and the 2020 First Amendment to that Agreement, also known as the Buyer-Seller Agreement. In accordance with the CO&A, Sunoco/Evergreen is responsible for addressing contamination at the Facility resulting from release(s) which occurred before September 8, 2012, i.e., “Pre-Existing Contamination”, and BDH is responsible for addressing contamination at the Facility resulting from release(s) which occurred after September 8, 2012, i.e., “Post-September 2012 Contamination.”

A Notice of Intent to Remediate (NIR) to enter the UDEX release into the Act 2 Program was completed in March 2022 and revised in May 2025 (see **Appendix A**). BDH has selected the site-specific standard (SSS) as the remediation goal on the revised NIR for soil and groundwater. As such, this CUP describes the remediation performed to achieve the SSS and proposes post-remediation care monitoring to demonstrate continued attainment of the SSS for UDEX release constituents of concern (COC) benzene and toluene, as characterized in the Remedial Investigation Report (RIR) (Stantec, 2025b). Documentation of public notification for this report required by the Act 2 Program is included in **Appendix B**.

1.1 Facility Description

The facility, located in south Philadelphia (see **Figure 1-1**), ceased operating in 2019. Up until that point, the facility and its predecessor, the Philadelphia Refinery, operated nearly continuously for over 100 years as a crude oil refinery. A brief ownership timeline relevant to the UDEX release is as follows:

[1] Evergreen Resources Management Operations, a series of Evergreen Resources Group, LLC, is managing the legacy remedial work for Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (“Evergreen”) and Sunoco (R&M), LLC. For clarity, Sunoco, Inc. n/k/a ETC Sunoco Holdings LLC, Sunoco, Inc. (R&M) f/k/a Sunoco (R&M), LLC n/k/a Energy Transfer (R&M), LLC effective 4/19/2021 and Evergreen shall be referred to collectively as “Evergreen” in this Report.

- 2012: The former Philadelphia Refinery was transferred from Sunoco to PESRM and became known as the PES Refining Complex.
- 2019: PESRM announced the closure of the former PES Refinery. All refinery operations ceased at this time.
- 2020: PESRM was purchased through a bankruptcy sale by HRP Philadelphia Holdings, LLC.
- 2024: By legal name change, PESRM became BDH.

The portion of the facility on the east side of the Schuylkill River is currently being redeveloped by BDH. The UDEX release is located within the redevelopment area in the former south yard of the Point Breeze Refinery Impoundment Area. This part of the facility is designated as Area of Interest (AOI) 3 by Evergreen. Historical operations and investigations that occurred in AOI 3 unrelated to this release were previously described in Evergreen's *Area of Interest 3 Remedial Investigation Report* (Langan, 2017) which was approved by the PADEP on June 14, 2017. To date, under Evergreen's Act 2 Program, facility-wide Pre-Existing Contamination reporting has been completed through approved risk assessments that were informed by fate and transport modeling results (Stantec, 2025a), including simulation of legacy plumes in the UDEX release area.

1.2 Discovery of UDEX Release

In the summer of 2018, Stantec performed a routine annual, sitewide well gauging event for the facility on behalf of Evergreen. During review and analysis of the gauging data, Stantec noted a first occurrence of apparent light nonaqueous phase liquid (LNAPL) in monitoring well S-414 and increased apparent LNAPL thicknesses (ANT) in wells S-283 and S-382, where LNAPL was first observed in 2017 and 2016, respectively (see **Figure 1-2** and **Table 1-1**). Stantec's field technician confirmed the gauging observations, and the findings were reported to Evergreen. Evergreen notified PESRM of the findings and on July 19, 2018, Stantec collected LNAPL samples from wells S-283, S-382, and S-414 in the presence of PES and Evergreen personnel. Stantec shipped the LNAPL samples to a contract laboratory for characterization on behalf of Evergreen, and duplicate LNAPL samples were provided to the onsite PES laboratory for analysis and fingerprinting to known products and refinery intermediates.

The PES laboratory indicated that the LNAPL was a refinery intermediate called reformate. Stantec's contracted laboratory provided a basic interpretation which indicated that the LNAPL collected from wells S-382 and S-414 was a light petroleum distillate of unknown weathering degree, and the LNAPL collected from well S-283 was chemically similar to the samples collected from wells S-382 and S-414 but also contained a relatively smaller amount of extremely weathered middle distillate petroleum. During late July 2018, PES identified a leak in the underground portion of a product line that conveyed reformate through the release area (a feed from an UDEX unit) and emptied, isolated, and bypassed that section of underground pipe (see **Figure 1-2**).

1.3 Act 2 Reporting History

The UDEX release was not formally entered into the Act 2 program at the time the release was discovered in 2018. The UDEX release was subsequently entered into the Act 2 program when the original NIR was filed by BDH in March 2022. On June 4, 2025, a revised NIR was submitted to the PADEP indicating a change in the selected remediation standard from the Statewide Health Standard (SHS) to the SSS (see **Appendix A**). Three Act 2 reports followed the revised NIR submission including a RIR (Stantec, 2025b), Human Health Risk Assessment (HHRA) (Stantec, 2026a), and Screening Level Ecological Risk Assessment (SLERA) (Stantec, 2026b). The RIR was approved by the PADEP on December 26, 2025, followed by approvals for the HHRA and SLERA on May 8, 2026. It is anticipated that this CUP report will be followed by a Final Report submission pending CUP review and approval.

2 Summary of Remediation Program

Remediation of the UDEX release, specifically LNAPL recovery efforts, began shortly after the release was discovered in 2018 and continued through July 2025. The remediation program is summarized in the sections below.

2.1 Remediation Objectives

The remediation objectives for the UDEX release were to (1) remove or destroy LNAPL to the extent that the SSS can be attained/demonstrated and (2) achieve stable or improving dissolved benzene and toluene concentrations in groundwater.

2.1.1 UDEX Release Volume Estimate

The UDEX release originated through a subsurface pipeline leak of unknown flow rate and duration and as such, the remediation target volume is not known. To estimate a range for the LNAPL specific and recoverable volumes for the UDEX release, Stantec used the American Petroleum Institute's (API) LNAPL Distribution and Recovery Model Version 2 (LDRM) to estimate the vertical distribution (saturation profile) of LNAPL near the water table using a combination of site-specific data and parameters from the API's published database (API, 2004). As documented in the RIR (Stantec, 2025b), site-specific data available at the time (circa 2019) included ANT measurements from wells in the UDEX release area and perimeter, UDEX feed LNAPL density and viscosity from laboratory analysis, surface tension data for former Philadelphia Refinery LNAPL samples, and estimates of hydraulic conductivity from direct injection logging (hydraulic profiling tool). The API parameter database was queried to pull other model inputs for soils with similar characteristics, and reasonable ranges of fluid characteristics to gauge the model's sensitivity.

In accordance with the LDRM manual, Stantec applied the Burdine permeability model as it is recommended for coarse-grained soils. LDRM results combined with the estimated LNAPL body area (which at the time was estimated at approximately 320,000 square feet) indicated that a reasonable range

for the UDEX release volume was 200,000 to 400,000 gallons. This preliminary estimate was later refined and updated in 2022 during the pilot testing of soil vapor extraction (SVE) with additional well measurements of ANT and through calibration to site-specific data collected as part of the remedial design characterization work. The updated volume estimate is discussed in **Section 2.4.2.1**.

2.1.2 Remediation Approach

As described in the RIR (Stantec, 2025b), the UDEX release LNAPL is a catalytic reformed light naphtha (reformate) that was used for gasoline blending. Chemically, the UDEX release is 100% volatile and includes the primary constituents benzene and toluene. An LNAPL of this character should be amenable to remedial technologies that leverage its volatility; however, remediation of the reformate would also need to be performed safely in a refinery environment with explosion and exposure hazards. Moreover, characterization of the UDEX release presented in the RIR (Stantec, 2025b) indicated that the reformate is commingled with older, legacy Sunoco LNAPL(s). The “legacy Sunoco LNAPLs” constitute Pre-Existing Contamination as defined in the Buyer-Seller Agreement and are being addressed by Evergreen. Note that Pre-Existing Contamination is not the subject of this CUP.

Given the unique circumstances of the release and to meet the stated objectives, the following approach to remediation was developed:

- Commence interim recovery efforts as soon as possible to reduce LNAPL saturations in the subsurface to minimize plume migration and mitigate risk to Schuylkill River surface water
- Develop a long-term remediation plan to clean up the UDEX release efficiently by selecting a technology that leverages its volatility while targeting the reformate LNAPL in a commingled environment through detailed design characterization work
- Pilot test and if successful, implement full-scale remediation
- Develop remediation performance monitoring metrics and establish remediation goals as guidelines for transitioning to post remediation monitoring
- When attainment of the SSS can be demonstrated and the majority of the UDEX release has been recovered, transition to monitoring of passive remediation relying on continued natural degradation processes

2.2 Interim Remediation

In accordance with the remediation approach, LNAPL bailing and passive skimming were initiated in September 2018 and continued through October 2018 using a combination of Evergreen monitoring wells including S-283, S-382, S-414, and later BDH monitoring wells S-429, S-430, S-431, and S-432 after they were installed following the early characterization work (Stantec, 2025b) (see **Figure 2-1a** and **Table 1-1**). A total of approximately 381 gallons of LNAPL were recovered by the passive systems and routine manual bailing events (see **Table 2-1a**).

Active LNAPL skimming began in late October 2018 and continued through November 2021 using a combination of monitoring wells S-283, S-382, S-429, and briefly at S-438. Initially, the three product

recovery systems included a float and pneumatic pump to skim and transfer LNAPL (and lesser amounts of groundwater) to an adjacent 550 gallon horizontal, carbon steel tank ventilated to the atmosphere through two 55-gallon granular activated carbon (GAC) drums in series (see **Figure 2-2**). The pumps were operated on compressed nitrogen to be intrinsically safe. A tank-mounted, tank-full shut-off (TFSO) control box was installed on each holding tank to prevent overfilling. The pneumatic skimming systems were eventually replaced with total fluids pneumatic pumps due to frequent issues with skimming floats and coiled tubing failures that resulted in remediation delays. Recovered fluids were routinely removed from the holding tanks by vacuum truck equipped with a scrubber system to remove volatile organic compound (VOC) emissions from the truck vent during pump out events. The recovered fluids were disposed of onsite through tankage (slop oil) and the refinery's wastewater treatment system.

The individual fluid recovery systems were taken offline at different times through the transition to SVE, with the S-283 system operating the longest (see **Table 2-1a**). Note that manual LNAPL bailing from UDEX release monitoring wells S-414, S-430, S-431, and BF-103R was a part of routine operations and maintenance (O&M) through this interim remedial stage, and that the LNAPL recovered from these wells was placed in one of the three system holding tanks and accounted for in the cumulative totals for the active skimming wells. In total, approximately 96,609 gallons of LNAPL were remediated by fluid recovery (see **Figure 2-1a**). Some groundwater was also collected by these systems, but the recovery was not tracked through onsite disposal.

2.3 Evaluation of Remediation Alternatives

The interim remediation program had been successful in removing approximately 96,609 gallons of LNAPL, however, there were inherent inefficiencies with a full scale active skimming system. The inefficiencies included management of three waste streams (LNAPL, entrained groundwater, and vapor), significant O&M effort to maintain the numerous systems that would need to be installed across the remediation area, cost of implementation, and time frame to reach remedial goals. Based on the inefficiency of implementing a full-scale active skimming system, alternative remedial technologies were evaluated.

To assist in the evaluation of alternative technologies, a full-scale remediation alternative technology design matrix was constructed (see **Table 2-2**). Technologies evaluated for full scale included expansion of active LNAPL skimming, SVE, multi-phase extraction, and dual-phase extraction. Evaluation criteria included effectiveness of the technology, waste generation, subsurface conditions, remedial time frame, capital cost, and O&M costs. There were also safety considerations inherent to the volatility of the reformate LNAPL. Based on the remedial technology evaluation, SVE using an internal combustion engine (ICE) designed for vapor extraction remediation was chosen as the full-scale remedial technology that best met the evaluation criteria.

2.4 Soil Vapor Extraction (SVE)

The following sections describe the pilot testing and full-scale implementation of SVE, which included a period of supplemental air sparging (AS).

2.4.1 SVE Pilot Test

The pilot test was conducted in 2021 to assess the efficacy of SVE technology and provide the necessary parameters for full scale remedial design to address reformate LNAPL resulting from the UDEX release.

2.4.1.1 Pilot Test Design

The pilot test design consisted of three treatment cells with each cell containing one vapor extraction well and three vapor monitoring points. The three areas were chosen due to variations in lithology that impact permeability, anticipated concentrations of vapor phase hydrocarbons, apparent thickness of LNAPL in area monitoring wells, and location of LNAPL based on previous ultraviolet optical screening tool with hydraulic profiling (UVOST®-HP) and membrane interface probe combined with hydraulic profiling tool (MiHPT) surveys. The locations of the pilot extraction wells and vapor points are shown on **Figure 2-3**. Vacuum source and vapor destruction were provided by an ICE unit. The components of the SVE reformate pilot test are discussed in the following sections.

2.4.1.1.1 Extraction Well Design

Six-inch diameter extraction wells were installed to depths ranging from 17 to 19 feet below ground surface (ft bgs). The extraction well construction consisted of five feet (ft) of six-inch diameter stainless-steel wire wrapped screen with the remaining casing constructed of polyvinyl chloride (PVC). The six-inch diameter and the wire wrap screens were specified to increase air flow rate to the wells which increased extraction efficiency and mass removal rates. The screened interval depths were designed based on lithology, UVOST response, membrane interface probe (MIP) data and hydrostatic pressure data collected during the UVOST and MiHPT surveys, well installation and soil boring logs, and soil core photos. The three SVE well locations (see **Figure 2-3**) were selected based on varying permeabilities also determined using the data set described above. Extraction wells EW-1, EW-3, and EW-2 were installed in the areas of lowest to highest estimated permeability. The extraction well screens were set to intersect coarse, permeable soil intervals at depths approximately 2-2.5 feet above average groundwater elevations for each area. The screen depths were set to minimize groundwater mounding and the entrainment of groundwater in the vapor stream. Soil types within the screened intervals were confirmed in the field during well installation activities. Well logs for the extraction wells are included in **Appendix E** and construction details are included in **Table 1-1**.

2.4.1.1.2 Vapor Monitoring Point Design

The soil vapor monitoring points were designed to provide subsurface pressure gradient measurements and soil gas concentrations at radial distances from the SVE wells. The vapor points were nested with three sample/monitoring intervals at approximate depths ranging from shallow (7-9 ft bgs), intermediate (10-14 ft bgs), and deep (13-19 ft bgs). The vapor points were installed at varying radial distances of approximately 10-15 ft, 20-30 ft, and 35-50 ft from the extraction wells. The varying distances and locations provided information on subsurface pressure gradients, potential short-circuiting, preferential

pathways, and vacuum radius of influence. The vapor point locations are shown on **Figure 2-3**. Construction logs for the vapor points are included in **Appendix E**.

2.4.1.2 Pilot Test ICE Unit

The ICE specified for the pilot test was a V4 model manufactured and supplied by Remediation Services International (RSI). The ICE consisted of two 460 cubic inch V8 engines running in parallel. Manifold vacuum from the engines was applied to one extraction well at a time via dedicated piping and hoses. The extracted vapors passed through a knockout tank (integral to the ICE) which removed entrained moisture and a paper element filter which removed particulates prior to reaching the engine. Computer controlled carburetors consisting of three actuated valves continually adjusted flow from the extraction well, supplemental fuel (propane) flow, and make up air to the engine. The ICE had the capability to add hydraulic load to each engine independently. The hydraulic load increased the stress on the engines which increased vacuum and fuel consumption (vapor destruction). A complete process flow diagram and piping and instrumentation diagram (P&ID) of the V4 system is provided in **Appendix C**. The onboard computer provided real-time web-based telemetry including system monitoring, system control, data collection, alarm notification (via email), and system data collection. The system data was stored in history files that, using RSI's Phoenix S.A.V.E.™ System, were converted into detailed operation and mass removal summary reports. An example ICE unit data summary report for Unit 407 Engine 1 operation during the SVE pilot test is included in **Appendix D**. The pilot test V4 ICE unit emissions were permitted through the City of Philadelphia Air Management Services (AMS) under Installation Permit No. IP21-000166 (see **Appendix H**).

2.4.1.3 Pilot Test Results

The pilot test data include extraction well vacuum readings, vapor point soil gas and pressure readings, vacuum radius of influence calculations, petroleum mass destruction rates, total petroleum mass destroyed, propane usage, and ICE system up time.

Treatment Cell 1: SVE pilot testing at extraction well EW-1 was conducted April 7 through May 24, 2021.

Extraction Well EW-1 Vacuum Measurements – Vacuum at EW-1 was measured using a dial vacuum gauge installed at the well head. Vacuum measurements were taken daily during normal work week hours. Vacuum readings at the EW-1 well head ranged from 20 inches of water (in. H_2O) at startup to a maximum of 81 in. H_2O. The low vacuum at the well head during initial testing was due to the high influent VOC concentrations in the soil gas. The high concentrations restricted the well valve opening at the carburetor limiting vacuum and vapor flow from the well head. Approximately 17 days following pilot test startup, the EW-1 vapor concentrations stabilized at approximately 25,000 parts per million-volume (ppmv). To increase VOC destruction rate, the initial hydraulic load (900 pounds per square inch [psi] fluid pressure) at both engines was increased to 1,200 psi. The pressure increase resulted in a well head vacuum increase to the maximum 81 in. H_2O, an increase of vapor concentration (33,000 ppmv), and an increase in flow rate from the extraction well. However, the increased well head vacuum resulted in a significant increase in the entrainment of groundwater and LNAPL in the vapor stream. To reduce/eliminate the entrainment of fluids during extraction, the hydraulic load was reduced to 1,000 psi

at both engines. Following reduction of hydraulic load, a steady state well head vacuum of 65 in. H_2O was achieved.

Cell 1 Vapor Point Pressure, Soil Gas Concentration Measurements, & Vacuum Radius of Influence – The vapor monitoring points were installed at the following radial distances from extraction well EW-1: VP-1A at 15 ft, VP-1B at 22 ft, and VP-1C at 35 ft. The nested vapor points were color coded in the field by depth as follows: Red (shallow) at 9 ft bgs, Yellow (intermediate) at 14 ft bgs, and Green (deep) at 19 ft bgs. The following chart contains the average subsurface negative pressures at the nested vapor points during steady state well head vacuum (approximately 65 in. H_2O).

Differential Pressure – in. H_2O								
VP-1A			VP-1B			VP-1C		
Red	Yellow	Green	Red	Yellow	Green	Red	Yellow	Green
2.94	4.05	3.76	2.56	2.67	3.01	2.43	2.97	3.06

The pressure measurements at VP-1C were somewhat anomalous due to the slightly higher vacuum readings at VP-1C compared to the measurements at VP-1B, which should have been higher due to closer proximity to EW-1. These pressure anomalies were potentially due to the heterogeneity of the subsurface soils which resulted in variable air permeability.

Initial soil gas concentrations at Cell 1 vapor points were oxygen deficient and carbon dioxide rich indicating anaerobic biodegradation of petroleum hydrocarbons. Final soil gas concentrations revealed an increase in oxygen (O_2) concentrations and a decrease in carbon dioxide (CO_2) as a likely result of soil gas turnover due to SVE. The table below contains initial (at startup) and final soil gas readings at each vapor point. These results indicated vacuum and flow influence from the ICE at the vapor monitoring points that reinforced the vacuum influence results. The increase in O_2 and decrease in CO_2 soil gas concentrations resulted in an increase in combustion efficiency. Increased O_2 in the recovered vapor reduced the amount of make-up air supplied by the carburetor and resulted in a higher flow rate from the extraction well and the combustion of more petroleum hydrocarbons. The reduction in CO_2 percentage reduces the volume of supplemental fuel (propane) necessary to maintain combustion.

S**oil Gas - Percent**		
	VP-1A - O2	VP-1A - CO2

DATE	Red	Yellow	Green	Red	Yellow	Green
4/7/2021	0	3.3	0	6.34	6.41	5.54
5/20/2021	13.8	14.5	9.5	4.04	3.88	4.87
	VP-1B - O2			VP-1B - CO2		
4/7/2021	0.54	0.12	0	5.72	7.34	5.14
5/20/2021	12.1	8.5	9.6	4.76	6.44	2.64
	VP-1C - O2			VP-1C - CO2		
4/7/2021	1.87	0	0	3.04	4.5	3
5/20/2021	17.3	6.2	NM	1.36	3.5	NM

NM = Not measured

Cell 1 Vacuum Radius of Influence – The vacuum radius of influence (ROI) for EW-1 was calculated using pressure differential data collected at the extraction well and the vapor monitoring points during pilot test steady state conditions. The following equation is based on pressure differentials at radial distances from the extraction well. The pressure at the ROI (P_{RI}) is preset to one atmosphere (atm) and R_1 is the estimated vacuum ROI.

$$Pr^2 - Pw^2 = (P_{RI}^2 - Pw^2)\frac{\ln(r/R_w)}{\ln(R_1/R_w)}$$

Pr = 0.99 Pressure at vapor point (atm)

Pw = 0.85 Pressure at well head (atm)

P_{RI} = 1.00 Pressure at ROI (preset)(atm)

r =	35	Radial distance from extraction well (ft)
Rw =	0.25	Radius of extraction well (ft)
R_I =		Radius of influence where pressure equals ROI (ft)
$Pr^2 - Pw^2$ =	0.26	
$(P_{RI}^2 - Pw^2)$ =	0.27	
$\ln(r/R_w)$ =	4.94	
$\ln(R_1/R_w)$ =	5.22	
(R_1/R_w) =	184.83	
R_1 =	**46.21**	ft

Cell 1 Petroleum Mass Destruction Rate and Total Mass Destroyed – The pilot test at extraction well EW-1 was conducted for 48 days, and approximately 48,172 pounds (lbs) of petroleum hydrocarbons, which equals approximately 7,769 equivalent gallons of gasoline, were destroyed by the ICE. The average mass removal rate during steady-state operation for both engines combined equaled approximately 44.0 lbs/hour.

Cell 1 Propane Usage – As described above, the ICE unit uses propane as a secondary fuel to compensate for low energy (Btu) values of the extracted vapor, low flow rate from the extraction well, and elevated CO_2 concentrations in the extracted soil gas. Initial propane usage (76.3 gals/day) was slightly higher than the average steady-state usage (63.2 gals/day) due to the soil gas conditions and the low vapor flow rate from the extraction well.

Cell 1 ICE System Up Time – ICE system uptime during pilot testing at EW-1 equaled approximately 85% for both engines. Down time was due to periodic engine maintenance and carburetor failure/replacement.

Treatment Cell 3: SVE pilot testing at extraction well EW-3 was conducted May 25 through June 30, 2021.

Extraction Well EW-3 Vacuum Measurements –Vacuum readings at the EW-3 well head ranged from 76 in. H_2O at startup to 50 in. H_2O at steady state. Influent vapor concentrations ranged from approximately 10,500 ppmv at startup to an average of 8,536 ppmv at steady state conditions. The initial well vacuum was lowered by reducing hydraulic load to reduce propane use and eliminate the entrainment of groundwater in the extracted vapor stream. The reduced vacuum did not significantly decrease VOC influent concentrations.

Cell 3 Vapor Point Pressure, Soil Gas Concentration Measurements, & Vacuum Radius of Influence – The vapor monitoring points were installed at the following radial distance from extraction well EW-3: VP-3A at 10 ft, VP-3B at 25 ft, and VP-3C at 50 ft. The radial distance of the vapor points from the extraction well were increased at Cell 3 (compared to Cell 1) due to an estimated higher air permeability in the subsurface. The depths of the nested vapor points were color coded as follows: Red at 9 ft bgs, Yellow at 13 ft bgs, and Green at 17 ft bgs. The following chart contains the average subsurface negative pressures at the nested vapor points during steady state well head vacuum (approximately 50 in. H_2O).

Differential Pressure – in. H_2O								
VP-3A			VP-3B			VP-3C		
Red	Yellow	Green	Red	Yellow	Green	Red	Yellow	Green
2.55	9.65	8.55	0.90	4.37	4.11	1.91	1.97	2.24

The pressure measurements at the EW-3 vapor points were generally consistent with expected results based on radial distance from the extraction well and the estimated permeability of the soil.

Initial soil gas concentrations at the Cell 3 vapor points were oxygen rich with some low concentrations of carbon dioxide indicating biodegradation of petroleum hydrocarbons is ongoing but at a slower pace than at the Cell 1 area. Final soil gas concentrations (vapor point VP-3C) revealed an increase in oxygen concentrations and a decrease in carbon dioxide. These results indicated vacuum and flow influence from the ICE at the vapor monitoring points reinforcing the vacuum influence results. The increase in O_2 and decrease in CO_2 soil gas concentrations resulted in an increase in combustion efficiency. Increased O_2 in the recovered vapor reduces the amount of make-up air supplied by the carburetor resulting in a higher flow rate from the extraction well and the combustion of more petroleum hydrocarbons. The reduction in CO_2 percentage reduces the volume of supplemental fuel (propane) necessary to maintain combustion. The following table contains initial and final soil gas concentrations at EW-3 vapor points.

S**oil Gas - Percent**

	VP-3A - O2			VP-3A - CO2		
DATE	Red	Yellow	Green	Red	Yellow	Green
5/26/2021	19.8	17.8	16	1.02	2.12	2.98
6/25/2021	19.7	18.4	16.8	0.34	1.14	1.48
	VP-3B - O2			VP-3B - CO2		
5/26/2021	19.06	17.1	1.8	0.44	3.48	9.94
6/25/2021	19.02	18.7	14.7	0.48	0.8	3.54
	VP-3C - O2			VP-3C - CO2		
5/26/2021	12.7	12.8	9	2.38	3.44	5.08
6/25/2021	15.5	14	7.7	3.02	3.54	4.84

Cell 3 Vacuum Radius of Influence – The vacuum ROI for EW-3 was calculated using pressure differential data collected at the extraction well and the vapor monitoring points during pilot test steady state conditions. The following equation is based on pressure differentials at radial distances from the extraction well. The pressure at the ROI (P_{RI}) is preset to one atm and R_1 is the estimated vacuum ROI.

$$Pr^2 - Pw^2 = (P_{RI}^2 - Pw^2)\ \frac{\ln(r/R_w)}{\ln(R_1/R_w)}$$

Pr = 0.99 Pressure at vapor point (atm)

Pw = 0.88 Pressure at well head (atm)

P_{RI} = 1.00 Pressure at ROI (preset)(atm)

r =	50	Radial distance from extraction well (ft)
Rw =	0.25	Radius of extraction well (ft)
R_I =		Radius of influence where pressure equals ROI (ft)
$Pr^2 - Pw^2$ =	0.22	
$(P_{RI}^2 - Pw^2)$ =	0.23	
$\ln(r/R_w)$ =	5.30	
$\ln(R_1/R_w)$ =	5.47	
(R_1/R_w) =	237.95	
R_1 =	**59.49**	ft

Cell 3 Petroleum Mass Destruction Rate and Total Mass Destroyed – The pilot test at extraction well EW-3 was conducted for 36 days, and approximately 13,941 lbs of petroleum hydrocarbons or approximately 2,245 equivalent gallons of gasoline were destroyed by the ICE. The average mass removal rate during steady-state operation for both engines combined equaled approximately 16.4 lbs/hour.

Cell 3 Propane Usage – The ICE unit uses propane as a secondary fuel to compensate for low energy (Btu) values of the extracted vapor, low flow rate from the extraction well, and elevated CO_2 concentrations in the extracted soil gas. Initial propane usage (91.3 gals/day) was like the average steady-state usage (92.3 gals/day). The higher propane usage at Cell 3 compared to Cell 1 was due to the lower VOC concentration and subsequently lower Btu content of the extracted soil vapor at Cell 3.

Cell 3 ICE System Up Time – ICE system uptime during pilot testing at EW-3 was approximately 98.7% for Engine 1 and 94.9% for Engine 2. System down time was due to periodic engine maintenance and a high oil temperature shut down at Engine 2. The high temperature alarm was the result of dust and oil accumulation on the engine radiator fins. The radiators for both engines were cleaned and engine temperatures returned to normal operating conditions.

Treatment Cell 2: SVE pilot testing at extraction well EW-2 began on June 30, 2021, and continued through December 9, 2021.

Extraction Well EW-2 Vacuum Measurements –Vacuum readings at the EW-2 well head ranged from 56 in. H_2O at startup to 64 in. H_2O at steady state. Influent vapor concentrations ranged from approximately 36,500 ppmv at startup to an average of 15,045 ppmv at steady state conditions. Due to numerous engine malfunctions, specifically issues with the carburetors on both Engine 1 and Engine 2, it took approximately 32 days to reach steady state conditions defined as consistent vacuum measurements at EW-2. The initial steady state well vacuum was lowered by reducing hydraulic load to reduce the entrainment of groundwater in the extracted vapor stream. The reduced vacuum did not decrease VOC influent concentrations.

Cell 2 Vapor Point Pressure, Soil Gas Concentration Measurements, & Vacuum Radius of Influence – The vapor monitoring points were installed at the following radial distance from extraction well EW-2: VP-2A at 10 ft, VP-2B at 25 ft and VP-2C at 50 ft. The depths of the nested vapor points are as follows: Red at 9 ft bgs, Yellow at 13 ft bgs, and Green at 17 ft bgs. The following chart contains the average subsurface negative pressures at the nested vapor points during steady state well head vacuum (approximately 64 in. H_2O).

Differential Pressure - inches H_2O								
VP-2A			VP-2B			VP-2C		
Red	Yellow	Green	Red	Yellow	Green	Red	Yellow	Green
2.68	3.38	3.48	0.82	0.82	0.61	0.37	0.49	0.47

The pressure measurements at the EW-2 vapor points were generally lower than expected based on radial distance from the extraction well and the estimated permeability of the soil. The lower pressure measurements may be due to an increase in groundwater elevation during the testing at EW-2. The increased groundwater elevation is possibly submerging more permeable layers in the subsurface resulting in reduced vacuum influence.

Initial soil gas concentrations at the Cell 2 vapor points were high in oxygen concentrations while carbon dioxide concentrations were low, indicating biodegradation of petroleum hydrocarbons in the Cell 2 area was occurring at a slower rate than at Cells 1 and 3. Final soil gas concentrations revealed an increase in oxygen concentrations and a decrease in carbon dioxide. These results indicate vacuum and air flow influence from the ICE at the vapor monitoring points reinforcing the vacuum influence results. The increase in O_2 and decrease in CO_2 soil gas concentrations result in an increase in combustion efficiency. Increased O_2 in the recovered vapor reduces the amount of make-up air supplied by the carburetor resulting in a higher flow rate from the extraction well and the combustion of more petroleum hydrocarbons. The reduction in CO_2 percentage reduces the volume of supplemental fuel (propane)

necessary to maintain combustion. The following table contains representative soil gas concentrations at EW-2 vapor points.

S**oil Gas - Percent**						
	VP-2A - O2			VP-2A - CO2		
DATE	Red	Yellow	Green	Red	Yellow	Green
7/7/2021	18.8	18.3	14.6	1.12	1.52	4.04
8/25/2021	18.8	18.4	17.4	0.96	1.08	1.58
	VP-2B - O2			VP-2B - CO2		
7/7/2021	17.6	14	8.7	1.84	4.66	9.7
8/25/2021	19.1	17	19.4	0.38	2.04	0.1
	VP-2C - O2			VP-2C - CO2		
7/7/2021	18.9	18.9	10.2	0.76	0.74	7.02
8/25/2021	18.9	18.9	13.1	0.24	0.24	4.16

Cell 2 Vacuum Radius of Influence – The ROI for EW-3 was calculated using pressure differential data collected at the extraction well and the vapor monitoring points during pilot test steady state conditions. The following equation is based on pressure differentials at radial distances from the extraction well. The pressure at the ROI (P_{RI}) is preset to one atm and R_1 is the estimated vacuum ROI.

$$Pr^2 - Pw^2 = (P_{RI}^2 - Pw^2) \frac{\ln(r/R_w)}{\ln(R_1/R_w)}$$

$Pr =$	1.00	Pressure at vapor point (atm)
$Pw =$	0.83	Pressure at well head (atm)
$P_{RI} =$	1.00	Pressure at ROI (preset)(atm)
$r =$	50	Radial distance from extraction well (ft)
$Rw =$	0.25	Radius of extraction well (ft)
$R_I =$		Radius of influence where pressure equals ROI (ft)
$Pr^2 - Pw^2 =$	0.31	
$(P_{RI}^2 - Pw^2) =$	0.31	
$\ln(r/R_w) =$	5.30	
$\ln(R_1/R_w) =$	5.34	
$(R_1/R_w) =$	207.83	
$R_1 =$	**51.96**	ft

Cell 2 Petroleum Mass Destruction Rate and Total Mass Destroyed – The pilot test at extraction well EW-2 began on June 30 and continued through December 9, 2021, by extension. The following mass removal rates are from pilot test results through September 15, 2021. During the reporting period approximately 36,177 lbs of petroleum hydrocarbons or approximately 5,838 equivalent gallons of gasoline were destroyed by the ICE. The average mass removal rate during steady-state operation for both engines combined equaled approximately 30.8 lbs/hour.

Cell 2 Propane Usage – The ICE unit uses propane as a secondary fuel to compensate for low energy (Btu) values of the extracted vapor, low flow rate from the extraction well, and elevated CO_2 concentrations in the extracted soil gas. Propane usage at EW-2 varied from a low of 4.5 gals/day to 87.1 gals/day maximum for an average consumption of 53.6 gals/day during steady-state operation. The lower propane usage directly corresponded with an increased VOC concentration and subsequently higher Btu

content of the extracted soil vapor at Cell 2. The high Btu content, high O_2, and low CO_2 concentrations in the soil gas resulted in more efficient combustion and lower usage of supplemental fuel.

Cell 2 ICE System Up Time – ICE system uptime during pilot testing at EW-2 was approximately 77.8% for Engine 1 and 86.6% for Engine 2. Extended down time at Engine 1 and Engine 2 occurred during the first three weeks of operation at EW-2 due to carburetor failure and failure of a check valve at the engine influent. After resolution of the operational issues, Engine 1 and Engine 2 up times were 99.4% and 92.2%, respectively.

2.4.1.4 Pilot Test Summary

Estimated Timeframe for Full Scale Remediation – To estimate the full-scale timeframe to remediate the LNAPL from the UDEX line release, the following parameters determined during pilot testing and remedial investigation were used:

- Average vacuum ROI (Cell 1, Cell 2, Cell 3)
- Estimated volume of recoverable LNAPL
- Average VOC mass destruction rate during steady-state conditions

Average vacuum ROI and VOC mass destruction rate were calculated using data collected during pilot testing (see **Section 2.4.1.3**). Data collected during previous remedial investigation activities including monitoring well gauging, MiHPT survey, and the UVOST® survey were documented in Stantec (2025b) and incorporated into the LDRM. Output from the LDRM included an estimate for saturated thickness of LNAPL which was applied to the lateral extent of the currently identified UDEX release area to calculate recoverable volume. The LNAPL volume estimate calculation ranged from 200,000 gallons to 400,000 gallons based on LDRM input parameters. The following table contains estimated remedial timeframe results based on the pilot test. The table provides estimates assuming the use of one or two ICE Units.

Estimated Remediation Timeframe				
Average ROI (ft)	**Est. Volume of LNAPL (gallons)**	**Avg. Mass Destruction Rate (lbs/Hr)**	**Remediation Timeframe (years) 1X ICE Unit**	**Remediation Timeframe (years) 2X ICE Unit**
52.6	200000	30.4	4.66	2.33
	400000	30.4	9.31	4.66

The remedial timeframe estimate was mostly dependent on the estimate of LNAPL volume and the mass removal rate. Additional remedial investigation activities and technologies were proposed at the time to refine the LDRM LNAPL volume estimate and further identify UDEX release LNAPL vertical and horizontal extent across the release area.

The pilot test results proved SVE using ICE was an effective, efficient, and safe technology for removal of reformate LNAPL from the subsurface.

2.4.2 Remedial Design Characterization

Based on the favorable SVE pilot test results using ICE technology, a remedial design characterization (RDC) was completed for BDH in late 2021 to update and refine the existing UDEX release conceptual site model (CSM) to better inform design of the full-scale SVE system through optimized extraction well placement. Details of the RDC were previously summarized in the UDEX release RIR (Stantec, 2025b). Findings of the RDC integrated with earlier high-resolution site characterization (HRSC) and forensic datasets informed full scale SVE system design in the following ways:

- The subsurface depositional framework includes heterogeneities that likely played a role as preferential flow pathways for UDEX LNAPL migration up until the time it stabilized. **Figure 2-4** panels visualize this finding by superimposing LNAPL fluorescence data on a model of hydraulic profiling tool (HPT) pressure. High pressure zones, shown in shades of red, have less permeability and are associated with less LNAPL fluorescence, particularly in the vadose zone and across the water table where SVE would apply. **Figure 2-4** Panel C also includes the location of a possible buried stream channel deposit, identified through geophysical investigation (Stantec, 2025b), that is supported to have aided LNAPL transport to the east. ANT observations in monitoring wells were minimal over time in the high pressure zones. Overall, these data support the CSM interpretation that the UDEX release LNAPL preferentially migrated around the low permeability zones historically.

- Pre-Existing Contamination is primarily located along the eastern perimeter of the UDEX release LNAPL body, and there is a commingled zone between the identified sources. RDC confirmation drilling location CD-03, completed as monitoring well S-480, was incorporated into the investigation based on geophysical signature, targeting a resistive anomaly in the eastern margin. Subsequent gauging and LNAPL sampling at this location indicated that the oil mixture was approximately 73% light naphtha range and middle distillate petroleum, with the remainder as reformate. The geophysics and chemical findings were supported by other lines of evidence including LNAPL color, odor, fuel fluorescence, and significant reduction in dissolved benzene and toluene.

As discussed in the UDEX release RIR (Stantec, 2025b), multiple lines of evidence converged to support that the UDEX release LNAPL body depicted on **Figure 2-3** based on 2019 estimates required updating in the 2021-2022 timeframe as a basis for establishing the remaining UDEX LNAPL extent and volume to target full scale remediation. The updated LNAPL body, presented in this CUP on **Figures 2-1, 2-5, and 2-6**, was drawn to contain internal void areas where neither the target LNAPL nor conditions favorable for SVE were present. Moreover, ANT trends from gauging (Stantec, 2025b) supported that LNAPL saturations near the northwestern perimeter had decreased through the period of record up until 2021, when LNAPL was no longer observed in wells S-430 and S-431 along the Schuylkill River. As such, the LNAPL body footprint was reduced in this area from what was delineated in 2019. Lastly, the LNAPL body was extended farther east and south, a revision supported by well S-480 and well S-483 findings where the RDC identified geophysical anomalies correlating to the core of a light naphtha and middle distillate plume (well S-480) and the southern extent of migration of the UDEX release (well S-483).

2.4.2.1 Updated UDEX Release Volume Estimate

Soon after discovery of the UDEX release, Stantec used initial CSM data in the API LDRM model to approximate its volume (see **Section 2.1.1**). Using the updated LNAPL body described in **Section 2.4.2** above, the LDRM was again used to estimate the total and recoverable LNAPL volumes remaining at the time of full-scale SVE design and transition away from fluid recovery. Recoverable volume in the context of this project is the portion of the total LNAPL that is perceived as recoverable by SVE and is based primarily on the model input parameter of residual saturation (the amount of LNAPL left behind). Because reformate LNAPL is entirely volatile, it was assumed for this estimate to have a residual saturation of 1%. This makes the estimate of recoverable LNAPL conservative as 99% of the total LNAPL is made available for SVE remediation. It is also considered to be conservative because legacy LNAPLs (Pre-Existing Contamination) present in the commingled body are included in the estimate.

Figure 2-5 displays the updated LNAPL body that was zoned into six areas, five of which were carried through the LDRM model with area-specific inputs of ANT based on January 2022 gauging data and LNAPL density from lab analyses presented in the UDEX release RIR (Stantec, 2025b). Area 6, discussed further below, used the same LDRM inputs as Area 2. The resulting LNAPL equilibrium profiles of saturation for the areas were exported from the LDRM, plotted, and the LDRM input parameters refined to best fit the saturations calculated from soil total petroleum hydrocarbon (TPH) data and the fluorescence profiles obtained from selected RDC borings (Stantec, 2025b). Based on the updated

conditions and subarea approach, it was conservatively estimated that in early 2022 the UDEX release LNAPL body recoverable volume was approximately 210,000 gallons.

Note that the legacy LNAPLs were identified to be proportionately significant in the eastern perimeter of the UDEX release LNAPL body (see hashed area of **Figure 2-5**) and by March 2022, were present as the prevailing LNAPL components in Area 3 (Stantec, 2025b). Using the forensic line of evidence and assuming the same ANT for well S-480, it is reasonable to estimate that at the time reformate represented approximately 27% of the LNAPL in Area 3, or approximately 9,318 gallons. Refining the overall estimate, the total recoverable UDEX release volume could be reduced by approximately 25,194 gallons resulting in an overall target volume of approximately 184,806 gallons. Because there were small amounts of legacy LNAPLs identified in samples collected from the other areas as well, this target volume could be further reduced. However, it was viewed as not necessary to further refine the total for full scale system design and optimized well placement because SVE wells would need to be installed in the areas where reformate was the primary component. The recoverable volume is discussed further in **Section 2.7** where the cumulative recovery totals are presented.

2.4.3 Full Scale SVE Remediation System Design

The primary design parameters for the full-scale SVE system included the SVE well layout (based on estimated permeability and radius of influence from the pilot test and contaminant distribution based on RDC data and LNAPL volume estimates) and SVE well design (based on pressure gradients, vacuum readings, and VOC concentrations from the pilot test).

2.4.3.1 SVE Well Layout

Using lines of project data integrated into the CSM including observations of ANT through time, passive soil gas data, electrical resistivity imaging (ERI), MIP data, optical interface probe (OIP) data, UVOST® data, electrical conductivity (EC) data, and HPT pressure from injection logging, Stantec developed the full scale SVE well layout shown on **Figure 2-6**. For the full-scale remedy, 20 additional SVE wells were placed and biased toward areas where UDEX release LNAPL was demonstrated to be dominant and where permeabilities in the SVE zone of interest were estimated to be moderate to high, supporting the efficacy of the chosen SVE technology. The anticipated ROI for each well is shown on **Figure 2-6** as a buffer around each well location based on the pilot test results across the range of conditions. The full scale extraction well layout assumed three values of ROI: 40-feet (ft), 50-ft and 60-ft. These radii were based on the vacuum ROIs calculated from pilot test subsurface pressure measurements and then assigned to each well based on the RDC permeability modeling results. Note that UDEX-EW-24 was installed later in time, along with the air sparge (AS) wells, as a replacement for UDEX-EW-11 after the well was inadvertently destroyed during earthwork activities.

The targeted zones of higher permeability correspond to the locations of elevated resistivity where spatial patterns recognized by Aestus LLC across the ERI profiles support that stream channel deposits are present in the shallow subsurface (as an example see **Figure 2-4** Panel C). Given the location and orientation of the example channel, it is supported to have functioned in part as a preferential flow path for UDEX release LNAPL in its early stages when it was migrating east from the active underground release.

However, there is a notable exception to the correlation between zones of high permeability and high resistivity in the overall UDEX release area that was important to the well layout. **Figure 2-4** Panel B best shows these areas. Confirmation drilling cores indicated that a portion of the channel deposits was backfilled with a variably muddy, medium to dense gravel that is resistive but relatively impervious to fluid flow, including LNAPL. As such, the noted areas, shown as voids in the LNAPL body on **Figure 2-6**, were avoided in the full scale SVE well layout.

2.4.3.2 SVE Well Design

The full scale SVE well design consisted of similar construction to the pilot test extraction wells (six-inch diameter polyvinylchloride [PVC] casing with six-inch diameter stainless steel wire wrap well screens). The diameter and the wire wrap screens were specified to maximize air flow rate to the wells which increased extraction efficiency and VOC mass removal rates. The full scale system wells were installed to depths ranging from 15 to 21 ft bgs (see **Table 1-1**; SVE well logs are included in **Appendix E**). The screened depth intervals were specified based on multiple lines of evidence including UVOST® response, OIP data, hydrostatic pressure data, visual/olfactory observations during well installation, soil gas data, and soil core photography.

As an example, **Figure 2-7** illustrates the use of HRSC data in selecting the screened interval for extraction well UDEX-EW-7. In general, the extraction well screen elevations were designed to intersect granular, permeable deposits (defined by low electrical conductivity and low HPT pressures) at depths approximately 2 to 2.5 ft above average groundwater elevations and directly above areas indicating measurable fuel fluorescence. The combined data on the charts shows a depth interval of high permeability with the presence of LNAPL which indicates an ideal location for the screened interval of an extraction well. The screen depths were specified to minimize groundwater mounding and the entrainment of groundwater in the vapor stream. Groundwater mounding can mask the well screens thereby reducing SVE efficiency, and groundwater entrainment would create an additional liquid waste stream requiring disposal.

2.4.4 Full-Scale SVE Remediation System Operation

The SVE pilot test began on April 7 and was extended through December 14, 2021, using RSI ICE Unit 407 (a dual engine V4 model). Full scale SVE operations were initiated on December 14, 2021, and completed on July 31, 2025, when the last of the leased ICE units was taken out of service. Note that the full scale SVE period was enhanced with AS beginning with pilot testing in September 2024 (see **Section 2.4.5**). Full scale operations began with the movement of ICE Unit 407 back to extraction well UDEX-EW-1 while 20 additional extraction wells (UDEX-EW-4 through UDEX-EW-23) were installed. To efficiently implement full scale operations, it was recognized that additional ICE units would be required. In the paragraph below, a chronological list of additional engine deliveries and replacements during full scale SVE operation is documented. Periodically during full scale SVE operations, new and/or replacement ICE engines were leased through RSI. Note that ICE unit replacements were due to one or more of the following factors – reduced engine performance due to excessive wear, rear and main engine seal leaks, excessive valve train wear, head gasket leaks and failure, and operating system failure.

RSI Unit 417 (V4 model) was delivered to the site and began operating in May 2022. In October 2022, two additional RSI ICE units, Unit 355 and Unit 408 (both single engine V3 models), were delivered to the site and began operating. The operation of two V4 Units (Units 407 and 417) and two V3 units (Units 355 and 408) for a total of six V8 engines was the main full-scale configuration for the duration of SVE remediation. Each ICE unit was initially operated under a City of Philadelphia AMS Installation Permit and later Air Pollution License with the two V3 units operating under a single permit/license. Copies of City of Philadelphia AMS Installation Permits and Air Pollution Licenses for each ICE are included in **Appendix H**. In January 2023, Unit 417 was replaced with Unit 419 and Unit 419 was replaced in December 2023 by RSI Unit 392. In January 2025, Unit 408 was switched to new Unit 412 for AS purposes and Unit 408 then replaced Unit 407, taking the longest tenured unit out of service for return to RSI. In June 2025, V4 ICE Unit 392 and V3 ICE Unit 408 were taken out of service and prepared for return to RSI. Lastly, on July 31, 2025, RSI ICE Unit 355 was removed from service after completing full scale SVE/AS operations (see **Section 2.4.6**).

As documented above, the typical ICE unit configuration during full scale SVE operations was two V4 and two V3 units for a total of six engines operating simultaneously on four SVE wells. The ICE units were rotated to various extraction wells during full-scale operations in accordance with performance monitoring criteria discussed in **Section 2.5**. Although the objective was to run all ICE units full time, operational run times were sometimes less due to mechanical issues, site conditions, and over extended holiday periods. Comments related to O&M are included in **Table 2-1b**. Evaluation of the ICE and extraction well performance data guided the SVE treatment rotation. When monitoring data supported that an operational extraction well was under performing, the ICE Unit was moved to another location/extraction well.

Through the course of full scale SVE implementation, 20 total wells were used (see **Figure 2-1b**) with some wells remediated multiple times and some wells remediated simultaneously by the same ICE to increase efficiency as cleanup progressed (see **Table 2-1b**). Pilot test well UDEX-EW-1 was remediated the most having received over 71 weeks of SVE treatment over 5 deployments. UDEX extraction wells UDEX-EW-9, UDEX-EW-16, UDEX-EW-18, and UDEX-EW-20 were not used during full scale operations primarily due to a combination of vacuum short circuiting to the surface, resulting in low VOC content in the extracted vapors, or excessive groundwater entrainment.

By late 2023, cumulative mass removal rates across engines had decreased, regardless of well configuration and even during times of favorable site conditions. This observation supported that the mass of UDEX residual LNAPL remaining in the more air permeable subsurface deposits had been significantly reduced. However, at the time, benzene and toluene concentrations in groundwater remained relatively high, particularly in the low permeability area of the UDEX release LNAPL body near monitoring wells S-484 and S-414 (well locations show on **Figure 2-1b**). CSM lines of evidence indicated a high likelihood for back diffusion of dissolved contamination from less permeable deposits that were not being thoroughly addressed by SVE alone and contributing to the elevated dissolved phase VOC concentrations in groundwater. For this reason, AS pilot testing was conducted to assess the efficacy of AS, as a supplement to SVE, at enhancing the removal rate of both residual LNAPL and dissolved-phase VOCs.

2.4.5 Air Sparge (AS) Pilot Test

AS is a proven in-situ technology for the remediation of VOCs in liquid (LNAPL) and dissolved (groundwater) phases. The technology consists of two mechanisms, volatilization and biodegradation, to address in situ VOC compounds. AS is the process of injecting compressed air into the subsurface via dedicated sparge wells screened into an impacted aquifer. Piston air compressors, positive displacement blowers, and regenerative blowers are typical sources for the compressed air. AS systems are typically operated in conjunction with SVE so that vapors generated by AS can be recovered. For the UDEX release project, the ICE units already in use would benefit from and recover/combust the additional VOC mass.

An AS pilot test was performed for three months beginning on September 12, 2024. The pilot test design was based on design parameters described in Hinchee (1994) and Leeson et al. (2002). The pilot test was conducted to determine the efficacy of air sparge technology in further reducing dissolved VOC (specifically benzene and toluene) concentrations in the saturated zone through volatilization from targeted areas of the release where data supported a high likelihood for continued back diffusion from less permeable deposits (weathered, muddy gravel) positioned directly above and seasonally intersecting the groundwater table (see **Section 2.4.2**).

The AS pilot test was designed with two treatment cells consisting of five dedicated air sparge wells per cell (see **Figure 2-8**). The treatment cells were centered around reference groundwater monitoring wells S-414 and S-484 (note that these are not the same treatment areas/cells used for the SVE pilot test that are shown on **Figure 2-3**). The five AS wells were located at varying distances radially around the reference wells. AS test cell one was located around groundwater monitoring well S-414 and AS test cell two around groundwater monitoring well S-484. AS wells UDEX-AS-1 through UDEX-AS-5 were in air sparge test cell one, and AS wells UDEX-AS-6 through UDEX-AS-10 were in test cell two.

To determine the efficacy of AS technology, ICE influent VOC concentrations were continuously monitored during the pilot test using ICE data files and real-time views telemetry. In addition, groundwater samples from the reference monitoring wells were collected periodically during the pilot test period and compared to pre-test groundwater analytical results for benzene and toluene. Data loggers were installed at reference well S-414 and in monitoring well S-437 to provide groundwater elevation data during the AS pilot test. Air injection rates, air pressure measurements, and equipment temperatures were recorded during the initial phases of the AS pilot test to aid in future full-scale system design.

2.4.5.1 AS Well Design

Based on design parameters outlined in the above referenced publications, a treatment zone depth of 4 feet was used for AS well design. The 10 AS injection wells (UDEX-AS-1 through UDEX-AS-10) were constructed with a screened interval length of two feet (see well logs in **Appendix E**). The bottom of the treatment zone was assumed to be at the top of the injection well screen at a depth of approximately 20 to 23 ft bgs. The depth of the injection wells was approximately 5 to 6 feet below the typical groundwater elevation for a total depth of up to 25 ft bgs. The pilot injection wells were constructed with 1.5-inch diameter, 0.020 slot 304 stainless steel (SS) wire wrapped well screen and 304 SS riser. Each well head

was completed with 2-inch 90-degree galvanized steel elbows connected to the riser via high pressure rated Fernco-style couplers. The inlet side of the elbow was completed with a Chicago style hose coupling.

2.4.5.2 AS Pilot Test System Design

To provide the compressed air to the sparge wells, a trailer enclosed AS system was supplied by Ground/Water Treatment and Technology LLC (GWTT). The air sparge system consisted of a Rietschle DLR-100, 10 horsepower (HP), rotary claw blower and a five-leg manifold with flow control valves, flow measurement (rotometers), and pressure gauges on each leg. The rotary claw blower delivered a maximum flow rate of 71 CFM and a maximum pressure of 31.9 psi. Each leg of the manifold was connected to an individual air sparge well using 1-inch diameter polyethylene reinforced PVC compressed air hose with a maximum working pressure of 250 psi. The ends of the air hose were finished with Chicago style couplers for quick connect/disconnect.

The AS system was powered by a hydraulically driven generator attached to RSI ICE Unit 355. The hydraulic motor attached to the generator was driven by a hydraulic pump which, in turn, was driven by operation of the ICE via SVE. The generator supplied 240v 3-phase power to the AS system control panel. A maximum of 40 amps of 3-phase power was supplied by the generator.

2.4.5.3 AS Pilot Test Results

Air Pressure and Flowrate – At the start of the pilot test, AS test cell one was sparged with ICE Unit 355 plumbed to extraction well UDEX-EW-14 (see **Figure 2-8**). To further aid in vapor recovery during the AS pilot test, ICE Unit 392 was located at extraction well UDEX-EW-1, ICE Unit 407 was plumbed to extraction wells UDEX-EW-5 and UDEX-EW-6, and ICE Unit 408 was located at extraction well UDEX-EW-13. Prior to starting the sparge blower, the air bypass valve on the blower effluent was fully opened. The air supply valves at each leg of the manifold were also fully opened. The AS blower was started and the bypass valve slowly closed allowing compressed air to the AS well manifold. The air flow at each leg of the manifold, measured by the rotometers, was adjusted for equalization across each leg. Pressure and temperature readings at the blower effluent were recorded.

The AS pilot system was connected to test cell two on October 10, 2024. The AS system was restarted in the same manner as test cell one using the same ICE unit SVE configuration by well. Subsequent pressure and temperature readings at the blower effluent were recorded. The AS pilot test was operated at each cell for approximately one month. The following charts contain pressure (pounds per square inch or PSI) and air flow (standard cubic feet per minute or SCFM) measurements for each leg (AS well) of the manifold for test cell one and test cell two collected during the pilot test.

	AS Pilot Test Injection Wells									
	AS-1		AS-2		AS-3		AS-4		AS-5	
Date/Time	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)
9/12/24 - 08:00	4.0	9.5	4.0	9.0	18.0	8.0	2.0	9.5	13.0	8.5
9/12/24 - 09:30	6.0	9.0	3.0	8.5	10.0	9.0	1.0	9.0	9.0	8.0
9/12/24 - 11:30	4.0	11.5	2.0	9.0	14.0	10.0	1.0	9.0	7.0	9.0
9/12/24 - 13:50	2.0	9.0	2.0	9.0	12.0	9.0	1.0	9.0	6.0	**13.0**
9/12/24 - 16:00	3.0	9.0	2.0	9.0	10.0	8.0	1.0	9.0	11.0	13.0
9/13/24 - 07:30	10.0	9.0	10.0	11.0	20.0	5.5	2.0	3.5	22.0	17.0
9/13/24 - 10:11	8.0	10.0	4.0	9.5	18.0	6.5	1.0	9.5	15.0	15.5
9/13/24 - 12:24	5.0	10.5	2.0	9.5	16.0	6.5	1.0	10.0	14.0	16.5
9/13/24 - 13:30	5.0	10.0	2.0	9.5	16.0	6.5	4.0	9.0	14.0	16.0
9/16/2024	2.0	8.5	4.0	8.2	17.0	8.7	2.0	6.7	6.0	9.0
9/27/2024	4.0	7.2	4.0	11.0	20.0	7.0	2.0	9.5	13.0	8.5
10/4/2024	6.0	9.0	3.0	8.5	10.0	9.0	1.0	9.0	9.0	8.0
10/7/2024	10.0	11.0	4.0	11.0	11.0	11.0	2.0	11.0	14.0	11.0
10/9/2024	10.0	11.0	2.0	11.0	16.0	9.0	2.0	11.0	12.0	12.0
	End of Test at Cell One									
Averages	5.6	9.6	3.4	9.6	14.9	8.1	1.6	8.9	11.8	11.8

	AS Pilot Test Injection Wells									
	AS-6		AS-7		AS-8		AS-9		AS-10	
Date/Time	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)	Pressure (PSI)	Flowrate (SCFM)
10/10/2024	2.0	8.5	4.0	8.2	17.0	8.7	2.0	6.7	6.0	9.0
10/14/2024	4.0	7.2	4.0	11.0	20.0	7.0	2.0	9.5	13.0	8.5
10/15/2024	6.0	9.0	3.0	8.5	10.0	9.0	1.0	9.0	9.0	8.0
10/16/2024	10.0	11.0	4.0	11.0	11.0	11.0	2.0	11.0	14.0	11.0
10/17/2024	22.0	7.0	2.0	12.0	1.0	11.0	8.0	11.0	1.0	11.0
10/18/2024	20.0	10.0	2.0	12.0	1.0	11.0	10.0	11.0	1.0	11.0
10/21/2024	20.0	10.0	2.0	12.0	1.0	11.0	10.0	11.0	1.0	11.0
10/22/2024	18.0	10.0	2.0	12.0	1.0	11.0	8.0	11.0	1.0	11.0
10/23/2024	16.0	11.0	1.0	11.0	1.0	11.0	10.0	11.5	1.0	11.0
10/24/2024	16.0	11.0	1.0	11.0	1.0	11.0	6.0	11.0	1.0	11.0
10/25/2024	16.0	11.0	2.0	12.0	1.0	12.0	10.0	12.0	1.0	11.0
10/28/2024	18.0	11.0	1.0	11.0	1.0	11.0	10.0	11.0	1.0	11.0
10/29/2024	20.0	11.0	2.0	12.0	1.0	12.0	8.0	12.5	1.0	12.0
10/31/2024	18.0	10.5	2.0	12.0	1.0	12.0	8.0	12.0	1.0	11.5
11/4/2024	20.0	9.0	4.0	12.0	2.0	12.0	10.0	12.0	2.0	11.0
11/5/2024	18.0	11.0	2.0	12.0	1.0	11.0	10.0	12.0	1.0	11.0
11/6/2024	16.0	11.0	1.0	12.0	1.0	11.0	8.0	12.0	1.0	11.0
11/8/2024	14.0	13.0	1.0	10.5	1.0	10.0	6.0	12.0	1.0	10.0
11/11/2024	16.0	12.0	1.0	12.0	1.0	11.0	6.0	12.0	1.0	11.0
11/12/2024	16.0	12.0	1.0	11.5	1.0	11.0	4.0	13.0	1.0	11.0
11/13/2024	16.0	11.0	2.0	12.0	1.0	12.0	10.0	13.0	1.0	11.0
11/14/2024	16.0	10.5	2.0	12.0	1.0	11.0	10.0	12.5	1.0	11.0
	End of Test at Cell Two									
Averages	15.4	10.4	2.1	11.4	3.5	10.8	7.2	11.3	2.8	10.7

The AS pilot test pressure and flowrate results indicated that permeability (air and hydraulic) varied considerably within the area of the two test cells and, therefore, across the UDEX release area. It was observed that anywhere from one to as much as 20 psi of injection pressure was necessary to achieve a flowrate of approximately 10 SCFM into the saturated zone. The average air pressures and flowrate data were used to size equipment and infrastructure for full-scale AS implementation.

Groundwater Monitoring Results – Prior to initiation of the AS pilot test, groundwater samples were collected from the referenced monitoring wells S-414 and S-484 as well as nearby monitoring wells S-382, S-429, S-482 and S-484 (see **Figure 2-8**). The sampled wells were all located within the UDEX release dissolved phase VOC plume. The groundwater samples were collected using low flow sampling procedures and analyzed for VOCs using EPA reference method 8260D. The UDEX release RIR (Stantec, 2025b) formally documented these data and included laboratory reports for the sampling events. The analytical results indicated elevated concentrations of dissolved phase VOCs, specifically for benzene and toluene. Additional groundwater sampling events were conducted in October and November 2024 during AS pilot test operation. The analytical results from samples collected from the AS pilot test reference wells (S-414 and S-484) for benzene and toluene are shown in the following chart.

Well ID	Sample Date	Constituent	Concentration (ug/l)	% Change from Baseline
S-414	9/5/24	Benzene	330000	**Baseline**
S-414	10/8/24	Benzene	230000	-30.30%
S-414	11/7/24	Benzene	300000	-9.09%
S-414	12/18/24	Benzene	220000	-33.33%
S-414	2/3/25	Benzene	160000	-51.51%
S-414	4/1/25	Benzene	160000	-51.51%
S-484	9/5/24	Benzene	480000	**Baseline**
S-484	10/8/24	Benzene	510000	6.25%
S-484	11/7/24	Benzene	280000	-41.66%
S-484	12/18/24	Benzene	150000	-68.75%
S-484	2/3/25	Benzene	120000	-75.00%
S-484	4/1/25	Benzene	200000	-58.33%

The groundwater monitoring analytical results and the percent difference calculations supported that AS technology, as a supplement to ongoing SVE, was effective in enhancing the removal of VOCs from groundwater in the pilot test cells.

VOC Mass Destruction Rate – As described in **Section 2.4.1**, the ICEs were equipped with onboard computers that controlled operations and simultaneously logged engine operating parameters while calculating vapor mass destruction. Mass destruction rates were observed to increase significantly during the AS pilot test. ICE Unit 355 influent British Thermal Unit (Btu) measurements pre-AS start-up averaged approximately 47,750 Btu from well UDEX-EW-14. During AS pilot test operation, ICE Unit 355 was achieving 571,000 Btu initially and approximately 270,000 Btu on average. ICE Unit 408, located nearby

at UDEX-EW-13, also saw a significant increase in influent Btu during pilot test operation – 40,000 Btu pre-AS startup and approximately 170,000 Btu during testing. The increase in Btu at each engine indicates an increase in energy content (a surrogate for VOC mass) in the influent vapor stream at each well. **Figure 2-9** details ICE Unit 355 engine performance monitoring data (see **Section 2.5** for additional monitoring details) collected during AS pilot testing at treatment cell 1 using UDEX-EW-14. As noted on the figure, there was a significant increase in cumulative recovery (equivalent gallons as gasoline) resulting from the increased extraction well fuel (Btu) available to the ICE during pilot system operation. This enhancement was attributable to the AS addition to SVE operations.

2.4.6 Full-Scale AS/SVE Operation

Based on the success of the pilot test, the AS system was expanded to full scale in January 2025 with the addition of two more AS cells, each including five additional injection wells, for a system total of 20 injection wells across four treatment cells (see **Figure 2-8**). Per the specification of the pilot test wells, AS wells UDEX-AS-11 through UDEX-AS-20 were constructed using 2-inch diameter (compared to 1.5-inch), 0.020 slot 304 SS wire wrapped well screen and 304 SS riser and installed using 4.25-inch hollow stem augers (see **Appendix E**). The additional cells were designed to treat groundwater in proximity to wells S-482 and S-437 within the core of the UDEX release groundwater plume. At the time of AS expansion, extraction well UDEX EW-24 was also installed to replace destroyed well UDEX-EW-11.

For full scale AS/SVE implementation, an additional trailer (Trailer 2) mounted AS system was leased from GWTT. The second (full-scale) system was designed identical to the pilot test system (Trailer 1) as described in **Section 2.5.1** with the following exception: a rotary vane compressor instead of a rotary claw blower was installed in Trailer 2. The rotary vane compressor used was a Becker Model KDT 3.140. The compressor was rated at 8.9hp and could supply up to 82 CFM of air at 20 psig. The blower was sized using data (pressure and flowrates) collected during the AS pilot test.

As with the pilot test, power was supplied to AS Trailer 1 using the hydraulic motor driven generator attached to ICE Unit 355. The generator delivered approximately 40 amps of 240v three phase power. Trailer 2 was powered by a belt driven generator installed on ICE Unit 412. The belt driven generator also delivered 40 amps at 240v three phase power.

The Trailer 1 AS system was set up to inject at AS treatment cells 1 and 2. The Trailer 2 system was set up to inject at AS Cells 3 and 4. Due to blower size and system manifolding, each AS treatment trailer initially operated one AS cell at a time. AS was pulsed at each cell for approximately six to eight hours per day. Compressed air from the blower and manifold was conveyed to the AS injection wells using 1 inch diameter pressure rated hose. Chicago style quick connect fittings were installed on the hoses and at the well head to facilitate quick changeout. AS operation was rotated periodically between the two treatment cells for each system by disconnecting the injection wells from one cell and connecting the supply hoses to the second cell. As cleanup progressed, the success of AS/SVE (as indicated by the ability to sustain elevated Btu over long durations at the associated ICE units) declined and the AS operations were adjusted to include more frequent pulsing across multiple cells, increasing efficiency. The full scale AS/SVE system was operated from January through the end of July 2025.

2.5 Remediation Performance Monitoring

Throughout full scale implementation of UDEX release remediation by SVE and a combination of SVE and AS technologies, the approach to operational decisions with respect to optimizing performance and completing active cleanup was supported by several metrics. This section describes the two main components of remediation performance monitoring, including monitoring ICE performance directly (via telemetry data) and monitoring of site conditions (e.g., groundwater concentrations, LNAPL measurements, etc.) that would lend insight into remediation performance decisions.

2.5.1 ICE Performance Monitoring

This section discusses the performance metrics used to evaluate ICE performance during SVE and combined SVE/AS remediation. This discussion is supported by **Figure 2-10** as an example of a performance monitoring dashboard, designed as a visual monitoring aid and used routinely for each ICE deployment.

2.5.1.1 Mass Removal Rates

Mass removal rates were calculated and continuously recorded by each ICE unit's onboard controller and were a function of the engine combustion rate based on influent soil gas concentrations of VOCs, CO2, and O2. Rationale for moving ICE units to new extraction wells was primarily based on mass removal rates approaching asymptotic conditions. In **Figure 2-10**, the decrease in mass removal rate (cumulative recovery) over ICE Unit 407 deployment at SVE wells UDEX-EW-15 and UDEX-EW-17 can be observed in the central performance, which flattens over time.

2.5.1.2 Influent VOC Concentrations

Influent VOCs concentrations were continually estimated by the ICE unit controllers which made carburetor adjustments to compensate for changes in available well fuel and recorded these data throughout SVE operations. Like mass removal rates, SVE remedial endpoint typically occurred when the influent concentration curve reached an asymptotic level. VOC concentrations approached asymptotic lows as LNAPL saturations declined within each well's ROI, causing decreased removal rates and increased propane consumption. The central plot on **Figure 2-10** exemplifies a gradual decline in mass removal rate and influent VOC concentrations (as estimated in Btu/Hr – gray and purple bars) over more than a year of near continuous SVE operation.

2.5.1.3 Alternative Fuel Usage

Alternative fuel (propane) usage was monitored routinely in the field through storage tank gauge observations and continually by propane flow rates into each ICE unit through a propane meter, recorded in each ICE operational data file. Increased propane usage correlated to reduced influent VOC concentrations and mass removal rates over time because of diminished subsurface hydrocarbon mass, sometimes exacerbated by a high water table. In general, SVE was concluded at each extraction well

when it was determined that excessive propane usage was being caused by the general lack of reformate LNAPL over other factors. In **Figure 2-10**, propane flow rate is plotted as pink lines in the central plot and can be observed to max out near three standard cubic feet per minute (SCFM) over time which, according to RSI, occurs when the ICE carburetor propane valve is nearly wide open.

2.5.1.4 SVE Well Vacuum and Condensate Production

Increased well vacuum and condensate production were operational parameters that paralleled a reduction in mass removal efficiency at each extraction well. Commonly, these monitored parameters were the result of rainfall (wetting fronts) and/or a high water table. As part of routine O&M, condensate collected in knockout tanks on each ICE unit was transferred to holding tanks previously used for interim remediation for later disposal. **Figure 2-10** includes vacuum measurements made at the wellhead in the lower plot and water-table elevations in the upper plot. Taken together, these plots illustrate the trend of higher well vacuum during times of high water table.

2.5.2 Site Conditions

Site conditions influencing the effectiveness of the SVE/AS remedy included groundwater and surface water elevations, availability of volatile LNAPL, subsurface permeability, and presence/co-mingling of non-reformate contamination. These conditions were monitored throughout remedy operation as discussed below.

2.5.2.1 Groundwater and Schuylkill River Levels

Generally, SVE remediation at the UDEX release was most successful when unsaturated conditions prevailed in the vadose zone. Times of increased precipitation and typical winter season conditions led to increased groundwater levels and increased soil moisture conditions. In addition, the Schuylkill River experienced elevated stage across the tidal prism during times of increased precipitation which raised groundwater levels while the water table was already rising from enhanced recharge. Both the Schuylkill River stage, local rainfall, and hydrographs from data loggers deployed across the UDEX release were used to aid in operational decisions regarding water levels, such as temporarily shutting down operations (e.g., over the weekend) to await better conditions or leveraging enhanced mass removal during times of rapidly falling water table. In **Figure 2-10**, two examples of high river and water-table conditions in January and April of 2024 show corresponding losses in well fuel (Btu/Hr) and well flow (SCFM) that resulted in increased well vacuum and a contemporaneous decline in recovery rate (note the small rebound in recovery beginning in June 2024 as groundwater elevations declined).

2.5.2.2 Apparent LNAPL Thickness

Through the active remediation period, performance monitoring included biweekly to weekly well gauging of the UDEX release well network to not only inform water-level conditions but also indirectly assess LNAPL saturation through discharge to wells. ANT observations in wells supported the presence of pore scale mobile (ability to flow to the well) LNAPL within the formation enveloping each well screened interval. Gradual reductions in observed ANT over time supported that LNAPL saturations in the

subsurface had been reduced. Observations of no measurable or significantly reduced ANT, particularly in reformate dominant areas, supported completion of active remediation in that area. As discussed in the UDEX release RIR (Stantec, 2025b), measurable LNAPL remained in only one of 14 UDEX release monitoring wells at the time of report submission, soon after completion of the SVE/AS period. It is expected that measurable LNAPL may be observed at times during post remediation monitoring. However, complete removal of measurable LNAPL was demonstrated through fate and transport modeling and risk assessment to not be necessary to maintain the UDEX release SSS, regardless of LNAPL source.

2.5.2.3 UVOST® Screenings

While UVOST® screenings were used as a HRSC and delineation tool early in the UDEX release project, the technology was also used periodically over the course of remediation to gauge the effectiveness of ongoing SVE at reformate removal. The performance monitoring surveys were completed by Dakota Technologies Company LLC (Dakota) in December 2022, June 2023, and March 2024 at selected boring locations (see **Figure 1-2**). Reviewing UVOST® signal strength and waveform/lifetime data, changes in apparent LNAPL saturations and LNAPL composition/weathering were observed across surveys. The comparative screenings offered detailed insights into the location and thickness[2] of LNAPL impacts within the formation and an estimate of LNAPL saturation based on fluorescence response. In general, reductions in signal strength across the LNAPL smear zone, coupled with shortened lifetimes and "red shifting" waveform data (losses in blue and green channel signal, which are indicative of VOC depletion), supported completion of reformate remediation by SVE. An additional line of information stemmed from the non-negative least squares (NNLS) advanced analysis performed by Dakota. NNLS results provided estimates of LNAPL component dominance across the smear zone over time based on waveform end members harvested from the UDEX release dataset. Waveforms consistent with Pre-Existing Contamination LNAPL were demonstrated to become dominant in the eastern portion of the UDEX release where ANT observations persisted over time, and dissolved benzene and toluene concentrations in groundwater were substantially lower in the absence of a primary reformate source. The UVOST® reports are included in **Appendix F**.

2.5.2.4 LNAPL Forensics

Repeated quantification and forensic analysis of UDEX release LNAPL samples lent molecular insights into remediation performance and whether reformate continued to be present in areas where LNAPL remained at high enough saturations to be measurable in wells. Because SVE was expected to preferentially remove reformate over time, this performance monitoring tool was most helpful in gauging area cleanup progress where Pre-Existing Contamination was present as a significant component (generally on the UDEX release eastern perimeter). ChemQuants Environmental Forensics

[2] Thickness of LNAPL impacts detected during UVOST® screenings indicates LNAPL presence in the formation but does not necessarily translate to presence or thickness of mobile LNAPL in the subsurface or measurable LNAPL in monitoring wells.

(ChemQuants) interpreted results of repeat LNAPL samples collected from well S-439 in February 2020 (pre-SVE) and March 2023 (Stantec, 2025b). ChemQuants concluded that the 2023 sample "exhibited enhanced reformate depletion" and "was more depleted of C2-monoaromatics, benzene, and toluene" when compared to the 2020 sample. These findings supported the efficacy of SVE in preferentially removing the UDEX release from the subsurface and complemented other performance monitoring metrics at the time.

2.6 Recovery Totals and Termination of Remediation Program

The cumulative recovery totals calculated through active remediation are presented on **Figures 2-1a** and **2-1b** and tabulated in **Tables 2-1a** and **2-1b**. By the end of July 2025, when the last ICE unit was taken out of service, approximately 293,950 gallons of LNAPL had been recovered by the remediation program. This included approximately 96,609 gallons by fluid recovery and the remaining equivalent through soil vapor extracted and combusted in the ICE units. When comparing the cumulative recovery total to the estimates of released and remaining volume presented in **Sections 2.1.1** and **2.4.2.1**, it was evident that most pore-scale mobile and recoverable UDEX release LNAPL had been removed from the subsurface to the limit of practicality.

This conclusion was supported by the monitoring metrics outlined in this report, including severely reduced SVE (and SVE/AS) efficiency, absence of measurable LNAPL in most wells (particularly where reformate had been the primary component), and depleted LNAPL chemistry. In the context of Act 2 closure, the risk assessments informed by conservative (applying maximum groundwater concentrations from a period predating further reductions through SVE/AS treatment) fate and transport modeling as presented in Stantec (2025b, 2026a, 2026b) indicated that no unacceptable risks were identified along the completed transport pathway to Schuylkill River surface water. Based on modeling, it has been concluded that the concentrations of benzene and toluene in groundwater would need to exceed past maximum concentrations to possibly cause exceedances of applicable screening criteria in Schuylkill River surface water. This is due to the dilution potential of the Schuylkill River demonstrated through modeling and risk assessment (Stantec, 2025b; Stantec, 2026a/b). As such, the decision was made to terminate the remediation program and transition into post remediation care monitoring.

3 Engineering and Institutional Controls

To demonstrate continued attainment of the Act 2 SSS for remaining UDEX Release contamination across site media, certain controls identified in the current and future exposure pathway assessment must be maintained in post remediation care monitoring through closure. These controls include:

- Facility safety and security – BDH is responsible for overall security and oversight of contractor safety, and BDH implements personal protective equipment (PPE) and safety protocols that mitigate the potential for worker exposure to impacted subsurface soil, soil vapors, groundwater, and/or LNAPL through the direct contact pathway. As part of the June 26, 2020 First Amendment to Consent Order and Agreement, also known as the Buyer-Seller Agreement, BDH is obligated

to "develop and implement a health and safety plan (HASP) to protect employees, on-site workers, and other persons visiting the Property (including, but not limited to, construction workers) from any contaminants they might encounter on the Property." This obligation includes any future excavation work in the UDEX release area related to redevelopment.

- Potential vapor intrusion – Future redevelopment plans for the general area are expected to include a slab on grade building. There are currently no buildings above the UDEX release impacts. Per the 2020 Soil Management Plan, any future building is required to have vapor barriers or a mitigation system which would eliminate the potential for vapor intrusion from the UDEX release impacts that remain in the subsurface after redevelopment. No subsurface preferential pathways that could potentially allow for migration of vapors exist in the UDEX release area. Therefore, indoor air inhalation exposures are incomplete. Alternatively, the plan allows for BDH to "conduct sampling and analysis to demonstrate that such controls are not needed to mitigate potential vapor intrusion (VI) into such buildings or structures in accordance with PADEP guidance."

- No groundwater withdrawals – In accordance with the Buyer-Seller Agreement, onsite groundwater is not currently and will not be used for potable or non-potable purposes.

- Engineering controls – There are no engineering controls in place at the UDEX release that would be required to remain in place to maintain the SSS for groundwater or soil.

4 Post Remediation Care Plan

As required under PA Code Section 250.410(b)(5), documentation of a proposed Post Remediation Care Plan (PRCP) is to be included as part of the Cleanup Plan. The proposed post-remediation care activities to address the above UDEX release controls and demonstrate continued SSS attainment are as follows:

- BDH will continue to comply with facility safety and security obligations established in the Buyer-Seller Agreement as described in **Section 3** to eliminate potential onsite worker exposures to remaining UDEX release contamination through the inhalation and direct contact pathways via HASP implementation.

- BDH will ensure that, per the June 15, 2020, Soil Management Plan (Attachment B to the 2020 Buyer-Seller Agreement), any future building will be required to have a vapor barrier or mitigation system. Alternatively, the plan allows for BDH to "conduct sampling and analysis to demonstrate that such controls are not needed to mitigate potential vapor intrusion into such buildings or structures in accordance with PADEP guidance." BDH's compliance with this obligation will maintain the incomplete pathway to potential future VI receptors.

- BDH will perform groundwater monitoring including gauging and sampling of the 12 remaining and replacement UDEX release area monitoring wells. Well construction is outlined in **Table 1-1**. As indicated in **Table 1-1**, 8 of the monitoring wells are replacements for wells abandoned following completion of redevelopment earthwork/grading. One new well location, S-521, was added based on findings of the fate and transport assessment (Stantec, 2025b). Well logs are included in **Appendix E**, and well abandonment reports are included in **Appendix G**. Post remediation groundwater gauging and sampling will be completed at the wells shown on **Table 4-1** and **Figure 4-1**. Groundwater sampling will be conducted using low-flow techniques, and samples will be analyzed for benzene and toluene via EPA Method 8260 by a Pennsylvania

certified laboratory. Groundwater sampling will be conducted on a quarterly basis for three years following Final Report approval and will then be reduced to annual sampling for two additional years. Five years post Final Report approval, groundwater monitoring will be terminated. The purpose of the PRCP groundwater monitoring will be to confirm groundwater conditions have not changed in a way that could pose unacceptable risk to Schuylkill River surface water receptors as evaluated in the HHRA and SLERA.

- BDH will replace or attempt to replace any of the 12 UDEX release area monitoring wells shown on **Figure 4-1** and listed in **Table 4-1** should they require future abandonment (to facilitate redevelopment of the property) prior to Act 2 closure. Monitoring wells will be replaced in kind where possible. Professional judgment of the project Professional Geologist will be exercised to select locations for appropriate replacement well locations if wells cannot be replaced in kind.

- For the five years of the PRCP groundwater monitoring program, BDH will submit annual reports to the PADEP to document the sampling activities and provide interpretation of updated groundwater and site conditions. The reports will also provide verification that no groundwater is being used in proximity to the UDEX release.

- BDH will promptly notify the PADEP of any nonattainment conditions and will include measures to correct nonattainment conditions, or propose changes, if applicable. Notification will include a written summary of the proposed approach and schedule to correct the nonattainment. After corrections have been implemented, additional reporting will be conducted to communicate the outcome of the correction either confirming attainment or notifying PADEP that nonattainment conditions persist following actions to correct nonattainment. Should this scenario be reached, BDH will work with PADEP to identify an acceptable solution.

5 Public Comments

As required by Act 2, public and municipal notices were made by BDH to announce the NIRs and subsequent submission of both the UDEX release RIR and HHRA/SLERA to the PADEP. Public notices were published in the Philadelphia Daily News on October 2, 2025, for the RIR and on February 10, 2026, for the HHRA/SLERA. A public notice for this CUP was published in the Philadelphia Daily News on September 25, 2026. Letters indicating the submission of the reports were also sent to the Philadelphia Department of Public Health Environmental Health Services. Copies of the public and municipal notices for the project are included in **Appendix B**. To date, BDH has not received a request from the City of Philadelphia for a Public Involvement Plan (PIP) for the UDEX release, and no public comments have been received for the project.

BDH remains committed to keeping the public informed of the overall facility's redevelopment and Act 2 program cleanup process, both for the UDEX release and other ongoing environmental projects. It is BDH's goal to continue to host quarterly community meetings during which UDEX release updates can be provided. Community meeting logs, environmental reports, and other public relations are available for the public to view at https://www.thebellwetherdistrict.com/community/.

6 References

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Stantec (2025b). Remedial Investigation Report, UDEX Feed Underground Line Release, Former Philadelphia Energy Solutions Refinery. Philadelphia, Pennsylvania. Prepared for: Bellwether District Holdings LLC c/o HRP Group. October 2, 2025.

Stantec (2026a). Human Health Risk Assessment, UDEX Feed Underground Line Release, Former PES Refinery. Philadelphia, Pennsylvania. Prepared for: Bellwether District Holdings LLC c/o HRP Group. February 11, 2026.

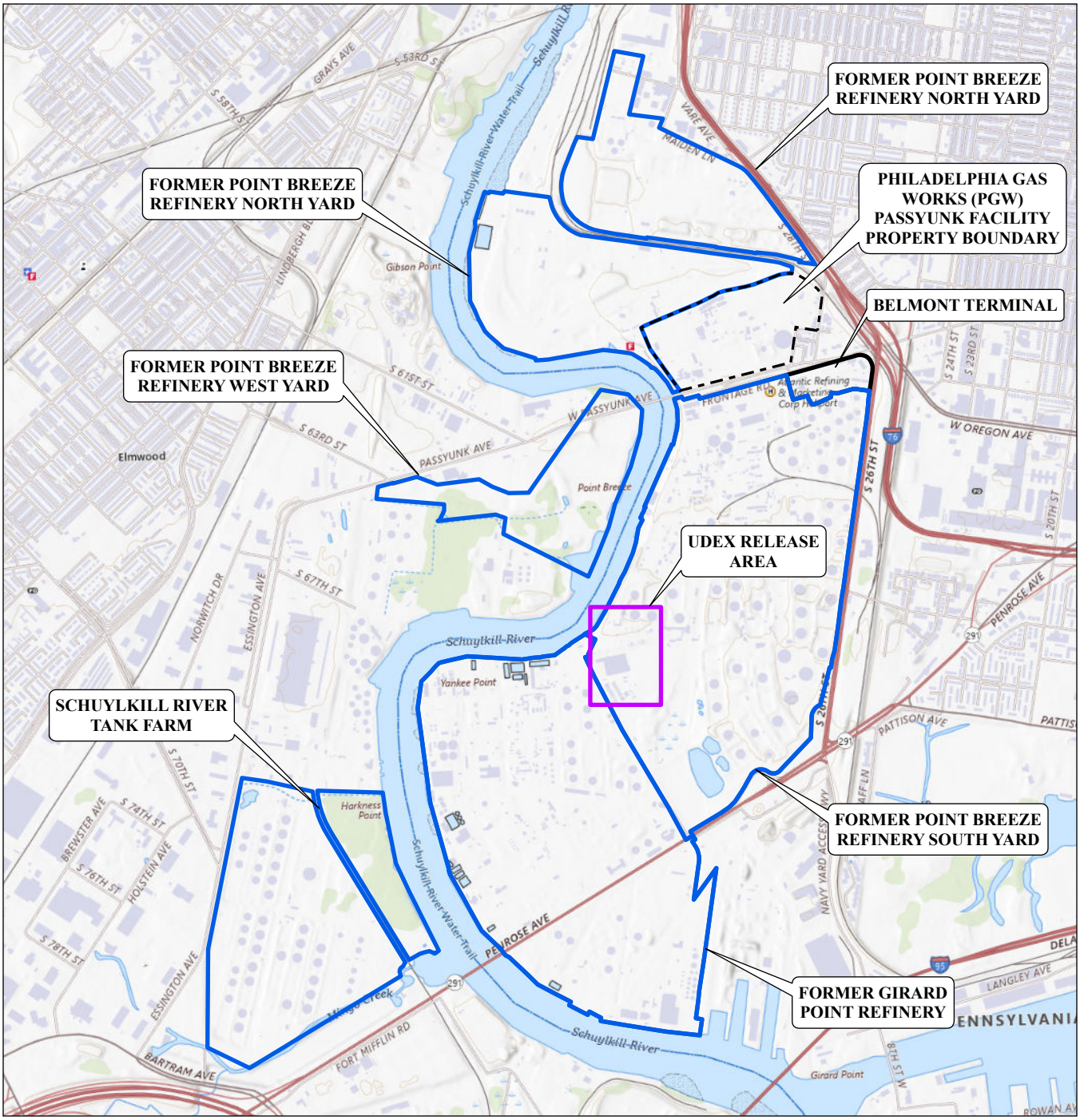
Stantec (2026b). Screening Level Ecological Risk Assessment, UDEX Feed Underground Line Release, Former PES Refinery. Philadelphia, Pennsylvania. Prepared for: Bellwether District Holdings LLC c/o HRP Group. February 11, 2026.

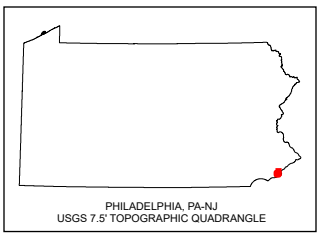
Stantec

Stantec is a global leader in sustainable architecture, engineering, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.



Figures





Legend

- UDEX Release Area
- Former PES Refinery
- Belmont Terminal
- Philadelphia Gas Works (PGW) Passyunk Facility Property Boundary

0 1,100 2,200 Feet

(At original document size of 8.5x11)
1:26,400

N

Stantec

Project Location
City of Philadelphia,
Philadelphia County, PA

Prepared by GWC on 2025-05-29
TR Review by ADK on 2025-07-15
IR Review by JKK on 2025-07-21

Client/Project 195603450
PHILADELPHIA ENERGY SOLUTIONS
REFINING & MARKETING LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

Figure No.
1-1

Title
Site Location Map

Notes
1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Data Sources: Stantec, USGS
3. Background: USGS Topo Layers (TMN): USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth Data; U.S. Department of State HIU; NOAA National Centers for Environmental Information. Data refreshed July, 2025.

\\us0245-pp\fs01\shared_projects\195603450\03_data\gis_cad\gis\PRO\udex_ri\udex_ri_sec1.aprx Revised: 2025-08-19 By: gcurry

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Legend

- SVE Well
- AS Well
- Monitoring Well*
- Replacement/New Monitoring Well (2026)
- Vapor Point
- UVOST-HP Boring
- Former UDEX Feed Line (limits of underground section)

Bulkhead Location
General Construction

- Concrete Wall
- Masonry Wall
- Steel Sheeting
- Timber Sheeting
- The Bellwether District Development Lot Boundary
- Former Central Warehouse
- Texas Eastern/PGW Metering Station

0 70 140 Feet
(At original document size of 22x34)
1:500

N

Stantec

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Data Sources: Stantec
3. Background: USGS Topo Layers (TMN): USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth Data; U.S. Department of State HIU; NOAA National Centers for Environmental Information. Data refreshed October 27, 2025-v2.1 PEMA Philadelphia County 2022 Aerial.
4. *See Cleanup Plan Table 1-1 for a list of updated well statuses.

Project Location
City of Philadelphia,
Philadelphia County, PA

Prepared by GWC on 2025-05-29
TR Review by ADK on 2025-07-15
IR Review by JKK on 2025-07-21

Client/Project
PHILADELPHIA ENERGY SOLUTIONS
REFINING & MARKETING LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

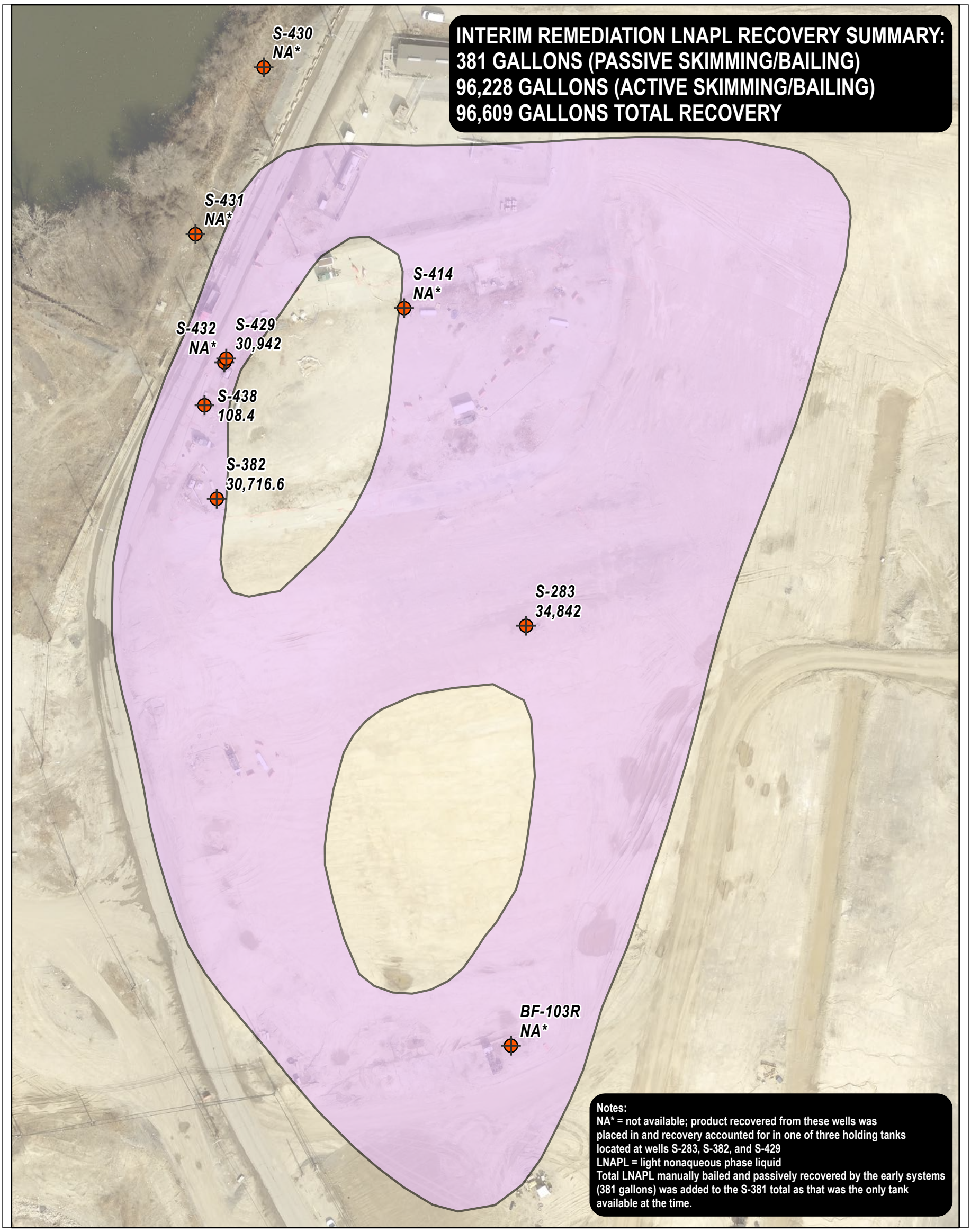
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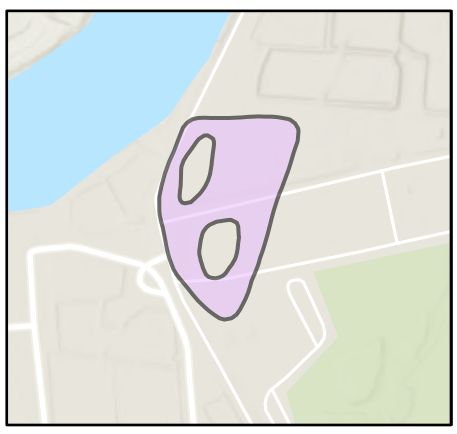
Figure No.
1-2

Title **Remediation Site Plan**

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Notes
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2. Coordinate System: NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
3. 2025 aerial photography obtained from the Pennsylvania Spatial Data Access (PASDA) mapping service
4. Source: Stantec
5. Service Layer Credits: Sources: ESRI

Legend

UDEX Monitoring Well (used for skimming and/or bailing)

Cumulative Recovery (gallons LNAPL)

UDEX Release LNAPL Body (2022)

0 500 1,000 Feet

(At original document size of 11x17)
1:1,000

N

Stantec

Project Location	Prepared by ADK on 2026-07-02
City of Philadelphia,	TR by JK on 2026-07-09
Philadelphia County, PA	IR by WH on 2026-07-09
Client/Project	213403039
PHILADELPHIA ENERGY SOLUTIONS	
REFINING & MARKETING LLC	
FORMER PES REFINERY	
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145	

Figure No.

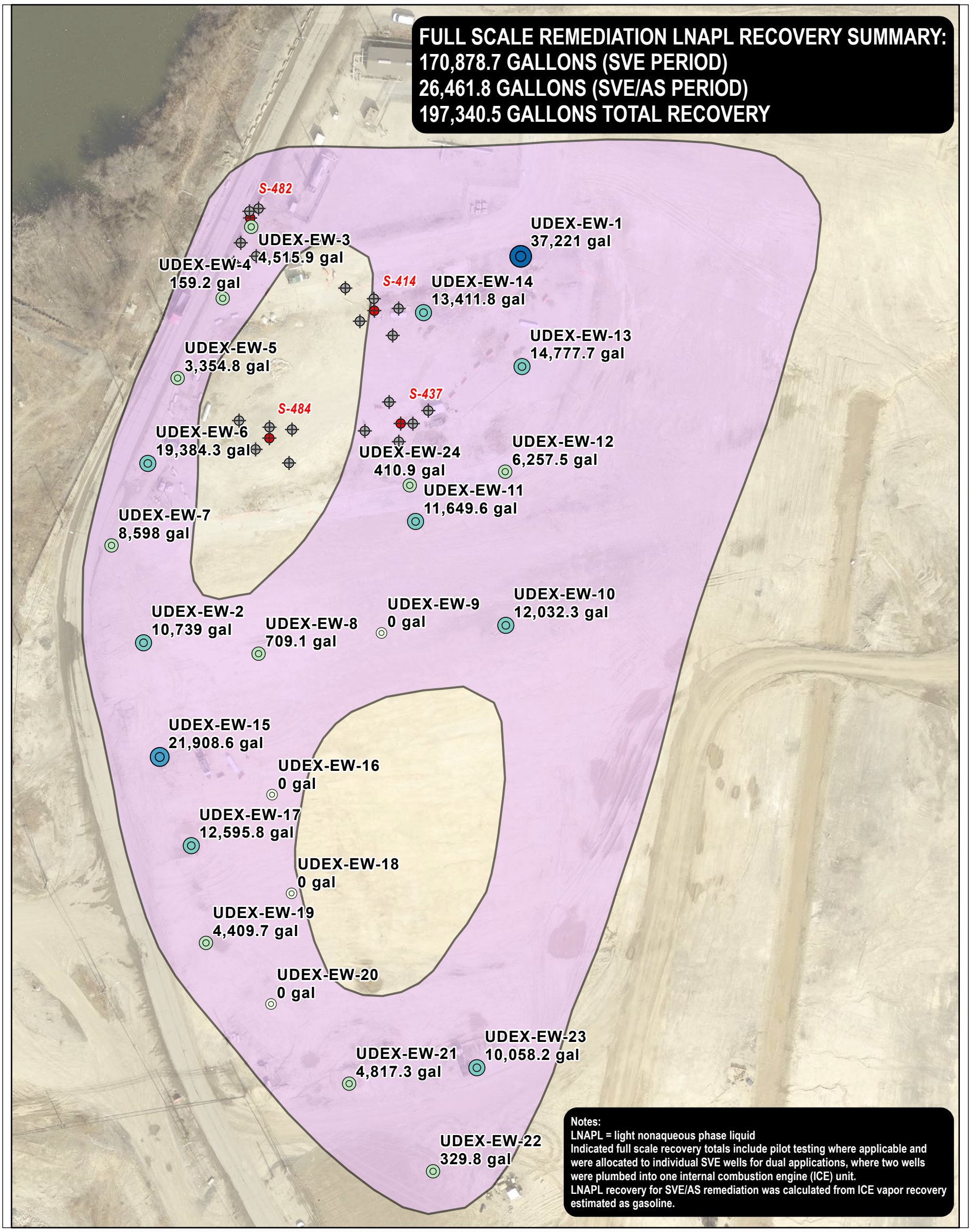
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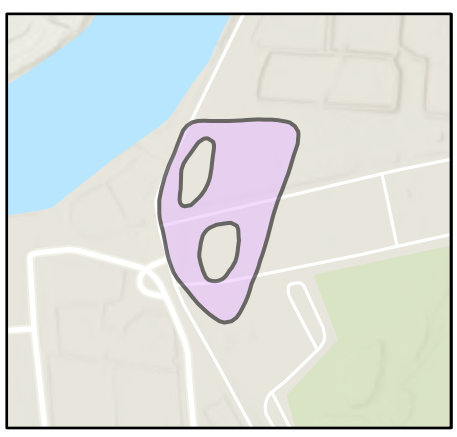
Title

UDEX RELEASE
INTERIM REMEDIATION SUMMARY

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Notes
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2. Coordinate System: NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
3. 2025 aerial photography obtained from the Pennsylvania Spatial Data Access (PASDA) mapping service
4. Source: Stantec
5. Service Layer Credits: Sources: ESRI

Legend

Soil Vapor Extraction (SVE) Well

Cumulative Recovery (gallons LNAPL equivalent)

- WELL NOT USED
- 0 - 10,000
- 10,000 - 20,000
- 20,000 - 30,000
- >30,000

- Air Sparge (AS) Well
- Monitoring Well (targeted with AS)
- UDEX Release LNAPL Body (2022)

0 500 1,000 Feet

(At original document size of 11x17)
1:1,000

N

Stantec

Project Location	Prepared by ADK on 2026-07-02
City of Philadelphia,	TR by JK on 2026-07-09
Philadelphia County, PA	IR by WH on 2026-07-09
Client/Project	213403039
PHILADELPHIA ENERGY SOLUTIONS	
REFINING & MARKETING LLC	
FORMER PES REFINERY	
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145	

Figure No.

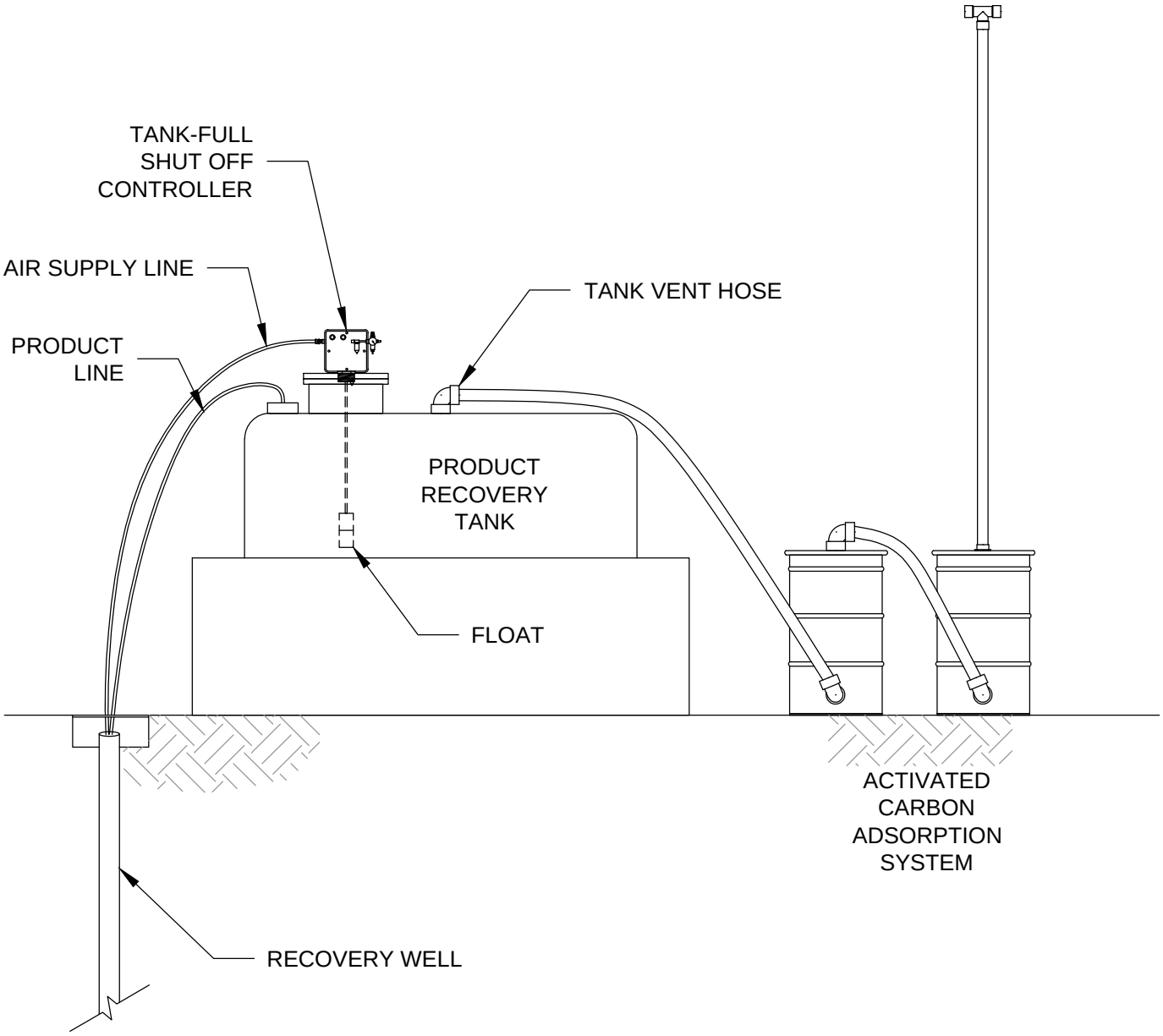
2-1b

Title

UDEX RELEASE
FULL SCALE REMEDIATION SUMMARY

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Client/Project
PHILADELPHIA ENERGY SOLUTIONS REFINING & MARKETING, LLC

REFORMATE RELEASE FROM UDEX FEED LINE

Project No.
213403039

Title
PRODUCT RECOVERY SYSTEM SCHEMATIC

Date
10/29/18

Figure No.
2-2

v:\2134\active\213403039\05_report_deliv\drawings_design\cad_fig\213403039-01

2018.10.29 2:16:26 PM





LEGEND

SVE PILOT TEST DESIGN

Well Type

- Extraction Well (EW)
- Vapor Point (VP)
- Monitoring Well
- Skimming Well (active during SVE pilot)
- Approximate Extent of LNAPL Body (2019)

30 0 30 60 90 Feet

1:1,000 (At Original document size of 11x17)

N

Stantec

Project Location
City of Philadelphia,
Philadelphia County,
Pennsylvania

213403039
Prepared by ADK on 9/23/2021
Technical Review by JP on 9/24/2021
Independent Review by JLM on 9/24/2021

Client/Project
PHILADELPHIA ENERGY SOLUTIONS
REFINING & MARKETING LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

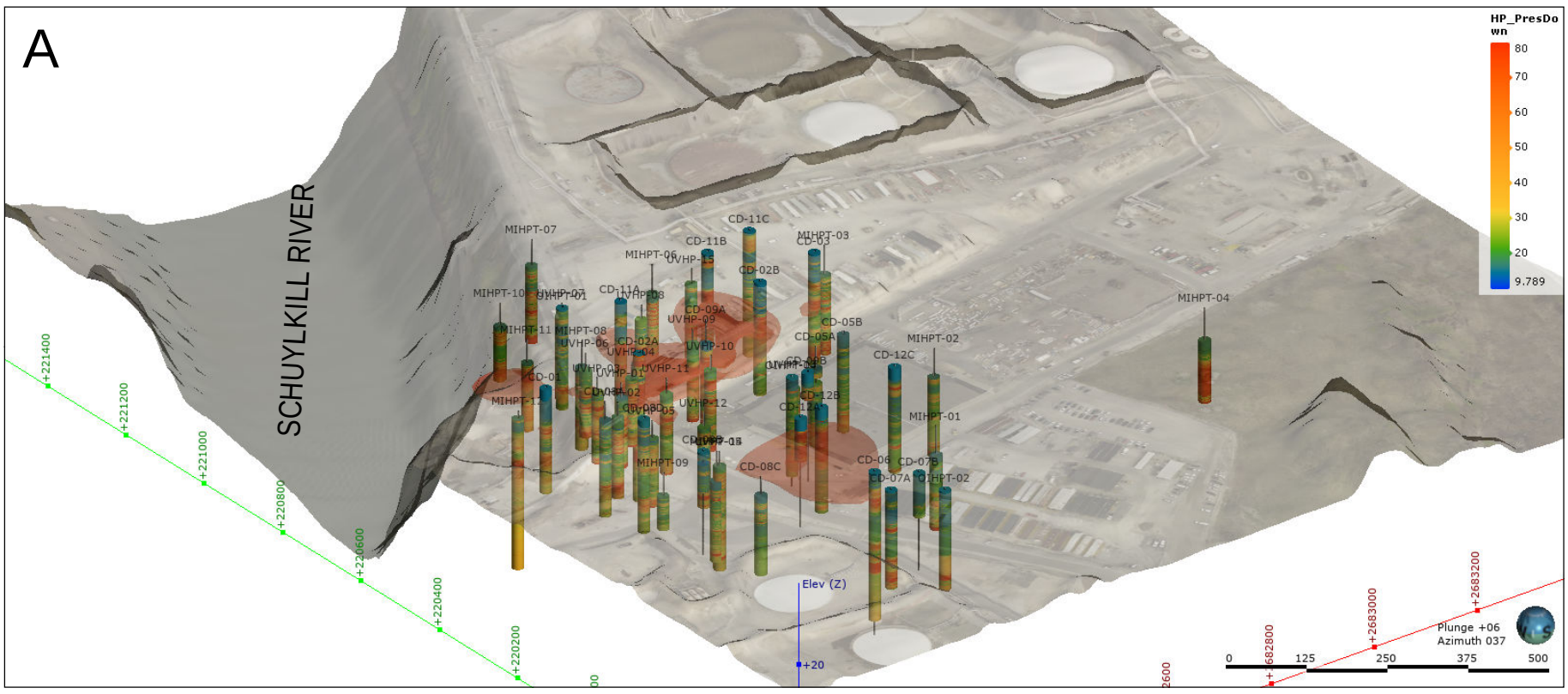
Figure No.
2-3

Title
UDEX RELEASE -
SVE PILOT TEST DESIGN SHOWING
EXTRACTION WELL LOCATIONS

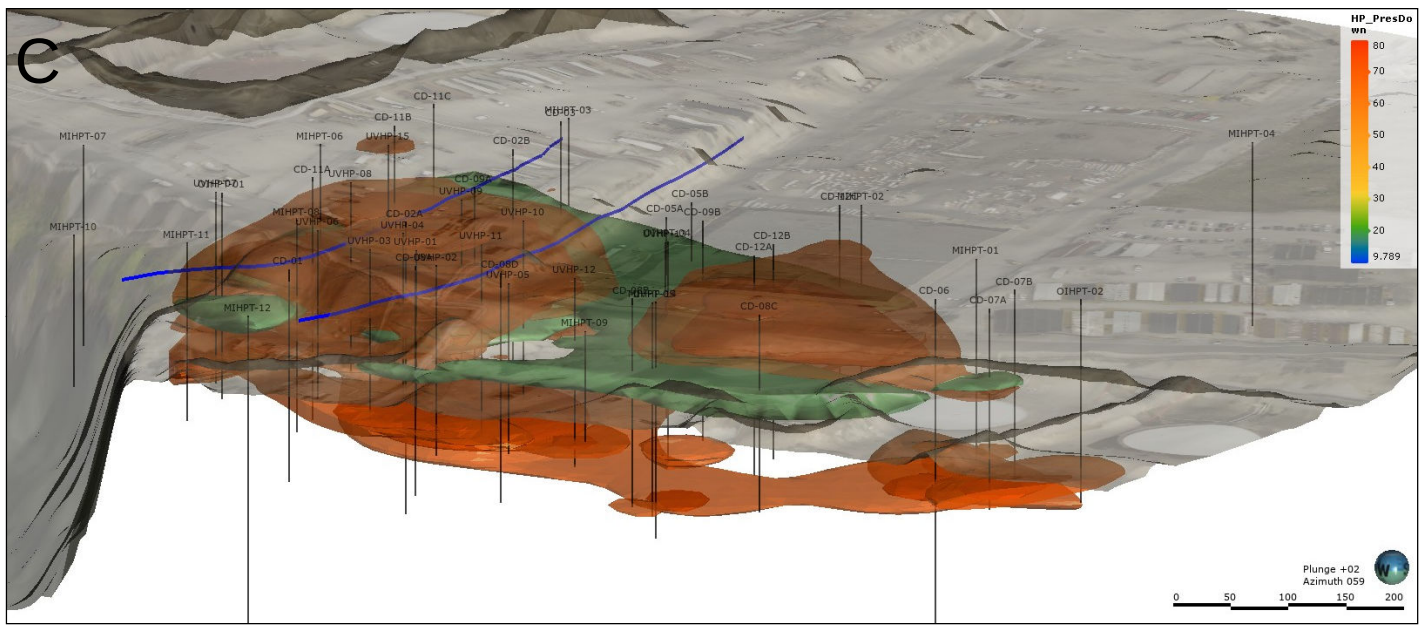
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1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec
4. Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community © Harris

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Notes
1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702
3. Feet
4. Source: Stantec
   Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed © Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO
5. © 2015 Microsoft Corporation
   2020 aerial photograph obtained from the Pennsylvania Spatial Data Access (PASDA) and shown draped over 2014 integrated topographic and bathymetric model obtained from the National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information

LEGEND

Panel A - View looking northeast of hydraulic profiling tool (HPT) maximum downhole pressure intervals shown with numerical model of high pressure zones (> 80 pounds per square inch [psi]).

Panel B - View looking northwest of CSM borehole traces shown with fluorescence graphs (green) of ultra-violet optical screening tool (UVOST®) and optical image profiler (OIP) data. HPT high pressure zones are included as presented in Panel A.

Panel C - View looking northeast of CSM borehole traces shown with numerical model of fluorescence data (> 10% fluorescence shown as green areas) superimposed on HPT high pressure zones (> 60 psi). The location of a possible buried stream channel deposit is shown outlined in blue at elevation 10 feet NAVD88.

Stantec

Project Location
City of Philadelphia,
Philadelphia County,
Pennsylvania

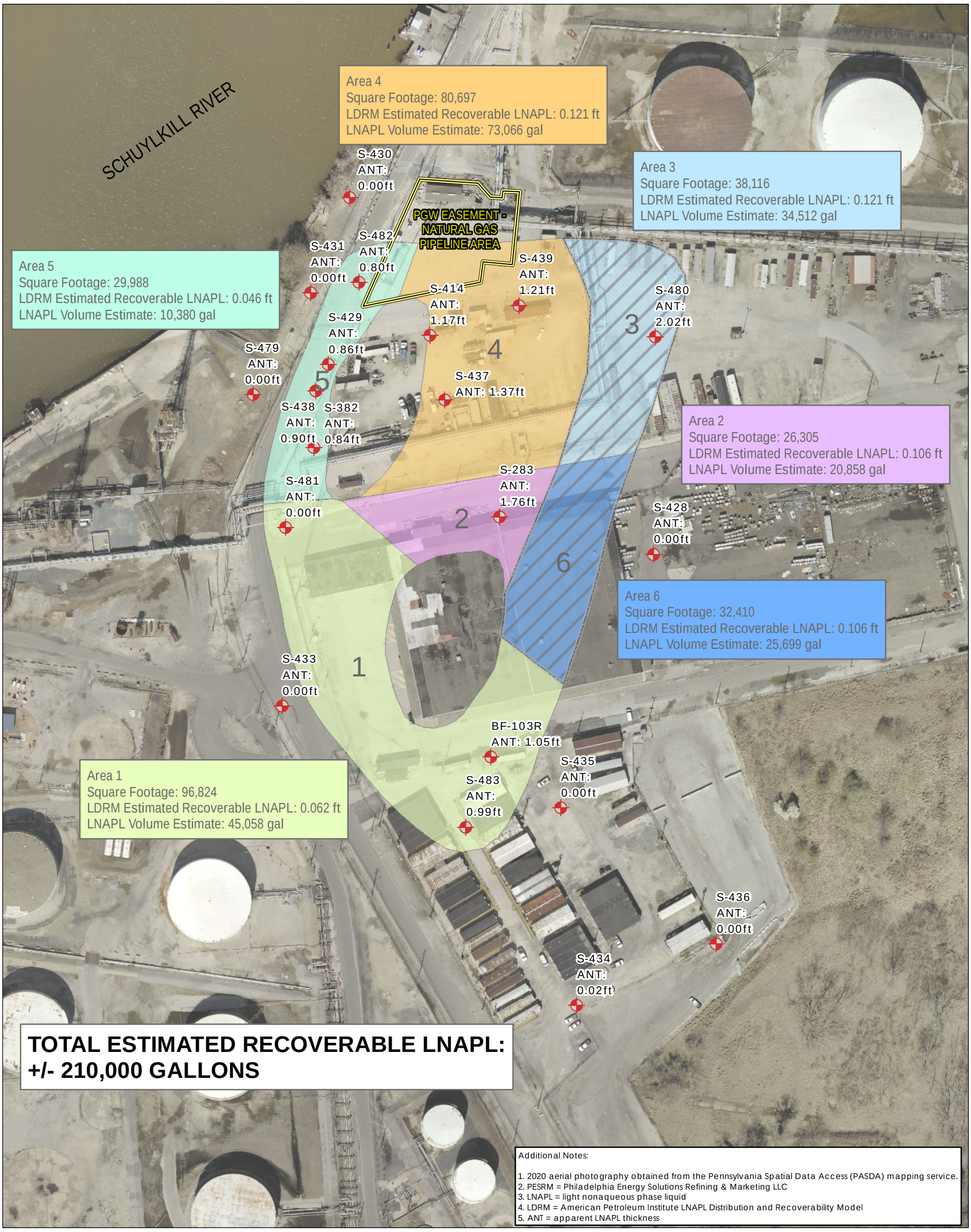
213403039
Prepared by ADK on 1/25/2022
Technical Review by JP on 1/26/2022
Independent Review by JLM on 1/26/2022

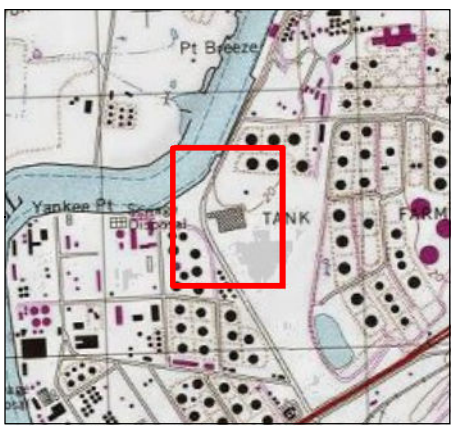
Client/Project
PHILADELPHIA ENERGY SOLUTIONS
REFINING & MARKETING LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

Figure No.
2-4

Title
UDEX RELEASE -
REMEDIAL DESIGN CHARACTERIZATION
DATA VISUALIZATIONS

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Notes

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2. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec
4. Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed © Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © 2015 Microsoft Corporation

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LEGEND

1/25/2022 WELL ANT

Monitoring Well Gauged

APPROXIMATE EXTENT OF LNAPL BODY (2022)

(Showing Sub-Areas Used for LDRM Modeling)

- Area 1
- Area 2
- Area 3
- Area 4
- Area 5
- Area 6
- Area of Significant Legacy LNAPL (Pre-Existing Contamination)

30 0 30 60 90 Feet

1:1,750 (At Original document size of 11x17)

N

Stantec

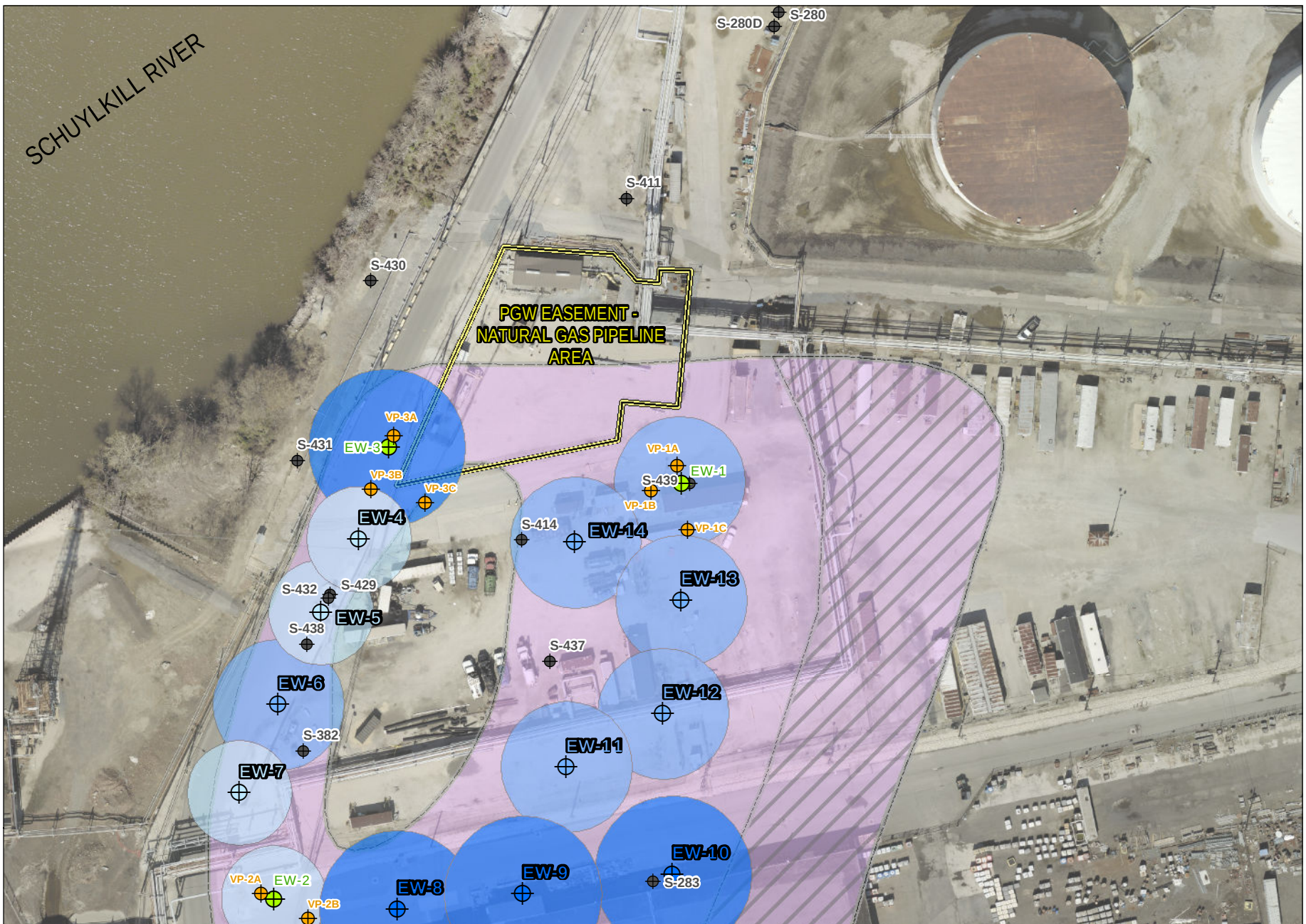
Project Location
City of Philadelphia,
Philadelphia County,
Pennsylvania

213403039
Prepared by ADK on 1/25/2022
Technical Review by JP on 1/26/2022
Independent Review by JLM on 1/26/2022

Client/Project
PHILADELPHIA ENERGY SOLUTIONS
REFINING & MARKETING LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

Figure No.
2-5

Title
UDEX RELEASE - UPDATED
LNAPL RECOVERABLE VOLUME
ESTIMATE





Notes

1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec
4. Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed © Harris Corp, Earthstar Geographics LLC Earthstar Geographics SIO © 2015 Microsoft Corporation

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LEGEND

EXISTING WELLS

- SVE Pilot Test Extraction Well (EW)
- SVE Pilot Test Vapor Point (VP)
- Monitoring Well

FULL SCALE SVE DESIGN
(Color Coded By Anticipated ROI)

- 40 feet
- 50 feet
- 60 feet

CALCULATED/ANTICIPATED SVE WELL ROI

- 40 feet
- 50 feet
- 60 feet
- Approximate Extent of LNAPL Body (2022)
- Area of Significant Legacy LNAPL (Pre-Existing Contamination)

30 0 30 60 90 Feet

1:1,250 (At Original document size of 11x17)

N

Stantec

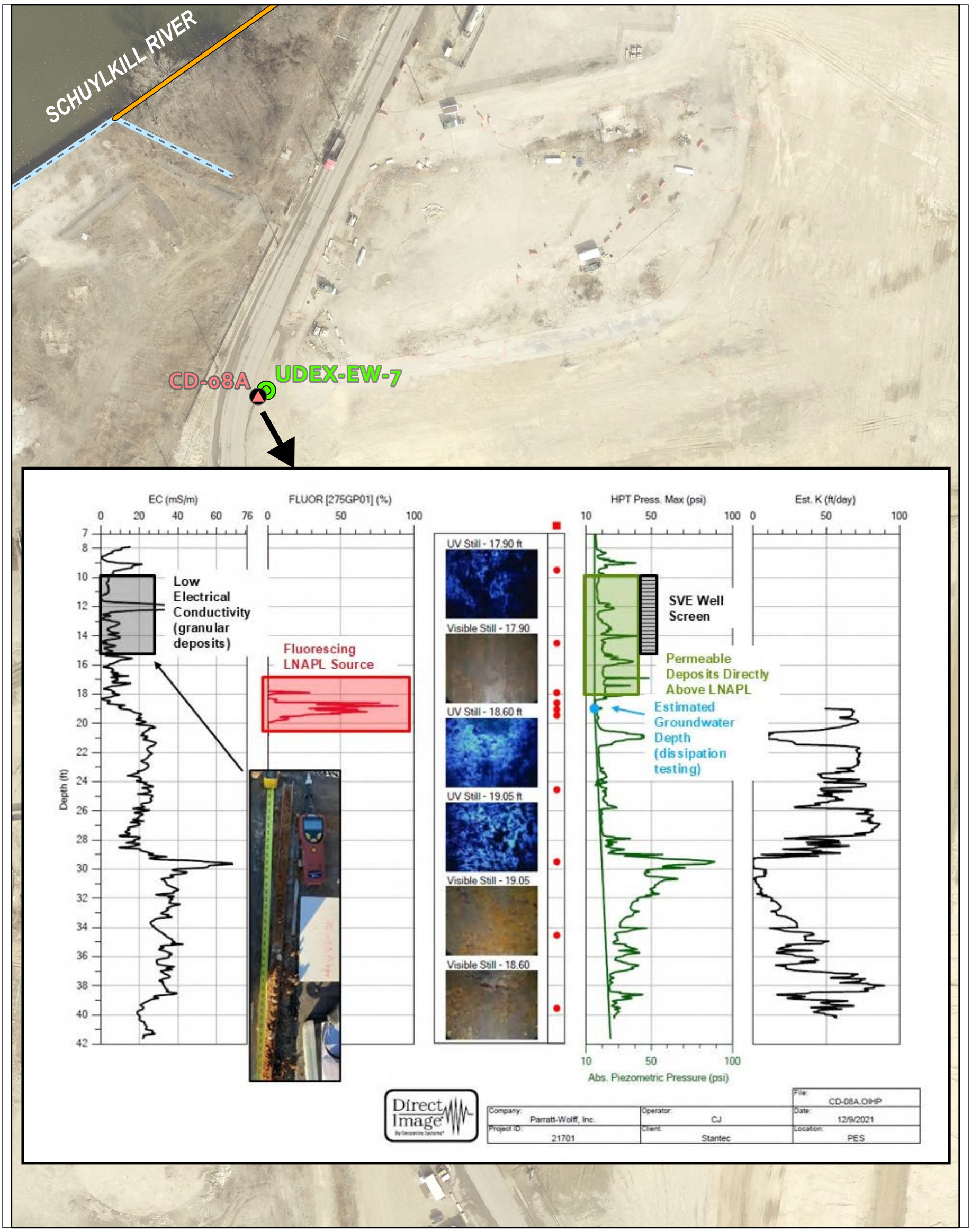
Project Location
City of Philadelphia,
Philadelphia County,
Pennsylvania

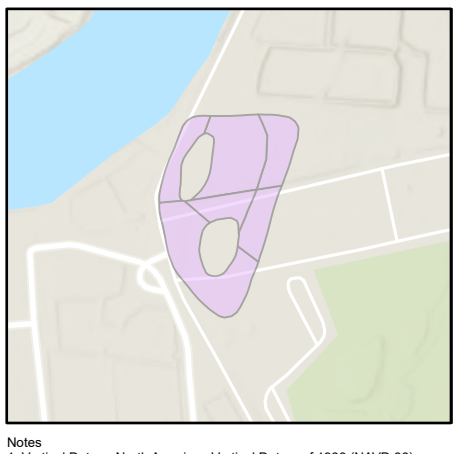
213403039
Prepared by ADK on 1/25/2022
Technical Review by JP on 1/26/2022
Independent Review by JLM on 1/26/2022

Client/Project
PHILADELPHIA ENERGY SOLUTIONS
REFINING & MARKETING LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

Figure No.
2-6

Title
UDEX RELEASE - FULL SCALE SVE REMEDIATION SYSTEM DESIGN EXTRACTION WELL LAYOUT





Notes
1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec, ArcGIS Map Service
4. Service Layer Credits: Sources: Esri, Vantor, Earthstar Geographics, and the GIS User Community
5. RDC = Remedial Design Characterization
6. SVE = Soil Vapor Extraction
7. LNAPL = light nonaqueous phase liquid

Legend

- RDC Confirmation Drilling (CD) Boring
- SVE Well EW-7 Location

River Bulkheads

- Steel Sheeting
- Timber Sheeting

0 500 1,000 Feet

(At original document size of 11x17)
1:1,000

N

Stantec

Project Location
City of Philadelphia,
Philadelphia County, PA

Prepared by ADK on 2026-06-29
TR by JK on 2026-07-10
IR by WH on 2026-07-10

Client/Project 195603450
BELLWETHER DISTRICT HOLDINGS LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

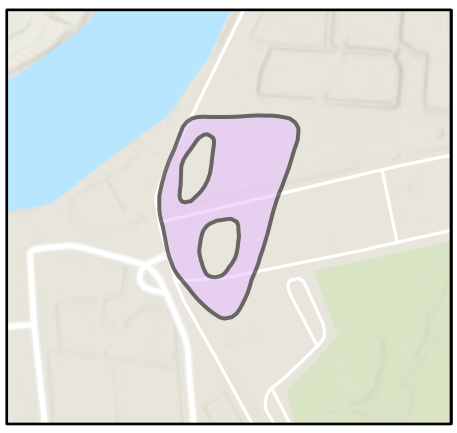
Figure No.
2-7

Title
UDEX RELEASE
EW-7 WELL SCREEN INTERVAL SELECTION CRITERIA

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S-430
S-431
S-482
UDEX-AS-17
UDEX-AS-16
UDEX-EW-3
UDEX-AS-20
UDEX-AS-18
UDEX-AS-19
AS Expansion Treatment Cell
AS Treatment Cell 1
UDEX-EW-1
S-439
UDEX-AS-2
UDEX-AS-1
UDEX-AS-5
UDEX-AS-3
S-414
UDEX-AS-4
UDEX-EW-14
UDEX-EW-4
S-432
S-429
UDEX-EW-5
AS Treatment Cell 2
AS Expansion Treatment Cell
UDEX-EW-13
S-438
UDEX-AS-7
UDEX-AS-6
UDEX-AS-8
S-484
UDEX-AS-10
UDEX-AS-9
UDEX-AS-13
UDEX-AS-11
S-437
UDEX-AS-12
UDEX-AS-15
UDEX-AS-14
UDEX-EW-6
UDEX-EW-12
UDEX-EW-24
S-382
UDEX-EW-11
UDEX-EW-7
UDEX-EW-9
S-283
UDEX-EW-10



Notes
1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
3. 2025 aerial photography obtained from the Pennsylvania Spatial Data Access (PASDA) mapping service
4. Source: Stantec
5. Service Layer Credits: Sources: ESRI
6. ug/L = micrograms per liter
* Benzene dissolved phase distribution as documented in the UDEX release Remedial Investigation Report (RIR) Figure 9-5a for groundwater flow (GWF) Model Layer 1.

Legend

Air Sparge (AS) Well

- Pilot Location
- Full Scale Expansion
- Soil Vapor Extraction (SVE) Well
- UDEX Monitoring Well
- AS Pilot Test Treatment Cell
- AS Expansion Areas Treatment Cell
- Approximate Extent of Low Permeability Deposit

Water-Table Benzene Dissolved Phase Distribution (F&T Initial Concentrations*)

ug/L

- 0 - 5 (no color)
- 5 - 100
- 100 - 1,000
- 1,000 - 10,000
- 10,000 - 100,000
- 100,000+

0 500 1,000 Feet

(At original document size of 11x17)
1:500

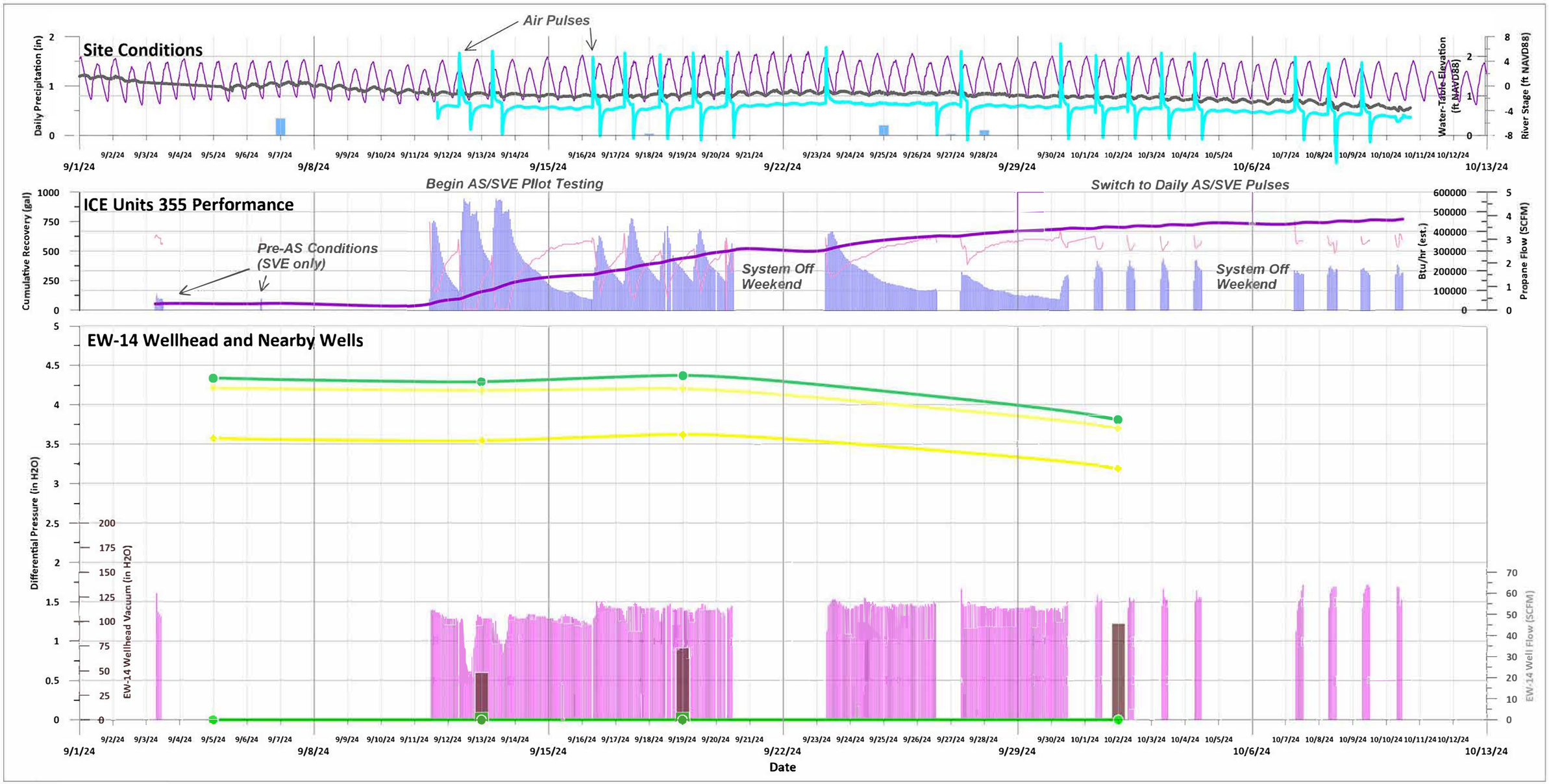
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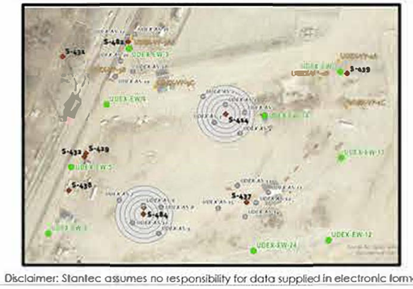
Stantec

Project Location	Prepared by ADK on 2026-07-02
City of Philadelphia,	TR by JK on 2026-07-09
Philadelphia County, PA	IR by WH on 2026-07-09
Client/Project	195603450
PHILADELPHIA ENERGY SOLUTIONS	
REFINING & MARKETING LLC	
FORMER PES REFINERY	
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145	
Figure No.	
2-8	
Title	
UDEX RELEASE AS SYSTEM DESIGN (SHOWING PILOT AND FULL SCALE EXPANSION AREAS)	

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Notes

1. S-414 and S-430 water levels were continuously recorded using non-vented data loggers set to record water depth at 10 minute intervals. Water depths were compensated for barometric pressure using linear correction to synoptic measurements collected with a barometric data logger.
2. Precipitation data obtained from the NOAA National Center for Environmental Information (NCEI) for Philadelphia International Airport (PHL USW00013739); Schuylkill River stage data obtained from the USGS/PWD gage near 30th Street (USGS 01474501).
3. 2025 aerial photograph obtained from the Pennsylvania Spatial Data Access (PASDA) internet mapping service.
4. FT NAVD 88 = feet referenced to the North American Vertical Datum of 1988
5. in = inches; gal = gallon; SCFM = standard cubic feet per minute; Btu = British Thermal Unit; hr = hour; est = estimated; AS = air sparge

Site Conditions
- Daily Precipitation - PHL International Airport
- Stage - Schuylkill River Near 30th St.
- Well S-414 Hydrograph
- Well S-437 Hydrograph

ICE Unit 355 Performance
- Unit 355 Cumulative Recovery
- Unit 355 Propane Flow
- Unit 355 Mass Removal Rate

EW-11 Wellhead and Nearby Wells
- EW-14 Wellhead Vacuum
- Unit 355 Well Flow
- VP-1B Green DP
- VP-1C Green DP
- VP-1C Yellow DP
- VP-1B Yellow DP

Stantec

Project Location
Former PES Refinery
Philadelphia, Pennsylvania

195603450
Prepared by ADK on 7/15/2026
Technical Review by JK on 7/20/2026
Independent Review by WH on 7/20/2026

Client/Project
PES REFINING AND MARKETING, LLC
3144 W. PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Figure No.
2-9

Title
UDEX RELEASE
AS PILOT TESTING PERFORMANCE MONITORING DATA
EXTRACTION WELL EW-14/AS TREATMENT CELL 1

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Site Conditions

Daily Precipitation (in)

River Stage (ft NAVD88)

ICE Unit 407 Performance

Cumulative Recovery (gal)

Btu/Hr (est.)

Propane Flow (SCFM)

EW-15/EW-17 Wellhead and Nearby Wells

Differential Pressure (in H2O)

EW-15 Well Flow (SCFM)

Date



Notes

1. S-430, S-437, and S-439 water levels were continuously recorded using a non-vented data logger set to record water depth at 10 minute intervals. Water depths were compensated for barometric pressure using linear correction to synoptic measurements collected with a barometric data logger.
2. Precipitation data obtained from the NOAA National Center for Environmental Information (NCEI) for Philadelphia International Airport (PHL USW00013739); Schuylkill River stage data obtained from the USGS/PWD gage near 30th Street (USGS 01474501).
3. 2021 aerial photograph obtained from the Pennsylvania Spatial Data Access (PASDA) internet mapping service.
4. FT NAVD 88 = feet referenced to the North American Vertical Datum of 1988
5. in = inches; gal = gallon; SCFM = standard cubic feet per minute; Btu = British Thermal Unit; hr = hour; est = estimated; DP = differential pressure

Site Conditions

- Daily Precipitation - PHL International Airport
- Stage - Schuylkill River Near 30th St.
- Well S-430 Hydrograph
- Well S-437 Hydrograph

ICE Unit 407 Performance

- Unit 407 Engine 1 Cumulative Recovery
- Unit 407 Engine 2 Cumulative Recovery
- Unit 407 Engine 1 Propane Flow
- Unit 407 Engine 2 Propane Flow
- Unit 407 Engine 1 Mass Removal Rate
- Unit 407 Engine 2 Mass Removal Rate

EW-15/EW-17 Wellhead and Nearby Wells

- EW-15 Wellhead Vacuum
- Unit 407 Engine 1 Well Flow
- Unit 407 Engine 2 Well Flow
- UDEX-EW-18 DP
- UDEX-VP-2C Yellow DP
- UDEX-EW-16 DP

Stantec

Project Location
Former PES Refinery
Philadelphia, Pennsylvania

195403450

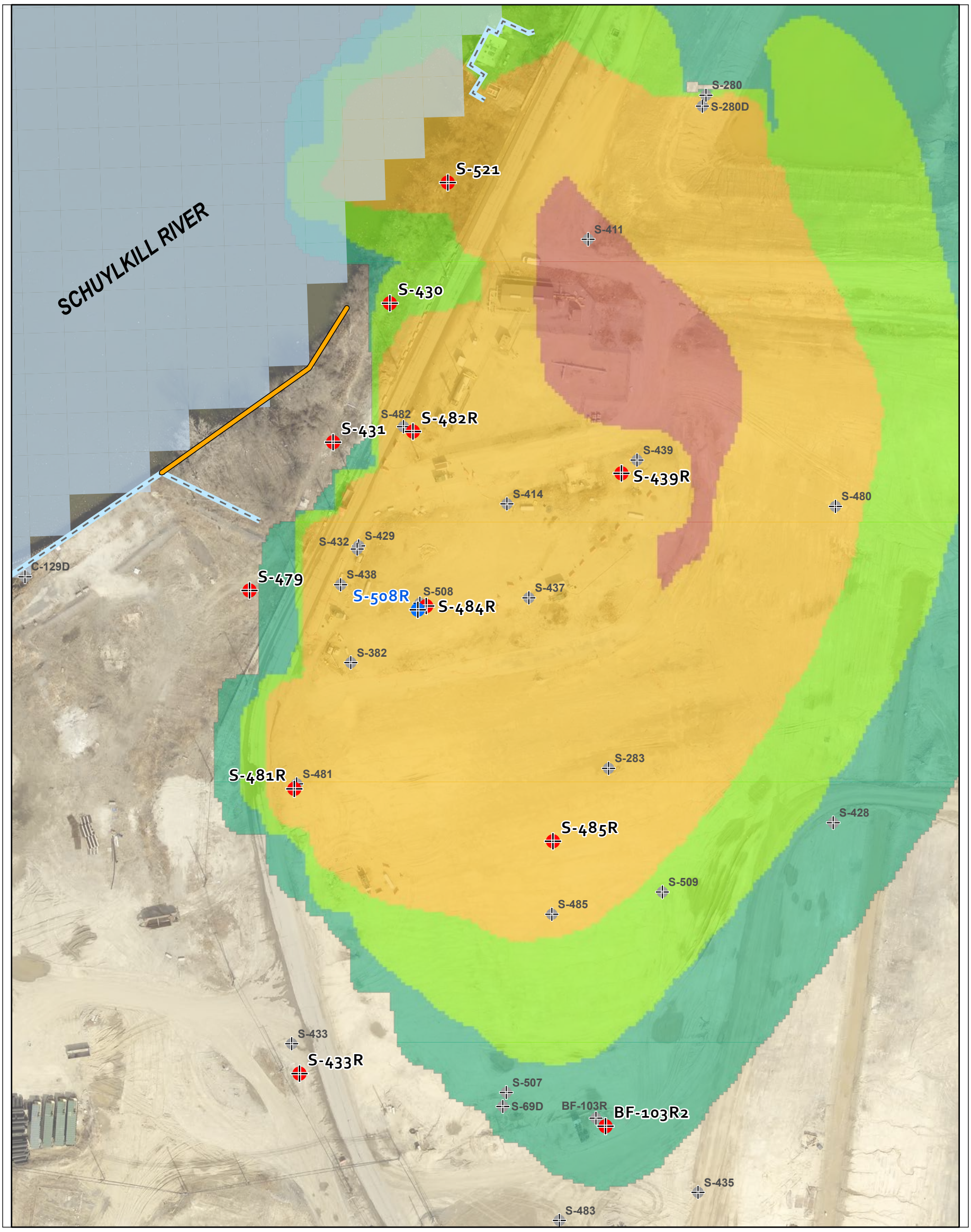
Prepared/Updated by ADK on 7/15/2026
Technical Review by JK on 7/20/2026
Independent Review by WH on 7/20/2026

Client/Project
PES REFINING AND MARKETING, LLC
3144 W. PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Figure No.
2-10

Title
UDEX RELEASE
EXAMPLE PERFORMANCE MONITORING DASHBOARD
EXTRACTION WELLS UDEX-EW-15 AND UDEX-EW-17

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Notes
1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec, ArcGIS Map Service
4. Service Layer Credits: Sources: Esri, Vantor, Earthstar Geographics, and the GIS User Community
5. PRCP = Post-Remediation Care Plan

Legend

PRCP Monitoring Well Network

- unconfined aquifer
- lower aquifer
- Former Monitoring Well Location

River Bulkheads

- Steel Sheeting
- Timber Sheeting

- Schuylkill River (groundwater model boundary)

Predicted Benzene Concentration (Layer 1 Simulation Year 28)

ppb

- 0 - 5 (NO COLOR)
- 5 - 100
- 100 - 1,000
- 1,000 - 10,000
- 10,000+

0 500 1,000 Feet

(At original document size of 11x17)
1:1,200

N

Stantec

Project Location
City of Philadelphia,
Philadelphia County, PA

Prepared by ADK on 2026-06-29
TR by JK on 2026-07-10
IR by WH on 2026-07-10

Client/Project
195603450
BELLWETHER DISTRICT HOLDINGS LLC
FORMER PES REFINERY
3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145

Figure No.
4-1

Title
UDEX RELEASE
WELL LOCATIONS FOR POST REMEDIATION CARE MONITORING

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Tables

Table 1-1
Well Construction Details and Status Updates
UDEX Release Cleanup Plan
Bellwether District Holdings, LLC, Philadelphia, PA

Well_ID	Former Well ID or Boring ID	Well Type	Status	Easting	Northing	Hydrostratigraphic Unit	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Completion Depth	Well Diameter	Top of Inner Casing Elevation	Ground Surface Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Depth to Screen	Screen Length
BF-103R		MW	ABANDONED	2682490.9	219959.25	unconfined	Y	Y	10/8/1986	14	4	14.57	12.43	8.43	-1.57	4	10
BF-103R2	BF-103R	MW		2682500.323	219951.288	unconfined	Y	Y	11/20/2025	18	2	16.64	12.70	4.70	-5.30	8	10
S-283		MW	ABANDONED	2682503.33	220303.4999	unconfined	Y	Y	5/14/2010	24	4	11.14	11.48	2.48	-12.52	9	15
S-382		MW	ABANDONED	2682249.73	220407.5601	unconfined	Y	Y	8/1/2013	28	4	20.32	- -	7.32	-7.68	13	15
S-414		MW	ABANDONED	2682403.3	220563.7999	unconfined	Y	Y	10/16/2015	30	4	22.53	20.01	10.01	-9.99	10	20
S-428		MW	ABANDONED	2682724.29	220249.9899	unconfined	Y	Y	9/18/2018	22.7	4	10.84	11.30	3.60	-11.40	7.7	15
S-429		MW	ABANDONED	2682257.5	220522.4601	unconfined	Y	Y	9/18/2018	27	4	21.21	19.40	2.40	-7.60	17	10
S-430	MIHPT-10	MW		2682288.19	220761.2598	unconfined	N	Y	9/27/2018	17	2	13.09	9.90	2.90	-7.10	7	10
S-431	MIHPT-11	MW		2682232.3	220624.4799	unconfined	N	Y	9/27/2018	18	2	17.52	14.00	6.00	-4.00	8	10
S-432	MIHPT-08	MW	ABANDONED	2682255.97	220519.32	unconfined	N	Y	8/23/2018	24.5	1.5	22.02	19.20	4.70	-5.30	14.5	10
S-433		MW	ABANDONED	2682191.6	220032.5001	unconfined	Y	Y	1/8/2020	23	4	11.68	12.20	-0.80	-10.80	13	10
S-433R	S-433	MW		2682199.28	220003.1	unconfined	Y	Y	11/20/2025	25	2	15.24	11.60	1.60	-13.40	10	15
S-434		MW	DESTROYED	2682610.4	219597.2999	unconfined	Y	Y	1/7/2020	20	4	13.10	10.90	0.90	-9.10	10	10
S-435		MW	ABANDONED	2682591.3	219886.1999	unconfined	Y	Y	1/8/2020	23	4	15.15	13.20	3.20	-9.80	10	13
S-436		MW	ABANDONED	2682814.2	219690.9998	unconfined	Y	Y	1/7/2020	20	4	13.90	11.70	1.70	-8.30	10	10
S-437		MW	ABANDONED	2682424.9	220471.3001	unconfined	N	Y	1/9/2020	27	4	20.85	18.50	5.50	-8.50	13	14
S-438	UVHP-06	MW	ABANDONED	2682239.7	220484.2	unconfined	N	Y	1/10/2020	24.5	4	21.26	18.70	4.20	-5.80	14.5	10
S-439	UVHP-15	MW	ABANDONED	2682531.3	220606.8999	unconfined	Y	Y	1/14/2020	30	4	22.55	20.00	5.00	-10.00	15	15
S-439R	S-439	MW		2682515.999	220593.862	unconfined	Y	Y	11/18/2025	26	2	20.92	17.60	6.60	-8.40	11	15
S-479	CD-01	MW		2682150.12	220478.56	unconfined	Y	Y	12/21/2021	22	1.5	15.51	15.80	3.80	-6.20	12	10
S-480	CD-03	MW	DESTROYED	2682726.49	220561.2901	unconfined	Y	Y	12/16/2021	26	1.5	18.71	18.90	2.90	-7.10	16	10
S-481	CD-08D	MW	ABANDONED	2682196.48	220288.23	unconfined	Y	Y	12/20/2021	23	1.5	16.52	16.80	3.80	-6.20	13	10
S-481R	S-481	MW		2682194.161	220283.325	unconfined	Y	Y	11/18/2025	25	2	20.19	16.30	6.30	-8.70	10	15
S-482	OIHPT-01	MW	ABANDONED	2682301.59	220639.7699	unconfined	Y	Y	12/17/2021	38	1.5	19.53	19.80	3.80	-6.20	16	10
S-482R	S-482	MW		2682310.863	220635.01	unconfined	Y	Y	11/21/2025	27	2	23.79	20.20	8.20	-6.80	12	15
S-483	OIHPT-02	MW	DESTROYED	2682454.88	219858.6101	unconfined	Y	Y	12/20/2021	35	1.5	12.44	12.80	2.80	-7.20	10	10
S-484	CD-02A	MW	ABANDONED	2682317.254	220459.3064	unconfined	N	Y	2/11/2022	25	4	17.67	18.00	3.00	-7.00	15	10
S-484R	S-484	MW		2682323.929	220463.264	unconfined	Y	Y	11/18/2025	26	2	21.21	17.60	6.60	-8.40	11	15
S-485	CD-12B	MW	ABANDONED	2682447.5	220159.9	unconfined	Y	Y	2/14/2022	24	4	15.44	15.80	1.80	-8.20	14	10
S-485R	S-485	MW		2682448.576	220231.754	unconfined	Y	Y	11/20/2025	25	2	17.20	13.70	3.70	-11.30	10	15
S-507	CD-06	MW	DESTROYED	2682402.689	219984.476	lower aquifer	Y	Y	6/28/2023	68	2	11.30	11.69	-41.31	-56.31	53	15
S-508	CD-02A	MW	ABANDONED	2682317.723	220466.022	lower aquifer	Y	Y	6/29/2023	88	2	17.85	18.17	-54.83	-69.83	73	15
S-508R	S-508	MW		2682315.664	220459.558	lower aquifer	Y	Y	11/19/2025	75	2	21.16	17.40	-42.60	-57.60	60	15
S-509	CD-12D	MW	ABANDONED	2682556.216	220181.797	lower aquifer	Y	Y	6/30/2023	86.5	2	15.31	15.74	-55.76	-70.76	71.5	15
S-521		MW		2682345.142	220880.031	unconfined	Y	Y	11/24/2025	19	2	13.47	9.78	2.78	-9.22	7	12
UDEX-AS-1		AS	ABANDONED	2682402.881	220573.5962	unconfined	N	Y	5/20/2024	24	1.5	- -	- -	- -	- -	22	2
UDEX-AS-2		AS	ABANDONED	2682379.534	220582.2841	unconfined	N	Y	5/21/2024	24	1.5	- -	- -	- -	- -	22	2
UDEX-AS-3		AS	ABANDONED	2682391.479	220555.1345	unconfined	N	Y	5/21/2024	25	1.5	- -	- -	- -	- -	23	2
UDEX-AS-4		AS	ABANDONED	2682418.355	220543.4602	unconfined	N	Y	5/22/2024	24	1.5	- -	- -	- -	- -	22	2
UDEX-AS-5		AS	ABANDONED	2682423.233	220565.5538	unconfined	N	Y	5/22/2024	24	1.5	- -	- -	- -	- -	22	2
UDEX-AS-6		AS	ABANDONED	2682317.36	220468.2517	unconfined	N	Y	5/23/2024	23	1.5	- -	- -	- -	- -	21	2
UDEX-AS-7		AS	ABANDONED	2682292.384	220473.6816	unconfined	N	Y	5/23/2024	22	1.5	- -	- -	- -	- -	20	2
UDEX-AS-8		AS	ABANDONED	2682335.821	220466.3512	unconfined	N	Y	5/28/2024	22	1.5	- -	- -	- -	- -	20	2
UDEX-AS-9		AS	ABANDONED	2682333.377	220438.9302	unconfined	N	Y	5/29/2024	22	1.5	- -	- -	- -	- -	20	2
UDEX-AS-10		AS	ABANDONED	2682305.958	220450.0615	unconfined	N	Y	5/29/2024	22	1.5	- -	- -	- -	- -	20	2

Table 1-1
Well Construction Details and Status Updates
UDEX Release Cleanup Plan
Bellwether District Holdings, LLC, Philadelphia, PA

Well_ID	Former Well ID or Boring ID	Well Type	Status	Easting	Northing	Hydrostratigraphic Unit	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Completion Depth	Well Diameter	Top of Inner Casing Elevation	Ground Surface Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Depth to Screen	Screen Length
UDEX-AS-11		AS	ABANDONED	2682447.561	220481.8595	unconfined	N	Y	1/21/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-12		AS	ABANDONED	2682434.899	220471.1856	unconfined	N	Y	1/22/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-13		AS	ABANDONED	2682415.413	220488.9067	unconfined	N	Y	1/28/2025	25	2	--	--	--	--	22.3	2.5
UDEX-AS-14		AS	ABANDONED	2682423.372	220456.3782	unconfined	N	Y	1/28/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-15		AS	ABANDONED	2682395.518	220465.2414	unconfined	N	Y	1/28/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-16		AS	ABANDONED	2682308.375	220647.5338	unconfined	N	Y	1/29/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-17		AS	ABANDONED	2682300.875	220645.2499	unconfined	N	Y	1/29/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-18		AS	ABANDONED	2682306.493	220608.4653	unconfined	N	Y	1/30/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-19		AS	ABANDONED	2682288.067	220603.1647	unconfined	N	Y	1/30/2025	25	2	--	--	--	--	22.5	2.5
UDEX-AS-20		AS	ABANDONED	2682293.821	220619.3999	unconfined	N	Y	1/31/2025	25	2	--	--	--	--	22.5	2.5
UDEX-EW-1		SVE	ABANDONED	2682523.307	220608.337	unconfined	Y	Y	2/17/2021	19	6	--	--	--	--	14	5
UDEX-EW-2		SVE	DESTROYED	2682214.135	220291.5446	unconfined	Y	Y	2/25/2021	13	6	--	--	--	--	8	5
UDEX-EW-3		SVE	ABANDONED	2682302.404	220632.5214	unconfined	Y	Y	2/24/2021	17	6	--	--	--	--	12	5
UDEX-EW-4		SVE	ABANDONED	2682279.007	220573.9738	unconfined	N	Y	2/2/2022	18	6	--	--	--	--	13	5
UDEX-EW-5		SVE	ABANDONED	2682242.06	220508.5379	unconfined	N	Y	2/1/2022	16	6	--	--	--	--	11	5
UDEX-EW-6		SVE	ABANDONED	2682217.64	220438.5907	unconfined	N	Y	2/2/2022	15	6	--	--	--	--	10	5
UDEX-EW-7		SVE	ABANDONED	2682187.89	220371.35	unconfined	N	Y	2/4/2022	15	6	--	--	--	--	10	5
UDEX-EW-8		SVE	DESTROYED	2682308.41	220282.6067	unconfined	N	Y	2/9/2022	10	6	--	--	--	--	5	5
UDEX-EW-9		SVE	DESTROYED	2682409.212	220299.5923	unconfined	N	Y	2/9/2022	9.5	6	--	--	--	--	4.5	5
UDEX-EW-10		SVE	DESTROYED	2682511.112	220305.8453	unconfined	N	Y	2/9/2022	9.5	6	--	--	--	--	4.5	5
UDEX-EW-11		SVE	DESTROYED	2682437.13	220391.02	unconfined	N	Y	1/27/2022	15	6	--	--	--	--	10	5
UDEX-EW-12		SVE	DESTROYED	2682510.636	220431.8221	unconfined	N	Y	2/1/2022	15	6	--	--	--	--	10	5
UDEX-EW-13		SVE	ABANDONED	2682524.39	220517.98	unconfined	N	Y	2/7/2022	16	6	--	--	--	--	11	5
UDEX-EW-14		SVE	ABANDONED	2682443.62	220562.19	unconfined	N	Y	2/4/2022	17	6	--	--	--	--	12	5
UDEX-EW-15		SVE	ABANDONED	2682227.382	220197.949	unconfined	N	Y	2/3/2022	13	6	--	--	--	--	8	5
UDEX-EW-16		SVE	ABANDONED	2682319.503	220167.0342	unconfined	N	Y	2/10/2022	11	6	--	--	--	--	6	5
UDEX-EW-17		SVE	ABANDONED	2682253.273	220125.2161	unconfined	N	Y	2/3/2022	13	6	--	--	--	--	8	5
UDEX-EW-18		SVE	ABANDONED	2682335.477	220086.1191	unconfined	N	Y	2/10/2022	10	6	--	--	--	--	5	5
UDEX-EW-19		SVE	ABANDONED	2682265.301	220045.5134	unconfined	N	Y	2/4/2022	11	6	--	--	--	--	6	5
UDEX-EW-20		SVE	ABANDONED	2682318.644	219995.4362	unconfined	N	Y	2/10/2022	10	6	--	--	--	--	5	5
UDEX-EW-21		SVE	ABANDONED	2682382.668	219930.1248	unconfined	N	Y	2/9/2022	10	6	--	--	--	--	5	5
UDEX-EW-22		SVE	ABANDONED	2682451.457	219858.2684	unconfined	N	Y	2/8/2022	11	6	--	--	--	--	6	5
UDEX-EW-23		SVE	ABANDONED	2682487.382	219943.1818	unconfined	N	Y	2/8/2022	11	6	--	--	--	--	6	5
UDEX-EW-24		SVE	ABANDONED	2682432.365	220420.6592	unconfined	Y	Y	1/29/2025	15	6	--	--	--	--	10	5

Notes:
Coordinate pairs are projected in the Pennsylvania State Plane Coordinate System (feet), referenced to the North American Vertical Datum of 1988 (NAVD88).
The hydrostratigraphic unit denotes the aquifer and/or mappable water-bearing stratum in which the well is interpreted to be screened by Stantec.
-- = parameter not available
MW = monitoring well
AS = air sparge
SVE = soil vapor extraction
ft bgs = feet below ground surface
in = inches
ft = feet
Y = Yes; N = No

Table 2-1a
UDEX Release LNAPL Recovery Totals - Interim Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	S-283 (gallons)[2,4]	S-382 (gallons)[2,4]	S-429 (gallons)[2,3,4]	S-438 (gallons)[3,4]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Sep 2018	205.2	- -	- -	- -	- -	205.2	Product recovery included passive skimming and pumping/bailing from a total of seven wells including S-283, S-382, S-414, S-429, S-430, S-431, and S-432
Oct 2018	199.0	7.2	16.0	- -	- -	404.2	175.8 gallons of continued passive recovery prior to the active skimming transition; Start S-382 and S-283 active systems
Nov 2018	1,180.4	231.1	127.4	821.9	- -	1,584.6	Start active skimming S-429 Holding tanks emptied
Dec 2018	3,207.4	600.1	303.3	2,304.0	- -	4,792.0	S-429 holding tank emptied Holding tanks emptied 12/17/2018 - Tank 429 Emptied, 12/20/2018 - All Tanks Emptied 12/24/2018 - Tank 429 Emptied, 12/27/2018 - All Tanks Emptied
Jan 2019	2,737.5	463.6	296.7	1,977.2	- -	7,529.5	12/31/2018 - Tank 429 Emptied, 1/4/2019 - All Tanks Emptied 1/7/2019, 1/9/2019, and 1/11/2019 - Tank 429 Emptied 1/17/2019 - Tank 429 Emptied 1/23/2019 - Tank 429 Emptied, 1/25/2019 - All Tanks Emptied
Feb 2019	3,127.2	604.4	396.8	2,126.0	- -	10,656.7	1/28/2019 and 2/1/2019 - Tank 429 Emptied 2/7/2019 - Tank 429 Emptied 2/15/2019 - All Tanks Emptied 2/21/2019 - Tank 429 Emptied
Mar 2019	4,527.7	987.8	818.7	2,721.2	- -	15,184.4	2/25/2019 - Tank 429 Emptied, 3/1/2019 - All Tanks Emptied 3/5/2019 - All Tanks Emptied 3/11/2019 - Tank 429 Emptied, 3/15/2019 - Tank 429 Emptied 3/21/2019 - All Tanks Emptied 3/27/2019 - All Tanks Emptied, 3/29/2019 - Tanks 382 and 429 emptied
Apr 2019	6,819.6	800.4	3,357.8	2,661.4	- -	22,003.9	4/2/2019 - All Tanks Emptied 4/8/2019 - Tanks 382 and 429 Emptied, 4/12/2019 - All Tanks Emptied 4/15/2019 - All Tanks Emptied, 4/17 and 4/19/2019 - Tanks 382 and 429 Emptied 4/22/2019 - All Tanks Emptied, 4/24 and 4/26/2019 - Tanks 382 and 429 Emptied
May 2019	8,669.1	1,572.7	4,969.5	2,126.9	- -	30,673.1	5/1/2019 - All Tanks Emptied, 4/29 and 5/3/2019 - Tanks 382 and 429 Emptied 5/10/2019 - All Tanks Emptied, 5/6 and 5/8/2019 - Tanks 382 and 429 Emptied 5/13, 5/15 and 5/17/2019 - Tanks 382 and 429 Emptied 5/20 and 5/24/2019 - All Tanks Emptied, 5/22 - Tanks 382 and 429 Emptied 5/27 and 5/31/2019 - All Tanks Emptied, 5/29 - Tanks 382 and 429 Emptied
Jun 2019	6,150.4	1,595.7	3,138.6	1,416.1	- -	36,823.5	6/3 and 6/7/2019 - All Tanks Emptied, 6/5 - Tanks 382 and 429 Emptied 6/10 and 6/14/2019 - All Tanks Emptied, 6/12 - Tanks 382 and 429 Emptied 6/17/2019 - All Tanks Emptied, 6/19/2019 - Tanks 382 and 429 Emptied 6/24 and 6/26/2019 - All Tanks Emptied
Jul 2019	2,989.6	943.3	1,421.2	625.0	- -	39,813.0	7/1/2019 - All Tanks Emptied 7/8 and 7/12/2019 - All Tanks Emptied 7/19/2019 - All Tanks Emptied 7/24/2019 - All Tanks Emptied
Aug 2019	5,380.8	2,112.6	2,339.3	928.9	- -	45,193.9	8/2/2019 - All Tanks Emptied 8/8/2019 - All Tanks Emptied 8/12/2019 - All Tanks Emptied 8/19/2019 - All Tanks Emptied 8/27/2019 - All Tanks Emptied
Sep 2019	3,515.6	826.3	1,673.3	1,016.0	- -	48,709.4	9/3/2019 - All Tanks Emptied 9/10/2019 - All Tanks Emptied 9/17/2019 - Tank 382 Emptied 9/23/2019 - All Tanks Emptied
Oct 2019	2,678.3	868.5	422.6	1,387.2	- -	51,387.7	10/1/2019 - All Tanks Emptied 10/7 and 10/11/2019 - All Tanks Emptied 10/14/2019 - All Tanks Emptied 10/22/2019 - Tanks 382 and 429 Emptied, 10/23/2019 - Tank S-283 Emptied
Nov 2019	2,688.6	897.1	520.3	1,271.3	- -	54,076.4	11/1/2019 - All Tanks Emptied 11/8/2019 - All Tanks Emptied 11/19/2019 - All Tanks Emptied 11/26/2019 - All Tanks Emptied
Dec 2019	1,397.2	522.0	281.0	594.1	- -	55,473.5	12/18/2019 - All Tanks Emptied 12/26/2019 - All Tanks Emptied
Jan 2020	1,968.4	808.5	404.4	755.5	- -	57,441.9	12/31/2019 - All Tanks Emptied 1/7/2020 - Tanks 283 and 429 Emptied 1/23/2020 - All Tanks Emptied
Feb 2020	1,627.9	300.3	424.3	903.3	- -	59,069.8	2/3/2020 - Tanks 429 Emptied, 2/7/2020 - All Tanks Emptied 2/20/2020 - All Tanks Emptied
Mar 2020	1,633.7	333.4	418.8	881.5	- -	60,703.5	3/9/2020 - All Tanks Emptied 3/24/2020 - All Tanks Emptied
Apr 2020	2,160.5	815.3	367.4	977.8	- -	62,864.0	3/31/2020 - All Tanks Emptied, 4/2/2020 - Tank 429 Emptied 4/7/2020 - All Tanks Emptied, 4/10/2020 - Tank 429 Emptied 4/16/2020 - Tank 283 Emptied 4/21/2020 - All Tanks Emptied, 4/24/2020 - Tank 429 Emptied
May 2020	2,526.7	927.6	610.5	988.6	- -	65,390.7	5/1/2020 - Tanks 382 and 429 Emptied 5/7/2020 - All Tanks Emptied 5/22/2020 - All Tanks Emptied

Table 2-1a
UDEX Release LNAPL Recovery Totals - Interim Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	S-283 (gallons)[2,4]	S-382 (gallons)[2,4]	S-429 (gallons)[2,3,4]	S-438 (gallons)[3,4]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Jun 2020	2,028.1	628.7	669.9	729.5	- -	67,418.7	6/5/2020 - All Tanks Emptied 6/8/2020 - Tank 429 Emptied 6/19/2020 - All Tanks Emptied
Jul 2020	2,060.5	638.3	737.0	685.2	- -	69,479.2	7/1/2020 - All Tanks Emptied 7/13 and 7/16/2020 - All Tanks Emptied 7/28/2020 - All Tanks Emptied
Aug 2020	1,744.8	772.0	469.4	503.4	- -	71,224.0	8/7/2020 - All Tanks Emptied 8/10/2020 - Tank 429 Emptied 8/18/2020 - Tanks 283 Emptied, 8/21/2020 - All Tanks Emptied 8/28/2020 - All Tanks Emptied
Sep 2020	1,880.3	746.6	561.3	572.4	- -	73,104.2	9/1/2020 - Tank 283 Emptied 9/11/2020 - All Tanks Emptied 9/25/2020 - All Tanks Emptied
Oct 2020	2,600.7	1,371.5	560.2	669.0	- -	75,704.9	10/2/2020 - All Tanks Emptied 10/14/2020 - All Tanks Emptied 10/23/2020 - All Tanks Emptied
Nov 2020	1,487.3	477.0	468.4	541.9	- -	77,192.2	11/2/2020 - All Tanks Emptied 11/13/2020 - All Tanks Emptied 11/17/2020 - Tank 429 Emptied 11/25/2020 - All Tanks Emptied
Dec 2020	2,850.1	1,051.5	1,153.8	644.8	- -	80,042.3	12/1/2020 - All Tanks Emptied 12/14/2020 - All Tanks Emptied, 12/18/2020 - Tank 429 Emptied 12/23/2020 - All Tanks Emptied 12/28/2020 - All Tanks Emptied
Jan 2021	2,264.0	944.5	1,207.6	111.9	- -	82,306.4	1/6/2021 - All Tanks Emptied 1/13/2021 - Tanks 283 and 382 Emptied 1/20/2021 - All Tanks Emptied 1/29/2021 - S-429 system moved to well S-438
Feb 2021	1,693.3	908.2	712.8	- -	72.2	83,999.6	2/5/2021 - All Tanks Emptied, S-429 system moved to well S-438 2/11/2021 - All Tanks Emptied 2/18/2021 - All Tanks Emptied
Mar 2021	1,449.2	989.8	423.3	- -	36.2	85,448.8	3/1/2021 - All Tanks Emptied; S-438 system shut down indefinitely 3/11/2021 - All Tanks Emptied 3/18/2021 - Tanks 283 and 382 Emptied 3/23/2021 - Tanks 283 and 382 Emptied
Apr 2021	1,950.1	1,512.3	437.8	- -	- -	87,398.9	3/31/2021 - Tanks 283 and 382 Emptied 4/7/2021 - SVE initiated on well UDEX-EW-1 4/12/2021 - Tanks 283 and 382 Emptied 4/20/2021 - Tanks 283 and 382 Emptied 4/28/2021 - Tanks 283 and 382 Emptied
May 2021	1,351.7	1,050.1	301.6	- -	- -	88,750.7	5/6/2021 - Tanks 283 and 382 Emptied 5/14/2021 - Tanks 283 and 382 Emptied 5/24/2021 - Tanks 283 and 382 Emptied; 5/25/2021 - SVE initiated on well UDEX-EW-3
Jun 2021	1,121.4	880.4	241.0	- -	- -	89,872.1	6/2/2021 - Tanks 283 and 382 Emptied 6/11/2021 - Tanks 283 and 382 Emptied 6/16/2021 - Tanks 283 and 382 Emptied 6/24/2021 - Tanks 283 and 382 Emptied
Jul 2021	1,464.2	1,380.6	83.6	- -	- -	91,336.3	7/2/2021 - Tanks 283 and 382 Emptied; 6/30/2021 - SVE initiated on well UDEX-EW-2 7/6/2021 - S-382 system shut down indefinitely; 7/9/2021 - Tanks 283 and 382 Emptied; 7/4/2021 - ICE Engine 1 failed and was inoperable through period 7/16/2021 - Tank 283 Emptied; 7/15/2021 - ICE Engine 1 carburetor replaced; replacement failed rendering Engine 1 inoperable through most of period; 7/15/2021 - ICE Engine 2 failed and was inoperable through remaining period 7/19/2021 - Engine 1 carburetor replaced and engine was restarted successfully; 7/20/2021 - Engine 2 carburetor replaced and engine was restarted successfully 7/27/2021 - Tank 283 Emptied; Engine 1 ASCO valve diaphragm failure limited well flow through carburetor thereby limiting vapor destruction
Aug 2021	1,263.5	1,263.5	- -	- -	- -	92,599.8	8/6/2021 - Tank 283 Emptied; 8/2/2021 malfunctioning ASCO valve diaphragms removed from both engines 8/12/2021 - Tank 283 Emptied 8/20/2021 - Tank 283 Emptied 8/27/2021 - Tank 283 Emptied
Sep 2021	1,133.1	1,133.1	- -	- -	- -	93,732.9	8/31/2021 - Tank 283 Emptied 9/7/2021 - Tank 283 Emptied 9/17/2021 - Tank 283 Emptied; 9/15/2021 Engine 2 shut down awaiting replacement part; 9/17/2021 Engine 2 restarted 9/24/2021 - Tank 283 Emptied; 9/20/2021 - 9/21/2021 Engine 2 down would not restart after manual shut down; battery replaced
Oct 2021	1,851.7	1,851.7	- -	- -	- -	95,584.7	9/30/2021 - Tank 283 Emptied 10/7/2021 - Tank 283 Emptied 10/14/2021 - Tank 283 Emptied; 10/13/2021 - 10/14/2021 Engine 1 was down due to oil hose rupture and replacement 10/21/2021 - Tank 283 Emptied 10/29/2021 - Tank 283 Emptied; 10/22/2021 - 10/29/2021 Engine 2 well valve was limiting flow to that engine resulting in less vapor destruction over the course of this recovery period

Table 2-1a
UDEX Release LNAPL Recovery Totals - Interim Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	S-283 (gallons)[2,4]	S-382 (gallons)[2,4]	S-429 (gallons)[2,3,4]	S-438 (gallons)[3,4]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Nov 2021	1,024.3	1,024.3	- -	- -	- -	96,609.0	11/5/2021 - Tank 283 Emptied; 11/1/2021 - 11/4/2021 Engine 2 down due to bad alternator; the alternator was replaced 11/12/2021 - Tank 283 Emptied 11/17/2021 - Tank 283 Emptied; 11/19/2021 1533 hours both engines shut down manually in anticipation of pulse testing on 11/22/2021 11/24/2021 - Tank 283 Emptied; 11/23/2021 - well S-283 remediation ended and pump removed from well; 11/23/2021 - 11/24/2021 ICE pulse test with engines otherwise off this period

Table 2-1b
UDEX Release LNAPL Recovery Totals - Full Scale Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	UDEX-EW-1 (gallons)[5,8,17,28,36]	UDEX-EW-2 (gallons)[7]	UDEX-EW-3 (gallons)[6,24,32]	UDEX-EW-4 (gallons)[35]	UDEX-EW-4/ EW-5 (gallons)[19,20,21]	UDEX-EW-5/ EW-6 (gallons)[30]	UDEX-EW-6 (gallons)[9]	UDEX-EW-7 (gallons)[14, 34]	UDEX-EW-6/ EW-7 (gallons)[27,28]	UDEX-EW-8 (gallons)[11]	UDEX-EW-10 (gallons)[12,25]	UDEX-EW-11/ EW-12 (gallons)[15,26]	UDEX-EW-13 (gallons)[16]	UDEX-EW-14 (gallons)[13, 29]	UDEX-EW-15 (gallons)[31]	UDEX-EW-15/ EW-17 (gallons)[22]	UDEX-EW-19 (gallons)[10]	UDEX-EW-21/ EW-22 (gallons)[23]	UDEX-EW-23 (gallons)[18]	UDEX-EW-24 (gallons)[33]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Apr 2021	3,826.8	3,826.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3,826.8	3/31/2021 - Tanks 283 and 382 Emptied 4/7/2021 - SVE initiated on well UDEX-EW-1 4/12/2021 - Tanks 283 and 382 Emptied 4/20/2021 - Tanks 283 and 382 Emptied 4/28/2021 - Tanks 283 and 382 Emptied
May 2021	4,387.6	4,116.7	--	270.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8,214.4	5/6/2021 - Tanks 283 and 382 Emptied 5/14/2021 - Tanks 283 and 382 Emptied 5/24/2021 - Tanks 283 and 382 Emptied; 5/25/2021 - SVE initiated on well UDEX-EW-3
Jun 2021	1,723.0	--	--	1,723.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9,937.4	6/2/2021 - Tanks 283 and 382 Emptied 6/11/2021 - Tanks 283 and 382 Emptied 6/16/2021 - Tanks 283 and 382 Emptied 6/24/2021 - Tanks 283 and 382 Emptied
Jul 2021	1,829.7	--	1,575.0	254.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11,767.1	7/2/2021 - Tanks 283 and 382 Emptied; 6/30/2021 - SVE initiated on well UDEX-EW-2 7/6/2021 - S-382 system shut down indefinitely; 7/9/2021 - Tanks 283 and 382 Emptied; 7/4/2021 - ICE Engine 1 failed and was inoperable through period 7/16/2021 - Tank 283 Emptied; 7/15/2021 - ICE Engine 1 carburetor replaced; replacement failed rendering Engine 1 inoperable through most of period; 7/15/2021 - ICE Engine 2 failed and was inoperable through remaining period 7/19/2021 - Engine 1 carburetor replaced and engine was restarted successfully; 7/20/2021 - Engine 2 carburetor replaced and engine was restarted successfully 7/27/2021 - Tank 283 Emptied; Engine 1 ASCO valve diaphragm failure limited well flow through carburetor thereby limiting vapor destruction
Aug 2021	2,074.0	--	2,074.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13,841.0	8/6/2021 - Tank 283 Emptied; 8/2/2021 malfunctioning ASCO valve diaphragms removed from both engines 8/12/2021 - Tank 283 Emptied 8/20/2021 - Tank 283 Emptied 8/27/2021 - Tank 283 Emptied
Sep 2021	2,918.2	--	2,918.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16,759.2	8/31/2021 - Tank 283 Emptied 9/7/2021 - Tank 283 Emptied 9/17/2021 - Tank 283 Emptied; 9/15/2021 Engine 2 shut down awaiting replacement part; 9/17/2021 Engine 2 restarted 9/24/2021 - Tank 283 Emptied; 9/20/2021 - 9/21/2021 Engine 2 down would not restart after manual shut down; battery replaced
Oct 2021	2,513.9	--	2,513.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	19,273.1	9/30/2021 - Tank 283 Emptied 10/7/2021 - Tank 283 Emptied 10/14/2021 - Tank 283 Emptied; 10/13/2021 - 10/14/2021 Engine 1 was down due to oil hose rupture and replacement 10/21/2021 - Tank 283 Emptied 10/29/2021 - Tank 283 Emptied; 10/22/2021 - 10/29/2021 Engine 2 well valve was limiting flow to that engine resulting in less vapor destruction over the course of this recovery period
Nov 2021	1,146.7	--	1,146.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20,419.8	11/5/2021 - Tank 283 Emptied; 11/1/2021 - 11/4/2021 Engine 2 down due to bad alternator; the alternator was replaced 11/12/2021 - Tank 283 Emptied 11/17/2021 - Tank 283 Emptied; 11/19/2021 1533 hours both engines shut down manually in anticipation of pulse testing on 11/22/2021 11/24/2021 - Tank 283 Emptied; 11/23/2021 - well S-283 remediation ended and pump removed from well; 11/23/2021 - 11/24/2021 ICE pulse test with engines otherwise off this period
Dec 2021	2,760.9	2,249.6	511.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	23,180.7	11/27/2021 - 11/28/2021 - ICE was shut off over the holiday weekend 12/7/2021 - 12/10/2021 - ICE was shut down to facilitate move back to well UDEX-EW-1; 12/10/2021 - ICE restarted at UDEX-EW-1 12/29/2021 - ICE ran out of propane and engines temporarily down; Engine 1 would not restart/run due to fouled flame arrestor pending repair
Jan 2022	2,292.8	2,292.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	25,473.5	1/1/2022 - 1/7/2022 - Engine 1 off due to flame arrestor replacement and fuel solenoid valve control board failure 1/10/2022 - Engine 1 restarted by rewired control board; Engine 1 later shut down due to bad alternator and low battery voltage; 1/13/2022 - Engine 1 alternator replaced and engine restarted 1/19/2022 - Engine 1 shut down for maintenance and wouldn't restart; control board replaced but didn't fix the issue 1/24/2022 - Engine 1 back up and running; issue diagnosed to a loose wire
Feb 2022	3,972.9	3,972.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	29,446.4	
Mar 2022	4,028.3	4,028.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33,474.7	Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency
Apr 2022	4,483.5	4,483.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	37,958.2	Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency; knockout tank pump failed and condensate filled tank causing Engine 1 to shut off three times loosing run time; Engine 2 continued to run Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency
May 2022	3,347.0	1,632.4	--	--	--	--	--	786.3	--	--	--	--	--	--	--	--	--	928.3	--	--	--	41,305.2	Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency; revised this total for EW-1 on 5/13 Engine 1 possible mechanical issue impacting performance/decreasing combustion efficiency; Unit 407 ICE shut down at EW-1 in preparation for move to EW-6 5/17/2022 - SVE initiated at wells UDEX-EW-6 (ICE Unit 417) and UDEX-EW-19 (ICE Unit 407); ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; EW-6 Engine 2 recovery has been temporarily estimated for this period ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; 5/20/2022 - controller failed on ICE Unit 417 Engine 2 and was replaced on 5/25/2022; 417 Engine 2 was inoperable until the controller was replaced
Jun 2022	4,342.3	--	--	--	--	--	--	2,776.7	--	--	--	--	--	--	--	--	--	1,565.6	--	--	--	45,647.5	ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; 5/28/2022 ICE Unit 407 Engine 1 controller closed well valve until 5/30/2022 when propane tank emptied; Unit 407 Engines 1 and 2 were restarted on 5/31/2022 ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 417 Engine 2 shut down overnight on condensate alarm on 6/6/2022 and was restarted on 6/7/2022; ICE Unit 417 Engine 2 shut down on LEL alarm on 6/10/2022 ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 407 Engine 1 shut down several times due to well valve closing unexpectedly; expect faulty carburetor needs replacing; ICE Unit 417 Engine 2 shut down multiple times due to false LEL sensor alarms ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 407 Engine 1 shut down 6/17-6/20 due to faulty carburetor which was replaced on 6/20; ICE Unit 417 Engine 1 is burning excessive engine oil
Jul 2022	6,168.3	--	--	--	--	--	--	4,170.2	--	--	82.3	--	--	--	--	--	--	1,915.8	--	--	--	51,815.8	ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 417 Engine 1 is burning excessive engine oil ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 417 Engine 1 is burning excessive engine oil ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 417 Engine 1 is burning excessive engine oil; ICE Unit 417 Engine 2 shut down 7/11-7/12 due to fouled propane regulator ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 407 shut down at EW-19 and moved to EW-8 on 7/28/2022; ICE Unit 417 Engine 1 catalytic converter failed and clogged the exhaust which shut down the engine on 7/29/2022
Aug 2022	5,935.5	--	--	--	--	--	--	3,019.2	--	--	626.8	1,323.0	--	--	966.5	--	--	--	--	--	--	57,751.3	ICE Unit 407 Engine 1 has low compression and will soon require offsite maintenance by RSI; ICE Unit 417 Engine 1 catalytic converter failed and clogged the exhaust which shut down the engine on 7/29/2022; ICE Unit 417 Engine 1 catalytic converter was replaced on 8/2/2022 ICE Unit 407 Engine 1 has low compression and will be taken offsite for maintenance by RSI on 8/25/2022; ICE Unit 407 shut down at EW-8 and moved to EW-10 on 8/10/2022; high temperature shut downs affected Unit 407 Engine 1 and Unit 417 Engine 1 performance ICE Unit 407 Engine 1 has low compression and will be taken offsite for maintenance by RSI on 8/25/2022; SVE initiated at well EW-14 on 8/17/2022 using ICE Units 355 and 408; ICE Unit 407 engines shut down unexpectedly on 8/18/2022 and Engine 1 could not be restarted ICE Unit 407 Engine 1 shut down unexpectedly on 8/18/2022 and could not be restarted until 8/23/2022; ICE Unit 407 shut down on 8/24/2022 and returned to RSI for maintenance on 8/25/2022; ICE Unit 417 briefly ran out of propane on 8/23/2022
Sep 2022	7,867.8	--	--	--	--	--	--	2,569.6	--	--	--	1,746.0	--	--	3,552.2	--	--	--	--	--	--	65,619.1	ICE Unit 407 offsite for maintenance this period; ICE Unit 417 Engine 1 would not restart after maintenance on 9/1/2022 and requires a new circuit board; Unit 408 recovery is estimated for 8/29/2022 0750 through 8/31/2022 2038 using Unit 355 data as the actual data was overwritten during EPC replacement ICE Unit 407 offsite for maintenance this period; ICE Unit 417 Engine 1 circuit board was replaced on 9/6/2022; ICE Unit 417 Engines 1 and 2 inoperable from 9/6/2022 through 9/8/2022 due to controllers getting wet during heavy rainfall; ICE Unit 417 Engine 1 shut down on 9/8 due to undiagnosed condition causing shutdowns to occur ICE Unit 407 returned on 9/12/2022 and was restarted on 9/13/2022; ICE Unit 417 Engine 1 restarted on 9/12 for troubleshooting ICE Unit 417 Engine 1 manually turned off on 9/16/2022 and 9/22/2022 to avoid undiagnosed shutdowns and battery drain over the weekends; ICE Unit 407 Engine 2 shut down on 9/22/2022 due to slipping engine belt ICE Unit 417 Engine 1 manually turned off on 9/22/2022 and restarted on 9/26/2022 to avoid undiagnosed shutdowns and battery drain over the weekends; ICE Unit 407 Engine 2 shut down on 9/22/2022 due to slipping engine belt and was restarted on 9/26/2022
Oct 2022	7,291.5	--	--	--	--	--	--	672.5	1,522.5	--	--	2,458.6	--	--	2,637.9	--	--	--	--	--	--	72,910.6	ICE Unit 417 shut down on 10/2/2022 due to full condensate tank and was restarted on 10/3/2022; air sparging at well S-283 initiated on 10/6/2022 ICE Unit 417 shut down at EW-6 and moved to EW-7 on 10/12/2022; ICE Unit 407 Engine 1 stalled on 10/13/2022 due to failing carburetor ICE Unit 407 Engine 1 stalled on 10/13/2022 due to failing carburetor and was restarted on 10/17/2022 when the carburetor was replaced; ICE Unit 407 Engine 1 overheated on 10/19 due to a slipping engine belt

Table 2-1b
UDEX Release LNAPL Recovery Totals - Full Scale Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	UDEX-EW-1 (gallons)[2,6,17,28,36]	UDEX-EW-2 (gallons)[7]	UDEX-EW-3 (gallons)[8,24,32]	UDEX-EW-4 (gallons)[35]	UDEX-EW-4/ EW-5 (gallons)[9,20,21]	UDEX-EW-5/ EW-6 (gallons)[30]	UDEX-EW-6 (gallons)[9]	UDEX-EW-7 (gallons)[14, 34]	UDEX-EW-6/ EW-7 (gallons)[7,28]	UDEX-EW-8 (gallons)[11]	UDEX-EW-10 (gallons)[12,25]	UDEX-EW-11/ EW-12 (gallons)[15,26]	UDEX-EW-13 (gallons)[16]	UDEX-EW-14 (gallons)[13, 29]	UDEX-EW-15 (gallons)[31]	UDEX-EW-15/ EW-17 (gallons)[22]	UDEX-EW-19 (gallons)[10]	UDEX-EW-21/ EW-22 (gallons)[23]	UDEX-EW-23 (gallons)[18]	UDEX-EW-24 (gallons)[33]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Nov 2022	6,260.8	--	--	--	--	--	--	--	2,356.3	--	--	1,685.7	--	--	2,218.8	--	--	--	--	--	--	79,171.4	ICE Unit 407 overheated and shut down on 10/29/2022 due to slipping Engine 1 belt and failing Engine 2 alternator; Unit 407 was restarted on 10/31/2022 ICE Unit 407 Engine 2 was shut down on 11/4/2022 due to a failing carburetor that was replaced on 11/7/2022; ICE Unit 355 shut down on 11/9/2022 due to a failing carburetor that was replaced on 11/14/2022 ICE Unit 417 Engine 1 briefly overheated on 11/17/2022; ICE Unit 417 Engine 2 was down from 11/15/2022 to 11/18/2022 due to a bad controller; ICE Unit 355 shut down on 11/9/2022 due to a failing carburetor that was replaced on 11/14/2022 ICE Unit 417 Engine 1 down from 11/19/2022 through 11/21/2022 due to full knockout pot; ICE Unit 417 Engine 1 shut down manually on 11/23/2022 prior to the holiday weekend to mitigate potential condensate issues from occurring; ICE Unit 407 Engine 1 down from 11/20/2022 through 11/21/2022 due to full knockout pot and from 11/21/2022 through 11/23/2022 due to a bad starter; ICE Unit 407 Engine 1 shut down manually on 11/23/2022 prior to the holiday weekend to mitigate potential condensate issues from occurring; ICE Unit 407 Engine 2 down from 11/20/2022 through 11/21/2022 due to full knockout pot
Dec 2022	4,124.9	451.8	--	--	--	--	--	--	1,021.3	--	--	1,049.2	127.6	328.2	1,146.8	--	--	--	--	--	--	83,296.3	ICE Unit 417 Engine 1 shut down through 11/28/2022 for the holiday weekend to mitigate potential condensate issues from occurring; ICE Unit 417 Engine 2 shut down manually from 11/29/2022 through 11/30/2022 to evaluate single engine operation; ICE Unit 407 Engine 1 shut down through 11/28/2022 for the holiday weekend to mitigate potential condensate issues from occurring; ICE Unit 407 Engine 2 down from 11/27/2022 through 11/28/2022 due to full knockout pot; ICE Unit 407 Engine 2 shut down manually from 11/29/2022 through 11/30/2022 to evaluate single engine operation ICE Unit 417 Engines 1 and 2 shut down on 12/4/2022 due to a frozen condensate drain line and were restarted on 12/5/2022; ICE Unit 417 Engine 1 shut down from 12/5/2022 through 12/8/2022 due to a bad carburetor that was replaced; ICE Unit 417 Engine 2 shut down on 12/5/2022 due to a full knockout drum; ICE Unit 407 ran out of propane on 12/5/2022 and both engines were restarted on 12/6/2022 ICE Unit 417 Engine 1 shut down on 12/12/2022 due to a plugged catalytic converter and was left off for the remainder of the period in preparation for relocation; ICE Unit 417 Engine 2 shut down on 12/12/2022, 12/13/2022, and 12/14/2022 due to full condensate knockout drum; ICE Unit 407 Engine 2 experienced some stalling on 12/13/2022 due to very low well vacuum and was restarted on 12/14/2022; ICE Unit 355 was shut down on 12/13/2022 due to a stuck closed well valve on carburetor and the unit was left off in preparation for relocation to a new extraction well ICE Unit 417 Engine 1 shut down on 12/12/2022 due to a plugged catalytic converter and was left off for the remainder of the periods in preparation for engine unit swap; ICE Unit 417 Engine 2 shut down on 12/19/2022 for relocation to EW-12 and was restarted on 12/22/2022; ICE Unit 407 was shut down on 12/19/2022 for relocation to well EW-13 and was restarted on 12/21/2022; ICE Unit 407 Engine 2 would not restart due to a fouled propane regulator that required replacement; ICE Unit 355 was left off this period due to high water table and in preparation for relocation to a new extraction well; ICE Unit 408 was shut down on 12/19/2022 for relocation to well EW-1 and was restarted on 12/21/2022 ICE Unit 417 Engine 1 shut down on 12/30/2022 after running out of engine oil and was left off for the remainder of the periods in preparation for engine unit replacement; ICE Unit 417 Engine 2 was not operated this period due to water table conditions and in preparation for unit replacement; ICE Unit 407 Engine 1 shut off on 12/23/2022 due to ice formation in the condensate line and remained off over the holiday weekend; ICE Unit 407 Engine 2 was restarted on 12/30/2022 when the propane regulator was replaced; ICE Unit 355 shut down briefly on 12/27/2022 due to full condensate drum; ICE Unit 408 shut off on 12/23/2022 due to ice formation in the condensate line and remained off over the holiday weekend
Jan 2023	2,786.7	1,192.1	--	--	--	--	--	--	--	--	--	--	259.6	1,266.6	--	--	--	--	--	68.4	--	86,083.0	ICE Unit 417 was not operated this period due to water table conditions and in preparation for replacement by Unit 419; ICE Unit 407 Engine 1 was not operated this period due to bad water pump requiring replacement; ICE Unit 407 Engine 2 shut off on 12/31/2022 and 1/6/2023 due to high condensate level ICE Unit 355 shut down on 1/8/2023 and 1/10/2023 due to high condensate level; ICE Unit 419 Engine 1 began operation on 1/11/2023 and Engine 2 began operation on 1/10/2023; ICE Unit 407 Engine 1 shut off on 1/12/2023 due to high condensate level; ICE Unit 407 Engine 2 shut off on 1/10/2023, 1/11/2023, and 1/13/2023 due to high condensate level ICE Unit 355 shut down on 1/14/2023 through 1/17/2023 due to high condensate level; ICE Unit 419 Engine 1 shut down from 1/17/2023 through 1/19/2023 due to a programming issue causing stalls; ICE Unit 419 Engine 2 shut down on 1/18/2023 due to a bad carburetor; ICE Unit 407 Engines 1 and 2 shut down from 1/14/2023 through 1/17/2023 due to high condensate level ICE Unit 419 Engine 2 down due to troubleshooting and repairs from 1/20/2023 through 1/27/2023; new oxygen sensor installed on 1/25/2023, new carburetor installed on 1/26/2023, and controller swapped from 1419 on 1/27/2023; ICE Unit 355 shut down from 1/22/2023 through 1/23/2023 and from 1/28/2023 through 1/30/2023 due to high condensate level; ICE Unit 408 was moved to well EW-23 on 1/25/2023 and SVE was initiated on 1/26/2023; ICE Unit 408 EPC failed on 1/27/2023 and will be replaced
Feb 2023	4,880.1	784.5	--	--	--	--	--	--	--	--	--	--	1,396.0	1,653.4	--	--	--	--	--	1,046.2	--	90,963.1	ICE Unit 355 shut down from 1/28/2023 through 1/31/2023 and from 1/31/2023 through 2/1/2023 due to high condensate level; ICE Unit 419 Engine 1 down from 1/27/2023 through 1/31/2023 awaiting new controller and was manually shut off on 2/1/2023 due to lack of sufficient well fuel to support operation of both engines; ICE Unit 407 Engine 2 broke a drive belt on 1/28/2023 that was replaced on 1/30/2023; ICE Unit 408 shut down on 2/1/2023 through 2/2/2023 due to a high RPM condition ICE Unit 355 shut down from 2/3/2023 through 2/6/2023 and from 2/6/2023 through 2/7/2023 due to high condensate level; ICE Unit 419 Engine 1 was manually shut off on 2/1/2023 and restarted on 2/6/2023 due to lack of sufficient well fuel to support operation of both engines; ICE Unit 419 Engine 1 manually shut off from 2/3/2023 through 2/6/2023 due to lack of well fuel to support operation of both engines; Unit 419 single engine operation switched from Engine 1 to Engine 2 on 2/10/2023 because of an oil leak; ICE Unit 419 Engine 2 shut down on 2/5/2023 through 2/6/2023 due to high condensate knockout level; ICE Unit 419 Engine 2 shut off from 2/6/2023 to 2/8/2023 and from 2/8/2023 to 2/10/2023 because the well could not support dual engine operation; ICE Unit 407 Engine 1 shut down from 2/5/2023 through 2/6/2023 due to high condensate level; ICE Unit 407 Engine 2 briefly shut down on 2/6/2023 due to high condensate level ICE Unit 355 shut down from 2/12/2023 through 2/13/2023 due to high condensate level; ICE Unit 419 Engine 1 was restarted on 2/13/2023 when the unit was connected to a second extraction well (EW-11); ICE Unit 419 Engine 2 was shut off on 2/14/2023 through 2/17/2023 because of an oil leak that was repaired ICE Unit 355 shut down from 2/18/2023 through 2/21/2023 due to high condensate level; ICE Unit 407 Engine 1 shut down on 2/18/2023 due to a bad alternator which was replaced and the engine restarted on 2/21/2023
Mar 2023	7,159.6	1,319.4	--	--	--	--	--	--	--	--	--	--	2,418.2	1,637.2	--	--	--	--	--	1,784.8	--	98,122.7	ICE Unit 355 shut down from 2/25/2023 through 2/27/2023 and 2/28/2023 through 3/1/2023 due to high condensate level; ICE Unit 407 overflowed the condensate drum during the overnight hours between 2/28/2023 and 3/1/2023 ICE Unit 355 shut down briefly on 3/8/2023 due to high condensate level; ICE Unit 355 shut down again on 3/8/2023 through 3/9/2023 due to a bad relay; ICE Unit 407 was shut down from 3/6 through 3/8 for spill cleanup; ICE Unit 407 Engine 1 stalled on 3/10/2023 due to a fouled propane fuel regulator; ICE Unit 408 shut down on 3/8/2023 due to a bad alternator that was replaced on 3/13/2023; *THIS PERIOD'S TOTAL WAS REVISED WHEN REPORTED ON 3/17/2023* ICE Unit 355 shut down from 3/12/2023 to 3/13/2023 due to high condensate level in the secondary knockout pot; ICE Unit 407 Engine 1 stalled on 3/10/2023 and was restarted on 3/13/2023 due to a fouled propane fuel regulator; ICE Unit 408 shut down on 3/8/2023 due to a bad alternator that was replaced on 3/13/2023 ICE Unit 355 shut down from 3/19/2023 to 3/20/2023 due to high condensate level in the secondary knockout pot; ICE Unit 407 shut down briefly on 3/23/2023 due to a full condensate drum ICE Unit 419 shut down briefly from 3/29/2023 to 3/30/2023 due to high condensate level in the secondary knockout pot; ICE Unit 407 shut down briefly from 3/27/2023 to 3/28/2023 due to a full condensate drum
Apr 2023	6,636.5	750.9	--	--	--	253.2	--	--	--	--	--	--	2,172.9	1,748.6	--	--	--	--	--	1,710.9	--	104,759.2	ICE Unit 419 Engine 2 shut down from 4/1/2023 to 4/3/2023 due to high condensate level in the secondary knockout pot ICE Unit 419 Engine 1 carburetor began malfunctioning causing reduced performance and was replaced on 4/18/2023; ICE Unit 355 was shut down at well EW-1 on 4/19/2023 and moved to well EW-5 where SVE was initiated on 4/20/2023 ICE Unit 419 Engine 2 shut down from 4/23/2023 to 4/24/2023 due to high condensate level in the secondary knockout pot; ICE Unit 407 shut down from 4/23/2023 to 4/24/2023 due to a full condensate drum; ICE Unit 355 was shut down at well EW-5 on 4/27/2023 and moved to well EW-4 where SVE was initiated on 4/27/2023; *UNIT 355 DATA WAS REVISED ON 5/5/2023 TO BE COMBINED ACROSS WELLS EW-4 AND EW-5 MOVING FORWARD*
May 2023	5,277.4	--	--	--	--	482.9	--	--	--	--	--	--	2,253.5	983.3	--	--	--	--	--	1,557.7	--	110,036.6	ICE Unit 419 Engine 2 shut down from 4/28/2023 to 5/1/2023 due to high condensate level in the secondary knockout pot; ICE Unit 419 shut down from 5/1/2023 to 5/2/2023 due to full condensate drum; ICE Unit 355 was switched back to well EW-5 on 5/1 to increase operational efficiency; EW-4 will be plumbed into Unit 355 and the wells will be tracked jointly moving forward; Unit 355 shut down from 5/2 to 5/4 due to engine overheating and poor SVE conditions ICE Unit 419 Engine 1 shut down from 5/10/2023 to 5/11/2023 due to high condensate level in the knockout tank; ICE Unit 407 ran out of propane and was shut down from 5/9/2023 to 5/11/2023 ICE Unit 419 Engine 2 alternator failed on 5/14/2023 and was replaced on 5/15/2023; ICE Unit 407 ran out of propane and was shut down from 5/14/2023 to 5/16/2023; ICE Unit 407 Engine 2 belt broke on 5/17/2023 causing damage to the radiator requiring the engine to be shut off pending a replacement fan; on 5/19/2023 well EW-4 was plumbed into Unit 355 well feed allowing both wells to be operated simultaneously ICE Unit 407 Engine 2 belt broke on 5/17/2023 causing damage to the radiator fan which was replaced on 5/23/2023; Unit 407 shut down from 5/24/2023 to 5/25/2023 due to a full condensate knockout drum
Jun 2023	9,881.4	--	--	--	--	1,966.8	--	--	--	--	--	--	3,474.2	615.1	--	--	1,911.4	--	--	1,913.9	--	119,918.0	ICE Unit 407 Engine 1 shut off on 5/26/2023 due to overheating and was restarted on 5/30/2023; ICE Unit 419 Engine 1 shut off on 5/28/2023 due to overheating and was restarted on 5/30/2023 ICE Unit 407 ran out of propane and shut off from 6/4/2023 to 6/5/2023 and from 6/7/2023 to 6/8/2023; ICE Unit 408 shut off due to overheating on 6/2/2023 and was restarted on 6/5/2023 ICE Unit 407 ran out of propane and shut off on 6/10/2023 and was not restarted at well EW-13; ICE Unit 407 was moved to EW-15 and SVE was initiated on 6/14/2023; on 6/16/2023, an additional well (EW-17) was plumbed into ICE Unit 407; ICE Unit 419 Engine 2 shut off on 6/16/2023 due to high condensate level in the knockout pot ICE Unit 419 Engine 2 shut off on 6/16/2023 due to high condensate level in the knockout pot and was restarted on 6/19/2023 ICE Unit 419 Engine 2 shut off from 6/25/2023 to 6/26/2023 and from 6/26/2023 to 6/27/2023 due to high condensate level in the knockout pot *ICE UNIT 355 TOTAL WAS REVISED ON 8/10/2023 DUE TO A MISCALCULATION IN THE DATA FILE*

Table 2-1b
UDEX Release LNAPL Recovery Totals - Full Scale Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	UDEX-EW-1 (gallons)[2,6,17,28,36]	UDEX-EW-2 (gallons)[7]	UDEX-EW-3 (gallons)[8,24,32]	UDEX-EW-4 (gallons)[35]	UDEX-EW-4/ EW-5 (gallons)[9,20,21]	UDEX-EW-5/ EW-6 (gallons)[30]	UDEX-EW-6 (gallons)[9]	UDEX-EW-7 (gallons)[14, 34]	UDEX-EW-6/ EW-7 (gallons)[27,28]	UDEX-EW-8 (gallons)[11]	UDEX-EW-10 (gallons)[12,25]	UDEX-EW-11/ EW-12 (gallons)[15,26]	UDEX-EW-13 (gallons)[16]	UDEX-EW-14 (gallons)[13, 29]	UDEX-EW-15 (gallons)[31]	UDEX-EW-15/ EW-17 (gallons)[22]	UDEX-EW-19 (gallons)[10]	UDEX-EW-21/ EW-22 (gallons)[23]	UDEX-EW-23 (gallons)[18]	UDEX-EW-24 (gallons)[33]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Jul 2023	7,522.0	--	--	--	--	602.3	--	--	--	--	--	--	413.0	--	--	--	3,861.5	--	1,406.0	1,239.2	--	127,440.0	ICE Unit 419 ran out of propane on 7/2/2023 and was restarted on 7/3/2023; ICE Unit 419 Engine 1 overheated on 7/4/2023 and was restarted on 7/5/2023; ICE Unit 419 Engine 2 shut off from 7/4/2023 to 7/5/2023 and from 7/5/2023 to 7/6/2023 due to high condensate level in the knockout pot ICE Unit 419 ran out of propane on 7/9/2023 and was not restarted pending relocation to wells EW-21 and EW-22; SVE was initiated at wells EW-21 and EW-22 on 7/12/2023 ICE Unit 419 ran out of propane on 7/16/2023 and was restarted on 7/17/2023; well EW-22 piping was closed off on 7/18/2023 to mitigate loss of well vacuum and reduced performance so that ICE Unit 419 is operating exclusively on well EW-21; ICE Unit 419 Engine 1 shut down from 7/19/2023 to 7/20/2023 due to a full condensate knockout pot; ICE Unit 355 was shut down on 7/17/2023 and moved to well EW-23 for engine diagnostic testing; well EW-23 totals include a period of ICE Unit 355 operation at the well which occurred from 7/17/2023 to 7/19/2023 (ICE Unit 408 was off during that period only) ICE Unit 407 shut down from 7/23/2023 to 7/24/2023 due to a full condensate knockout tank; ICE Unit 407 Engine 1 shut down from 7/25/2023 to 7/27/2023 due to high catalytic converter temperature caused by a bad spark plug; ICE Unit 355 was not operated this period due to troubleshooting engine performance issues
Aug 2023	7,159.2	--	--	208.3	--	49.6	--	--	--	--	--	--	--	--	--	--	4,018.3	--	2,163.7	719.3	--	134,599.2	ICE Unit 419 Engine 2 shut down from 8/3/2023 to 8/4/2023 due to a bad propane regulator; ICE Unit 355 resumed SVE at wells EW-4 and EW-5 on 8/4/2023 ICE Unit 419 Engine 1 shut down from 8/7/2023 to 8/8/2023 due to a full condensate knockout pot; ICE Unit 407 Engine 1 shut down on 8/7/2023 and 8/10/2023 due to full condensate knockout drum; ICE Unit 355 ran out of propane and shut down on 8/7/2023; ICE Unit 355 was shut down and moved to well EW-3 on 8/8/2023 ICE Unit 419 ran out of propane and shut down from 8/13/2023 to 8/14/2023; ICE Unit 407 shut down briefly on 8/14/2023 due to full condensate knockout drum; ICE Unit 355 ran out of propane and shut down on 8/7/2023; ICE Unit 355 initiated SVE at well EW-3 on 8/14/2023 ICE Unit 419 ran out of propane and shut down from 8/20/2023 to 8/21/2023; ICE Unit 407 ran out of propane and shut down from 8/20/2023 to 8/21/2023; ICE Unit 407 Engine 1 overheated and shut down from 8/23/2023 to 8/24/2023; ICE Unit 408 was shut down from 8/22/2023 to 8/24/2023 to evaluate the efficacy of pulsing SVE
Sep 2023	10,285.0	--	--	63.2	--	--	--	--	--	--	--	1,482.9	2,069.3	--	--	--	5,113.0	--	1,538.8	17.8	--	144,884.2	ICE Unit 419 shut down from 8/27/2023 to 8/28/2023 due to a full condensate drum; ICE Unit 408 was shut down on 8/28/2023 at well EW-23 and moved to well EW-10 where SVE was initiated on 8/31/2023; ICE Unit 355 was shut down on 8/29/2023 at well EW-3 and moved to well EW-11 where SVE was initiated on 8/31/2023 ICE Unit 419 shut down from 9/2/2023 to 9/5/2023 due to a full condensate drum ICE Unit 419 Engine 1 shut down from 9/9/2023 to 9/11/2023 due to a full condensate knockout pot and Engine 2 shut down from 9/10/2023 to 9/11/2023 due to a full condensate knockout drum; ICE Unit 419 shut down briefly on 9/12/2023 and 9/15/2023 due to a full condensate knockout drum ICE Unit 419 shut down from 9/16/2023 to 9/18/2023, 9/19/2023 to 9/20/2023, 9/20/2023 to 9/21/2023, and 9/21/2023 to 9/22/2023 due to a full condensate knockout drum ICE Unit 419 shut down from 9/22/2023 to 9/25/2023, 9/25/2023 to 9/26/2023, 9/26/2023 to 9/27/2023, 9/27/2023 to 9/28/2023, and 9/28/2023 to 9/29/2023 due to a full condensate knockout drum; ICE Unit 407 shut down from 9/24/2023 to 9/25/2023 and briefly on 9/26/2023 due to a full condensate knockout drum; ICE Unit 407 Engine 2 alternator failed on 9/29/2023
Oct 2023	6,291.4	--	--	--	--	--	--	--	--	1,150.0	--	839.8	1,116.3	--	--	--	3,146.7	--	38.6	--	--	151,175.6	ICE Unit 419 shut down from 9/29/2023 to 10/2/2023 and 10/2/2023 to 10/3/2023 due to a full condensate knockout drum; ICE Unit 419 was shut down on 10/4/2023 in preparation for a move to wells EW-6 and EW-7; ICE Unit 419 initiated SVE at wells EW-6 and EW-7 on 10/6/2023; ICE Unit 407 Engine 2 alternator failed on 9/29/2023 and was replaced on 10/2/2023; ICE Unit 355 shut down from 10/3/2023 to 10/4/2023 and from 10/4/2023 to 10/5/2023 due to a full condensate knockout pot ICE Unit 419 ran out of propane and shut down from 10/9/2023 to 10/11/2023 ICE Unit 419 shut down from 10/14/2023 to 10/16/2023 due to a full condensate knockout drum; ICE Unit 407 ran out of propane and shut down from 10/19/2023 to 10/20/2023; ICE Unit 408 was shut down from 10/19/2023 to 10/20/2023 for troubleshooting ICE Unit 419 shut down from 10/22/2023 to 10/23/2023 due to a full condensate knockout drum; ICE Unit 408 was shut down from 10/23/2023 to 10/24/2023 for troubleshooting
Nov 2023	5,112.7	--	--	--	--	--	--	--	--	1,464.1	--	430.8	1,024.6	--	--	--	2,193.2	--	--	--	--	156,288.3	ICE Unit 419 shut down from 10/29/2023 to 10/30/2023 due to a full condensate knockout drum; ICE Unit 407 Engine 1 shut down from 11/2/2023 to 11/3/2023 due to a full condensate knockout pot; ICE Unit 355 shut down from 11/1/2023 to 11/3/2023 due to a full condensate knockout pot ICE Unit 407 Engine 1 shut off briefly on 11/6/2023 due to a full condensate knockout pot; ICE Unit 355 shut down from 11/5/2023 to 11/6/2023 due to a full condensate knockout pot; ICE Unit 408 was shut off from 11/8/2023 through 11/10/2023 awaiting a replacement controller ICE Unit 407 Engine 1 shut down from 11/11/2023 to 11/13/2023 due to a full condensate knockout pot; ICE Unit 355 shut down from 11/11/2023 to 11/13/2023 due to a full condensate knockout pot; ICE Unit 408 was shut off for most of the recovery period for troubleshooting and awaiting replacement parts; ICE Unit 419 Engine 2 has excessive valve chatter and was shut down on 11/17/2023 at the request of RSI ICE Unit 407 Engine 1 shut down from 11/19/2023 to 11/20/2023 due to a full condensate knockout pot; ICE Unit 408 was shut off for most of the recovery period for continued troubleshooting and awaiting a replacement pulsar unit; ICE Unit 419 Engine 2 will remain off at the request of RSI to prevent engine damage; ICE Unit 419 will be replaced when a new unit is ready for shipping; all units were shut off from 11/22/2023 through 11/26/2023 for the Thanksgiving holiday weekend
Dec 2023	3,923.9	--	--	--	--	--	--	--	--	773.0	--	631.2	622.9	--	--	--	1,896.8	--	--	--	--	160,212.2	ICE Unit 407 Engine 1 shut down from 11/28/2023 to 11/29/2023 due to a full condensate knockout pot; ICE Unit 408 pulsar unit was replaced on 11/27/2023 putting the unit back into service; ICE Unit 419 Engine 2 will remain off at the request of RSI to prevent engine damage; ICE Unit 419 is scheduled to be replaced next week; all units were shut off from 11/22/2023 through 11/26/2023 for the Thanksgiving holiday weekend ICE Unit 407 Engine 2 shut down from 12/7/2023 to 12/8/2023 due to hard starting; ICE Unit 408 was shut off from 12/4/2023 through 12/8/2023 due to an engine oil leak; ICE Unit 355 shut down from 12/3/2023 to 12/4/2023 due to a full condensate knockout pot; ICE Unit 355 was shut off from 12/4/2023 through 12/8/2023 due to an engine oil leak; ICE Unit 419 Engine 2 will remain off at the request of RSI to prevent engine damage; ICE Unit 419 is scheduled to be replaced next week after final testing and shipping of the replacement unit ICE Unit 408 was shut off from 12/8/2023 through 12/11/2023 due to an engine oil leak; ICE Unit 355 was shut off from 12/8/2023 through 12/12/2023 due to an engine oil leak; ICE Unit 419 Engine 2 will remain off at the request of RSI to prevent engine damage; ICE Unit 419 is scheduled to be replaced on 12/19/2023 ICE Unit 419 Engine 2 will remain off at the request of RSI to prevent engine damage; ICE Unit 419 was shut down on 12/19/2023 and prepped for return to RSI; ICE Unit 419 was replaced by ICE Unit 392 on 12/20/2023; ICE Unit 392 Engine 1 remained off due to site water-level conditions; ICE Unit 392 Engine 2 shut off on 12/21/2023 and again on 12/21/2023 through 12/22/2023 due to a full condensate knockout pot; all units were shut off on 12/22/2023 for the Christmas holiday weekend All units were returned to service on 12/27/2023 after the Christmas holiday weekend; ICE Unit 392 was shut off on 12/28/2023 due to unfavorable SVE conditions; all other ICE units were shut off on 12/29/2023 for the New Year's holiday weekend
Jan 2024	1,310.1	664.0	--	--	--	--	--	--	--	11.7	--	184.5	127.6	--	--	--	322.3	--	--	--	--	161,522.3	All units were returned to service on 1/2/2024 after the New Year's holiday weekend; ICE Unit 392 was shut off on 1/3/2024 in preparation for a move to well EW-1; SVE was initated at well EW-1 on 1/4/2024; all other ICE units were shut off on 1/5/2024 for the weekend due to poor water-level conditions ICE Units 355, 407, and 408 were returned to service on 1/8/2024 after the weekend; ICE Unit 392 shut off from 1/6/2024 to 1/8/2024 due to a full condensate knockout pot and from 1/11/204 to 1/12/2024 due to poor conditions; ICE Units 355 and 407 were shut off from 1/9/2024 to 1/12/2024 due to poor conditions; ICE Unit 408 was shut off from 1/9/2024 to 1/10/2024 and from 1/10/2024 to 1/12/2024 due to poor conditions; all ICE units were shut off in the early afternoon on 1/12/2024 in preparation for the weekend due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 1/16/2024 after the MLK holiday; ICE Units 355, 407, and 408 were pulsed briefly through the week but otherwisew remained off; ICE Unit 392 remained off due to a frozen knockout tank; all ICE units were shut off in the early afternoon on 1/19/2024 in preparation for a weekend shut down due to poor water-level and sub-freezing temperature conditions ICE Units 355, 392, 407, and 408 were returned to service on 1/22/2024 after being off for the weekend; ICE Units 355, 392, 407, and 408 were shut off overnight from 1/22/2024 to 1/23/2024 due to sub-freezing conditions; ICE Unit 407 shut off on 1/26/2024 due to a full condensate knockout pot; all ICE units were shut off on 1/26/2024 in preparation for a weekend shut down due to poor water-level conditions
Feb 2024	992.0	595.7	--	--	--	--	--	--	--	--	--	57.1	83.9	--	--	--	255.3	--	--	--	--	162,514.3	ICE Units 355, 392, 407, and 408 were returned to service on 1/29/2024 after being off for the weekend; ICE Unit 392 was shut off overnight from 1/30/2024 to 2/2/2024 due to poor water-level conditions; ICE Units 355, 407, and 408 were shut off overnight from 1/29/2024 to 2/2/2024 due to poor water-level conditions; all ICE units were shut off on 2/2/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 2/5/2024 after being off for the weekend; Except for the period 2/7/2024 to 2/8/2024, ICE Unit 392 was shut off overnight from 2/5/2024 to 2/9/2024 due to poor water-level conditions; ICE Units 355, 407, and 408 were shut off overnight from 2/5/2024 to 2/9/2024 due to poor water-level conditions; All ICE units were shut off on 2/9/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 2/12/2024 after being off for the weekend; Except for the period 2/12/2024 to 2/13/2024 and 2/15/2024 to 2/16/2024, ICE Unit 392 was shut off overnight from 2/12/2024 to 2/16/2024 due to poor water-level conditions; ICE Units 355, 407, and 408 were shut off overnight from 2/12/2024 to 2/16/2024 due to poor water-level conditions; All ICE units were shut off on 2/16/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 2/20/2024 after being off for the holiday weekend; ICE Unit 392 briefly ran out of propane on 2/23/2024; ICE Units 355 and 408 were shut off overnight from 2/20/2024 to 2/23/2024 due to poor water-level conditions; ICE Unit 407 was shut off overnight from 2/20/2024 to 2/21/2024 due to poor water level conditions; ICE Units 355 and 408 were shut off on 2/23/2024 in preparation for a weekend shut down due to poor water-level conditions

Table 2-1b
UDEX Release LNAPL Recovery Totals - Full Scale Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	UDEX-EW-1 (gallons)[2,6,17,28,36]	UDEX-EW-2 (gallons)[7]	UDEX-EW-3 (gallons)[8,24,32]	UDEX-EW-4 (gallons)[35]	UDEX-EW-4/ EW-5 (gallons)[9,20,21]	UDEX-EW-5/ EW-6 (gallons)[30]	UDEX-EW-6 (gallons)[9]	UDEX-EW-7 (gallons)[14, 34]	UDEX-EW-6/ EW-7 (gallons)[27,28]	UDEX-EW-8 (gallons)[11]	UDEX-EW-10 (gallons)[12,25]	UDEX-EW-11/ EW-12 (gallons)[15,26]	UDEX-EW-13 (gallons)[16]	UDEX-EW-14 (gallons)[13, 29]	UDEX-EW-15 (gallons)[31]	UDEX-EW-15/ EW-17 (gallons)[22]	UDEX-EW-19 (gallons)[10]	UDEX-EW-21/ EW-22 (gallons)[23]	UDEX-EW-23 (gallons)[18]	UDEX-EW-24 (gallons)[33]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Mar 2024	1,827.8	914.0	--	--	--	--	--	--	--	--	--	143.5	181.4	13.4	--	--	575.5	--	--	--	--	164,342.1	ICE Units 355, 407, and 408 were returned to service on 2/26/2024 after being off for the weekend; ICE Unit 392 shut down from 2/25/2024 to 2/26/2024 due to a full condensate knockout pot; ICE Units 355 and 408 were shut off overnight from 2/26/2024 to 2/27/2024 due to poor water-level conditions; ICE Unit 407 shut off from 2/28/2024 to 2/29/2024 due to a full condensate knockout drum; ICE Units 355, 392, and 408 were shut off on 3/1/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, and 408 were returned to service on 3/4/2024 after being off for the weekend; ICE Unit 392 Engine 2 was shut down from 3/7/2024 to 3/8/2024 due to poor conditions; ICE Unit 408 was shut off for most of the period 3/6/2024 to 3/8/2024 due to poor conditions being caused by nearby stormwater discharges and flooding; ICE Unit 407 shut off briefly on 3/7/2024 due to a full condensate knockout drum; ICE Units 355, 392, 407, and 408 were shut off on 3/8/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 3/11/2024 after being off for the weekend; ICE Unit 392 Engine 2 shut down from 3/12/2024 to 3/13/2024 due to a controller alarm; ICE Units 355 and 408 were shut off overnight between 3/12/2024 and 3/14/2024 due to poor conditions being caused by nearby stormwater discharges and intermittent flooding; ICE Unit 407 shut off three times between 3/11/2024 and 3/13/2024 due to a full condensate knockout drum; ICE Unit 407 was shut off overnight between 3/13/2024 and 3/14/2024 due to poor conditions being caused by nearby stormwater discharges and intermittent flooding; ICE Units 355, 392, 407, and 408 were shut off on 3/14/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 3/18/2024 after being off for the weekend; except for 3/19/2024 to 3/20/2024, ICE Unit 392 was shut off overnight due to poor conditions; ICE Units 355, 407, and 408 were shut off overnight between 3/18/2024 and 3/22/2024 due to poor conditions being caused by nearby stormwater discharges, intermittent flooding, and additional rainfall; ICE Unit 407 shut off on 3/18/2024 due to a full condensate knockout drum; ICE Units 355, 392, 407, and 408 were shut off on 3/22/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 3/25/2024 after being off for the weekend; except for 3/25/2024 to 3/27/2024, ICE Unit 392 was shut off overnight due to poor conditions; ICE Unit 392 Engine 1 shut down on 3/26/2024 due to a full condensate knockout pot; ICE Units 355 and 407 were shut off overnight between 3/26/2024 and 3/29/2024 due to poor conditions being caused by nearby stormwater discharges, intermittent flooding, and additional rainfall; ICE Unit 407 shut off on 3/26/2024 due to a full condensate knockout drum; ICE Unit 408 was shut off at well EW-10 on 3/25/2024, restarted at well EW-13 on 3/27/2024, and was shut off overnight through 3/29/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were shut off on 3/29/2024 in preparation for a weekend shut down due to poor water-level conditions
Apr 2024	559.3	202.3	--	--	--	--	--	--	--	--	--	--	64.1	118.8	--	--	174.1	--	--	--	--	164,901.4	ICE Units 355, 392, 407, and 408 were returned to service on 4/1/2024 after being off for the weekend; all ICE Units were shut off overnight between 4/1/2024 and 4/5/2024 due to excessive rainfall, surface flooding, and poor conditions; ICE Unit 407 shut down briefly on 4/4/2024 due to a full condensate knockout drum; ICE Units 355, 392, 407, and 408 were shut off on 4/5/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 4/8/2024 after being off for the weekend; all ICE Units were shut off overnight between 4/8/2024 and 4/12/2024 due to poor conditions; ICE Unit 407 Engine 1 and ICE Unit 355 shut down briefly on 4/9/2024 due to a full condensate knockout drum; ICE Unit 407 Engine 1 would not start and was not run on 4/10/2024; ICE Units 355, 392, 407, and 408 were shut off on 4/12/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 4/15/2024 after being off for the weekend; all ICE Units were shut off overnight between 4/15/2024 and 4/18/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were not run on 4/19/2024 and remained shut off through the weekend due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 4/22/2024 after being off for the weekend; ICE Unit 392 was manually shut off overnight from 4/22/2024 to 4/23/2024 and 4/24/2024 to 4/25/2024 due to poor conditions; ICE Unit 392 shut off overnight between 4/25/2024 and 4/26/2024 due to a full condensate knockout pot; ICE Unit 407 was manually shut off overnight between 4/22/2024 and 4/23/2024 due to nearby stormwater discharge and poor conditions; ICE Unit 407 shut off briefly on 4/24/2024 due to a full condensate knockout tank and was not operated on 4/25/2024 due to hard starting; ICE Units 355 and 408 were manually shut off overnight from 4/22/2024 to 4/23/2024 and 4/24/2024 to 4/25/2024 due to nearby stormwater discharge and poor conditions; ICE Units 355, 392, 407, and 408 were shut off on 4/26/2024 in preparation for a weekend shut down due to poor water-level conditions
May 2024	1,121.1	404.1	--	--	--	--	--	--	--	--	--	--	83.9	261.4	--	--	371.7	--	--	--	--	166,022.5	ICE Units 355, 392, 407, and 408 were returned to service on 4/29/2024 after being off for the weekend; ICE Unit 392 was manually shut off overnight from 4/30/2024 to 5/3/2024 due to poor conditions; ICE Unit 392 shut off briefly on 4/29/2024 due to a full condensate knockout pot; ICE Unit 407 was manually shut off overnight between 5/1/2024 and 5/3/2024 due to poor conditions; ICE Unit 407 shut off briefly on 4/30/2024 due to a full condensate knockout tank; ICE Units 355 and 408 were manually shut off overnight from 5/1/2024 to 5/3/2024 due to poor conditions; ICE Unit 355 shut off on 4/29/2024 due to a full condensate knockout drum and was not run on 4/30/2024; ICE Units 355, 392, 407, and 408 were shut off on 5/3/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 5/6/2024 after being off for the weekend and were manually shut off overnight between 5/6/2024 and 5/10/2024 due to poor conditions; ICE Unit 407 was not operated on 5/8 due to hard starting; ICE Units 355, 392, 407, and 408 were shut off on 5/10/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 5/13/2024 after being off for the weekend; ICE Unit 392 shut off on 5/14/2024 and 5/17/2024 due to a full condensate knockout pot; ICE Unit 407 Engine 1 shut off on 5/16/2024 due to a full condensate knockout tank; ICE Unit 355 was not operated overnight and was not operated on 5/14/2024 and 5/16/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were shut off on 5/17/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 5/20/2024 after being off for the weekend; ICE Units 392, 407, and 408 were manually shut off on 5/22/2024 and were not run on 5/23/2024 due to poor conditions; ICE Unit 407 Engine 1 shut off on 5/20/2024 due to high oil pressure; ICE Unit 355 was not operated overnight and was not operated on 5/23/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were shut off on 5/24/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 5/28/2024 after being off for the holiday weekend; ICE Units 355, 392, 407, and 408 were manually shut off overnight between 5/28/2024 and 5/31/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were shut off on 5/31/2024 in preparation for a weekend shut down due to poor water-level conditions
Jun 2024	1,762.7	602.1	--	--	--	--	--	--	--	--	--	--	18.1	366.9	24.9	--	750.7	--	--	--	--	167,785.2	ICE Units 355, 392, 407, and 408 were returned to service on 6/3/2024 after being off for the holiday weekend; ICE Units 392, 407, and 408 were manually shut off overnight between 6/3/2024 and 6/7/2024 due to poor conditions; ICE Unit 355 was shut off overnight between 6/3/2024 and 6/5/2024 and was moved to SVE well UDEX-EW-14 on 6/6/2024; SVE was initiated at SVE well UDEX-EW-14 on 6/7/2024; ICE Units 355, 392, 407, and 408 were shut off on 6/7/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 6/10/2024 after being off for the holiday weekend; ICE Units 355, 392, 407, and 408 were manually shut off overnight between 6/10/2024 and 6/13/2024 and were not operated on 6/14/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were left off on 6/14/2024 in preparation for a weekend shut down due to poor water-level conditions ICE Units 355, 392, 407, and 408 were returned to service on 6/17/2024 after being off for the holiday weekend; ICE Units 392 and 407 were manually shut off overnight between 6/18/2024 and 6/19/2024 due to poor conditions; ICE Unit 355 was not operated overnight this period due to poor conditions; ICE Unit 408 shut off on 6/20/2024 due to high hydraulic oil temperature; ICE Unit 355 was left off on 6/21/2024 in preparation for a weekend shut down due to poor conditions ICE Unit 355 was returned to service on 6/24/2024 after being off for the weekend; ICE Unit 355 was manually shut off overnight between 6/24/2024 and 6/28/2024 and was not run on 6/25/2024 due to poor conditions; ICE Unit 355 was shut off on 6/28/2024 in preparation for a weekend shut down due to poor conditions
Jul 2024	1,916.9	627.1	--	--	--	--	91.2	--	--	--	--	--	--	587.0	10.6	--	601.0	--	--	--	--	169,702.1	ICE Unit 355 was returned to service on 7/1/2024 after being off for the weekend; ICE Unit 355 was manually shut off overnight between 7/1/2024 and 7/5/2024 and was not run on 7/4/2024 due to poor conditions and the July 4 holiday; ICE Units 392, 407, and 408 were shut off early on 7/3/2024 and not operated on 7/4/2024 due to the July 4 holiday; ICE Unit 355 was shut off on 7/5/2024 in preparation for a weekend shut down due to poor conditions ICE Unit 355 was returned to service on 7/8/2024 after being off for the weekend; ICE Unit 355 was operated daily on 7/8/2024, 7/9/2024, 7/12/2024 and was not operated on 7/10/2024 and 7/11/2024 due to poor conditions ;ICE Unit 392 ran out of propane and shut off on 7/9/2024; ICE Unit 392 was restarted on 7/12/2024 after hard starting and replacement of both engine starters; ICE Unit 407 Engine 1 shut off due to high engine temperature on 7/7/2024, 7/8/2024, and 7/11/2024; ICE Unit 408 shut off on 7/11/2024 due to high hydraulic oil temperature; ICE Unit 355 and ICE Unit 392 Engine 1 were shut off on 7/12/2024 in preparation for a weekend shut down due to poor conditions ICE Unit 392 Engine 1 was restarted on 7/15/2024 after a planned weekend shutdown; ICE Unit 407 Engine 1 shut off due to high engine temperature on 7/13/2024 and was restarted on 7/15/2024; ICE Unit 407 ran out of propane on 7/18/2024 and was left off in preparation for a move to wells EW-5 and EW-6; ICE Unit 355 was run briefly on 7/17/2024 and 7/19/2024 to assess conditions; ICE Unit 355 was left off on 7/19/2024 in preparation for a weekend shutdown due to poor conditions ICE Unit 407 initiated SVE at wells EW-5 and EW-6 on 7/22/2024; ICE Units 392 and 407 were not run overnight between 7/24/2024 and 7/26/2024 due to poor conditions; ICE Unit 355 was run briefly on 7/22/2024 and 7/24/2024 to assess conditions; ICE Units 355, 392, and 407 were left off on 7/26/2024 in preparation for a weekend shutdown due to poor conditions

Table 2-1b
UDEX Release LNAPL Recovery Totals - Full Scale Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	UDEX-EW-1 (gallons)[2,6,17,28,36]	UDEX-EW-2 (gallons)[7]	UDEX-EW-3 (gallons)[8,24,32]	UDEX-EW-4 (gallons)[35]	UDEX-EW-4/ EW-5 (gallons)[19,20,21]	UDEX-EW-5/ EW-6 (gallons)[30]	UDEX-EW-6 (gallons)[9]	UDEX-EW-7 (gallons)[14, 34]	UDEX-EW-6/ EW-7 (gallons)[7,28]	UDEX-EW-8 (gallons)[11]	UDEX-EW-10 (gallons)[12,25]	UDEX-EW-11/ EW-12 (gallons)[15,26]	UDEX-EW-13 (gallons)[16]	UDEX-EW-14 (gallons)[13, 29]	UDEX-EW-15 (gallons)[31]	UDEX-EW-15/ EW-17 (gallons)[22]	UDEX-EW-19 (gallons)[10]	UDEX-EW-21/ EW-22 (gallons)[23]	UDEX-EW-23 (gallons)[18]	UDEX-EW-24 (gallons)[33]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Aug 2024	1,021.5	320.8	--	--	--	--	324.1	--	--	--	--	--	--	359.5	17.1	--	--	--	--	--	--	170,723.6	ICE Units 355, 392, and 407 were restarted on 7/29/2024 after a planned weekend shutdown; ICE Units 392 and 407 were not run overnight between 7/30/2024 and 8/2/2024 due to poor conditions; ICE Unit 355 was run briefly on 7/29/2024, 7/30/2024, and 7/31/2024 to assess conditions; ICE Unit 408 was not run overnight between 8/1/2024 and 8/2/2024 due to poor conditions; ICE Units 355, 392, 407, and 408 were left off on 8/2/2024 in preparation for a weekend shutdown due to poor conditions ICE Units 355, 392, 407, and 408 were restarted on 8/5/2024 after a planned weekend shutdown; ICE Unit 392 was not run overnight between 8/5/2024 and 8/8/2024 due to poor conditions; ICE Units 407 and 408 were not run overnight between 8/6/2024 and 8/8/2024 due to poor conditions; ICE Unit 355 was run briefly on 8/5/2024, 8/8/2024, and 8/9/2024 to assess conditions; ICE Units 355, 392, 407, and 408 were shut off on 8/9/2024 in preparation for a weekend shutdown due to poor conditions ICE Units 355, 392, 407, and 408 were restarted on 8/12/2024 after a planned weekend shutdown; ICE Units 392 and 407 ran out of propane on 8/14/2024 and were restarted on 8/15/2024; ICE Unit 408 was not run overnight on 8/15/2024; ICE Unit 355 was run briefly on 8/12/2024, 8/13/2024, and 8/15/2024 to assess conditions; ICE Units 355, 392, 407, and 408 were not run on 8/16/2024 and were left off in preparation for a weekend shutdown due to poor conditions ICE Units 355, 392, 407, and 408 were restarted on 8/19/2024 after a planned weekend shutdown; ICE Units 392 and 408 were not run overnight on 8/21/2024 and ICE Unit 392 was not run overnight on 8/19/2024; ICE Units 407 and 355 were not run overnight this period; ICE Units 355, 392, 407, and 408 were not run on 8/22/2024; ICE Unit 355 was not run on 8/23 and all other units were shut off early in preparation for a weekend shutdown due to poor conditions ICE Units 355, 392, 407, and 408 were restarted on 8/26/2024 after a planned weekend shutdown; ICE Units 392, 407, and 408 were not run overnight between 8/27/2024 and 8/30/2024; ICE Unit 355 was run briefly on 8/26/2024 and 8/30/2024 to assess conditions; ICE Units 355, 392, 407, and 408 were shut off on 8/30/2024 in preparation for a weekend shutdown due to poor conditions
Sep 2024	1,559.3	315.8	--	--	--	--	154.4	--	--	--	--	--	--	497.6	591.5	--	--	--	--	--	--	172,282.9	ICE Units 355, 392, 407, and 408 were restarted on 9/3/2024 after a planned holiday weekend shutdown; ICE Units 392 and 407 were not run overnight this period; ICE Unit 408 was not run overnight between 9/3/2024 and 9/5/2024; ICE Unit 355 was run briefly on 9/3/2024 and 9/6/2024 to assess conditions; ICE Units 355, 392, 407, and 408 were shut off on 9/6/2024 in preparation for a weekend shutdown due to poor conditions ICE Units 392, 407, and 408 were restarted on 9/9/2024 after a planned weekend shutdown; ICE Units 392 and 407 were not run overnight this period; ICE Unit 408 was not run overnight between 9/9/2024 and 9/11/2024; air sparge pilot testing began on 9/11/2024 and ICE Unit 355 was run continuously through the remainder of the period; ICE Units 392 and 407 were shut off on 9/13/2024 in preparation for a weekend shutdown ICE Units 392 and 407 were restarted on 9/16/2024 after a planned weekend shutdown; ICE Units 392 and 407 were not run overnight this period; ICE Units 355 and 408 were run continuously between 9/13/2024 and 9/20/2024; ICE Units 355, 392, 407, and 408 were shut off on 9/20/2024 in preparation for a weekend shutdown ICE Units 355, 392 and 408 were restarted on 9/23/2024 and Unit 407 restarted on 9/24/2024 after a planned weekend shutdown; ICE Unit 407 was not run overnight this period; ICE Units 355, 392, and 408 were not run overnight between 9/26/2024 and 9/27/2024; ICE Units 392, 407, and 408 were shut off on 9/27/2024 in preparation for a weekend shutdown
Oct 2024	1,882.7	340.7	--	--	--	--	661.2	--	--	--	--	--	--	392.9	487.9	--	--	--	--	--	--	174,165.6	ICE Units 392, 407, and 408 were restarted on 9/30/2024 after a planned weekend shutdown and were not run overnight this period; ICE Unit 355 was not run overnight between 9/30/2024 and 10/4/2024; ICE Units 355, 392, 407, and 408 were shut off on 10/4/2024 in preparation for a weekend shutdown ICE Units 355, 392, 407, and 408 were restarted on 10/7/2024 after a planned weekend shutdown and were not run overnight this period; ICE Unit 408 was not run between 10/8/2024 and 10/11/2024 due to a faulty engine controller that required replacement; ICE Units 355, 392, 407, and 408 were shut off on 10/11/2024 in preparation for a weekend shutdown ICE Units 355, 392, and 407 were restarted on 10/14/2024 after a planned weekend shutdown and were not run overnight between 10/14/2024 and 10/17/2024; ICE Unit 408 was restarted on 10/15/2024 after engine controller replacement and was not run overnight between 10/15/2024 and 10/17/2024; ICE Unit 392 shut down briefly on 10/17/2024 due to a full condensate knockout pot ICE Unit 392 ran out of propane on 10/20/2024 and was restarted on 10/21/2024; ICE Unit 392 was not run overnight between 10/21/2024 and 10/25/2024; ICE Units 355, 392, 407, and 408 were shut off on 10/25/2024 in preparation for a weekend shutdown
Nov 2024	4,205.8	483.2	--	--	--	--	1,786.2	--	--	--	--	--	--	1,003.3	933.1	--	--	--	--	--	--	178,371.4	ICE Units 355, 392, and 407 were restarted on 10/28/2024 after a planned weekend shutdown; ICE Unit 392 was not run overnight between 10/28/2024 and 10/30/2024; ICE Unit 408 would not start on 10/28/2024 and was not run overnight between 10/30/2024 and 10/31/2024; ICE Units 355 and 392 were shut off on 11/1/2024 in preparation for a weekend shutdown ICE Units 355 and 392 were restarted on 11/4/2024 after a planned weekend shutdown; ICE Unit 392 was not run overnight between 11/4/2024 and 11/6/2024; ICE Unit 408 would not start on 11/5/2024 and was restarted on 11/6/2024 after repair of a loose wiring harness; ICE Unit 392 was shut off on 11/8/2024 in preparation for a weekend shutdown ICE Unit 392 was restarted on 11/11/2024 after a planned weekend shutdown; ICE Unit 392 was only run overnight on 11/13/2024; ICE Units 392 and 408 were shut off on 11/15/2024 in preparation for a weekend shutdown ICE Units 392 and 408 were restarted on 11/18/2024 after a planned weekend shutdown; ICE Unit 392 was not run overnight between 11/19/2024 and 11/22/2024; ICE Unit 408 would not start on 11/19/2024 due to a bad starter and was restarted on 11/21/2024 after starter replacement; ICE Unit 392 was shut off on 11/22/2024 in preparation for a weekend shutdown ICE Unit 392 was restarted on 11/25/2024 after a planned weekend shutdown; ICE Unit 392 was not run overnight between 11/25/2024 and 11/27/2024; ICE Units 355 and 407 shut down on 11/23/2024 due to full condensate knockout pots and were restarted on 11/25/2024; All ICE units were shut off on 11/27 in preparation for an extended holiday weekend shutdown
Dec 2024	2,790.1	70.7	--	--	--	--	450.5	--	--	--	--	--	--	720.7	522.3	1,025.9	--	--	--	--	--	181,161.5	All ICE units were restarted on 12/2/2024 after a planned weekend shutdown; ICE Unit 392 was not run overnight between 12/2/2024 and 12/4/2024; Unit 392 shut off on 12/5 due to a full condensate knockout pot and was left of in preparation for a move to extraction well EW-15; ICE Unit 355 shut down briefly on 12/3/2024, 12/4/2024, and 12/6/2024 due to full condensate knockout pot; Unit 407 Engine 1 carburetor and pulsar failed on 12/2/2024 and the engine was left off for the remainder of the period; ICE Unit 355 was shut off on 12/6/2024 in preparation for a weekend shutdown ICE Unit 392 was restarted on 12/9/2024 after a planned weekend shutdown; ICE Unit 407 Engine 1 was restarted on 12/13/2024 after the carburetor was replaced; ICE Unit 392 was not run overnight between 12/10/2024 and 12/11/2024; ICE Unit 407 Engine 2 was not run overnight between 12/12/2024 and 12/13/2024; ICE Unit 355 was shut off on 12/13/2024 in preparation for a weekend shutdown ICE Units 355 and 408 were restarted on 12/16/2024 after a planned weekend shutdown; Ice Units 392 and 407 shut down on 12/14/2024 due to full condensate knockout pots and were restarted on 12/16/2024; ICE Unit 407 Engine 2 was off on 12/17/2024 and 12/18/2024 due to a bad carburetor; ICE Unit 408 shut down on 12/16/2024 due to a LEL sensor fault and was restarted on 12/17/2024; all ICE Units were shut off on 12/20/2024 in preparation for a weekend shutdown ICE Units 355, 392, and 408 were restarted on 12/23/2024 after a planned weekend shutdown; all ICE Units were not operated on 12/24/2024 and 12/25/2024 due to the Christmas holiday; ICE Unit 407 was not operated on 12/23/2024 due to hard starting and was not operated overnight between 12/26/2024 and 12/27/2024; all ICE Units were shut off on 12/27/2024 in preparation for a weekend shutdown
Jan 2025	1,487.1	--	--	--	--	--	129.7	--	--	--	--	--	--	158.6	136.0	1,062.8	--	--	--	--	--	182,648.6	All ICE Units were restarted on 12/30/2024 after a planned weekend shutdown; all ICE Units were not operated on 1/1/2025 due to the New Year's holiday; ICE Unit 407 was not operated overnight this period; ICE Unit 407 Engine 1 recovery estimated from run times due to a faulty controller; ICE Unit 355 shut down on 12/30/2024 due to a full condensate knockout pot and was not operated overnight from 1/2/2025 to 1/3/2025; ICE Unit 408 was not operated on 12/31/2024 in preparation for an engine swap to Unit 412 which began operating on 1/2/2025; all ICE Units were shut off on 1/3/2025 in preparation for a weekend shutdown All ICE Units were restarted on 1/6/2025 after a planned weekend shutdown; none of the ICE units were operated overnight this period; ICE Unit 407 Engine 1 recovery and propane usage estimated from run times due to a faulty controller; ICE Unit 407 was shut off on 1/7/2025 in preparation for replacement by Unit 408; ICE Unit 392 Engine 2 was operated minimally from 1/7/2025 through 1/9/2025 due to low oil pressure causing the engine to shut off; ICE Units 355, 392, and 412 were shut off on 1/10/2025 in preparation for a weekend shutdown ICE Units 355, 392, and 412 were restarted on 1/13/2025 after a planned weekend shutdown; none of the ICE units were operated overnight this period; ICE Unit 408 replaced ICE Unit 407 and began operating on 1/17/2025; all ICE Units were shut off on 1/17/2025 in preparation for a weekend shutdown ICE Units 392, 408, and 412 were restarted on 1/21/2025 after a planned holiday weekend shutdown; none of the ICE units were operated overnight this period and operations were limited by very cold weather conditions causing ICE Units 355 and 392 to either not start and/or stay running; all ICE Units were shut off on 1/24/2025 in preparation for a weekend shutdown All ICE Units were restarted on 1/27/2025 after a planned weekend shutdown; ICE Units 392 and 412 were not operated overnight between 1/27/2025 and 1/28/2025; ICE Unit 355 was not operated overnight between 1/27/2025 and 1/30/2025; ICE Unit 408 was not operated between 1/27/2025 and 1/30/2025 due to a wiring issue causing the LEL sensor to shut off the engine repeatedly; ICE Unit 408 was repaired on 1/31/2025; all ICE Units were shut off on 1/31/2025 in preparation for a weekend shutdown
Feb 2025	4,015.4	--	--	897.2	--	--	888.8	--	--	--	--	--	--	63.5	166.2	1,699.6	--	--	--	300.1	186,664.0	All ICE Units were restarted on 2/3/2025 after a planned weekend shutdown; ICE Unit 355 was shut off on 2/7/2025 in preparation for a move to EW-3; ICE Unit 412 was shut off on 2/7/2025 and moved to EW-24 ICE Unit 392 Engine 1 shut down on 2/9/2025 due to a full condensate knockout pot and was restarted on 2/10/2025; ICE Unit 408 stalled on 2/9/2025 and was restarted on 2/11/2025 after the starter was replaced; ICE Unit 355 was moved to EW-3 on 2/10/2025 and initiated a second round of remediation at that well on 2/12/2025; ICE Unit 412 was moved to new well EW-24 on 2/7/2025 and initiated remediation at that well on 2/10/2025; ICE Unit 392 was shut off on 2/14/2025 in preparation for a holiday weekend shutdown ICE Unit 392 was restarted on 2/18/2025 after the holiday weekend; ICE Unit 392 shut down on 2/18/2025, 2/19/2025, and 2/20/2025 due to a frozen condensate knockout high-level switch and was left off on 2/20/2025 for the weekend; ICE Unit 355 was shut off on 2/20/2025 due to a propane hose leak that was ordered and replaced on 2/24/2025; ICE Unit 412 shut off on 2/18/2025 and 2/19/2025 due to blown fuses related to a bad relay; ICE Unit 408 was shut off on 2/21/2025 in preparation for a weekend shutdown All ICE Units were restarted on 2/24/2025 after a planned weekend shutdown; ICE Unit 355 leaky propane supply hose was replaced; a faulty ICE Unit 412 relay was diagnosed as the cause for repeatedly blown fuses and shut downs and was replaced; ICE Unit 412 was operated minimally between 2/27/2025 and 2/28/2025 due to conditions and was left off on 2/28/2025 for the weekend

Table 2-1b
UDEX Release LNAPL Recovery Totals - Full Scale Remediation
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

Month	Period LNAPL Recovery (gallons)[1]	UDEX-EW-1 (gallons)[3,6,17,28,36]	UDEX-EW-2 (gallons)[7]	UDEX-EW-3 (gallons)[8,24,32]	UDEX-EW-4 (gallons)[35]	UDEX-EW-4/ EW-5 (gallons)[19,20,21]	UDEX-EW-5/ EW-6 (gallons)[30]	UDEX-EW-6 (gallons)[9]	UDEX-EW-7 (gallons)[14, 34]	UDEX-EW-6/ EW-7 (gallons)[27,28]	UDEX-EW-8 (gallons)[11]	UDEX-EW-10 (gallons)[12,25]	UDEX-EW-11/ EW-12 (gallons)[15,26]	UDEX-EW-13 (gallons)[16]	UDEX-EW-14 (gallons)[13, 29]	UDEX-EW-15 (gallons)[31]	UDEX-EW-15/ EW-17 (gallons)[22]	UDEX-EW-19 (gallons)[10]	UDEX-EW-21/ EW-22 (gallons)[23]	UDEX-EW-23 (gallons)[18]	UDEX-EW-24 (gallons)[33]	Cumulative LNAPL Recovery (gallons)[1]	Notes
Mar 2025	4,192.0	--	--	623.3	--	--	493.6	--	--	--	--	--	--	680.8	--	2,283.5	--	--	--	--	110.8	190,856.0	ICE Unit 412 was restarted on 3/3/2025 after a planned weekend shutdown; ICE Unit 392 shut down on 3/2/2025 due to a full condensate knockout pot; ICE Unit 412 was not operated overnight between 3/6/2025 and 3/7/2025 due to poor conditions; ICE Units 355, 408, and 412 were shut off on 3/7/2025 in preparation for a weekend shutdown ICE Units 355, 408, and 412 were restarted on 3/10/2025 after a planned weekend shutdown; ICE Unit 355 was not operated overnight between 3/13/2025 and 3/14/2025; ICE Unit 412 well piping was moved from well UDEX-EW-24 to UDEX-EW-13 on 3/12/2025; ICE Units 355 and 408 were shut off on 3/14/2025 in preparation for a weekend shutdown ICE Units 355 and 408 were restarted on 3/17/2025 after a planned weekend shutdown ICE Units 355 and 408 were not operated overnight between 3/24/2025 and 3/26/2025; ICE Unit 408 was not operated overnight between 3/27/2025 and 3/28/2025
Apr 2025	2,358.7	--	--	286.7	--	--	304.4	--	--	--	--	--	--	518.5	--	1,249.1	--	--	--	--	--	193,214.7	ICE Unit 392 Engine 2 was restarted on 3/31/2025 after a planned weekend shutdown; ICE Units 355 and 408 were not operated overnight between 4/1/2025 and 4/2/2025 and were shut off early on 4/4/2025 in preparation for a weekend shutdown ICE Unit 355 was restarted on 4/7/2025 after being off for the weekend; ICE Unit 408 was not operated this period while awaiting a new pulsar unit; ICE Unit 392 shut off on 4/6/2025 due to a full condensate knockout pot and was restarted on 4/7/2025; ICE Units 355 and 412 were shut off on 4/11/2025 in preparation for a weekend shutdown ICE Units 355 and 412 were restarted on 4/14/2025 after being off for the weekend; ICE Unit 355 was not operated overnight between 4/14/2025 and 4/15/2025; ICE Unit 408 was restarted on 4/15/2025 after pulsar replacement and was not operated overnight between 4/17/2025 and 4/18/2025; ICE Unit 392 shut off on 4/12/2025 due to a full condensate knockout pot and was restarted on 4/14/2025; ICE Units 355, 392, and 412 were shut off on 4/18/2025 in preparation for a weekend shutdown ICE Units 355, 392, and 412 were restarted on 4/21/2025 after being off for the weekend; ICE Unit 408 was not operated between 4/21/2025 and 4/25/2025 due to oil accumulation in the propane regulator which was cleaned and rebuilt; ICE Units 355, 392, 408, and 412 were shut off on 4/25/2025 in preparation for a weekend shutdown
May 2025	2,178.2	--	--	188.6	38.5	--	105.7	--	88.9	--	--	--	--	502.9	--	1,253.6	--	--	--	--	--	195,392.9	ICE Units 355, 392, 408, and 412 were restarted on 4/28/2025 after being off for the weekend; ICE Unit 392 ran out of propane on 4/30/2025 and was restarted on 5/1/2025; ICE Units 355 and 408 were shut off on 5/2/2025 in preparation for a weekend shutdown ICE Units 355 and 408 were restarted on 5/5/2025 after being off for the weekend; ICE Unit 392 ran out of propane on 5/5/2025 and was restarted on 5/6/2025; ICE Unit 408 was shut off on 5/9/2025 in preparation for a weekend shutdown ICE Unit 408 was restarted on 5/12/2025 after being off for the weekend; ICE Unit 392 Engine 1 was operated minimally this period due to repeatedly shutting off because of high RPM and temperature alarms later diagnosed to a bad wire connection; ICE Units 355 and 408 were not operated overnight between 5/13/2025 and 5/14/2025; ICE Units 355 and 408 were shut off on 5/16/2025 in preparation for a weekend shutdown Unit 408 was restarted on 5/19 after piping was relocated to EW-7; Unit 355 was restarted on 5/20 after piping was relocated to EW-4; Unit 392 Engine 1 bad wire connection was repaired on 5/22 and the engine was restarted; Unit 392 Engine 2 shut down on 5/17 due to high engine temperature and was restarted on 5/20; Unit 412 was not operated overnight between 5/20 and 5/21; all ICE units were shut off early on 5/23 in preparation for a holiday weekend shutdown All ICE units were restarted on 5/27/2025 after being off for the weekend; ICE Unit 392 Engine 2 shut off on 5/30/2025 due to high engine temperature; ICE Unit 408 was not operated overnight between 5/29/2025 and 5/30/2025; ICE Unit 355 was not operated overnight between 5/28/2025 and 5/29/2025; ICE Units 355 and 408 were shut off early on 5/30/2025 in preparation for a weekend shutdown
Jun 2025	1,329.1	--	--	--	120.7	--	--	--	209.4	--	--	--	--	299.5	--	699.5	--	--	--	--	--	196,722.0	ICE Units 355 and 392 Engine 2 were restarted on 6/2/2025 after being off for the weekend; ICE Unit 392 Engine 1 and Unit 412 ran out of propane on 6/1/2025 and were off briefly until the tanks were refilled on 6/2/2025; ICE Unit 408 ran out of propane on 6/2/2025 and was off briefly until the tank was refilled; ICE Unit 392 Engine 2 shut off on 6/3/2025 due to high engine temperature and was run briefly on 6/5/2025 and 6/6/2025 ICE Unit 392 Engine 1 stalled on 6/8/2025 and was restarted on 6/9/2025; ICE Unit 392 Engine 2 was not operated this period due to significant oil leakage requiring heavy maintenance and will no longer be operated for the remainder of the project; ICE Unit 355 shut down on 6/10/2025 and 6/12/2025 due to a full condensate knockout tank; ICE Unit 412 was operated minimally between 6/9/2025 and 6/11/2025 due to repeatedly stalling; ICE Units 355 and 408 were shut down early on 6/13/2025 in preparation for a weekend shutdown ICE Units 355 and 408 were restarted on 6/16/2025 after being off for the weekend; ICE Unit 392 Engine 2 remained off and is no longer being operated ICE Unit 392 Engine 2 remained off and is no longer being operated; ICE Unit 355 shut down on 6/21/2025 due to a full condensate knockout drum and was restarted on 6/23/2025; ICE Unit 355 was shut off on 6/27/2025 and moved to EW-1; ICE Unit 412 ran out of propane on 6/27/2025 and was not restarted; ICE Unit 412 will be prepared for return to RSI
Jul 2025	618.5	578.8	--	--	--	--	--	--	0.8	--	--	--	--	--	--	38.9	--	--	--	--	--	197,340.5	ICE Unit 355 initiated another round of SVE at EW-1 on 6/27/2025; ICE Units 392 and 408 ran out of propane on 6/29/2025 and were not restarted; both units were prepared for return to RSI ICE Unit 355 ran out of propane on 7/20/2025 and was restarted on 7/21/2025; ICE Unit 355 drive belt broke on 7/21/2025 and was repaired and the unit restarted on 7/22/2025 ICE Unit 355 ran out of propane on 7/31/2025 and was not restarted; ICE Unit 355 was taken out of service and prepared for return to RSI

Table 2-1
UDEX Release LNAPL Recovery Totals - Additional Operational Notes
UDEX Release Cleanup Plan
Former PES Refinery
Bellwether District Holdings, LLC, Philadelphia, PA

NOTES:

1. LNAPL: Light Nonaqueous Phase Liquid

2. Remediation of the UDEX feed underground line release was initiated in September 2018 utilizing passive skimming. Three active skimming systems were installed in wells S-283, S-382, and S-429 in late October and early November 2018. Each skimming system has a dedicated holding tank. LNAPL passively skimmed and/or pumped prior to October 31, 2018, was placed in and accounted for in the holding tank for S-382 as this was the only tank at the time.
3. On 1/29/21, the S-429 well remediation equipment was removed and placed into well S-438. Well S-429 was switched to a bi-weekly manual pumping schedule. On 3/2/21, the S-438 LNAPL recovery system was shut down indefinitely due to low LNAPL recovery rates. The S-438 holding tank was taken offline after it was emptied on 3/11/21.
4. LNAPL is manually pumped from non-skimming wells as a part of Stantec's regular O&M activities. In general, approximately 15-30 gallons of LNAPL is recovered two times per week. LNAPL recovered from these wells is added to one of the system holding tanks, generally the tank with the greatest capacity at the time. As such, note that the weekly system totals presented in the table for any given tank may include added recovery pumped from other wells within the UDEX release area.

5. From 4/7/21 - 5/25/21, soil vapor extraction (SVE) was performed on well UDEX-EW-1 utilizing trailer-mounted internal combustion engines (ICE). Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

6. From 5/25/21 - 6/30/21, soil vapor extraction (SVE) was performed on well UDEX-EW-3 utilizing trailer-mounted internal combustion engines (ICE). Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

7. On 6/30/21, the ICE was relocated and SVE was initiated on well UDEX-EW-2. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

8. On 12/9/21, the ICE was moved back to well UDEX-EW-1. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

9. On 5/16/22, ICE Unit 417 was delivered and set up on well UDEX-EW-6. SVE was initiated on 5/17/22. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

10. On 5/13/22, ICE Unit 407 was moved to well UDEX-EW-19. SVE was initiated on 5/17/22. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

11. On 7/28/22, ICE Unit 407 was moved to well UDEX-EW-8 and SVE was initiated. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

12. On 8/10/22, ICE Unit 407 was moved to well UDEX-EW-10 and SVE was initiated. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

13. On 8/15/22, ICE Units 355 and 408 were delivered to the facility. SVE remediation was initiated with these single engine units at well UDEX-EW-14 on 8/17/22. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

14. On 10/12/22, ICE Unit 417 was moved to well UDEX-EW-7 and SVE was initiated. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
15. On 12/19/22, ICE Unit 417 was moved to well UDEX-EW-12 and SVE was initiated on 12/22/2022. Unit 419 replaced Unit 417 on 1/10/2023. Well EW-11 was connected to the engine unit on 2/13/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

16. On 12/19/22, ICE Unit 407 was moved to well UDEX-EW-13 and SVE was initiated on 12/21/2022. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
17. On 12/19/22, ICE Units 355/408 were moved to well UDEX-EW-1 and SVE was initiated on 12/21/2022. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
18. On 1/25/2023, ICE Unit 408 was moved to well UDEX-EW-23 and SVE was initiated on 1/26/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
19. On 4/19/2023, ICE Unit 355 was moved to well UDEX-EW-5 and SVE was initiated on 4/20/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
20. On 4/27/2023, ICE Unit 355 was moved to well UDEX-EW-4 and SVE was initiated. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
21. On 5/1/2023, ICE Unit 355 was moved back to well UDEX-EW-5 and SVE was continued. Moving forward, recovery at these wells will be tracked jointly. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
22. On 6/12/2023, ICE Unit 407 was moved to well UDEX-EW-15 and SVE was initiated on 6/14/2023. An additional well, UDEX-EW-17, was plumbed into the engine on 6/16/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
23. On 7/10/2023, ICE Unit 419 was moved to wells UDEX-EW-21 and UDEX-EW-22. SVE was initiated on 7/12/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
24. On 8/8/2023, ICE Unit 355 was moved to well UDEX-EW-3. SVE was initiated on 8/14/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
25. On 8/28/2023, ICE Unit 408 was moved to well UDEX-EW-10. SVE was initiated on 8/31/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
26. On 8/29/2023, ICE Unit 355 was moved to well UDEX-EW-11. SVE was initiated on 8/31/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
27. On 10/5/2023, ICE Unit 419 was moved to wells UDEX-EW-6 and UDEX-EW-7. SVE was initiated on 10/6/2023. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
28. On 12/20/2023, ICE Unit 392 replaced ICE Unit 419. On 1/3/2024, ICE Unit 392 was moved to well UDEX-EW-1. SVE was initiated on 1/4/2024. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
29. On 6/6/2024, ICE Unit 355 was moved to well UDEX-EW-14. SVE was initiated on 6/7/2024. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
30. On 7/19/2024, ICE Unit 407 was moved to wells UDEX-EW-5 and UDEX-EW-6. SVE was initiated on 7/22/2024. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
31. On 12/5/2024, ICE Unit 392 was moved to well UDEX-EW-15. SVE was initiated on 12/9/2024. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
32. On 2/10/2025, ICE Unit 355 was moved to well UDEX-EW-3 for an additional round of SVE. SVE was initiated on 2/12/2025. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
33. On 2/7/2025, ICE Unit 412 was moved to new well UDEX-EW-24. SVE was initiated on 2/10/2025. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
34. On 5/19/2025, ICE Unit 408 was moved to well UDEX-EW-7 for an additional round of SVE. SVE was initiated on 5/19/2025. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
35. On 5/20/2025, ICE Unit 355 was moved to well UDEX-EW-4 for an additional round of SVE. SVE was initiated on 5/20/2025. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.
36. On 6/27/2025, ICE Unit 355 was moved to well UDEX-EW-1 for a final round of SVE. SVE was initiated on 6/27/2025. Gallons of LNAPL recovered/combusted by the ICE are included as estimated utilizing a series of assumptions and conversions from engine performance metrics and assuming gasoline composition. Cumulative recovery is reported for the indicated date through approximately 1700 hours EST.

Table 2-2. Qualitative Remedy Evaluation Table
Former PES Refinery - UDEX Release
Philadelphia, PA
November 2018

Alternative Remedial Options	Rating	Evaluation Criteria Categories: Remedial Objective Success – Technical Practicability: Technology	Source Remediation	Dissolved Phase Plume	Vapor Intrusion	Sustainability: Waste Generation	Strategic: Remedial Strategy	Miscellaneous: Implementability	Financial: Remedial Time Frame	Capital Cost	O&M Cost
Active LNAPL Skimming (Expand Interim System)	2	**Pneumatic Skimmer Pumps** Direct removal of LNAPL via active skimming using pneumatic skimmer pumps. The pumps collect LNAPL via hydrophobic filter or a specific gravity float.	Medium likelihood of technical success. Active skimming will recover LNAPL to residual levels. Based on volume of LNAPL in subsurface and LNAPL recovery rates, this is a long term remedy.	Active LNAPL skimming is ineffectual on dissolved phase constituents. LNAPL removal will reduce, by the reduction of VOC mass, but not eliminate partitioning of LNAPL to dissolved phase VOCs.	This technology is ineffectual on capturing and/or controlling vapors.	The waste stream will consist of LNAPL with traces of impacted groundwater. Vapors from the LNAPL recovery tank will require treatment prior to discharge	Tier one of a two tier strategy. Tier one designed to mitigate LNAPL only. Technology will effectively reduce LNAPL mass at the source and within the plume. Residual LNAPL and dissolved phase COCs will be addressed via alternative technology (sparge, biosparge, enhanced bioremediation for example) if required.	Technology will require the installation of infrastructure including additional recovery wells, trenching, subgrade/overhead piping. Installation may be disruptive to facility operations. A designated treatment compound will be required to stage/house system. LNAPL AST vapors from vents will require treatment (GAC).	3 to 8 years. Duration will be dependent on system up time, volume of LNAPL present in subsurface, LNAPL transmissivity and end point.	Procurement of equipment and system installation will incur relatively high initial capital costs. Costs may be reduced by using facility resources (compressed air, LNAPL recovery tank, etc.). Installation costs include the installation of EXP components, fittings, and conduit.	Moderate O&M effort is required to maintain system up-time which is necessary to maintain system efficiency. Less complicated technology than MPE and, therefore, will require less maintenance. Disposal costs (LNAPL) will affect O&M costs.
		Pneumatic Double Diaphragm and/or Peristaltic Pumps Direct removal of LNAPL via active skimming using pneumatic double diaphragm and/or peristaltic pumps. The pumps collect LNAPL via down hole hydrophobic filter or a specific gravity float.	Medium likelihood of technical success. Active skimming will recover LNAPL to residual levels. Based on volume of LNAPL in subsurface and LNAPL recovery rates, this is a long term remedy.	Active LNAPL skimming is ineffectual on dissolved phase constituents. LNAPL removal will reduce, by the reduction of VOC mass, but not eliminate partitioning of LNAPL to dissolved phase VOCs.	This technology is ineffectual on capturing and/or controlling vapors.	The waste stream will consist of LNAPL with traces of impacted groundwater. Vapors from the LNAPL recovery tank will require treatment prior to discharge	Tier one of a two tier strategy. Tier one designed to mitigate LNAPL only. Technology will effectively reduce LNAPL mass at the source and within the plume. Residual LNAPL and dissolved phase COCs will be addressed via alternative technology (sparge, biosparge, enhanced bioremediation for example) if required.	Technology will require the installation of infrastructure including additional recovery wells, trenching, subgrade/overhead piping. Installation may be disruptive to facility operations. A designated treatment compound will be required to stage/house system. LNAPL AST vapors from vents will require treatment (GAC).	3 to 8 years. Duration will be dependent on system up time, volume of LNAPL present in subsurface, LNAPL transmissivity and end point.	Procurement of equipment and system installation will incur relatively high initial capital costs. Costs may be reduced by using facility resources (compressed air, LNAPL recovery tank, etc.). Installation costs include the installation of EXP components, fittings, and conduit.	Moderate O&M effort is required to maintain system up-time which is necessary to maintain system efficiency. Less complicated technology than MPE and, therefore, will require less maintenance. Disposal costs (LNAPL) will affect O&M costs.
Soil Vapor Extraction (SVE)	1	**Positive Displacement Blower** Direct removal of LNAPL via soil vapor extraction. A vacuum will be applied to purposely designed SVE wells using a high vacuum/high flow positive displacement blower. Vacuum produces a negative pressure gradient that will draw LNAPL to the extraction wells. Due to high volatility of reformate, the LNAPL under vacuum will be transferred to vapor phase and extracted from the subsurface.	High likelihood of technical success. Removal of LNAPL in vapor (SVE) form is highly efficient. Will require additional remedial technologies to reach dissolved phase ROs. Medium term remedial remedy.	SVE is ineffectual on dissolved phase constituents. However, removing VOC mass will significantly reduce LNAPL partitioning to dissolved phase.	High likelihood of success. Vacuum extraction will provide sub-slab negative pressure mitigating the potential for migration of vapors into the warehouse.	High vapor concentrations will require air permit or air permit modification and off gas treatment via CatOx or ThermOx.	Significantly reduces LNAPL mass at the source and within the plume. Vapor extraction will increase mass removal of LNAPL and soil vapor and provide sub slab negative pressure to address potential vapor intrusion into warehouse.	Technology will require the installation of infrastructure including extraction wells, trenching, subgrade/overhead piping. Installation may be disruptive to facility operations. A designated treatment compound will be required to stage/house system. Blower effluent will require treatment via CatOx or ThermOx. GAC inefficient due to high VOC concentrations of effluent vapor stream.	2 to 4 years. Duration will be dependent on system up time, volume of LNAPL and end point. Duration will also be dependent on the catox/thermox destruction efficiency of the vapor stream.	Procurement of equipment and system installation will incur relatively high initial capital costs. Installation costs include the installation of EXP components, fittings, and conduit.	Moderate to high O&M effort is required to maintain system up-time which is necessary to maintain system efficiency. Maintaining catox/thermox can be labor intensive.
		Internal Combusion Engine(s) (ICE) Direct removal of LNAPL via soil vapor extraction. A vacuum will be applied to purposely designed SVE wells using internal combustion engines (ICE). The ICE produces a negative pressure gradient that will draw LNAPL to the extraction wells. Due to high volatility of reformate, the LNAPL under vacuum will be transferred to vapor phase and extracted from the subsurface. The ICE has the added advantage of utilizing the extracted vapors as fuel making off-gas treatment of the extracted vapors not necessary.	High likelihood of technical success. Removal of LNAPL in vapor (SVE) form is highly efficient. Will require additional remedial technologies to reach dissolved phase ROs. Medium term remedial remedy.	SVE is ineffectual on dissolved phase constituents. However, removing VOC mass will significantly reduce LNAPL partitioning to dissolved phase.	High likelihood of success. Vacuum extraction will provide sub-slab negative pressure mitigating the potential for migration of vapors into the warehouse.	High vapor concentrations will require air permit or air permit modification and off gas treatment will be accomplished via the ICE.	Significantly reduces LNAPL mass at the source and within the plume. Vapor extraction will increase mass removal of LNAPL and soil vapor and provide sub slab negative pressure to address potential vapor intrusion into warehouse.	Technology will require the installation of infrastructure including extraction wells, trenching, subgrade/overhead piping. Installation may be disruptive to facility operations. A designated treatment compound will be required to stage/house system. Extracted vapors could be used by ICE unit as fuel. Additional treatment is not necessary.	2 to 4 years. Duration will be dependent on system up time, volume of LNAPL and end point.	Procurement of equipment and system installation will incur relatively high initial capital costs. Installation costs include the installation of EXP components, fittings, and conduit. Capital costs may be reduced with leasing of the ICE unit.	Moderate to high O&M effort is required to maintain system up-time which is necessary to maintain system efficiency. The ICE option will be more efficient by eliminating downtime due to catox/thermox maintenance issues.
Multi-Phase Extraction (MPE)	3	Direct removal of LNAPL, groundwater, and soil vapor from subsurface by using a high volume, high vacuum pump. The pump will be manifolded to extraction wells. Vacuum will create pressure gradient which will enhance LNAPL flow to well increasing extraction rate. Groundwater extraction will create hydraulic gradient which will control petroleum mass migration.	High likelihood of technical success. Removal of LNAPL to residual only. Long/Medium term remedial remedy. Vapor phase treatment dependent on destruction efficiency of catox/thermox unit.	MPE is ineffectual on dissolved phase constituents. LNAPL removal will reduce, by the reduction of VOC mass, but not eliminate partitioning of LNAPL to dissolved phase VOCs. Hydraulic control of dissolved phase plume will be achieved via groundwater extraction.	High likelihood of success. Vacuum extraction will provide sub-slab negative pressure mitigating the migration of vapors into warehouse.	MPE produces three waste streams; LNAPL, impacted groundwater, and vapor effluent. LNAPL will be removed and collected using a OWS. Treated groundwater will be discharged to on site waste water treatment system. Vapor phase will be treated using catox/thermox.	MPE technology will significantly reduce LNAPL mass and effectively address vapor intrusion while operating. Post shut down, remaining infrastructure may be utilized for sub-slab depressurization. Will not address dissolved phase concentrations, but will hydraulically contain dissolved phase plume.	Technology will require extensive infrastructure including numerous extraction wells, some trenching and the installation of sub grade process piping to prevent freezing. A designated treatment compound will be required to stage equipment. Contemplating mobile system design to limit trenching/ground disturbance.	2 to 6 years. Duration will be dependent on system up time, volume of LNAPL and end point. Duration will also be dependent on the catox/thermox destruction efficiency of the vapor stream.	Procurement of equipment and system installation will incur relatively high initial capital costs.	Significant O&M effort is required to maintain system up-time which is necessary to ensure constant hydraulic control, consistent subsurface vacuum, maximize thermal destruction of vapor stream, and maximize LNAPL recovery. Due to extraction of groundwater, iron/mineral fouling of manifold, valves, blower, recovery wells, etc. is anticipated. Maintaining catox/thermox can be labor intensive.
Dual-Phase Extraction (DPE)	4	Direct removal of LNAPL and groundwater from subsurface using top loading pneumatic pumps. Removal of groundwater will depress water table reducing hydrostatic pressure allowing submerged LNAPL to more easily flow towards extraction well increasing recovery. Groundwater extraction will create hydraulic gradient which will control petroleum mass migration.	Medium likelihood of technical success. Removal of LNAPL to residual only. Long term remedy.	DPE is ineffectual on dissolved phase constituents. LNAPL removal will reduce, by the reduction of VOC mass, but not eliminate partitioning of LNAPL to dissolved phase VOCs.	This technology is ineffectual on controlling petroleum vapors.	DPE produces two waste streams; LNAPL and impacted groundwater. LNAPL will be removed and collected using a OWS. Treated groundwater will be discharged to on site waste water treatment system.	Technology designed to mitigate LNAPL only. Technology will effectively reduce LNAPL mass at the source and within the plume. Residual LNAPL and dissolved phase COCs will be addressed via alternative technology (sparge, biosparge, enhanced bioremediation for example) if required.	Technology will require the installation of infrastructure including additional recovery wells, trenching, subgrade piping. Installation may be disruptive to facility operations. A designated treatment compound will be required to stage/house system. LNAPL AST vapors from vents will require treatment (GAC).	3 to 8 years. Duration will be dependent on system up time, volume of LNAPL present in subsurface, LNAPL transmissivity and end point.	Procurement of equipment and system installation will incur relatively high initial capital costs. Costs may be reduced by using facility resources (compressed air, LNAPL recovery tank, etc.). Installation costs include the installation of EXP components, fittings, and conduit.	Significant O&M effort is required to maintain system up-time which is necessary to ensure constant hydraulic control and LNAPL/groundwater recovery. Due to extraction of groundwater, iron/mineral fouling of manifold, valves, blower, recovery wells, etc. is anticipated.

Table 4-1
Post Remediation Care Monitoring Well List
UDEX Release Cleanup Plan
Bellwether District Holdings, LLC, Philadelphia, PA

Well_ID	Former Well ID or Boring ID	Well Type	Status	Easting	Northing	Hydrostratigraphic Unit	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Completion Depth	Well Diameter	Top of Inner Casing Elevation	Ground Surface Elevation	Top of Screen Elevation	Bottom of Screen Elevation	Depth to Screen	Screen Length
BF-103R2	BF-103R	MW		2682500.323	219951.288	unconfined	Y	Y	11/20/2025	18	2	16.64	12.70	4.70	-5.30	8	10
S-430	MIHPT-10	MW		2682288.19	220761.2598	unconfined	N	Y	9/27/2018	17	2	13.09	9.90	2.90	-7.10	7	10
S-431	MIHPT-11	MW		2682232.3	220624.4799	unconfined	N	Y	9/27/2018	18	2	17.52	14.00	6.00	-4.00	8	10
S-433R	S-433	MW		2682199.28	220003.1	unconfined	Y	Y	11/20/2025	25	2	15.24	11.60	1.60	-13.40	10	15
S-439R	S-439	MW		2682515.999	220593.862	unconfined	Y	Y	11/18/2025	26	2	20.92	17.60	6.60	-8.40	11	15
S-479	CD-01	MW		2682150.12	220478.56	unconfined	Y	Y	12/21/2021	22	1.5	15.51	15.80	3.80	-6.20	12	10
S-481R	S-481	MW		2682194.161	220283.325	unconfined	Y	Y	11/18/2025	25	2	20.19	16.30	6.30	-8.70	10	15
S-482R	S-482	MW		2682310.863	220635.01	unconfined	Y	Y	11/21/2025	27	2	23.79	20.20	8.20	-6.80	12	15
S-484R	S-484	MW		2682323.929	220463.264	unconfined	Y	Y	11/18/2025	26	2	21.21	17.60	6.60	-8.40	11	15
S-485R	S-485	MW		2682448.576	220231.754	unconfined	Y	Y	11/20/2025	25	2	17.20	13.70	3.70	-11.30	10	15
S-508R	S-508	MW		2682315.664	220459.558	lower aquifer	Y	Y	11/19/2025	75	2	21.16	17.40	-42.60	-57.60	60	15
S-521		MW		2682345.142	220880.031	unconfined	Y	Y	11/24/2025	19	2	13.47	9.78	2.78	-9.22	7	12

Notes:
Coordinate pairs are projected in the Pennsylvania State Plane Coordinate System (feet), referenced to the North American Vertical Datum of 1988 (NAVD88).
The hydrostratigraphic unit denotes the aquifer and/or mappable water-bearing stratum in which the well is interpreted to be screened by Stantec.
-- = parameter not available
MW = monitoring well
ft bgs = feet below ground surface
in = inches
ft = feet
Y = Yes; N = No

Appendix A Notice of Intent to Remediate Documentation

Stantec Consulting Services Inc.
1060 Andrew Drive, Suite 140
West Chester PA 19380-5602

June 4, 2025

C. David Brown, Ph. D., PG
Department of Environmental Protection
Southeast Regional Office
2 East Main Street
Norristown, PA 19401

Dear Mr. Brown,

Reference: Revised Notice of Intent to Remediate
UDEX Release Area – Point Breeze South Yard
Former PES Refinery
3144 West Passyunk Avenue
Philadelphia, PA 19153

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed is a revised Notice of Intent to Remediate (NIR) for the UDEX release area at the former Philadelphia Energy Solutions Refinery Point Breeze South Yard (site). The original NIR for the site was submitted in March 2022. The purpose of this revised NIR is to change the selected remediation standard for contamination in soil and groundwater to the site-specific standard for the UDEX release site.

Please call me at (610) 850-1420 if you have any questions or comments.

Sincerely,

Stantec Consulting Services Inc.

Andrew Klingbeil PG
Associate Geologist
Phone: (610) 840-2525
Mobile: (610) 850-1420
andrew.klingbeil@stantec.com

cc: Joseph Jeray, HRP Group

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL CLEANUP AND BROWNFIELDS

NOTICE OF INTENT TO REMEDIATE

For DEP Use Only
PF # _____
Rem ID # _____

Date: 6/4/2025 NIR Status: ☐ New ☒ Revised

Act 1995-2 requires four general information items to be included in the NIR: the general location, listing of contaminants, intended use of property, and proposed remediation measures. In addition, indicate the standard(s) to be obtained and attach a scaled site map (if available). Certain project amendments or changes will require submission of a revised NIR, a new public notice, and a new notification to the municipality. Changes to information marked by (**) or (††) indicate when a new NIR and new public and municipal notices are needed. DEP should also be notified of any significant changes to the initial NIR submission, including the change of future use of the property, contaminants added or removed, change of standards from site-specific to background or Statewide health, any change in the media being investigated, or change of any contact information.

Property Name UDEX Release Area - Point Breeze South Yard

Former Name(s)/AKA Former Philadelphia Energy Solutions Refinery

Address/Location 3144 West Passyunk Avenue

City Philadelphia Zip Code 19153

**Municipality(s) Philadelphia County(ies) Philadelphia County

Tax Parcel ID# (if known) _____

Latitude 39 º (deg). 54 ‘ (min) 36 “ (sec)

Longitude 75 º (deg). 12 ‘ (min) 18 “ (sec)

Horizontal Collection Method GIS

Horizontal Reference Datum NAD83 Reference Point see Figure 1 attached

☐ **Wish to participate in the DEP/EPA One Cleanup Program.

Contact the Land Recycling Program Manager for details at landrecycling@pa.gov.

EPA ID#, if known _____

DEP ID#(s), if known 51-33620

(i.e., eFACTs primary facility ID#, storage tank facility ID#, water quality permit #, etc.)

Date Release Occurred (if known) July 2018

Date each municipality was notified of any plan or report submitted under any remediation standard

_____

Place the newspaper name and date that your notice of your plan/report submission was published

_____

** A change in municipality, the addition of a new municipality, or deciding to participate in the DEP/EPA One Cleanup Program requires a new NIR to be submitted with new public and municipal notifications.

Contamination, Land Usage, and Proposed Remediation Section

Provide a brief description of the site contamination, to the extent known, in plain language (e.g., fuel oil spill, historical chemical industrial area, etc.), the current and intended future use of the property in the box below.

In late July 2018, Bellwether District Holdings, LLC (BDH) (formerly known as Philadelphia Energy Solutions Refining and Marketing, LLC [PESRM]) identified a leak from an underground portion of a product line that conveys reformate (a gasoline blending stock used as feed for the UDEX unit). The line was emptied, isolated, bypassed and replaced with a new aboveground line constructed in the same location as the underground line. The future use of the property is expected to be non-residential.

Provide a general description of proposed remediation measures.

Multiple rounds of subsurface investigation have been conducted to characterize the nature and extent of the release. Additionally, at the time of this revised NIR, over 286,000 gallons of product have been recovered from the subsurface through a combination of remediation technologies including skimming, soil vapor extraction (SVE), and air sparging (AS). Full-scale SVE/AS system operations are expected to continue active cleanup through June 2025.

Standards Selection Section

Check all the boxes that apply for the appropriate contaminant groups according to the standard(s) and media of the remediation to be performed.

NOTE: Either the site-specific standard or a special industrial area requires a 30-day public and municipal comment period.

Contaminant Groups	Background		Statewide Health–Residential		Statewide Health–Non-Residential		††Site-Specific Standard		††Special Industrial Area	
	Soil	GW	Soil	GW	Soil	GW	Soil	GW	Soil	GW
Aviation Gasoline	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Diesel Fuel	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Oil No. 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Oil No. 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Oil No. 4	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Oil No. 5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Oil No. 6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kerosene	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jet Fuel	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Leaded Gasoline	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
New Motor Oil	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Unleaded Gasoline	☐	☐	☐	☐	☐	☐	☒	☒	☐	☐
Used Motor Oil	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Chlorinated Solvents	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inorganics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lead	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
MTBE	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other Organics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
PAHs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
PCBs	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pesticides	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
PFAS	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

GW: groundwater

†† Changing the selected standard from either background or Statewide health to the site-specific standard, changing to a combination of standards that includes the site-specific standard, or choosing the special industrial area designation requires a new NIR submission with new public and municipal notifications.

Please list individual contaminants here, by environmental medium and cleanup standard (optional):

benzene (groundwater and soil) (Site Specific Standard)

toluene (groundwater and soil) (Site Specific Standard)

Property Owner, Remediator/Participant, and Consultant
Complete the form below for each recipient obtaining a release of liability upon approval of the final report. Attach additional sheets as necessary.

Property Owner

Contact Person/Title Anne Garr / Assistant Secretary

eFACTs Client ID(If Known) Facility No. 51-33620

Phone Number (312) 283-4469

Email Address agarr@hilcoglobal.com

Company Name Bellwether District Holdings, LLC

EIN or Federal ID #

Address (street, city, state, zip) 3144 West Passyunk Ave, Philadelphia, PA 19145

Client Type (choose from list below) Pennsylvania Corporation

Client Types:

Association/Organization		
Authority	Limited Liability Partnership	Partnership-General
County	Municipality	Partnership-Limited
Estate/Trust	Non-Pennsylvania	Pennsylvania Corporation
Federal Agency	Government	School District
Individual	Other (Government)	Sole Proprietorship
Limited Liability company	Other (Non-Government)	State Agency

Consultant

Contact Person/Title Andrew Klingbeil

Email Address andrew.klingbeil@stantec.com

Phone Number (610) 850-1420

Company Name Stantec Consulting Services, Inc.

Address (street, city, state, zip) 1060 Andrew Dr, Suite 140, West Chester, PA, 19380

Other Participant (Remediator)

Contact Person/Title Anne Garr / Assistant Secretary

Relationship to Site Owner
(e.g. remediator, participant in cleanup if other than owner, etc.)

Phone Number (312) 283-4469

Email Address agarr@hilcoglobal.com

Company Name Bellwether District Holdings, LLC

EIN or Federal ID #

Address (street, city, state, zip) 3144 West Passyunk Ave, Philadelphia, PA 19145

Preparer of Notice of Intent to Remediate

Name Andrew Klingbeil

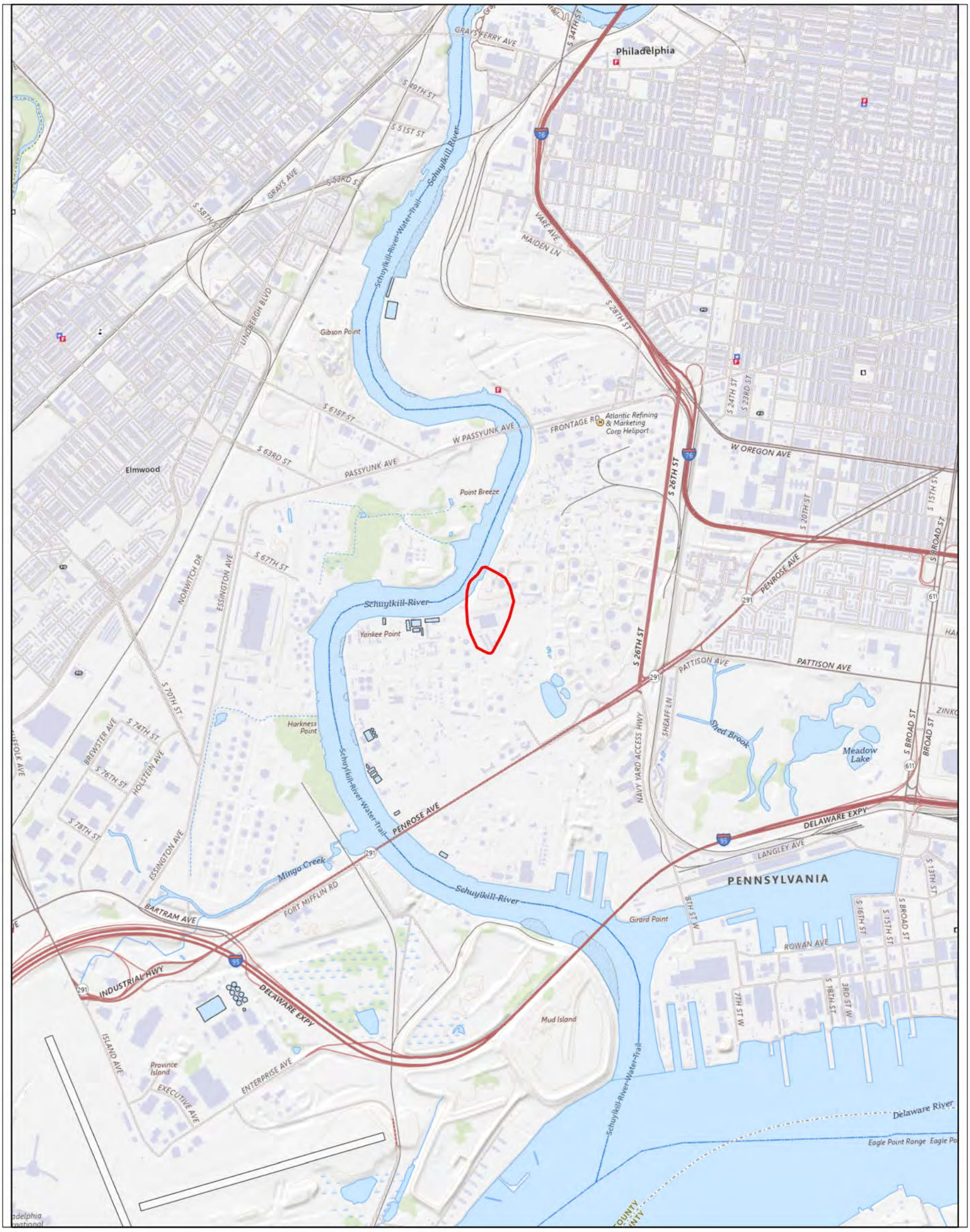
Title Associate Geologist

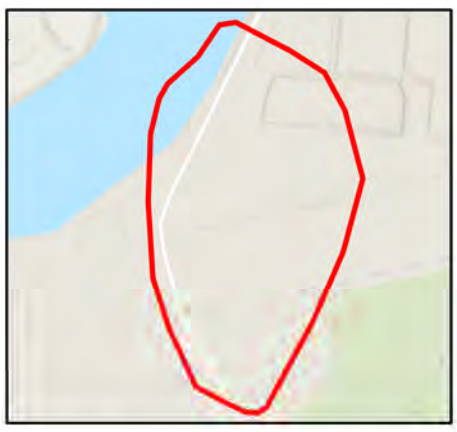
Phone Number (610) 850-1420

Email Address andrew.klingbeil@stantec.com

Company Name Stantec Consulting Services, Inc.

Address (street, city, state, zip) 1060 Andrew Dr, Suite 140, West Chester, PA, 19380





Notes
1. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
2. Coordinate System: NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
3. Source: Stantec
4. Service Layer Credits: ESRI, USGS National Map

Legend

UDEX Release Location

0 500 1,000 Feet

(At original document size of 11x17)
1:1,000

N

Stantec

PHILADELPHIA ENERGY SOLUTIONS

Project Location City of Philadelphia, Philadelphia County, PA	Prepared by ADK on 2024-04-14 TR by JK IR by GC
Client/Project PHILADELPHIA ENERGY SOLUTIONS REFINING & MARKETING LLC FORMER PES REFINERY 3144 PASSYUNK AVENUE, PHILADELPHIA, PA 19145	195603450
Figure No. **1**	
Title **PESRM UDEX RELEASE NOTICE OF INTENT TO REMEDIATE REFERENCE POINT**	

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

C:\Users\aklingbeil\OneDrive - Stantec\Work Files\Projects\figure\fig_pesrm_udex_nir_rev_20240414.aprx Revised: 2025-05-21 By: aklingbeil

Stantec Consulting Services Inc.
1060 Andrew Drive, Suite 140
West Chester PA 19380-5602

June 4, 2025

Leigh Anne Rainford, MPH
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue - 2nd Floor
Philadelphia, PA 19104

Dear Ms. Rainford,

Reference: Revised Notice of Intent to Remediate
UDEX Release Area – Point Breeze South Yard
Former PES Refinery
3144 West Passyunk Avenue
Philadelphia, PA 19153

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) a site be provided to the municipality in which the site is located. On behalf of Bellwether District Holdings, LLC (BDH), this notification is to inform the City of Philadelphia of the submission of a revision to the previously submitted NIR for this project. The purpose of the revised NIR is to change the selected remediation standard from the Statewide Health Standard to the Site-Specific Standard for the UDEX Release area. A copy of the revised NIR (enclosed) will be sent to the Pennsylvania Department of Environmental Protection (PADEP) and published in the Pennsylvania Bulletin.

Please call me at (610) 850-1420 if you have any questions concerning the proposed remediation.

Sincerely,

Stantec Consulting Services Inc.

Andrew Klingbeil PG
Associate Geologist
Phone: (610) 840-2525
Mobile: (610) 850-1420
andrew.klingbeil@stantec.com

cc: C. David Brown, PADEP
Joseph Jeray, HRP Group

The Philadelphia Inquirer
100 S. INDEPENDENCE MALL W, STE 600, PHILADELPHIA, PA 19106

Affidavit of Publication

On Behalf of:
STANTEC
1060 Andrew Drive
WEST CHESTER, PA 19380

STATE OF PENNSYLVANIA COUNTY OF PHILADELPHIA:

Before the undersigned authority personally appeared the undersigned who, on oath represented a and say: that I am an employee of The Philadelphia Inquirer, LLC, and am authorized to make this affidavit of publication, and being duly sworn, I depose and say:

1. The Philadelphia Inquirer, LLC is the publisher of the Philadelphia Daily News, with its headquarters at 100 S. Independence Mall West, Suite 600, Philadelphia, PA 19106.
2. The Philadelphia Daily News is an edition of The Philadelphia Inquirer. The Philadelphia Daily News is continuously published and distributed Sunday-Friday in the City of Philadelphia, count and state aforesaid.
3. The printed notice or publication attached hereto set forth on attached
hereto was published in all regular print editions of the Philadelphia Daily News on

Legal Notices

as published in **Daily News Legals** in the issue(s) of:

6/4/2025

4. Under oath, I state that the following is true and correct, and that neither I nor The Philadelphia Inquirer, LLC have any is interest in the subject matter of the aforesaid notice or advertisement.

Helene Sweeney

Nancy S. Fisher

Notary Public

My Commission Expires:

Commonwealth of Pennsylvania - Notary Seal
Nancy S Fisher, Notary Public
Philadelphia County
My Commission Expires June 27, 2027
Commission Number 1433937

Ad No: 188203
Customer No: 103409

COPY OF ADVERTISEMENT

Notice of an Intent to Remediate
to an Environmental Standard.
(Sections 302(e)(1)(ii), 303(h)(1)(ii),
304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act, the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Bellwether District Holdings, LLC (BDH) (formerly known as Philadelphia Energy Solutions Refining and Marketing LLC) will submit to the Pennsylvania Department of Environmental Protection a revised Notice of Intent to Remediate a site located at 3144 West Passyunk Avenue, Philadelphia, PA. This revised Notice of Intent to Remediate states that the site is the Former Philadelphia Energy Solutions Refinery. The site has been found to be contaminated with petroleum released from an underground portion of a product line that conveyed reformate (a gasoline blending stock used as feed from an UDEX unit). BDH has revised a previously submitted Notice of Intent to Remediate this release to select the site-specific standard for cleanup. BDH has been remediating this release since 2018 through a combination of technologies including separate phase petroleum recovery, soil vapor extraction (SVE), and air sparging (AS). The proposed future use of the property will be non-residential for commercial/industrial use.

The Act provides for a 30-day public comment period for site-specific standard remediations. The 30-day comment period is initiated with the publication of this notice. Until July 4, 2025, the City of Philadelphia may submit a request to BDH to develop and implement a public involvement plan involving the municipality in the development of the remediation and reuse plans for the site. Copies of these requests and of any comments should also be submitted to C. David Brown at the Pennsylvania Department of Environmental Protection Southeast Regional Office located at 2 East Main Street, Norristown, PA.

From: FedEx Tracking
To: Klingbeil, Andrew
Subject: Your shipment was delivered 881774480141
Date: Thursday, June 5, 2025 9:05:06 AM

Your shipment was delivered.

Delivery Date

Thu, 06/05/2025
9:01am

Delivered to

7801 ESSINGTON AVE, 19153, PA 19153

Received by

H.River

Report missing package

How was your delivery?

Tracking details

Tracking ID	881774480141
From	Stantec Consulting Corporation 1060 ANDREW DR STE 140 WEST CHESTER, PA, US 19380

To	Phila. Dept. of Public Health 7801 Essington Avenue 19153, PA, US 19153
Ship date	Wed 6/04/2025 05:01 PM
Number of pieces	1
Total shipment weight	1.00 LB
Service	FedEx Standard Overnight®
Reference	195603450.202
Shipper reference	195603450.202

TRACK SHIPMENT

FedEx

Plan like a pro

Got gifts for moms, dads, or grads? Drop them off at one of thousands of convenient retail locations, including FedEx Office, FedEx Ship Centers, Walgreens, and more. See our shipping options and packing tips here.

FIND LOCATIONS

Please do not respond to this message. This email was sent from an unattended mailbox. This report was generated at approximately 8:04 AM CDT 06/05/2025.

All weights are estimated.

To track the latest status of your shipment, click on the tracking number above.

Standard transit is the date and time the package is scheduled to be delivered by, based on the selected service, destination and ship date. Limitations and exceptions may apply. Please see the FedEx Service Guide for terms and conditions of service, including the FedEx Money-Back Guarantee, or contact your FedEx Customer Support representative.

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2610-FM-BECB0010 6/2014

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL CLEANUP AND BROWNFIELDS

For DEP Use Only
PF #_____
Rem ID #_____

NOTICE OF INTENT TO REMEDIATE

Act 1995-2 requires four general information items to be included in the NIR: the general location, listing of contaminants, intended use of property, and proposed remediation measures. In addition, indicate the standard(s) to be obtained (if known) and attach a scaled site map (if available).

Property Name UDEX Release Area – Point Breeze South Yard

Former Name(s) / AKA Former Philadelphia Energy Solutions Refinery

Address / Location 3144 Passyunk Avenue

City Philadelphia Zip Code 19153

Municipality(s) Philadelphia County(ies) Philadelphia County

Latitude 39 º (deg). 54 ‘ (min) 36 “ (sec) Longitude 75 º (deg). 12 ‘ (min) 18 “ (sec)

Horizontal Collection Method GIS

Horizontal Reference Datum NAD83 Reference Point see Figure 1 attached

☐ Wish to participate in the DEP/EPA MOA. Contact the Land Recycling Program Manager at landrecycling@pa.gov for details.

EPA ID#, if known

DEP ID#(s), if known 51-33620
(i.e., eFACTS site ID#, storage tank facility ID#, water quality permit #, watershed permit, air quality permit #, etc.)

Date Release Occurred (if known) July 2018

Provide a brief description of the site contamination in plain language (e.g. fuel oil spill, historical chemical industrial area contamination), the names of any know primary contaminants to be addressed, and the intended future use of the property.

In late July 2018, PESRM identified a leak from an underground portion of a product line that conveys reformate (a gasoline blending stock used as feed for the UDEX unit). The line was emptied, isolated, bypassed and replaced with a new aboveground line constructed in the same location as the underground line. The future use of the property is expected to be non-residential.

Provide a general description of proposed remediation measures.

Multiple rounds of subsurface investigation have been conducted to characterize the nature and extent of the release. Additionally, over 96,000 gallons of free product was recovered from the subsurface by skimmer pumps operated at three recovery wells between September 2018 and November 2021, and over 24,000 gallons of free product was converted to vapor, extracted, and combusted during a pilot test of soil vapor extraction (SVE) technology between April 2021 and January 2022. A full-scale SVE system is being designed and is expected to begin operation in 2Q 2022.

Remediation Standard(s) planned (if known at this time):

☐ Unknown at this time	☐ Soil	☐ Groundwater
☐ Background Contaminants:	☐ Soil	☐ Groundwater
☐ Statewide Health - Residential Contaminants:	☐ Soil	☐ Groundwater
☒ Statewide Health – Non-Residential Contaminants: petroleum constituents	☒ Soil	☒ Groundwater
☐ Site Specific Contaminants:	☐ Soil	☐ Groundwater
☐ Special Industrial Area* Contaminants:	☐ Soil	☐ Groundwater

*NOTE: Specific standard or Special Industrial Area require a 30-day municipal comment period

Remediator / Property Owner / Consultant. Complete the form below for ***each*** recipient obtaining a release of liability upon approval of the final report. Attach additional sheets as necessary.

Remediator

Contact Person/Title Anne Garr / Assistant Secretary — eFACTS Client ID* Facility No. 51-33620

Relationship to Site Owner — Client Type* LLC
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (312) 283-4469 — Email Address agarr@hilcoglobal.com

Company Name Philadelphia Energy Solutions Refining and Marketing LLC — EIN or Federal ID #

Address (street, city, state, zip) 111 S Wacker Dr, Suite 3000, Chicago, IL, 60606

Property Owner

Contact Person/Title Anne Garr / Assistant Secretary — eFACTS Client ID* Facility No. 51-33620

Relationship to Site Owner — Client Type* LLC
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (312) 283-4469 — Email Address agarr@hilcoglobal.com

Company Name Philadelphia Energy Solutions Refining and Marketing LLC — EIN or Federal ID #

Address (street, city, state, zip) 111 S Wacker Dr, Suite 3000, Chicago, IL, 60606

Consultant

Contact Person/Title Kevin Long / Principal Consultant — eFACTS Client ID*

Relationship to Site Consultant — Client Type* Corporation
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number 609-236-8171, ext 93 — Email Address kevin.long@terraphase.com

Company Name Terraphase Engineering Inc. — EIN or Federal ID # 27-3543127

Address (street, city, state, zip) 100 Canal Pointe Blvd, Suite 108, Princeton, NJ 08540

*Include eFACTS Client ID (if known) – "Client Types" below:

Association/Organization	Limited Liability company	Partnership-General
Authority	Limited Liability Partnership	Partnership-Limited
County	Municipality	School District
Estate/Trust	Non-Pennsylvania Government	Sole Proprietorship
Federal Agency	Other (Non-Government)	State Agency
Individual	Pennsylvania Corporation	

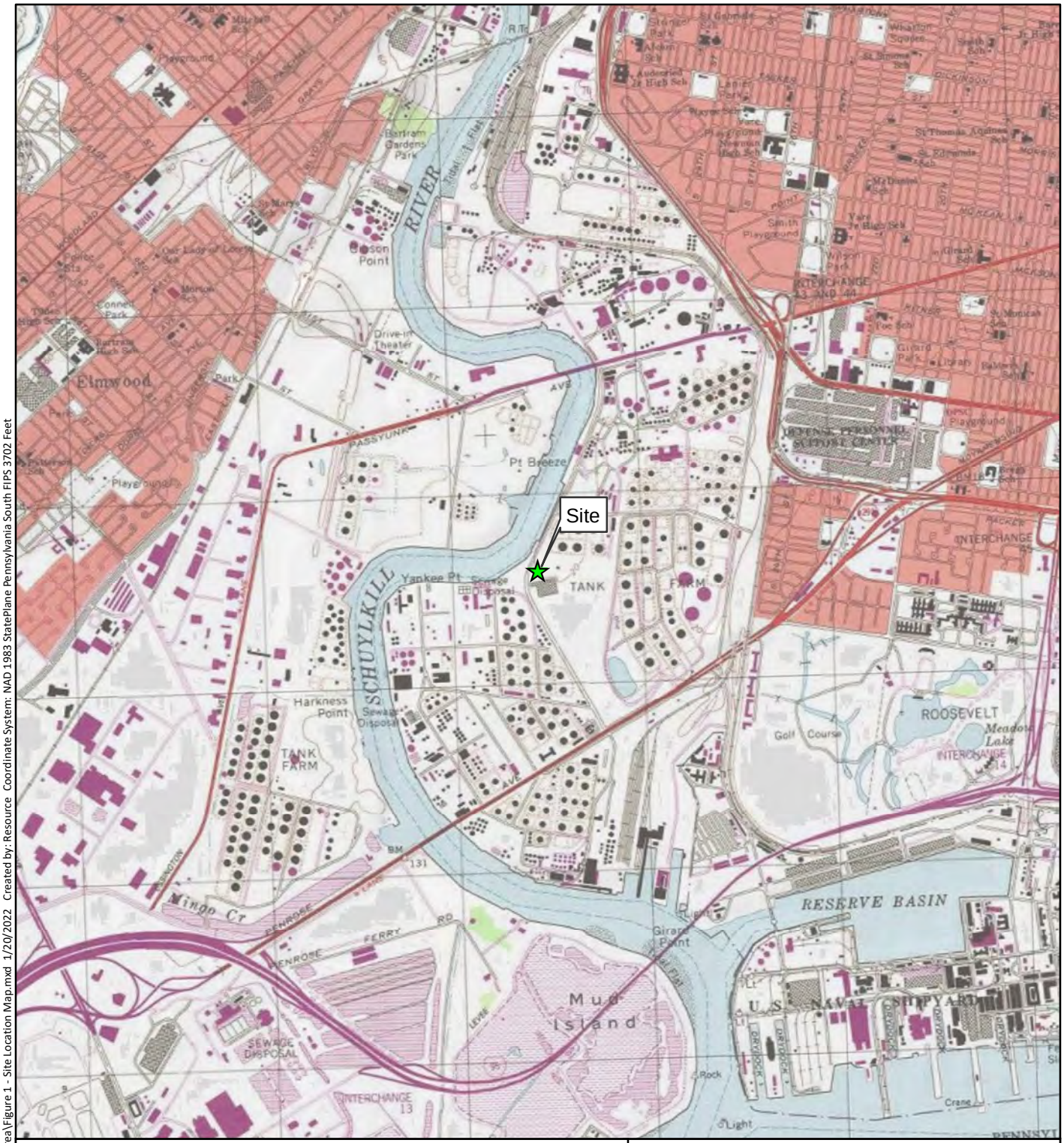
Preparer of Notice of Intent to Remediate

Name Kevin Long / Principal Consultant — Title Principal Consultant

Phone Number 609-236-8171, ext 93 — Email Address kevin.long@terraphase.com

Company Name Terraphase Engineering Inc. — eFACTS Client ID

Address (street, city, state, zip) 100 Canal Pointe Blvd, Suite 108, Princeton, NJ 08540



0 2,500 5,000 Feet

1 inch = 2,500 feet

N

Legend

Site Location

Base Map: USGS Philadelphia (1995) 7.5 Minute Quadrangle.

SAFETY FIRST

terraphase engineering

CLIENT: Philadelphia Energy Solutions Refining and Marketing LLC

PROJECT: UDEX Release Area

PROJECT NUMBER: P044.001.007

Site Location Map

FIGURE 1

File: N:\GIS\Prj\P044.001_PESRM-PES\MXDs\UDEX Release Area\Figure 1 - Site Location Map.mxd 1/20/2022 Created by: Resource Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

terraphase engineering

March 1, 2022

Ms. Leigh Anne Rainford
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue – 2nd Floor
Philadelphia, PA 19104

sent via UPS, Proof of Delivery Requested

Subject: **Notice of Intent to Remediate**
UDEX Release Area – Point Breeze South Yard
Former Philadelphia Energy Solutions Refinery
3144 West Passyunk Ave.
Philadelphia, PA 19153

Dear Ms. Rainford:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) be provided to the municipality in which the site is located. In accordance with this provision of Act 2, Terraphase Engineering, Inc. (Terraphase), on behalf of Philadelphia Energy Solutions Refining and Marketing LLC (PESRM), is formally notifying you of PESRM's intent to remediate the above-referenced site to the non-residential Statewide Health Standard. A copy of the Notice of Intent to Remediate, which will be sent to the Department of Environmental Protection (DEP), is enclosed. This notice will also be published in the Pennsylvania Bulletin, and a summary of the notice will be placed in a local newspaper.

Should you have any questions or comments regarding the proposed remediation, please contact me at kevin.long@terraphase.com or 609-236-8171, ext. 93.

Sincerely,

for Terraphase Engineering Inc.

Kevin L. Long
Principal Consultant

KL:cs

Enclosure: Notice of Intent to Remediate

cc: Julianna Connolly (jconnolly@hilcoglobal.com)
Joseph Jeray (jjeray@hilcoglobal.com)

Proof of Delivery

Dear Customer,

This notice serves as proof of delivery for the shipment listed below.

Tracking Number
1Z75YA673037794200

Weight
0.50 LBS

Service

UPS Next Day Air Saver®

Shipped / Billed On
03/01/2022

Delivered On

03/02/2022 10:14 A.M.

Delivered To
PHILADELPHIA, PA, US

Received By

CD MONROE

Left At
Office

Thank you for giving us this opportunity to serve you. Details are only available for shipments delivered within the last 120 days. Please print for your records if you require this information after 120 days.

Sincerely,

UPS

Tracking results provided by UPS: 03/02/2022 11:09 A.M. EST

Notice of an Intent
to Remediate to an Environmental Standard.
(Sections 302(e)(1)(ii), 303(h)(1)(ii),
304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act, the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Philadelphia Energy Solutions Refining and Marketing LLC will submit to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 West Passyunk Avenue, Philadelphia. This Notice of Intent to Remediate states that the site is the Former Philadelphia Energy Solutions Refinery. The site has been found to be contaminated with separate-phase petroleum release from an underground portion of a product line that conveys reformate (a gasoline blending stock used as feed from an UDEX unit). Philadelphia Energy Solutions Refining and Marketing LLC has indicated that the proposed remediation measures will be to monitor and remove separate-phase petroleum from monitoring and recovery wells. In addition, a soil vapor extraction (SVE) system is being designed to destroy the remaining separate-phase petroleum, which is expected to begin operation in 2Q 2022. The proposed future use of the property will be non-residential for commercial/industrial use.

The Philadelphia Inquirer

801 MARKET STREET, SUITE 300, PHILADELPHIA, PA 19107

Affidavit of Publication

On Behalf of:
TERRAPHASE ENGINEERING
1100 E HECTOR ST
SUITE 416
CONSHOHOCKEN, PA 19428

STATE OF PENNSYLVANIA COUNTY OF PHILADELPHIA:

Before the undersigned authority personally appeared the undersigned who, on oath represented a and say: that I am an employee of The Philadelphia Inquirer, LLC, and am authorized to make this affidavit of publication, and being duly sworn, I depose and say:

1. The Philadelphia Inquirer, LLC is the publisher of the Philadelphia Daily News, with its headquarters at 801 Market Street, Suite 300, Philadelphia, Pennsylvania 19107.
2. The Philadelphia Daily News is an edition of The Philadelphia Inquirer. The Philadelphia Daily News is continuously published and distributed Sunday-Friday in the City of Philadelphia, count and state aforesaid.
3. The printed notice or publication attached hereto set forth on attached
hereto was published in all regular print editions of the Philadelphia Daily News on

Legal Notices

as published in **Daily News Legals** in the issue(s) of:

3/4/2022

4. Under oath, I state that the following is true and correct, and that neither I nor The Philadelphia Inquirer, LLC have any is interest in the subject matter of the aforesaid notice or advertisement.

Helene Sweeney

Kathern V. Harley
Notary Public

My Commission Expires:

Commonwealth of Pennsylvania - Notary Seal
KATHERINE V. HARLEY, Notary Public
Philadelphia County
My Commission Expires May 25, 2025
Commission Number 1312829

Ad No: 98354
Customer No: 104799

COPY OF ADVERTISEMENT

Notice of an Intent
to Remediate to an Environmental Standard.
(Sections 302(e)(1)(ii), 303(h)(1)(ii),
304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act, the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Philadelphia Energy Solutions Refining and Marketing LLC will submit to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 West Passyunk Avenue, Philadelphia. This Notice of Intent to Remediate states that the site is the Former Philadelphia Energy Solutions Refinery. The site has been found to be contaminated with separate-phase petroleum release from an underground portion of a product line that conveys reformate (a gasoline blending stock used as feed from an UDEX unit). Philadelphia Energy Solutions Refining and Marketing LLC has indicated that the proposed remediation measures will be to monitor and remove separate-phase petroleum from monitoring and recovery wells. In addition, a soil vapor extraction (SVE) system is being designed to destroy the remaining separate-phase petroleum, which is expected to begin operation in 2Q 2022. The proposed future use of the property will be non-residential for commercial/industrial use.

Appendix B Report Notices

The Philadelphia Inquirer
100 S. INDEPENDENCE MALL W, STE 600, PHILADELPHIA, PA 19106

Affidavit of Publication

On Behalf of:
STANTEC
1060 Andrew Drive
WEST CHESTER, PA 19380

STATE OF PENNSYLVANIA COUNTY OF PHILADELPHIA:

Before the undersigned authority personally appeared the undersigned who, on oath represented a and say: that I am an employee of The Philadelphia Inquirer, LLC, and am authorized to make this affidavit of publication, and being duly sworn, I depose and say:

1. The Philadelphia Inquirer, LLC is the publisher of the Philadelphia Daily News, with its headquarters at 100 S. Independence Mall West, Suite 600, Philadelphia, PA 19106.
2. The Philadelphia Daily News is an edition of The Philadelphia Inquirer. The Philadelphia Daily News is continuously published and distributed Sunday-Friday in the City of Philadelphia, count and state aforesaid.
3. The printed notice or publication attached hereto set forth on attached
hereto was published in all regular print editions of the Philadelphia Daily News on

Legal Notices

as published in **Daily News Legals** in the issue(s) of:

9/25/2026

4. Under oath, I state that the following is true and correct, and that neither I nor The Philadelphia Inquirer, LLC have any is interest in the subject matter of the aforesaid notice or advertisement.

Helene Sweeney

Nancy S. Fisher
Notary Public

My Commission Expires:

Commonwealth of Pennsylvania - Notary Seal
Nancy S Fisher, Notary Public
Philadelphia County
My Commission Expires June 27, 2027
Commission Number 1433937

Ad No: 212763
Customer No: 103409

COPY OF ADVERTISEMENT

Bellwether District – UDEX Release Cleanup Plan

Pursuant to the Land Recycling and Environmental Remediation Standards Act, the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Bellwether District Holdings, LLC (BDH) is submitting a Cleanup Plan to the Pennsylvania Department of Environmental Protection (PADEP) Southeast Regional Office for the UDEX release site at the former Philadelphia Energy Solutions Refinery located at 3144 West Passyunk Avenue, Philadelphia, Philadelphia County, Pennsylvania on September 25, 2026. The plan is being submitted in accordance with site-specific remediation standards.

Stantec Consulting Services Inc.
1060 Andrew Drive, Suite 140
West Chester PA 19380-5602

September 23, 2026

Leigh Anne Rainford, MPH
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue - 2nd Floor
Philadelphia, PA 19104

Dear Ms. Rainford,

Reference: Submission of Cleanup Plan
UDEX Release Area – Point Breeze South Yard
Former PES Refinery
3144 West Passyunk Avenue
Philadelphia, PA 19153

This letter is to provide notice to the City of Philadelphia that Bellwether District Holdings, LLC (BDH) is submitting a Cleanup Plan (CUP) to the Pennsylvania Department of Environmental Protection (PADEP) Southeast Regional Office on September 25, 2026, for the UDEX Release located in the Point Breeze South Yard area of the former Philadelphia Energy Solutions Refinery at 3144 West Passyunk Avenue in Philadelphia, Pennsylvania (Site). The CUP provides information for the Site under Pennsylvania's Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2 (Act 2) in accordance with the site-specific remediation standards.

Please call me at (610) 850-1420 if you have any questions concerning the plan submission.

Sincerely,

Stantec Consulting Services Inc.

Andrew Klingbeil PG
Associate Geologist
Phone: (610) 840-2525
Mobile: (610) 850-1420
andrew.klingbeil@stantec.com

cc: C. David Brown, PADEP (via email)
Joseph Jeray, HRP Group (via email)

September 25, 2026

Dear Customer,

The following is the proof-of-delivery for tracking number: 877645614383

Delivery Information:

Status:	Delivered	**Delivered To:**	Shipping/Receiving
Signed for by:	H.River	**Delivery Location:**	
Service type:	FedEx Priority Overnight		
Special Handling:	Deliver Weekday		Philadelphia, PA,
		Delivery date:	Sep 24, 2026 09:14

Shipping Information:

Tracking number:	877645614383	**Ship Date:**	Sep 23, 2026
		Weight:	0.5 LB/0.23 KG

Recipient:	**Shipper:**
PHILADELPHIA, PA, US,	WEST CHESTER, PA, US,

Reference	195603450.206
Purchase Order	195603450.206

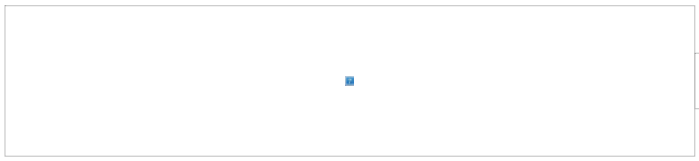
FedEx Express proof-of-delivery details appear below; however, no signature is currently available for this shipment. Please check again later for a signature.

Thank you for choosing FedEx

From: Klingbeil, Andrew
To: Klingbeil, Andrew
Subject: FW: Delivery Notification shipment was delivered 877645614383
Date: Friday, September 25, 2026 11:08:14 AM

From: FedEx Tracking <TrackingUpdates@fedex.com>
Sent: Thursday, September 24, 2026 9:21 AM
To: Middleton, Karen <Karen.Middleton@stantec.com>
Subject: Your shipment was delivered 877645614383

We've included the delivery details for you





Your shipment was delivered.

Delivery Date
Thu, 09/24/2026
9:14am

Get alerts on future deliveries

Stay informed with delivery notifications for all your shipments. You can also share delivery instructions and manage your delivery.

SIGN UP

Delivered to
7801 ESSINGTON AVE, Philadelphia, PA 19153

Received by
H.River

Report missing package

How was your delivery?



Tracking details

Tracking ID	877645614383
From	Karen Middleton Stantec Consulting Corporation 1060 ANDREW DR STE 140 WEST CHESTER, PA, US 19380
To	Leigh Anne Rainford Philadelphia Dept of Public Health 7801 Essington Avenue Environmental Health Services Philadelphia, PA, US 19153
Ship date	Wed 9/23/2026 06:13 PM
Number of pieces	1
Total shipment weight	0.50 LB
Service	FedEx Priority Overnight®
Reference	195603450.206
Shipper reference	195603450.206
Purchase order number	195603450.206

TRACK SHIPMENT

FedEx

Track your package and see when it's coming

With Map View, follow your package's journey and get an estimated delivery time window—so you can plan ahead and avoid missed deliveries.

DOWNLOAD THE MOBILE APP

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Thank you for your business.

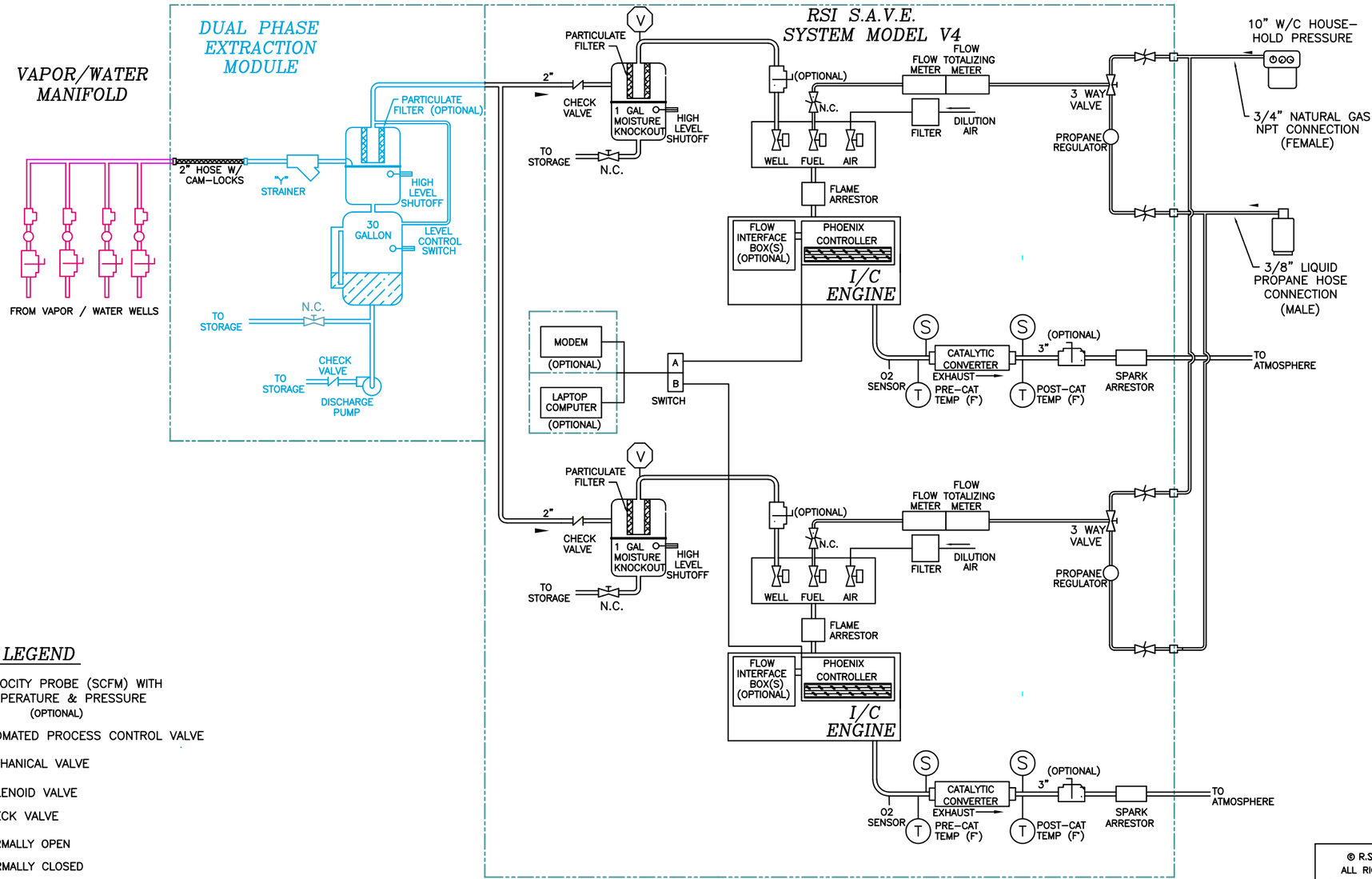
Terms of Use
Privacy notice
Support
Fraud & security
ID 1026

[redacted]

Appendix C RSI V4 ICE Piping and Instrumentation Diagram

ALL EQUIPMENT AND PARTS SHOWN INSIDE PHANTOM BOXES ARE CONSIDERED TO BE THE RESPONSIBILITY OF R.S.I.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



LEGEND

- VELOCITY PROBE (SCFM) WITH TEMPERATURE & PRESSURE (OPTIONAL)
- AUTOMATED PROCESS CONTROL VALVE
- MECHANICAL VALVE
- SOLENOID VALVE
- CHECK VALVE
- N.O. NORMALLY OPEN
- N.C. NORMALLY CLOSED
- (PV) PRESSURE/VACUUM GUAGE
- (S) SAMPLE PORT
- (V) VACUUM TRANSDUCER MEASUREMENT
- (T) TEMPERATURE MEASUREMENT

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RSI REMEDIATION SERVICE, INT'L

GENERAL PROCESS FLOW WITH PIPING & INSTRUMENTATION DIAGRAM
V4 (2 ENGINES) / DUAL PHASE EXTRACTION

SIZE	FSCM NO.	DWG NO.	REV
		P&ID V4DPE	–
SCALE		SHEET	1 OF 1

Appendix D Example RSI ICE Data Summary Report

Remediation Service Int'l
4835 Colt Unit D
Ventura CA 93003
805.644.8382
805.644.8378 FAX
www.rsi-save.com

REMEDIATION SERVICE, INT'L

Report Generator Version 1.4

Due to file size, data has been resampled from 'O2' events only at an event frequency of 1 out of 4

Date of Report:	5/25/2021
Project Name:	STANTEC RENTAL UNIT407 ENG1 PILOT STUDY
Unit ID:	1407
Controller S/N:	509
Software version:	844

Assumptions:

20000	Btu/lb
6.2	lb/gallon of gasoline
120	Mole Weight of Extracted VOC
2520	Btu/Cubic Foot of Propane
1000	Btu/Cubic Foot of Natural Gas

Date Range From:	4/7/2021 10:29
Date Range To :	5/25/2021 8:46
Lbs. Removed/Period:	26190.28
Gal Removed/Period:	4224.24
SCF Processed/Period:	2071859

Parts/Million by Volume (PPMV) Conversion to Micrograms/Liter (ug/L)
(PPMV/24.055)*AVG. Mole Weight=ug/L

Mass Transfer Equation to Convert to Pounds/Hour:
(ug/L)*(Flow SCFM)*28.3 L/SCF*60 Minutes/Hour*2.2 lbs/Kg*(1/10^9)

There are no express or implied warranties for fitness of use or any other purpose of the data contained herein.
See report footnotes for disclaimer details and other technical information relating to calculation procedures.

Footnotes:

RSIs Innovative Approach to Estimating Btu/Hr:
1. Measure alternate fuel usage of engine prior to introduction of process flow
2. Multiply the SCFM flow rate of the alternate fuel (propane or natural gas) by the Btu value to determine energy demand on the engine at static conditions
3. The controller records a "snapshot" of the energy demand at a given RPM and engine manifold vacuum just prior to allowing the process flow to begin
4. The controller adjusts the initial baseline based on engine load or oxygen deficiency as necessary
5. Any drop in energy demand is assumed to be caused by the introduction of the process flow and is displayed as Estimated Btu/hr and recorded accordingly

RSIs Innovative Approach to Estimating PPMV:
1. The controller completes the Btu/hr calculation as explained above
2. The controller looks at the well flow rate (estimated or measured in SCFM)
3. The controller then computes the average PPMV using the mass transfer equation to solve for PPMV
4. If the flow rate is estimated then PPMV is subject to accuracy of estimated flow and accuracy of the Btu/hr calculation
5. If the flow rate is measured then this PPMV estimate will be relative to actual lab data assuming the flow measurement and the Btu calculations are correct

There are many advantages to using RSIs innovative approach in calculating how much mass was removed from a project in a given time period.
Our method eliminates human calculation error and prevents incorrect or non-calibrated use of field instrumentation and it is a consistent
periodic measurement over time which when used properly will reduces costly laboratory analysis.

Our estimates of VOC removal have proven to be reasonable when compared to independent lab data. Because the process flow rate
and the alternate fuel flow rate measurements are dependent upon proper system operation there are no expressed or implied warrantees
of fitness of use for any purpose when using this report or the data contained herein.

Please do not hesitate to contact RSI 1-800-368-8685 if you should have any questions or require further information

Remediation Service Int'l
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Ventura CA 93003
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Report Generator Version 1.4

Due to file size, data has been resampled from 'O2' events only at an event frequency of 1 out of 4

Date of Report: 5/25/2021
Project Name: STANTEC RENTAL UNIT407 ENG1 PILOT STUDY
Unit ID: 1407
Controller S/N: 509
Software version: 844

Assumptions:
20000 Btu/lb
6.2 lb/gallon of gasoline
120 Mole Weight of Extracted VOC
2520 Btu/Cubic Foot of Propane
1000 Btu/Cubic Foot of Natural Gas

Date Range From: 4/7/2021 10:29
Date Range To : 5/25/2021 8:46
Lbs. Removed/Period: 26190.28
Gal Removed/Period: 4224.24
SCF Processed/Period: 2071859

Parts/Million by Volume (PPMV) Conversion to Micrograms/Liter (ug/L)
(PPMV/24.055)*AVG. Mole Weight=ug/L

Mass Transfer Equation to Convert to Pounds/Hour:
(ug/L)*(Flow SCFM)*28.3 L/SCF*60 Minutes/Hour*2.2 lbs/Kg*(1/10^9)

There are no express or implied warranties for fitness of use or any other purpose of the data contained herein.
See report footnotes for disclaimer details and other technical information relating to calculation procedures.

Installed Flow Boxes: Box1 - Y Box2 - N Box3 - N

Mass Transfer Btu/Hr Approach:

Mass Transfer Equation (indirectly based on Btu/hr estimate)

Time Stamp	Murphy Status	Op Status	BTU/Hr(est)	PPMV(est)	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Cubic Feet Processed Cumulative	Cumulative Time (hours)	Delta Time (Hours)
04-07-2021 10:29	SNAPSHOT	Auto	0	0	0	0	0	0	0	0	0	0	0	0	0
04-07-2021 14:48	SHUTDOWN	Auto	578000	0	0	0	58.19	87.57	14.12	0	14.29	2.3	120	3.03	2.01
04-07-2021 15:00	SNAPSHOT	Auto	578000	0	0	0	0	87.57	14.12	0	14.29	2.3	120	3.23	0.2
04-07-2021 17:00	O2	Auto	482000	637000	19.36	0	12.05	135.17	21.8	0	14.29	2.3	120	5.23	0.5
04-07-2021 19:00	O2	Auto	478000	631800	19.36	0	11.95	182.57	29.45	0	14.29	2.3	120	7.23	0.5
04-07-2021 20:59	O2	Auto	470000	624000	19.36	0	11.75	228.98	36.93	0	14.29	2.3	120	9.21	0.5
04-07-2021 22:59	O2	Auto	470000	621000	19.36	0	11.75	275.58	44.45	0	14.29	2.3	120	11.21	0.5
04-08-2021 00:59	O2	Auto	466000	618700	19.36	0	11.65	322.28	51.98	0	14.29	2.3	120	13.21	0.5
04-08-2021 02:58	O2	Auto	466000	617800	19.36	0	11.65	368.29	59.4	0	14.29	2.3	120	15.2	0.5
04-08-2021 04:58	O2	Auto	462000	615000	19.36	0	11.55	414.49	66.85	0	14.29	2.3	120	17.2	0.5
04-08-2021 06:58	O2	Auto	462000	612700	19.36	0	11.55	460.79	74.32	0	14.29	2.3	120	19.2	0.5
04-08-2021 08:58	O2	Auto	466000	616100	19.36	0	11.65	507.29	81.82	0	14.29	2.3	120	21.2	0.5
04-08-2021 10:57	O2	Auto	466000	619800	19.36	0	11.65	553.4	89.26	0	14.29	2.3	120	23.18	0.5
04-08-2021 12:57	O2	Auto	466000	620400	17.21	0	11.65	600.2	96.81	0	14.29	2.3	120	25.18	0.5
04-08-2021 14:57	O2	Auto	466000	619500	17.21	0	11.65	647.2	104.39	0	14.29	2.3	120	27.18	0.5
04-08-2021 16:56	O2	Auto	486000	642500	19.36	0	12.15	695.3	112.14	0	14.29	2.3	120	29.16	0.5
04-08-2021 18:56	O2	Auto	482000	637300	17.21	0	12.05	743.6	119.94	0	14.29	2.3	120	31.16	0.5
04-08-2021 20:56	O2	Auto	478000	633200	19.36	0	11.95	791.6	127.68	0	14.29	2.3	120	33.16	0.5
04-08-2021 22:56	O2	Auto	478000	634900	19.36	0	11.95	839.4	135.39	0	14.29	2.3	120	35.16	0.5
04-09-2021 00:55	O2	Auto	474000	631000	19.36	0	11.85	886.7	143.02	0	14.29	2.3	120	37.15	0.5
04-09-2021 02:55	O2	Auto	482000	639600	19.36	0	12.05	934.5	150.73	0	14.29	2.3	120	39.15	0.5
04-09-2021 04:55	O2	Auto	478000	633800	19.36	0	11.95	982.3	158.44	0	14.29	2.3	120	41.15	0.5
04-09-2021 06:54	O2	Auto	478000	631300	19.36	0	11.55	1029.5	166.05	0	14.29	2.3	120	43.13	0.48
04-09-2021 08:54	O2	Auto	478000	631400	19.36	0	11.95	1077.1	173.73	0	14.29	2.3	120	45.13	0.5
04-09-2021 10:54	O2	Auto	474000	629000	19.36	0	11.85	1124.6	181.39	0	14.29	2.3	120	47.13	0.5
04-09-2021 12:54	O2	Auto	482000	637100	19.36	0	12.05	1172.3	189.08	0	14.29	2.3	120	49.13	0.5
04-09-2021 14:53	O2	Auto	478000	635200	19.36	0	11.95	1219.6	196.71	0	14.29	2.3	120	51.11	0.5
04-09-2021 16:53	O2	Auto	478000	633800	19.36	0	11.95	1267.5	204.44	0	14.29	2.3	120	53.11	0.5
04-09-2021 18:53	O2	Auto	474000	629700	19.36	0	11.85	1315.5	212.18	0	14.29	2.3	120	55.11	0.5
04-09-2021 20:52	O2	Auto	474000	629100	19.36	0	11.46	1363	219.84	0	14.29	2.3	120	57.1	0.48
04-09-2021 22:52	O2	Auto	478000	632300	19.36	0	11.95	1410.9	227.57	0	14.29	2.3	120	59.1	0.5
04-10-2021 00:52	O2	Auto	478000	633600	19.36	0	11.95	1458.7	235.27	0	14.29	2.3	120	61.1	0.5
04-10-2021 02:52	O2	Auto	482000	637100	19.36	0	12.05	1506.5	242.98	0	14.29	2.3	120	63.1	0.5
04-10-2021 04:51	O2	Auto	482000	640300	19.36	0	12.05	1554	250.65	0	14.29	2.3	120	65.08	0.5
04-10-2021 06:51	O2	Auto	478000	633400	21.51	0	11.95	1601.9	258.37	0	14.29	2.3	120	67.08	0.5
04-10-2021 08:51	O2	Auto	482000	637400	19.36	0	12.05	1650	266.13	0	14.29	2.3	120	69.08	0.5
04-10-2021 10:50	O2	Auto	478000	634800	21.51	0	11.55	1697.5	273.79	0	14.29	2.3	120	71.06	0.48
04-10-2021 12:50	O2	Auto	478000	635000	19.36	0	11.95	1745.6	281.55	0	14.29	2.3	120	73.06	0.5
04-10-2021 14:50	O2	Auto	502000	665000	19.36	0	12.55	1795.5	289.6	0	14.29	2.3	120	75.06	0.5
04-10-2021 16:50	O2	Auto	502000	665500	19.36	0	12.55	1845.6	297.68	0	14.29	2.3	120	77.06	0.5
04-10-2021 18:49	O2	Auto	498000	661500	21.51	0	12.45	1895.19	305.68	0	14.29	2.3	120	79.05	0.5
04-10-2021 20:49	O2	Auto	502000	665200	19.36	0	12.55	1945.19	313.74	0	14.29	2.3	120	81.05	0.5
04-10-2021 22:49	O2	Auto	494000	654900	19.36	0	12.35	1994.89	321.76	0	14.29	2.3	120	83.05	0.5
04-11-2021 00:49	O2	Auto	498000	662200	21.51	0	12.45	2044.69	329.79	0	14.29	2.3	120	85.05	0.5
04-11-2021 02:48	O2	Auto	498000	658300	19.36	0	12.45	2094.17	337.77	0	14.29	2.3	120	87.03	0.5
04-11-2021 04:48	O2	Auto	498000	661200	19.36	0	12.45	2144.07	345.82	0	14.29	2.3	120	89.03	0.5
04-11-2021 06:48	O2	Auto	498000	657900	19.36	0	12.45	2193.67	353.82	0	14.29	2.3	120	91.03	0.5
04-11-2021 08:47	O2	Auto	494000	656600	19.36	0	12.35	2242.86	361.75	0	14.29	2.3	120	93.01	0.5
04-11-2021 10:47	O2	Auto	498000	661600	19.36	0	12.45	2292.76	369.8	0	14.29	2.3	120	95.01	0.5
04-11-2021 12:47	O2	Auto	502000	663900	19.36	0	12.55	2343.06	377.91	0	14.29	2.3	120	97.01	0.5
04-11-2021 14:47	O2	Auto	494000	656900	19.36	0	12.35	2392.96	385.96	0	14.29	2.3	120	99.01	0.5
04-11-2021 16:46	O2	Auto	502000	665900	19.36	0	12.55	2442.54	393.96	0	14.29	2.3	120	101	0.5
04-11-2021 18:46	O2	Auto	502000	665200	19.36	0	12.55	2492.74	402.05	0	14.29	2.3	120	103	0.5
04-11-2021 20:46	O2	Auto	494000	657000	21.51	0	12.35	2542.14	410.02	0	14.29	2.3	120	105	0.5
04-11-2021 22:45	O2	Auto	498000	329000	21.51	4	12.45	2591.33	417.96	12.26	38.35	6.19	356	106.98	0.5
04-12-2021 00:45	O2	Auto	494000	327400	21.51	4	12.35	2640.93	425.96	12.2	87.39	14.09	896	108.98	0.5
04-12-2021 02:45	O2	Auto	498000	328700	21.51	4	12.45	2690.33	433.92	12.25	136.03	21.94	1436	110.98	0.5
04-12-2021 04:45	O2	Auto	490000	324900	19.36	4	12.25	2739.73	441.89	12.11	184.78	29.8	1976	112.98	0.5
04-12-2021 06:44	O2	Auto	486000	321900	21.51	4	12.15	2788.22	449.71	12	232.79	37.55	2572	114.96	0.5
04-12-2021 08:44	O2	Auto	494000	327100	21.51	4	12.35	2837.42	457.65	12.19	287.45	46.36	3232	116.96	0.5
04-12-2021 10:44	O2	Auto	486000	322800	21.51	4	12.15	2886.02	465.49	12.03	335.46	54.11	3832	118.96	0.5
04-12-2021 12:43	O2	Auto	486000	215000	23.66	6	11.74	2934.41	473.29	11.62	383.27	61.82	4546	120.95	0.48
04-12-2021 14:43	O2	Auto	486000	215400	21.51	6	12.15	2983.11	481.15	12.04	419.44	67.65	5086	122.95	0.5
04-12-2021 16:43	O2	Auto	494000	326600	21.51	4	12.35	3031.81	489	12.17	467.55	75.41	5686	124.95	0.5
04-12-2021 18:43	O2	Auto	498000	220400	23.66	6	12.45	3080.81	496.91	12.32	515.93	83.21	6286	126.95	0.5
04-12-2021 20:42	O2	Auto	494000	218400	23.66	6	12.35	3129.51	504.76	12.21	564.09	90.98	7030	128.93	0.5
04-12-2021 22:42	O2	Auto	490000	184900	23.66	7	12.25	3178.51	512.66	12.06	612.47	98.79	7780	130.93	0.5
04-13-2021 00:42	O2	Auto	486000	184600	23.66	7	12.15	3227.41	520.55	12.04	660.79	106.58	8560	132.93	0.5
04-13-2021 02:41	O2	Auto	490000	185800	23.66	7	11.84	3276	528.39	11.71	708.82	114.33	9453	134.91	0.48
04-13-2021 04:41	O2	Auto	486000	161500	23.66	8	12.15	3325.1	536.31	12.04	757.38	122.16	10413	136.91	0.5
04-13-2021 06:41	O2	Auto	494000	187300	23.66	7	12.35	3374.7	544.31	12.22	806.33	130.05	11313	138.91	0.5
04-13-2021 08:41	O2	Auto	498000	187800	23.66	7	12.45	3424	552.26	12.25	854.94	137.89	12243	140.91	0.5
04-13-2021 10:40	O2	Auto	494000	218400	25.81	6	12.35	3472.89	560.14	12.21	903.22	145.68	13017	142.9	0.5
04-13-2021 12:40	O2	Auto	502000	222400	23.66	6	12.55	3522.69	568.18	12.43	952.43	153.62	13737	144.9	0.5
04-13-2021 14:40	O2	Auto	506000	668500	23.66	0	12.65	3572.99	576.29	0	952.43	153.62	13737	146.9	0.5
04-13-2021 16:40	O2	Auto	534000	709500	25.81	0	13.35	3626.69	584.95	0	952.43	153.62	13737	148.9	0.5
04-13-2021 18:39	O2	Auto	534000	710200	25.81	0	13.35	3680.23	593.59	0	952.43	153.62	13737	150.88	0.5
04-13-2021 20:39	O2	Auto	542000	358600	25.81	4	13.55	3734.43	602.33	13.36	1005.98	162.26	14277	152.88	0.5
04-13-2021 22:39	O2	Auto	538000	204400	25.81	7	13.45	3788.43	611.04	13.33	1059.33	170.86	15057	154.88	0.5
04-14-2021 00:38	O2	Auto	534000	176600	25.81	8	13.35	3841.68	619.63	13.16	1111.96	179.35	15979	156.86	0.5
04-14-2021 02:38	O2	Auto	538000	178700	25.81	8	13.45	3895.38	628.29	13.32	1164.96	187.9	16999	158.86	0.5
04-14-2021 04:38	O2	Auto	538000	178800	25.81	8	13.45	3948.48	636.85	13.33	1217.46	196.37	18019	160.86	0.5
04-14-2021 06:38	O2	Auto	534000	141900	27.97	10	13.35	4001.18	645.35	13.22	1269.56	204.77	19039	162.86	0.5
04-14-2021 08:37	O2	Auto	538000	178100	25.81	8	13.45	4054.34	653.93	13.28	1322.07	213.24	20051	164.85	0.5
04-14-2021 10:37	O2	Auto	538000	204100	25.81	7	13.45	4108.04	662.59	13.31	1375.14	221.8	20921	166.85	0.5
04-14-2021 12:37	O2	Auto	526000	232700	25.81	6	13.15	4161.54	671.22	13.01	1428.03	230.33	21461	168.85	0.5
04-14-2021 15:06	O2	Auto	534000	353600	25.81	4	13.35	4228.35	681.99	13.18	1494	240.97	22177	171.33	0.5
04-14-2021 17:06	O2	Auto	534000	236500	25.81	6	13.35	4282.15	690.67	13.22	1547.16	249.54	22867	173.33	0.5
04-14-2021 19:06	O2	Auto	542000	205200	25.81	7	13.55	4336.15	699.38	13.38	1598.59	257.84	23617	175.33	0.5
04-14-2021 21:06	O2	Auto	534000	201400	25.81	7	13.35	4389.55	707.99	13.14	1651.26	266.33	24457	177.33	0.5
04-14-2021 23:05	O2	Auto	534000	177500	25.81	8	13.35	4442.4	716.52	13.23	1703.52	274.76	25290	179.31	0.5
04-15-2021 01:05	O2	Auto	506000	224300	23.66	6	12.65	4494.7	724.95	12.54	1755.35	283.12	26070	181.31	0.5
04-15-2021 03:05	O2	Auto	530000	175600	25.81	8	13.25	4547.8	733.52	13.09	1807.79	291.58	27000	183.31	0.5
04-15-2021 05:04	O2	Auto	526000	174800	25.81	8	13.15	4600.16	741.96	13.03	1859.56	299.93	27982	185.3	0.5
04-15-2021 07:04	O2	Auto	522000	172400	25.81	8	13.05	4652.16	750.35	12.85	1910.97	308.22	28912	187.3	0.5
04-15-2021 09:04	O2	Auto	514000	170200	25.81	8	12.85	4703.86	758.69	12.69	1961.95	316.44	29902	189.3	0.5
04-15-2021 11:04	O2	Auto	514000	194300	25.81	7	12.85	4755.06	766.95	12.67	2012.48	324.59	30772	191.3	0.5
04-15-2021 13:03	O2	Auto	506000	191700	25.81	7	12.65	4805.74	775.12	12.5	2064.63	333.01	31635	193.28	0.5
04-15-2021 15:03	O2	Auto	510000	673500	23.66	0	12.75	4857.04	783.39	0	2102.73	339.15	32115	195.28	0.5
04-15-2021 17:03	O2	Auto	554000	183500	27.97	8	13.85	4909.64	791.88	13.68	2142.13	345.5	32655	197.28	0.5
04-15-2021 19:02	O2	Auto	558000	164500	27.97	9	13.48	4964.67	800.75	13.33	2196.5	354.27	33696	199.26	0.48
04-15-2021 21:02	O2	Auto	534000	141700	27.97	10	13.35	5019.17	809.54	13.2	2250.39	362.97	34896	201.26	0.5
04-15-2021 23:02	O2	Auto	554000	122300	27.97	12	13.85	5074.37	818.45	13.67	2304.93	371.76	36216	203.26	0.5
04-16-2021 01:32	O2	Auto	538000	101600	30.12	14	13.45	5142.82	829.49	13.25	2372.54	382.67	38076	205.76	0.5
04-16-2021 03:31	O2	Auto	538000	102000	30.12	14	13.45	5197.07	838.24	13.31	2426.07	391.3	39712	207.75	0.5
04-16-2021 05:31	O2	Auto	550000	103900	30.12	14	13.75	5251.97	847.09	13.55	2480.17	400.03	41392	209.75	0.5
04-16-2021 07:31	O2	Auto	546000	103300	30.12	14	13.65	5306.67	855.91	13.47	2534.14	408.73	43072	211.75	0.5
04-16-2021 09:30	O2	Auto	546000	103100	30.12	14	13.2	5360.31	864.57	13	2587.11	417.28	44708	213.73	0.48
04-16-2021 11:30	O2	Auto	542000	102600	30.12	14	13.55	5414.51	873.31	13.38	2640.55	425.89	46388	215.73	0.5
04-16-2021 13:30	O2	Auto	546000	111200	30.12	13	13.65	5468.81	882.07	13.47	2694.2	434.55	48008	217.73	0.5
04-16-2021 15:30	O2	Auto	546000	111400	30.12	13	13.65	5523.21	890.84	13.49	2748	443.23	49628	219.73	0.5
04-16-2021 17:29	O2	Auto	538000	102000	30.12	14	13.45	5576.17	899.38	13.31	2801.52	451.86	51116	221.71	0.5
04-16-2021 19:29	O2	Auto	542000	102200	32.27	14	13.55	5630.17	908.09	13.33	2854.77	460.45	52646	223.71	0.5
04-16-2021 21:29	O2	Auto	538000	101800	32.27	14	13.45	5684.57	916.87	13.28	2908.37	469.09	54356	225.71	0.5
04-16-2021 23:28	O2	Auto	538000	102100	32.27	14	13	5737.92	925.47	12.87	2961.16	477.61	56022	227.7	0.48
04-17-2021 01:28	O2	Auto	542000	95500	32.27	15	13.55	5791.82	934.16	13.35	3014.33	486.18	57762	229.7	0.5

Mass Transfer Btu/Hr Approach:

Mass Transfer Equation (indirectly based on Btu/hr estimate)

Time Stamp	Murphy Status	Op Status	BTU/Hr(est)	PPMV(est)	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Cubic Feet Processed Cumulative	Cumulative Time (hours)	Delta Time (Hours)
04-17-2021 03:28	O2	Auto	550000	96800	32.27	15	13.75	5845.72	942.86	13.53	3067.57	494.77	59562	231.7	0.5
04-17-2021 05:28	O2	Auto	538000	95300	34.42	15	13.45	5899.02	951.45	13.32	3120.22	503.26	61362	233.7	0.5
04-17-2021 07:27	O2	Auto	530000	88000	34.42	16	13.25	5952.27	960.04	13.12	3172.84	511.75	63236	235.68	0.5
04-17-2021 09:27	O2	Auto	546000	96500	34.42	15	13.65	6005.97	968.71	13.49	3225.89	520.3	65036	237.68	0.5
04-17-2021 11:27	O2	Auto	550000	97400	34.42	15	13.75	6060.17	977.45	13.61	3279.48	528.95	66806	239.68	0.5
04-17-2021 13:27	O2	Auto	530000	93700	34.42	15	13.25	6114.17	986.16	13.1	3332.77	537.54	68576	241.68	0.5
04-17-2021 15:26	O2	Auto	538000	95100	34.42	15	13.45	6167.62	994.78	13.29	3385.49	546.05	70331	243.66	0.5
04-17-2021 17:26	O2	Auto	546000	96700	34.42	15	13.65	6221.72	1003.5	13.51	3438.94	554.67	72131	245.66	0.5
04-17-2021 19:26	O2	Auto	530000	93800	34.42	15	13.25	6275.22	1012.13	13.11	3491.81	563.19	73901	247.66	0.5
04-17-2021 21:25	O2	Auto	542000	84700	38.72	17	13.55	6328.67	1020.75	13.42	3544.65	571.72	75746	249.65	0.5
04-17-2021 23:25	O2	Auto	542000	84200	34.42	17	13.55	6382.47	1029.43	13.34	3597.78	580.29	77726	251.65	0.5
04-18-2021 01:25	O2	Auto	542000	84500	36.57	17	13.55	6436.47	1038.14	13.38	3651.01	588.87	79736	253.65	0.5
04-18-2021 03:25	O2	Auto	534000	83400	38.72	17	13.35	6489.97	1046.77	13.21	3703.91	597.41	81806	255.65	0.5
04-18-2021 05:24	O2	Auto	530000	77900	36.57	18	13.25	6543.11	1055.34	13.06	3756.26	605.85	83889	257.63	0.5
04-18-2021 07:24	O2	Auto	534000	78700	38.72	18	13.35	6596.41	1063.94	13.2	3808.81	614.32	86049	259.63	0.5
04-18-2021 09:24	O2	Auto	534000	82900	38.72	17	13.35	6649.41	1072.49	13.13	3861.03	622.75	88179	261.63	0.5
04-18-2021 11:23	O2	Auto	538000	89300	36.57	16	13	6702.97	1081.12	12.87	3913.96	631.28	90113	263.61	0.48
04-18-2021 13:23	O2	Auto	538000	89000	38.72	16	13.45	6756.77	1089.8	13.27	3966.95	639.83	92033	265.61	0.5
04-18-2021 15:23	O2	Auto	538000	89200	38.72	16	13.45	6810.57	1098.48	13.3	4020.96	648.54	93953	267.61	0.5
04-18-2021 17:23	O2	Auto	530000	88000	38.72	16	13.25	6863.97	1107.09	13.12	4073.8	657.06	95843	269.61	0.5
04-18-2021 19:22	O2	Auto	534000	83300	38.72	17	13.35	6917.12	1115.66	13.19	4126.41	665.55	97806	271.6	0.5
04-18-2021 21:22	O2	Auto	550000	76800	40.87	19	13.75	6972.12	1124.54	13.6	4180.71	674.31	100026	273.6	0.5
04-18-2021 23:22	O2	Auto	554000	77000	40.87	19	13.85	7027.02	1133.39	13.63	4234.85	683.04	102276	275.6	0.5
04-19-2021 01:21	O2	Auto	546000	72500	40.87	20	13.2	7081.36	1142.16	13.06	4288.52	691.7	104626	277.58	0.48
04-19-2021 03:21	O2	Auto	550000	72800	40.87	20	13.75	7135.86	1150.95	13.57	4342.24	700.36	107026	279.58	0.5
04-19-2021 05:21	O2	Auto	530000	67100	40.87	21	13.25	7189.46	1159.59	13.13	4395.27	708.91	109546	281.58	0.5
04-19-2021 07:21	O2	Auto	538000	67900	43.02	21	13.45	7243.76	1168.35	13.29	4448.8	717.55	112066	283.58	0.5
04-19-2021 09:20	O2	Auto	538000	71400	40.87	20	13.45	7297.22	1176.97	13.31	4501.52	726.05	114535	285.56	0.5
04-19-2021 11:20	O2	Auto	546000	72400	40.87	20	13.65	7351.72	1185.76	13.49	4555.4	734.74	116905	287.56	0.5
04-19-2021 13:20	O2	Auto	546000	72400	40.87	20	13.65	7406.22	1194.55	13.49	4609.23	743.42	119305	289.56	0.5
04-19-2021 15:20	O2	Auto	546000	72300	40.87	20	13.65	7460.52	1203.31	13.47	4662.96	752.09	121705	291.56	0.5
04-19-2021 17:19	O2	Auto	530000	70200	43.02	20	13.25	7513.77	1211.9	13.08	4715.53	760.57	124085	293.55	0.5
04-19-2021 19:19	O2	Auto	530000	67000	43.02	21	13.25	7567.57	1220.58	13.11	4768.68	769.14	126515	295.55	0.5
04-19-2021 21:19	O2	Auto	546000	65500	45.18	22	13.65	7621.27	1229.24	13.43	4821.59	777.68	129095	297.55	0.5
04-19-2021 23:18	O2	Auto	530000	61100	45.18	23	13.25	7674.61	1237.84	13.09	4874.22	786.16	131803	299.53	0.5
04-20-2021 01:18	O2	Auto	530000	60900	45.18	23	13.25	7728.11	1246.47	13.05	4927.02	794.68	134563	301.53	0.5
04-20-2021 03:18	O2	Auto	530000	58500	45.18	24	13.25	7781.11	1255.02	13.08	4979.4	803.13	137383	303.53	0.5
04-20-2021 05:18	O2	Auto	526000	58000	47.33	24	13.15	7833.81	1263.52	12.97	5031.49	811.53	140233	305.53	0.5
04-20-2021 07:17	O2	Auto	534000	56500	47.33	25	13.35	7886.57	1272.03	13.16	5083.05	819.85	143060	307.51	0.5
04-20-2021 09:17	O2	Auto	534000	59100	47.33	24	13.35	7939.67	1280.59	13.22	5135.45	828.3	145970	309.51	0.5
04-20-2021 11:17	O2	Auto	538000	61700	47.33	23	13.45	7992.87	1289.17	13.22	5187.87	836.75	148760	311.51	0.5
04-20-2021 13:16	O2	Auto	554000	63800	47.33	23	13.39	8046.71	1297.86	13.22	5241.01	845.32	151467	313.5	0.48
04-20-2021 15:16	O2	Auto	542000	65100	47.33	22	13.55	8100.81	1306.58	13.34	5294.37	853.93	154137	315.5	0.5
04-20-2021 17:16	O2	Auto	538000	64800	47.33	22	13.45	8154.91	1315.31	13.28	5347.71	862.53	156777	317.5	0.5
04-20-2021 19:16	O2	Auto	538000	61900	47.33	23	13.45	8208.81	1324	13.27	5400.91	871.12	159567	319.5	0.5
04-20-2021 21:15	O2	Auto	538000	59100	49.48	24	13.45	8261.77	1332.54	13.22	5453.1	879.53	162423	321.48	0.5
04-20-2021 23:15	O2	Auto	530000	56000	49.48	25	13.25	8314.87	1341.11	13.04	5505.44	887.97	165363	323.48	0.5
04-21-2021 01:15	O2	Auto	534000	56500	49.48	25	13.35	8367.77	1349.64	13.16	5557.22	896.33	168333	325.48	0.5
04-21-2021 03:14	O2	Auto	530000	56300	51.63	25	12.81	8420.12	1358.08	12.68	5608.82	904.65	171278	327.46	0.48
04-21-2021 05:14	O2	Auto	522000	55300	49.48	25	13.05	8472.72	1366.57	12.88	5660.74	913.02	174278	329.46	0.5
04-21-2021 07:14	O2	Auto	530000	56200	51.63	25	13.25	8525.52	1375.08	13.09	5712.84	921.43	177308	331.46	0.5
04-21-2021 09:14	O2	Auto	522000	57700	51.63	24	13.05	8578.62	1383.65	12.9	5765.31	929.89	180248	333.46	0.5
04-21-2021 11:13	O2	Auto	530000	58500	51.63	24	13.25	8631.48	1392.17	13.08	5817.51	938.31	183163	335.45	0.5
04-21-2021 13:13	O2	Auto	534000	58800	49.48	24	13.35	8684.88	1400.79	13.15	5870.17	946.8	186043	337.45	0.5
04-21-2021 15:03	SHUTDOWN	Auto	486000	0	0	0	8.1	8732.53	1408.47	0	5909.15	953.09	188293	339.28	0.33
04-21-2021 15:09	SNAPSHOT	Auto	486000	0	0	0	0	8732.53	1408.47	0	5909.15	953.09	188293	339.38	0.1
04-21-2021 17:38	O2	Auto	446000	39300	51.63	30	10.78	8787.6	1417.36	10.62	5963.43	961.84	192673	341.86	0.48
04-21-2021 19:38	O2	Auto	442000	37900	51.63	31	11.05	8832	1424.52	10.95	6007.3	968.92	196393	343.86	0.5
04-21-2021 21:38	O2	Auto	442000	36500	55.93	32	11.05	8876.1	1431.63	10.88	6050.82	975.94	200173	345.86	0.5
04-21-2021 23:38	O2	Auto	442000	35400	55.93	33	11.05	8920.3	1438.76	10.88	6094.41	982.97	204073	347.86	0.5
04-22-2021 01:37	O2	Auto	442000	35600	60.23	33	11.05	8963.94	1445.8	10.95	6137.5	989.92	208000	349.85	0.5
04-22-2021 03:37	O2	Auto	446000	34800	62.38	34	11.15	9008.14	1452.93	11.02	6181.12	996.96	212020	351.85	0.5
04-22-2021 05:37	O2	Auto	442000	33600	64.54	35	11.05	9051.64	1459.94	10.96	6224.04	1003.88	216220	353.85	0.5
04-22-2021 07:34	SHUTDOWN	Auto	434000	0	0	0	9.76	9093.75	1466.73	0	6256	1009.03	219400	355.8	0.45
04-22-2021 12:28	SNAPSHOT	Auto	434000	0	0	0	0	9093.75	1466.73	0	6256	1009.03	219400	357.76	1.96
04-22-2021 12:58	O2	Auto	626000	44700	23.66	37	15.65	9109.4	1469.26	15.41	6271.41	1011.52	220510	358.26	0.5
04-22-2021 14:58	O2	Auto	606000	45800	23.66	35	15.15	9171.3	1479.24	14.94	6332.42	1021.36	224560	360.26	0.5
04-22-2021 16:57	O2	Auto	618000	49500	51.63	33	15.45	9232.99	1489.19	15.22	6393.27	1031.17	228516	362.24	0.5
04-22-2021 18:57	O2	Auto	598000	45300	23.66	35	14.95	9293.59	1498.97	14.77	6453.14	1040.83	232776	364.24	0.5
04-22-2021 20:57	O2	Auto	598000	44100	23.66	36	14.95	9353.89	1508.69	14.79	6512.71	1050.44	237096	366.24	0.5
04-22-2021 22:57	O2	Auto	594000	45000	23.66	35	14.85	9413.59	1518.32	14.67	6571.59	1059.93	241386	368.24	0.5
04-23-2021 00:56	O2	Auto	602000	44300	23.66	36	15.05	9473.78	1528.03	14.86	6630.87	1069.49	245670	370.22	0.5
04-23-2021 02:56	O2	Auto	602000	44100	23.66	36	15.05	9534.18	1537.77	14.79	6690.37	1079.09	249990	372.22	0.5
04-23-2021 04:56	O2	Auto	602000	43100	25.81	37	15.05	9594.28	1547.46	14.86	6749.68	1088.66	254370	374.22	0.5
04-23-2021 06:55	O2	Auto	598000	42900	25.81	37	14.45	9653.98	1557.09	14.3	6808.55	1098.15	258773	376.21	0.48
04-23-2021 08:55	O2	Auto	622000	47100	32.27	35	15.55	9714.48	1566.85	15.36	6868.28	1107.79	263123	378.21	0.5
04-23-2021 10:55	O2	Auto	614000	47900	49.48	34	15.35	9775.48	1576.69	15.17	6928.52	1117.5	267173	380.21	0.5
04-23-2021 11:54	SHUTDOWN	Auto	602000	0	0	0	14.55	9805.38	1581.51	0	6943.65	1119.94	268253	381.19	0.48
04-23-2021 12:04	SNAPSHOT	Semi	602000	0	0	0	0	9805.38	1581.51	0	6943.65	1119.94	268253	381.36	0.17
04-23-2021 13:33	O2	Auto	450000	33000	23.66	36	10.88	9838.86	1586.91	10.7	6976.65	1125.27	271337	382.84	0.48
04-23-2021 15:33	O2	Auto	458000	36900	40.87	33	11.45	9884.66	1594.3	11.35	7021.94	1132.57	275227	384.84	0.5
04-23-2021 17:33	O2	Auto	458000	36700	40.87	33	11.45	9930.36	1601.67	11.28	7066.95	1139.83	279287	386.84	0.5
04-23-2021 19:33	O2	Auto	450000	35100	43.02	34	11.25	9975.36	1608.93	11.12	7111.4	1147	283277	388.84	0.5
04-23-2021 21:32	O2	Auto	438000	34200	43.02	34	10.95	10019.19	1616	10.83	7154.79	1154	287323	390.82	0.5
04-23-2021 23:32	O2	Auto	430000	32400	43.02	35	10.75	10062.19	1622.93	10.57	7197.19	1160.84	291433	392.82	0.5
04-24-2021 02:02	O2	Auto	442000	31600	45.18	36	11.05	10115.94	1631.54	10.6	7248.61	1169.29	296593	395.32	0.5
04-24-2021 04:01	O2	Auto	438000	31300	47.33	37	10.58	10159.37	1638.61	10.43	7292.79	1176.26	300996	397.31	0.48
04-24-2021 06:01	O2	Auto	434000	31100	47.33	37	10.85	10202.57	1645.58	10.72	7335.54	1183.15	305436	399.31	0.5
04-24-2021 08:01	O2	Auto	438000	30400	49.48	38	10.95	10246.07	1652.59	10.76	7367.68	1188.34	308856	401.31	0.5
04-24-2021 10:01	O2	Auto	434000	31100	47.33	37	10.85	10289.67	1659.62	10.72	7410.79	1195.29	313326	403.31	0.5
04-24-2021 12:00	O2	Auto	438000	32400	47.33	36	10.95	10333.6	1666.71	10.87	7454.28	1202.3	317669	405.29	0.5
04-24-2021 14:00	O2	Auto	442000	32600	45.18	36	11.05	10377.7	1673.82	10.93	7497.82	1209.33	321989	407.29	0.5
04-24-2021 16:00	O2	Auto	410000	31000	23.66	35	10.25	10418.5	1680.4	10.11	7538.14	1215.83	326219	409.29	0.5
04-24-2021 18:00	O2	Auto	406000	29700	23.66	36	10.15	10459.3	1686.98	9.96	7578.35	1222.32	330539	411.29	0.5
04-24-2021 19:59	O2	Auto	406000	29800	23.66	36	10.15	10499.36	1693.44	10	7617.92	1228.7	334793	413.27	0.5
04-24-2021 21:59	O2	Auto	402000	30600	21.51	35	10.05	10539.96	1699.99	9.98	7658.15	1235.18	339023	415.27	0.5
04-24-2021 23:59	O2	Auto	410000	31000	21.51	35	10.25	10581.26	1706.65	10.11	7698.84	1241.75	343223	417.27	0.5
04-25-2021 01:58	O2	Auto	390000	29500	21.51	35	9.75	10620.73	1713.02	9.62	7737.81	1248.03	347388	419.26	0.5
04-25-2021 03:58	O2	Auto	406000	30600	21.51	35	10.15	10660.43	1719.42	9.98	7776.86	1254.33	351528	421.26	0.5
04-25-2021 05:58	O2	Auto	402000	30300	21.51	35	10.05	10700.53	1725.89	9.88	7816.3	1260.69	355698	423.26	0.5
04-25-2021 07:58	O2	Auto	394000	28900	21.51	36	9.85	10740.13	1732.28	9.69	7855.44	1267.01	359928	425.26	0.5
04-25-2021 09:57	O2	Auto	394000	29800	21.51	35	9.85	10779.2	1738.58	9.72	7894.05	1273.23	364093	427.24	0.5
04-25-2021 11:57	O2	Auto	394000	30600	21.51	34	9.85	10818.8	1744.97	9.69	7933.37	1279.58	368203	429.24	0.5
04-25-2021 13:57	O2	Auto	406000	30700	21.51	35	10.15	10859.2	1751.48	10.01	7973.19	1286	372343	431.24	0.5
04-25-2021 15:56	O2	Auto	402000	31300	21.51	34	9.72	10899.36	1757.96	9.59	8012.88	1292.4	376449	433.22	0.48
04-25-2021 17:56	O2	Auto	402000	30400	21.51	35	10.05	10939.56	1764.45	9.91	8052.56	1298.8	380619	435.22	0.5
04-25-2021 19:56	O2	Auto	398000	30200	21.51	35	9.95	10979.56	1770.9	9.85	8092.06	1305.17	384819	437.22	0.5
04-25-2021 21:56	O2	Auto	390000	28700	21.51	36	9.75	11018.76	1777.22	9.63	8130.82	1311.42	389109	439.22	0.5
04-25-2021 23:55	O2	Auto	386000	27700	21.51	37	9.65	11057.44	1783.46	9.55	8169.03	1317.59	393423	441.21	0.5
04-26-2021 01:55	O2	Auto	394000	28100	21.51	37	9.85	11096.94	1789.83	9.69	8207.92	1323.86	397863	443.21	0.5
04-26-2021 03:55	O2	Auto	394000	27500	23.66	38	9.85	11136.94	1796.28	9.74	8247.39	1330.22	402363	445.21	0.5
04-26-2021 05:55	O2	Auto	386000	26900	21.51	38	9.65	11176.04	1802.59	9.52	8286.02	1336.46	406923	447.21	0.5
04-26-2021 07:54	O2	Auto	394000	26800	23.66	39	9.85	11214.71	1808.82	9.74	8324.29	1342.63	411534	449.19	0.5
04-26-2021 09:54	O2	Auto	386000	26900	23.66	38	9.65	11253.51	1815.08	9.52	8362.93	1348.86	416124	451.19	0.5
04-26-2021 11:54	O2	Auto	390000	27200	23.66	38	9.75	11292.31	1821.34	9.63	8401.31	1355.05	420684	453.19	0.5
04-26-2021 13:53	O2	Auto	414000	29700	47.33	37	10.01	11332.67	1827.85	9.9	8441.08	1361.47	425027	455.17	0.48
04-26-2021 15:53	O2	Auto	426000	30400	49.48	37	10.65	11374.77	1834.64	10.48	8482.58	1368.16	429437	457.17	0.5
04-26-2021 17:53	O2	Auto	430000	30700	49.48	37	10.75	11417.57	1841.54	10.58	8524.81	1374.97	433877	459.17	0.5
04-26-2021 19:53	O2	Auto	422000	29500	51.63	38	10.55	11460.17	1848.41	10.44	8567.02	1381.78	438407	461.17	0.5
04-26-2021 21:52	O2	Auto	410000	28700	51.63	38	10.25	11501.32	1855.05	10.16	8607.68	1388.34	442929	463.16	0.5
04-26-2021 23:52	O2	Auto	398000	27800	53.78	38	9.95	11541.82	1861.58	9.84	8647.58	1394.77	447489	465.16	0.5
04-27-2021 01:52	O2	Auto	406000	27400	53.78	39	10.15	11581.82	1868.04	9.96	8686.99	1401.13	452079	467.16	0.5
04-27-2021 03:52	O2	Auto	394000	27400	53.78	38	9.85	11621.32	1874.41	9.7	8725.73	1407.38	456639	469.16	0.5
04-27-2021 05:51	O2	Auto	418000	27600	55.93	40	10.45	11662.19	1881	10.29	8766.1	1413.89	461340	471.14	0.5
04-27-2021 07:51	O2	Auto	418000	27700	55.93	40	10.45	11703.89	1887.72	10.32	8807.25	1420.52	466140	473.14	0.5
04-27-2021 09:51	O2	Auto	418000	27800	55.93	40	10.45	11745.89	1894.5	10.36	8848.65	1427.2	470940	475.14	0.5
04-27-2021 11:50	O2	Auto	402000	28600	53.78	37	10.05	11786.35	1901.02	9.86	8888.6	1433.65	475462	477.12	0.5
04-27-2021 13:50	O2	Auto	402000	29700	51.63	36	10.05	11825.85	1907.39	9.96	8927.75	1439.96	479782	479.12	0.5
04-27-2021 15:50	O2	Auto	398000	30300	51.63	35	9.95	11865.35	1913.77	9.88	8966.87	1446.27	484042	481.12	0.5
04-27-2021 17:50	O2	Auto	394000	29800	53.78	35	9.85	11905.05	1920.17	9.72	9006.04	1452.59	488242	483.12	0.5
04-27-2021 19:49	O2	Auto	330000	24900	25.81	35	8.25	11936.39	1925.22	8.12	9036.96	1457.57	492407	485.11	0.5
04-27-2021 21:49	O2	Auto	338000	24900	25.81	36	8.45	11969.89	1930.63	8.35	9070	1462.9	496697	487.11	0.5
04-27-2021 23:49	O2	Auto	334000	25400	23.66	35	8.35	12003.59	1936.06	8.28	9103.4	1468.29	500987	489.11	0.5
04-28-2021 01:48	O2	Auto	346000	25600	23.66	36	8.36	12037.5	1941.53	8.3	9137.02	1473.71	505241	491.09	0.48
04-28-2021 03:48	O2	Auto	342000	25200	23.66	36	8.55	12072	1947.1	8.45	9171.23	1479.23	509561	493.09	0.5
04-28-2021 05:48	O2	Auto	350000	25900	23.66	36	8.75	12106.7	1952.69	8.69	9205.48	1484.76	513881	495.09	0.5
04-28-2021 07:48	O2	Auto	350000	25700	23.66	36	8.75	12141.4	1958.29	8.62	9239.7	1490.27	518201	497.09	0.5
04-28-2021 09:47	O2	Auto	350000	26600	21.51	35	8.75	12176.11	1963.89	8.67	9274.06	1495.82	522426	499.07	0.5
04-28-2021 11:47	O2	Auto	366000	28500	21.51	34	9.15	12212.21	1969.71	9.03	9309.7	1501.56	526566	501.07	0.5
04-28-2021 13:47	O2	Auto	382000	30500	21.51	33	9.55	12249.61	1975.74	9.38	9346.61	1507.52	530556	503.07	0.5
04-28-2021 15:47	O2	Auto	378000	31100	21.51	32	9.45	12287.11	1981.79	9.27	9383.58	1513.48	534396	505.07	0.5
04-28-2021 17:46	O2	Auto	370000	30800	21.51	32	9.25	12324.49	1987.82	9.18	9420.51	1519.44	538174	507.06	0.5

Time Stamp	Murphy Status	Op Status	Mass Transfer Btu/Hr Approach: BTU/Hr(est)	PPMV(est)	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Mass Transfer Equation (indirectly based on Btu/hr estimate) Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Cubic Feet Processed Cumulative	Cumulative Time (hours)	Delta Time (Hours)
04-28-2021 19:46	O2	Auto	362000	29100	19.36	33	9.05	12361.29	1993.76	8.95	9456.9	1525.31	542104	509.06	0.5
04-28-2021 21:46	O2	Auto	358000	28700	21.51	33	8.95	12397.19	1999.55	8.82	9492.29	1531.01	546064	511.06	0.5
04-28-2021 23:45	O2	Auto	346000	27900	19.36	33	8.36	12431.8	2005.13	8.29	9526.6	1536.55	549991	513.04	0.48
04-29-2021 01:45	O2	Auto	346000	26900	19.36	34	8.65	12466.5	2010.73	8.52	9560.86	1542.07	554011	515.04	0.5
04-29-2021 03:45	O2	Auto	350000	27200	19.36	34	8.75	12501.5	2016.37	8.62	9595.41	1547.65	558031	517.04	0.5
04-29-2021 05:45	O2	Auto	346000	26800	19.36	34	8.65	12536.2	2021.97	8.49	9629.66	1553.17	562111	519.04	0.5
04-29-2021 07:44	O2	Auto	334000	26100	19.36	34	8.35	12569.72	2027.37	8.27	9662.83	1558.52	566098	521.02	0.5
04-29-2021 09:44	O2	Auto	326000	26300	19.36	33	8.15	12603.12	2032.76	8.09	9695.88	1563.85	570058	523.02	0.5
04-29-2021 11:44	O2	Auto	358000	30800	45.18	31	8.95	12637.72	2038.34	8.9	9730.15	1569.38	573778	525.02	0.5
04-29-2021 13:43	O2	Auto	350000	32100	36.57	29	8.46	12672.13	2043.89	8.38	9764.2	1574.87	577379	527.01	0.48
04-29-2021 15:43	O2	Auto	362000	32000	43.02	30	9.05	12708.43	2049.75	8.94	9800.01	1580.65	581069	529.01	0.5
04-29-2021 17:43	O2	Auto	358000	31600	43.02	30	8.95	12744.93	2055.63	8.83	9835.95	1586.44	584669	531.01	0.5
04-29-2021 19:43	O2	Auto	318000	28200	19.36	30	7.95	12777.43	2060.88	7.88	9868.31	1591.66	588209	533.01	0.5
04-29-2021 21:42	O2	Auto	306000	27000	19.36	30	7.65	12807.37	2065.71	7.55	9897.89	1596.43	591838	534.99	0.5
04-29-2021 23:42	O2	Auto	326000	28000	19.36	31	8.15	12838.97	2070.8	8.09	9929.15	1601.48	595498	536.99	0.5
04-30-2021 01:42	O2	Auto	322000	26700	19.36	32	8.05	12871.47	2076.04	7.96	9961.31	1606.66	599308	538.99	0.5
04-30-2021 03:42	O2	Auto	330000	27300	19.36	32	8.25	12904.37	2081.35	8.14	9993.75	1611.9	603178	540.99	0.5
04-30-2021 05:41	O2	Auto	334000	26200	19.36	34	8.35	12937.1	2086.63	8.3	10026.22	1617.13	607165	542.97	0.5
04-30-2021 07:24	SHUTDOWN	Auto	338000	0	0	0	3.66	12965.71	2091.24	0	10050.9	1621.11	610315	544.69	0.22
04-30-2021 08:07	STALL	Startup	338000	0	0	0	0	12965.71	2091.24	0	10050.9	1621.11	610315	545.41	0.72
04-30-2021 08:16	SNAPSHOT	Auto	338000	0	0	0	0	12965.71	2091.24	0	10050.9	1621.11	610315	545.56	0.15
04-30-2021 08:46	O2	Auto	402000	40900	43.02	26	10.05	12975.76	2092.86	9.91	10060.81	1622.71	611095	546.06	0.5
04-30-2021 10:46	O2	Auto	514000	37800	51.63	36	12.85	13025.36	2100.86	12.68	10109.77	1630.61	615355	548.06	0.5
04-30-2021 12:45	O2	Auto	530000	39100	51.63	36	12.81	13077.32	2109.25	12.68	10161.05	1638.88	619639	550.04	0.48
04-30-2021 14:45	O2	Auto	518000	38200	49.48	36	12.95	13129.72	2117.7	12.81	10212.78	1647.22	623959	552.04	0.5
04-30-2021 16:45	O2	Auto	530000	39000	51.63	36	13.25	13182.82	2126.26	13.08	10265.1	1655.66	628279	554.04	0.5
04-30-2021 18:45	O2	Auto	526000	37500	55.93	37	13.15	13235.22	2134.71	12.93	10316.71	1663.99	632719	556.04	0.5
04-30-2021 20:44	O2	Auto	518000	35300	60.23	39	12.95	13286.89	2143.05	12.83	10367.74	1672.22	637241	558.02	0.5
04-30-2021 22:44	O2	Auto	522000	34500	62.38	40	13.05	13338.89	2151.43	12.86	10419.04	1680.49	641981	560.02	0.5
05-01-2021 00:44	O2	Auto	506000	32800	66.69	41	12.65	13389.89	2159.66	12.53	10469.47	1688.62	646811	562.02	0.5
05-01-2021 02:44	O2	Auto	502000	32500	68.84	41	12.55	13440.39	2167.8	12.42	10519.36	1696.67	651761	564.02	0.5
05-01-2021 04:43	O2	Auto	506000	31900	73.14	42	12.65	13490.27	2175.85	12.48	10568.57	1704.61	656789	566.01	0.5
05-01-2021 06:43	O2	Auto	506000	28400	75.29	47	12.65	13540.67	2183.98	12.44	10618.32	1712.63	662219	568.01	0.5
05-01-2021 08:43	O2	Auto	514000	28900	75.29	47	12.85	13591.77	2192.22	12.66	10668.68	1720.75	667739	570.01	0.5
05-01-2021 10:42	O2	Auto	510000	30000	75.29	45	12.75	13642.24	2200.36	12.58	10718.38	1728.77	673183	571.99	0.5
05-01-2021 12:42	O2	Auto	510000	30100	73.14	45	12.75	13692.94	2208.54	12.62	10768.58	1736.87	678553	573.99	0.5
05-01-2021 14:42	O2	Auto	514000	30900	75.29	44	12.85	13744.14	2216.8	12.67	10819	1745	683833	575.99	0.5
05-01-2021 16:42	O2	Auto	514000	31000	73.14	44	12.85	13795.24	2225.04	12.71	10869.41	1753.13	689023	577.99	0.5
05-01-2021 18:41	O2	Auto	566000	34700	75.29	43	14.15	13849.52	2233.79	13.9	10923	1761.77	694140	579.97	0.5
05-01-2021 20:41	O2	Auto	554000	33300	77.44	44	13.85	13905.52	2242.83	13.65	10978.23	1770.68	699360	581.97	0.5
05-01-2021 22:41	O2	Auto	550000	32400	77.44	45	13.75	13960.72	2251.73	13.58	11032.75	1779.48	704700	583.97	0.5
05-02-2021 00:40	O2	Auto	558000	32700	77.44	45	13.95	14015.75	2260.61	13.71	11086.89	1788.21	710085	585.96	0.5
05-02-2021 02:40	O2	Auto	554000	31800	77.44	46	13.85	14071.15	2269.54	13.63	11141.54	1797.02	715605	587.96	0.5
05-02-2021 04:40	O2	Auto	554000	32000	79.59	46	13.85	14126.25	2278.43	13.72	11196	1805.81	721035	589.96	0.5
05-02-2021 06:40	O2	Auto	554000	31900	79.59	46	13.85	14181.45	2287.33	13.67	11250.47	1814.59	726465	591.96	0.5
05-02-2021 08:39	O2	Auto	562000	33000	79.59	45	14.05	14236.89	2296.27	13.84	11305.07	1823.4	731879	593.94	0.5
05-02-2021 10:39	O2	Auto	566000	34800	77.44	43	14.15	14293.19	2305.35	13.94	11360.26	1832.3	737099	595.94	0.5
05-02-2021 12:39	O2	Auto	562000	35400	77.44	42	14.05	14349.59	2314.45	13.85	11415.9	1841.27	742229	597.94	0.5
05-02-2021 14:38	O2	Auto	562000	37300	75.29	40	13.58	14405.62	2323.49	13.44	11471.17	1850.19	747079	599.92	0.48
05-02-2021 16:38	O2	Auto	566000	37400	77.44	40	14.15	14462.32	2332.63	13.94	11527.11	1859.21	751879	601.92	0.5
05-02-2021 18:38	O2	Auto	562000	36300	77.44	41	14.05	14518.72	2341.73	13.87	11582.77	1868.19	756769	603.92	0.5
05-02-2021 20:38	O2	Auto	558000	34400	77.44	43	13.95	14574.82	2350.78	13.78	11638.03	1877.1	761839	605.92	0.5
05-02-2021 22:37	O2	Auto	562000	33800	79.59	44	14.05	14630.36	2359.73	13.86	11692.74	1885.93	766986	607.91	0.5
05-03-2021 00:37	O2	Auto	554000	33200	79.59	44	13.85	14686.06	2368.72	13.61	11747.55	1894.77	772236	609.91	0.5
05-03-2021 02:37	O2	Auto	546000	33700	79.59	43	13.65	14741.36	2377.64	13.5	11802.02	1903.55	777456	611.91	0.5
05-03-2021 04:36	O2	Auto	546000	32200	79.59	45	13.2	14795.7	2386.4	13.05	11855.59	1912.19	782751	613.89	0.48
05-03-2021 06:36	O2	Auto	558000	32200	81.75	46	13.95	14851	2395.32	13.8	11910.28	1921.01	788241	615.89	0.5
05-03-2021 08:36	O2	Auto	562000	31700	81.75	47	14.05	14907.1	2404.37	13.88	11965.59	1929.93	793881	617.89	0.5
05-03-2021 10:36	O2	Auto	438000	27700	34.42	42	10.95	14951.7	2411.56	10.84	12009.64	1937.04	799041	619.89	0.5
05-03-2021 12:35	O2	Auto	470000	29600	32.27	42	11.75	14997.22	2418.91	11.58	12054.58	1944.29	804039	621.87	0.5
05-03-2021 13:40	SHUTDOWN	Auto	466000	0	0	0	1.94	15022.56	2422.99	0	12077.69	1948.01	806499	622.96	0.08
05-03-2021 13:57	SNAPSHOT	Auto	466000	0	0	0	0	15022.56	2422.99	0	12077.69	1948.01	806499	623.24	0.28
05-03-2021 14:48	SHUTDOWN	Auto	0	0	0	0	0	15031.51	2424.44	0	12086.51	1949.44	807339	624.09	0.35
05-03-2021 15:01	SNAPSHOT	Auto	0	0	0	0	0	15031.51	2424.44	0	12086.51	1949.44	807339	624.31	0.22
05-03-2021 15:31	O2	Auto	446000	28900	58.08	41	11.15	15042.66	2426.24	11.04	12097.55	1951.22	808569	624.81	0.5
05-03-2021 17:30	O2	Auto	430000	29900	49.48	38	10.39	15086.2	2433.26	10.23	12140.46	1958.14	813181	626.79	0.48
05-03-2021 19:30	O2	Auto	410000	29400	49.48	37	10.25	15127.9	2439.98	10.14	12181.63	1964.78	817621	628.79	0.5
05-03-2021 21:30	O2	Auto	422000	28700	49.48	39	10.55	15169.6	2446.71	10.43	12222.77	1971.41	822181	630.79	0.5
05-03-2021 23:30	O2	Auto	422000	28700	49.48	39	10.55	15211.4	2453.45	10.43	12264.05	1978.07	826861	632.79	0.5
05-04-2021 01:29	O2	Auto	410000	28500	49.48	38	10.25	15252.36	2460.06	10.09	12304.46	1984.59	831383	634.77	0.5
05-04-2021 03:29	O2	Auto	410000	28500	49.48	38	10.25	15293.26	2466.65	10.09	12344.85	1991.11	835943	636.77	0.5
05-04-2021 05:29	O2	Auto	402000	28700	49.48	37	10.05	15333.26	2473.11	9.89	12384.36	1997.48	840383	638.77	0.5
05-04-2021 07:28	O2	Auto	394000	28200	49.48	37	9.52	15372.23	2479.39	9.4	12422.82	2003.68	844786	640.76	0.48
05-04-2021 09:28	O2	Auto	394000	28300	49.48	37	9.85	15411.13	2485.67	9.76	12461.16	2009.86	849136	642.76	0.5
05-04-2021 11:28	O2	Auto	394000	28300	49.48	37	9.85	15450.23	2491.97	9.76	12499.81	2016.1	853546	644.76	0.5
05-04-2021 12:31	SHUTDOWN	Auto	490000	0	0	0	1.23	15476.35	2496.19	0	12524.38	2020.06	856036	645.81	0.05
05-04-2021 12:33	STALL	Auto	490000	0	0	0	0	15476.35	2496.19	0	12524.38	2020.06	856036	645.84	0.03
05-04-2021 12:40	SNAPSHOT	Auto	490000	0	0	0	0	15476.35	2496.19	0	12524.38	2020.06	856036	645.96	0.12
05-04-2021 13:40	O2	Auto	474000	29300	60.23	43	11.85	15499.65	2499.94	11.74	12547.43	2023.78	858586	646.96	0.5
05-04-2021 15:39	O2	Auto	506000	30500	60.23	44	12.65	15549.33	2507.96	12.5	12596.42	2031.68	863792	648.94	0.5
05-04-2021 17:39	O2	Auto	518000	30500	58.08	45	12.95	15601.23	2516.33	12.79	12647.57	2039.93	869192	650.94	0.5
05-04-2021 19:39	O2	Auto	506000	30500	58.08	44	12.65	15652.43	2524.59	12.5	12698.08	2048.08	874502	652.94	0.5
05-04-2021 21:39	O2	Auto	482000	30400	60.23	42	12.05	15701.73	2532.54	11.9	12746.71	2055.92	879602	654.94	0.5
05-04-2021 23:38	O2	Auto	466000	30900	60.23	40	11.65	15748.63	2540.1	11.52	12793.07	2063.4	884480	656.92	0.5
05-05-2021 01:38	O2	Auto	458000	31100	60.23	39	11.45	15794.53	2547.5	11.3	12838.34	2070.7	889190	658.92	0.5
05-05-2021 03:38	O2	Auto	446000	30300	60.23	39	11.15	15839.83	2554.81	11.01	12882.99	2077.9	893840	660.92	0.5
05-05-2021 05:37	O2	Auto	442000	30800	58.08	38	11.05	15883.56	2561.86	10.91	12926.09	2084.85	898302	662.91	0.5
05-05-2021 07:37	O2	Auto	434000	30900	60.23	37	10.85	15927.16	2568.9	10.65	12969.2	2091.81	902802	664.91	0.5
05-05-2021 09:37	O2	Auto	414000	30500	60.23	36	10.35	15969.36	2575.7	10.23	13011.18	2098.58	907212	666.91	0.5
05-05-2021 11:37	O2	Auto	430000	32500	66.69	35	10.75	16013.06	2582.75	10.6	13054.27	2105.53	911622	668.91	0.5
05-05-2021 13:36	O2	Auto	418000	32500	68.84	34	10.45	16054.91	2589.5	10.3	13095.63	2112.2	915698	670.89	0.5
05-05-2021 15:36	O2	Auto	414000	34300	66.69	32	10.35	16096.41	2596.2	10.23	13136.67	2118.82	919568	672.89	0.5
05-05-2021 17:36	O2	Auto	418000	33500	68.84	33	10.45	16138.31	2602.95	10.3	13178.44	2125.55	923498	674.89	0.5
05-05-2021 19:35	O2	Auto	422000	30900	68.84	36	10.55	16179.76	2609.64	10.36	13219.36	2132.15	927633	676.87	0.5
05-05-2021 21:35	O2	Auto	426000	30400	68.84	37	10.65	16222.16	2616.48	10.48	13261.2	2138.9	932043	678.87	0.5
05-05-2021 23:35	O2	Auto	414000	29800	68.84	37	10.35	16263.86	2623.2	10.27	13302.46	2145.56	936483	680.87	0.5
05-06-2021 01:35	O2	Auto	414000	29700	68.84	37	10.35	16305.36	2629.9	10.24	13343.48	2152.17	940893	682.87	0.5
05-06-2021 03:34	O2	Auto	430000	31500	68.84	36	10.75	16347.41	2636.68	10.57	13384.89	2158.85	945207	684.86	0.5
05-06-2021 05:34	O2	Auto	410000	31000	68.84	35	10.25	16389.01	2643.39	10.11	13425.91	2165.47	949437	686.86	0.5
05-06-2021 07:34	O2	Auto	414000	31300	68.84	35	10.35	16430.21	2650.03	10.21	13466.64	2172.04	953637	688.86	0.5
05-06-2021 09:33	O2	Auto	430000	29900	68.84	38	10.39	16472.15	2656.8	10.23	13508	2178.71	958039	690.84	0.48
05-06-2021 11:33	O2	Auto	438000	29600	68.84	39	10.95	16515.75	2663.83	10.76	13550.97	2185.64	962659	692.84	0.5
05-06-2021 13:33	O2	Auto	438000	30500	68.84	38	10.95	16559.75	2670.93	10.8	13594.38	2192.64	967219	694.84	0.5
05-06-2021 15:33	O2	Auto	438000	31400	68.84	37	10.95	16603.65	2678.01	10.82	13637.61	2199.62	971689	696.84	0.5
05-06-2021 17:32	O2	Auto	438000	30500	68.84	38	10.95	16647.28	2685.05	10.8	13680.65	2206.56	976181	698.82	0.5
05-06-2021 19:32	O2	Auto	438000	30500	68.84	38	10.95	16691.08	2692.11	10.8	13723.95	2213.54	980741	700.82	0.5
05-06-2021 21:32	O2	Auto	430000	30800	68.84	37	10.75	16734.18	2699.06	10.62	13766.61	2220.42	985271	702.82	0.5
05-06-2021 23:31	O2	Auto	426000	30500	68.84	37	10.3	16776.33	2705.86	10.16	13808.32	2227.15	989674	704.81	0.48
05-07-2021 01:31	O2	Auto	426000	30500	70.99	37	10.65	16819.43	2712.81	10.51	13850.86	2234.01	994114	706.81	0.5
05-07-2021 03:31	O2	Auto	430000	30900	68.84	37	10.75	16862.33	2719.73	10.65	13893.25	2240.85	998524	708.81	0.5
05-07-2021 05:31	O2	Auto	422000	31200	68.84	36	10.55	16904.53	2726.54	10.47	13934.89	2247.56	1002874	710.81	0.5
05-07-2021 07:30	O2	Auto	426000	31300	68.84	36	10.65	16946.47	2733.3	10.5	13976.2	2254.23	1007158	712.79	0.5
05-07-2021 09:30	O2	Auto	438000	31400	68.84	37	10.95	16989.47	2740.24	10.82	14018.62	2261.07	1011568	714.79	0.5
05-07-2021 11:30	O2	Auto	450000	30500	68.84	39	11.25	17033.87	2747.4	11.08	14062.49	2268.14	1016218	716.79	0.5
05-07-2021 13:30	O2	Auto	438000	31500	68.84	37	10.95	17078.47	2754.59	10.86	14106.56	2275.25	1020778	718.79	0.5
05-07-2021 15:29	O2	Auto	442000	31500	68.84	37	11.05	17122.41	2761.68	10.86	14149.89	2282.24	1025210	720.77	0.5
05-07-2021 17:29	O2	Auto	446000	31000	68.84	38	11.15	17167.21	2768.9	10.98	14194.04	2289.36	1029770	722.77	0.5
05-07-2021 19:29	O2	Auto	430000	30600	68.84	37	10.75	17210.61	2775.9	10.55	14236.83	2296.26	1034240	724.77	0.5
05-07-2021 21:28	O2	Auto	410000	30300	68.84	36	10.25	17251.47	2782.49	10.16	14277.28	2302.79	1038525	726.76	0.5
05-07-2021 23:28	O2	Auto	406000	30600	68.84	35	10.15	17291.87	2789.01	9.98	14317.21	2309.23	1042755	728.76	0.5
05-08-2021 01:28	O2	Auto	402000	30500	68.84	35	10.05	17331.97	2795.48	9.95	14356.87	2315.62	1046925	730.76	0.5
05-08-2021 03:28	O2	Auto	398000	30200	68.84	35	9.95	17372.37	2801.99	9.85	14396.77	2322.06	1051155	732.76	0.5
05-08-2021 05:27	O2	Auto	402000	31200	68.84	34	10.05	17411.94	2808.38	9.88	14435.82	2328.36	1055201	734.74	0.5
05-08-2021 07:27	O2	Auto	386000	30200	68.84	34	9.65	17451.04	2814.68	9.57	14474.4	2334.58	1059251	736.74	0.5
05-08-2021 09:27	O2	Auto	410000	30200	68.84	36	10.25	17491.34	2821.18	10.13	14514.15	2340.99	1063451	738.74	0.5
05-08-2021 11:26	O2	Auto	414000	30500	68.84	36	10.01	17531.59	2827.84	9.89	14554.93	2347.57	1067735	740.72	0.48
05-08-2021 13:26	O2	Auto	418000	30800	68.84	36	10.45	17574.29	2834.56	10.33	14596.11	2354.21	1072115	742.72	0.5
05-08-2021 15:26	O2	Auto	422000	31000	68.84	36	10.55	17615.59	2841.22	10.4	14637	2360.81	1076435	744.72	0.5
05-08-2021 17:26	O2	Auto	410000	30200	68.84	36	10.25	17657.69	2848.02	10.13	14678.56	2367.51	1080755	746.72	0.5
05-08-2021 19:25	O2	Auto	394000	29800	68.84	35	9.85	17697.66	2854.46	9.72	14718.06	2373.88	1084950	748.71	0.5
05-08-2021 21:25	O2	Auto	394000	30600	70.99	34	9.85	17737.16	2860.83	9.69	14756.98	2380.16	1089090	750.71	0.5
05-08-2021 23:25	O2	Auto	386000	30100	68.84	34	9.65	17775.66	2867.04	9.54	14795.06	2386.3	1093140	752.71	0.5
05-09-2021 01:24	O2	Auto	378000	29500	70.99	34	9.14	17813.44	2873.14	9.03	14832.41	2392.32	1097186	754.69	0.48
05-09-2021 03:24	O2	Auto	386000	30000	70.99	34	9.65	17851.84	2879.33	9.5	14870.33	2398.44	1101236	756.69	0.5
05-09-2021 05:24	O2	Auto	370000	29900	68.84	33	9.25	17889.04	2885.33	9.19	14907.14	2404.38	1105196	758.69	0.5
05-09-2021 07:24	O2	Auto	374000	30000	68.84	33	9.35	17925.84	2891.26	9.22	14943.45	2410.23	1109156	760.69	0.5
05-09-2021 09:23	O2	Auto	386000	29100	68.84	35	9.65	17963.92	2897.41	9.49	14981.04	2416.3	1113202	762.67	0.5
05-09-2021 11:23	O2	Auto	398000	30200	68.84	35	9.95	18003.82	2903.84	9.85	15020.5	2422.66	1117462	764.67	0.5
05-09-2021 13:23	O2	Auto	406000	29100	68.84	37	10.15	18044.32	2910.37	10.03	15060.45	2429.11	1121902	766.67	0.5
05-09-2021 15:23	O2	Auto	402000	30500	68.84	35	10.05	18084.62	2916.87	9.95	15100.2	2435.52	1126162	768.67	0.5
05-09-2021 17:22	O2	Auto	422000	30900	68.84	36	10.55	18125.58	2923.48	10.36	15140.59	2442.03	1130446	770.66	0.5
05-09-2021 19:22	O2	Auto	414000	31400	68.84	35	10.35	18166.98	2930.16	10.24	15181.61	2448.65	1134796	772.66	0.5

Mass Transfer Btu/Hr Approach:

Mass Transfer Equation (indirectly based on Btu/hr estimate)

Time Stamp	Murphy Status	Op Status	BTU/Hr(est)	PPMV(est)	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Cubic Feet Processed Cumulative	Cumulative Time (hours)	Delta Time (Hours)
05-09-2021 21:22	O2	Auto	406000	30800	70.99	35	10.15	18207.68	2936.72	10.04	15221.81	2455.13	1139086	774.66	0.5
05-09-2021 23:21	O2	Auto	414000	30300	68.84	36	10.35	18248.54	2943.31	10.16	15262.1	2461.63	1143340	776.64	0.5
05-10-2021 01:21	O2	Auto	414000	31300	68.84	35	10.35	18289.84	2949.97	10.21	15302.8	2468.19	1147540	778.64	0.5
05-10-2021 03:21	O2	Auto	406000	30800	68.84	35	10.15	18330.84	2956.59	10.04	15343.24	2474.72	1151740	780.64	0.5
05-10-2021 05:21	O2	Auto	398000	30300	68.84	35	9.95	18371.04	2963.07	9.88	15383.02	2481.13	1155940	782.64	0.5
05-10-2021 07:20	O2	Auto	386000	30000	70.99	34	9.65	18409.71	2969.31	9.5	15421.31	2487.31	1159986	784.62	0.5
05-10-2021 08:55	SHUTDOWN	Auto	394000	0	0	0	1.64	18440.4	2974.26	0	15449.97	2491.93	1163076	786.21	0.08
05-10-2021 12:49	STALL	Auto	394000	0	0	0	0	18440.4	2974.26	0	15449.97	2491.93	1163076	787.87	1.66
05-10-2021 12:52	STALL	Auto	394000	0	0	0	0	18440.4	2974.26	0	15449.97	2491.93	1163076	787.92	0.05
05-10-2021 12:59	SNAPSHOT	Auto	394000	0	0	0	0	18440.4	2974.26	0	15449.97	2491.93	1163076	788.04	0.12
05-10-2021 14:58	O2	Auto	466000	32500	58.08	38	11.65	18485.74	2981.57	11.51	15494.69	2499.14	1167657	790.02	0.5
05-10-2021 16:58	O2	Auto	486000	33000	58.08	39	12.15	18533.74	2989.31	11.99	15542.02	2506.78	1172307	792.02	0.5
05-10-2021 18:58	O2	Auto	494000	32700	60.23	40	12.35	18582.94	2997.25	12.19	15590.5	2514.6	1177107	794.02	0.5
05-10-2021 20:57	O2	Auto	486000	31400	62.38	41	12.15	18631.83	3005.13	12	15638.43	2522.33	1181956	796	0.5
05-10-2021 22:57	O2	Auto	490000	30800	64.54	42	12.25	18680.93	3013.05	12.05	15686.82	2530.13	1186966	798	0.5
05-11-2021 00:57	O2	Auto	498000	31400	66.69	42	12.45	18730.63	3021.07	12.29	15735.89	2538.05	1192006	800	0.5
05-11-2021 02:57	O2	Auto	506000	31800	68.84	42	12.65	18780.83	3029.17	12.44	15785.39	2546.03	1197046	802	0.5
05-11-2021 04:56	O2	Auto	486000	31500	68.84	41	12.15	18829.92	3037.08	12.03	15833.8	2553.84	1202014	803.99	0.5
05-11-2021 06:56	O2	Auto	486000	32200	68.84	40	12.15	18878.42	3044.91	12	15881.69	2561.56	1206844	805.99	0.5
05-11-2021 08:56	O2	Auto	490000	31700	68.84	41	12.25	18927.02	3052.74	12.11	15929.61	2569.29	1211704	807.99	0.5
05-11-2021 10:55	O2	Auto	498000	31300	68.84	42	12.04	18976	3060.65	11.84	15977.92	2577.08	1216642	809.97	0.48
05-11-2021 12:55	O2	Auto	506000	32600	68.84	41	12.65	19026.2	3068.74	12.45	16027.73	2585.12	1221682	811.97	0.5
05-11-2021 14:55	O2	Auto	506000	32600	68.84	41	12.65	19076.8	3076.9	12.45	16077.59	2593.16	1226692	813.97	0.5
05-11-2021 16:55	O2	Auto	490000	32500	68.84	40	12.25	19126.5	3084.92	12.11	16126.69	2601.08	1231582	815.97	0.5
05-11-2021 18:54	O2	Auto	486000	32100	68.84	40	12.15	19175.29	3092.79	11.96	16174.76	2608.83	1236342	817.95	0.5
05-11-2021 20:54	O2	Auto	478000	33300	70.99	38	11.95	19223.59	3100.58	11.79	16222.38	2616.51	1240992	819.95	0.5
05-11-2021 22:54	O2	Auto	474000	31400	68.84	40	11.85	19271.39	3108.29	11.7	16269.57	2624.12	1245792	821.95	0.5
05-12-2021 00:53	O2	Auto	466000	31700	68.84	39	11.26	19317.6	3115.74	11.14	16315.26	2631.49	1250463	823.94	0.48
05-12-2021 02:53	O2	Auto	466000	32500	68.84	38	11.65	19364	3123.23	11.51	16361.02	2638.87	1255083	825.94	0.5
05-12-2021 04:53	O2	Auto	454000	31700	68.84	38	11.35	19410	3130.65	11.22	16406.34	2646.18	1259643	827.94	0.5
05-12-2021 06:53	O2	Auto	446000	31200	68.84	38	11.15	19455.5	3137.98	11.05	16451.35	2653.44	1264203	829.94	0.5
05-12-2021 08:52	O2	Auto	454000	31700	68.84	38	11.35	19500.32	3145.21	11.22	16495.64	2660.59	1268695	831.92	0.5
05-12-2021 10:52	O2	Auto	478000	30800	68.84	41	11.95	19547.02	3152.75	11.77	16541.63	2668.01	1273465	833.92	0.5
05-12-2021 12:52	O2	Auto	486000	29900	68.84	43	12.15	19595.42	3160.55	11.98	16589.43	2675.71	1278595	835.92	0.5
05-12-2021 14:52	O2	Auto	386000	23300	38.72	44	9.65	19642.32	3168.12	9.55	16635.76	2683.19	1283785	837.92	0.5
05-12-2021 16:51	O2	Auto	394000	23600	36.57	44	9.85	19686.89	3175.3	9.68	16679.59	2690.26	1288961	839.9	0.5
05-12-2021 18:51	O2	Auto	438000	27000	34.42	43	10.95	19729.79	3182.22	10.82	16721.93	2697.09	1294181	841.9	0.5
05-12-2021 20:51	O2	Auto	450000	26400	36.57	45	11.25	19774.49	3189.43	11.07	16766.04	2704.2	1299491	843.9	0.5
05-12-2021 22:50	O2	Auto	446000	26100	34.42	45	11.15	19818.81	3196.58	10.94	16809.74	2711.25	1304846	845.89	0.5
05-13-2021 00:50	O2	Auto	450000	26400	34.42	45	11.25	19863.61	3203.81	11.07	16853.93	2718.38	1310246	847.89	0.5
05-13-2021 02:50	O2	Auto	454000	27200	32.27	44	11.35	19908.81	3211.1	11.15	16898.5	2725.56	1315616	849.89	0.5
05-13-2021 04:50	O2	Auto	450000	27000	32.27	44	11.25	19954.01	3218.39	11.07	16943.07	2732.75	1320956	851.89	0.5
05-13-2021 06:49	O2	Auto	450000	26400	32.27	45	11.25	19998.64	3225.59	11.07	16987.02	2739.84	1326252	853.87	0.5
05-13-2021 08:49	O2	Auto	458000	27500	32.27	44	11.45	20044.34	3232.96	11.27	17032.12	2747.12	1331592	855.87	0.5
05-13-2021 10:49	O2	Auto	454000	28100	30.12	43	11.35	20089.74	3240.28	11.26	17077.19	2754.38	1336812	857.87	0.5
05-13-2021 12:48	O2	Auto	458000	29600	30.12	41	11.45	20135.35	3247.64	11.31	17122.11	2761.63	1341751	859.85	0.5
05-13-2021 14:48	O2	Auto	454000	29400	27.97	41	11.35	20180.95	3254.99	11.23	17167.15	2768.89	1346671	861.85	0.5
05-13-2021 16:48	O2	Auto	458000	30400	27.97	40	11.45	20227.05	3262.43	11.33	17212.61	2776.23	1351531	863.85	0.5
05-13-2021 18:48	O2	Auto	470000	30300	27.97	41	11.75	20273.45	3269.91	11.58	17258.38	2783.61	1356451	865.85	0.5
05-13-2021 20:47	O2	Auto	458000	28900	27.97	42	11.45	20319.46	3277.33	11.31	17303.77	2790.93	1361420	867.84	0.5
05-13-2021 22:47	O2	Auto	458000	28800	27.97	42	11.45	20365.06	3284.69	11.27	17348.77	2798.19	1366460	869.84	0.5
05-14-2021 00:47	O2	Auto	454000	28600	25.81	42	11.35	20410.66	3292.04	11.19	17393.8	2805.45	1371530	871.84	0.5
05-14-2021 02:46	O2	Auto	450000	28400	25.81	42	10.88	20455.19	3299.22	10.74	17437.69	2812.53	1376528	873.82	0.48
05-14-2021 04:46	O2	Auto	450000	28500	25.81	42	11.25	20499.89	3306.43	11.15	17481.87	2819.66	1381568	875.82	0.5
05-14-2021 06:46	O2	Auto	462000	28400	27.97	43	11.55	20545.49	3313.79	11.38	17526.83	2826.91	1386638	877.82	0.5
05-14-2021 08:46	O2	Auto	458000	28800	25.81	42	11.45	20591.59	3321.22	11.27	17572.33	2834.25	1391738	879.82	0.5
05-14-2021 09:18	SHUTDOWN	Auto	462000	0	0	0	0.77	20603.91	3323.21	0	17583.67	2836.08	1392968	880.35	0.03
05-14-2021 09:51	SHUTDOWN	Auto	462000	0	0	0	0	20603.91	3323.21	0	17583.67	2836.08	1392968	880.9	0.55
05-14-2021 10:19	SNAPSHOT	Auto	462000	0	0	0	0	20603.91	3323.21	0	17583.67	2836.08	1392968	881.37	0.47
05-14-2021 11:49	O2	Auto	454000	28700	55.93	42	11.35	20637.46	3328.62	11.23	17616.83	2841.42	1396718	882.87	0.5
05-14-2021 13:49	O2	Auto	406000	33800	45.18	32	10.15	20681.86	3335.78	10.08	17660.72	2848.5	1401428	884.87	0.5
05-14-2021 15:49	O2	Auto	410000	34000	45.18	32	10.25	20722.56	3342.35	10.14	17700.69	2854.95	1405238	886.87	0.5
05-14-2021 17:48	O2	Auto	410000	32800	45.18	33	10.25	20763.02	3348.87	10.09	17740.61	2861.39	1409165	888.85	0.5
05-14-2021 19:48	O2	Auto	402000	32300	45.18	33	10.05	20803.42	3355.39	9.93	17780.52	2867.83	1413125	890.85	0.5
05-14-2021 21:48	O2	Auto	398000	31000	47.33	34	9.95	20843.32	3361.83	9.82	17819.95	2874.19	1417175	892.85	0.5
05-14-2021 23:47	O2	Auto	394000	30000	47.33	35	9.52	20882.49	3368.14	9.46	17858.69	2880.43	1421340	894.84	0.48
05-15-2021 01:47	O2	Auto	390000	29500	47.33	35	9.75	20921.59	3374.45	9.62	17897.27	2886.66	1425540	896.84	0.5
05-15-2021 03:47	O2	Auto	394000	29700	47.33	35	9.85	20961.09	3380.82	9.69	17936.21	2892.94	1429740	898.84	0.5
05-15-2021 05:47	O2	Auto	394000	29000	49.48	36	9.85	21000.49	3387.18	9.73	17975.18	2899.22	1434030	900.84	0.5
05-15-2021 07:46	O2	Auto	402000	29500	51.63	36	10.05	21039.76	3393.51	9.9	18013.9	2905.47	1438314	902.82	0.5
05-15-2021 09:46	O2	Auto	414000	30300	49.48	36	10.35	21080.56	3400.09	10.16	18054.11	2911.95	1442634	904.82	0.5
05-15-2021 11:46	O2	Auto	406000	30900	49.48	35	10.15	21121.46	3406.69	10.08	18094.49	2918.47	1446894	906.82	0.5
05-15-2021 13:45	O2	Auto	406000	31600	47.33	34	9.81	21161.12	3413.08	9.68	18133.66	2924.78	1450970	908.8	0.48
05-15-2021 15:45	O2	Auto	390000	29600	49.48	35	9.75	21200.62	3419.45	9.65	18172.67	2931.08	1455080	910.8	0.5
05-15-2021 17:45	O2	Auto	414000	30500	49.48	36	10.35	21241.12	3425.99	10.23	18212.67	2937.53	1459310	912.8	0.5
05-15-2021 19:45	O2	Auto	398000	29200	49.48	36	9.95	21281.32	3432.47	9.79	18252.28	2943.92	1463540	914.8	0.5
05-15-2021 21:44	O2	Auto	394000	29100	51.63	36	9.85	21320.79	3438.84	9.76	18291.51	2950.24	1467794	916.79	0.5
05-15-2021 23:44	O2	Auto	398000	28500	51.63	37	9.95	21360.69	3445.27	9.83	18330.95	2956.61	1472234	918.79	0.5
05-16-2021 01:44	O2	Auto	394000	28300	53.78	37	9.85	21399.89	3451.6	9.76	18369.74	2962.86	1476644	920.79	0.5
05-16-2021 03:44	O2	Auto	394000	28200	51.63	37	9.85	21439.29	3457.95	9.72	18408.56	2969.12	1481084	922.79	0.5
05-16-2021 05:43	O2	Auto	394000	28200	53.78	37	9.85	21478.26	3464.24	9.72	18447.04	2975.33	1485517	924.77	0.5
05-16-2021 07:43	O2	Auto	394000	27400	53.78	38	9.85	21517.46	3470.56	9.7	18485.74	2981.57	1490017	926.77	0.5
05-16-2021 09:43	O2	Auto	394000	29100	51.63	36	9.85	21556.76	3476.9	9.76	18524.65	2987.85	1494457	928.77	0.5
05-16-2021 11:42	O2	Auto	402000	29500	53.78	37	10.05	21596.43	3483.3	10.17	18564.01	2994.2	1498771	930.75	0.5
05-16-2021 13:42	O2	Auto	398000	29300	53.78	36	9.95	21635.93	3489.67	9.83	18603.11	3000.5	1503061	932.75	0.5
05-16-2021 15:42	O2	Auto	394000	29800	53.78	36	9.85	21675.43	3496.04	10	18642.47	3006.85	1507321	934.75	0.5
05-16-2021 17:42	O2	Auto	406000	29100	53.78	37	10.15	21715.93	3502.57	10.03	18682.49	3013.3	1511671	936.75	0.5
05-16-2021 19:41	O2	Auto	406000	29100	53.78	37	10.15	21755.89	3509.02	10.03	18722.01	3019.68	1516044	938.74	0.5
05-16-2021 21:41	O2	Auto	390000	28000	55.93	37	9.75	21795.59	3515.42	9.65	18761.21	3026	1520484	940.74	0.5
05-16-2021 23:41	O2	Auto	394000	28300	55.93	37	9.85	21834.89	3521.76	9.76	18800.06	3032.27	1524924	942.74	0.5
05-17-2021 01:40	O2	Auto	386000	26900	55.93	38	9.33	21873.67	3528.01	9.21	18838.37	3038.45	1529446	944.72	0.48
05-17-2021 03:40	O2	Auto	386000	27000	55.93	38	9.65	21912.37	3534.25	9.56	18876.57	3044.61	1534006	946.72	0.5
05-17-2021 05:40	O2	Auto	382000	26700	55.93	38	9.55	21950.77	3540.45	9.45	18914.46	3050.72	1538566	948.72	0.5
05-17-2021 07:40	O2	Auto	390000	26500	58.08	39	9.75	21989.87	3546.75	9.63	18952.98	3056.93	1543156	950.72	0.5
05-17-2021 09:39	O2	Auto	398000	28600	55.93	37	9.95	22029.04	3553.07	9.86	18991.76	3063.19	1547648	952.7	0.5
05-17-2021 11:39	O2	Auto	450000	26500	66.69	45	11.25	22072.54	3560.09	11.11	19034.77	3070.12	1552898	954.7	0.5
05-17-2021 13:39	O2	Auto	454000	26700	68.84	45	11.35	22117.74	3567.38	11.19	19079.33	3077.31	1558298	956.7	0.5
05-17-2021 15:38	O2	Auto	458000	26900	68.84	45	11.07	22162.86	3574.65	10.9	19123.74	3084.47	1563653	958.69	0.48
05-17-2021 17:38	O2	Auto	466000	26800	70.99	46	11.65	22208.96	3582.09	11.49	19169.1	3091.79	1569113	960.69	0.5
05-17-2021 19:38	O2	Auto	462000	26100	73.14	47	11.55	22255.46	3589.59	11.43	19215.01	3099.19	1574723	962.69	0.5
05-17-2021 21:38	O2	Auto	450000	25400	73.14	47	11.25	22300.76	3596.9	11.12	19259.84	3106.43	1580303	964.69	0.5
05-17-2021 23:37	O2	Auto	446000	25200	75.29	47	11.15	22345.67	3604.14	11.04	19304.22	3113.58	1585982	966.67	0.5
05-18-2021 01:37	O2	Auto	454000	24500	75.29	49	11.35	22390.77	3611.41	11.19	19348.59	3120.74	1591802	968.67	0.5
05-18-2021 03:37	O2	Auto	442000	24300	75.29	48	11.05	22435.37	3618.61	10.87	19392.69	3127.85	1597622	970.67	0.5
05-18-2021 05:37	O2	Auto	438000	24100	75.29	48	10.95	22479.37	3625.7	10.78	19436.12	3134.86	1603412	972.67	0.5
05-18-2021 07:36	O2	Auto	446000	24100	75.29	49	11.15	22523.31	3632.79	11	19479.46	3141.85	1609154	974.65	0.5
05-18-2021 09:36	O2	Auto	466000	24100	75.29	51	11.65	22568.91	3640.15	11.45	19524.42	3149.1	1615124	976.65	0.5
05-18-2021 11:36	O2	Auto	482000	24100	75.29	54	12.05	22616.71	3647.86	12.13	19571.78	3156.74	1621484	978.65	0.5
05-18-2021 13:35	O2	Auto	458000	25200	68.84	48	11.45	22662.03	3655.17	11.27	19616.49	3163.95	1627286	980.64	0.5
05-18-2021 15:35	O2	Auto	454000	25100	68.84	48	11.35	22707.83	3662.55	11.23	19661.45	3171.2	1633076	982.64	0.5
05-18-2021 17:35	O2	Auto	454000	25500	68.84	47	11.35	22753.53	3669.92	11.17	19706.52	3178.47	1638806	984.64	0.5
05-18-2021 19:35	O2	Auto	454000	25600	68.84	47	11.35	22798.43	3677.17	11.21	19750.94	3185.64	1644386	986.64	0.5
05-18-2021 21:34	O2	Auto	426000	25100	68.84	45	10.65	22841.96	3684.19	10.52	19793.88	3192.56	1649889	988.62	0.5
05-18-2021 23:34	O2	Auto	430000	25200	68.84	45	10.75	22884.76	3691.09	10.57	19835.97	3199.35	1655289	990.62	0.5
05-19-2021 01:34	O2	Auto	422000	25300	70.99	44	10.55	22926.76	3697.86	10.37	19877.38	3206.03	1660569	992.62	0.5
05-19-2021 03:33	O2	Auto	414000	25000	68.84	44	10.35	22968.21	3704.55	10.25	19918.32	3212.63	1665805	994.6	0.5
05-19-2021 05:33	O2	Auto	418000	25100	68.84	44	10.45	23009.91	3711.28	10.29	19959.44	3219.26	1671085	996.6	0.5
05-19-2021 07:33	O2	Auto	418000	25100	70.99	44	10.45	23051.31	3717.95	10.29	20000.25	3225.85	1676305	998.6	0.5
05-19-2021 09:33	O2	Auto	438000	24700	68.84	47	10.95	23094.11	3724.86	10.82	20042.51	3232.66	1681825	1000.6	0.5
05-19-2021 11:32	O2	Auto	454000	25600	68.84	47	11.35	23139.03	3732.1	11.21	20086.83	3239.81	1687357	1002.59	0.5
05-19-2021 13:32	O2	Auto	454000	25600	68.84	47	11.35	23184.73	3739.47	11.21	20131.98	3247.09	1692997	1004.59	0.5
05-19-2021 15:32	O2	Auto	478000	24200	70.99	52	11.95	23231.73	3747.05	11.73	20178.39	3254.58	1698997	1006.59	0.5
05-19-2021 17:31	O2	Auto	478000	24800	68.84	51	11.95	23278.83	3754.65	11.78	20224.85	3262.07	1705066	1008.57	0.5
05-19-2021 19:31	O2	Auto	466000	24600	70.99	50	11.65	23325.83	3762.23	11.46	20271.15	3269.54	1711126	1010.57	0.5
05-19-2021 21:31	O2	Auto	454000	25000	70.99	48	11.35	23371.43	3769.59	11.18	20316.16	3276.8	1716946	1012.57	0.5
05-19-2021 23:31	O2	Auto	438000	24600	70.99	47	10.95	23415.43	3776.68	10.77	20359.61	3283.81	1722616	1014.57	0.5
05-20-2021 01:30	O2	Auto	430000	24300	70.99	47	10.75	23458.67	3783.66	10.64	20402.37	3290.7	1728179	1016.55	0.5
05-20-2021 03:30	O2	Auto	426000	24600	68.84	46	10.65	23501.47	3790.56	10.54	20444.64	3297.52	1733729	1018.55	0.5
05-20-2021 05:30	O2	Auto	418000	24200	70.99	46	10.45	23543.87	3797.4	10.37	20486.49	3304.27	1739219	1020.55	0.5
05-20-2021 07:29	O2	Auto	418000	24600	70.99	45	10.1	23585.32	3804.08	9.97	20527.4	3310.87	1744574	1022.54	0.48
05-20-2021 09:29	O2	Auto	430000	24300	70.99	47	10.75	23627.82	3810.94	10.64	20569.43	3317.65	1750154	1024.54	0.5
05-20-2021 11:29	O2	Auto	462000	24400	70.99	50	11.55	23673.22	3818.26	11.37	20614.35	3324.9	1756064	1026.54	0.5
05-20-2021 13:29	O2	Auto	462000	25100	66.69	49	11.55	23719.42	3825.71	11.46	20659.97	3332.25	1762004	1028.54	0.5
05-20-2021 15:28	O2	Auto	454000	24500	66.69	49	11.35	23764.64	3833.01	11.19	20704.46	3339.43	1767924	1030.52	0.5
05-20-2021 17:28	O2	Auto	450000	24300	66.69	49	11.25	23809.64	3840.26	11.09	20748.93	3346.6	1773774	1032.52	0.5
05-20-2021 19:28	O2	Auto	438000	24200	66.69	48	10.95	23853.74	3847.38	10.82	20792.52	3353.63	1779534	1034.52	0.5
05-20-2021 21:27	O2	Auto	414000	23800	66.69	46	10.01	23895.69	3854.14	9.86	20833.9	3360.31	1785038	1036.5	0.48
05-20-2021 23:27	O2	Auto	402000	23800	66.69	45	10.05	23936.69	3860.76	9.98	20874.41	3366.84	1790468	1038.5	0.5
05-21-2021 01:27	O2	Auto	406000	24500	66.69	44	10.15	23977.29	3867.31	10.04	20914.4	3373.29	1795778	1040.5	0.5
05-21-2021 03:27	O2	Auto	398000	24000	66.69	44	9.95	24017.59	3873.81	9.84	20954.17	3379.7	1801058	1042.5	0.5
05-21-2021 05:26	O2	Auto	402000	24300	66.69	44	10.05	24057.65	3880.27	9.96	20993.76	3386.09	1806353	1044.49	0.5
05-21-2021 07:26	O2	Auto	406000	23900	66.69	45	10.15	24098.15	3886.8	10.02	21033.67	3392.53	1811663	1046.49	0.5

			Mass Transfer Btu/Hr Approach:							Mass Transfer Equation (indirectly based on Btu/hr estimate)						
Time Stamp	Murphy Status	Op Status	BTU/Hr(est)	PPMV(est)	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Removed Lbs/Period	Cumulative Lbs Removed	Cumulative Gallons Removed	Cubic Feet Processed Cumulative	Cumulative Time (hours)	Delta Time (Hours)	
05-21-2021 09:26	O2	Auto	422000	23800	66.69	46	10.55	24139.65	3893.49	10.2	21074.37	3399.09	1817153	1048.49	0.5	
05-21-2021 11:26	O2	Auto	442000	23800	66.69	49	11.05	24183.05	3900.49	10.87	21117.13	3405.99	1822913	1050.49	0.5	
05-21-2021 13:25	O2	Auto	438000	25100	64.54	46	10.95	24226	3907.42	10.76	21159.41	3412.81	1828358	1052.47	0.5	
05-21-2021 15:25	O2	Auto	446000	25600	66.69	46	11.15	24270.3	3914.56	10.97	21203.12	3419.86	1833878	1054.47	0.5	
05-21-2021 17:25	O2	Auto	442000	26100	64.54	45	11.05	24314.4	3921.68	10.94	21246.7	3426.89	1839338	1056.47	0.5	
05-21-2021 19:24	O2	Auto	434000	26000	64.54	44	10.85	24357.84	3928.68	10.66	21289.45	3433.78	1844663	1058.45	0.5	
05-21-2021 21:24	O2	Auto	418000	25900	66.69	43	10.45	24399.94	3935.47	10.38	21331.08	3440.5	1849853	1060.45	0.5	
05-21-2021 23:24	O2	Auto	418000	26300	64.54	42	10.45	24441.64	3942.2	10.29	21372.13	3447.12	1854953	1062.45	0.5	
05-22-2021 01:24	O2	Auto	410000	25800	64.54	42	10.25	24482.94	3948.86	10.1	21413.16	3453.74	1860053	1064.45	0.5	
05-22-2021 03:23	O2	Auto	406000	25700	64.54	42	10.15	24523.39	3955.39	10.06	21453.13	3460.18	1865051	1066.44	0.5	
05-22-2021 05:23	O2	Auto	398000	25800	66.69	41	9.95	24563.89	3961.92	9.86	21493.17	3466.64	1870001	1068.44	0.5	
05-22-2021 07:23	O2	Auto	406000	25500	66.69	42	10.15	24604.19	3968.42	9.98	21532.92	3473.05	1874981	1070.44	0.5	
05-22-2021 09:22	O2	Auto	422000	26000	66.69	43	10.55	24645.15	3975.02	10.42	21573.35	3479.57	1879979	1072.42	0.5	
05-22-2021 11:22	O2	Auto	454000	25600	64.54	47	11.35	24689.55	3982.19	11.21	21617.27	3486.66	1885439	1074.42	0.5	
05-22-2021 13:22	O2	Auto	466000	25700	64.54	48	11.65	24735.75	3989.64	11.49	21662.79	3494	1891109	1076.42	0.5	
05-22-2021 15:22	O2	Auto	466000	25800	64.54	48	11.65	24782.75	3997.22	11.54	21709.08	3501.46	1896869	1078.42	0.5	
05-22-2021 17:21	O2	Auto	462000	26500	64.54	46	11.55	24828.76	4004.64	11.36	21754.38	3508.77	1902432	1080.4	0.5	
05-22-2021 19:21	O2	Auto	450000	26600	66.69	45	11.25	24874.16	4011.96	11.15	21799.18	3516	1907922	1082.4	0.5	
05-22-2021 21:21	O2	Auto	438000	25800	64.54	45	10.95	24918.56	4019.12	10.82	21842.96	3523.06	1913322	1084.4	0.5	
05-22-2021 23:20	O2	Auto	438000	26400	66.69	44	10.58	24962.1	4026.14	10.46	21885.89	3529.98	1918558	1086.39	0.48	
05-23-2021 01:20	O2	Auto	434000	26800	66.69	43	10.85	25005.8	4033.19	10.74	21929.01	3536.94	1923808	1088.39	0.5	
05-23-2021 03:20	O2	Auto	426000	27000	66.69	42	10.65	25048.5	4040.08	10.57	21971.27	3543.75	1928938	1090.39	0.5	
05-23-2021 05:20	O2	Auto	430000	27100	66.69	42	10.75	25091.4	4047	10.61	22013.66	3550.59	1934008	1092.39	0.5	
05-23-2021 07:19	O2	Auto	426000	26900	64.54	42	10.65	25133.94	4053.86	10.53	22055.57	3557.35	1939006	1094.37	0.5	
05-23-2021 09:19	O2	Auto	442000	26000	66.69	45	11.05	25177.54	4060.89	10.9	22098.7	3564.31	1944286	1096.37	0.5	
05-23-2021 11:19	O2	Auto	458000	25800	64.54	47	11.45	25223.14	4068.25	11.3	22143.69	3571.56	1949836	1098.37	0.5	
05-23-2021 13:18	O2	Auto	478000	25800	66.69	49	11.55	25269.74	4075.76	11.39	22189.64	3578.97	1955577	1100.35	0.48	
05-23-2021 15:18	O2	Auto	478000	25800	64.54	49	11.95	25317.54	4083.47	11.78	22236.8	3586.58	1961457	1102.35	0.5	
05-23-2021 17:18	O2	Auto	466000	26200	66.69	47	11.65	25364.44	4091.04	11.47	22283.09	3594.05	1967157	1104.35	0.5	
05-23-2021 19:18	O2	Auto	462000	26700	64.54	46	11.55	25410.94	4098.54	11.44	22329.02	3601.46	1972707	1106.35	0.5	
05-23-2021 21:17	O2	Auto	446000	25700	64.54	46	11.15	25455.76	4105.77	11.02	22373.23	3608.59	1978181	1108.34	0.5	
05-23-2021 23:17	O2	Auto	442000	26000	64.54	45	11.05	25499.86	4112.88	10.9	22416.66	3615.59	1983581	1110.34	0.5	
05-24-2021 01:17	O2	Auto	430000	26600	66.69	43	10.75	25543.06	4119.85	10.66	22459.29	3622.47	1988801	1112.34	0.5	
05-24-2021 03:16	O2	Auto	422000	26000	64.54	43	10.2	25585.51	4126.7	10.07	22501.09	3629.21	1993948	1114.32	0.48	
05-24-2021 05:16	O2	Auto	418000	25700	66.69	43	10.45	25627.51	4133.47	10.3	22542.52	3635.89	1999108	1116.32	0.5	
05-24-2021 07:16	O2	Auto	398000	25100	66.69	42	9.95	25668.21	4140.03	9.82	22582.67	3642.37	2004178	1118.32	0.5	
05-24-2021 09:16	O2	Auto	406000	25600	66.69	42	10.15	25708.61	4146.55	10.02	22622.55	3648.8	2009218	1120.32	0.5	
05-24-2021 11:15	O2	Auto	410000	25300	64.54	43	10.25	25749.27	4153.11	10.14	22662.8	3655.29	2014335	1122.3	0.5	
05-24-2021 13:15	O2	Auto	418000	25100	64.54	44	10.45	25790.57	4159.77	10.29	22703.3	3661.82	2019525	1124.3	0.5	
05-24-2021 15:15	O2	Auto	414000	25400	66.69	43	10.35	25831.47	4166.37	10.18	22743.63	3668.33	2024715	1126.3	0.5	
05-24-2021 17:15	O2	Auto	426000	24600	66.69	46	10.65	25872.77	4173.03	10.54	22784.5	3674.92	2029965	1128.3	0.5	
05-24-2021 19:14	O2	Auto	426000	24400	66.69	46	10.65	25914.81	4179.81	10.46	22825.98	3681.61	2035439	1130.29	0.5	
05-24-2021 21:14	O2	Auto	410000	24100	68.84	45	10.25	25956.21	4186.49	10.1	22866.74	3688.18	2040839	1132.29	0.5	
05-24-2021 23:14	O2	Auto	406000	23900	66.69	45	10.15	25996.91	4193.05	10.02	22906.95	3694.67	2046239	1134.29	0.5	
05-25-2021 01:13	O2	Auto	406000	23800	66.69	45	10.15	26036.97	4199.51	9.98	22946.44	3701.04	2051594	1136.27	0.5	
05-25-2021 03:13	O2	Auto	410000	24100	66.69	45	10.25	26077.47	4206.04	10.1	22986.44	3707.49	2056994	1138.27	0.5	
05-25-2021 05:13	O2	Auto	406000	24000	66.69	45	10.15	26117.97	4212.58	10.06	23026.48	3713.95	2062394	1140.27	0.5	
05-25-2021 07:13	O2	Auto	406000	23900	66.69	45	10.15	26158.47	4219.11	10.02	23066.48	3720.4	2067794	1142.27	0.5	
05-25-2021 08:46	SHUTDOWN	Auto	418000	0	0	0	1.39	26190.28	4224.24	0	23096.49	3725.24	2071859	1143.82	0.07	

Remediation Service Int'l
4835 Colt Unit D
Ventura CA 93003
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REMEDIATION SERVICE, INT'L

Report Generator Version 1.4

Due to file size, data has been resampled from 'O2' events only at an event frequency of 1 out of 4

Date of Report: 5/25/2021
Project Name: STANTEC RENTAL UNIT407 ENG1 PILOT STU
Unit ID: 1407
Controller S/N: 509
Software version: 844

Btu/lb
lb/gallon of gasoline
Mole Weight of Extracted VOC
Btu/Cubic Foot of Propane
Btu/Cubic Foot of Natural Gas

Date Range From: 4/7/2021 10:29
Date Range To : 5/25/2021 8:46
Lbs. Removed/Period: 26190.28
Gal Removed/Period: 4224.24
SCF Processed/Period: 2071859

There are no express or implied warranties for fitness of use or any other purpose of the data contained herein.
See report footnotes for disclaimer details and other technical information relating to calculation procedures.

Installed Flow Boxes Box1 - Y Box2 - N

Time Stamp	Murphy Status	Op Status	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Air Flow (SCFM)	Fuel Flow (SCFM)	Well/Process Valve Position	Air Valve Position	Fuel Valve Position	RPM	Manifold Vac (Hg)	PreCat Temp (F)	PostCat Temp (F)	O2 (mV)
04-07-2021 10:29	SNAPSHOT	Auto	0	0	92	3.87	0	170	128	1992	13.31	848	880	1776
04-07-2021 14:48	SHUTDOWN	Auto	0	0	93	3.07	0	170	128	2036	13.46	960	1008	608
04-07-2021 15:00	SNAPSHOT	Auto	0	0	92	3.67	0	166	118	1994	13.31	840	872	1808
04-07-2021 17:00	O2	Auto	19.36	0	98	0.67	122	168	14	1998	12.67	960	1008	1760
04-07-2021 19:00	O2	Auto	19.36	0	98	0.67	122	168	18	2003	12.67	952	1016	1792
04-07-2021 20:59	O2	Auto	19.36	0	97	0.67	122	168	16	2003	12.83	952	1008	1776
04-07-2021 22:59	O2	Auto	19.36	0	97	0.67	122	168	18	2006	12.83	960	1016	1808
04-08-2021 00:59	O2	Auto	19.36	0	97	0.6	122	170	18	2005	12.83	952	1016	1792
04-08-2021 02:58	O2	Auto	19.36	0	97	0.67	122	168	16	2010	12.83	960	1016	1776
04-08-2021 04:58	O2	Auto	19.36	0	96	0.6	122	172	16	1998	12.99	952	1016	1808
04-08-2021 06:58	O2	Auto	19.36	0	96	0.67	122	170	16	1994	12.99	960	1016	1792
04-08-2021 08:58	O2	Auto	19.36	0	96	0.6	122	170	16	1993	12.99	960	1024	1776
04-08-2021 10:57	O2	Auto	19.36	0	96	0.6	122	170	18	1992	12.99	952	1016	1792
04-08-2021 12:57	O2	Auto	17.21	0	97	0.6	122	170	18	1977	12.99	960	1016	1808
04-08-2021 14:57	O2	Auto	17.21	0	96	0.6	122	166	16	2004	12.99	952	1016	1776
04-08-2021 16:56	O2	Auto	19.36	0	97	0.53	124	168	18	1992	12.83	952	1016	1808
04-08-2021 18:56	O2	Auto	17.21	0	97	0.6	124	168	18	1998	12.99	960	1016	1792
04-08-2021 20:56	O2	Auto	19.36	0	98	0.6	126	172	16	1993	12.83	960	1016	1760
04-08-2021 22:56	O2	Auto	19.36	0	97	0.6	126	172	20	1997	12.83	960	1016	1792
04-09-2021 00:55	O2	Auto	19.36	0	97	0.6	126	172	14	2005	12.83	960	1016	1776
04-09-2021 02:55	O2	Auto	19.36	0	97	0.6	126	172	18	2003	12.83	960	1016	1792
04-09-2021 04:55	O2	Auto	19.36	0	97	0.6	128	172	16	2011	12.83	960	1016	1872
04-09-2021 06:54	O2	Auto	19.36	0	97	0.6	128	170	12	2011	12.99	960	1016	1760
04-09-2021 08:54	O2	Auto	19.36	0	95	0.53	126	166	14	1997	13.15	952	1016	1776
04-09-2021 10:54	O2	Auto	19.36	0	97	0.53	128	170	14	2007	12.99	960	1016	1792
04-09-2021 12:54	O2	Auto	19.36	0	96	0.53	130	170	16	2006	12.99	960	1024	1792
04-09-2021 14:53	O2	Auto	19.36	0	97	0.53	128	174	18	2003	12.99	952	1008	1776
04-09-2021 16:53	O2	Auto	19.36	0	97	0.6	130	170	14	2008	12.83	952	1008	1776
04-09-2021 18:53	O2	Auto	19.36	0	97	0.53	130	170	18	2010	12.99	952	1008	1776
04-09-2021 20:52	O2	Auto	19.36	0	97	0.53	130	170	16	2008	12.99	952	1008	1744
04-09-2021 22:52	O2	Auto	19.36	0	97	0.6	132	172	18	1996	12.99	960	1016	1808
04-10-2021 00:52	O2	Auto	19.36	0	97	0.53	130	170	18	1989	12.99	952	1008	1792
04-10-2021 02:52	O2	Auto	19.36	0	97	0.6	132	170	16	1993	12.83	960	1016	1776
04-10-2021 04:51	O2	Auto	19.36	0	97	0.6	130	172	18	2008	12.83	960	1016	1776
04-10-2021 06:51	O2	Auto	21.51	0	97	0.53	132	172	18	2007	12.83	960	1016	1760
04-10-2021 08:51	O2	Auto	19.36	0	97	0.6	134	170	14	2008	12.83	960	1008	1744
04-10-2021 10:50	O2	Auto	21.51	0	97	0.6	134	170	16	1998	12.83	960	1016	1792
04-10-2021 12:50	O2	Auto	19.36	0	98	0.6	132	168	20	2006	12.67	960	1016	1776
04-10-2021 14:50	O2	Auto	19.36	0	99	0.53	136	170	18	1990	12.51	960	1016	1776
04-10-2021 16:50	O2	Auto	19.36	0	99	0.53	136	168	14	2010	12.51	960	1016	1776
04-10-2021 18:49	O2	Auto	21.51	0	99	0.53	138	170	18	2008	12.51	960	1016	1776
04-10-2021 20:49	O2	Auto	19.36	0	99	0.53	138	172	18	1992	12.51	960	1016	1808
04-10-2021 22:49	O2	Auto	19.36	0	99	0.6	138	174	14	1991	12.51	960	1024	1824
04-11-2021 00:49	O2	Auto	21.51	0	100	0.6	140	174	18	2001	12.51	960	1016	1792
04-11-2021 02:48	O2	Auto	19.36	0	100	0.6	138	174	14	1999	12.51	960	1016	1776
04-11-2021 04:48	O2	Auto	19.36	0	100	0.6	140	176	16	1996	12.36	960	1016	1792
04-11-2021 06:48	O2	Auto	19.36	0	99	0.53	140	168	12	2011	12.51	952	1016	1760
04-11-2021 08:47	O2	Auto	19.36	0	100	0.6	140	172	14	2003	12.51	952	1016	1760
04-11-2021 10:47	O2	Auto	19.36	0	100	0.53	142	172	18	2005	12.36	952	1008	1792
04-11-2021 12:47	O2	Auto	19.36	0	99	0.6	140	174	18	1976	12.51	952	1008	1792
04-11-2021 14:47	O2	Auto	19.36	0	100	0.6	142	176	20	2009	12.36	960	1008	1760
04-11-2021 16:46	O2	Auto	19.36	0	100	0.6	142	170	18	1988	12.36	952	1008	1776
04-11-2021 18:46	O2	Auto	19.36	0	99	0.53	144	170	18	2003	12.36	952	1008	1808
04-11-2021 20:46	O2	Auto	21.51	0	98	0.6	146	170	14	2001	12.67	952	1000	1808
04-11-2021 22:45	O2	Auto	21.51	4	95	0.53	146	170	12	1996	12.67	952	1008	1792
04-12-2021 00:45	O2	Auto	21.51	4	95	0.53	148	172	14	2001	12.67	952	1008	1776
04-12-2021 02:45	O2	Auto	21.51	4	95	0.53	148	172	14	1998	12.67	952	1008	1792
04-12-2021 04:45	O2	Auto	19.36	4	94	0.6	148	170	16	1992	12.67	952	1008	1808
04-12-2021 06:44	O2	Auto	21.51	4	94	0.6	150	172	18	1987	12.67	952	1008	1808
04-12-2021 08:44	O2	Auto	21.51	4	94	0.53	152	172	18	1995	12.67	952	1016	1792
04-12-2021 10:44	O2	Auto	21.51	4	94	0.53	152	168	18	1994	12.67	952	1008	1776
04-12-2021 12:43	O2	Auto	23.66	6	92	0.53	154	170	14	1996	12.67	952	1008	1808
04-12-2021 14:43	O2	Auto	21.51	6	92	0.6	154	170	16	1985	12.67	952	1008	1824
04-12-2021 16:43	O2	Auto	21.51	4	94	0.6	156	172	16	1993	12.67	952	1008	1808
04-12-2021 18:43	O2	Auto	23.66	6	93	0.53	158	172	16	2007	12.51	960	1016	1776
04-12-2021 20:42	O2	Auto	23.66	6	92	0.53	160	172	20	2003	12.67	960	1016	1792
04-12-2021 22:42	O2	Auto	23.66	7	91	0.53	160	170	18	2006	12.67	952	1016	1792
04-13-2021 00:42	O2	Auto	23.66	7	91	0.53	162	170	16	2003	12.67	952	1008	1760
04-13-2021 02:41	O2	Auto	23.66	7	91	0.53	164	174	16	1993	12.67	960	1016	1824
04-13-2021 04:41	O2	Auto	23.66	8	90	0.53	164	172	16	1999	12.67	960	1016	1792
04-13-2021 06:41	O2	Auto	23.66	7	91	0.53	166	174	16	1994	12.67	968	1016	1792
04-13-2021 08:41	O2	Auto	23.66	7	91	0.53	168	172	18	1992	12.67	960	1016	1792
04-13-2021 10:40	O2	Auto	25.81	6	92	0.53	168	168	14	2009	12.67	960	1008	1776
04-13-2021 12:40	O2	Auto	23.66	6	93	0.53	168	172	18	1983	12.51	960	1016	1808
04-13-2021 14:40	O2	Auto	23.66	0	99	0.47	168	170	14	2009	12.51	960	1016	1776
04-13-2021 16:40	O2	Auto	25.81	0	97	0.33	176	164	8	1975	12.67	968	1032	1744
04-13-2021 18:39	O2	Auto	25.81	0	99	0.27	178	170	14	1985	12.51	960	1016	1824
04-13-2021 20:39	O2	Auto	25.81	4	96	0.33	182	174	12	1999	12.36	968	1024	1776
04-13-2021 22:39	O2	Auto	25.81	7	93	0.33	186	174	12	2005	12.36	968	1032	1824
04-14-2021 00:38	O2	Auto	25.81	8	92	0.33	182	174	10	1994	12.51	968	1024	1792
04-14-2021 02:38	O2	Auto	25.81	8	92	0.33	186	172	10	1999	12.36	968	1032	1760
04-14-2021 04:38	O2	Auto	25.81	8	92	0.33	186	176	14	2002	12.36	968	1032	1792
04-14-2021 06:38	O2	Auto	27.97	10	90	0.33	188	172	10	2001	12.36	968	1032	1808
04-14-2021 08:37	O2	Auto	25.81	8	92	0.33	190	180	16	1977	12.36	976	1032	1824
04-14-2021 10:37	O2	Auto	25.81	7	94	0.33	190	172	14	2012	12.2	976	1032	1744
04-14-2021 12:37	O2	Auto	25.81	6	95	0.4	188	172	10	2011	12.2	968	1024	1760
04-14-2021 15:06	O2	Auto	25.81	4	97	0.33	188	172	12	1993	12.2	968	1024	1808
04-14-2021 17:06	O2	Auto	25.81	6	95	0.4	190	178	12	1993	12.2	976	1032	1808
04-14-2021 19:06	O2	Auto	25.81	7	95	0.33	194	178	10	2013	12.04	976	1040	1776
04-14-2021 21:06	O2	Auto	25.81	7	94	0.4	192	176	14	2003	12.04	976	1032	1792
04-14-2021 23:05	O2	Auto	25.81	8	94	0.4	194	176	12	1997	12.04	976	1040	1776
04-15-2021 01:05	O2	Auto	23.66	6	95	0.6	186	176	12	2002	12.2	976	1024	1776
04-15-2021 03:05	O2	Auto	25.81	8	94	0.47	192	176	12	2003	12.04	976	1032	1760
04-15-2021 05:04	O2	Auto	25.81	8	94	0.47	194	180	14	2000	12.04	976	1032	1792
04-15-2021 07:04	O2	Auto	25.81	8	94	0.53	192	178	18	2008	12.04	976	1032	1776
04-15-2021 09:04	O2	Auto	25.81	8	95	0.6	192	178	14	1995	11.88	976	1032	1824
04-15-2021 11:04	O2	Auto	25.81	7	95	0.53	192	178	14	1995	12.04	976	1032	1776
04-15-2021 13:03	O2	Auto	25.81	7	95	0.6	190	176	20	1998	11.88	976	1024	1776
04-15-2021 15:03	O2	Auto	23.66	0	102	0.6	190	172	18	2000	12.04	968	1024	1776
04-15-2021 17:03	O2	Auto	27.97	8	95	0.27	206	174	6	2022	11.72	976	1032	1776
04-15-2021 19:02	O2	Auto	27.97	9	93	0.27	208	176	14	1987	11.88	976	1032	1808
04-15-2021 21:02	O2	Auto	27.97	10	91	0.4	204	172	14	2009	12.04	968	1024	1792
04-15-2021 23:02	O2	Auto	27.97	12	91	0.27	212	176	12	2010	11.88	976	1040	1808
04-16-2021 01:32	O2	Auto	30.12	14	89	0.4	214	180	12	1990	11.88	976	1040	1776
04-16-2021 03:31	O2	Auto	30.12	14	88	0.4	212	176	8	1999	12.04	976	1032	1824
04-16-2021 05:31	O2	Auto	30.12	14	88	0.33	216	184	14	1967	12.04	976	1040	1808
04-16-2021 07:31	O2	Auto	30.12	14	88	0.33	212	180	14	1987	12.04	976	1032	1776
04-16-2021 09:30	O2	Auto	30.12	14	89	0.33	220	176	12	1998	11.88	984	1040	1792
04-16-2021 11:30	O2	Auto	30.12	14	89	0.33	218	174	6	2013	11.88	976	1032	1792
04-16-2021 13:30	O2	Auto	30.12	13	87	0.33	216	170	12	1968	12.04	976	1032	1856
04-16-2021 15:30	O2	Auto	30.12	13	91	0.33	222	172	10	2021	11.72	976	1040	1776
04-16-2021 17:29	O2	Auto	30.12	14	90	0.4	224	178	10	1996	11.72	984	1040	1792
04-16-2021 19:29	O2	Auto	32.27	14	89	0.33	226	180	16	1982	11.72	984	1040	1792

Time Stamp	Murphy Status	Op Status	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Air Flow (SCFM)	Fuel Flow (SCFM)	Well/Process Valve Position	Air Valve Position	Fuel Valve Position	RPM	Manifold Vac (Hg)	PreCat Temp (F)	PostCat Temp (F)	O2 (mV)
04-16-2021 21:29	O2	Auto	32.27	14	89	0.4	226	178	16	1991	11.88	984	1032	1824
04-16-2021 23:28	O2	Auto	32.27	14	90	0.33	232	180	12	2012	11.72	984	1040	1760
04-17-2021 01:28	O2	Auto	32.27	15	88	0.33	232	178	10	2011	11.72	984	1032	1808
04-17-2021 03:28	O2	Auto	32.27	15	88	0.33	232	178	14	2005	11.88	984	1040	1792
04-17-2021 05:28	O2	Auto	34.42	15	89	0.4	236	180	10	1997	11.72	984	1040	1792
04-17-2021 07:27	O2	Auto	34.42	16	88	0.4	240	180	14	1995	11.72	992	1048	1792
04-17-2021 09:27	O2	Auto	34.42	15	89	0.33	242	178	10	1985	11.72	984	1040	1840
04-17-2021 11:27	O2	Auto	34.42	15	90	0.27	250	178	8	2007	11.56	992	1048	1776
04-17-2021 13:27	O2	Auto	34.42	15	89	0.4	244	176	12	2007	11.56	984	1032	1792
04-17-2021 15:26	O2	Auto	34.42	15	88	0.4	242	174	12	1996	11.72	984	1040	1808
04-17-2021 17:26	O2	Auto	34.42	15	88	0.33	248	176	14	1972	11.56	984	1040	1872
04-17-2021 19:26	O2	Auto	34.42	15	90	0.4	252	176	12	2021	11.4	992	1048	1744
04-17-2021 21:25	O2	Auto	38.72	17	88	0.33	262	180	10	1995	11.56	992	1040	1808
04-17-2021 23:25	O2	Auto	34.42	17	88	0.33	256	178	14	2007	11.56	992	1040	1792
04-18-2021 01:25	O2	Auto	36.57	17	88	0.33	262	180	12	2003	11.56	992	1048	1792
04-18-2021 03:25	O2	Auto	38.72	17	88	0.4	264	180	10	2013	11.4	992	1048	1744
04-18-2021 05:24	O2	Auto	36.57	18	87	0.47	266	180	14	1996	11.4	1000	1048	1776
04-18-2021 07:24	O2	Auto	38.72	18	88	0.4	270	182	10	2009	11.4	1000	1056	1776
04-18-2021 09:24	O2	Auto	38.72	17	89	0.4	268	180	12	2001	11.4	992	1048	1760
04-18-2021 11:23	O2	Auto	36.57	16	90	0.33	270	178	14	2008	11.25	1000	1048	1792
04-18-2021 13:23	O2	Auto	38.72	16	90	0.4	272	180	12	1982	11.25	992	1048	1808
04-18-2021 15:23	O2	Auto	38.72	16	90	0.4	274	180	12	1998	11.25	992	1048	1808
04-18-2021 17:23	O2	Auto	38.72	16	89	0.4	272	178	16	2002	11.4	992	1040	1792
04-18-2021 19:22	O2	Auto	38.72	17	89	0.4	278	182	18	1990	11.25	992	1048	1776
04-18-2021 21:22	O2	Auto	40.87	19	88	0.27	292	180	6	1997	11.25	1000	1048	1792
04-18-2021 23:22	O2	Auto	40.87	19	88	0.27	292	186	12	1987	11.09	1000	1056	1808
04-19-2021 01:21	O2	Auto	40.87	20	88	0.33	298	186	10	2001	10.93	1008	1064	1824
04-19-2021 03:21	O2	Auto	40.87	20	88	0.27	298	192	16	1965	11.09	1008	1056	1792
04-19-2021 05:21	O2	Auto	40.87	21	87	0.4	300	184	12	2005	10.93	1008	1064	1808
04-19-2021 07:21	O2	Auto	43.02	21	88	0.4	308	188	10	2009	10.93	1016	1072	1808
04-19-2021 09:20	O2	Auto	40.87	20	89	0.4	306	186	10	1998	10.93	1008	1064	1792
04-19-2021 11:20	O2	Auto	40.87	20	88	0.33	306	182	12	2002	10.77	1008	1064	1824
04-19-2021 13:20	O2	Auto	40.87	20	88	0.33	308	184	14	1993	10.93	1008	1064	1792
04-19-2021 15:20	O2	Auto	40.87	20	86	0.33	310	174	6	1984	10.93	1008	1064	1664
04-19-2021 17:19	O2	Auto	43.02	20	89	0.4	314	188	14	1987	10.77	1008	1056	1760
04-19-2021 19:19	O2	Auto	43.02	21	88	0.4	320	184	8	1996	10.77	1016	1064	1792
04-19-2021 21:19	O2	Auto	45.18	22	87	0.33	322	186	12	2010	10.77	1016	1064	1776
04-19-2021 23:18	O2	Auto	45.18	23	86	0.4	330	186	14	2014	10.77	1016	1064	1760
04-20-2021 01:18	O2	Auto	45.18	23	87	0.47	330	184	8	2001	10.77	1016	1064	1792
04-20-2021 03:18	O2	Auto	45.18	24	86	0.47	338	184	10	2017	10.61	1016	1064	1776
04-20-2021 05:18	O2	Auto	47.33	24	87	0.47	344	192	14	2009	10.61	1024	1072	1760
04-20-2021 07:17	O2	Auto	47.33	25	86	0.4	354	188	14	1999	10.45	1024	1080	1760
04-20-2021 09:17	O2	Auto	47.33	24	86	0.4	356	196	18	1971	10.45	1024	1080	1792
04-20-2021 11:17	O2	Auto	47.33	23	87	0.4	348	188	16	1980	10.61	1024	1072	1824
04-20-2021 13:16	O2	Auto	47.33	23	87	0.27	354	180	10	2019	10.61	1016	1072	1776
04-20-2021 15:16	O2	Auto	47.33	22	89	0.33	354	184	14	2012	10.45	1024	1064	1776
04-20-2021 17:16	O2	Auto	47.33	22	90	0.4	358	182	12	2016	10.3	1016	1064	1744
04-20-2021 19:16	O2	Auto	47.33	23	88	0.4	360	184	8	2000	10.45	1024	1072	1776
04-20-2021 21:15	O2	Auto	49.48	24	86	0.4	366	184	8	1984	10.45	1024	1072	1792
04-20-2021 23:15	O2	Auto	49.48	25	86	0.47	370	188	16	2016	10.45	1024	1072	1808
04-21-2021 01:15	O2	Auto	49.48	25	83	0.4	372	182	10	1956	10.45	1024	1080	1792
04-21-2021 03:14	O2	Auto	51.63	25	88	0.4	378	192	12	1996	10.3	1024	1080	1760
04-21-2021 05:14	O2	Auto	49.48	25	84	0.47	362	184	12	1956	10.61	1016	1072	1952
04-21-2021 07:14	O2	Auto	51.63	25	87	0.4	378	190	14	2016	10.3	1024	1080	1776
04-21-2021 09:14	O2	Auto	51.63	24	88	0.47	372	192	18	1989	10.3	1024	1072	1808
04-21-2021 11:13	O2	Auto	51.63	24	89	0.4	380	192	14	1994	10.14	1024	1072	1760
04-21-2021 13:13	O2	Auto	49.48	24	90	0.4	376	188	16	2017	9.98	1024	1064	1776
04-21-2021 15:03	SHUTDOWN	Auto	0	0	92	3.13	0	176	124	2006	13.31	1000	1032	1344
04-21-2021 15:09	SNAPSHOT	Auto	0	0	93	3.07	0	176	132	1992	12.99	848	872	1824
04-21-2021 17:38	O2	Auto	51.63	30	86	0.27	440	202	14	2021	9.5	1040	1088	1792
04-21-2021 19:38	O2	Auto	51.63	31	85	0.33	446	202	14	2006	9.5	1048	1088	1792
04-21-2021 21:38	O2	Auto	55.93	32	83	0.33	472	204	14	1958	9.5	1048	1104	1792
04-21-2021 23:38	O2	Auto	55.93	33	81	0.33	474	202	14	1965	9.5	1048	1104	1872
04-22-2021 01:37	O2	Auto	60.23	33	82	0.27	490	204	14	1985	9.5	1048	1104	1824
04-22-2021 03:37	O2	Auto	62.38	34	83	0.27	2	210	12	1986	9.5	1056	1104	1824
04-22-2021 05:37	O2	Auto	64.54	35	79	0.27	10	204	16	1970	9.5	1048	1104	1840
04-22-2021 07:34	SHUTDOWN	Auto	0	0	90	3.33	0	174	124	1992	13.62	1008	1040	1424
04-22-2021 12:28	SNAPSHOT	Auto	0	0	91	4.13	0	180	126	2004	13.31	864	896	1792
04-22-2021 12:58	O2	Auto	23.66	37	78	0.33	430	202	12	1913	9.19	1048	1096	1888
04-22-2021 14:58	O2	Auto	23.66	35	84	0.47	434	216	20	1982	9.03	1072	1112	1792
04-22-2021 16:57	O2	Auto	51.63	33	84	0.4	466	202	14	1996	9.5	1040	1088	1792
04-22-2021 18:57	O2	Auto	23.66	35	83	0.47	424	206	16	2007	9.19	1072	1112	1808
04-22-2021 20:57	O2	Auto	23.66	36	82	0.47	428	204	12	2026	9.35	1072	1112	1760
04-22-2021 22:57	O2	Auto	23.66	35	83	0.53	418	204	12	2021	9.5	1064	1112	1760
04-23-2021 00:56	O2	Auto	23.66	36	81	0.47	424	208	18	1992	9.35	1072	1112	1808
04-23-2021 02:56	O2	Auto	23.66	36	82	0.47	422	214	24	2001	9.35	1072	1112	1744
04-23-2021 04:56	O2	Auto	25.81	37	80	0.47	432	206	14	2011	9.35	1072	1112	1792
04-23-2021 06:55	O2	Auto	25.81	37	81	0.47	434	208	12	2024	9.35	1072	1120	1760
04-23-2021 08:55	O2	Auto	32.27	35	82	0.33	434	206	18	1988	9.5	1056	1096	1792
04-23-2021 10:55	O2	Auto	49.48	34	77	0.4	456	190	12	1922	9.66	1048	1104	1936
04-23-2021 11:54	SHUTDOWN	Auto	0	0	89	3	0	168	126	2010	13.78	1024	1056	1392
04-23-2021 12:04	SNAPSHOT	Semi	0	0	91	3.13	0	174	138	2005	13.31	816	840	1776
04-23-2021 13:33	O2	Auto	23.66	36	83	0.4	434	206	16	2010	9.19	1072	1112	1792
04-23-2021 15:33	O2	Auto	40.87	33	85	0.33	448	206	22	1992	9.19	1048	1088	1776
04-23-2021 17:33	O2	Auto	40.87	33	84	0.33	450	200	22	2006	9.35	1048	1088	1760
04-23-2021 19:33	O2	Auto	43.02	34	83	0.4	454	200	20	2013	9.35	1048	1088	1792
04-23-2021 21:32	O2	Auto	43.02	34	84	0.47	458	202	22	2003	9.35	1048	1088	1776
04-23-2021 23:32	O2	Auto	43.02	35	83	0.53	460	204	22	2003	9.35	1048	1088	1776
04-24-2021 02:02	O2	Auto	45.18	36	83	0.47	500	218	28	1982	8.87	1064	1104	1792
04-24-2021 04:01	O2	Auto	47.33	37	83	0.47	504	214	20	2016	9.03	1064	1104	1776
04-24-2021 06:01	O2	Auto	47.33	37	83	0.47	0	210	16	2012	9.03	1064	1112	1792
04-24-2021 08:01	O2	Auto	49.48	38	82	0.47	4	212	24	2003	9.03	1064	1104	1760
04-24-2021 10:01	O2	Auto	47.33	37	82	0.47	508	208	24	2006	8.87	1056	1096	1808
04-24-2021 12:00	O2	Auto	47.33	36	84	0.47	498	210	26	1993	9.03	1056	1088	1776
04-24-2021 14:00	O2	Auto	45.18	36	84	0.4	496	208	22	2000	9.03	1056	1096	1776
04-24-2021 16:00	O2	Auto	23.66	35	84	0.67	438	204	30	1999	9.03	1072	1104	1776
04-24-2021 18:00	O2	Auto	23.66	36	84	0.73	436	212	32	1996	9.03	1080	1112	1776
04-24-2021 19:59	O2	Auto	23.66	36	83	0.67	432	214	32	1981	9.03	1072	1112	1792
04-24-2021 21:59	O2	Auto	21.51	35	84	0.67	428	212	30	1996	8.87	1072	1112	1776
04-24-2021 23:59	O2	Auto	21.51	35	85	0.67	424	212	26	2002	9.03	1072	1112	1760
04-25-2021 01:58	O2	Auto	21.51	35	85	0.8	416	216	28	2004	9.03	1072	1112	1760
04-25-2021 03:58	O2	Auto	21.51	35	85	0.67	416	218	34	1996	8.87	1072	1112	1760
04-25-2021 05:58	O2	Auto	21.51	35	85	0.67	416	216	28	2013	8.87	1072	1112	1792
04-25-2021 07:58	O2	Auto	21.51	36	84	0.73	422	218	32	1995	9.03	1080	1112	1776
04-25-2021 09:57	O2	Auto	21.51	35	84	0.8	418	216	36	1993	9.03	1080	1112	1776
04-25-2021 11:57	O2	Auto	21.51	34	86	0.73	416	210	26	2009	9.03	1072	1104	1792
04-25-2021 13:57	O2	Auto	21.51	35	84	0.73	418	212	34	1997	9.03	1072	1104	1776
04-25-2021 15:56	O2	Auto	21.51	34	85	0.73	418	208	28	2008	9.03	1072	1104	1808
04-25-2021 17:56	O2	Auto	21.51	35	84	0.67	422	212	30	1995	9.03	1072	1112	1776
04-25-2021 19:56	O2	Auto	21.51	35	85	0.73	424	212	28	1996	9.03	1080	1112	1808
04-25-2021 21:56	O2	Auto	21.51	36	83	0.73	428	212	36	1999	9.03	1080	1112	1792
04-25-2021 23:55	O2	Auto	21.51	37	82	0.8	432	212	30	1996	9.03	1080	1112	1792
04-26-2021 01:55	O2	Auto	21.51	37	82	0.73	438	214	36	2001	8.87	1080	1112	1792
04-26-2021 03:55	O2	Auto	23.66	38	81	0.73	448	214	34	2001	8.87	1080	1120	1792
04-26-2021 05:55	O2	Auto	21.51	38	82	0.8	450	218	36	2009	8.87	1088	1120	1776
04-26-2021 07:54	O2	Auto	23.66	39	81	0.73	454	222	36	1970	8.87	1088	1120	1808
04-26-2021 09:54	O2	Auto	23.66	38	81	0.8	448	212	32	2007	9.03	1088	1120	1808
04-26-2021 11:54	O2	Auto	23.66	38	82	0.8	450	214	32	1992	9.03	1088	1120	1792
04-26-2021 13:53	O2	Auto	47.33	37	82	0.6	510	208	28	1998	8.87	1064	1104	1792
04-26-2021 15:53	O2	Auto	49.48	37	82	0.53	6	206	26	2006	9.03	1064	1104	1776
04-26-2021 17:53	O2	Auto	49.48	37	83	0.53	14	210	26	1993	9.03	1064	1104	1792
04-26-2021 19:53	O2	Auto	51.63	38	81	0.53	24	212	28	1978	9.03	1064	1104	1824
04-26-2021 21:52	O2	Auto	51.63	38	82	0.6	30	210	28	2004	9.03	1072	1104	1744
04-26-2021 23:52	O2	Auto	53.78	38	81	0.73	32	214	30	1986	9.03	1072	1104	1792
04-27-2021 01:52	O2	Auto	53.78	39	80	0.67	42	210	30	2020	8.87	1072	1104	1760
04-27-2021 03:52	O2	Auto	53.78	38	82	0.73	42	214	32	1990	9.03	1072	1104	1776
04-27-2021 05:51	O2	Auto	55.93	40	80	0.6	66	212	32	2005	8.87	1072	1112	1760
04-27-2021 07:51	O2	Auto	55.93	40	79	0.6	68	210	32	2002	9.03	1064	1104	1760
04-27-2021 09:51	O2	Auto	55.93	40	79	0.6	58	206	26	1981	9.03	1064	1104	1776
04-27-2021 11:50	O2	Auto	53.78	37	82	0.73	24	206	32	1997	9.03	1064	1088	1776
04-27-2021 13:50	O2	Auto	51.63	36	83	0.67	16	208	32	1975	9.03	1056	1088	1792
04-27-2021 15:50	O2	Auto	51.63	35	84	0.73	12	202	34	2010	9.03	1056	1088	1744
04-27-2021 17:50	O2	Auto	53.78	35	84	0.73	24	202	32	2005	8.87	1056	1088	1792
04-27-2021 19:49	O2	Auto	25.81	35	83	1.2	446	202	42	1998	9.03	1072	1104	1808
04-27-2021 21:49	O2	Auto	25.81	36	83	1.13	446	208	50	2007	8.87	1072	1104	1744
04-27-2021 23:49	O2	Auto	23.66	35	83	1.13	440	206	42	1991	9.03	1072	1104	1808
04-28-2021 01:48	O2	Auto	23.66	36	83	1.07	442	212	44	2002	9.03	1072	1104	1760
04-28-2021 03:48	O2	Auto	23.66	36	82	1.07	438	208	46	2001	9.03	1072	1104	1776
04-28-2021 05:48	O2	Auto	23.66	36	82	1	440	212	46	1994	9.03	1080	1104	1776
04-28-2021 07:48	O2	Auto	23.66	36	82	1.07	436	214	50	2000	8.87	1072	1104	1776

Time Stamp	Murphy Status	Op Status	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Air Flow (SCFM)	Fuel Flow (SCFM)	Well/Process Valve Position	Air Valve Position	Fuel Valve Position	RPM	Manifold Vac (Hg)	PreCat Temp (F)	PostCat Temp (F)	O2 (mV)
04-28-2021 09:47	O2	Auto	21.51	35	84	1	430	206	38	2001	9.03	1072	1096	1792
04-28-2021 11:47	O2	Auto	21.51	34	86	0.93	430	202	38	2013	8.87	1072	1096	1760
04-28-2021 13:47	O2	Auto	21.51	33	87	0.87	426	204	40	1979	9.03	1064	1080	1776
04-28-2021 15:47	O2	Auto	21.51	32	87	0.87	418	198	34	2015	9.03	1064	1080	1744
04-28-2021 17:46	O2	Auto	21.51	32	88	0.87	420	206	40	1990	9.03	1064	1088	1744
04-28-2021 19:46	O2	Auto	19.36	33	87	0.93	422	204	40	1986	9.03	1064	1096	1824
04-28-2021 21:46	O2	Auto	21.51	33	86	1	424	208	44	2007	9.03	1072	1096	1760
04-28-2021 23:45	O2	Auto	19.36	33	85	1	420	210	48	2001	9.03	1072	1096	1792
04-29-2021 01:45	O2	Auto	19.36	34	84	1.07	420	210	42	1981	9.03	1072	1096	1808
04-29-2021 03:45	O2	Auto	19.36	34	85	1.07	418	214	50	2003	8.87	1072	1104	1776
04-29-2021 05:45	O2	Auto	19.36	34	85	1.07	420	210	44	2010	9.03	1072	1104	1776
04-29-2021 07:44	O2	Auto	19.36	34	84	1.07	420	210	48	2002	9.03	1072	1104	1792
04-29-2021 09:44	O2	Auto	19.36	33	86	1.2	410	214	52	1989	9.03	1072	1104	1776
04-29-2021 11:44	O2	Auto	45.18	31	88	1	474	208	42	2002	9.03	1056	1080	1776
04-29-2021 13:43	O2	Auto	36.57	29	88	1.07	426	204	44	1997	9.19	1048	1072	1776
04-29-2021 15:43	O2	Auto	43.02	30	88	1	462	208	46	1999	9.03	1048	1072	1792
04-29-2021 17:43	O2	Auto	43.02	30	89	1	460	206	40	1994	9.03	1048	1072	1776
04-29-2021 19:43	O2	Auto	19.36	30	89	1.2	398	206	50	2007	9.03	1064	1088	1824
04-29-2021 21:42	O2	Auto	19.36	30	89	1.33	396	212	58	1997	9.03	1064	1088	1776
04-29-2021 23:42	O2	Auto	19.36	31	87	1.27	400	208	50	2005	9.03	1064	1096	1808
04-30-2021 01:42	O2	Auto	19.36	32	86	1.2	404	212	52	1988	9.03	1064	1096	1792
04-30-2021 03:42	O2	Auto	19.36	32	87	1.2	408	210	50	2005	8.87	1072	1096	1760
04-30-2021 05:41	O2	Auto	19.36	34	85	1.13	424	212	50	2006	9.03	1072	1096	1792
04-30-2021 07:24	SHUTDOWN	Auto	0	0	91	2.87	0	176	138	2009	13.46	1016	1048	1440
04-30-2021 08:07	STALL	Startup	0	0	0	0	0	90	0	0	0	112	120	2096
04-30-2021 08:16	SNAPSHOT	Auto	0	0	93	3.87	0	174	124	2001	13.15	848	872	1760
04-30-2021 08:46	O2	Auto	43.02	26	85	1.47	380	184	48	1998	10.3	1000	1032	1824
04-30-2021 10:46	O2	Auto	51.63	36	84	0.73	10	202	22	1992	9.03	1048	1080	1792
04-30-2021 12:45	O2	Auto	51.63	36	83	0.53	12	202	22	1975	9.03	1040	1080	1776
04-30-2021 14:45	O2	Auto	49.48	36	83	0.67	6	198	24	2009	9.03	1040	1072	1776
04-30-2021 16:45	O2	Auto	51.63	36	83	0.6	22	200	24	2004	8.87	1048	1080	1776
04-30-2021 18:45	O2	Auto	55.93	37	83	0.6	46	202	26	1994	9.03	1048	1080	1792
04-30-2021 20:44	O2	Auto	60.23	39	81	0.6	72	204	24	2004	9.03	1048	1088	1760
04-30-2021 22:44	O2	Auto	62.38	40	79	0.6	106	198	20	2014	8.87	1056	1096	1792
05-01-2021 00:44	O2	Auto	66.69	41	79	0.73	142	200	20	2010	8.87	1056	1096	1760
05-01-2021 02:44	O2	Auto	68.84	41	79	0.73	168	202	24	2000	9.03	1056	1096	1776
05-01-2021 04:43	O2	Auto	73.14	42	78	0.73	200	204	30	2004	9.03	1056	1096	1808
05-01-2021 06:43	O2	Auto	75.29	47	73	0.73	246	204	24	1990	9.03	1056	1104	1808
05-01-2021 08:43	O2	Auto	75.29	47	72	0.67	250	202	26	1990	9.03	1056	1096	1808
05-01-2021 10:42	O2	Auto	75.29	45	74	0.73	246	198	26	2003	9.03	1056	1096	1776
05-01-2021 12:42	O2	Auto	73.14	45	75	0.67	232	196	24	2000	8.87	1056	1096	1776
05-01-2021 14:42	O2	Auto	75.29	44	75	0.67	224	190	24	2015	9.03	1048	1088	1792
05-01-2021 16:42	O2	Auto	73.14	44	75	0.67	230	194	26	1997	9.03	1056	1088	1808
05-01-2021 18:41	O2	Auto	75.29	43	70	0.33	226	182	14	1885	9.03	1032	1088	1792
05-01-2021 20:41	O2	Auto	77.44	44	68	0.4	242	178	14	1911	9.03	1032	1088	1808
05-01-2021 22:41	O2	Auto	77.44	45	69	0.47	268	182	18	1899	9.03	1032	1088	1824
05-02-2021 00:40	O2	Auto	77.44	45	69	0.4	270	180	18	1909	8.87	1032	1088	1760
05-02-2021 02:40	O2	Auto	77.44	46	68	0.47	274	182	14	1912	9.03	1032	1088	1760
05-02-2021 04:40	O2	Auto	79.59	46	68	0.4	276	182	18	1912	9.03	1032	1088	1776
05-02-2021 06:40	O2	Auto	79.59	46	68	0.4	280	184	16	1902	9.03	1032	1080	1760
05-02-2021 08:39	O2	Auto	79.59	45	69	0.4	280	180	14	1912	9.03	1032	1080	1760
05-02-2021 10:39	O2	Auto	77.44	43	71	0.33	242	178	14	1911	9.03	1032	1080	1792
05-02-2021 12:39	O2	Auto	77.44	42	71	0.4	242	178	18	1886	9.03	1032	1080	1808
05-02-2021 14:38	O2	Auto	75.29	40	74	0.4	206	176	14	1904	9.03	1024	1072	1792
05-02-2021 16:38	O2	Auto	77.44	40	74	0.33	214	178	16	1897	9.03	1032	1072	1760
05-02-2021 18:38	O2	Auto	77.44	41	73	0.4	242	172	12	1921	9.03	1024	1080	1760
05-02-2021 20:38	O2	Auto	77.44	43	71	0.4	270	184	20	1894	8.87	1032	1080	1776
05-02-2021 22:37	O2	Auto	79.59	44	70	0.4	284	178	14	1901	9.03	1032	1080	1776
05-03-2021 00:37	O2	Auto	79.59	44	70	0.47	290	184	22	1854	9.03	1032	1080	1808
05-03-2021 02:37	O2	Auto	79.59	43	71	0.47	286	180	16	1913	9.03	1032	1088	1776
05-03-2021 04:36	O2	Auto	79.59	45	69	0.47	298	186	22	1886	9.03	1032	1080	1776
05-03-2021 06:36	O2	Auto	81.75	46	67	0.4	326	180	14	1882	9.03	1032	1088	1808
05-03-2021 08:36	O2	Auto	81.75	47	66	0.33	328	176	14	1923	9.03	1032	1088	1776
05-03-2021 10:36	O2	Auto	34.42	42	71	1.2	0	178	42	1906	8.87	1056	1088	1776
05-03-2021 12:35	O2	Auto	32.27	42	72	0.93	502	176	38	1909	9.03	1048	1080	1760
05-03-2021 13:40	SHUTDOWN	Auto	0	0	81	3.2	0	146	110	1897	14.26	976	1016	1568
05-03-2021 13:57	SNAPSHOT	Auto	0	0	83	3.2	0	150	112	1901	14.1	792	816	1792
05-03-2021 14:48	SHUTDOWN	Auto	0	0	82	3.33	0	150	114	1895	14.26	864	904	1824
05-03-2021 15:01	SNAPSHOT	Auto	0	0	83	3.33	0	148	116	1903	13.94	800	824	1792
05-03-2021 15:31	O2	Auto	58.08	41	73	0.6	82	176	26	1906	8.87	1032	1072	1760
05-03-2021 17:30	O2	Auto	49.48	38	73	0.73	510	170	28	1900	9.35	1016	1048	1792
05-03-2021 19:30	O2	Auto	49.48	37	73	0.8	496	172	32	1881	9.5	1016	1048	1808
05-03-2021 21:30	O2	Auto	49.48	39	74	0.8	16	178	34	1894	9.19	1024	1064	1792
05-03-2021 23:30	O2	Auto	49.48	39	73	0.8	8	176	34	1912	9.19	1024	1056	1792
05-04-2021 01:29	O2	Auto	49.48	38	75	0.87	6	180	36	1899	9.19	1024	1056	1776
05-04-2021 03:29	O2	Auto	49.48	38	74	0.8	510	180	36	1890	9.35	1016	1056	1792
05-04-2021 05:29	O2	Auto	49.48	37	74	0.87	492	176	40	1886	9.66	1008	1048	1792
05-04-2021 07:28	O2	Auto	49.48	37	73	0.93	488	174	42	1898	9.5	1008	1048	1808
05-04-2021 09:28	O2	Auto	49.48	37	73	0.93	490	170	42	1911	9.5	1008	1040	1792
05-04-2021 11:28	O2	Auto	49.48	37	75	0.93	504	176	42	1911	9.35	1016	1048	1776
05-04-2021 12:31	SHUTDOWN	Auto	0	0	78	3	0	136	104	1951	15.36	952	992	1712
05-04-2021 12:33	STALL	Auto	0	0	0	0	0	90	0	0	0	792	848	0
05-04-2021 12:40	SNAPSHOT	Auto	0	0	80	2.87	0	136	108	1954	15.05	776	792	1760
05-04-2021 13:40	O2	Auto	60.23	43	71	0.47	80	170	20	1942	9.5	1056	1104	1792
05-04-2021 15:39	O2	Auto	60.23	44	70	0.27	88	170	20	1964	9.5	1056	1120	1776
05-04-2021 17:39	O2	Auto	58.08	45	71	0.2	124	166	12	1974	9.19	1048	1112	1760
05-04-2021 19:39	O2	Auto	58.08	44	71	0.27	100	168	16	1958	9.35	1048	1112	1792
05-04-2021 21:39	O2	Auto	60.23	42	69	0.4	50	160	18	1955	9.82	1032	1088	1808
05-04-2021 23:38	O2	Auto	60.23	40	70	0.53	14	156	22	1966	10.3	1024	1064	1760
05-05-2021 01:38	O2	Auto	60.23	39	70	0.6	6	160	26	1939	10.3	1024	1064	1808
05-05-2021 03:38	O2	Auto	60.23	39	69	0.6	0	158	24	1941	10.45	1016	1056	1776
05-05-2021 05:37	O2	Auto	58.08	38	70	0.73	500	156	24	1944	10.45	1008	1048	1792
05-05-2021 07:37	O2	Auto	60.23	37	70	0.73	484	156	32	1977	10.77	1008	1040	1776
05-05-2021 09:37	O2	Auto	60.23	36	69	0.87	474	158	36	1931	10.93	1008	1040	1792
05-05-2021 11:37	O2	Auto	66.69	35	70	0.73	484	158	32	1943	10.93	1008	1040	1760
05-05-2021 13:36	O2	Auto	68.84	34	71	0.87	476	152	32	1969	10.93	1000	1032	1760
05-05-2021 15:36	O2	Auto	66.69	32	73	0.87	468	152	36	1971	10.93	1000	1024	1776
05-05-2021 17:36	O2	Auto	68.84	33	73	0.87	476	150	30	1954	10.93	1000	1024	1776
05-05-2021 19:35	O2	Auto	68.84	36	69	0.8	496	148	32	1972	10.93	1000	1032	1760
05-05-2021 21:35	O2	Auto	68.84	37	68	0.8	508	154	34	1910	11.09	1008	1032	1792
05-05-2021 23:35	O2	Auto	68.84	37	67	0.87	500	150	32	1939	11.25	1000	1032	1776
05-06-2021 01:35	O2	Auto	68.84	37	66	0.87	492	146	34	1932	11.4	1000	1024	1808
05-06-2021 03:34	O2	Auto	68.84	36	64	0.8	480	144	30	1880	11.4	984	1016	1792
05-06-2021 05:34	O2	Auto	68.84	35	63	0.93	462	136	34	1906	11.72	976	1008	1776
05-06-2021 07:34	O2	Auto	68.84	35	64	0.87	466	138	36	1908	11.56	976	1008	1760
05-06-2021 09:33	O2	Auto	68.84	38	63	0.8	500	138	24	1894	11.25	992	1024	1808
05-06-2021 11:33	O2	Auto	68.84	39	63	0.73	0	142	32	1905	11.09	1000	1032	1792
05-06-2021 13:33	O2	Auto	68.84	38	64	0.73	510	140	30	1903	10.93	992	1032	1776
05-06-2021 15:33	O2	Auto	68.84	37	66	0.73	508	144	32	1886	11.09	992	1024	1792
05-06-2021 17:32	O2	Auto	68.84	38	64	0.73	0	140	28	1895	10.93	1000	1032	1792
05-06-2021 19:32	O2	Auto	68.84	38	64	0.73	2	142	30	1887	10.93	992	1032	1792
05-06-2021 21:32	O2	Auto	68.84	37	64	0.73	500	138	26	1897	11.25	992	1024	1792
05-06-2021 23:31	O2	Auto	68.84	37	63	0.8	492	140	30	1885	11.4	992	1024	1808
05-07-2021 01:31	O2	Auto	70.99	37	63	0.8	490	140	32	1899	11.4	984	1016	1792
05-07-2021 03:31	O2	Auto	68.84	37	63	0.8	488	142	34	1889	11.4	984	1016	1792
05-07-2021 05:31	O2	Auto	68.84	36	63	0.87	474	138	34	1912	11.56	976	1016	1776
05-07-2021 07:30	O2	Auto	68.84	36	63	0.8	474	138	30	1898	11.72	976	1008	1776
05-07-2021 09:30	O2	Auto	68.84	37	63	0.73	494	134	28	1913	11.4	984	1016	1792
05-07-2021 11:30	O2	Auto	68.84	39	63	0.6	10	138	28	1907	10.93	992	1032	1776
05-07-2021 13:30	O2	Auto	68.84	37	66	0.73	508	140	24	1892	11.09	992	1024	1792
05-07-2021 15:29	O2	Auto	68.84	37	66	0.67	510	140	22	1904	11.09	992	1024	1808
05-07-2021 17:29	O2	Auto	68.84	38	64	0.67	2	142	30	1886	11.09	992	1032	1792
05-07-2021 19:29	O2	Auto	68.84	37	64	0.8	496	140	28	1922	11.25	984	1024	1776
05-07-2021 21:28	O2	Auto	68.84	36	65	0.87	482	140	32	1893	11.4	984	1016	1792
05-07-2021 23:28	O2	Auto	68.84	35	64	1	474	146	36	1876	11.56	984	1016	1792
05-08-2021 01:28	O2	Auto	68.84	35	64	0.93	472	138	34	1903	11.56	984	1016	1808
05-08-2021 03:28	O2	Auto	68.84	35	63	1	464	140	38	1905	11.56	976	1008	1776
05-08-2021 05:27	O2	Auto	68.84	34	65	0.93	458	140	38	1891	11.72	976	1008	1792
05-08-2021 07:27	O2	Auto	68.84	34	63	1.07	452	138	40	1904	11.72	976	1008	1792
05-08-2021 09:27	O2	Auto	68.84	36	64	0.93	478	138	34	1900	11.4	984	1016	1760
05-08-2021 11:26	O2	Auto	68.84	36	64	0.8	482	138	30	1885	11.56	984	1016	1808
05-08-2021 13:26	O2	Auto	68.84	36	64	0.87	480	138	36	1915	11.4	984	1016	1760
05-08-2021 15:26	O2	Auto	68.84	36	64	0.8	486	138	30	1884	11.4	984	1016	1808
05-08-2021 17:26	O2	Auto	68.84	36	63	0.93	480	136	34	1895	11.4	984	1016	1808
05-08-2021 19:25	O2	Auto	68.84	35	62	1	462	138	38	1887	11.72	976	1008	1792
05-08-2021 21:25	O2	Auto	70.99	34	62	1	452	136	42	1892	12.04	976	1000	1792
05-08-2021 23:25	O2	Auto	68.84	34	62	1.07	446	136	40	1906	12.2	968	1000	1760
05-09-2021 01:24	O2	Auto	70.99	34	61	1.13	442	134	42	1902	12.2	968	992	1792
05-09-2021 03:24	O2	Auto	70.99	34	61	1.07	440	134	44	1904	12.2	968	992	1776
05-09-2021 05:24	O2	Auto	68.84	33	61	1.13	428	132	40	1914	12.36	960	992	1776

Time Stamp	Murphy Status	Op Status	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Air Flow (SCFM)	Fuel Flow (SCFM)	Well/Process Valve Position	Air Valve Position	Fuel Valve Position	RPM	Manifold Vac (Hg)	PreCat Temp (F)	PostCat Temp (F)	O2 (mV)
05-09-2021 07:24	O2	Auto	68.84	33	61	1.13	434	132	44	1914	12.36	960	992	1776
05-09-2021 09:23	O2	Auto	68.84	35	61	1.07	456	134	42	1891	12.04	968	1000	1792
05-09-2021 11:23	O2	Auto	68.84	35	62	1	464	136	38	1900	11.88	976	1000	1760
05-09-2021 13:23	O2	Auto	68.84	37	62	0.93	478	140	40	1888	11.72	984	1008	1808
05-09-2021 15:23	O2	Auto	68.84	35	64	0.93	466	138	38	1919	11.72	976	1008	1760
05-09-2021 17:22	O2	Auto	68.84	36	63	0.8	480	136	34	1905	11.56	984	1008	1792
05-09-2021 19:22	O2	Auto	68.84	35	64	0.87	470	136	32	1905	11.72	976	1008	1760
05-09-2021 21:22	O2	Auto	70.99	35	63	0.87	466	136	38	1911	11.88	976	1008	1776
05-09-2021 23:21	O2	Auto	68.84	36	63	0.93	474	140	34	1896	11.56	984	1008	1808
05-10-2021 01:21	O2	Auto	68.84	35	64	0.87	472	140	34	1910	11.56	976	1008	1760
05-10-2021 03:21	O2	Auto	68.84	35	65	0.93	474	138	34	1916	11.56	984	1016	1760
05-10-2021 05:21	O2	Auto	68.84	35	63	0.93	462	136	36	1882	11.72	976	1008	1792
05-10-2021 07:20	O2	Auto	70.99	34	62	1.07	450	136	44	1891	12.04	968	1000	1808
05-10-2021 08:55	SHUTDOWN	Auto	0	0	73	2.4	0	128	96	1897	16	904	944	1632
05-10-2021 12:49	STALL	Auto	0	0	0	0	0	92	124	0	0.79	88	88	16
05-10-2021 12:52	STALL	Auto	0	0	0	0	0	92	124	0	6.34	112	104	16
05-10-2021 12:59	SNAPSHOT	Auto	0	0	75	3.07	0	130	104	1902	15.52	744	760	1760
05-10-2021 14:58	O2	Auto	58.08	38	64	0.93	478	140	38	1894	10.93	1000	1032	1776
05-10-2021 16:58	O2	Auto	58.08	39	64	0.8	482	138	40	1898	10.93	1000	1040	1792
05-10-2021 18:58	O2	Auto	60.23	40	62	0.73	498	134	32	1919	10.93	1000	1040	1792
05-10-2021 20:57	O2	Auto	62.38	41	62	0.73	506	140	36	1893	10.93	1008	1040	1776
05-10-2021 22:57	O2	Auto	64.54	42	59	0.8	6	136	34	1895	10.93	1008	1048	1776
05-11-2021 00:57	O2	Auto	66.69	42	60	0.73	22	138	34	1891	11.09	1008	1056	1808
05-11-2021 02:57	O2	Auto	68.84	42	61	0.67	30	140	32	1882	11.09	1008	1056	1792
05-11-2021 04:56	O2	Auto	68.84	41	60	0.73	4	134	32	1898	11.4	1000	1040	1776
05-11-2021 06:56	O2	Auto	68.84	40	59	0.8	508	134	40	1877	11.4	992	1032	1808
05-11-2021 08:56	O2	Auto	68.84	41	59	0.73	6	132	36	1917	11.4	1000	1032	1776
05-11-2021 10:55	O2	Auto	68.84	42	60	0.73	24	132	36	1906	10.93	1000	1040	1792
05-11-2021 12:55	O2	Auto	68.84	41	62	0.67	22	134	32	1902	10.93	1008	1040	1776
05-11-2021 14:55	O2	Auto	68.84	41	61	0.67	16	132	32	1903	11.25	1000	1040	1776
05-11-2021 16:55	O2	Auto	68.84	40	61	0.73	0	128	36	1913	11.4	992	1032	1760
05-11-2021 18:54	O2	Auto	68.84	40	60	0.8	508	130	34	1913	11.25	992	1032	1776
05-11-2021 20:54	O2	Auto	70.99	38	61	0.87	488	130	38	1892	11.72	984	1016	1776
05-11-2021 22:54	O2	Auto	68.84	40	60	0.87	508	130	42	1915	11.4	992	1032	1760
05-12-2021 00:53	O2	Auto	68.84	39	59	0.93	488	128	38	1891	11.88	984	1016	1776
05-12-2021 02:53	O2	Auto	68.84	38	60	0.93	484	132	42	1891	11.88	984	1016	1808
05-12-2021 04:53	O2	Auto	68.84	38	57	1	474	130	48	1889	12.04	976	1008	1776
05-12-2021 06:53	O2	Auto	68.84	38	58	1.07	470	126	42	1922	12.04	976	1008	1776
05-12-2021 08:52	O2	Auto	68.84	38	59	1	482	126	44	1922	11.88	984	1016	1760
05-12-2021 10:52	O2	Auto	68.84	41	60	0.87	6	132	40	1901	11.4	1000	1032	1792
05-12-2021 12:52	O2	Auto	68.84	43	60	0.8	36	136	40	1874	10.93	1016	1040	1808
05-12-2021 14:52	O2	Auto	38.72	44	57	1.47	484	126	66	1887	10.93	1008	1032	1808
05-12-2021 16:51	O2	Auto	36.57	44	58	1.47	478	126	64	1913	10.93	1008	1040	1760
05-12-2021 18:51	O2	Auto	34.42	43	58	1.07	472	130	52	1904	11.09	1024	1056	1808
05-12-2021 20:51	O2	Auto	36.57	45	56	1.07	482	134	50	1885	11.09	1032	1072	1824
05-12-2021 22:50	O2	Auto	34.42	45	57	1.07	478	134	46	1898	10.93	1032	1064	1776
05-13-2021 00:50	O2	Auto	34.42	45	57	1	476	134	44	1900	10.93	1032	1040	1776
05-13-2021 02:50	O2	Auto	32.27	44	58	1	472	138	46	1907	10.93	1040	1072	1808
05-13-2021 04:50	O2	Auto	32.27	44	57	1.07	472	142	48	1876	11.09	1040	1072	1808
05-13-2021 06:49	O2	Auto	32.27	45	56	1	476	138	46	1897	10.93	1040	1080	1792
05-13-2021 08:49	O2	Auto	32.27	44	58	1	466	136	44	1888	10.93	1040	1072	1776
05-13-2021 10:49	O2	Auto	30.12	43	58	1	456	134	48	1902	10.93	1032	1064	1792
05-13-2021 12:48	O2	Auto	30.12	41	62	0.93	446	136	46	1899	10.93	1032	1056	1744
05-13-2021 14:48	O2	Auto	27.97	41	61	1	444	134	42	1916	11.09	1032	1056	1776
05-13-2021 16:48	O2	Auto	27.97	40	62	1	444	134	44	1915	11.09	1032	1056	1760
05-13-2021 18:48	O2	Auto	27.97	41	61	0.93	444	136	46	1907	10.93	1032	1064	1776
05-13-2021 20:47	O2	Auto	27.97	42	60	1	446	138	46	1883	10.93	1032	1064	1808
05-13-2021 22:47	O2	Auto	27.97	42	60	0.93	450	140	46	1914	10.93	1040	1072	1760
05-14-2021 00:47	O2	Auto	25.81	42	59	1	448	142	48	1901	10.93	1040	1072	1792
05-14-2021 02:46	O2	Auto	25.81	42	60	1	444	142	46	1911	10.93	1040	1072	1776
05-14-2021 04:46	O2	Auto	25.81	42	59	1	442	142	50	1916	11.09	1040	1072	1776
05-14-2021 06:46	O2	Auto	27.97	43	59	0.93	454	138	44	1896	10.93	1040	1080	1792
05-14-2021 08:46	O2	Auto	25.81	42	59	1	448	136	46	1902	10.93	1040	1072	1760
05-14-2021 09:18	SHUTDOWN	Auto	0	0	72	2.73	0	122	102	1901	16.16	952	992	1600
05-14-2021 09:51	SHUTDOWN	Auto	0	0	74	2.87	0	126	92	1900	16	672	640	1792
05-14-2021 10:19	SNAPSHOT	Auto	0	0	74	2.67	0	122	94	1910	15.84	736	752	1760
05-14-2021 11:49	O2	Auto	55.93	42	60	0.6	0	134	24	1906	10.93	1008	1064	1776
05-14-2021 13:49	O2	Auto	45.18	32	64	1	406	128	38	1903	11.88	968	1000	1760
05-14-2021 15:49	O2	Auto	45.18	32	65	0.93	404	128	34	1896	12.04	968	992	1776
05-14-2021 17:48	O2	Auto	45.18	33	64	0.93	410	124	36	1912	11.88	968	1000	1776
05-14-2021 19:48	O2	Auto	45.18	33	63	1	412	128	34	1891	12.04	968	1000	1808
05-14-2021 21:48	O2	Auto	47.33	34	62	1.07	416	130	36	1886	12.04	976	1000	1808
05-14-2021 23:47	O2	Auto	47.33	35	61	1	418	130	40	1888	12.04	976	1008	1808
05-15-2021 01:47	O2	Auto	47.33	35	61	1.07	420	130	42	1917	11.88	976	1008	1760
05-15-2021 03:47	O2	Auto	47.33	35	61	1.07	420	130	40	1892	12.04	976	1008	1808
05-15-2021 05:47	O2	Auto	49.48	36	60	1	426	130	40	1899	11.88	976	1008	1792
05-15-2021 07:46	O2	Auto	51.63	36	60	1	436	128	38	1900	12.04	976	1008	1792
05-15-2021 09:46	O2	Auto	49.48	36	61	0.93	434	126	38	1886	12.04	976	1008	1792
05-15-2021 11:46	O2	Auto	49.48	35	62	0.93	430	124	38	1906	12.04	976	1000	1792
05-15-2021 13:45	O2	Auto	47.33	34	62	1	420	124	38	1905	12.04	976	992	1776
05-15-2021 15:45	O2	Auto	49.48	35	61	1	426	126	40	1907	12.04	976	1000	1792
05-15-2021 17:45	O2	Auto	49.48	36	61	0.87	436	124	36	1913	12.04	976	1000	1760
05-15-2021 19:45	O2	Auto	49.48	36	60	1	434	126	38	1908	12.04	976	1000	1792
05-15-2021 21:44	O2	Auto	51.63	36	60	1.07	438	126	38	1892	11.88	976	1008	1808
05-15-2021 23:44	O2	Auto	51.63	37	59	1.07	442	126	36	1897	12.04	984	1008	1792
05-16-2021 01:44	O2	Auto	53.78	37	59	1	446	126	40	1913	12.04	984	1008	1760
05-16-2021 03:44	O2	Auto	51.63	37	59	1.07	442	128	42	1902	12.04	984	1008	1792
05-16-2021 05:43	O2	Auto	53.78	37	59	1	448	126	36	1922	12.04	984	1016	1760
05-16-2021 07:43	O2	Auto	53.78	38	58	1.07	454	126	40	1913	12.04	984	1016	1760
05-16-2021 09:43	O2	Auto	51.63	36	61	1	446	126	38	1891	12.04	984	1008	1776
05-16-2021 11:42	O2	Auto	53.78	37	60	1	448	124	40	1877	12.04	984	1008	1792
05-16-2021 13:42	O2	Auto	53.78	36	59	1	442	124	40	1887	12.04	984	1000	1808
05-16-2021 15:42	O2	Auto	53.78	36	61	1.07	444	124	42	1894	12.04	976	1000	1792
05-16-2021 17:42	O2	Auto	53.78	37	61	0.93	450	126	38	1884	12.04	976	1000	1776
05-16-2021 19:41	O2	Auto	53.78	37	61	0.93	450	124	36	1909	12.04	984	1008	1760
05-16-2021 21:41	O2	Auto	55.93	37	59	1.07	452	124	40	1898	12.04	984	1008	1808
05-16-2021 23:41	O2	Auto	55.93	37	59	1	454	126	38	1893	12.04	984	1008	1776
05-17-2021 01:40	O2	Auto	55.93	38	58	1.07	454	124	42	1913	12.04	984	1016	1792
05-17-2021 03:40	O2	Auto	55.93	38	58	1.07	458	126	38	1906	12.04	992	1016	1776
05-17-2021 05:40	O2	Auto	55.93	38	59	1.13	458	128	40	1913	11.88	984	1016	1776
05-17-2021 07:40	O2	Auto	58.08	39	57	1	466	126	42	1914	11.88	984	1016	1760
05-17-2021 09:39	O2	Auto	55.93	37	58	1.07	460	126	38	1880	12.04	984	1008	1808
05-17-2021 11:39	O2	Auto	66.69	45	57	0.67	58	130	26	1892	11.09	1024	1048	1792
05-17-2021 13:39	O2	Auto	68.84	45	57	0.67	62	130	26	1879	11.09	1016	1048	1792
05-17-2021 15:38	O2	Auto	68.84	45	58	0.6	68	124	22	1923	10.93	1016	1048	1776
05-17-2021 17:38	O2	Auto	70.99	46	56	0.6	82	124	20	1894	10.93	1024	1048	1792
05-17-2021 19:38	O2	Auto	73.14	47	55	0.6	88	130	26	1878	11.09	1024	1056	1792
05-17-2021 21:38	O2	Auto	73.14	47	56	0.67	92	130	30	1913	10.93	1024	1056	1744
05-17-2021 23:37	O2	Auto	75.29	47	55	0.67	100	128	24	1915	10.93	1032	1064	1776
05-18-2021 01:37	O2	Auto	75.29	49	55	0.67	134	134	26	1892	10.77	1032	1072	1808
05-18-2021 03:37	O2	Auto	75.29	48	55	0.73	118	132	26	1882	10.93	1024	1064	1824
05-18-2021 05:37	O2	Auto	75.29	48	55	0.73	118	134	30	1882	10.93	1032	1064	1808
05-18-2021 07:36	O2	Auto	75.29	49	53	0.73	118	130	28	1897	10.93	1032	1072	1808
05-18-2021 09:36	O2	Auto	75.29	51	53	0.6	158	134	26	1880	10.61	1040	1080	1776
05-18-2021 11:36	O2	Auto	75.29	54	55	0.47	206	134	22	1897	10.3	1048	1088	1760
05-18-2021 13:35	O2	Auto	68.84	48	56	0.6	100	124	22	1890	10.77	1032	1056	1808
05-18-2021 15:35	O2	Auto	68.84	48	55	0.6	92	128	32	1897	10.93	1048	1072	1760
05-18-2021 17:35	O2	Auto	68.84	47	56	0.67	90	126	26	1881	10.93	1024	1048	1776
05-18-2021 19:35	O2	Auto	68.84	47	55	0.67	86	128	30	1892	10.93	1024	1056	1808
05-18-2021 21:34	O2	Auto	68.84	45	56	0.8	56	126	34	1917	11.25	1016	1040	1728
05-18-2021 23:34	O2	Auto	68.84	45	55	0.8	50	126	34	1915	11.25	1016	1048	1776
05-19-2021 01:34	O2	Auto	70.99	44	56	0.87	42	126	32	1895	11.4	1016	1040	1792
05-19-2021 03:33	O2	Auto	68.84	44	55	0.87	36	124	36	1906	11.56	1008	1040	1792
05-19-2021 05:33	O2	Auto	68.84	44	55	0.93	34	126	36	1901	11.56	1008	1032	1808
05-19-2021 07:33	O2	Auto	70.99	44	56	0.93	42	122	30	1917	11.4	1016	1040	1776
05-19-2021 09:33	O2	Auto	68.84	47	55	0.73	82	126	32	1902	10.93	1024	1056	1760
05-19-2021 11:32	O2	Auto	68.84	47	56	0.67	82	120	24	1911	10.93	1024	1048	1776
05-19-2021 13:32	O2	Auto	68.84	47	56	0.6	94	120	26	1904	10.77	1032	1048	1792
05-19-2021 15:32	O2	Auto	70.99	52	54	0.47	150	126	26	1878	10.3	1040	1072	1792
05-19-2021 17:31	O2	Auto	68.84	51	54	0.47	144	124	22	1900	10.45	1040	1072	1760
05-19-2021 19:31	O2	Auto	70.99	50	55	0.6	126	124	22	1917	10.61	1040	1072	1760
05-19-2021 21:31	O2	Auto	70.99	48	55	0.67	96	124	28	1910	10.93	1024	1056	1760
05-19-2021 23:31	O2	Auto	70.99	47	56	0.73	88	130	32	1889	11.09	1024	1056	1776
05-20-2021 01:30	O2	Auto	70.99	47	54	0.8	72	124	32	1923	11.09	1024	1048	1808
05-20-2021 03:30	O2	Auto	68.84	46	54	0.8	56	126	32	1898	11.4	1016	1048	1792
05-20-2021 05:30	O2	Auto	70.99	46	54	0.8	50	122	34	1913	11.56	1016	1048	1776
05-20-2021 07:29	O2	Auto	70.99	45	54	0.87	48	120	34	1918	11.56	1016	1048	1776
05-20-2021 09:29	O2	Auto	70.99	47	54	0.8	76	124	30	1904	11.4	1024	1048	1792
05-20-2021 11:29	O2	Auto	70.99	50	52	0.6	108	118	20	1906	11.09	1024	1056	1792
05-20-2021 13:29	O2	Auto	66.69	49	52	0.6	88	116	26	1895	11.09	1024	1048	1792

Time Stamp	Murphy Status	Op Status	Well/Process Vac (In-H2O)	Well/Process Flow (SCFM)	Air Flow (SCFM)	Fuel Flow (SCFM)	Well/Process Valve Position	Air Valve Position	Fuel Valve Position	RPM	Manifold Vac (Hg)	PreCat Temp (F)	PostCat Temp (F)	O2 (mV)
05-20-2021 15:28	O2	Auto	66.69	49	54	0.6	90	120	26	1899	10.93	1024	1048	1776
05-20-2021 17:28	O2	Auto	66.69	49	52	0.67	78	116	30	1897	11.25	1016	1048	1792
05-20-2021 19:28	O2	Auto	66.69	48	53	0.73	64	122	30	1894	11.4	1016	1040	1776
05-20-2021 21:27	O2	Auto	66.69	46	53	0.93	38	118	32	1901	11.72	1008	1032	1776
05-20-2021 23:27	O2	Auto	66.69	45	52	0.93	28	120	34	1905	11.72	1008	1032	1776
05-21-2021 01:27	O2	Auto	66.69	44	54	0.93	22	122	40	1889	11.88	1008	1032	1792
05-21-2021 03:27	O2	Auto	66.69	44	52	1	18	120	40	1906	11.88	1008	1032	1792
05-21-2021 05:26	O2	Auto	66.69	44	52	1	20	120	40	1907	11.88	1008	1032	1776
05-21-2021 07:26	O2	Auto	66.69	45	53	0.93	26	118	38	1918	11.72	1008	1032	1792
05-21-2021 09:26	O2	Auto	66.69	46	52	0.87	48	122	36	1883	11.56	1016	1040	1808
05-21-2021 11:26	O2	Auto	66.69	49	52	0.73	76	122	34	1882	11.25	1024	1048	1808
05-21-2021 13:25	O2	Auto	64.54	46	55	0.73	52	118	28	1909	11.25	1016	1040	1792
05-21-2021 15:25	O2	Auto	66.69	46	55	0.67	54	118	30	1904	11.25	1016	1040	1792
05-21-2021 17:25	O2	Auto	64.54	45	55	0.73	42	118	32	1887	11.4	1008	1032	1792
05-21-2021 19:24	O2	Auto	64.54	44	55	0.8	32	122	34	1884	11.56	1008	1032	1792
05-21-2021 21:24	O2	Auto	66.69	43	55	0.87	10	116	32	1899	11.88	992	1016	1792
05-21-2021 23:24	O2	Auto	64.54	42	55	0.87	4	122	36	1879	12.04	992	1016	1792
05-22-2021 01:24	O2	Auto	64.54	42	56	0.93	0	120	34	1905	12.04	992	1016	1776
05-22-2021 03:23	O2	Auto	64.54	42	54	1	510	122	40	1904	11.88	992	1024	1792
05-22-2021 05:23	O2	Auto	66.69	41	55	1	508	120	36	1898	12.04	992	1016	1792
05-22-2021 07:23	O2	Auto	66.69	42	55	1	0	120	34	1903	12.04	992	1024	1808
05-22-2021 09:22	O2	Auto	66.69	43	56	0.87	22	120	36	1895	11.56	1008	1024	1808
05-22-2021 11:22	O2	Auto	64.54	47	55	0.6	64	122	30	1887	11.09	1024	1048	1760
05-22-2021 13:22	O2	Auto	64.54	48	55	0.53	86	120	28	1918	10.77	1024	1048	1760
05-22-2021 15:22	O2	Auto	64.54	48	55	0.53	88	118	26	1901	10.61	1024	1048	1808
05-22-2021 17:21	O2	Auto	64.54	46	56	0.6	70	120	30	1915	10.93	1024	1040	1776
05-22-2021 19:21	O2	Auto	66.69	45	57	0.67	54	122	32	1890	11.09	1016	1040	1776
05-22-2021 21:21	O2	Auto	64.54	45	57	0.73	50	126	32	1881	11.09	1024	1040	1808
05-22-2021 23:20	O2	Auto	66.69	44	58	0.73	40	122	30	1902	11.25	1016	1032	1792
05-23-2021 01:20	O2	Auto	66.69	43	58	0.8	34	120	30	1886	11.4	1016	1032	1792
05-23-2021 03:20	O2	Auto	66.69	42	57	0.8	22	122	36	1894	11.4	1008	1032	1776
05-23-2021 05:20	O2	Auto	66.69	42	58	0.8	18	122	34	1894	11.4	1008	1032	1776
05-23-2021 07:19	O2	Auto	64.54	42	58	0.8	24	120	36	1898	11.4	1008	1032	1792
05-23-2021 09:19	O2	Auto	66.69	45	57	0.73	54	120	34	1916	11.09	1016	1040	1776
05-23-2021 11:19	O2	Auto	64.54	47	57	0.6	80	118	26	1917	10.77	1024	1040	1792
05-23-2021 13:18	O2	Auto	66.69	49	57	0.47	108	120	24	1918	10.3	1032	1048	1760
05-23-2021 15:18	O2	Auto	64.54	49	57	0.47	108	124	24	1888	10.45	1032	1048	1760
05-23-2021 17:18	O2	Auto	66.69	47	56	0.6	80	120	28	1907	10.77	1024	1048	1792
05-23-2021 19:18	O2	Auto	64.54	46	57	0.6	74	118	28	1894	10.93	1024	1040	1792
05-23-2021 21:17	O2	Auto	64.54	46	57	0.73	60	120	32	1917	10.93	1024	1040	1776
05-23-2021 23:17	O2	Auto	64.54	45	57	0.73	48	122	32	1890	11.25	1016	1040	1760
05-24-2021 01:17	O2	Auto	66.69	43	58	0.8	30	120	34	1898	11.4	1016	1032	1760
05-24-2021 03:16	O2	Auto	64.54	43	55	0.8	14	120	36	1880	11.88	1000	1024	1808
05-24-2021 05:16	O2	Auto	66.69	43	54	0.93	8	116	36	1900	12.04	1000	1024	1808
05-24-2021 07:16	O2	Auto	66.69	42	54	1	0	118	38	1894	12.04	1000	1024	1792
05-24-2021 09:16	O2	Auto	66.69	42	54	0.93	2	116	42	1902	12.2	992	1024	1776
05-24-2021 11:15	O2	Auto	64.54	43	54	0.93	8	116	38	1908	12.04	1000	1024	1792
05-24-2021 13:15	O2	Auto	64.54	44	53	0.93	16	114	38	1923	11.88	1000	1024	1792
05-24-2021 15:15	O2	Auto	66.69	43	54	0.93	12	118	42	1904	11.88	1000	1024	1792
05-24-2021 17:15	O2	Auto	66.69	46	53	0.8	40	120	40	1893	11.72	1008	1032	1792
05-24-2021 19:14	O2	Auto	66.69	46	52	0.8	36	116	40	1907	11.72	1008	1032	1776
05-24-2021 21:14	O2	Auto	68.84	45	52	1	34	116	40	1917	11.88	1008	1032	1760
05-24-2021 23:14	O2	Auto	66.69	45	52	1	30	120	38	1883	11.88	1008	1032	1776
05-25-2021 01:13	O2	Auto	66.69	45	52	1	30	122	40	1901	11.88	1008	1032	1760
05-25-2021 03:13	O2	Auto	66.69	45	52	1	30	120	38	1891	11.72	1016	1040	1792
05-25-2021 05:13	O2	Auto	66.69	45	53	0.93	30	120	40	1909	11.88	1016	1040	1792
05-25-2021 07:13	O2	Auto	66.69	45	53	0.93	28	120	44	1903	11.88	1016	1040	1776
05-25-2021 08:46	SHUTDOWN	Auto	0	0	71	2.6	0	122	94	1884	16.32	928	968	1760

Appendix E SVE/AS and Monitoring Well Construction Logs

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **BF-103R2**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **11/20/25** COMPLETED: **11/20/25**
INSTALLATION: STARTED **11/20/25** COMPLETED: **11/20/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **219951.288** EASTING (ft): **2682500.323**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **12.7** TOC ELEV (ft): **16.64**
INITIAL DTW (ft): **17.05** BOREHOLE DEPTH (ft): **20**
STATIC DTW (ft): WELL DEPTH (ft): **18**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A, Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
0–9			ASSORTED FILL, gravel, clay, sand, brick, wood, saturated to moist, no odor					0 0 0 0 0 0 9		2" PVC Casing Grout Bentonite Sand Pack #1 Well Sand
9–10		SP	SP; SAND, loose, orange, medium, moist, well sorted, no odor							
10–11		SW	SW; SAND with rounded gravel (1"), gray, coarse, poorly sorted					175	10	
12		SC	SC; CLAYEY SAND with some gravel (1/2"), yellow, saturated, non-plastic, cohesive					999+		
12–13		GM	GM; SILTY GRAVEL with sand, loose, red/gray, saturated, some odor, rust ring					36 170		2" PVC Screen
13–15								22 0	15	
19–20		SP	SP; SAND, loose, brown/orange, medium, saturated, no odor					0 0	20	
20			End of Boring							

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

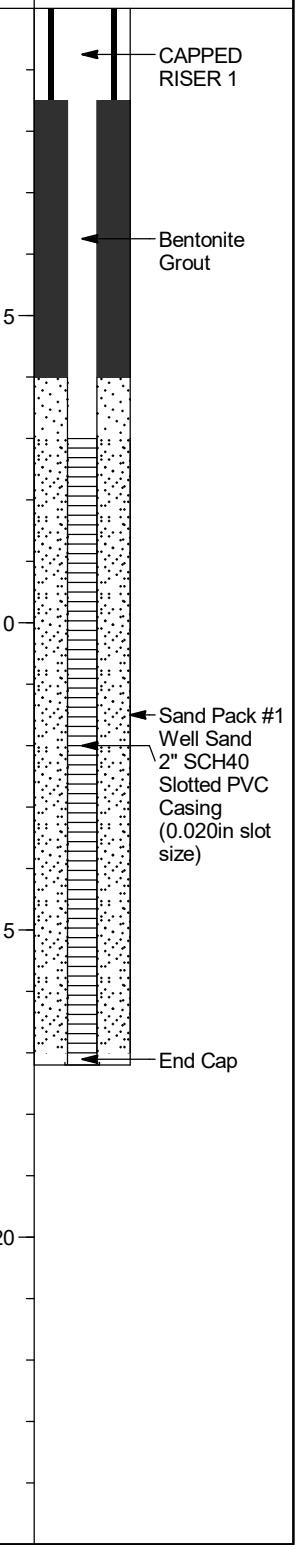
WELL / PROBEHOLE / BOREHOLE NO: **S-430**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **9/27/18** COMPLETED: **9/27/18**
INSTALLATION: STARTED **9/27/18** COMPLETED: **9/27/18**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Geoprobe 7822 DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220761** EASTING (ft): **2682288**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **9.9** TOC ELEV (ft): **13.09**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **17**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **A Klingbeil** CHECKED BY: **J. Kachel**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			NO SAMPLING PERFORMED; WELL SET USING MIHPT-10 LOG							
17			End of Boring							



GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-431**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **9/27/18** COMPLETED: **9/27/18**
INSTALLATION: STARTED **9/27/18** COMPLETED: **9/27/18**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Geoprobe 7822 DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220624** EASTING (ft): **2682232**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **14** TOC ELEV (ft): **17.52**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **18**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **A Klingbeil** CHECKED BY: **J. Kachel**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			NO SAMPLING PERFORMED; WELL SET USING MIHPT-11 LOG							
18			End of Boring							

Well Construction:
- CAPPED RISER 1
- Bentonite Grout
- Sand Pack #1 Well Sand
- 2" SCH40 Slotted PVC Casing (0.020in slot size)
- End Cap

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-433R**
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Stantec

DRILLING: STARTED **11/20/25** COMPLETED: **11/20/25**
INSTALLATION: STARTED **11/20/25** COMPLETED: **11/20/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220003.1** EASTING (ft): **2682199.28**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **11.6** TOC ELEV (ft): **15.24**
INITIAL DTW (ft): **15.82** BOREHOLE DEPTH (ft): **35**
STATIC DTW (ft): WELL DEPTH (ft): **25**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A, Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–5			GRAVEL FILL/DGW, no odor							2" PVC Casing; Grout
6–9			FILL, crushed coal and silty clay, some rounded gravel, tan/orange, moist, low plasticity, cohesive					0; 0; 0		Bentonite
10–19		SP	SP; SAND with subrounded gravel up to 4", silty coarse grain sand, pale red/brown, saturated, poorly sorted, no odor, no staining					0; 4; 7	10; 15	Sand Pack #1 Well Sand
20–26			Limited recovery					13; 9; 15; 0; 1	20; 25	2" PVC Screen
27–31		SW	SW; SAND with rounded gravel up to 2", orange, very coarse to medium, saturated, poorly sorted, no odor					0; 0; 0; 0; 0	30	
32–34		CH	CH; FAT CLAY, very dense, yellow/orange, moist, high plasticity, cohesive, no odor Change to light gray at 33'					0; 0; 0; 0		
35			Change to sandy at 34.5' End of Boring					0	35	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-439R**
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Stantec

DRILLING: STARTED **11/17/25** COMPLETED: **11/17/25**
INSTALLATION: STARTED **11/18/25** COMPLETED: **11/18/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220593.862** EASTING (ft): **2682515.999**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **17.6** TOC ELEV (ft): **20.92**
INITIAL DTW (ft): **21.22** BOREHOLE DEPTH (ft): **30**
STATIC DTW (ft): WELL DEPTH (ft): **26**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
10		SWG	SWG; SAND, rounded gravel (up to 2"), loose, light brown, medium to coarse, moist, odor, no visual impacts					75	10	Sand Pack #1 Well Sand
								72		
								60		
								80		
								53		
15		SM	SM; Some silt present, dark brown, strong odor					222	15	
								999+		
17			Saturated at 17'					999+		
								999+		
								999+		2" PVC Screen
20			Change to some odor						20	
21		SWG	SWG; GRAVELLY SAND (2"), loose, saturated, poorly sorted, slight odor					180 ▽		
24			Rust band							
25		CL	CL; SANDY CLAY, some gravel, medium dense, tan, low plasticity, cohesive, no odor						25	
30			End of Boring						30	

Well Construction: 2" PVC Casing; Grout; Bentonite; Sand Pack #1 Well Sand; 2" PVC Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-479**
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Stantec

DRILLING: STARTED **12/21/21** COMPLETED: **12/21/21**
INSTALLATION: STARTED **12/21/21** COMPLETED: **12/21/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Geoprobe 7822 DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220479** EASTING (ft): **26821250**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **15.8** TOC ELEV (ft): **15.51**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **35**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in): **2**
LOGGED BY: **D Hopkins** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–12			FILL (brick), sand (very dark gray-dark red brown, silty, fine to medium) (dry to moist)			1		0		1.5" PVC Casing
13–18		SC	SC; SAND (very dark gray to dark red brown, silty, fine to medium), clay (little, some fine grained, dark staining) (wet)			3		0 48 50 250 2430	5 10 15	Bentonite and Grout 1.5" SCH40 Slotted PVC Casing (0.020in slot size) Sand Pack #2 Well Sand
19–20		SP	SP; SAND (dark red brown, poorly graded) (slight staining) (saturated)			3.5		5		
20–22		SW	SW; SAND (dark red brown, well graded), gravel (small) (trace fine grain sediments)					1.9	20	End Cap
22–25		SC	SC; SAND (gray, clayey, fine to very fine)			4.5		32.7 5.1	25	
25–30		CL	CL; SAND (gray to light gray, clayey, fine to very fine), transitioning to clay (sandy, finer to very fine) (saturated)			3		0	30	
30–35		SP	SP; SAND (red brown, poorly graded, very fine) (micaceous, trace fine grain sediments) (saturated)			5		0	35	
35		SC	SC; SAND (very dark brown, clayey, very fine) (saturated) End of Boring							

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-481R**
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Stantec

DRILLING: STARTED **11/18/25** COMPLETED: **11/18/25**
INSTALLATION: STARTED **11/18/25** COMPLETED: **11/18/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220283.325** EASTING (ft): **2682194.161**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **16.3** TOC ELEV (ft): **20.19**
INITIAL DTW (ft): **20.86** BOREHOLE DEPTH (ft): **30**
STATIC DTW (ft): WELL DEPTH (ft): **25**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No Samples from 0-10' bgs							2" PVC Casing
										Grout
									5	
										Bentonite
										Sand Pack #1 Well Sand
10		SP-SM	SP-SM; SILTY SAND, some silt and 1/4" to 1/2" rounded pebble, medium brown to orange, medium to coarse grain, moist, some odor					0	10	
								0		
								3		
								110		
15			More clay, more red					65	15	
								317		
17			3" rounded gravel							2" PVC Screen
		SM	SM; SILTY SAND, orange, medium grain, saturated					1000		
19			Medium brown					1000		
20		SWG	SWG; SAND with rounded gravel (2-3"), black, medium to coarse grain, saturated					560	20	
								3		
22			Rust ring at 22-23'					7		
23			Orange/brown					13		
24								6		
25		CL	CL; SANDY CLAY, gray/tan, saturated, medium plasticity, cohesive, no odor, no impacts					0	25	
								0		
27								0		
28								0		
29								0		
30			End of Boring					0	30	
31										
32										
33										
34										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-482R**
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Stantec

DRILLING: STARTED **11/21/25** COMPLETED: **11/21/25**
INSTALLATION: STARTED **11/21/25** COMPLETED: **11/21/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220635.01** EASTING (ft): **2682310.863**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **20.2** TOC ELEV (ft): **23.79**
INITIAL DTW (ft): **24.04** BOREHOLE DEPTH (ft): **30**
STATIC DTW (ft): WELL DEPTH (ft): **27**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1		CL-ML	CL-ML; SILTY CLAY, medium stiff, brown, moist, non-plastic, cohesive, no odor							2" PVC Casing
2								0		
3										
4										Grout
5									5	
6		SP	SP; SAND with rounded gravel (1/4" to 3"), loose, brown, fine to coarse, dry to moist, poorly sorted, no odor							
7										
8										
9										Bentonite
10			More moist beginning ~10ft bgs; odors observed beginning ~10ft bgs					38	10	
11								44		Sand Pack #1 Well Sand
12								56		
13								60		
14			Orange 14ft - 15ft bgs					35		
15		SP	SP; SAND, trace gravel (1/2"), loose, medium grain, brown/orange, moist, odor					31	15	
16			Gravel beginning at 16' bgs, bright orange					116		
17								230		
18		SM	SM; SILTY SAND wth trace rounded gravel (1/4"), loose, yellow, moist, odor					380		
19		SP-SM	SP-SM; SILTY SAND, gravel (1/4" to 2.5"), loose, brown orange, medium grain, saturated, poorly sorted, strong odor					999+		
20		SM	SM; SILTY SAND with rounded gravel (1/4" to 3"), loose, dark brown, saturated, poorly sorted, odor					999+	20	2" PVC Screen
21								388		
22		SW-SM	SW-SM; SILTY SAND, medium brown/orange, fine to medium grain, saturated, well sorted, odor					305		
23								250		
24								110		
25		SM	SM; SILTY SAND with rounded gravel (1/4" to 3"), red/orange, poorly sorted, slight odor. Shift in color from brown to orange to brown to orange.					36	25	
26								6		
27		CH	CH; FAT CLAY, dense, white/gray, saturated, high plasticity, cohesive, no odor					5		
28								3		
29								2		
30		CW-CL	CW-CL; SANDY CLAY, white, moist and saturated, non-plastic, cohesive, well sorted					3	30	
31			End of Boring							
32										
33										
34										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-484R**
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Stantec

DRILLING: STARTED **11/18/25** COMPLETED: **11/18/25**
INSTALLATION: STARTED **11/18/25** COMPLETED: **11/18/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220463.264** EASTING (ft): **2682323.929**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **17.6** TOC ELEV (ft): **21.21**
INITIAL DTW (ft): **21.73** BOREHOLE DEPTH (ft): **30**
STATIC DTW (ft): WELL DEPTH (ft): **26**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–9			No Samples from 0-10' bgs							2" PVC Casing; Grout
10–18		GM	GM; GRAVEL, rounded up to 1.5", sand, loose, orange to light brown, moist, poorly sorted, no odor, no impacts, rounded gravel up to 1.5"					2 1 1 3 1 1 1	5 10	Bentonite; Sand Pack #1 Well Sand
19		SM	SM; SILTY SAND, orange, medium grain, moderate odor					999+	15	2" PVC Screen
20		SM	Some pebbles, saturated					999+	20	
21–24			SM; SILTY SAND with some rounded gravel (1/2"-1"), medium brown/orange, medium to coarse grain, saturated, poorly sorted					66 135 6 3		
25			Increased gravel (1"-2.5")					5	25	
26–29		CL	CL; SANDY CLAY, tan, medium plasticity, cohesive, no odor, no impacts					2 1 0 0		
30			End of Boring					0	30	
31–34										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-485R**
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Stantec

DRILLING: STARTED **11/20/25** COMPLETED: **11/20/25**
INSTALLATION: STARTED **11/20/25** COMPLETED: **11/20/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220231.754** EASTING (ft): **2682448.576**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **13.697** TOC ELEV (ft): **17.2**
INITIAL DTW (ft): **17.46** BOREHOLE DEPTH (ft): **30**
STATIC DTW (ft): WELL DEPTH (ft): **25**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No Samples taken 0-10' bgs							2" PVC Casing
										Grout
									5	
										Bentonite
										Sand Pack #1 Well Sand
10		SWG	SWG; GRAVELLY SAND, orange/brown, fine to coarse to rounded gravel 1.5", saturated, poorly sorted, strong odor					999+	10	
								999+		
								999+		
								999+		
								999+		
15		SWG	SWG; GRAVELLY SAND, orange/brown, fine to coarse to some rounded gravel 1", saturated, poorly sorted, slight odor, less gravel than above					840	15	
								340		
								117		2" PVC Screen
								17		
								22		
20		SM	SM; SAND/SILT, trace gravel (1-2"), orange, coarse grain, saturated.					19	20	
								0		
								0		
								0		
			Rust ring at 24'					0		
25		SM	SM; SILTY SAND, loose, orange, coarse grain, saturated, no odor					0	25	
								0		
								0		
								0		
								0		
30		SWG	SWG; Rounded GRAVEL up to 3", poorly sorted					0	30	
			End of Boring							

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-508R**
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Stantec

DRILLING: STARTED **11/19/25** COMPLETED: **11/19/25**
INSTALLATION: STARTED **11/19/25** COMPLETED: **11/19/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220459.558** EASTING (ft): **2682315.664**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **17.4** TOC ELEV (ft): **21.16**
INITIAL DTW (ft): **21.55** BOREHOLE DEPTH (ft): **90**
STATIC DTW (ft): WELL DEPTH (ft): **75**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No Sample taken 0-30'							2" PVC Casing
30		CL	CL; SANDY CLAY, tan, fine grain, saturated, medium plasticity, cohesive, non uniform clay and silt/sand, vary in compositional percentages throughout, slight odor					45 100 245		Grout

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-508R**
PAGE 2 OF 3

Stantec

DRILLING: STARTED **11/19/25** COMPLETED: **11/19/25**
INSTALLATION: STARTED **11/19/25** COMPLETED: **11/19/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220459.558** EASTING (ft): **2682315.664**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **17.4** TOC ELEV (ft): **21.16**
INITIAL DTW (ft): **21.55** BOREHOLE DEPTH (ft): **90**
STATIC DTW (ft): WELL DEPTH (ft): **75**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
		CL								
36		SM	SM; SAND SILT, some rounded gravel, light tan with orange mottling, saturated, slight odor					300		
37		SM	SM; SILTY SAND, loose, tan, coarse grain, saturated, no odor					225		
38		CL						0		
		SP	CL; SANDY CLAY, tan, medium grain, saturated, medium plasticity, cohesive, no odor					0		
39								0		
40		SP	SP; SAND, trace clay, trace rounded gravel, loose, medium to fine grain, saturated, no odor, no impacts					0	40	
41			SP; SAND, loose, orange/tan (40 ft - 41ft bgs), light brown/tan (41ft-45ft bgs), medium, saturated, well sorted, no odor							
42										
43										
44										
45		CL	CL; SANDY CLAY						45	
46		SM	SM; SILTY SAND, burnt orange, saturated, well sorted, no odor							
47										
48										
49										
50		SP	SP; SAND rounded cobble (4"-5"), some trace clay, loose, gray to dark red, fine, saturated, poorly sorted, no odor					0	50	
51										
52										
53										
54										
55								0	55	
56										
57										Bentonite
58										
59		GP	GP; POORLY SORTED GRAVEL, loose, orange/brown, 0.5" - 1" rounded gravel with coarse grain sand, saturated, no odor, 1-4" subrounded cobbles							Sand Pack #1 Well Sand
60		GP	GP; POORLY SORTED GRAVEL, orange/brown, 0.5" - 5" cobble with coarse grain sand, saturated, very poorly sorted, no odor Dark brown to orange from 61' to 61.5'					0	60	
61										
62										
63										
64										
65								0	65	
66										
67										
68										2" PVC Screen
69										

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-508R**
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DRILLING: STARTED **11/19/25** COMPLETED: **11/19/25**
INSTALLATION: STARTED **11/19/25** COMPLETED: **11/19/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220459.558** EASTING (ft): **2682315.664**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **17.4** TOC ELEV (ft): **21.16**
INITIAL DTW (ft): **21.55** BOREHOLE DEPTH (ft): **90**
STATIC DTW (ft): WELL DEPTH (ft): **75**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **6**
LOGGED BY: **C. Danyi** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
71		GP	Dark brown							
72		SM	SM; SILTY SAND, tan/brown, medium grain, satuarted, well sorted, no odor							
73		GP	GP; POORLY SORTED GRAVEL, coarse grain sand							
74										
75			Dark grey 75ft - 75.5ft bgs, 6" subrounded gravel					0	75	
76		SC	SC; CLAYEY SAND, white, fine grain, saturated, non-plastic, noncohesive, well sorted, no odor							
77		CH	CH; CLAY, tight/dense, white, saturated, high plasticity, cohesive							
78		SC	SC; CLAYEY SAND, white, medium grain, saturated, non-plastic, noncohesive, well sorted, no odor							
79										
80		GP	GP; POORLY SORTED GRAVEL, poorly sorted sand with rounded gravel up to 6" cobble, white to gray, saturated, no odor					0	80	
81										
82										
83			Yellow/tan							
84		CH	CH; FAT CLAY with trace gravel 0.5", dense, blue to gray, speckled white, wet, high plasticity, cohesive							
85			White/gray mottling begins at 85ft bgs					0	85	
86										
87										
88										
89			WEATHERED BEDROCK, biotite layers, micaceous, stiff, white/dark gray, wet							
90			End of Boring						90	
91										
92										
93										
94										
95									95	
96										
97										
98										
99										
100									100	
101										
102										
103										
104										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refining Complex**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **S-521**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **11/24/25** COMPLETED: **11/24/25**
INSTALLATION: STARTED **11/24/25** COMPLETED: **11/24/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Boart Longyear LS250**
DRILLING METHOD: **Rotosonic**
SAMPLING EQUIPMENT: **4" Sonic Core Barrel**

NORTHING (ft): **220880.031** EASTING (ft): **2682345.142**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **9.78** TOC ELEV (ft): **13.47**
INITIAL DTW (ft): **13.21** BOREHOLE DEPTH (ft): **20**
STATIC DTW (ft): WELL DEPTH (ft): **19**
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **N. Degan** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
0–8		FILL	FILL; CLAY, some silt and fine grain sand, roots, trace fill bricks, light brown, dry, noncohesive, brittle					0.8 1.0 3.5 1.3 0.6		2" PVC Casing Grout Bentonite Sand Pack #1 Well Sand
8–9		SP	SP; SAND with few subrounded gravel, few clay, light brown, medium grain, moist, noncohesive					0.2		
9–10		GP	GP; GRAVEL with some coarse grain sand, few clay and trace silt, light brown, moist, noncohesive.					0.0	10	
10–13			Fining downard to medium grain sand and trace silt, dark brown/gray					0.0 0.0		
13–17								0.0		2" PVC Screen
17–19		SP	SP; SAND with some rounded gravel, trace silt/clay, dark brown/gray, medium grain, wet, noncohesive					0.0 0.0	15	
19–20		CL	CL; CLAY with trace rounded gravel, light brown, medium plasticity, cohesive					0.0		
20			Enf of Boring						20	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

25 30

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 7/2/26

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-AS-01**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **5/20/24** COMPLETED: **5/20/24**
INSTALLATION: STARTED **5/20/24** COMPLETED: **5/20/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220574** EASTING (ft): **2682403**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **24**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
22		SP	SP; SAND (medium brown, coarse), gravel (some, angular) (saturated)				8 8 13 14	30		Grout
24			End of Boring							Sand
										1.5" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-02**

Stantec

DRILLING: STARTED **5/21/24** COMPLETED: **5/21/24**
INSTALLATION: STARTED **5/21/24** COMPLETED: **5/21/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220582** EASTING (ft): **2682380**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **24**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
22		SP	SP; SAND (medium brown, coarse), gravel (some, multicolored, rounded) (saturated)				4 8 11 14	382 1974		Grout Sand 1.5" Stainless Steel Screen
24			End of Boring							

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-03**

Stantec

DRILLING: STARTED **5/21/24** COMPLETED: **5/21/24**
INSTALLATION: STARTED **5/21/24** COMPLETED: **5/21/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220555** EASTING (ft): **2682391**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **26**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
22		GP	GP; GRAVEL with sandy clay (some)				13	896		Clay
23		GP	GP; GRAVEL (medium), sand (some, medum brown) (saturated)			0.41	12 6	88		
24		SP	SP; SAND (medium brown, coarse), gravel (few, small) (saturated)				6 8	193		1.5" Stainless Steel Screen
25		SM	SM; SILTY SAND (red brown), gravel (medium, angular)			2	16 22	40		Sand
26			End of Boring				30	3		

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-04**

Stantec

DRILLING: STARTED **5/22/24** COMPLETED: **5/22/24**
INSTALLATION: STARTED **5/22/24** COMPLETED: **5/22/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220543** EASTING (ft): **2682418**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **24**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							
22		SP	SP; SAND (medium brown), gravel (some, multicolor, round, small to large with depth) (saturated)			2	5 5 13 13	2436.9 142.7		
24			End of Boring							

Well Construction: 1.5" Stainless Steel Casing; Grout; Clay; Sand; 1.5" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-05**

Stantec

DRILLING: STARTED **5/22/24** COMPLETED: **5/22/24**
INSTALLATION: STARTED **5/22/24** COMPLETED: **5/22/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220566** EASTING (ft): **2682423**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **24**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
22		SP	SP; SAND (medium brown, coarse), gravel (some, multicolor, round) (saturated)			2	4 11 15 17	2500		Sand
23			(reddish brown in bottom 1")							1.5" Stainless Steel Screen
24			End of Boring					27		

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-06**

Stantec

DRILLING: STARTED **5/23/24** COMPLETED: **5/23/24**
INSTALLATION: STARTED **5/23/24** COMPLETED: **5/23/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220468** EASTING (ft): **2682317**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **24**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
20		SP	SP; SAND (medium brown), silt (some), gravel (some, multicolor, round) (saturated)				6	1312	20	Clay
21							7	26.3		
22			1" lense of weathered rock (red brown)				8 13	2300		Sand 1.5" Stainless Steel Screen
23							7 11 13 14			
24			End of Boring					95		

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-07**

Stantec

DRILLING: STARTED **5/23/24** COMPLETED: **5/23/24**
INSTALLATION: STARTED **5/23/24** COMPLETED: **5/23/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220474** EASTING (ft): **2682292**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **22**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
20		SP	SP; SAND (medium brown, coarse), gravel (some, multicolor) (saturated)			1	3 3 1 1	1407.5	20	Clay Sand
22			End of Boring					407		1.5" Stainless Steel Screen

Grout

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-08**

Stantec

DRILLING: STARTED **5/28/24** COMPLETED: **5/28/24**
INSTALLATION: STARTED **5/28/24** COMPLETED: **5/28/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220466** EASTING (ft): **2682336**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **22**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
20		SP	SP; SAND (medium brown, coarse), gravel (some, multicolor, round) (saturated)			2	3 9 9 14	2126.2	20	Clay Sand 1.5" Stainless Steel Screen
22			End of Boring					265		

Grout

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-09**

Stantec

DRILLING: STARTED **5/29/24** COMPLETED: **5/29/24**
INSTALLATION: STARTED **5/29/24** COMPLETED: **5/29/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220439** EASTING (ft): **2682333**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **22**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
20		SP	SP; SAND (dark brown, coarse), gravel (multicolor, round) (saturated)			2	4 8 8 15	2156	20	Grout
22			(medium brown) End of Boring					199		Clay Sand 1.5" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-AS-10**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **5/29/24** COMPLETED: **5/29/24**
INSTALLATION: STARTED **5/29/24** COMPLETED: **5/29/24**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220450** EASTING (ft): **2682306**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **22**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1.5** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							1.5" Stainless Steel Casing
20		SP	SP; SAND (dark brown, coarse), gravel (multicolor, round) (saturated)			2	5 10 15 17	2302 283	20	Clay Sand 1.5" Stainless Steel Screen
22			End of Boring							

Grout

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-AS-11**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **1/21/25** COMPLETED: **1/21/25**
INSTALLATION: STARTED **1/21/25** COMPLETED: **1/21/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220482** EASTING (ft): **2682448**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **21.5** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							2" Stainless Steel Casing
23		SP	SP; SAND (fine), gravel (tan, angular) (dry)				32	4241		
24		GP	GP; Crushed ROCK (light gray) (dry)			1	23			
		SP	SP; SAND (medium brown, coarse), gravel (multicolor, small) (wet)				16			
25			End of Boring				14	2047		
										Grout
										Bentonite
										Sand
										2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-AS-12**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **1/22/25** COMPLETED: **1/22/25**
INSTALLATION: STARTED **1/22/25** COMPLETED: **1/22/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220471** EASTING (ft): **2682435**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)
			No sampling performed					
23		SP	SP; SAND (fine), gravel (tan, angular) (dry)				47	4042
24		GP	GP; Crushed ROCK (light gray) (dry)			0.75	22 16 12	
25			End of Boring					3192

Depth (feet): 5, 10, 15, 20, 25

Well Construction:
- 2" Stainless Steel Casing
- Grout
- Bentonite
- Sand
- 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-13**

Stantec

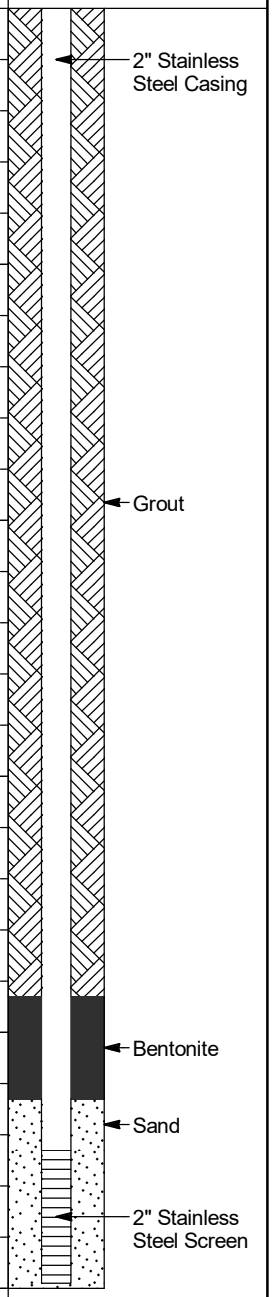
DRILLING: STARTED **1/28/25** COMPLETED: **1/28/25**
INSTALLATION: STARTED **1/28/25** COMPLETED: **1/28/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220489** EASTING (ft): **2682415**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)
			No sampling performed					
23		SP	SP; SAND (medium gray, fine), gravel (angular) (damp)				26	2808
24		GP	GP; GRAVEL (gray, crushed)			1.16	5	2654
		SP	SP; SAND (dark gray, coarse), silt (little), gravel (some, multicolor) (saturated)				13	
25			End of Boring				5	430

Depth (feet): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29

Well Construction



GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-14**

Stantec

DRILLING: STARTED **1/28/25** COMPLETED: **1/28/25**
INSTALLATION: STARTED **1/28/25** COMPLETED: **1/28/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220456** EASTING (ft): **2682423**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							
23		SP	SP; SAND (gray brown, coarse), silt (little), gravel (multicolor, round, small) (saturated)			1.58	7 10 16 25	1078 2570		
25			End of Boring							

Well Construction: 2" Stainless Steel Casing; Grout; Bentonite; Sand; 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-15**

Stantec

DRILLING: STARTED **1/28/25** COMPLETED: **1/28/25**
INSTALLATION: STARTED **1/28/25** COMPLETED: **1/28/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220465** EASTING (ft): **2682396**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							
23		SP	SP; SAND (dark brown, coarse), silt (little), gravel (multicolor) (saturated)			1	2 1 1 1	298		
25			End of Boring					2680		

Well Construction: 2" Stainless Steel Casing; Grout; Bentonite; Sand; 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-AS-16**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **1/29/25** COMPLETED: **1/29/25**
INSTALLATION: STARTED **1/29/25** COMPLETED: **1/29/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220648** EASTING (ft): **2682308**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							2" Stainless Steel Casing
23		SM	SM; SILTY SAND (medium brown), gravel (some, multicolor) (saturated)			2	1 4 5 9	2655		
24		SM	SM; SILTY SAND (medium brown, fine), mica flakes (some) (damp)							
25			End of Boring					203		

Grout
Bentonite
Sand
2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-17**

Stantec

DRILLING: STARTED **1/29/25** COMPLETED: **1/29/25**
INSTALLATION: STARTED **1/29/25** COMPLETED: **1/29/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220645** EASTING (ft): **2682301**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							
23		SP	SP; SAND (medium brown, fine to coarse), gravel (some, multicolor), silt (some) (saturated)				3 3 8 10	665 432		
25			End of Boring							

Well Construction: 2" Stainless Steel Casing; Grout; Bentonite; Sand; 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-18**

Stantec

DRILLING: STARTED **1/30/25** COMPLETED: **1/30/25**
INSTALLATION: STARTED **1/30/25** COMPLETED: **1/30/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220608** EASTING (ft): **2682306**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							
23		GW	GW; GRAVEL (black), silt (some product, odor)			0.33		4199		
25			End of Boring							

Well Construction: 2" Stainless Steel Casing; Grout; Bentonite; Sand; 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-AS-19**

Stantec

DRILLING: STARTED **1/30/25** COMPLETED: **1/31/25**
INSTALLATION: STARTED **1/31/25** COMPLETED: **1/31/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220603** EASTING (ft): **2682288**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)
			No sampling performed					
23		GM	GM; GRAVEL and SAND (dark brown, coarse), silt (some) (wet)				22	3753
24		SM	SM; SILTY SAND (tan, fine), gravel			0.75	42 22 14	
25			End of Boring					1211

Well Construction: 2" Stainless Steel Casing; Grout; Bentonite; Sand; 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-AS-20**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **1/31/25** COMPLETED: **1/31/25**
INSTALLATION: STARTED **1/31/25** COMPLETED: **1/31/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **CME 75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220619** EASTING (ft): **2682294**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **2** BOREHOLE DIAMETER (in):
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No sampling performed							
23		SM	SM; SILTY CLAYEY SAND (brown), gravel (few small) (wet)			1.1	5	2621		
24		SM	SM; SILTY SAND (medium brown, coarse), gravel (rounded) (wet)				14 10 8			
25			End of Boring					2634		

Well Construction: 2" Stainless Steel Casing; Grout; Bentonite; Sand; 2" Stainless Steel Screen

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-EW-01**
PAGE 1 OF 1

DRILLING: STARTED **2/16/21** COMPLETED: **2/17/21**
INSTALLATION: STARTED **2/17/21** COMPLETED: **2/17/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**

NORTHING (ft): **220608** EASTING (ft): **2682523**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **20**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **A Klingbeil, Dana H.** CHECKED BY: **J. Kachel**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							Cuttings 6" PVC Casing
5		SC	SC; SAND (greenish brown to ??? yellow, coarse to fine), gravel (trace), clay/silt (moist)			0.7	1 1 6 9	0 0	5	Hole Plug
7		SC	SC; SAA (moist)				6 10	0		
8		GM	GM; GRAVEL (reddish brown) sand (fine to coarse), silt (little) (moist) (gravel hererogeneous, red mudstone and quartz)			1.2	13 21	0		
9		GM	GM; SAA (damp)					164		
10						1.4	31 15 15 16		10	Bentonite
13		GM	GM; SAA (moist)				40 22 27 28	160		Sand Pack #2 Well Sand
15		GM	GM; SAA (moist)				27 38 49 38	103	15	6" SCH40 Slotted PVC Casing (0.020in slot size)
18		GM	GM; SAA (reddish yellow) (moist)					232		
19						1.9				End Cap
20			End of Boring						20	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-02**

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/25/21**
INSTALLATION: STARTED **2/25/21** COMPLETED: **2/25/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220292** EASTING (ft): **2682214**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **15**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							6" PVC Casing
5		SP	SP; SAND (gray, fine), gravel (some medium at base)					1	5	Bentonite
7		SP	SP; SAND (orange to gray, fine to medium), gravel (fine to medium, rounded) (moist)			3		1		Sand Pack #2 Well Sand
10		SP	SP; SAA (orangish brown to gray to reddish brown to orange) (fine in last 1'), gravel (little) (moist)			2		1 2 45	10	6" SCH40 Slotted PVC Casing (0.020in slot size)
15			End of Boring					800	15	End Cap
20									20	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-03**

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/24/21**
INSTALLATION: STARTED **2/24/21** COMPLETED: **2/24/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220633** EASTING (ft): **2682302**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **18**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			Air Knife; APPARENET FILL {possible re-worked Cape May to possible real}							6" PVC Casing
2										
3										
4										
5									5	Bentonite
6		SW	SW; SAND (coarse) gravel (some, fine to medium, trace from 7-8') (2" red mudstone clast at 8')					0		
7								0		
8		SP-SM	SP-SM; SAND to SILT grading to SAND (fine) gravel (trace) (gray to yellowish brown) (moist to dry)			3.5		3.3		
9								36		
10		SPG	SPG; SAND (Cape May, fine) to gravel (coarse) (light grayish tan)						10	
11								2.8		Sand Pack #2 Well Sand
12			(orangish brown)			3		20.7		
13			(broken quatzire cobble)					135		
14		SPG	SPG; SAA (dry to moist) (wet at bottom)					12.3		
15								17.8	15	6" SCH40 Slotted PVC Casing (0.020in slot size)
16						3		59.5		
17								1728		End Cap
18			End of Boring					1128		
19										
20									20	
21										
22										
23										
24										

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

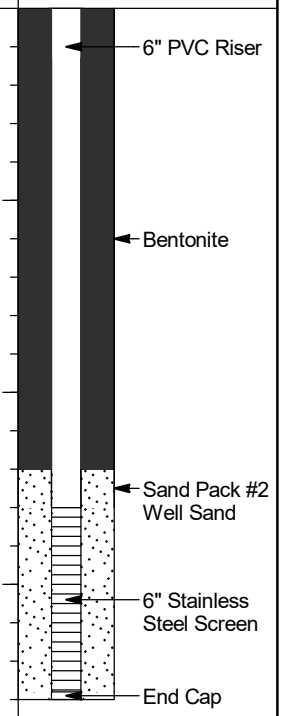
WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-04**

Stantec

DRILLING: STARTED **2/2/22** COMPLETED: **2/2/22**
INSTALLATION: STARTED **2/2/22** COMPLETED: **2/2/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220574** EASTING (ft): **2682279**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **18**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–18			No logging or sampling performed						1–18	6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
18			End of Boring							
19–39									19–39	



GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-EW-05**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/1/22** COMPLETED: **2/1/22**
INSTALLATION: STARTED **2/1/22** COMPLETED: **2/1/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220509** EASTING (ft): **2682242**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **16**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–16			No logging or sampling performed						1–16	6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
16			End of Boring							
17–39									20–35	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-06**

Stantec

DRILLING: STARTED **2/2/22** COMPLETED: **2/2/22**
INSTALLATION: STARTED **2/2/22** COMPLETED: **2/2/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220439** EASTING (ft): **2682218**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **15**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–15			No logging or sampling performed						1–15	6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
15			End of Boring							
16–39									20–35	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-EW-07**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/4/22** COMPLETED: **2/4/22**
INSTALLATION: STARTED **2/4/22** COMPLETED: **2/4/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220371** EASTING (ft): **2682188**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **15**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–15			No logging or sampling performed						0–15	6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
15			End of Boring							
16–39										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-08**

Stantec

DRILLING: STARTED **2/9/22** COMPLETED: **2/9/22**
INSTALLATION: STARTED **2/9/22** COMPLETED: **2/9/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220283** EASTING (ft): **2682308**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **10**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10			End of Boring						10	End Cap
11										
12										
13										
14										
15									15	
16										
17										
18										
19										
20									20	
21										
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39										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-09**

Stantec

DRILLING: STARTED **2/9/22** COMPLETED: **2/9/22**
INSTALLATION: STARTED **2/9/22** COMPLETED: **2/9/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220300** EASTING (ft): **2682409**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **9.5**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										Sand Pack #2 Well Sand
5									5	
6										
7										6" Stainless Steel Screen
8										
9										End Cap
10			End of Boring						10	
11										
12										
13										
14										
15									15	
16										
17										
18										
19										
20									20	
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PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-10**

Stantec

DRILLING: STARTED **2/9/22** COMPLETED: **2/9/22**
INSTALLATION: STARTED **2/9/22** COMPLETED: **2/9/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220306** EASTING (ft): **2682511**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **9.5**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										Sand Pack #2 Well Sand
5									5	
6										
7										6" Stainless Steel Screen
8										
9										End Cap
10			End of Boring						10	
11										
12										
13										
14										
15									15	
16										
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20									20	
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35									35	
36										
37										
38										
39										

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-EW-11**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **1/27/22** COMPLETED: **1/27/22**
INSTALLATION: STARTED **1/27/22** COMPLETED: **1/27/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220391** EASTING (ft): **2682437**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **15**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–15			No logging or sampling performed						1–15	6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
15			End of Boring							

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-12**

Stantec

DRILLING: STARTED **2/1/22** COMPLETED: **2/1/22**
INSTALLATION: STARTED **2/1/22** COMPLETED: **2/1/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220432** EASTING (ft): **2682511**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **15**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–14			No logging or sampling performed						1–14	6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
15			End of Boring						15	
16–39									16–39	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

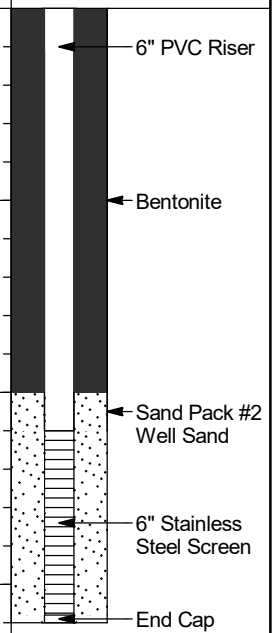
WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-13**

Stantec

DRILLING: STARTED **2/7/22** COMPLETED: **2/7/22**
INSTALLATION: STARTED **2/7/22** COMPLETED: **2/7/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220518** EASTING (ft): **2682524**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **16**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1–16			No logging or sampling performed							
16			End of Boring							



GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-14**

Stantec

DRILLING: STARTED **2/4/22** COMPLETED: **2/4/22**
INSTALLATION: STARTED **2/4/22** COMPLETED: **2/4/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220562** EASTING (ft): **2682444**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **17**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
5									5	Bentonite
10									10	Sand Pack #2 Well Sand
15									15	6" Stainless Steel Screen
17			End of Boring							End Cap
20									20	
25									25	
30									30	
35									35	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-15**

Stantec

DRILLING: STARTED **2/3/22** COMPLETED: **2/3/22**
INSTALLATION: STARTED **2/3/22** COMPLETED: **2/3/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220198** EASTING (ft): **2682227**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **13**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										
3										Bentonite
4										
5									5	
6										
7										Sand Pack #2 Well Sand
8										
9										
10									10	6" Stainless Steel Screen
11										
12										End Cap
13			End of Boring							
14										
15									15	
16										
17										
18										
19										
20									20	
21										
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23										
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25									25	
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35									35	
36										
37										
38										
39										

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-16**

Stantec

DRILLING: STARTED **2/10/22** COMPLETED: **2/10/22**
INSTALLATION: STARTED **2/10/22** COMPLETED: **2/10/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220167** EASTING (ft): **2682320**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **11**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10									10	
11			End of Boring							End Cap
12										
13										
14										
15									15	
16										
17										
18										
19										
20									20	
21										
22										
23										
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25									25	
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30									30	
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32										
33										
34										
35									35	
36										
37										
38										
39										

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-17**

Stantec

DRILLING: STARTED **2/3/22** COMPLETED: **2/3/22**
INSTALLATION: STARTED **2/3/22** COMPLETED: **2/3/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220125** EASTING (ft): **2682253**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **13**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										
3										Bentonite
4										
5									5	
6										
7										Sand Pack #2 Well Sand
8										
9										
10									10	6" Stainless Steel Screen
11										
12										End Cap
13			End of Boring							
14										
15									15	
16										
17										
18										
19										
20									20	
21										
22										
23										
24										
25									25	
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GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-18**

Stantec

DRILLING: STARTED **2/10/22** COMPLETED: **2/10/22**
INSTALLATION: STARTED **2/10/22** COMPLETED: **2/10/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220086** EASTING (ft): **2682335**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **10**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10			End of Boring						10	End Cap
11										
12										
13										
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15									15	
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PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-19**

Stantec

DRILLING: STARTED **2/4/22** COMPLETED: **2/4/22**
INSTALLATION: STARTED **2/4/22** COMPLETED: **2/4/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **220046** EASTING (ft): **2682265**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **11**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10									10	
11			End of Boring							End Cap
12										
13										
14										
15									15	
16										
17										
18										
19										
20									20	
21										
22										
23										
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30									30	
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35									35	
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37										
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PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-20**

Stantec

DRILLING: STARTED **2/10/22** COMPLETED: **2/10/22**
INSTALLATION: STARTED **2/10/22** COMPLETED: **2/10/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **219995** EASTING (ft): **2682319**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **10**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10			End of Boring						10	End Cap
11										
12										
13										
14										
15									15	
16										
17										
18										
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20									20	
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GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-21**

Stantec

DRILLING: STARTED **2/9/22** COMPLETED: **2/9/22**
INSTALLATION: STARTED **2/9/22** COMPLETED: **2/9/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **219930** EASTING (ft): **2682383**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **10**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10			End of Boring						10	End Cap
11										
12										
13										
14										
15									15	
16										
17										
18										
19										
20									20	
21										
22										
23										
24										
25									25	
26										
27										
28										
29										
30									30	
31										
32										
33										
34										
35									35	
36										
37										
38										
39										

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-22**

Stantec

DRILLING: STARTED **2/8/22** COMPLETED: **2/8/22**
INSTALLATION: STARTED **2/8/22** COMPLETED: **2/8/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **219858** EASTING (ft): **2682451**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **11**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No logging or sampling performed							6" PVC Riser; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap
			End of Boring							

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-23**

Stantec

DRILLING: STARTED **2/8/22** COMPLETED: **2/8/22**
INSTALLATION: STARTED **2/8/22** COMPLETED: **2/8/22**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Auger Cuttings**

NORTHING (ft): **219943** EASTING (ft): **2682487**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **11**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **M. Vitale** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
1			No logging or sampling performed							6" PVC Riser
2										Bentonite
3										
4										
5									5	Sand Pack #2 Well Sand
6										
7										
8										6" Stainless Steel Screen
9										
10									10	
11			End of Boring							End Cap
12										
13										
14										
15									15	
16										
17										
18										
19										
20									20	
21										
22										
23										
24										
25									25	
26										
27										
28										
29										
30									30	
31										
32										
33										
34										
35									35	
36										
37										
38										
39										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-EW-24**

Stantec

DRILLING: STARTED **1/29/25** COMPLETED: **1/29/25**
INSTALLATION: STARTED **1/29/25** COMPLETED: **1/29/25**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-75**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft): **220421** EASTING (ft): **2682432**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **13**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **6** BOREHOLE DIAMETER (in): **12**
LOGGED BY: **C. Lee** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			No log or sampling information.							
9			APPARENT FILL [crushed rock, angular gravel, some fine sand] (wet)				10	0.0		
10		SP	SP; SAND (red brown, fine), gravel (round), silt (little) (damp)			1.7	18 6 6	1.5		
11							7	0.9		
12						1.4	6 9 16	0.0		
13			End of Boring							

Well Construction: 6" PVC Riser; Grout; Bentonite; Sand Pack #2 Well Sand; 6" Stainless Steel Screen; End Cap

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-VP-1A**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/23/21** COMPLETED: **2/23/21**
INSTALLATION: STARTED **2/23/21** COMPLETED: **2/23/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220620** EASTING (ft): **2682522**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5			No Sampling							
8		GW-SW	GW-SW; GRAVEL (Cape May, coarse) to SAND (multicolored, medium), silt (trace, few fines), mudstone clasts (moist)			2		39		
12		GW-SW	GW-SW; SAA, mostly sand, gravel (some, fine to coarse, rounded), silt (trace) (moist)			4		27 36 73 63		
16		GW-SW	GW-SW; SAA (light gray), gravel (very few coarse) (moist)			4		88 76 48		
18		GW-SW	GW-SW; SAA (orangish brown)							
20		GW-SW	GW-SW; SAA			3				
24		SW	SW; SAND (dark brown grading to black, fine) (wet)							
25			End of Boring							

Bentonite
#2 Sand
4" Plastic Screen and 1/4" Plastic Tubing
4" Plastic Screen and 1/4" Plastic Tubing

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-VP-1B**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/17/21** COMPLETED: **2/23/21**
INSTALLATION: STARTED **2/23/21** COMPLETED: **2/23/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore MC5**

NORTHING (ft): **220602** EASTING (ft): **2682502**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **18**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **A Klingbeil, Dana H.** CHECKED BY: **J. Kachel**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5			No Sampling						5	Bentonite
10		SP	SP; SAND (grayish brown to reddish yellow, fine to medium), gravel (little coarse, little fine) SILT (trace to no) (damp)					11.3	10	#2 Sand; 4" Plastic Screen and 1/4" Plastic Tubing
12		GM	GM; SILTY GRAVEL (very coarse), silt (some to trace), silt (trace to little lenses) (damp)			3.2		19.9		
14		GW-GM	GW-GM; GRAVEL (reddish ???, fine to very coarse), sand (some coarse to fine), silt (trace to little) (damp to moist)					14		
15								32.6	15	
18			End of Boring							4" Plastic Screen and 1/4" Plastic Tubing
20									20	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-VP-1C**

Stantec

DRILLING: STARTED **2/23/21** COMPLETED: **2/24/21**
INSTALLATION: STARTED **2/24/21** COMPLETED: **2/24/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220572** EASTING (ft): **2682530**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **19**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5			No Sampling						5	Bentonite
9		SPG	SPG; FILL [sandy gravel]					22.5		#2 Sand
10		SW	SW; SAND (fine) (moist)					1.6	10	4" Plastic Screen and 1/4" Plastic Tubing
11		SP	SP; SAND (fine to medium, no fines) (moist)			2.5		9.3		
12								23.9		
13		SP	SP; SAND (Cape May, multicolored, fine), gravel (coarse), (moist), mudstone clasts (red)					36.8		
14		SP	SP; SAA (moist)					19.5		
15								23.8	15	
16			(0.5' sandy lens)			3.3		288		
17								87		
18								186		4" Plastic Screen and 1/4" Plastic Tubing
19			(0.5' sandy lens) End of Boring					236		
20									20	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-VP-2A**

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/26/21**
INSTALLATION: STARTED **2/26/21** COMPLETED: **2/26/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220294** EASTING (ft): **2682205**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **20**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5		CL-ML	CL-ML; SILTY CLAY (Cape May), gravel (little)					0	5	
6		SP	SP; SAND (fine to medium), gravel (some, varicolored)							
		SP	SP; SAND (grayish brown with brown bands, fine)					0		
7						2.8				
8		SP	SP; SAND (fine to medium), gravel (some, varicolored)							
10		SP	SP; SAA (light grayish brown with orange brown intervals), clayey lens (moist)					2	10	
12						3.2				
13								7		
15		SP	SP; SAA (dark black)					6	15	
16								>1000		
17			Sand with gravel lens (fine)			3.5				
18								>1000		
20			End of Boring					497	20	

Bentonite
#2 Sand
4" Plastic Screen and 1/4" Plastic Tubing

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 1 OF 1 **UDEX-VP-2B**

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/26/21**
INSTALLATION: STARTED **2/26/21** COMPLETED: **2/26/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220275** EASTING (ft): **2682241**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **15**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5		SC	SC; SAND (Cape May, light gray grading to orangish brown, fine to coarse), gravel (fine)			2.5		0 7	5	Bentonite #2 Sand 4" Plastic Screen and 1/4" Plastic Tubing
10		SC	SC; SAA (fine)					42 5	10	
12		SC	SC; SAND (broken quartz fragments)							
13		SC	SC; SAND (Cape May, light gray grading to orangish brown, fine to coarse), gravel (fine)					7		
15			End of Boring					648	15	
20									20	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-VP-2C**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/26/21**
INSTALLATION: STARTED **2/26/21** COMPLETED: **2/26/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220243** EASTING (ft): **2682196**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **17**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5		SC	SC; SAND (Cape May, gray grading to grayish brown, fine to coarse), gravel (multicolored)					3	5	Bentonite
						2		6		#2 Sand; 4" Plastic Screen and 1/4" Plastic Tubing
10			No Recovery					27	10	
15		SP	SP; SAND (fine), 0.2" LNAPL			0.5			15	
17			End of Boring							
20									20	

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-VP-3A**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/24/21**
INSTALLATION: STARTED **2/24/21** COMPLETED: **2/24/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220643** EASTING (ft): **2682306**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5		ML	ML; SILT (red and gray layered), mudstone clast at 6' (red)							
6		SP	SP; SAND (brownish gray, fine to medium), gravel (some, fine to medium, rounded) (few to no fines) (wet)					0.5		
7						2.5		8.2		
8								10.3		#2 Sand
9		SP	SP; SAA					14.8		4" Plastic Screen and 1/4" Plastic Tubing
10								51.8	10	
11			(light grayish tan) (moist)			3		9.9		
12			(orangish brown)					216		
13		SP	SP; SAA (orangish brown)					91.8		
14								109		
15						2.2		240	15	
16								276		
17		SP	SP; SAA (wet)					558		
18								250		
19						3.2		475		
20								1299	20	
21			(fine sand) No Recovery					2670		
22										
23						0				
24										
25			End of Boring						25	

Bentonite

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-VP-3B**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/25/21**
INSTALLATION: STARTED **2/25/21** COMPLETED: **2/25/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR/Geoprobe 7822DT**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220602** EASTING (ft): **2682288**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **20**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5		SP	SP; SAND (Cape May, multicolored, fine to medium), gravel (coarse) (dry)					190	5	
7						2.3		0		
8		ML	ML; SILT (gray, soft) (moist)							
10								0	10	
10		SP	SP; SAND (Cape May, medium gray), ??? (some, brown), gravel (trace, fine)					0		
12		SP	SP; SAND (multicolored, fine to coarse), gravel (fine to coarse) (moist)			2.5		0		
15								0	15	
15								0		
16		SP	SP; SAND (clean fine), mudstone clast at 17'							
17		SP	SP; SAND (orange, fine to coarse), gravel (fine to coarse) (moist)			3		0		
20			End of Boring					0	20	

Bentonite
#2 Sand
4" Plastic Screen and 1/4" Plastic Tubing

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

PROJECT: **PESRM UDEX Release**
LOCATION: **Former PES Refinery**
PROJECT NUMBER: **195603450**

WELL / PROBEHOLE / BOREHOLE NO: **UDEX-VP-3C**
PAGE 1 OF 1

Stantec

DRILLING: STARTED **2/24/21** COMPLETED: **2/25/21**
INSTALLATION: STARTED **2/25/21** COMPLETED: **2/25/21**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted IR**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Direct Push Macrocore**

NORTHING (ft): **220592** EASTING (ft): **2682330**
LATITUDE: LONGITUDE:
GROUND ELEV (ft): **--** TOC ELEV (ft): **--**
INITIAL DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **25**
STATIC DTW (ft): WELL DEPTH (ft):
WELL CASING DIAMETER (in): **1** BOREHOLE DIAMETER (in): **4**
LOGGED BY: **J. Kachel** CHECKED BY: **A Klingbeil**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Well Construction
			Air Knife							
5		SP	SP; SAND (Cape May, multicolored light grayish, fine to medium) (dry to moist)					10.3	5	Bentonite
						2.3		0		
								0		#2 Sand
								0		4" Plastic Screen and 1/4" Plastic Tubing
10								0	10	
								5.6		
12		CH	CH; CLAY (reddish gray) (plastic) (moist)			3.4		20.8		
13		SP	SP; SAND (Cape May, orangish brown, fine) (dry to moist)					49.2		
								54		
15								0	15	
								0		
17			Less gravel 17-18'			3.2		0		
								5		
								10		
20									20	
								847		
22			(wet)			2.5				
								36.7		
25			End of Boring					87	25	
26										
27										

GEO FORM 304 213403039_UDEX_2023.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 10/2/25

Appendix F UVOST® Reports December 2022, August 2023, March 2024

High Resolution Site Characterization Report

UVOST®-HP Investigation

PES Complex
3144 Passyunk Ave
Philadelphia, PA

DTC Project No: 0248.2022 (December)

December 20, 2022

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APPENDICES

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1.0 General Site Information

Dakota Technologies Company, LLC (DTC) was contracted by Stantec to perform a High-Resolution Site Characterization (HRSC) study at the PES Complex site, located at 3144 Passyunk Ave, Philadelphia, PA. This was a return visit to a site that was originally investigated in 2019 with a follow up visit in July 2022. The goal of this visit was to investigate any changes within the LNAPL plume body since 2019, as various methods of remediation and LNAPL extraction have been in place since the original visit. Fieldwork included Laser Induced Fluorescence (LIF) to verify the presence of, and delineate the extent of, the LNAPL present in the subsurface. The LIF portion of the study employed the use of an Ultra-Violet Optical Screening Tool (UVOST®) combined with a hydraulic profiling (HP) sensor.

A description of the UVOST® technology, waveforms, cluster plots, limitations of LIF, and a UVOST® Reference Log are included in this report.

2.0 Laser-Induced Fluorescence - UVOST® Technology Overview

Fluorescence is a property of some compounds where absorbed excitation light stimulates the emission of light of a longer wavelength relative to the excitation source (laser). The stimulated release of light can be used to detect small amounts of polycyclic aromatic hydrocarbons (PAHs) in a larger matrix (soil, NAPL, water). This sensitive method of PAH detection has been used in laboratories for decades. With the commercial availability of lasers and optical fibers, this technology can also be applied *in situ* in the field to identify the presence of non-aqueous phase liquids (LNAPL) that contain a wide variety of PAHs.

The UVOST® system sends ultraviolet (UV) laser light (308-nanometer wavelength) through a fiber optic cable strung through probe rods on a direct push drill rig. The light is reflected by a parabolic mirror within the probe and out a sapphire window on the side of the SPOC. As the probe is advanced, soil that is contiguous to the sapphire window is exposed to the pulsed UV laser light. If PAHs (compounds in petroleum, oils and lubricants that fluoresce) are present, these PAHs absorb a portion of the UV light and enter an electronically excited state. When returning to ground state, the PAHs release excess absorbed energy by emitting photons of longer wavelength light than the original UV excitation light.

This fluorescence is transmitted through a return fiber to the surface where the OST system transforms the fluorescence light into time-resolved multi-wavelength waveforms that capture the fluorescence intensity, wavelength, and lifetime (duration of the fluorescence).

The UVOST system is particularly sensitive to NAPL (compared to dissolved phase for instance); in other words, it focuses on the source term contaminant at the site. Vapor, dissolved, and absorbed hydrocarbon phases are usually invisible to the UVOST system, with dissolved phase PAHs in the vicinity of heavy NAPLs like coal tar being a notable (and confounding) exception. In most cases, only the NAPL-entrained PAHs respond to the UVOST system. These PAHs fluoresce most intently in saturated free product in the soil pore spaces and the response drops off with saturation, down to sheens of product lightly coating the soil particles. LIF essentially "ignores" any water in the pore spaces. Therefore, valid fluorescence data can be collected both above and below the water table.

2.1 Reference Emitter

The UVOST® system is checked for background signal (sources of fluorescence in the fiber, filter, mirror and sapphire window) and this signal is stored in the data file. A proprietary LNAPL mixture known as the Reference Emitter (RE) is used for quality assurance and quality control for the qualitative and semi-quantitative response of the UVOST. DTC has used this same RE for decades. During the pre-log calibration, a cuvette containing the RE fluid is placed over the sapphire window; the laser is adjusted to achieve optimal signal amplitude, and the response from the RE is then recorded. The RE's fluorescence intensity (brightness) is then used as a definition of fluorescence intensity of 100% relative to the RE, or 100% RE. Typically, the RE's raw total fluorescence will fall between 10,000 and 12,000 picovolt-seconds (pVs). The system background fluorescence can vary from 0.1% to 1% RE, or 0 to 100 pVs raw total fluorescence. The operator ensures the RE response has the correct shape and intensity so that the UVOST® system is "calibrated" for each log and minimizes system background by keeping the mirror and window clean and the SPOC purged of moisture. All the fluorescence responses obtained in the subsequent borehole are gauged against the RE's fluorescence response.

The relationship between the instrument responses from NAPL in the subsurface and the % RE depends on the NAPL type, age, and other factors. There are NAPLs that fluoresce much more brightly than the RE (>100% RE) at full pore saturation, such as gasolines, diesels, and crude. Other NAPLs might only fluoresce half as intensely as RE, such as heavy crudes which might fluoresce at 50% RE. One must be careful to "temper" their interpretations of fluorescence based on the fuel type, degree of weathering and other site-specific factors. Please ask for assistance with this and we'll be glad to help you do site-specific calibration of your data set!

The combined fluorescence of non-NAPL impacted natural soils and system background (the optic surfaces) generally fall in the range 0.25-0.75% RE. A signal response greater than 1.0% RE *typically* indicates the presence of LNAPL, however, various natural materials including calcareous and carbonaceous soils may produce "false positive" results with signal responses as high as 10% to 20%RE. Lifetimes above the average baseline soils are often KEY indicators of NAPL. Buried wood and organics can be even more fluorescent than background soils but again, the lifetime information can assist in helping you "make the call" on whether it's NAPL vs. natural fluorescence. Therefore, it is crucial that consumers of fluorescence data rigorously inspect the fluorescence responses (waveforms, fill colors, lifetimes, etc.) to distinguish the presence of NAPL from false positives from natural soils and organic materials. With a little practice and knowledge, it's generally easy to sort out the false positive fluorescence from the actual NAPL, which is key to prevent over-estimation of NAPL impact.

2.2 Waveforms

Waveforms are fluorescence "signatures" that are used to differentiate LNAPL types such as kerosene versus intact gasoline, weathered gasoline versus diesel fuel, etc. **Waveforms also provide the capability to effectively differentiate false positives from intact LNAPLs**. Various waveform patterns for pure PAHs, fuels/oils, weathered gasoline, and false positive substances can be viewed at Dakota's website: http://www.dakotatechnologies.com/learn-more/intro-to-lif/data-interpretation.

Figure 1 shows three sample waveforms used to characterize NAPL.

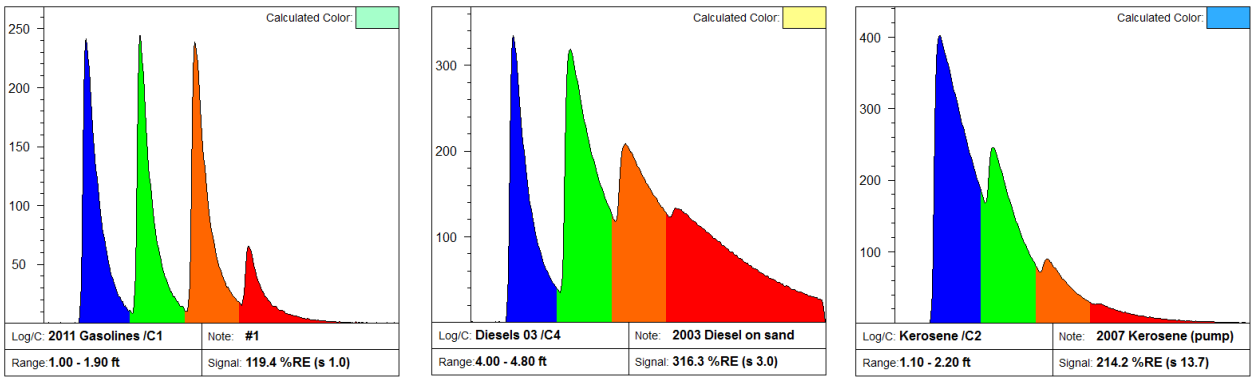


Figure 1: Waveforms generated by gasoline, diesel and kerosene. The four colored peaks in the waveforms (referred to as channels) represent different PAH emission wavelengths (colors) that are filtered by the UVOST system into four categories: 350-nanometers (blue), 400-nanometers (green), 450-nanometers (orange), and 500-nanometers (red). In the waveform callouts (graphs from selected parts of a log) shown, the y-axis represents the intensity of the fluorescence signal (V) and the x-axis is time (approximately 350-nanoseconds).

The relative contribution of each channel's area to the total waveform area defines the Signal (% RE) fill color on the main UVOST log. For example, a waveform with a stronger contribution by the blue channel relative to the other three channels will plot with a bluish color on the UVOST log (see the kerosene waveform, and the resulting blue fill color in the upper right, in Figure 1). In the case of the gasoline waveform, the calculated color is a pale green that is displayed in a box in the upper right-hand corner of the waveform plot window. The shorter wavelength channels on the left (blue/green) represent smaller PAHs with two to three benzene rings; the middle two channels (green/orange) contain response from intermediate size PAHs with three to four benzene rings; the rightmost channels (orange/red) correspond to larger PAHs with four or more benzene rings. Note, the blue, green, orange, and red colors associated with the four channel wavelengths are **not** the actual color of fluorescence, they are placeholder colors. The true colors of the UVOST waveform's four channels are ultraviolet, violet, indigo, and blue/cyan from left to right. The ultraviolet fluorescence in the first channel (invisible to the human eye or visible-light spectrum cameras such as the OIP (Optical Image Profiler)) is particularly useful for identifying "intact" gasolines at petroleum service stations.

The waveform's four channels are sequentially delayed pulses of fluorescence arriving as a "train" on the detector. The amplitude of each channel corresponds to the intensity of each fluorescence color

being released by the PAHs following the excitation by the UVOST laser pulse. The pulse of each color starts out strongest immediately following the excitation laser pulse. But after the laser pulse is gone, the fluorescence quickly begins to decay, eventually returning to darkness (no more light being emitted). The time it takes for the laser excitation energy to dissipate (and the subsequent PAH fluorescence to fade away to darkness) is recorded on the times axis and leads to a "ski slope" on the right side of each channel or "peak". The point in time at which each channel's fluorescence has decayed to approximately 1/e of the maximum is classically referred to as that channel's "lifetime". In general, longer lifetimes (wide peaks) are indicative of intact "juicy" LNAPL with lots of intact solvent molecules such as aliphatics. False positive soils or highly weathered NAPLs with little very solvent left usually have shorter lifetimes (skinny peaks). Heavy NAPLs like coal tar are a notable exception, as they experience intramolecular energy transfer after excitation (due to their excessive PAH content), resulting in extremely low fluorescence (only a few %RE even when fully saturating the soil), extremely short lifetimes (narrow peaks) and domination by the orange and/or red channels. Atmospheric concentrations of molecular oxygen that are present under "bench-top" NAPL testing conditions artificially lower fluorescence lifetimes compared to in-situ conditions where oxygen is lacking due to bioremediation processes. You can always expect to see longer lifetimes (and larger overall %RE) from in-situ readings compared to NAPLs take from wells and tested under atmospheric oxygen (~20%) conditions.

2.3 Cluster Plots

The hundreds, or thousands, of waveforms in each UVOST log are immensely useful, but with only five callouts in each log, it's hard to take it all in and make sense of all of them. Cluster plots provide a method for viewing all the waveforms by converting them into simple color and lifetime data and plotting each waveform as a bubble on a Cartesian coordinate system. The cluster plot axis corresponds to fluorescence wavelength (λ) (or color) on the X-axis and the fluorescence lifetime (τ) on the Y-axis as measured and weighted in each the four channels. In this fashion, all data points from a UVOST log are sorted by their color and lifetime properties and can be viewed in a single figure, allowing intuitive comparisons to be made among potential fluorescence categories. Figure 2 demonstrates the relationship between data points in the log and how they appear in the cluster plot.

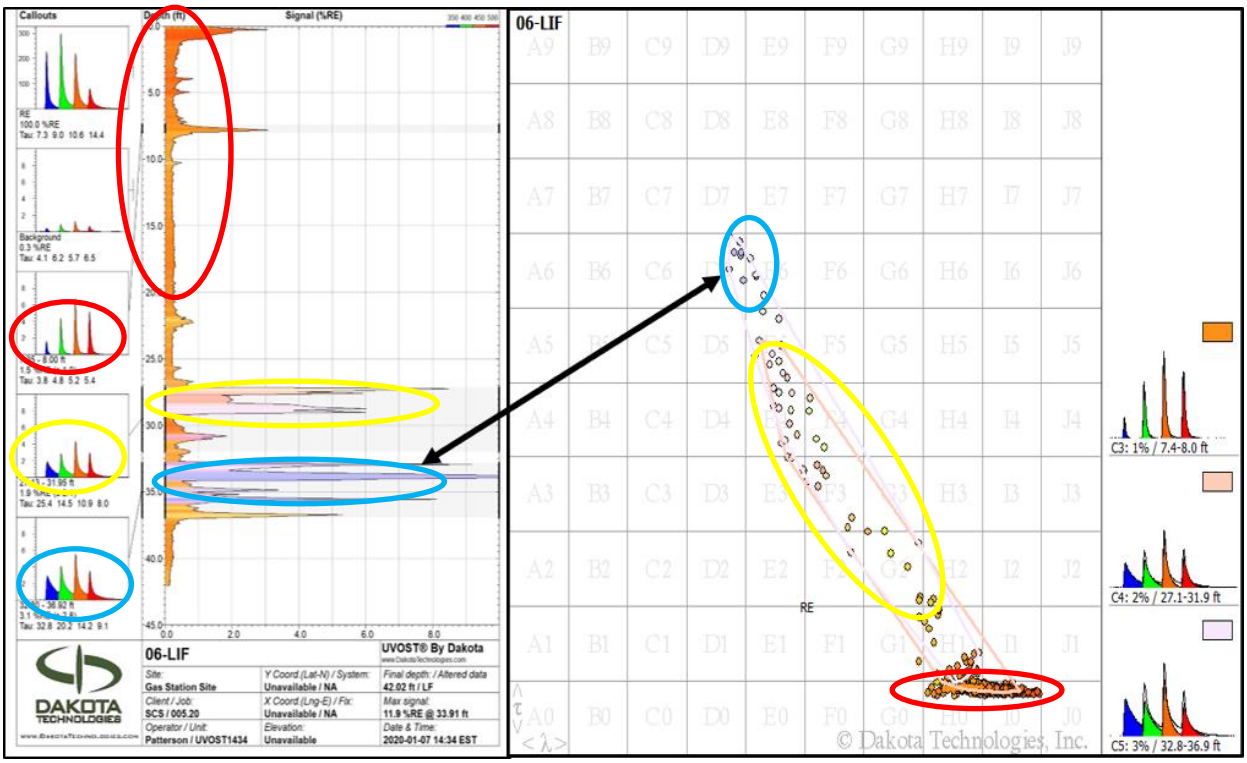


Figure 2: The X-axis of the Cluster Plot (right) corresponds to the balance of the four colored channels in the waveform; the Y-axis relates to fluorescence decay or "lifetimes" of the four-waveform channels.

Responses dominated in the blue/green channels (intact gasolines for instance) will plot in the left side of the cluster plot (see blue ovals in Figure 2). Likewise, if the orange and red channels make up bulk of the fluorescence response (background soils), the data point will plot on the right side of the cluster (see orange ovals in Figure 2). Waveforms with a relatively equivalent contribution from all four channels, or with the two central peaks dominating such as modestly weathered NAPLs or light staining of intact NAPLs, will plot somewhere in the middle (yellow ovals in Figure 2). Similarly, longer-lived responses from intact fuels (wide at the base of the waveform) will plot higher on the Y-axis and waveforms with shorter lifetimes (narrow at the base of the waveform) such as carbonaceous soils or heavily weathered NAPL, plot lower on the Y-axis. In a simple sense, if waveforms leave the "home cluster" of soils and highly weathered NAPL at lower right, they are highly suspect of indicating NAPL.

To further aid in determining the source on the UVOST® log for a point cluster, the main callouts from the log with their respective depth intervals are depicted on the upper left corner of the cluster plot (not

depicted here). Polygons (for depth ranges) and circled data points (for discrete depths) with the same coloration as the callout waveform enclose the point clusters included in that callout.

Weathering and formulation of each LNAPL will influence where the LNAPL appears on the cluster plot. In other words, it is **not** possible to identify a fuel solely by its location on a cluster plot. In Figure 3, the formulation of the 2 different diesel signatures labeled 1995 and 2007, fall into different regions of the plot. This is due to the difference in lifetime and wavelength characteristics of the four channels that make up these slightly different diesel waveforms due to source, age, and oxygen levels when this data was recorded.

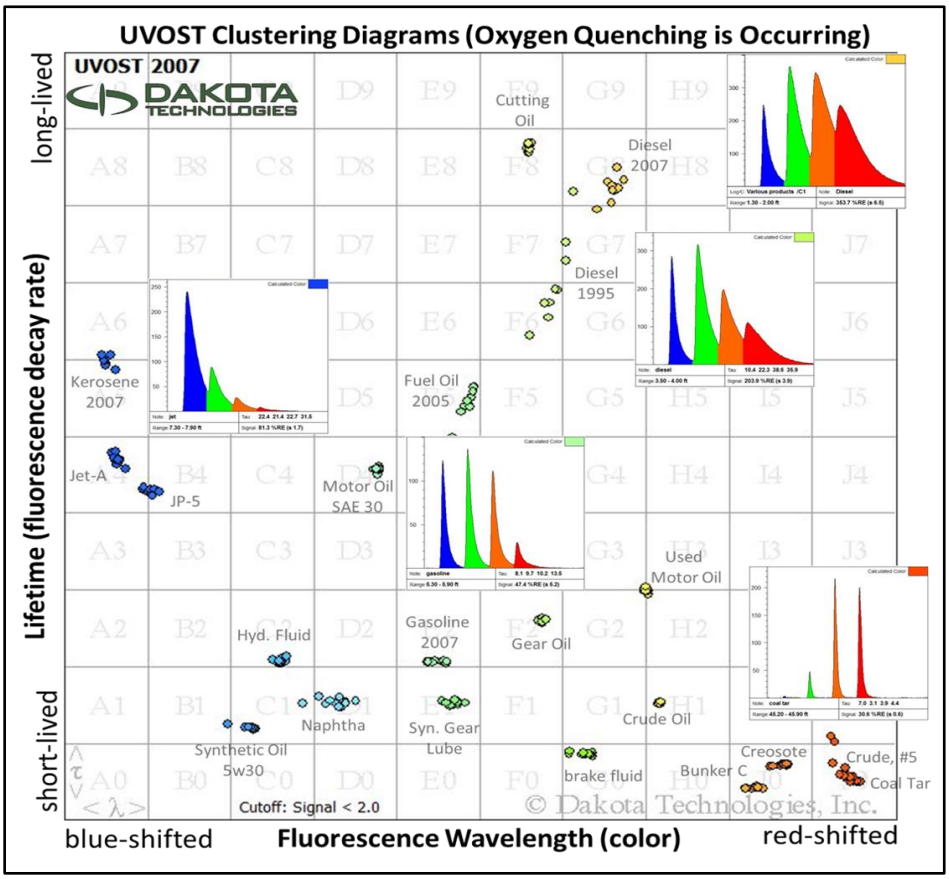


Figure 3: Reference examples of LNAPL types that were placed on the window of a UVOST® system in a laboratory setting. The cluster plot positions displayed illustrates the cluster separation of LNAPL types achievable with the UVOST and is not indicative of exclusive plotting location—LNAPL may plot across multiple grid cells as the plume weathers or interacts with the native soil.

3.0 Hydraulic Profiling (HP) Description

The Hydraulic Profiling add-on is a logging tool that measures the pressure required to inject a flow of water into the soil as the probe is advanced into the subsurface. The injection pressure log is an excellent indicator of formation permeability. In addition to injection pressure, hydrostatic pressure can be measured under a zero flow condition, called a dissipation test. This allows a calculation of potentiometric surface (water table) upon successful completion of the dissipation test.

Prior to starting a log, there is a quality assurance (QA) check on the down-hole transducer to ensure proper function. The probe is submerged in a reference tube and filled with water. A reading is taken at the hydraulic port when it is submerged to a depth of 1 foot and a second reading at 0 feet, or baseline, under zero flow conditions. The reading at 0 feet, or the baseline pressure, is equal to the measurement of atmospheric pressure. Subtracting reading 2 from reading 1 should produce a result of 0.433 psi (+/- 10%), which is the hydrostatic weight of a 1-foot column of water.

The UVOST®-HP probe is advanced into the ground at a rate of approximately 2 cm/sec. The pump in the HP flow module draws water from the supply tank and pumps water down the trunk line at a constant flow rate (60 mL/min). The downhole transducer monitors the pressure generated by injecting water into the formation matrix. The log provides graphs of the pressure and flow rate versus depth alongside the fluorescence plot. If a dissipation test is performed below the water table and the test successfully stabilizes, the result can be corrected to an absolute hydrostatic value, from which a potentiometric surface (water table) can be calculated. Using the calculated water table to correct for hydrostatic pressure increase, a hydraulic conductivity (K) value for a given depth below the water table can be estimated using the following equation:

$$K = \ln(Q/P') * 20.0 + 7.0$$

where P'= downhole pressure – (0.433 * depth below water table) – atmospheric pressure, and Q is equal to flow. K values above the water table are also reported after a successful dissipation test even though they are suspect due to varying permeability behavior of dry soils. These values still maintain

some qualitative value to the eye and may lend insight into preferential pathways in the vadose zone. HP data can be incorporated into a 4DIM visualization protocol.

4.0 Site-Specific Results and Discussion

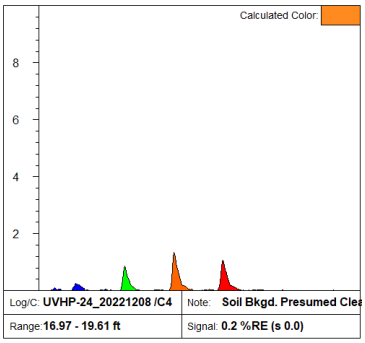
This round of UVOST investigation took place from December 7 to December 8, 2022. A total of 14 borings were completed. The target depth for the UVOST®-HP locations was approximately 20 ft below ground surface (bgs). Most borings were advanced to greater depths to capture the NAPL signatures. All borings were able to be advanced to adequate depth with no step-outs required. Each boring contained responses that indicated the presence of LNAPL. All borings were completed in the same locations as the previous HRSC investigations, so these locations were expected to have LNAPL responses.

UVHP-15_20221208 contained an elevated fluorescence background starting at approximately 26 ft. A post-log QA check determined that moisture intrusion was present. The elevated background was reduced to nominal levels after cleaning. The elevated signal, while possible NAPL, is more likely due to the moisture intrusion.

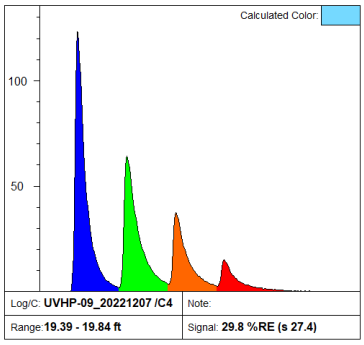
HP signal was lost at approximately 17 ft on UVHP-20_20221208. HP data after 17 feet is not to be considered accurate.

4.1 Site-specific Waveforms

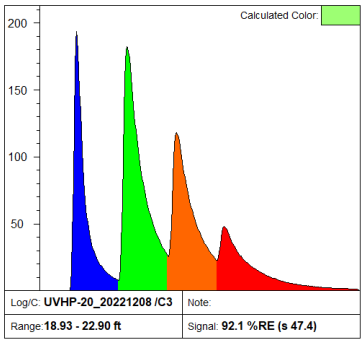
Several different waveforms identified at locations with elevated fluorescence response across the site. These waveforms range from 350 nm (blue channel) dominant with downward stair stepping through the 400, 450 and 500 nm (green, orange, and red channels respectively) wavelengths and relatively long lifetimes, to waveforms with short lifetimes that stair-step up from the 350 nm channel through the longer wavelengths.



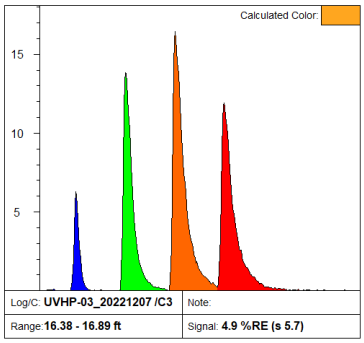
Waveform from 17.0-19.6 feet bgs at location UVHP-24-20221208. This waveform is typical of the "clean" background soil fluorescence in the subsurface throughout the site. Total fluorescence signal is 0.2% RE. The combined colors of the four peaks result in an orange fill color as indicated in the top right-hand corner of the waveform callout box.



Waveform from 19.4-19.8 feet bgs at location UVHP-09-20221207. This waveform is dominated by the 350 nm (blue) wavelength and steps down through the 400, 450 and 500 nm wavelengths. This blue-shifted waveform possibly indicates naphtha or naphtha-based products such as kerosene.



Waveform from 18.9-22.9 feet bgs at location UVHP-20-20221208. This waveform contains peaks with increased lifetimes, with much of the contribution coming from the green (400nm) and blue (350nm) channels resulting in a light green color. This could be a result of a light NAPL such as seen in the waveform above mixing with a slightly heavier LNAPL.



Waveform from 16.40-16.9 feet bgs at location UVHP-03_20221207. This waveform could represent a weathered LNAPL that has red-shifted as indicated by the smaller 350nm (blue) channel and more dominant 450nm (orange). Red-shifting is common as NAPLs weather. The resultant fill color is orange.

The above waveforms (or combination thereof) were the most common waveforms encountered at the site. It is important to note that even small fluorescence responses can indicate NAPL. Slight changes in waveform colors and wavelength lifetimes are the key indicators of NAPL versus background fluorescence. When reviewing UVOST waveforms to determine NAPL type, it is important to consider additional lines of evidence such as cluster plots, confirmation soil sampling and lab analysis. Consistent waveforms at a site typically indicate consistent product and saturation.

4.2 Site Cluster Plots

Cluster Plots (bubble diagrams) are displayed on each individual log in Appendix B. Each "bubble" represents one of the waveforms from the corresponding UVOST log and the fill color of the bubble matches the fill color from the depth specific waveform associated with that bubble. The larger the bubble, the higher the %RE associated with that particular depth. Background and natural fluorescence signals are included in the clustering presentation and typically "cluster" in a tight group in the lower right of the cluster plot. Low NAPL signals will "drift away" from this group. The further away each waveform's bubble is from the background cluster, the higher the likelihood it represents NAPL. In addition, bubbles that cluster close together typically represent the same NAPL type and/or degree of weathering.

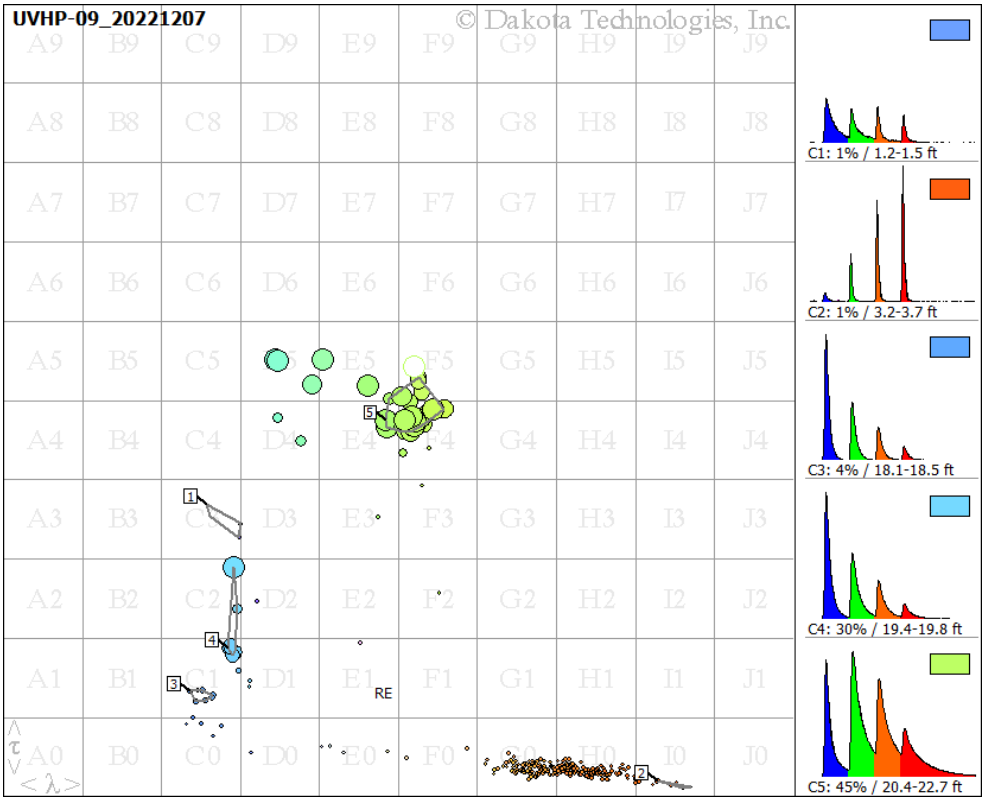


Figure 4: The image above, from location UVHP-09_20221207, shows the typical cluster plot diagram from the site. The tight cluster of "bubbles" located in the lower right, ranging from G0 to J0, of the cluster plot represents the background fluorescence encountered throughout the fluorescence versus depth log at this location. Callouts 1, 3 and 4 found in the C1 to C3 range contain blue-dominant characteristics in the waveforms. This is generally only seen in very light NAPLs. Callout 4 (C4) represents a different LNAPL that is more green-dominant.

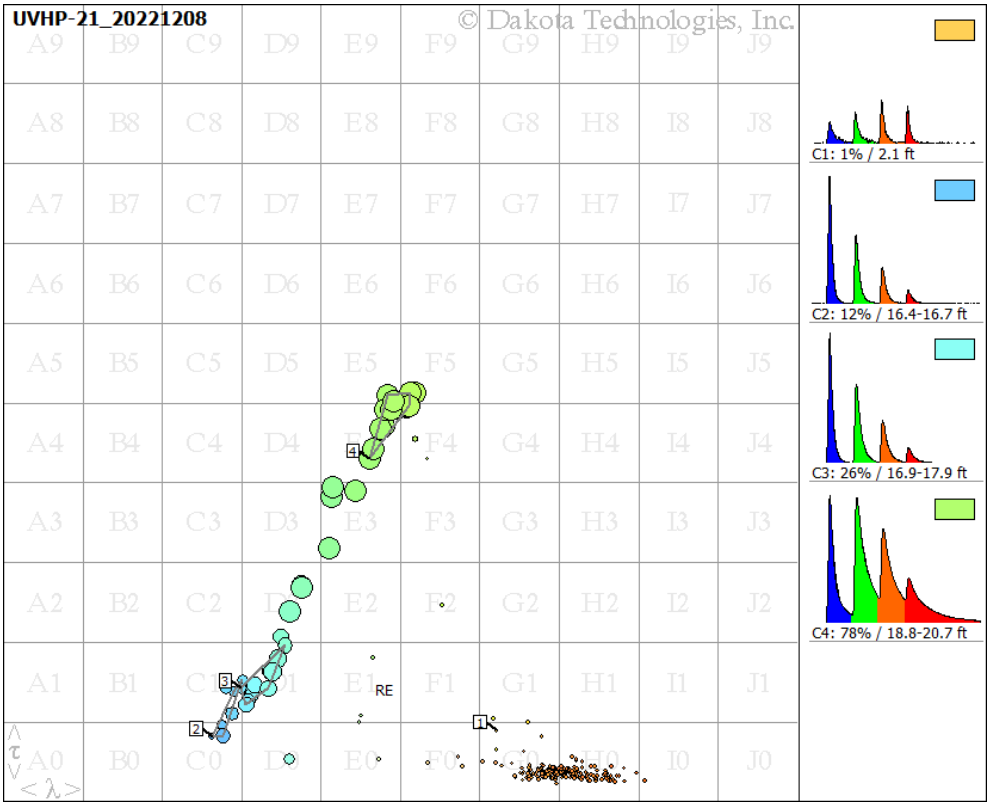


Figure 5: As observed in the above cluster plot, this plot from UVHP-21_20221208 shows elements of blue channel dominant waveforms. There is also a cluster residing in the E4 to F5 quadrants that is green-dominant with a prominent trail linking the dissimilar signals. This cluster plot seems to indicate that mixing is occurring between two or more NAPLs.

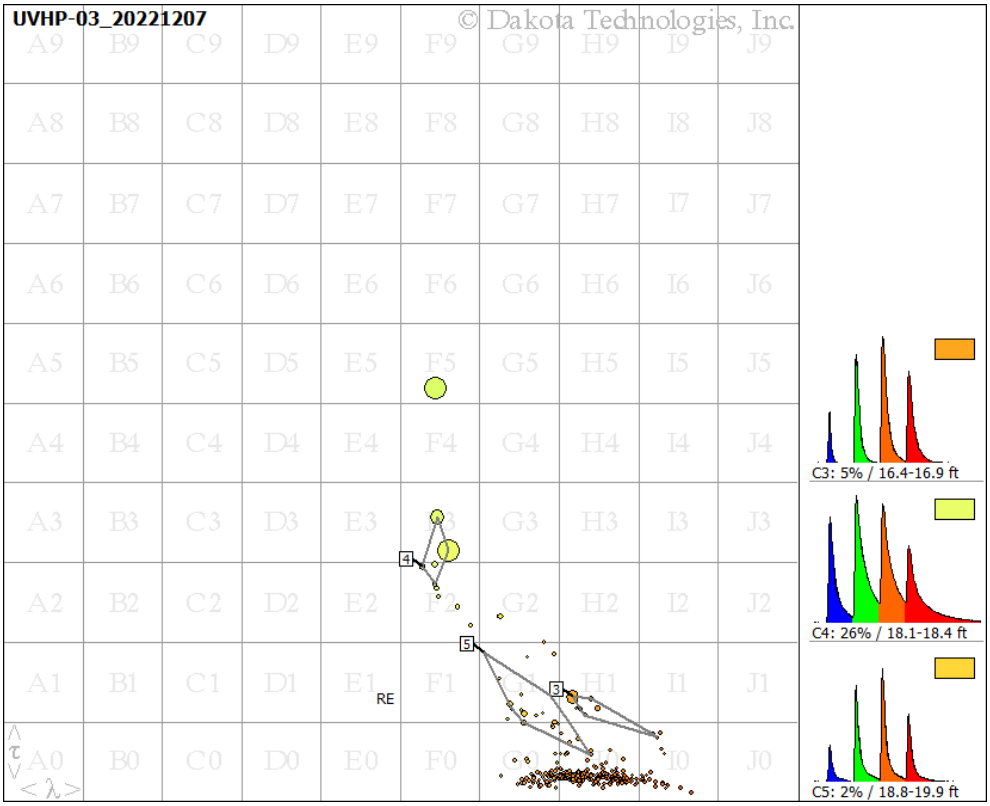


Figure 6: The cluster plot from location UVHP-03_20221207 shows a NAPL signal in the F3 and F5 quadrants with a trail leading down and to the right towards background fluorescence's. This red-shifting with decreasing lifetimes is a typical characteristic of a NAPL such as gasoline as it weathers.

Please do not hesitate to contact Randy St. Germain for additional assistance with interpretation of your site's UVOST logs. He can be reached at stgermain@dakotatechnologies.com or 701-237-4908 and can assist you with unlocking the wealth of information in your UVOST logs with regard to fuel type, degree of weathering, removal of false positives, isolation of certain target fluorescence types from other types, relating NAPL saturation to % RE, and other common UVOST site data interpretation/processing approaches.

5.0 GPS Data/Survey Control

No GPS data was collected by Dakota during this visit.

6.0 Limitations

The UVOST® system is limited in that it responds in a highly preferential manner to non-aqueous phase liquid petroleum, making it an ideal tool for source delineation. UVOST® does not typically respond (to any useful degree) to dissolved phase VOCs or SVOCs. In addition, the soil matrix (soil grain size) can influence how a NAPL fluoresces. UVOST® responses are typically higher on coarse or poorly sorted sands than in fine grain clays and silts. The UVOST® system should never be used to delineate coal tars and creosotes due to a misleadingly small fluorescence response (due to internal quenching of fluorescence) while simultaneously encountering a heightened response to dissolved phase PAHs in and near to the heavy NAPL, which can easily be misinterpreted as the presence of refined LNAPLs.

The use of specific language to identify UVOST® fluorescence such as LNAPL, gasoline, diesel or other specific petroleum, oil or lubricant types are intended to describe the fluorescence response within the limited context of the UVOST® data set, and the actual presence of these NAPLs must be verified with other lines of evidence (sampling, history, etc.) to confirm any stated interpretations. Signal identified and listed in this report as false positives, natural soil, etc. should also be viewed within these same constraints because extremely weathered fuels can occasionally mimic natural soil fluorescence.

The analysis and opinions expressed in this report are based upon data obtained from the specific test locations and from other information discussed in this report. Exceptions, if any, are discussed in the accompanying comments section of this report. This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted practices. Reported results shall not be reproduced, except in full, without written approval of Dakota. No warranties, expressed or implied, are intended or made.

The hydraulic data acquired from UVOST® tool should be reviewed in conjunction with representative soil samples to best understand soil behavior.

Appendix A

UVOST®-HP Field Summary

DAKOTA TECHNOLOGIES

UVOST®-HP Field Summary Log

PES Complex

Philadelphia, PA

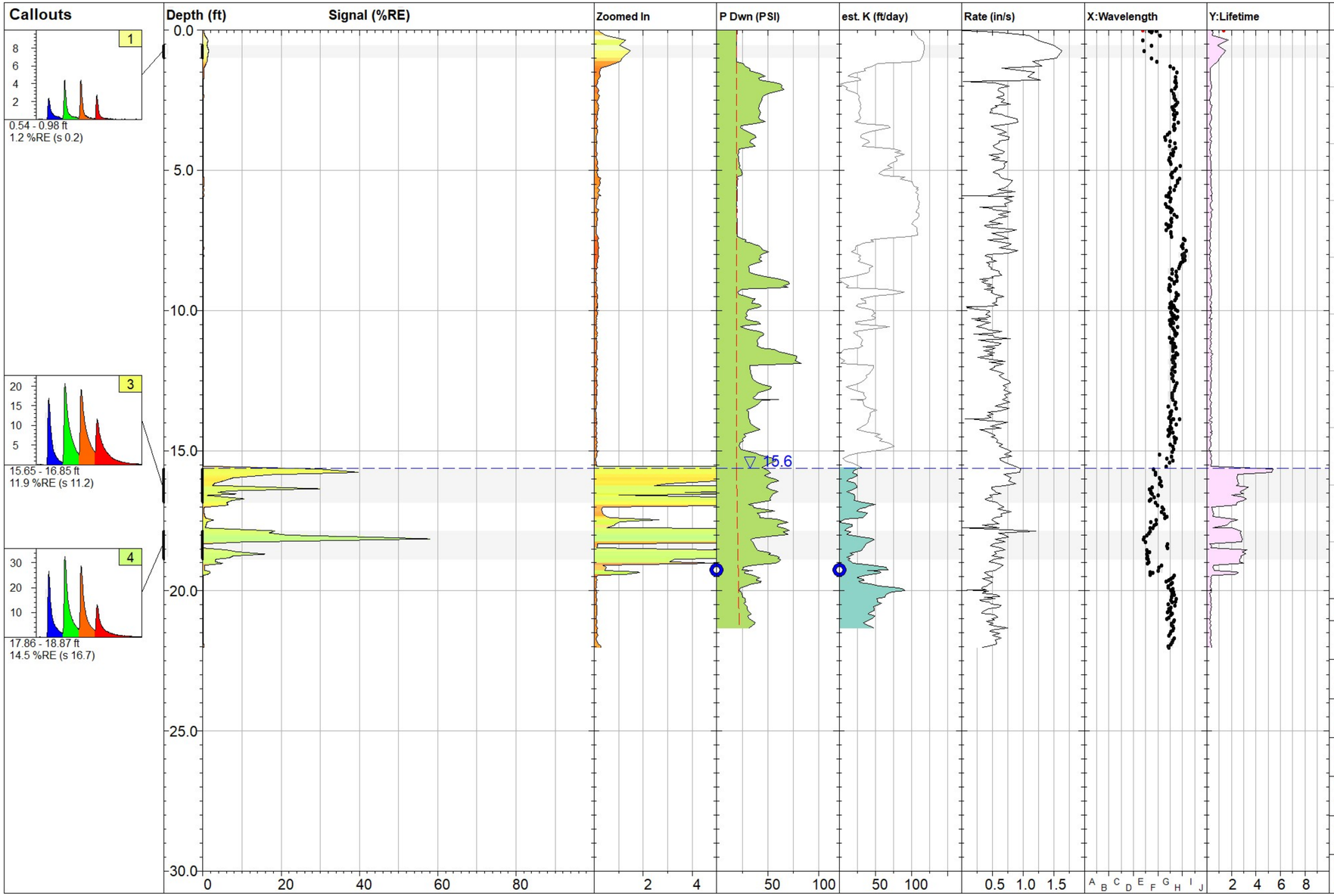
File Log ID	Date / Time	Pre-Probe (ft)	Final Depth (ft)	Max Signal (%RE)	Max Signal Depth (ft)	Initial RE Area (pVs)	Background Area (pVs)	Stable Dissipation (yes or no)	Calculated Water Table (bgs)	Fluorescence Top - Bottom (ft)
UVHP-01_20221207	12/7/22 10:37 AM	0	22.0	59	18.2	11727	8	YES	15.6	0.2-1.1, 15.6-19.4
UVHP-02_20221207	12/7/22 1:47 PM	0	23.1	55	15.7	11973	12	YES	15.4	(0.4?), 15.1-20.5
UVHP-03_20221207	12/7/22 11:29 AM	1	23.1	75	18.4	11739	5	YES	16.0	16.0-20.1
UVHP-05_20221207	12/7/22 1:04 PM	0	20.2	10	14.2	11869	10	YES	15.1	13.7-17.5
UVHP-08_20221207	12/7/22 3:27 PM	0	24.3	1	20.1	11752	7	YES	18.3	0.9-1.3, 20.1, (21.0-22.1?)
UVHP-09_20221207	12/7/22 2:42 PM	0	25.9	170	21.0	11894	4	YES	17.8	1.1-1.6, (3.2-3.8?), 17.7-23.3
UVHP-12_20221208	12/8/22 1:34 PM	1	20.0	16	11.4	11638	19	YES	11.3	11.2-14.6
UVHP-13_20221208	12/8/22 11:55 AM	1	22.1	2	11.5	11915	33	YES	12.4	10.5-12.1, (17.2-22.0?)
UVHP-15_20221208	12/8/22 8:26 AM	0	29.8	387	21.6	12149	15	YES	20.8	0.9-2.3, 17.5-17.9, 19.4-25.5, (25.6-29.8?)
UVHP-20_20221208	12/8/22 9:55 AM	0	25.4	202	20.4	12050	29	NO	N/A	1.5-1.8, 18.4-23.9
UVHP-21_20221208	12/8/22 10:50 AM	0	24.0	143	20.4	11891	21	YES	16.6	(2.1?), 15.5-21.2
UVHP-22_20221208	12/8/22 2:10 PM	1	20.0	67	12.6	11997	20	YES	13.1	10.8-13.8
UVHP-23_20221208	12/8/22 2:43 PM	0	20.1	11	13.2	12036	18	YES	10.3	11.7-13.4
UVHP-24_20221208	12/8/22 3:19 PM	1	20.2	3	12.2	11826	19	YES	12.3	12.1-12.7
	Total Footage (this sheet)		**320.3**							

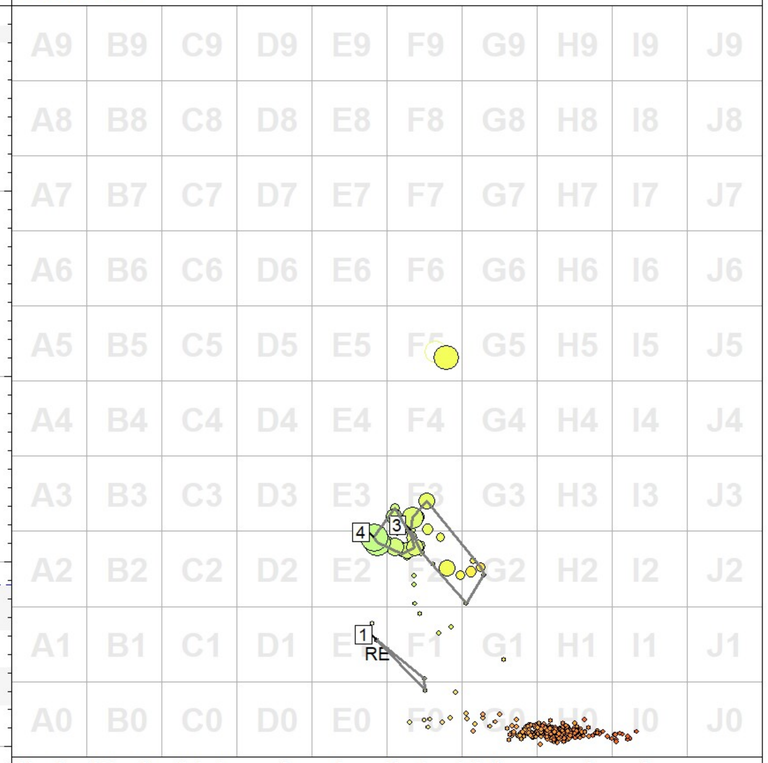
(1) Signal responses in the indicated pre-probed regions may not be accurate due to soil disturbance

Appendix B

UVOST®-HP Logs at 100% RE Floor with Cluster Plots

DAKOTA TECHNOLOGIES





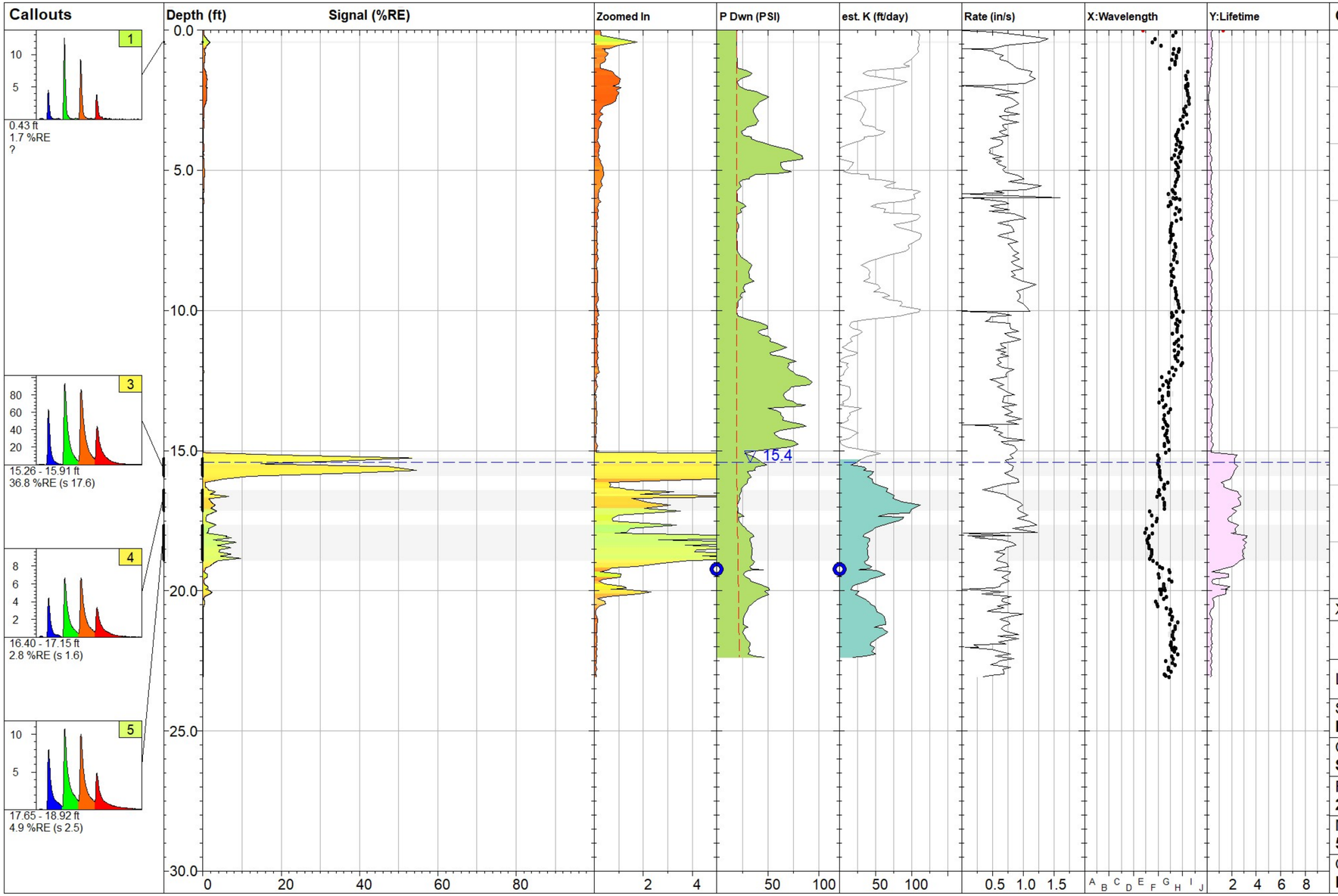
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

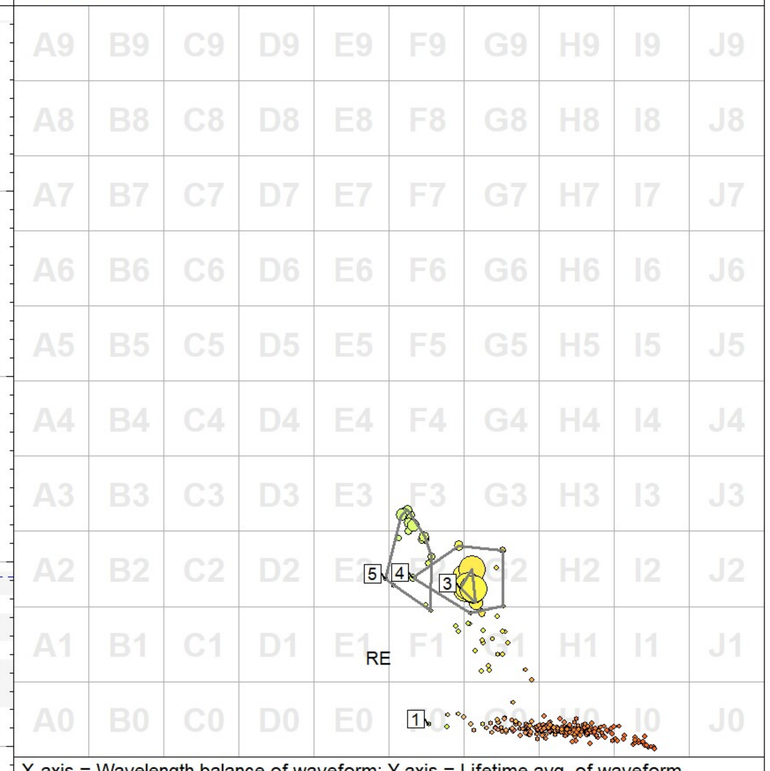
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-01_20221207**

Site: **PES Complex**	Date & Time: **2022-12-07 10:37 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **22.01 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **58.5 %RE @ 18.15 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





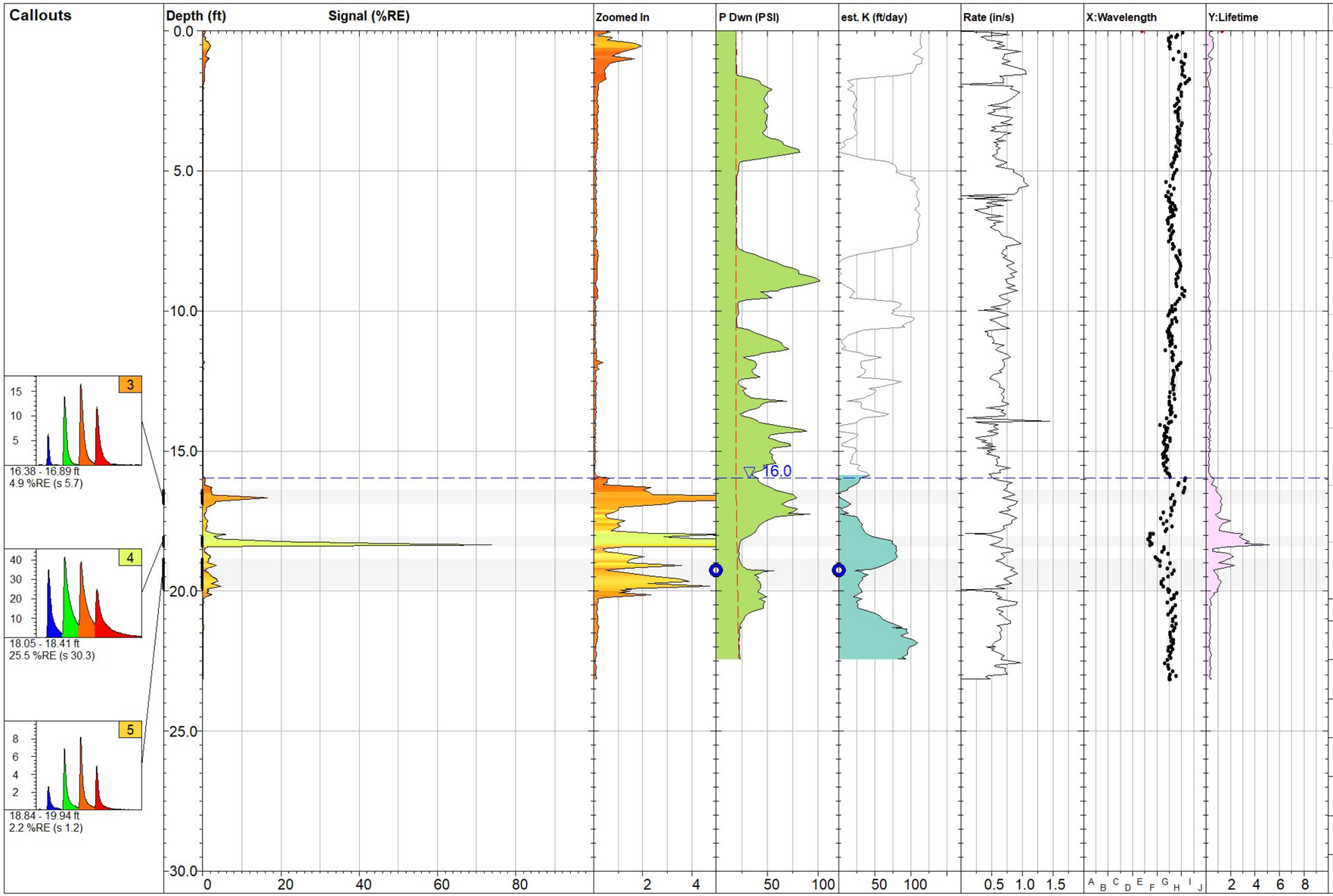
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

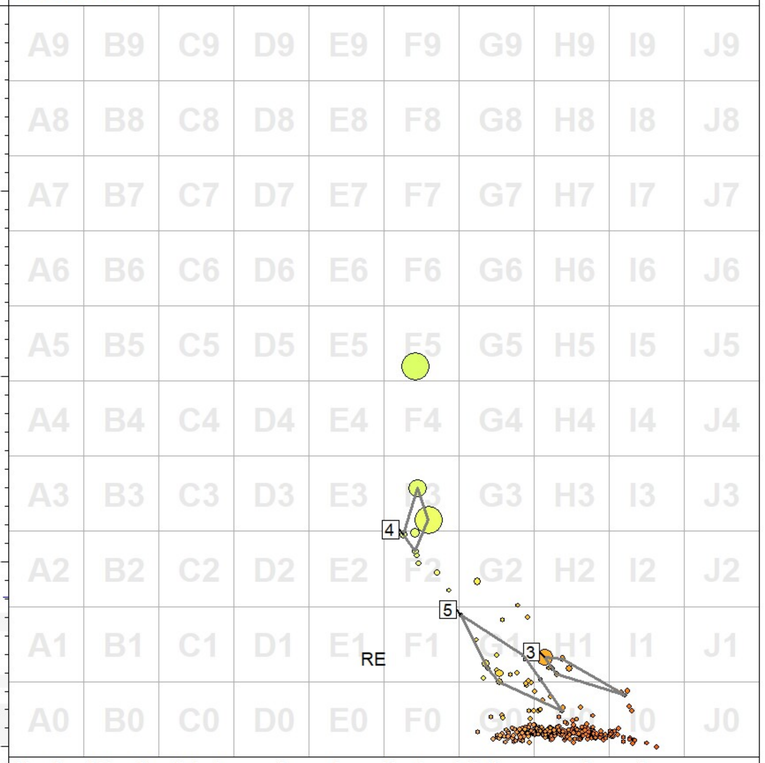
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-02_20221207**

Site: **PES Complex**	Date & Time: **2022-12-07 13:47 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **23.07 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **54.6 %RE @ 15.70 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





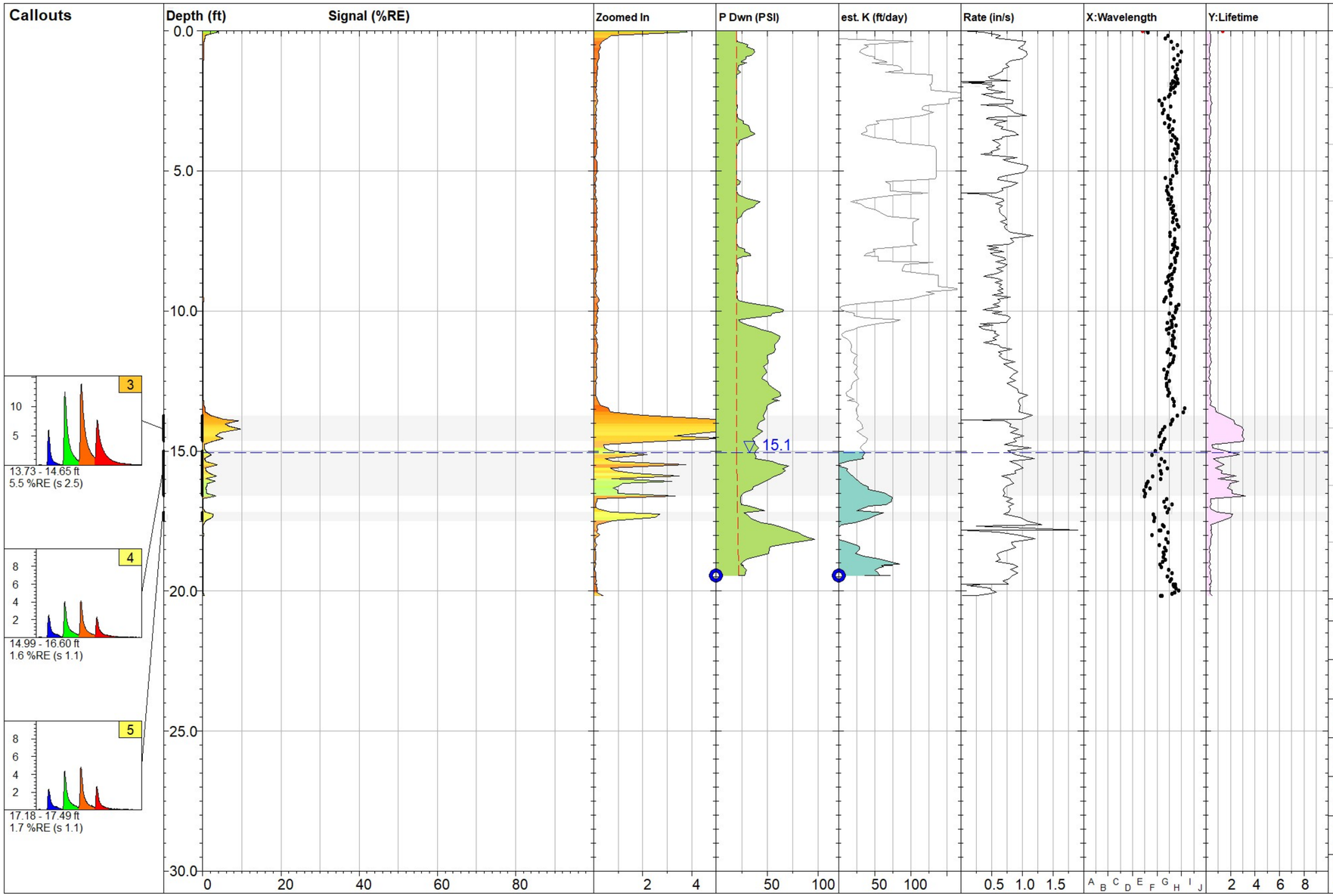
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

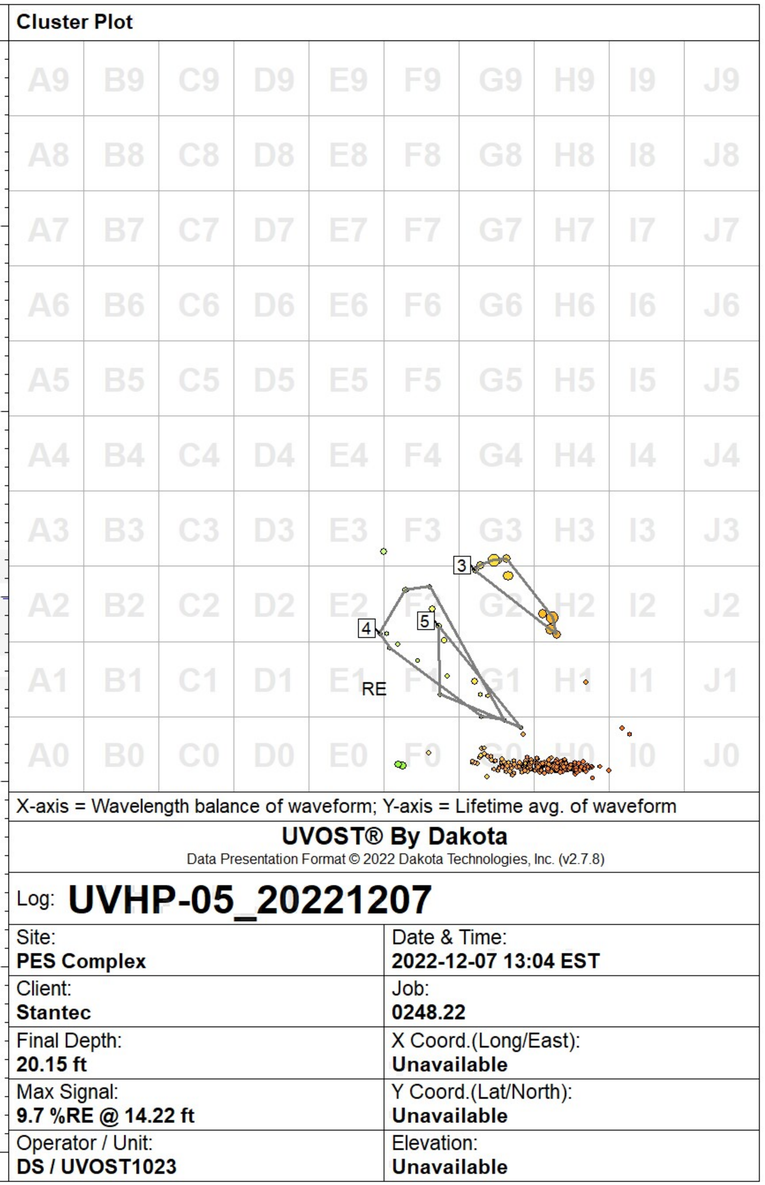
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-03_20221207**

Site: **PES Complex**	Date & Time: **2022-12-07 11:29 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **23.13 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **74.7 %RE @ 18.35 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





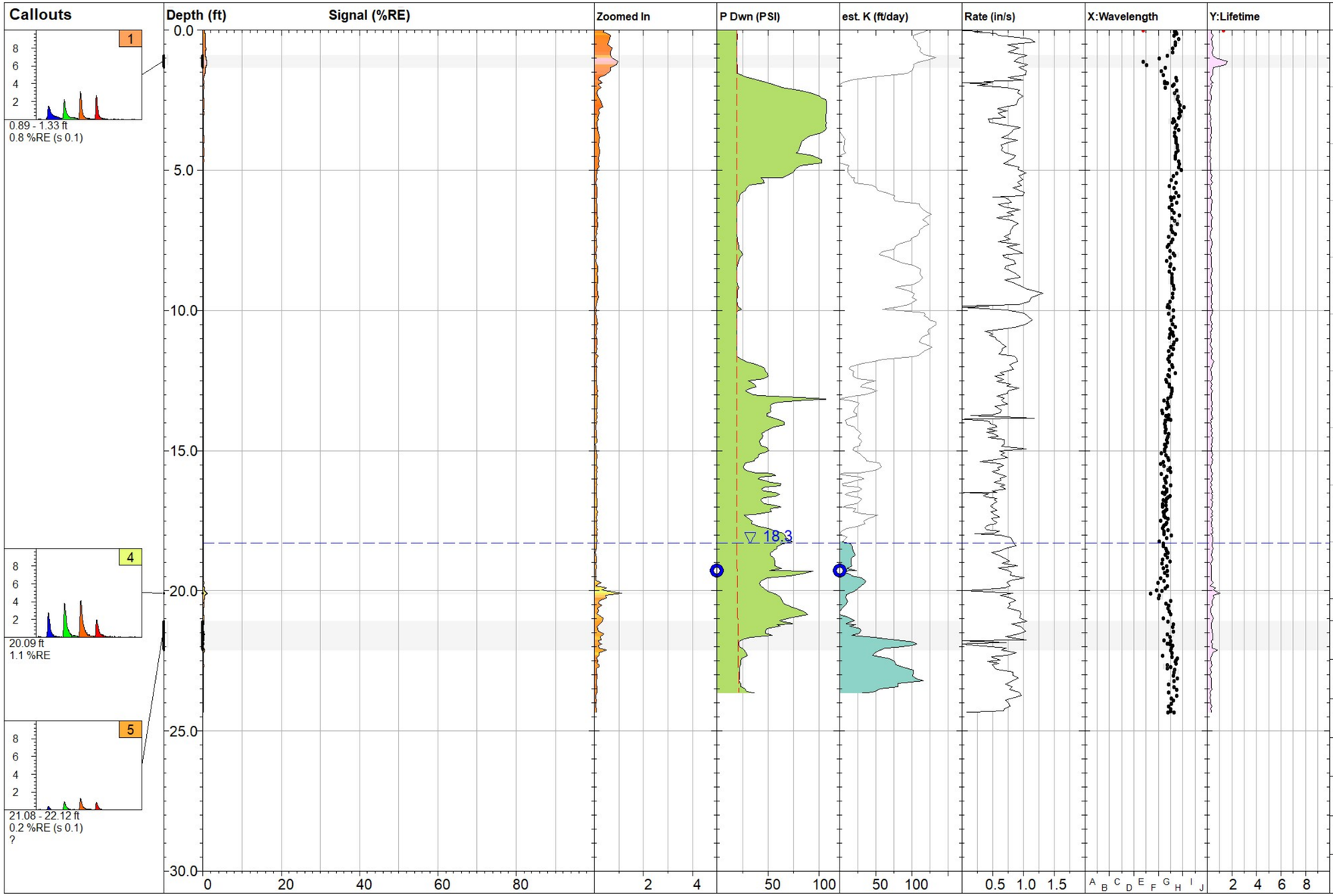
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

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Log: **UVHP-05_20221207**

Site: **PES Complex**	Date & Time: **2022-12-07 13:04 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **20.15 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **9.7 %RE @ 14.22 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**



Cluster Plot



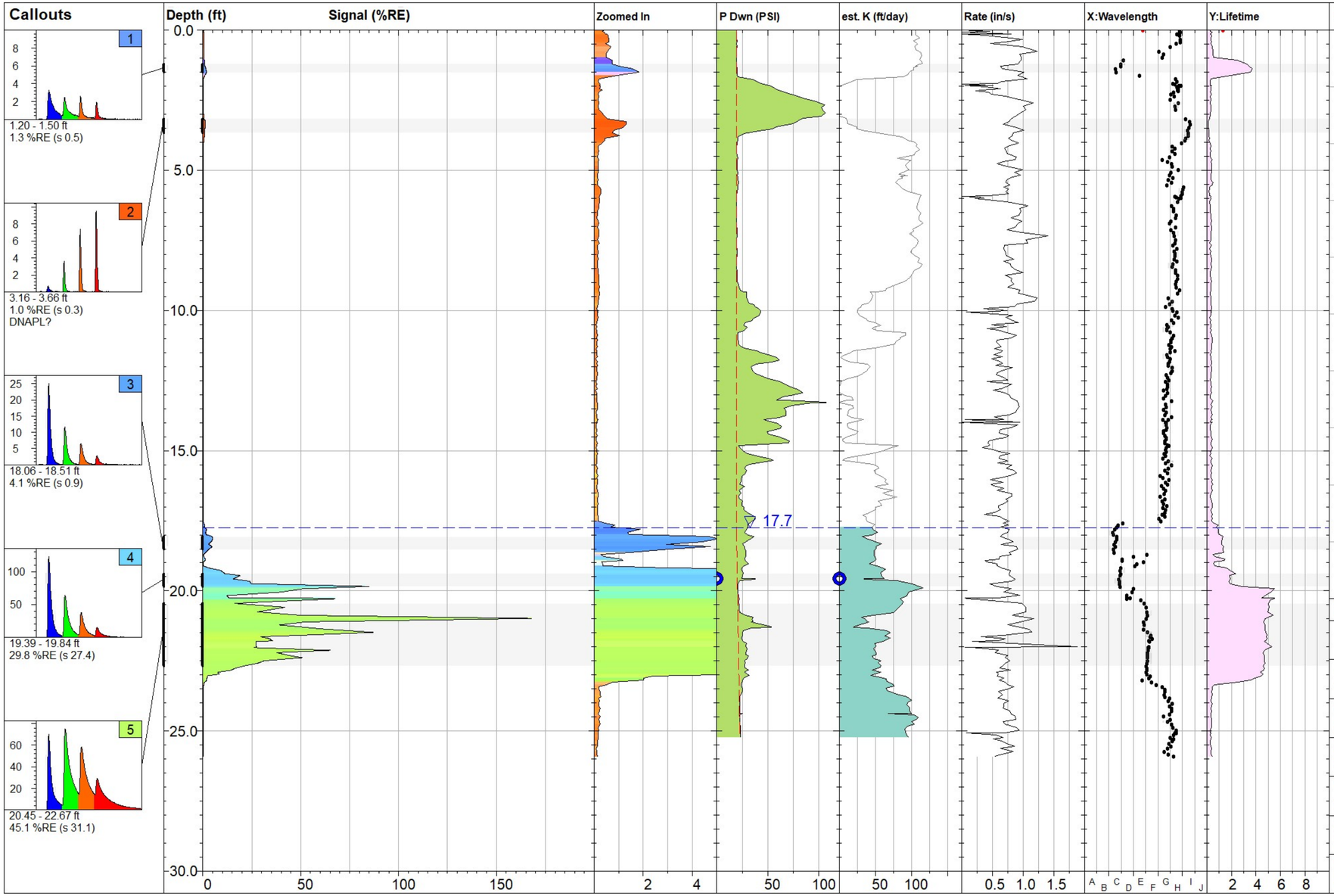
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

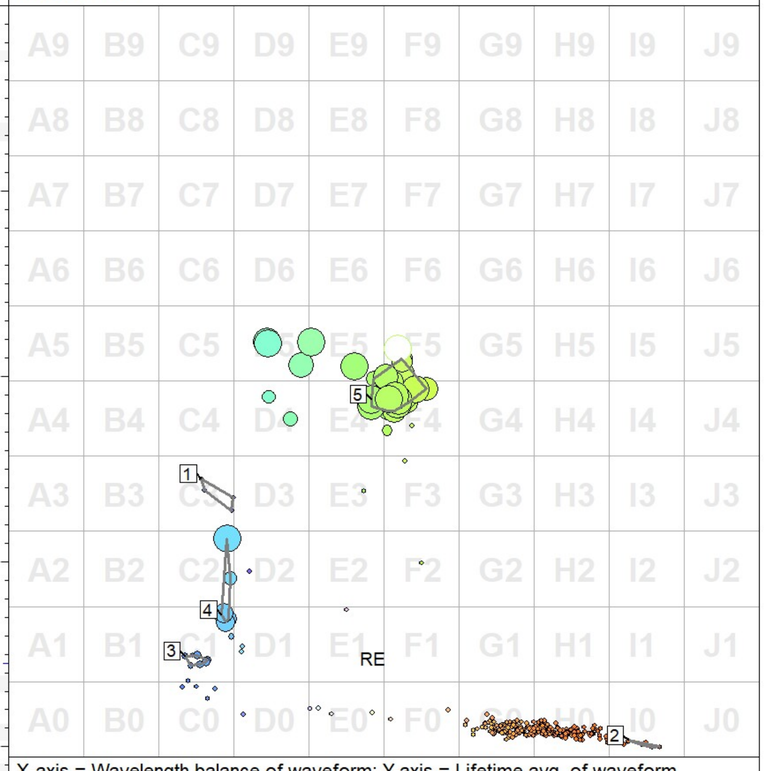
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-08_20221207**

Site: **PES Complex**	Date & Time: **2022-12-07 15:27 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **24.34 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **1.1 %RE @ 20.09 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





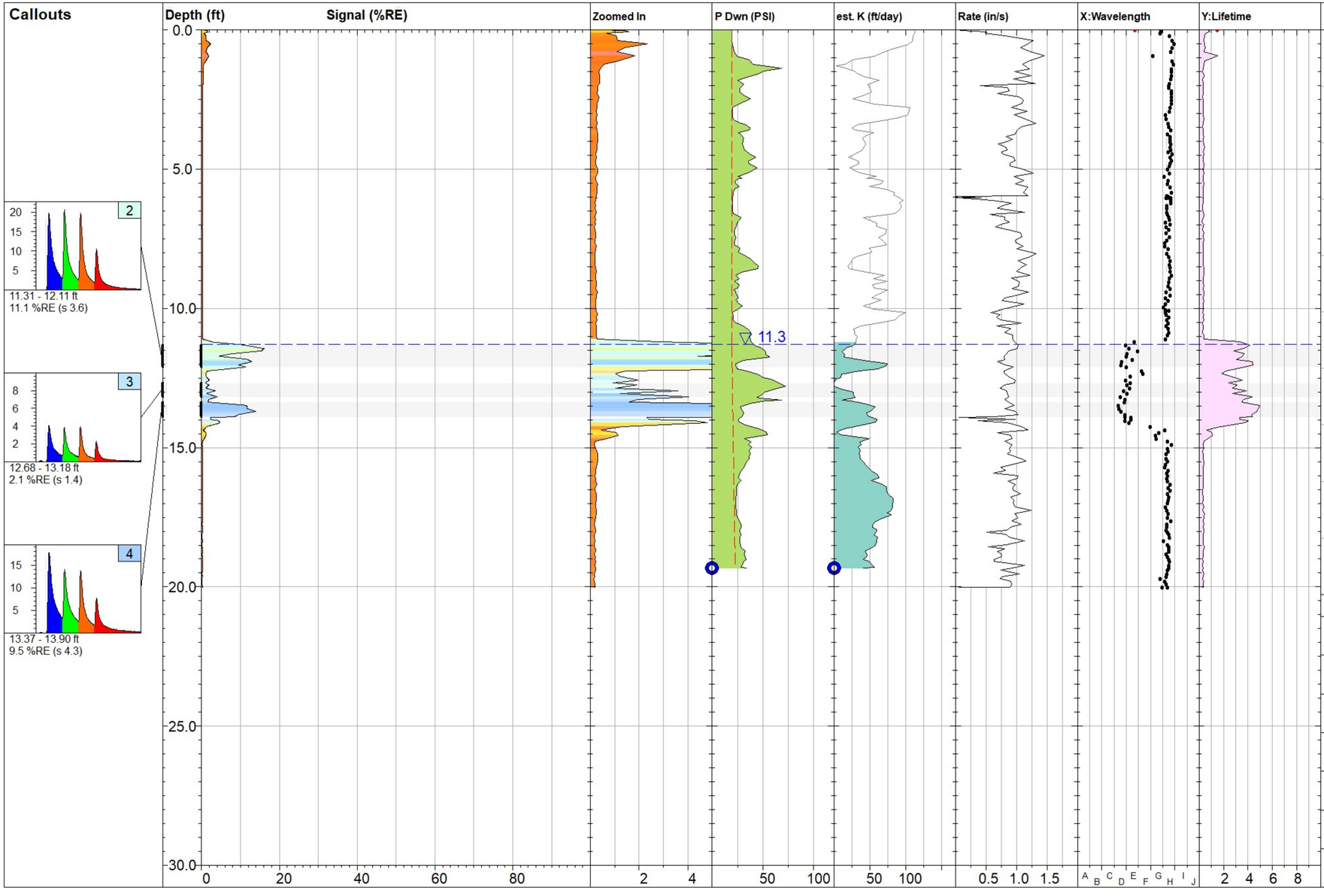
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

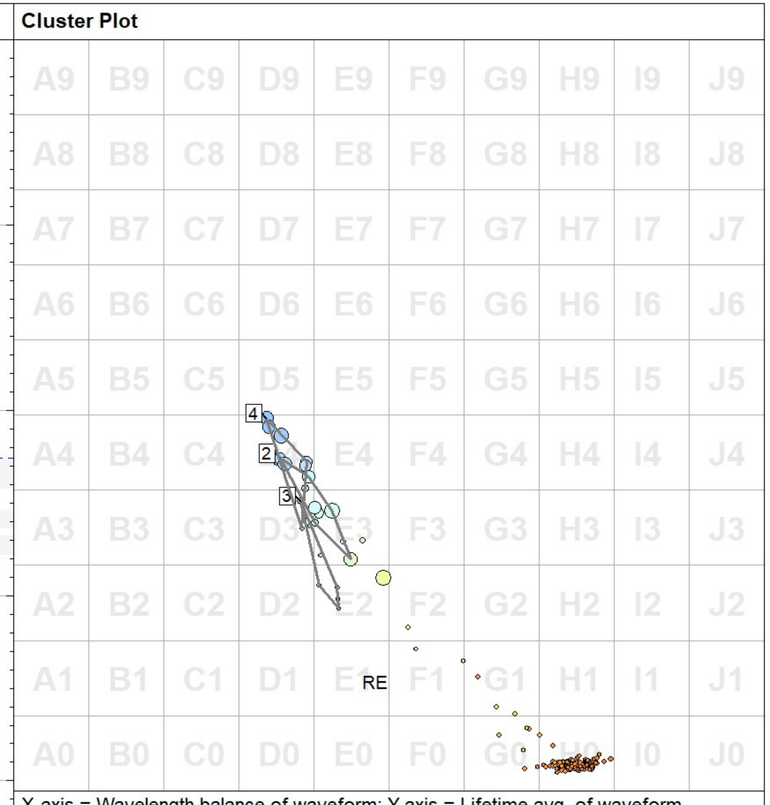
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-09_20221207**

Site: **PES Complex**	Date & Time: **2022-12-07 14:42 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **25.90 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **170.0 %RE @ 20.98 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





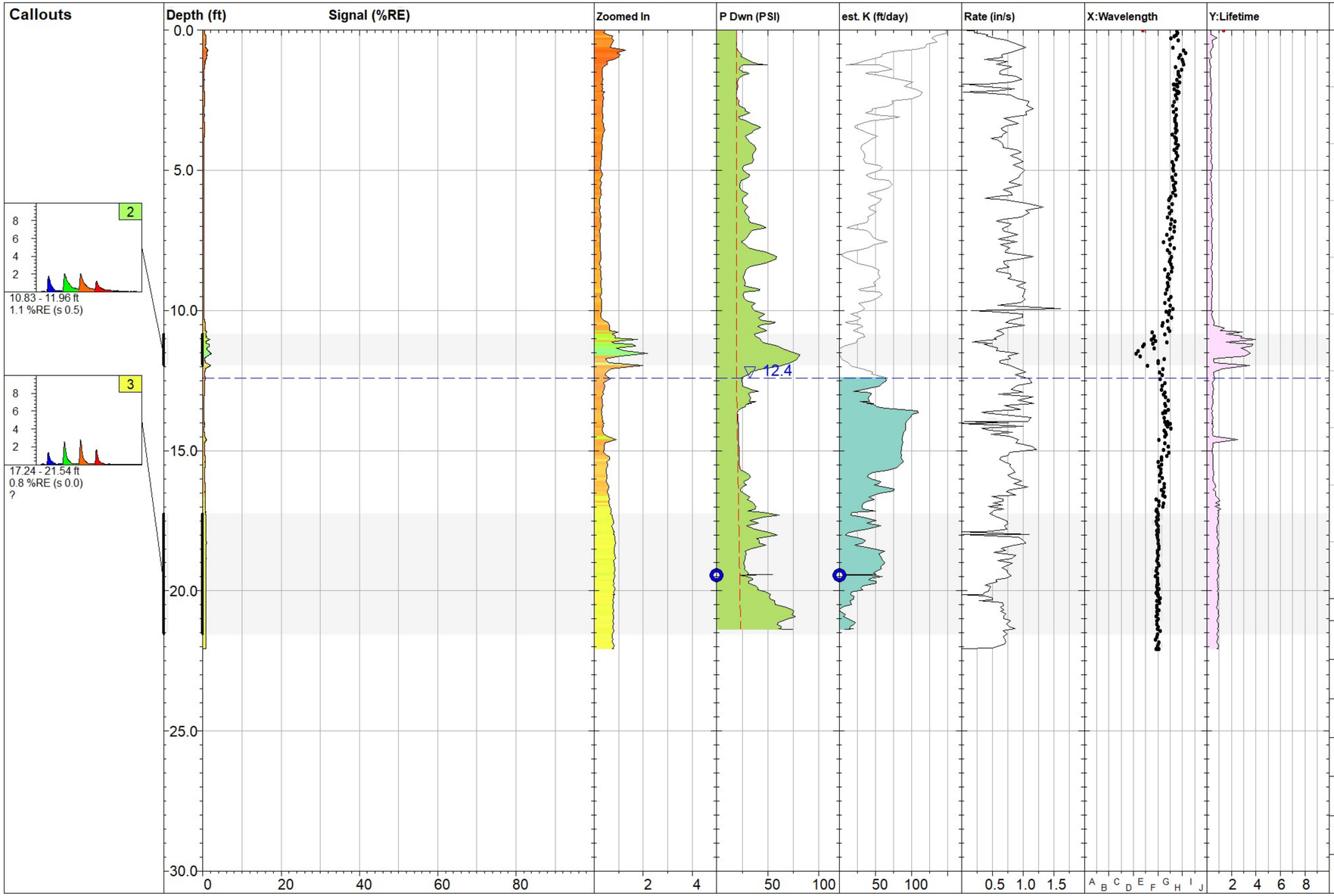
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

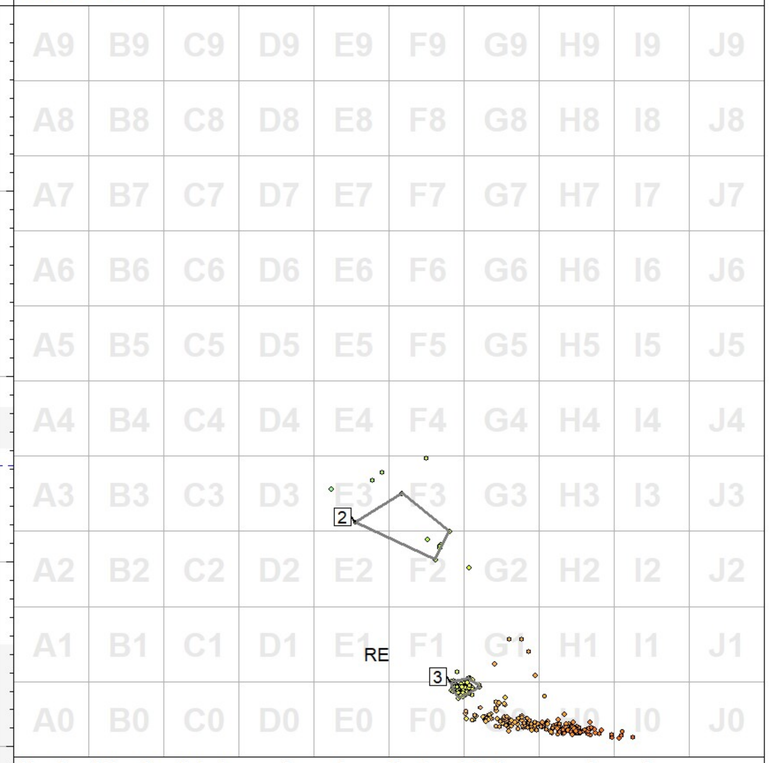
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-12_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 13:34 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **20.02 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **16.1 %RE @ 11.44 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





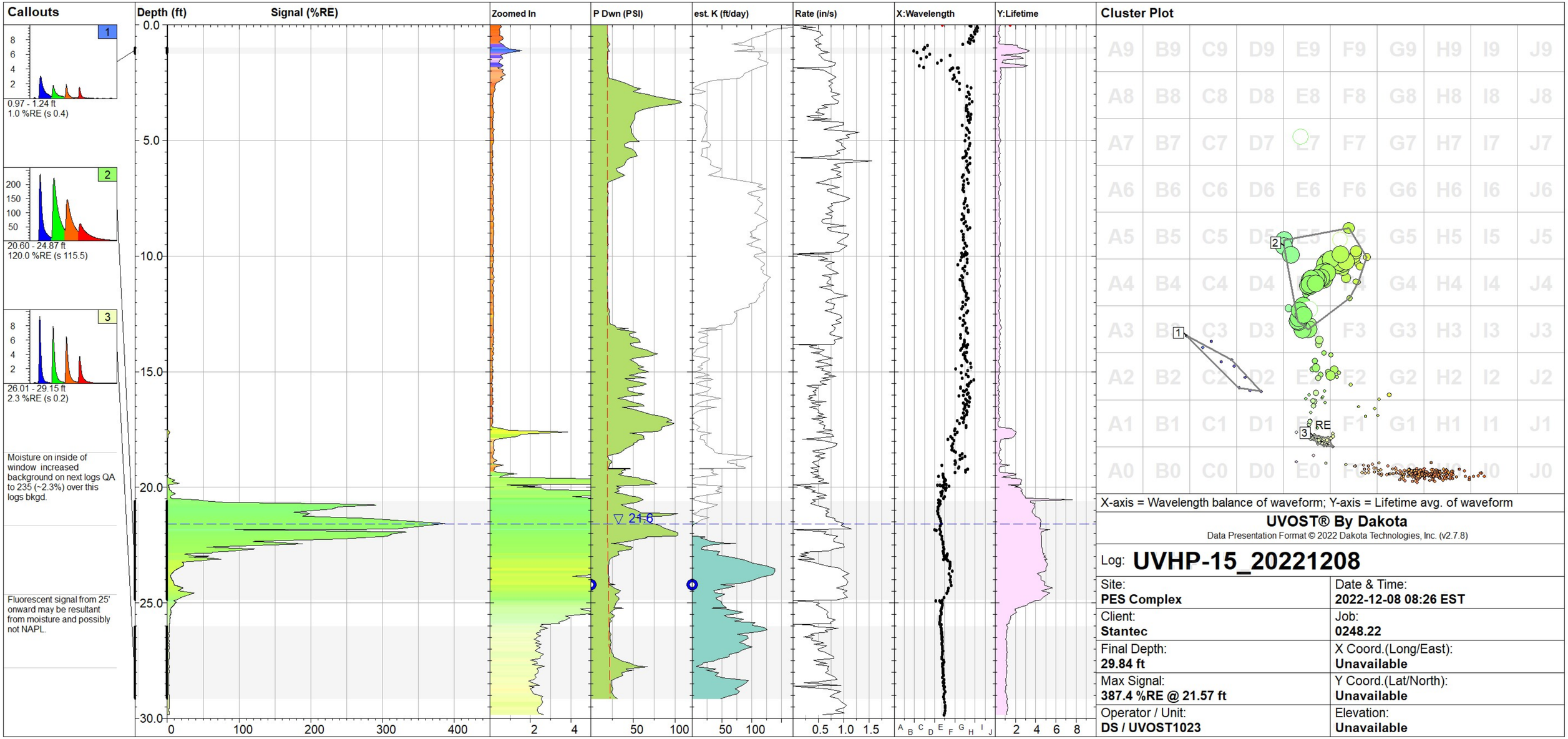
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

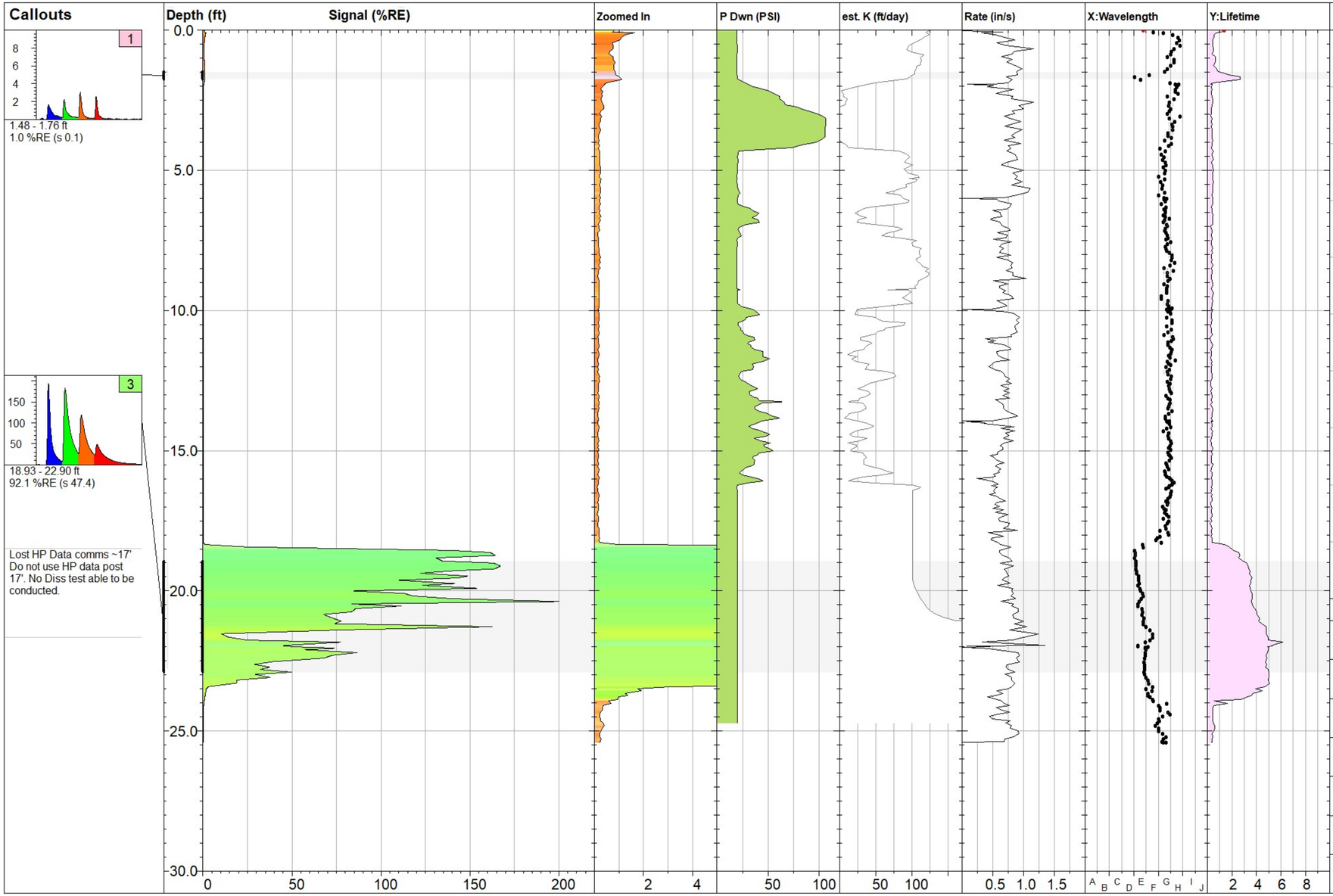
UVOST® By Dakota

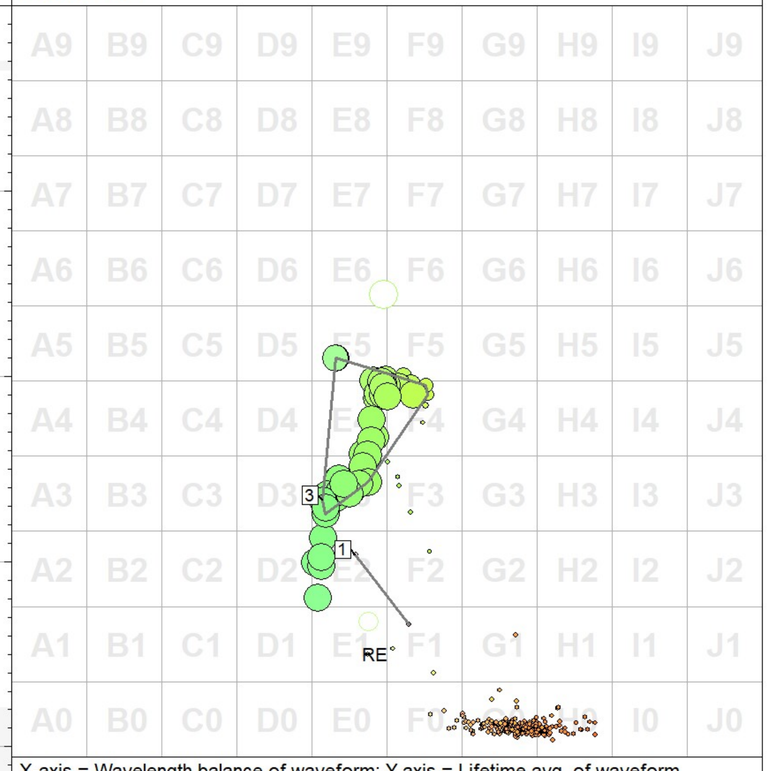
Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-13_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 11:55 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **22.07 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **2.2 %RE @ 11.54 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**


Callouts
1
0.97 - 1.24 ft
1.0 %RE (s 0.4)
2
20.60 - 24.87 ft
120.0 %RE (s 115.5)
3
26.01 - 29.15 ft
2.3 %RE (s 0.2)
Moisture on inside of window increased background on next logs QA to 235 (~2.3%) over this logs bkgd.
Fluorescent signal from 25' onward may be resultant from moisture and possibly not NAPL.
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
est. K (ft/day)
Rate (in/s)
X:Wavelength
Y:Lifetime
21.6
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)
Log: UVHP-15_20221208
Site: PES Complex
Date & Time: 2022-12-08 08:26 EST
Client: Stantec
Job: 0248.22
Final Depth: 29.84 ft
X Coord.(Long/East): Unavailable
Max Signal: 387.4 %RE @ 21.57 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: DS / UVOST1023
Elevation: Unavailable





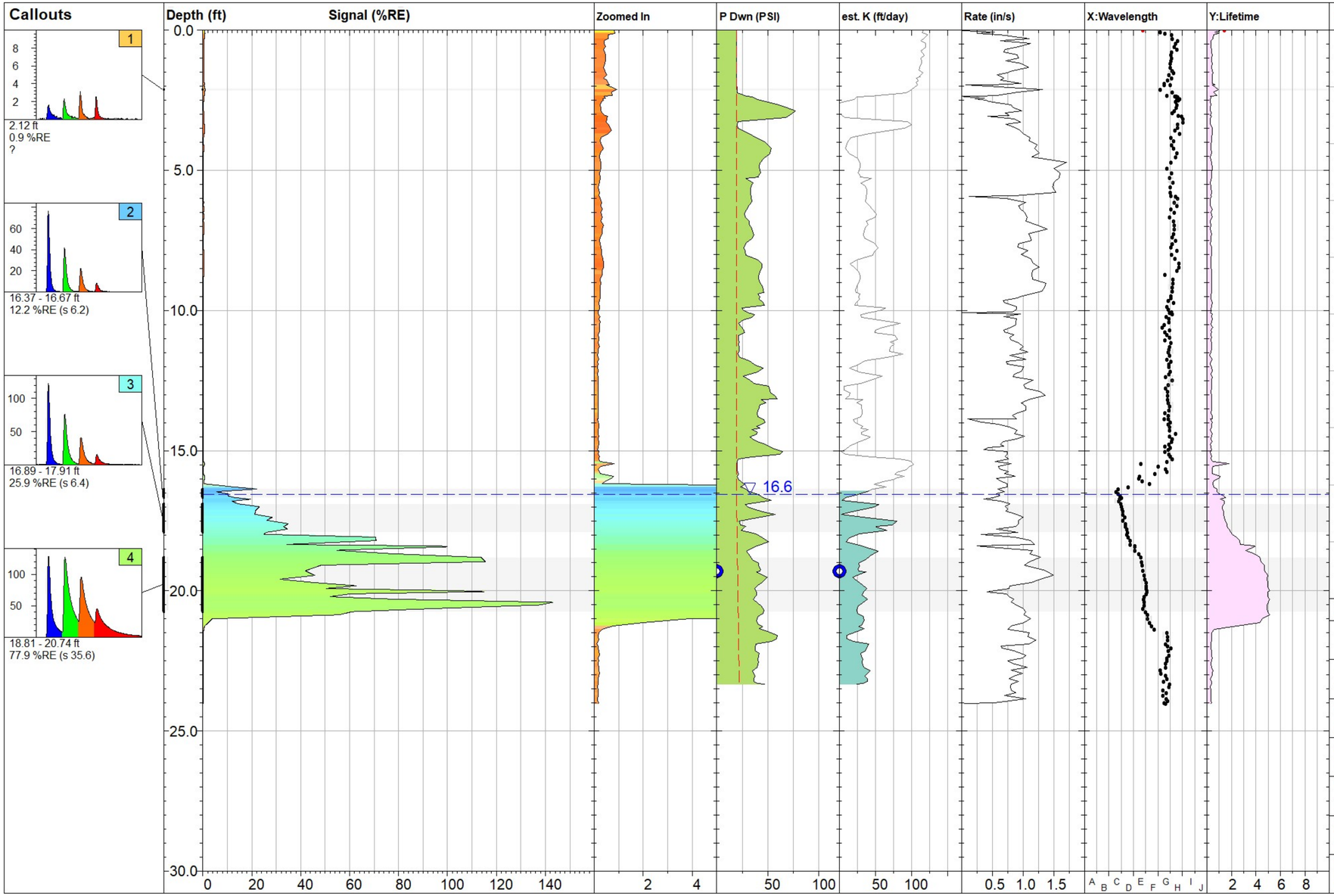
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

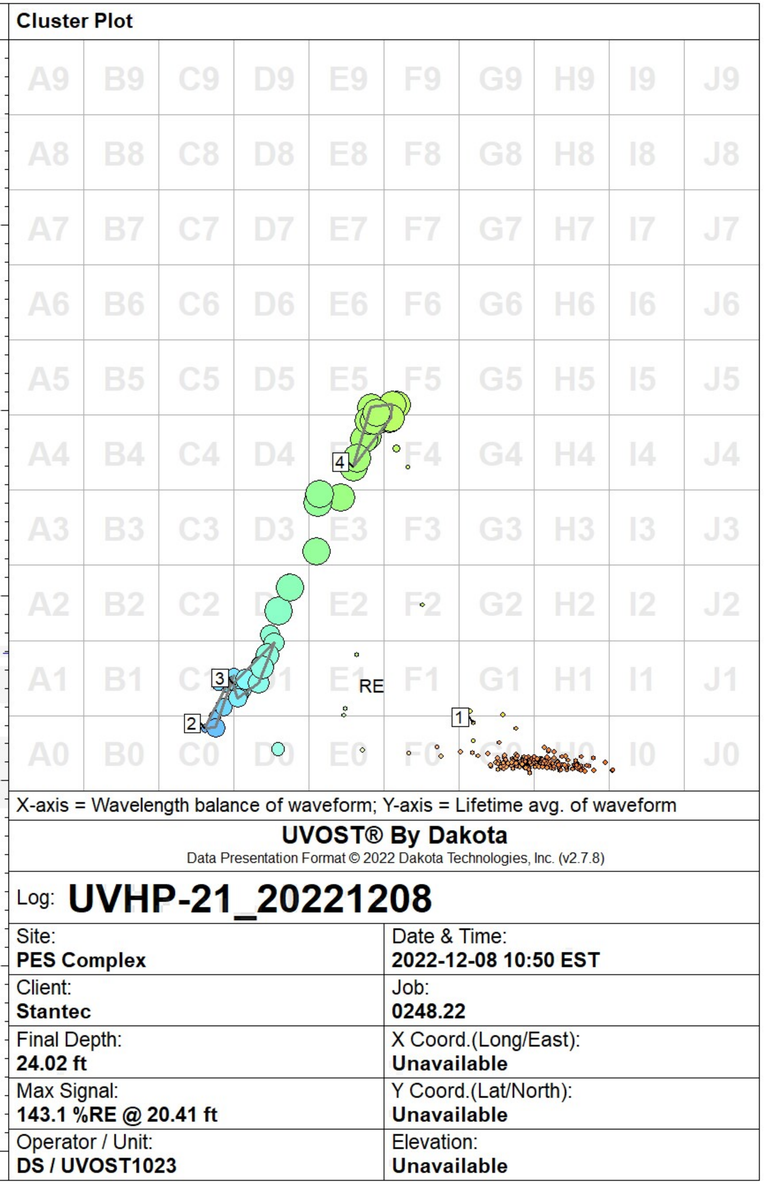
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-20_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 09:55 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **25.40 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **201.6 %RE @ 20.38 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





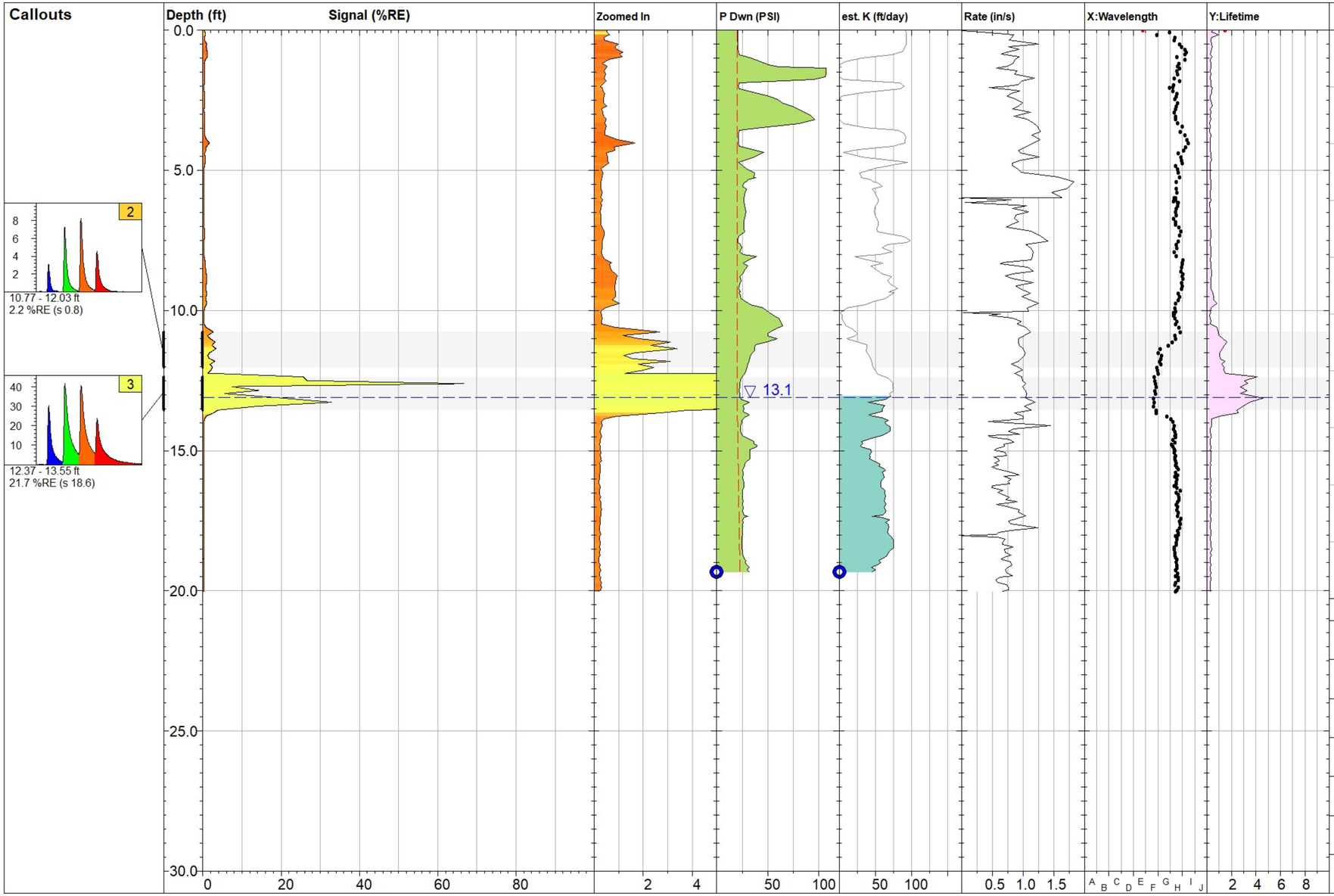
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

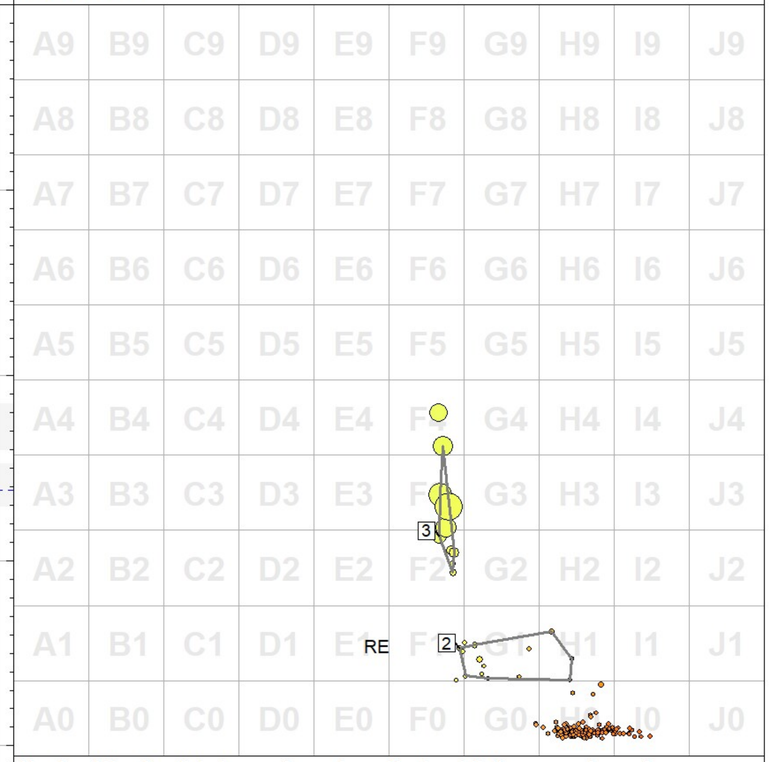
UVOST® By Dakota

Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-21_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 10:50 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **24.02 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **143.1 %RE @ 20.41 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





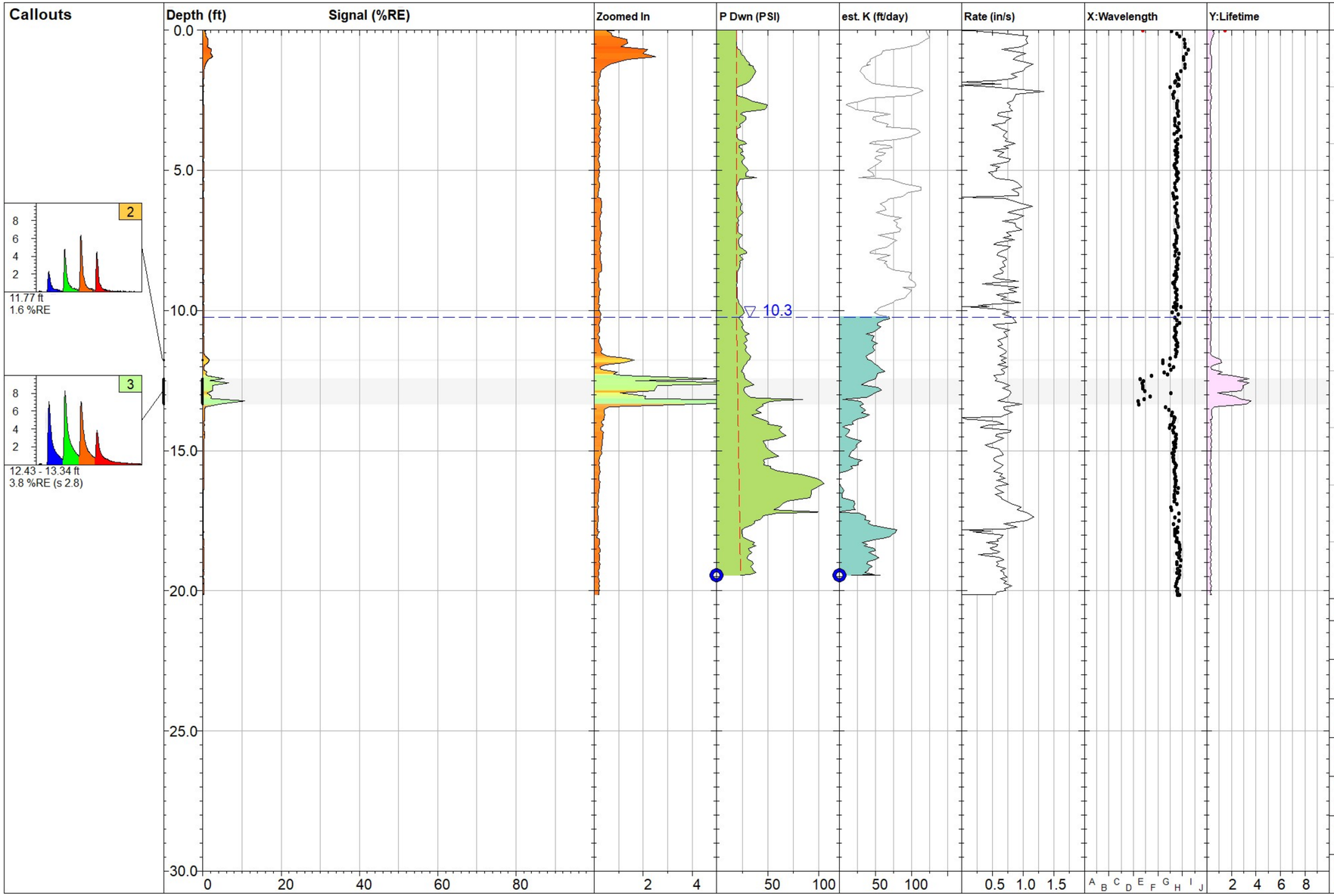
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

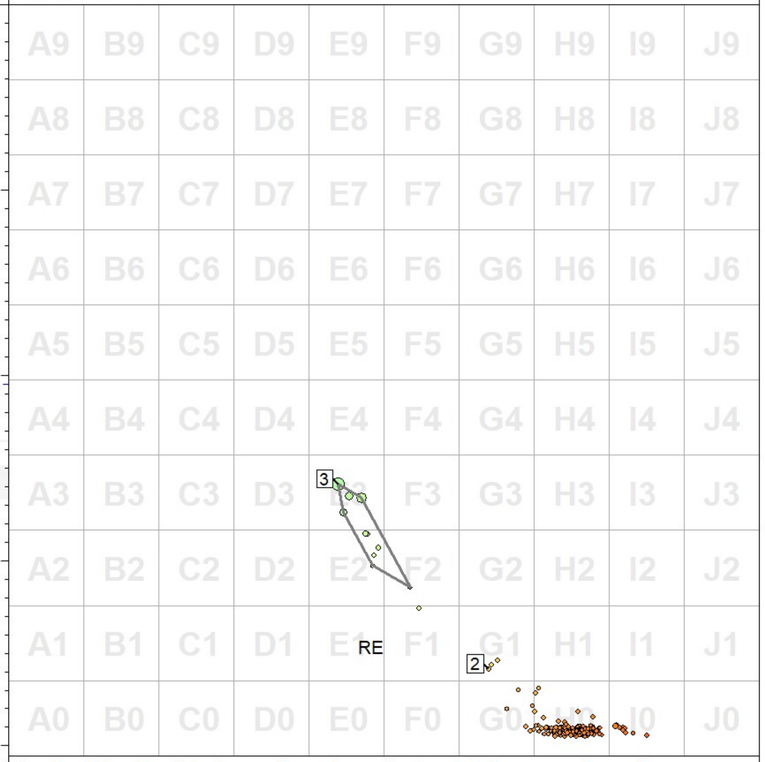
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Data Presentation Format © 2022 Dakota Technologies, Inc. (v2.7.8)

Log: **UVHP-22_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 14:10 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **20.02 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **67.0 %RE @ 12.61 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





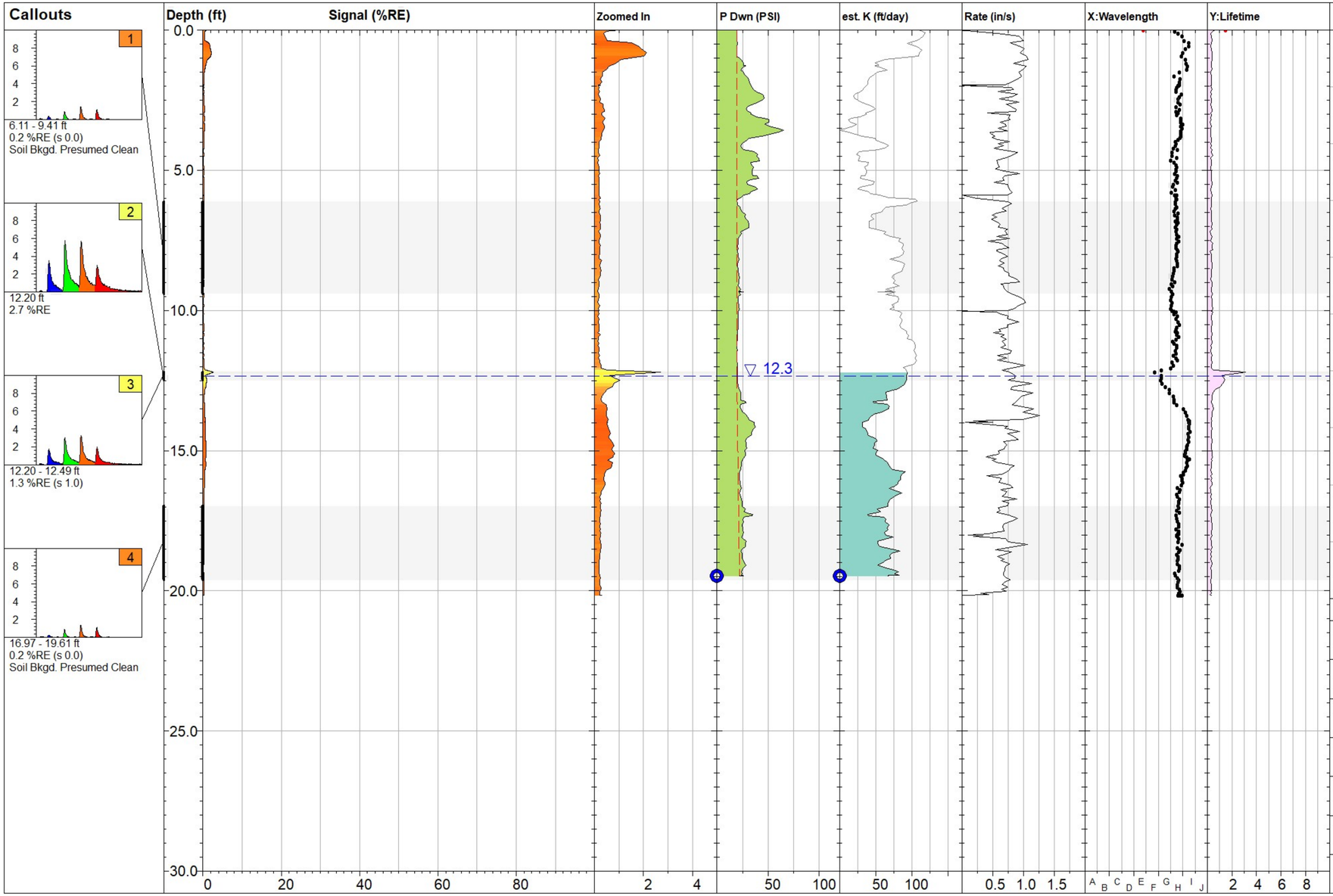
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

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Log: **UVHP-23_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 14:43 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **20.14 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **10.7 %RE @ 13.23 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**





X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

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Log: **UVHP-24_20221208**

Site: **PES Complex**	Date & Time: **2022-12-08 15:19 EST**
Client: **Stantec**	Job: **0248.22**
Final Depth: **20.16 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **2.7 %RE @ 12.20 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **DS / UVOST1023**	Elevation: **Unavailable**

Appendix C

Reference Log

Dakota Technologies
UVOST®-HP Reference Log

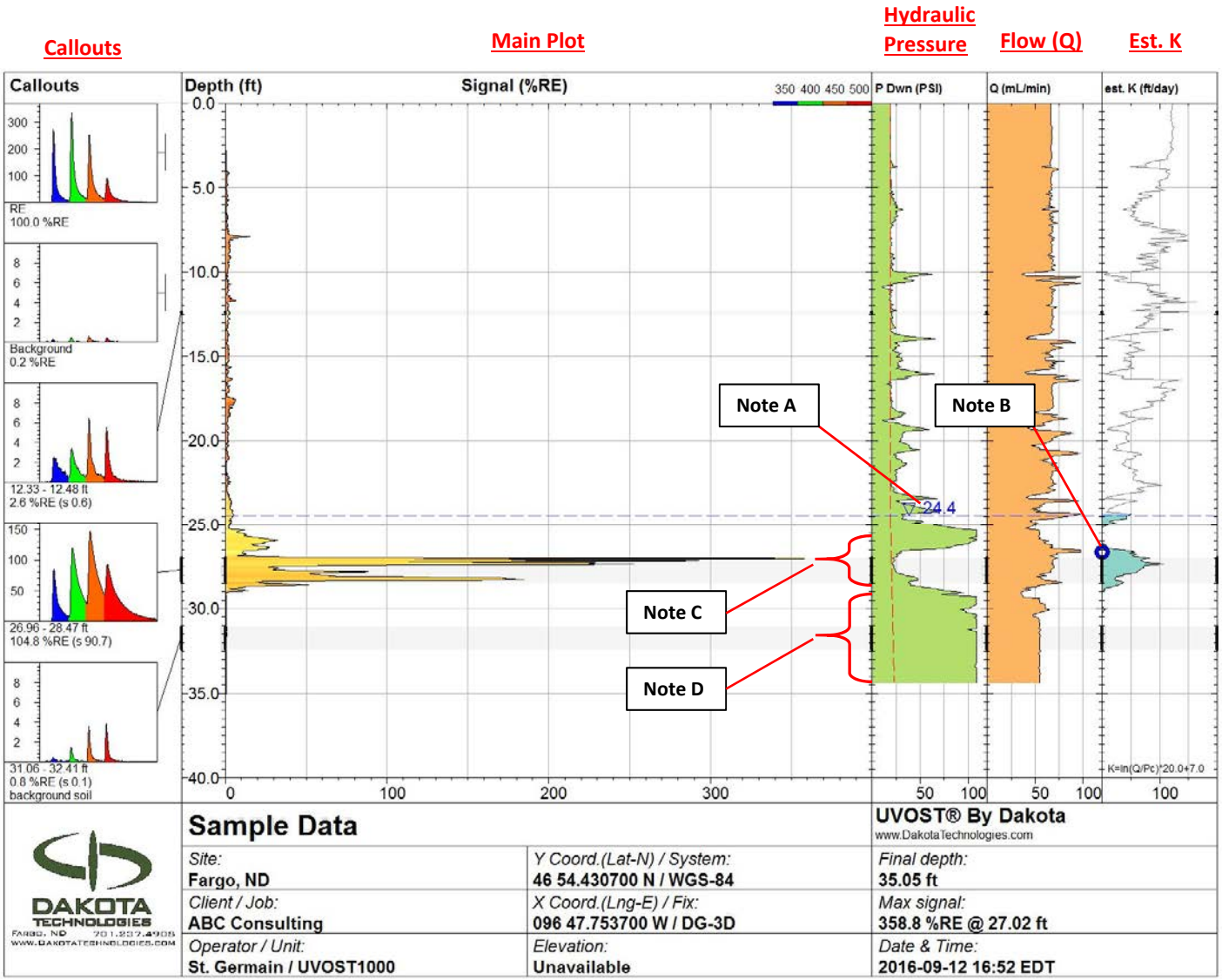
Callouts: Waveforms from selected depths or depth ranges showing the multi-wavelength waveform for that depth. The four peaks are due to fluorescence at four wavelengths and referred to as “channels”. Each channel is assigned a color. Various NAPLs will have a unique waveform “fingerprint” due to the relative amplitude of the four channels and/or broadening of one or more channels. Basic waveform statistics and any operator notes are given below the callout.

Main Plot: Signal (total fluorescence) versus depth where signal is relative to the Reference Emitter (RE). The total area of the waveform is divided by the total area of the Reference Emitter yielding the %RE. This %RE scales with the NAPL fluorescence. The fill color is based on the relative distribution of each channel’s area to the total waveform area (see callout waveform). The channel-to-color relationship and corresponding wavelengths are given in the upper right corner of the plot.

Hydraulic Pressure (P Dwn): Downhole hydraulic pressure is measured in response to pumping water into the formation at a constant rate. Measurements are logged simultaneously with UVOST data. The resulting log gives insight into the permeability of the soils.

Flow (Q): Water is pumped out of the port of the UVOST-HP probe at a constant rate of 60 mL/min. A change in flow (usually accompanied by an inverse pressure change) is an indicator of hydraulic properties of the soil.

Estimated K: The estimated hydraulic conductivity (K) is internally calculated by utilizing pressure and flow data in conjunction with dissipation test(s) performed at each location. The estimated K is calculated by the equation: K = ln(Q/P’)*20.0 + 7.0.



Note A: The water table has been calculated and plotted at 24.4’ bgs.

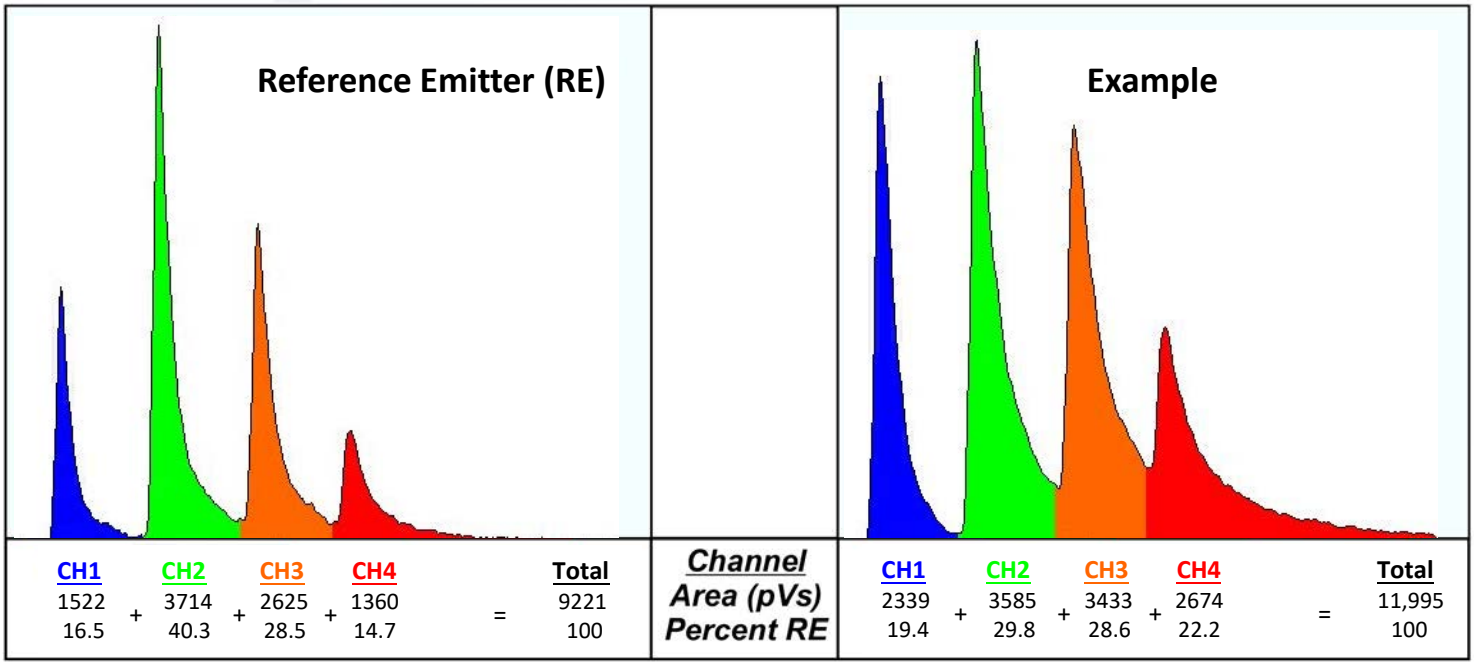
Note B: The circle on the Estimated K plot represents the location(s) of dissipation tests. Here, a single dissipation test was performed at 26.67 bgs’.

Note C: The highest LNAPL response in this log is present in an area of relatively higher permeability, as indicated by low pressure and higher estimated k values at approximately 26’ to 28’.

Note D: The increase in pressure starting near 29’ (transducer is maxed out, 100 psi) is due to low permeability conditions. In this example, the increase in pressure below the LNAPL represents a potential confining unit.

Dakota Technologies
UVOST® Reference Log

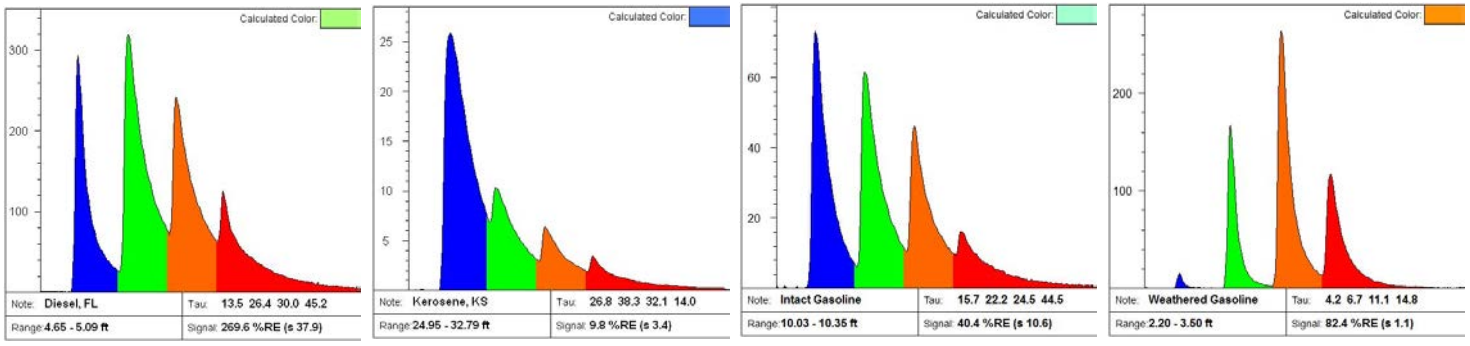
Waveform Signal Calculation



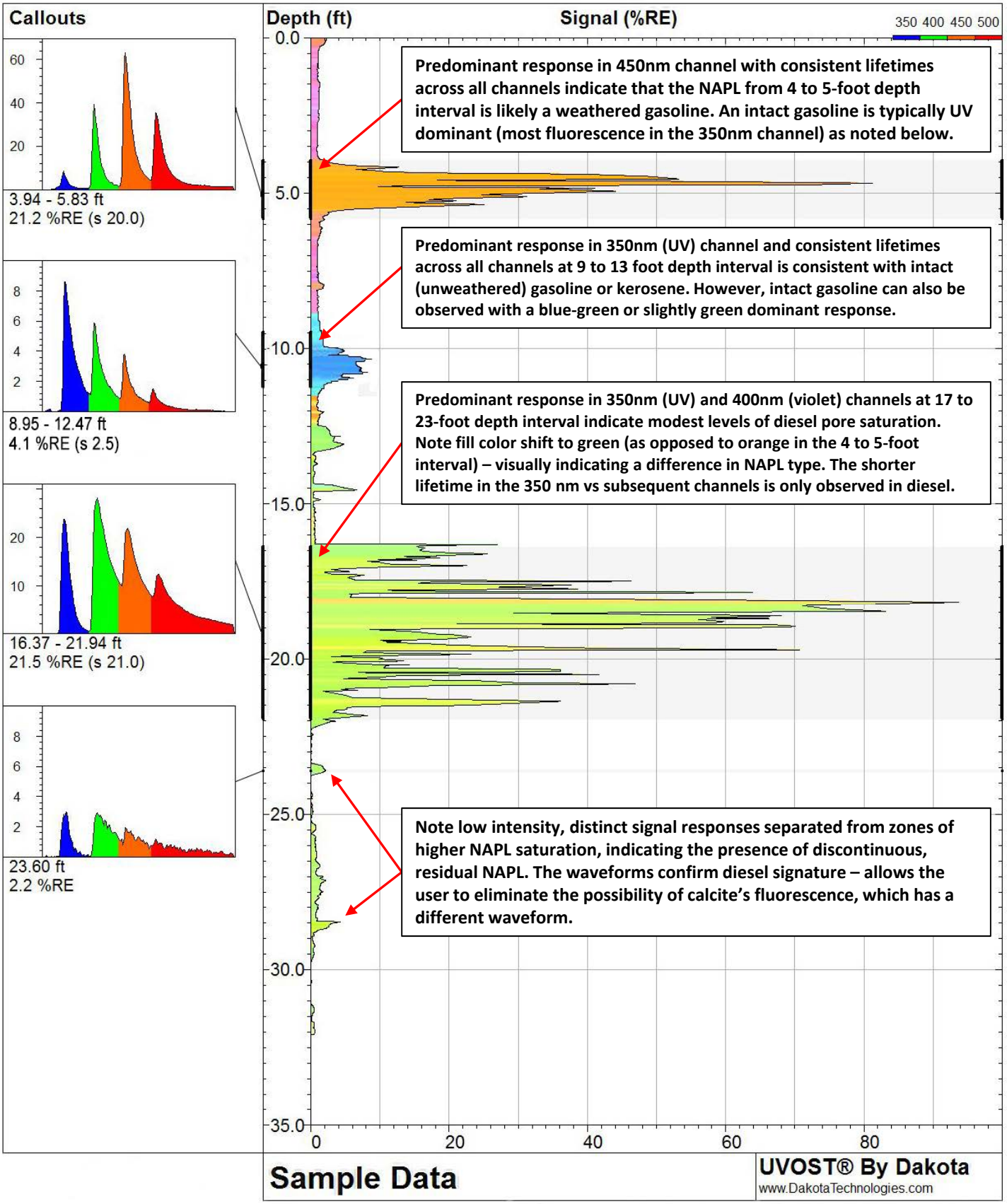
Data Files

***.lif.raw.bin**	Raw data file. Header is ASCII format and contains information stored when the file was initially written (e.g. date, total depth, max signal, GPS, etc., and any information entered by the operator). All Raw waveforms are appended to the bottom of the file in a binary format.
***.lif.plt**	Stores the plot scheme history (e.g. callout depths) for associated Raw file. Transfer along with the Raw file in order to recall previous plots.
***.lif.jpg**	A .jpg image of the OST log including the main signal vs. depth plot, callouts, information, etc.
***.lif.dat.txt**	Data export of a single Raw file. Tab delimited format. No string header is provided for the columns to make importing into some programs easier. Each row is a unique depth reading. The columns are: 1-Depth; 2-Total Signal (%RE); 3-CH1%; 4-Ch2%; 5-CH3%; 6-Ch4%; 7-Rate; 8-EC Depth; 9-EC Signal; 10-Hammer Rate Depth; 11-Hammer Rate; 12-Color (RRGGBB). Summing channels 1 to 4 yields the Total Signal.
***.lif.sum.txt**	A summary file for a number of Raw files. ASCII tab delimited format. The file contains a string header. The summary includes one row for each Raw file and contains information for each filed including: the file name, GPS coordinates, max depth, max signal, and depth at which the max signal occurred.
***.lif.log.txt**	An activity log generated automatically is located in the OST application directory in the 'log' subfolder. Each OST unit the computer operates will generate a separate log file per month. A log file contains much of the header information contained within each separate Raw file, including: data rate, total depth, max signal, etc.

Common Waveforms (highly dependent on soil, weathering, etc.)



Dakota Technologies
UVOST® Reference Log



High Resolution Site Characterization Report

UVOST®-HP Investigation

Project: UDEX – (Former PES Refinery)

3144 West Passyunk Avenue
Philadelphia, PA

DTC Project No: 0173.2023

August 11, 2023
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1.0 General Site Information

Dakota Technologies Company, LLC (DTC) was contracted by Stantec to perform a High Resolution Site Characterization (HRSC) investigation at UDEX – (Former PES Refinery), located at 3144 West Passyunk Avenue, Philadelphia, PA. The LIF phase of the investigation employed the use of Dakota's Ultra-Violet Optical Screening Tool (UVOST®) combined with Hydraulic Profiling (HP) sensor to investigate the extent of the LNAPL plume.

A description of the UVOST® technology, waveforms, cluster plots, limitations of LIF, and a UVOST® Reference Log are included in this report.

2.0 Laser-Induced Fluorescence - UVOST® Technology Overview

Fluorescence is luminescent behavior of certain compounds where absorbed excitation light stimulates the emission of photons (light) of a longer wavelength relative to the source emission. The release of these photons can be used to detect small amounts of certain substances such as Polycyclic Aromatic Hydrocarbons (PAHs) in a larger matrix (e.g., soil). This method of PAH detection has been used in laboratories for decades. With the commercial availability of lasers and optical fibers, this technology can also be applied *in situ* in the field to identify the presence of light non-aqueous phase liquids (LNAPL).

The UVOST® system sends ultraviolet (UV) laser light (308 nanometer wavelength) through a fiber optic cable strung through probe rods on a direct push drill rig. The light is reflected by a parabolic mirror within the Shock-Protected Optical Chamber (SPOC) through a sapphire window on the side of the SPOC. As the probe is advanced, soil that is contiguous to the sapphire window is exposed to the pulsed UV laser light. If PAHs (compounds in petroleum, oils and lubricants that fluoresce) are present, these PAHs absorb a portion of the UV light and enter an electronically excited state. When returning to ground state, the PAHs release excess absorbed energy by emitting photons of longer wavelength light than the original UV excitation light. This fluorescence is transmitted through a return fiber to the surface where the OST system transforms the fluorescence light into multi-wavelength waveform "signals" that represent the intensity, wavelength, and lifetime information of the return fluorescence.

The UVOST system is designed to focus on NAPL, the source term contaminant at many sites. Vapor,

dissolved, and absorbed hydrocarbon phases are usually invisible to the UVOST system, with dissolved phase PAHs in the vicinity of heavy NAPLs like coal tar being a notable (and confounding) exception. In most cases, only the NAPL-entrained PAHs respond to the UVOST system. These phase-separate PAHs can be free product in the subsurface or light sheens of product adsorbed to soil particles. In addition, valid fluorescence data can be collected both above and below the water table.

2.1 Reference Emitter

The UVOST® system is checked for optical quality by observing the background signal for sources of signal in the fiber, filter, mirror, and sapphire window. A proprietary LNAPL mixture known as the Reference Emitter (RE) is used for quality assurance and quality control for the qualitative and semi-quantitative response of the UVOST. During the pre-log calibration, a cuvette containing the RE fluid is placed over the sapphire window; the response from the RE is recorded and the RE's fluorescence intensity (brightness) is then used as a definition of fluorescence intensity of 100%. Typically, the RE will fall between 10,000 and 12,000 picovolt-seconds (pVs), which is a measure of waveform area or total fluorescence. The system background fluorescence can vary from 0.1% to 1% RE, or 0 to 100 pVs. The operator ensures the RE response has the correct shape and intensity so that the UVOST® system is "calibrated" for each log and minimizes system background by keeping the mirror and window clean and the SPOC purged of moisture. All the fluorescence responses obtained in the subsequent borehole are gauged against the RE's fluorescence response.

The relationship between the instrument responses from NAPL in the subsurface and the RE depends on the properties of the NAPL. The calibration of the system is therefore not to a concentration, but to a fluorescent material with a known waveform, intensity, and color. In this way, all UVOST data points are normalized to the RE, allowing for an "apples to apples" comparisons of boring data across the site, from logs completed during earlier mobilizations, or at other locations. There are NAPLs that fluoresce with a higher signal than the RE, so they readily return fluorescence intensity greater than 100%.

The combined fluorescence of natural soils and system background (the optic surfaces) generally fall in the range 0.25-0.75% RE. A signal response greater than 1.0% RE *typically* indicates the presence of LNAPL, however, various natural materials including calcareous and carbonaceous soils may produce "false positive" results with signal responses as high as 10% to 20% RE. Buried wood and organics can be

even more fluorescent. Therefore, it is crucial that consumers of fluorescence data rigorously inspect the fluorescence responses to distinguish the presence of NAPL from false positives from natural soils and organic materials.

2.2 Waveforms

Waveforms are fluorescence "signatures" that are used to differentiate LNAPL types such as kerosene versus intact gasoline, weathered gasoline versus diesel fuel, etc. **Waveforms also provide the capability to effectively differentiate false positives from intact LNAPLs**. Various waveform patterns for pure PAHs, fuels/oils, weathered gasoline, and false positive substances can be viewed at Dakota's website: http://www.dakotatechnologies.com/learn-more/intro-to-lif/data-interpretation.

Figure 1 shows three sample waveforms used to characterize NAPL.

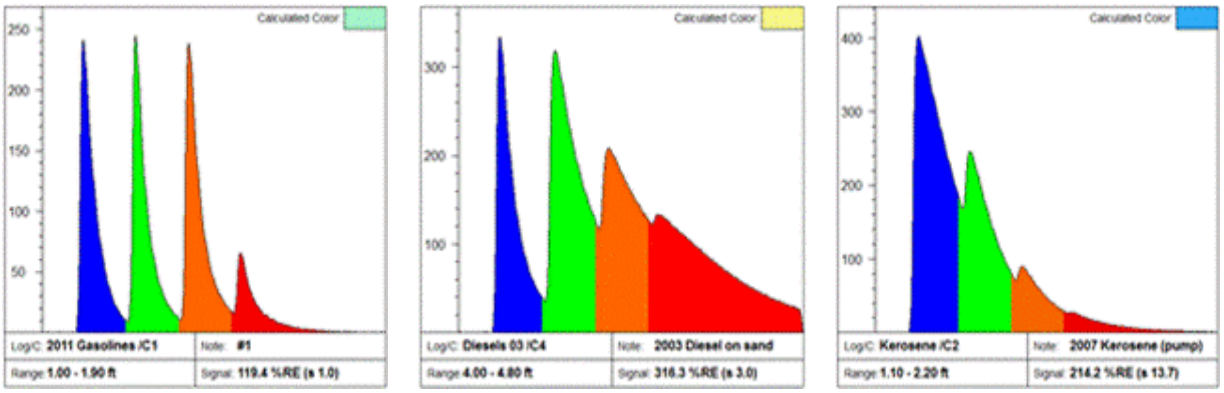


Figure 1: Waveforms generated by gasoline, diesel and kerosene. The four colored peaks in the waveforms (referred to as channels) represent different PAH emission wavelengths (colors) that are filtered by the UVOST system into four categories: 350 nanometers (blue), 400 nanometers (green), 450 nanometers (orange), and 500 nanometers (red). In the waveform callouts (graphs from selected parts of a log) shown, the y-axis represents the intensity of the fluorescence signal (V) and the x-axis is time (approximately 350-nanoseconds).

The relative contribution of each channel's area to the total waveform area defines the Signal (% RE) fill color on the main UVOST log. For example, a waveform with a stronger contribution by the blue channel relative to the other three channels will plot with a bluish color on the UVOST log (see the kerosene waveform in Figure 1). In the case of the RE waveform, the calculated color is a pale green that is displayed in a box in the upper right-hand corner of the waveform plot window.

The shorter wavelength channels on the left (blue/green) represent smaller PAHs with two to three

benzene rings; the middle two channels (green/orange) contain response from intermediate size PAHs with three to four benzene rings; the rightmost channels (orange/red) correspond to larger PAHs with four or more benzene rings. Note, the blue, green, orange, and red colors associated with the four channel wavelengths are **not** the actual color of fluorescence, they are place-holder colors. Actual fluorescence colors range from dominantly ultraviolet in the first channel (invisible to the human eye or visible-light spectrum cameras such as the OIP (Optical Image Profiler)) increasing in wavelength from violet to green moving from left to right in the waveform.

The four waveform channels are sequentially delayed by the UVOST system so that they will arrive as a "train" on the graph. The amplitude of each channel corresponds to the intensity of the fluorescence released by the PAHs following the excitation by the UVOST laser pulse. The time it takes for the excitation energy to dissipate (and the subsequent fluorescence to fade away to darkness) is recorded on the times axis and leads to a "ski slope" on the right side of each peak. The point in time at which each channel's fluorescence has decayed to approximately 1/e of the maximum is referred to as that channel's "lifetime". In general, longer lifetimes (wide peaks) are indicative of intact LNAPL as opposed to false positive substances, which usually have shorter lifetimes (skinny peaks). Heavy NAPLs like coal tar are a notable exception, as they experience intramolecular energy transfer during fluorescence due to their excessive PAH content, resulting in narrow peaks. High or atmospheric levels of molecular oxygen present under "bench-top" conditions artificially lower fluorescence lifetimes compared to in-situ conditions where oxygen is lacking due to bioremediation processes.

2.3 Cluster Plots

Cluster plots provide a method for viewing the waveform data in the context of a Cartesian coordinate system. The cluster plot axes correspond to fluorescence wavelength (λ) on the X-axis and the fluorescence lifetime (τ) on the Y-axis as measured and weighted in the four channels. Data points collected during UVOST® logging are hexadecimal color-coded based on fluorescence lifetimes and wavelengths calculated from the waveform and are plotted individually in the cluster plot. In this fashion, all data points from a boring are sorted by waveform and can be viewed in a single figure, allowing intuitive comparisons to be made among potential fluorescence categories. Figure 2 demonstrates the relationship between data points in the log and how they appear in the cluster plot.

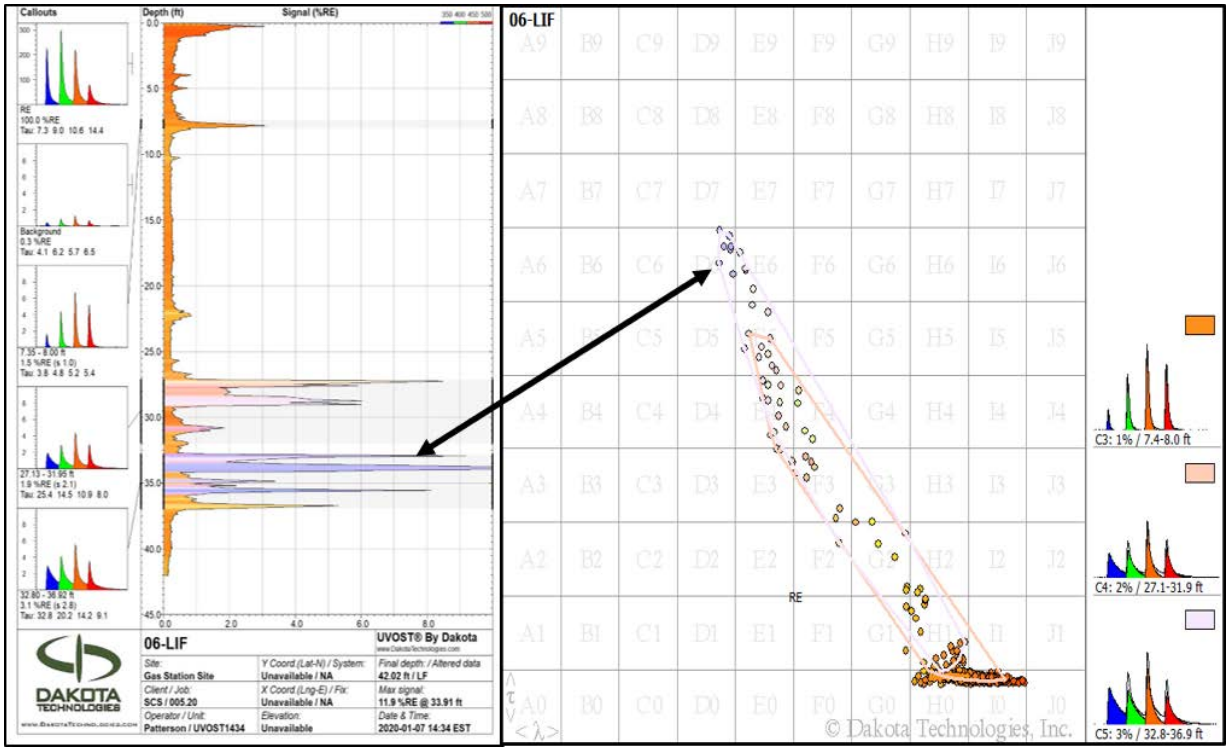


Figure 2: The X-axis of the Cluster Plot (right) corresponds to the balance of the four colored channels in the waveform; the Y-axis relates to fluorescence decay or "lifetimes" of the four-waveform channels.

Responses dominated in the blue/green channels will plot in the left side of the cluster plot; likewise, if the orange and red channels make up bulk of the fluorescence response, the data point will plot on the right side of the cluster. Waveforms with a relatively equivalent contribution from all four channels, or with the two central peaks dominating, will plot somewhere in the middle. Similarly, longer-lived responses (wide at the base of the waveform) will plot higher on the Y-axis and waveforms with shorter lifetimes (narrow at the base of the waveform) plot lower on the Y-axis.

To further aid in determining the source on the UVOST® log for a point cluster, the main callouts from the log with their respective depth intervals are depicted on the upper left corner of the cluster plot (not depicted here). Polygons (for depth ranges) and circled data points (for discrete depths) with the same coloration as the callout waveform enclose the point clusters included in that callout.

Weathering and formulation of each LNAPL will influence where the LNAPL appears on the cluster plot.

In other words, it is **not** possible to identify a fuel solely by its location on a cluster plot. In Figure 3, the formulation of the 2 different diesel signatures labeled 1995 and 2007, fall into different regions of the plot. This is due to the difference in Lifetime and Wavelength characteristics of the 4 channels that make up these slightly different diesel waveforms.

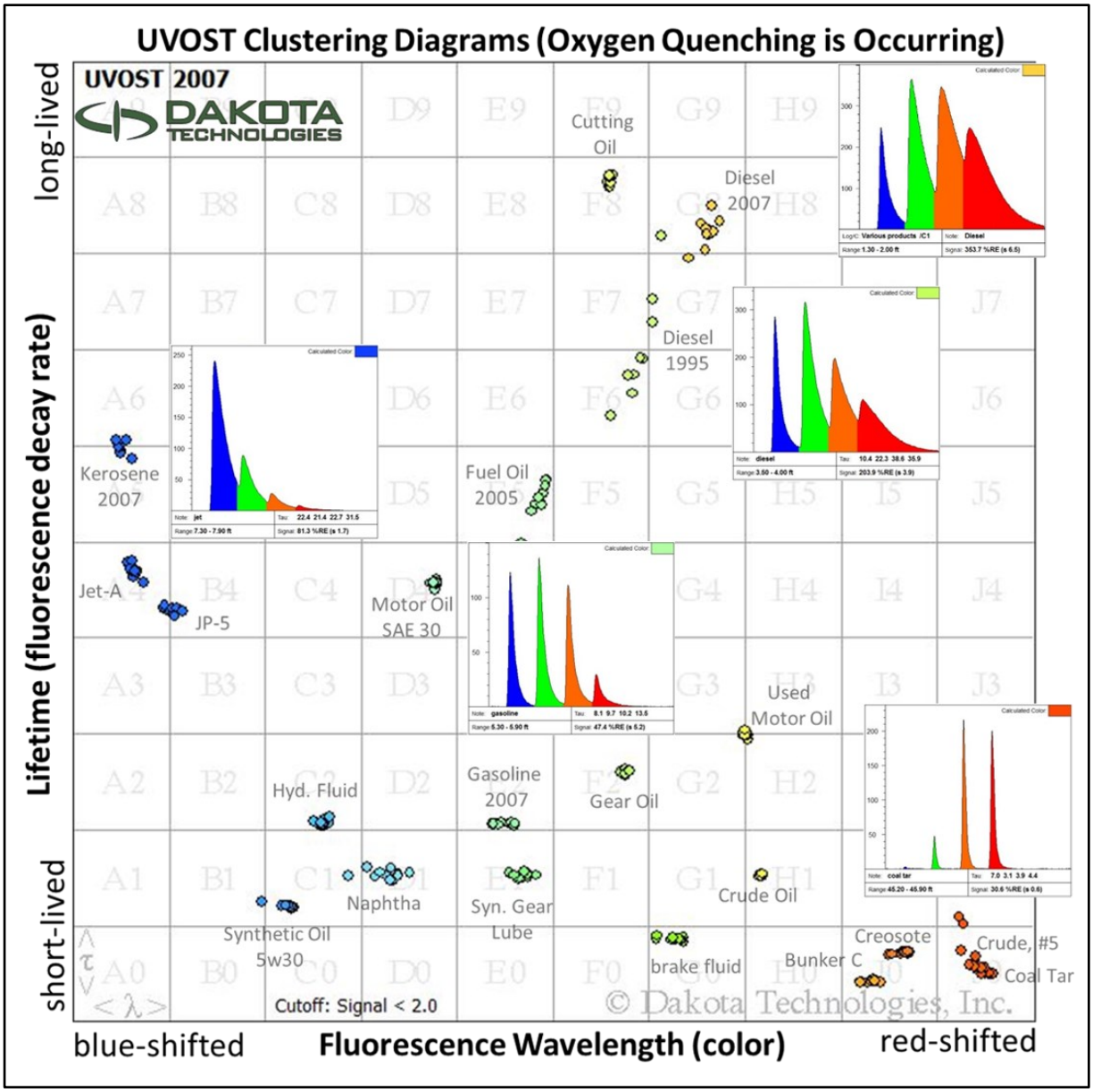


Figure 3: Reference examples of LNAPL types that were placed on the window of a UVOST® system in a laboratory setting. The cluster plot positions displayed illustrates the cluster separation of LNAPL types achievable with the UVOST and is not indicative of exclusive plotting location—LNAPL may plot across multiple grid cells as the plume weathers or interacts with the native soil.

Cluster plots from the UVOST boreholes will be included as an Appendix to this report (if applicable).

3.0 Hydraulic Profiling (HP) Description

The Hydraulic Profiling add-on is a logging tool that measures the pressure required to inject a flow of water into the soil as the probe is advanced into the subsurface. The injection pressure log is an excellent indicator of formation permeability. In addition to injection pressure, hydrostatic pressure can be measured under a zero flow condition, called a dissipation test. This allows a calculation of potentiometric surface (water table) upon successful completion of the dissipation test.

Prior to starting a log, quality assurance (QA) checks on the down-hole transducer are performed to ensure proper function. The probe is submerged in a reference tube and filled with water. A reading is taken at the hydraulic port when it is submerged to a depth of 1 foot and a second reading at 0 feet, or baseline, under zero flow conditions. The reading at 0 feet, or the baseline pressure, is equal to the measurement of atmospheric pressure. Subtracting reading 2 from reading 1 should produce a result of 0.433 psi (+/- 10%), which is the hydrostatic weight of a 1 foot column of water.

The UVOST®-HP probe is advanced into the ground at a rate of approximately 2 cm/sec. The pump in the HP flow module draws water from the supply tank and pumps water down the trunk line at a constant flow rate (60 mL/min). The downhole transducer monitors the pressure generated by injecting water into the formation matrix. The log provides graphs of the pressure and flow rate versus depth alongside the fluorescence plot. If a dissipation test is performed below the water table and the test successfully stabilizes, the result can be corrected to an absolute hydrostatic value, from which a potentiometric surface (water table) can be calculated. Using the calculated water table to correct for hydrostatic pressure increase, a hydraulic conductivity (K) value for a given depth below the water table can be estimated using the following equation:

$$\mathbf{K = \ln(Q/P') * 20.0 + 7.0}$$

where P'= downhole pressure – (0.433 * depth below water table) – atmospheric pressure, and Q is equal to flow. K values above the water table are also reported after a successful dissipation test even though they are suspect due to varying permeability behavior of dry soils. These values still maintain some qualitative value to the eye and may lend insight into preferential pathways in the vadose zone.

HP data can be incorporated into a 4DIM visualization protocol

4.0 Site-Specific Results and Discussion

Field activities included the completion of 26 UVOST®-HP borings. The target depth for all UVOST®-HP locations was approximately 25' below ground surface (bgs); actual depths ranged between eight' and 30' bgs based on signal responses at the site.

23 of 26 the UVOST®-HP borings pushed, showed at least some signal responses indicative of LNAPL. Of the remaining three borings, only one showed little to no fluorescence to suggest a "clean" location. Two of the three borings were logged again due to refusal or equipment malfunction (fiber optic breaks, software malfunction, amongst other things). See appendix A for details.

Water table calculation data was collected at 24 of 26 locations. Dissipation tests require coarse grained material for these tests to fully equilibrate. Of those, 14 were considered stable dissipation tests. The remaining 12 soil near the piezometric surface was likely tight and fine grained, thus limiting the number of dissipation tests that reached a usable and stable end point.

The site lithology appears somewhat heterogeneous, as seen by the HP pressure and Est. K data, and NAPL distribution relative to depth. All locations displayed HP data indicating tight, fine grained soil behavior at different depths between 0' and 30'. On a few occasions HP data suggested relatively coarse grained soil for the majority of the log. See Appendix B for more details.

Further lines of evidence such as soil cores and analytical lab results are needed to fully substantiate the UVOST data.

4.1 Site UVOST Discussion: Waveforms

In this section, several waveforms have been selected to assist with understanding the major waveforms encountered on the site, including background (natural soil fluorescence) waveforms and LNAPL-like responses (See Figures 4). Several waveforms were captured by UVOST® at this site. Their corresponding Cluster Plot diagrams were created to aid with data interpretation. Waveforms and Cluster plot diagrams are a very powerful tool used in conjunction with other lines of evidence to develop a conceptual site

model of how the NAPL body varies in fluorescent nature with respect to depth below surface and even across the entire site. **This data is also useful for identifying false positives such as limestone or other fluorescing material.**

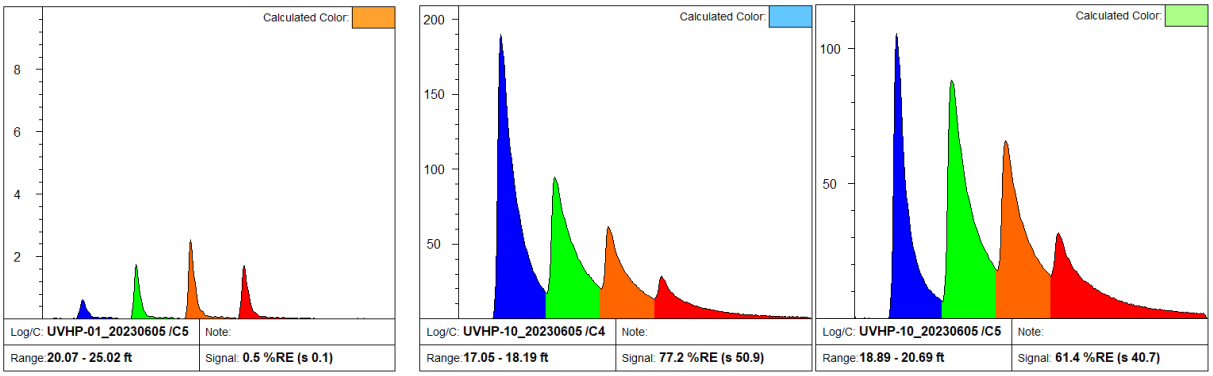


Figure 4: Waveforms typical across the site: The natural (presumed clean) soil background appears in the left waveform. The blue-dominant waveform from UVHP-10_202306065 at 17.1-18.2' in the center may represent a relatively intact LNAPL. The callout from UVHP-010_20230605 at 18.9-20.7' could represent a weathered version of center waveform.

4.2 Site UVOST Discussion: Cluster Plots

A Clustering Plot diagram for each individual log is displayed in the appropriate Appendix below. Typically, the low soil signal will be included with the clustering presentation to help distinguish this natural signal from low NAPL signal. This section is a summary of the site's cluster diagram output data.

Cluster Plot – UVHP-04_20230605

Callouts 3, 4, and 5 in the cluster image below represent natural, soil background fluorescence. This is depicted by the orange filled ovals seen along the bottom axis of the cartesian plane. Such waveforms are attributed by short lifetimes and low signal fluorescence typical in "clean" soil.

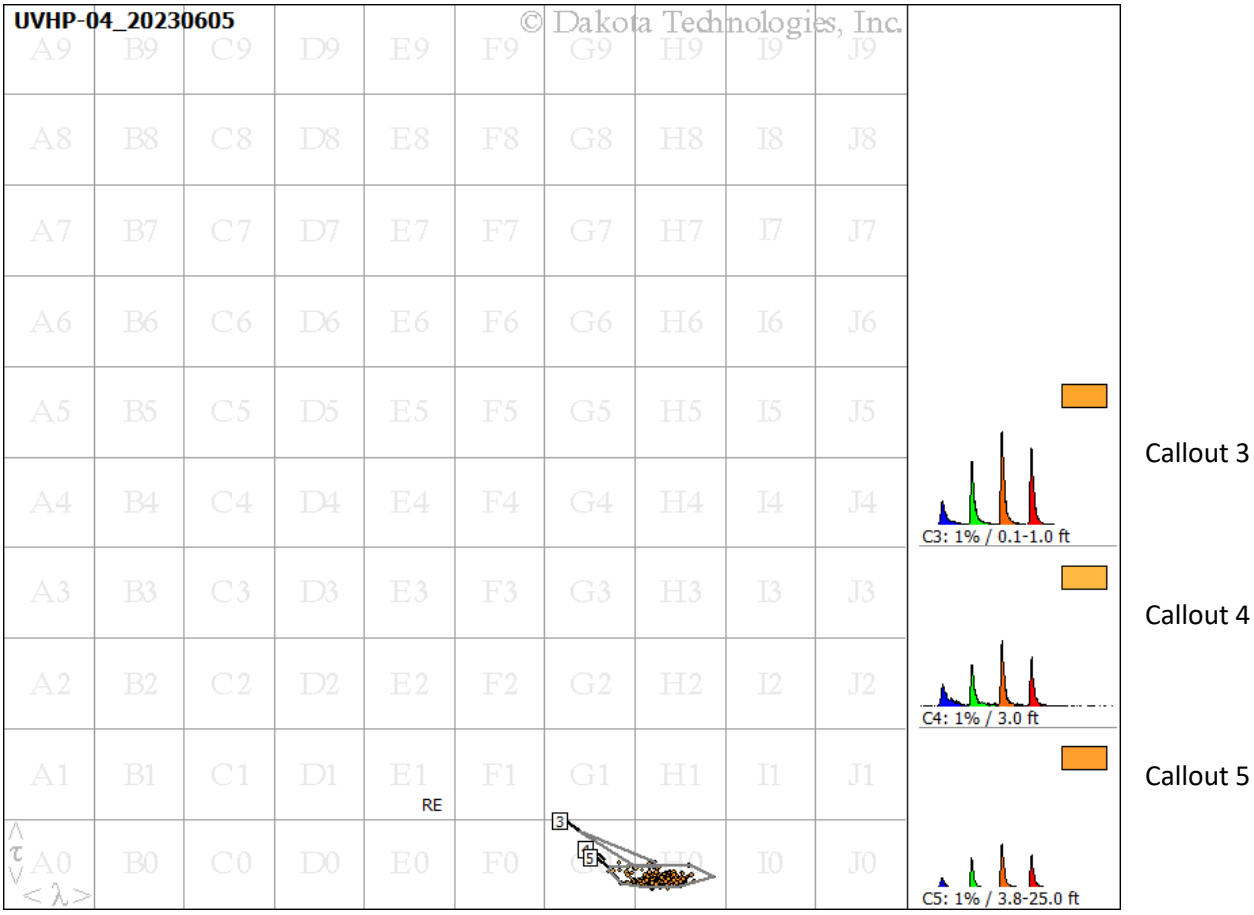


Figure 5: UVHP-04_20230605 represents a NAPL-free result or a location with only very little NAPL present in the form of sheen or residue.

Cluster Plot – UVHP-09_20230606

Callout 3, taken from 17.6 – 19.0' in the image below, represents a blue-dominant waveform (350nm channel). This is indicative of NAPL's such as synthetic oils, hydraulic oils or naphtha as shown in Figure 3. Callout 5, green-dominant (400nm channel) waveform based on wavelength strength and fluorescence lifetimes would suggest a different NAPL for this boring.

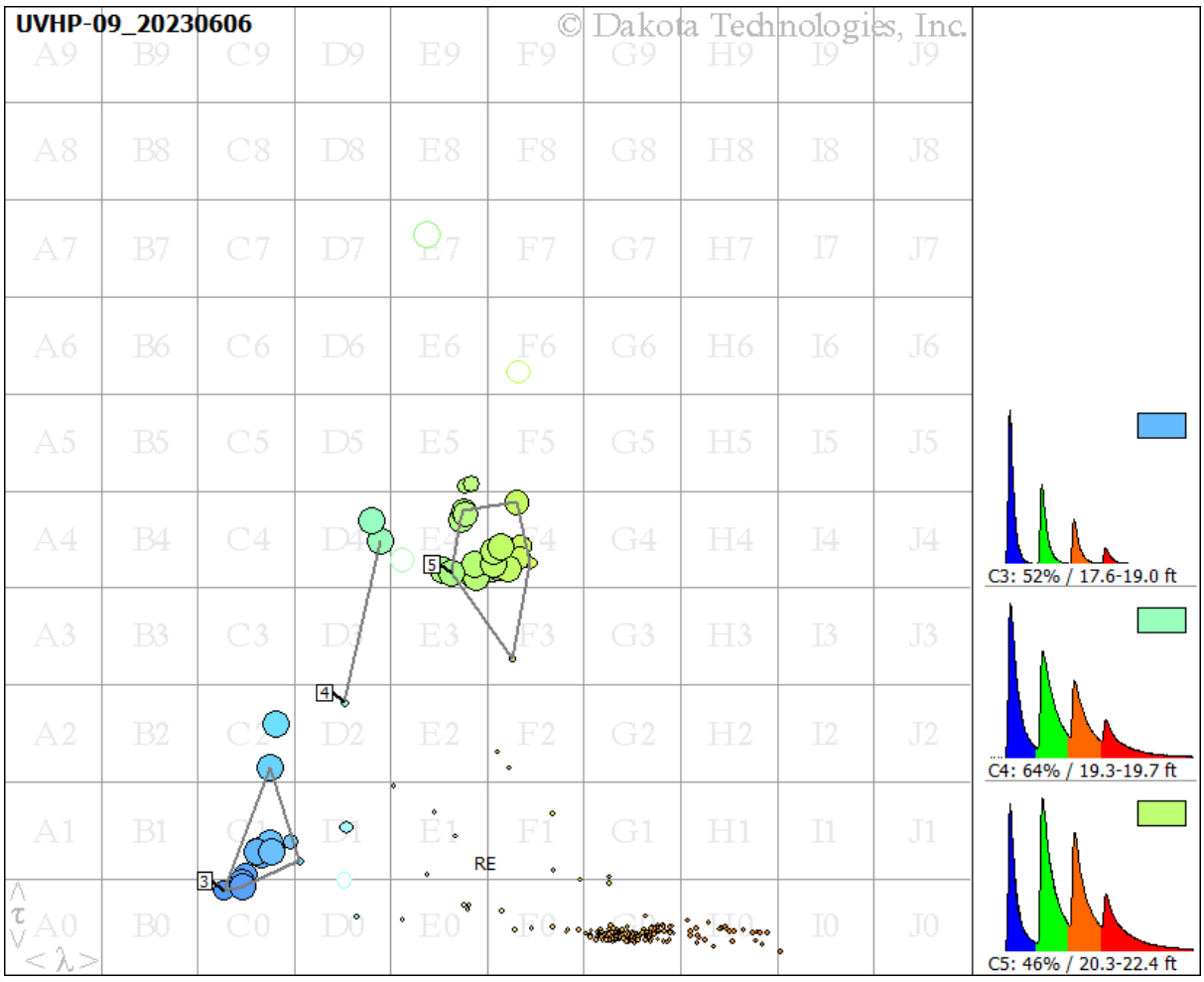


Figure 6: UVHP-09_20230606 likely represents two distinct LNAPL's encountered in one boring.

Cluster Plot – UVHP-13c_20230601

Unlike the previous two cluster plots, this one would suggest a weathered LNAPL. This is depicted by the red shift that occurs between waveforms callout 3 and callout 4. Graphically the waveforms create a trail that slopes towards the background fluorescence cluster located at the bottom of the Cartesian plot in cells H0 and I0.

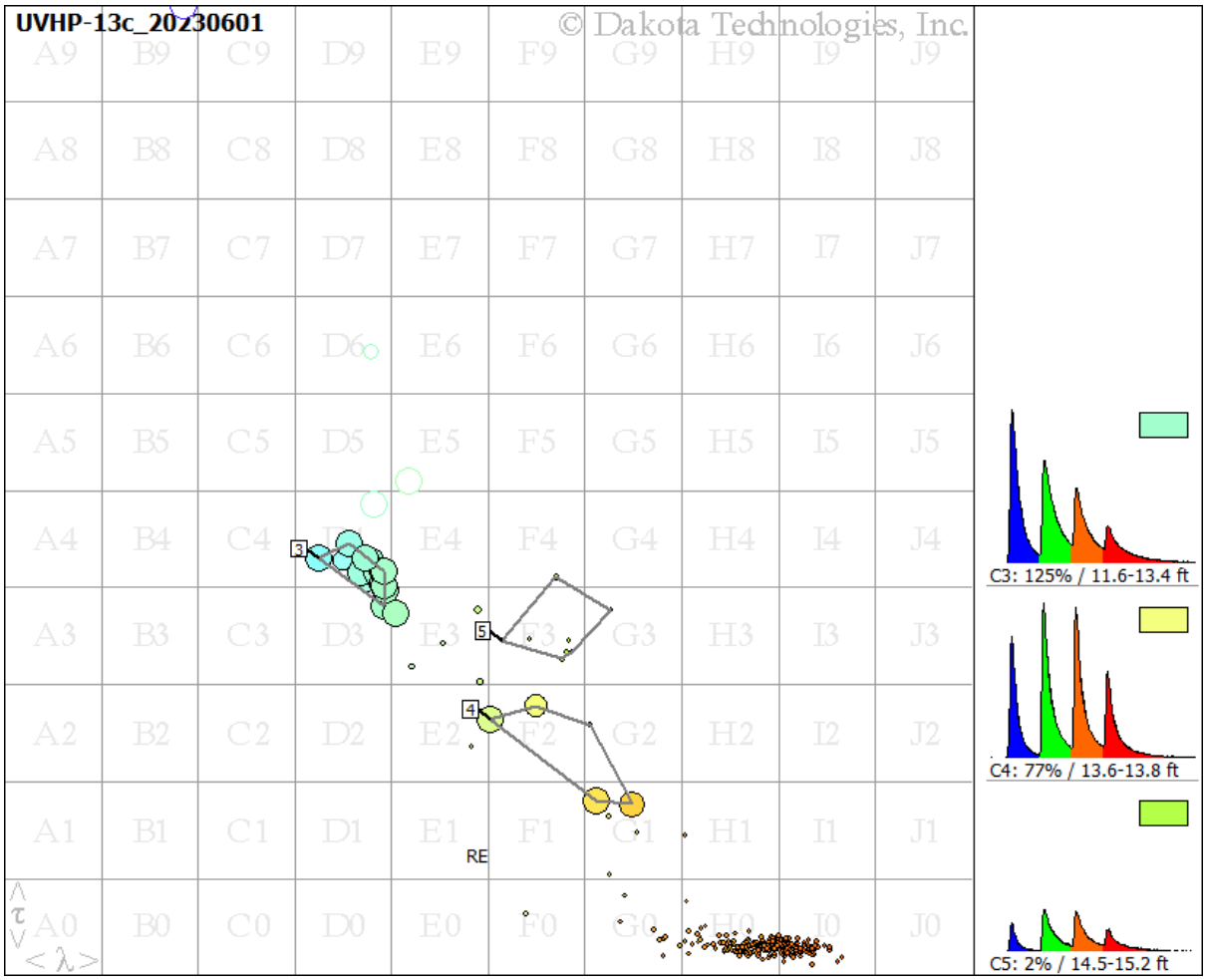


Figure 7: UVHP-13c_20230601 depicts some other of the waveforms encountered on site.

Composite Cluster Plot

This image shows the sum of all the cluster images created at this site.

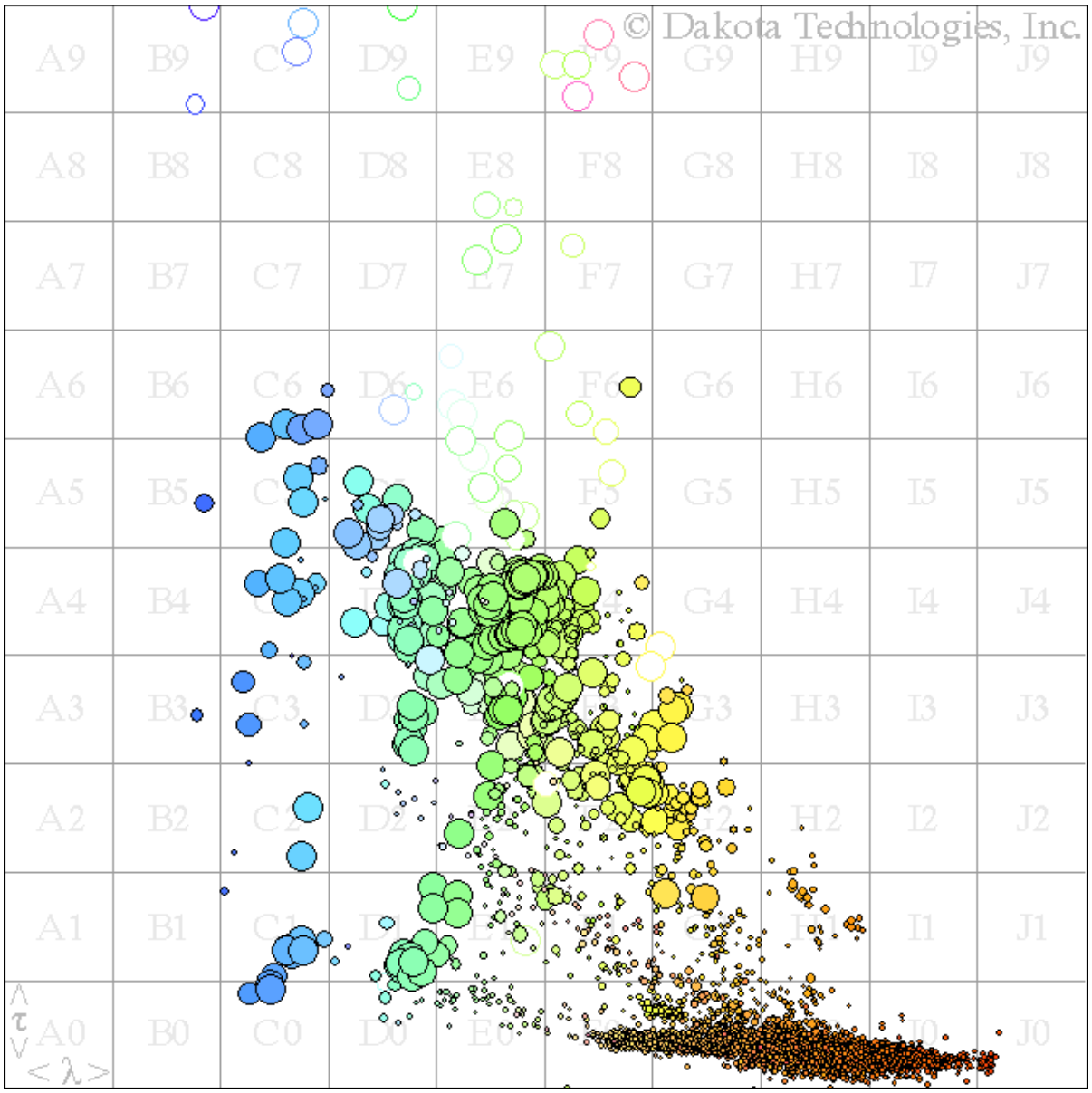


Figure 8: Composite Cluster Plot for the site.

4.3 Site Advanced Analysis (NNLS)

An analyst at Dakota Technologies, Inc. met online with Andrew Klingbeil to discuss the *in situ* UVOST data with respect to multiple lines of evidence gathered on the nature of the soils and NAPLs involved at the site. It was decided it would be beneficial to perform a non-negative least squares (NNLS) analysis of the UVOST waveform data in order to separate the general classes of NAPL responses into three main classes. The end goal is to be able to visualize the differing LIF responses as separate 3D bodies – each representing a different class of NAPL.

The waveforms chosen to represent the NAPL classes are illustrated in Figure 7. For reasons not fully understood, there appeared to be both short- and long-lived responses emitted from both the light naphtha range (**LNR**) and reformate (**REF**) NAPLs. Subsequently, two waveforms were required to assemble all the suspected light naphtha range NAPL waveforms into one data set (**LNR-LL** and **LNR-SL)** and two waveforms were required to assemble all the suspected reformate NAPL waveforms into one data set (**REF-LL** and **REF-SL)**. Finally, a fermentation-related NAPL sludge (**FERM**) suspected waveform was included to round out the Basis Set of waveforms from which the NNLS software draws upon to determine the amount of each to best fit each in-situ waveform in every log.

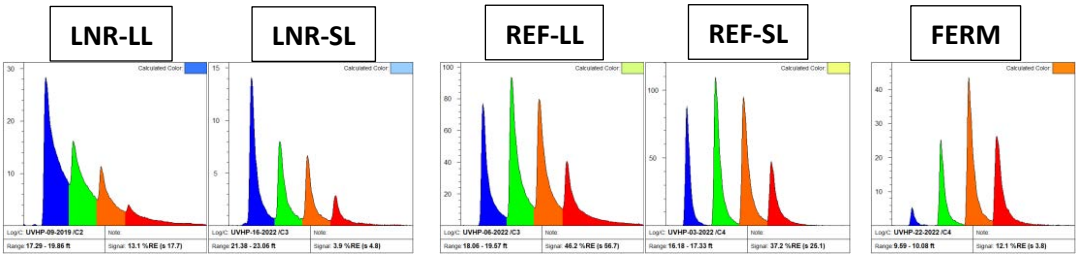


Figure 7. Basis Set waveforms used for NNLS fluorescence filtering.

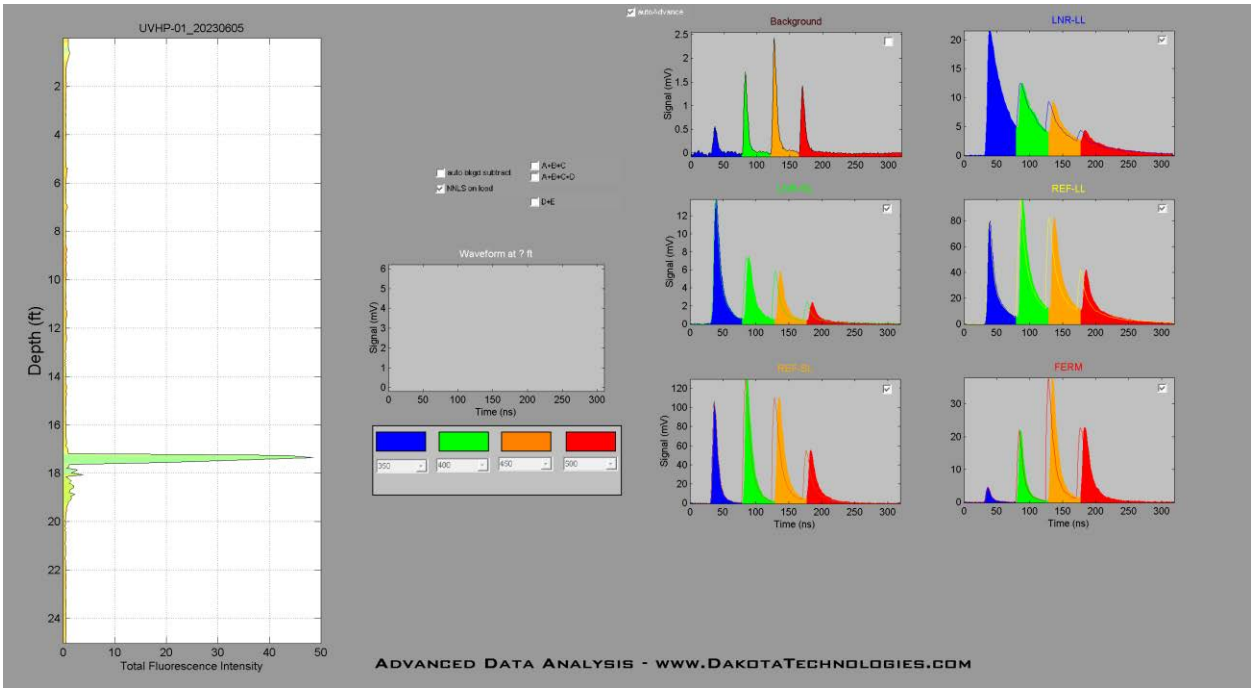


Figure 8. The NNLS analysis setup – with the Basis Set waveforms shown at right.

Figure 8 contains a screenshot of the NNLS processing software set up to analyze log UV-HP-01-20230605. Appendix D contains the NNLS processing output for each log analysis. These figures contain the relative contribution for each of the Basis Set waveforms for every depth of each field log. The residual column at far right illustrates how well the sum of the Basis Set waveforms matched the original Field Data waveforms. The data in these graphs were also saved as numerical text files (depth vs % RE) and were made available to Stantec for subsequent NAPL CSM visualization.

5.0 GPS Data/Survey Control

Dakota surveyed the UVOST® borehole locations using a Trimble Geo7x centimeter grade GPS. Differential correction was applied to enhance the accuracy of the field collected data points. This differential correction relies on publicly available base station data. The proximity of the site to the nearest high-quality base station can have an impact on positional accuracy. When possible, Dakota uses the Continuously Operating Reference Station (CORS) operated by the national Geodetic Survey (NGS). When a CORS base station is not available, Dakota uses the closest alternative selected based on the integrity index provided by the GPS Pathfinder Office processing software. Dakota provides coordinates

in NAD 83 US Feet, with the appropriate state plane projection.

6.0 Limitations

The UVOST® system is limited in that it can only detect phase-separated material, making it an ideal tool for source delineation. The UVOST® system does not respond to dissolved phase VOCs or SVOCs. In addition, the soil matrix can influence how a product fluoresces. UVOST® responses are typically higher on sands than in clays. Due to fluorescence quenching, the UVOST® system should not be used to delineate coal tars and creosotes.

The use of specific language to identify UVOST® signal as LNAPL, gasoline, diesel or other specific petroleum, oil or lubricant types are intended to describe these compounds within the limited context of the UVOST® data set and must be interpreted with other lines of evidence to confirm stated findings. Signal identified and listed in this report as false positives, natural soil, etc. should also be viewed within these same constraints.

The analysis and opinions expressed in this report are based upon data obtained from the specific test locations and from other information discussed in this report. Exceptions, if any, are discussed in the accompanying comments section of this report. This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted practices. Reported results shall not be reproduced, except in full, without written approval of Dakota. No warranties, expressed or implied, are intended or made.

The HP portion of the tool is limited to a max working depth of 120 feet below ground water and the pressure transducer output range is 0-100 psi. Coarse (sandy), saturated soils are required for dissipation tests to be performed. Successful (fully stabilized) dissipations are required for water table and hydraulic conductivity (Est. K) calculations. The lower K boundary for the empirical calculation model is about 0.1 ft./day and the upper boundary is near 75 ft./day.

Hydraulic data acquired from the UVOST®-HP tool should be reviewed in conjunction with representative soil samples to best understand soil behavior.

Appendix A

UVOST®-HP Field Summary

DAKOTA TECHNOLOGIES

UVOST®-HP Field Summary Log

UDEX

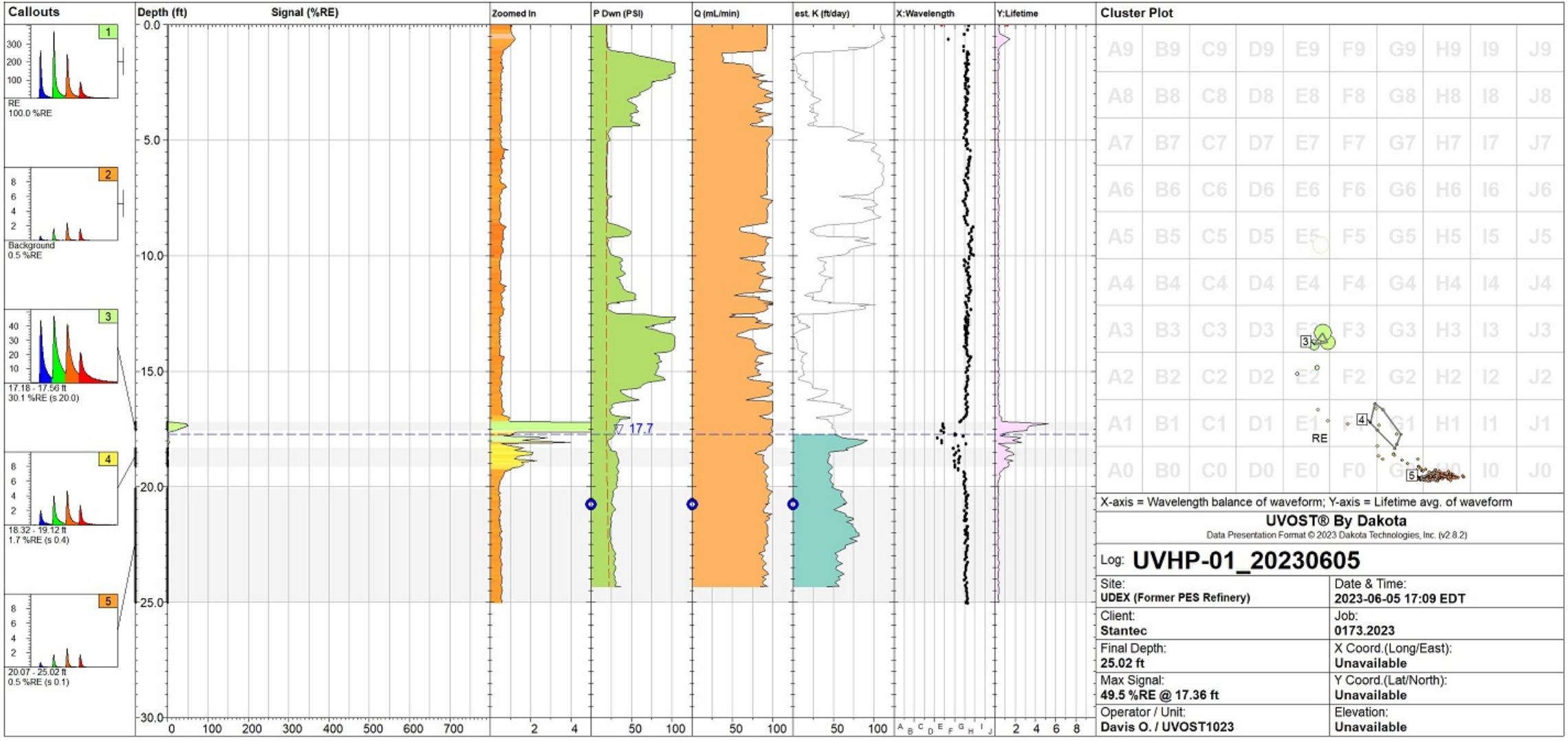
Philadelphia, PA

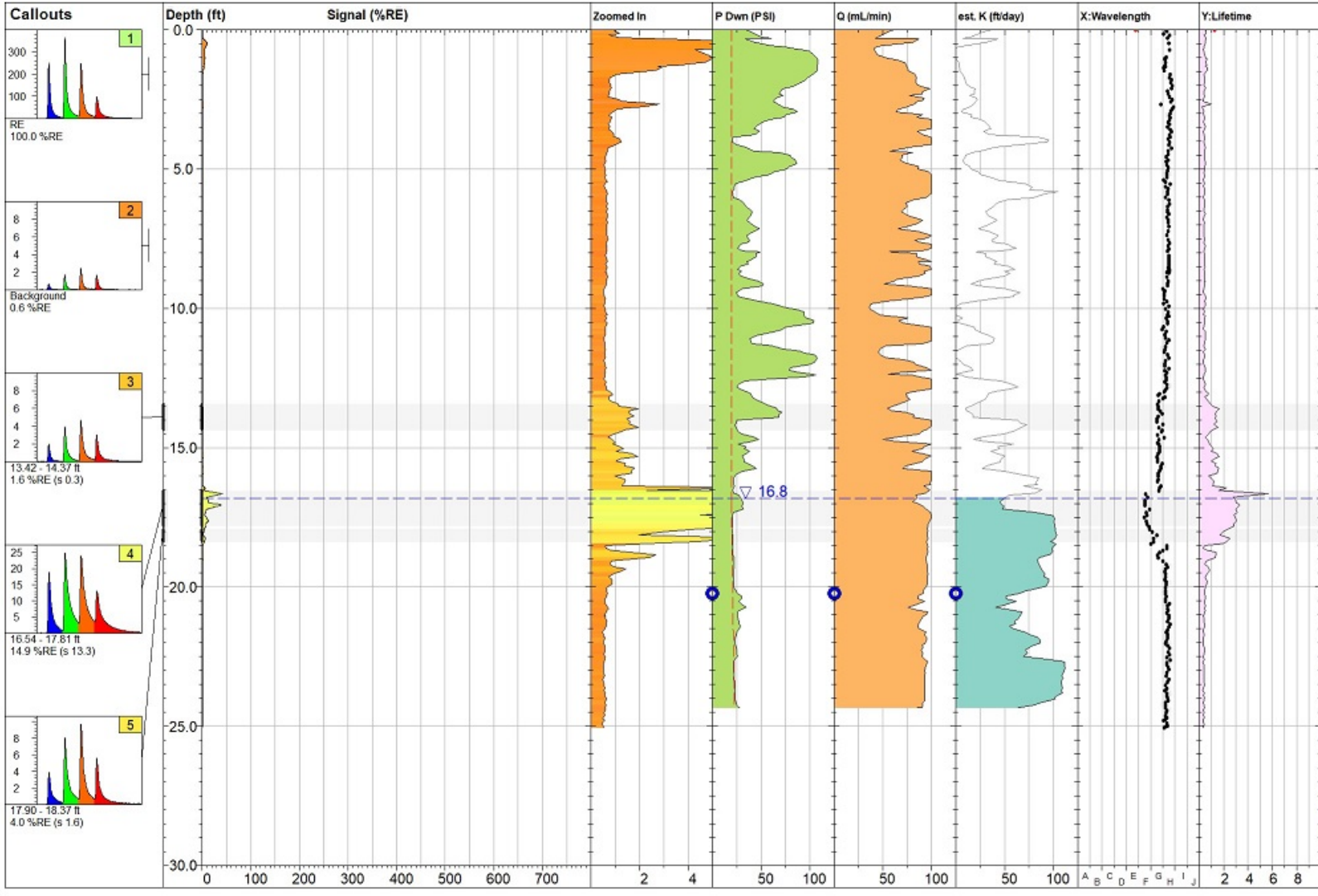
File Log ID	Date / Time	Pre-Probe (ft)	Final Depth (ft)	Max Signal (%RE)	Max Signal Depth (ft)	Initial RE Area (pVs)	Background Area (pVs)	Stable Dissipation (Yes or No)	Calculated Water Table (bgs)	Fluorescence Top - Bottom (ft)
UVHP-01_20230605	6/5/23 5:09 PM	1.5	25.0	50	17.4	10109	48	Yes	17.7	17.1-19.3
UVHP-02_20230605	6/5/23 2:55 PM	1	25.0	42	16.7	10382	65	Yes	16.8	13.4-18.9
UVHP-03_20230601	6/1/23 9:04 AM	1.5	25.6	103	18.3	11083	23	Yes	17.9	17.8-19.8
UVHP-04_20230605	6/5/23 5:52 PM	1.5	25.0	2	1.0	10059	46	Yes	18.0	N/A
UVHP-05 A_20230601	6/1/23 10:54 AM	1.5	25.7	510	15.0	10555	13	No	15.2	12.6-16.4, 16.7-17.3
UVHP-05_20230601	6/1/23 10:17 AM	0	12.1	5	12.1	10132	16	N/A	N/A	See UVHP-05 A
UVHP-06_20230606	6/6/23 1:44 PM	1	25.0	39	18.9	10651	42	No	18.3	17.9-19.1, 19.6-19.9
UVHP-07_20230606	6/6/23 12:43 PM	1.5	26.6	193	26.2	10257	40	No	20.9	18.4-22.0
UVHP-08_20230606	6/6/23 11:24 AM	1.5	30.0	18	24.9	10760	41	No	18.9	23.9-25.0
UVHP-09_20230606	6/6/23 2:58 PM	1.5	25.0	157	20.3	10539	52	Yes	17.7	16.5-16.8, 17.4-22.7
UVHP-10_20230605	6/5/23 4:07 PM	2	24.4	162	18.7	10790	53	Yes	17.1	2.3-4.1, 15.8-20.8
UVHP-11_20230605	6/5/23 3:45 PM	0	8.4	1	0.1	10746	46	N/A	N/A	See UVHP-11_20230606
UVHP-11_20230606	6/6/23 3:48 PM	2	25.0	35	16.4	10238	36	Yes	16.8	16.3-17.2
UVHP-12_20230601	6/1/23 11:58 AM	1	25.1	221	13.6	11174	13	Yes	12.7	11.3-13.8
UVHP-13a_20230602	6/2/23 8:02 AM	1	25.1	234	11.9	10759	10	No	7.2	10.2-15.0
UVHP-13b_20230601	6/1/23 1:44 PM	1	25.2	15	11.3	10295	11	No	11.9	10.2-12.3, 15.0-15.4
UVHP-13c_20230601	6/1/23 2:52 PM	4	25.7	291	11.6	10244	18	No	12.0	10.6-13.8, 14.4-15.2
UVHP-14_20230602	6/2/23 9:33 AM	1.5	25.0	799	14.0	10389	27	No	16.6	11.6-15.2, 15.5-15.9
UVHP-15_20230606	6/6/23 10:18 AM	1.5	30.1	416	20.4	10617	39	No	20.1	1.0-1.5 [(1)], 18.7-25.2
UVHP-20_20230606	6/6/23 9:23 AM	1.5	30.1	287	20.7	10802	40	No	19.2	1.5-2.3, 16.7-23.7
UVHP-21_20230606	6/6/23 8:18 AM	1.5	30.0	480	17.3	10761	39	No	17.1	14.5-21.6
UVHP-22_20230602	6/2/23 10:19 AM	1	25.2	45	12.3	10862	12	No	10.4	9.4-10.1, 11.1-13.7
UVHP-23_20230605	6/5/23 12:25 PM	1	19.9	33	11.1	11313	1	Yes	11.4	11.0-11.6
UVHP-24_20230602	6/2/23 12:27 PM	1.5	25.0	3	12.0	10482	4	Yes	12.6	11.7-13.1
UVHP-25_20230602	6/2/23 11:40 AM	1	25.0	283	11.7	10211	4	Yes	12.2	11.4-12.7
UVHP-26_20230601	6/1/23 12:52 PM	1	25.1	167	11.4	10394	12	Yes	11.9	10.8-12.9, 13.2-14.2, 14.5-14.8
		Total footage	**639.5**							

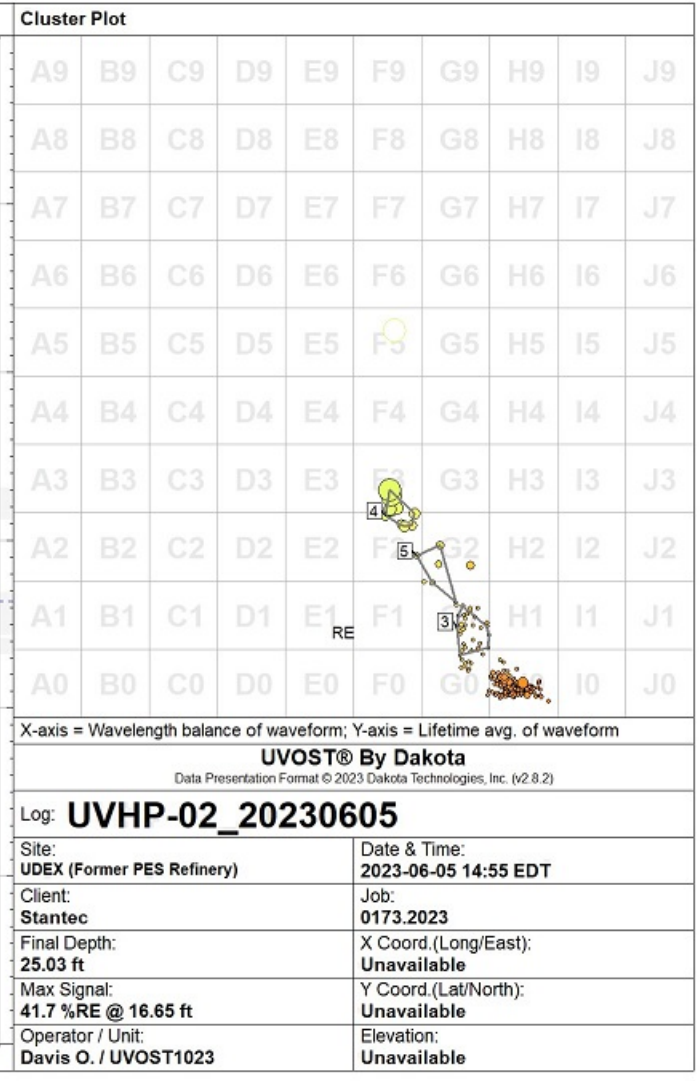
[(1)] **Top - Bottom** are within the precleared zone.

Appendix B

UVOST®-HP Logs at 800% RE with 5% Zoom


Callouts
1
300
200
100
RE
100.0 %RE
2
8
6
4
2
Background
0.5 %RE
3
40
30
20
10
17.18 - 17.56 ft
30.1 %RE (s 20.0)
4
8
6
4
2
18.32 - 19.12 ft
1.7 %RE (s 0.4)
5
8
6
4
2
20.07 - 25.02 ft
0.5 %RE (s 0.1)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
0.0
5.0
10.0
15.0
20.0
25.0
30.0
17.7
0
100
200
300
400
500
600
700
2
4
50
100
50
100
50
100
A B C D E F G H I J
2
4
6
8
Cluster Plot
A9 B9 C9 D9 E9 F9 G9 H9 I9 J9
A8 B8 C8 D8 E8 F8 G8 H8 I8 J8
A7 B7 C7 D7 E7 F7 G7 H7 I7 J7
A6 B6 C6 D6 E6 F6 G6 H6 I6 J6
A5 B5 C5 D5 E5 F5 G5 H5 I5 J5
A4 B4 C4 D4 E4 F4 G4 H4 I4 J4
A3 B3 C3 D3 E3 F3 G3 H3 I3 J3
A2 B2 C2 D2 E2 F2 G2 H2 I2 J2
A1 B1 C1 D1 E1 F1 G1 H1 I1 J1
A0 B0 C0 D0 E0 F0 G0 H0 I0 J0
3
4
5
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-01_20230605
Site:
UDEX (Former PES Refinery)
Date & Time:
2023-06-05 17:09 EDT
Client:
Stantec
Job:
0173.2023
Final Depth:
25.02 ft
X Coord.(Long/East):
Unavailable
Max Signal:
49.5 %RE @ 17.36 ft
Y Coord.(Lat/North):
Unavailable
Operator / Unit:
Davis O. / UVOST1023
Elevation:
Unavailable





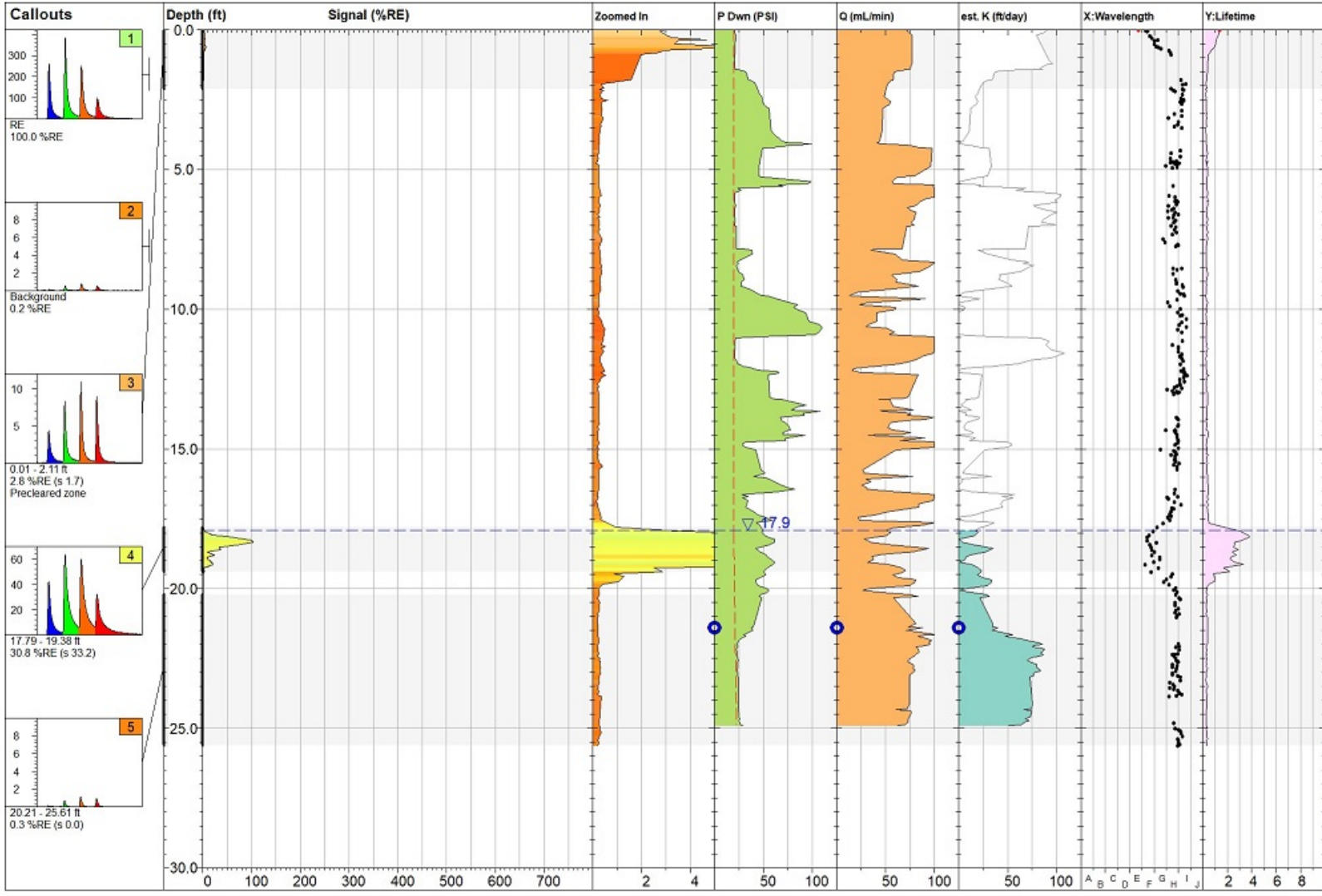
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

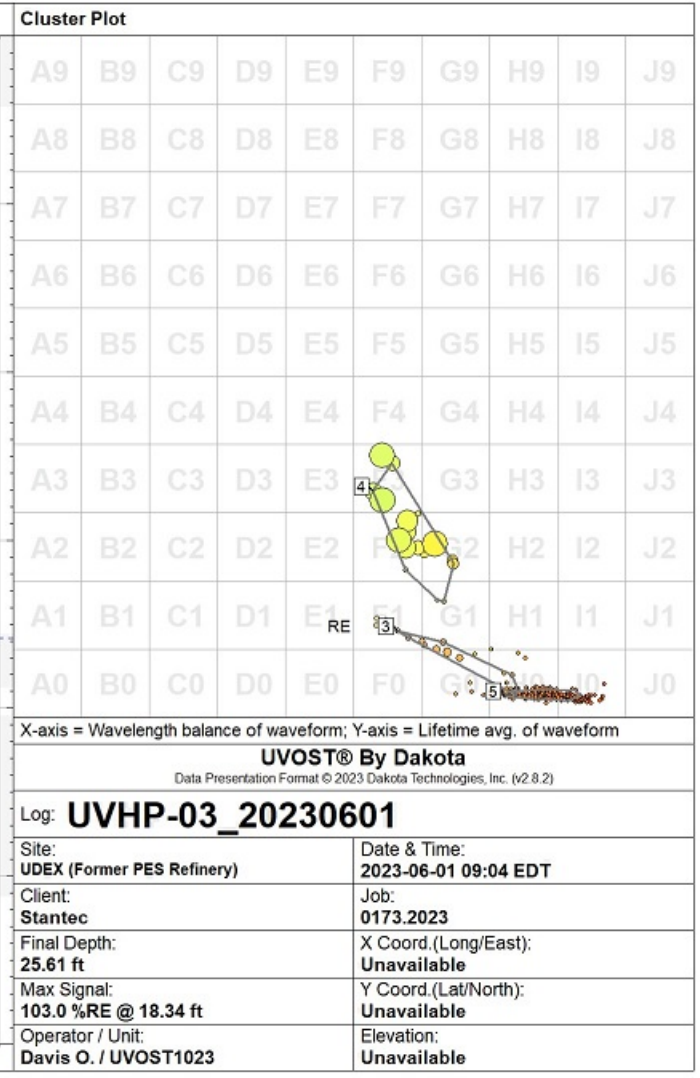
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-02_20230605**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-05 14:55 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.03 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **41.7 %RE @ 16.65 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**





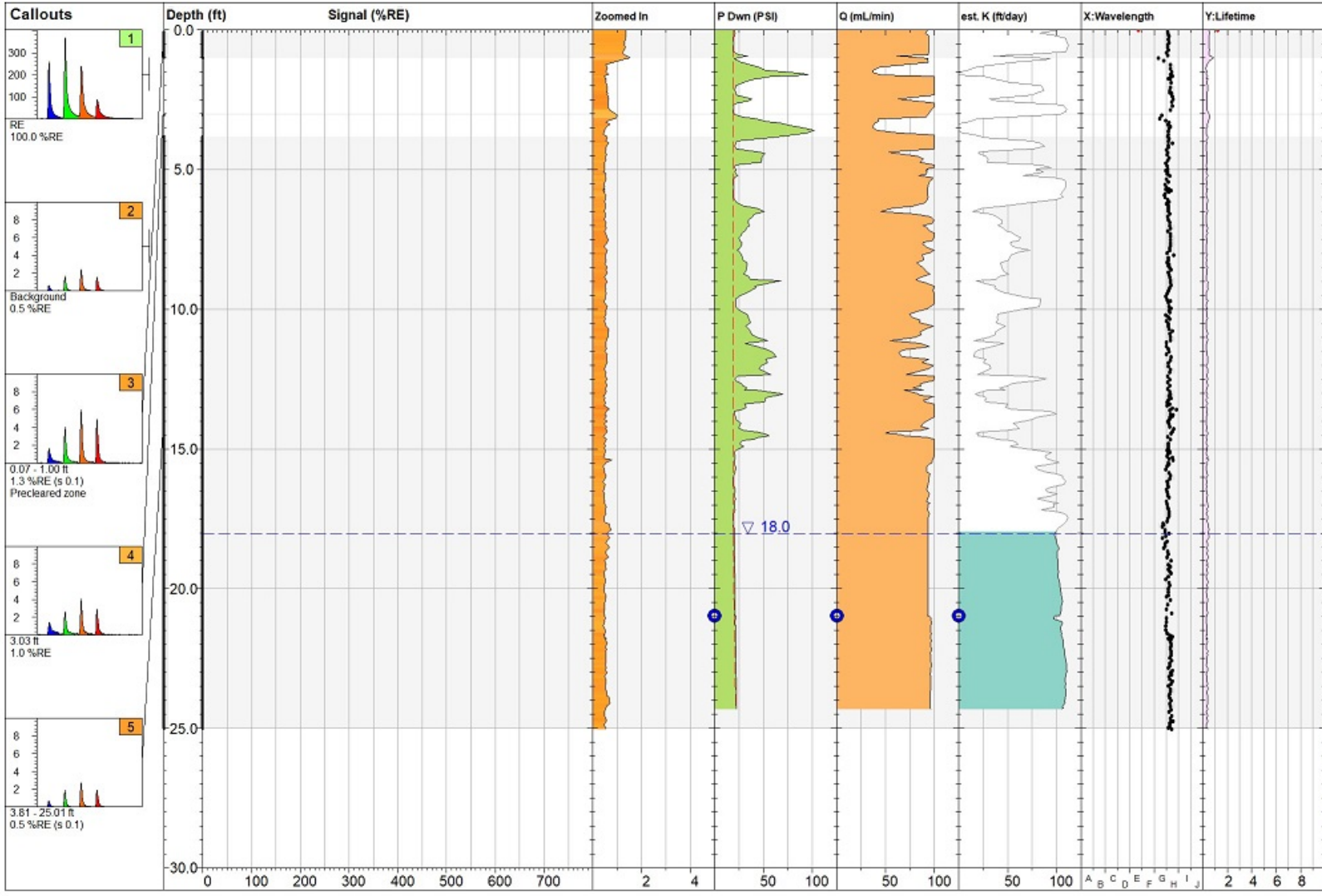
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

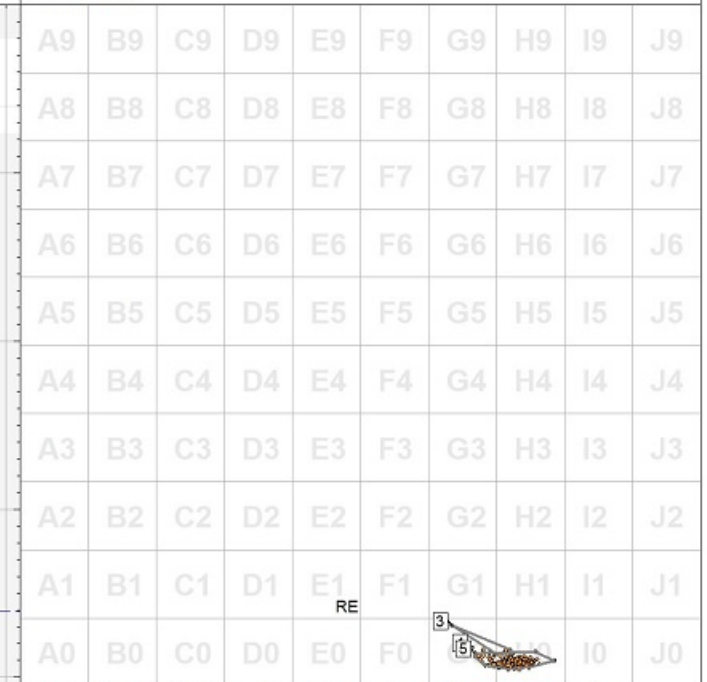
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-03_20230601**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-01 09:04 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.61 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **103.0 %RE @ 18.34 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**





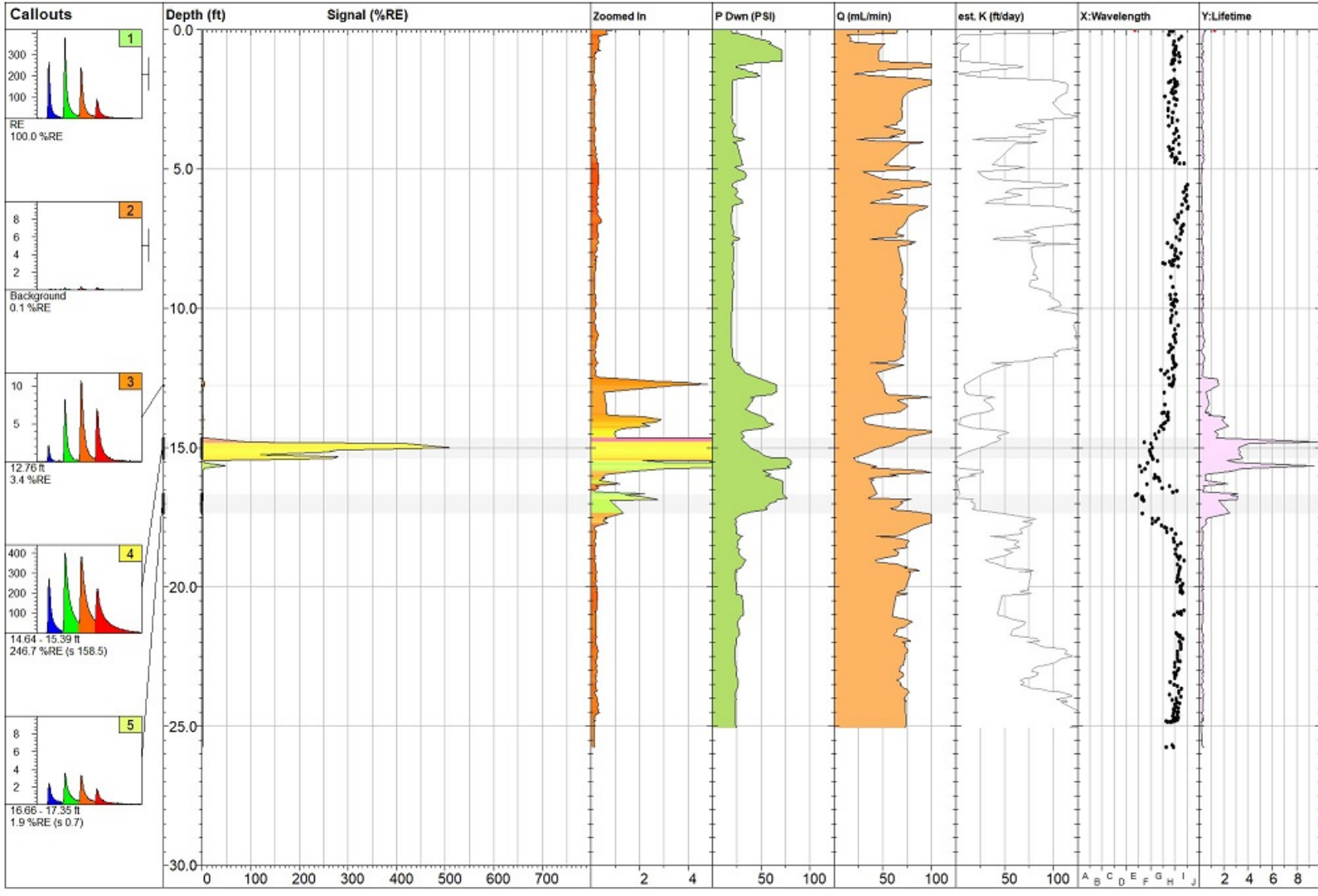
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

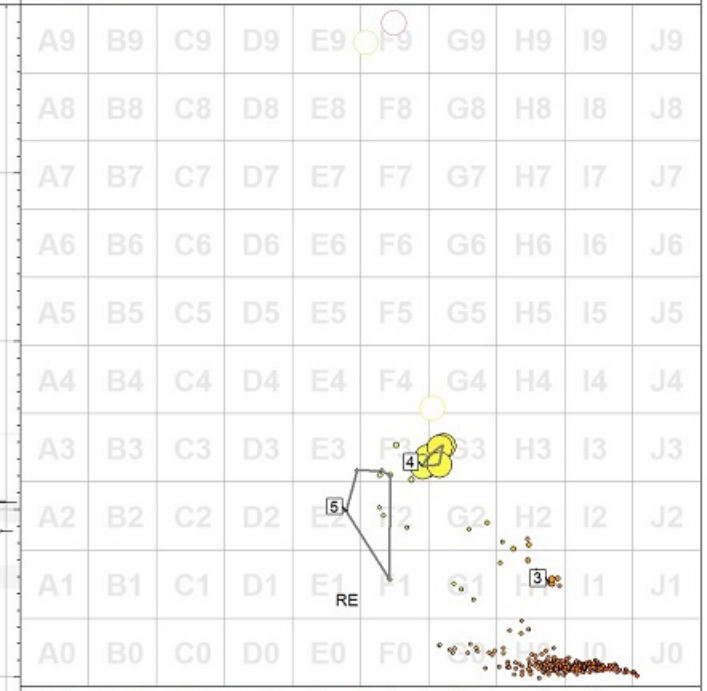
UVOST® By Dakota

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Log: **UVHP-04_20230605**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-05 17:52 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.01 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **1.5 %RE @ 1.00 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**





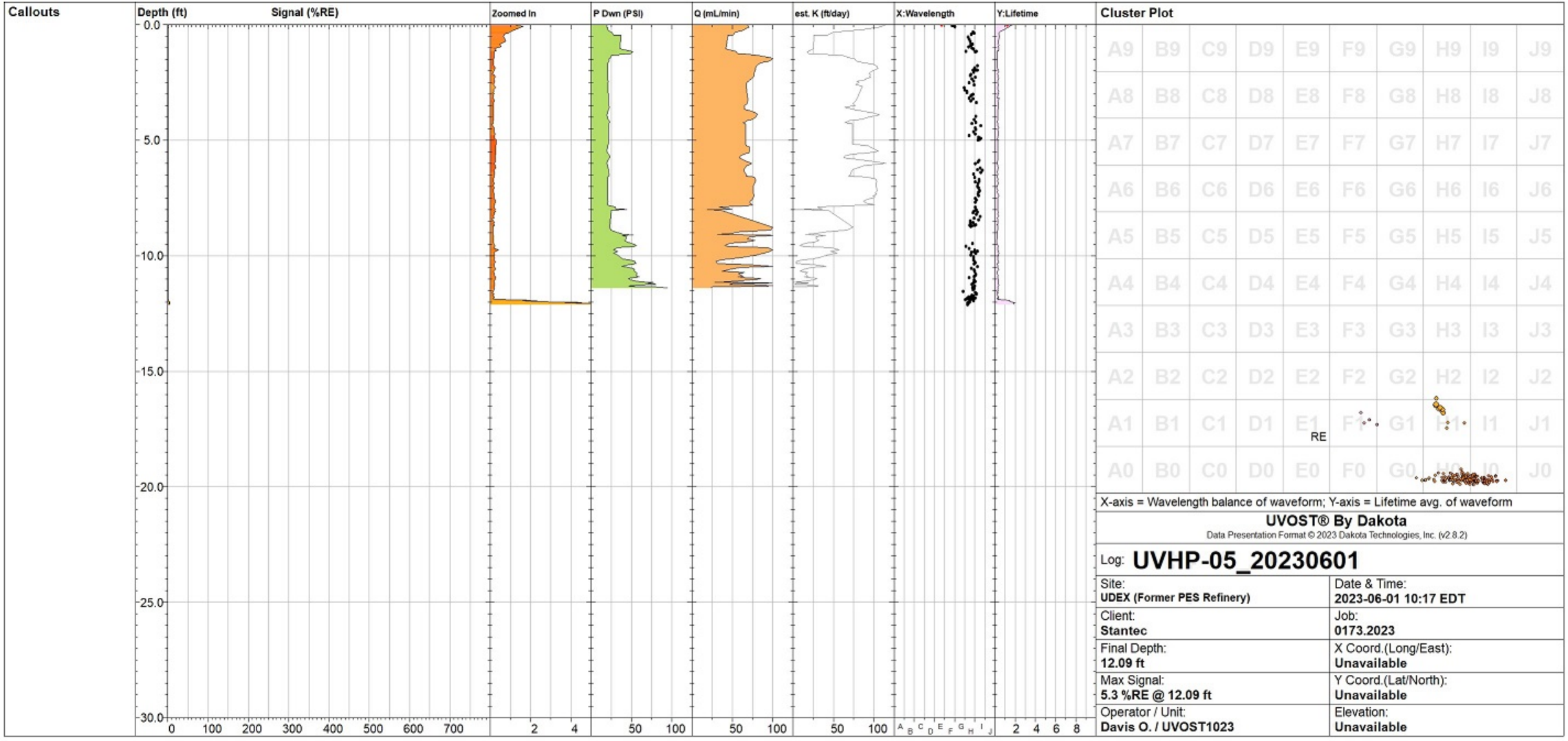
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

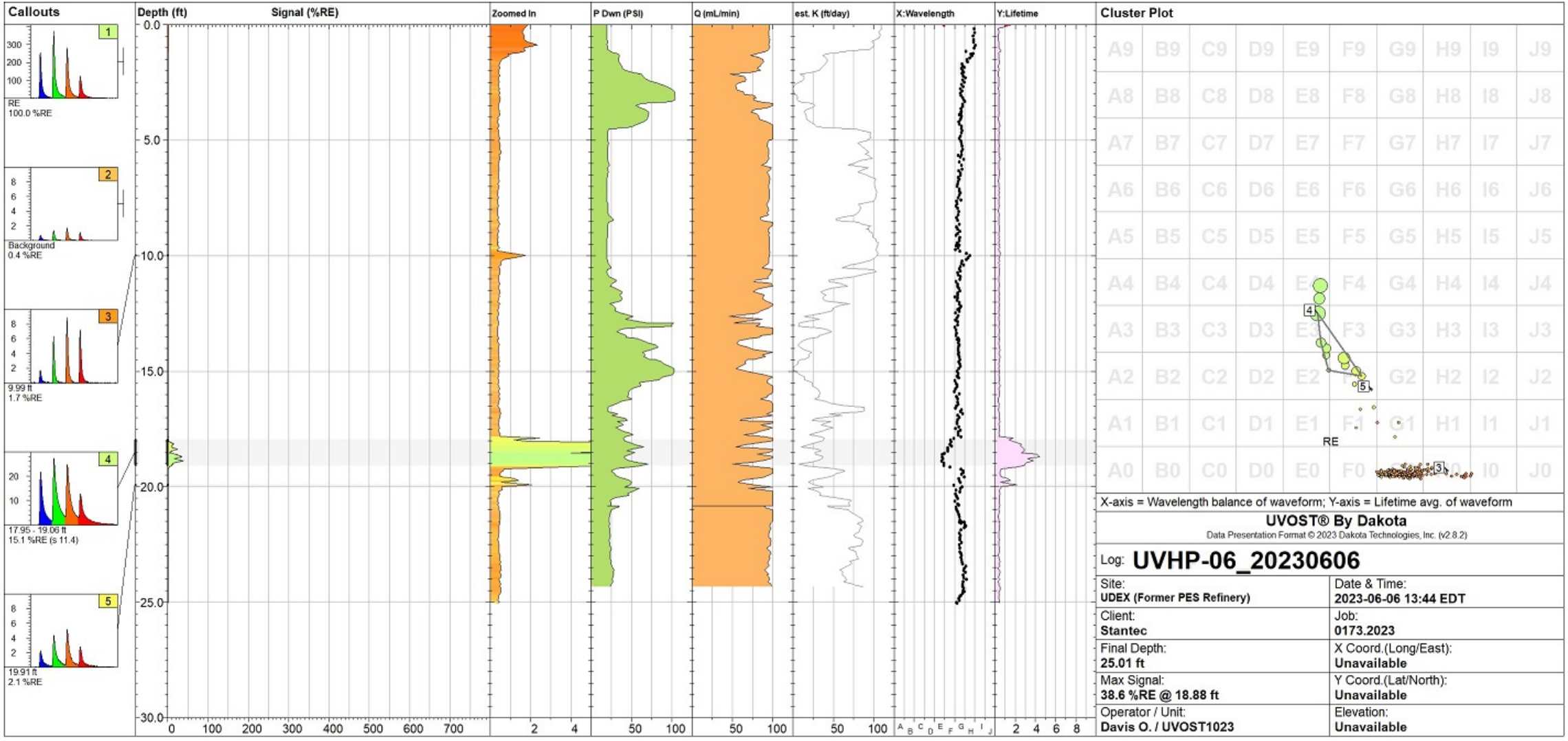
UVOST® By Dakota

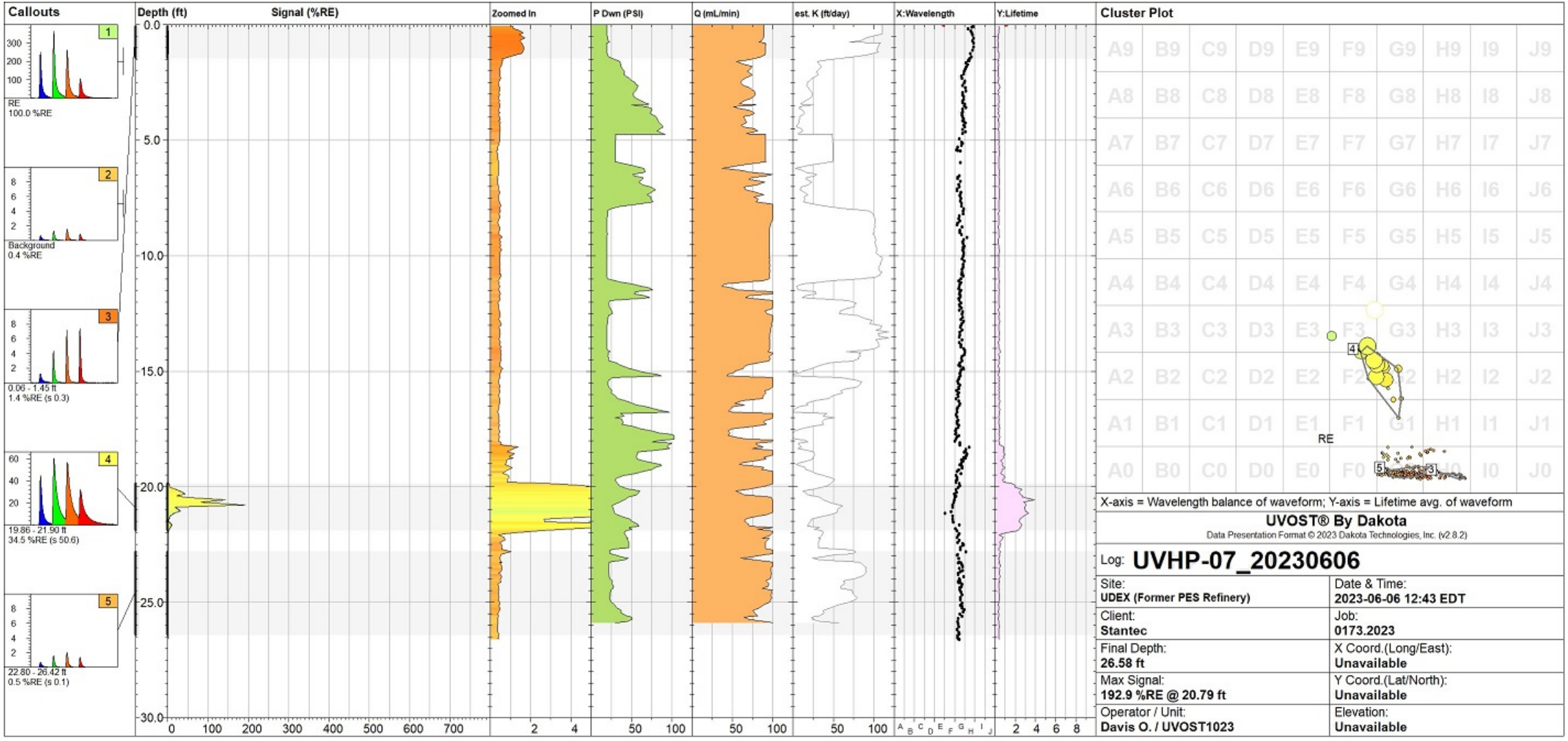
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-05 A_20230601**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-01 10:54 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.74 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **509.5 %RE @ 15.00 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
0.0
5.0
10.0
15.0
20.0
25.0
30.0
0
100
200
300
400
500
600
700
2
4
50
100
50
100
50
100
A B C D E F G H I J
2
4
6
8
Cluster Plot
A9 B9 C9 D9 E9 F9 G9 H9 I9 J9
A8 B8 C8 D8 E8 F8 G8 H8 I8 J8
A7 B7 C7 D7 E7 F7 G7 H7 I7 J7
A6 B6 C6 D6 E6 F6 G6 H6 I6 J6
A5 B5 C5 D5 E5 F5 G5 H5 I5 J5
A4 B4 C4 D4 E4 F4 G4 H4 I4 J4
A3 B3 C3 D3 E3 F3 G3 H3 I3 J3
A2 B2 C2 D2 E2 F2 G2 H2 I2 J2
A1 B1 C1 D1 E1 F1 G1 H1 I1 J1
A0 B0 C0 D0 E0 F0 G0 H0 I0 J0
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-05_20230601
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-01 10:17 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 12.09 ft
X Coord.(Long/East): Unavailable
Max Signal: 5.3 %RE @ 12.09 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable


Callouts
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
1
RE
100.0 %RE
2
Background
0.4 %RE
3
9.99 ft
1.7 %RE
4
17.95 - 19.06 ft
15.1 %RE (s 11.4)
5
19.91 ft
2.1 %RE
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-06_20230606
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-06 13:44 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.01 ft
X Coord.(Long/East): Unavailable
Max Signal: 38.6 %RE @ 18.88 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable



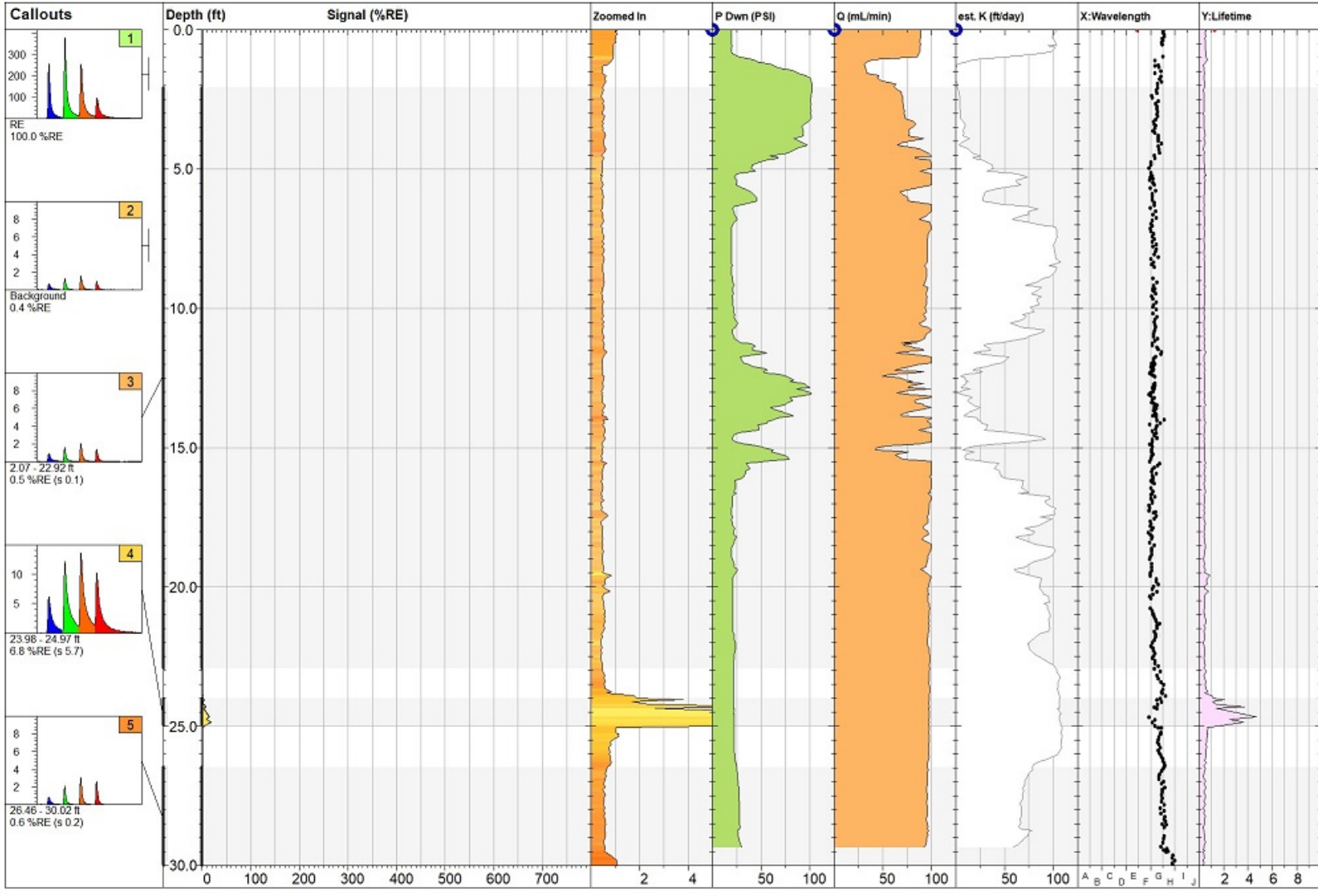
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

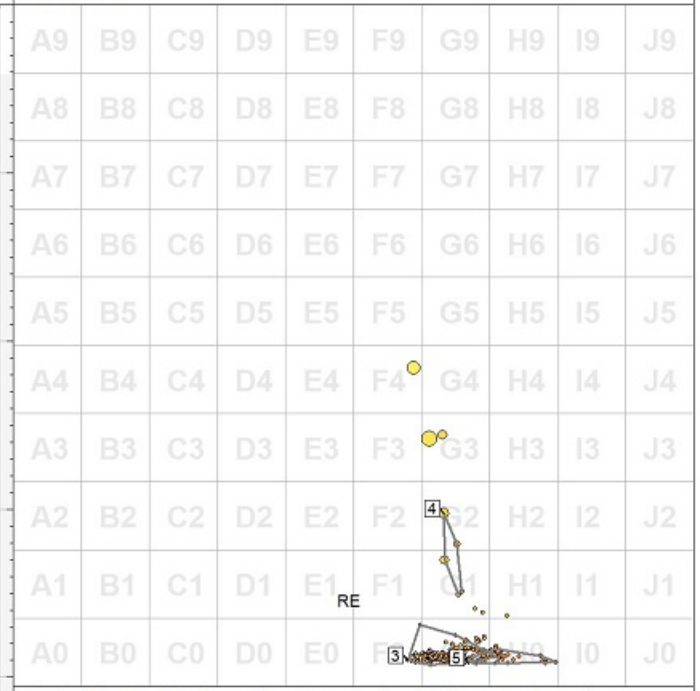
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-07_20230606**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-06 12:43 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **26.58 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **192.9 %RE @ 20.79 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**





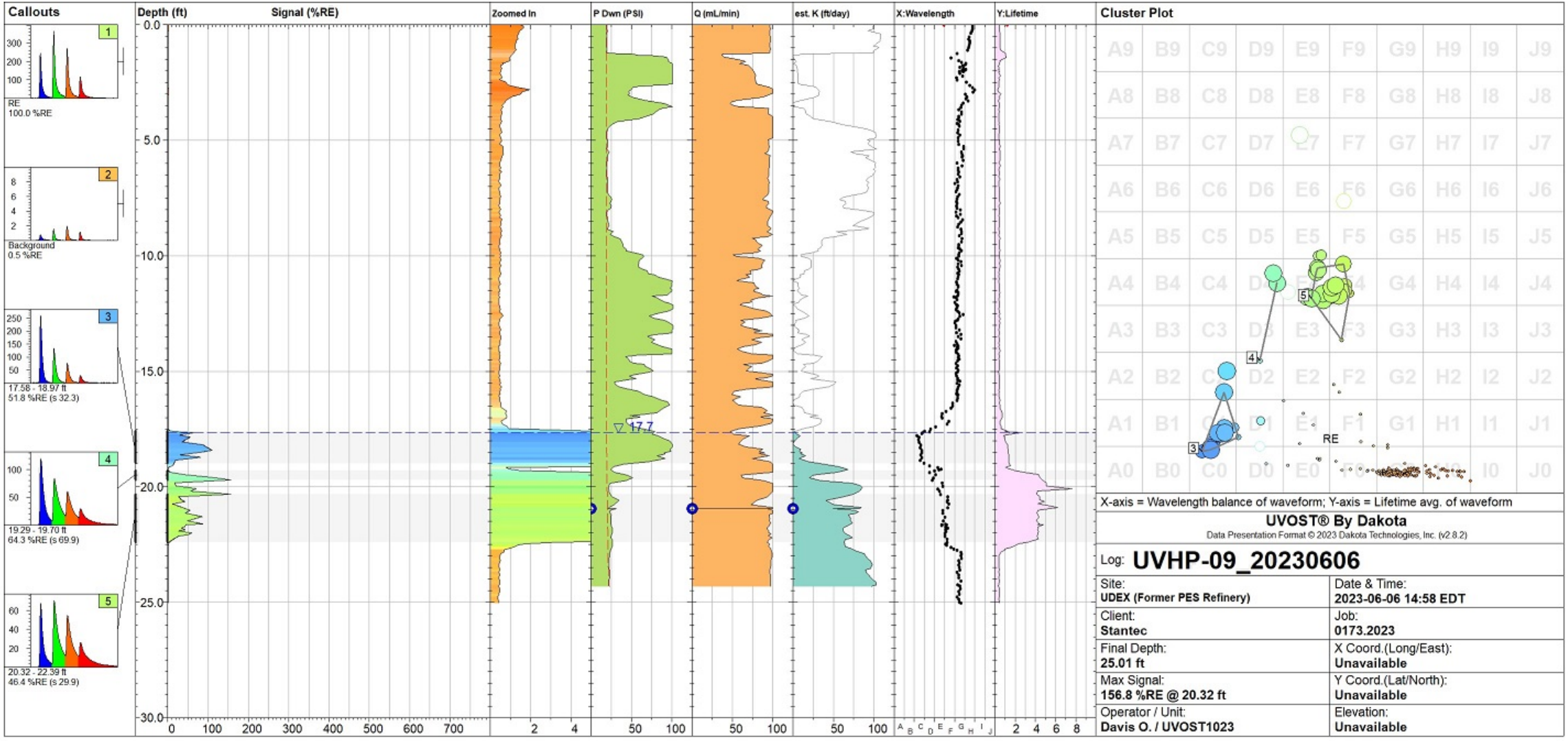
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

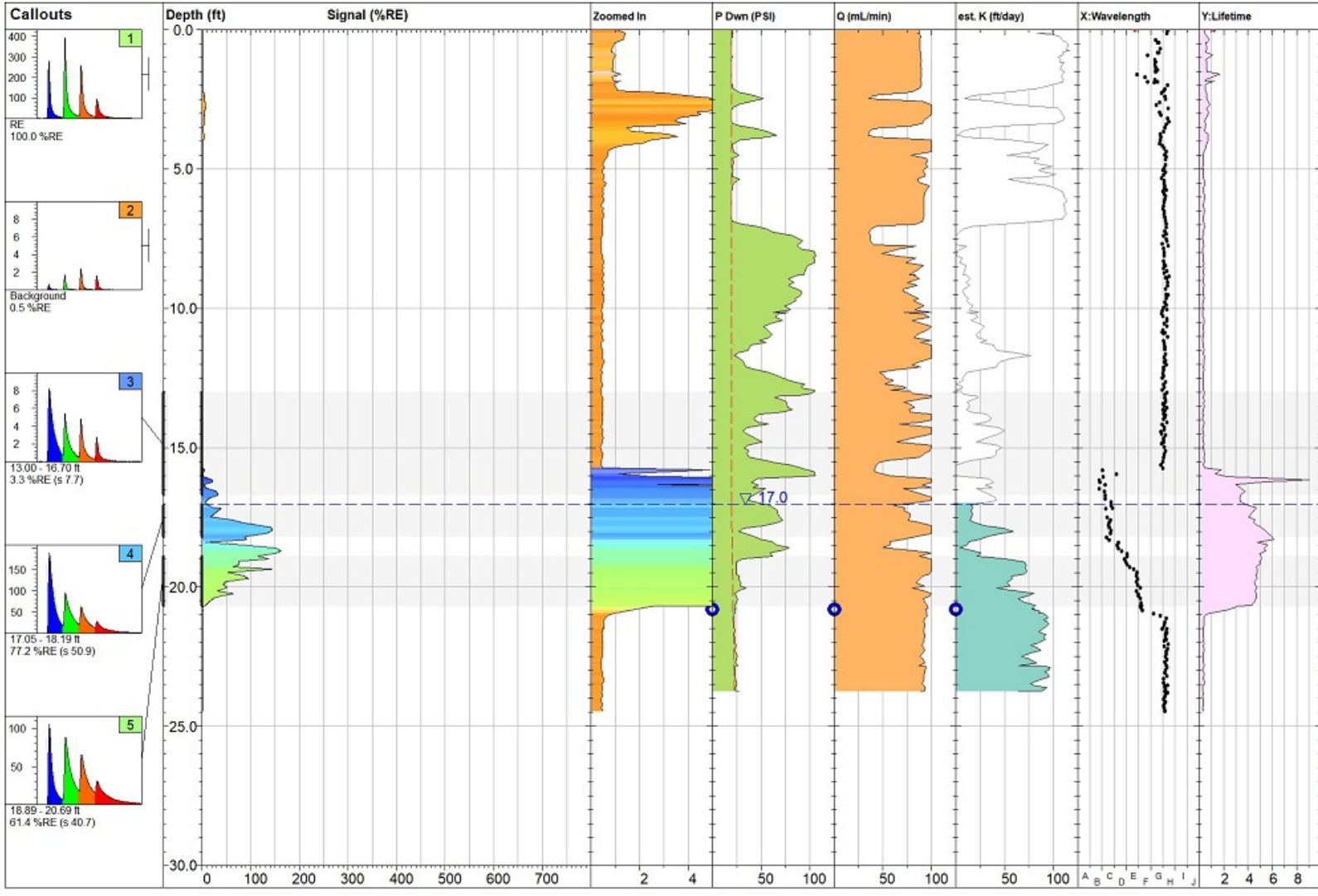
UVOST® By Dakota

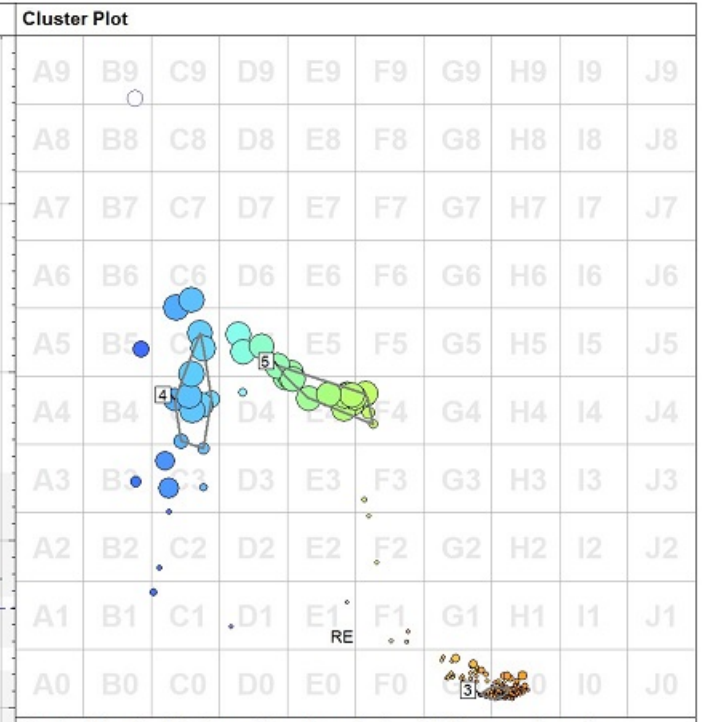
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-08_20230606**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-06 11:24 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **30.02 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **18.2 %RE @ 24.86 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
1
RE
100.0 %RE
2
Background
0.5 %RE
3
17.58 - 18.97 ft
51.8 %RE (s 32.3)
4
19.29 - 19.70 ft
64.3 %RE (s 69.9)
5
20.32 - 22.39 ft
46.4 %RE (s 29.9)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
17.7
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-09_20230606
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-06 14:58 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.01 ft
X Coord.(Long/East): Unavailable
Max Signal: 156.8 %RE @ 20.32 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable





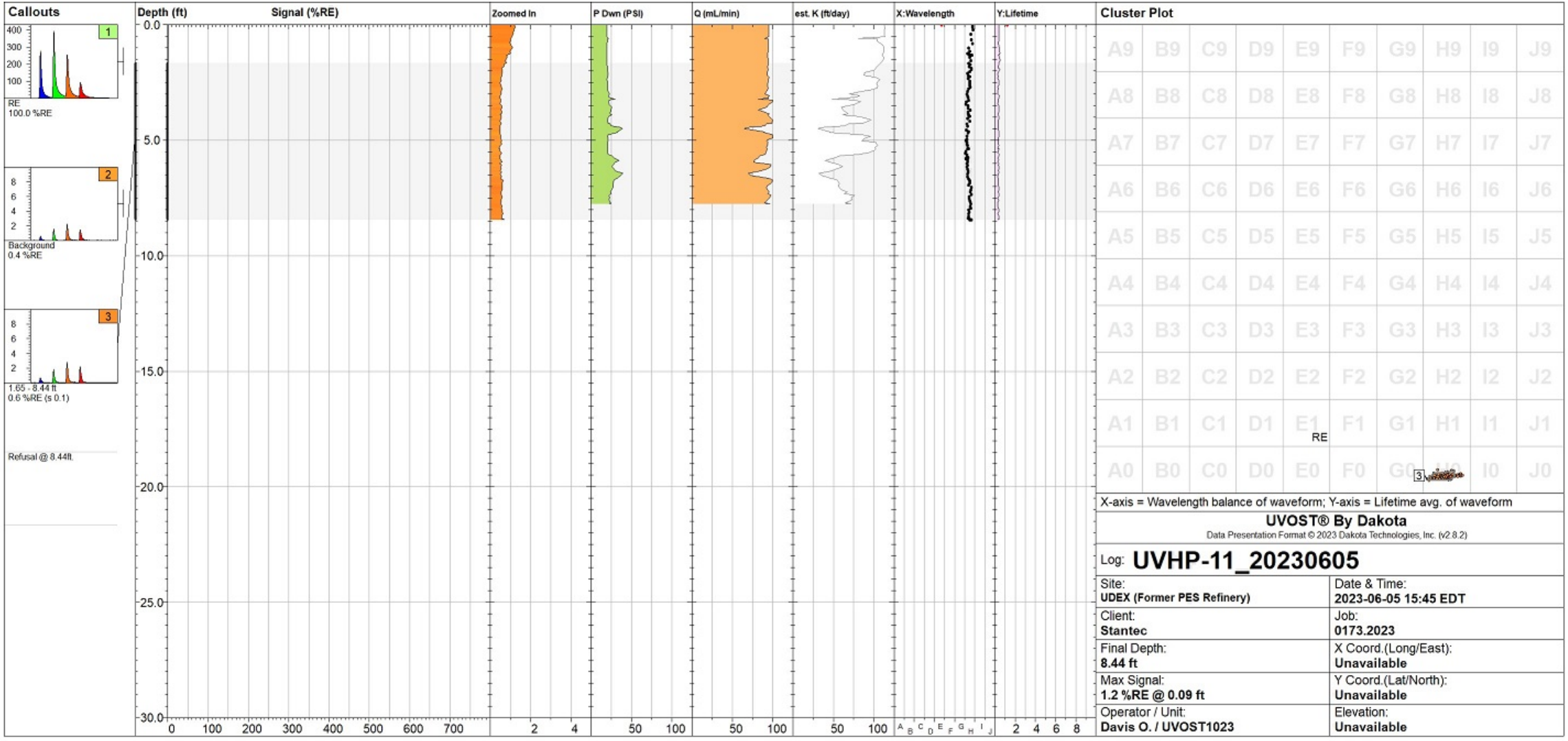
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

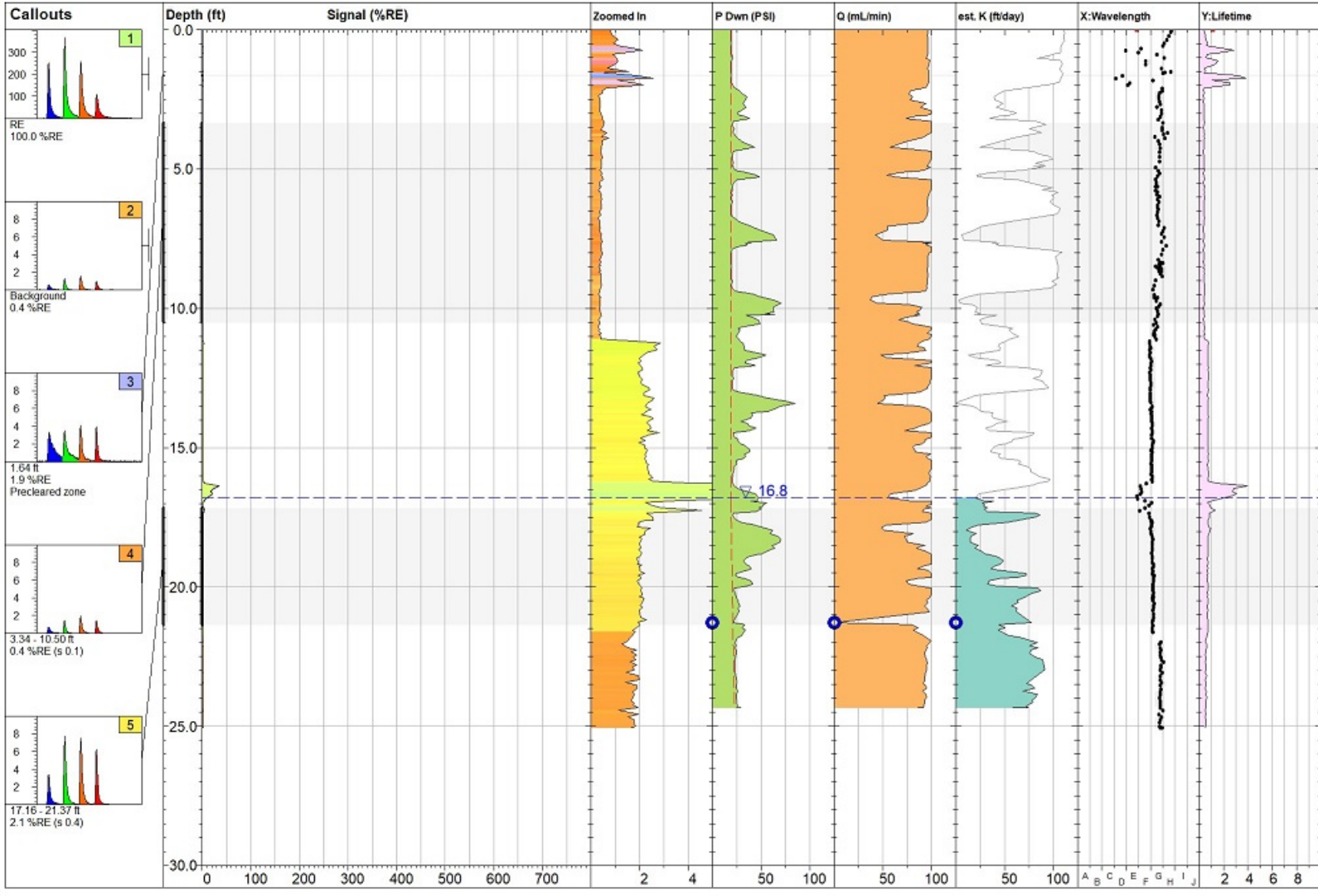
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

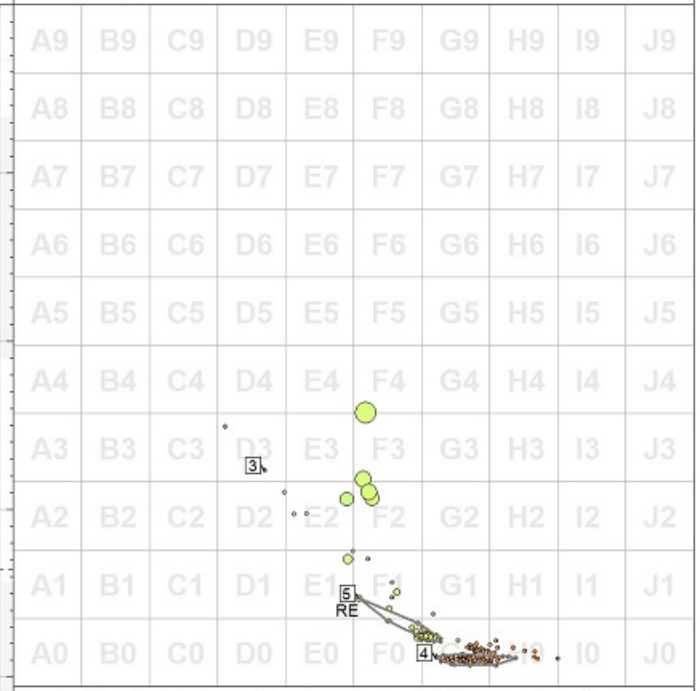
Log: **UVHP-10_20230605**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-05 16:07 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **24.44 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **162.3 %RE @ 18.71 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
1
RE
100.0 %RE
2
Background
0.4 %RE
3
1.65 - 8.44 ft
0.6 %RE (s 0.1)
Refusal @ 8.44ft.
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-11_20230605
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-05 15:45 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 8.44 ft
X Coord.(Long/East): Unavailable
Max Signal: 1.2 %RE @ 0.09 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable



Cluster Plot



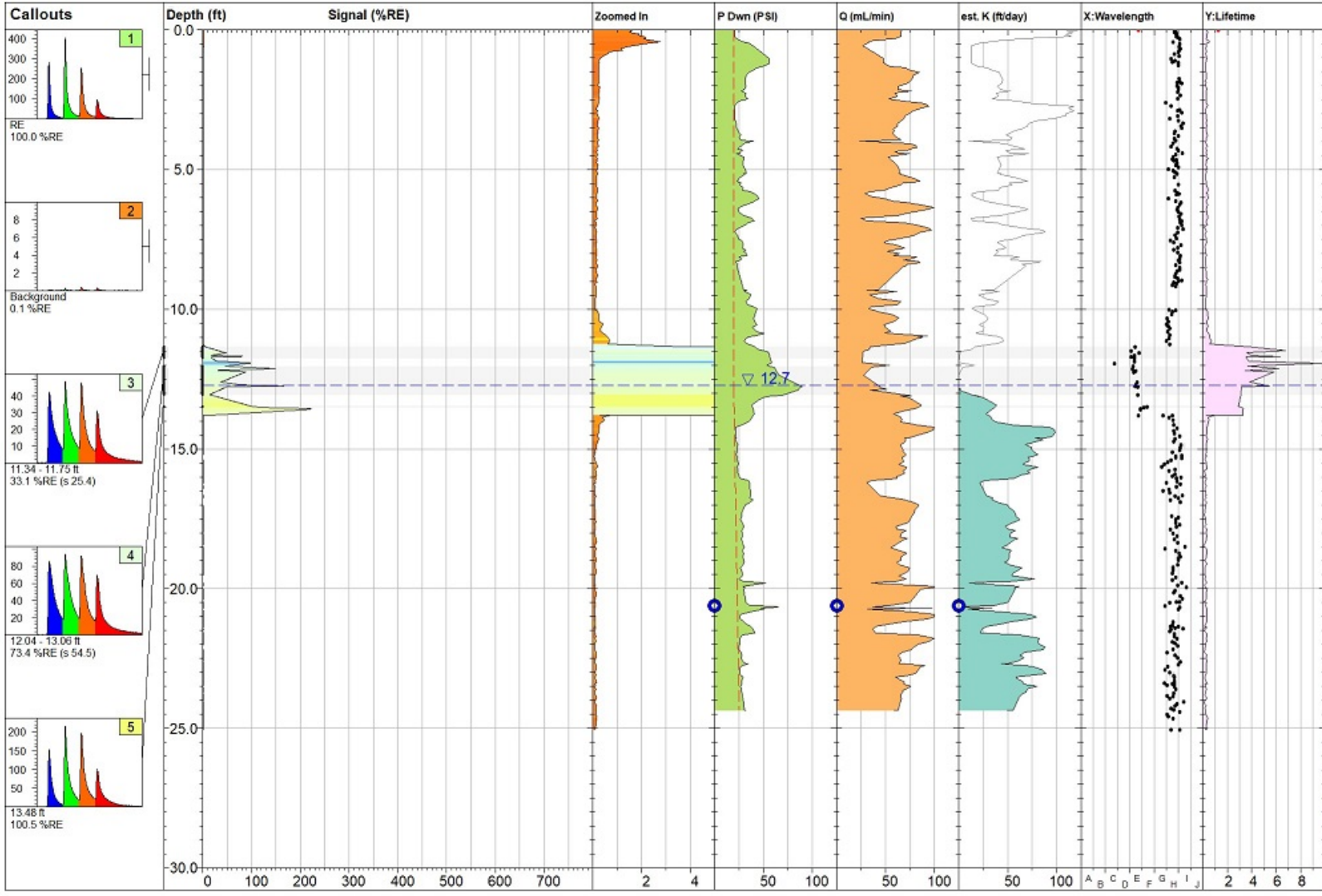
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

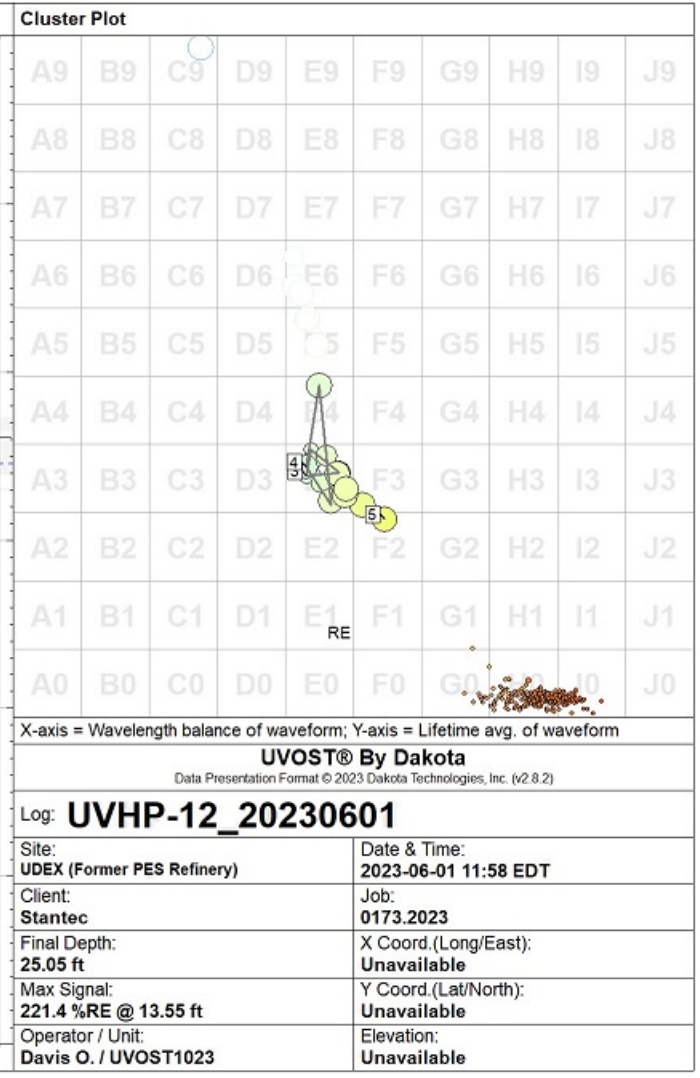
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-11_20230606**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-06 15:48 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.04 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **34.8 %RE @ 16.37 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**





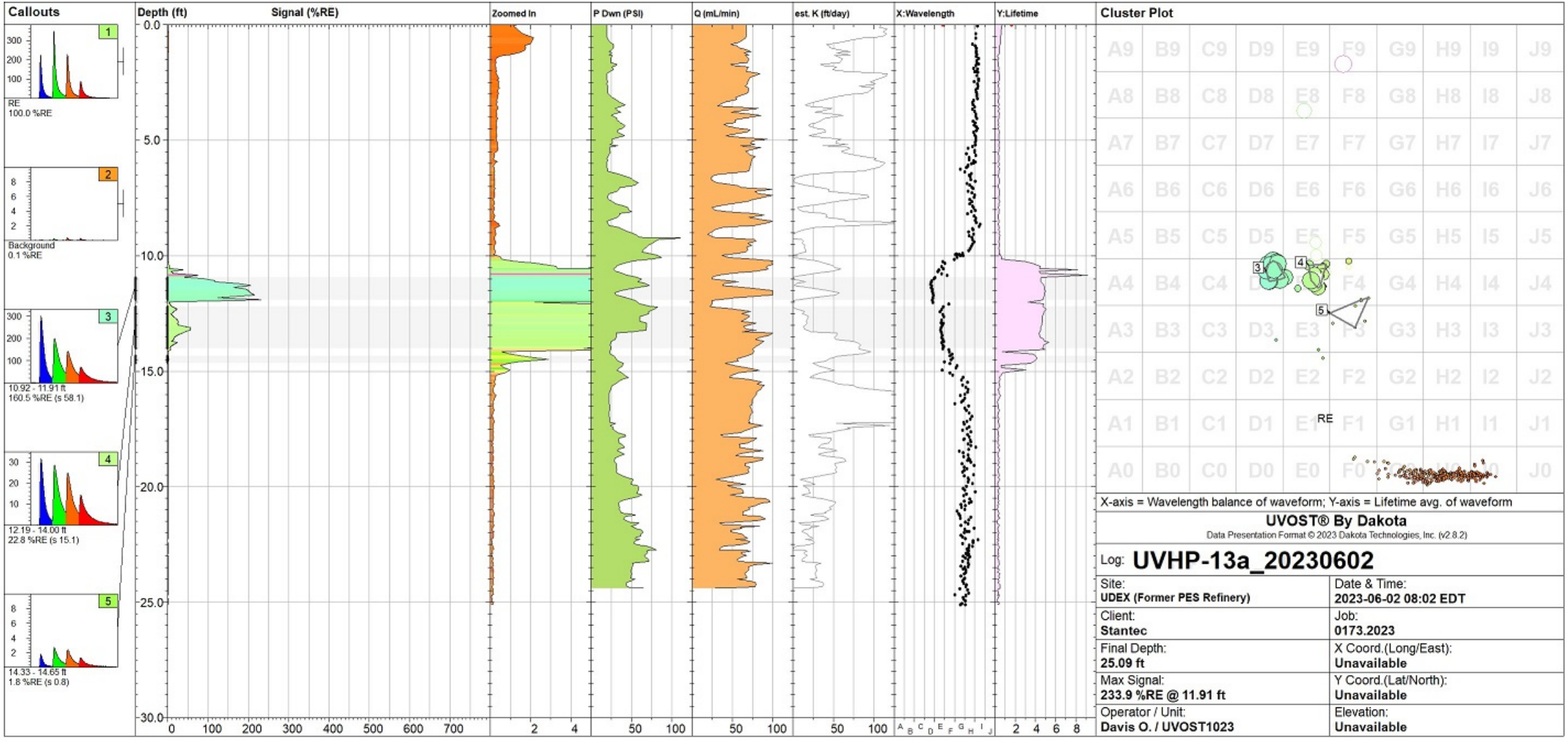
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

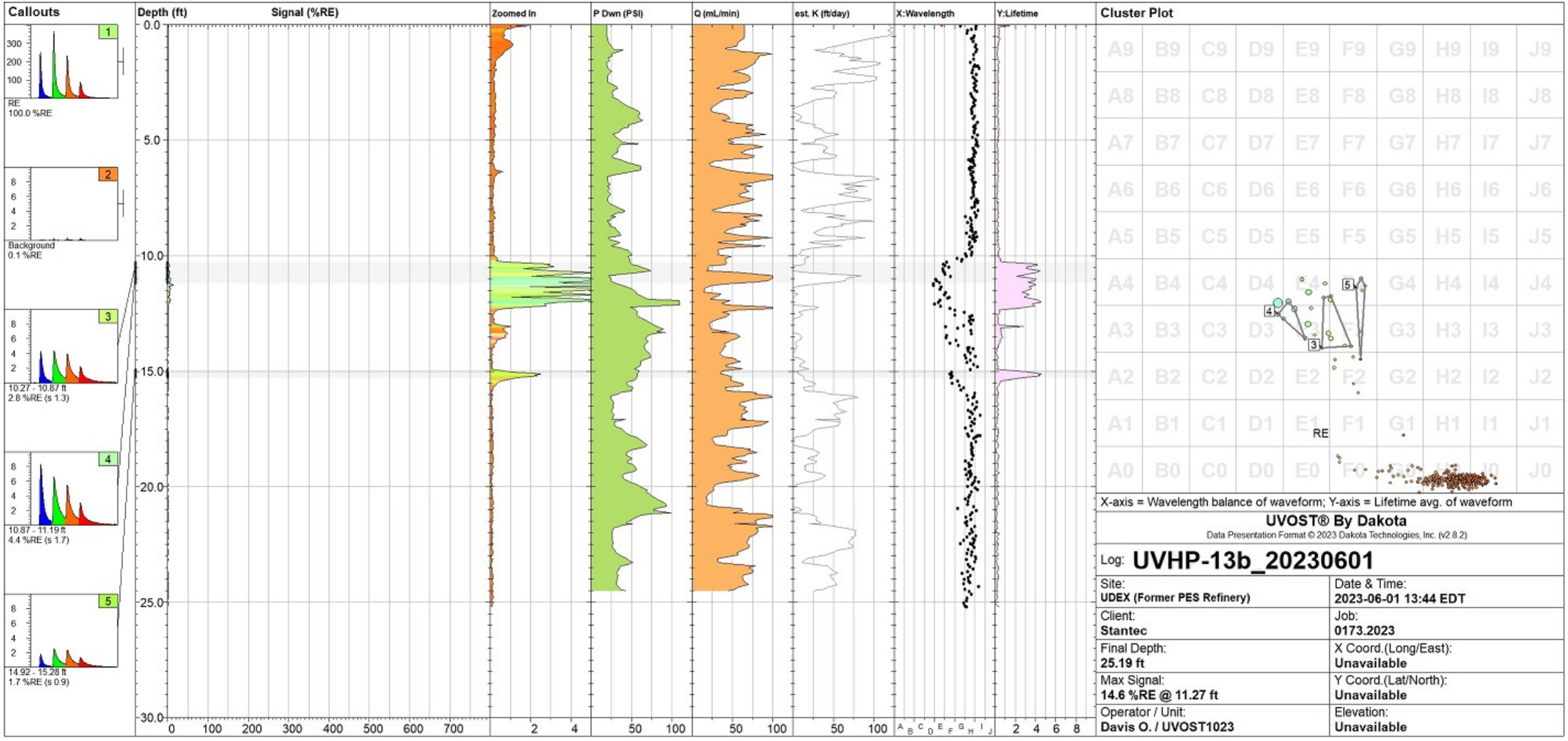
UVOST® By Dakota

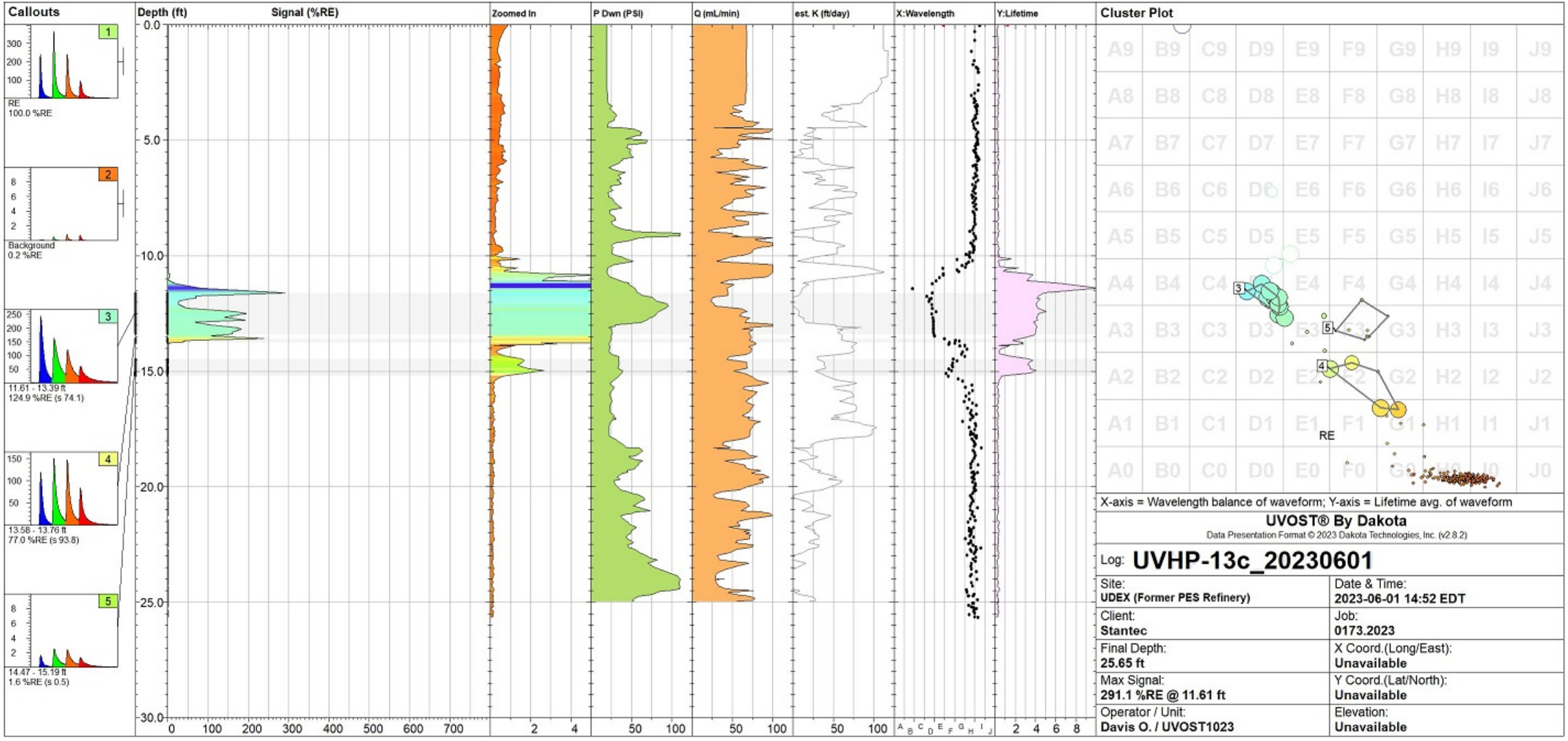
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

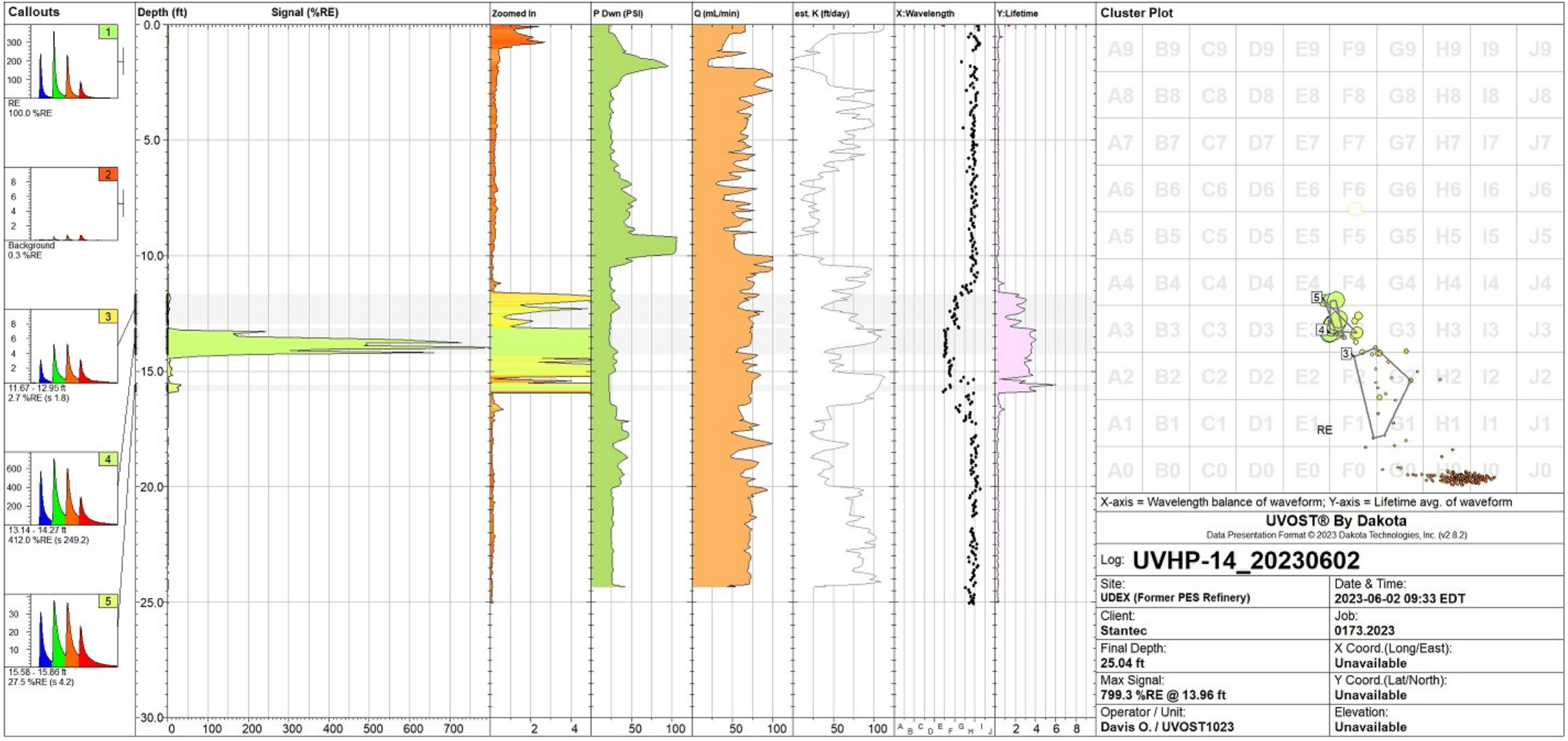
Log: **UVHP-12_20230601**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-01 11:58 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.05 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **221.4 %RE @ 13.55 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
1
RE
100.0 %RE
2
Background
0.1 %RE
3
10.92 - 11.91 ft
160.5 %RE (s 58.1)
4
12.19 - 14.00 ft
22.8 %RE (s 15.1)
5
14.33 - 14.65 ft
1.8 %RE (s 0.8)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-13a_20230602
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-02 08:02 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.09 ft
X Coord.(Long/East): Unavailable
Max Signal: 233.9 %RE @ 11.91 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable


Callouts
1
RE
100.0 %RE
2
Background
0.1 %RE
3
10.27 - 10.87 ft
2.8 %RE (s 1.3)
4
10.87 - 11.19 ft
4.4 %RE (s 1.7)
5
14.92 - 15.28 ft
1.7 %RE (s 0.9)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-13b_20230601
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-01 13:44 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.19 ft
X Coord.(Long/East): Unavailable
Max Signal: 14.6 %RE @ 11.27 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable


Callouts
1
RE
100.0 %RE
2
Background
0.2 %RE
3
11.61 - 13.39 ft
124.9 %RE (s 74.1)
4
13.58 - 13.76 ft
77.0 %RE (s 93.8)
5
14.47 - 15.19 ft
1.6 %RE (s 0.5)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-13c_20230601
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-01 14:52 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.65 ft
X Coord.(Long/East): Unavailable
Max Signal: 291.1 %RE @ 11.61 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable



Cluster Plot

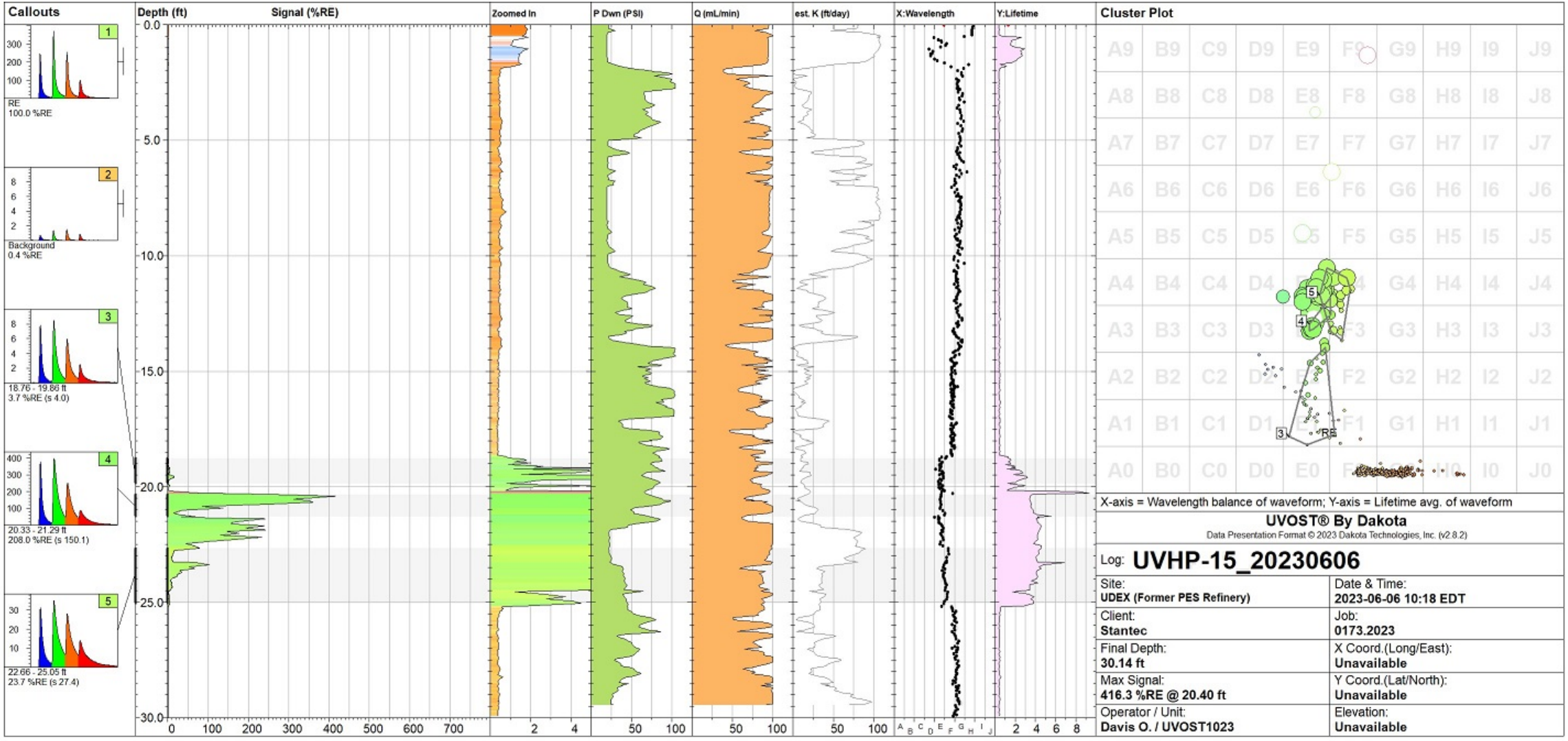
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

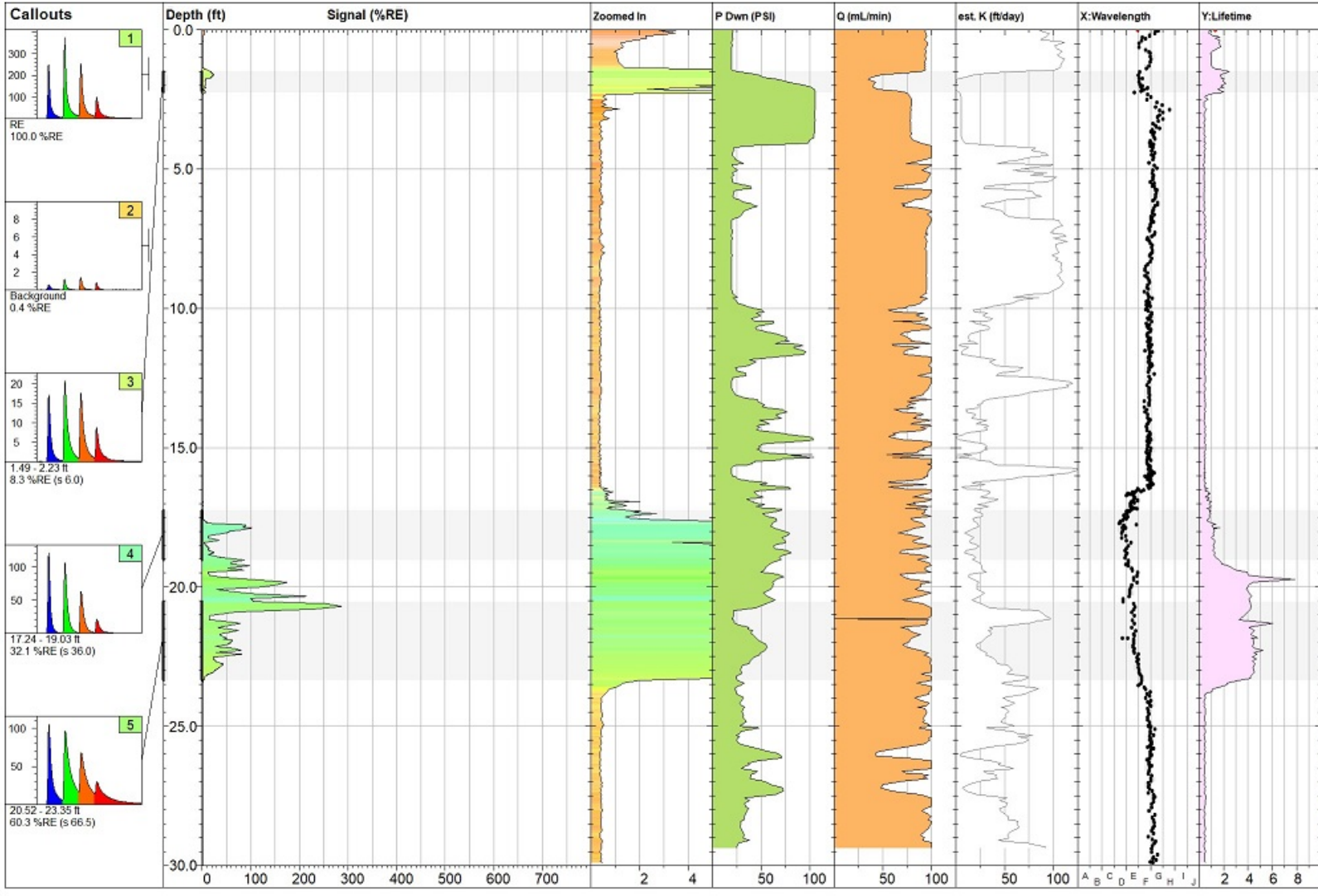
UVOST® By Dakota

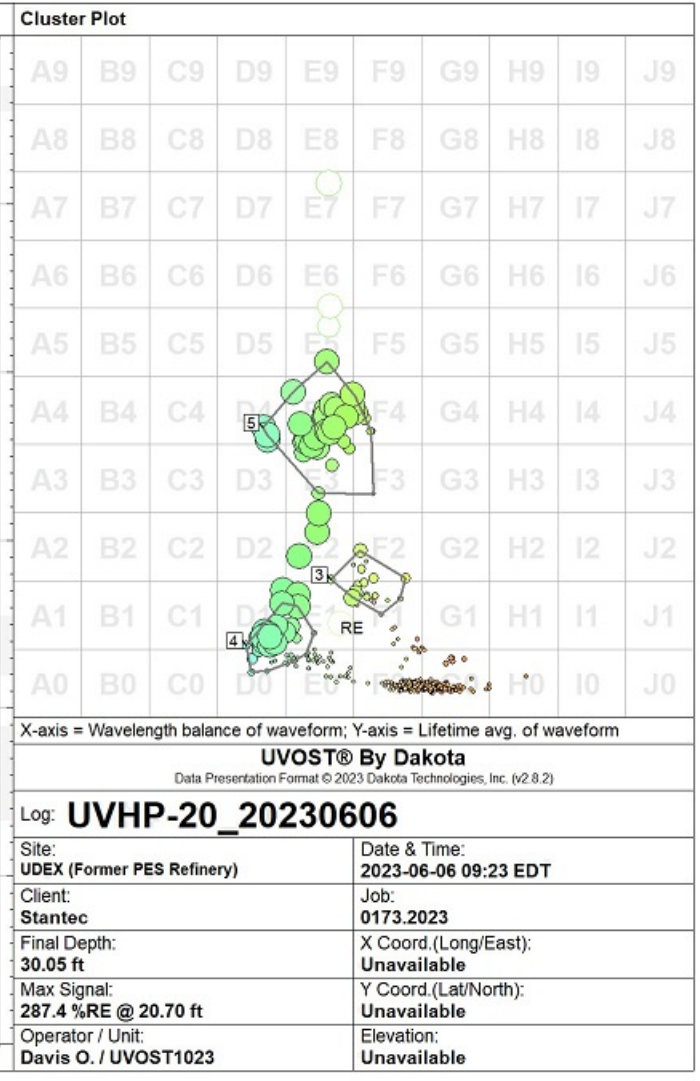
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-14_20230602**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-02 09:33 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.04 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **799.3 %RE @ 13.96 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
1
RE
100.0 %RE
2
Background
0.4 %RE
3
18.76 - 19.86 ft
3.7 %RE (s 4.0)
4
20.33 - 21.29 ft
208.0 %RE (s 150.1)
5
22.66 - 25.05 ft
23.7 %RE (s 27.4)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-15_20230606
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-06 10:18 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 30.14 ft
X Coord.(Long/East): Unavailable
Max Signal: 416.3 %RE @ 20.40 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable





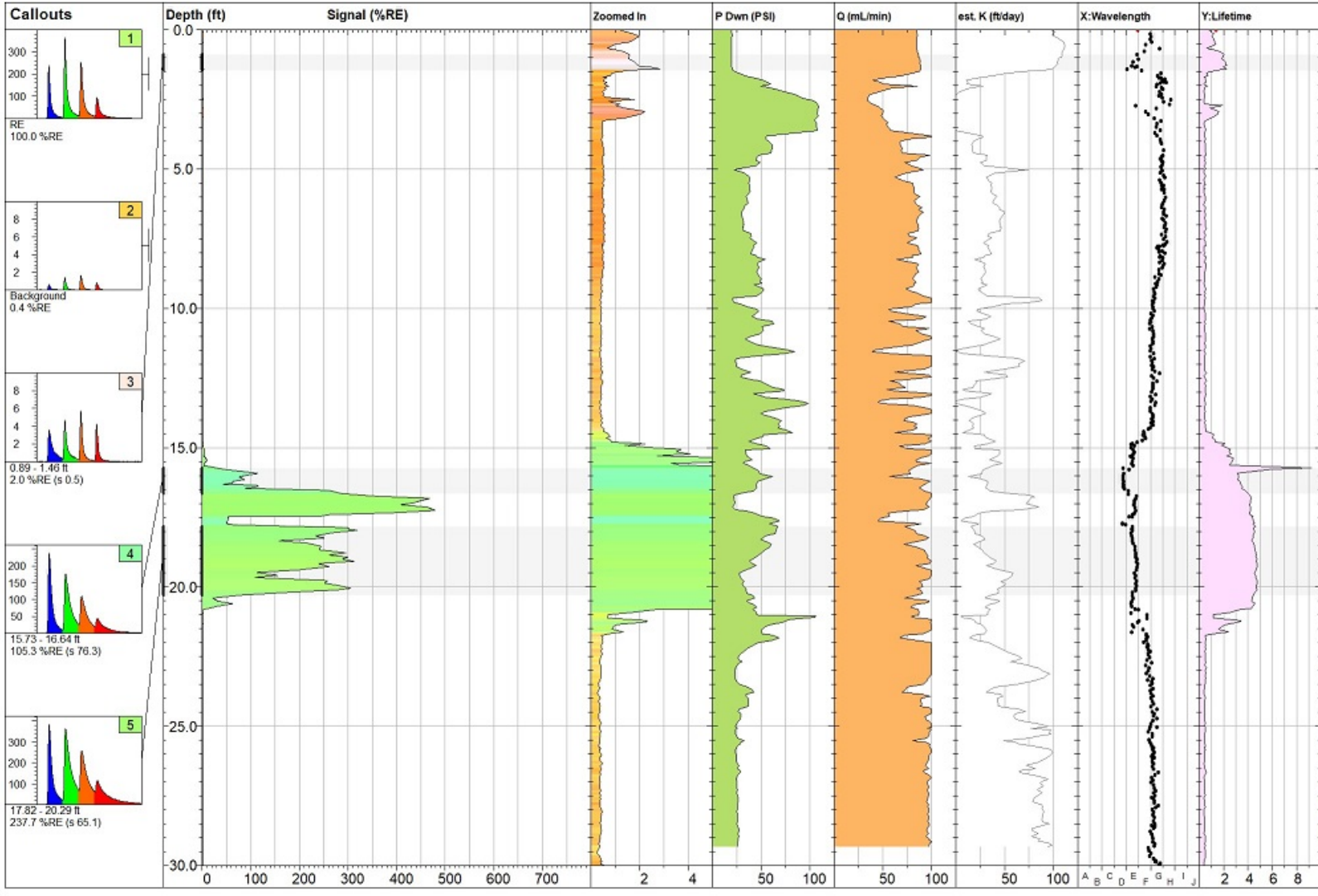
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

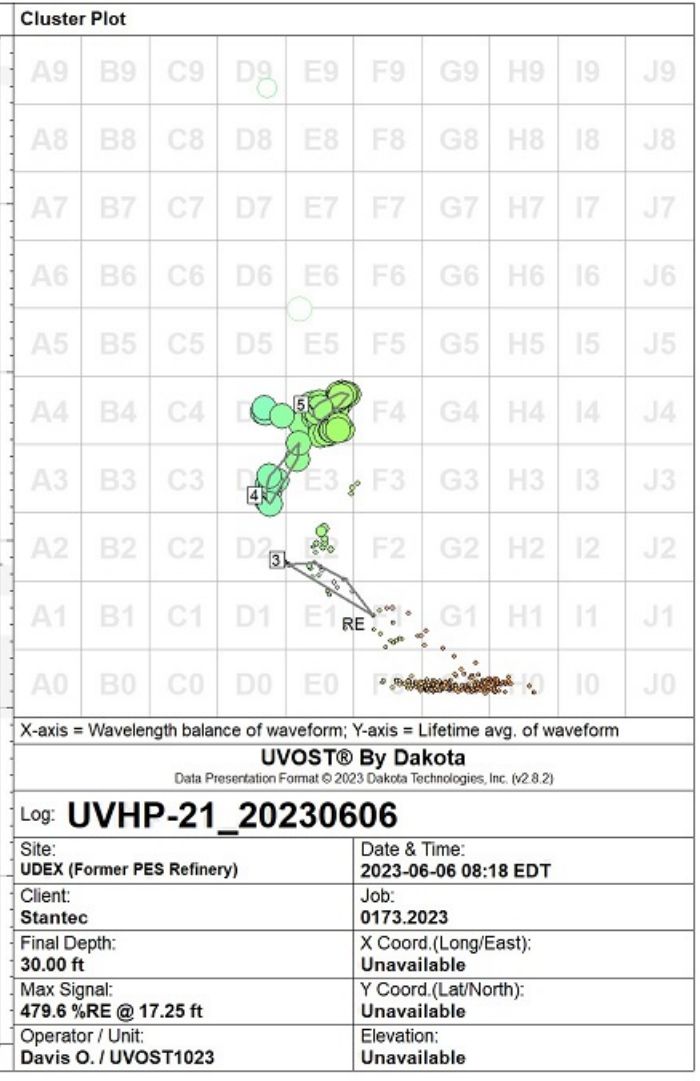
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-20_20230606**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-06 09:23 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **30.05 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **287.4 %RE @ 20.70 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**





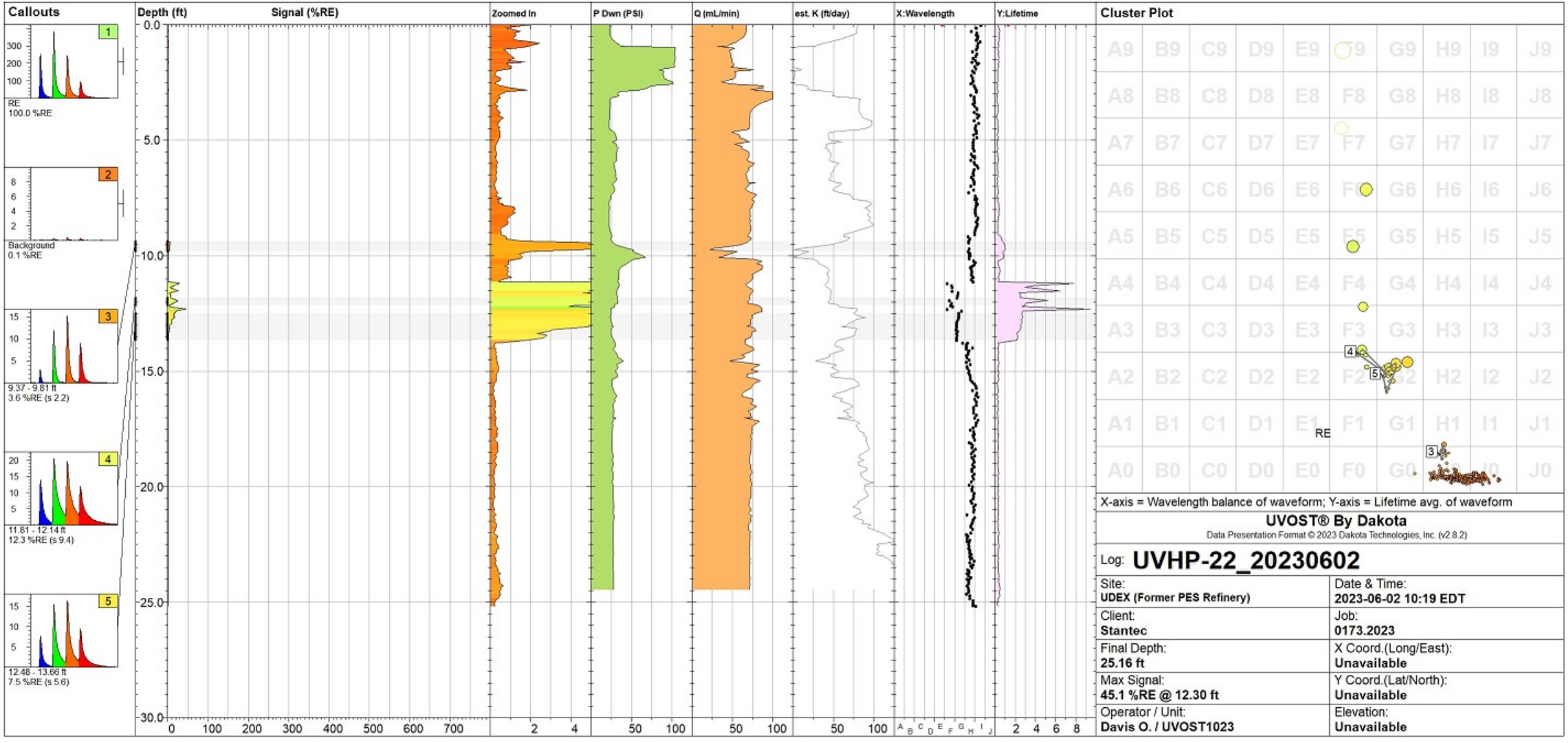
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

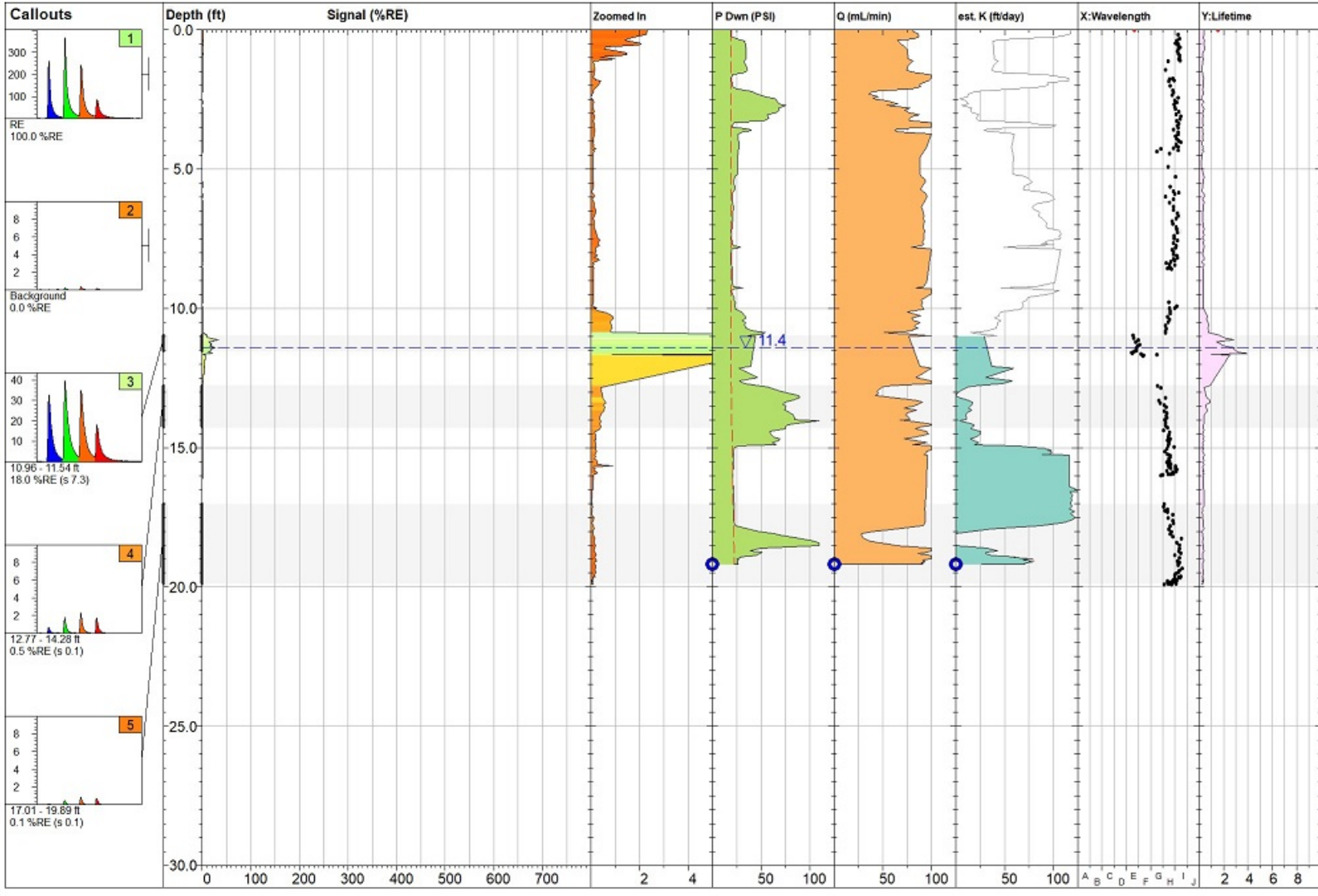
UVOST® By Dakota

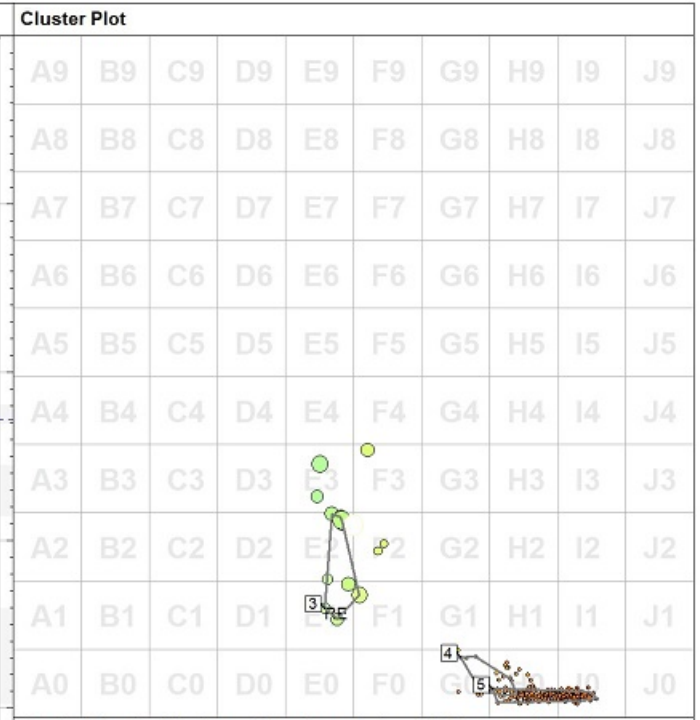
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-21_20230606**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-06 08:18 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **30.00 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **479.6 %RE @ 17.25 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
1
RE
100.0 %RE
2
Background
0.1 %RE
3
9.37 - 9.81 ft
3.6 %RE (s 2.2)
4
11.81 - 12.14 ft
12.3 %RE (s 9.4)
5
12.48 - 13.66 ft
7.5 %RE (s 5.6)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-22_20230602
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-02 10:19 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.16 ft
X Coord.(Long/East): Unavailable
Max Signal: 45.1 %RE @ 12.30 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable





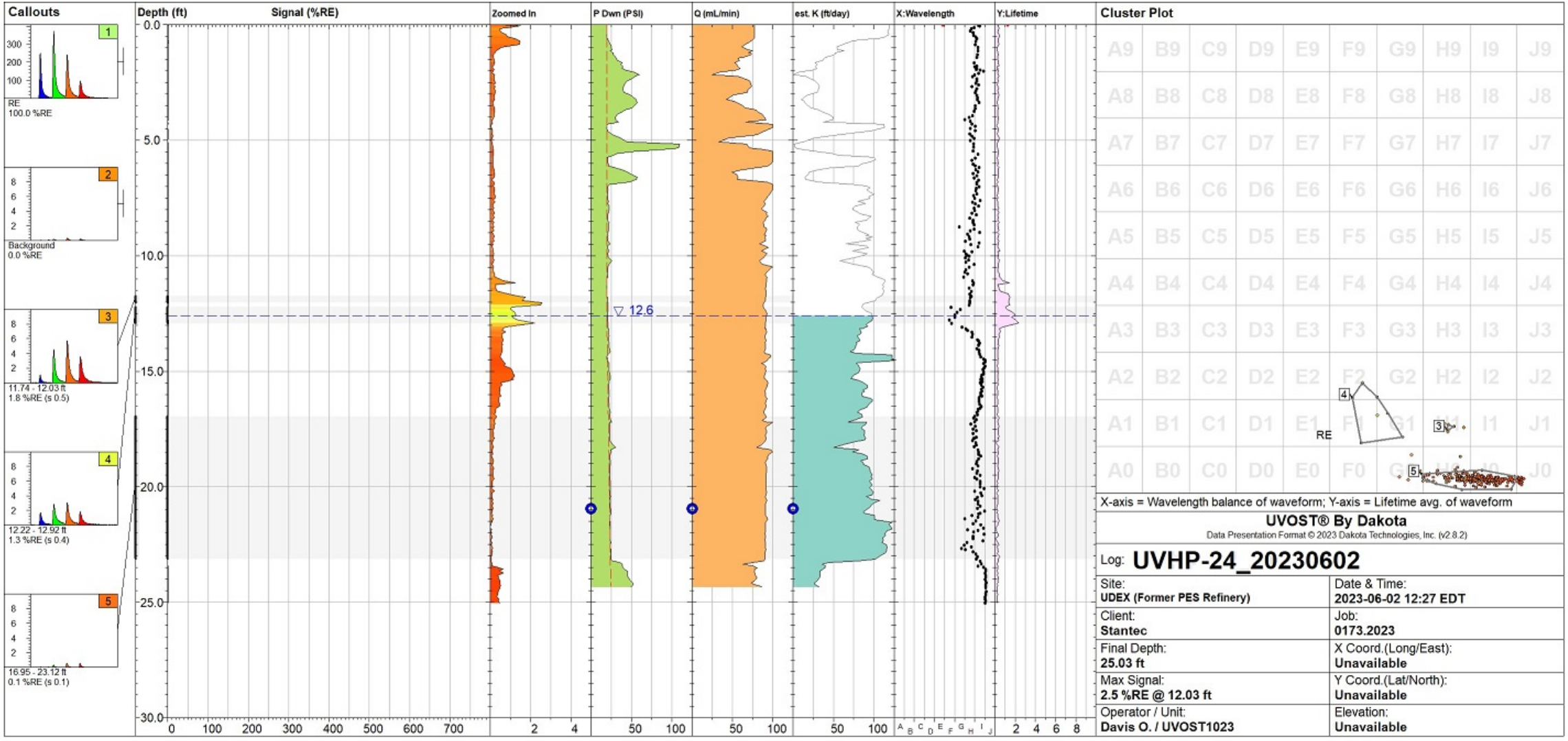
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-23_20230605**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-05 12:25 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **19.89 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **33.3 %RE @ 11.13 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**

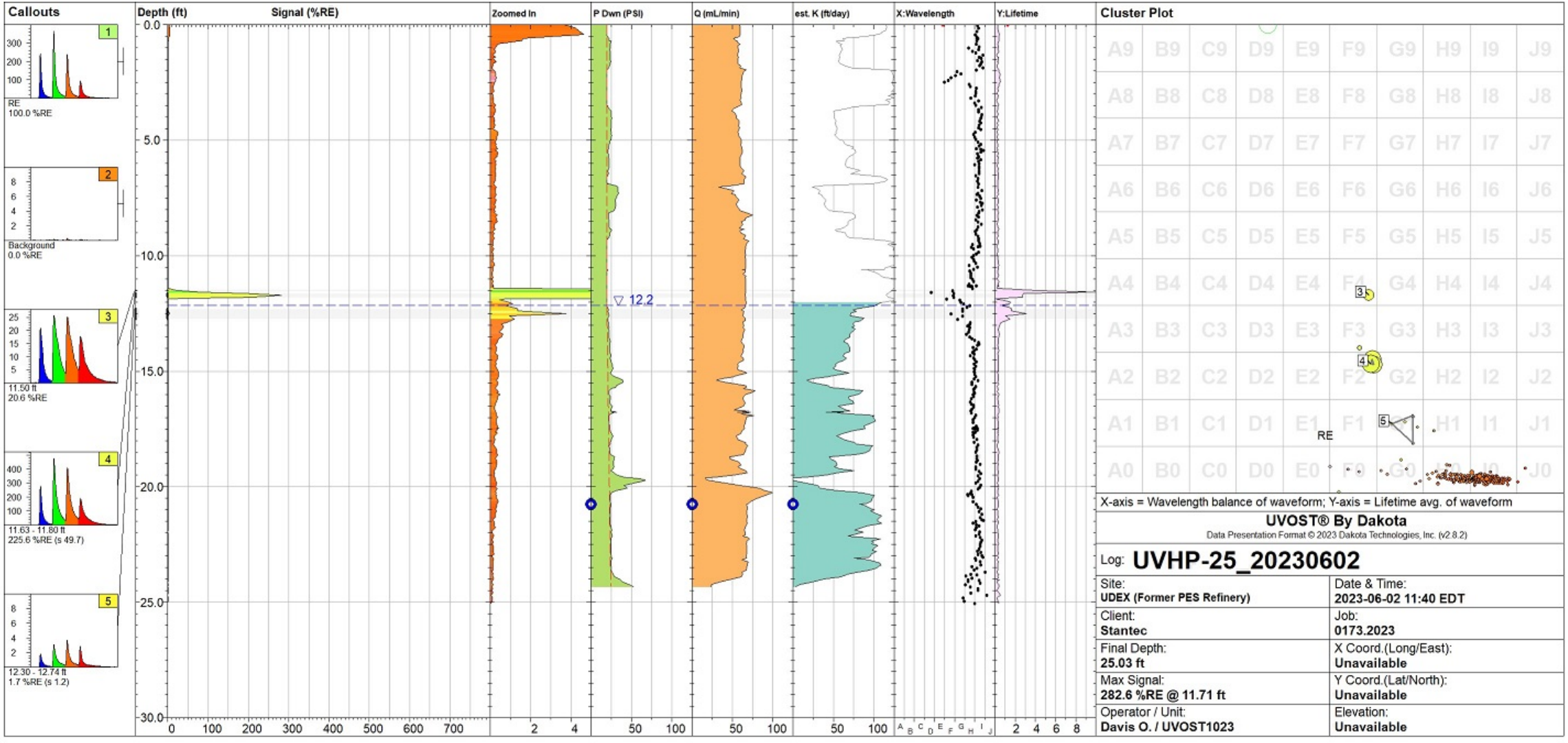


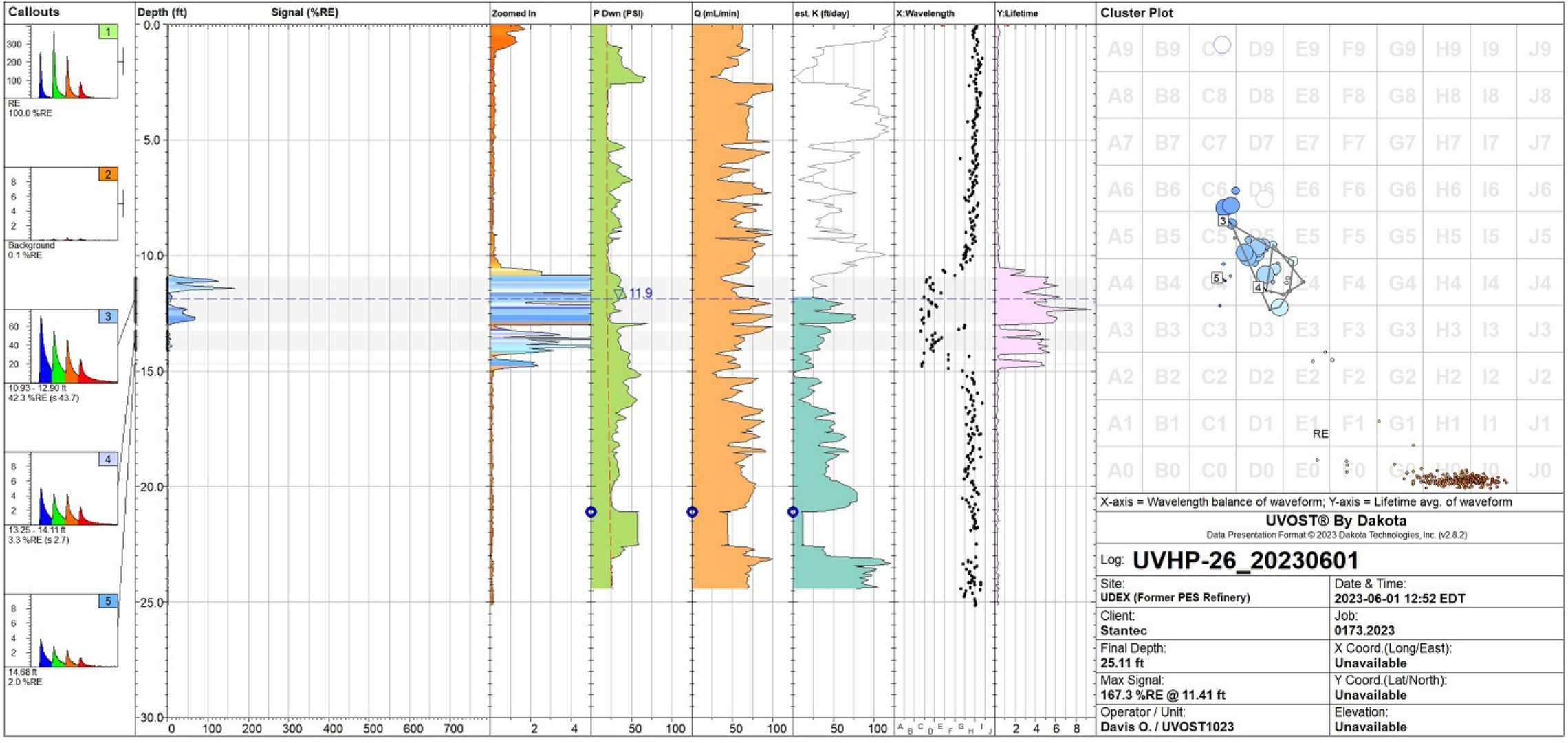
UVOST® By Dakota

Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)

Log: **UVHP-24_20230602**

Site: **UDEX (Former PES Refinery)**	Date & Time: **2023-06-02 12:27 EDT**
Client: **Stantec**	Job: **0173.2023**
Final Depth: **25.03 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **2.5 %RE @ 12.03 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **Davis O. / UVOST1023**	Elevation: **Unavailable**


Callouts
1
RE
100.0 %RE
2
Background
0.0 %RE
3
11.50 ft
20.6 %RE
4
11.63 - 11.80 ft
225.6 %RE (s 49.7)
5
12.30 - 12.74 ft
1.7 %RE (s 1.2)
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
12.2
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-25_20230602
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-02 11:40 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.03 ft
X Coord.(Long/East): Unavailable
Max Signal: 282.6 %RE @ 11.71 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable


Callouts
1
RE
100.0 %RE
2
Background
0.1 %RE
3
10.93 - 12.90 ft
42.3 %RE (s 43.7)
4
13.25 - 14.11 ft
3.3 %RE (s 2.7)
5
14.68 ft
2.0 %RE
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
11.9
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2023 Dakota Technologies, Inc. (v2.8.2)
Log: UVHP-26_20230601
Site: UDEX (Former PES Refinery)
Date & Time: 2023-06-01 12:52 EDT
Client: Stantec
Job: 0173.2023
Final Depth: 25.11 ft
X Coord.(Long/East): Unavailable
Max Signal: 167.3 %RE @ 11.41 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: Davis O. / UVOST1023
Elevation: Unavailable

Appendix C

UVOST®-HP Reference Log

DAKOTA TECHNOLOGIES

Dakota Technologies
UVOST®-HP Reference Log

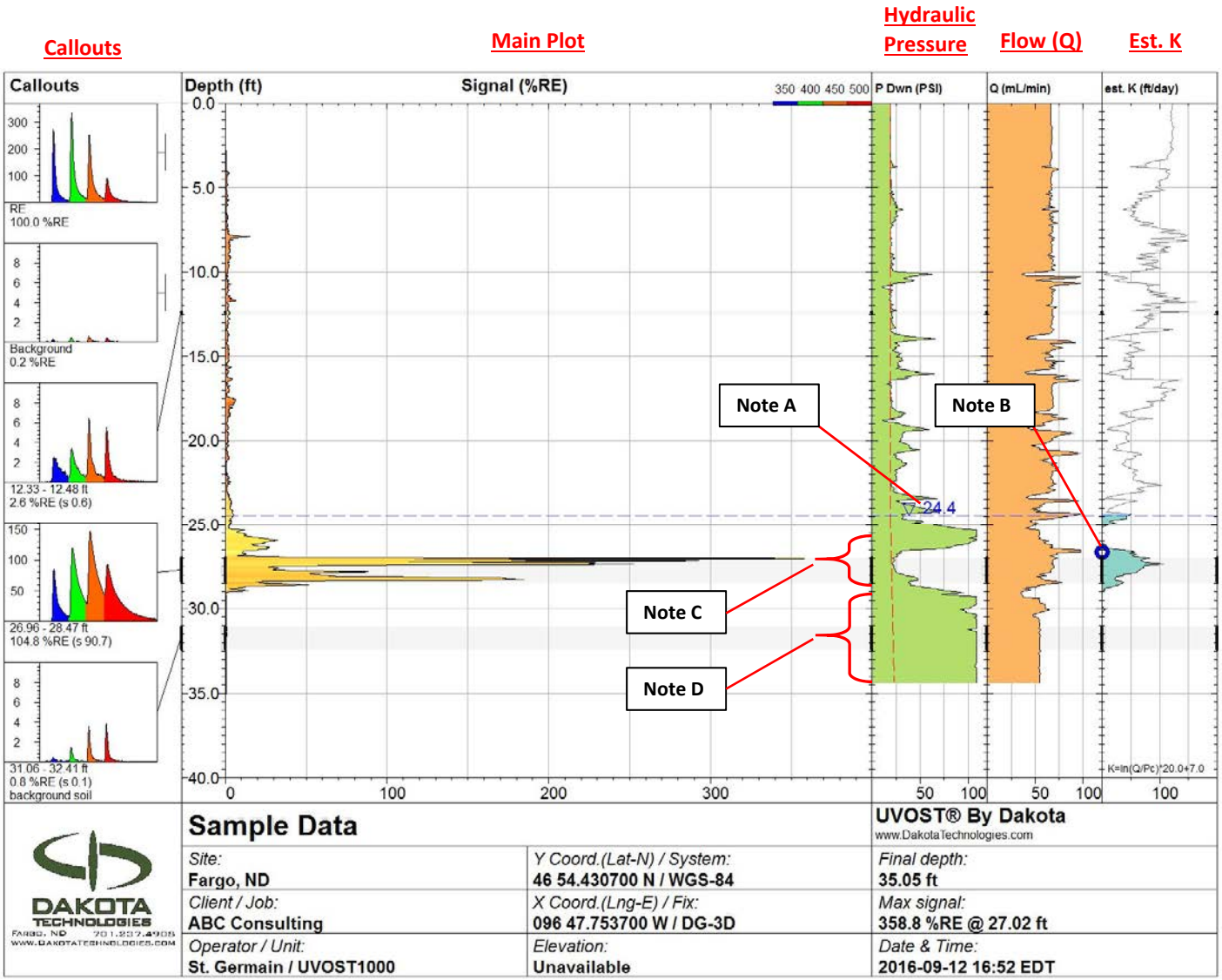
Callouts: Waveforms from selected depths or depth ranges showing the multi-wavelength waveform for that depth. The four peaks are due to fluorescence at four wavelengths and referred to as “channels”. Each channel is assigned a color. Various NAPLs will have a unique waveform “fingerprint” due to the relative amplitude of the four channels and/or broadening of one or more channels. Basic waveform statistics and any operator notes are given below the callout.

Main Plot: Signal (total fluorescence) versus depth where signal is relative to the Reference Emitter (RE). The total area of the waveform is divided by the total area of the Reference Emitter yielding the %RE. This %RE scales with the NAPL fluorescence. The fill color is based on the relative distribution of each channel’s area to the total waveform area (see callout waveform). The channel-to-color relationship and corresponding wavelengths are given in the upper right corner of the plot.

Hydraulic Pressure (P Dwn): Downhole hydraulic pressure is measured in response to pumping water into the formation at a constant rate. Measurements are logged simultaneously with UVOST data. The resulting log gives insight into the permeability of the soils.

Flow (Q): Water is pumped out of the port of the UVOST-HP probe at a constant rate of 60 mL/min. A change in flow (usually accompanied by an inverse pressure change) is an indicator of hydraulic properties of the soil.

Estimated K: The estimated hydraulic conductivity (K) is internally calculated by utilizing pressure and flow data in conjunction with dissipation test(s) performed at each location. The estimated K is calculated by the equation: K = ln(Q/P’)*20.0 + 7.0.



Note A: The water table has been calculated and plotted at 24.4’ bgs.

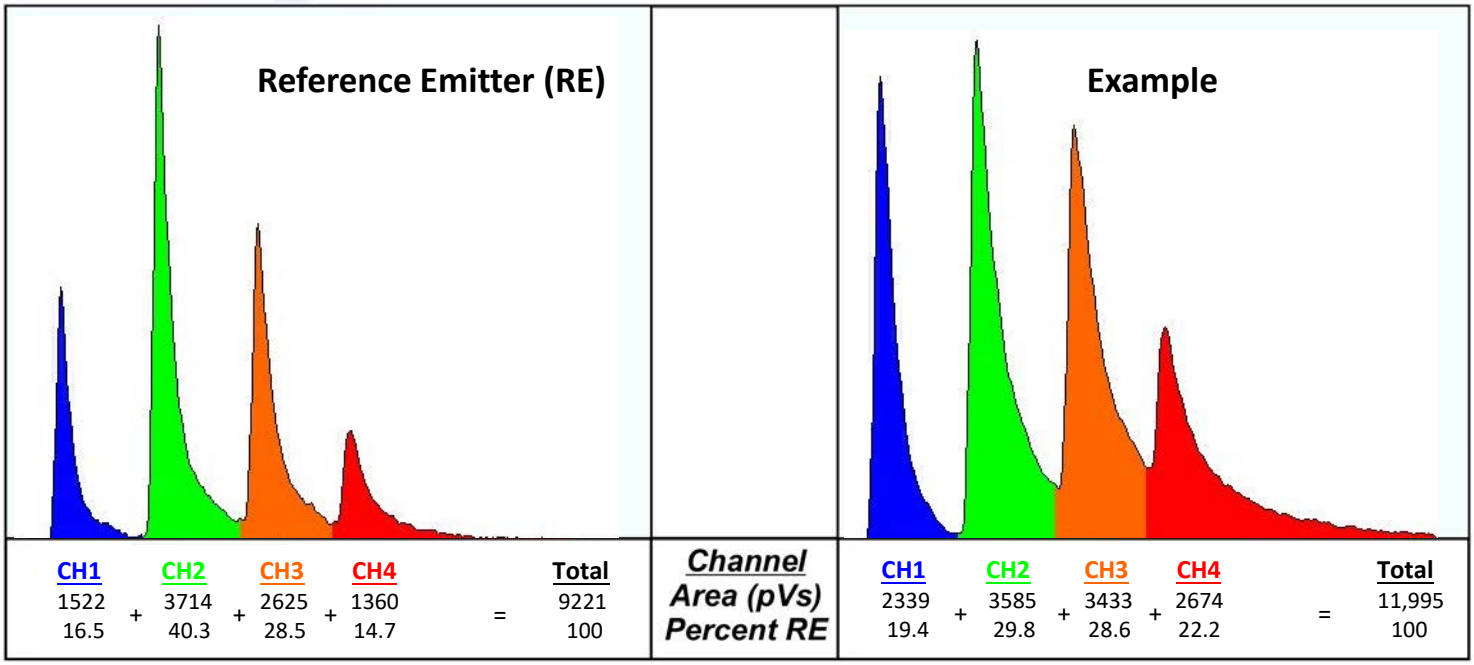
Note B: The circle on the Estimated K plot represents the location(s) of dissipation tests. Here, a single dissipation test was performed at 26.67 bgs’.

Note C: The highest LNAPL response in this log is present in an area of relatively higher permeability, as indicated by low pressure and higher estimated k values at approximately 26’ to 28’.

Note D: The increase in pressure starting near 29’ (transducer is maxed out, 100 psi) is due to low permeability conditions. In this example, the increase in pressure below the LNAPL represents a potential confining unit.

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UVOST® Reference Log

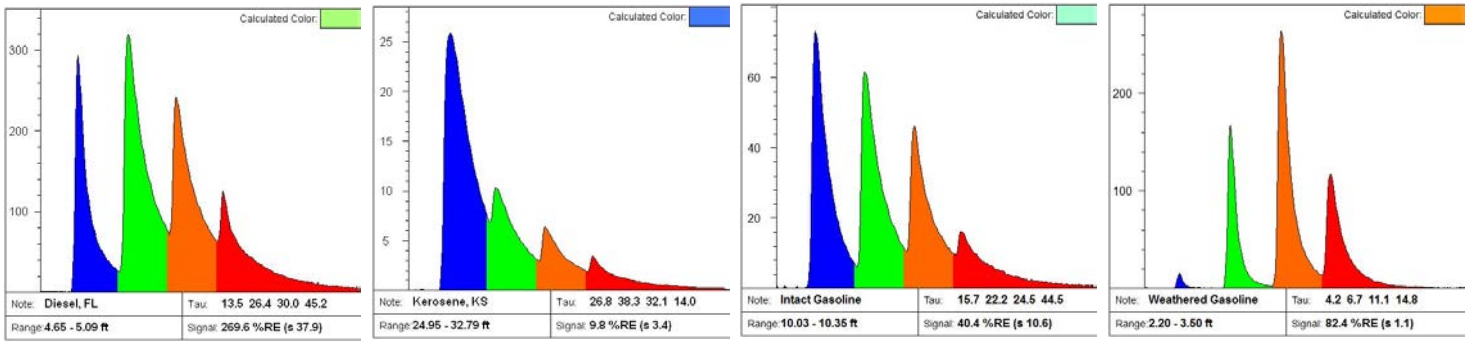
Waveform Signal Calculation



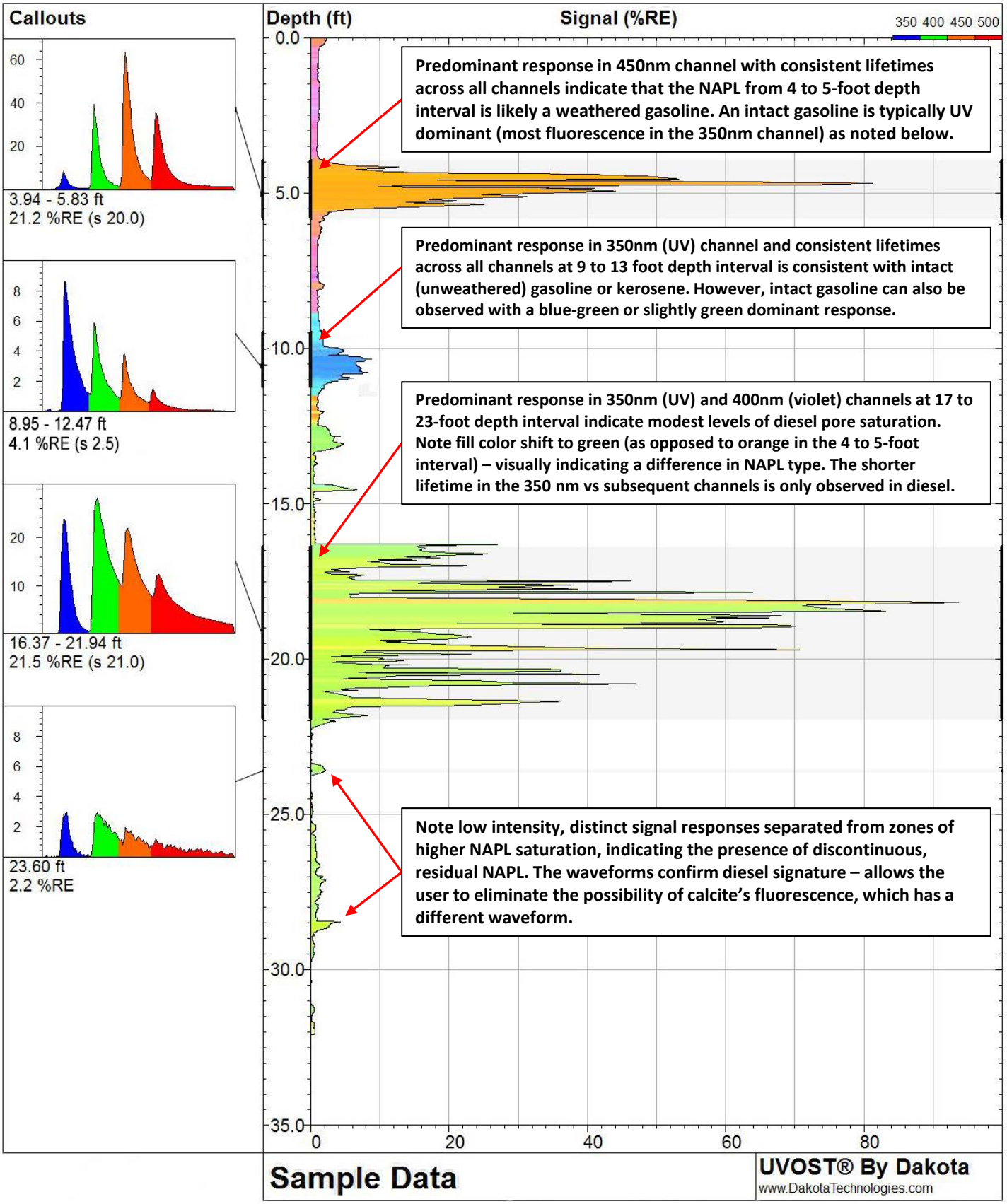
Data Files

***.lif.raw.bin**	Raw data file. Header is ASCII format and contains information stored when the file was initially written (e.g. date, total depth, max signal, GPS, etc., and any information entered by the operator). All Raw waveforms are appended to the bottom of the file in a binary format.
***.lif.plt**	Stores the plot scheme history (e.g. callout depths) for associated Raw file. Transfer along with the Raw file in order to recall previous plots.
***.lif.jpg**	A .jpg image of the OST log including the main signal vs. depth plot, callouts, information, etc.
***.lif.dat.txt**	Data export of a single Raw file. Tab delimited format. No string header is provided for the columns to make importing into some programs easier. Each row is a unique depth reading. The columns are: 1-Depth; 2-Total Signal (%RE); 3-CH1%; 4-Ch2%; 5-CH3%; 6-Ch4%; 7-Rate; 8-EC Depth; 9-EC Signal; 10-Hammer Rate Depth; 11-Hammer Rate; 12-Color (RRGGBB). Summing channels 1 to 4 yields the Total Signal.
***.lif.sum.txt**	A summary file for a number of Raw files. ASCII tab delimited format. The file contains a string header. The summary includes one row for each Raw file and contains information for each filed including: the file name, GPS coordinates, max depth, max signal, and depth at which the max signal occurred.
***.lif.log.txt**	An activity log generated automatically is located in the OST application directory in the 'log' subfolder. Each OST unit the computer operates will generate a separate log file per month. A log file contains much of the header information contained within each separate Raw file, including: data rate, total depth, max signal, etc.

Common Waveforms (highly dependent on soil, weathering, etc.)

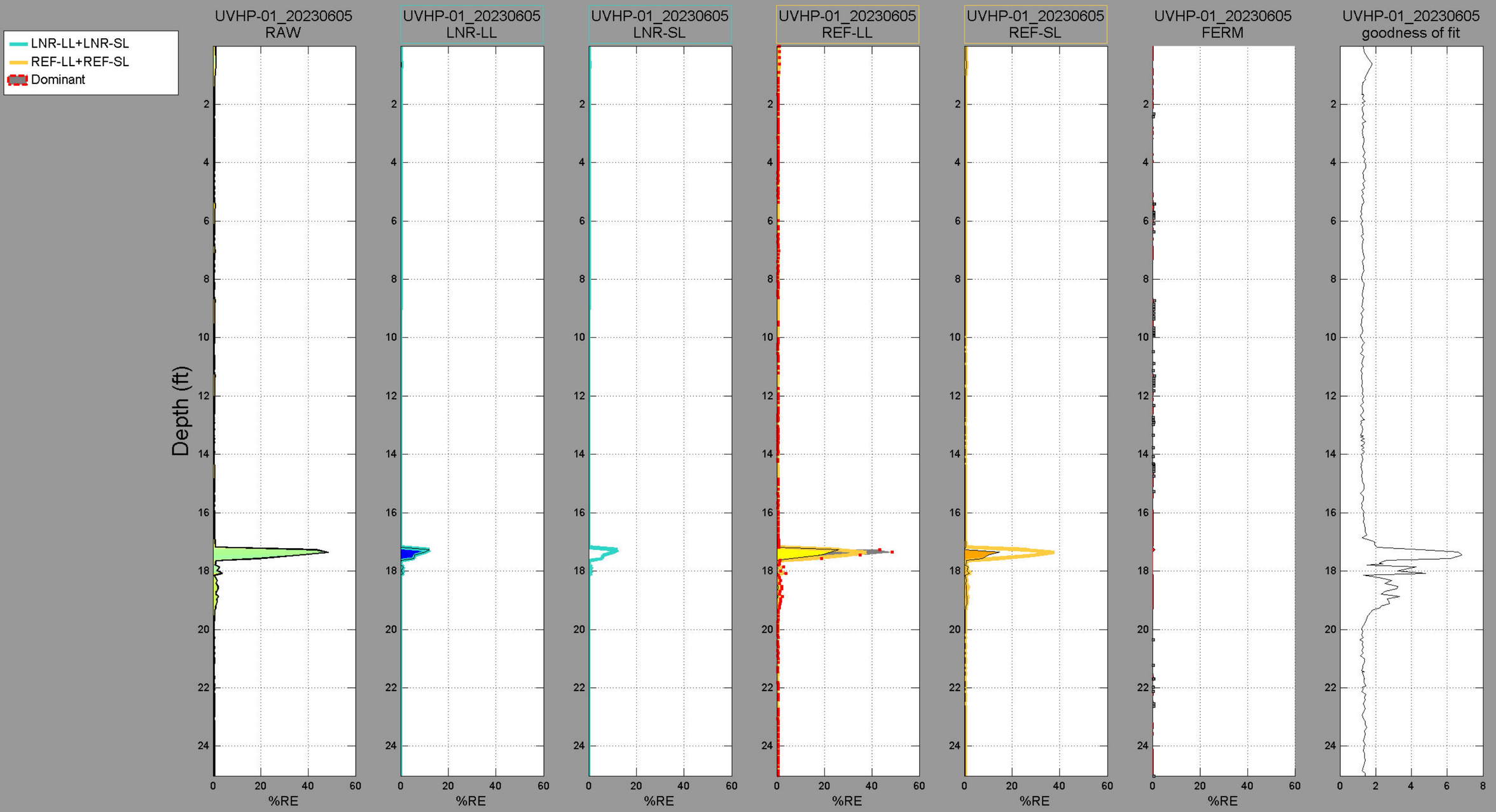


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UVOST® Reference Log

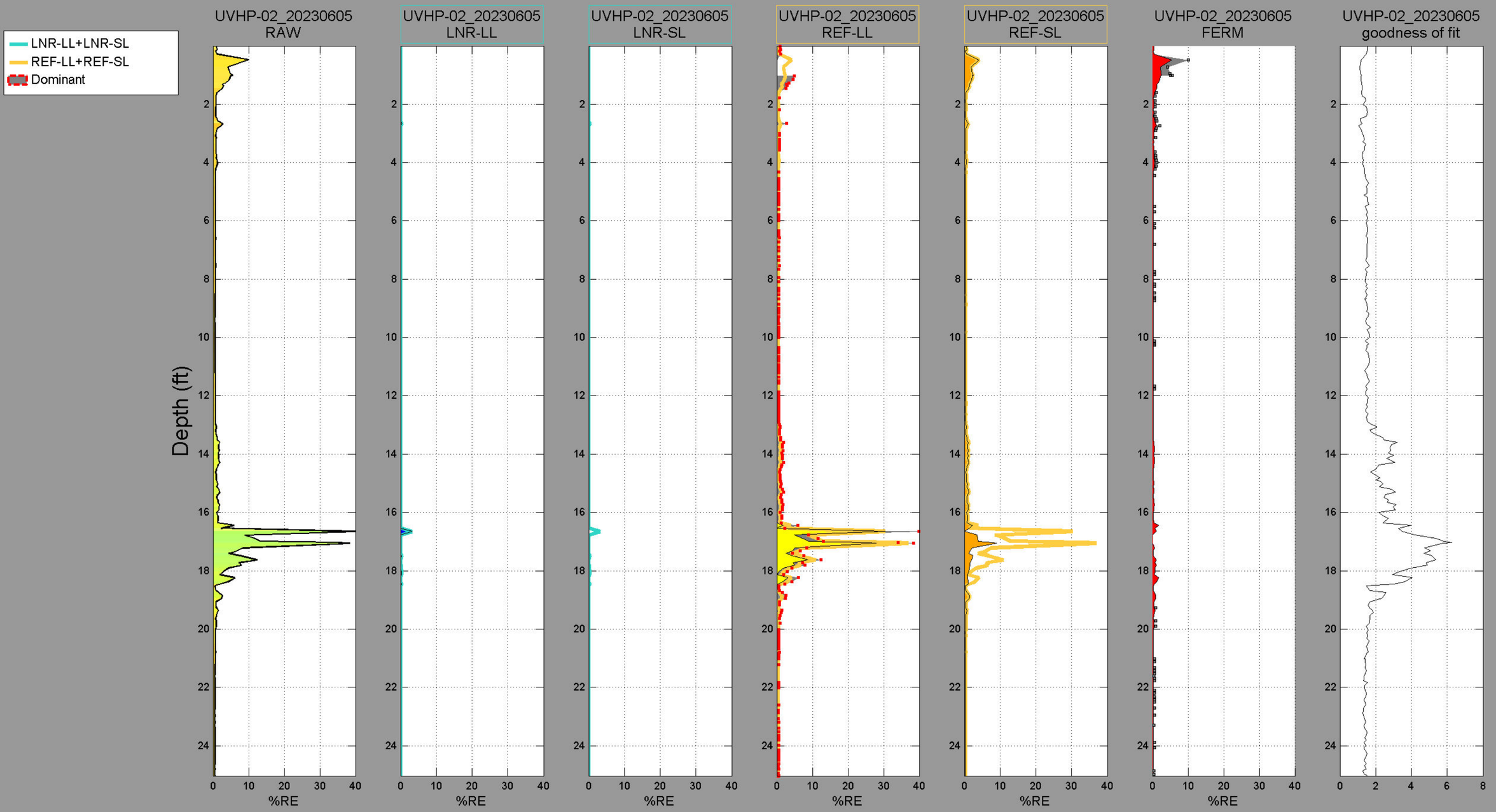


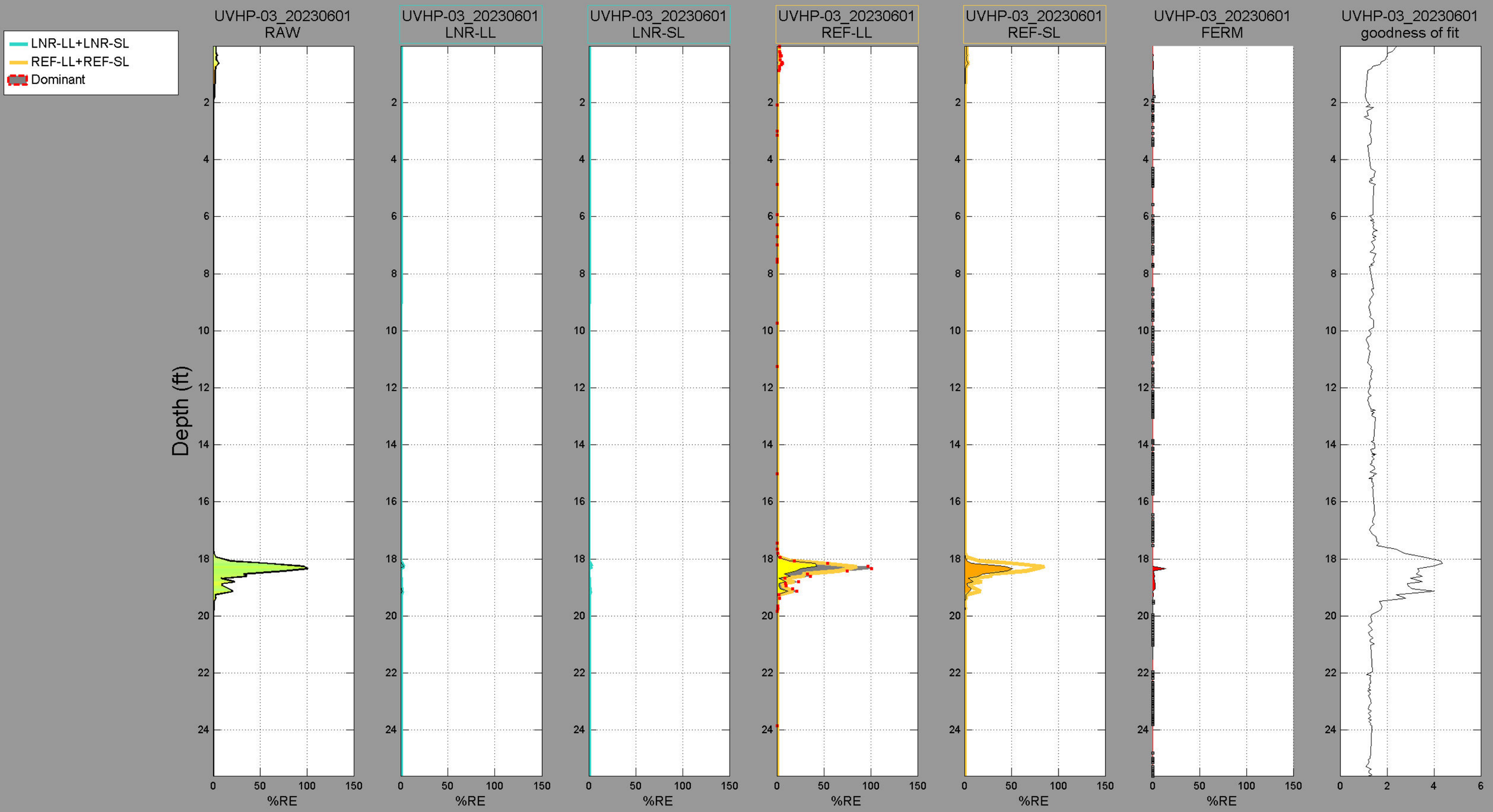
Appendix D

NNLS Output

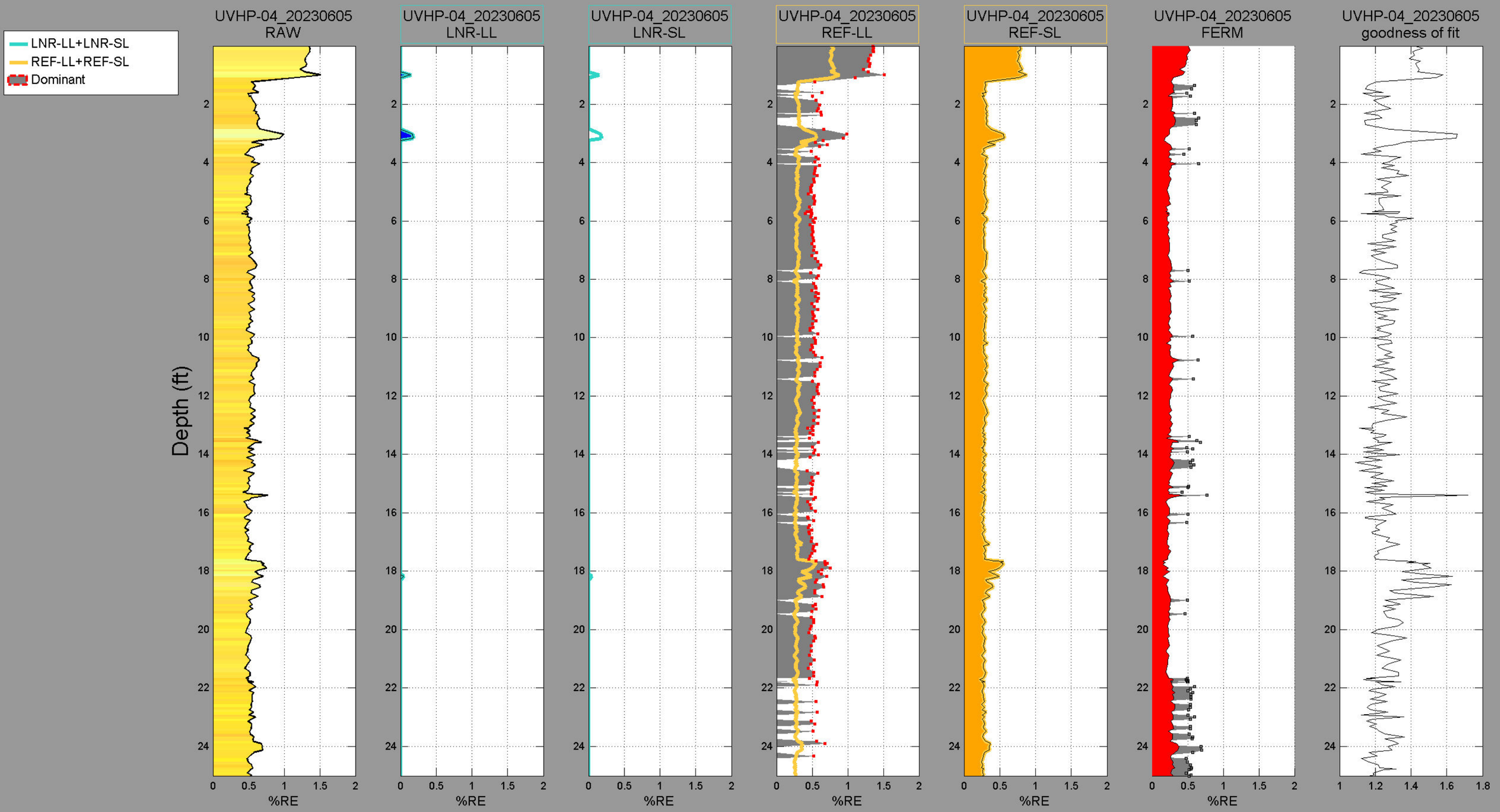


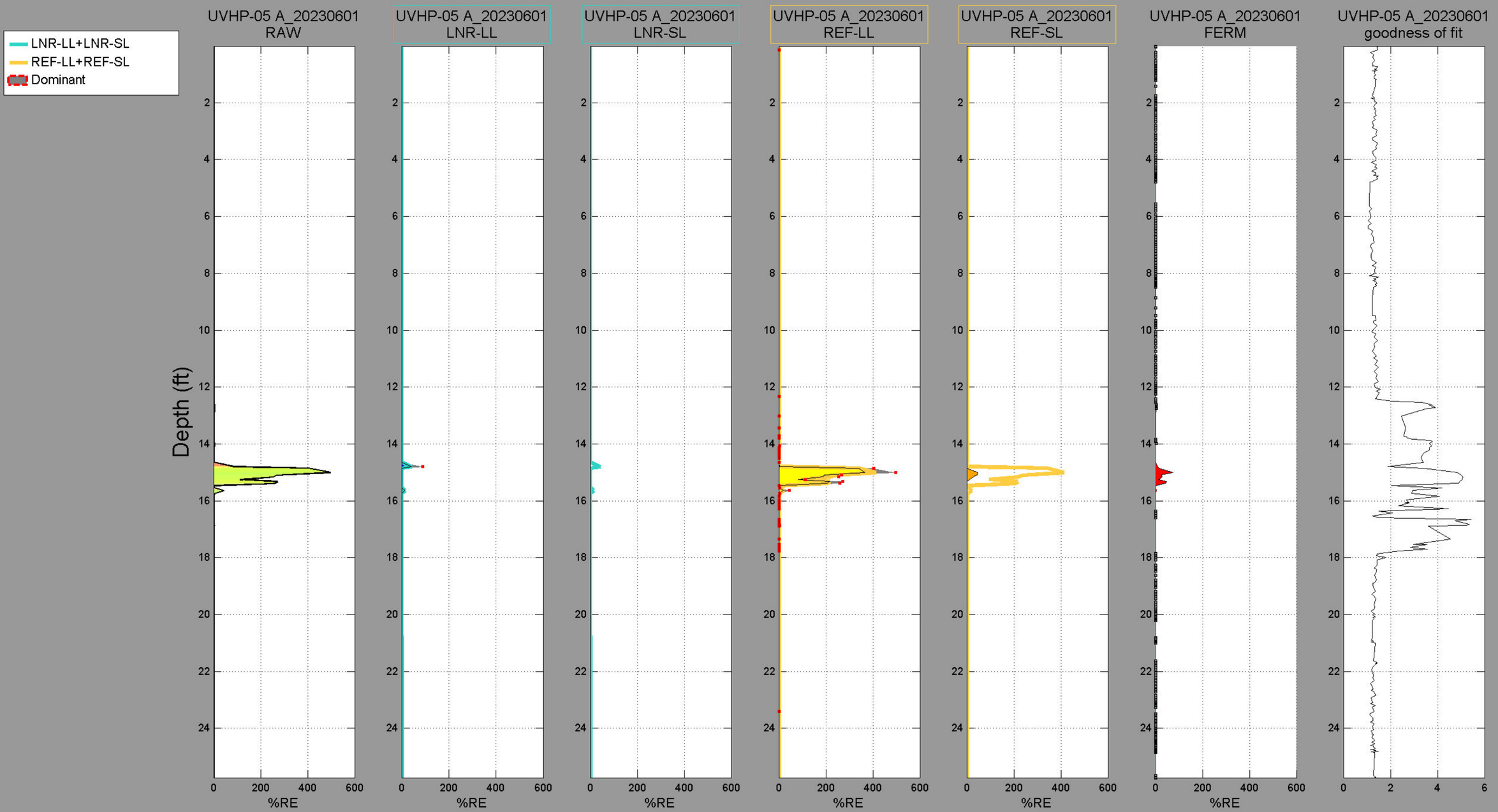
Advanced Data Analysis - www.DakotaTechnologies.com

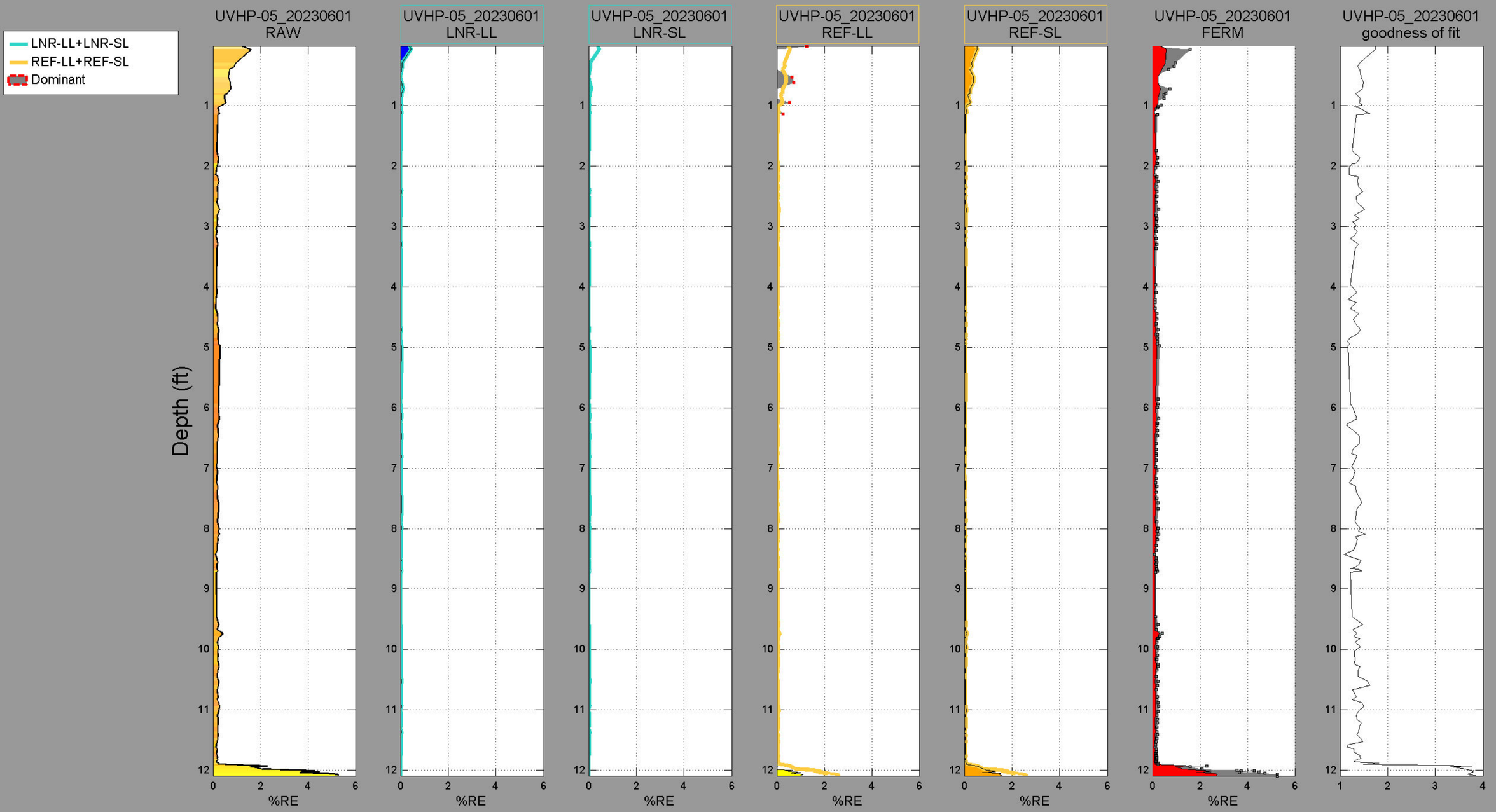

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-02_20230605
RAW
UVHP-02_20230605
LNR-LL
UVHP-02_20230605
LNR-SL
UVHP-02_20230605
REF-LL
UVHP-02_20230605
REF-SL
UVHP-02_20230605
FERM
UVHP-02_20230605
goodness of fit
Depth (ft)
%RE
%RE
%RE
%RE
%RE
%RE
%RE

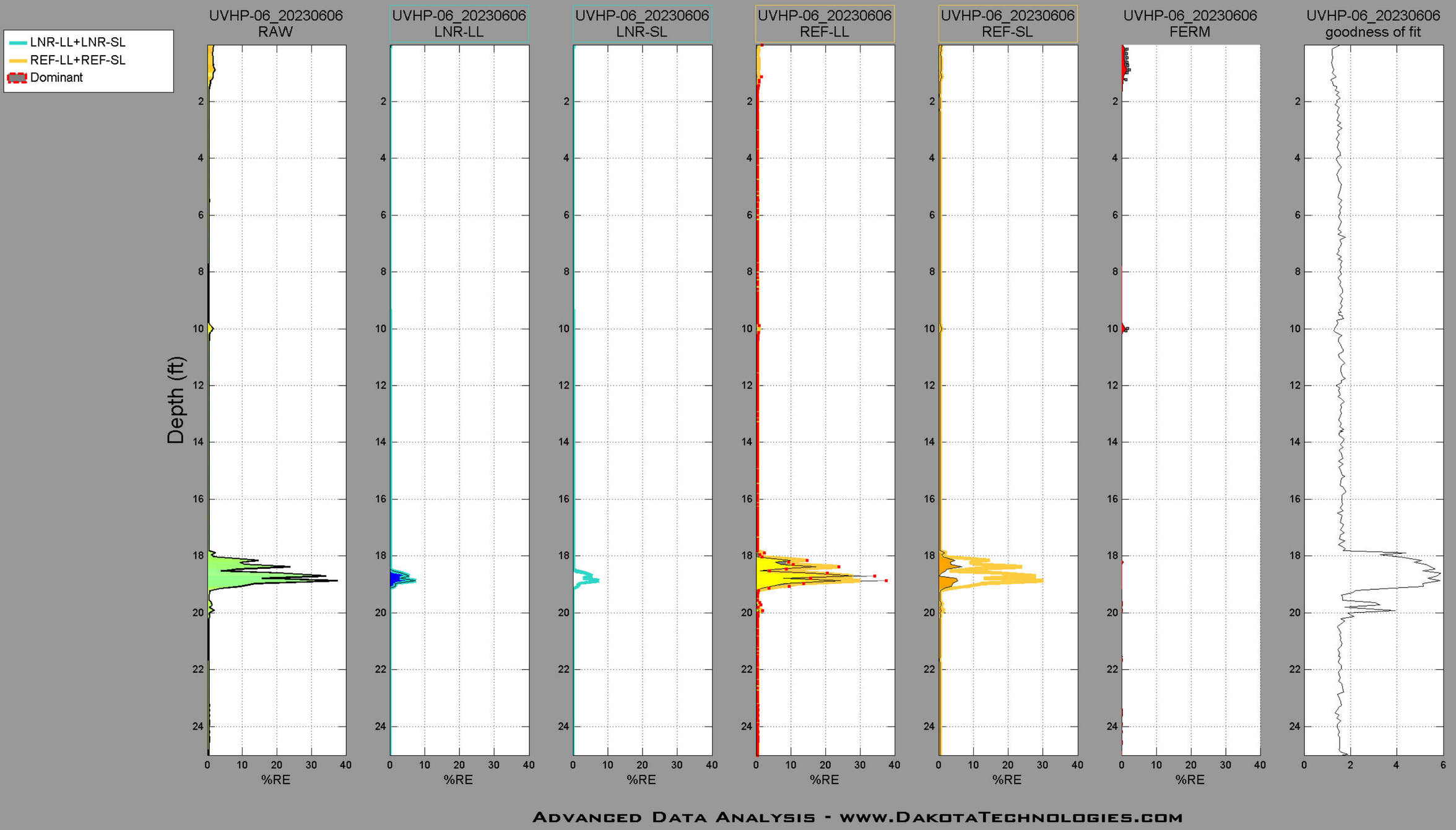


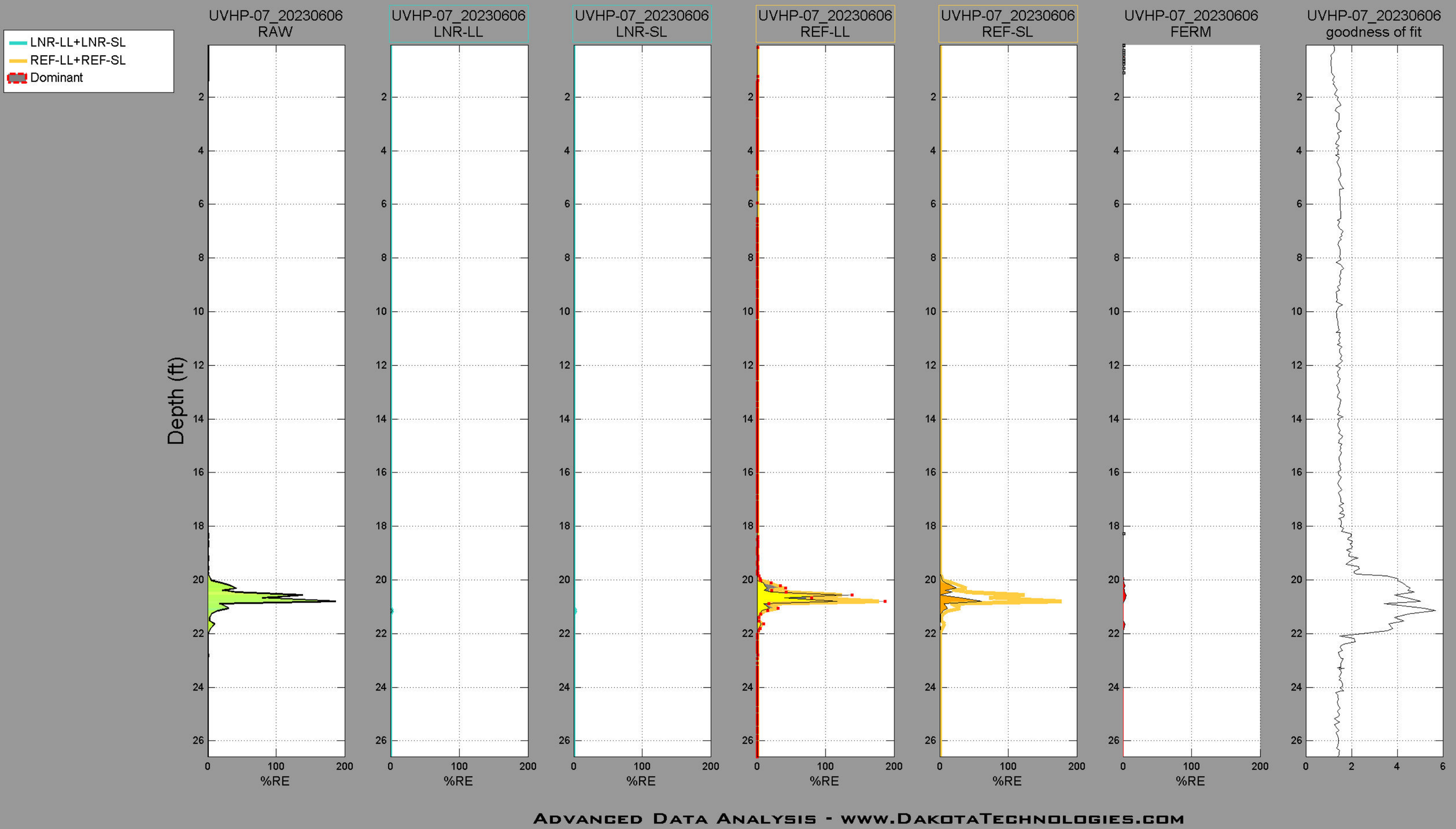
Advanced Data Analysis - www.DakotaTechnologies.com

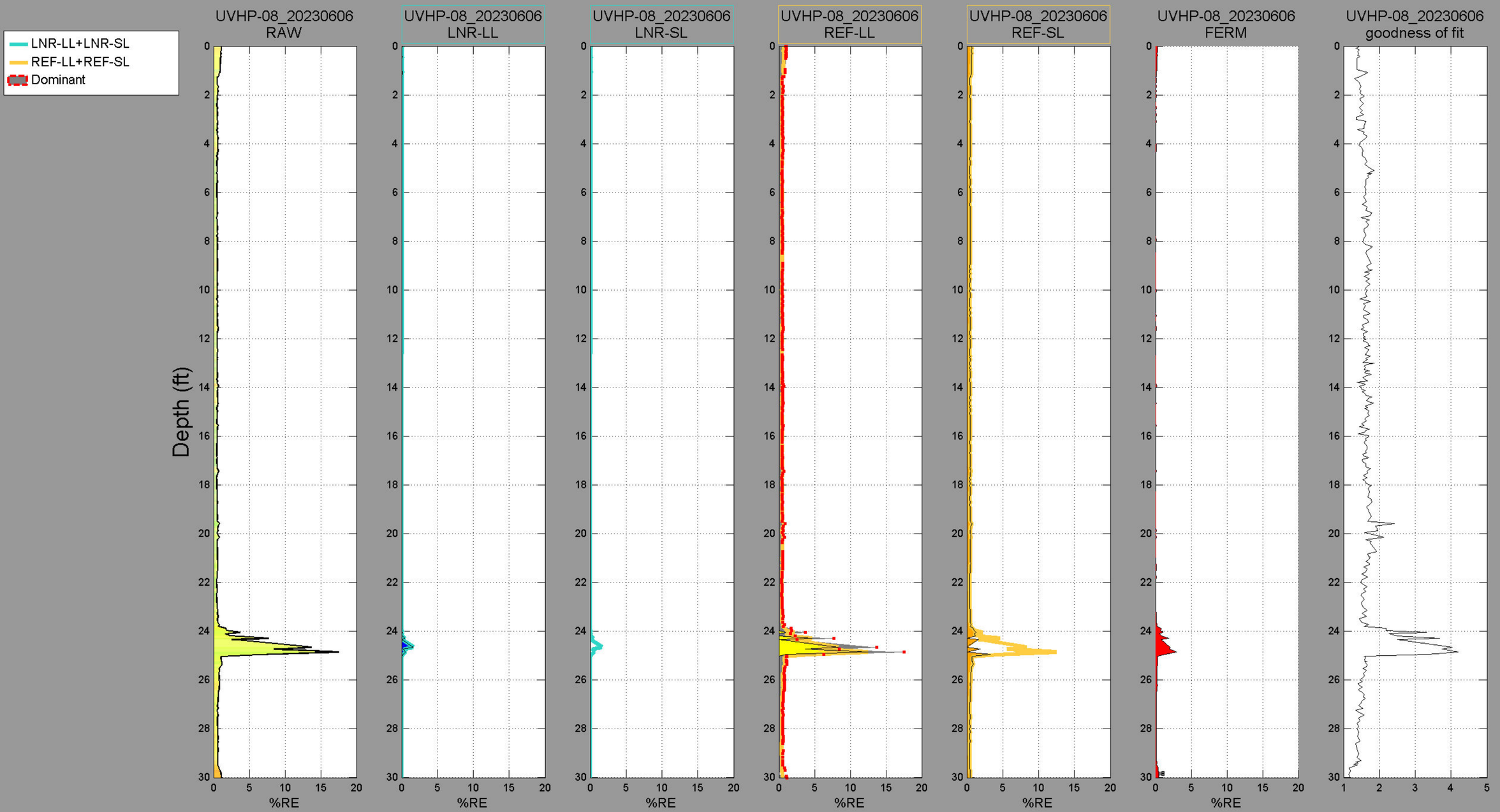

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-04_20230605
RAW
UVHP-04_20230605
LNR-LL
UVHP-04_20230605
LNR-SL
UVHP-04_20230605
REF-LL
UVHP-04_20230605
REF-SL
UVHP-04_20230605
FERM
UVHP-04_20230605
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

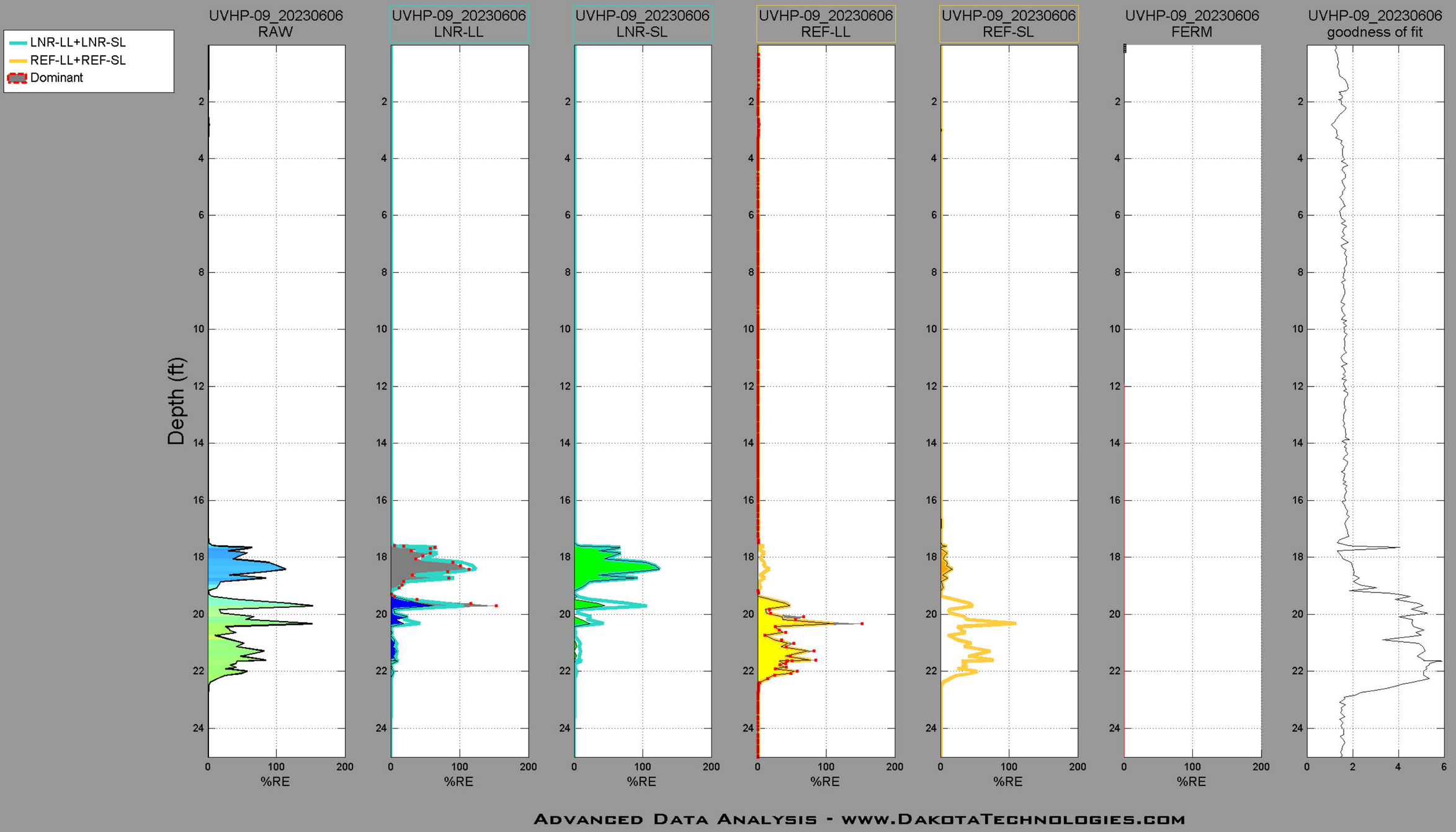

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-05 A_20230601
RAW
UVHP-05 A_20230601
LNR-LL
UVHP-05 A_20230601
LNR-SL
UVHP-05 A_20230601
REF-LL
UVHP-05 A_20230601
REF-SL
UVHP-05 A_20230601
FERM
UVHP-05 A_20230601
goodness of fit
Depth (ft)
%RE
%RE
%RE
%RE
%RE
%RE
%RE

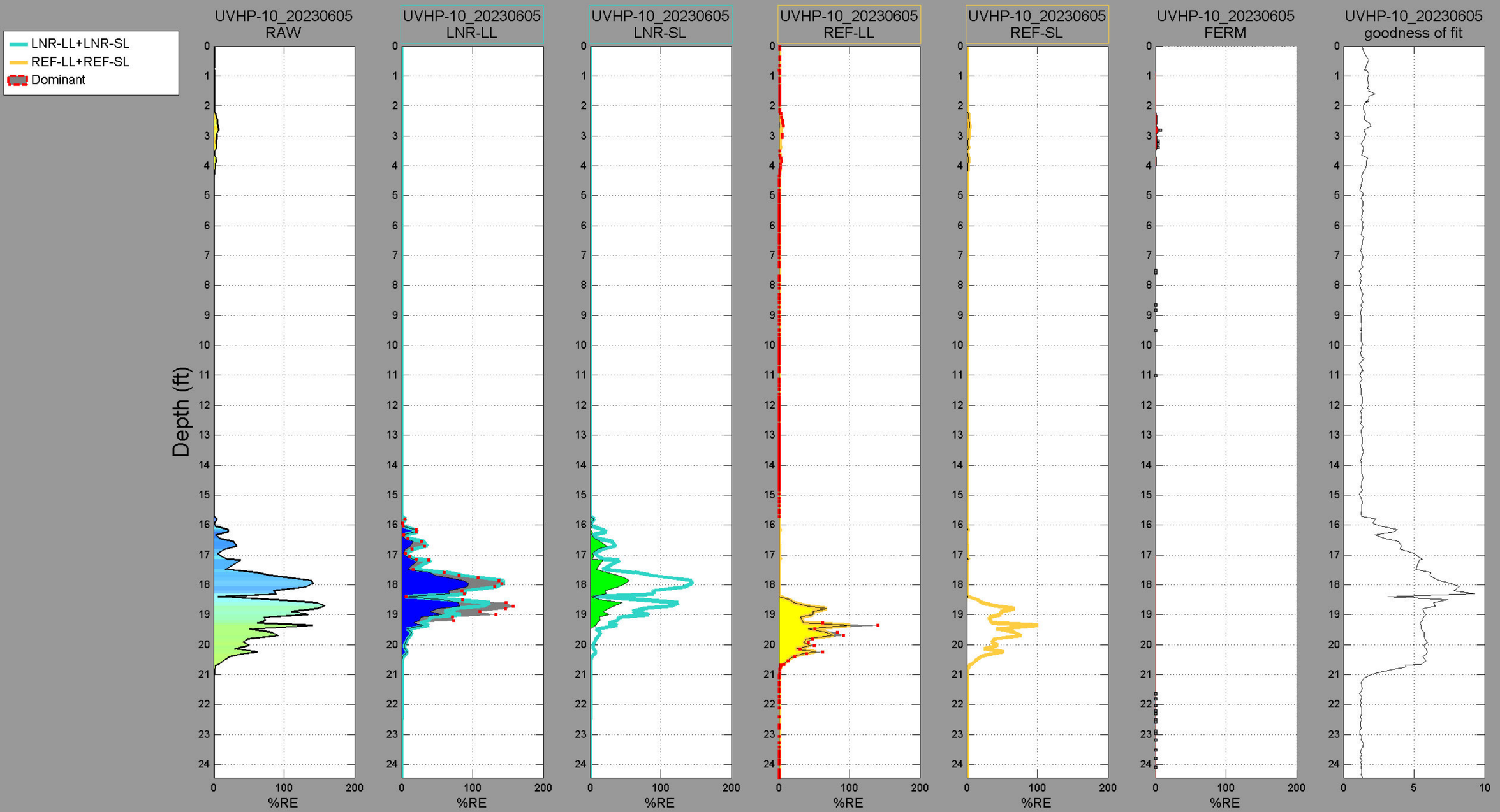

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-05_20230601
RAW
UVHP-05_20230601
LNR-LL
UVHP-05_20230601
LNR-SL
UVHP-05_20230601
REF-LL
UVHP-05_20230601
REF-SL
UVHP-05_20230601
FERM
UVHP-05_20230601
goodness of fit
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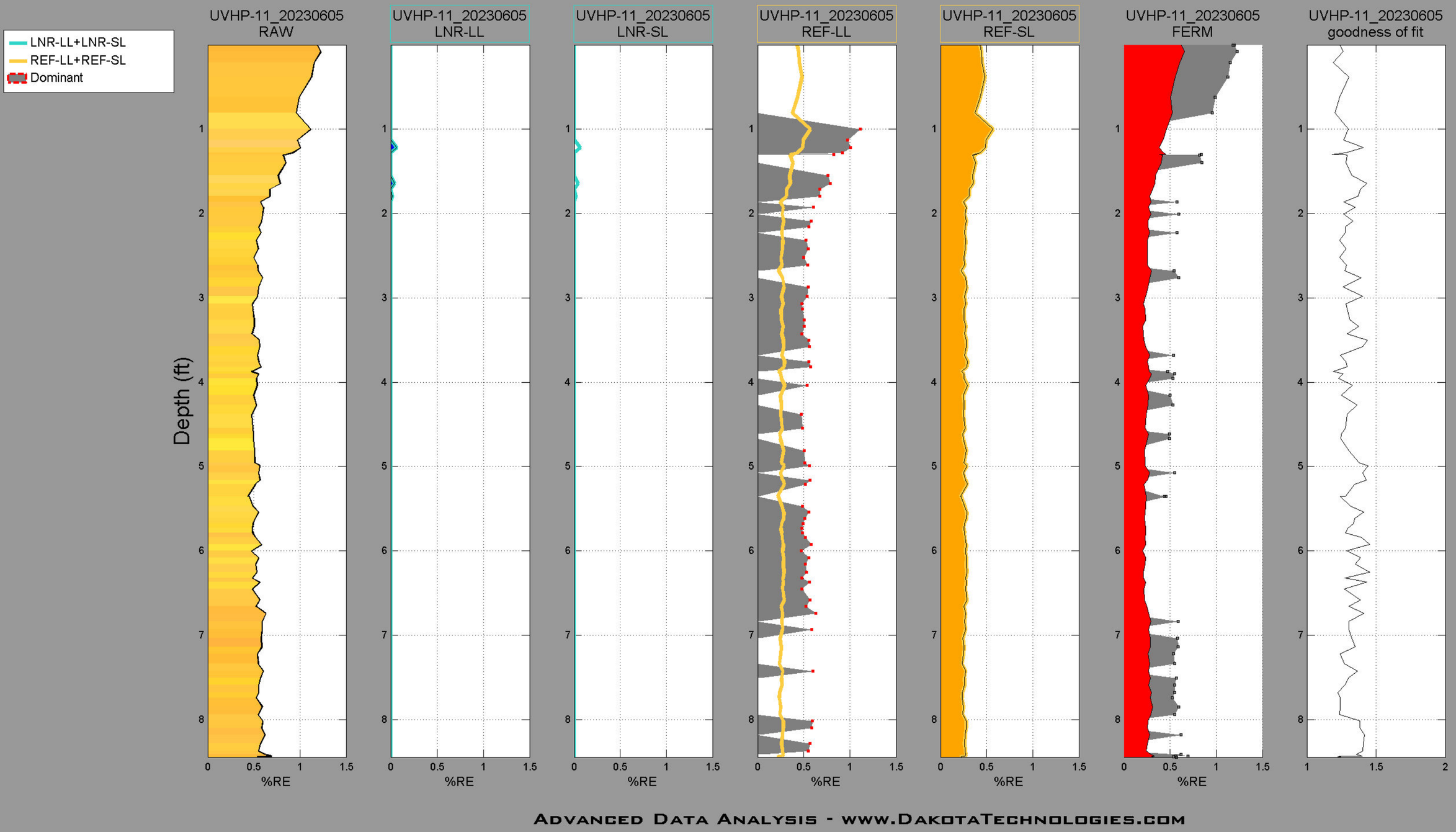

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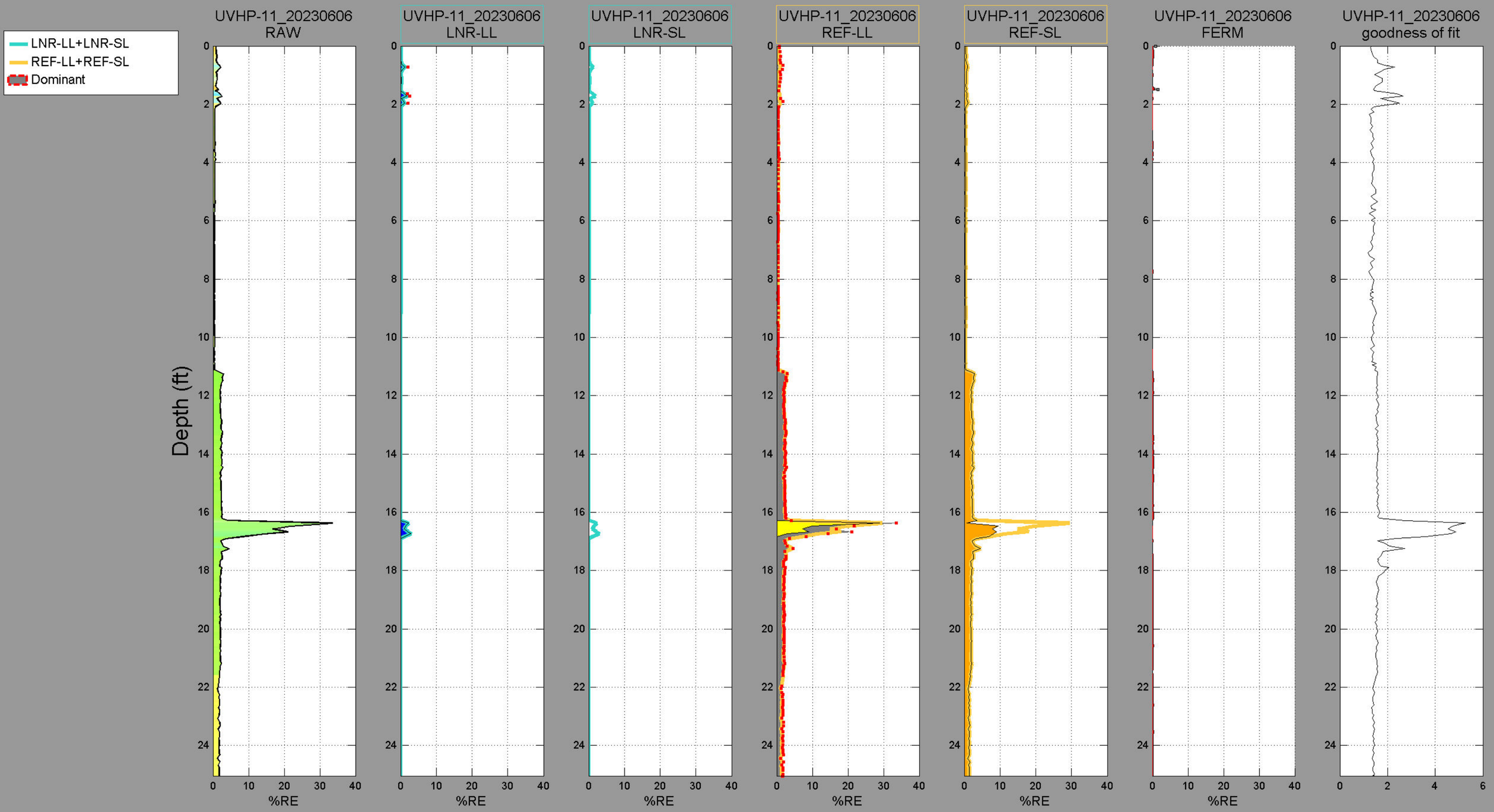

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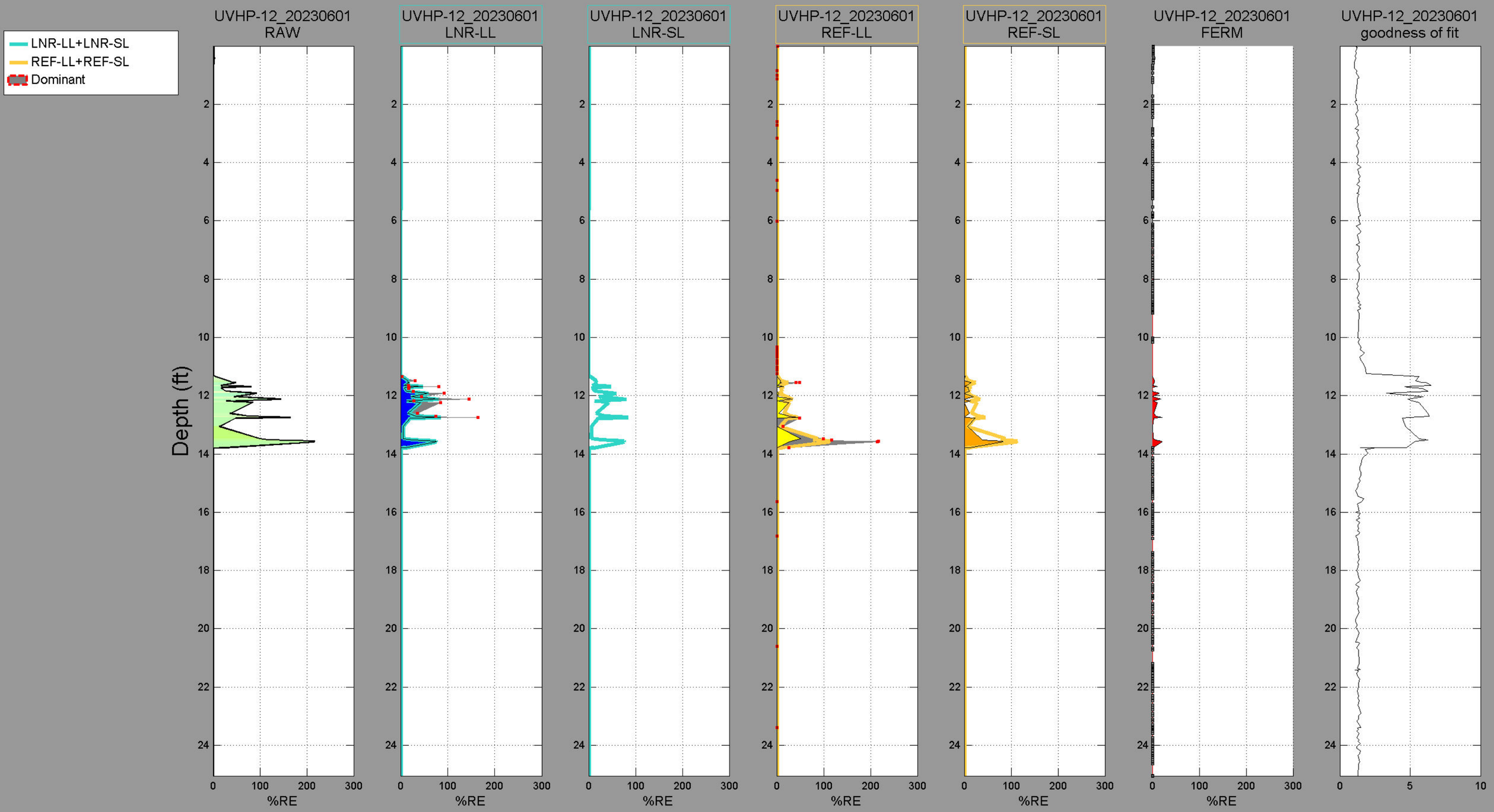

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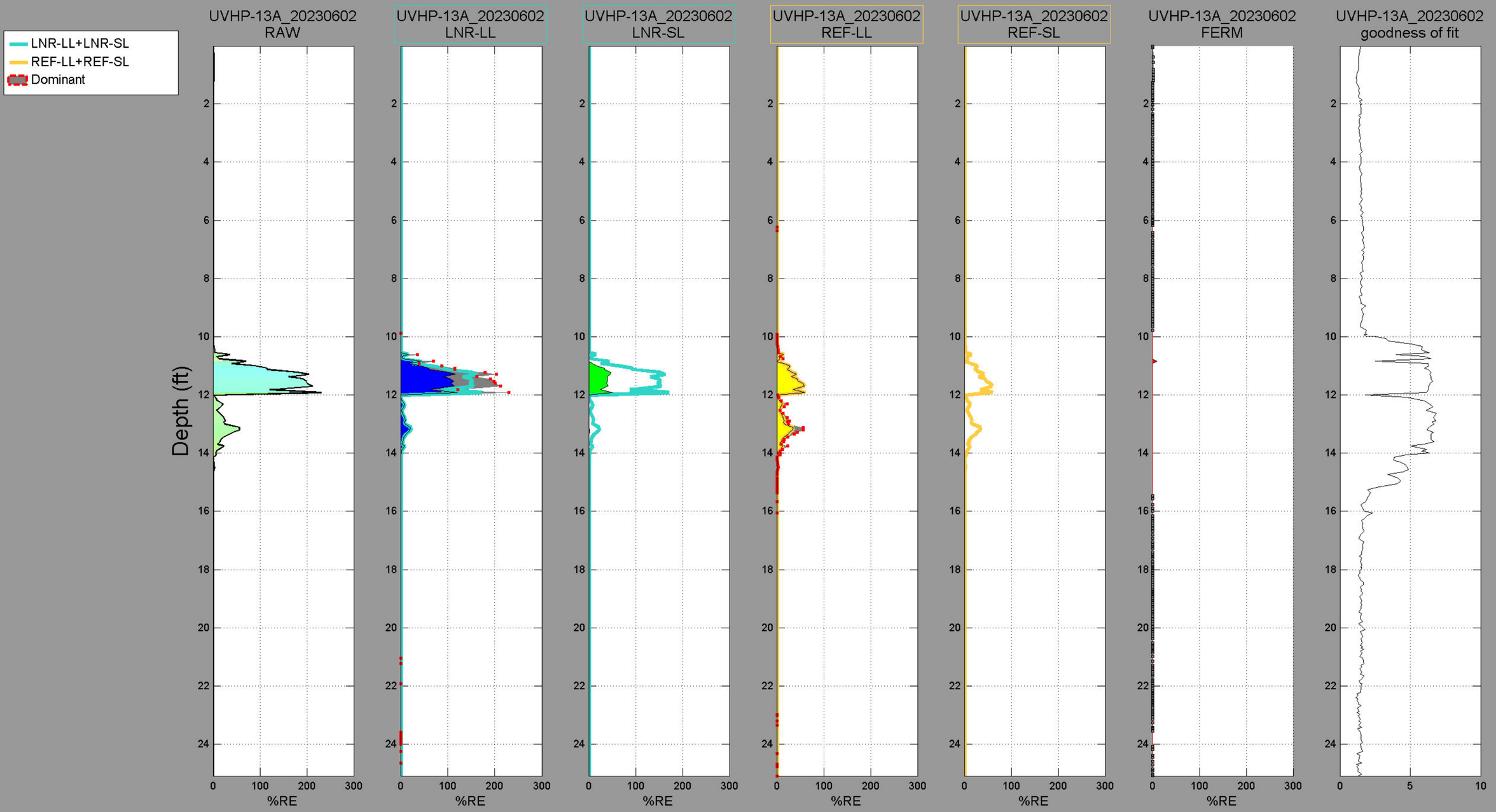

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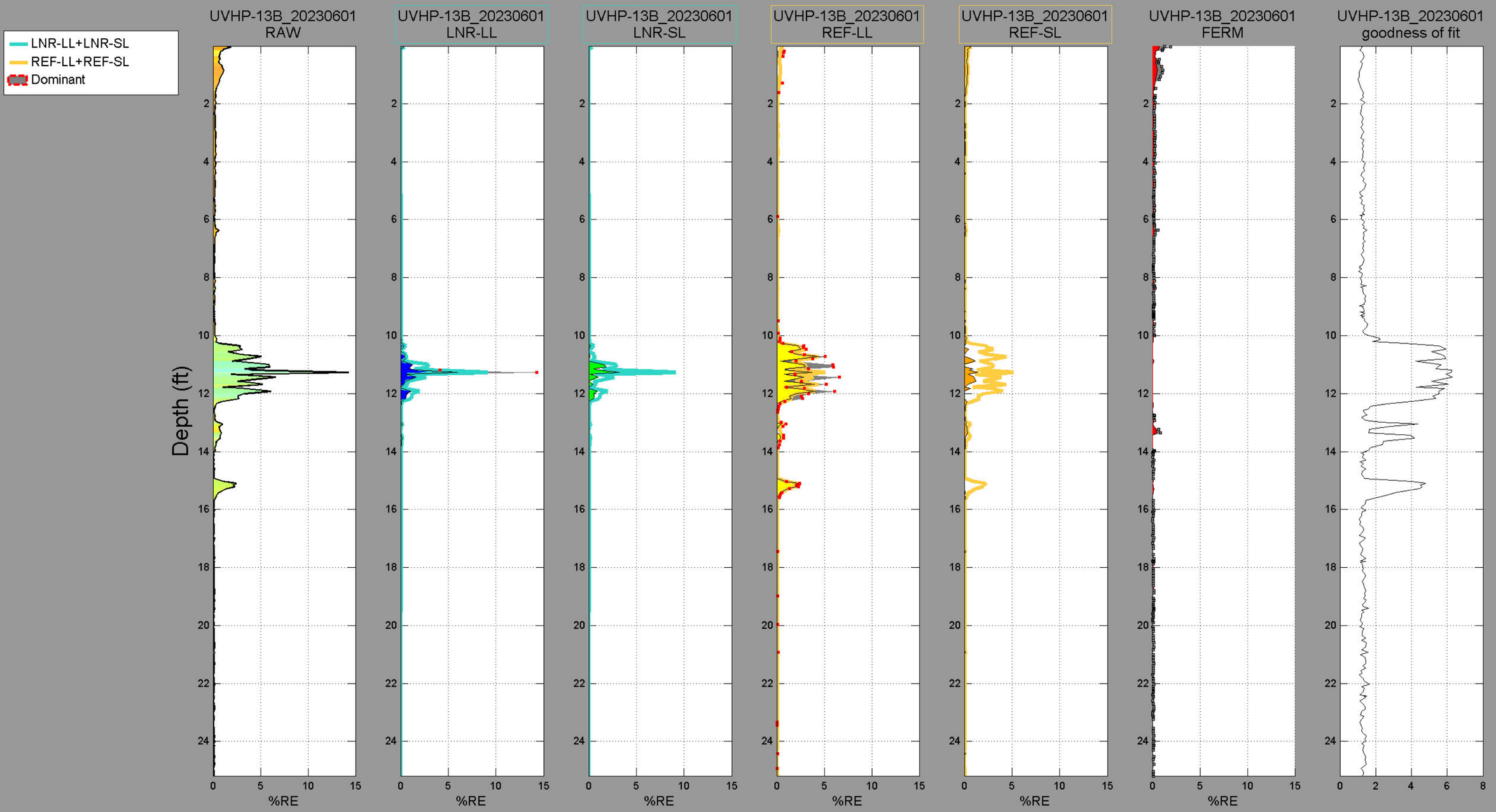

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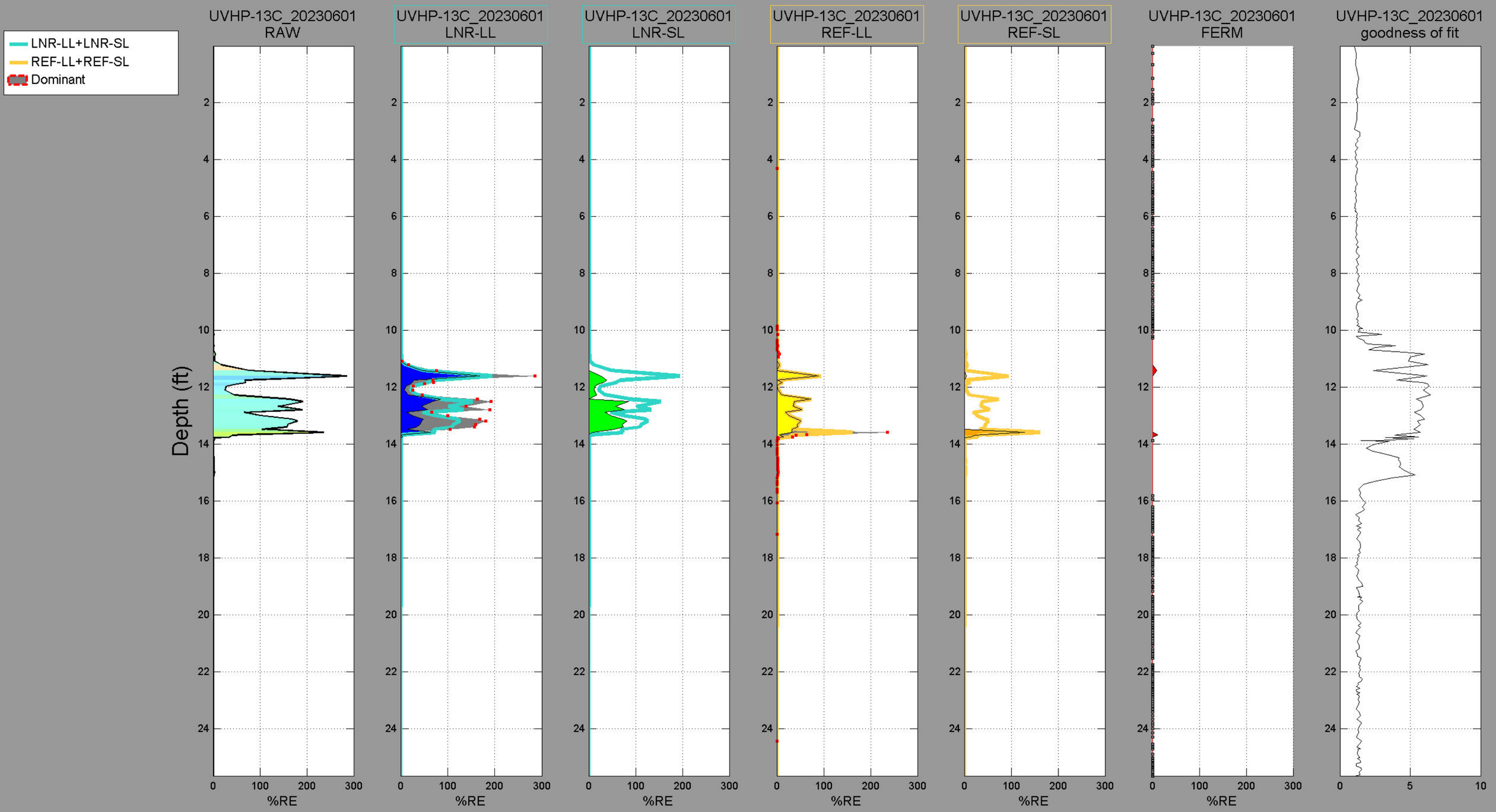

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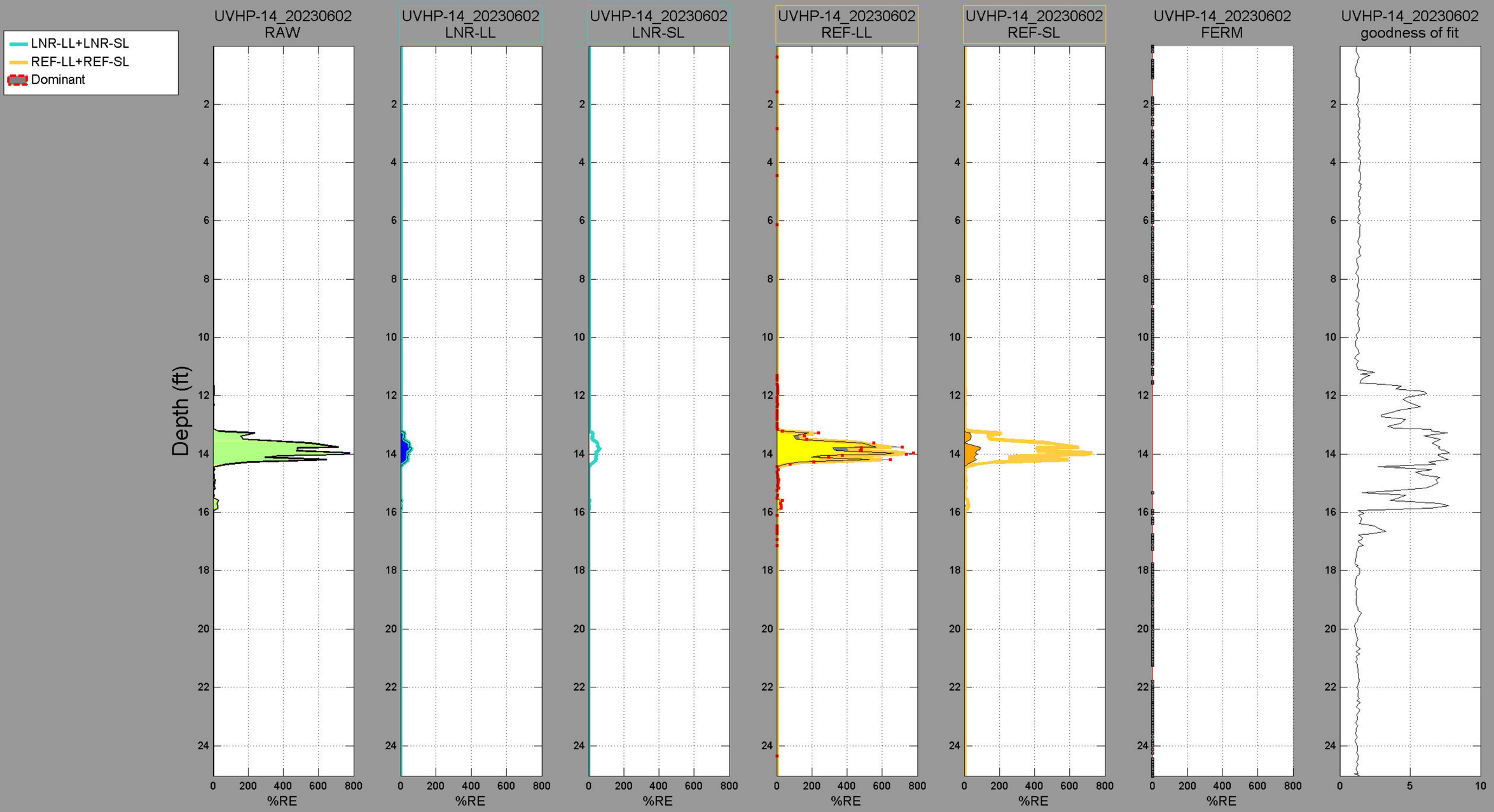


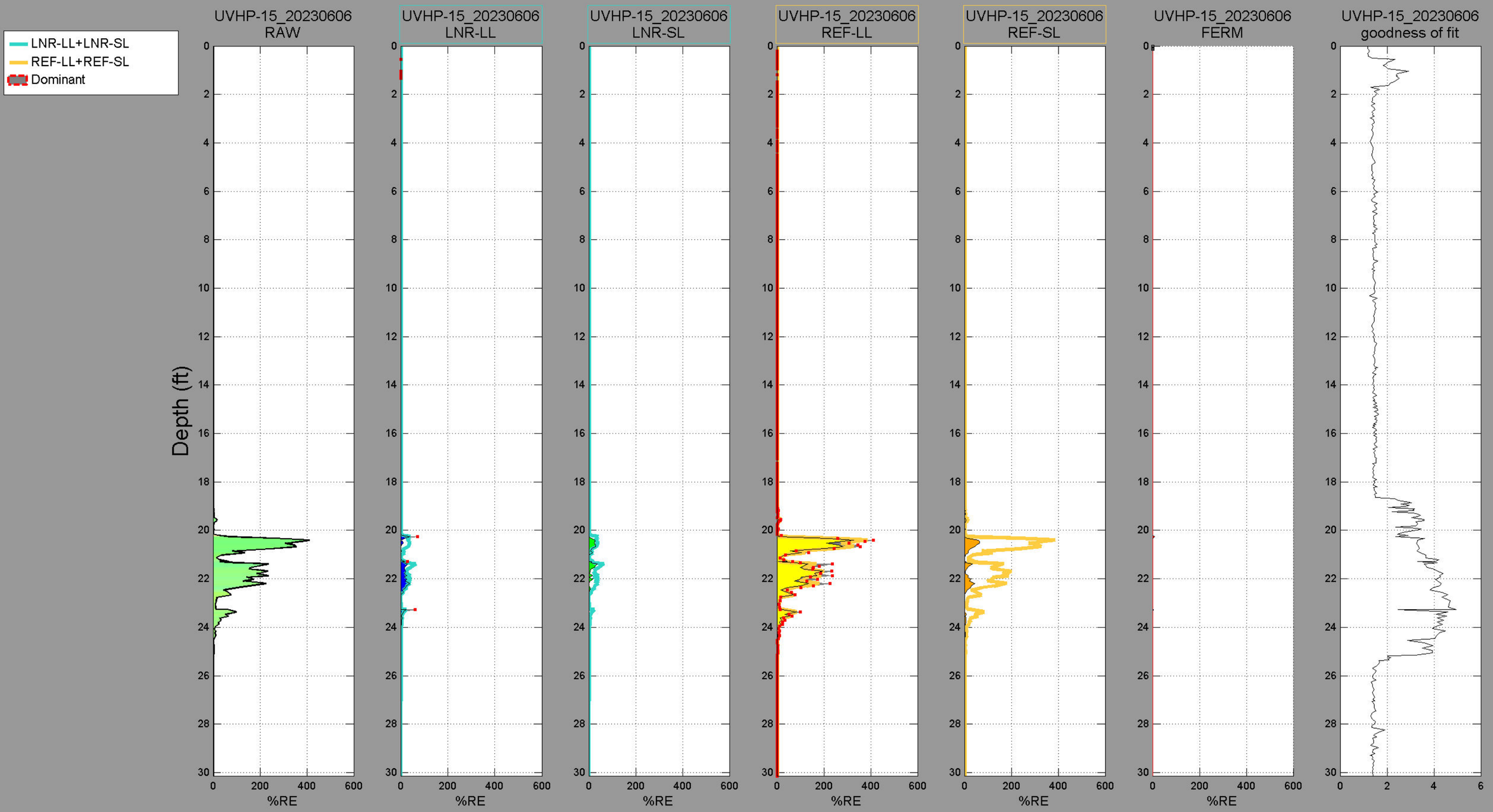
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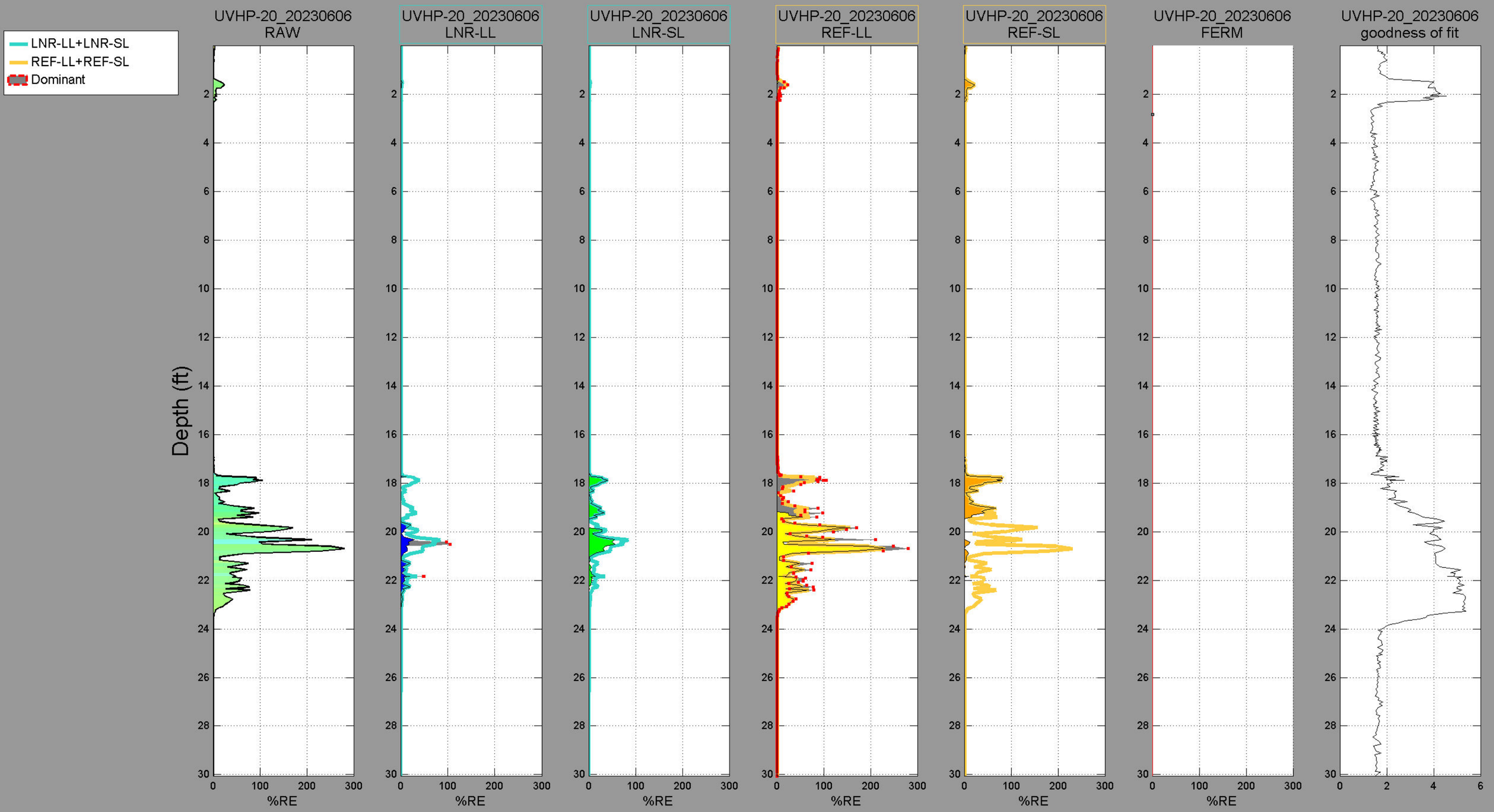

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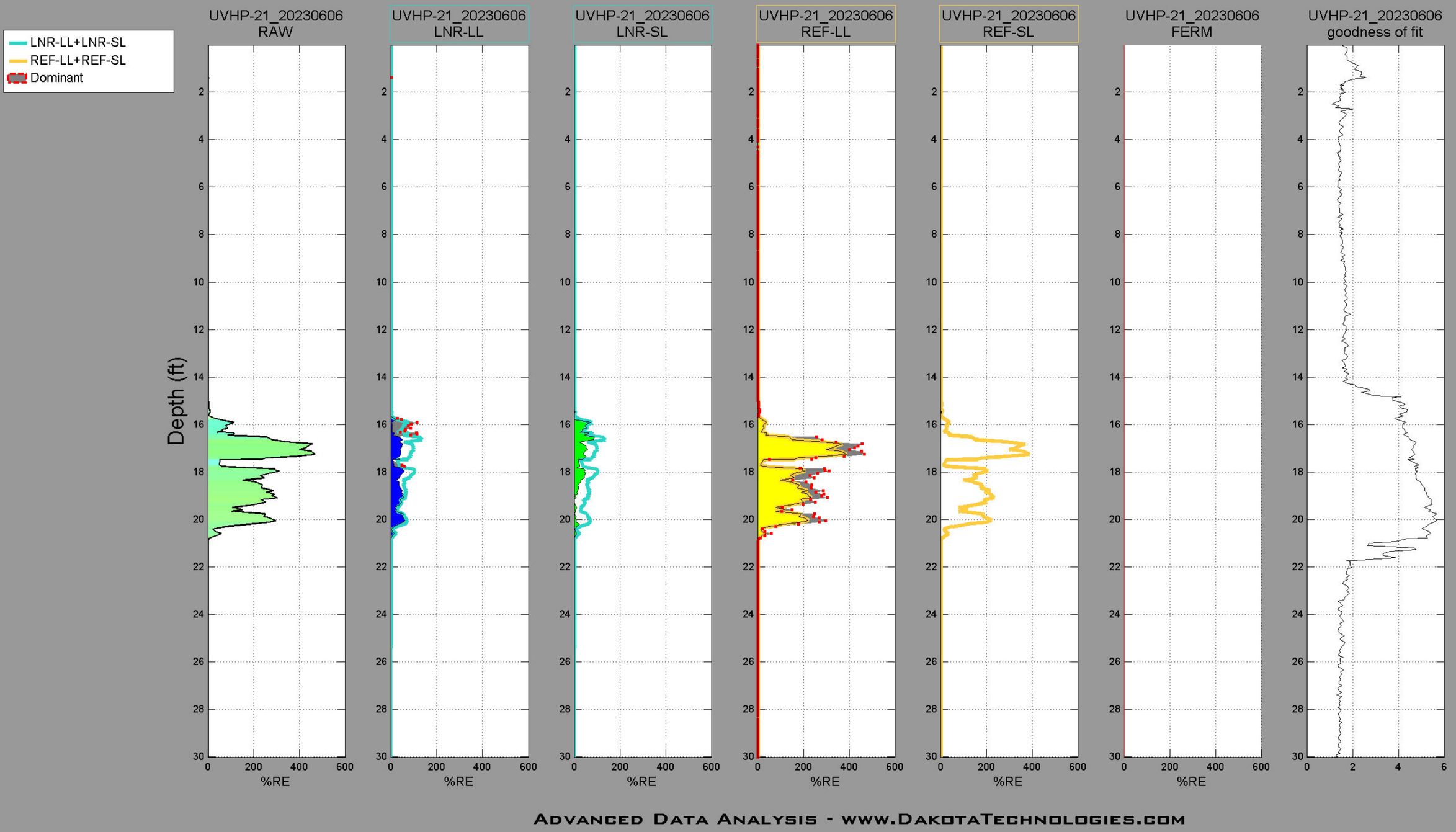

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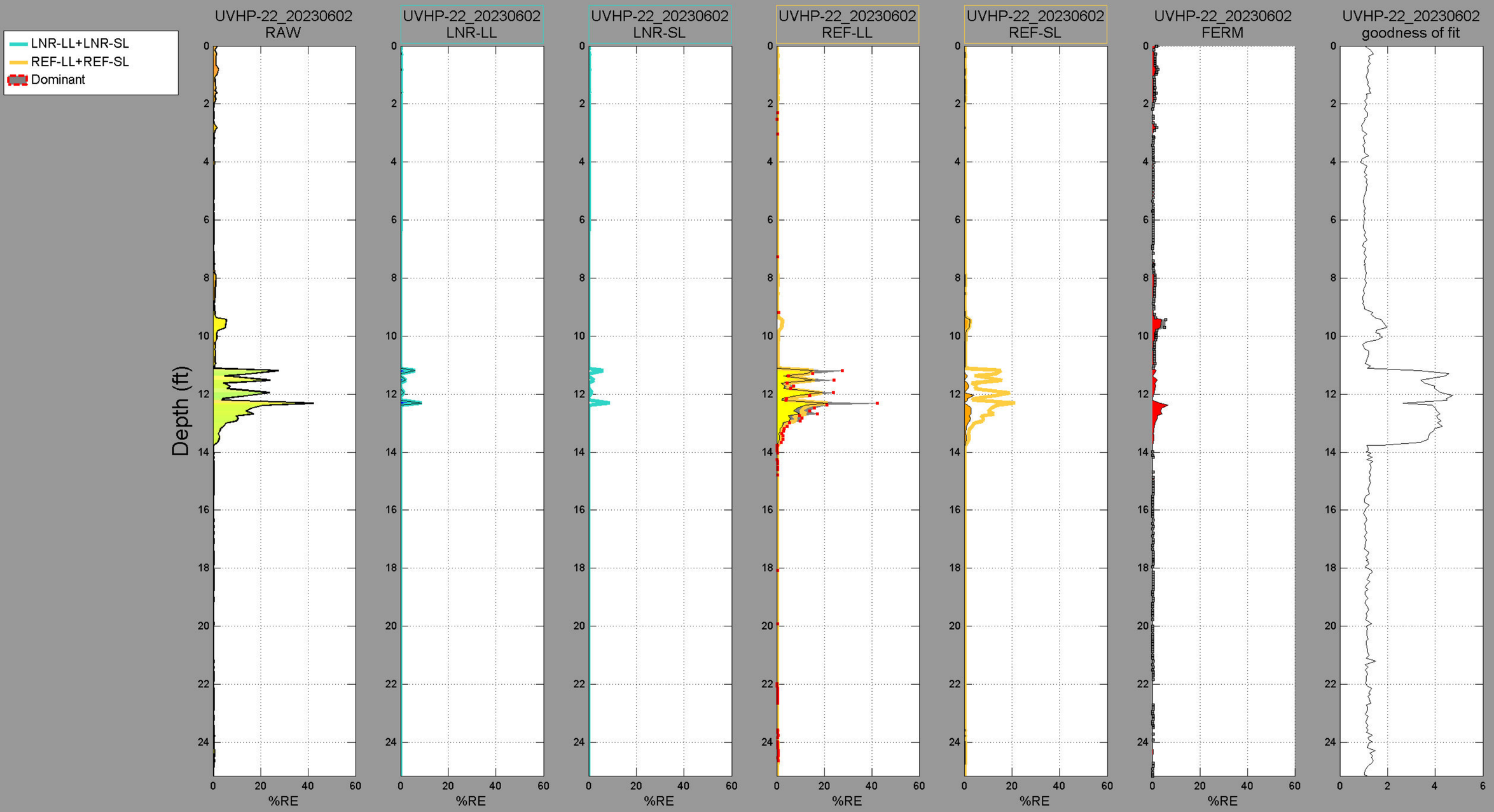

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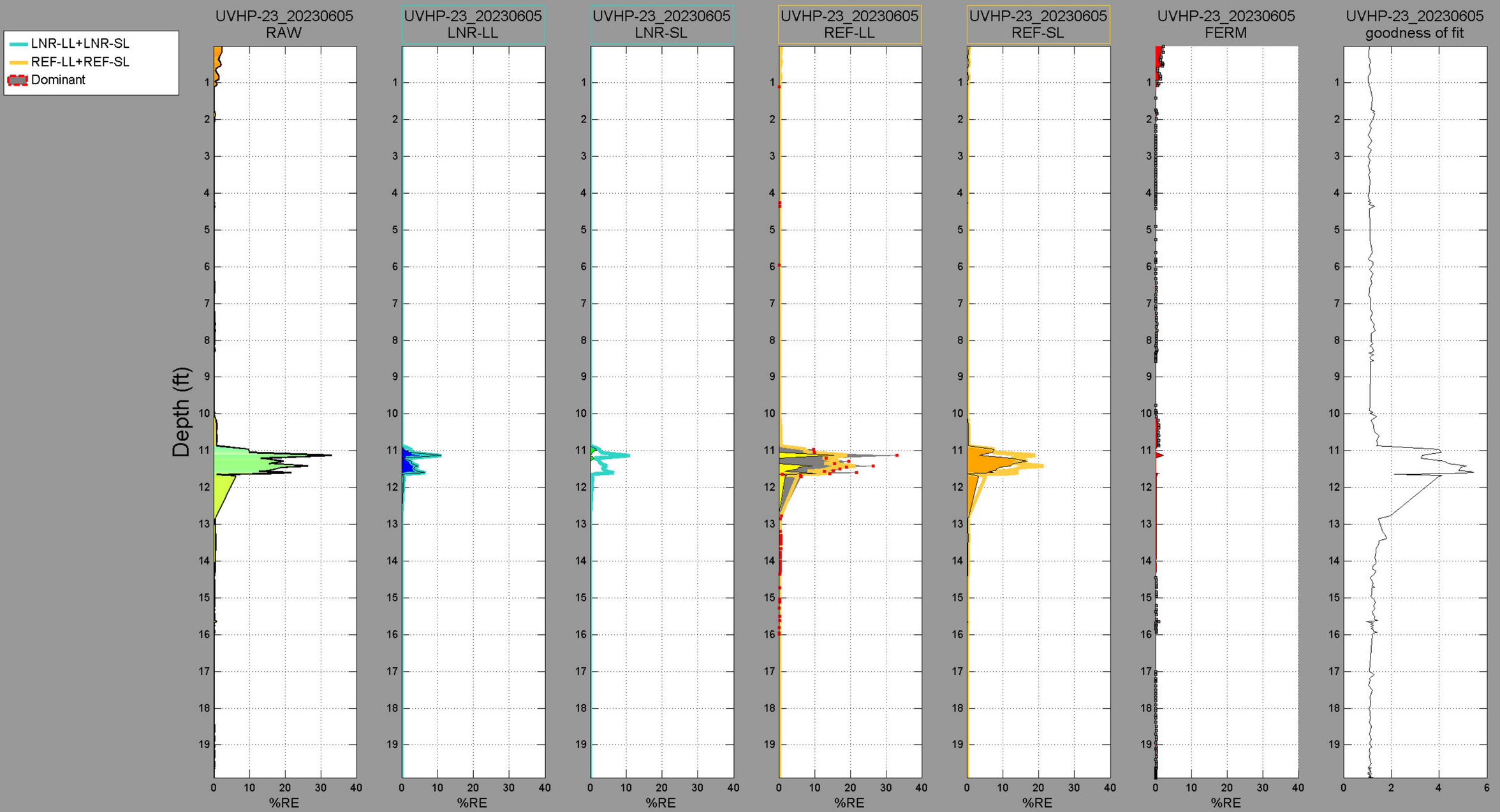

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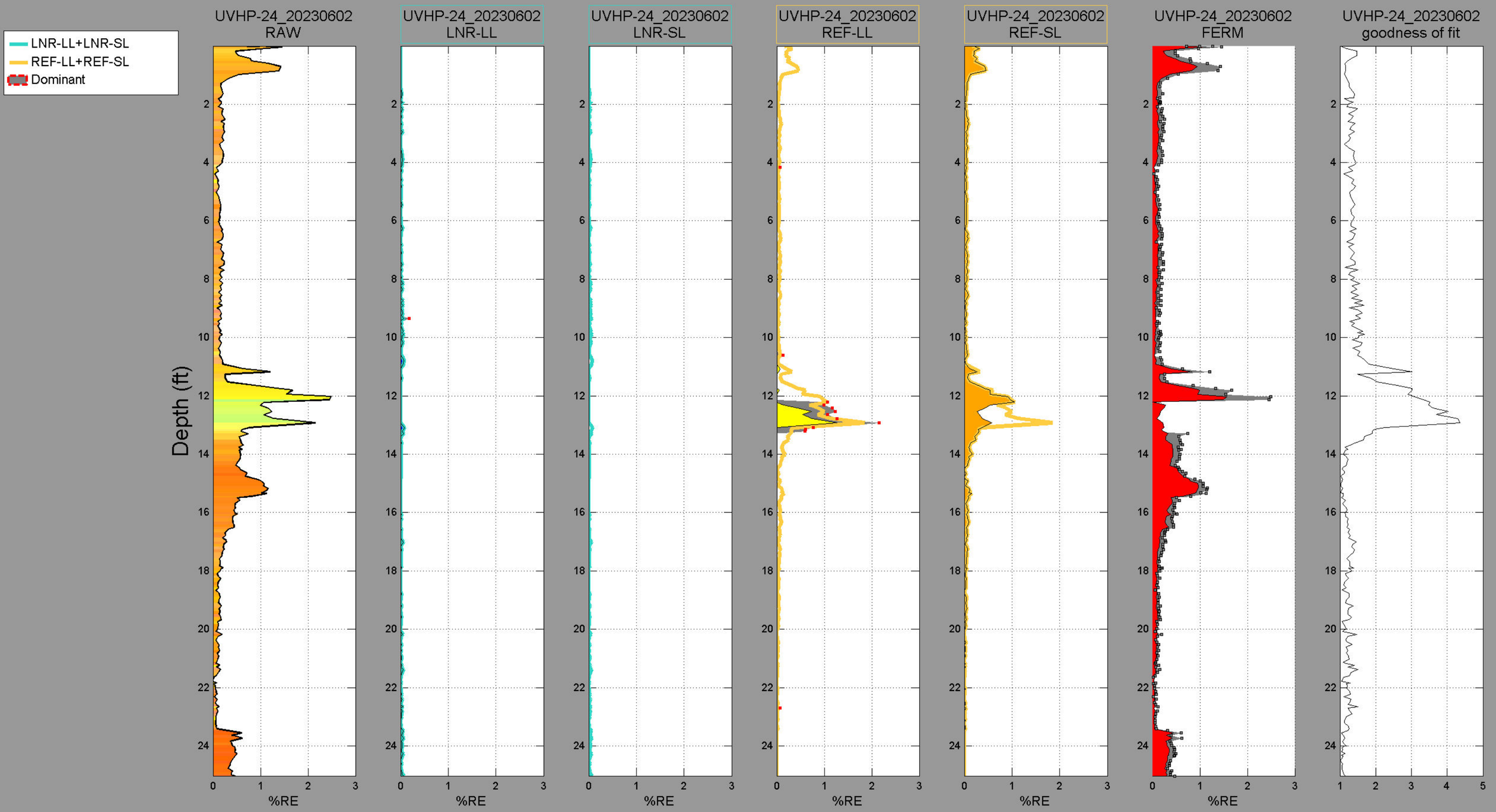

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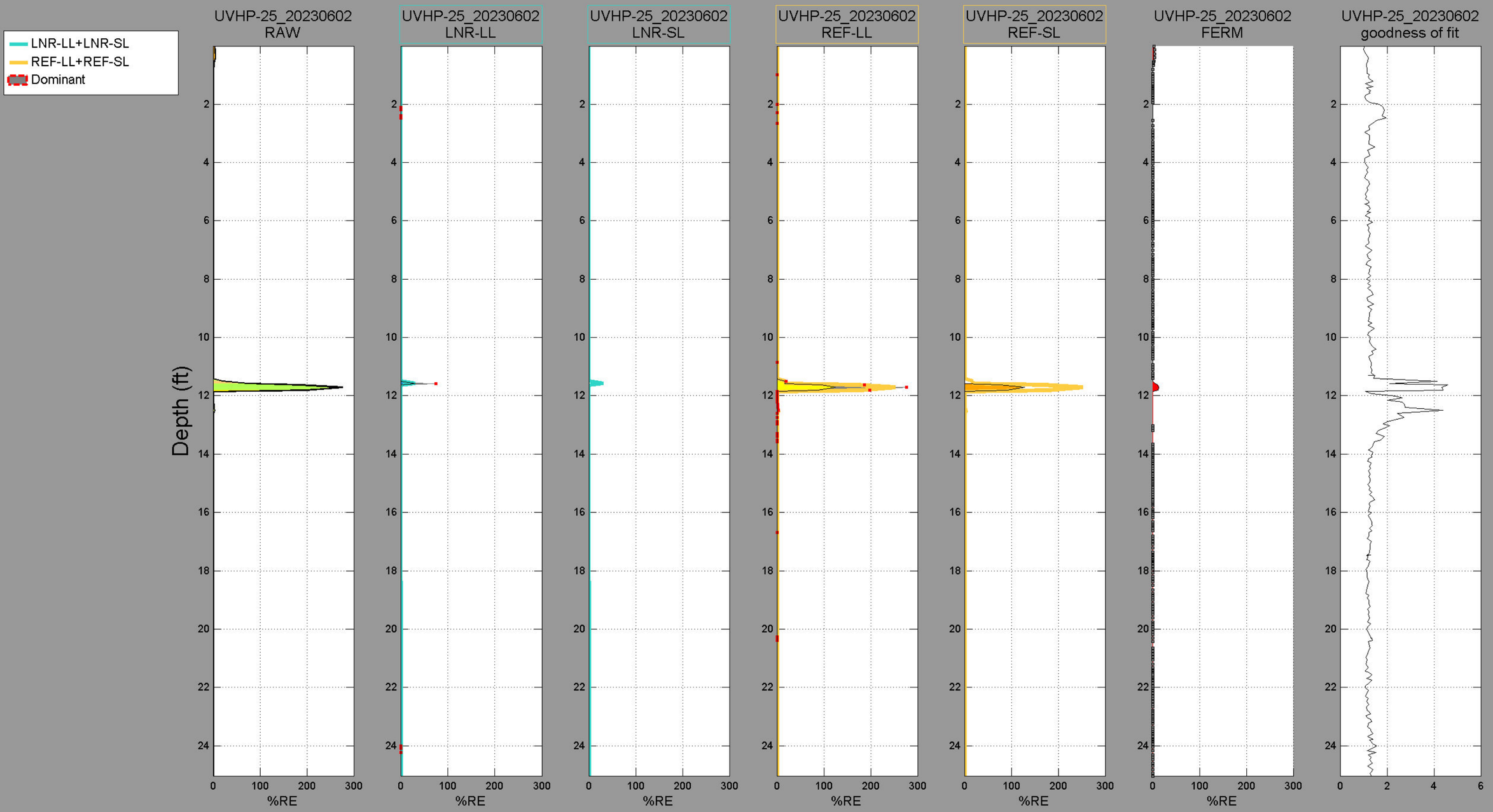

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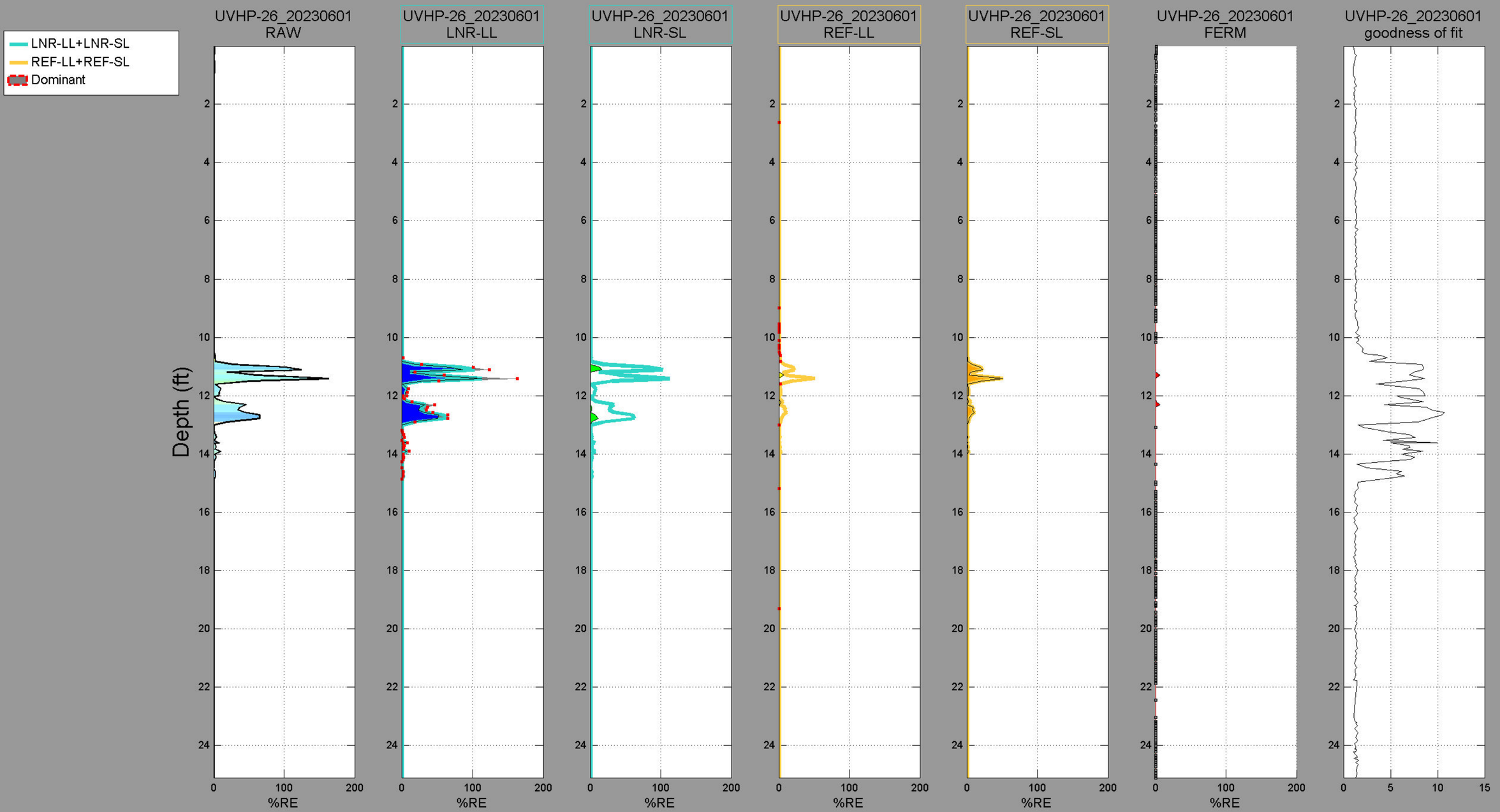


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goodness of fit
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High Resolution Site Characterization Report

UVOST®-HP Investigation

Project: UDEX – (Former PES Refinery)
3144 West Passyunk Avenue
Philadelphia, PA

DTC Project No: 0088.2024

March 13, 2024
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APPENDICES

Appendix A UVOST®-HP Field Summary

Appendix B UVOST®-HP Logs @ 800% RE with 5% zoom

Appendix C UVOST®-HP Reference Log

Appendix D NNLS Output

1.0 General Site Information

Dakota Technologies Company, LLC (DTC) was contracted by Stantec to perform a High Resolution Site Characterization (HRSC) investigation at the UDEX site within the former PES Refinery , located at 3144 West Passyunk Avenue, Philadelphia, PA. The LIF phase of the investigation employed the use of Dakota's Ultra-Violet Optical Screening Tool (UVOST®) combined with Hydraulic Profiling (HP) sensor to investigate the extent of the LNAPL plume

A description of the UVOST® technology, waveforms, cluster plots, limitations of LIF, and a UVOST® Reference Log are included in this report.

2.0 Laser-Induced Fluorescence - UVOST® Technology Overview

Fluorescence is luminescent behavior of certain compounds where absorbed excitation light stimulates the emission of photons (light) of a longer wavelength relative to the source emission. The release of these photons can be used to detect small amounts of certain substances such as Polycyclic Aromatic Hydrocarbons (PAHs) in a larger matrix (e.g., soil). This method of PAH detection has been used in laboratories for decades. With the commercial availability of lasers and optical fibers, this technology can also be applied *in situ* in the field to identify the presence of light non-aqueous phase liquids (LNAPL).

The UVOST® system sends ultraviolet (UV) laser light (308 nanometer wavelength) through a fiber optic cable strung through probe rods on a direct push drill rig. The light is reflected by a parabolic mirror within the Shock-Protected Optical Chamber (SPOC) through a sapphire window on the side of the SPOC. As the probe is advanced, soil that is contiguous to the sapphire window is exposed to the pulsed UV laser light. If PAHs (compounds in petroleum, oils and lubricants that fluoresce) are present, these PAHs absorb a portion of the UV light and enter an electronically excited state. When returning to ground state, the PAHs release excess absorbed energy by emitting photons of longer wavelength light than the original UV excitation light. This fluorescence is transmitted through a return fiber to the surface where the OST system transforms the fluorescence light into multi-wavelength waveform "signals" that represent the intensity, wavelength, and lifetime information of the return fluorescence.

The UVOST system is designed to focus on NAPL, the source term contaminant at many sites. Vapor, dissolved, and absorbed hydrocarbon phases are usually invisible to the UVOST system, with dissolved phase PAHs in the vicinity of heavy NAPLs like coal tar being a notable (and confounding) exception. In most cases, only the NAPL-entrained PAHs respond to the UVOST system. These phase-separate PAHs can be free product in the subsurface or light sheens of product adsorbed to soil particles. In addition, valid fluorescence data can be collected both above and below the water table.

2.1 Reference Emitter

The UVOST® system is checked for optical quality by observing the background signal for sources of signal in the fiber, filter, mirror, and sapphire window. A proprietary LNAPL mixture known as the Reference Emitter (RE) is used for quality assurance and quality control for the qualitative and semi-quantitative response of the UVOST. During the pre-log calibration, a cuvette containing the RE fluid is placed over the sapphire window; the response from the RE is recorded and the RE's fluorescence intensity (brightness) is then used as a definition of fluorescence intensity of 100%. Typically, the RE will fall between 10,000 and 12,000 picovolt-seconds (pVs), which is a measure of waveform area or total fluorescence. The system background fluorescence can vary from 0.1% to 1% RE, or 0 to 100 pVs. The operator ensures the RE response has the correct shape and intensity so that the UVOST® system is "calibrated" for each log and minimizes system background by keeping the mirror and window clean and the SPOC purged of moisture. All the fluorescence responses obtained in the subsequent borehole are gauged against the RE's fluorescence response.

The relationship between the instrument responses from NAPL in the subsurface and the RE depends on the properties of the NAPL. The calibration of the system is therefore not to a concentration, but to a fluorescent material with a known waveform, intensity, and color. In this way, all UVOST data points are normalized to the RE, allowing for an "apples to apples" comparisons of boring data across the site, from logs completed during earlier mobilizations, or at other locations. There are NAPLs that fluoresce with a higher signal than the RE, so they readily return fluorescence intensity greater than 100%.

The combined fluorescence of natural soils and system background (the optic surfaces) generally fall in the range 0.25-0.75% RE. A signal response greater than 1.0% RE *typically* indicates the presence of LNAPL, however, various natural materials including calcareous and carbonaceous soils may produce

"false positive" results with signal responses as high as 10% to 20% RE. Buried wood and organics can be even more fluorescent. Therefore, it is crucial that consumers of fluorescence data rigorously inspect the fluorescence responses to distinguish the presence of NAPL from false positives from natural soils and organic materials.

2.2 Waveforms

Waveforms are fluorescence "signatures" that are used to differentiate LNAPL types such as kerosene versus intact gasoline, weathered gasoline versus diesel fuel, etc. **Waveforms also provide the capability to effectively differentiate false positives from intact LNAPLs**. Various waveform patterns for pure PAHs, fuels/oils, weathered gasoline, and false positive substances can be viewed at Dakota's website: http://www.dakotatechnologies.com/learn-more/intro-to-lif/data-interpretation.

Figure 1 shows three sample waveforms used to characterize NAPL.

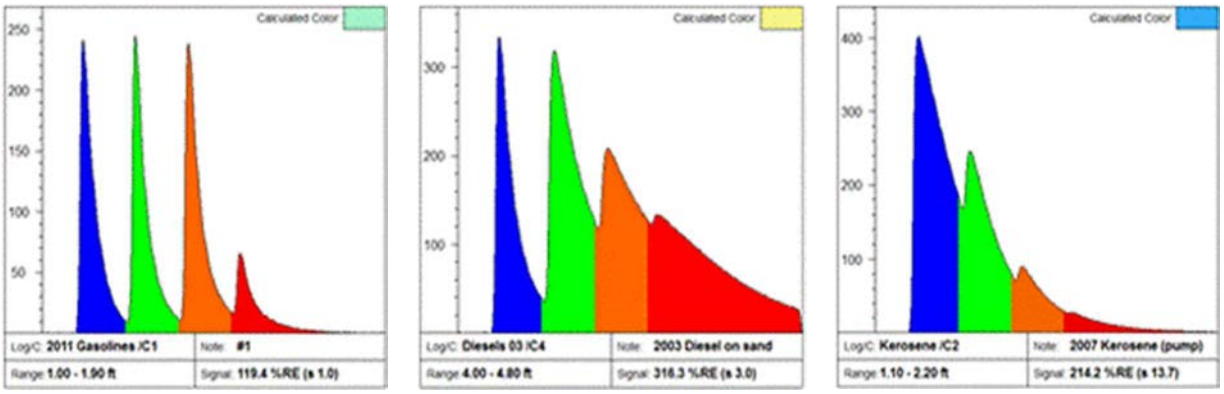


Figure 1: Waveforms generated by gasoline, diesel and kerosene. The four colored peaks in the waveforms (referred to as channels) represent different PAH emission wavelengths (colors) that are filtered by the UVOST system into four categories: 350 nanometers (blue), 400 nanometers (green), 450 nanometers (orange), and 500 nanometers (red). In the waveform callouts (graphs from selected parts of a log) shown, the y-axis represents the intensity of the fluorescence signal (V) and the x-axis is time (approximately 350-nanoseconds).

The relative contribution of each channel's area to the total waveform area defines the Signal (% RE) fill color on the main UVOST log. For example, a waveform with a stronger contribution by the blue channel relative to the other three channels will plot with a bluish color on the UVOST log (see the kerosene waveform in Figure 1). In the case of the RE waveform, the calculated color is a pale green that is displayed in a box in the upper right-hand corner of the waveform plot window.

The shorter wavelength channels on the left (blue/green) represent smaller PAHs with two to three benzene rings; the middle two channels (green/orange) contain response from intermediate size PAHs with three to four benzene rings; the rightmost channels (orange/red) correspond to larger PAHs with four or more benzene rings. Note, the blue, green, orange, and red colors associated with the four channel wavelengths are **not** the actual color of fluorescence, they are place-holder colors. Actual fluorescence colors range from dominantly ultraviolet in the first channel (invisible to the human eye or visible-light spectrum cameras such as the OIP (Optical Image Profiler)) increasing in wavelength from violet to green moving from left to right in the waveform.

The four waveform channels are sequentially delayed by the UVOST system so that they will arrive as a "train" on the graph. The amplitude of each channel corresponds to the intensity of the fluorescence released by the PAHs following the excitation by the UVOST laser pulse. The time it takes for the excitation energy to dissipate (and the subsequent fluorescence to fade away to darkness) is recorded on the times axis and leads to a "ski slope" on the right side of each peak. The point in time at which each channel's fluorescence has decayed to approximately 1/e of the maximum is referred to as that channel's "lifetime". In general, longer lifetimes (wide peaks) are indicative of intact LNAPL as opposed to false positive substances, which usually have shorter lifetimes (skinny peaks). Heavy NAPLs like coal tar are a notable exception, as they experience intramolecular energy transfer during fluorescence due to their excessive PAH content, resulting in narrow peaks. High or atmospheric levels of molecular oxygen present under "bench-top" conditions artificially lower fluorescence lifetimes compared to in-situ conditions where oxygen is lacking due to bioremediation processes.

2.3 Cluster Plots

Cluster plots provide a method for viewing the waveform data in the context of a Cartesian coordinate system. The cluster plot axes correspond to fluorescence wavelength (λ) on the X-axis and the fluorescence lifetime (τ) on the Y-axis as measured and weighted in the four channels. Data points collected during UVOST® logging are hexadecimal color-coded based on fluorescence lifetimes and wavelengths calculated from the waveform and are plotted individually in the cluster plot. In this fashion, all data points from a boring are sorted by waveform and can be viewed in a single figure, allowing intuitive comparisons to be made among potential fluorescence categories. Figure 2 demonstrates the

relationship between data points in the log and how they appear in the cluster plot.

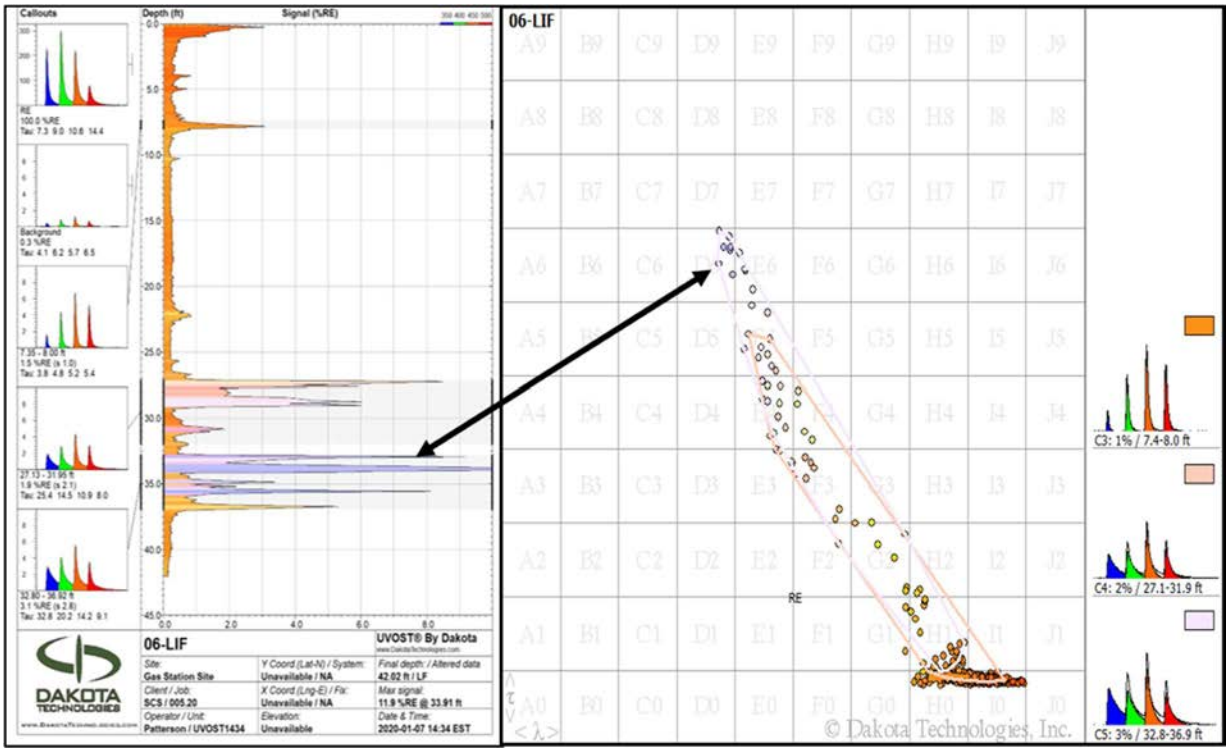


Figure 2: The X-axis of the Cluster Plot (right) corresponds to the balance of the four colored channels in the waveform; the Y-axis relates to fluorescence decay or "lifetimes" of the four-waveform channels.

Responses dominated in the blue/green channels will plot in the left side of the cluster plot; likewise, if the orange and red channels make up bulk of the fluorescence response, the data point will plot on the right side of the cluster. Waveforms with a relatively equivalent contribution from all four channels, or with the two central peaks dominating, will plot somewhere in the middle. Similarly, longer-lived responses (wide at the base of the waveform) will plot higher on the Y-axis and waveforms with shorter lifetimes (narrow at the base of the waveform) plot lower on the Y-axis.

To further aid in determining the source on the UVOST® log for a point cluster, the main callouts from the log with their respective depth intervals are depicted on the upper left corner of the cluster plot (not depicted here). Polygons (for depth ranges) and circled data points (for discrete depths) with the same coloration as the callout waveform enclose the point clusters included in that callout.

Weathering and formulation of each LNAPL will influence where the LNAPL appears on the cluster plot. In other words, it is **not** possible to identify a fuel solely by its location on a cluster plot. In Figure 3, the formulation of the 2 different diesel signatures labeled 1995 and 2007, fall into different regions of the plot. This is due to the difference in Lifetime and Wavelength characteristics of the 4 channels that make up these slightly different diesel waveforms.

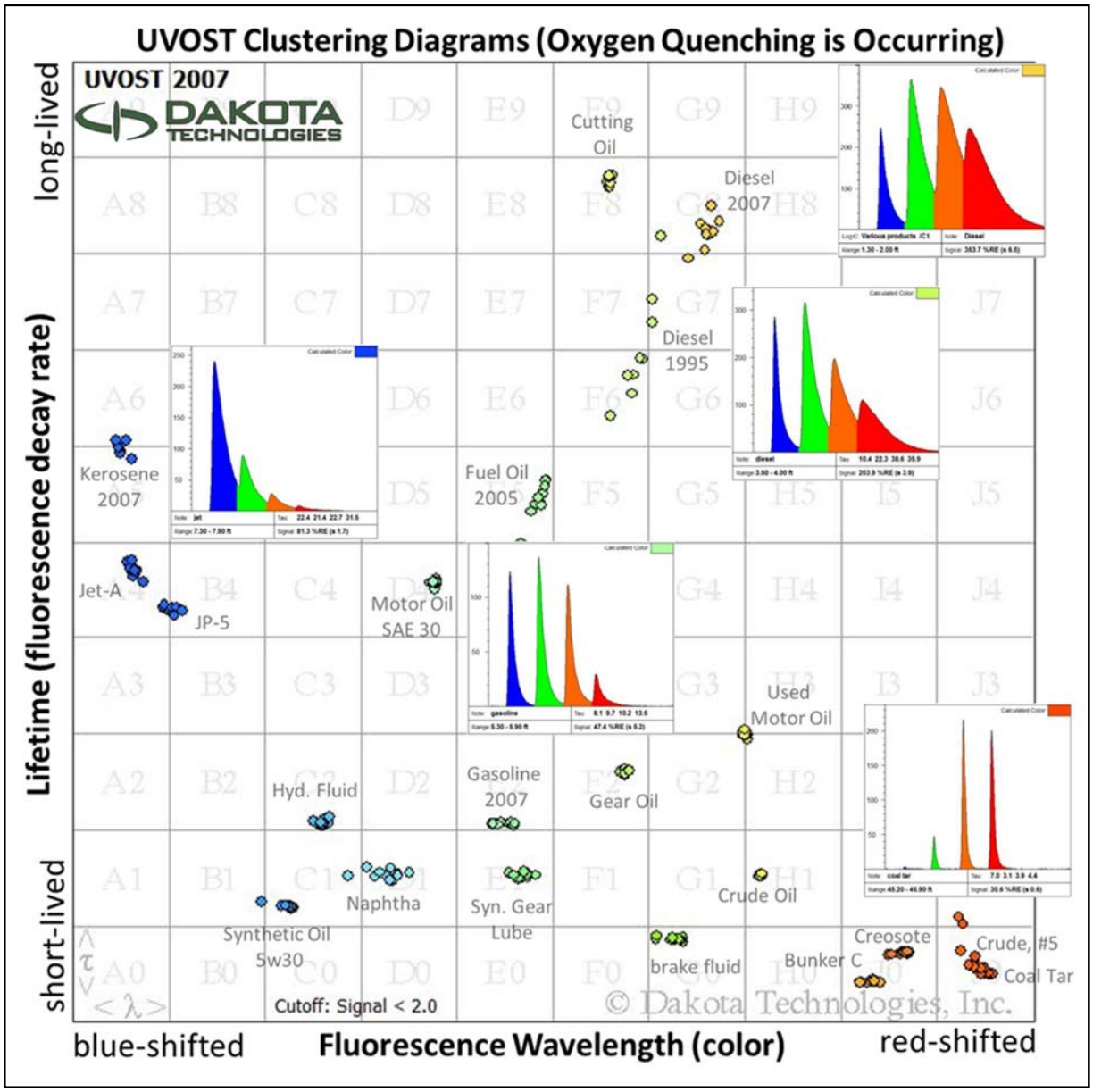


Figure 3: Reference examples of LNAPL types that were placed on the window of a UVOST® system in a laboratory setting. The cluster plot positions displayed illustrates the cluster separation of LNAPL types achievable with the UVOST and is not indicative of exclusive plotting location—LNAPL may plot across multiple grid cells as the plume weathers or interacts with the native soil.

Cluster plots from the UVOST boreholes will be included as an Appendix to this report (if applicable).

3.0 Hydraulic Profiling (HP) Description

The Hydraulic Profiling add-on is a logging tool that measures the pressure required to inject a flow of water into the soil as the probe is advanced into the subsurface. The injection pressure log is an excellent indicator of formation permeability. In addition to injection pressure, hydrostatic pressure can be measured under a zero flow condition, called a dissipation test. This allows a calculation of potentiometric surface (water table) upon successful completion of the dissipation test.

Prior to starting a log, quality assurance (QA) checks on the down-hole transducer are performed to ensure proper function. The probe is submerged in a reference tube and filled with water. A reading is taken at the hydraulic port when it is submerged to a depth of 1 foot and a second reading at 0 feet, or baseline, under zero flow conditions. The reading at 0 feet, or the baseline pressure, is equal to the measurement of atmospheric pressure. Subtracting reading 2 from reading 1 should produce a result of 0.433 psi (+/- 10%), which is the hydrostatic weight of a 1 foot column of water.

The UVOST®-HP probe is advanced into the ground at a rate of approximately 2 cm/sec. The pump in the HP flow module draws water from the supply tank and pumps water down the trunk line at a constant flow rate (60 mL/min). The downhole transducer monitors the pressure generated by injecting water into the formation matrix. The log provides graphs of the pressure and flow rate versus depth alongside the fluorescence plot. If a dissipation test is performed below the water table and the test successfully stabilizes, the result can be corrected to an absolute hydrostatic value, from which a potentiometric surface (water table) can be calculated. Using the calculated water table to correct for hydrostatic pressure increase, a hydraulic conductivity (K) value for a given depth below the water table can be estimated using the following equation:

$K = \ln(Q/P') * 20.0 + 7.0$

where P'= downhole pressure – (0.433 * depth below water table) – atmospheric pressure, and Q is equal to flow. K values above the water table are also reported after a successful dissipation test even though they are suspect due to varying permeability behavior of dry soils. These values still maintain some qualitative value to the eye and may lend insight into preferential pathways in the vadose zone.

HP data can be incorporated into a 4DIM visualization protocol

4.0 Site-Specific Results and Discussion

Field activities included the completion of 15 UVOST®-HP borings. The target depth for all UVOST®-HP locations was approximately 25-30' below ground surface (bgs); actual depths ranged between 25' and 30' bgs based on signal responses at the site.

All 15 of the UVOST®-HP borings pushed, showed at least some signal responses indicative of LNAPL. See appendix A for details.

Water table calculation data was collected at eight locations. Dissipation tests require coarse grained material for these tests to fully equilibrate in a timely manner. All dissipation tests were stable indicating a valid test.

Location UVHP-03 was pushed again as the fiber broke during the initial push. The second push of the boring was named UVHP-03A to preserve the HP data in case that was of interest in the future. The stringpot stopped recording depth on two of the borings (UVHP-21 and UVHP-06). On both borings, the rods were pulled up and the log restarted from a known joint. The stringpot was changed after UVHP-06 and there were no more problems with depth.

The site lithology appears heterogeneous, as seen by the HP pressure and Est. K data, and NAPL distribution relative to depth. The HP logs showed areas of lower pressure and higher pressure. Comparing the HP pressure to logs from the same well location, there are differences that suggest a high amount of heterogeneity to the investigation area.

Further lines of evidence such as soil cores and analytical lab results are needed to fully substantiate the UVOST data.

4.1 Site UVOST Discussion: Waveforms

In this section, several waveforms have been selected to assist with understanding the major waveforms encountered on the site, including background (natural soil fluorescence) waveforms and LNAPL-like

responses (See Figures 4). Several waveforms were captured by UVOST® at this site. Their corresponding Cluster Plot diagrams were created to aid with data interpretation. Waveforms and Cluster plot diagrams are a very powerful tool used in conjunction with other lines of evidence to develop a conceptual site model of how the NAPL body varies in fluorescent nature with respect to depth below surface and even across the entire site. **This data is also useful for identifying false positives such as limestone or other fluorescing material.**

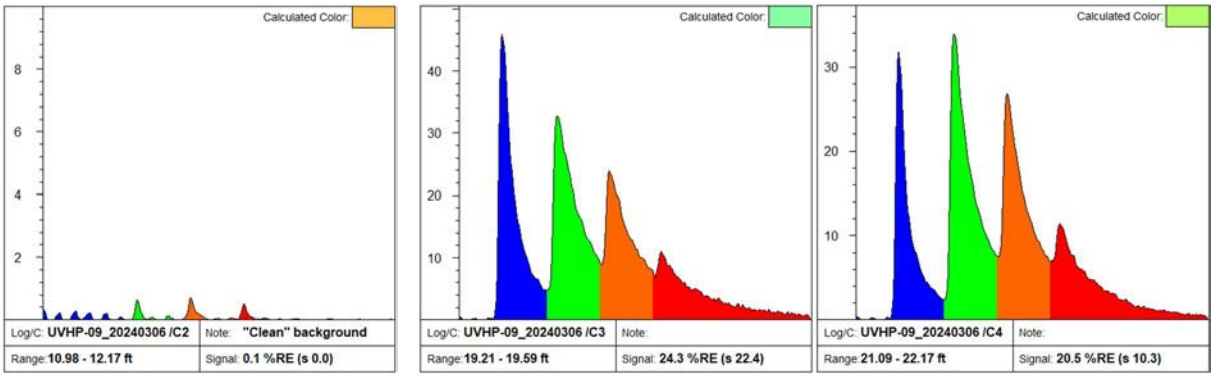


Figure 4: Waveforms typical across the site: The natural (presumed clean) soil background appears in the left waveform. The blue-dominant waveform from UVHP-09 at 19.2-19.6' in the center may represent a more intact LNAPL. The callout from UVHP-09 from 21.1-22.2' most likely represents a weathered version of the waveform shown in the center of figure 4.

4.2 Site UVOST Discussion: Cluster Plots

A Clustering Plot diagram for each individual log is displayed in the appropriate Appendix below. Typically, the low soil signal will be included with the clustering presentation to help distinguish this natural signal from low NAPL signal. This section is a summary of the site's cluster diagram output data.

Cluster Plot – UVHP-01_20240307

Callouts 3, 4, and 5 in the cluster image below represent low responding LNAPL. The blue oval drawn on the cluster plot in cells G0, H0 and I0 represents the natural soil fluorescence. When data points pull away from the natural fluorescence they are considered as possible LNAPL fluorescence.

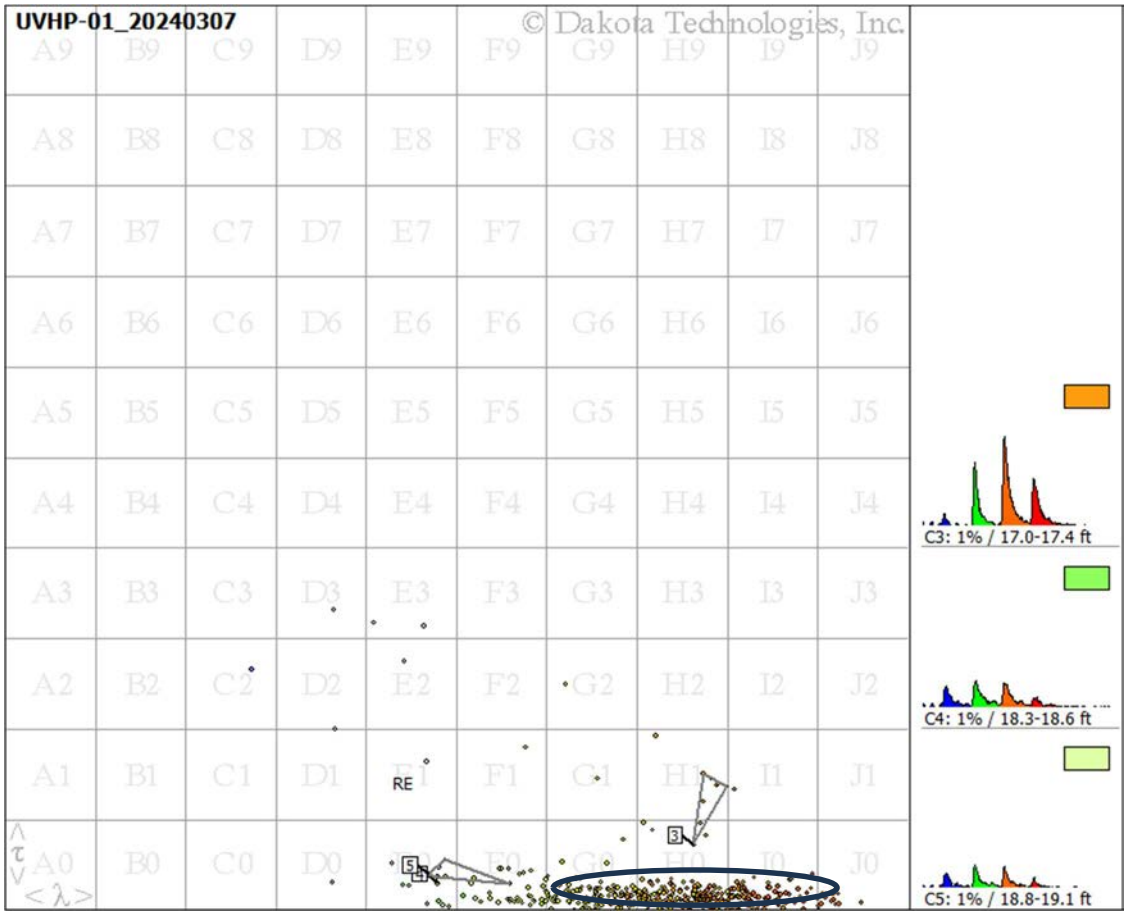


Figure 5: UVHP-01_20240307 represents a low response from the LNAPL by UVOST.

Cluster Plot – UVHP-10_20240306

The waveforms on the right represent a more blue-shifted NAPL and possibly a mixing of a couple of NAPLs. Callout 4 below is more blue-shifted than the other callouts. Normal weathering likely would trend toward the bottom of the grid for more weathered examples. Callout 5 has longer lifetimes and is a little more red-shifted than callout 4. This could be the addition of another NAPL or different conditions (aerobic/anaerobic) due to being below the water table. More evidence would be required to determine for sure.

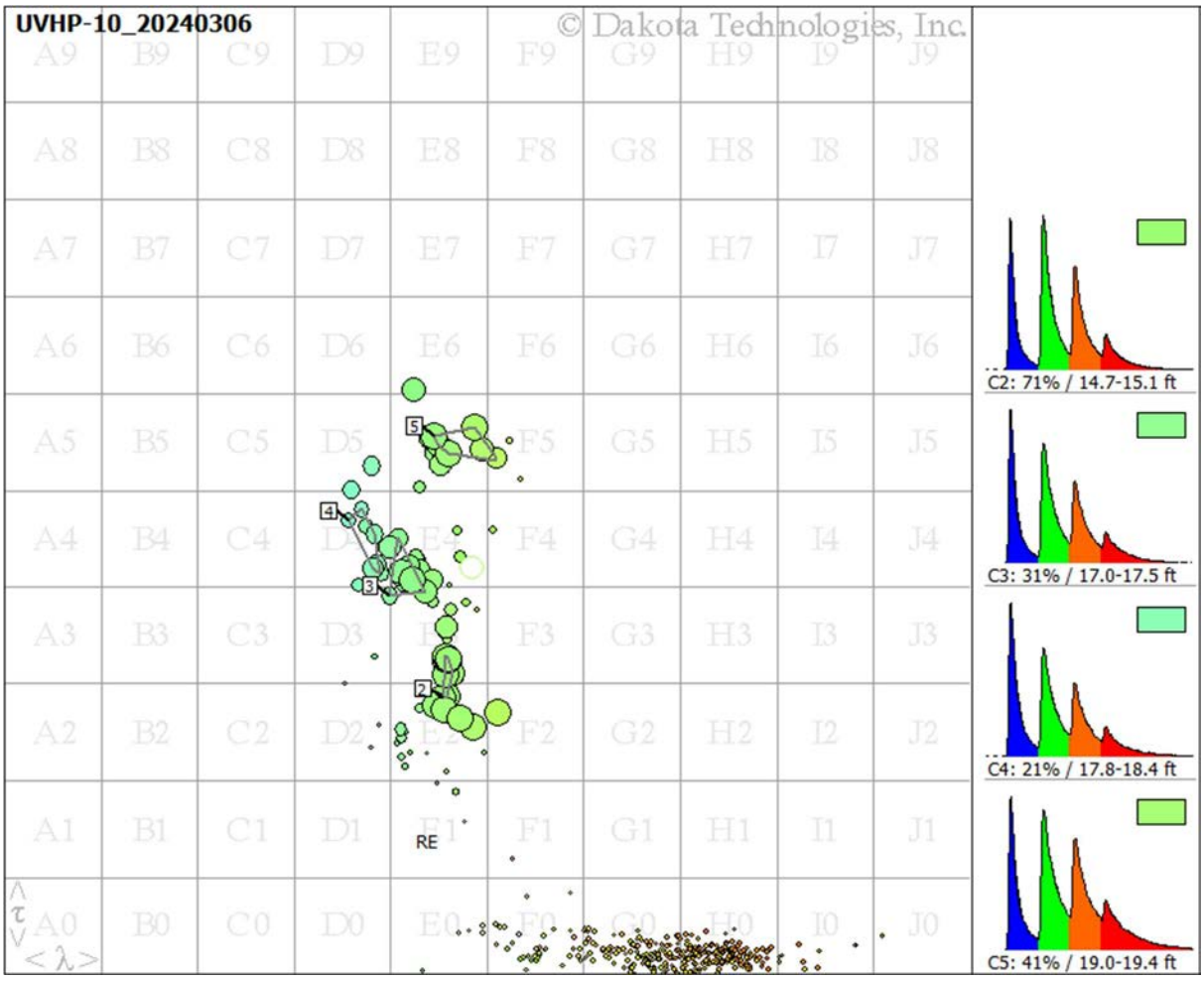


Figure 6: UVHP-10 may represent a location with more than one NAPL or different subsurface conditions.

Cluster Plot – UVHP-07_03062024

This plot represents either a more weathered or lower responding NAPL that was seen in a few locations.

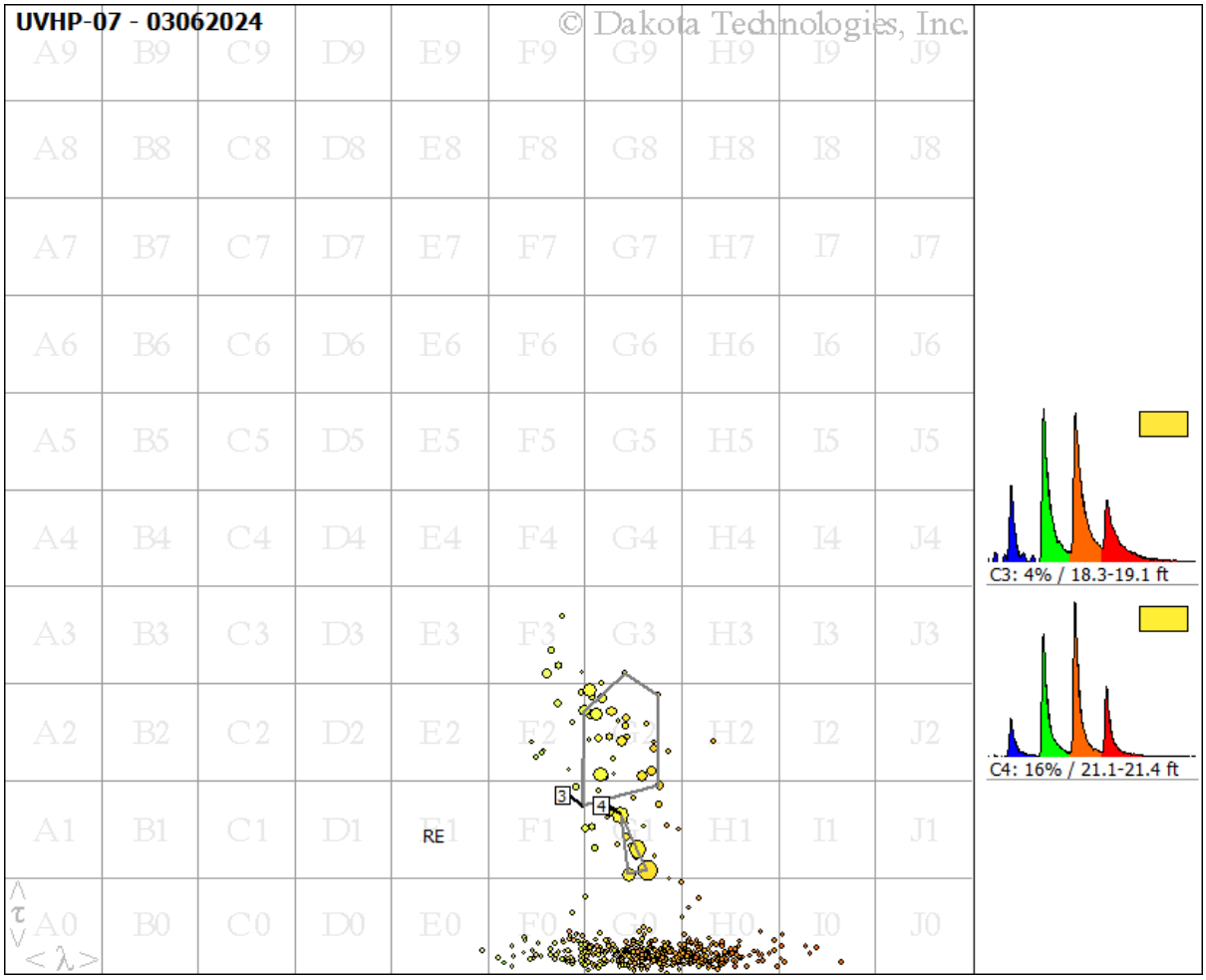


Figure 7: UVHP-07 represents another NAPL found on the site.

Composite Cluster Plot

This image shows the sum of all the callouts created at this site.

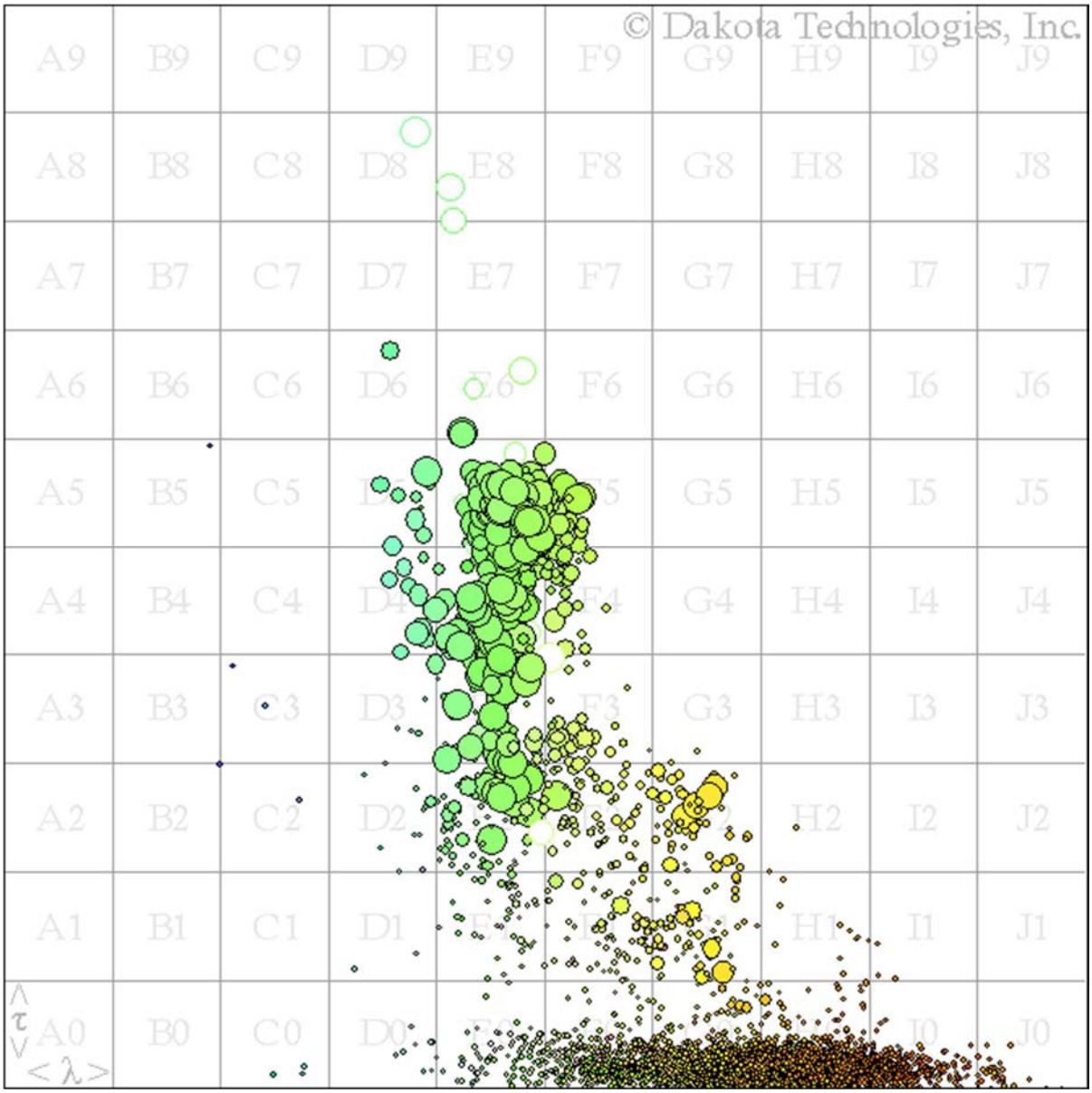


Figure 8: Composite Cluster Plot for the site.

4.3 Site Advanced Analysis (NNLS)

An analyst at Dakota Technologies, Inc. met online with Andrew Klingbeil to discuss the *in situ* UVOST data with respect to multiple lines of evidence gathered on the nature of the soils and NAPLs involved at the site. It was decided it would be beneficial to perform a non-negative least squares (NNLS) analysis of the UVOST waveform data in order to separate the general classes of NAPL responses into three main classes. The end goal is to be able to visualize the differing LIF responses as separate 3D bodies – each representing a different class of NAPL.

The waveforms chosen to represent the NAPL classes are illustrated on the righthand side of Figure 7. For reasons not fully understood, there appeared to be both short- and long-lived responses emitted from both the light naphtha range (LNR) and reformate (REF) NAPLs. Subsequently, two waveforms were required to assemble all the suspected light naphtha range NAPL waveforms into one data set (LNR-LL and LNR-SL) and two waveforms were required to assemble all the suspected reformate NAPL waveforms into one data set (REF-LL and REF-SL). Finally, a fermentation-related NAPL sludge (FERM) suspected waveform was included to round out the Basis Set of waveforms from which the NNLS software draws upon to determine the amount of each to best fit each in-situ waveform in every log.

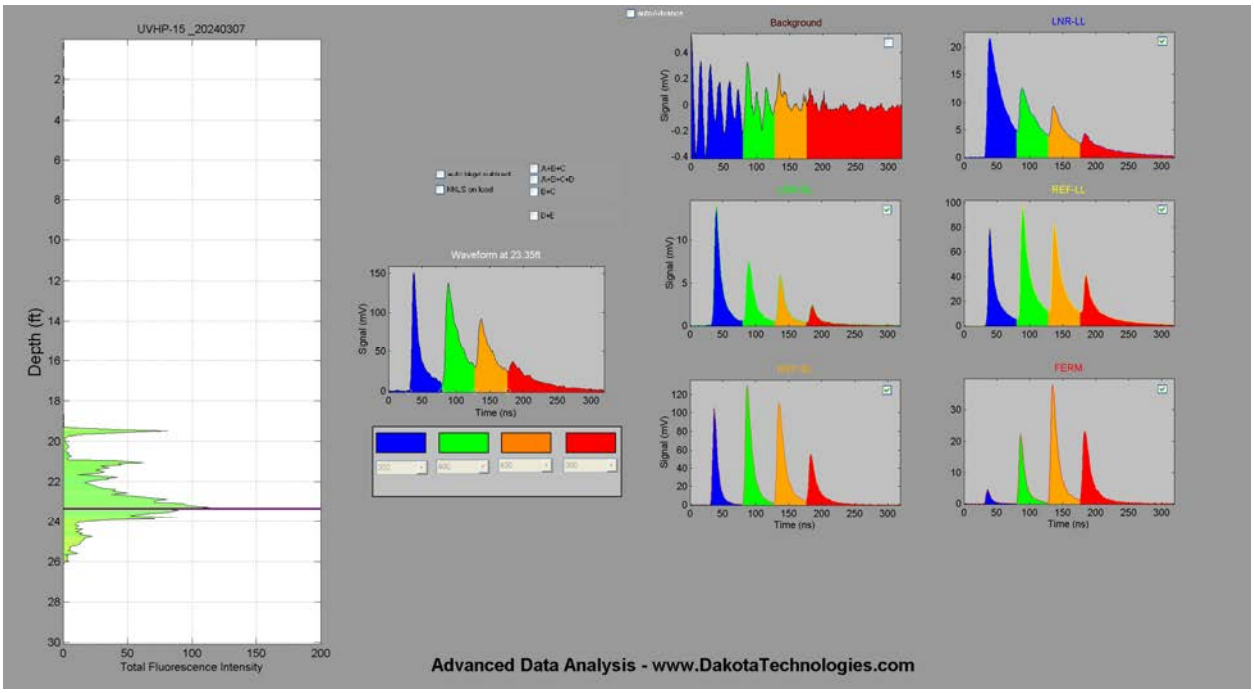


Figure 7. The NNLS analysis setup – with the Basis Set waveforms shown at right.

Figure 7 contains a screenshot of the NNLS processing software set up to analyze log UV-HP-15-20240307. Appendix D contains the NNLS processing output for each log analysis. These figures contain the relative contribution for each of the Basis Set waveforms for every depth of each field log. The residual column at far right illustrates how well the sum of the Basis Set waveforms matched the original Field Data waveforms. The data in these graphs were also saved as numerical text files (depth vs % RE) and were made available to Stantec for subsequent NAPL CSM visualization.

5.0 GPS Data/Survey Control

GPS coordinates were not taken.

6.0 Limitations

The UVOST® system is limited in that it can only detect phase-separated material, making it an ideal tool for source delineation. The UVOST® system does not respond to dissolved phase VOCs or SVOCs. In addition, the soil matrix can influence how a product fluoresces. UVOST® responses are typically higher on sands than in clays. Due to fluorescence quenching, the UVOST® system should not be used to delineate coal tars and creosotes.

The use of specific language to identify UVOST® signal as LNAPL, gasoline, diesel or other specific petroleum, oil or lubricant types are intended to describe these compounds within the limited context of the UVOST® data set and must be interpreted with other lines of evidence to confirm stated findings. Signal identified and listed in this report as false positives, natural soil, etc. should also be viewed within these same constraints.

The analysis and opinions expressed in this report are based upon data obtained from the specific test locations and from other information discussed in this report. Exceptions, if any, are discussed in the accompanying comments section of this report. This report is prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted practices. Reported results shall not be reproduced, except in full, without written approval of Dakota. No warranties, expressed or implied, are intended or made.

The HP portion of the tool is limited to a max working depth of 120 feet below ground water and the pressure transducer output range is 0-100 psi. Coarse (sandy), saturated soils are required for dissipation tests to be performed. Successful (fully stabilized) dissipations are required for water table and hydraulic conductivity (Est. K) calculations. The lower K boundary for the empirical calculation model is about 0.1 ft./day and the upper boundary is near 75 ft./day.

Hydraulic data acquired from the UVOST®-HP tool should be reviewed in conjunction with representative soil samples to best understand soil behavior.

Appendix A

UVOST®-HP Field Summary Log

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UVOST®-HP Field Summary Log

Former PES Refinery - UDEX

Philadelphia, PA

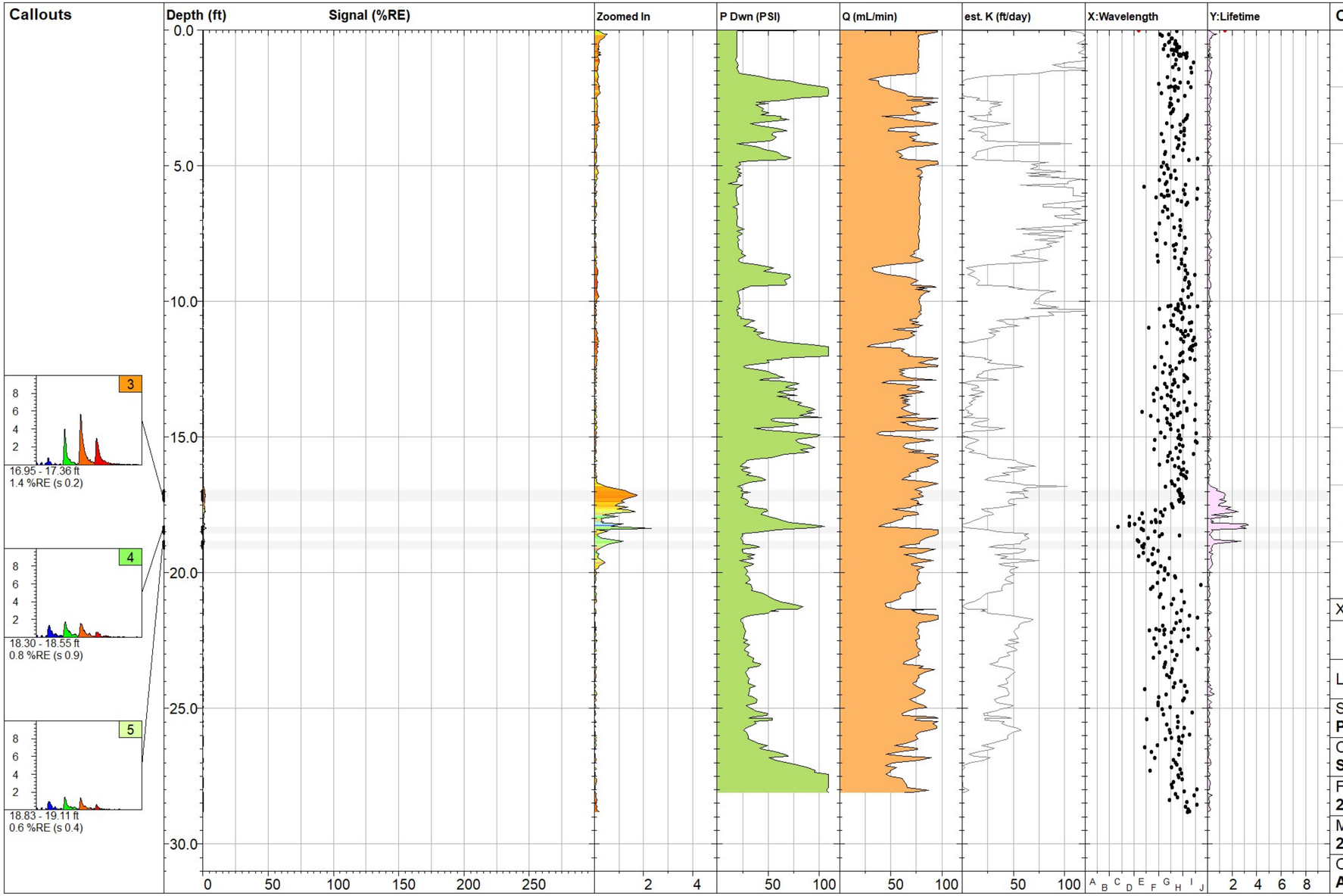
File Log ID	Date / Time	Pre-Probe (ft)	Final Depth (ft)	Max Signal (%RE)	Max Signal Depth (ft)	Initial RE Area (pVs)	Background Area (pVs)	Stable Dissipation (yes or no)	Calculated Water Table (bgs)	Fluorescence Top - Bottom (ft)
UVHP-01_20240307	3/7/24 8:14 AM	2	28.8	2	18.4	11861	3	N/A	N/A	16.9-18.9
UVHP-02_20240307	3/7/24 12:36 PM	4	25.0	29	18.4	11954	17	Y	16.6	16.1-20.0
UVHP-03_20240307	3/7/24 10:29 AM	2	20.1	0	1.9	11995	3	N/A	N/A	fiber broke during push. Repushed as UVHP-03A
UVHP-03A_20240307	3/7/24 11:42 AM	2	27.0	38	17.6	12049	30	Y	15.9	17.4-18.3
UVHP-05_20240307	3/7/24 1:37 PM	4	25.4	29	17.0	11877	29	Y	14.9	14.5-19.0
UVHP-06_20240307	3/7/24 9:17 AM	2	26.0	4	19.1	11997	5	N/A	N/A	12.8, 18.6-20.0
UVHP-07 - 03062024	3/6/24 9:29 AM	2	29.7	26	21.2	11908	35	N/A	N/A	17.3-22.2
UVHP-08 _20240306	3/6/24 10:37 AM	3	29.9	3	20.1	12166	10	N/A	N/A	20.0-20.8
UVHP-09_20240306	3/6/24 1:58 PM	3	29.7	69	19.9	11801	19	Y	16.9	16.4-23.4
UVHP-10_20240306	3/6/24 3:58 PM	2	25.9	132	14.5	11480	11	Y	15.7	14.1-20.1
UVHP-13D_20240307	3/7/24 2:27 PM	4	25.4	58	10.3	11816	0	N/A	N/A	9.8-14.9
UVHP-14_20240307	3/7/24 3:17 PM	4	25.4	27	11.9	11787	15	Y	12.2	11.3-16.1
UVHP-15 _20240307	3/6/24 11:34 AM	4	30.1	114	23.3	11595	9	Y	20.3	18.8-26.0
UVHP-20_20240306	3/6/24 12:48 PM	2.5	29.2	197	18.3	11837	17	N/A	N/A	6.5-7.7, 16.9-23.9
UVHP-21_20240306	3/6/24 3:03 PM	3	29.9	263	18.9	11639	15	Y	17.7	16.1-24.5
UVHP-23_20240307	3/7/24 4:06 PM	4	25.4	20	11.9	12102	24	N/A	N/A	11.0-13.8
			433.0							

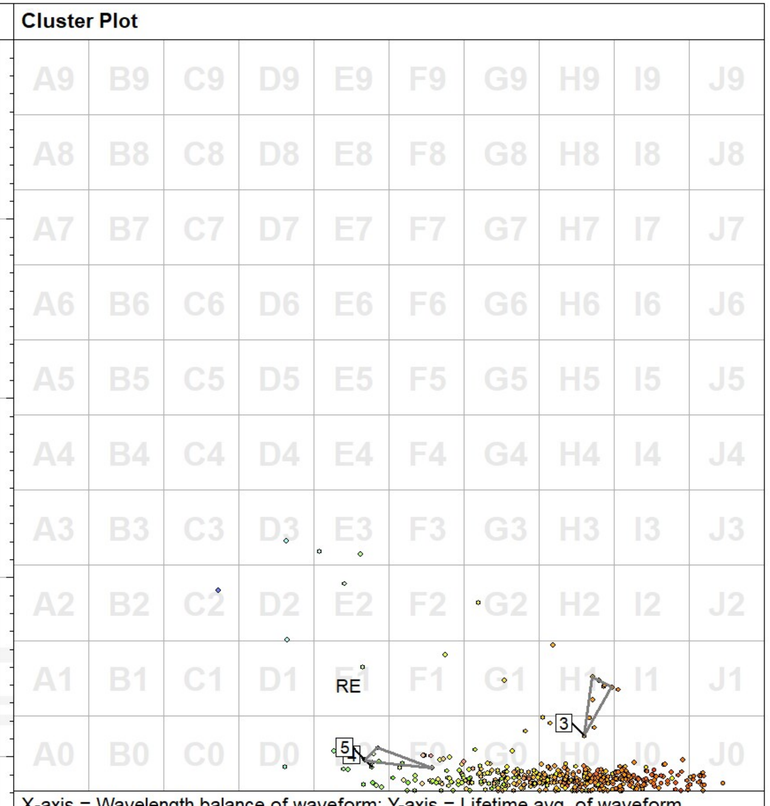
(1) Signal responses in the indicated pre-probed regions may not be accurate due to soil disturbance.

Appendix B

UVOST®-HP Logs at 300% RE with a 5% zoom

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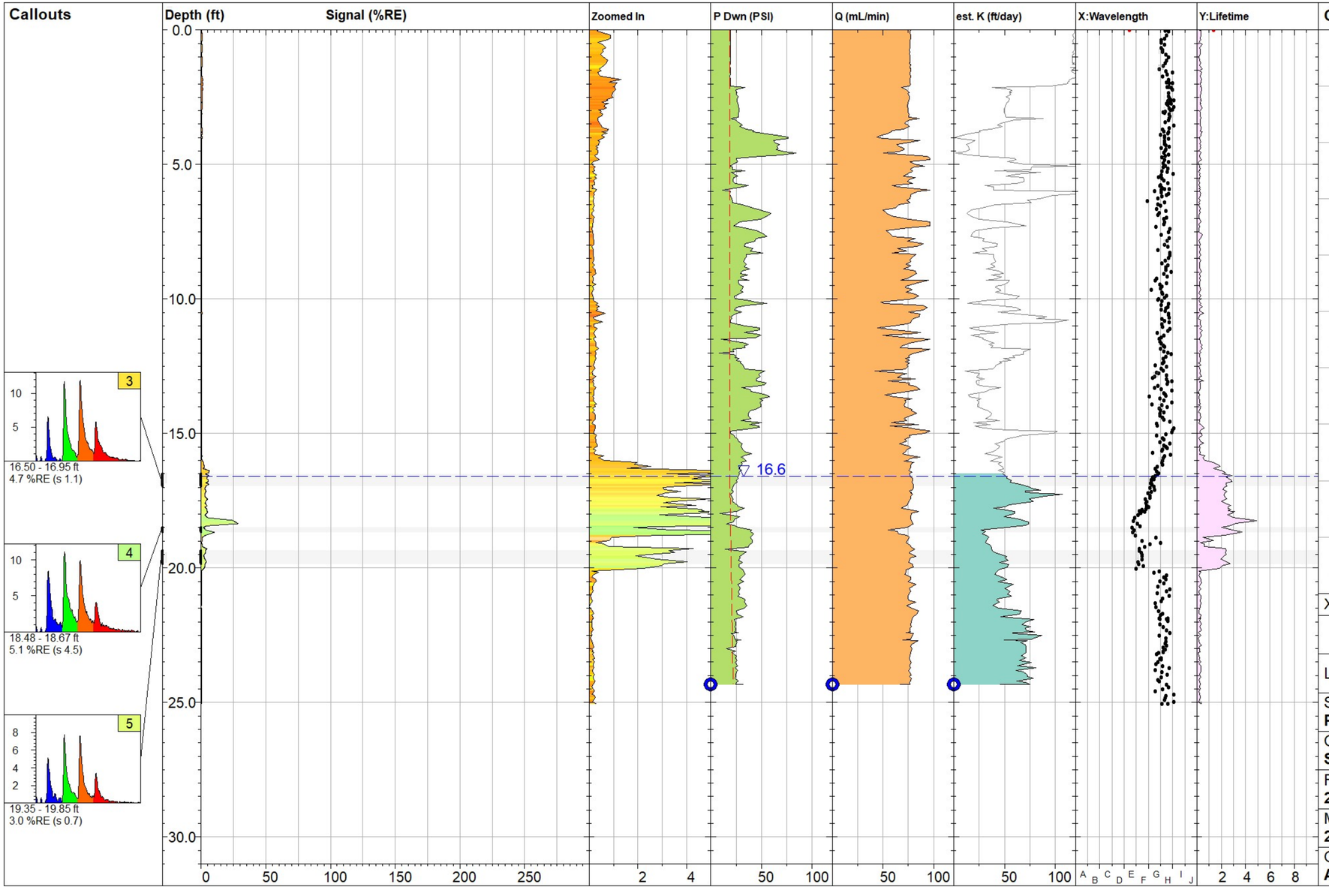
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

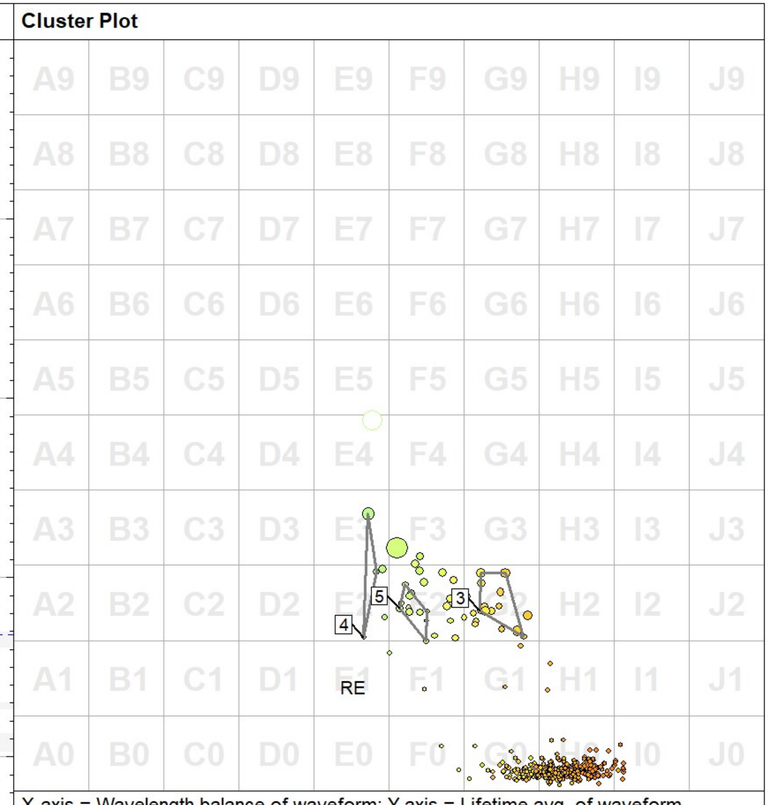
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-01_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 08:14 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **28.80 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **2.3 %RE @ 18.36 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





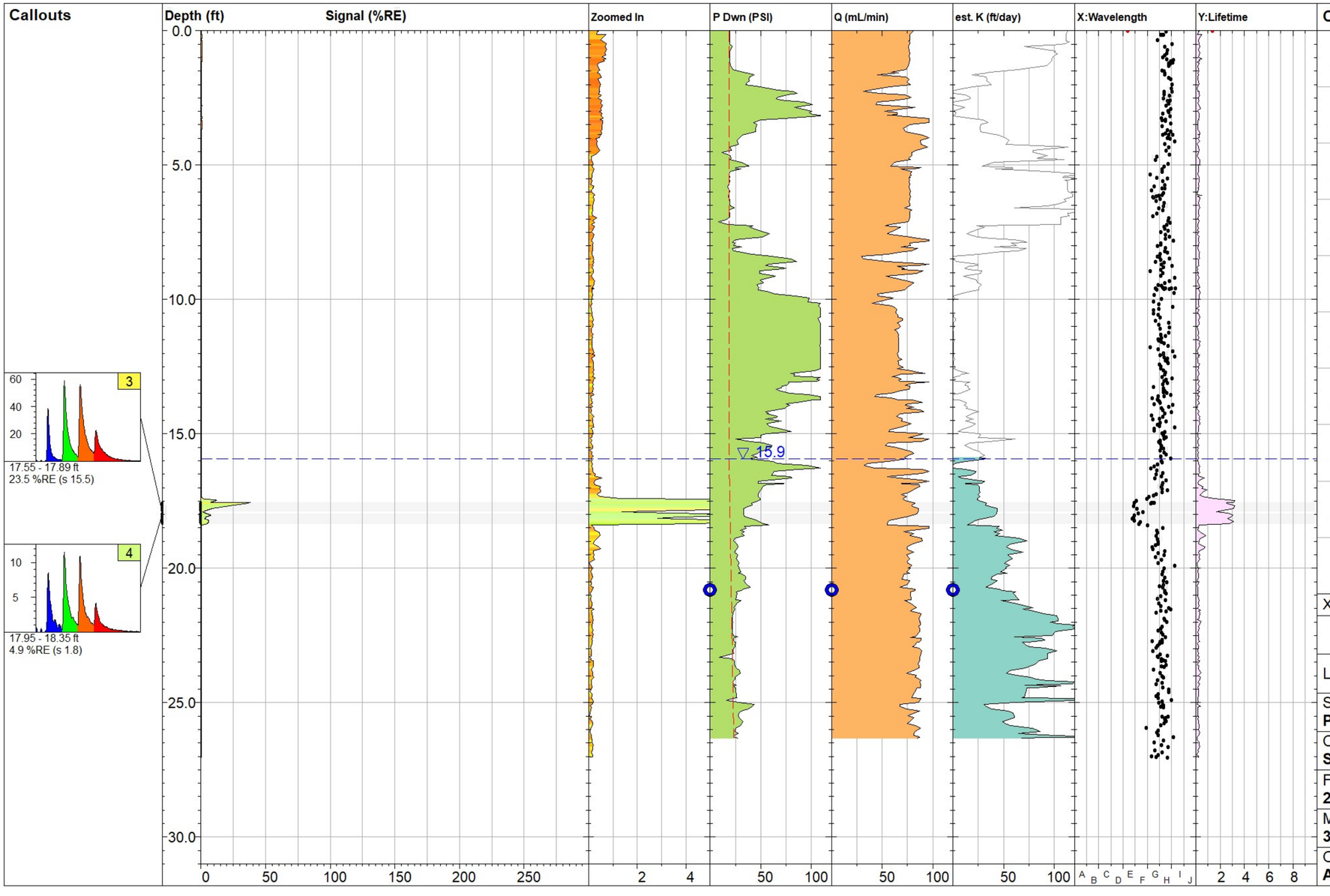
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

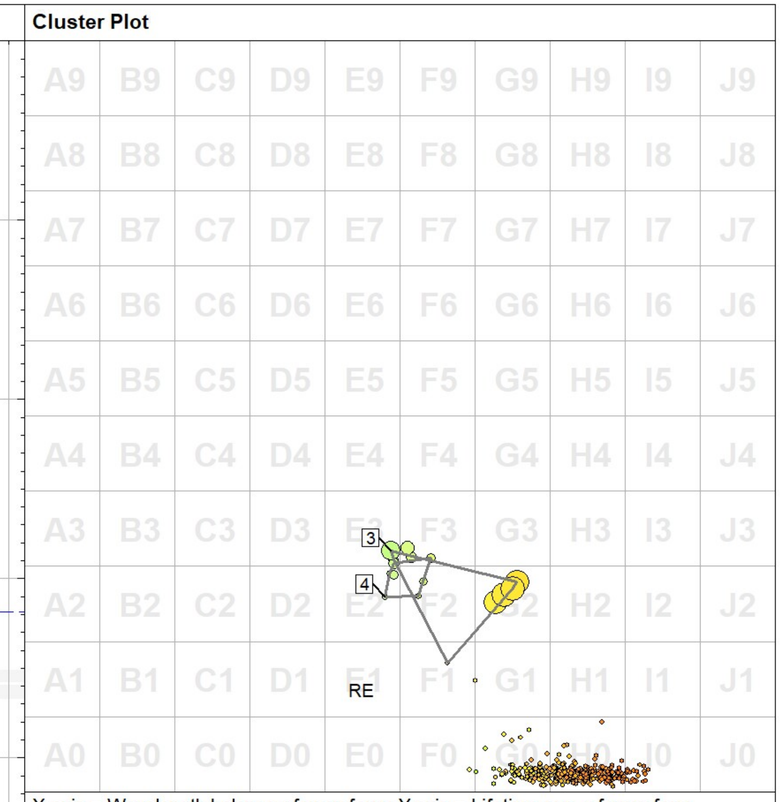
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-02_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 12:36 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **25.04 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **28.6 %RE @ 18.35 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





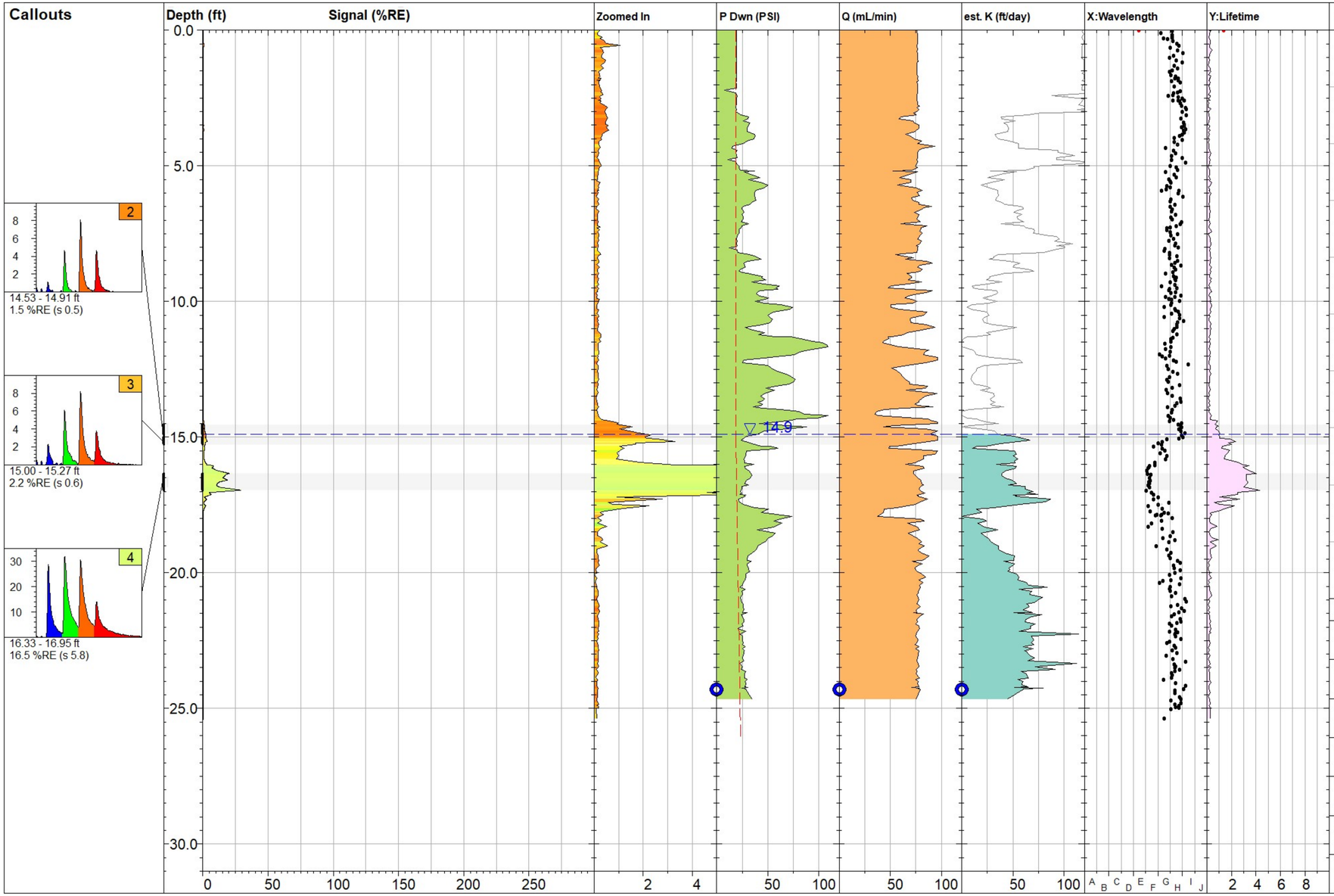
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

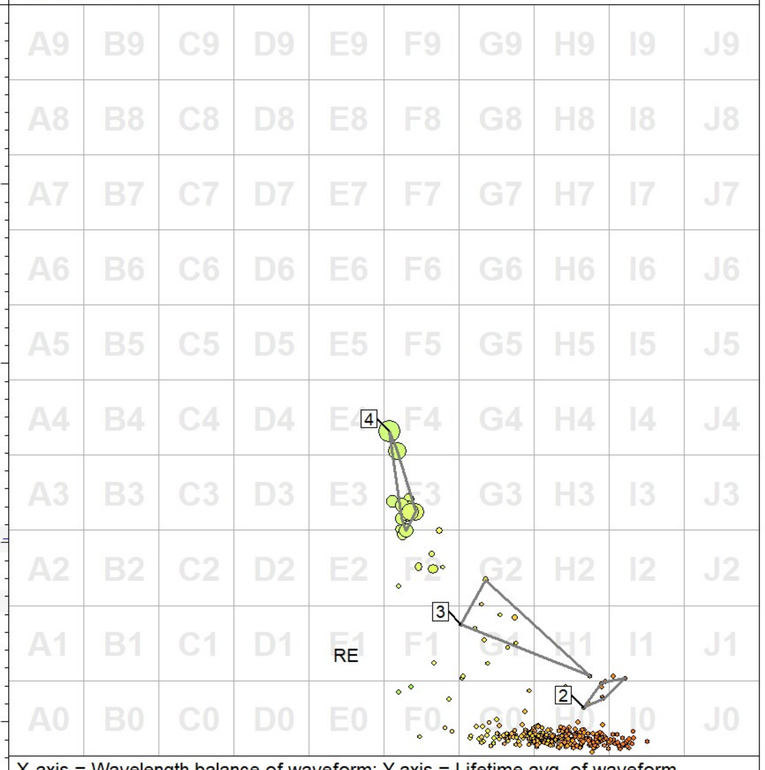
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-03A_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 11:42 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **27.03 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **38.0 %RE @ 17.56 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





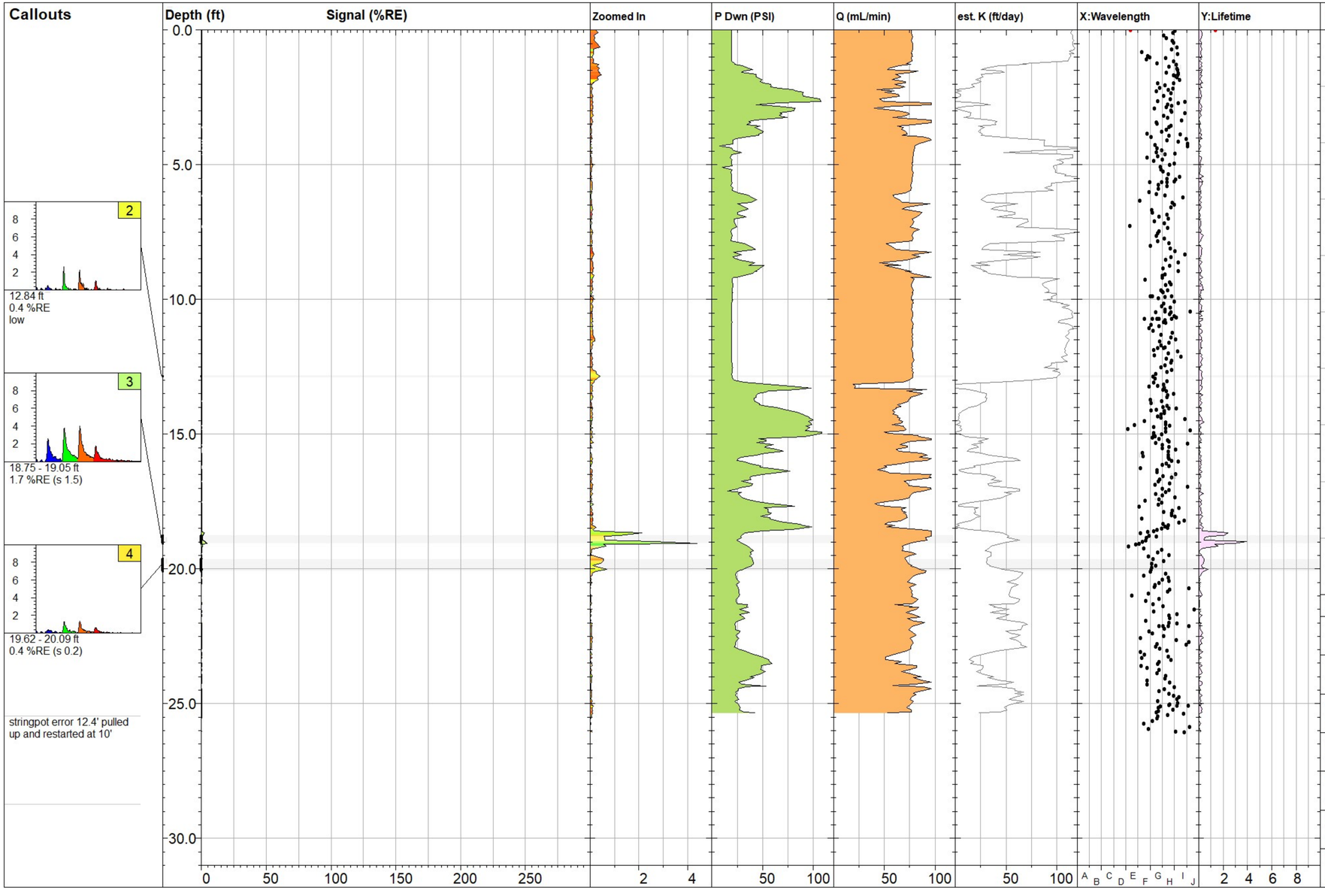
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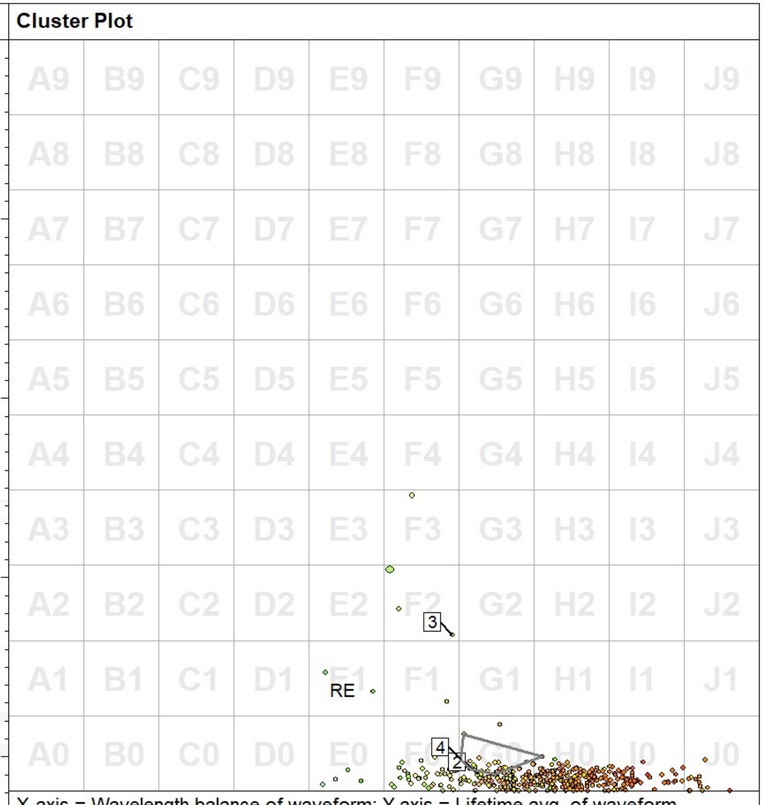
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-05_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 13:37 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **25.40 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **29.2 %RE @ 16.95 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**



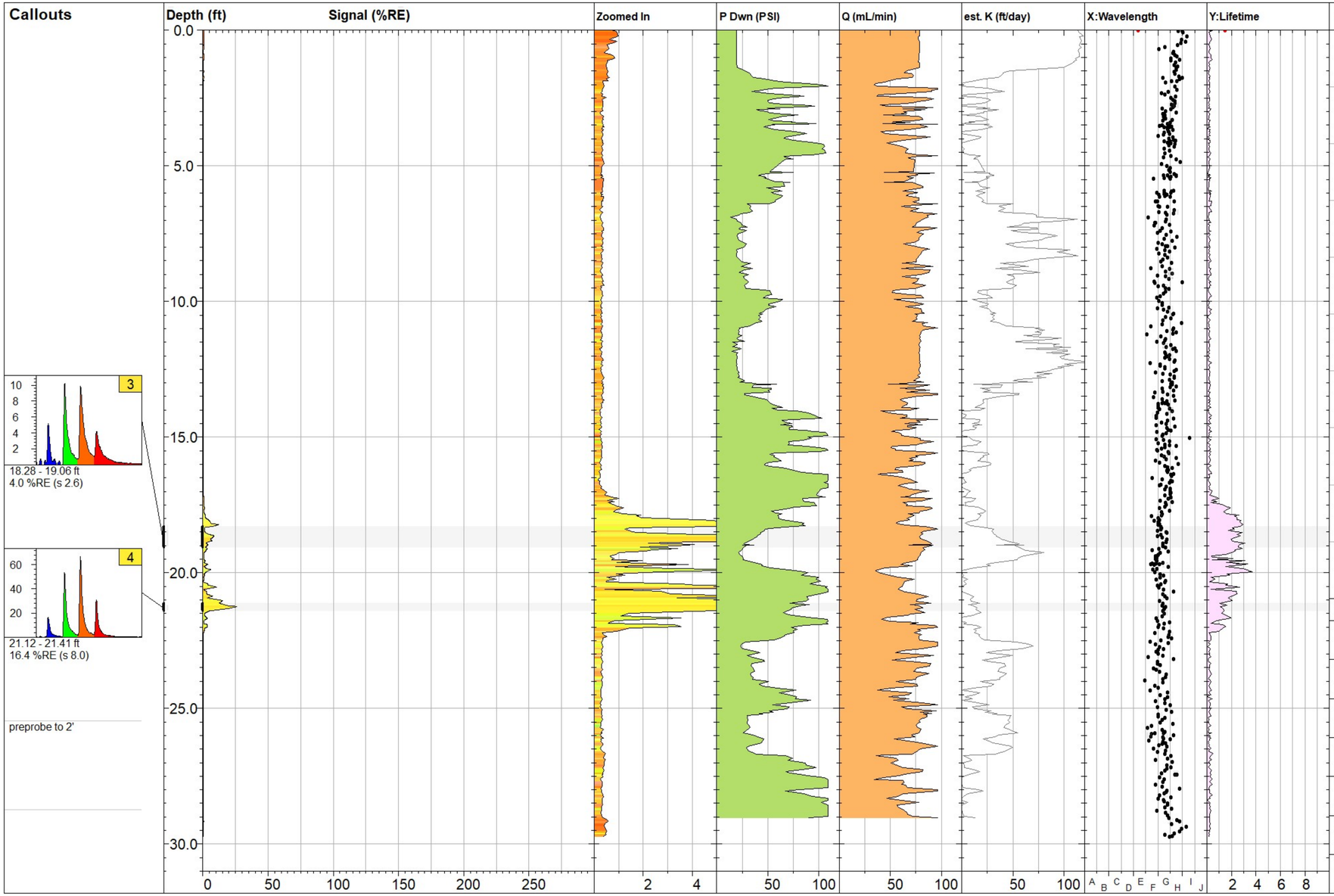


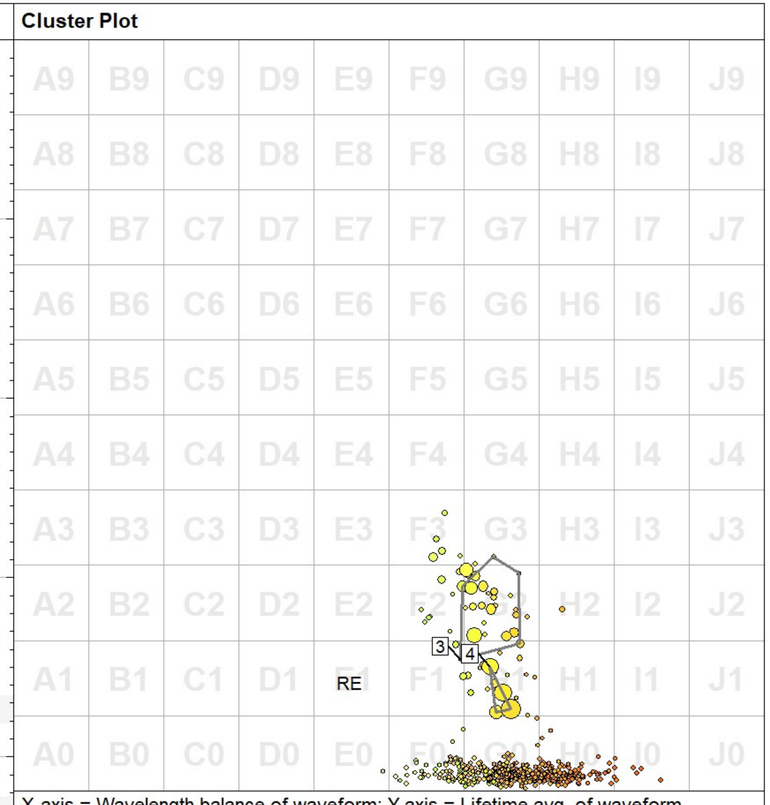
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-06_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 09:17 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **26.04 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **4.4 %RE @ 19.05 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

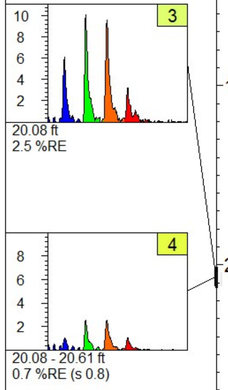
UVOST® By Dakota

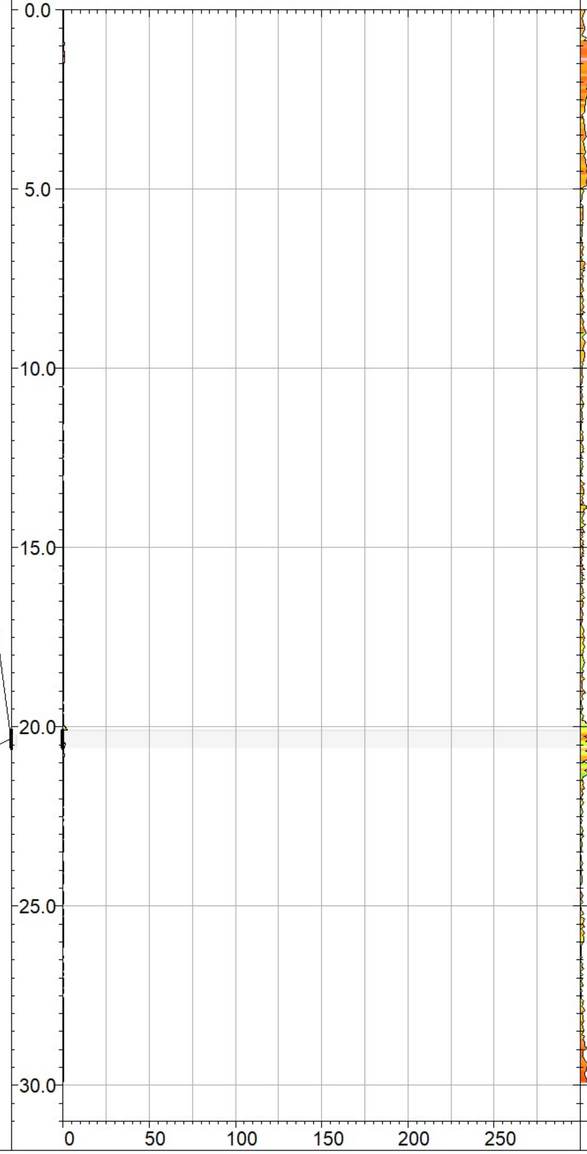
Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

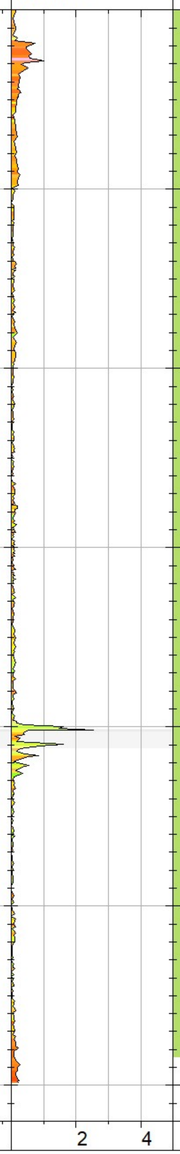
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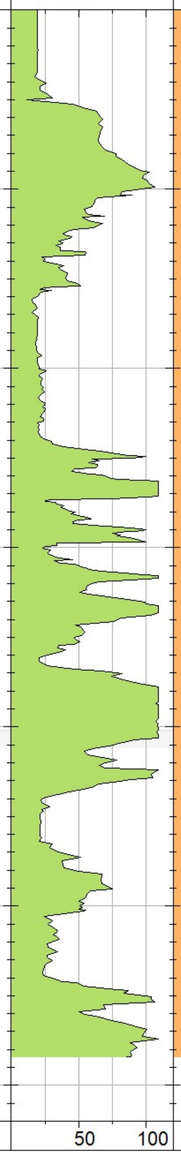
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Client: **Stantec**	Job: **0088.2024**
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Max Signal: **26.2 %RE @ 21.24 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**

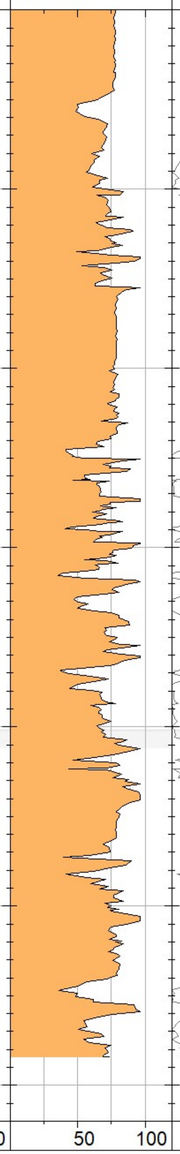
Callouts

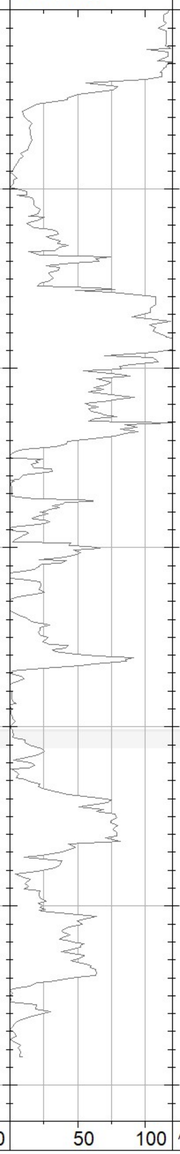


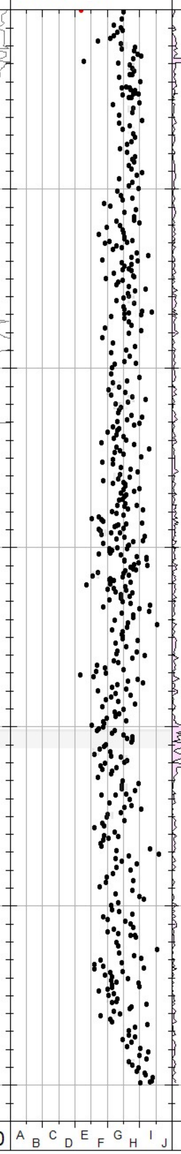


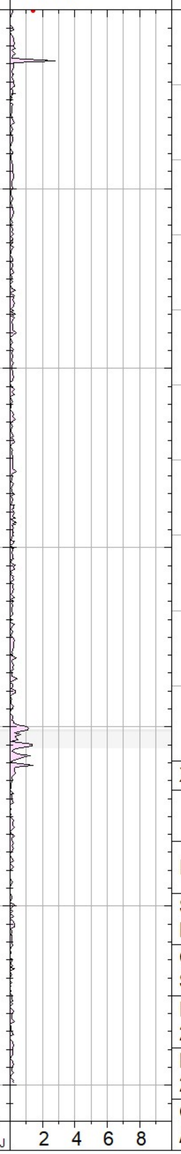




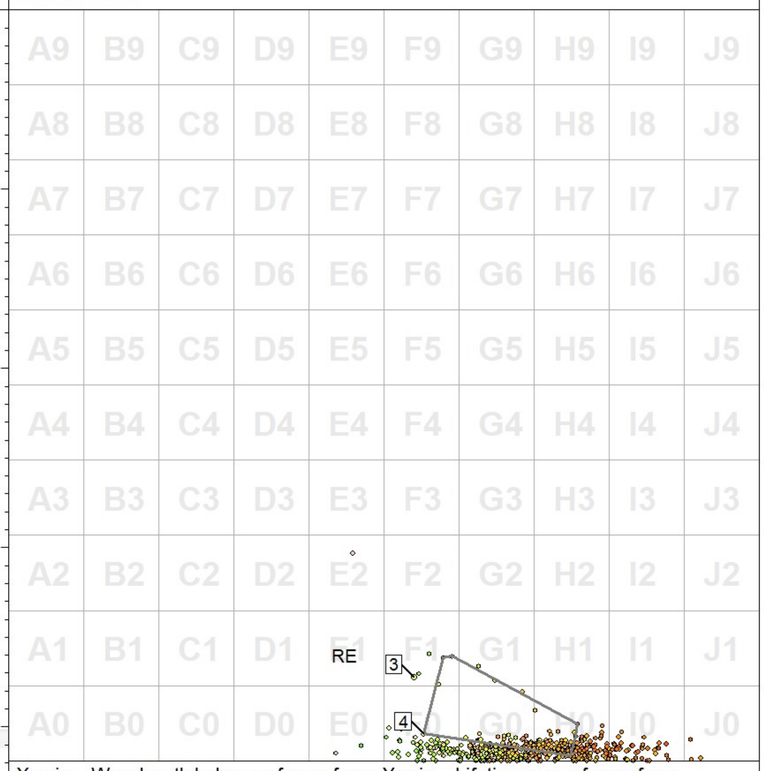








Cluster Plot



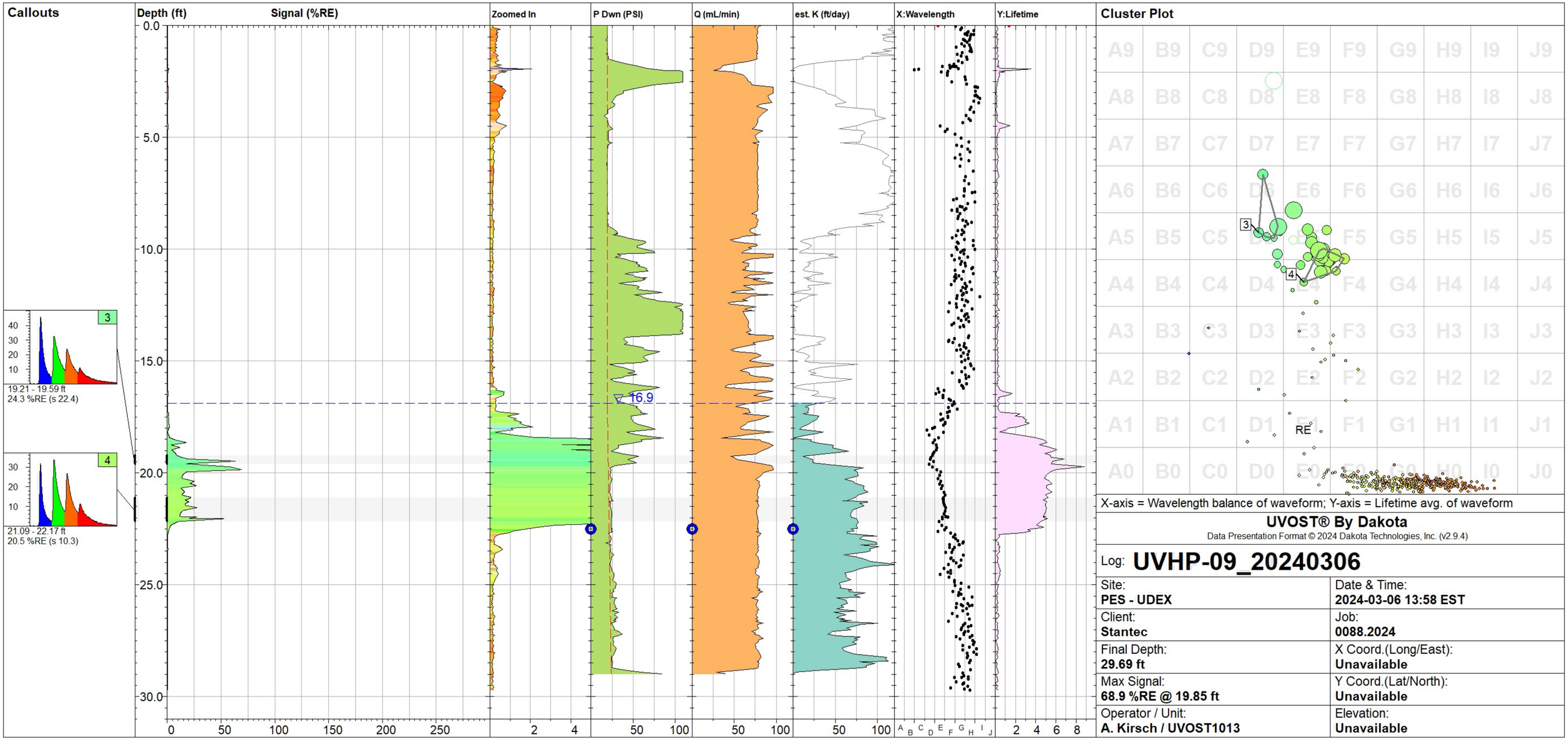
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

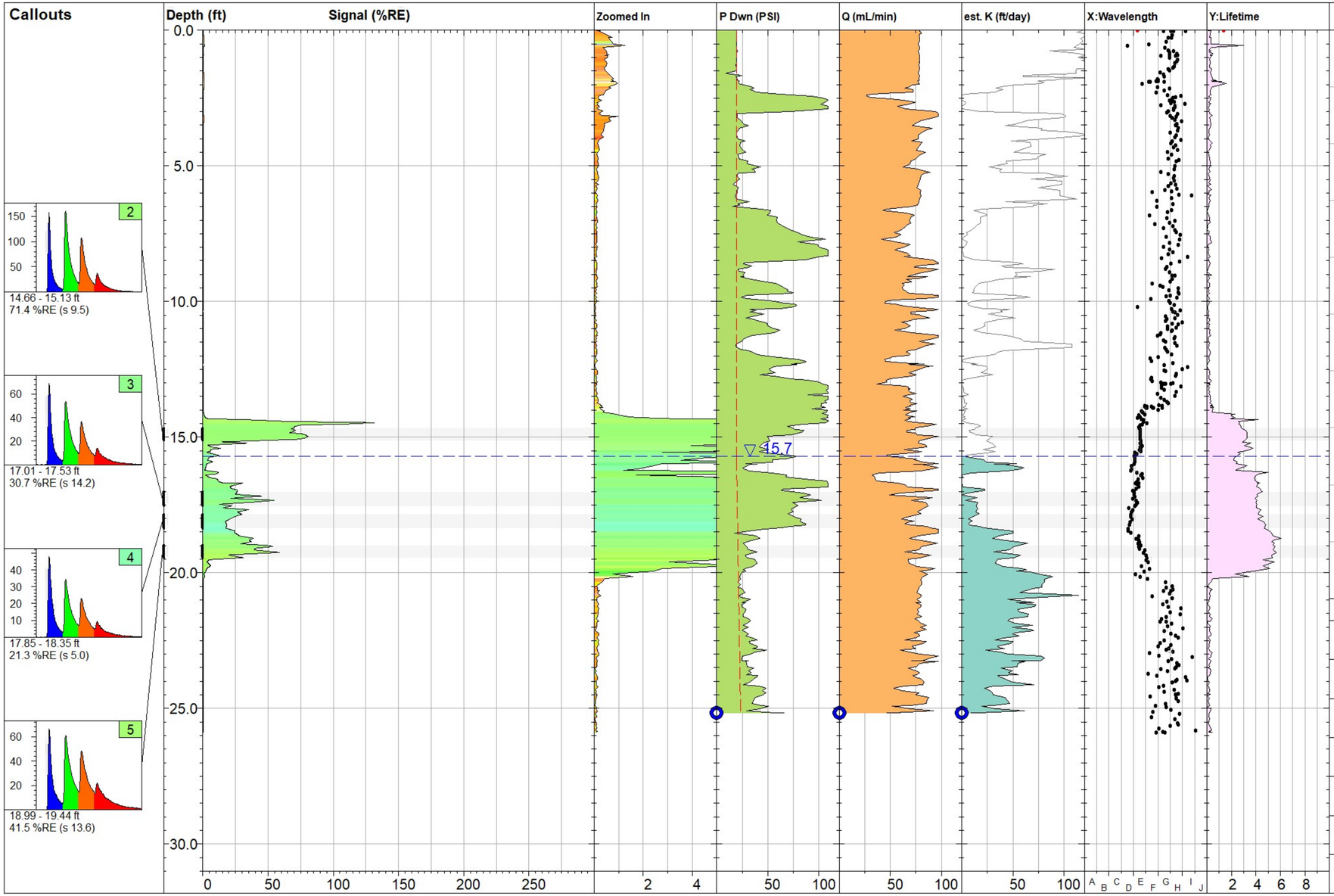
UVOST® By Dakota

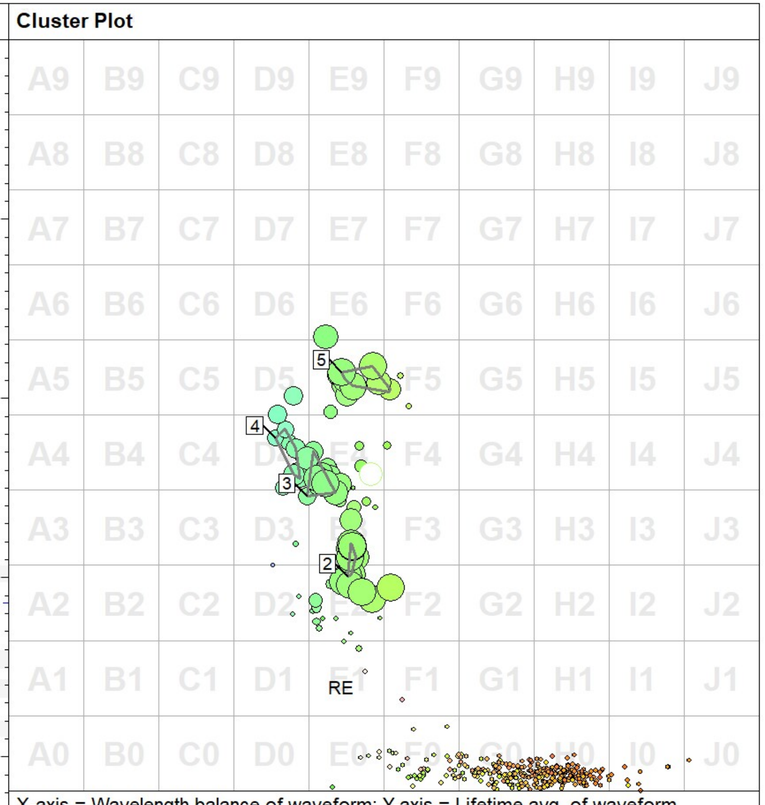
Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-08 _20240306**

Site: **PES - UDEX**	Date & Time: **2024-03-06 10:37 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **29.91 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **2.5 %RE @ 20.08 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**


Callouts
Depth (ft)
Signal (%RE)
Zoomed In
P Dwn (PSI)
Q (mL/min)
est. K (ft/day)
X:Wavelength
Y:Lifetime
3
19.21 - 19.59 ft
24.3 %RE (s 22.4)
4
21.09 - 22.17 ft
20.5 %RE (s 10.3)
16.9
Cluster Plot
RE
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform
UVOST® By Dakota
Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)
Log: UVHP-09_20240306
Site: PES - UDEX
Date & Time: 2024-03-06 13:58 EST
Client: Stantec
Job: 0088.2024
Final Depth: 29.69 ft
X Coord.(Long/East): Unavailable
Max Signal: 68.9 %RE @ 19.85 ft
Y Coord.(Lat/North): Unavailable
Operator / Unit: A. Kirsch / UVOST1013
Elevation: Unavailable





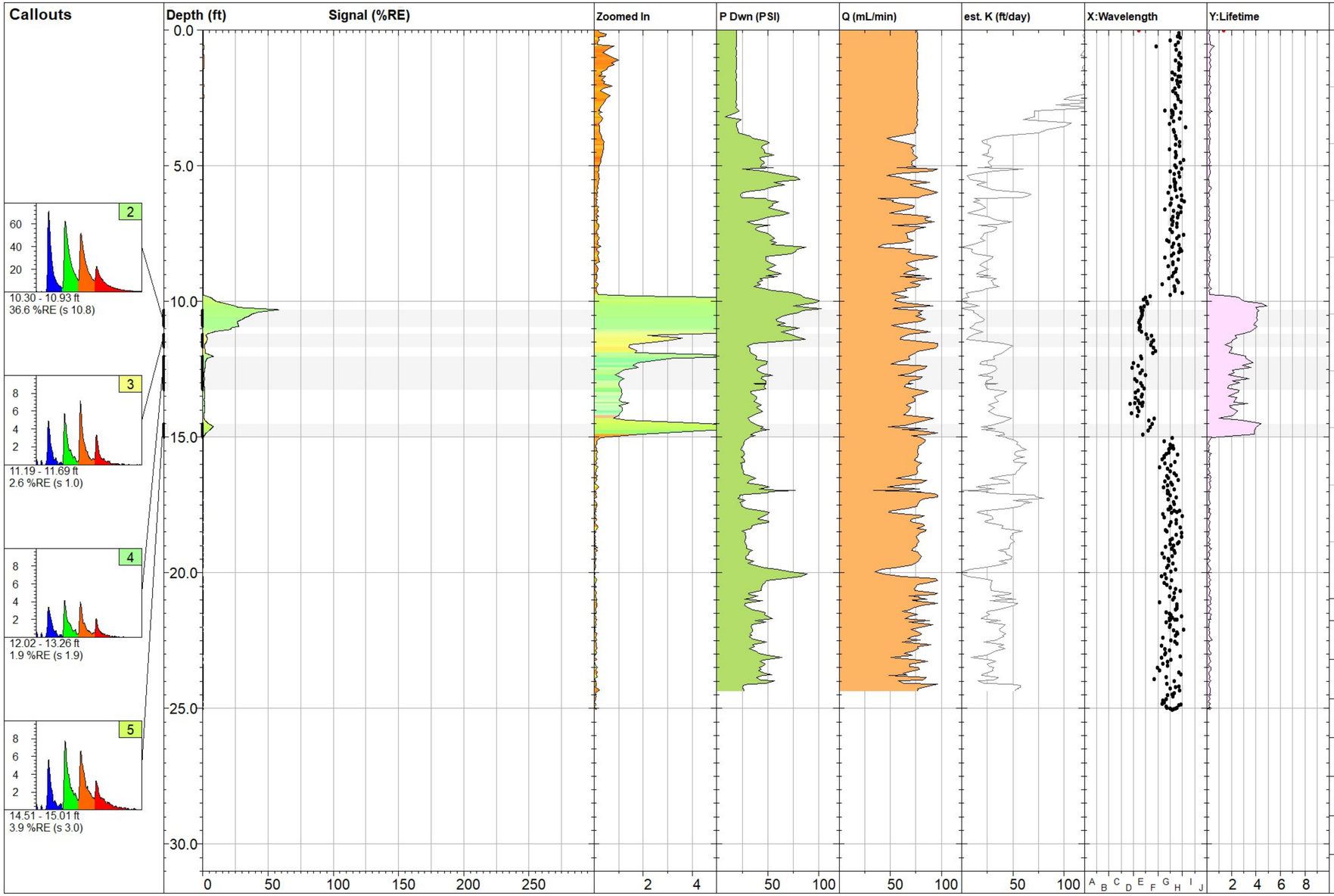
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

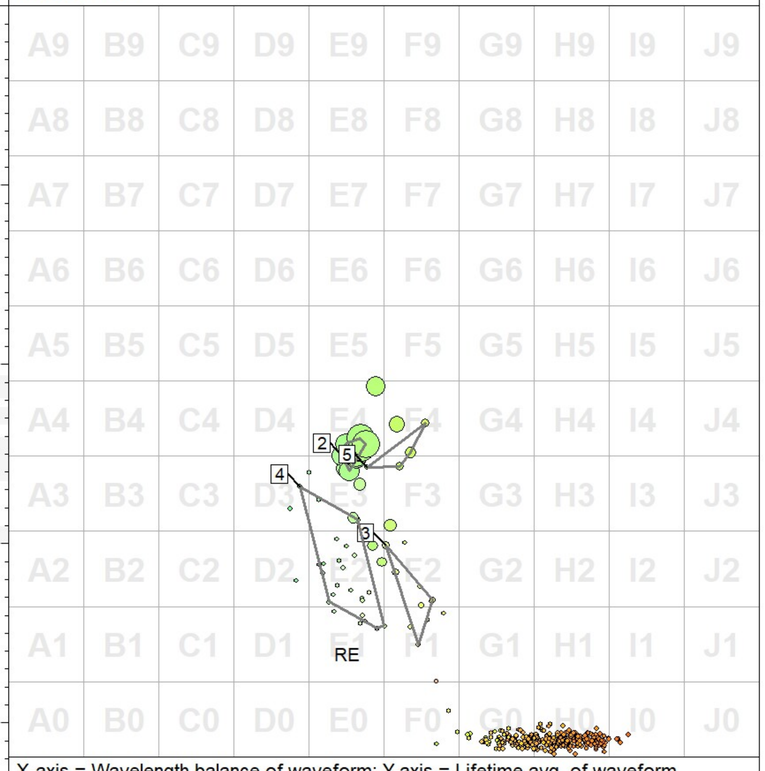
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-10_20240306**

Site: **PES - UDEX**	Date & Time: **2024-03-06 15:58 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **25.87 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **131.9 %RE @ 14.47 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





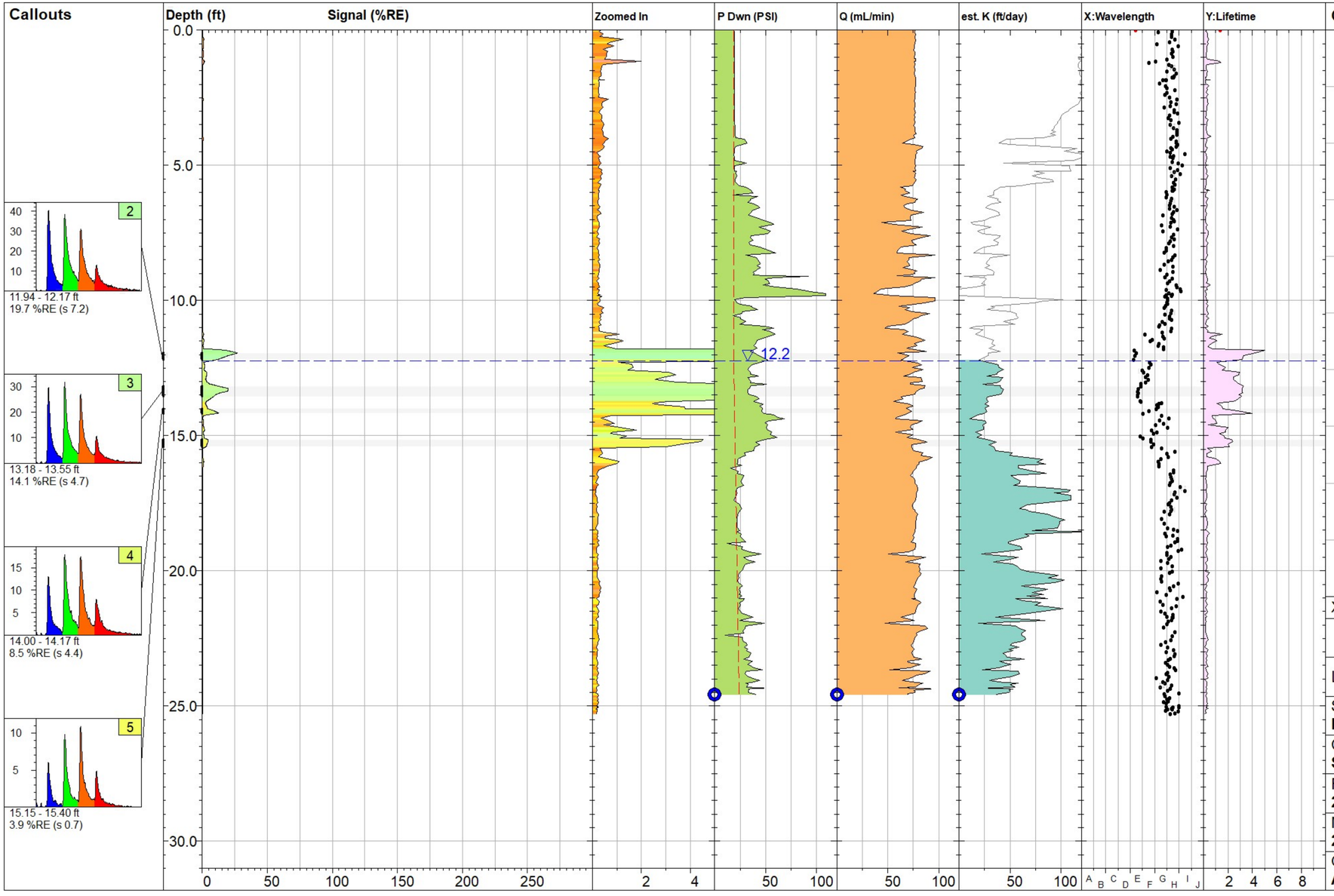
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

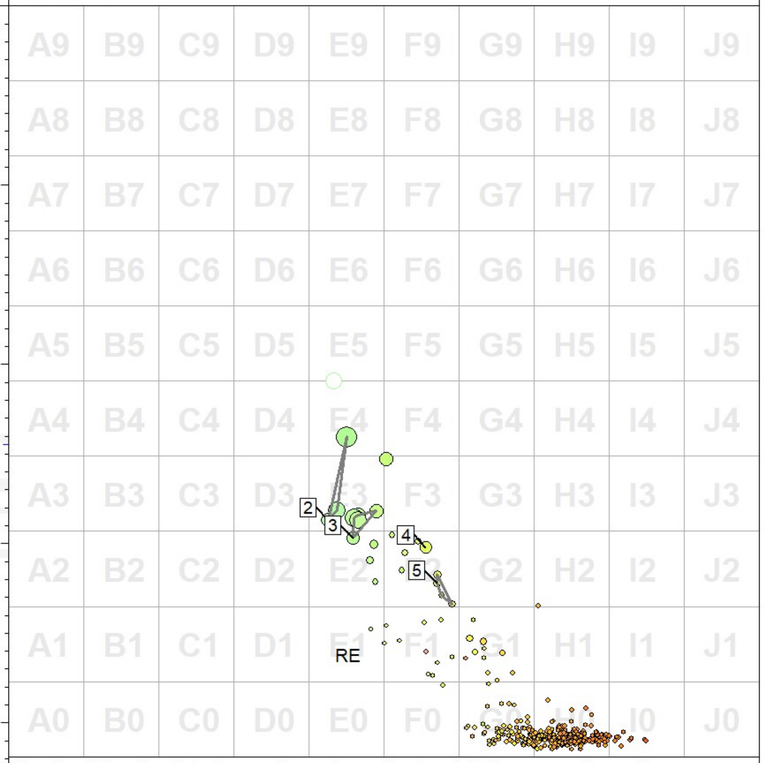
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-13D_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 14:27 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **25.04 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **58.4 %RE @ 10.30 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





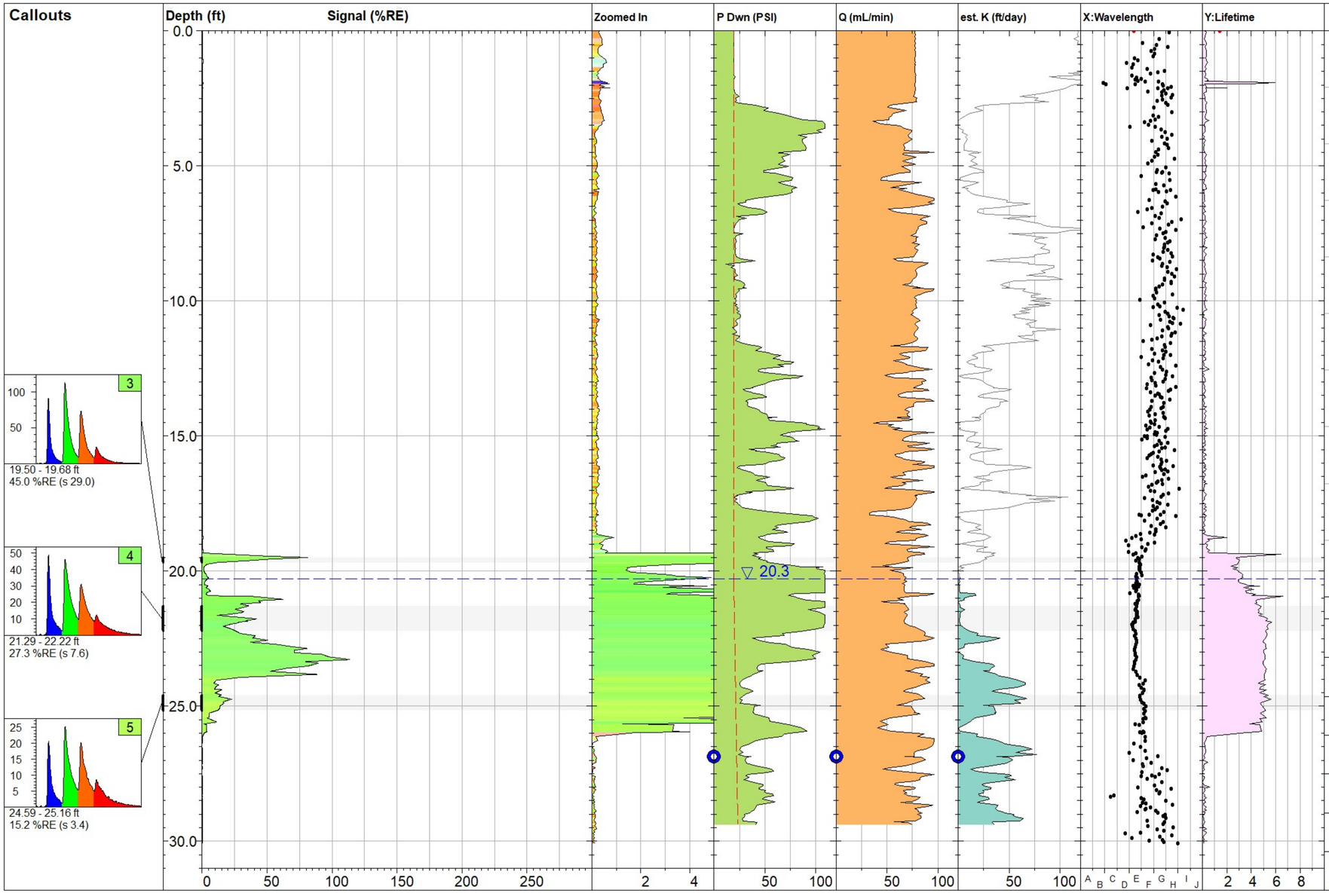
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

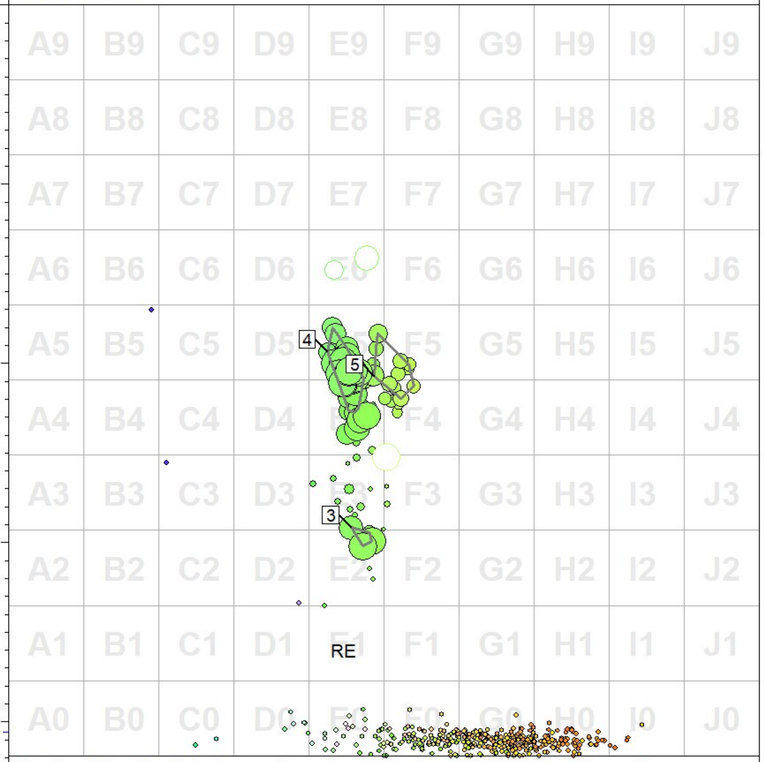
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-14_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 15:17 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **25.28 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **27.1 %RE @ 11.94 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





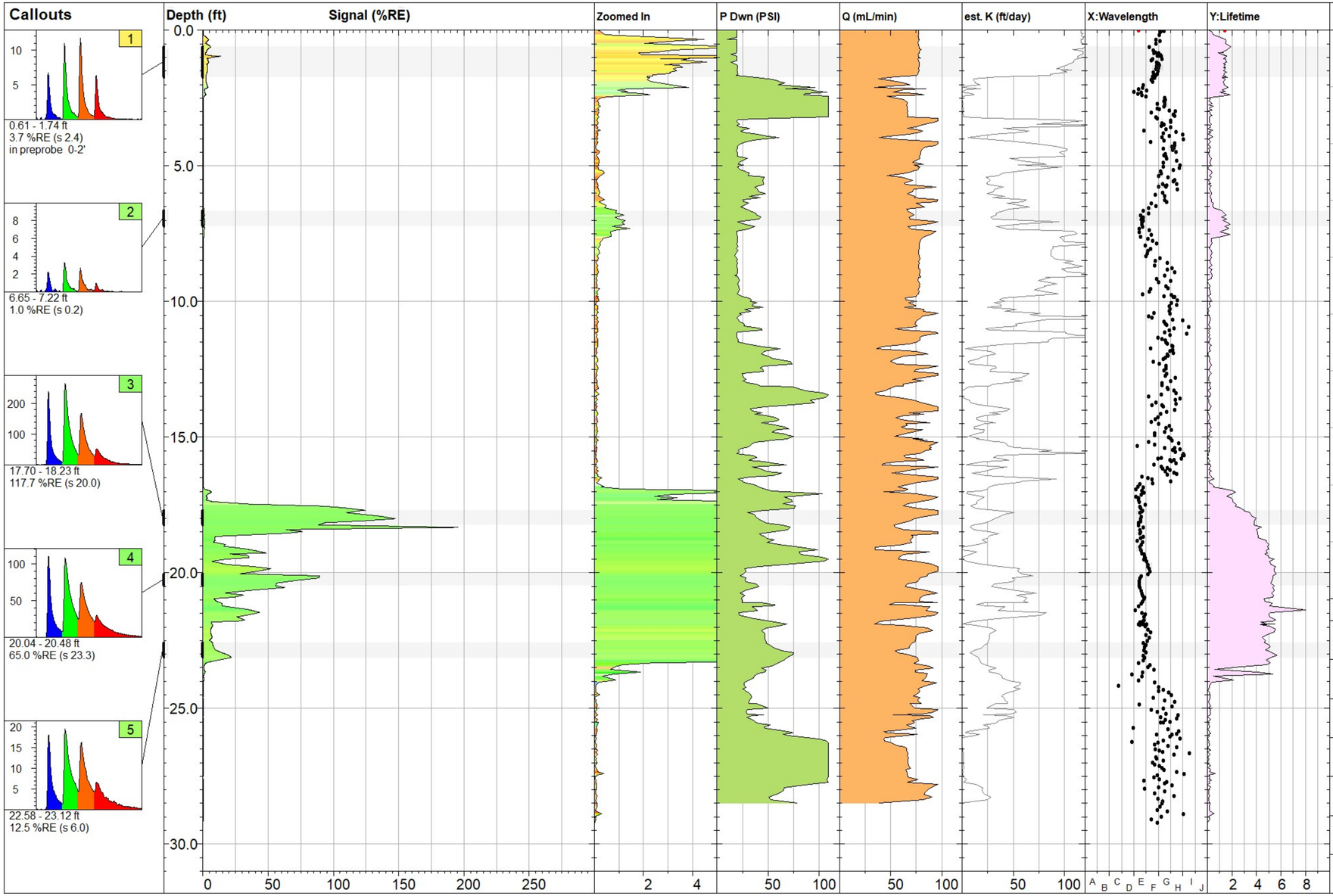
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

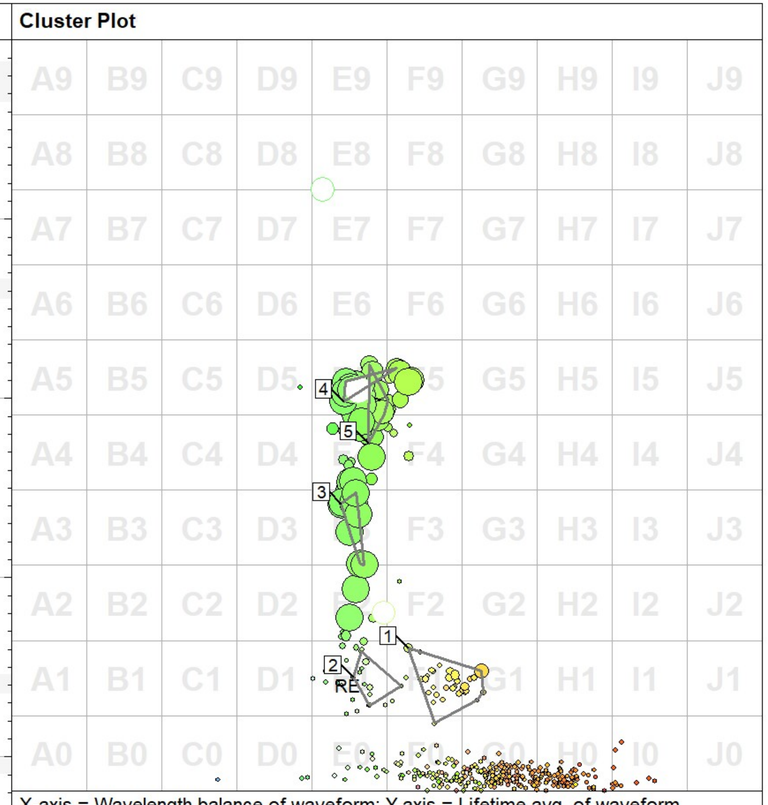
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-15 _20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-06 11:34 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **30.07 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **113.7 %RE @ 23.27 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





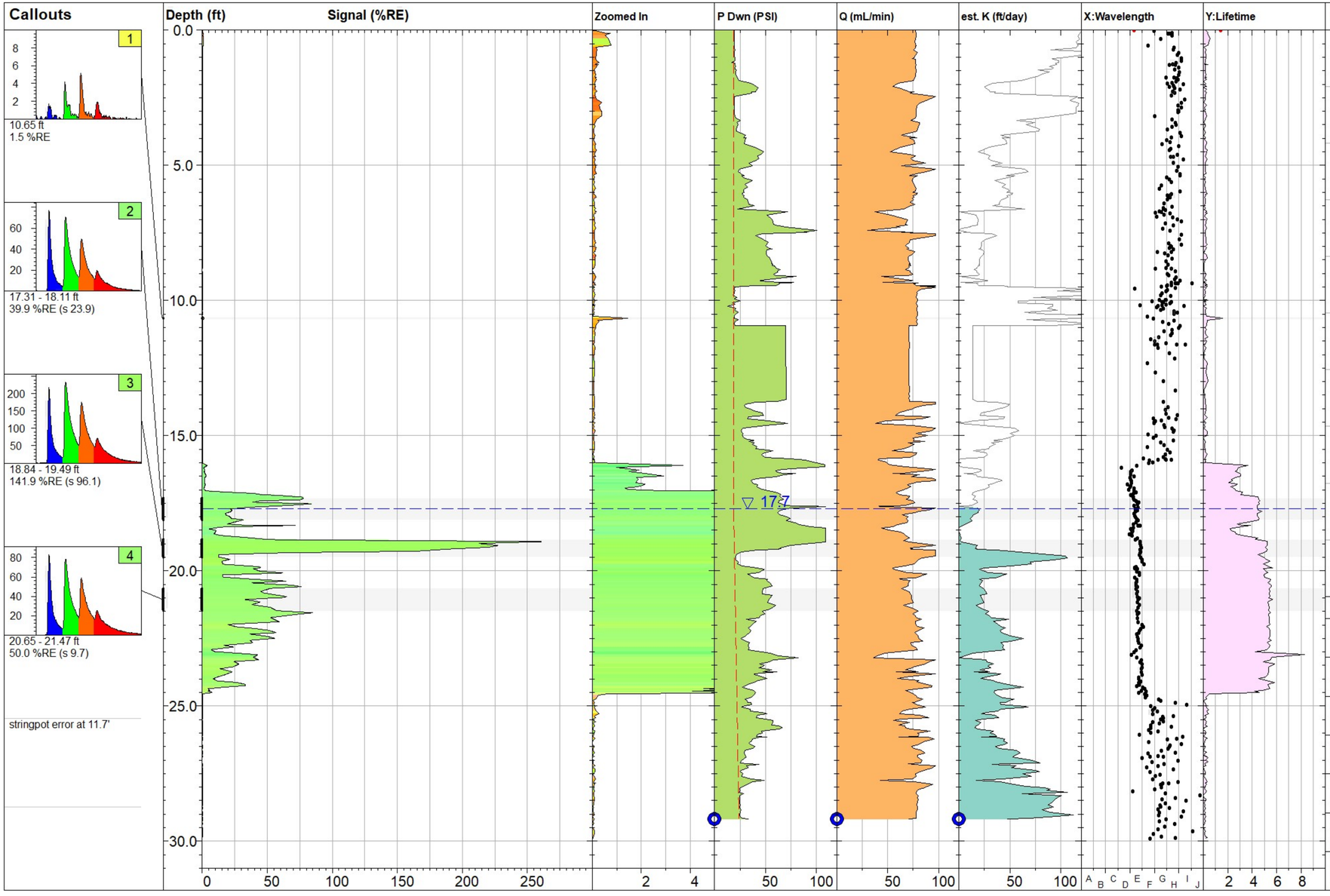
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

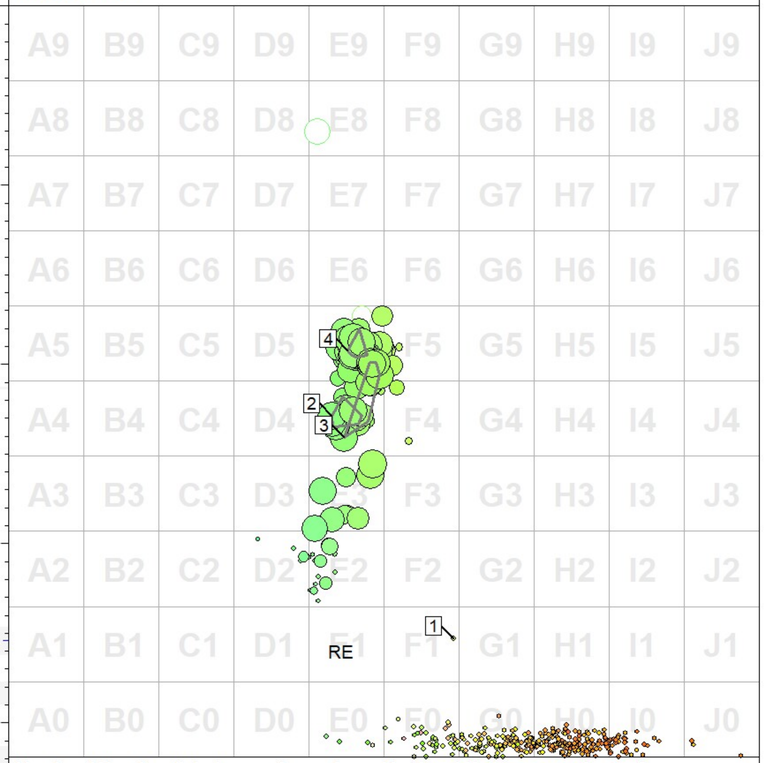
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-20_20240306**

Site: **PES - UDEX**	Date & Time: **2024-03-06 12:48 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **29.19 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **196.9 %RE @ 18.32 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





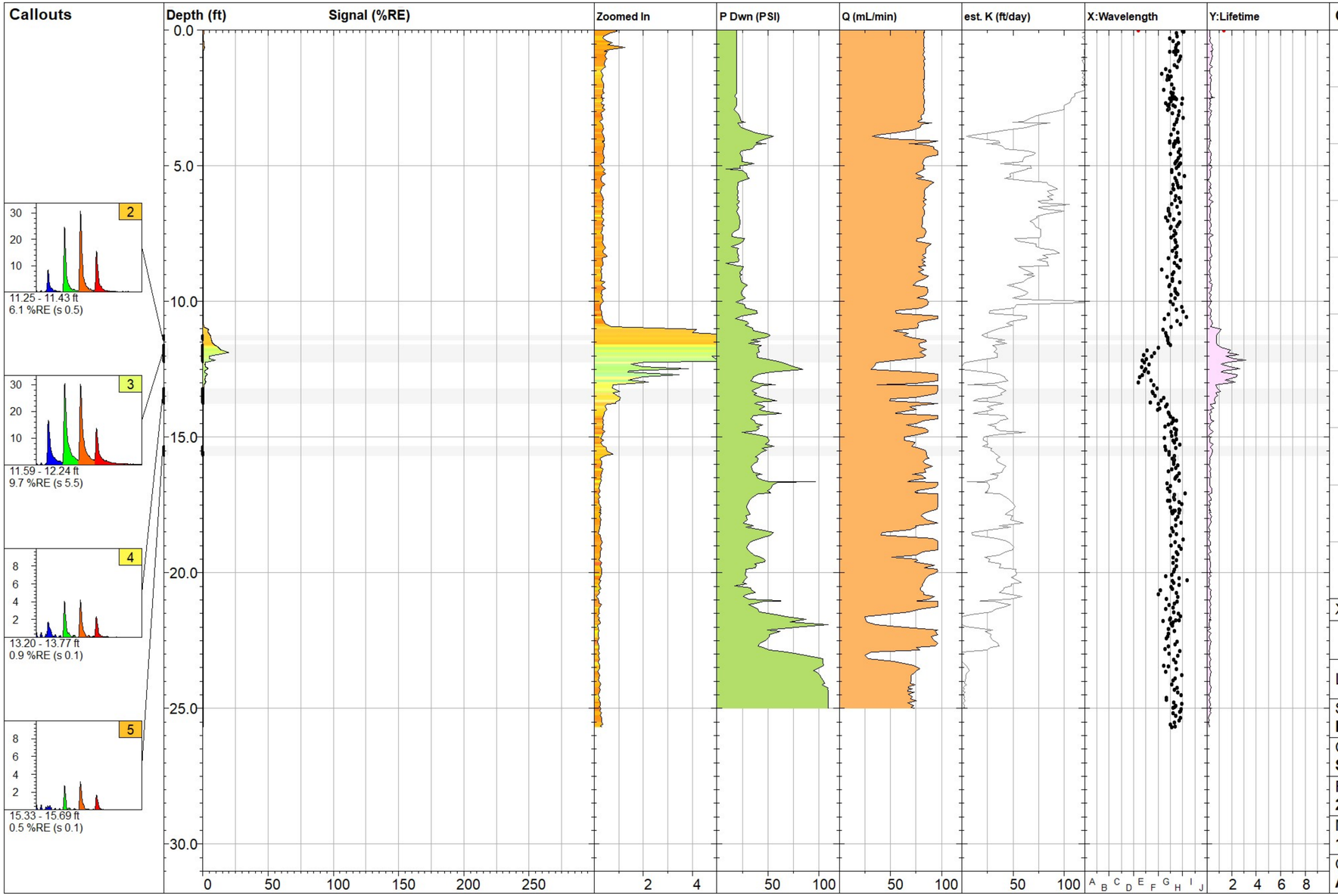
X-axis = Wavelength balance of waveform; Y-axis = Lifetime avg. of waveform

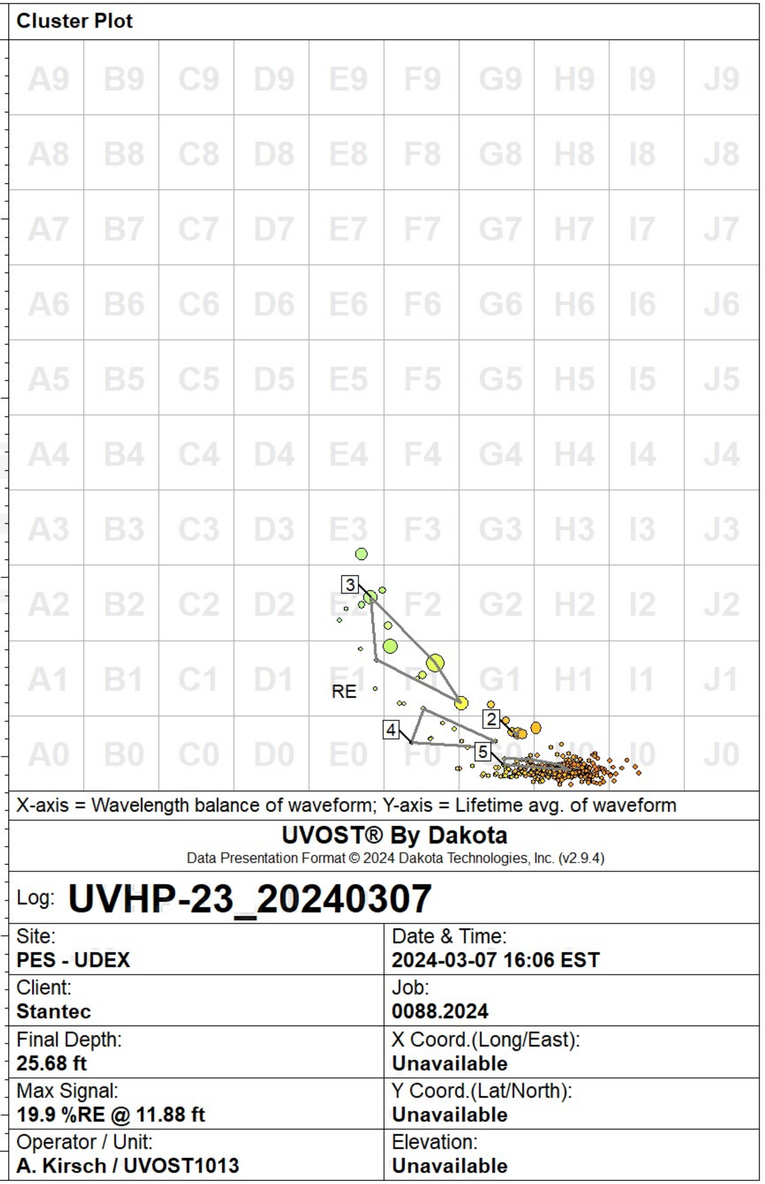
UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-21_20240306**

Site: **PES - UDEX**	Date & Time: **2024-03-06 15:03 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **29.89 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **262.8 %RE @ 18.92 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**





UVOST® By Dakota

Data Presentation Format © 2024 Dakota Technologies, Inc. (v2.9.4)

Log: **UVHP-23_20240307**

Site: **PES - UDEX**	Date & Time: **2024-03-07 16:06 EST**
Client: **Stantec**	Job: **0088.2024**
Final Depth: **25.68 ft**	X Coord.(Long/East): **Unavailable**
Max Signal: **19.9 %RE @ 11.88 ft**	Y Coord.(Lat/North): **Unavailable**
Operator / Unit: **A. Kirsch / UVOST1013**	Elevation: **Unavailable**

Appendix C

UVOST®-HP Reference Log

DAKOTA TECHNOLOGIES

Dakota Technologies
UVOST®-HP Reference Log

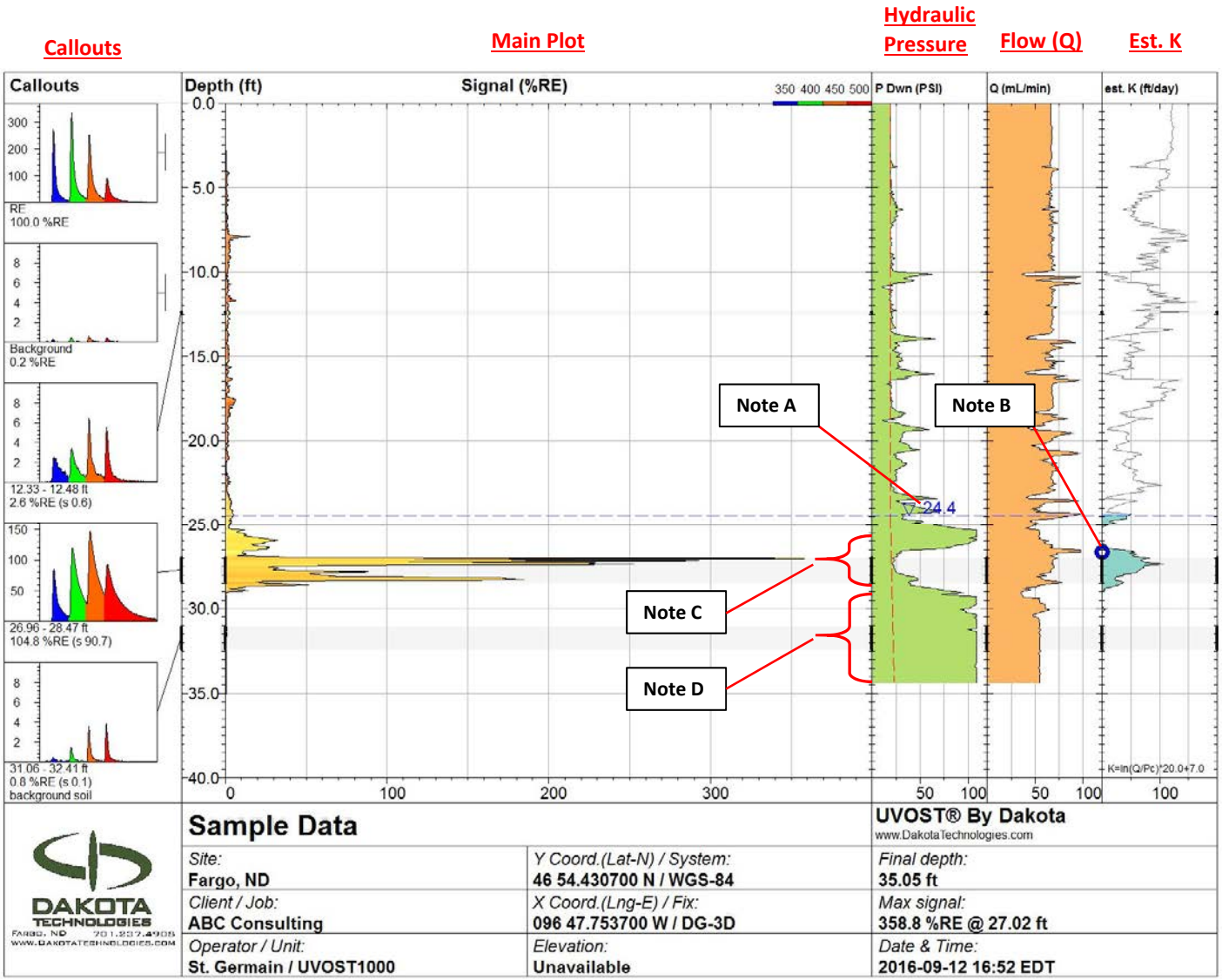
Callouts: Waveforms from selected depths or depth ranges showing the multi-wavelength waveform for that depth. The four peaks are due to fluorescence at four wavelengths and referred to as “channels”. Each channel is assigned a color. Various NAPLs will have a unique waveform “fingerprint” due to the relative amplitude of the four channels and/or broadening of one or more channels. Basic waveform statistics and any operator notes are given below the callout.

Main Plot: Signal (total fluorescence) versus depth where signal is relative to the Reference Emitter (RE). The total area of the waveform is divided by the total area of the Reference Emitter yielding the %RE. This %RE scales with the NAPL fluorescence. The fill color is based on the relative distribution of each channel’s area to the total waveform area (see callout waveform). The channel-to-color relationship and corresponding wavelengths are given in the upper right corner of the plot.

Hydraulic Pressure (P Dwn): Downhole hydraulic pressure is measured in response to pumping water into the formation at a constant rate. Measurements are logged simultaneously with UVOST data. The resulting log gives insight into the permeability of the soils.

Flow (Q): Water is pumped out of the port of the UVOST-HP probe at a constant rate of 60 mL/min. A change in flow (usually accompanied by an inverse pressure change) is an indicator of hydraulic properties of the soil.

Estimated K: The estimated hydraulic conductivity (K) is internally calculated by utilizing pressure and flow data in conjunction with dissipation test(s) performed at each location. The estimated K is calculated by the equation: K = ln(Q/P’)*20.0 + 7.0.



Note A: The water table has been calculated and plotted at 24.4’ bgs.

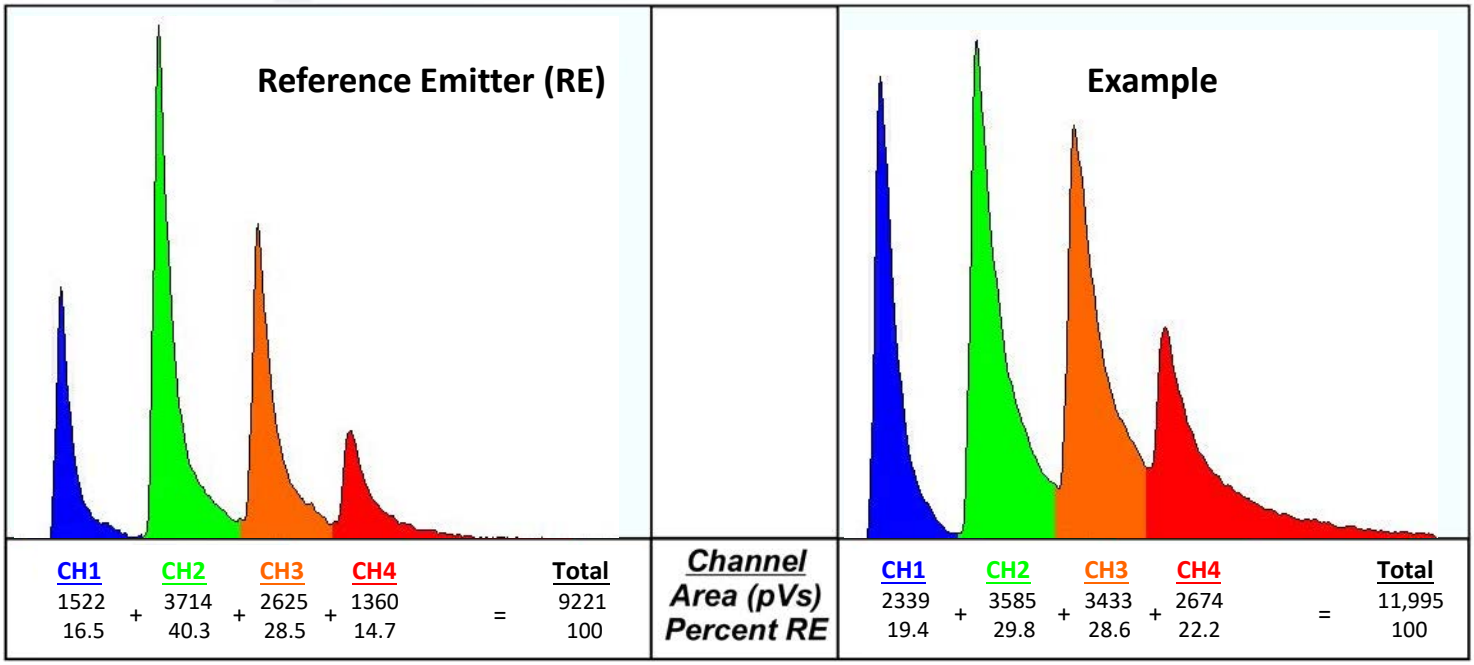
Note B: The circle on the Estimated K plot represents the location(s) of dissipation tests. Here, a single dissipation test was performed at 26.67 bgs’.

Note C: The highest LNAPL response in this log is present in an area of relatively higher permeability, as indicated by low pressure and higher estimated k values at approximately 26’ to 28’.

Note D: The increase in pressure starting near 29’ (transducer is maxed out, 100 psi) is due to low permeability conditions. In this example, the increase in pressure below the LNAPL represents a potential confining unit.

Dakota Technologies
UVOST® Reference Log

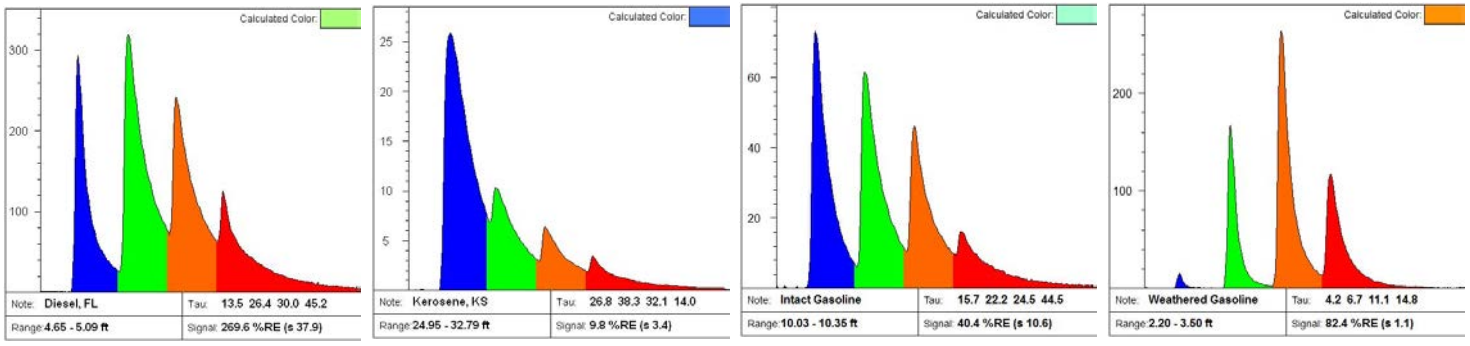
Waveform Signal Calculation



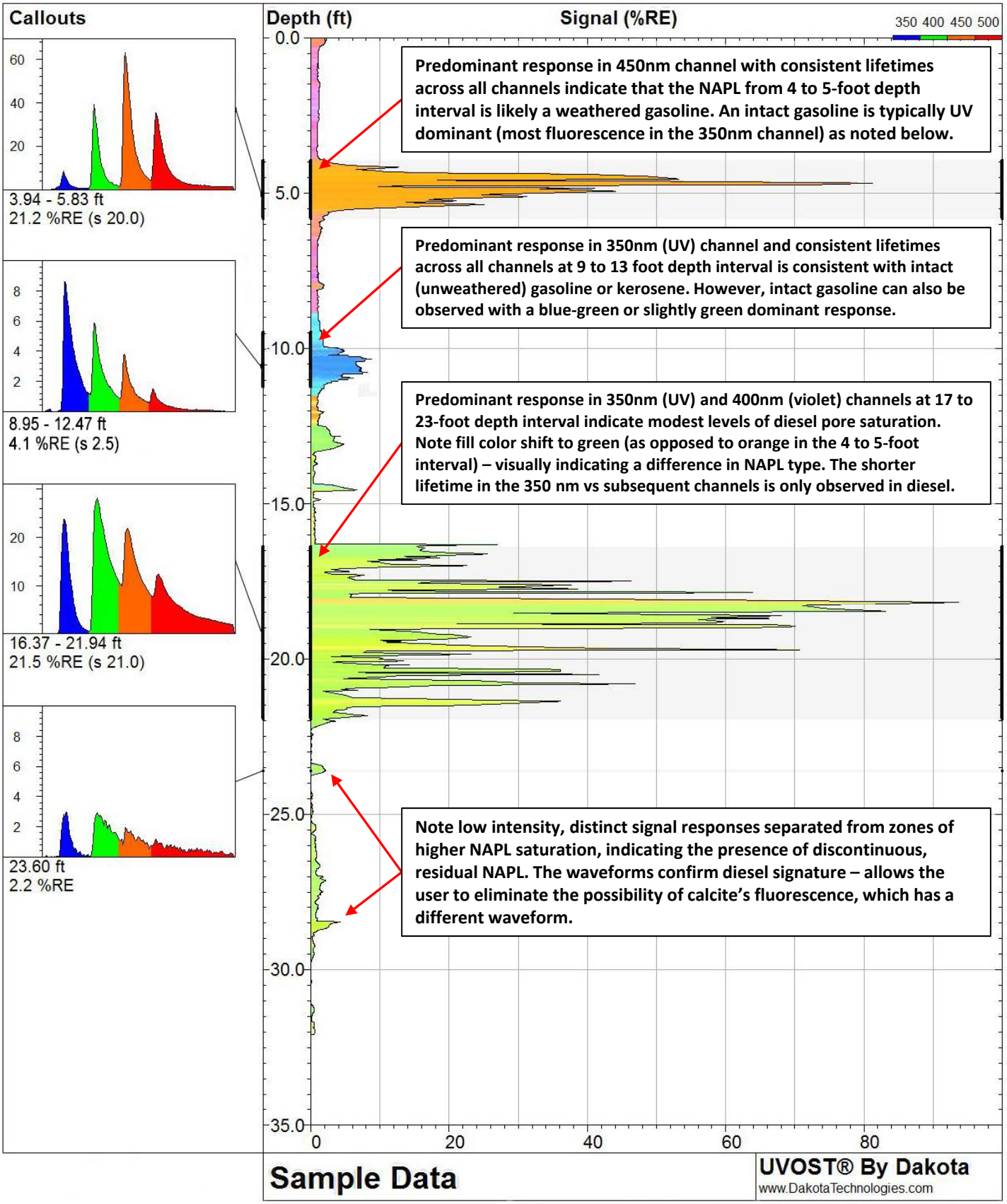
Data Files

***.lif.raw.bin**	Raw data file. Header is ASCII format and contains information stored when the file was initially written (e.g. date, total depth, max signal, GPS, etc., and any information entered by the operator). All Raw waveforms are appended to the bottom of the file in a binary format.
***.lif.plt**	Stores the plot scheme history (e.g. callout depths) for associated Raw file. Transfer along with the Raw file in order to recall previous plots.
***.lif.jpg**	A .jpg image of the OST log including the main signal vs. depth plot, callouts, information, etc.
***.lif.dat.txt**	Data export of a single Raw file. Tab delimited format. No string header is provided for the columns to make importing into some programs easier. Each row is a unique depth reading. The columns are: 1-Depth; 2-Total Signal (%RE); 3-CH1%; 4-Ch2%; 5-CH3%; 6-Ch4%; 7-Rate; 8-EC Depth; 9-EC Signal; 10-Hammer Rate Depth; 11-Hammer Rate; 12-Color (RRGGBB). Summing channels 1 to 4 yields the Total Signal.
***.lif.sum.txt**	A summary file for a number of Raw files. ASCII tab delimited format. The file contains a string header. The summary includes one row for each Raw file and contains information for each filed including: the file name, GPS coordinates, max depth, max signal, and depth at which the max signal occurred.
***.lif.log.txt**	An activity log generated automatically is located in the OST application directory in the 'log' subfolder. Each OST unit the computer operates will generate a separate log file per month. A log file contains much of the header information contained within each separate Raw file, including: data rate, total depth, max signal, etc.

Common Waveforms (highly dependent on soil, weathering, etc.)

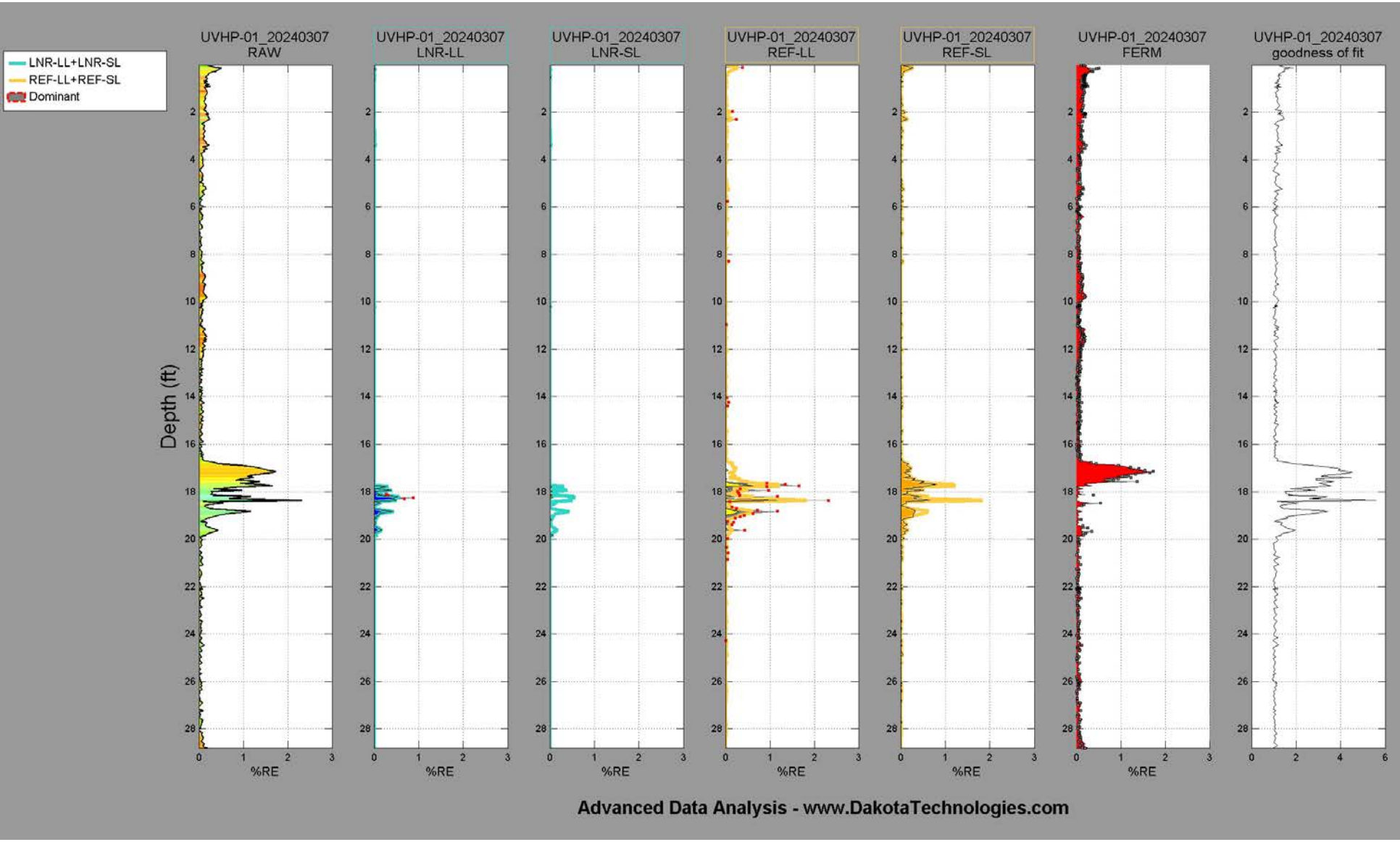


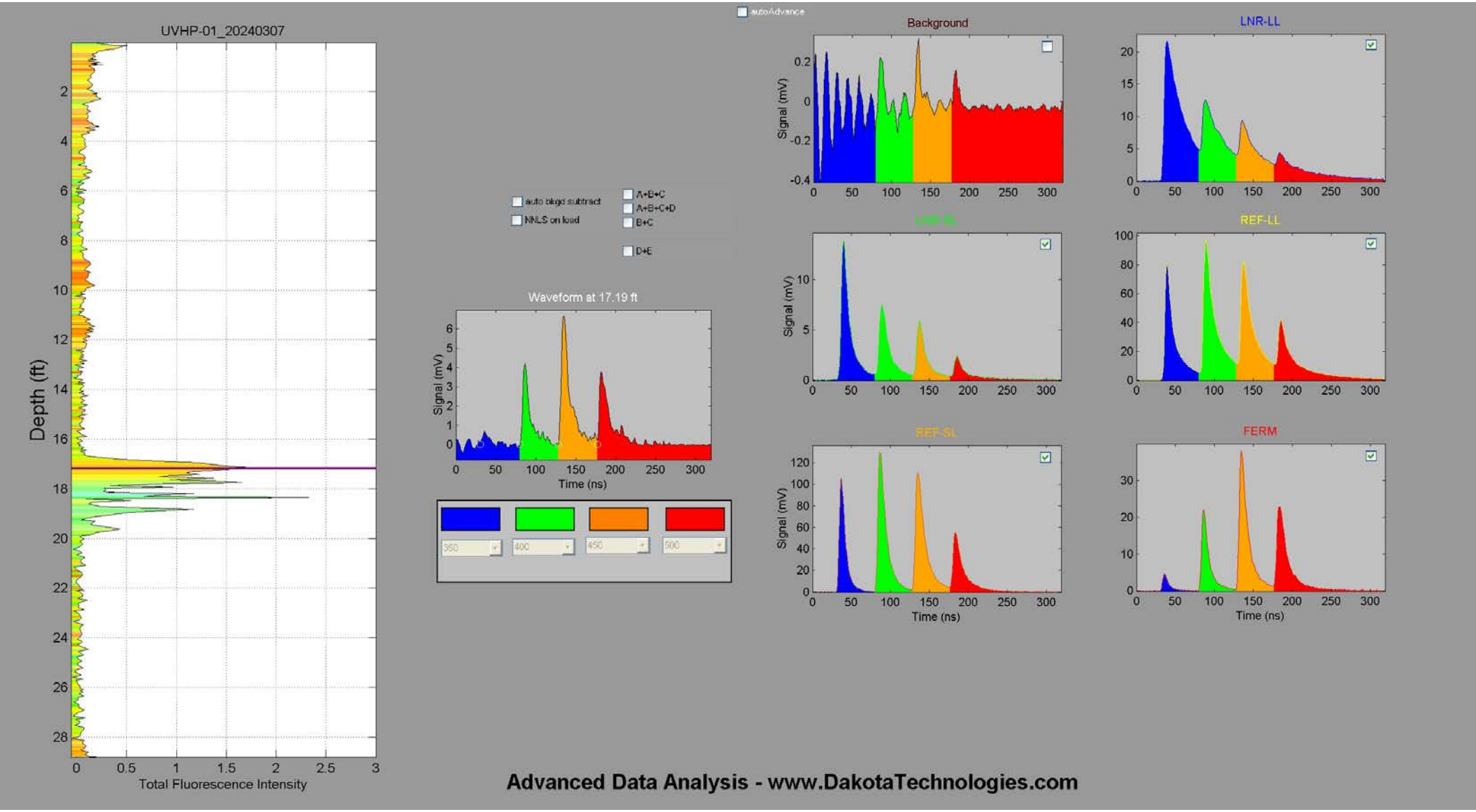
Dakota Technologies
UVOST® Reference Log

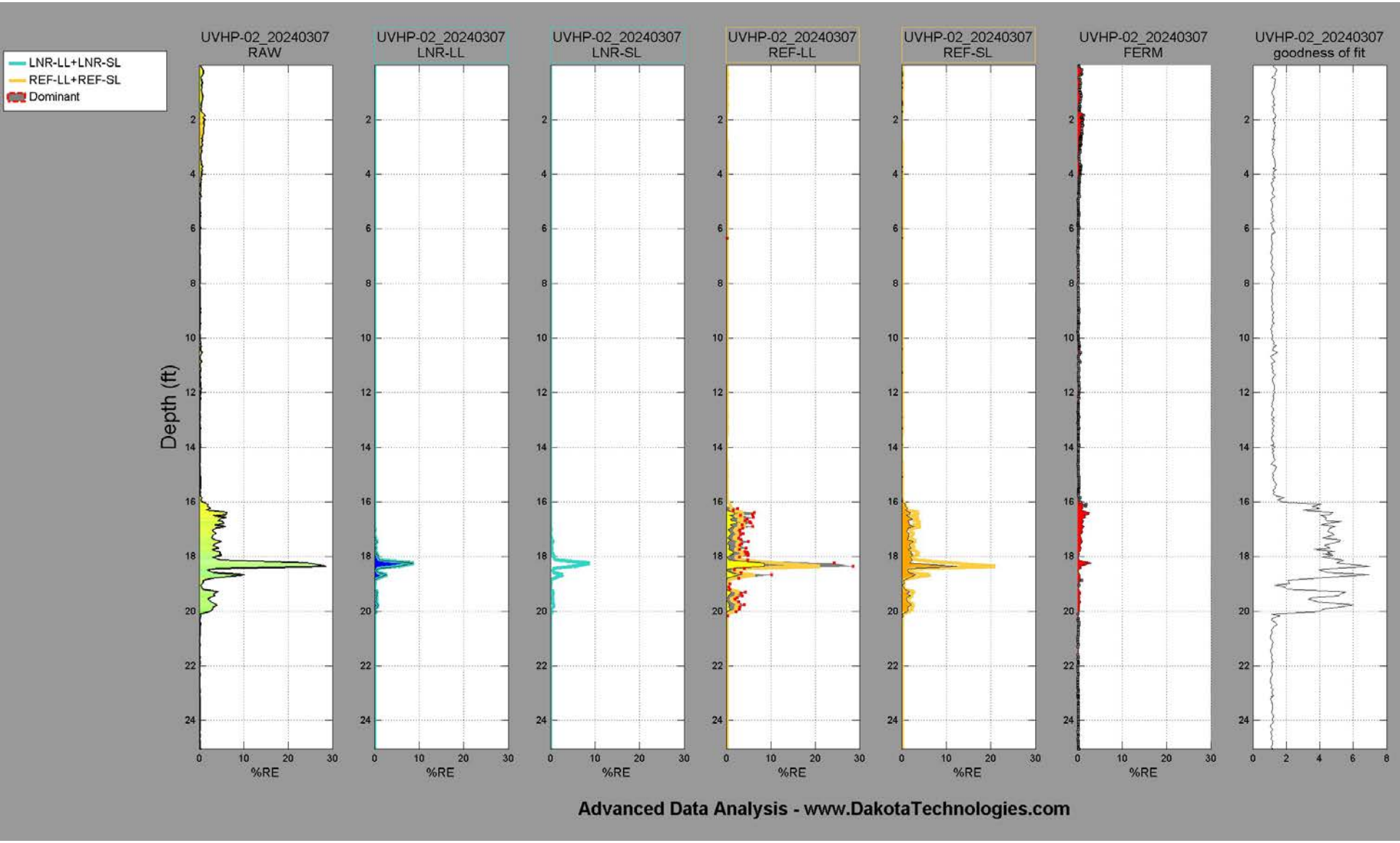


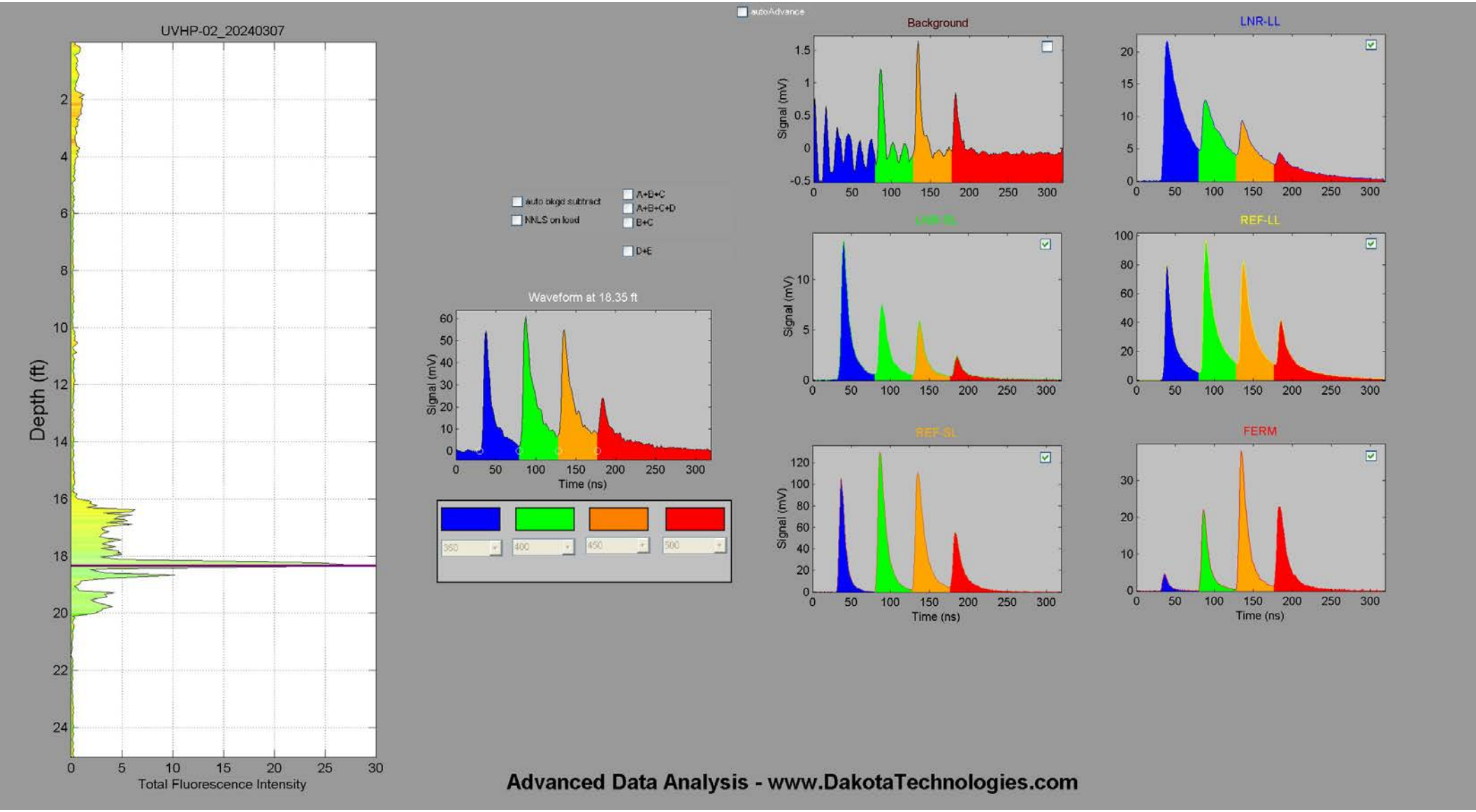
Appendix D

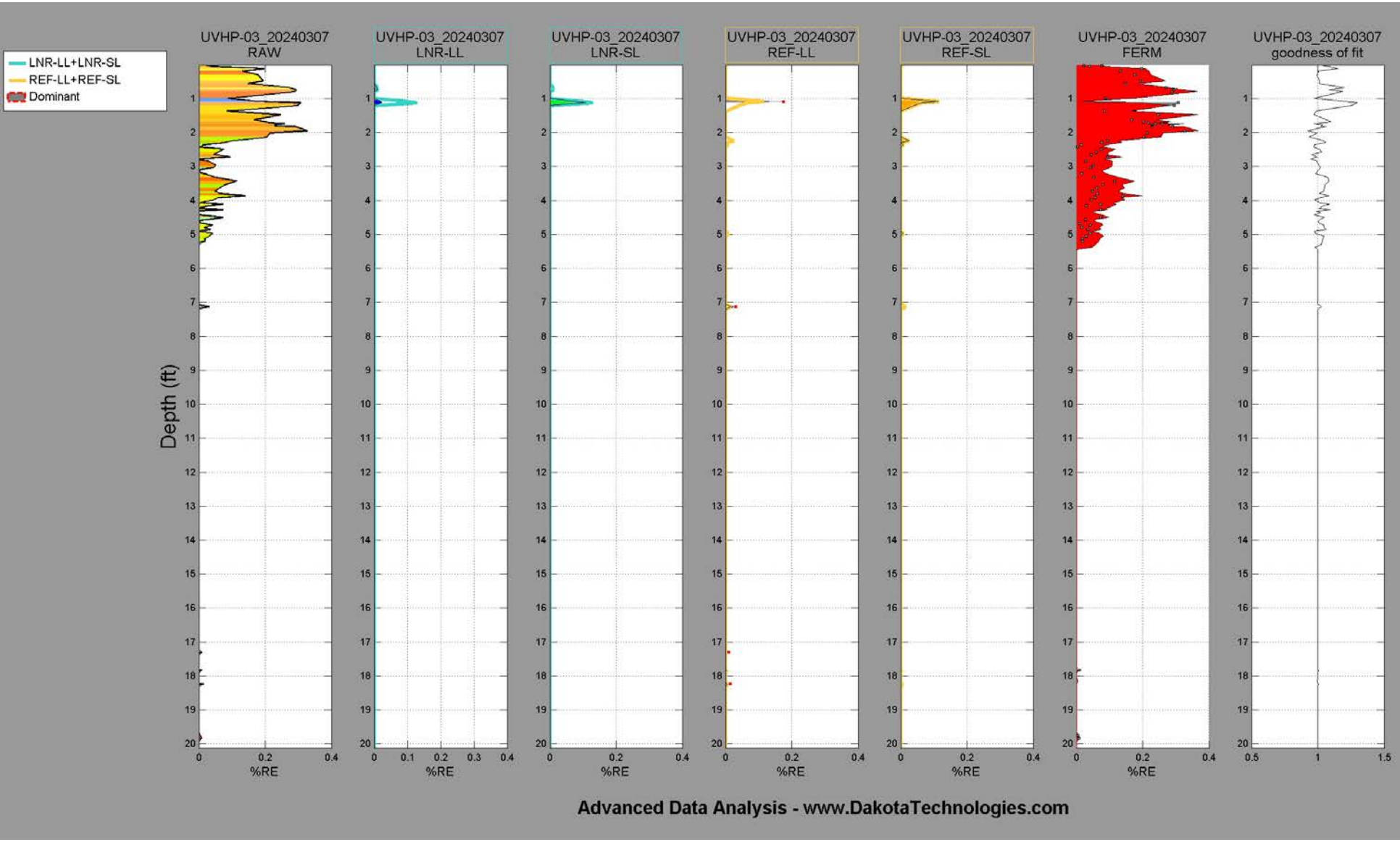
NNLS Output

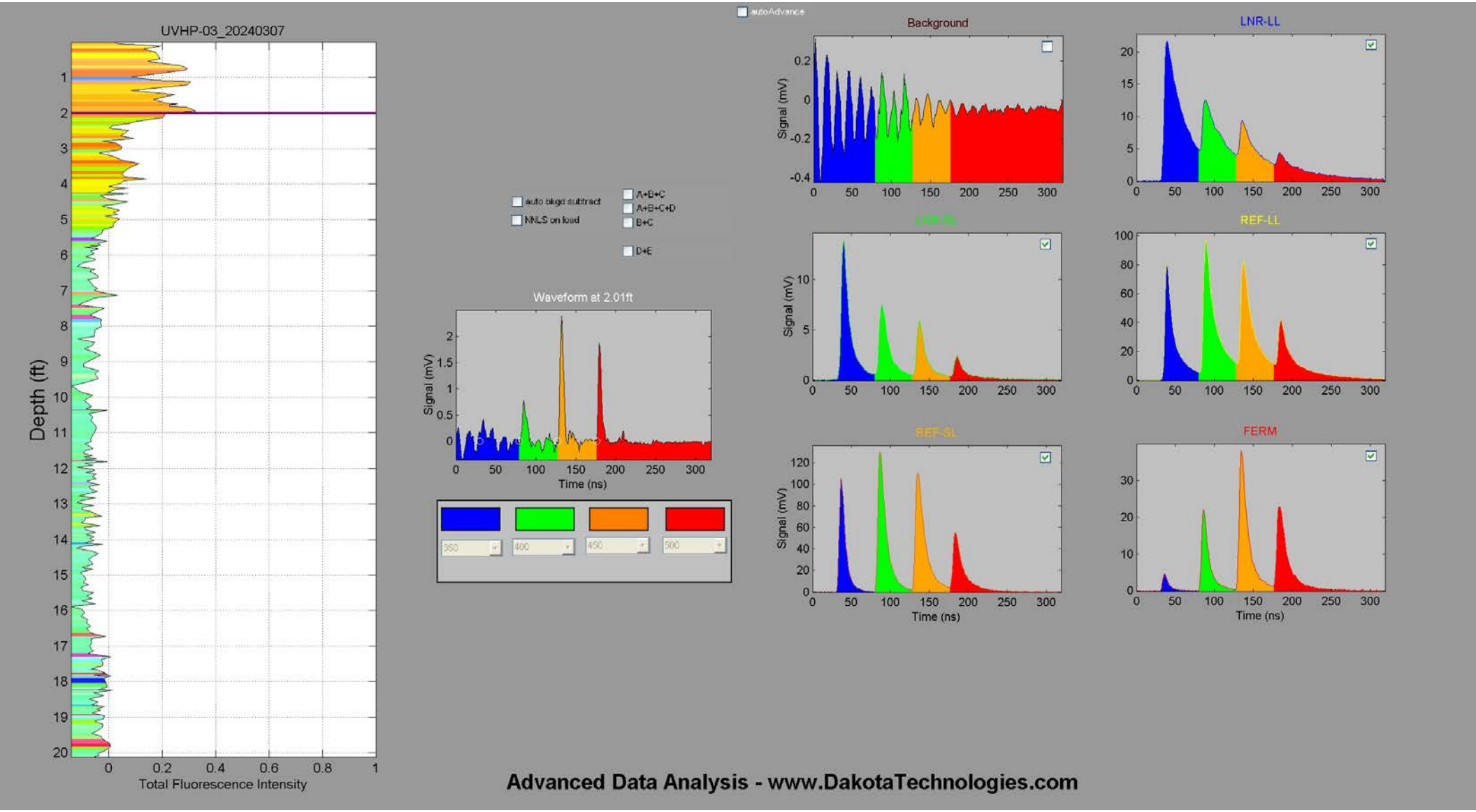

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-01_20240307
RAW
UVHP-01_20240307
LNR-LL
UVHP-01_20240307
LNR-SL
UVHP-01_20240307
REF-LL
UVHP-01_20240307
REF-SL
UVHP-01_20240307
FERM
UVHP-01_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

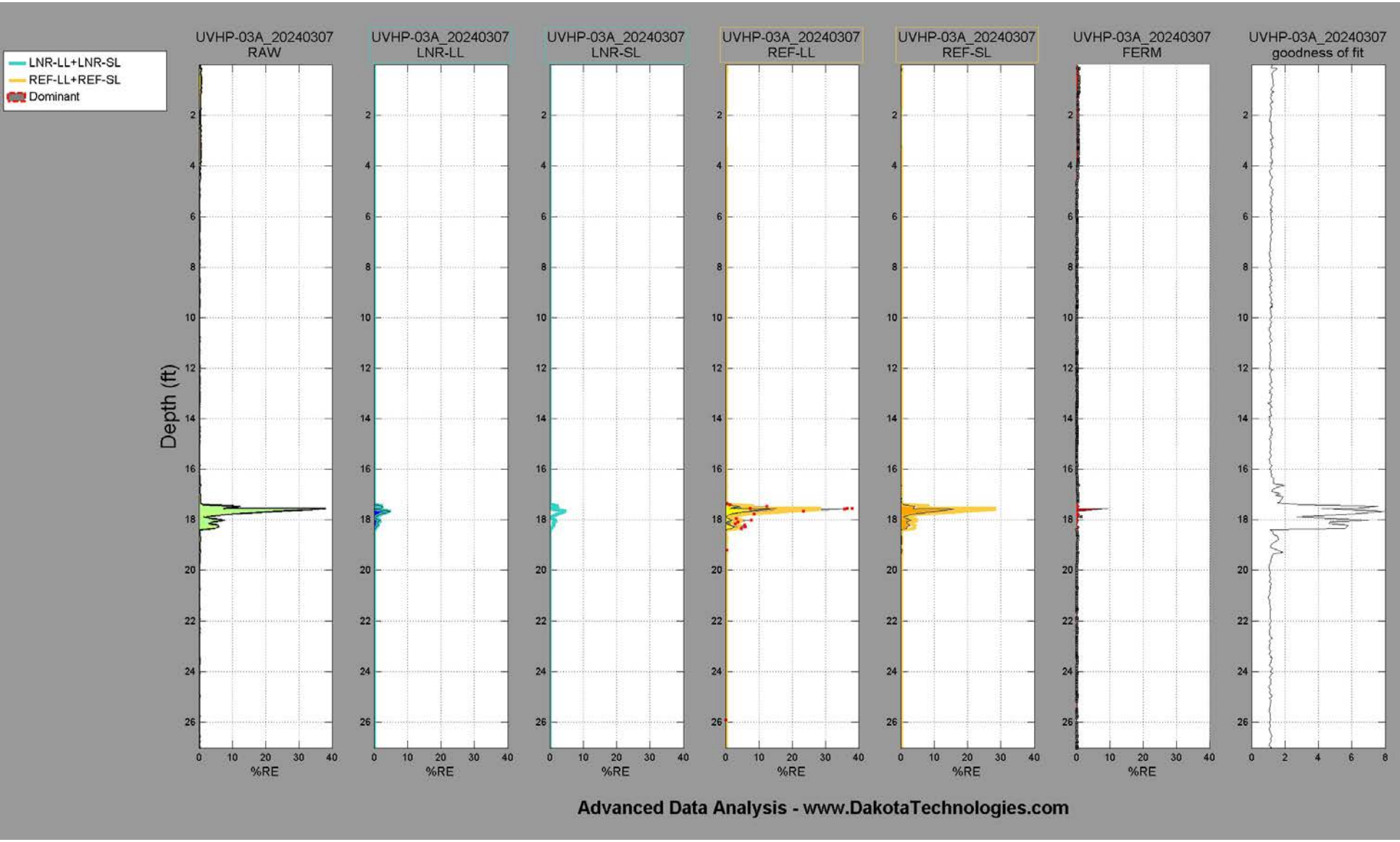

UVHP-01_20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 17.19 ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

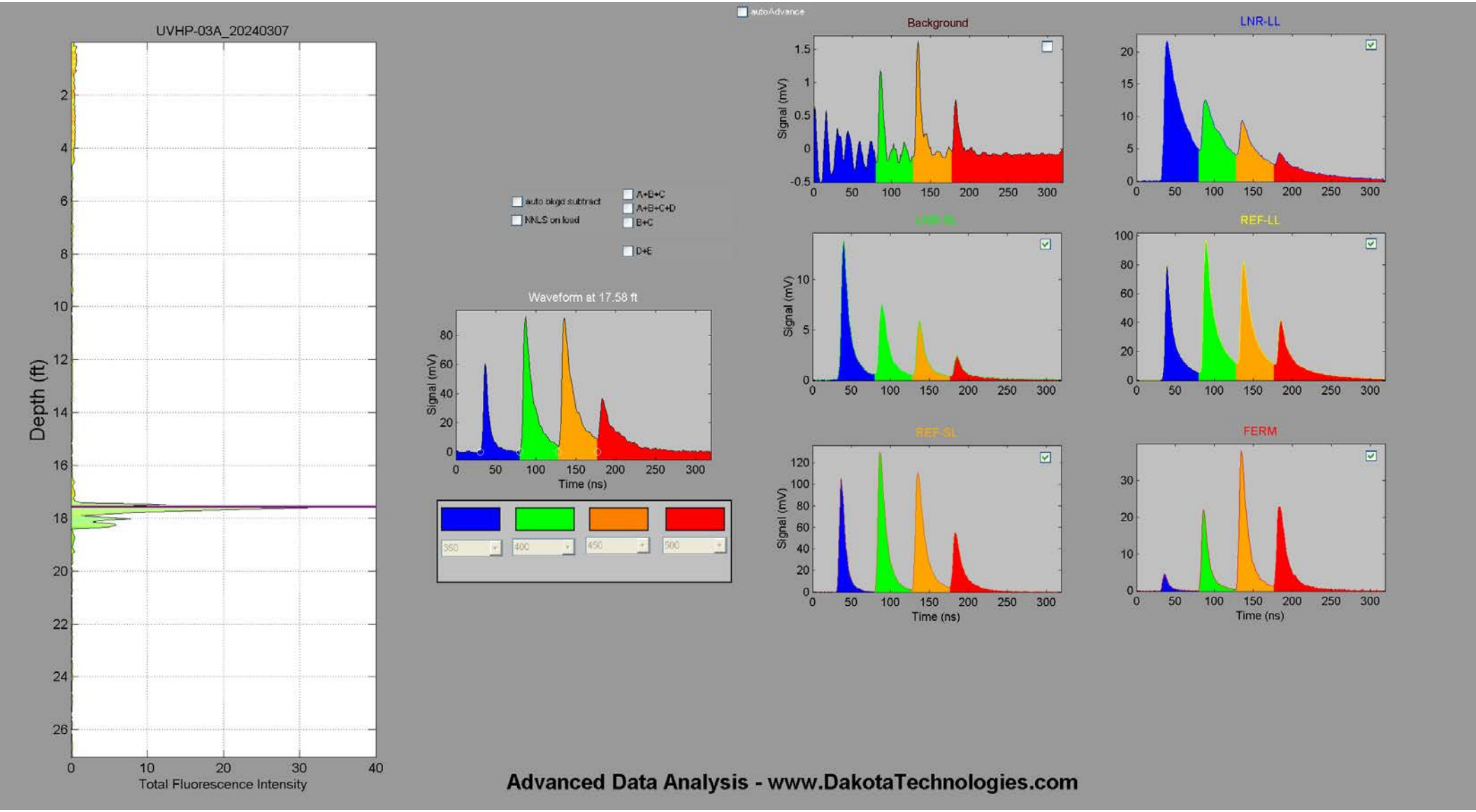

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-02_20240307
RAW
UVHP-02_20240307
LNR-LL
UVHP-02_20240307
LNR-SL
UVHP-02_20240307
REF-LL
UVHP-02_20240307
REF-SL
UVHP-02_20240307
FERM
UVHP-02_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com


UVHP-02_20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 18.35 ft
Signal (mV)
Time (ns)
360
400
450
500
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

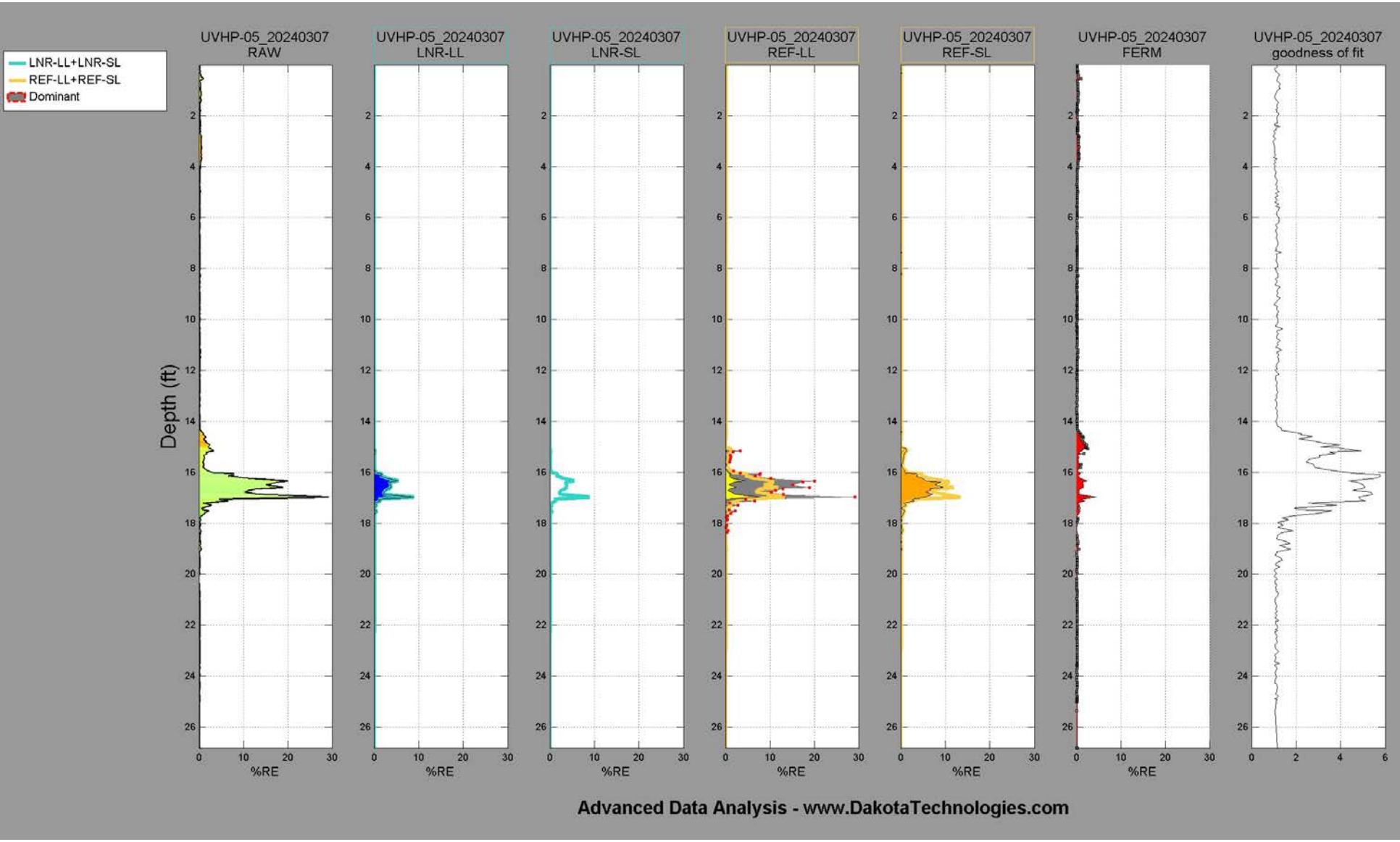

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-03_20240307
RAW
UVHP-03_20240307
LNR-LL
UVHP-03_20240307
LNR-SL
UVHP-03_20240307
REF-LL
UVHP-03_20240307
REF-SL
UVHP-03_20240307
FERM
UVHP-03_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

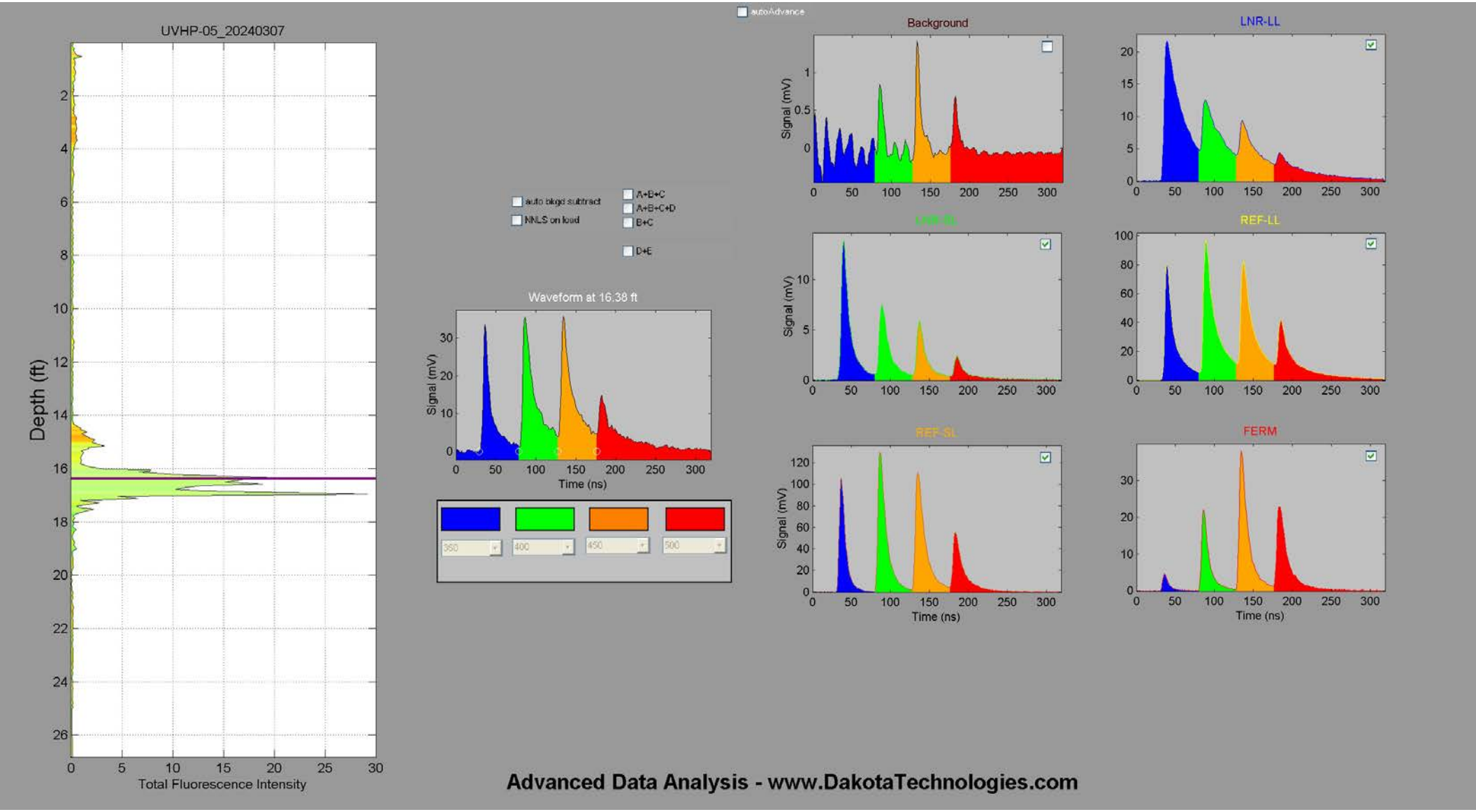

UVHP-03_20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 2.01ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com


LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-03A_20240307
RAW
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

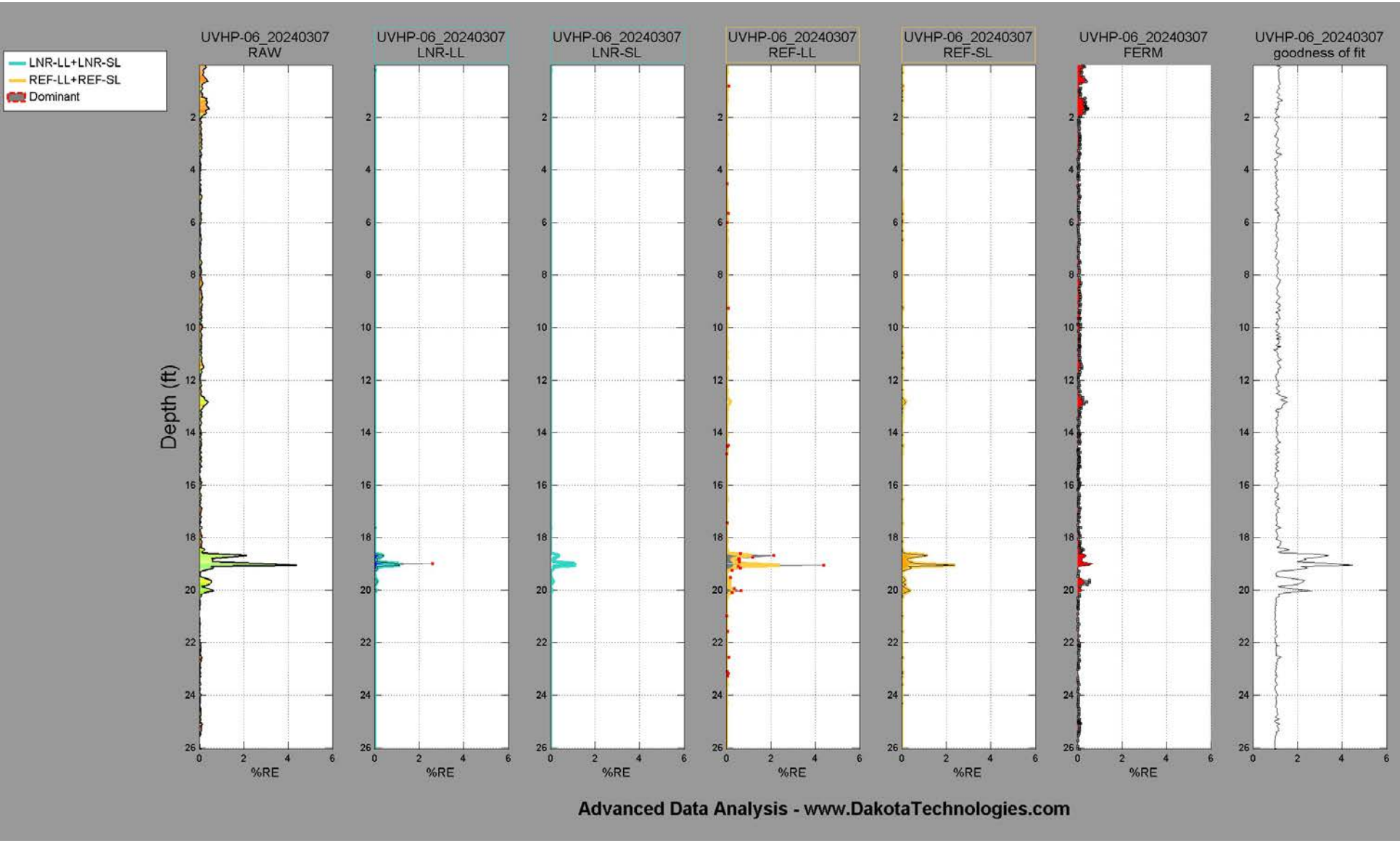


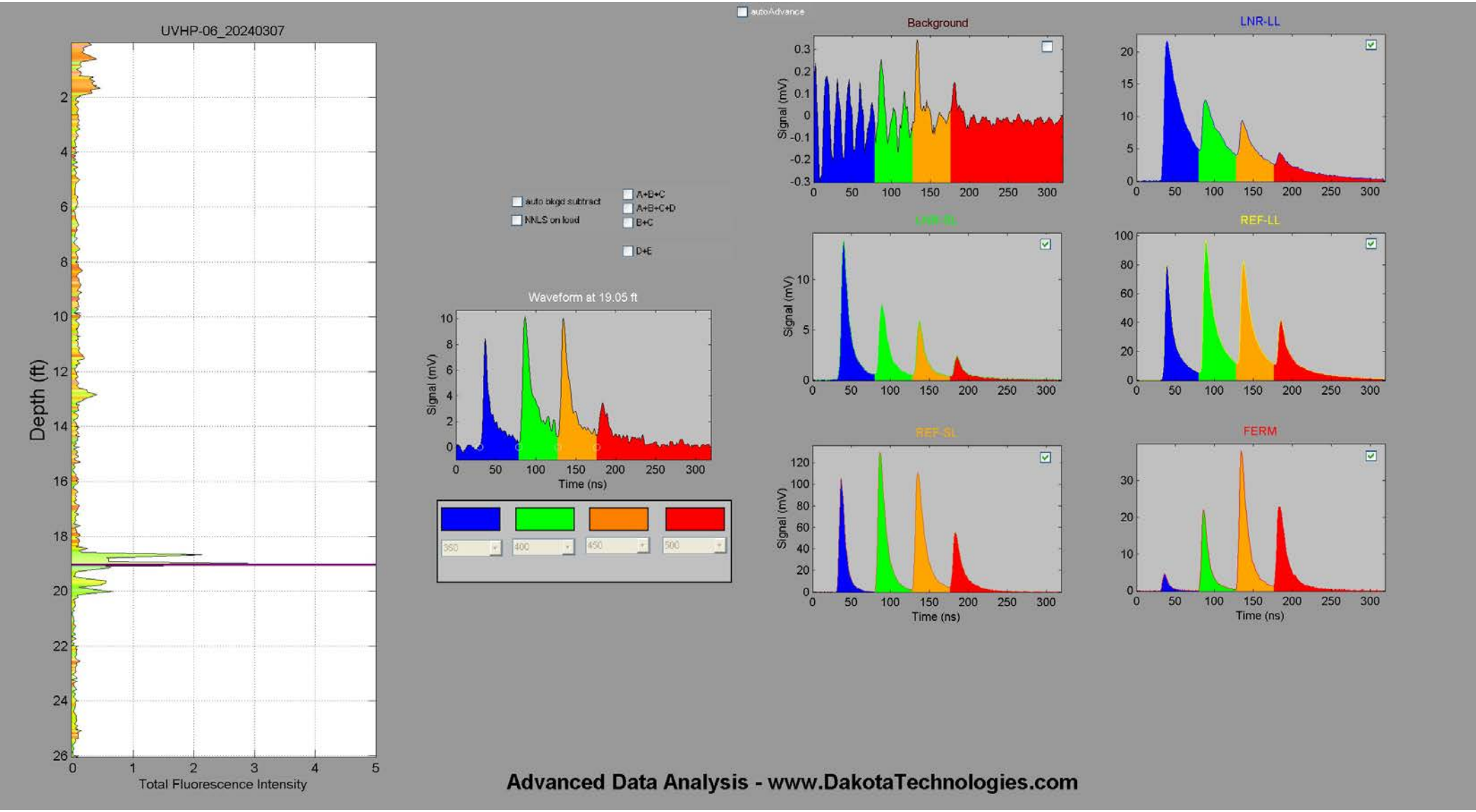
Advanced Data Analysis - www.DakotaTechnologies.com

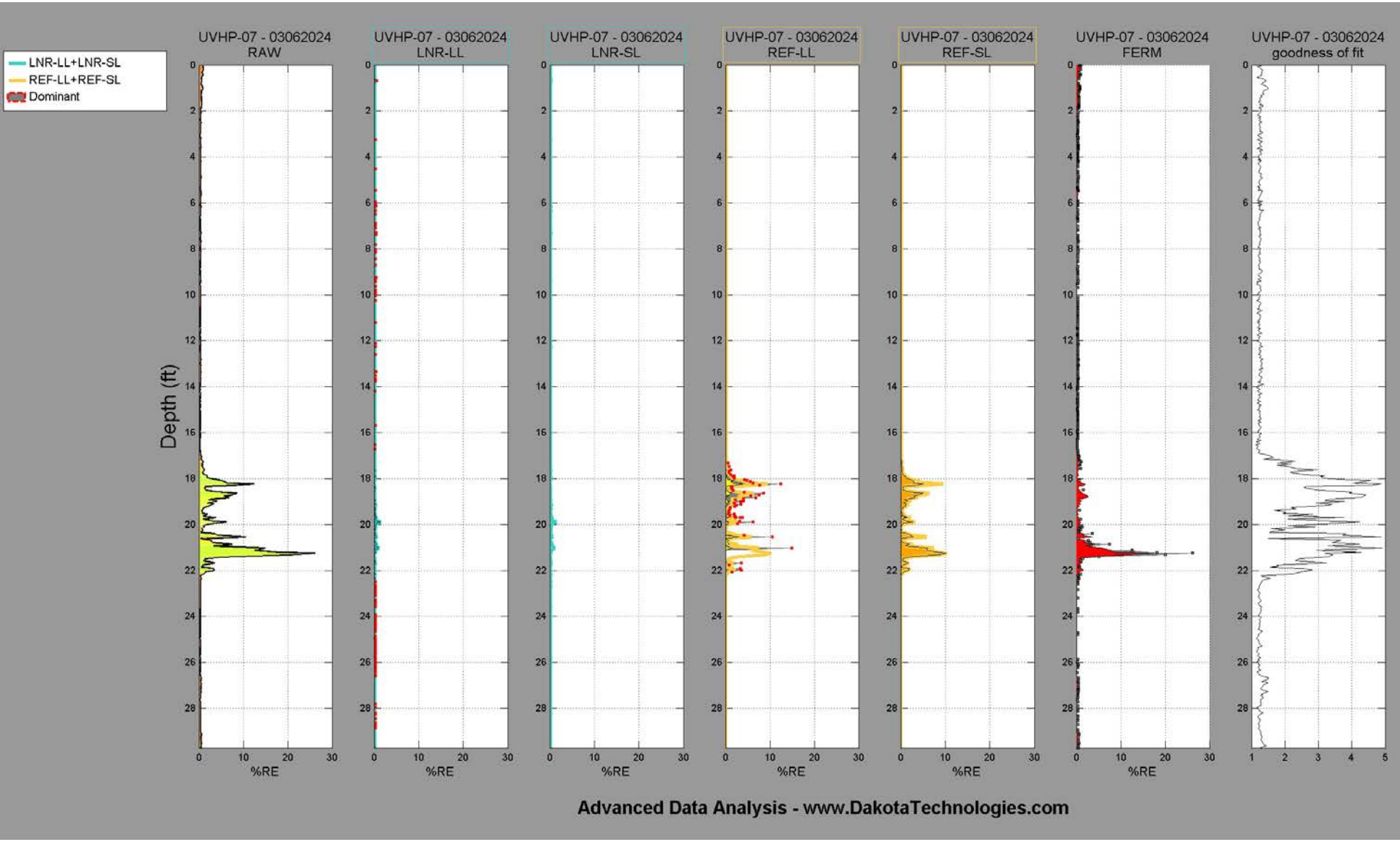

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-05_20240307
RAW
UVHP-05_20240307
LNR-LL
UVHP-05_20240307
LNR-SL
UVHP-05_20240307
REF-LL
UVHP-05_20240307
REF-SL
UVHP-05_20240307
FERM
UVHP-05_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

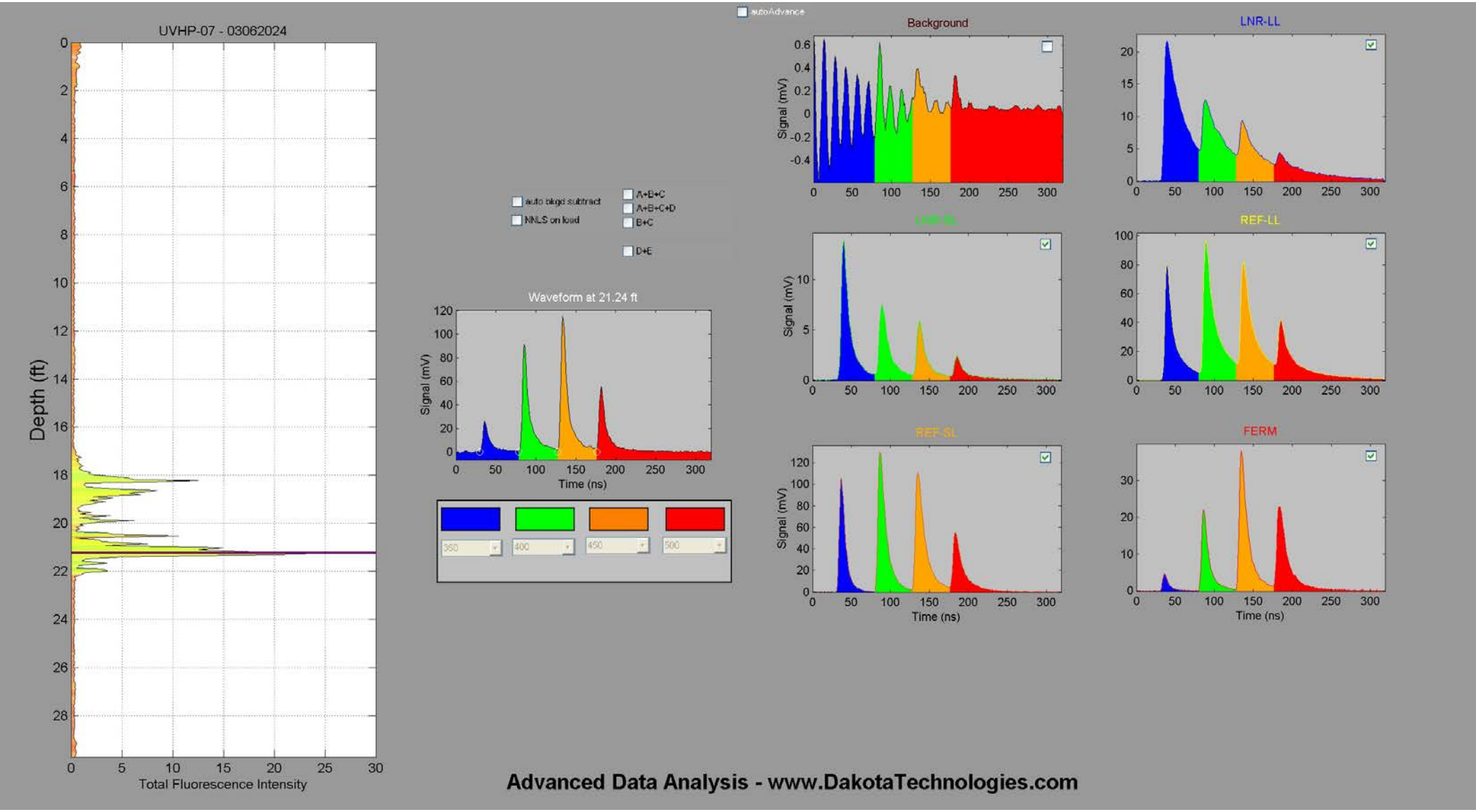


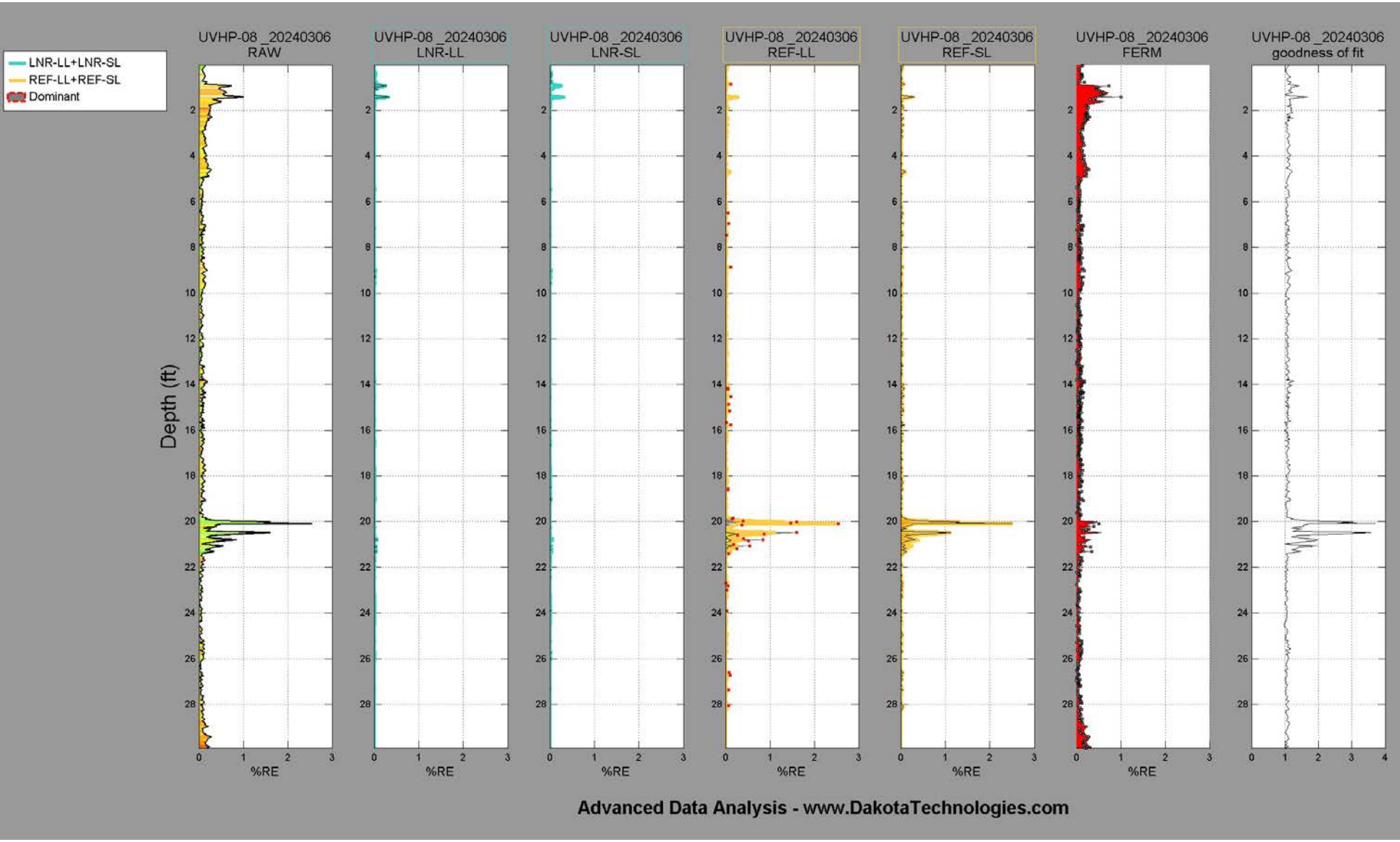
Advanced Data Analysis - www.DakotaTechnologies.com

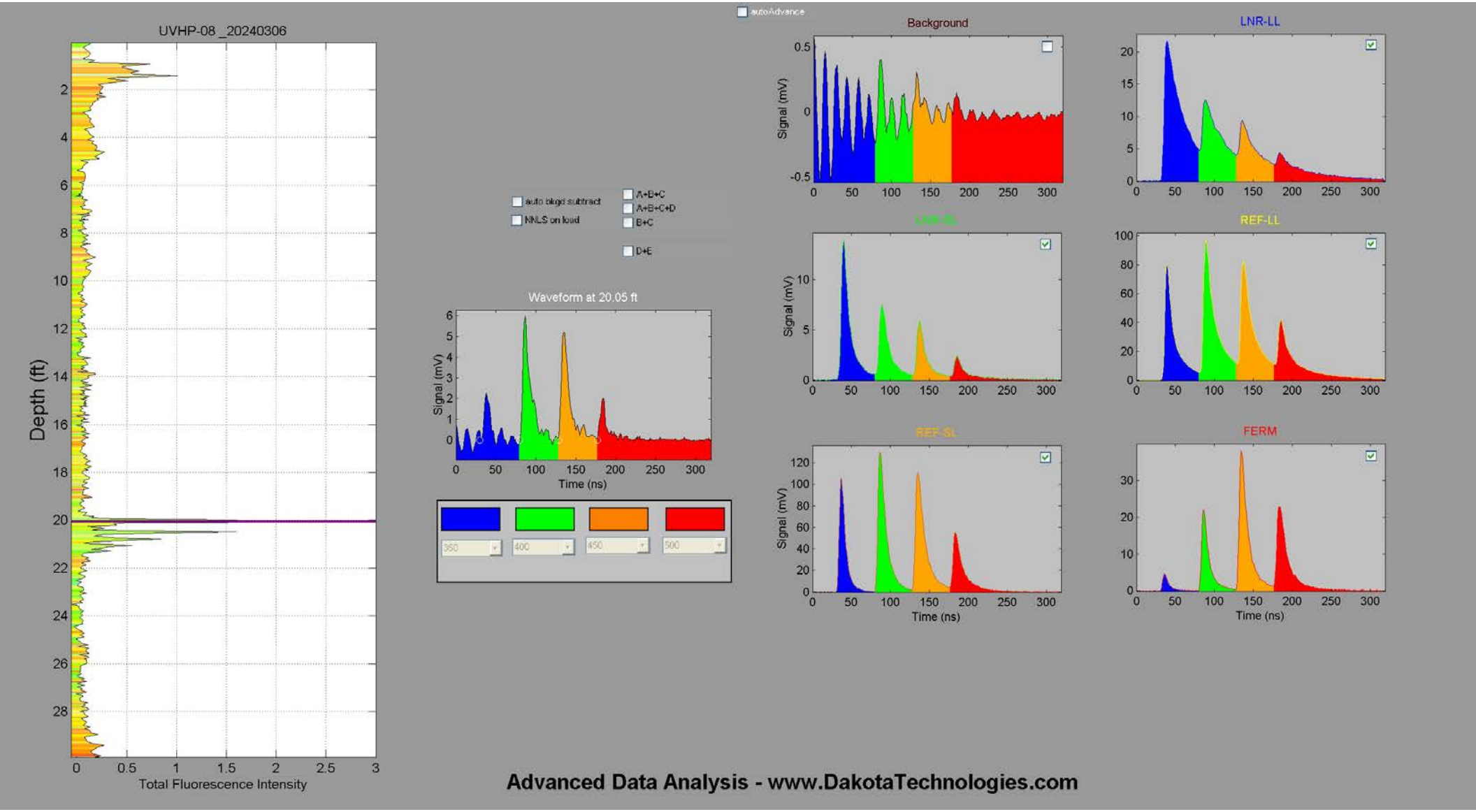

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-06_20240307
RAW
UVHP-06_20240307
LNR-LL
UVHP-06_20240307
LNR-SL
UVHP-06_20240307
REF-LL
UVHP-06_20240307
REF-SL
UVHP-06_20240307
FERM
UVHP-06_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

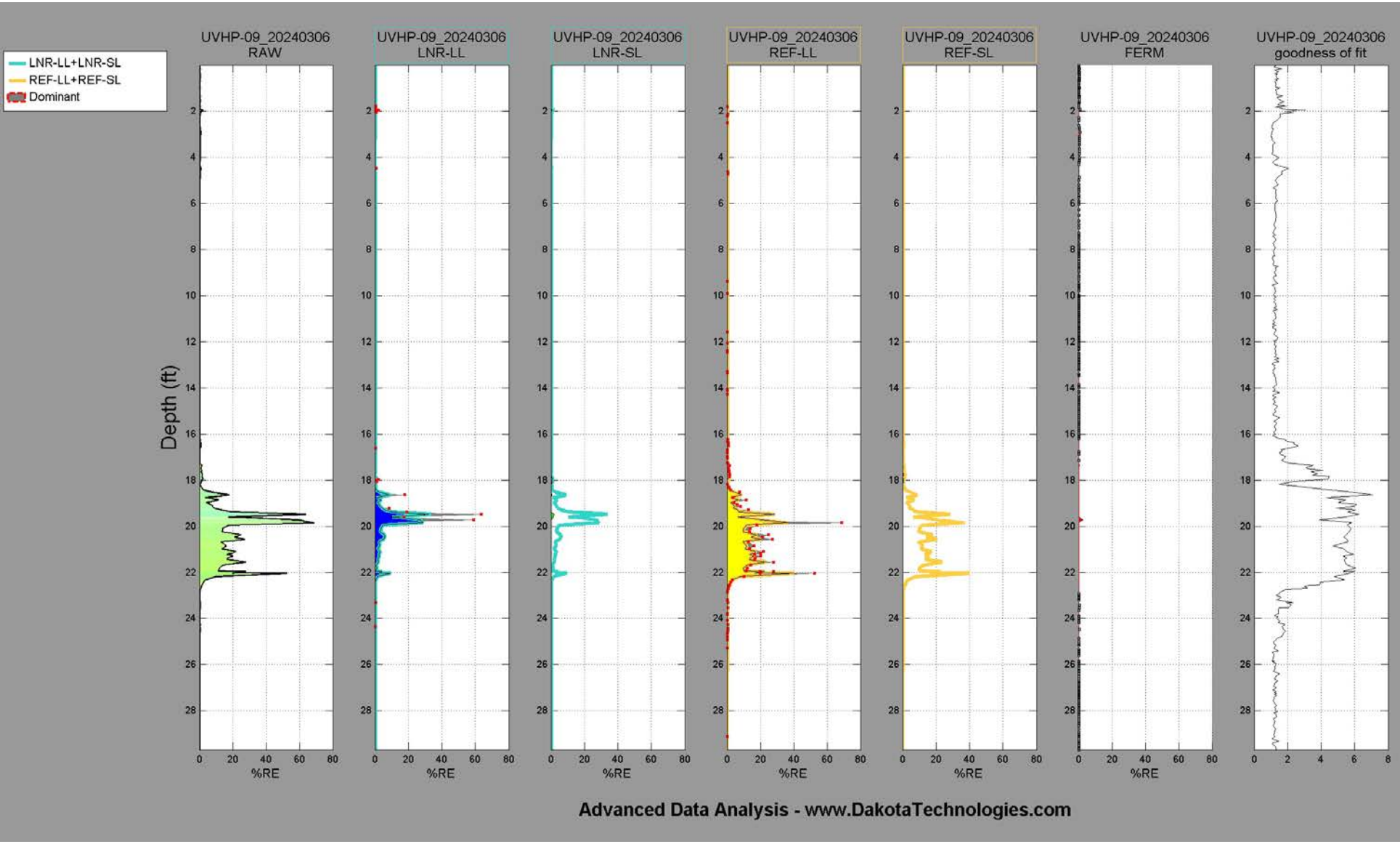

UVHP-06_20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 19.05 ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

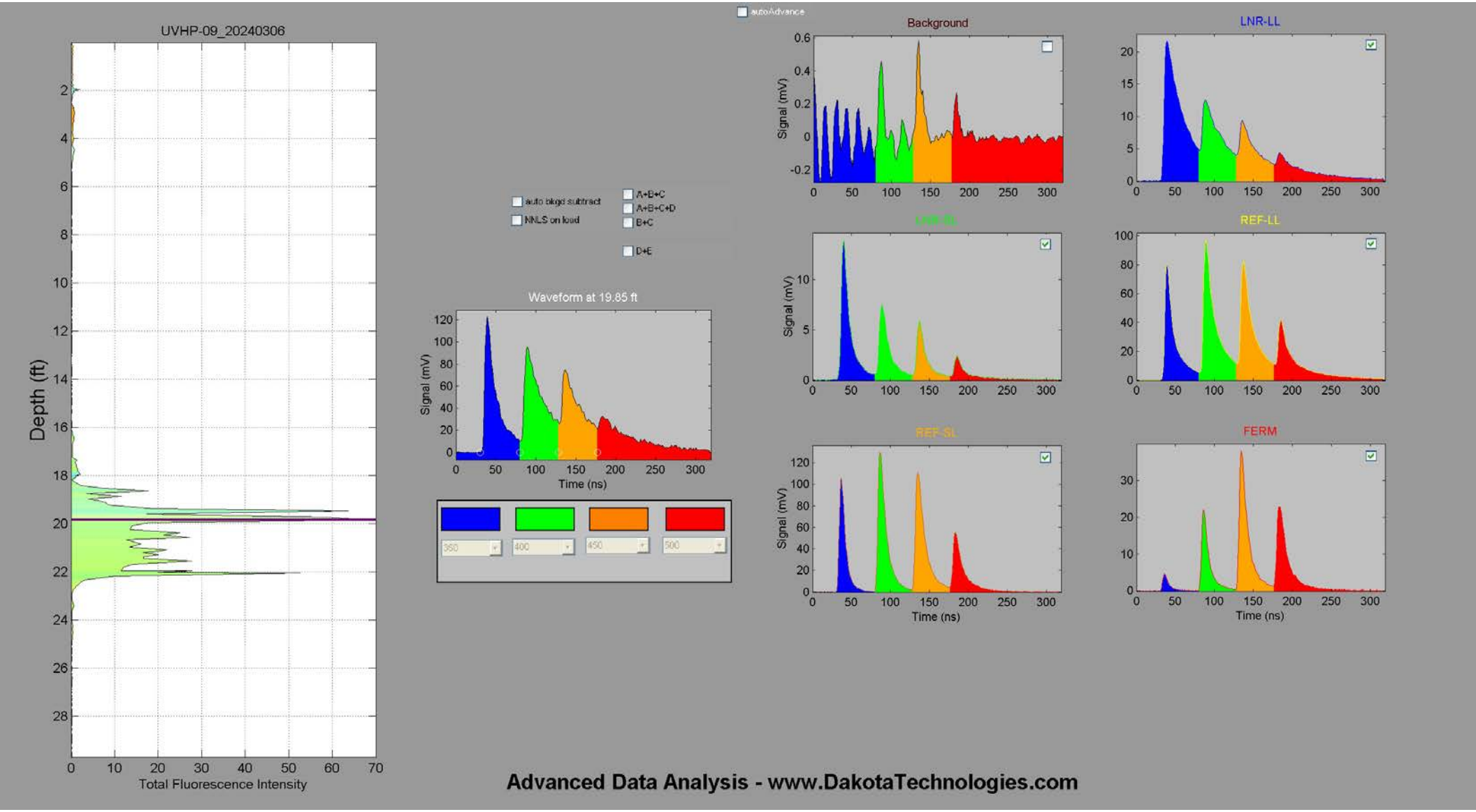

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-07 - 03062024
RAW
UVHP-07 - 03062024
LNR-LL
UVHP-07 - 03062024
LNR-SL
UVHP-07 - 03062024
REF-LL
UVHP-07 - 03062024
REF-SL
UVHP-07 - 03062024
FERM
UVHP-07 - 03062024
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

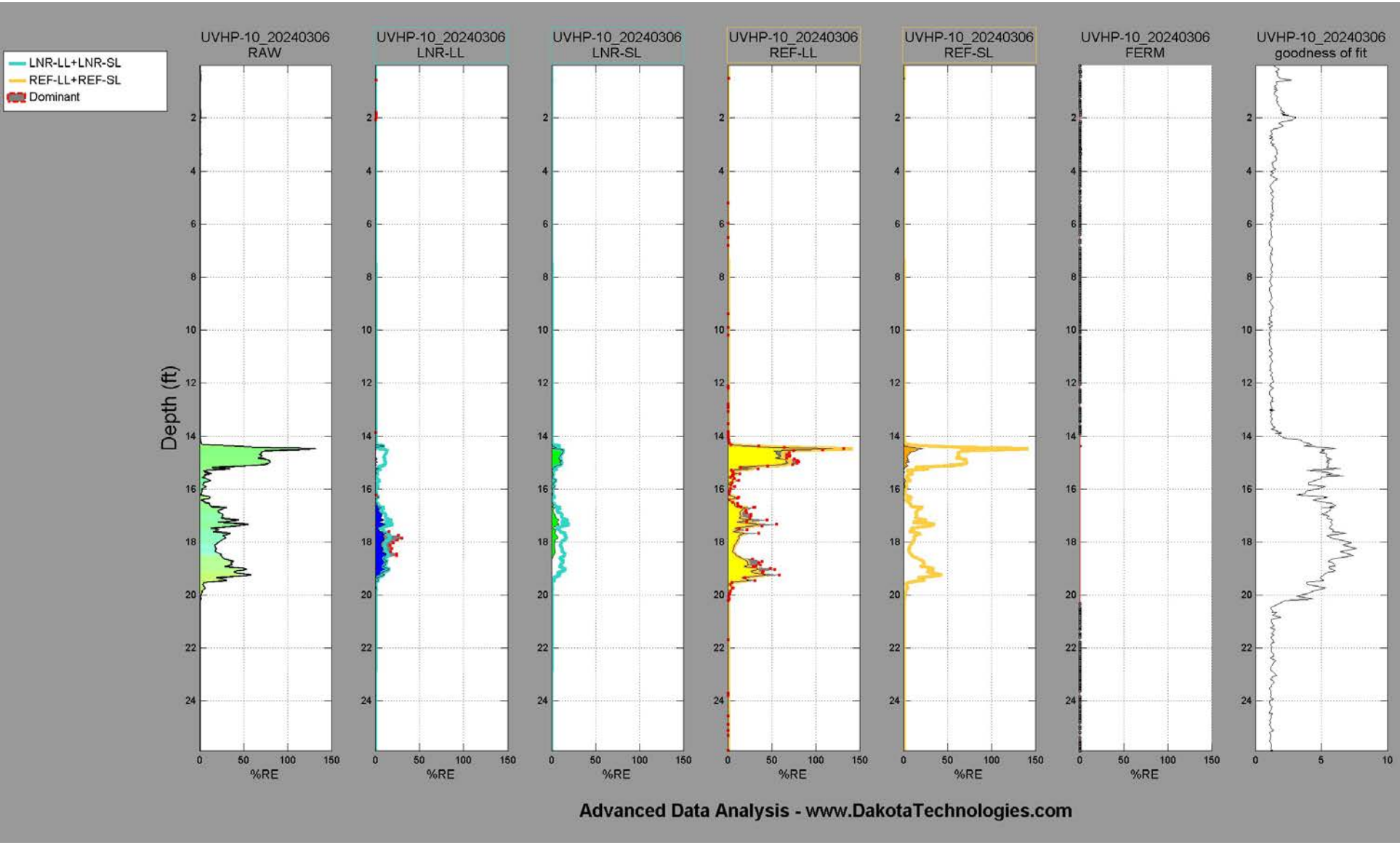

UVHP-07 - 03062024
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 21.24 ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

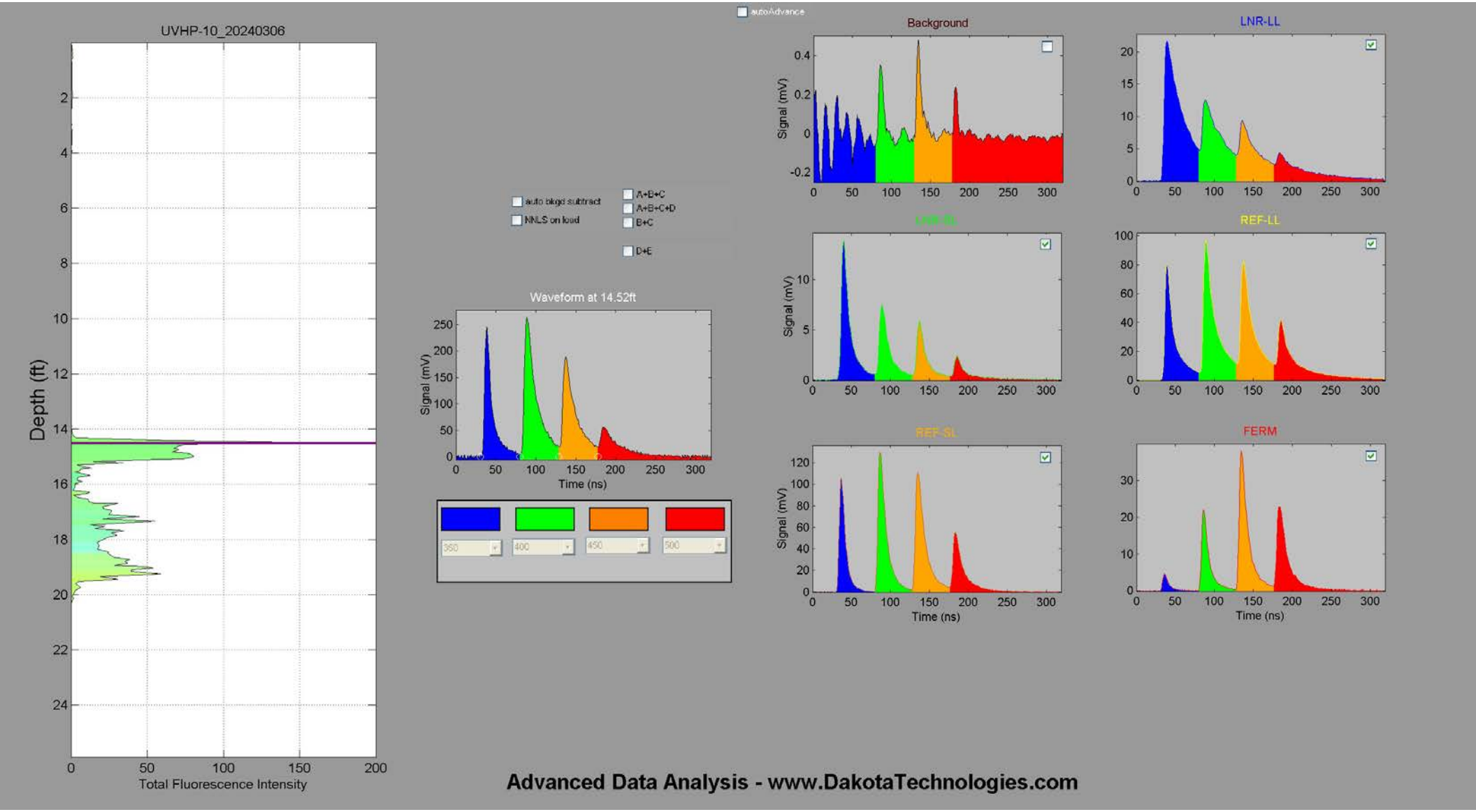

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-08 _20240306
RAW
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com


UVHP-08 _20240306
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 20.05 ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

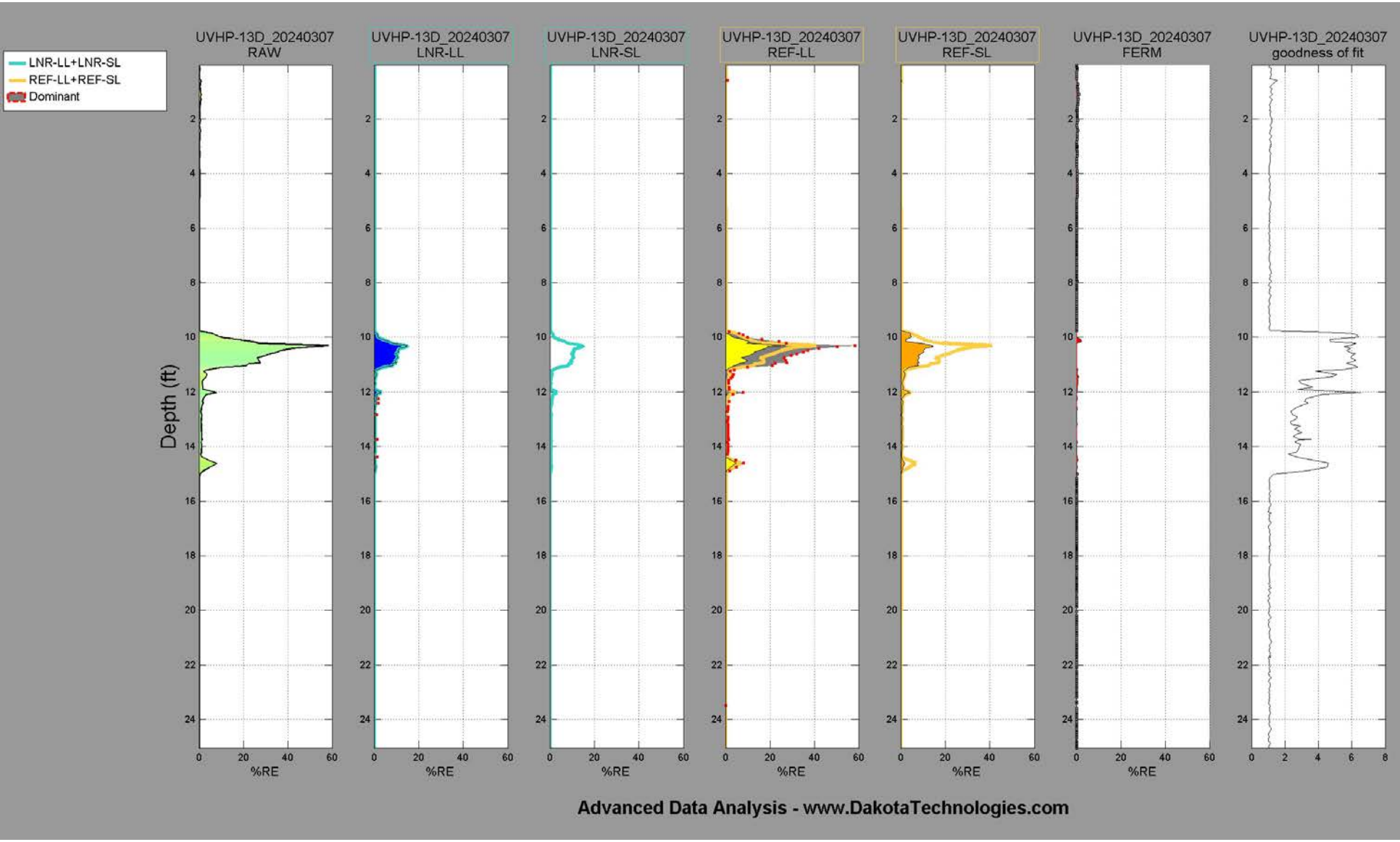

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-09_20240306
RAW
UVHP-09_20240306
LNR-LL
UVHP-09_20240306
LNR-SL
UVHP-09_20240306
REF-LL
UVHP-09_20240306
REF-SL
UVHP-09_20240306
FERM
UVHP-09_20240306
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

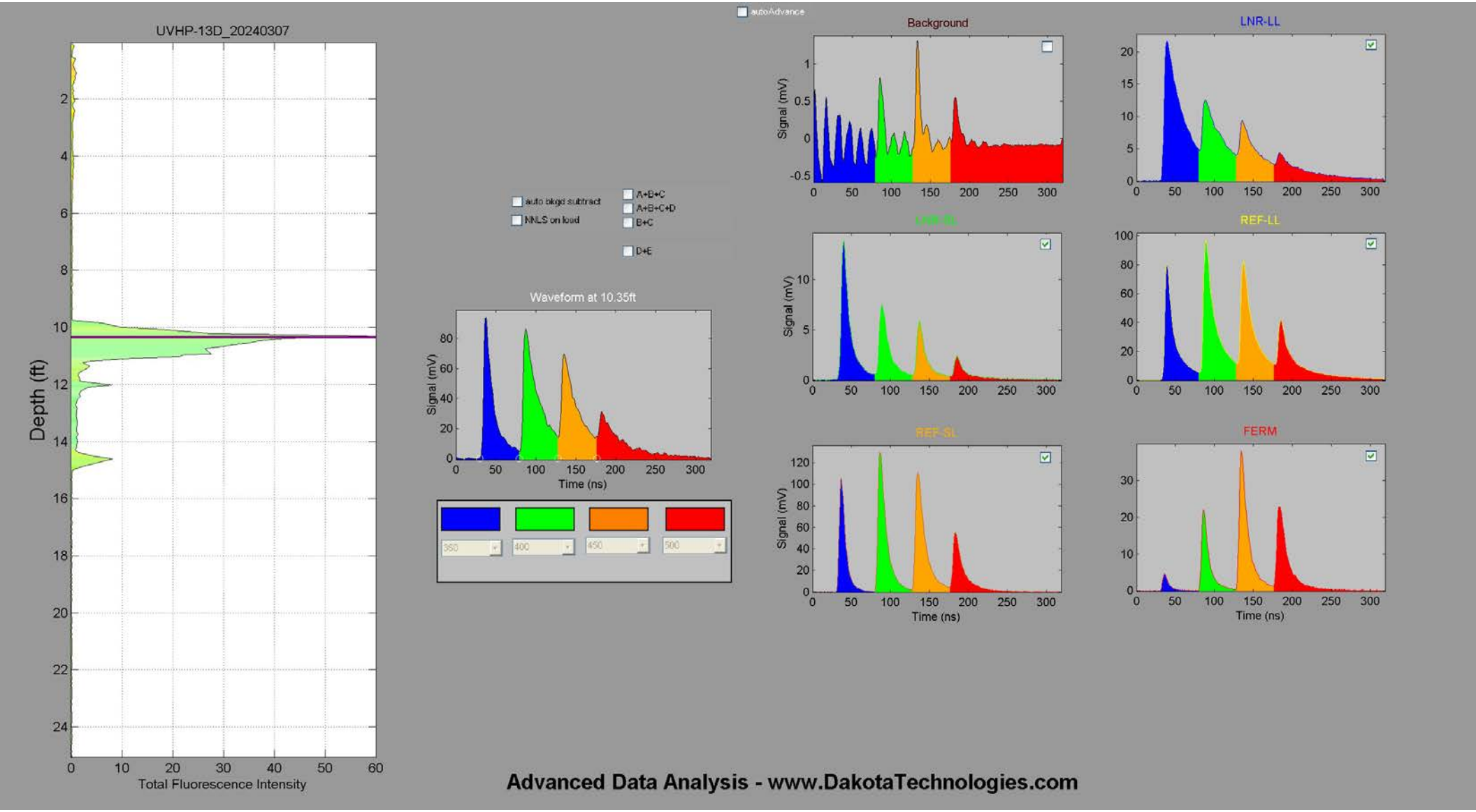

UVHP-09_20240306
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 19.85 ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

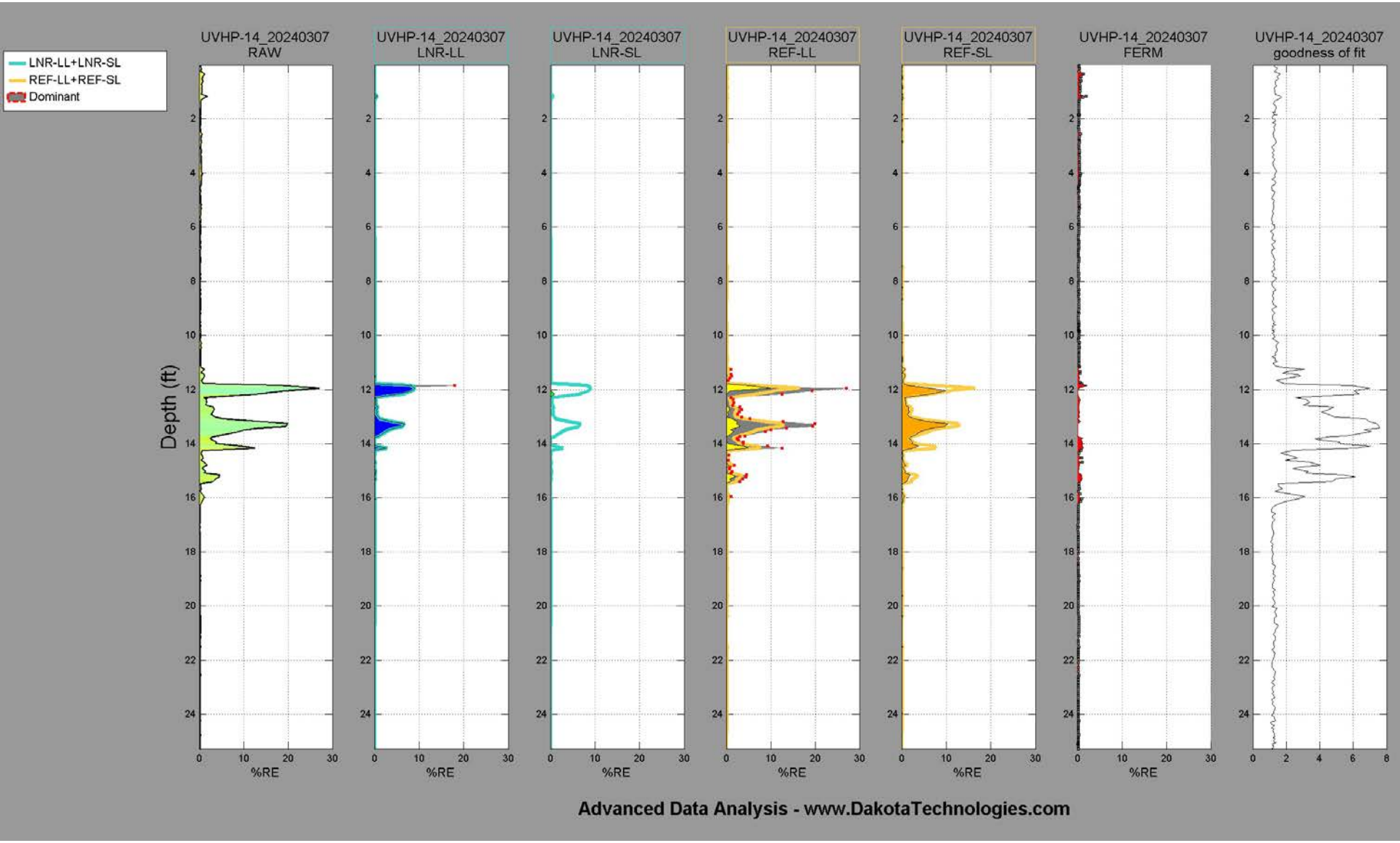

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-10_20240306
RAW
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

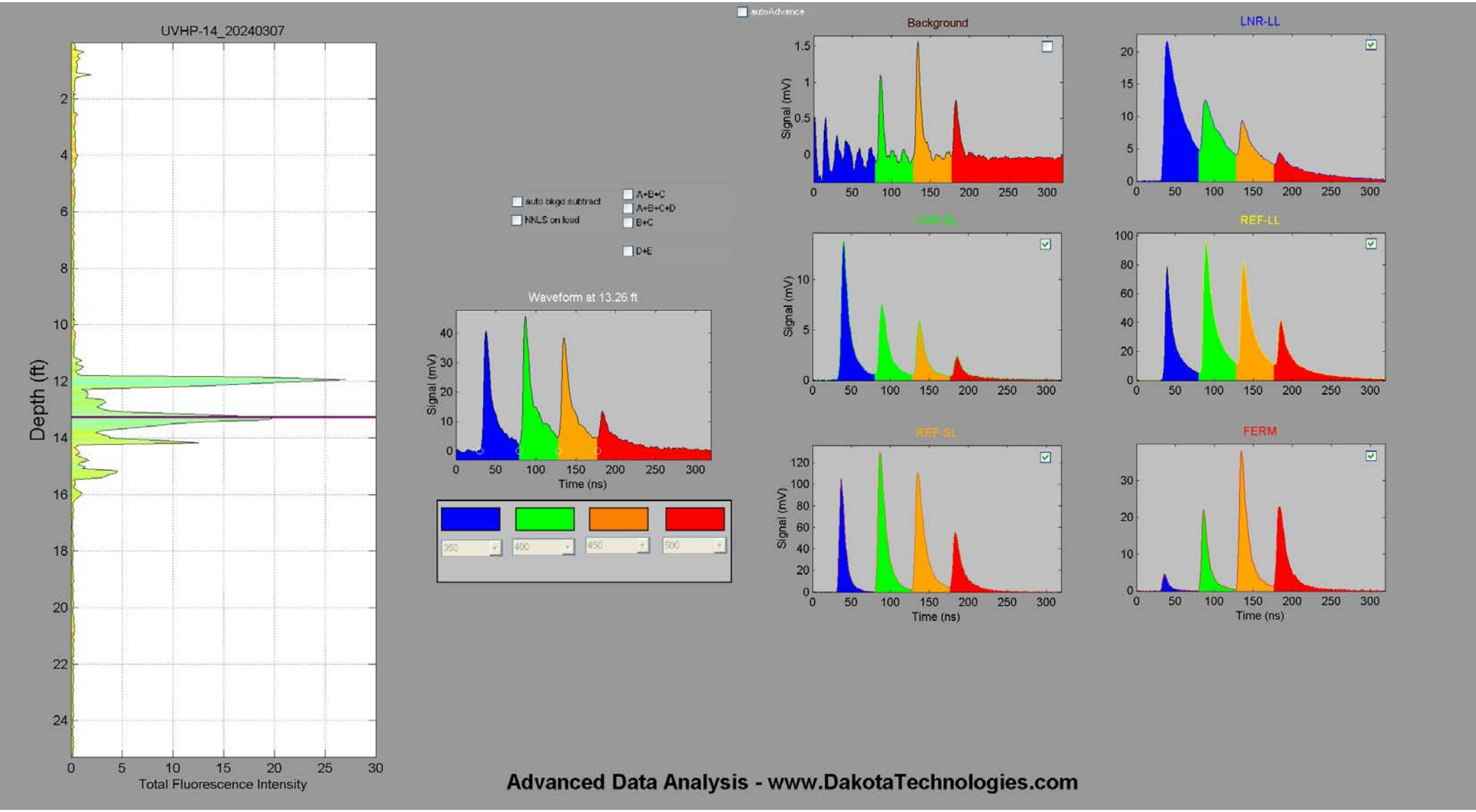


Advanced Data Analysis - www.DakotaTechnologies.com

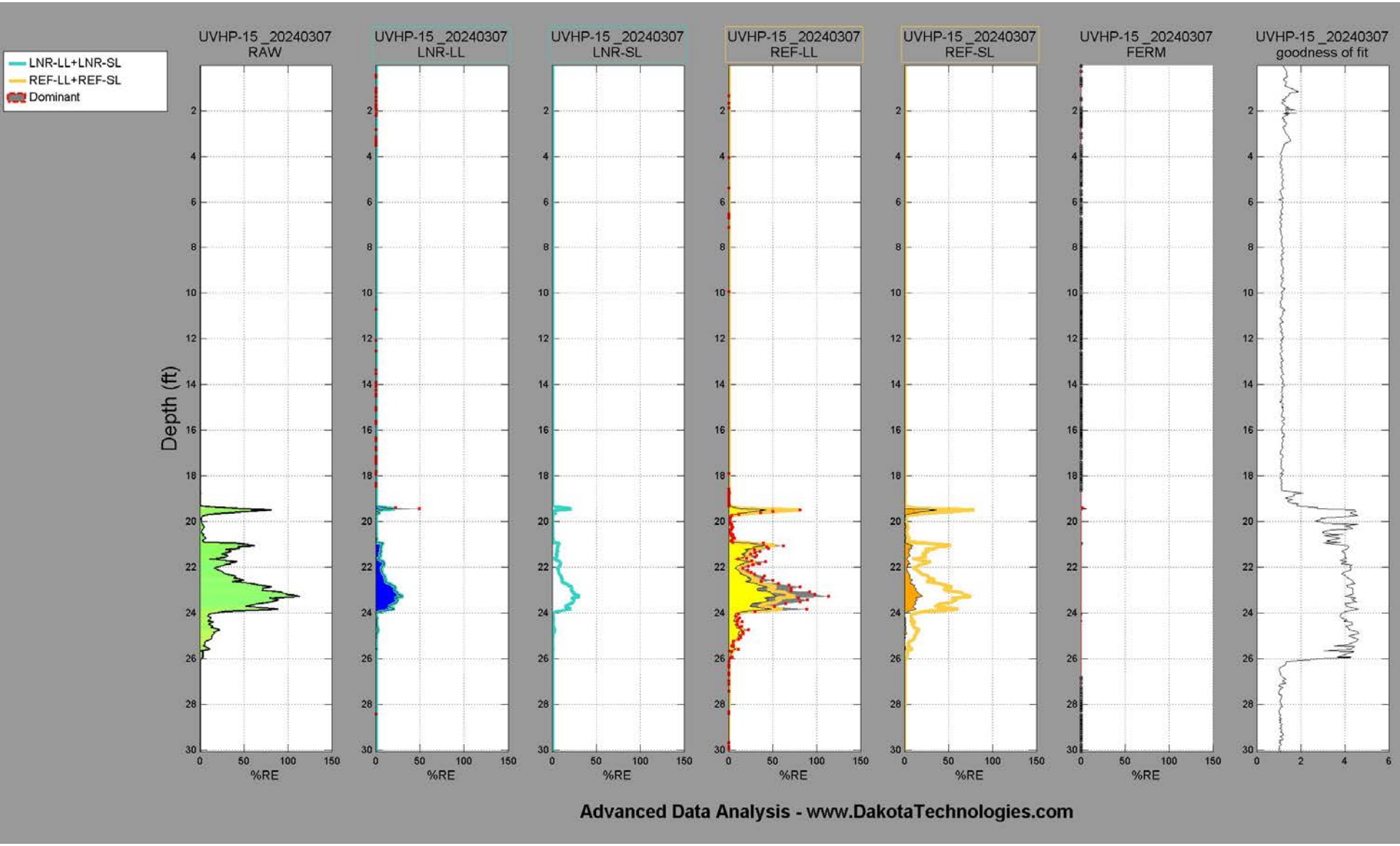

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-13D_20240307
RAW
UVHP-13D_20240307
LNR-LL
UVHP-13D_20240307
LNR-SL
UVHP-13D_20240307
REF-LL
UVHP-13D_20240307
REF-SL
UVHP-13D_20240307
FERM
UVHP-13D_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

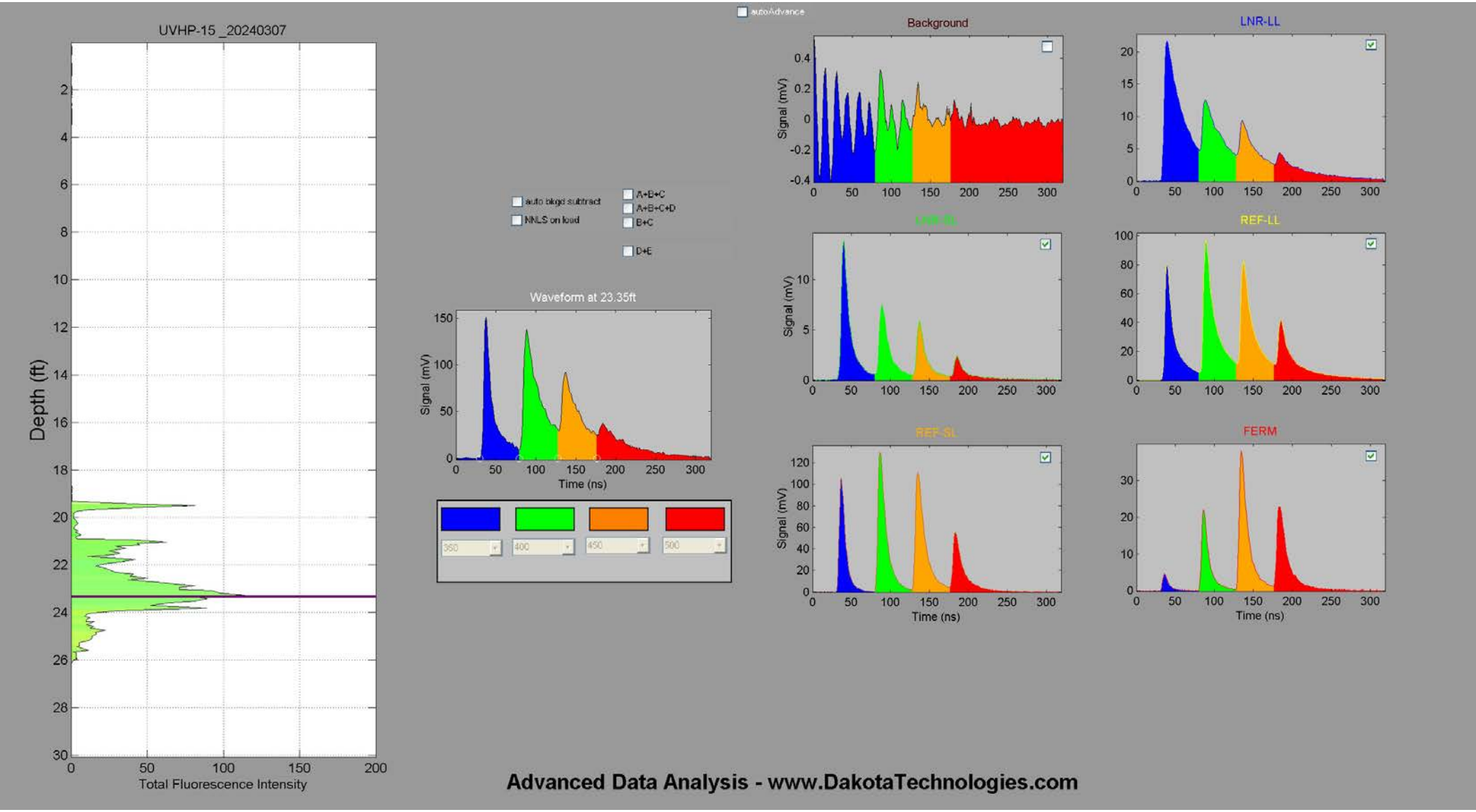

UVHP-13D_20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 10.35ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

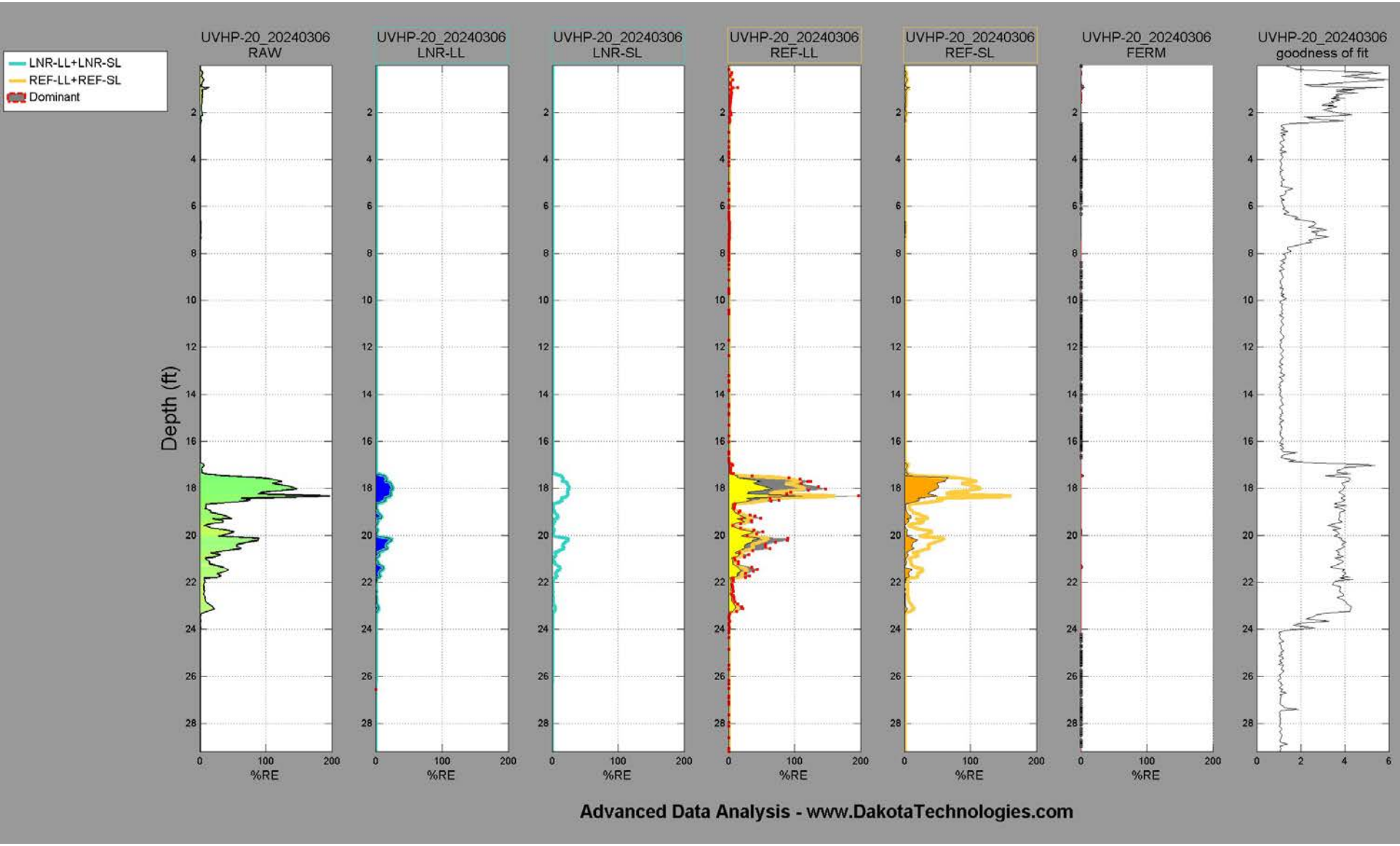

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-14_20240307
RAW
UVHP-14_20240307
LNR-LL
UVHP-14_20240307
LNR-SL
UVHP-14_20240307
REF-LL
UVHP-14_20240307
REF-SL
UVHP-14_20240307
FERM
UVHP-14_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

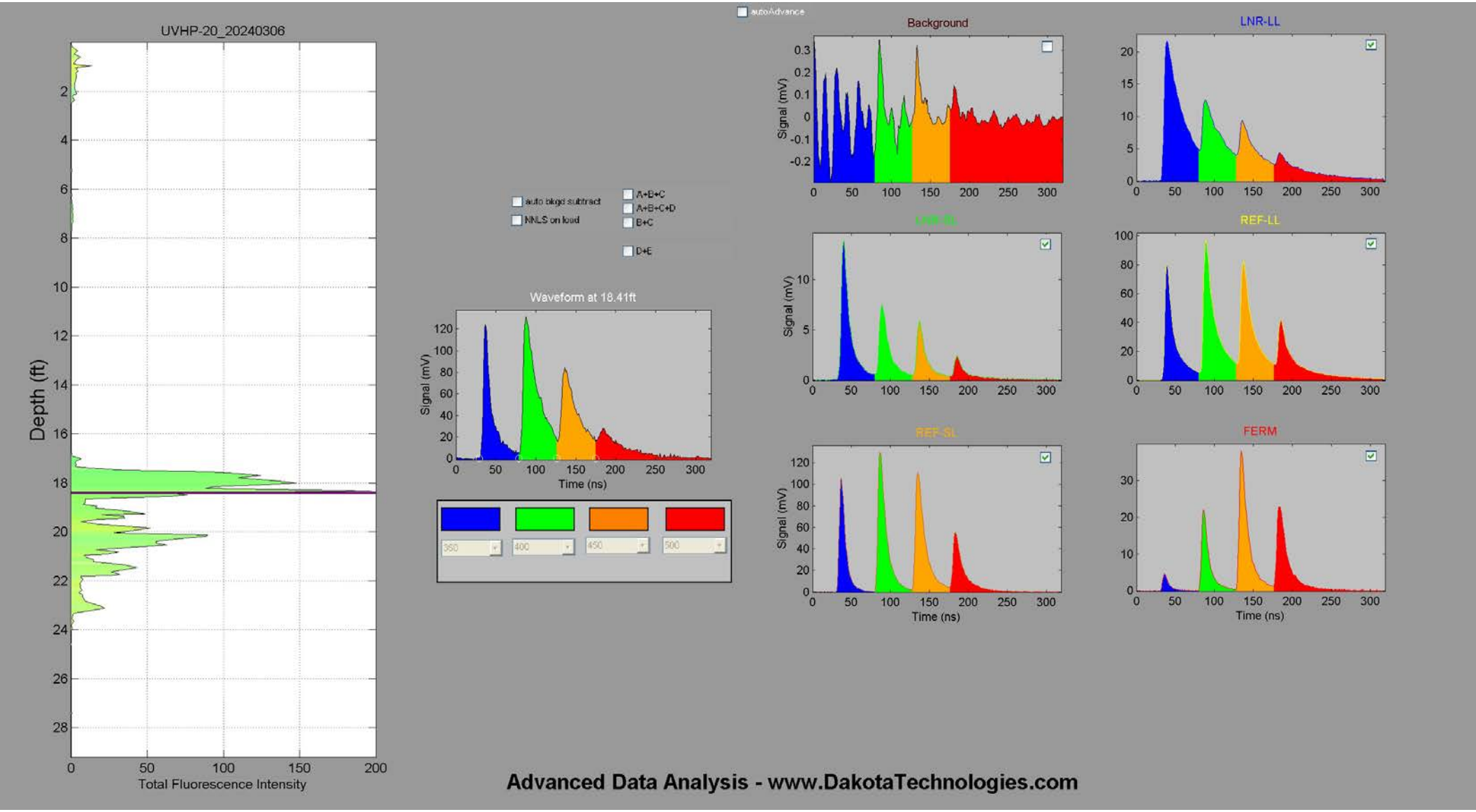


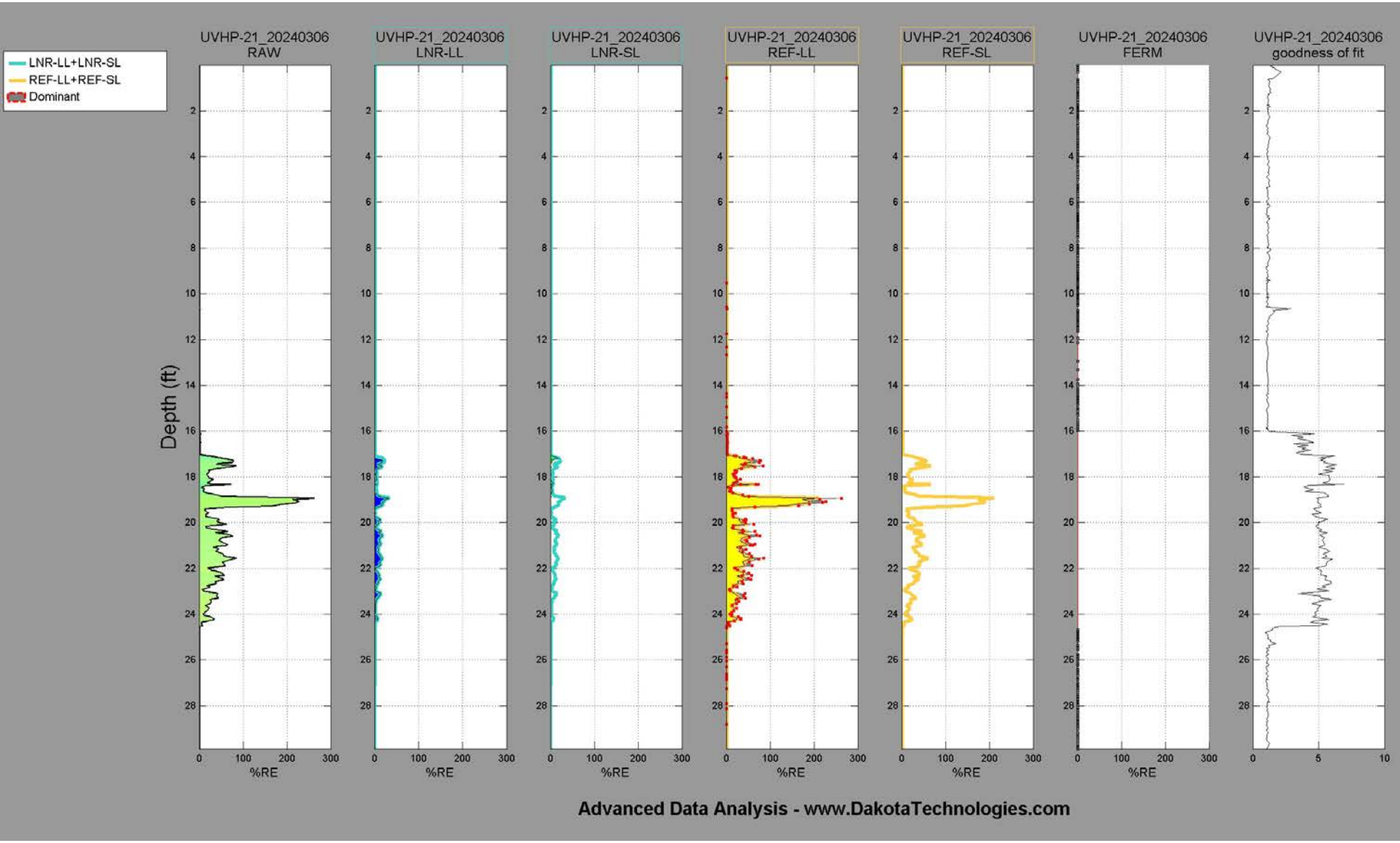
Advanced Data Analysis - www.DakotaTechnologies.com

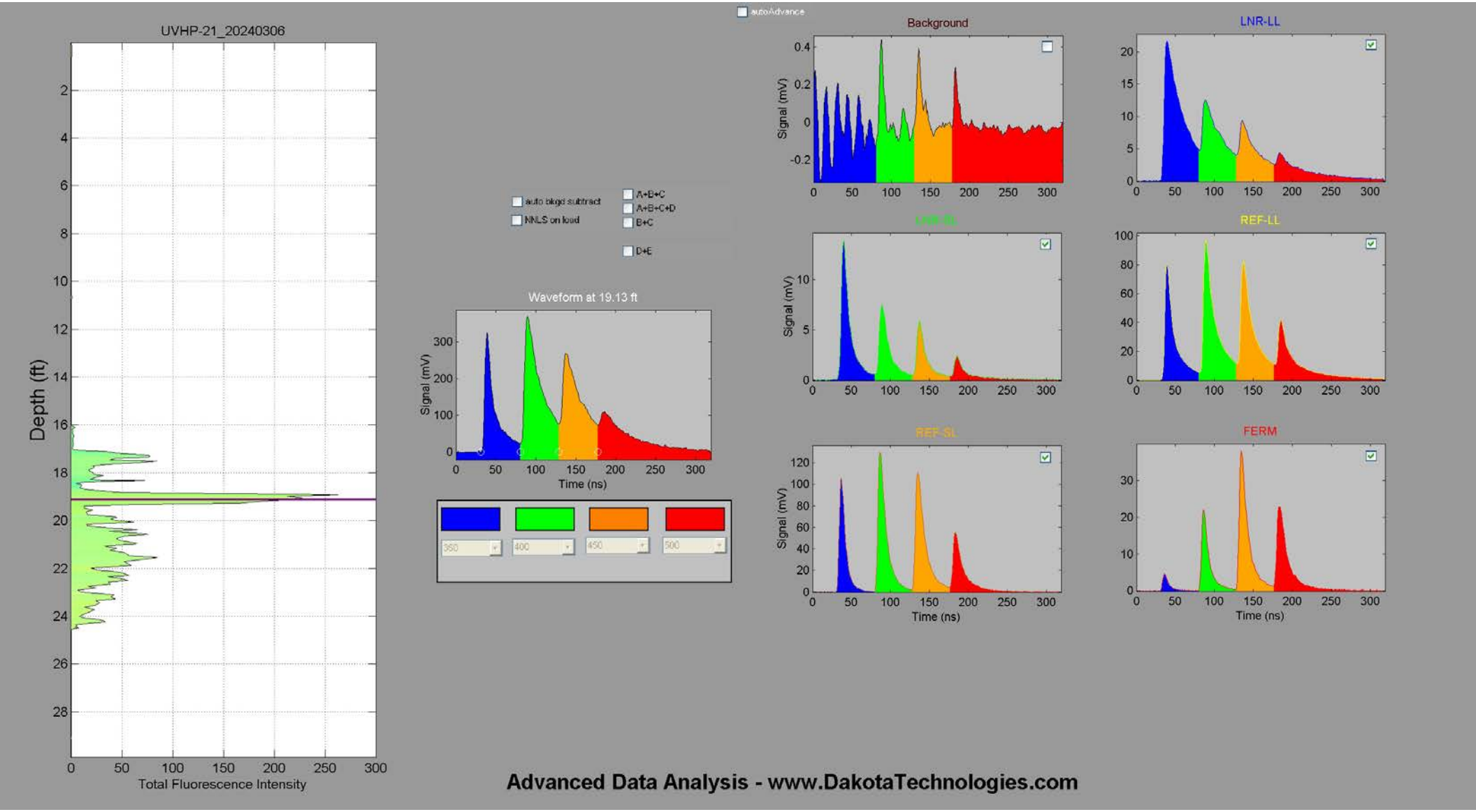

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-15 _20240307
RAW
UVHP-15 _20240307
LNR-LL
UVHP-15 _20240307
LNR-SL
UVHP-15 _20240307
REF-LL
UVHP-15 _20240307
REF-SL
UVHP-15 _20240307
FERM
UVHP-15 _20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com

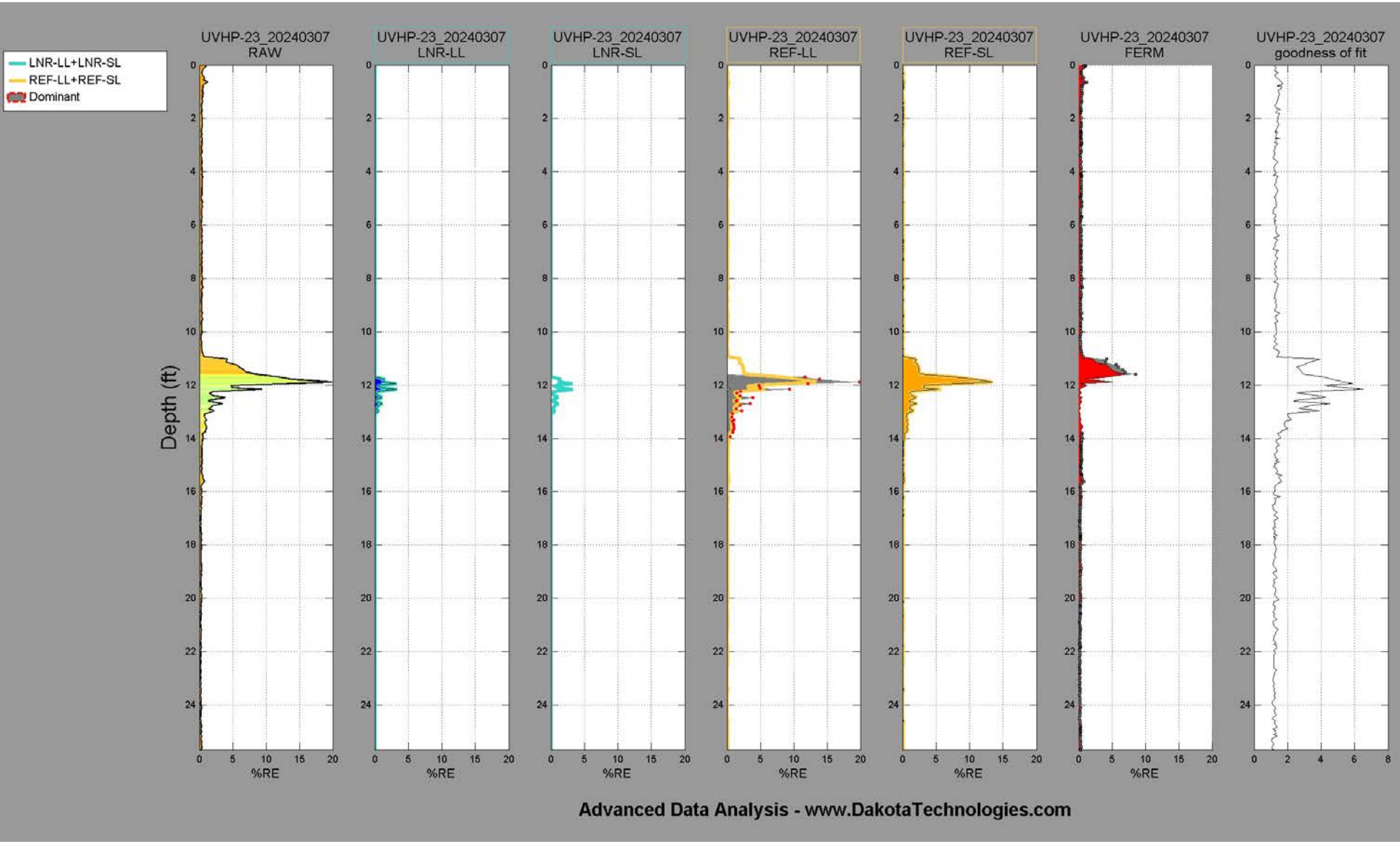

UVHP-15 _20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 23.35ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

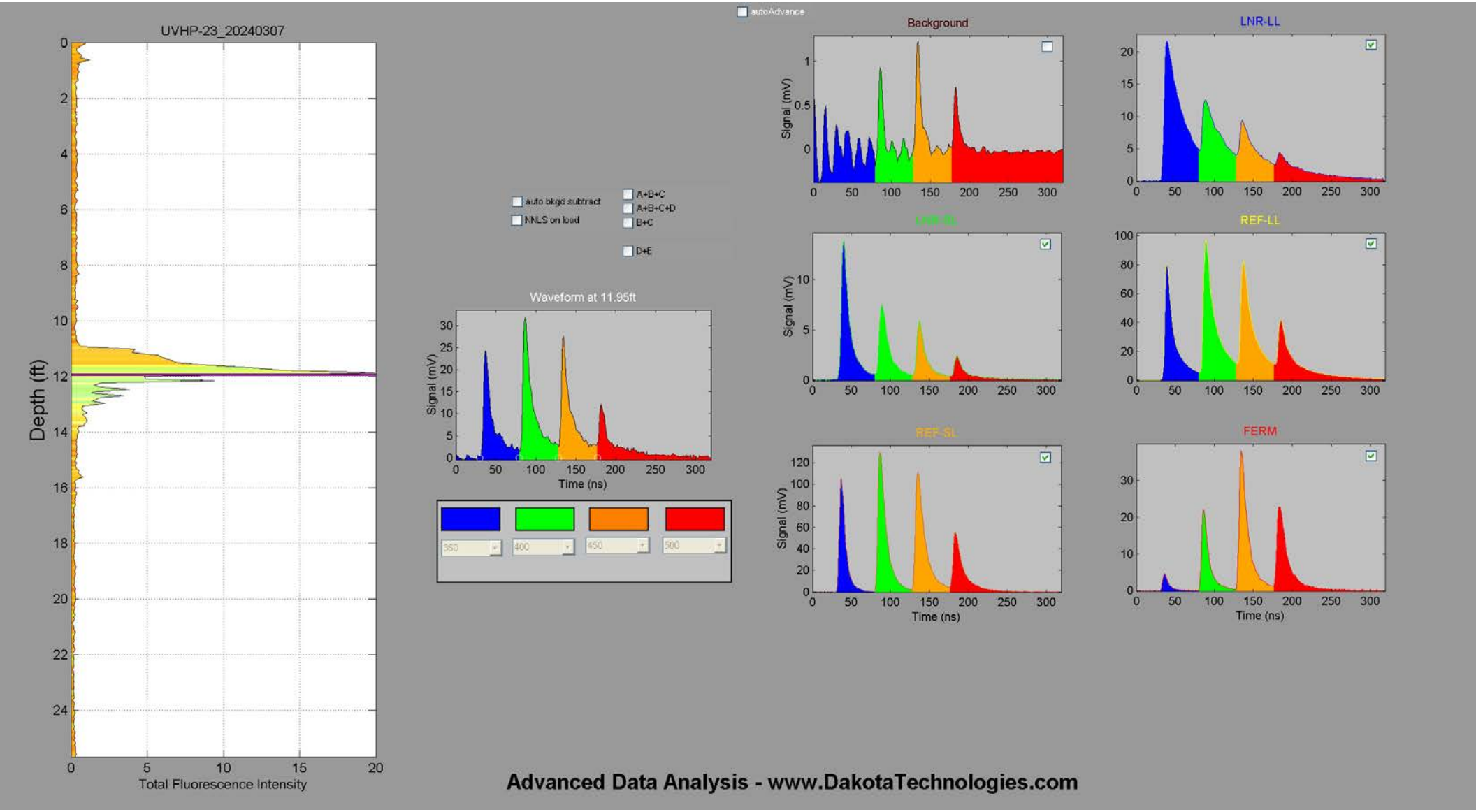

LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-20_20240306
RAW
UVHP-20_20240306
LNR-LL
UVHP-20_20240306
LNR-SL
UVHP-20_20240306
REF-LL
UVHP-20_20240306
REF-SL
UVHP-20_20240306
FERM
UVHP-20_20240306
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com


UVHP-20_20240306
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 18.41ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com


LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-21_20240306
RAW
UVHP-21_20240306
LNR-LL
UVHP-21_20240306
LNR-SL
UVHP-21_20240306
REF-LL
UVHP-21_20240306
REF-SL
UVHP-21_20240306
FERM
UVHP-21_20240306
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com


UVHP-21_20240306
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 19.13 ft
Signal (mV)
Time (ns)
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com


LNR-LL+LNR-SL
REF-LL+REF-SL
Dominant
UVHP-23_20240307
RAW
UVHP-23_20240307
LNR-LL
UVHP-23_20240307
LNR-SL
UVHP-23_20240307
REF-LL
UVHP-23_20240307
REF-SL
UVHP-23_20240307
FERM
UVHP-23_20240307
goodness of fit
Depth (ft)
%RE
Advanced Data Analysis - www.DakotaTechnologies.com


UVHP-23_20240307
Depth (ft)
Total Fluorescence Intensity
autoAdvance
auto bkgd subtract
NNLS on load
A+B+C
A+B+C+D
B+C
D+E
Waveform at 11.95ft
Signal (mV)
Time (ns)
360
400
450
500
Background
LNR-LL
LNR-SL
REF-LL
REF-SL
FERM
Advanced Data Analysis - www.DakotaTechnologies.com

Appendix G Well Abandonment Reports

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-382**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776088**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91014**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20537**
Well Depth (ft)	**28**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**28**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**28**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**28**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **10/02/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-414**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777327**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91057**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.2048**
Well Depth (ft)	**30**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**30**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**30**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**30**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/06/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-429**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777352**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91048**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20532**
Well Depth (ft)	**27**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**27**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**27**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**27**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-432**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777351**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91046**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20533**
Well Depth (ft)	**24.5**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**24.5**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**24.5**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**24.5**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

Draft Print for REVIEW Only

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701M) S-437**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**778617**		
Reason for Abandonment	**Other**		
Date Abandoned	**01/09/2026**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method	**Map Services**	Latitude	**39.9103**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20476**
Well Depth (ft)	**30**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**30**	**8**

CASING

Section 1

Top	Bottom	Diameter	Material
14	**14**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**30**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
PUMP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-438**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777348**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91037**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.2054**
Well Depth (ft)	**24.5**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**24.5**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**24.5**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**24.5**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/07/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-439**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777331**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91067**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20434**
Well Depth (ft)	**30**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**30**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**30**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**30**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/06/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-482**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777359**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91079**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20516**
Well Depth (ft)	**38**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**38**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**38**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**38**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/07/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-484**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776079**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9103**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20512**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **10/02/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) S-508**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776070**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91031**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20512**
Well Depth (ft)	**88**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**88**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**88**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**88**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
PUMP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **10/02/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-01**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777323**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91059**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20482**
Well Depth (ft)	**24**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**24**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**24**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**24**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/06/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-02**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777322**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91062**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20489**
Well Depth (ft)	**24**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**24**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**24**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**24**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/06/2025**

Driller's Signature (required) Date

Draft Print for REVIEW Only

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-03**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777318**		

Reason for Abandonment			
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91056**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20486**

Well Depth (ft) **25**

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-04**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777314**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9105**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20475**
Well Depth (ft)	**24**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**24**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**24**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**24**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/06/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-05**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777326**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91057**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20473**
Well Depth (ft)	**24**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**24**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**24**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**24**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/06/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX - AS-06**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776035**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91032**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20512**
Well Depth (ft)	**23**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**23**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**23**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**23**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **10/02/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**UDEX -AS-07 (21701L)**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776033**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91033**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20521**
Well Depth (ft)	**22**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**22**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**22**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**22**	**GROUT WITH BENTONITE**

Installation Method | Volume/Weight Used

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **09/30/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-08**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776067**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9103**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20506**
Well Depth (ft)	**22**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**22**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**22**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**22**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **10/02/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-09**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776085**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.90952**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20431**
Well Depth (ft)	**22**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**22**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**22**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**22**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **10/02/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-10**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776034**		
Reason for Abandonment	**Well was unused**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91027**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20517**
Well Depth (ft)	**22**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**22**	**1.5**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**22**	**1.5**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**22**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **09/30/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-11**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776343**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91034**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20465**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **10/09/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-12**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776687**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91031**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.2047**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **10/21/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) AS-13**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776320**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91037**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20478**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
25	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required)	Date
PARRATT-WOLFF INC	**10/08/2025**

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-14**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777261**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91027**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20475**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/05/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) AS15**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**776319**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9103**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20484**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **10/08/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-16**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777356**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9108**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20514**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-17**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777357**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9108**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20515**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-18**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777354**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91071**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20514**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**25**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(210701) UDEX-AS-19**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777353**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91069**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20521**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-AS-20**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777355**		
Reason for Abandonment	**Other**		
Date Abandoned	**10/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91074**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.2052**
Well Depth (ft)	**25**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**25**	**2**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**25**	**2**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**25**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/07/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L)UDEX-EW-01**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777330**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91069**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20437**
Well Depth (ft)	**19**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**19**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**19**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**19**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/06/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-03**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777358**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91077**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20516**
Well Depth (ft)	**17**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**17**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**17**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**17**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required)	Date
PARRATT-WOLFF INC	**11/07/2025**

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-04**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777333**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.9106**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20525**
Well Depth (ft)	**18**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**18**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**18**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**18**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required)	Date
PARRATT-WOLFF INC	**11/06/2025**

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L)UDEX-EW-05**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777334**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91043**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20538**
Well Depth (ft)	**16**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**16**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**16**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**6**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/06/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-06**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777350**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91024**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20548**
Well Depth (ft)	**15**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**15**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**15**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**15**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/07/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-07**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777349**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91036**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.2054**
Well Depth (ft)	**15**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**15**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**15**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**15**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required)	Date
PARRATT-WOLFF INC	**11/07/2025**

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX - EW-13**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777297**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91044**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20439**
Well Depth (ft)	**16**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**16**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**16**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**16**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC **11/06/2025**

Driller's Signature (required) Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-14**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777328**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/01/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91056**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20466**
Well Depth (ft)	**17**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**17**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**17**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**17**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/06/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-15**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777360**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.90958**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20547**
Well Depth (ft)	**13**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**13**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**13**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**13**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

Driller's Signature (required)	Date
PARRATT-WOLFF INC	**11/07/2025**

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-EW-24**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777263**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/02/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91017**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20471**
Well Depth (ft)	**15**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**15**	**6**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**15**	**6**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**15**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/05/2025**

Driller's Signature (required) — Date

PA Code, Title 17
§ 47.7. Well records: Form WWI

Pennsylvania Department of Conservation and Natural Resources
Bureau of Geological Survey
Water-Well Drillers Licensing Program
3240 Schoolhouse Road
Middletown, PA 17057
717-702-2017

Water-Well Abandonment Report

Well Driller	**PARRATT-WOLFF INC**	Abandon Well ID	**(21701L) UDEX-S-437**
Driller License	**2186**	Local Permit #	
Type of Activity	**Well Abandonment**	Original Well By	**PARRATT-WOLFF INC**
PA Well ID	**777265**		
Reason for Abandonment	**Other**		
Date Abandoned	**09/03/2025**		
Owner	**PES**		
Address of Well		Zip Code	**19145**
County	**PHILADELPHIA**		
Municipality	**PHILADELPHIA**	Municipality Type	**C**
Coordinate Method		Latitude	**39.91031**
Quadrangle	**PHILADELPHIA**	Longitude	**-75.20474**
Well Depth (ft)	**27**		

Abandonment Notes:

BOREHOLE

Section 1

Top	Bottom	Diameter
0	**27**	**4**

CASING

Section 1

Top	Bottom	Diameter	Material
0	**27**	**4**	**PVC OR OTHER PLASTIC**

Seal(Grout)

Top	Bottom	Material

SEAL

Section 1

Top	Bottom	Material
0	**27**	**GROUT WITH BENTONITE**

Installation Method	Volume/Weight Used
DROP THRU TREMMIE	

I hereby certify that the above information is true and complete to the best of my knowledge and belief.

PARRATT-WOLFF INC — **11/05/2025**

Driller's Signature (required) — Date

Appendix H City of Philadelphia AMS Installation Permits and Air Pollution Licenses

CITY OF PHILADELPHIA
DEPARTMENT OF PUBLIC HEALTH
AIR MANAGEMENT SERVICES

INSTALLATION PERMIT

Installation Permit No: IP21-000166 Date: March 24, 2021

Plant ID: 01501

Owner: Philadelphia Energy Solutions (PES)
Address: 3144 West Passyunk Avenue
Philadelphia PA 19145

Source: PES
3144 West Passyunk Avenue
Philadelphia, PA 19145

Attention: jjeray@hilcoglobal.com
Phone: 978-729-3209

Pursuant to the provisions of Title 3 of the Philadelphia Code, the Air Management Code of February 17, 1995, as amended, and after due consideration of an installation permit application received under the rules and regulations of the Philadelphia Air Pollution Control Board, the City of Philadelphia, Department of Public Health, Air Management Services (AMS) on March 24, 2021 approved plans for the installation and temporary operation of the air contamination control device(s) described below:

Installation of the following to control emissions of VOC from a Soil Vapor Extraction system

Source Description	Manufacturer (Model)	Process Rate	Fuel
Pilot Test of Remediation System /soil vapor extraction (SVE) Using Two (2) RSI/Ford LSG 875- 460 cubic inch internal combustion engines (ICE) rated at 49 BHP each without load module • The vacuum from the ICE will draw soil vapor from the extraction wells, through an air/water separator, and into the engines for combustion. Exhaust gas from the engine is treated by catalytic converters prior to discharge to the atmosphere.	Remediation Service, International (RSI) Model: V4	75 pounds per hour (lbs/hr) of reformate Volume of exhaust: 138 CFM @ 900 F	Propane

This installation permit expires on March 24, 2022. If construction has not been completed by this date, an application for either an extension or new installation permit must be made. The conditions of this installation permit will remain in effect until they are incorporated in an operating permit or operating license.

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 21-000166
COMPANY: PES

This Installation Permit is subject to conditions prescribed in the attachment.

Rahel Gebrekidan

Rahel Gebrekidan
Environmental Engineer
(215)-685-9429

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 21-000166
COMPANY: PES

1. Each ICE and catalytic converters shall be installed, operated, and maintained in accordance with the manufacturer's specifications and with the specifications in the application (as approved herein).

2. Emissions from each soil vapor extraction (SVE) system shall comply with the following requirements:
   a) VOC concentration in the catalytic converters effluent stream shall not exceed 95 ppmv or the minimum VOC destruction efficiency of the ICE shall be 99.9%. [Application]
   b) Air toxic contaminant concentrations shall be below the ambient guidelines stated in Air Management Services Regulation VI. Ambient benzene concentrations when modeled shall be below 24 ppb.
   c) Actual VOC emissions from the SVE shall be less than 2.7 tons during the terms of this permit [March 15, 2021 - March 15, 2022]. [Application]

   d) Actual HAP emission from SVE shall be less than 1 ton during the terms of this permit [March 15, 2021 - March 15, 2022]. [Application]

3. Particulate Matter (PM) emissions from each ICE unit shall not exceed 0.04 grain per dry standard cubic foot. [25 Pa Code §123.13(c)(1)(i)]

4. Carbon Monoxide (CO) emissions from each ICE unit shall not exceed 1% by volume of exhaust gases. [AMR VIII]

5. The SVE system shall be operated without causing any odor nuisances or noise violations beyond the property boundary. [AMR V, Sec XX]

6. All gasoline vapors extracted from SVE activities at the facility shall pass through the ICE and units prior to discharge. [application]

7. The Permittee may not permit the emission into the outdoor atmosphere of visible air contaminants in such a manner that the opacity of the emission is either of the following: [25 Pa Code §123.41]
   (a) Equal to or greater than 20% for a period or periods aggregating more than three (3) minutes in any one hour.
   (b) Equal to or greater than 60% at any time.

8. For the ICE and catalytic converters SVE system, for the first ten (10) days of operation, the Permittee shall monitor the VOC concentration at the influent, and effluent streams at least once a day with a flame ionization detector (FID) or photoionization detector (PID) to demonstrate compliance with Condition 2(a). If the measurements demonstrate that the VOC concentrations at the effluent are consistently below 95 ppmv, or greater than 99.9% of efficiency, the frequency of monitoring may be adjusted to twice a month (bi-weekly) with approval from AMS. Data should be submitted to AMS for approval. The Permittee shall continue to monitor on a daily basis until written approval is obtained from AMS. A log of the measurements shall be kept on site and made available to AMS personnel upon request.
9. The operations of the pilot test shall be concluded no later than March 25, 2022.

10. The Permittee shall keep records of the following:
    (a) Maintenance performed on the ICE according to manufacturer's specifications.
    (b) Date and time of the monitoring.
    (c) Personnel conducting the monitoring.
    (d) VOC concentration, concentrations of the influent and/or effluent streams.
    (e) VOC and HAP emissions calculation or verification to demonstrate compliance with Conditions 2(c)-(d).
    (f) Records of the occurrence, duration, and cause (if known) of each malfunction of the catalytic converters

11. All records shall be kept for a period of two (2) years and made available to AMS upon request.

12. A written report shall be submitted to AMS within two (2) working days following the notification of a malfunction that may cause emissions in excess of those allowed in conditions 2 and shall describe, at a minimum, the following:
    (a) The nature and degree of malfunction(s)
    (b) The duration.
    (c) Any corrective action taken.
    (d) Start and end date of the pilot test.

13. Any violation of an emission limitation shall be reported (by phone call or facsimile transmission) to AMS within 24 hours of detection and followed by a written notification within thirty-one (31) days.

CITY OF PHILADELPHIA
DEPARTMENT OF PUBLIC HEALTH
AIR MANAGEMENT SERVICES

INSTALLATION PERMIT

Installation Permit No: IP22-000097 Date: March 23, 2022

Plant ID: 01501

Owner: Philadelphia Energy Solutions (PES)
Address: 3144 West Passyunk Avenue
Philadelphia PA 19145

Source: PES
3144 West Passyunk Avenue
Philadelphia, PA 19145

Attention: jjeray@hilcoglobal.com
Phone: 978-729-3209

Pursuant to the provisions of Title 3 of the Philadelphia Code, the Air Management Code of February 17, 1995, as amended, and after due consideration of an installation permit application received under the rules and regulations of the Philadelphia Air Pollution Control Board, the City of Philadelphia, Department of Public Health, Air Management Services (AMS) on March 23, 2022 approved plans for the installation and temporary operation of the air contamination control device(s) described below:

Installation of the following to control emissions of VOC from a Soil Vapor Extraction system

Source Description	Manufacturer (Model)	Process Rate	Fuel
Pilot Test of Remediation System /soil vapor extraction (SVE) Using Two (2) RSI/Ford LSG 875- 460 cubic inch internal combustion engines (ICE) rated at 49 BHP each without load module • The vacuum from the ICE will draw soil vapor from the extraction wells, through an air/water separator, and into the engines for combustion. Exhaust gas from the engine is treated by catalytic converters prior to discharge to the atmosphere.	Remediation Service, International (RSI) Model: V4	75 pounds per hour (lbs/hr) of reformate Volume of exhaust: 138 CFM @ 900 F	Propane

This installation permit expires on March 23, 2023. If construction has not been completed by this date, an application for either an extension or new installation permit must be made. The conditions of this installation permit will remain in effect until they are incorporated in an operating permit or operating license.

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 22-000097
COMPANY: PES

This Installation Permit is subject to conditions prescribed in the attachment.

Rahel Gebrekidan

Rahel Gebrekidan
Environmental Engineer
(215)-685-9429

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 22-000097
COMPANY: PES

1. Each ICE and catalytic converters shall be installed, operated, and maintained in accordance with the manufacturer's specifications and with the specifications in the application (as approved herein).

2. Emissions from each soil vapor extraction (SVE) system shall comply with the following requirements:
   a) VOC concentration in the catalytic converters effluent stream shall not exceed 95 ppmv or the minimum VOC destruction efficiency of the ICE shall be 99.9%. [Application]
   b) Air toxic contaminant concentrations shall be below the ambient guidelines stated in Air Management Services Regulation VI. Ambient benzene concentrations when modeled shall be below 24 ppb.
   c) Actual VOC emissions from the SVE shall be less than 2.7 tons during the terms of this permit [March 15, 2021 - March 15, 2022]. [Application]

   d) Actual HAP emission from SVE shall be less than 1 ton during the terms of this permit [March 15, 2021 - March 15, 2022]. [Application]

3. Particulate Matter (PM) emissions from each ICE unit shall not exceed 0.04 grain per dry standard cubic foot. [25 Pa Code §123.13(c)(1)(i)]

4. Carbon Monoxide (CO) emissions from each ICE unit shall not exceed 1% by volume of exhaust gases. [AMR VIII]

5. The SVE system shall be operated without causing any odor nuisances or noise violations beyond the property boundary. [AMR V, Sec XX]

6. All gasoline vapors extracted from SVE activities at the facility shall pass through the ICE and units prior to discharge. [application]

7. The Permittee may not permit the emission into the outdoor atmosphere of visible air contaminants in such a manner that the opacity of the emission is either of the following: [25 Pa Code §123.41]
   (a) Equal to or greater than 20% for a period or periods aggregating more than three (3) minutes in any one hour.
   (b) Equal to or greater than 60% at any time.

8. For the ICE and catalytic converters SVE system, for the first ten (10) days of operation, the Permittee shall monitor the VOC concentration at the influent, and effluent streams at least once a day with a flame ionization detector (FID) or photoionization detector (PID) to demonstrate compliance with Condition 2(a). If the measurements demonstrate that the VOC concentrations at the effluent are consistently below 95 ppmv, or greater than 99.9% of efficiency, the frequency of monitoring may be adjusted to twice a month (bi-weekly) with approval from AMS. Data should be submitted to AMS for approval. The Permittee shall continue to monitor on a daily basis until written approval is obtained from AMS. A log of the measurements shall be kept on site and made available to AMS personnel upon request.
9. The operations of the pilot test shall be concluded no later than March 15, 2022.

10. The Permittee shall keep records of the following:
    (a) Maintenance performed on the ICE according to manufacturer's specifications.
    (b) Date and time of the monitoring.
    (c) Personnel conducting the monitoring.
    (d) VOC concentration, concentrations of the influent and/or effluent streams.
    (e) VOC and HAP emissions calculation or verification to demonstrate compliance with Conditions 2(c)-(d).
    (f) Records of the occurrence, duration, and cause (if known) of each malfunction of the catalytic converters

11. All records shall be kept for a period of two (2) years and made available to AMS upon request.

12. A written report shall be submitted to AMS within two (2) working days following the notification of a malfunction that may cause emissions in excess of those allowed in conditions 2 and shall describe, at a minimum, the following:
    (a) The nature and degree of malfunction(s)
    (b) The duration.
    (c) Any corrective action taken.
    (d) Start and end date of the pilot test.

13. Any violation of an emission limitation shall be reported (by phone call or facsimile transmission) to AMS within 24 hours of detection and followed by a written notification within thirty-one (31) days.

CITY OF PHILADELPHIA
DEPARTMENT OF PUBLIC HEALTH
AIR MANAGEMENT SERVICES

DRAFT INSTALLATION PERMIT

Installation Permit No: IP22-000098 Date: May 6, 2022

Plant ID: 01501

Owner: Philadelphia Energy Solutions (PES)
Address: 3144 West Passyunk Avenue
Philadelphia PA 19145

Source: PES
3144 West Passyunk Avenue
Philadelphia, PA 19145

Attention: jjeray@hilcoglobal.com
Phone: 978-729-3209

Pursuant to the provisions of Title 3 of the Philadelphia Code, the Air Management Code of February 17, 1995, as amended, and after due consideration of an installation permit application received under the rules and regulations of the Philadelphia Air Pollution Control Board, the City of Philadelphia, Department of Public Health, Air Management Services (AMS) on May 6, 2022 approved plans for the installation and temporary operation of the air contamination control device(s) described below:

Installation of the following to control emissions of VOC from a Soil Vapor Extraction system

Source Description	Manufacturer (Model)	Process Rate	Fuel
Soil Remediation System /soil vapor extraction (SVE) Using Two (2) RSI/Ford LSG 875- 460 cubic inch internal combustion engines (ICE) rated at 49 BHP each without load module • The vacuum from the ICE will draw soil vapor from the extraction wells, through an air/water separator, and into the engines for combustion. Exhaust gas from the engine is treated by catalytic converters prior to discharge to the atmosphere.	Remediation Service, International (RSI) Model: V4	75 pounds per hour (lbs/hr) of reformate Volume of exhaust: 138 CFM @ 900 F	Propane

This installation permit expires on May 6, 2023. If construction has not been completed by this date, an application for either an extension or new installation permit must be made. The conditions of this installation permit will remain in effect until they are incorporated in an operating permit or operating license.

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 22-000098
COMPANY: PES

This Installation Permit is subject to conditions prescribed in the attachment.

Rahel Gebrekidan

Rahel Gebrekidan
Environmental Engineer
(215)-685-9429

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 22-000098
COMPANY: PES

1. Each ICE and catalytic converters shall be installed, operated, and maintained in accordance with the manufacturer's specifications and with the specifications in the application (as approved herein).

2. Emissions from each soil vapor extraction (SVE) system shall comply with the following requirements:
   a) VOC concentration in the catalytic converters effluent stream shall not exceed 95 ppmv or the minimum VOC destruction efficiency of the ICE shall be 99.9%. [Application]
   b) Air toxic contaminant concentrations shall be below the ambient guidelines stated in Air Management Services Regulation VI. Ambient benzene concentrations when modeled shall be below 24 ppb.
   c) Actual VOC emissions from the SVE shall be less than 2.7 tons during the terms of this permit [May 6, 2022 – May 6, 2023]. [Application]

   d) Actual HAP emission from SVE shall be less than 1 ton during the terms of this permit [May 6, 2022 – May 6, 2023]. [Application]

3. Particulate Matter (PM) emissions from each ICE unit shall not exceed 0.04 grain per dry standard cubic foot. [25 Pa Code §123.13(c)(1)(i)]

4. Carbon Monoxide (CO) emissions from each ICE unit shall not exceed 1% by volume of exhaust gases. [AMR VIII]

5. The SVE system shall be operated without causing any odor nuisances or noise violations beyond the property boundary. [AMR V, Sec XX]

6. All gasoline vapors extracted from SVE activities at the facility shall pass through the ICE and units prior to discharge. [application]

7. The Permittee may not permit the emission into the outdoor atmosphere of visible air contaminants in such a manner that the opacity of the emission is either of the following: [25 Pa Code §123.41]
   (a) Equal to or greater than 20% for a period or periods aggregating more than three (3) minutes in any one hour.
   (b) Equal to or greater than 60% at any time.

8. For the ICE and catalytic converters SVE system, for the first ten (10) days of operation, the Permittee shall monitor the VOC concentration at the influent, and effluent streams at least once a day with a flame ionization detector (FID) or photoionization detector (PID) to demonstrate compliance with Condition 2(a). If the measurements demonstrate that the VOC concentrations at the effluent are consistently below 95 ppmv, or greater than 99.9% of efficiency, the frequency of monitoring may be adjusted to twice a month (bi-weekly) with approval from AMS. Data should be submitted to AMS for approval. The Permittee shall continue to monitor on a daily basis until written approval is obtained from AMS. A log of the measurements shall be kept on site and made available to AMS personnel upon request.

9. The Permittee shall keep records of the following:
   (a) Maintenance performed on the ICE according to manufacturer's specifications.
   (b) Date and time of the monitoring.
   (c) Personnel conducting the monitoring.
   (d) VOC concentration, concentrations of the influent and/or effluent streams.
   (e) VOC and HAP emissions calculation or verification to demonstrate compliance with Conditions 2(c)-(d).
   (f) Records of the occurrence, duration, and cause (if known) of each malfunction of the catalytic converters

10. All records shall be kept for a period of two (2) years and made available to AMS upon request.

11. A written report shall be submitted to AMS within two (2) working days following the notification of a malfunction that may cause emissions in excess of those allowed in conditions 2 and shall describe, at a minimum, the following:
   (a) The nature and degree of malfunction(s)
   (b) The duration.
   (c) Any corrective action taken.
   (d) Start and end date of the pilot test.

12. Any violation of an emission limitation shall be reported (by phone call or facsimile transmission) to AMS within 24 hours of detection and followed by a written notification within thirty-one (31) days.

CITY OF PHILADELPHIA
DEPARTMENT OF PUBLIC HEALTH
AIR MANAGEMENT SERVICES

DRAFT INSTALLATION PERMIT

Installation Permit No: IP22-0000286 Date: August 15, 2022

Plant ID: 01501

Owner: Philadelphia Energy Solutions (PES)
Address: 3144 West Passyunk Avenue
Philadelphia PA 19145

Source: PES
3144 West Passyunk Avenue
Philadelphia, PA 19145

Attention: jjeray@hilcoglobal.com
Phone: 978-729-3209

Pursuant to the provisions of Title 3 of the Philadelphia Code, the Air Management Code of February 17, 1995, as amended, and after due consideration of an installation permit application received under the rules and regulations of the Philadelphia Air Pollution Control Board, the City of Philadelphia, Department of Public Health, Air Management Services (AMS) on August 15, 2022, approved plans for the installation and temporary operation of the air contamination control device(s) described below:

Installation of the following to control emissions of VOC from a Soil Vapor Extraction system

Source Description	Manufacturer (Model)	Process Rate	Fuel
Soil Remediation System /soil vapor extraction (SVE) Using Two (2) RSI/Ford LSG 875- 460 cubic inch internal combustion engines (ICE) rated at 49 BHP each without load module • The vacuum from the ICE will draw soil vapor from the extraction wells, through an air/water separator, and into the engines for combustion. Exhaust gas from the engine is treated by catalytic converters prior to discharge to the atmosphere.	Remediation Service, International (RSI) Model: V3	75 pounds per hour (lbs/hr) of reformate Volume of exhaust: 138 CFM @ 900 F	Propane

This installation permit expires on August 15, 2023. If construction has not been completed by this date, an application for either an extension or new installation permit must be made. The conditions of this installation permit will remain in effect until they are incorporated in an operating permit or operating license.

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 22-000286
COMPANY: PES

This Installation Permit is subject to conditions prescribed in the attachment.

Rahel Gebrekidan

_____

Rahel Gebrekidan
Environmental Engineer
(215)-685-9429

INSTALLATION PERMIT CONDITIONS
INSTALLATION PERMIT NO. IP: 22-000286
COMPANY: PES

1. Each ICE and catalytic converters shall be installed, operated, and maintained in accordance with the manufacturer's specifications and with the specifications in the application (as approved herein).

2. Emissions from each soil vapor extraction (SVE) system shall comply with the following requirements:
   a) VOC concentration in the catalytic converters effluent stream shall not exceed 95 ppmv or the minimum VOC destruction efficiency of the ICE shall be 99.9%. [Application]
   b) Air toxic contaminant concentrations shall be below the ambient guidelines stated in Air Management Services Regulation VI. Ambient benzene concentrations when modeled shall be below 24 ppb.
   c) Actual VOC emissions from the SVE shall be less than 2.7 tons during the terms of this permit [XXXX]. [Application]

   d) Actual HAP emission from SVE shall be less than 1 ton during the terms of this permit [XXXXX]. [Application]

3. Particulate Matter (PM) emissions from each ICE unit shall not exceed 0.04 grain per dry standard cubic foot. [25 Pa Code §123.13(c)(1)(i)]

4. Carbon Monoxide (CO) emissions from each ICE unit shall not exceed 1% by volume of exhaust gases. [AMR VIII]

5. The SVE system shall be operated without causing any odor nuisances or noise violations beyond the property boundary. [AMR V, Sec XX]

6. All gasoline vapors extracted from SVE activities at the facility shall pass through the ICE and units prior to discharge. [application]

7. The Permittee may not permit the emission into the outdoor atmosphere of visible air contaminants in such a manner that the opacity of the emission is either of the following: [25 Pa Code §123.41]
   (a) Equal to or greater than 20% for a period or periods aggregating more than three (3) minutes in any one hour.
   (b) Equal to or greater than 60% at any time.

8. For the ICE and catalytic converters SVE system, for the first ten (10) days of operation, the Permittee shall monitor the VOC concentration at the influent, and effluent streams at least once a day with a flame ionization detector (FID) or photoionization detector (PID) to demonstrate compliance with Condition 2(a). If the measurements demonstrate that the VOC concentrations at the effluent are consistently below 95 ppmv, or greater than 99.9% of efficiency, the frequency of monitoring may be adjusted to twice a month (bi-weekly) with approval from AMS. Data should be submitted to AMS for approval. The Permittee shall continue to monitor on a daily basis until written approval is obtained from AMS. A log of the measurements shall be kept on site and made available to AMS personnel upon request.

9. The Permittee shall keep records of the following:
   (a) Maintenance performed on the ICE according to manufacturer's specifications.
   (b) Date and time of the monitoring.
   (c) Personnel conducting the monitoring.
   (d) VOC concentration, concentrations of the influent and/or effluent streams.
   (e) VOC and HAP emissions calculation or verification to demonstrate compliance with Conditions 2(c)-(d).
   (f) Records of the occurrence, duration, and cause (if known) of each malfunction of the catalytic converters

10. All records shall be kept for a period of two (2) years and made available to AMS upon request.

11. A written report shall be submitted to AMS within two (2) working days following the notification of a malfunction that may cause emissions in excess of those allowed in conditions 2 and shall describe, at a minimum, the following:
   (a) The nature and degree of malfunction(s)
   (b) The duration.
   (c) Any corrective action taken.
   (d) Start and end date of the pilot test.

12. Any violation of an emission limitation shall be reported (by phone call or facsimile transmission) to AMS within 24 hours of detection and followed by a written notification within thirty-one (31) days.

CITY OF PHILADELPHIA
Department of Public Health
Air Management Services

321 University Avenue, 2nd Floor
Philadelphia PA 19104-4543
Phone: (215) 685-7572
FAX: (215) 685-7593

AIR POLLUTION LICENSE

License Code: 3216 **Tax ID: *****9574**

FACILITY:	MAILING ADDRESS:
3144 W PASSYUNK AVE PHILADELPHIA, PA 19145 PLID: 01501	Philadelphia Energy Solutions Refining and Marketing LLC 111 South Wacker Drive Chicago, IL 60606

AMS License No: APL23-000099
Equipment: REMEDIATION OF PETROLEUM HYDROCARBONS IN SUB SURFACE USING SOIL VAPOR EXTRACTION
Detail Equipment Info: TWO (2) RSI/FORD LSG 875 - 460 CUBIC INCH INTERNAL COMBUSTION ENGINES WITH CATALYTIC OXIDIZERS
AMS Installation Permit No: IP22-000097
Annual Fee: $600.00
Expiration Date: 10/31/2024

Pursuant to § 5-1005 of the Philadelphia Home Rule Charter, an administrative appeal of this License may be filed with the Board of Licenses and Inspections Review (BLIR). Any such appeal should be filed within thirty (30) days, include a copy of this License and be directed to:

Board of License and Inspection Review
Municipal Services Building, 11th Floor
1401 JFK Blvd.
Philadelphia, PA 19102

Please keep on site at the facility and present to an inspector upon request.

	CITY OF PHILADELPHIA **Department of Public Health** **Air Management Services** **321 University Avenue, 2nd Floor** **Philadelphia PA 19104-4543** **Phone: (215) 685-7572** **FAX: (215) 685-7593**

AIR POLLUTION LICENSE

License Code: 3216 Tax ID: *****9574

FACILITY: 3144 W PASSYUNK AVE PHILADELPHIA, PA 19145 PLID: 01501	MAILING ADDRESS: Philadelphia Energy Solutions Refining and Marketing LLC 111 South Wacker Drive Chicago, IL 60606

AMS License No: APL23-000185
Equipment: REMEDIATION OF PETROLEUM HYDROCARBONS IN THE SUBSURFACE USING SOIL VAPOR EXTRACTION
Detail Equipment Info: TWO (2) RSI/FORD LSG 875-460 CUBIC INCH INTERNAL COMBUSTION ENGINES WITH CATALYTIC OXIDIZERS
AMS Installation Permit No: IP22-000098
Annual Fee: $600.00
Expiration Date: 10/31/2024

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	CITY OF PHILADELPHIA **Department of Public Health** **Air Management Services** **321 University Avenue, 2nd Floor** **Philadelphia PA 19104-4543** **Phone: (215) 685-7572** **FAX: (215) 685-7593**

AIR POLLUTION LICENSE

License Code: 3216 Tax ID: *****9574

FACILITY: 3144 W PASSYUNK AVE PHILADELPHIA, PA 19145 PLID: 01501	MAILING ADDRESS: Philadelphia Energy Solutions Refining and Marketing LLC 111 South Wacker Drive Chicago, IL 60606

AMS License No: APL23-000204
Equipment: REMEDIATION OF PETROLEUM HYDROCARBONS IN THE SUBSURFACE USING SOIL VAPOR EXTRACTION
Detail Equipment Info: TWO (2) RSI/FORD LSG 875 - 460 CUBIC INCH INTERNAL COMBUSTION ENGINES WITH CATALYTIC OXIDIZERS
AMS Installation Permit No: IP22-000286
Annual Fee: $600.00
Expiration Date: 10/31/2024

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