DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-2022-BF125-02-001

August 11, 2022

Mr. Rick Shean
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Received
AUG 11 2022
NMED Hazardous Waste Bureau

Subject: Submittal of the Periodic Monitoring Report for 2021 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Periodic Monitoring Report for 2021 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50." Submittal of this periodic monitoring report fulfills the New Mexico Environment Department requirement in the approval of the "Phase III Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50" (December 2011) that vapor monitoring, which includes sampling for volatile organic compounds (VOCs) and tritium, be conducted semiannually from 80 sampling ports in 18 boreholes at Material Disposal Area C. This report includes presentation and analysis of subsurface vapor monitoring data for VOCs and tritium from two sampling rounds in 2021.

If you have any questions, please contact David Diehl at (505) 551-2496 (david.diehl@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

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Date: 2022.08.11 07:36:43 -06'00'

Arturo Q. Duran
Compliance and Permitting Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s):

1. Two hard copies with electronic files:
   Periodic Monitoring Report for 2021 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50 (EM2022-0434)

cc (letter with hard-copy enclosure[s]):
Cheryl Rodriguez, EM-LA

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August 2022
EM2022-0434

Periodic Monitoring Report for 2021 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50

N3B Los Alamos

EM2022-0434

Periodic Monitoring Report for 2021 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50

August 2022

Responsible program director:

Michael O. Erickson		Program Director	RCRA Remediation Program	7/24/22
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Responsible N3B representative:

Troy Thomson		Program Manager	N3B Environmental Remediation Program	7/25/22
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Responsible DOE EM-LA representative:

Arturo Q. Duran	ARTURO DURAN Digitally signed by ARTURO DURAN Date: 2022.08.11 07:37:12 -06'00'	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	
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EXECUTIVE SUMMARY

This periodic monitoring report (PMR) summarizes vapor-monitoring activities conducted for calendar year 2021 at Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, at Technical Area 50, at Los Alamos National Laboratory. Submittal of this PMR fulfills the New Mexico Environment Department (NMED) requirement that vapor monitoring be conducted semiannually from 80 sampling ports in 18 boreholes at MDA C. The objectives of the current vapor monitoring at MDA C are to (1) monitor for potential plume expansion and new releases, and (2) collect additional vapor-monitoring data to support the updated corrective measures evaluation report that was submitted to NMED on June 30, 2021.

Vapor monitoring in the first round of sampling was conducted from March 23 through April 16, 2021. This round included collecting 80 vapor samples for volatile organic compound (VOC) analysis, along with 8 field duplicate samples and 8 field blank samples, and 80 samples for tritium analysis, along with 7 field duplicates and 8 field blanks. Samples were collected from all 80 sample ports at the 18 wells. Vapor monitoring in the second round of sampling was conducted from February 28 through March 18, 2022. This round included collecting 80 vapor samples for VOC analysis, along with 8 field duplicates and 8 field blanks, and 80 tritium samples, along with 8 field duplicates and 8 field blanks.

Validated analytical results demonstrated the presence of 31 VOCs detected in subsurface pore gas. The VOC screening evaluation identified 4 VOCs in the first round and 3 VOCs in the second round in MDA C pore gas at concentrations exceeding Tier I pore-gas screening levels (SLs), which are based on protection of groundwater. However, the only VOC consistently detected above its screening level was trichloroethene (TCE).

Data trends in the MDA C VOC plumes for both total VOCs and TCE were evaluated from vapor-monitoring activities from 2010 through 2022. VOC trends for TCE from 2010 through 2022 show that VOC concentrations at MDA C are consistent with a diffusive plume. The lateral extent of the plume has expanded slightly, but concentrations are decreasing slowly at the edges of the plume. Concentrations in the center of the plume peak at depths of approximately 210–300 ft below ground surface, well below possible source areas, and appear to be decreasing slowly with time. The plume has not expanded vertically downward into the Guaje Pumice Bed and Tschicoma Formation dacite. Concentrations in the upper portion of the plume near the surface have decreased substantially. Concentrations in the source area show no signs of significant continued releases of VOCs.

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1.0 INTRODUCTION

This periodic monitoring report (PMR) presents the results of vapor-monitoring activities conducted for calendar year 2021 at Material Disposal Area (MDA) C, Solid Waste Management Unit (SWMU) 50-009, in Technical Area 50 (TA-50), at Los Alamos National Laboratory (LANL or the Laboratory). Submittal of this PMR fulfills the New Mexico Environment Department (NMED) requirement that vapor monitoring be conducted semiannually from 80 sampling ports in 18 boreholes at MDA C and include sampling for volatile organic compounds (VOCs) and tritium (NMED 2011, 208797).

The objectives of the current vapor monitoring at MDA C, are to (1) monitor for plume expansion and new releases, and (2) collect additional vapor-monitoring data to support the updated corrective measures evaluation (CME) submitted to NMED on June 30, 2021 (N3B 2021, 701508).

This report discusses the results obtained during the two vapor-monitoring rounds, and evaluates trends in VOC and tritium concentrations from vapor-monitoring activities at MDA C from 2010 through 2022. All pore-gas samples were submitted for off-site analysis of VOCs and tritium.

To evaluate changes in plume concentrations over time, the trends in concentrations of both total VOCs and tricholorethene (TCE) are analyzed in the analytical data results section of this report and the VOC plume trend analysis appendix. The selection of TCE for the trend analysis was based on the information reported since the 2012 MDA C CME report (LANL 2012, 222830). TCE was the most frequently detected VOC, with 96% of the VOC vapor samples collected at MDA C in 2021 showing concentrations above detection limits. TCE was also the VOC most frequently detected above the Tier I pore-gas screening levels (SLs), with 77% of all 2021 TCE sampling results exceeding the Tier I SLs.

No regulatory criteria exist for vapor-phase contaminants as a potential source of groundwater contamination, so this report presents the results of a screening evaluation of the pore-gas VOC data. The maximum concentrations of VOCs in pore gas are compared with pore-gas SLs developed using a Henry's Law calculation to determine the VOC concentration in groundwater for the hypothetical case of the VOC pore gas being in contact with the groundwater.

Tritium samples were collected during both sampling rounds. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with U.S. Department of Energy policy.

Section IX of the Compliance Order on Consent (Consent Order) describes the role of data screening in the corrective action process. Screening values are used to identify the potential for unacceptable risk resulting from the presence of contaminants in groundwater. SLs for evaluating pore-gas monitoring data for potential impacts to groundwater are based on, in descending order of precedence, New Mexico Water Quality Control Commission (NMWQCC) groundwater standards, U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs), NMED SLs for tap water, and EPA regional SLs for tap water. Additional risk evaluation is required to determine the need for cleanup (corrective action) if results indicate that contaminants are present at concentrations above SLs.

This report is divided into seven sections:

- Section 1 (this introductory section) includes a description of the site location.
- Section 2 describes the scope of the vapor-monitoring activities.
- Section 3 addresses regulatory criteria.
- Section 4 presents field-screening results.

- Section 5 presents analytical data results.
- Section 6 summarizes the information presented in this report.
- Section 7 includes references and map data sources.

The appendices include

- Acronyms, a metric conversion table, and definitions of data qualifiers (Appendix A)
- Field methods (Appendix B)
- The analytical data management and evaluation process (Appendix C)
- A VOC plume trend analysis (Appendix D)
- Analytical suites and results, analytical reports, and sample collection logs (SCLs) (Appendix E, on DVD included with this document)

1.1 Background

MDA C, also known as SWMU 50-009, is located within TA-50 at the head of Ten Site Canyon. TA-50 is bounded on the north by Effluent and Mortandad Canyons, on the east by the upper reaches of Ten Site Canyon, on the south by Twomile Canyon, and on the west by TA-55 (Figure 1.1-1).

MDA C is an inactive 11.8-acre landfill consisting of 6 solid waste disposal pits, a chemical disposal pit, and 108 shafts (Figure 1.1-2). The 7 pits range in depth from 12 ft to 25 ft below the original ground surface. The shafts range in depth from 4 ft to 25 ft below the original ground surface. From 1948 to 1974, these pits and shafts received solid waste containing hazardous substances and radioactive waste. Descriptions of the waste are included in the CME reports for MDA C (LANL 2012, 222830; N3B 2021, 701508). Pits were filled with dirt as a temporary cover as the pits were being filled, and with crushed tuff upon decommissioning. The shafts were sealed by being filled first with crushed tuff, followed by concrete. All shafts except Shafts 98 through 107 were unlined.

Pore-gas monitoring boreholes located within MDA C have been used to characterize the nature and extent of the subsurface vapor plume at the site since 2000. Figure 1.1-3 shows the pore-gas monitoring boreholes at MDA C. VOC concentrations in the subsurface plume decrease with depth from the plume maximum at approximately 250 ft below ground surface (bgs) to borehole total depth.

2.0 SCOPE OF ACTIVITIES

The first round of sampling at MDA C for calendar year 2021 occurred in late March to mid-April 2021. Because of contract delays, the second round of 2021 sampling occurred in late February to mid-March 2022. Two additional rounds of sampling are planned for calendar year 2022, which will return the monitoring program to the prescribed schedule. Table 2.0-1 lists the vapor-monitoring locations and their port depths, which correspond to sampling intervals for both sampling rounds. (For details of sampling protocols see “Sampling Subsurface Vapor,” N3B-SOP-ER-2008).

- Before sampling, pore gas was field-screened to measure concentrations of carbon dioxide (CO_2), oxygen (O_2), and VOCs. For the first round of sampling, field screening was performed using a MultiRAE multi-gas detector equipped with a 10.6-eV photoionization detector (PID) and O_2 sensors, and a ToxiRAE Pro CO_2 sensor. For the second round of sampling, field screening was performed using a MultiRAE multi-gas detector equipped with a 10.6-eV PID and RKI Instruments Eagle 2 gas detector. In each of the two sampling rounds, 80 ports in 18 vapor-monitoring boreholes were field screened and sampled (Figure 1.1-3).

- Vapor monitoring in the first round of sampling was conducted from March 23 through April 16, 2021, while vapor monitoring in the second round of sampling was conducted from February 28 through March 18, 2022. In both rounds, 80 samples were collected for VOC analysis, and an additional 80 samples were collected for tritium analysis. Both rounds of VOC sampling included 8 field duplicate (FD) samples and 8 field blank (FB) samples; the first round of tritium sampling included 7 FDs and 8 FBs, while the second round included 8 FDs and 8 FBs.
- After collection, samples were submitted to the Newport News Nuclear BWXT-Los Alamos, LLC (N3B) Sample Management Office for shipment to analytical laboratories per standard operating procedure (SOP) N3B-SOP-SDM-1102, “Sample Receiving and Shipping by the N3B Sample Management Office.” Vapor samples were submitted to off-site analytical laboratories in SUMMA canisters for VOC analysis using EPA Method TO-15, and in silica-gel columns for tritium analysis using EPA Method 906.
- All analytical data were subject to data validation reviews in accordance with N3B guidance and procedures. Field duplicate samples were collected at a minimum frequency of 1 for every 10 samples. The data validation process for reviews of MDA C pore-gas data is presented in Appendix C.

Waste generated from sampling activities was handled in accordance with the waste characterization strategy form for MDA C developed in accordance with N3B-AP-TRU-2150, “Waste Characterization Strategy Form.”

Further discussion of the field methods used for pore-gas field screening and sample collection is presented in Appendix B. Field chain-of-custody forms and SCLs are provided in Appendix E (on DVD included with this document).

The pore-gas field-screening results are discussed in section 4.0, and the pore-gas analytical results are discussed in section 5.0. Any deviations from the NMED-required vapor-monitoring plan (LANL 2011, 204370; NMED 2011, 208797) are discussed in the following section.

2.1 Deviations

During the first sampling round in the spring of 2021, a field duplicate for tritium analysis was not collected at one location because of a sampling field crew error (Table 2.1-1). In the second sampling round, samples for tritium analysis from 13 ports listed in Table 2.0-1 did not collect at least 5 g of moisture (Table 2.1-2).

3.0 REGULATORY CRITERIA

Vapor-phase contaminants are a potential source of groundwater contamination. VOCs present in the wastes disposed of at MDA C may volatilize and be released into subsurface media (e.g., soil, tuff, fractured rock) as vapors. These vapor-phase contaminants may potentially be transported through the subsurface to the water table. Once in contact with the water table, vapor-phase VOCs might dissolve into the water. For MDA C, monitoring of subsurface vapors is being performed to evaluate the potential for groundwater contamination, and, if necessary, to evaluate the need for corrective actions to prevent possible groundwater contamination.

Under the Consent Order, results of environmental investigations and monitoring are compared with SLs, which are media-specific contaminant concentrations that indicate the potential for unacceptable risk. The Consent Order specifies that SLs for soil and groundwater developed by NMED be used to evaluate soil and groundwater contamination. NMED has developed vapor-intrusion screening levels (VISLs) for evaluating the potential for vapor intrusion into buildings and subsequent exposure through inhalation. However, NMED's VISLs do not address potential absorption of vapors into groundwater. Because the Consent Order does not identify SLs for subsurface vapor as a potential groundwater contamination source, N3B developed Tier I pore-gas SLs to evaluate monitoring results.

The Tier I approach evaluates whether pore gas containing a VOC at the concentration detected in the vapor sample could contaminate groundwater above the groundwater SL. The approach assumes pore gas containing VOCs at the concentrations detected in the pore-gas sample is in hypothetical contact with the water table in sufficient quantity to dissolve into groundwater in accordance with Henry's law. If Tier I SLs are not exceeded, VOCs could not contaminate groundwater above cleanup levels even if the vapor plume were in direct contact with groundwater, and no further screening is necessary.

3.1 Tier I Groundwater Screening

The Tier I screening analysis evaluates the potential for contamination of groundwater by VOCs in pore gas. The analysis calculates the pore-gas concentration that would be in equilibrium with a groundwater concentration equal to the groundwater SL. The equilibrium between pore-gas and groundwater concentrations is described by Henry's law partitioning. If the maximum pore gas concentration is less than the pore-gas SL, then no potential exists for exceedances of groundwater cleanup levels.

Because there are no SLs for pore gas that address the potential for groundwater contamination, the screening evaluation is based on Section IX of the Consent Order, which describes the role of data screening in the corrective action process, and the Henry's law constant that describes the equilibrium between vapor and water concentrations. As described in Section IX.C of the Consent Order, the presence of contaminants at concentrations above SLs does not necessarily indicate that cleanup is required, but does indicate the need for additional risk evaluation. The source of Henry's law constants is the NMED "Risk Assessment Guidance for Site Investigations and Remediation Volume 1, Soil Screening Guidance for Human Health Risk Assessments," (NMED 2021, 701849) or the EPA regional screening tables (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables), whichever is lower for each individual VOC. The following dimensionless form of Henry's law constant is used:

$$H' = \frac{C_{air}}{C_{water}} \qquad \textbf{Equation 3.1-1}$$

Where H' = the dimensionless Henry's law constant,
C_{water} = the volumetric concentration of the contaminant in water, and
C_{air} = the volumetric concentration of the contaminant in air (or pore gas).

If the air concentration is equal to the pore-gas SL and the water concentration is equal to the groundwater SL, Equation 3.1-1 can be used to calculate the Tier I pore-gas screening level (SL_{pgI}) as follows:

$$SL_{pgI} = H' \times SL_{gw} \times 1000 \qquad \textbf{Equation 3.1-2}$$

Where SL_{pgI} = the Tier I pore-gas SL (μg/m^3),
SL_{gw} = the groundwater SL (μg/L), and
1000 = a conversion factor (to convert liters to cubic meters).

The Tier I methodology conservatively assumes groundwater is in equilibrium with the maximum detected concentration of a VOC in pore gas. This assumption would only be true if the maximum pore-gas concentration was immediately above the water table. At MDA C, the samples with maximum VOC concentrations are hundreds of feet above the water table, and VOC concentrations decrease with depth below the maximum concentrations due to diffusion (see cross-sections in Appendix D). The Tier I methodology also assumes that the equilibrium groundwater concentration is representative of the aquifer. In reality, this equilibrium exists only at the air-water interface, and water concentrations in the aquifer decrease with increasing distance from the interface due to mixing with clean water. Therefore, assuming equilibrium conditions conservatively overestimates the concentration in groundwater.

Identification of groundwater SLs follows the process in Section XXVI.D of the Consent Order for evaluating groundwater monitoring data. For each individual VOC, the lower concentration of the NMWQCC groundwater standard or EPA MCL is used as the groundwater SL. If an NMWQCC groundwater standard or an MCL has not been established for a specific substance for which toxicological information is published, the NMED SL for tap water is used as the groundwater SL. NMED tap water SLs are established for either a cancer- or noncancerous-risk type; for the cancer-risk type, SLs are based on a 10^{-5} excess cancer risk. This report was prepared using the 2021 “NMED Risk Assessment Guidance for Site Investigations and Remediation Volume 1, Soil Screening Guidance for Human Health Risk Assessments” (NMED 2021, 701849). If an NMED tap water SL has not been established for a specific substance for which toxicological information is published, the EPA regional SL for tap water (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables) is used. The EPA SLs are established for either a cancer- or noncancerous-risk type. For the cancer-risk type, the Consent Order specifies screening at a 10^{-5} excess cancer risk. The EPA tap water SLs are defined at 10^{-6} excess cancer risk; for these calculations, the EPA tap water SLs are multiplied by 10 to convert to 10^{-5} risk for equivalence with NMED SLs.

Results of these calculations are presented in Tables 3.1-1 through 3.1-3.

- Table 3.1-1 presents Tier I pore-gas SLs calculated using Equation 3.1-2.
- Table 3.1-2 presents the results of the Tier I screening for the first round of 2021 vapor-monitoring data. Four VOCs [1,4-dioxane, methylene chloride, 1,1,2-trichloroethane (1,1,2-TCA), and TCE] exceeded Tier I SLs.
- Table 3.1-3 presents the results of the Tier I screening for the second round of 2021 vapor-monitoring data. Three VOCs (methylene chloride, 1,1,2-TCA, and TCE) exceeded Tier I SLs.

An analysis of the MDA C data is presented in section 5.0 and Appendix D.

4.0 FIELD-SCREENING RESULTS

Before each sampling, field screening was performed in each borehole at the targeted sampling interval to ensure that CO_2, total VOC, and O_2 levels at each sampling port had stabilized at values representative of subsurface pore-gas conditions. The two rounds of subsurface vapor monitoring were conducted at the locations and depths described in section 2.0 and shown in Table 2.0-1. Before sampling, each interval was purged in accordance with SOP N3B-SOP-ER-2008, “Sampling Subsurface Vapor,” to ensure that pore gas was being collected. The pore gas from each port was then field-screened for CO_2, O_2, and VOCs using the detectors described in section 2.0. Each interval was purged until the readings stabilized. The stabilized CO_2, O_2, and VOC results from the two sampling rounds performed at each sampling location are shown in Appendix B.

5.0 ANALYTICAL DATA RESULTS

Subsurface vapor samples were collected at MDA C from March 23 through April 16, 2021, and from February 28 through March 18, 2022. VOC samples were submitted for laboratory analysis in SUMMA canisters using EPA Method TO-15, and tritium samples were submitted in silica-gel cartridges using EPA Method 906.0.

All analytical data were subject to validation reviews in accordance with N3B guidance and procedures. Appendix C presents a description of these data validation reviews for 2021 MDA C vapor-monitoring data. All validated analytical results from 2021 monitoring rounds are presented in Appendix E (on DVD included with this document). MDA C vapor-monitoring data are also available at the Intellus New Mexico website (http://www.intellusnm.com/).

5.1 2021 VOC Pore-Gas Results

Validated VOC analytical results from the first and second 2021 sampling rounds are presented in Tables 5.1-1 and 5.1-2, respectively. Thirty-one VOCs were detected in subsurface pore gas. The VOC screening evaluation identified four VOCs (1,4-dioxane, methylene chloride, 1,1,2-TCA, and TCE) in MDA C pore gas at concentrations exceeding Tier I pore-gas SLs. There were only five detections above Tier I pore-gas SLs at depths of 600 ft bgs or greater. TCE was detected at 600 ft bgs in boreholes 50-24813 and 50-603467 in both sampling rounds, and 1,4-dioxane was detected at 600 ft bgs in borehole 50-613185 in the first sampling round. This shows that the bulk of the plume remains above the Tschicoma Formation dacite (Tvt 2). No VOCs were detected above Tier I SLs in the deepest sampling ports (632.5 ft to 664.5 ft bgs) near the surface of the Tschicoma dacite.

TCE was detected in 79 of 80 samples during the first round and 75 of 80 samples during the second round and was the VOC detected at the highest concentration. TCE was detected at a concentration of 51,000 µg/m3 in borehole location 50-24813 at 241 ft bgs during the first round and at 50,000 µg/m3 in the same borehole location and depth during the second round.

The 2012 MDA C CME (LANL 2012, 222830) estimated the total mass of TCE in the subsurface to be in the range of 134 kg to 239 kg (equivalent to 24 to 43 gal. as liquid). Most of the TCE mass is present in the upper stratigraphic units (i.e., above the Cerro Toledo interval).

Data trends in the MDA C VOC plume for TCE were evaluated from vapor-monitoring activities from 2010 through 2022. VOC trends for TCE from 2010 through 2022 show that VOC concentrations at MDA C are consistent with a diffusive plume. The lateral extent of the plume has expanded slightly, but concentrations are decreasing slowly at the edges of the plume. Concentrations in the center of the plume reach their maximum values at depths of approximately 210–300 ft bgs, well below possible source areas, and appear to be decreasing slowly with time. The plume has not expanded vertically downward into the Guaje Pumice Bed and Tschicoma Formation dacite. Concentrations in the upper portion of the plume near the surface have decreased substantially. Concentrations in the source area show no signs of significant continued releases of VOCs.

5.2 2011–2022 VOC Pore-Gas Tritium Data

Tritium analytical data from the first and second sampling rounds are presented in Tables 5.2-1 and 5.2-2, respectively. Tritium was detected in 56 of 80 samples in the first round and 45 of 80 samples during the second round at activities ranging from 373 to 2.08 × 106 pCi/L. The maximum tritium activity in both rounds was detected at borehole location 50-603470 at a depth of 83 ft bgs from October 2011 through March 2022. Plots of tritium concentrations versus time in boreholes 50-603383 at 139 ft bgs and

50-603470 at 83 ft bgs are shown in Figure 5.2-1. Historically, a decrease in activities has been occurring at a rate consistent with tritium's half-life. However, beginning in early 2020, a possible increasing trend at borehole 50-603470 can be seen. Continued monitoring will confirm this trend.

5.3 Evaluation of VOC Pore-Gas Data as Related to Hypothetical Groundwater Contamination

The VOC results from the 2021 monitoring rounds were screened in a Tier I analysis to evaluate whether the concentrations of VOCs would be a potential source of groundwater contamination if the pore gas were in contact with the groundwater (section 3.1). If the maximum concentration of a particular VOC in pore gas is less than the appropriate pore-gas SL, then no potential exists for exceedances of groundwater cleanup levels (see section 3.1).

Equation 3.1-2 was used to calculate pore-gas SLs for VOCs detected in pore-gas samples at MDA C during the two sampling rounds. As shown in Table 3.1-1, 28 VOCs were detected for which there are MCLs, NMWQCC standards, or NMED or EPA regional tap water SLs.

Table 3.1-2 shows the four VOCs that exceeded Tier I SLs in the first sampling round, while Table 3.1-3 shows the three VOCs that exceeded Tier I SLs in the second sampling round.

- TCE, which exceeded the Tier I SL in 58 samples in the first round and 65 samples in the second round, is the only contaminant to consistently exceed its SL.
- Dioxane[1,4-] exceeded the Tier I SL in 1 sample in the first round.
- TCA[1,1,2-] exceed the Tier I SL in 1 sample in both rounds.
- Methylene chloride exceeded the Tier I SL in 2 samples in both rounds.

Because some Tier I SLs were exceeded, further screening was performed using the concentrations from the deepest pore-gas sample (i.e., the sample collected closest to the regional aquifer).

Results of this screening for the first sampling round follow:

- The deepest detection of 1,4-dioxane, at 600 ft bgs at borehole location 50-613185, exceeded the Tier I SL. This was the only detection of 1,4-dioxane in the first sampling round, and the reported concentration was an estimated value, which was greater than the method detection limit but less than the reporting detection limit (i.e., quantitation limit).
- The deepest detection of methylene chloride was 450 ft bgs at five locations (50-24813, 50-24822, 50-603470, 50-603471, and 50-603472). The maximum concentration from these five locations was less than the Tier I SL. The deepest detection of methylene chloride greater than the Tier I SL was 292 ft bgs at location 50-603472.
- The deepest detection of 1,1,2-TCA, at 203 ft bgs at location 50-603470, was less than the Tier I SL. The deepest detection of 1,1,2-TCA greater than the Tier I SL was 150 ft bgs at location 50-24813.
- The deepest detection of TCE, at 664.5 ft bgs at location 50-613184, was less than the Tier I SL. The deepest detection of TCE greater than the Tier I SL was at 600 ft bgs at locations 50-24813 and 50-603467. TCE was not detected above the Tier I SL in any of the deepest sampling ports (632.5 ft to 664.5 ft bgs) near the surface of the Tschicoma dacite.

Results of the screening for the second sampling round follow:

- The deepest detection of methylene chloride was 450 ft bgs at four locations (50-24813, 50-603470, 50-603471, and 50-603472); the maximum concentration from these four locations was less than the Tier I SL. The deepest detection of methylene chloride greater than the Tier I SL was 360 ft bgs at location 50-603471.
- The deepest detection of 1,1,2-TCA, at 241 ft bgs at location 50-24813, was less than the Tier I SL. The deepest detection of 1,1,2-TCA greater than the Tier I SL was 150 ft bgs at location 50-24813.
- The deepest detection of TCE was at 600 ft bgs at four locations (50-24813, 50-603467, 50-613184, and 50-613185); the maximum concentration from these four locations was less than the Tier I SL. The deepest detection of TCE greater than the Tier I SL was at 600 ft bgs at locations 50-24813 and 50-603467. TCE was not detected above the Tier I SL in any of the deepest sampling ports (632.5 ft to 664.5 ft bgs) near the surface of the Tschicoma dacite.

6.0 SUMMARY

The purpose of monitoring VOCs in pore gas at MDA C is to identify changes in the configuration of the VOC plumes, monitor changes in contaminant concentration distribution, and identify gaps in VOC data for future modeling or trend analyses.

The results from the two 2021 sampling rounds, combined with data collected between 2010 and 2022, are summarized as follows.

- VOC concentrations at MDA C are consistent with a diffusive plume.
- There is no evidence of increased VOC concentrations in the source region of MDA C, suggesting that leakage is not happening at a significant rate.
- VOC concentrations increase with depth from ground surface to the plume maximum at approximately 250 ft bgs and then decrease with depth to borehole total depth.
- TCE is the primary constituent above SLs and was detected in 79 of 80 samples in the first round and 75 of 80 samples in the second round. The remaining VOCs are below Tier I SLs, with the exception of 3 VOCs detected in 1 or 2 wells at concentrations generally less than a factor of 2 above their conservative SLs.
- VOC measurements over the last 12 yr show a decrease in contaminant concentrations near the source areas and a slight increase in contaminant concentrations at a distance from the source areas.
- VOC concentrations close to the source continue to migrate toward lower concentration areas at the edges of the plume. As this happens, concentration gradients will decrease and outward plume growth will slow over time.
- VOC concentrations measured below the central portion of each source area in the deepest ports near the Tschicoma Formation dacite are below groundwater SLs.
- Tritium was detected at concentrations ranging from 373 to 2,081,339 pCi/L, with a general decreasing trend consistent with radioactive decay.

7.0 REFERENCE AND MAP DATA SOURCES

7.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

LANL (Los Alamos National Laboratory), June 2011. "Phase III Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-11-3429, Los Alamos, New Mexico. (LANL 2011, 204370)

LANL (Los Alamos National Laboratory), September 2012. "Corrective Measures Evaluation Report for Material Disposal Area C, Solid Waste Management Unit 50-009 at Technical Area 50," Los Alamos National Laboratory document LA-UR-12-24944, Los Alamos, New Mexico. (LANL 2012, 222830)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), June 2021. "Corrective Measures Evaluation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2021-0177, Los Alamos, New Mexico. (N3B 2021, 701508)

NMED (New Mexico Environment Department), December 8, 2011. "Approval, Phase III Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 208797)

NMED (New Mexico Environment Department), November 2021. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments," Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2021, 701849)

7.1 Map Data Sources

Data sources used in original figures created for this report are described below and identified by legend title.

Legend Item	Data Source
Disposal pit/ impoundment	Waste Storage Features; LANL, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0032; 1:2,500 Scale Data; 13 April 2007.
Disposal shaft	Waste Storage Features; LANL, Environment and Remediation Support Services Division, GIS/Geotechnical Services Group, EP2007-0032; 1:2,500 Scale Data; 13 April 2007.
Elevation contour	Hypsography, 10, 20, & 100 Foot Contour Intervals; LANL, ENV Environmental Remediation and Surveillance Program; 1991.
Fence	Security and Industrial Fences and Gates; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
LANL boundary	LANL Areas Used and Occupied; LANL, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2008.
Material disposal area	Materials Disposal Areas; LANL, ENV Environmental Remediation and Surveillance Program; ER2004-0221; 1:2,500 Scale Data; 23 April 2004.
Paved road	Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
Structure	Structures; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
TA boundary	Technical Area Boundaries; LANL, Site Planning & Project Initiation Group, Infrastructure Planning Division; 19 September 2007.
Unpaved road	Dirt Road Arcs; LANL, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 10 September 2007.
Vapor-monitoring well	Point Feature Locations of the Environmental Restoration Project Database; LANL, Environment and Remediation Support Services Division, EP2007-0754; 30 November 2007.

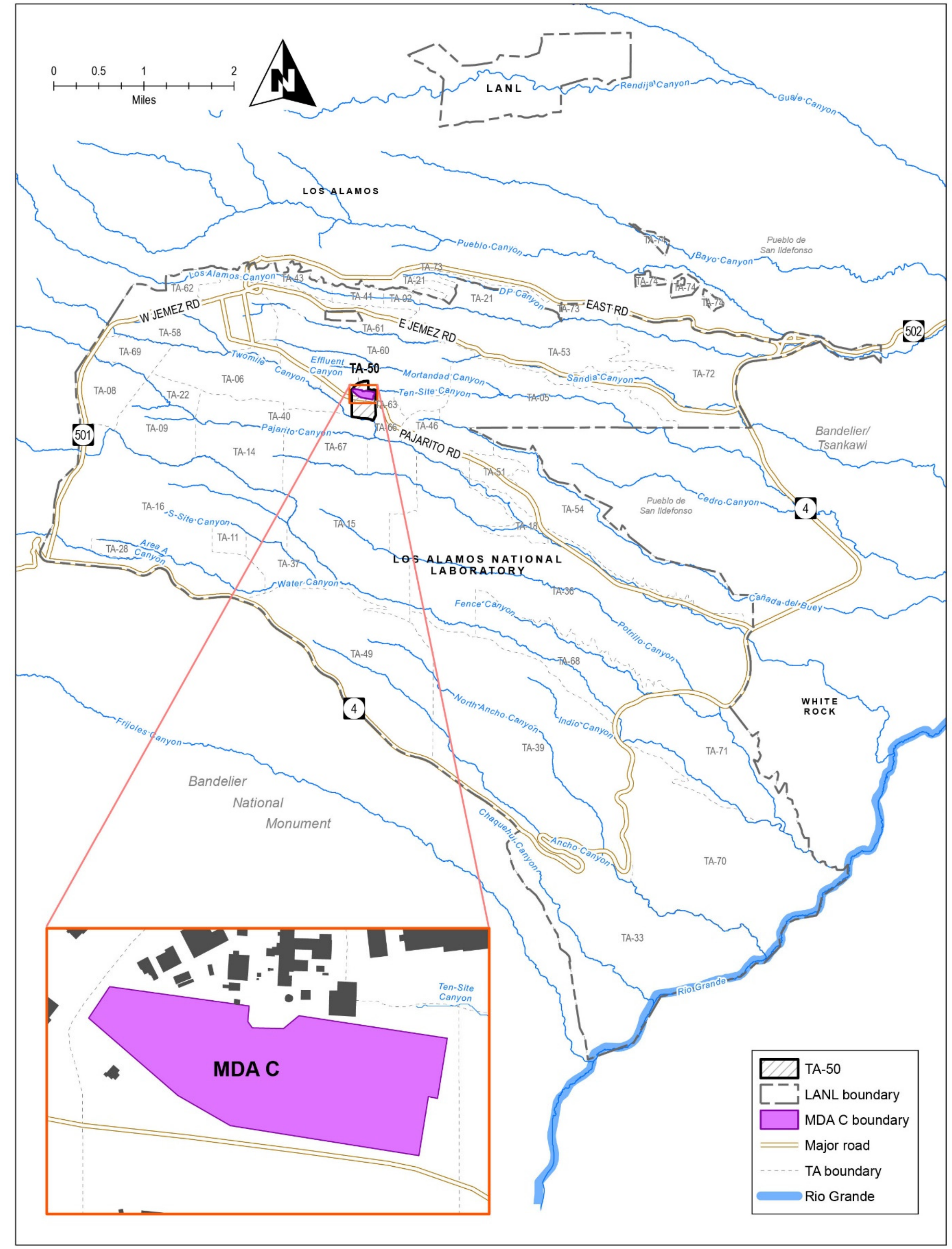

Figure 1.1-1 Location of MDA C in TA-50 with respect to Laboratory technical areas and surrounding landholdings

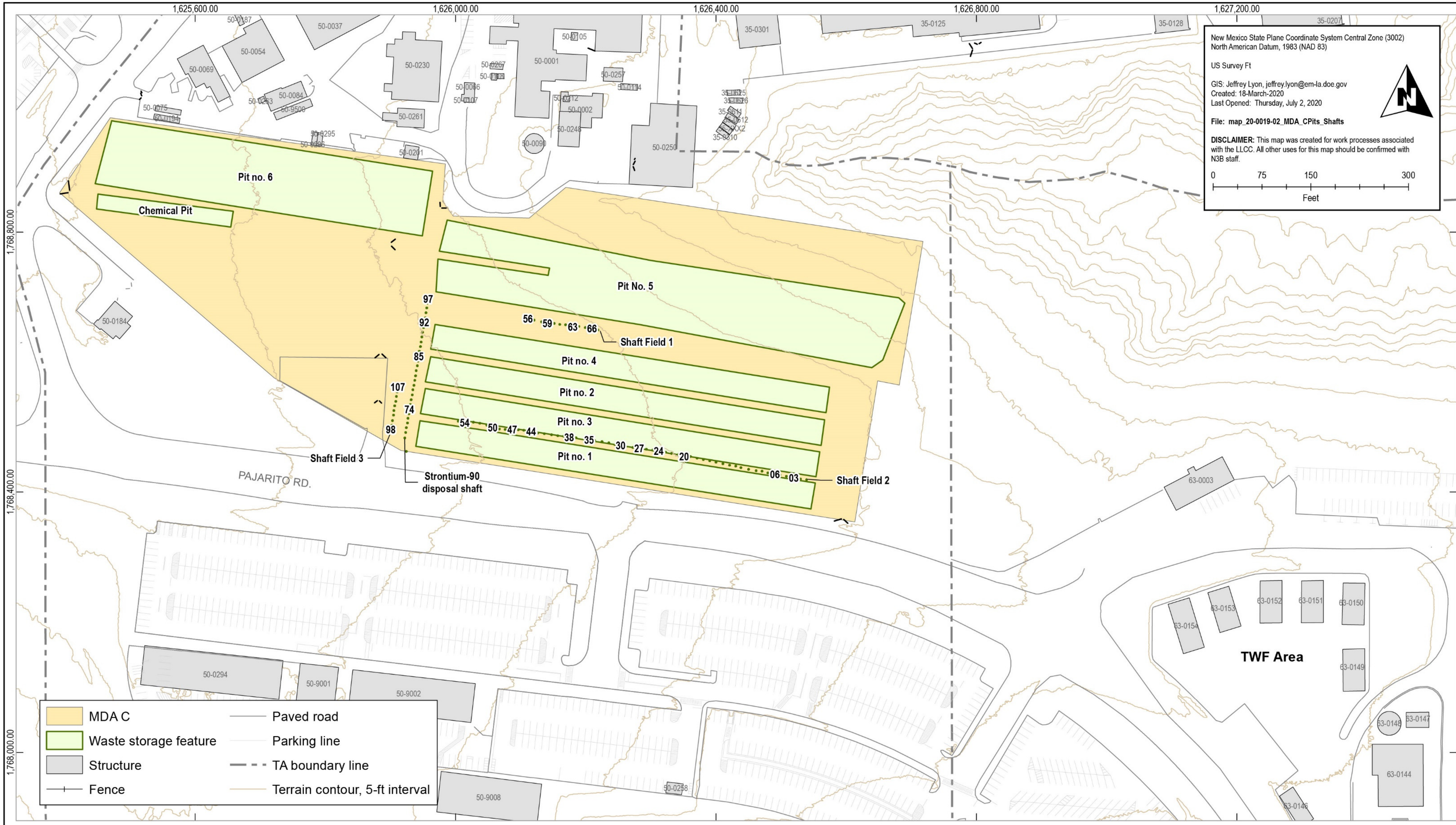

Figure 1.1-2 Location of MDA C pits and shafts

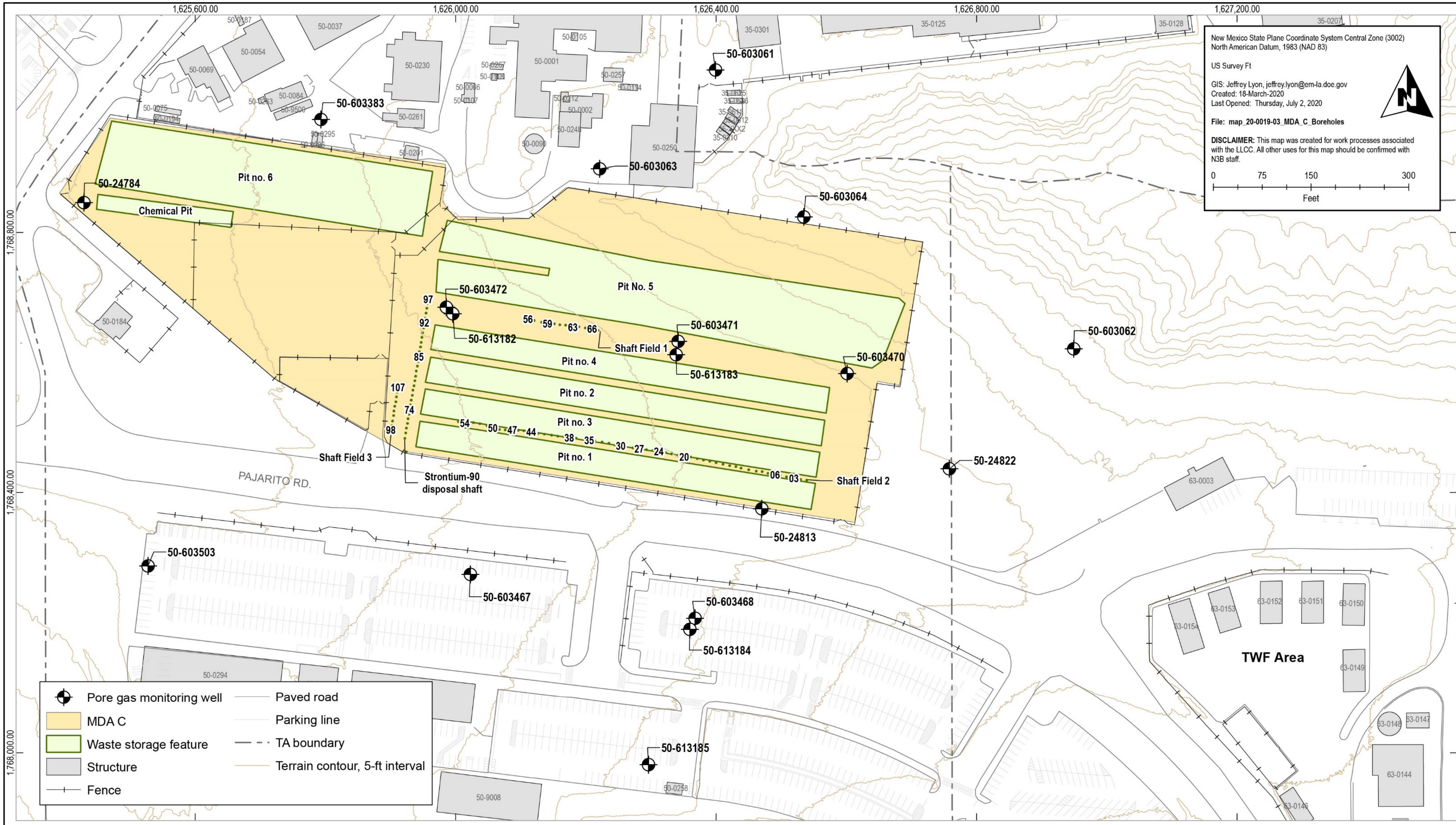

Figure 1.1-3 Location of MDA C monitoring boreholes

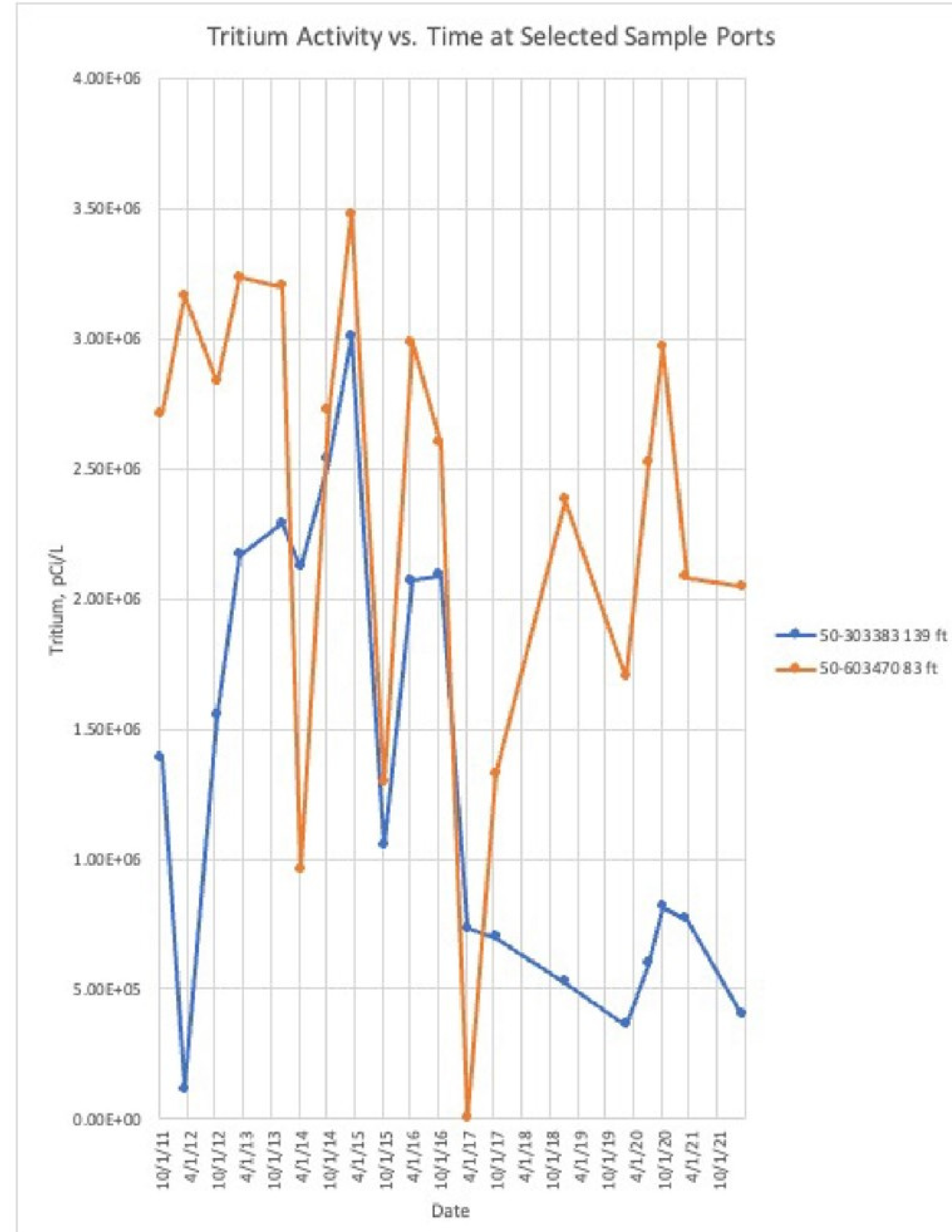

Figure 5.2-1 Tritium concentration versus time for boreholes 50-603470 and 50-603383

Table 2.0-1
2021 MDA C Subsurface Vapor-Monitoring Locations

Borehole	Screening Conducted	Sampling Port Depth (vertical depth in ft)
50-24784	Yes	155, 244, 362, 450
50-24813	Yes	25, 150, 241, 358, 450, 600
50-24822	Yes	25, 142, 235, 351, 450
50-603061	Yes	25, 128, 228, 347 ,450
50-603062	Yes	122, 217, 337, 450
50-603063	Yes	25, 128, 228, 347, 450
50-603064	Yes	113, 214, 332, 500
50-60383	Yes	26, 139, 244, 359, 450
50-603467	Yes	143, 244, 360, 500, 600
50-603468/50-613184	Yes	142, 233, 354, 403, 500, 600, 664.5
50-603470	Yes	83, 203, 278,351 450, 650
50-603471/50-613183	Yes	90, 209, 288, 360, 450, 550, 642.5, and unknown port depth*
50-603472/50-613182	Yes	27, 146, 292, 364, 450, 550, 632.5
50-603503	Yes	133, 237, 347, 450
50-613185	Yes	145, 235, 350, 450, 600

* The unknown port depth could be at 30 ft or it could be at 90 ft, and the one labeled 90 ft could actually be the 30-ft port. During sampling, the sampling team was unable to determine the actual depth, which is why both ports were sampled.

Table 2.1-1
First Round 2021 Sampling Requirements Deviations

Borehole	Port	Deviation	Cause
n/a*	n/a	A total of eight tritium field duplicate samples were planned for collection, however only seven tritium field duplicates were collected for analysis.	Sampling field crew error.

* n/a = Not applicable.

Table 2.1-2
Second Round 2021 Sampling Requirements Deviations

Borehole	Port	Deviation	Cause
50-603062	122	Samples for tritium analysis that did not collect at least 5 g of moisture.	Pore-gas moisture content was too low to collect 5 g of moisture within a reasonable time period.
	122 (FD)		
50-603064	113		
	113 (FD)		
	214		
	500		
50-60467	143		
50-603503	133		
	237		
	347		
	450		
50-613184	664.5		
50-613185	600		

Table 3.1-1
MDA C Tier I Pore-Gas Screening Calculations

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater SL (µg/L)	Source of Groundwater SL	Tier I Pore-Gas SL (µg/m³)
Acetone	0.00144	14,100	NMED Tap Water[b]	20,300
Benzene	0.228	5	NM GW[c]	1140
Bromodichloromethane	0.0869	1.34	NMED Tap Water	116
Carbon disulfide	0.59	810	NMED Tap Water	478,000
Carbon tetrachloride	1.13	5	NM GW	5650
Chlorobenzene	0.128	100	EPA MCL[d]	12,800
Chloroform	0.15	80	EPA MCL	12,000
Cyclohexane	6.1	13,000	EPA Tap Water[e]	79,300,000
Dichlorodifluoromethane	14.1	197	NMED Tap Water	2,780,000
Dichloroethane[1,1-]	0.23	25	NM GW	5750
Dichloroethane[1,2-]	0.0484	5	NM GW	242
Dichloroethene[1,1-]	1.07	7	NM GW	7490
Dichloroethene[cis-1,2-]	0.167	70	NM GW	11,700
Dichloropropane[1,2-]	0.116	5	NM GW	580
Dioxane[1,4-]	0.000197	4.59	NMED Tap Water	0.9
Ethanol	na[f]	na	na	na
Ethyltoluene[4-]	na	na	na	na

Table 3.1-1 (continued)

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater SL (µg/L)	Source of Groundwater SL	Tier I Pore-Gas SL (µg/m^3)
Heptane[n-]	81.8	6.0	EPA Tap Water	491,000
Hexane	73.8	319	NMED Tap Water	23,500,000
Isooctane	na	na	na	na
Methylene chloride	0.133	5	NM GW	665
Propanol[2-]	0.000331	410	EPA Tap Water	136
Tetrachloroethene	0.726	5	NM GW	3630
Toluene	0.272	1000	NM GW	272,000
Trichloro-1,2,2-trifluoroethane[1,1,2-]	21.6	55,000	NMED Tap Water	1,190,000,000
Trichloroethane[1,1,1-]	0.706	200	NM GW	141,000
Trichloroethane[1,1,2-]	0.0338	5	NM GW	169
Trichloroethene (TCE)	0.404	5	NM GW	2020
Trichlorofluoromethane	3.98	1140	NMED Tap Water	4,540,000
Trimethylbenzene[1,2,4-]	0.252	56	EPA Tap Water	14,100
Xylene[1,3-]+xylene[1,4-]	0.212	193[g]	NM Tap Water	40,900

Notes: Tier I screening concentration is the calculated concentration in pore gas exceeding groundwater standard derived from Equation 3.1-2.

[a] The source of Henry's law constant is the NMED "Risk Assessment Guidance for Site Investigations and Remediation Volume 1, Soil Screening Guidance for Human Health Risk Assessments" (NMED 2021, 701849) or the EPA regional screening tables (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).

[b] Screening level from NMED 2021, 701849.

[c] Screening level from 20.6.2.3103 New Mexico Administrative Code.

[d] Screening level from 40 Code of Federal Regulations 141 Subpart G.

[e] Screening level from https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

[f] na = Not available.

[g] Xylene mixture used as surrogate based on structural similarity.

Table 3.1-2
Screening of VOCs Detected in Pore Gas during First 2021 Sampling Round at MDA C

VOC	Maximum Pore-Gas Concentration (µg/m^3)	Tier I Pore-Gas SL (µg/m^3)	Tier I Potential for Groundwater Impact[a]
Acetone	57	20,300	No
Benzene	61	1140	No
Bromodichloromethane	13	116	No
Carbon disulfide	87	478,000	No
Carbon tetrachloride	1000	5650	No
Chlorobenzene	21	12,800	No
Chloroform	2200	12,000	No

Table 3.1-2 (continued)

VOC	Maximum Pore-Gas Concentration (µg/m^3)	Tier I Pore-Gas SL (µg/m^3)	Tier I Potential for Groundwater Impact[a]
Dichlorodifluoromethane	790	2,780,000	No
Dichloroethane[1,1-]	30	5750	No
Dichloroethane[1,2-]	130	242	No
Dichloroethene[1,1-]	990	7490	No
Dichloroethene[cis-1,2-]	400	11,700	No
Dichloropropane[1,2-]	360	580	No
Dioxane[1,4-]	43	0.9	Yes
Ethanol	110	na[b]	na
Ethyltoluene[4-]	5.9	na	na
Isooctane	20	na	na
Methylene chloride	1100	665	Yes
Tetrachloroethene	1500	3630	No
Toluene	5.6	272,000	No
Trichloro-1,2,2-trifluoroethane[1,1,2-]	18,000	1,190,000,000	No
Trichloroethane[1,1,1-]	2100	141,000	No
Trichloroethane[1,1,2-]	190	169	Yes
Trichloroethene	51,000	2020	Yes
Trichlorofluoromethane	42	4,540,000	No
Trimethylbenzene[1,2,4-]	7.4	14,100	No
Xylene[1,3-]+xylene[1,4-]	12	40,900	No

Notes: Tier I screening level is the calculated concentration in pore gas exceeding groundwater standard derived from Equation 3.1-2. Shaded cells indicate VOCs that did not pass the Tier I screen.

[a] If concentration of a VOC measured in a pore-gas sample is less than the pore-gas SL, the concentration of the VOC in groundwater will not exceed the groundwater SL, even if the VOC plume is in direct contact with groundwater.

[b] na = not available.

Table 3.1-3
Screening of VOCs Detected in Pore Gas during Second 2021 Sampling Round at MDA C

VOC	Maximum Pore-Gas Concentration (µg/m^3)	Tier I Pore-Gas SL (µg/m^3)	Tier I Potential for Groundwater Impact*
Acetone	78	20,300	No
Benzene	15	1140	No
Carbon tetrachloride	1000	5650	No
Chlorobenzene	22	12,800	No
Chloroform	2200	12,000	No

Table 3.1-3 (continued)

VOC	Maximum Pore-Gas Concentration (µg/m³)	Tier I Pore-Gas SL (µg/m³)	Tier I Potential for Groundwater Impact*
Cyclohexane	48	79,300,000	No
Dichlorodifluoromethane	790	2,780,000	No
Dichloroethane[1,1-]	65	5750	No
Dichloroethane[1,2-]	85	242	No
Dichloroethene[1,1-]	1100	7490	No
Dichloroethene[cis-1,2-]	440	11,700	No
Dichloropropane[1,2-]	400	580	No
Heptane[n-]	49	491,000	No
Hexane	49	23,500,000	No
Methylene chloride	1100	665	Yes
Propanol[2-]	110	136	No
Tetrachloroethene	1800	3630	No
Toluene	29	272,000	No
Trichloro-1,2,2-trifluoroethane[1,1,2-]	21,000	1,190,000,000	No
Trichloroethane[1,1,1-]	1900	141,000	No
Trichloroethane[1,1,2-]	190	169	Yes
Trichloroethene	50,000	2020	Yes
Trichlorofluoromethane	52	4,540,000	No

Notes: Tier I screening level is the calculated concentration in pore gas exceeding groundwater standard derived from Equation 3.1-2. Shaded cells indicate VOCs that did not pass the Tier I screen.

* If concentration of a VOC measured in a pore-gas sample is less than the pore-gas SL, the concentration of the VOC in groundwater will not exceed the groundwater SL, even if the VOC plume is in direct contact with groundwater.

Table 5.1-1
First Round 2021 VOC Pore-Gas Detected Results at MDA C (in µg/m^3)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Bromodichloromethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]	Dioxane[1,4-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**116**	**478,000**	**5650**	**12,800**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**	**0.9**
MD50-21-219735	50-24784 P155	155	—[b]	38	—	—	94	—	200	50 (J)	—	—	—	—	44 (J)	—
MD50-21-219737	50-24784 P244	244	—	18 (J)	—	—	200	—	110	100	—	—	—	12 (J)	35 (J)	—
MD50-21-219739	50-24784 P362	362	—	13 (J)	—	—	350	—	32 (J)	170	—	—	—	—	—	—
MD50-21-219741	50-24784 P450	450	—	—	—	—	140	—	—	79	—	—	—	—	—	—
MD50-21-219743	50-24813 P25	25	57 (J)	—	—	—	820	—	730	120	—	—	—	33 (J)	—	—
MD50-21-219745	50-24813 P150	150	—	—	—	—	940	—	2200	370	—	69 (J)	—	380	60 (J)	—
MD50-21-219747	50-24813 P241	241	—	—	—	—	1000	—	—	—	—	—	—	400	—	—
MD50-21-219749	50-24813 P358	358	—	—	—	—	750	—	—	91	—	—	—	170	—	—
MD50-21-219751	50-24813 P450	450	—	—	—	—	450	—	160	640	—	—	—	59 (J)	—	—
MD50-21-219753	50-24813 P600	600	—	—	—	—	61 (J)	—	—	310	—	—	—	—	—	—
MD50-21-219755	50-24822 P25	25	—	—	—	—	62 (J)	—	180	74	—	—	—	—	—	—
MD50-21-219757	50-24822 P142	142	—	7.7 (J)	—	—	210	—	460	350	—	—	—	—	—	—
MD50-21-219759	50-24822 P235	235	—	9.6 (J)	—	—	320	—	470	540	—	—	—	110	—	—
MD50-21-219761	50-24822 P351	351	—	8.3 (J)	—	—	250	—	160	500	—	—	—	40 (J)	—	—
MD50-21-219763	50-24822 P450	450	21 (J)	5.7 (J)	—	—	160	—	43 (J)	370	—	—	—	11 (J)	—	—
MD50-21-219765	50-603061 P25	25	—	—	—	—	—	—	—	230	—	—	130	—	—	—
MD50-21-219767	50-603061 P128	128	—	3.5 (J)	—	—	69 (J)	—	63	240	18 (J)	—	990	—	—	—
MD50-21-219769	50-603061 P228	228	—	—	—	—	75	—	50 (J)	170	13 (J)	—	800	12 (J)	—	—
MD50-21-219771	50-603061 P347	347	26 (J)	—	—	—	100	—	11 (J)	190	—	—	300	—	—	—
MD50-21-219773	50-603061 P450	450	—	—	—	—	58 (J)	—	—	120	—	—	99	—	—	—
MD50-21-219775	50-603062 P122	122	31 (J)	61	—	—	—	—	—	—	—	—	—	—	—	—
MD50-21-219777	50-603062 P217	217	—	—	—	—	17 (J)	—	18 (J)	64	—	—	—	—	—	—
MD50-21-219779	50-603062 P337	337	22 (J)	—	—	—	33 (J)	—	—	140	—	—	—	—	—	—
MD50-21-219781	50-603062 P450	450	—	60 (J)	—	—	—	—	—	59 (J)	—	—	—	—	—	—
MD50-21-219783	50-603063 P25	25	—	—	—	—	23 (J)	—	20 (J)	100	—	—	—	—	—	—

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Bromodichloromethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]	Dioxane[1,4-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**116**	**478,000**	**5650**	**12,800**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**	**0.9**
MD50-21-219785	50-603063 P128	128	—	—	—	—	88	—	100	170	30 (J)	—	110	16 (J)	—	—
MD50-21-219787	50-603063 P228	228	26 (J)	26 (J)	—	—	—	—	—	—	—	—	—	—	—	—
MD50-21-219789	50-603063 P347	347	23 (J)	—	—	—	180	—	190	200	16 (J)	—	52	33 (J)	—	—
MD50-21-219791	50-603063 P450	450	—	—	—	—	140	—	93	170	15 (J)	—	14 (J)	—	—	—
MD50-21-219793	50-603064 P113	113	—	5.4 (J)	—	—	140	—	590	270	—	—	360	130	43 (J)	—
MD50-21-219795	50-603064 P214	214	20 (J)	8.9 (J)	—	—	230	—	470	410	—	—	440	150	20 (J)	—
MD50-21-219797	50-603064 P332	332	—	—	—	—	140	—	73	330	—	—	140	23 (J)	—	—
MD50-21-219799	50-603064 P500	500	—	—	—	—	60 (J)	—	—	210	—	—	8.7 (J)	—	—	—
MD50-21-219801	50-603383 P26	26	—	—	—	—	100	—	78	240	—	—	26 (J)	—	60	—
MD50-21-219803	50-603383 P139	139	—	—	—	—	190	—	150	200	15 (J)	—	52	29 (J)	220	—
MD50-21-219805	50-603383 P244	244	—	—	—	—	340	—	170	280	21 (J)	—	55	44 (J)	360	—
MD50-21-219807	50-603383 P359	359	—	—	—	—	300	—	33 (J)	200	—	—	29 (J)	19 (J)	45 (J)	—
MD50-21-219809	50-603383 P450	450	—	—	—	—	210	—	12 (J)	200	—	—	12 (J)	—	—	—
MD50-21-219811	50-603467 P143	143	—	—	—	—	410	21 (J)	400	260	—	—	—	100	—	—
MD50-21-219813	50-603467 P244	244	—	5.4 (J)	—	—	460	—	540	220	—	—	—	110	21 (J)	—
MD50-21-219815	50-603467 P360	360	—	—	—	—	400	—	240	200	—	—	—	59	—	—
MD50-21-219817	50-603467 P500	500	—	—	—	—	210	—	54	200	—	—	—	—	—	—
MD50-21-219819	50-603467 P600	600	—	—	—	—	140	—	47 (J)	120	—	—	—	—	—	—
MD50-21-219821	50-603468 P142	142	—	—	—	—	150	—	230	100	—	—	—	52	—	—
MD50-21-219823	50-603468 P233	233	—	—	—	—	450	—	500	300	—	—	—	130	—	—
MD50-21-219825	50-603468 P354	354	—	5.4 (J)	—	—	470	—	360	420	—	—	—	100	—	—
MD50-21-219827	50-603468 P403	403	—	5.7 (J)	—	—	450	—	230	470	—	—	—	80	—	—
MD50-21-219829	50-603470 P83	83	—	—	—	—	180	—	730	120	—	22 (J)	—	83	24 (J)	—
MD50-21-219831	50-603470 P203	203	—	11 (J)	—	—	400	—	1000	490	—	20 (J)	36 (J)	250	36 (J)	—
MD50-21-219833	50-603470 P278	278	—	13 (J)	—	—	510	—	830	690	—	—	38 (J)	250	28 (J)	—
MD50-21-219835	50-603470 P351	351	—	10 (J)	—	—	430	—	370	690	—	—	27 (J)	130	—	—
MD50-21-219837	50-603470 P450	450	—	5.4 (J)	—	—	270	—	93	540	—	—	14 (J)	40 (J)	—	—
MD50-21-219839	50-603470 P650	650	20 (J)	—	—	—	10 (J)	—	—	48 (J)	—	—	—	—	—	—
MD50-21-219841	50-603471	UNK[c]	—	—	—	—	1000	—	1400	170 (J)	—	130 (J)	—	160 (J)	—	—

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Bromodichloromethane	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]	Dioxane[1,4-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**116**	**478,000**	**5650**	**12,800**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**	**0.9**
MD50-21-219843	50-603471 P90	90	—	—	—	—	620	—	1200	79 (J)	—	93 (J)	—	91 (J)	35 (J)	—
MD50-21-219845	50-603471 P209	209	—	10 (J)	—	—	620	—	780	590	—	17 (J)	21 (J)	210	—	—
MD50-21-219847	50-603471 P288	288	—	—	—	—	750	—	1200	590	—	40 (J)	—	280	74 (J)	—
MD50-21-219849	50-603471 P360	360	—	—	—	—	600	—	590	590	—	—	—	180	—	—
MD50-21-219851	50-603471 P450	450	—	—	—	—	410	—	360	450	—	—	—	83 (J)	—	—
MD50-21-219853	50-603472 P27	27	—	—	—	—	28 (J)	—	160	25 (J)	—	—	—	—	—	—
MD50-21-219855	50-603472 P146	146	43 (J)	—	—	—	200	—	450	130	—	40 (J)	—	80	79	—
MD50-21-219857	50-603472 P292	292	—	10 (J)	—	—	470	—	590	340	—	15 (J)	13 (J)	150	65	—
MD50-21-219859	50-603472 P364	364	—	—	—	—	410	—	210	350	—	—	—	63	—	—
MD50-21-219861	50-603472 P450	450	—	—	—	—	300	—	78	310	—	—	—	25 (J)	—	—
MD50-21-219863	50-603503 P133	133	—	11 (J)	—	—	17 (J)	—	28 (J)	—	—	—	—	—	—	—
MD50-21-219865	50-603503 P237	237	—	—	—	—	—	—	16 (J)	—	—	—	—	—	—	—
MD50-21-219867	50-603503 P347	347	—	—	—	—	26 (J)	—	—	20 (J)	—	—	—	—	—	—
MD50-21-219869	50-603503 P450	450	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MD50-21-219871	50-613182 P550	550	—	—	—	—	190	—	12 (J)	270	—	—	—	—	—	—
MD50-21-219873	50-613182 P632.5	632.5	—	—	13 (J)	—	—	—	21 (J)	—	—	—	—	—	—	—
MD50-21-219875	50-613183 P550	550	52 (J)	—	—	—	200	—	—	370	—	—	—	—	—	—
MD50-21-219879	50-613184 P500	500	—	—	—	—	180	—	16 (J)	260	—	—	—	—	—	—
MD50-21-219881	50-613184 P600	600	—	—	—	—	75 (J)	—	—	140	—	—	—	—	—	—
MD50-21-219883	50-613184 P664.5	664.5	36 (J)	—	—	—	17 (J)	—	—	29 (J)	—	—	—	—	—	—
MD50-21-219885	50-613185 P145	145	21 (J)	—	—	—	82	—	88	79	—	—	—	—	—	—
MD50-21-219887	50-613185 P235	235	31 (J)	—	—	—	140	—	93	130	—	—	—	32 (J)	—	—
MD50-21-219889	50-613185 P350	350	23 (J)	—	—	—	110	—	21 (J)	140	—	—	—	—	—	—
MD50-21-219891	50-613185 P450	450	26 (J)	—	—	—	82	—	—	110	—	—	—	—	—	—
MD50-21-219893	50-613185 P600	600	—	—	—	87 (J)	30 (J)	—	—	59	—	—	—	—	—	43 (J)

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Ethanol	Ethyltoluene[4-]	Isooctane	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane	Trinethylbenzene[1,2,4-]	Xylene[1,3-]+Xylene[1,4-]
Tier I Pore Gas SL[a]			**na[d]**	**na**	**na**	**665**	**136**	**3630**	**272,000**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**	**14,100**	**40,900**
MD50-21-219735	50-24784 P155	155	—	—	—	—	22 (J)	1100	—	80 (J)	19 (J)	—	1900	—	—	—
MD50-21-219737	50-24784 P244	244	—	—	—	—	—	1400	—	92	25 (J)	—	3000	14 (J)	—	—
MD50-21-219739	50-24784 P362	362	—	—	—	—	—	1300	—	63 (J)	17 (J)	—	2800	19 (J)	—	—
MD50-21-219741	50-24784 P450	450	—	—	—	—	—	310	—	—	—	—	700	7.9 (J)	—	—
MD50-21-219743	50-24813 P25	25	—	—	—	—	—	300	—	—	—	35 (J)	8600	—	—	—
MD50-21-219745	50-24813 P150	150	—	—	—	220 (J)	—	430	—	—	—	190	31,000	—	—	—
MD50-21-219747	50-24813 P241	241	—	—	—	290 (J)	—	600	—	64 (J)	—	—	51,000	28 (J)	—	—
MD50-21-219749	50-24813 P358	358	—	—	—	—	—	500	—	53 (J)	—	—	47,000	36 (J)	—	—
MD50-21-219751	50-24813 P450	450	—	—	—	130 (J)	—	260	—	—	—	—	30,000	33 (J)	—	—
MD50-21-219753	50-24813 P600	600	—	—	—	—	—	—	—	—	—	—	4100	—	—	—
MD50-21-219755	50-24822 P25	25	—	—	—	—	—	81	—	37 (J)	7.1 (J)	—	5000	—	—	—
MD50-21-219757	50-24822 P142	142	—	—	—	130 (J)	—	190	—	170	27 (J)	—	20,000	15 (J)	—	—
MD50-21-219759	50-24822 P235	235	—	—	—	230	—	220	—	200	31 (J)	—	32,000	27 (J)	—	—
MD50-21-219761	50-24822 P351	351	—	—	—	100 (J)	—	100	—	130	9.8 (J)	—	20,000	26 (J)	—	—
MD50-21-219763	50-24822 P450	450	—	—	—	28 (J)	—	60 (J)	—	58 (J)	—	—	10,000	20 (J)	—	—
MD50-21-219765	50-603061 P25	25	—	—	20 (J)	—	—	110	—	6200	600	—	500	11 (J)	—	—
MD50-21-219767	50-603061 P128	128	—	—	—	—	—	300	—	18,000	2100	—	2300	22 (J)	—	—
MD50-21-219769	50-603061 P228	228	—	5.9 (J)	—	29 (J)	—	170	—	11,000	2000	—	2900	19 (J)	—	12 (J)
MD50-21-219771	50-603061 P347	347	—	—	—	—	24 (J)	110	—	7400	470	—	1800	19 (J)	—	—
MD50-21-219773	50-603061 P450	450	—	—	—	—	—	36 (J)	—	2500	60 (J)	—	970	14 (J)	—	—
MD50-21-219775	50-603062 P122	122	110 (J)	—	—	—	120 (J)	—	—	—	—	—	860	—	—	—
MD50-21-219777	50-603062 P217	217	—	—	—	—	—	—	—	180	14 (J)	—	2300	—	—	—
MD50-21-219779	50-603062 P337	337	—	—	—	—	—	—	—	220	6 (J)	—	2200	—	—	—
MD50-21-219781	50-603062 P450	450	—	—	—	—	61 (J)	—	—	—	—	—	810	—	—	—
MD50-21-219783	50-603063 P25	25	—	—	—	—	—	240	5.6 (J)	1400	130	—	970	12 (J)	—	—

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Ethanol	Ethyltoluene[4-]	Isooctane	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane	Trinethylbenzene[1,2,4-]	Xylene[1,3-]+Xylene[1,4-]
Tier I Pore Gas SL[a]			**na[d]**	**na**	**na**	**665**	**136**	**3630**	**272,000**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**	**14,100**	**40,900**
MD50-21-219785	50-603063 P128	128	—	—	—	—	—	480	—	2000	250	—	4400	22 (J)	—	—
MD50-21-219787	50-603063 P228	228	—	—	—	—	—	28 (J)	—	—	—	—	180	—	—	—
MD50-21-219789	50-603063 P347	347	—	—	—	—	—	530	—	1000	52 (J)	—	10,000	20 (J)	—	—
MD50-21-219791	50-603063 P450	450	—	—	—	—	—	260	—	280	9.8 (J)	—	6400	16 (J)	—	—
MD50-21-219793	50-603064 P113	113	—	—	—	80 (J)	—	460	—	6600	1200	—	18,000	22 (J)	—	—
MD50-21-219795	50-603064 P214	214	—	—	—	290	—	410	—	8400	1300	—	25,000	36 (J)	—	—
MD50-21-219797	50-603064 P332	332	—	—	—	28 (J)	—	160	—	3400	170	—	10,000	31 (J)	—	—
MD50-21-219799	50-603064 P500	500	—	—	—	—	—	33 (J)	—	400	—	—	1900	19 (J)	—	—
MD50-21-219801	50-603383 P26	26	—	—	—	—	—	600	—	740	87	—	2100	32 (J)	—	—
MD50-21-219803	50-603383 P139	139	—	—	—	30 (J)	—	1100	—	1000	130	—	4400	36 (J)	—	—
MD50-21-219805	50-603383 P244	244	—	—	—	59 (J)	—	1000	—	840	130	—	6400	40 (J)	—	—
MD50-21-219807	50-603383 P359	359	—	—	—	—	—	630	—	400	44 (J)	—	3400	29 (J)	—	—
MD50-21-219809	50-603383 P450	450	—	—	—	—	—	360	—	160	15 (J)	—	1800	22 (J)	—	—
MD50-21-219811	50-603467 P143	143	—	—	—	—	—	500	—	—	—	—	21,000	19 (J)	—	—
MD50-21-219813	50-603467 P244	244	—	—	—	49 (J)	—	560	—	—	7.1 (J)	—	21,000	15 (J)	—	—
MD50-21-219815	50-603467 P360	360	—	—	—	—	—	520	—	—	—	—	19,000	19 (J)	—	—
MD50-21-219817	50-603467 P500	500	—	—	—	—	—	250	—	—	—	—	8600	14 (J)	—	—
MD50-21-219819	50-603467 P600	600	—	—	—	—	—	170	—	—	—	—	5200	—	—	—
MD50-21-219821	50-603468 P142	142	—	—	—	—	—	160	—	—	—	—	8100	—	—	—
MD50-21-219823	50-603468 P233	233	—	—	—	340	—	350	—	—	—	—	24,000	12 (J)	—	—
MD50-21-219825	50-603468 P354	354	—	—	—	220	—	330	—	—	—	—	24,000	17 (J)	7.4 (J)	—
MD50-21-219827	50-603468 P403	403	—	—	—	180	—	280	—	—	—	—	22,000	20 (J)	—	—
MD50-21-219829	50-603470 P83	83	—	—	—	34 (J)	—	630	—	220	38 (J)	93	9700	—	—	—
MD50-21-219831	50-603470 P203	203	—	—	—	420	—	500	—	840	100	20 (J)	35,000	24 (J)	—	—
MD50-21-219833	50-603470 P278	278	—	—	—	590	—	500	—	1000	87	—	46,000	40 (J)	—	—
MD50-21-219835	50-603470 P351	351	—	—	—	330	—	310	—	840	48 (J)	—	40,000	42 (J)	—	—
MD50-21-219837	50-603470 P450	450	—	—	—	87 (J)	—	180	—	320	10 (J)	—	18,000	31 (J)	—	—
MD50-21-219839	50-603470 P650	650	—	—	—	—	—	—	—	—	—	—	150	—	—	—
MD50-21-219841	50-603471	UNK	—	—	—	150 (J)	—	750	—	300 (J)	45 (J)	71 (J)	17,000	—	—	—

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Ethanol	Ethyltoluene[4-]	Isooctane	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane	Trinethylbenzene[1,2,4-]	Xylene[1,3-]+Xylene[1,4-]
Tier I Pore Gas SL[a]			**na[d]**	**na**	**na**	**665**	**136**	**3630**	**272,000**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**	**14,100**	**40,900**
MD50-21-219843	50-603471 P90	90	—	—	—	—	—	580	—	200 (J)	26 (J)	54 (J)	12,000	—	—	—
MD50-21-219845	50-603471 P209	209	—	—	—	76 (J)	—	810	—	370	24 (J)	—	41,000	38 (J)	—	—
MD50-21-219847	50-603471 P288	288	—	—	—	1100	—	880	—	540	34 (J)	—	45,000	40 (J)	—	—
MD50-21-219849	50-603471 P360	360	—	—	—	620	—	750	—	410	16 (J)	—	40,000	33 (J)	—	—
MD50-21-219851	50-603471 P450	450	—	—	—	220 (J)	—	570	—	180 (J)	—	—	28,000	32 (J)	—	—
MD50-21-219855	50-603472 P146	146	—	—	—	310	23 (J)	640	—	120	24 (J)	—	12,000	14 (J)	—	—
MD50-21-219853	50-603472 P27	27	—	—	—	—	—	310	—	32 (J)	31 (J)	—	1900	—	—	—
MD50-21-219857	50-603472 P292	292	—	—	—	700	—	1500	—	180	33 (J)	—	30,000	39 (J)	—	—
MD50-21-219859	50-603472 P364	364	—	—	—	290	—	1100	—	110	14 (J)	—	20,000	36 (J)	—	—
MD50-21-219861	50-603472 P450	450	—	—	—	100 (J)	—	670	—	42 (J)	6.5 (J)	—	13,000	29 (J)	—	—
MD50-21-219863	50-603503 P133	133	—	—	—	—	—	120	—	28 (J)	—	—	500	—	—	—
MD50-21-219865	50-603503 P237	237	—	—	—	—	—	43 (J)	—	—	—	—	460	—	—	—
MD50-21-219867	50-603503 P347	347	—	—	—	—	—	81 (J)	—	—	—	—	860	—	—	—
MD50-21-219869	50-603503 P450	450	—	—	—	—	—	31 (J)	—	—	—	—	330	—	—	—
MD50-21-219871	50-613182 P550	550	—	—	—	—	—	260	—	—	—	—	4500	20 (J)	—	—
MD50-21-219873	50-613182 P632.5	632.5	—	—	—	—	—	—	—	—	—	—	59	—	—	—
MD50-21-219875	50-613183 P550	550	—	—	—	—	—	150 (J)	—	—	—	—	5000	—	—	—
MD50-21-219879	50-613184 P500	500	—	—	—	—	—	95	—	—	—	—	5900	16 (J)	—	—
MD50-21-219881	50-613184 P600	600	—	—	—	—	—	22 (J)	—	—	—	—	1300	—	—	—
MD50-21-219883	50-613184 P664.5	664.5	—	—	—	—	—	—	—	—	—	—	250	—	—	—
MD50-21-219885	50-613185 P145	145	—	—	—	—	—	70 (J)	—	—	—	—	4000	—	—	—
MD50-21-219887	50-613185 P235	235	—	—	—	59 (J)	—	110	—	—	—	—	7000	—	—	—
MD50-21-219889	50-613185 P350	350	—	—	—	—	—	75 (J)	—	—	—	—	4200	—	—	—
MD50-21-219891	50-613185 P450	450	—	—	—	—	—	34 (J)	—	—	—	—	2100	—	—	—
MD50-21-219893	50-613185 P600	600	—	—	—	—	—	—	—	—	—	—	280	—	—	—

Notes: Results are in μg/m^3. Data qualifiers are defined in Appendix A. Shading denotes concentrations greater than Tier I SLs.

[a] Tier I SLs are from Table 3.1-1.

[b] — = Not detected.

[c] Port depth is not labeled and is unknown.

[d] na = Not available.

Table 5.1-2
Second Round 2021 VOC Pore-Gas Detected Results at MDA C (in μg/m³)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	Cyclohexane	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]	Heptane[n-]	Hexane
Tier I Pore Gas SL[a]			**20,300**	**1140**	**5650**	**12,800**	**12,000**	**79,300,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**	**491,000**	**23,500,000**
MD50-22-241827	50-24784 P155	155	—[b]	—	150	—	310	33 (J)	79	—	—	—	—	65	49	49
MD50-22-241829	50-24784 P244	244	—	—	240	—	130	—	130	—	—	—	—	41 (J)	—	—
MD50-22-241831	50-24784 P362	362	—	—	320	—	29 (J)	—	180	—	—	—	—	—	—	—
MD50-22-241833	50-24784 P450	450	—	—	270	—	—	—	170	—	—	—	—	—	—	—
MD50-22-241839	50-24813 P25	25	—	—	750	—	680	—	110	—	—	—	25 (J)	—	—	—
MD50-22-241835	50-24813 P150	150	—	—	1000	—	2200	—	400	—	65	—	400	55	—	—
MD50-22-241837	50-24813 P241	241	—	—	1000	—	1600	—	740	—	23 (J)	—	440	42 (J)	—	—
MD50-22-241841	50-24813 P358	358	—	—	530	—	400	—	690	—	—	—	200	—	—	—
MD50-22-241843	50-24813 P450	450	—	—	400	—	160	—	590	—	—	—	48	—	—	—
MD50-22-241845	50-24813 P600	600	—	—	160	—	—	—	370	—	—	—	—	—	—	—
MD50-22-241851	50-24822 P25	25	—	—	69 (J)	—	190	—	100	—	—	—	—	—	—	—
MD50-22-241847	50-24822 P142	142	—	—	250	—	500	—	460	—	—	—	130	—	—	—
MD50-22-241849	50-24822 P235	235	—	—	330	—	480	—	590	—	—	—	130	—	—	—
MD50-22-241853	50-24822 P351	351	—	—	260	—	170	—	590	—	—	—	63 (J)	—	—	—
MD50-22-241855	50-24822 P450	450	—	—	180	—	54 (J)	—	450	—	—	—	—	—	—	—
MD50-22-241861	50-603061 P25	25	45 (J)	—	—	—	16 (J)	—	200	—	—	110	—	—	—	—
MD50-22-241857	50-603061 P128	128	64 (J)	—	60 (J)	—	68	—	250	17 (J)	—	1100	—	—	—	—
MD50-22-241859	50-603061 P228	228	—	—	58 (J)	—	38 (J)	—	120	12 (J)	—	710	—	—	—	—
MD50-22-241863	50-603061 P347	347	—	—	110	—	—	—	230	—	—	370	—	—	—	—
MD50-22-241865	50-603061 P450	450	—	—	62 (J)	—	14 (J)	—	100	—	—	110	—	—	—	—
MD50-22-241867	50-603062 P122	122	—	—	26 (J)	—	44 (J)	—	110	—	—	—	—	—	—	—
MD50-22-241869	50-603062 P217	217	—	—	38 (J)	—	37 (J)	—	170	—	—	15 (J)	—	—	—	—
MD50-22-241871	50-603062 P337	337	—	—	42 (J)	—	—	—	210	—	—	—	—	—	—	—
MD50-22-241873	50-603062 P450	450	—	—	23 (J)	—	—	—	150	—	—	—	—	—	—	—
MD50-22-241879	50-603063 P25	25	—	—	18 (J)	—	30 (J)	—	100	—	—	—	—	—	—	—
MD50-22-241875	50-603063 P128	128	—	—	160	—	280	—	300	57	—	190	29 (J)	—	—	—
MD50-22-241877	50-603063 P228	228	—	—	300	—	500	—	440	65	—	300	120	45 (J)	—	—
MD50-22-241881	50-603063 P347	347	—	—	290	—	310	—	360	20 (J)	—	83	55	—	—	—

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	Cyclohexane	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]	Heptane[n-]	Hexane
Tier I Pore Gas SL[a]			**20,300**	**1140**	**5650**	**12,800**	**12,000**	**79,300,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**	**491,000**	**23,500,000**
MD50-22-241883	50-603063 P450	450	43 (J)	—	100	—	78	—	160	—	—	9.9 (J)	—	—	—	—
MD50-22-241885	50-603064 P113	113	—	—	140	—	630	—	310	—	—	400	180	36 (J)	—	—
MD50-22-241887	50-603064 P214	214	—	—	330	—	630	—	640	—	—	710	220	—	—	—
MD50-22-241889	50-603064 P332	332	—	—	230	—	100	—	540	—	—	210	40 (J)	—	—	—
MD50-22-241891	50-603064 P500	500	—	—	75	—	—	—	260	—	—	15 (J)	—	—	—	—
MD50-22-241897	50-603383 P26	26	—	—	38 (J)	—	28 (J)	—	89	—	—	—	—	—	—	—
MD50-22-241893	50-603383 P139	139	—	—	170	—	160	—	240	15 (J)	—	67	37 (J)	190	—	—
MD50-22-241895	50-603383 P244	244	—	—	330	—	190	48	310	27 (J)	—	75	55	400	—	—
MD50-22-241899	50-603383 P359	359	—	—	300	—	48 (J)	—	260	—	—	33 (J)	21 (J)	55	—	—
MD50-22-241901	50-603383 P450	450	78 (J)	—	130	—	—	—	120	—	—	—	—	—	—	—
MD50-22-241903	50-603467 P143	143	—	—	300	—	440	—	210	—	—	—	83	—	—	—
MD50-22-241905	50-603467 P244	244	—	—	470	—	540	—	260	—	—	—	130	16 (J)	—	—
MD50-22-241907	50-603467 P360	360	—	—	470 (J)	—	400 (J)	—	270	—	—	—	99	—	—	—
MD50-22-241909	50-603467 P500	500	—	—	280	—	78	—	260	—	—	—	24 (J)	—	—	—
MD50-22-241911	50-603467 P600	600	—	—	160	—	59	—	170	—	—	—	—	—	—	—
MD50-22-241913	50-603468 P142	142	—	—	190	—	380	—	47 (J)	—	—	—	91	—	—	—
MD50-22-241915	50-603468 P233	233	—	—	470	22 (J)	480	—	450	—	—	—	150	—	—	—
MD50-22-241917	50-603468 P354	354	—	—	470	—	330	—	500	—	—	—	100	—	—	—
MD50-22-241919	50-603468 P403	403	—	—	390	—	220	—	540	—	—	—	91	—	—	—
MD50-22-241921	50-603470 P203	203	—	6.4 (J)	360	—	930	—	540	—	20 (J)	38 (J)	260	32 (J)	—	—
MD50-22-241923	50-603470 P278	278	50 (J)	9.3 (J)	350	—	540	—	500	—	—	29 (J)	190	16 (J)	—	—
MD50-22-241925	50-603470 P351	351	—	9.6 (J)	400	—	380	—	790	—	—	35 (J)	140	—	—	—
MD50-22-241927	50-603470 P450	450	—	—	180	—	59	—	360	—	—	—	22 (J)	—	—	—
MD50-22-241929	50-603470 P650	650	—	—	—	—	—	—	54	—	—	—	—	—	—	—
MD50-22-241931	50-603470 P83	83	—	—	180	—	630	—	120	—	—	—	80	22 (J)	—	—
MD50-22-244103	50-603471	UNK[c]	—	—	880	—	1100	—	160	—	80	15 (J)	200	60	—	—
MD50-22-241941	50-603471 P90	90	—	—	600	—	1000	—	94	—	85	—	95	36 (J)	—	—
MD50-22-241933	50-603471 P209	209	—	8.3 (J)	600	—	930	15 (J)	380	—	44	23 (J)	260	55	—	—
MD50-22-241935	50-603471 P288	288	—	15 (J)	820	—	1200	—	640	—	34 (J)	32 (J)	340	60	—	—

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	Cyclohexane	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]	Heptane[n-]	Hexane
Tier I Pore Gas SL[a]			**20,300**	**1140**	**5650**	**12,800**	**12,000**	**79,300,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**	**491,000**	**23,500,000**
MD50-22-241937	50-603471 P360	360	—	13 (J)	750	—	680	—	740	—	—	27 (J)	230	30 (J)	—	—
MD50-22-241939	50-603471 P450	450	—	—	470	—	410	—	500	—	—	14 (J)	120	—	—	—
MD50-22-241943	50-603472 P146	146	—	—	180	—	430	—	130	—	32 (J)	9.9 (J)	87	69	—	—
MD50-22-241945	50-603472 P27	27	—	—	—	—	93	—	29 (J)	—	—	—	—	—	—	—
MD50-22-241947	50-603472 P292	292	—	—	280	—	330	—	220	—	—	—	95	35 (J)	—	—
MD50-22-241949	50-603472 P364	364	—	—	350	—	190	—	340	—	—	—	63 (J)	—	—	—
MD50-22-241951	50-603472 P450	450	—	—	270	—	68	—	300	—	—	—	23 (J)	—	—	—
MD50-22-241953	50-603503 P133	133	—	—	50 (J)	—	88	—	45 (J)	—	—	—	—	25 (J)	—	—
MD50-22-241955	50-603503 P237	237	—	—	88	—	120	—	74	—	—	—	28 (J)	44 (J)	—	—
MD50-22-241957	50-603503 P347	347	—	—	140	—	68	—	100	—	—	—	19 (J)	—	—	—
MD50-22-241959	50-603503 P450	450	—	—	94	—	26 (J)	—	84	—	—	—	—	—	—	—
MD50-22-241961	50-613182 P550	550	45 (J)	—	160	—	—	—	260	—	—	—	—	—	—	—
MD50-22-241963	50-613182 P632.5	632.5	—	—	—	—	21 (J)	—	—	—	—	—	—	—	—	—
MD50-22-241967	50-613183 P550	550	—	—	200	—	—	—	450	—	—	—	—	—	—	—
MD50-22-241971	50-613184 P500	500	—	—	170	—	—	—	300	—	—	—	—	—	—	—
MD50-22-241973	50-613184 P600	600	—	—	75 (J)	—	—	—	200	—	—	—	—	—	—	—
MD50-22-241975	50-613184 P664.5	664.5	—	—	—	—	—	—	40 (J)	—	—	—	—	—	—	—
MD50-22-241977	50-613185 P145	145	—	—	82	—	78	—	100	—	—	—	—	—	—	—
MD50-22-241979	50-613185 P235	235	—	—	150 (J)	—	110 (J)	—	100 (J)	—	—	—	—	—	—	—
MD50-22-241981	50-613185 P350	350	—	—	110	—	22 (J)	—	200	—	—	—	—	—	—	—
MD50-22-241983	50-613185 P450	450	—	—	82 (J)	—	—	—	170	—	—	—	—	—	—	—
MD50-22-241985	50-613185 P600	600	—	—	27 (J)	—	—	—	94	—	—	—	—	—	—	—

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane
Tier I Pore Gas SL[a]			**665**	**136**	**3630**	**272,000**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**
MD50-22-241827	50-24784 P155	155	—	—	1800	—	110	28 (J)	—	3000 (J+)	—
MD50-22-241829	50-24784 P244	244	—	—	1800	—	100	29 (J)	—	3500 (J+)	—
MD50-22-241831	50-24784 P362	362	—	—	1000	—	69 (J)	14 (J)	—	2800 (J+)	—
MD50-22-241833	50-24784 P450	450	—	—	620	—	21 (J)	—	—	1300 (J+)	—
MD50-22-241839	50-24813 P25	25	—	—	310	—	—	—	35 (J)	7500	—
MD50-22-241835	50-24813 P150	150	140 (J)	—	490	—	34 (J)	—	190	31,000	—
MD50-22-241837	50-24813 P241	241	310	—	630	—	64 (J)	14 (J)	30 (J)	50,000	30 (J)
MD50-22-241841	50-24813 P358	358	42 (J)	—	380	—	56 (J)	—	—	35,000	26 (J)
MD50-22-241843	50-24813 P450	450	100 (J)	—	260	—	20 (J)	—	—	24,000	30 (J)
MD50-22-241845	50-24813 P600	600	—	—	56 (J)	—	—	—	—	4600 (J+)	—
MD50-22-241851	50-24822 P25	25	—	—	95 (J)	—	37 (J)	—	—	5200	—
MD50-22-241847	50-24822 P142	142	150 (J)	—	210	—	190	33 (J)	—	20,000	—
MD50-22-241849	50-24822 P235	235	230	—	240	—	240	38 (J)	—	31,000	—
MD50-22-241853	50-24822 P351	351	110 (J)	—	160	—	150 (J)	—	—	21,000	—
MD50-22-241855	50-24822 P450	450	—	—	95 (J)	—	75 (J)	—	—	11,000	—
MD50-22-241861	50-603061 P25	25	—	27 (J)	130	—	4900	510	—	470	—
MD50-22-241857	50-603061 P128	128	—	—	320	—	21,000	1900	—	2400	—
MD50-22-241859	50-603061 P228	228	—	—	170	—	8400	1300	—	2400	—
MD50-22-241863	50-603061 P347	347	—	—	160	—	8000	500	—	2200	—
MD50-22-241865	50-603061 P450	450	—	—	60 (J)	—	2700	76	—	1000	—
MD50-22-241867	50-603062 P122	122	—	—	43 (J)	29 (J)	300 (J)	26 (J)	—	3700 (J)	—
MD50-22-241869	50-603062 P217	217	—	57 (J)	37 (J)	8.3 (J)	430	35 (J)	—	4400	—
MD50-22-241871	50-603062 P337	337	—	—	—	—	290	—	—	2700	—
MD50-22-241873	50-603062 P450	450	—	—	—	—	92	—	—	1000	—
MD50-22-241879	50-603063 P25	25	—	—	280	—	1200	130	—	970	—
MD50-22-241875	50-603063 P128	128	—	—	880	—	3500	410	—	7500	—
MD50-22-241877	50-603063 P228	228	—	57 (J)	1000	—	4400	500	—	20,000	45 (J)
MD50-22-241881	50-603063 P347	347	—	—	880	—	2000	82	—	17,000	36 (J)

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane
Tier I Pore Gas SL[a]			**665**	**136**	**3630**	**272,000**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**
MD50-22-241883	50-603063 P450	450	—	86 (J)	250	—	260	—	—	4500	—
MD50-22-241885	50-603064 P113	113	83 (J)	—	500	—	6500	1100	—	18,000	—
MD50-22-241887	50-603064 P214	214	380	—	670	—	11,000	1700	—	35,000	50 (J)
MD50-22-241889	50-603064 P332	332	—	—	250	—	4700	250	—	20,000	49 (J)
MD50-22-241891	50-603064 P500	500	—	—	52 (J)	—	510 (J+)	—	—	2400 (J+)	—
MD50-22-241897	50-603383 P26	26	—	—	310	—	210	35 (J)	—	750	—
MD50-22-241893	50-603383 P139	139	—	—	1100	—	1200	130	—	4100	38 (J)
MD50-22-241895	50-603383 P244	244	70 (J)	—	1500	—	920	140	—	6400	38 (J)
MD50-22-241899	50-603383 P359	359	—	—	700	—	500	53 (J)	—	3400	30 (J)
MD50-22-241901	50-603383 P450	450	—	100 (J)	260	—	120	—	—	1200	—
MD50-22-241903	50-603467 P143	143	—	—	360	—	—	—	17 (J)	12,000 (J+)	—
MD50-22-241905	50-603467 P244	244	—	—	580	—	—	—	—	19,000	—
MD50-22-241907	50-603467 P360	360	—	—	660 (J)	—	—	—	—	23,000 (J)	—
MD50-22-241909	50-603467 P500	500	—	—	300	19 (J)	—	—	—	10,000 (J+)	—
MD50-22-241911	50-603467 P600	600	—	—	210	—	—	—	—	6400 (J+)	—
MD50-22-241913	50-603468 P142	142	—	—	220	—	—	—	—	15,000	—
MD50-22-241915	50-603468 P233	233	310	—	300	—	—	—	—	21,000	—
MD50-22-241917	50-603468 P354	354	200	—	310	—	—	—	—	23,000	—
MD50-22-241919	50-603468 P403	403	160 (J)	—	300	—	—	—	—	20,000	—
MD50-22-241931	50-603470 P83	83	—	—	660	—	250	37 (J)	93	9100	—
MD50-22-241921	50-603470 P203	203	420	—	500	—	800	100	17 (J)	33,000	—
MD50-22-241923	50-603470 P278	278	420	110 (J)	370	—	800	54 (J)	—	31,000	—
MD50-22-241925	50-603470 P351	351	300	—	390	—	1000	40 (J)	—	40,000	39 (J)
MD50-22-241927	50-603470 P450	450	59 (J)	—	120	—	290	—	—	12,000	—
MD50-22-241929	50-603470 P650	650	—	—	—	—	—	—	—	—	—
MD50-22-244103	50-603471	UNK	120 (J)	—	810	—	300	29 (J)	82	20,000	—
MD50-22-241941	50-603471 P90	90	—	—	600	—	130	23 (J)	53 (J)	11,000	—
MD50-22-241933	50-603471 P209	209	560	52 (J)	700	9.4 (J)	440	35 (J)	20 (J)	29,000	28 (J)
MD50-22-241935	50-603471 P288	288	1100	—	1100	—	660	41 (J)	—	48,000	44 (J)

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane
Tier I Pore Gas SL[a]			**665**	**136**	**3630**	**272,000**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**
MD50-22-241937	50-603471 P360	360	700	—	950	—	610	29 (J)	—	44,000	52 (J)
MD50-22-241939	50-603471 P450	450	200	—	750	—	250	15 (J)	—	31,000	44 (J)
MD50-22-241943	50-603472 P146	146	270	—	750	—	100	19 (J)	29 (J)	10,000	—
MD50-22-241945	50-603472 P27	27	—	—	—	—	—	—	—	—	—
MD50-22-241947	50-603472 P292	292	420	—	880	—	110	21 (J)	—	20,000	—
MD50-22-241949	50-603472 P364	364	250	—	950	—	92 (J)	—	—	17,000	—
MD50-22-241951	50-603472 P450	450	80 (J)	—	590	—	44 (J)	—	—	10,000	30 (J)
MD50-22-241953	50-603503 P133	133	—	—	310	—	76 (J)	—	—	1800 (J+)	—
MD50-22-241955	50-603503 P237	237	94 (J)	—	450	—	44 (J)	14 (J)	—	4500 (J+)	—
MD50-22-241957	50-603503 P347	347	56 (J)	23 (J)	490	—	25 (J)	—	—	5000 (J+)	—
MD50-22-241959	50-603503 P450	450	—	—	280	—	—	—	—	3000 (J+)	—
MD50-22-241961	50-613182 P550	550	—	29 (J)	200	—	—	—	—	3900 (J+)	—
MD50-22-241963	50-613182 P632.5	632.5	—	—	22 (J)	—	—	—	—	—	—
MD50-22-241967	50-613183 P550	550	—	—	100	—	34 (J)	—	—	5000 (J+)	30 (J)
MD50-22-241971	50-613184 P500	500	—	—	81 (J)	—	—	—	—	5000 (J+)	—
MD50-22-241973	50-613184 P600	600	—	—	26 (J)	—	—	—	—	1500 (J+)	—
MD50-22-241975	50-613184 P664.5	664.5	—	—	—	—	—	—	—	—	—
MD50-22-241977	50-613185 P145	145	—	—	75 (J)	—	—	—	—	4000 (J+)	—
MD50-22-241979	50-613185 P235	235	—	—	120 (J)	—	—	—	—	7000 (J+)	—
MD50-22-241981	50-613185 P350	350	—	—	81 (J)	—	—	—	—	4900 (J+)	—
MD50-22-241983	50-613185 P450	450	—	—	47 (J)	—	—	—	—	2400 (J+)	—
MD50-22-241985	50-613185 P600	600	—	—	—	—	—	—	—	340 (J+)	—

Notes: Results are in µg/m^3. Data qualifiers are defined in Appendix A. Shading denotes concentrations greater than Tier I SLs.

[a] Tier I SLs are from Table 3.1-1.

[b] — = Not detected.

[c] Port depth is not labeled and is unknown.

Table 5.2-1
Detected Tritium Results in Pore-Gas Samples at
MDA C Vapor-Monitoring Wells, First 2021 Sampling Round

Field Sample ID	Location ID	Depth (ft bgs)	Analytical Result (pCi/L)
MD50-21-219734	50-24784 P155	155	1790
MD50-21-219736	50-24784 P244	244	1705
MD50-21-219738	50-24784 P362	362	1624
MD50-21-219740	50-24784 P450	450	599
MD50-21-219742	50-24813 P25	25	654
MD50-21-219744	50-24813 P150	150	68,990
MD50-21-219746	50-24813 P241	241	1735
MD50-21-219748	50-24813 P358	358	796
MD50-21-219750	50-24813 P450	450	840
MD50-21-219754	50-24822 P25	25	755
MD50-21-219756	50-24822 P142	142	624
MD50-21-219758	50-24822 P235	235	707
MD50-21-219760	50-24822 P351	351	581
MD50-21-219766	50-603061 P128	128	660
MD50-21-219768	50-603061 P228	228	1531
MD50-21-219770	50-603061 P347	347	1600
MD50-21-219782	50-603063 P25	25	794 (J+)
MD50-21-219784	50-603063 P128	128	2355 (J+)
MD50-21-219786	50-603063 P228	228	3236 (J+)
MD50-21-219788	50-603063 P347	347	1674 (J+)
MD50-21-219790	50-603063 P450	450	1224 (J+)
MD50-21-219792	50-603064 P113	113	750 (J)
MD50-21-219794	50-603064 P214	214	1713 (J)
MD50-21-219796	50-603064 P332	332	1929 (J)
MD50-21-219800	50-603383 P26	26	209,607
MD50-21-219802	50-603383 P139	139	768,564
MD50-21-219804	50-603383 P244	244	440,894
MD50-21-219806	50-603383 P359	359	392,589
MD50-21-219808	50-603383 P450	450	223,225
MD50-21-219810	50-603467 P143	143	44,322
MD50-21-219812	50-603467 P244	244	785 (J)
MD50-21-219814	50-603467 P360	360	774 (J)
MD50-21-219816	50-603467 P500	500	643 (J)
MD50-21-219818	50-603467 P600	600	29,250 (J)
MD50-21-219826	50-603468 P403	403	694
MD50-21-219830	50-603470 P203	203	2061

Table 5.2-1 (continued)

Field Sample ID	Location ID	Depth (ft bgs)	Analytical Result (pCi/L)
MD50-21-219832	50-603470 P278	278	978
MD50-21-219834	50-603470 P351	351	1063
MD50-21-219836	50-603470 P450	450	784
MD50-21-219828	50-603470 P83	83	2,081,340
MD50-21-219840	50-603471	UNK*	32,761
MD50-21-219842	50-603471 P90	90	10,172
MD50-21-219844	50-603471 P209	209	12,439
MD50-21-219846	50-603471 P288	288	15,003
MD50-21-219848	50-603471 P360	360	7946
MD50-21-219850	50-603471 P450	450	6076
MD50-21-219852	50-603472 P27	27	1,389,130
MD50-21-219854	50-603472 P146	146	2582
MD50-21-219856	50-603472 P292	292	3402
MD50-21-219858	50-603472 P364	364	1710
MD50-21-219860	50-603472 P450	450	1187
MD50-21-219862	50-603503 P133	133	748
MD50-21-219864	50-603503 P237	237	982
MD50-21-219866	50-603503 P347	347	636
MD50-21-219870	50-613182 P550	550	937
MD50-21-219872	50-613182 P632.5	632.5	7436 (J)

Note: Data qualifiers are defined in Appendix A.

* Port depth is not labeled and is unknown.

Table 5.2-2
Detected Tritium Results in Pore-Gas Samples at
MDA C Vapor-Monitoring Wells, Second 2021 Sampling Round

Field Sample ID	Location ID	Depth (ft bgs)	Analytical Result (pCi/L)
MD50-22-241826	50-24784 P155	155	2729
MD50-22-241828	50-24784 P244	244	2880
MD50-22-241830	50-24784 P362	362	1985
MD50-22-241832	50-24784 P450	450	910
MD50-22-241838	50-24813 P25	25	23,474
MD50-22-241834	50-24813 P150	150	61,463
MD50-22-241836	50-24813 P241	2411	1693
MD50-22-241840	50-24813 P358	358	835
MD50-22-241842	50-24813 P450	450	373
MD50-22-241850	50-24822 P25	25	35,471
MD50-22-241858	50-603061 P228	228	1497

Table 5.2-2 (continued)

Field Sample ID	Location ID	Depth (ft bgs)	Analytical Result (pCi/L)
MD50-22-241862	50-603061 P347	347	1179
MD50-22-241866	50-603062 P122	122	126,226
MD50-22-241874	50-603063 P128	128	1170
MD50-22-241876	50-603063 P228	228	1459
MD50-22-241880	50-603063 P347	347	950
MD50-22-241882	50-603063 P450	450	1388
MD50-22-241884	50-603064 P113	113	1117
MD50-22-241886	50-603064 P214	214	979
MD50-22-241896	50-603383 P26	26	111,124
MD50-22-241892	50-603383 P139	139	399,323
MD50-22-241894	50-603383 P244	244	264,004
MD50-22-241898	50-603383 P359	359	247,157
MD50-22-241900	50-603383 P450	450	220,329
MD50-22-241930	50-603470 P83	83	2,048,140
MD50-22-241920	50-603470 P203	203	1314
MD50-22-241922	50-603470 P278	278	934
MD50-22-241924	50-603470 P351	351	829
MD50-22-241926	50-603470 P450	450	49,463
MD50-22-244102	50-603471	UNK*	12,212
MD50-22-241940	50-603471 P90	90	12,289
MD50-22-241932	50-603471 P209	209	12,311
MD50-22-241934	50-603471 P288	288	9166
MD50-22-241936	50-603471 P360	360	8293
MD50-22-241938	50-603471 P450	450	20,525
MD50-22-241944	50-603472 P27	27	1,522,860
MD50-22-241942	50-603472 P146	146	992
MD50-22-241946	50-603472 P292	292	16,466
MD50-22-241948	50-603472 P364	364	1606
MD50-22-241950	50-603472 P450	450	4841
MD50-22-241952	50-603503 P133	133	21,770
MD50-22-241954	50-603503 P237	237	1538
MD50-22-241960	50-613182 P550	550	7542
MD50-22-241962	50-613182 P632.5	632.5	1685
MD50-22-241982	50-613185 P450	450	1158

Note: Data qualifiers are defined in Appendix A.

* Port depth is not labeled and is unknown.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review (EIM module)
bgs	below ground surface
CME	corrective measures evaluation
COC	chain of custody
Consent Order	Compliance Order on Consent
DOE	Department of Energy (U.S.)
DQO	data quality objective
EDD	electronic data deliverable
EIM	Environmental Information Management (database)
EPA	Environmental Protection Agency (U.S.)
FB	field blank
FD	field duplicate
FY	fiscal year
IR	infrared
LANL	Los Alamos National Laboratory
MCL	maximum contaminant level
MDA	material disposal area
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
PID	photoionization detector
PMR	periodic monitoring report
QA	quality assurance
QC	quality control
SCL	sample collection log
SL	screening level
slpm	standard liters per minute
SMO	Sample Management Office
SOP	standard operating procedure
SWMU	solid waste management unit
TA	technical area
TCA	trichloroethane
TCE	trichloroethene
Triad	Triad National Security, LLC
VISL	vapor-intrusion screening level
VOC	volatile organic compound

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.47	Acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million by mass (ppmm)
micrograms per gram (μg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million by volume (ppmv)
degrees Celsius (°C)	9/5 (then + 32)	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control parameters.

Appendix B

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes the field methods used during the calendar year 2021 sampling activities at Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, in Technical Area 50 at Los Alamos National Laboratory (LANL or the Laboratory). All activities were conducted in accordance with the applicable standard operating procedures (SOPs), quality procedures, and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) implementation and procedural requirements. Table B-1.0-1 summarizes the field methods used, Table B-1.0-2 lists the applicable procedures, and Table B-1.0-3 lists the field-screening data.

B-2.0 FIELD METHODS

All work was conducted according to site-specific health and safety documents and an integrated work document. The field activities conducted according to SOPs are discussed below.

B-2.1 Volatile Organic Compound Pore-Gas Sample Collection

Samples were collected following purging of the sample port and stabilization of field parameters. Monitored field parameters include static pressure of port, purge flow rate, and concentrations of carbon dioxide (CO_2), oxygen (O_2), and volatile organic compounds (VOCs). Each port was purged for a minimum of 10 min, after which O_2, CO_2, and VOCs were monitored to ensure levels were stable before sample collection. A minimum sample purge flow rate of 0.3 slpm is required for collection. Once stabilization occurred, the sample was collected in a SUMMA canister. Field crews noted the pressure measurements of the SUMMA canister before and after the sample was taken and noted all field parameters. Field duplicates (FDs) were collected immediately following the original sample. FD and field blank (FB) samples were collected at a minimum frequency of 1 for every 10 samples. FBs were collected with the use of ultrapure (≥99.9%) nitrogen gas. Information was recorded on the appropriate sample collection logs (SCLs). Field chain-of-custody (COC) forms and SCLs are provided in Appendix E (on CD included with this document).

All samples were collected in accordance with the current version of N3B-SOP-ER-2008, “Sampling Subsurface Vapor.”

All samples were submitted to the N3B Sample Management Office (SMO) for processing and transport to off-site contract analytical laboratories.

B-2.2 Volatile Organic Compound Pore-Gas Field Screening

All VOC samples were field-screened in accordance with the current version of N3B-SOP-ER-2008, which covers the use of the MultiRAE IR multi-gas monitor. All field-screening results were recorded on the appropriate SCLs in the field logbook and/or in tables, and are provided in Appendix E (on CD included with this document).

Before each sampling event, each sampling port was purged of stagnant air and then field-screened to measure concentrations of CO_2, O_2, and VOCs. For the first round of sampling, field screening was performed using a MultiRAE multi-gas detector equipped with a 10.6-eV photoionization detector (PID) and O_2 sensors and a ToxiRAE Pro CO_2 sensor. For the second round of sampling, field screening was performed using a MultiRAE multi-gas detector equipped with a 10.6-eV PID and RKI Instruments Eagle 2 gas detector. Each rented instrument was shipped factory-calibrated to the subcontractor, and the calibration was checked daily.

Oxygen values should be near the zero point for O_2. The CO_2 reading should be near zero. Readings deviating from the zero points for O_2 and CO_2 may be because of subsurface conditions or a need for calibration.

Drawing sufficient air from the sampling interval through the line ensured that the vapor-sample tubing was purged of stagnant air. Every sampling activity included a purge cycle to ensure that the sample collected was representative of the subsurface air at depth.

The CO_2, O_2, and VOC screening levels are presented in Table B.1-0.3.

B-2.3 Tritium Pore-Gas Sample Collection

All tritium samples were collected in accordance with the current version of N3B-SOP-ER-2008. Silica gel was the medium used to collect water vapor intended for tritium analysis from pore gas. A pore-gas sample was pulled through a canister of silica gel (silica-gel column), and the sample information was recorded on the appropriate SCL (included in Appendix E [on CD included with this document]). The moisture was analyzed for tritium by liquid scintillation counting. Silica-gel column FD and FB samples were planned to be collected at a frequency of 1 per every 10 samples in accordance with the current version of N3B-SOP-SDM-1100, “Sample Containers, Preservation, and Field Quality Control.” During the first round of sampling, one of eight tritium FD samples planned for collection was not collected due to a sampling field crew error, leaving only seven FDs collected. FBs for tritium analysis were collected by filling a silica-gel column with approximately 5 g of distilled water. All required FB samples were collected per N3B-SOP-SDM-1100.

Silica gel was prepared for sampling by drying at a temperature above 100°C. Drying removes moisture from the silica gel but does not remove bound water, as demonstrated when the bound water percentage in each batch of silica gel is measured. Before sample collection, the amount of silica gel used in each sample was weighed (typically about 135 g). The sample canister with silica gel was also weighed before sampling. N3B-SOP-ER-2008 requires that at least 5 g of moisture be collected. After sampling, the sample canister with silica gel was weighed again to verify that at least 5 g of water vapor had been collected.

The sample (canister plus silica gel) was shipped to the analytical laboratory where it was weighed again. The silica gel was emptied into a distillation apparatus and heated to 110°C to drive moisture from the silica gel. This moisture was collected and analyzed for tritium by liquid scintillation. The analytical laboratory also weighed the empty canister and calculated the percent moisture of the sample by dividing the mass of collected moisture by the calculated weight of the wet silica gel. The value of the tritium activity and the calculated percent moisture were reported to N3B in the analytical data package and the electronic data deliverable.

Table B-1.0-1
Summary of Field Methods

Method	Summary
General Instructions for Field Investigations	General instructions for field investigations (e.g., pre-work briefings, plan-of-the-day meetings, tailgate meetings) provide an overview of instructions regarding activities performed before, during, and after field investigations. Field investigations are assumed to involve standard sampling equipment, personal protective equipment, waste management, and site-control equipment/materials. General fieldwork guidance covers premobilization activities, mobilization to the site, documentation and sample collection activities, sample media evaluation, surveillance, and completion of lessons learned.
Sample Containers and Preservation	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on U.S. Environmental Protection Agency guidance for environmental sampling, preservation, and quality assurance. Specific requirements were met for each sample and were printed in the SCLs provided by N3B's SMO (size and type of container, preservatives, etc.).
Handling, Packaging, and Transporting Field Samples	Field team members sealed and labeled samples before packing to ensure sample and transport containers were free of external contamination. All environmental samples were collected, preserved, packaged, and transported to the SMO under COC (N3B-SOP-SDM-1102, "Sample Receiving and Shipping by the N3B Sample Management Office"). The SMO arranged for shipping of the samples to analytical laboratories. Any levels of radioactivity (i.e., action-level or limited-quantity ranges) were documented in SCLs submitted to the SMO.
Sample Control and Field Documentation	The collection, screening, and transport of samples were documented in standard forms generated by the SMO. These forms include SCLs, COC forms, sample container labels, and custody seals. Collection logs were completed at the time of sample collection and were signed by the sampler and by a reviewer who verified the logs for completeness and accuracy. Corresponding labels were initialed and applied to each sample container, and custody seals were placed around container lids or openings. COC forms were completed and signed to verify that the samples were not left unattended.
Field Quality Control Samples	Field quality control samples were collected as follows: FDs and FBs for VOC and tritium analysis were collected at a frequency of 10%, at the same time as regular samples, and submitted for the same analyses. During the first round of sampling, one of eight tritium FD samples planned for collection was not collected due to a sampling field crew error, leaving only seven FDs collected. FBs for VOC analyses were collected with the use of ultrapure nitrogen gas, and FBs for tritium analysis were collected by filling a silica-gel column with approximately 5 g of distilled water. FBs were kept with the other sample containers during the sampling process and were submitted for laboratory analyses.
Sampling Subsurface Vapor	Vapor sampling was performed at 18 monitoring boreholes in accordance with the current version of N3B-SOP-ER-2008, and samples were analyzed for VOCs and tritium. This SOP describes the process of sampling subsurface air from vapor ports in monitoring wells and boreholes. The procedure covers pre-sampling activities, sampling to detect and quantify gaseous organic concentration in air, SUMMA sampling (a passive collection and containment system of laboratory-quality air samples), adsorbent column sampling, sampling through the packer system (a sampling system that uses inflatable bladders to seal off a desired interval in an open borehole or at the end of a drill casing to obtain a sample from a discrete section), and post-sampling activities.

Table B-1.0-2
List of Procedures Used for MDA C Pore-Gas Monitoring Activities

Document Number	N3B Procedure Title
N3B-AP-ER-1002	Environmental Remediation (ER) Field Work Requirements
N3B-SOP-SDM-1100	Sample Containers, Preservation, and Field Quality Control
N3B-SOP-SDM-1101	Sample Control and Field Documentation
N3B-SOP-ER-2002	Field Decontamination of Equipment
N3B-SOP-ER-2008	Sampling Subsurface Vapor
N3B-P101-6	Personal Protective Equipment
N3B-AP-SDM-1200	Requesting and Managing Data Sets
N3B-POL-QAT-0019	Notification, Investigation and Learning from Events
N3B-AP-SDM-1103	Preparation and Storage of Final Records Packages for Analytic Data
N3B-SOP-SDM-1102	Sample Receiving and Shipping by the N3B Sample Management Office
N3B-AP-ER-1001	Environmental Remediation Project Preparedness Review
N3B-AP-TRU-2150	Waste Characterization Strategy Form

Table B-1.0-3
Field-Screening Results for 2021 Sampling

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-24784	155	CO_2 (ppmv)	7300	8000
		O_2 (%)	20.0	20.2
		VOC (ppmv)	0.6	1.7
	244	CO_2 (ppmv)	7500	7000
		O_2 (%)	19.2	20.9
		VOC (ppmv)	0.8	1.8
	362	CO2 (ppmv)	7000	5000
		O_2 (%)	18.8	20.9
		VOC (ppmv)	0.8	1.2
	450	CO_2 (ppmv)	2300	4000
		O_2 (%)	19.5	20.9
		VOC (ppmv)	0.4	0.4
50-24813	25	CO2 (ppmv)	21,300	15,000
		O_2 (%)	18.8	18.4
		VOC (ppmv)	1.6	2.8
	150	CO_2 (ppmv)	18,700	11,000
		O_2 (%)	19.0	19.0
		VOC (ppmv)	6.4	8.5

Table B-1.0-3 (continued)

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-24813 (cont.)	241	CO_2 (ppmv)	12,700	6000
		O_2 (%)	19.5	19.4
		VOC (ppmv)	16.9	11.4
	358	CO_2 (ppmv)	9200	3000
		O_2 (%)	19.7	20.0
		VOC (ppmv)	9.8	6.5
	450	CO_2 (ppmv)	7000	2000
		O_2 (%)	19.8	20.2
		VOC (ppmv)	5.6	4.2
	600	CO_2 (ppmv)	4300	1000
		O_2 (%)	19.9	20.4
		VOC (ppmv)	1.1	0.9
50-24822	25	CO_2 (ppmv)	13,900	12,000
		O_2 (%)	20.2	19.6
		VOC (ppmv)	0.9	3.0
	142	CO_2 (ppmv)	13,200	9000
		O_2 (%)	20.1	19.8
		VOC (ppmv)	3.4	8.2
	235	CO_2 (ppmv)	10,600	3000
		O_2 (%)	20.2	20.9
		VOC (ppmv)	4.8	8.8
	351	CO_2 (ppmv)	7600	1000
		O_2 (%)	20.3	20.9
		VOC (ppmv)	3.4	5.5
	450	CO_2 (ppmv)	5900	1000
		O_2 (%)	20.4	20.9
		VOC (ppmv)	1.6	2.2
50-603061	25	CO_2 (ppmv)	49,999	39,000
		O_2 (%)	15.6	15.9
		VOC (ppmv)	0.2	0.2
	128	CO_2 (ppmv)	36,300	20,000
		O_2 (%)	18.1	18.2
		VOC (ppmv)	0.6	1.2
	228	CO_2 (ppmv)	14,200	9000
		O_2 (%)	19.5	20.0
		VOC (ppmv)	0.6	1.1
	347	CO_2 (ppmv)	9000	7000
		O_2 (%)	19.5	20
		VOC (ppmv)	0.4	0.9

Table B-1.0-3 (continued)

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-603061 (cont.)	450	CO_2 (ppmv)	5900	5000
		O_2 (%)	19.8	20.2
		VOC (ppmv)	0.2	0.4
50-603062	122	CO_2 (ppmv)	11,700	6000
		O_2 (%)	20.9	20.9
		VOC (ppmv)	1.1	1.6
	217	CO_2 (ppmv)	4200	5000
		O_2 (%)	20.9	20.9
		VOC (ppmv)	1.2	2.2
	337	CO_2 (ppmv)	7300	3000
		O_2 (%)	20.9	20.9
		VOC (ppmv)	0.7	1.1
	450	CO_2 (ppmv)	5800	3000
		O_2 (%)	20.9	20.9
		VOC (ppmv)	0.5	0.9
50-603063	25	CO_2 (ppmv)	31,800	18,000
		O_2 (%)	19.6	18.3
		VOC (ppmv)	0.0	1.0
	128	CO_2 (ppmv)	19,900	15,000
		O_2 (%)	19.8	18.8
		VOC (ppmv)	0.7	4.0
	228	CO_2 (ppmv)	300	12,000
		O_2 (%)	20.6	19.1
		VOC (ppmv)	0.0	9.5
	347	CO_2 (ppmv)	7700	7000
		O_2 (%)	20.2	20.0
		VOC (ppmv)	1.3	7.2
	450	CO_2 (ppmv)	7500	6000
		O_2 (%)	19.8	20.2
		VOC (ppmv)	0.9	4.0
50-603064	113	CO_2 (ppmv)	16,400	9000
		O_2 (%)	19.4	20.9
		VOC (ppmv)	3.3	6.1
	214	CO_2 (ppmv)	12,600	9000
		O_2 (%)	19.7	20.5
		VOC (ppmv)	4.6	10.3

Table B-1.0-3 (continued)

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-603064 (cont.)	332	CO_2 (ppmv)	9100	6000
		O_2 (%)	19.8	20.9
		VOC (ppmv)	1.8	4.9
	500	CO_2 (ppmv)	5200	3000
		O_2 (%)	19.9	20.9
		VOC (ppmv)	0.2	0.8
50-603383	26	CO_2 (ppmv)	30,800	15,000
		O_2 (%)	17.9	18.9
		VOC (ppmv)	0.3	0.2
	139	CO_2 (ppmv)	23,600	15,000
		O_2 (%)	18.7	18.9
		VOC (ppmv)	0.8	1.3
	244	CO_2 (ppmv)	16,900	11,000
		O_2 (%)	19.3	19.6
		VOC (ppmv)	1.0	1.9
	359	CO_2 (ppmv)	9200	7000
		O_2 (%)	19.6	20.2
		VOC (ppmv)	0.5	1.0
	450	CO_2 (ppmv)	6000	5000
		O_2 (%)	20.1	20.3
		VOC (ppmv)	0.2	0.7
50-603467	143	CO_2 (ppmv)	9400	8000
		O_2 (%)	19.5	19.8
		VOC (ppmv)	3.2	4.5
	244	CO_2 (ppmv)	10,800	6000
		O_2 (%)	19.5	20.2
		VOC (ppmv)	3.4	6.8
	360	CO_2 (ppmv)	6500	4000
		O_2 (%)	19.9	20.7
		VOC (ppmv)	2.8	6.2
	500	CO_2 (ppmv)	4500	2000
		O_2 (%)	19.4	20.9
		VOC (ppmv)	1.4	2.7
	600	CO_2 (ppmv)	4200	2000
		O_2 (%)	20.0	20.9
		VOC (ppmv)	0.9	1.6
50-603468	142	CO_2 (ppmv)	15,800	3000
		O_2 (%)	20.1	20.9
		VOC (ppmv)	1.2	2.8

Table B-1.0-3 (continued)

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-603468 (cont.)	233	CO_2 (ppmv)	12,800	4000
		O_2 (%)	20.2	20.9
		VOC (ppmv)	3.5	3.1
	354	CO_2 (ppmv)	8900	2000
		O_2 (%)	20.3	20.9
		VOC (ppmv)	3.8	3.0
	403	CO_2 (ppmv)	7000	2000
		O_2 (%)	20.4	20.9
		VOC (ppmv)	3.6	3.0
50-603470	83	CO_2 (ppmv)	17,700	7000
		O_2 (%)	19.7	20.3
		VOC (ppmv)	2.0	3.5
	203	CO_2 (ppmv)	14,500	5000
		O_2 (%)	19.7	20.7
		VOC (ppmv)	7.0	8.4
	278	CO_2 (ppmv)	15,900	5000
		O_2 (%)	19.6	20.7
		VOC (ppmv)	9.0	12.2
	351	CO_2 (ppmv)	14,500	5000
		O_2 (%)	19.5	20.3
		VOC (ppmv)	7.0	9.6
	450	CO_2 (ppmv)	11,200	2000
		O_2 (%)	19.6	20.9
		VOC (ppmv)	3.0	2.9
	650	CO_2 (ppmv)	4200	1000
		O_2 (%)	19.9	20.9
		VOC (ppmv)	0.0	0
50-603471	90	CO_2 (ppmv)	15,100	4000
		O_2 (%)	19.4	20.9
		VOC (ppmv)	2.1	6.6
	209	CO_2 (ppmv)	9900	3000
		O_2 (%)	19.6	20.9
		VOC (ppmv)	8.2	15.3
	288	CO_2 (ppmv)	11,900	3000
		O_2 (%)	19.6	20.9
		VOC (ppmv)	10.9	18.4
	360	CO_2 (ppmv)	11,400	3000
		O_2 (%)	19.5	20.9
		VOC (ppmv)	9.0	14.5

Table B-1.0-3 (continued)

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-603471 (cont.)	450	CO_2 (ppmv)	8700	2000
		O_2 (%)	19.6	20.9
		VOC (ppmv)	6.5	11.4
	Unknown[b]	CO_2 (ppmv)	11,700	3000
		O_2 (%)	2.7	20.9
		VOC (ppmv)	0.6	7.3
50-603472	27	CO_2 (ppmv)	10,200	4000
		O_2 (%)	16.6	19.8
		VOC (ppmv)	0.4	1.2
	146	CO_2 (ppmv)	12,600	5000
		O_2 (%)	16.5	19.7
		VOC (ppmv)	2.6	3.6
	292	CO_2 (ppmv)	16,200	3000
		O_2 (%)	16.2	19.7
		VOC (ppmv)	6.4	5.2
	364	CO_2 (ppmv)	13,200	4000
		O_2 (%)	16.2	19.4
		VOC (ppmv)	4.8	5.6
	450	CO_2 (ppmv)	10,200	3000
		O_2 (%)	16.3	19.8
		VOC (ppmv)	2.9	2.8
50-603503	133	CO_2 (ppmv)	4800	0
		O_2 (%)	20.2	20.9
		VOC (ppmv)	0.4	0.4
	237	CO_2 (ppmv)	7200	0
		O_2 (%)	19.9	20.9
		VOC (ppmv)	0.7	0.5
	347	CO_2 (ppmv)	5000	0
		O_2 (%)	19.8	20.9
		VOC (ppmv)	0.7	0.5
	450	CO_2 (ppmv)	1300	0
		O_2 (%)	20.1	20.9
		VOC (ppmv)	0.4	0.6

Table B-1.0-3 (continued)

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-613182	550	CO_2 (ppmv)	6700	2000
		O_2 (%)	16.4	20.0
		VOC (ppmv)	0.9	1.1
	632.5	CO_2 (ppmv)	3500	1000
		O_2 (%)	16.8	20.2
		VOC (ppmv)	0.0	1.1
50-613183	550	CO_2 (ppmv)	5400	1000
		O_2 (%)	19.6	20.9
		VOC (ppmv)	0.8	0.1
	642.5	CO_2 (ppmv)	4000	2000
		O_2 (%)	19.9	20.7
		VOC (ppmv)	0.0	0.6
50-613184	500	CO_2 (ppmv)	4200	0
		O_2 (%)	20.5	20.9
		VOC (ppmv)	0.8	0.5
	600	CO_2 (ppmv)	3200	0
		O_2 (%)	20.5	20.9
		VOC (ppmv)	0.2	0.3
	664.5	CO_2 (ppmv)	2700	0
		O_2 (%)	20.9	20.9
		VOC (ppmv)	0.0	0.2
50-613185	145	CO_2 (ppmv)	21,000	18,000
		O_2 (%)	19.7	18.8
		VOC (ppmv)	0.5	1.9
	235	CO_2 (ppmv)	10,300	10,000
		O_2 (%)	20.9	20.1
		VOC (ppmv)	0.9	2.9
	350	CO_2 (ppmv)	4500	6000
		O_2 (%)	20.4	20.5
		VOC (ppmv)	0.3	1.9
	450	CO_2 (ppmv)	3400	5000
		O_2 (%)	20.5	20.5
		VOC (ppmv)	0.2	1.0
	600	CO_2 (ppmv)	3100	4000
		O_2 (%)	20.5	20.7
		VOC (ppmv)	0.0	0.2

[a] bgs = Below ground surface.

[b] During the two sampling rounds, the depth of two unlabeled ports in borehole 50-603471 was unclear. The ports are known to be at 30 ft and 90 ft and both were sampled, but because the ports were not labeled, it is not possible to assign the data to a specific depth.

Appendix C

Analytical Program

C-1.0 INTRODUCTION

This appendix discusses the analytical methods and data-quality review for samples collected during vapor-sampling activities at Material Disposal Area (MDA) C, Solid Waste Management Unit (SWMU) 50-009, at Technical Area 50 at Los Alamos National Laboratory (LANL or the Laboratory).

Newport News Nuclear BWXT-Los Alamos, LLC (N3B) uses the Environmental Information Management (EIM) database for data management. This is a cloud-based data management platform, written and maintained by Locus Technologies, that is used for managing sampling events, tracking the packaging and transportation of samples, and storing the resultant data. N3B, Triad National Security, LLC (Triad) and the U.S. Department of Energy (DOE) Oversight Bureau of the New Mexico Environment Department (NMED) share EIM for all LANL environmental analytical data. EIM interfaces with Intellus New Mexico (Intellus), a fully searchable database available to the public through the Intellus website (http://www.intellusnm.com).

The EIM system consists of a cloud-based Structured Query Language server database platform coupled with a web-based user interface. It is a comprehensive sample and data management application, designed to manage the process from sample planning through data review and reporting. It includes modules for sample planning, sample tracking, manual and electronic field data upload, uploading of electronic data deliverables (EDDs), Automated Data Review (ADR) routines, notification emails, and reporting tools.

The analytical data are submitted in EDDs by the analytical laboratory, and N3B data stewards upload them to the N3B EIM database. The received data are then independently validated through the N3B data validation process, per the data quality objectives (DQOs) described in section C-2.1, to qualify the data. The laboratory also submits PDFs that detail the entire analytical process for each sample analysis.

The entire data validation process includes a description of the reasons for any failure to meet method, procedural, or contractual requirements, and an evaluation of the impact of such failure on the associated data or data set.

C-2.0 ANALYTICAL DATA

This report evaluates the analytical results of vapor samples that were collected during semiannual vapor-sampling activities at MDA C. All samples were submitted to, and analyzed by, approved off-site analytical laboratories. These data have been reviewed and revalidated to current quality assurance/quality control (QA/QC) standards, as described in section C-2.1, and have been determined to be of sufficient quality for decision-making purposes.

In the first 2021 sampling round, 96 samples [80 regular samples, 8 field blanks (FBs) and 8 field duplicates (FDs)] were collected and analyzed for volatile organic chemicals (VOCs), and an additional 95 samples (80 regular samples, 8 FBs, and 7 FDs) were collected and analyzed for tritium. (A planned eighth tritium FD sample was not collected due to a field sampling error.) In the second 2021 sampling round, 96 samples (80 regular samples, 8 FBs, and 8 FDs) were collected and analyzed for VOCs, and an additional 96 samples (80 regular samples, 8 FBs, and 8 FDs) were collected and analyzed for tritium. The analytical methods used are listed in Table C-2.0-1.

These samples were planned using the EIM Sample Request module, and sample collection logs (SCLs) were created and printed to serve as chain of custody (COC) documents and analytical request forms.

The sampling events included collection of FB and FD field QA/QC samples. Detection of analytes in FBs may indicate contamination resulting from sample collection, transportation, or the analytical laboratory processes. Differences in analytical results between an FD and its corresponding regular sample may indicate the samples were not uniform or that significant variation in analysis occurred between the two samples.

The FBs for VOC analysis, which are subjected to the same conditions as regular samples, were collected in SUMMA canisters filled with pure (≥99.9%) nitrogen. FBs for tritium analysis consist of distilled water added to a silica gel sample collection cartridge. FBs are collected from locations where the regular samples are collected, at a minimum frequency of 10% of all VOC and tritium samples collected during the monitoring event.

FDs are split samples collected from the same locations as the regular samples, at a rate of 10% of all VOC and tritium samples collected during the monitoring event.

Following sample collection, sampling personnel deliver the samples and the SCLs to sample management personnel at the N3B Sample Management Office (SMO). An analytical COC is then created, which includes the field sample identification number, the date and time of field sample collection, the analytical parameters group code(s), and the number of bottles for each analytical parameter group. The N3B SMO then ships the samples to the appropriate laboratory for analysis.

In addition to analyzing the field samples and field QA/QC samples, laboratories also use laboratory batch QA/QC samples, which include matrix spikes, duplicates, method blanks, and laboratory control samples. These QA/QC samples are prepared and analyzed by the laboratories to monitor their analytical process quality. The laboratory QA/QC process is defined in the appropriate analytical method (Table C-2.0-1) and the external analytical laboratory statement of work.

Tables within the main text of this MDA C vapor-sampling periodic monitoring report summarize the analytical results from all samples collected at MDA C for calendar year 2021. All VOCs and tritium analytical results are provided in Appendix E (on DVD included with this document). Analytical chemical and radiological data presented in this report can also be found in the public Intellus database at http://www.intellusnm.com.

C-2.1 Data Validation Definitions and Procedures

Analytical results meet the N3B minimum DQOs as outlined in N3B-PLN-SDM-1000, “Sample and Data Management Plan.” N3B-PLN-SDM-1000 sets the validation frequency criteria at 100% for Level 1 examination and Level 2 verification of data, and at 10% minimum for Level 3 validation of data.

- A Level 1 examination assesses the completeness of the data as delivered from the analytical laboratory, identifies any reporting errors, and checks the usability of the data based on the analytical laboratory’s evaluation of the data.
- A Level 2 verification evaluates the data to determine the extent to which the laboratory met the analytical method and the contract-specific quality control and reporting requirements.
- A Level 3 validation includes Level 1 and 2 criteria and determines the effect of potential anomalies encountered during analysis as well as possible effects on data quality and usability. A Level 3 validation is performed manually with method-specific data validation procedures.

Laboratory analytical data are validated by N3B personnel as outlined in N3B-PLN-SDM-1000; N3B-AP-SDM-3000, "General Guidelines for Data Validation"; N3B-AP-SDM-3014, "Examination and Verification of Analytical Data"; and additional method-specific analytical data validation procedures. All associated validation procedures have been developed, where applicable, from the U.S. Environmental Protection Agency (EPA) QA/G-8 Guidance on Environmental Data Verification and Data Validation, the U.S. Department of Defense/Department of Energy "Consolidated Quality Systems Manual for Environmental Laboratories," the EPA "National Functional Guidelines for Data Validation," and the American National Standards Institute/American Nuclear Society 41.5: "Verification and Validation of Radiological Data."

N3B data validation is performed independently of the analytical laboratory and the end users of the data. Data validation provides a level of assurance of the data quality.

Validation qualifiers and reason codes applied during this process are also reviewed and approved by an N3B chemist to assess data usability and quality. The EIM data are then made available to the public in the Intellus New Mexico database (https://intellusnm.com/).

Validated data are qualified as accepted or rejected. Data that are accepted per the validation criteria have one of the following qualifiers:

- not detected (U)
- estimated but not detected (UJ)
- estimated (J), or
- detected without data qualification (NQ)

Accepted data can then be used as needed, assuming that no problems occurred during the sampling events.

Data that are qualified as rejected (R), per the validation criteria, are unusable. In addition, the analytical results can also be further labeled with data validation reason codes that explain the reason for the qualification. (See Appendix A of this report, which includes data qualifier definitions.)

The analytical data, laboratory report, and data validation reports are provided in Appendix E (on CD included with this report). In addition to the laboratory analytical data, SCLs and COC forms are also provided in Appendix E.

Table C-2.0-1
Volatile Organic Compound and
Radionuclide Analytical Methods for Samples Collected at SWMU 50-009

Analytical Method	Analytical Description	Analytical Suite
VOCs		
EPA Air Method Toxic Organics (TO15)	Determination VOCs in air collected in specially prepared canisters and analyzed by gas chromatography/mass spectrometry	VOCs
Radionuclides		
EPA 906.0	Tritium in water (liquid scintillation)	Tritium

Appendix D

Volatile Organic Compound Plume Trend Analysis

D-1.0 INTRODUCTION

This appendix summarizes data from the Material Disposal Area (MDA) C volatile organic compound (VOC) plume at Technical Area 50, Los Alamos National Laboratory (LANL or the Laboratory). Figure D-1.0-1 shows the pore-gas monitoring boreholes at MDA C. The data were collected as part of an ongoing monitoring program to support a corrective measures evaluation (CME). In December 2011, the New Mexico Environment Department (NMED) approved the Phase III MDA C investigation report (NMED 2011, 208797) and directed vapor monitoring that replaced the monitoring recommended in the Phase III investigation report. NMED's approval requires semiannual monitoring from 80 sampling ports at 18 locations, with all samples analyzed for VOCs and tritium. Table D-1.0-1 lists all 18 boreholes analyzed in this appendix, with the final column indicating the region of the plume where a given borehole (in map view) is located:

- The core of the plume (5 boreholes) is located where maximum total VOC concentrations have been greater than 30,000 $\mu g/m^3$.
- The intermediate part of the plume (7 boreholes) is located where maximum total VOC concentrations have been between 10,000 $\mu g/m^3$ and 30,000 $\mu g/m^3$.
- The outer edge of the plume (6 boreholes) is located where maximum total VOC concentrations have been less than 10,000 $\mu g/m^3$.

Data from these three regions are broken out in separate sections of this appendix.

For each section of this appendix (plume core, plume intermediate, plume outer edge), data from each borehole are presented first with time series plots of trichloroethene (TCE) concentration with depth, followed by a selection of histograms at different depths showing how total VOC concentration and the TCE fraction of the total vary over time, where generally the VOC plume consists of mostly TCE on a consistent basis. All plots showing TCE concentration also include a dashed red line representing the Tier I pore-gas screening level (SL) of 2020 $\mu g/m^3$. On the TCE versus depth plots, this is a vertical dashed red line; on the histograms of TCE and total VOCs, this is a horizontal dashed red line.

Vapor monitoring in the two rounds of 2021 sampling included collecting 80 vapor samples from 80 sample ports within 18 boreholes. Vapor samples were submitted for laboratory analysis of VOCs and tritium. Validated analytical results demonstrate the presence of 31 VOCs detected in subsurface vapor. The VOC Tier I screening evaluation identified 4 VOCs [1,4-dioxane, methylene chloride, TCE, 1,1,2-trichloroethane (1,1,2-TCA)] in the first round of screening, and 3 VOCs (methylene chloride, TCE, and 1,1,2-TCA) in the second, in MDA C pore gas at concentrations exceeding Tier I pore-gas SLs, which are based on protection of groundwater. Of these, only TCE is consistently in exceedance of its SL. Dioxane[1,4-] exceeded the Tier I SL in 1 of 80 samples in the first round; 1,1,2-TCA exceeded the Tier I SL in 1 of 80 samples in both rounds; and methylene chloride exceeded the Tier I SL in 2 of 80 samples in both rounds. TCE exceeded the Tier I SL in 58 of 80 samples in the first round and 65 of 80 samples in the second round. Therefore, TCE is the primary contaminant of concern. The lateral and vertical extent of the TCE plume, based on data from the first and second rounds of sampling in 2021, are shown in Figure D-1.0-2.

The data show that at depths of 600 ft below ground surface (bgs) or greater, there were only five detections above Tier I SLs. TCE was detected above its Tier I SL at 600 ft bgs in boreholes 50-24813 and 50-603467 in both sampling rounds and 1,4-dioxane was detected above its Tier I SL at 600 ft bgs in borehole 50-613185 in the first sampling round. These results show that the bulk of the plume remains above the Tschicoma Formation dacite (Tvt 2) and is consistent with the conceptual model favoring diffusive transport in the Bandelier Tuff over migration into the wetter Tschicoma Formation dacite and underlying Puye Formation.

VOC concentration trends from MDA C monitoring activities are analyzed in this appendix. Data trends in the MDA C VOC plume for TCE and total VOCs at individual wells and screens were evaluated from results of vapor-monitoring activities conducted over the period October 2011 to March 2022. Changes in the TCE plume were evaluated by comparing the horizontal and vertical distribution of TCE based on nine quarters of sampling performed in 2010, 2011, and 2012 with the distribution based on the results of the two 2021 monitoring events. Trends for TCE show that concentrations at MDA C are consistent with a diffusive plume. Concentrations are increasing slowly laterally at the edges of the plume but are stable at depth. Concentrations in the center of the plume peak at depths of approximately 200–300 ft bgs for a given well and appear to be either stable or decreasing slowly with time. Concentrations in the source area show no signs of significant continued releases of VOCs, and concentrations in shallow ports have decreased over time.

D-2.0 PLUME CORE BOREHOLE DATA

The trend analysis begins with a discussion of five boreholes in the core of the VOC plume with total depth measurements of 450 ft to 650 ft bgs (50-24813, 50-24822, 50-603064, 50-603471, and 50-613183). The core of the plume is defined as samples having concentrations greater than 30,000 μg/m^3 of total VOCs. Although total VOCs at borehole 50-603061 have exceeded 30,000 μg/m^3, this borehole is not included in the core boreholes because, unlike the other five core boreholes, TCE is only a minor contributor to total VOCs instead of being the major contributor. Peak concentrations in the core of the VOC plume have decreased since 2011. Any trend analyses at depths less than 550 ft bgs do not apply to borehole 50-613183 since this borehole has ports only at 550 ft bgs and 642.5 ft bgs, and no shallower soil-vapor data are available. Data from November 2011 to March 2022 from boreholes 50-24813 (Figures D-2.0-1 through D-2.0-6), 50-24822 (Figures D-2.0-7 through D-2.0-10), 50-603064 (Figures D-2.0-11 through D-2.0-13), 50-603471 (Figures D-2.0-14 through D-2.0-16), and 50-613183 (Figures D-2.0-17 through D-2.0-19) share several common aspects:

- Shallow ports (less than 100 ft bgs) in boreholes 50-24813 and 50-603471 experienced a slight increase from October 2020 but continue to show an overall drop in concentration and show no evidence for continued leakage in the source region.
- The highest concentrations of TCE (Figures D-2.0-1, D-2.0-7, D-2.0-11, and D-2.0-14) are on the order of 30,000 μg/m^3 to 50,000 μg/m^3.
- The peak concentrations measured are consistently at a depth between 200 and 300 ft bgs.
- The concentrations at depths showing total VOC greater than 10,000 μg/m^3 generally show overall decreases over time (Figures D-2.0-2, D-2.0-3, D-2.0-4, D-2.0-5, D-2.0-8, D-2.0-9, D-2.0-12, D-2.0-15, and D-2.0-16). Boreholes 50-603471 (Figures D-2.0-15 and D-2.0-16) and 50-613183 (Figures D-2.0-18 and D-2.0-19) had unusually low concentrations of TCE in July 2020, but October 2020 concentrations returned to historical levels and remained so in March 2021 and March 2022. Figures D-2.0-5 and D-2.0-16 show concentrations at a depth of 450 ft bgs, which is below the peak in boreholes 50-24813 and 50-603471, respectively. In both these sets of data, the histograms show variability in the range of 20,000 to 40,000 μg/m^3. While there was a clear trend in borehole 50-603471 at 450 ft bgs toward lower concentrations with time until July 2020, the TCE concentration increased to 37,000 μg/m^3 in October 2020; 28,000 μg/m^3 in March 2021; and 33,000 μg/m^3 in March 2022. No clear trend exists at 450 ft bgs in borehole 50-24813, where concentrations show a minimum total VOC in April 2016 of near 20,000 μg/m^3 followed by increases to between 21,000 and 34,000 μg/m^3 for all subsequent measurements.

- The deepest ports in the map-view center of the plume, at depths of between 550 and 650 ft bgs, with detected concentrations in the 90–6000-μg/m^3 total VOC range, show no clear trends with time (Figures D-2.0-6, D-2.0-18, and D-2.0-19).
- Borehole 50-24822 has two ports at 235 and 450 ft bgs (Figures D-2.0-9 and D-2.0-10) where TCE concentrations generally decreased from 2011 to 2014 and then leveled off before starting to increase again in 2016. The port at 142 ft bgs in borehole 50-24822 followed a similar trend with an initial decrease that leveled off. However, total VOC concentration from October 2020 increased. Concentrations decreased again in March 2021 and March 2022; further monitoring will determine whether this trend continues. The results from April 2017 appear anomalously low and well outside the range of previously detected concentrations.

D-2.1 Borehole 50-24813

The vertical distribution of TCE concentrations in sampling ports at borehole 50-24813 over time is shown in Figure D-2.0-1. Since March 2012, the highest concentrations for this borehole have been at a depth of 241 ft bgs. Concentrations of TCE and total VOCs over time at depths of 150, 241, and 358 ft bgs are shown in Figures D-2.0-2, D-2.0-3, and D-2.0-4, respectively. Concentrations generally decrease with time at these three depths, although the results from October 2020 at 150 and 241 ft bgs, and October 2012 at 358 ft bgs, appear anomalously low and well outside the range of previously-detected concentrations. Concentrations of TCE and total VOCs over time at 450 ft bgs are shown in Figure D-2.0-5 and show no consistent trends over time. Concentrations of TCE and total VOCs over time at 600 ft bgs are shown in Figure D-2.0-6 and show a gradual increase over time, although the results from November 2013 and October 2020 appear anomalously low and outside the range of previously-detected concentrations.

D-2.2 Borehole 50-24822

The vertical distribution of TCE concentrations in sampling ports at borehole 50-24822 over time is shown in Figure D-2.0-7. With the exception of the anomalous result in October 2017, the highest TCE concentrations for this borehole have been at a depth of 235 ft bgs. October 2017 data from this borehole are suspect because of the one-time shift of the plume maximum from 235 ft bgs to 351 ft bgs. Continued monitoring has indicated that these data are anomalous and that the maximum concentration has remained at 235 ft bgs in recent monitoring events. Concentrations of TCE and total VOCs over time at depths of 142, 233, and 450 ft bgs are shown in Figures D-2.0-8, D-2.0-9, and D-2.0-10, respectively. Concentrations generally decrease over time at 142 and 233 ft bgs and show no consistent trends over time at 450 ft bgs. The results from April 2017 from 142 and 235 ft bgs and October 2016 at 450 ft bgs appear anomalously low, significantly outside the range of previously detected concentrations.

D-2.3 Borehole 50-603064

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603064 over time is shown in Figure D-2.0-11. The highest TCE concentrations for this borehole have generally been at a depth of 213 ft bgs. Concentrations of TCE and total VOCs over time at depths of 113 and 500 ft bgs are shown in Figures D-2.0-12 and D-2.0-13, respectively. This borehole shows a gradual slight decrease in TCE and total VOC concentrations at 113 ft bgs, consistent with gradual diffusion away from higher concentrations toward lower concentrations (Figure D-2.0-12). At 500 ft bgs, total VOC concentrations appear to be increasing gradually through time (Figure D-2.0-13). The results from July 2020 at 500 ft bgs appear anomalously low, significantly outside the range of previously detected concentrations.

D-2.4 Boreholes 50-603471 and 50-613183

Borehole 50-603471 is centrally located in the core of the plume between Pit 4 and Pit 5 (Figure D-1.0-1). The vertical distribution of TCE concentrations in sampling ports at borehole 50-603471 over time is shown in Figure D-2.0-14. Since March 2012, the highest TCE concentrations for this borehole have been at a depth of 288 ft bgs (other than the anomalous results for October 2017). This borehole also shows the highest concentrations between 200 and 300 ft bgs with a concentration of TCE over 100,000 µg/m^3 in 2011 (Figure D-2.0-14). Subsequent measurements show a trend toward lower peak values of TCE, with the most recent concentrations on the order of 50,000 µg/m^3 TCE.

Concentrations of TCE and total VOCs over time at depths of 288 ft bgs and 450 ft bgs are shown in Figures D-2.0-15 and D-2.0-16, respectively. Concentrations at 288 ft bgs of this borehole are also trending downward through time, with high ratios of TCE/total VOCs that are consistent with the majority of observations at all but the deepest ports in borehole 50-603471. At the deepest port (450 ft bgs), there was a clear trend toward both lower TCE and total VOC concentrations with time through July 2020, but concentrations have since increased to levels seen in 2016 and 2017 (Figure D-2.0-16). If the January and July 2020 results are disregarded, concentrations have remained relatively stable since 2013.

Borehole 50-613183 is located adjacent to borehole 50-603471 and serves as an extension to greater depths. The vertical distribution of TCE concentrations in sampling ports at borehole 50-603471 over time is shown in Figure D-2.0-17. Concentrations consistently decrease with depth and are substantially below the Tier I pore-gas SL at the deeper sampling depth (642.5 ft bgs). Concentrations of TCE and total VOCs over time at depths of 550 and 642.5 ft bgs are shown in Figures D-2.0-18 and D-2.0-19, respectively. Concentrations of TCE appear to be nearly stable through time at 642.5 ft bgs (Figure D-2.0-19), while increases in concentrations are seen at 550 ft bgs (Figure D-2.0-18). Ratios of TCE/total VOCs are lower in both ports of borehole 50-613183, with very little TCE present in the deepest port at 642.5 ft bgs.

The results from July 2020 at 288, 450, and 550 ft bgs appear anomalously low and well outside the range of previously detected concentrations (Figures D-2.0-15, D-2.0-16, and D-2.0-18).

D-3.0 PLUME INTERMEDIATE BOREHOLE DATA

Data from plume intermediate boreholes (50-603063, 50-603467, 50-603468, 50-603470, 50-603472, 50-613182, and 50-613184) are shown in Figures D-3.0-1 through D-3.0-23. The intermediate portion of the plume is defined as samples having total VOC concentrations greater than 10,000 µg/m^3 but less than 30,000 µg/m^3.

The plume intermediate boreholes share characteristics with the plume core boreholes, including the following:

- Shallow ports (less than 100 ft bgs) continue to drop in concentration and show no evidence for continued leakage in the source region.
- Maximum concentrations are generally at depths between 200 and 250 ft bgs.
- Deep ports in the intermediate portion of the plume with concentrations less than 10,000 µg/m^3 show mixed trends. Total VOC concentrations in borehole 50-603467 at 600 ft bgs were decreasing, with concentrations near or below the 2020 µg/m^3 Tier I pore-gas SL from January 2020 through October 2020, but rebounded in March 2021 and March 2022 (Figure D-3.0-6). Concentrations at 500 ft bgs show a stable to slightly increasing trend (Figure D-3.0-5). Note that the January 2020 data for the port at 500 ft bgs are suspect, as the VOC concentrations are below historical and subsequent measurements.

- Concentrations in borehole 50-603470 at 650 ft bgs and borehole 50-613182 at 632.5 ft bgs are relatively stable (Figures D-3.0-14 and D-3.0-20). Concentrations in borehole 50-613182 at 550 and 632 ft bgs, and in borehole 50-613184 at 550 and 664.5 ft bgs had been gradually increasing, but this trend reversed itself in the July 2020 and October sampling events, and then increased again in March 2021 and March 2022 (Figures D-3.0-19, D-3.0-20, D-3.0-22, and D-3.0-23). Continued monitoring will determine whether this trend continues.

D-3.1 Borehole 50-603063

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603063 over time is shown in Figure D-3.0-1. The maximum TCE concentrations have been at 228 ft bgs, except for October 2020 and March 2021, when the maximum concentrations were at 347 ft bgs. These results shows a tentative increase in concentrations from diffusion moving mass from the bulge at 228 ft bgs downward to 347 ft bgs (Figure D-3.0-1). Concentrations of TCE and total VOCs over time at depths of 347 and 450 ft bgs are shown in Figures D-3.0-2 and D-3.0-3, respectively. Concentrations of TCE at 347 ft bgs increased slightly through July 2020, although the results from October 2017 appear to be anomalously high (Figure D-3.0-2). Concentrations then decreased in October 2020 and March 2021 and rebounded in March 2022 to values seen in July 2020. Very little evidence of change is seen at 450 ft bgs; the lowest concentration of TCE (3300 $\mu g/m^3$) was found in the October 2020 sampling event, but concentrations rebounded in March 2021 and March 2022 (Figure D-3.0-3). The results from October 2017 for 450 ft bgs also appear to be anomalously high.

D-3.2 Borehole 50-603467

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603467 over time is shown in Figure D-3.0-4. The maximum TCE concentrations have been at 244 or 360 ft bgs, and concentrations at these depths have generally decreased with time. Concentrations of TCE and total VOCs over time at depths of 500 and 600 ft bgs, shown in Figures D-3.0-5 and D-3.0-6, respectively, do not show consistent trends over time, with substantially variability between sampling events. Results from January 2020 for 500 ft bgs and November 2013 and October 2020 for 600 ft bgs appear anomalously low.

D-3.3 Boreholes 50-603468 and 50-613184

Borehole 50-603468 is on the south side of the plume approximately 200 ft south of pit 1 (Figure D-1.0-1). The vertical distribution of TCE concentrations in sampling ports at borehole 50-603468 over time is shown in Figure D-3.0-7. Maximum concentrations are between 233 and 354 ft bgs and have generally decreased over time. Concentrations of TCE and total VOCs over time at depths of 142, 233, and 403 ft bgs are shown in Figures D-3.0-8, D-3.0-9, and D-3.0-10, respectively. Concentrations at 142 ft bgs are decreasing with time. Concentrations at 233 and 403 ft bgs show little obvious trend through time (Figures D-3.0-9 and D-3.0-10); however, TCE concentrations at these depths were at or below 11,000 $\mu g/m^3$ during the first and second sampling events in 2020, and then rebounded in April 2021 and March 2022. Note that the July 2020 concentrations for all three depths are suspect as they do not follow previous data trends. Continued monitoring will confirm if these data are truly anomalous.

Borehole 50-613184 is adjacent to 50-603468 and serves as an extension to greater depths. The vertical distribution of TCE concentrations in sampling ports at borehole 50-613184 over time is shown in Figure D-3.0-21. Concentrations consistently decrease with depth and are substantially below the Tier I pore-gas SL at the two deeper sampling depths (600 and 664.5 ft bgs). Concentrations of TCE and total VOCs over time at depths of 500 and 664.5 ft bgs are shown in Figures D-3.0-22 and D-3.0-23, respectively. Borehole 50-613184 had been exhibiting a gradually increasing trend in the port at

500 ft bgs, but this trend reversed itself in the July 2020 and October 2020 sampling events and then increased again in March 2021 and March 2022 (Figure D-3.0-22). Continued monitoring will determine if this trend continues. A similar trend was seen for the port at 664.5 ft bgs, except concentrations decreased noticeably in March 2022 (Figure D-3.0-23). The results for July 2020 and October 2020 for 500 ft bgs and July 2020 for 664.5 ft bgs appear anomalously low and outside the range of previously reported results.

D-3.4 Borehole 50-603470

Borehole 50-603470 is located at the southeast corner of Pit 5 (Figure D-1.0-1). Historically, this borehole has had some of the highest VOC concentrations found at the site, though they have been decreasing with time. The vertical distribution of TCE concentrations in sampling ports at borehole 50-603470 over time is shown in Figure D-3.0-11. Concentrations of TCE reach a maximum in the borehole between 200 and 300 ft bgs. In this depth range, concentrations have decreased over time from over 80,000 $\mu g/m^3$ in November 2011 to approximately 40,000 $\mu g/m^3$ in March 2021 and March 2022. The results from October 2020 appear anomalously low and inconsistent with the trend from the other sampling events.

Concentrations of TCE and total VOCs over time at depths of 83, 278, and 650 ft bgs are shown in Figures D-3.0-12, D-3.0-13, and D-3.0-14, respectively. These results show a decrease with time at both 83 and 278 ft bgs, while at 650 ft bgs there was a tentative trend towards higher values of total VOCs, followed by a reduction in March 2022. At this deepest port, the ratios of TCE/total VOCs are quite low through time, consistent with deep values throughout the plume, and also consistent with ratios found in borehole 50-603061. Values of TCE in the deepest port are well below the Tier I pore-gas SL of 2020 $\mu g/m^3$.

D-3.5 Boreholes 50-603472 and 50-613182

Borehole 50-603472, on the west side of the plume between Pits 4 and 5 (Figure D-1.0-1). The vertical distribution of TCE concentrations in sampling ports at borehole 50-603472 over time is shown in Figure D-3.0-15. The maximum TCE concentrations have generally been at 292 ft bgs. Concentrations at this depth have shown no consistent trend with time since 2012 (other than the anomalous result for October 2020). Concentrations of TCE and total VOCs over time at depths of 146 and 364 ft bgs are shown in Figures D-3.0-16 and D-3.0-17, respectively. Concentrations at 146 and 364 ft bgs show little change in concentration with time. The results from December 2013 at 364 ft bgs, and October 2020 at both 146 and 364 ft bgs, appear anomalously low, and well outside the range of concentrations at all other sampling events.

Borehole 50-613182 is adjacent to borehole 50-603472 and serves as an extension to greater depths. The vertical distribution of TCE concentrations in sampling ports at borehole 50-613182 over time is shown in Figure D-3.0-18. Concentrations consistently decrease with depth and are substantially below the Tier I pore-gas SL at the deeper sampling depth (632.5 ft bgs). Concentrations of TCE and total VOCs over time at depths of 550 and 632.5 ft bgs are shown in Figures D-3.0-19 and D-3.0-20, respectively. TCE concentrations at borehole 50-613182 have been relatively constant at around 4000 $\mu g/m^3$ at 550 ft bgs since October 2014, aside from results from October 2020, which appear anomalously low (Figure D-3.0-19). Continued monitoring will confirm if this trend continues. Results from the 632.5-ft bgs port show no obvious trends in TCE or total VOC concentrations, and TCE concentrations are well below the Tier I pore-gas SL of 2020 $\mu g/m^3$ (Figure D-3.0-20).

D-4.0 PLUME OUTER-EDGE BOREHOLE DATA

Data from the boreholes on the outer edge of the plume (50-24784, 50-603061, 50-603062, 50-603383, 50-603503, and 50-613185) are shown in Figures D-4.0-1 through D-4.0-18. The outer-edge of the plume is defined as samples having concentrations less than 10,000 µg/m^3 of total VOCs.

Boreholes on the outer edge of the plume show a trend toward higher VOC concentrations through time, consistent with diffusion from higher concentration areas in the plume towards the plume edges.

D-4.1 Borehole 50-24784

The vertical distribution of TCE concentrations in sampling ports at borehole 50-24784 over time is shown in Figure D-4.0-1. The maximum TCE concentrations have generally been at 244 ft bgs. Concentrations of TCE and total VOCs over time at depths of 362 and 450 ft bgs are shown in Figures D-4.0-2 and D-4.0-3, respectively. Concentrations in these ports showed gradually increasing total VOC concentrations consistent with diffusion from higher concentration areas in the plume towards the plume edges through January 2020. Outlier points in July 2020 showed a major reduction, with little relationship to previous measurements. Concentrations increased in subsequent sampling events and results from the most recent event are consistent with results prior to July 2020 (Figures D-4.0-2 and D-4.0-3). Continued monitoring will confirm if the July 2020 data are anomalous.

D-4.2 Borehole 50-603061

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603061 over time is shown in Figure D-4.0-4. The maximum TCE concentrations have generally been at 228 ft bgs. Concentrations of TCE and total VOCs over time at depths of 228 and 450 ft bgs are shown in Figures D-4.0-5 and D-4.0-6, respectively. Concentrations at 228 ft bgs have generally increased with time to a maximum in October 2020, followed by sharp reductions in March 2021 and February 2022. Concentrations at 450 ft bgs show increasing VOC concentrations with time. Borehole 50-603061 is the only borehole for which TCE is not the predominant VOC. The VOC present at the highest concentration at this location is 1,1,2-trichloro-1,2,2-trifluoroethane, with 1,1-dichloroethene and 1,1,1-TCA also present at concentrations similar to TCE.

D-4.3 Borehole 50-603062

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603062 over time is shown in Figure D-4.0-7. The maximum TCE concentrations have consistently been at 217 ft bgs. Concentrations of TCE and total VOCs over time at depths of 217 and 450 ft bgs are shown in Figures D-4.0-8 and D-4.0-9, respectively. Total VOC concentrations at both depths may show a gradual increase over time, with results from 217 ft bgs showing substantially more variability. Both ports showed anomalously low results in October 2020, which are well outside the range of previously detected concentrations (Figures D-4.0-8 and D-4.0-9).

D-4.4 Borehole 50-603383

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603383 over time is shown in Figure D-4.0-10. The maximum TCE concentrations have consistently been at 244 ft bgs. Concentrations of TCE and total VOCs over time at depths of 244 and 450 ft bgs are shown in Figures D-4.0-11 and D-4.0-12, respectively. Concentrations of total VOC at these depths are increasing gradually with time. Note that the TCE and total VOC concentrations are unusually low in October 2020 compared with previous sampling events. Continued monitoring will determine whether these data are anomalous.

D-4.5 Borehole 50-603503

The vertical distribution of TCE concentrations in sampling ports at borehole 50-603503 over time is shown in Figure D-4.0-13. The maximum TCE concentrations were at 237 ft bgs through October 2020 and were at the next lower port at 347 ft bgs for April 2021 and March 2022. Concentrations of TCE and total VOCs over time at depths of 347 and 450 ft bgs are shown in Figures D-4.0-14 and D-4.0-15, respectively. Concentrations of TCE and total VOC at 347 ft bgs were generally increasing through January 2020, then decreased for the next three sampling events, with the results from October 2020 and April 2021 being the lowest since March 2012, and rebounded in March 2022 to levels consistent with those from January 2020 (Figure D-4.0-14). Concentrations at 450 ft bgs were generally stable through January 2020, then decreased for the next three sampling events, and rebounded in March 2022 (Figure D-4.0-15). Note that the TCE and total VOC concentrations are unusually low in October 2020 at depths deeper than 150 ft bgs compared with previous sampling events. Continued monitoring will confirm if these data are anomalous.

D-4.6 Borehole 50-613185

The vertical distribution of TCE concentrations in sampling ports at borehole 50-613185 over time is shown in Figure D-4.0-16. Since March 2012, the maximum TCE concentrations have consistently been at 235 ft bgs, and have generally decreased over time. Concentrations of TCE and total VOCs over time at depths of 350 and 600 ft bgs are shown in Figures D-4.0-17 and D-4.0-18, respectively. TCE concentrations are increasing with time at both 350 and 600 ft bgs. These trends are consistent with the behavior of a diffusive plume.

D-5.0 PLUME TRENDS

Changes in plume concentrations through time from 2010 to 2021 support a conceptual model of migration of VOC, and more importantly TCE, from higher concentration areas directly under the source region towards lower concentration regions around the edge of the plume, both laterally and vertically. The lateral and vertical extent of the TCE plume, based on average concentrations from nine quarters of monitoring from 2010 through 2012 and maximum concentrations from the two rounds of monitoring for 2021, are shown in Figure 5.0-1.

The plots of the lateral plume extent presented in Figure 5.0-1 show that the lateral extent of the outer edge of the plume exceeding the Tier I pore-gas SL has expanded slightly. The lateral extent of the core area with concentrations greater than 25 times the Tier I SL has decreased substantially. These results are consistent with diffusion of TCE from areas of high concentrations near the source to low concentrations at the periphery of the plume. The cross-sections presented in Figure 5.0-1 show that the vertical extent of the plume has not expanded. Concentrations in the upper 80 ft of the plume have decreased substantially, generally from 5 to 10 times the Tier I SL, to 1 to 5 times the SL. Similar to lateral extent, the vertical extent of the core area with concentrations greater than 25 times the Tier I SL has decreased substantially. These results are consistent with diffusion from high concentrations to low concentrations at the surface of the site. Expansion of the plume downward into Guaje Pumice Bed and Tschicoma Formation dacite does not appear to be occurring.

As with most field data collected by different teams over many years, the data at MDA C show a few cases of odd behaviors that are likely related to data collection and/or laboratory analysis inconsistencies. For example, data from October 2017 in Figure D-3.0-2 and Figure D-3.0-3 show shifts in the depth of peak concentrations that are not persistent. At many locations, the results from July 2020 and October 2020 are anomalously low, outside the range of previous results, and otherwise inconsistent with temporal trends (Figures D-2.0-2, D-2.0-3, D-2.0-13, D-2.0-15, D-2.0-16, D-2.0-18, D-3.0-8, D-3.0-9, D-3.0-10, D-3.0-12, D-3.0-13, D-3.0-16, D-3.0-17, D-3.0-22, D-3.0-23, D-4.0-2, D-4.0-3, D-4.0-8, D-4.0-9, D-4.0-11, and D-4.0-14). Such sudden shifts in surface data cannot be explained by processes known to be acting on the movement of gas phase chemicals in the Bandelier Tuff (Stauffer et al. 2005, 090537; Stauffer et al. 2011, 255584; Behar et al. 2019, 700854) and are thus most likely explained by issues with sample collection and/or analysis.

D-6.0 CONCLUSIONS

The 2012 MDA C CME report (LANL 2012, 222830) estimated the total mass of TCE in the subsurface to be in the range of 134 to 239 kg (equivalent to 24 to 43 gal. as liquid). Given that the highest concentration ports in the center of the plume appear to have decreased through 2021 (Figure 5.0-1), it is logical to assume that the total mass in the subsurface is less than previously estimated, possibly due to upward diffusion through the surface and into the atmosphere. Because the high concentrations in the core have not migrated downward, most of the TCE mass is still present in the upper stratigraphic units (i.e., above the Cerro Toledo interval). The distribution of mass, slow increases at the edge of the plume, and decreases in shallow concentrations are consistent with the conceptual model of vapor diffusion, with the added benefit of diffusion through the lower units (the Tschicoma Formation dacite [Tvt-2] and Puye Formation [Tpf] shown in Figure D-5.0-1) being impeded by the relatively higher moisture content of these units. The purpose of field screening and monitoring at MDA C is to identify changes in the configuration of the plumes, monitor changes in contaminant concentration distribution, and identify data-gap needs for future modeling or trend analyses.

D-7.0 REFERENCES

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

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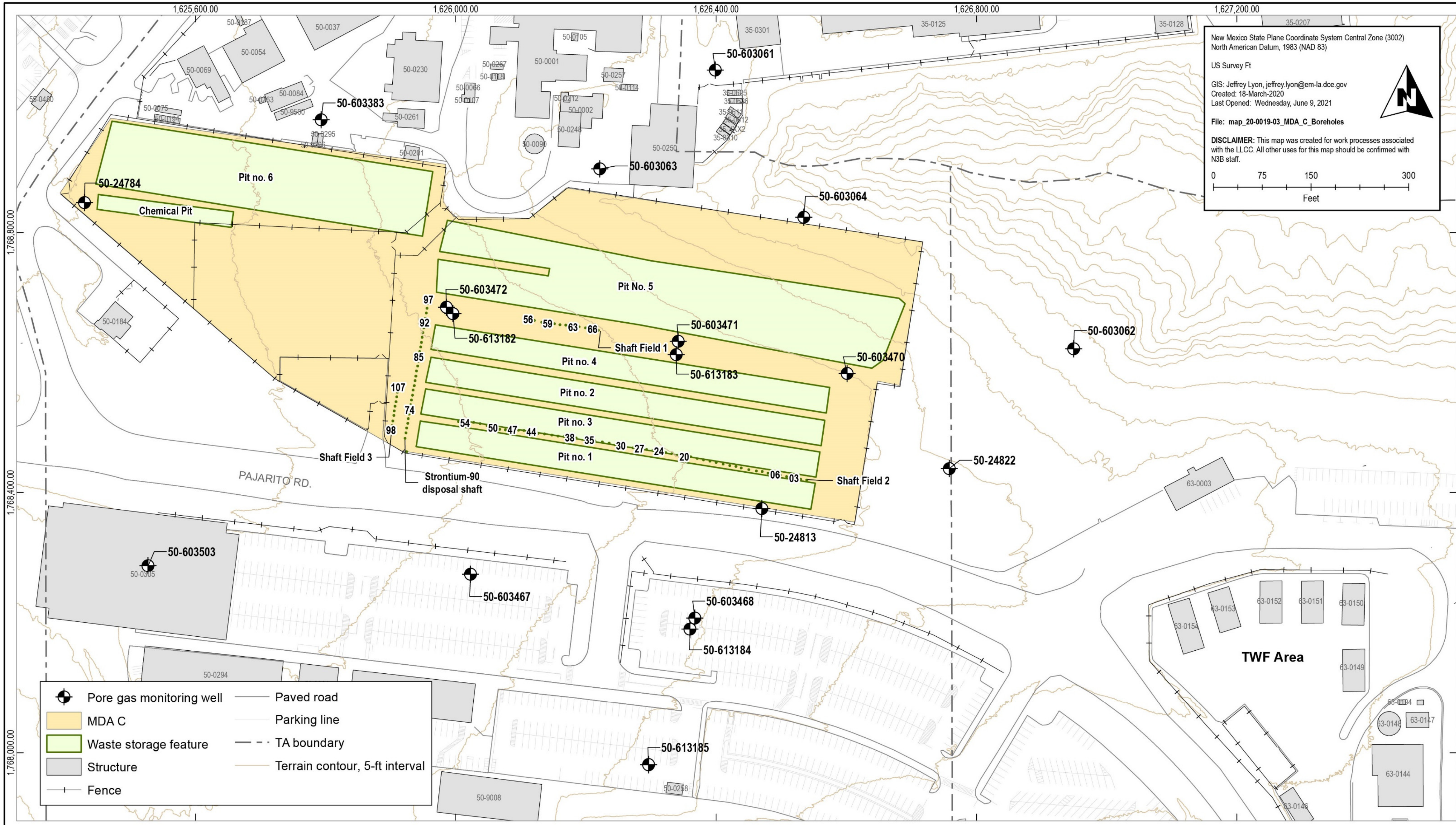


Figure D-1.0-1 Location of MDA C monitoring boreholes

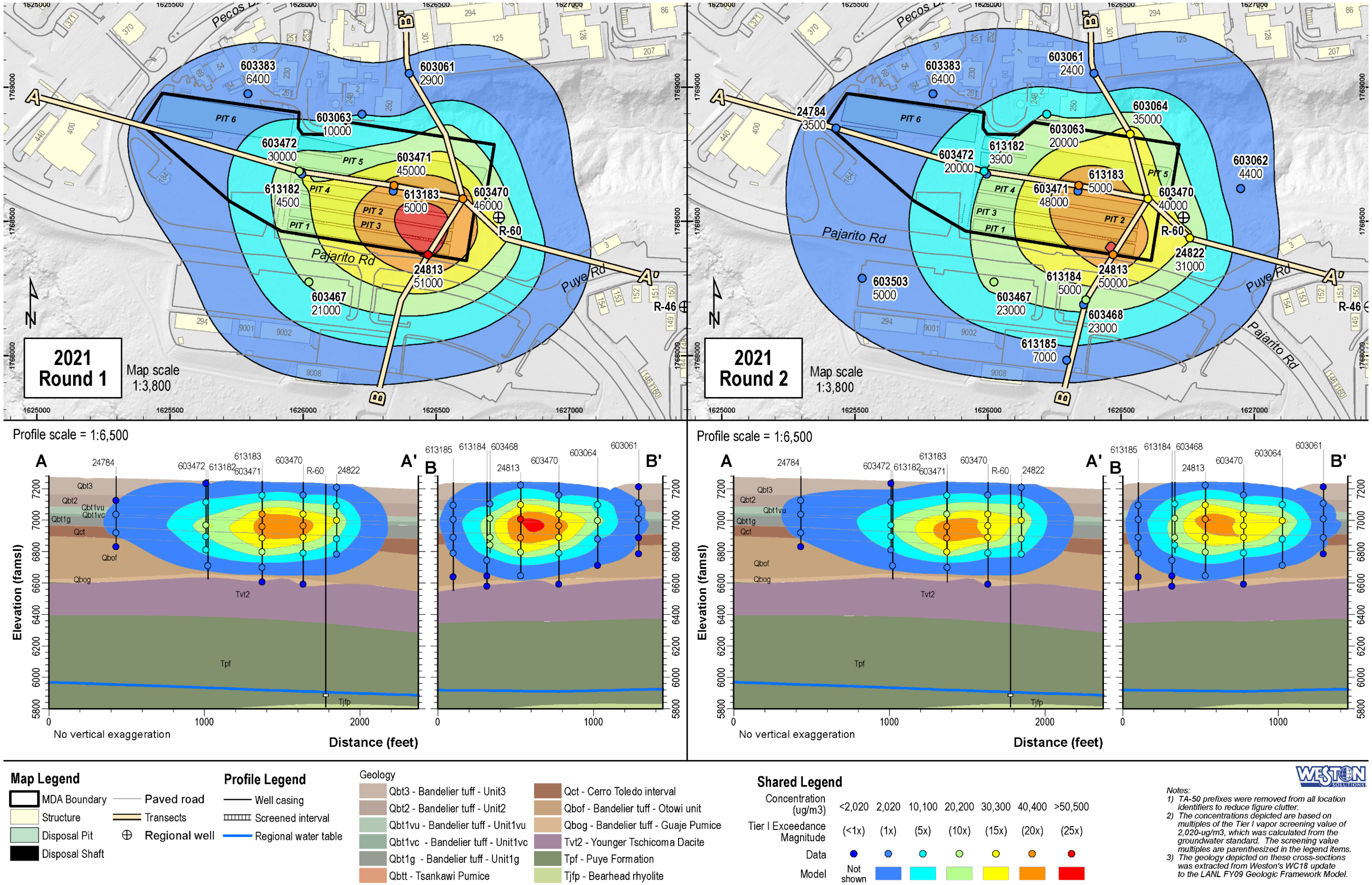
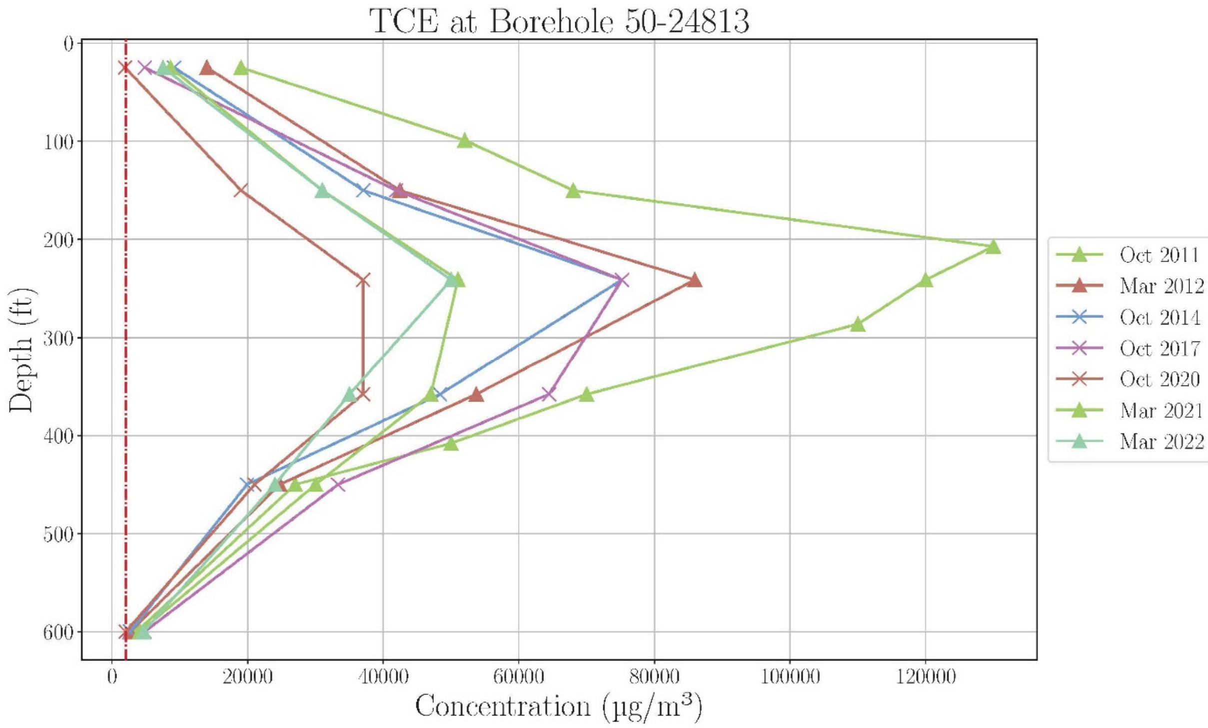
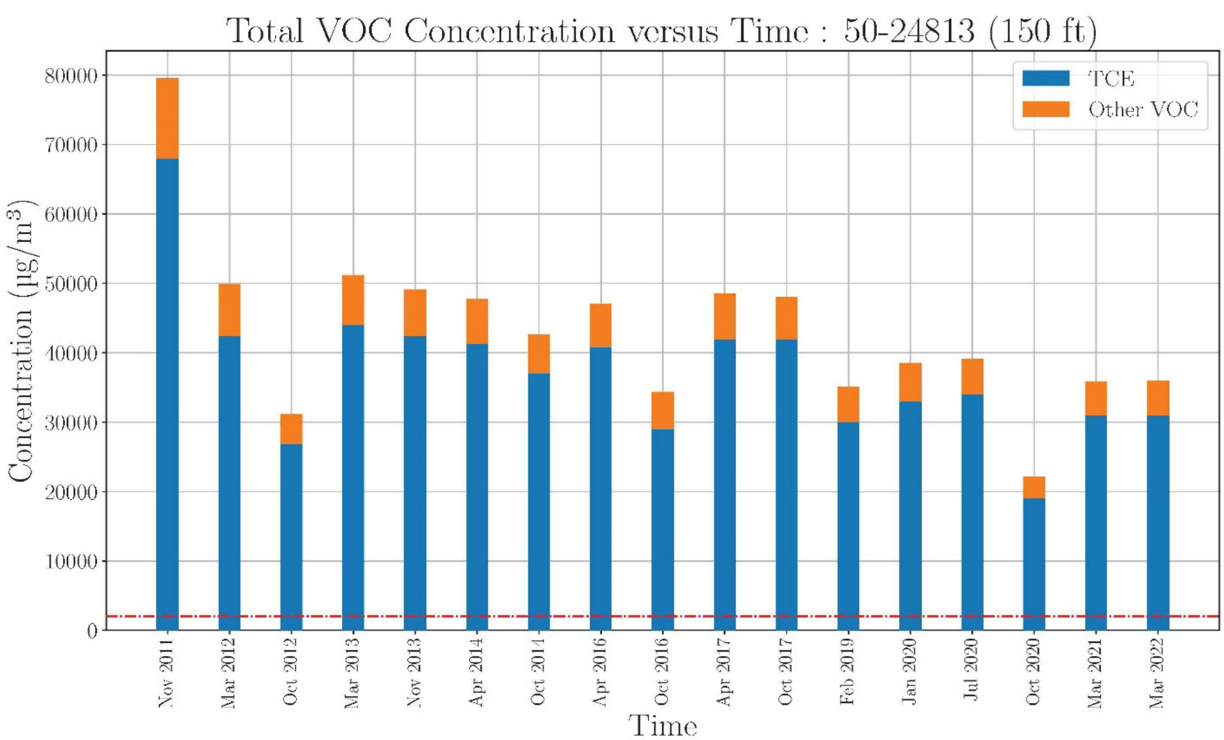


Figure D-1.0-2 Lateral and vertical extent of the MDA C TCE plume. First 2021 sampling round shown on the left and second 2021 sampling round shown on the right.



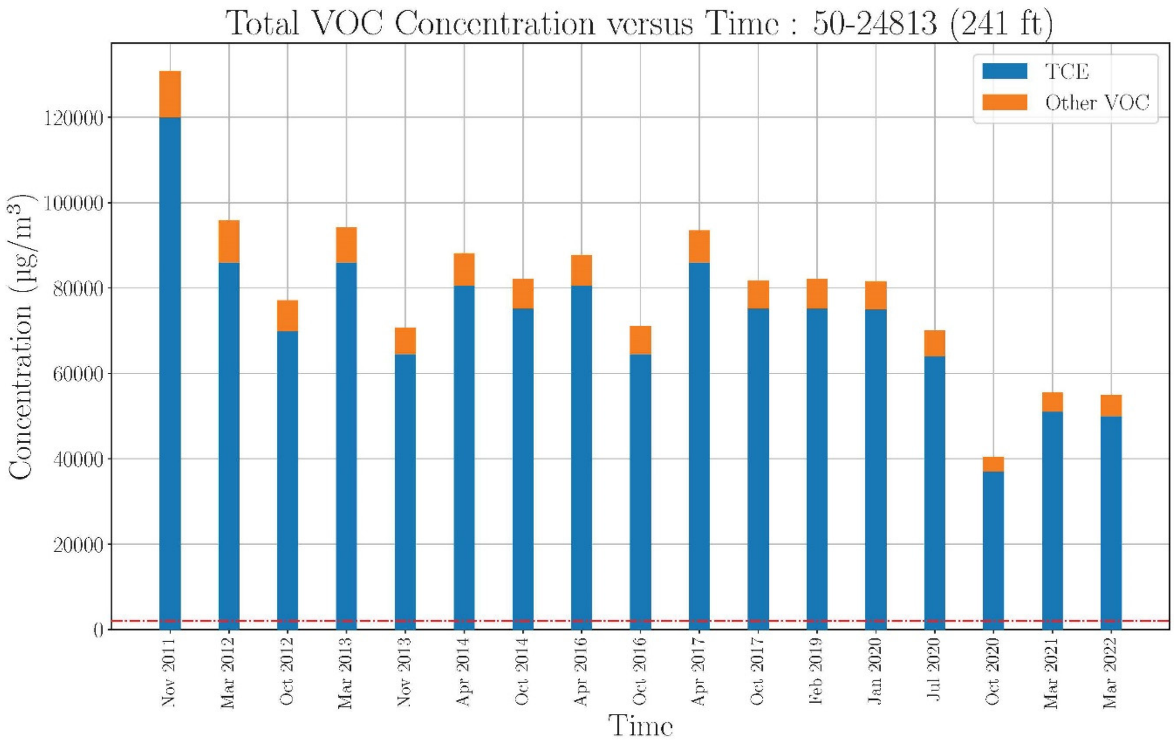
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-1 TCE concentration versus depth and time at borehole 50-24813



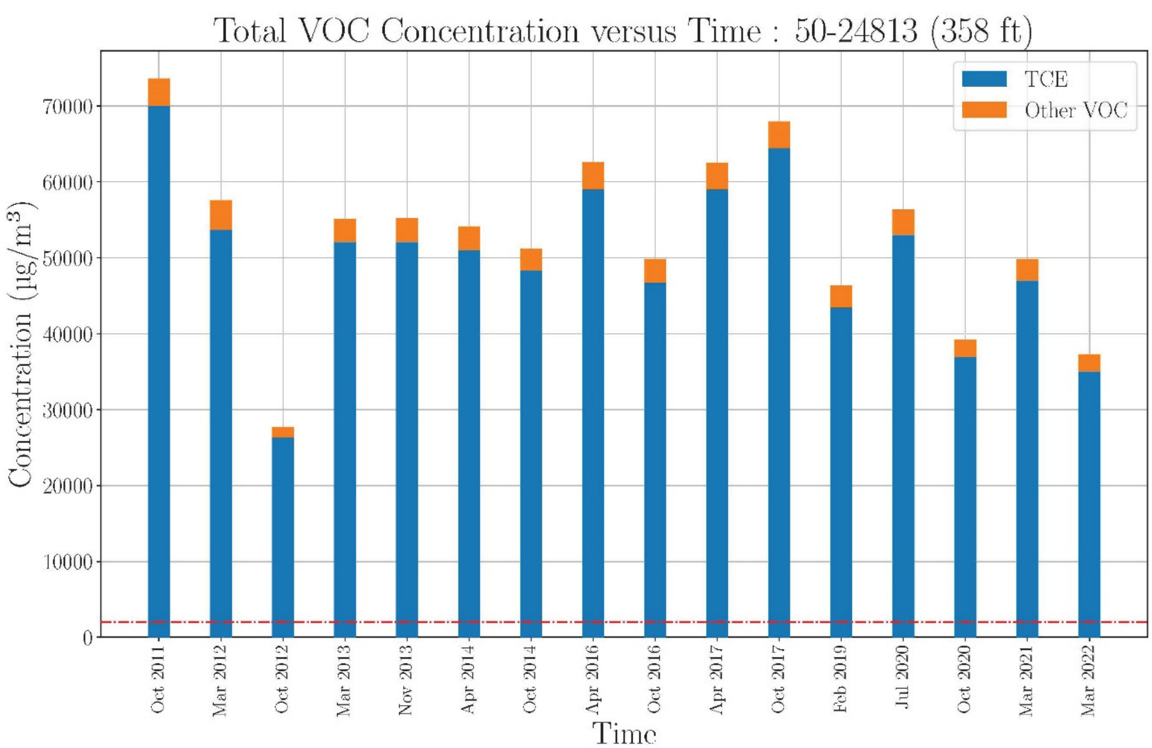
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-2 Total VOC concentration at 150 ft bgs at borehole 50-24813 over time



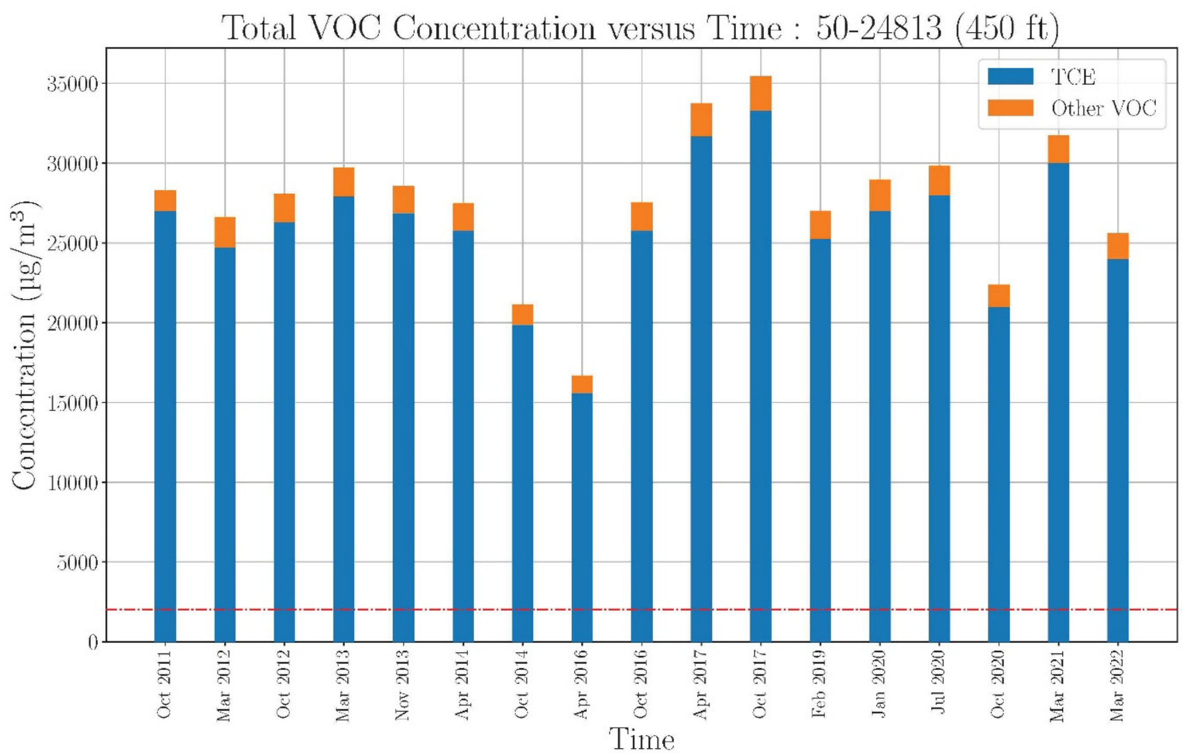
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-3 Total VOC concentration at 241 ft bgs at borehole 50-24813 over time



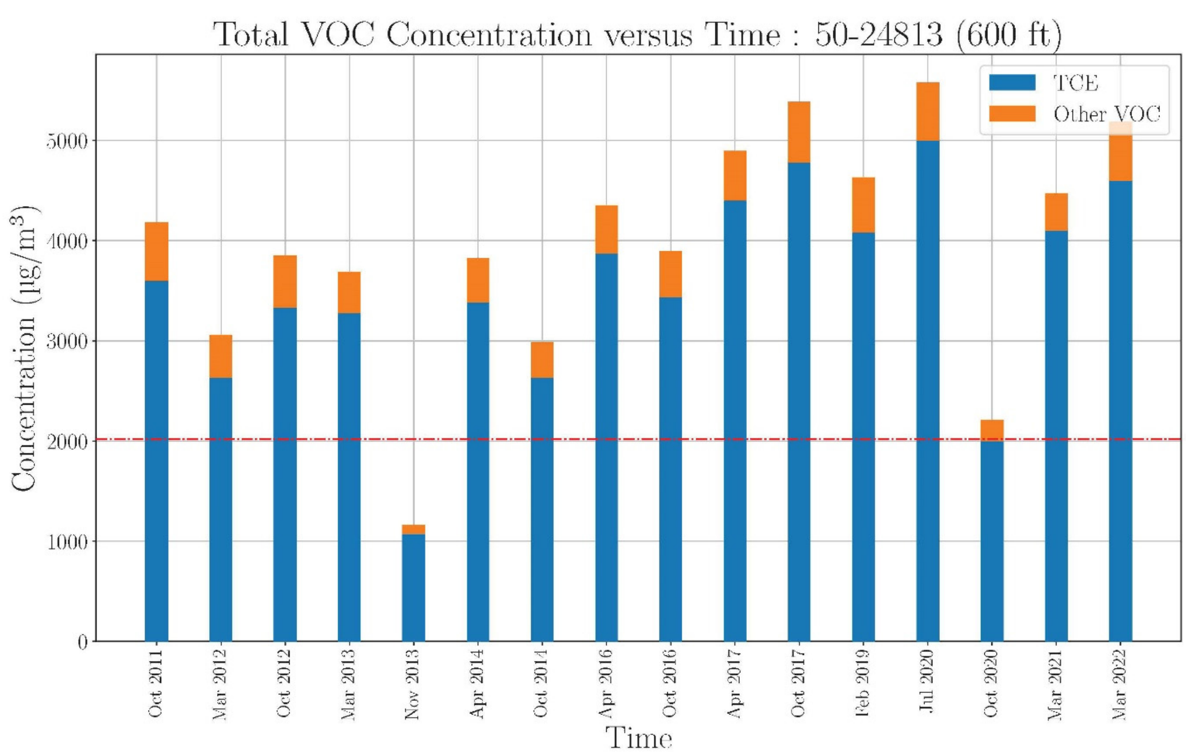
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-4 Total VOC concentration at 358 ft bgs at borehole 50-24813 over time



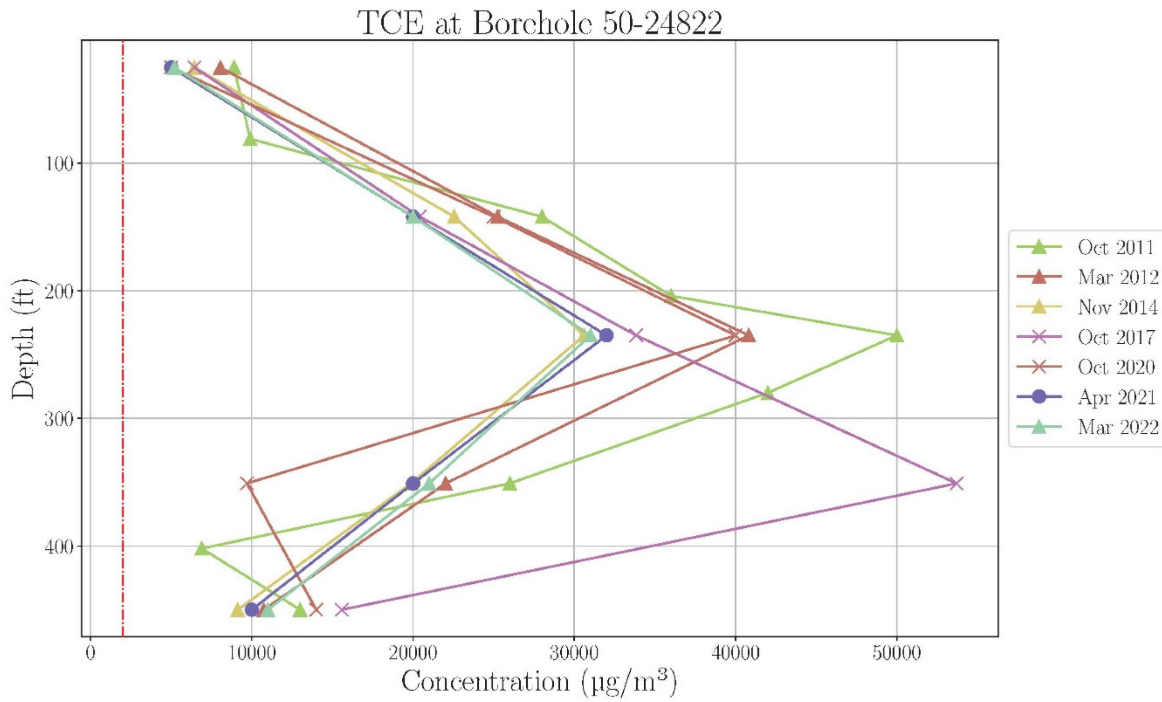
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-5 Total VOC concentration at 450 ft bgs at borehole 50-24813 over time



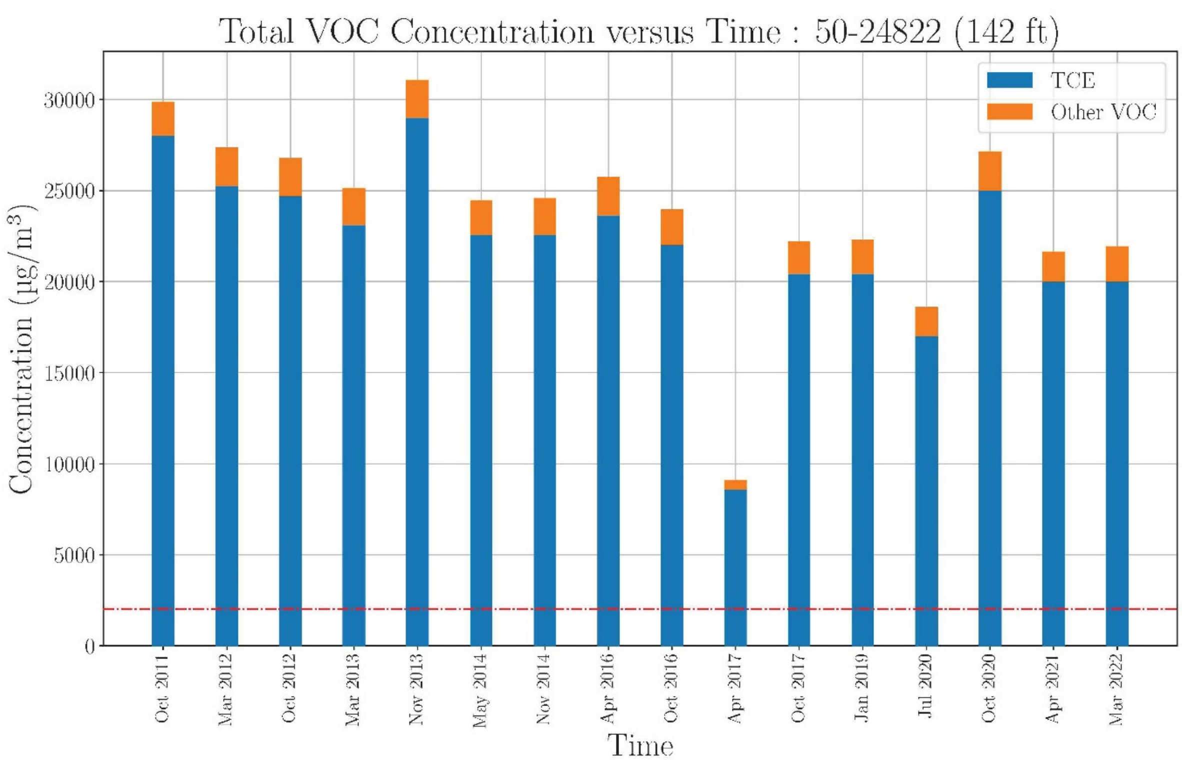
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-6 Total VOC concentration at 600 ft bgs at borehole 50-24813 over time



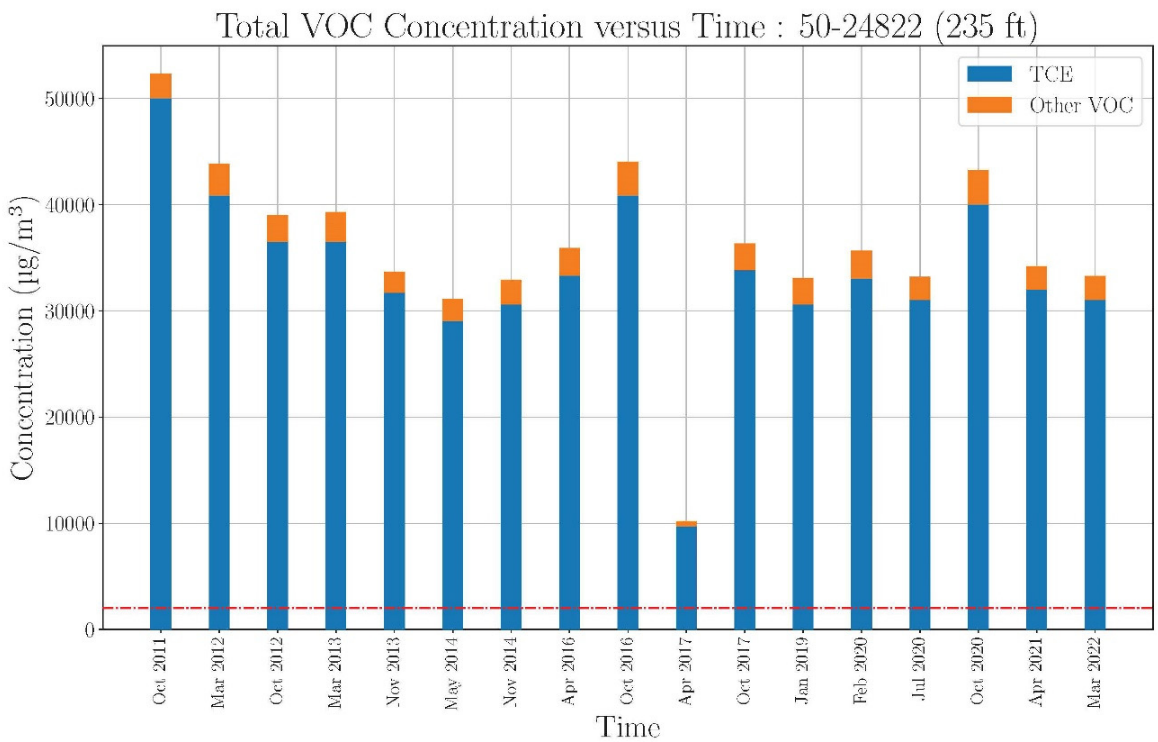
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-7 TCE concentration versus depth and time at borehole 50-24822



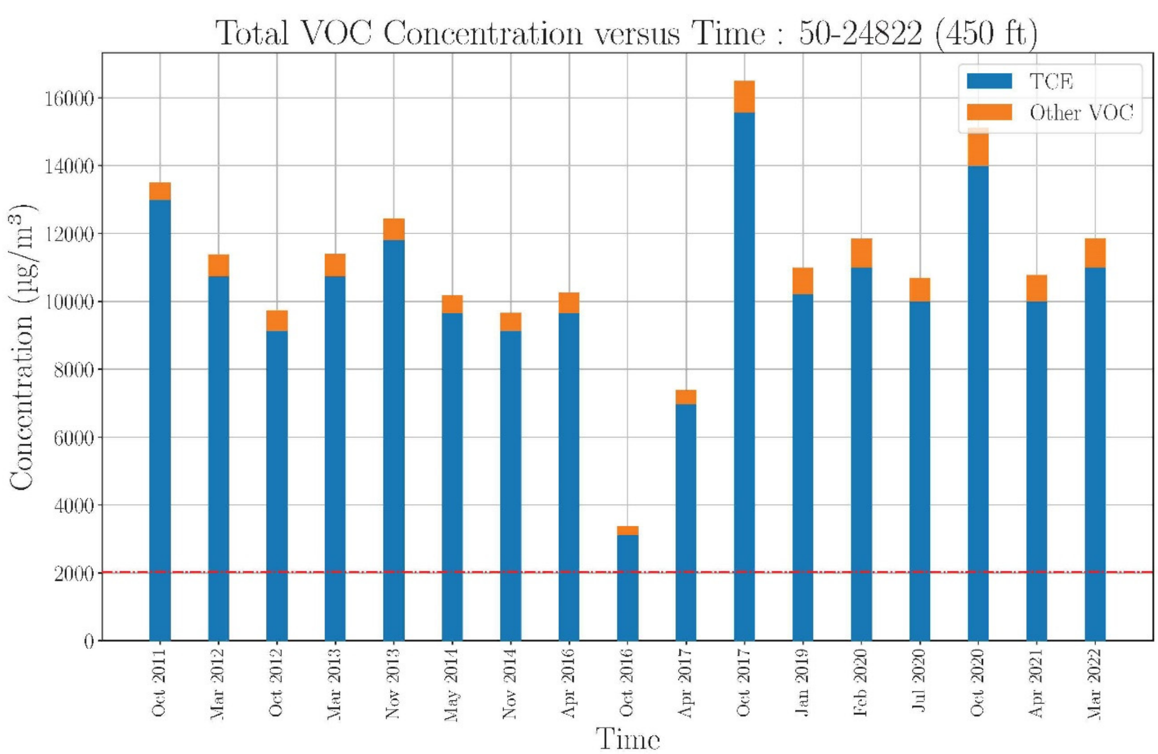
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-8 Total VOC concentration at 142 ft bgs at borehole 50-24822 over time



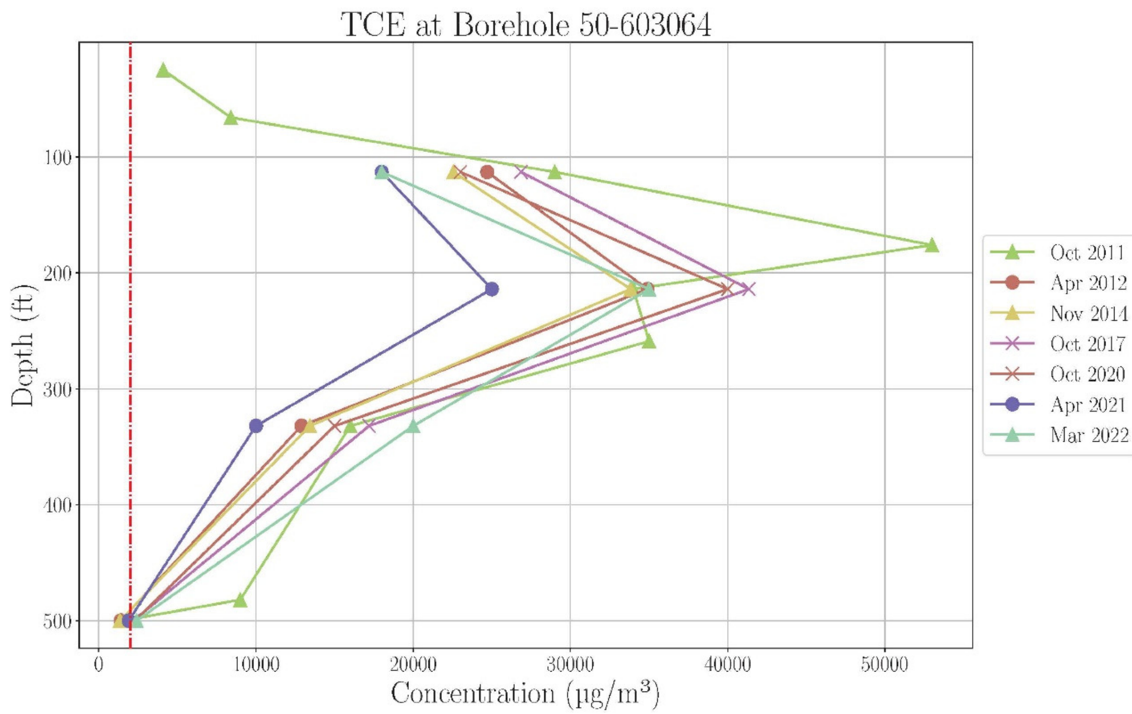
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-9 Total VOC concentration at 235 ft bgs at borehole 50-24822 over time



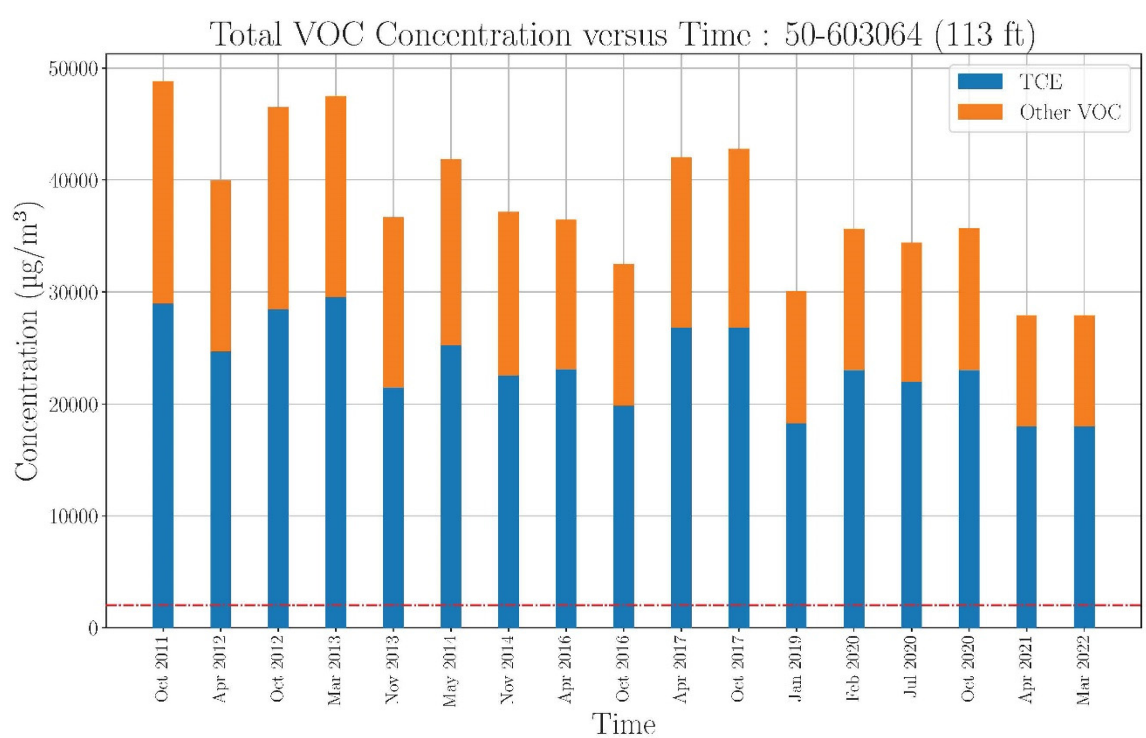
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-10 Total VOC concentration at 450 ft bgs at borehole 50-24822 over time



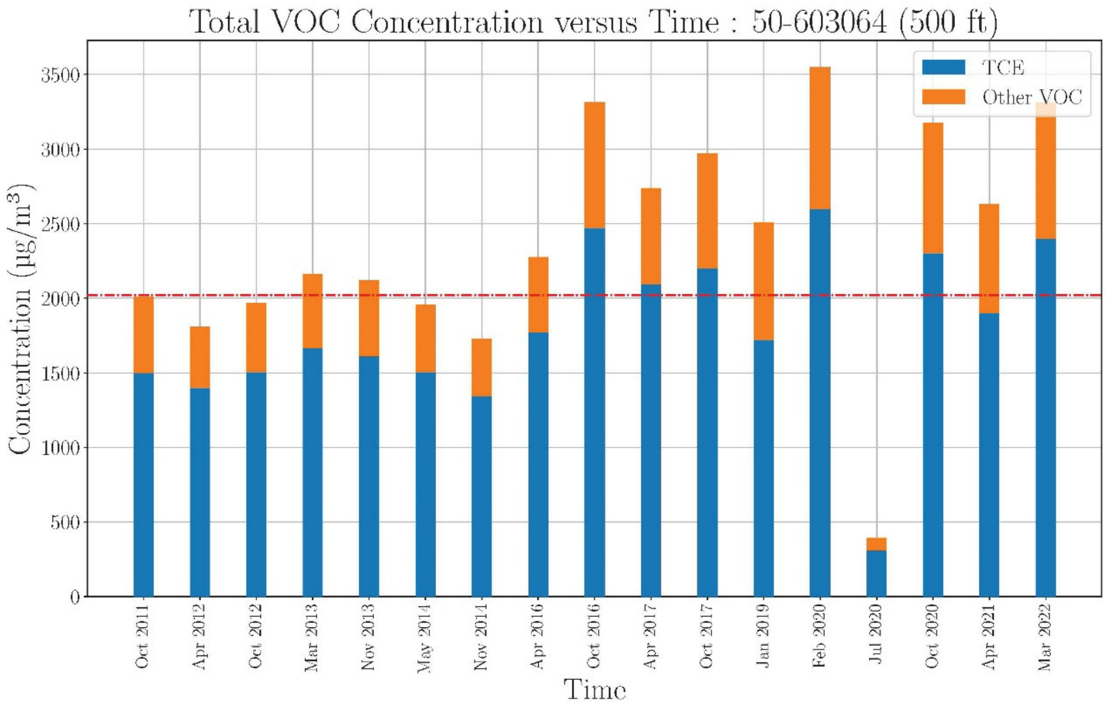
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-11 TCE concentration versus depth and time at borehole 50-603064



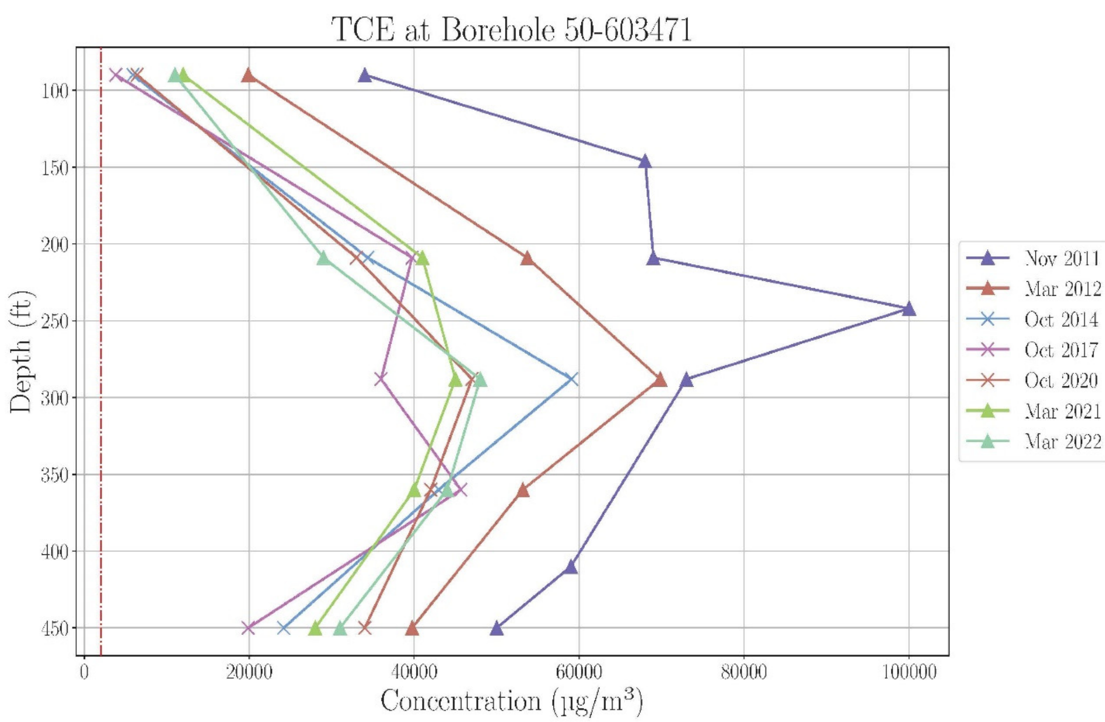
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-12 Total VOC concentration at 113 ft bgs at borehole 50-603064 over time



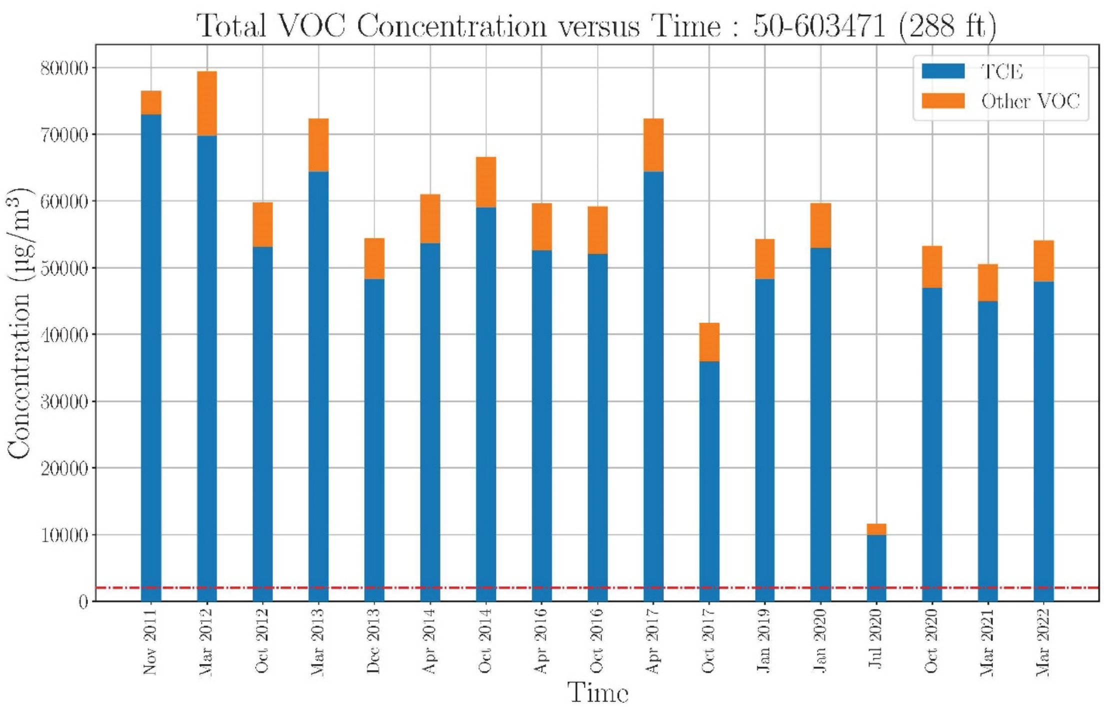
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-13 Total VOC concentration at 500 ft bgs at borehole 50-603064 over time



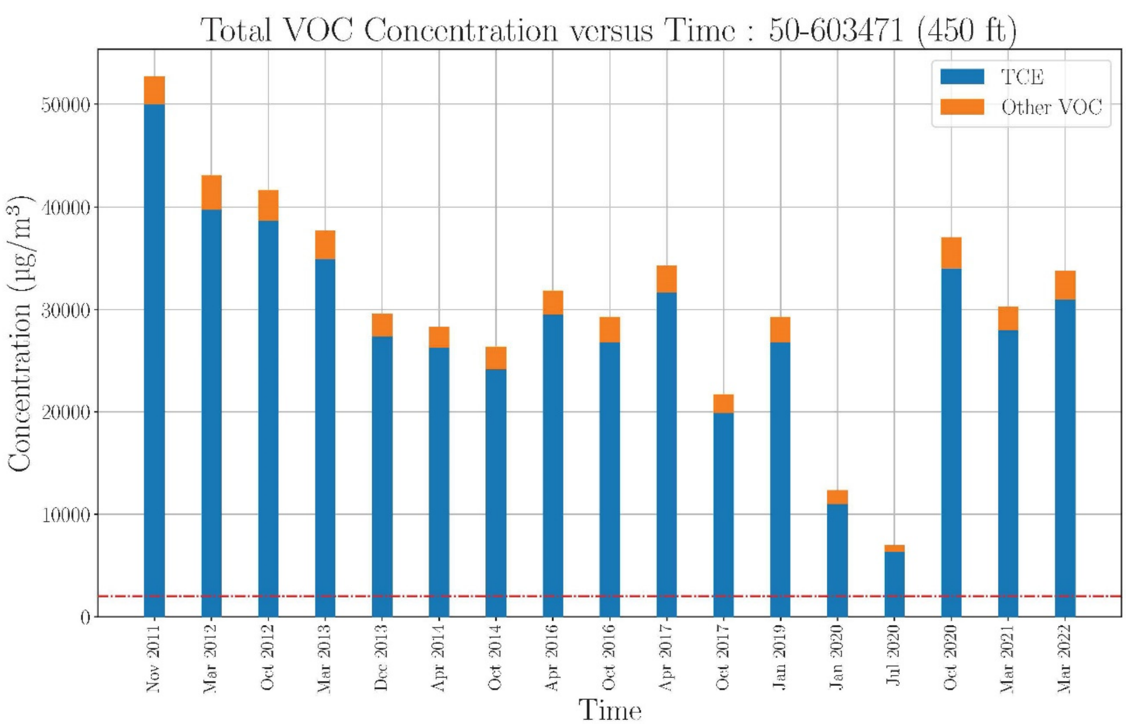
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-14 TCE concentration versus depth and time at borehole 50-603471



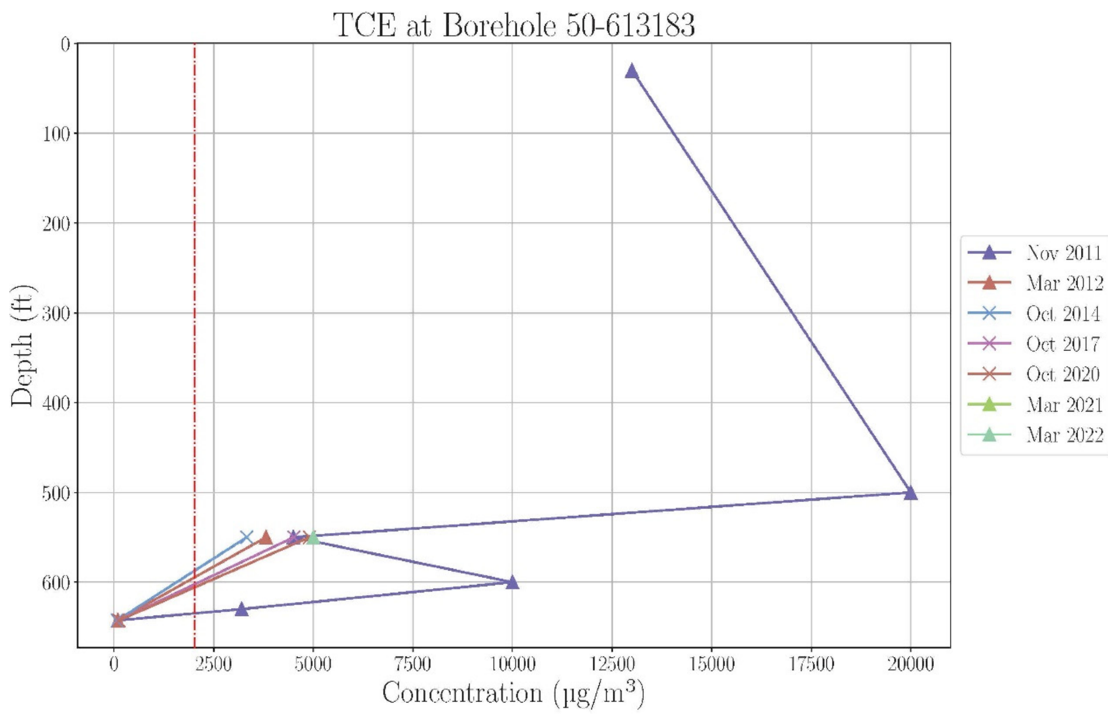
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-15 Total VOC concentration at 288 ft bgs at borehole 50-603471 over time



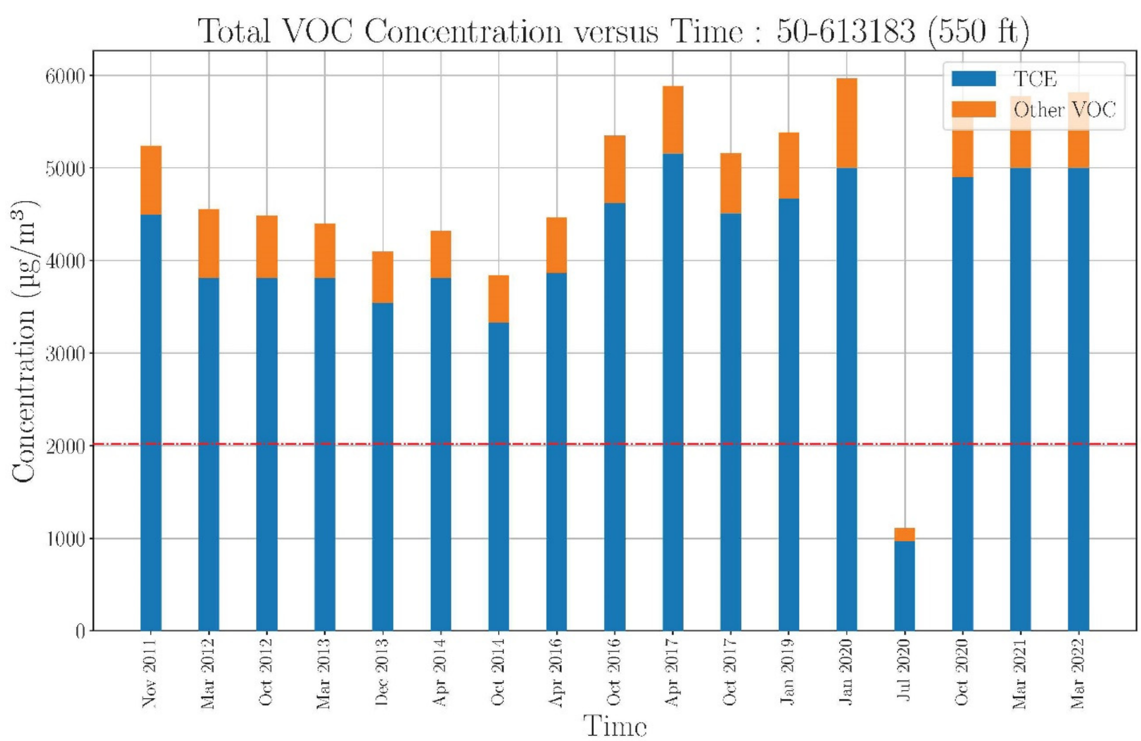
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-16 Total VOC concentration at 450 ft bgs at borehole 50-603471 over time



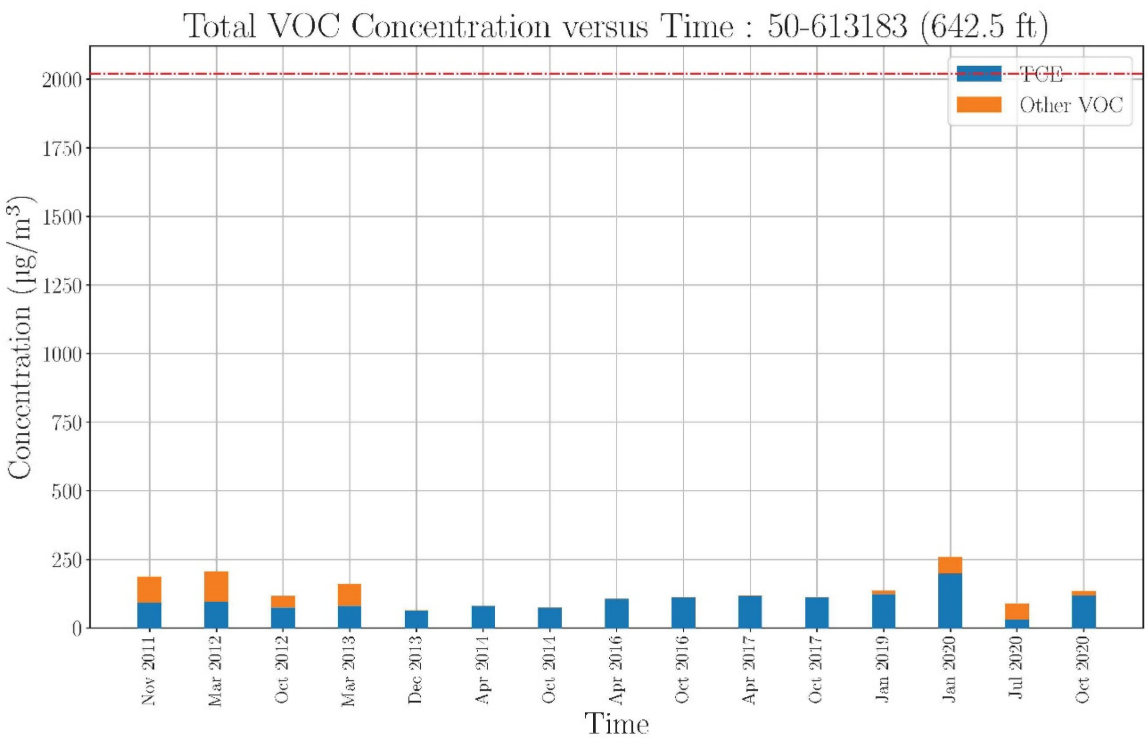
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-17 TCE concentration versus depth and time at borehole 50-613183



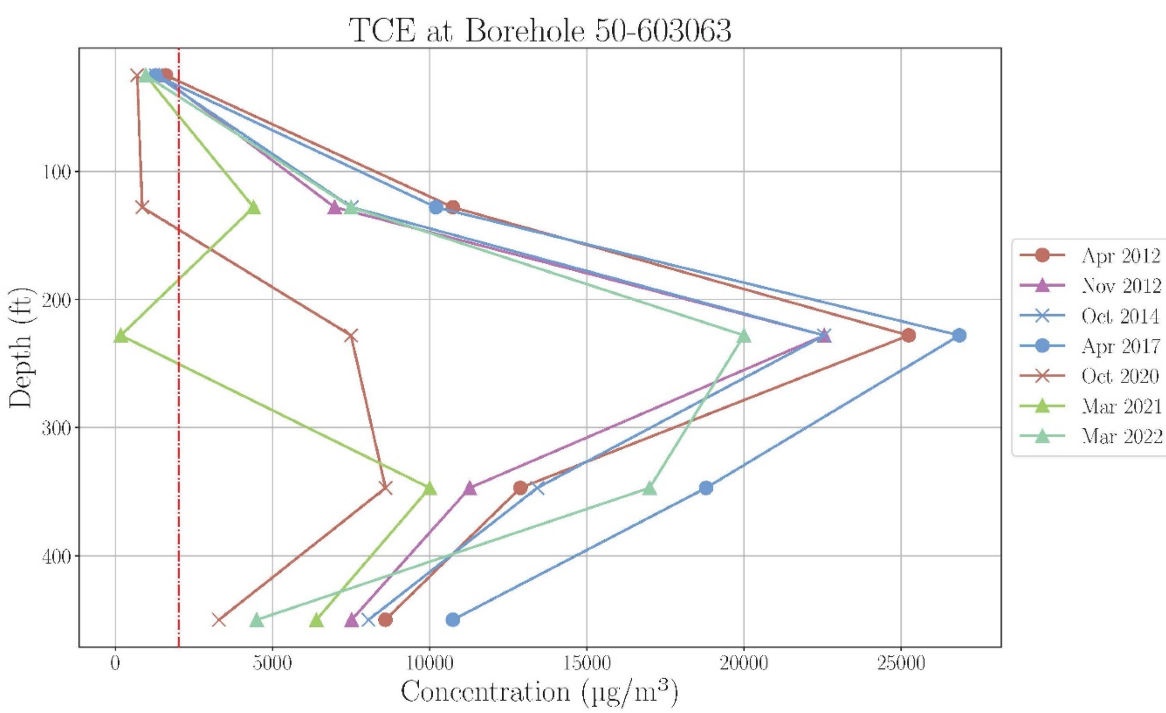
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-18 Total VOC concentration at 550 ft bgs at borehole 50-613183 over time



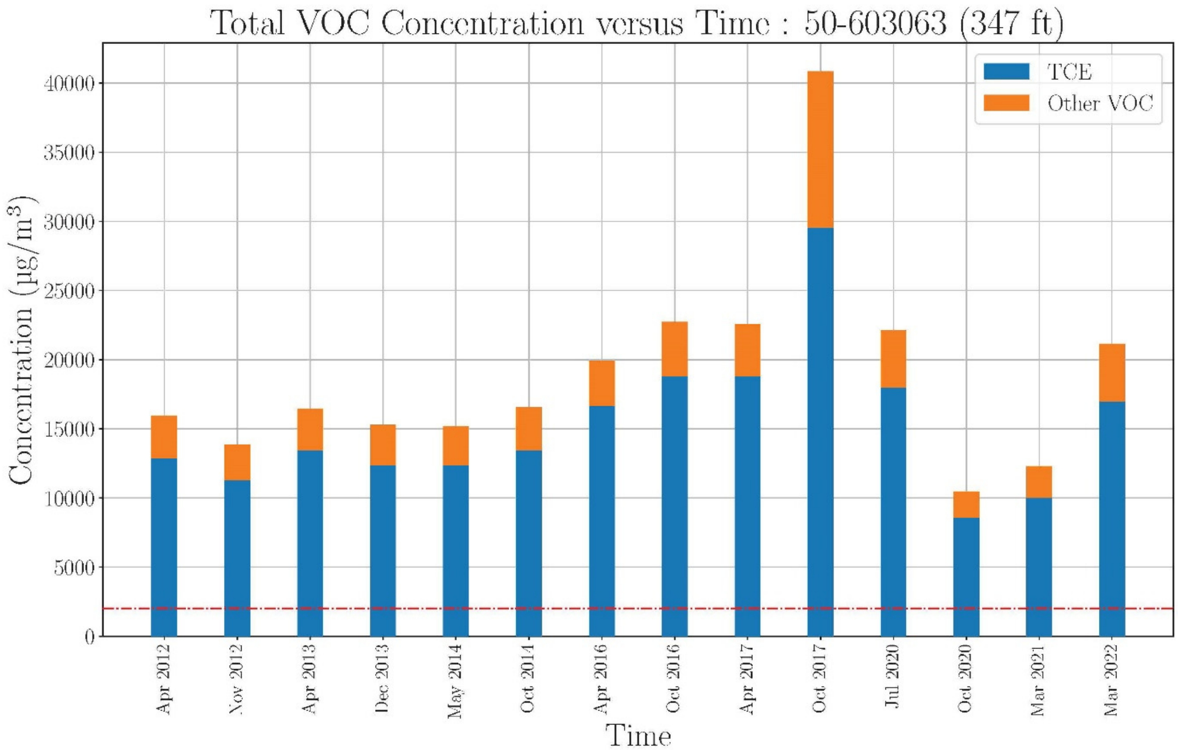
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-19 Total VOC concentration at 642.5 ft bgs at borehole 50-613183 over time



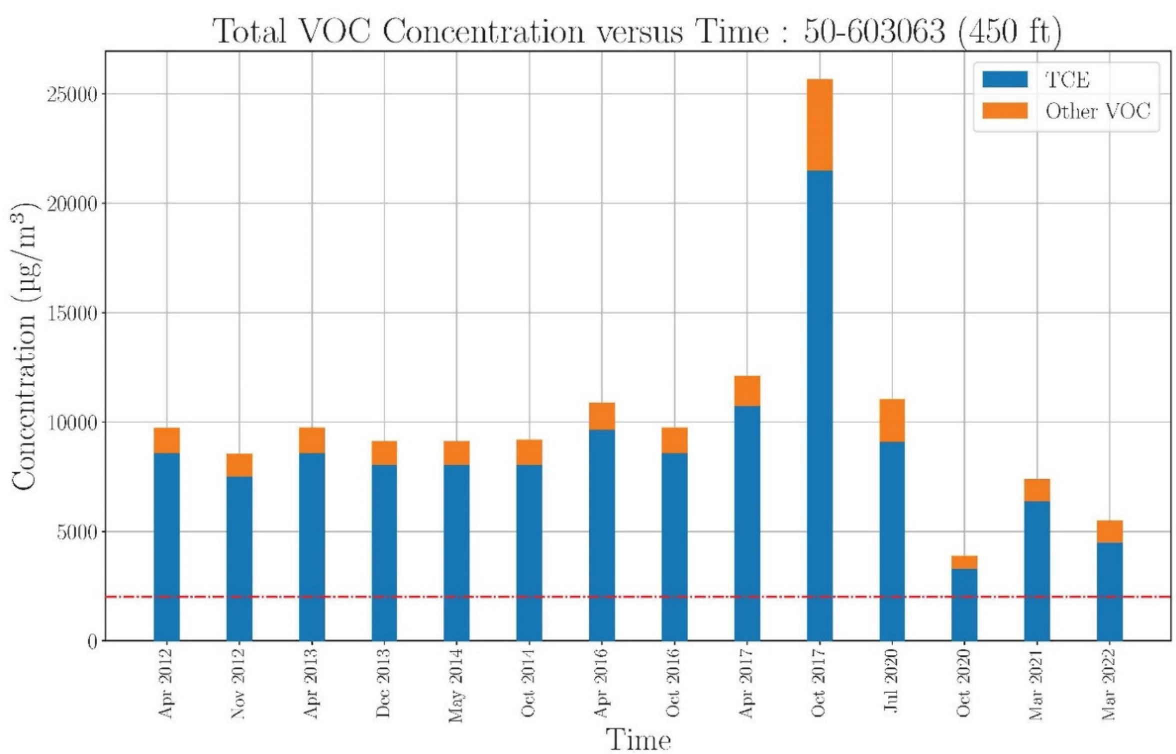
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-1 TCE concentration versus depth and time at borehole 50-603063



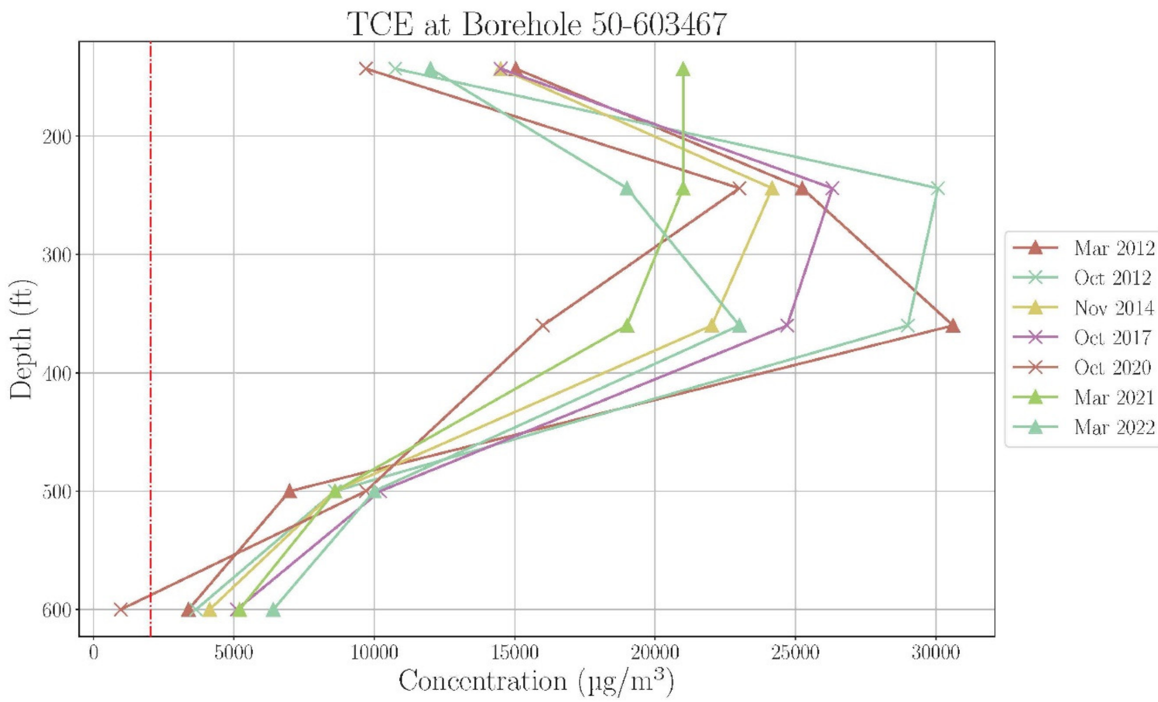
Note: Dashed red line is the 2020-µg/m[3] Tier I pore-gas SL for TCE.

Figure D-3.0-2 Total VOC concentration at 347 ft bgs at borehole 50-603063 over time



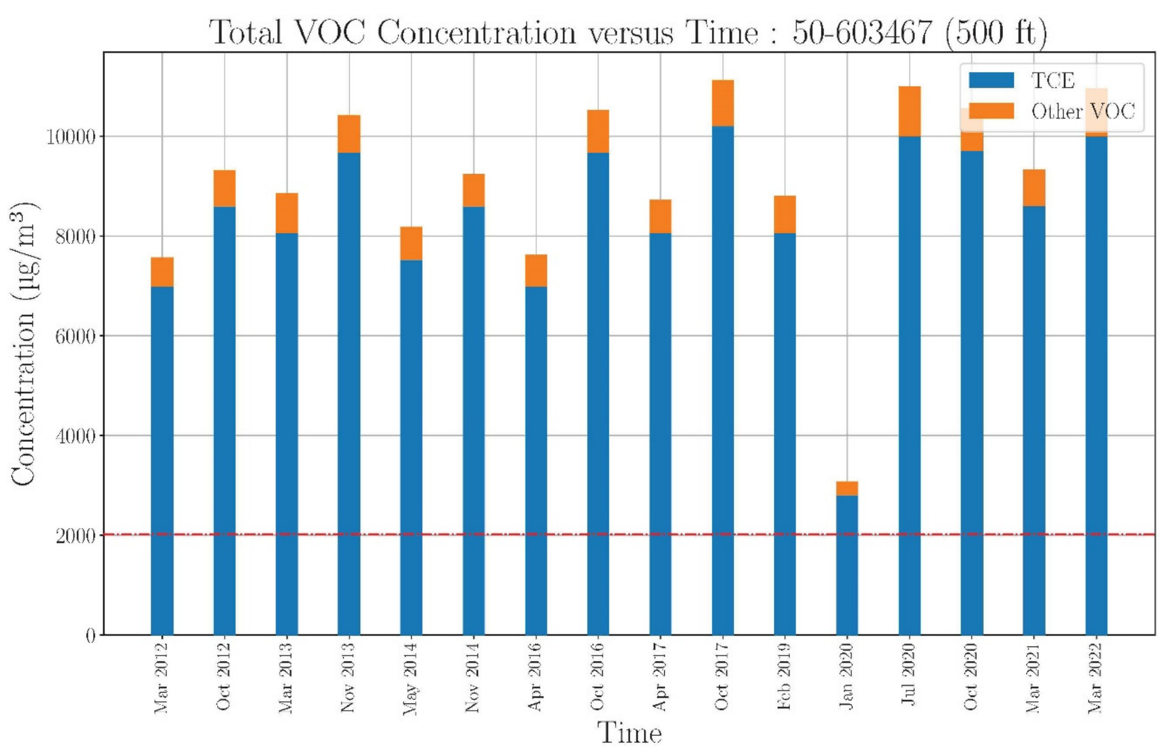
Note: Dashed red line is the 2020-µg/m[3] Tier I pore-gas SL for TCE.

Figure D-3.0-3 Total VOC concentration at 450 ft bgs at borehole 50-603063 over time



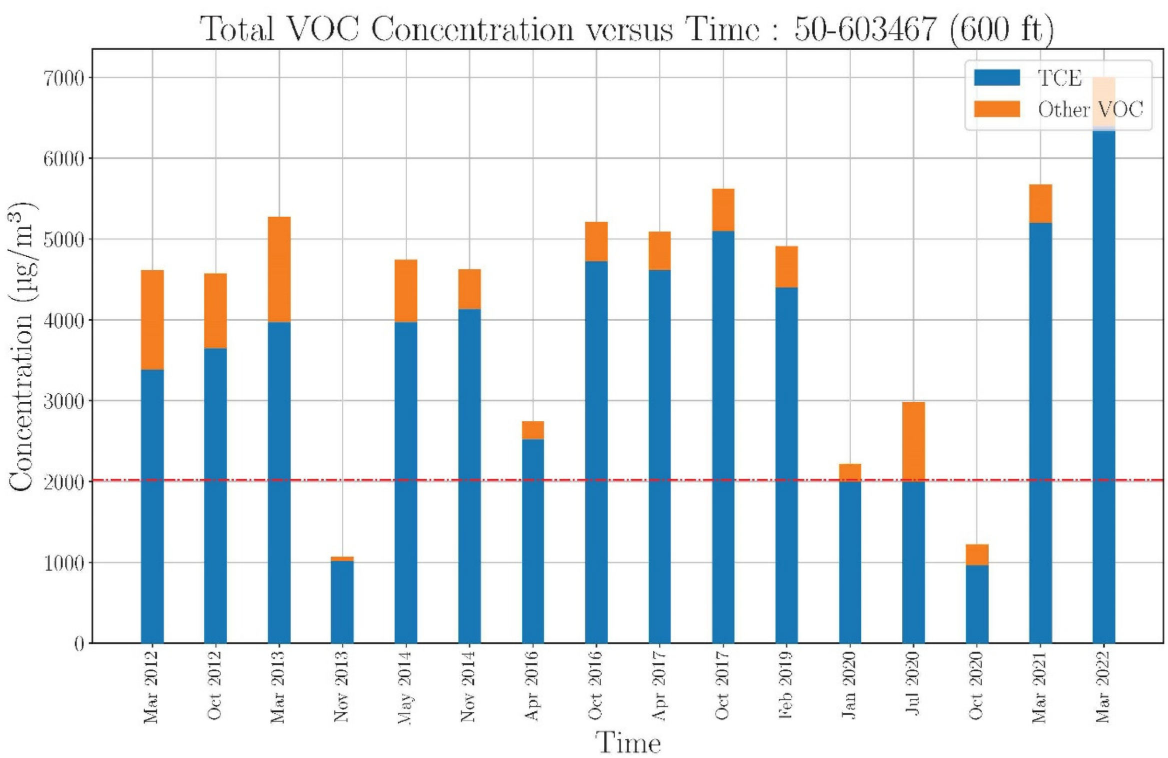
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-4 TCE concentration versus depth and time at borehole 50-603467



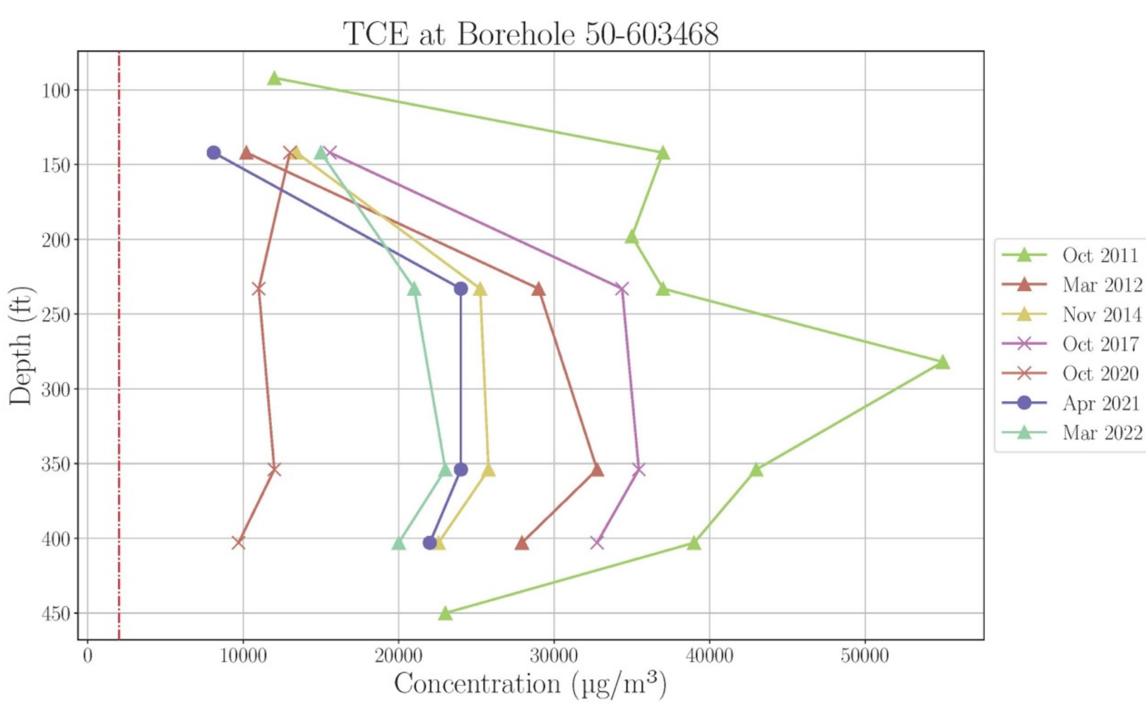
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-5 Total VOC concentration at 500 ft bgs at borehole 50-603467 over time



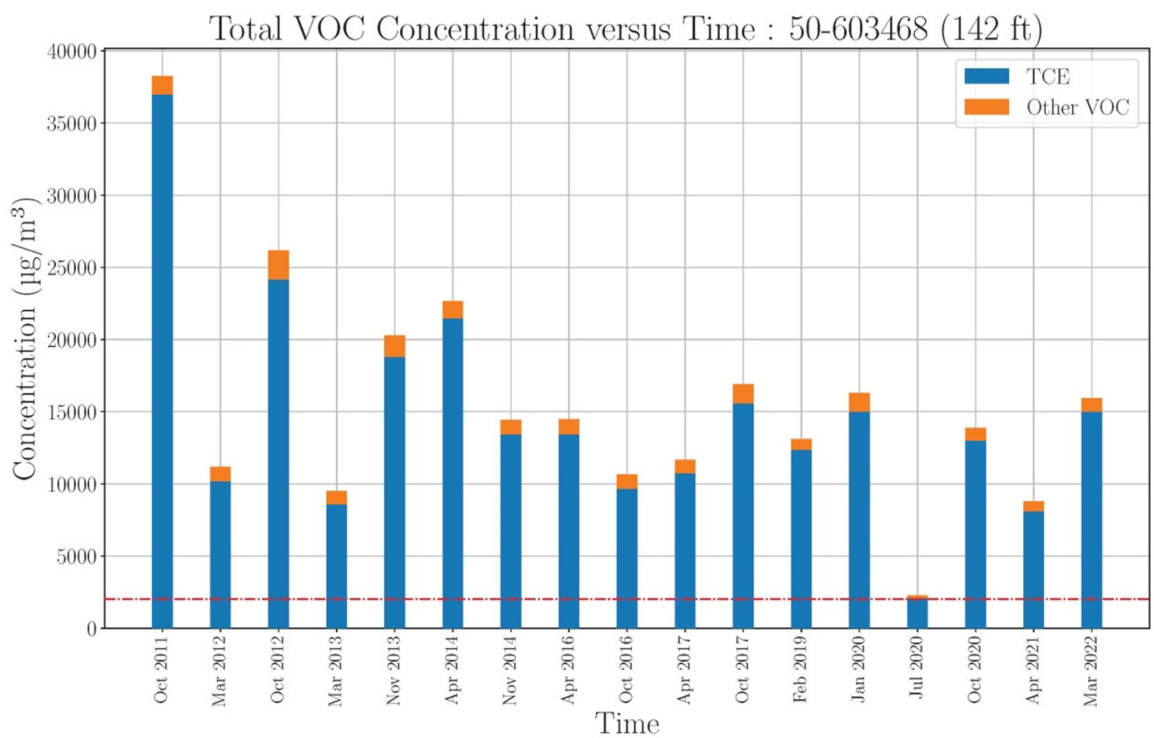
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-6 Total VOC concentration at 600 ft bgs at borehole 50-603467 over time



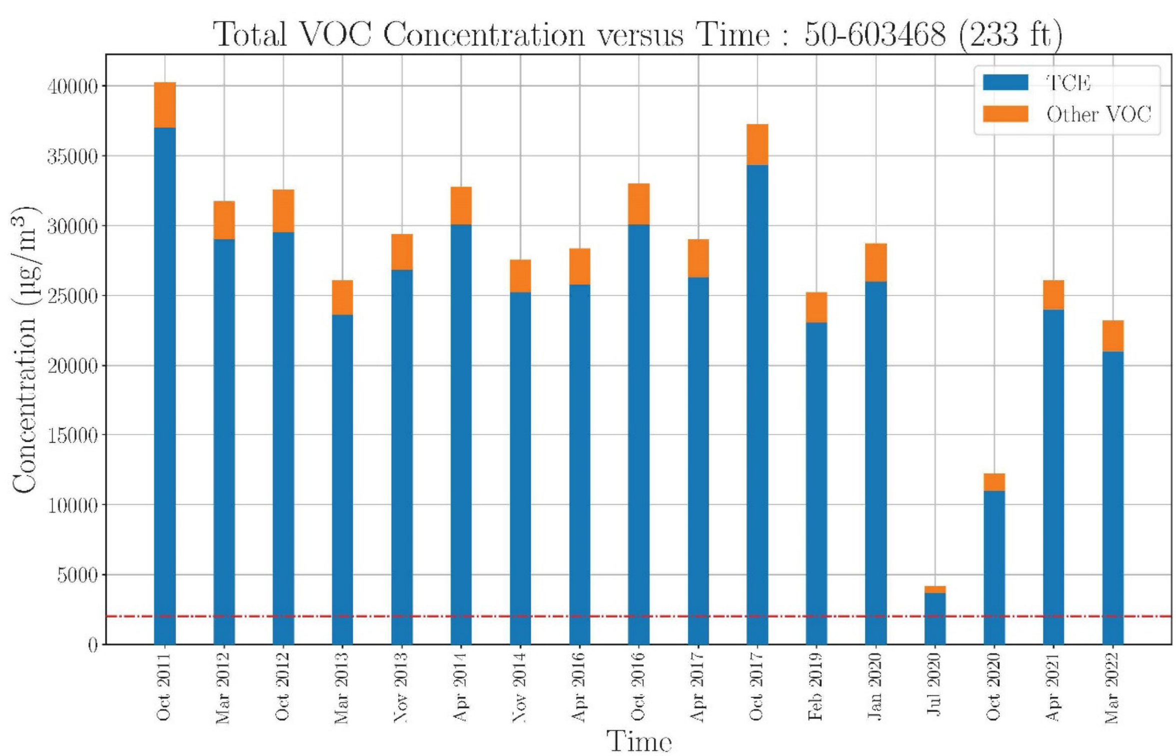
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-7 TCE concentration versus depth and time at borehole 50-603468



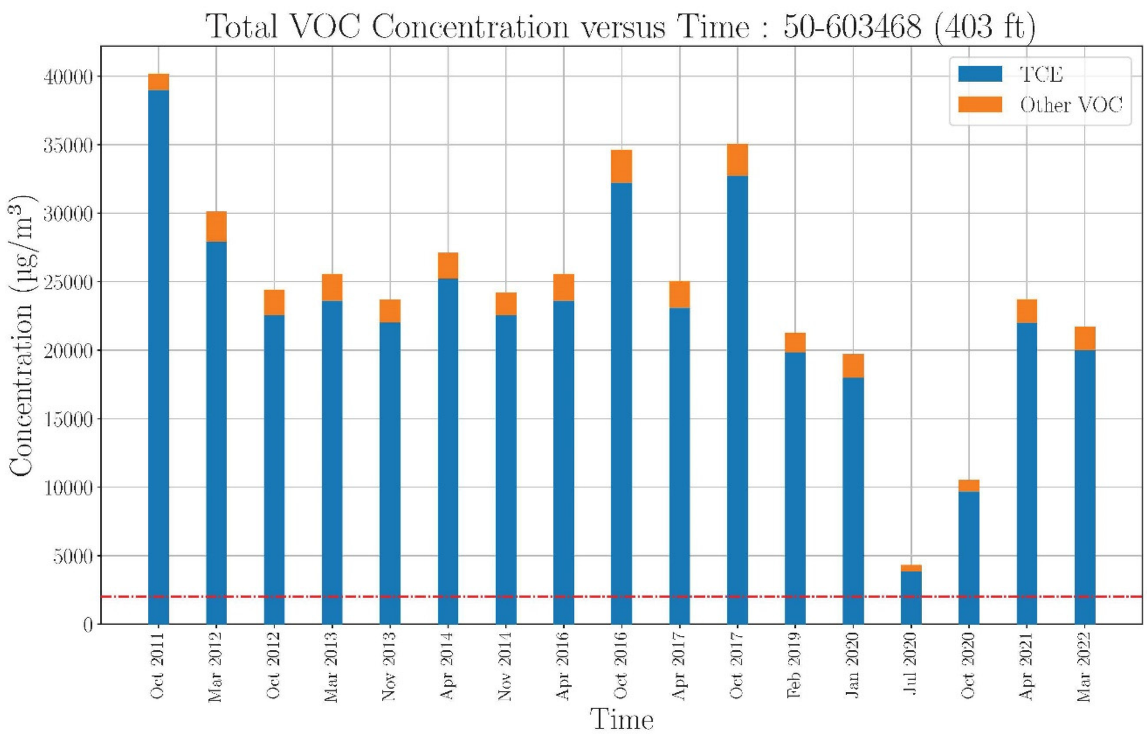
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-8 Total VOC concentration at 142 ft bgs at borehole 50-603468 over time



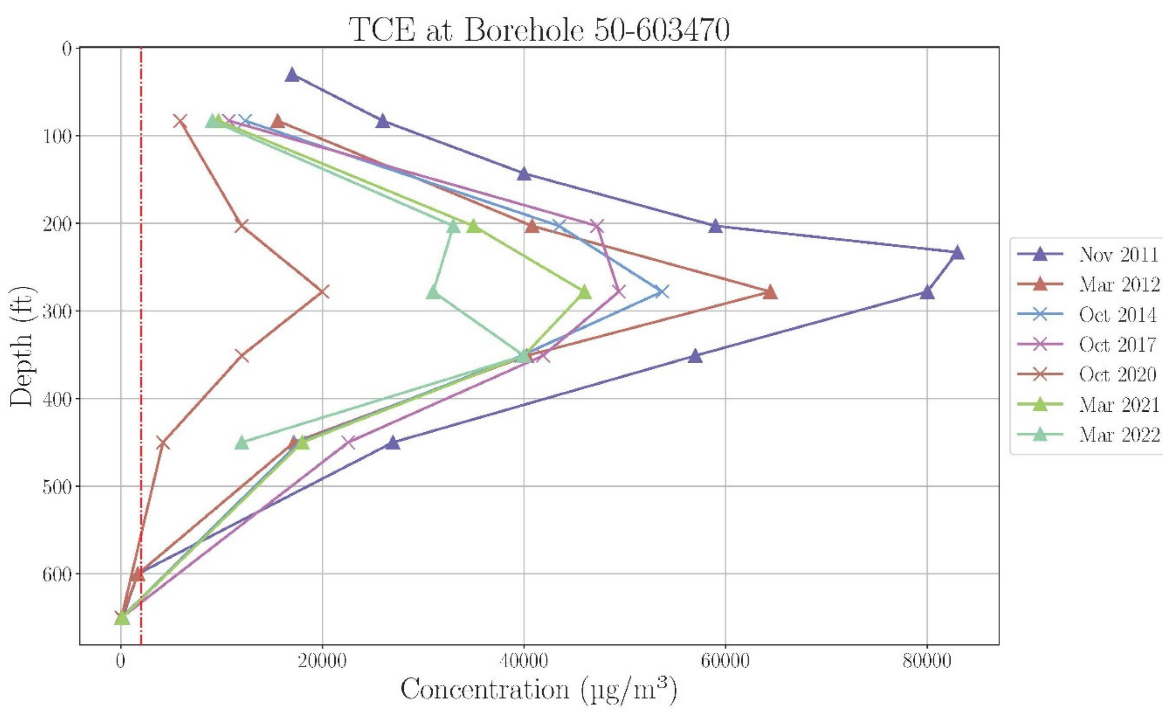
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-9 Total VOC concentration at 233 ft bgs at borehole 50-603468 over time



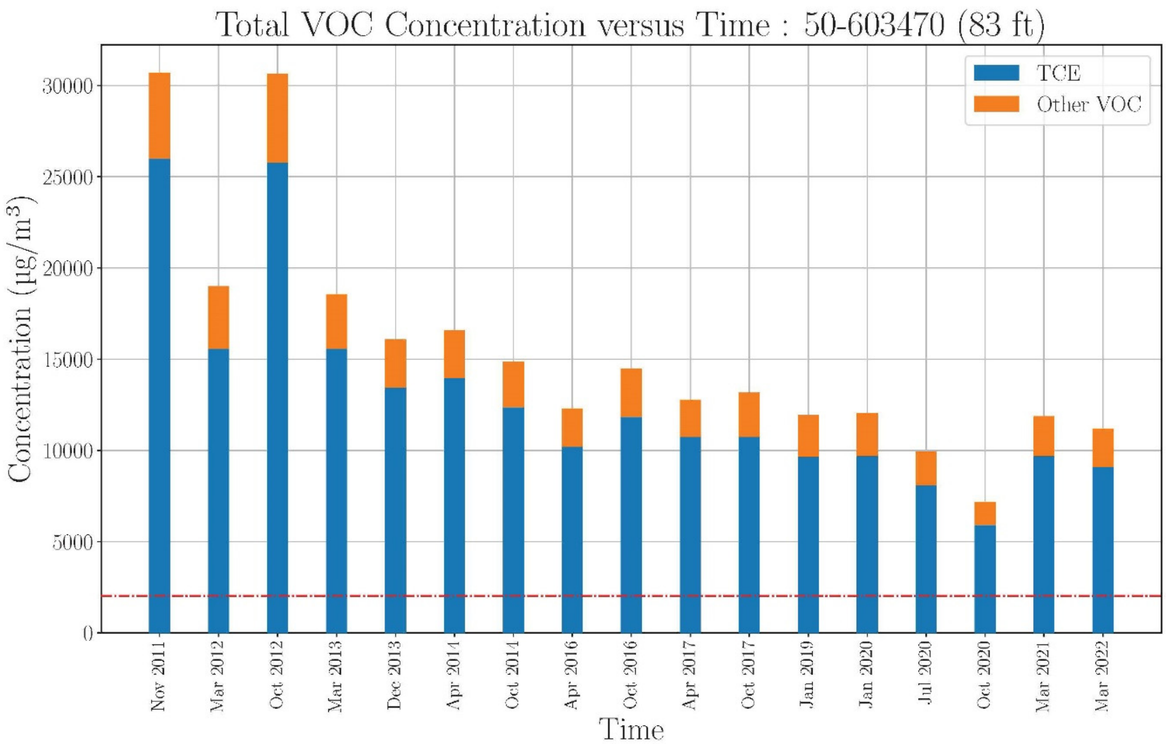
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-10 Total VOC concentration at 403 ft bgs at borehole 50-603468 over time



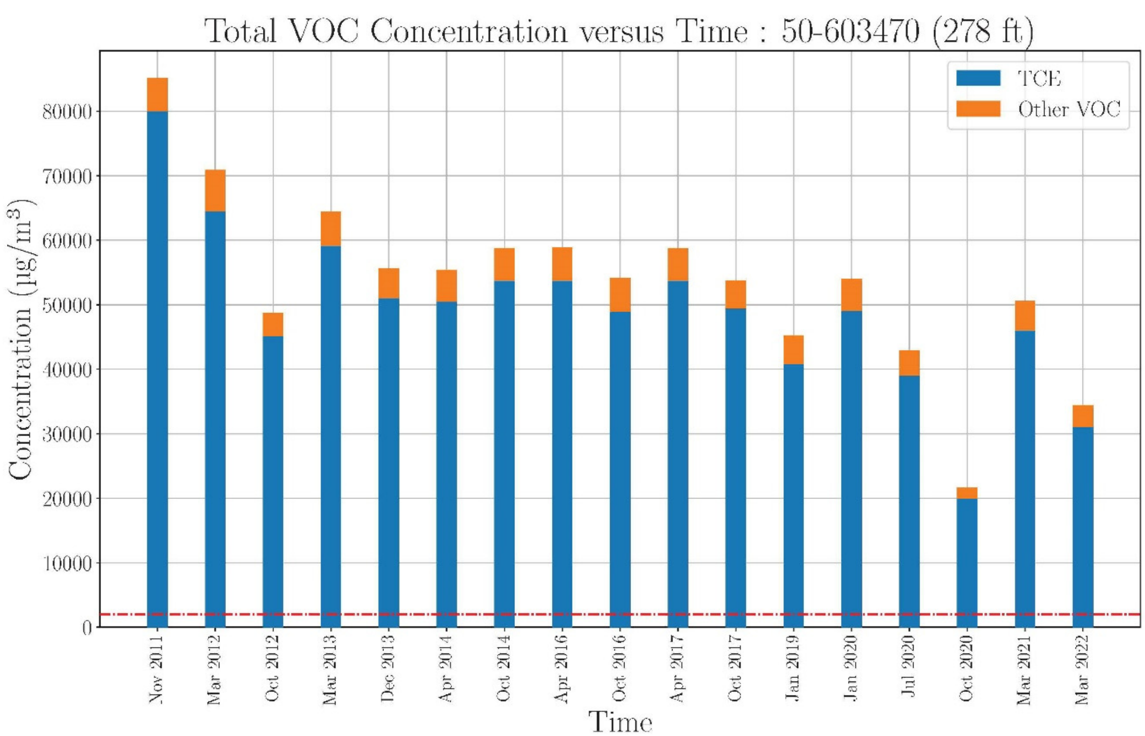
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-11 TCE concentration versus depth and time at borehole 50-603470



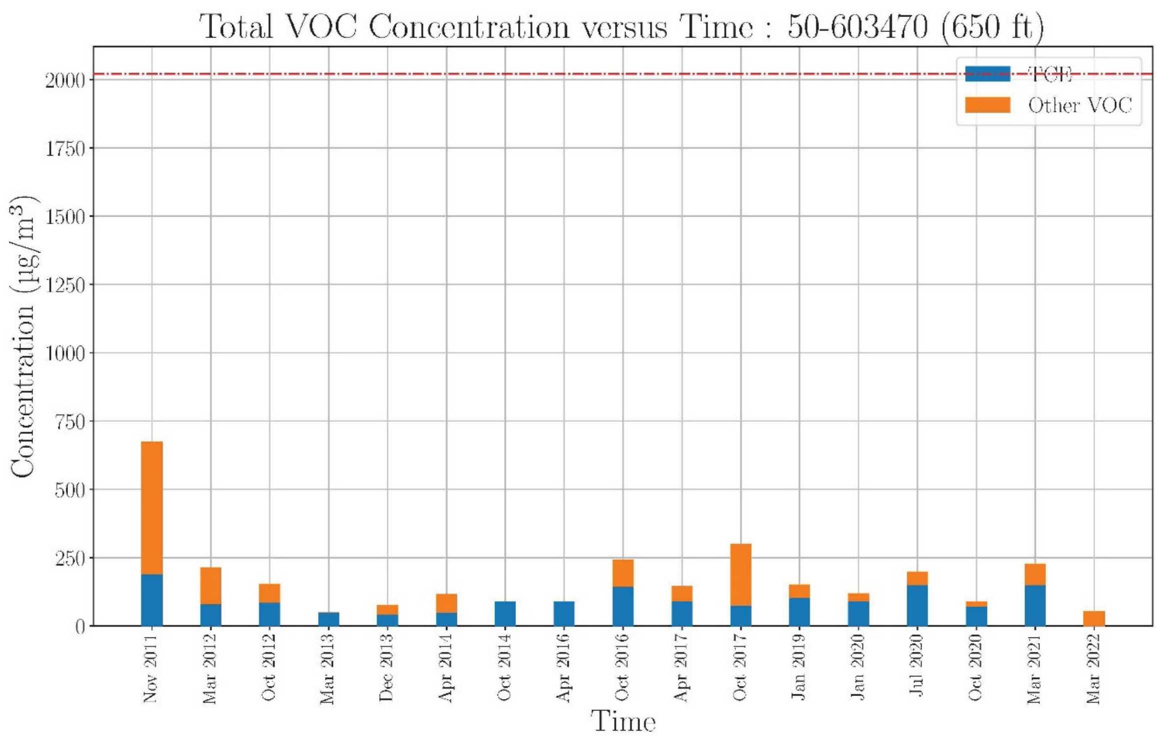
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-12 Total VOC concentration at 83 ft bgs at borehole 50-603470 over time



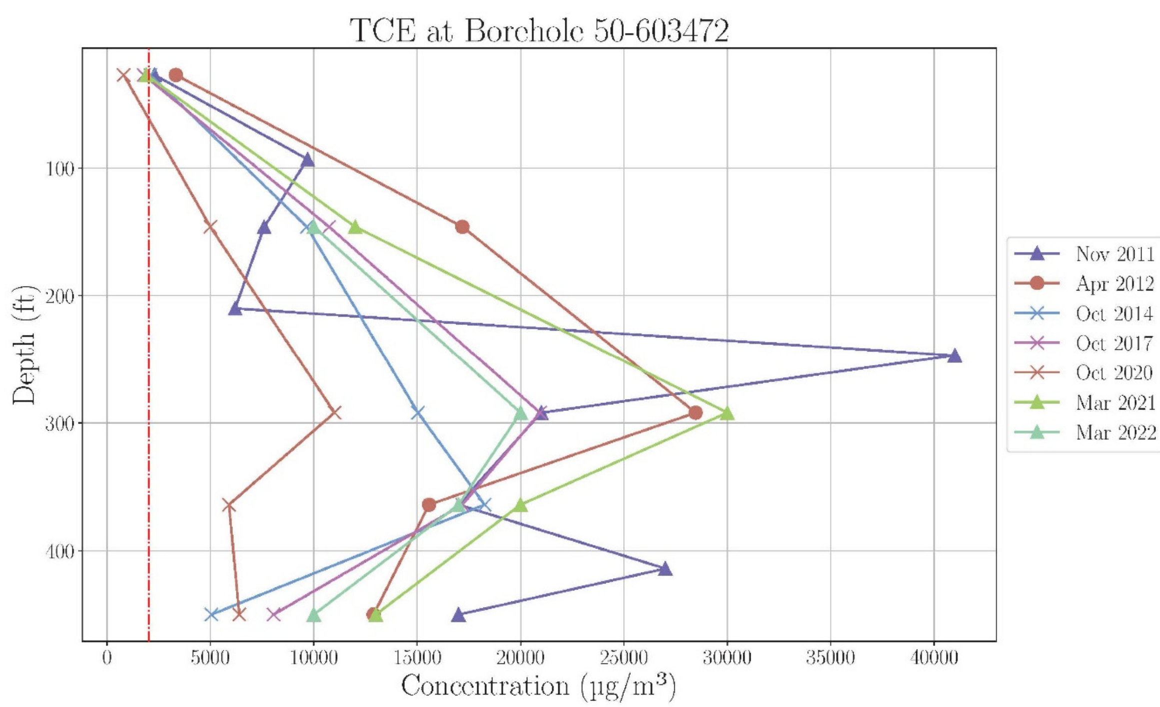
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-13 Total VOC concentration at 278 ft bgs at borehole 50-603470 over time



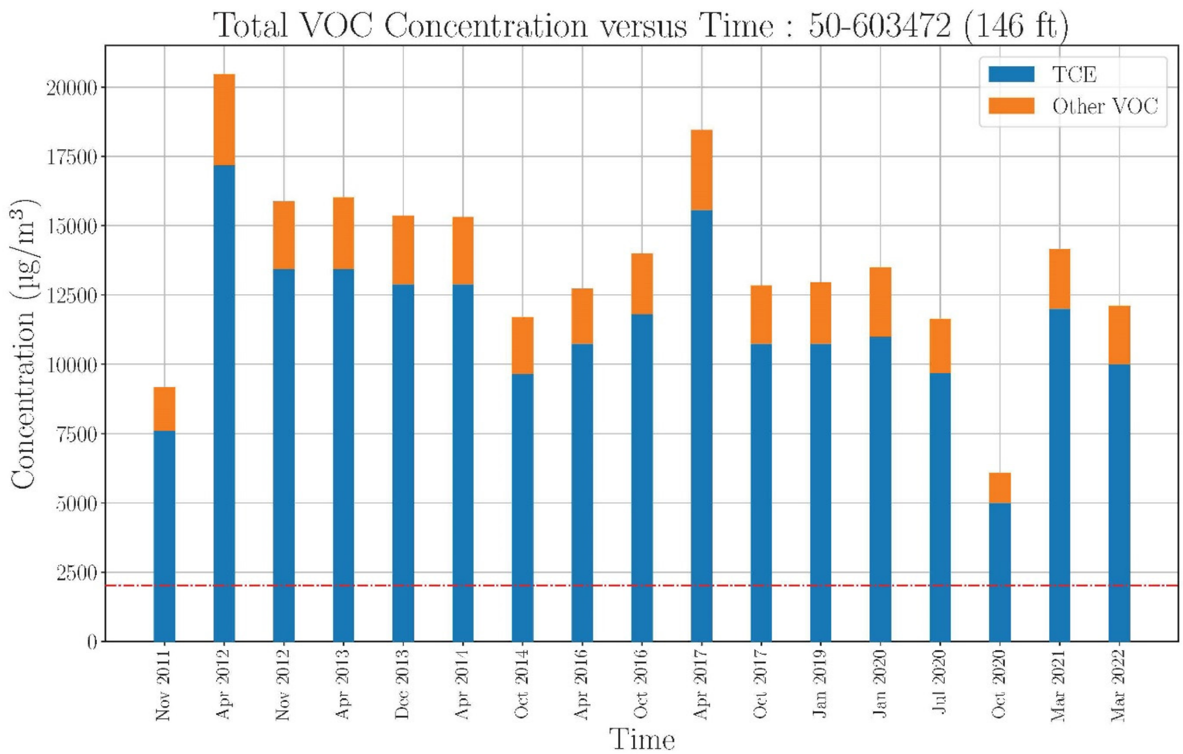
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-14 Total VOC concentration at 650 ft bgs at borehole 50-603470 over time



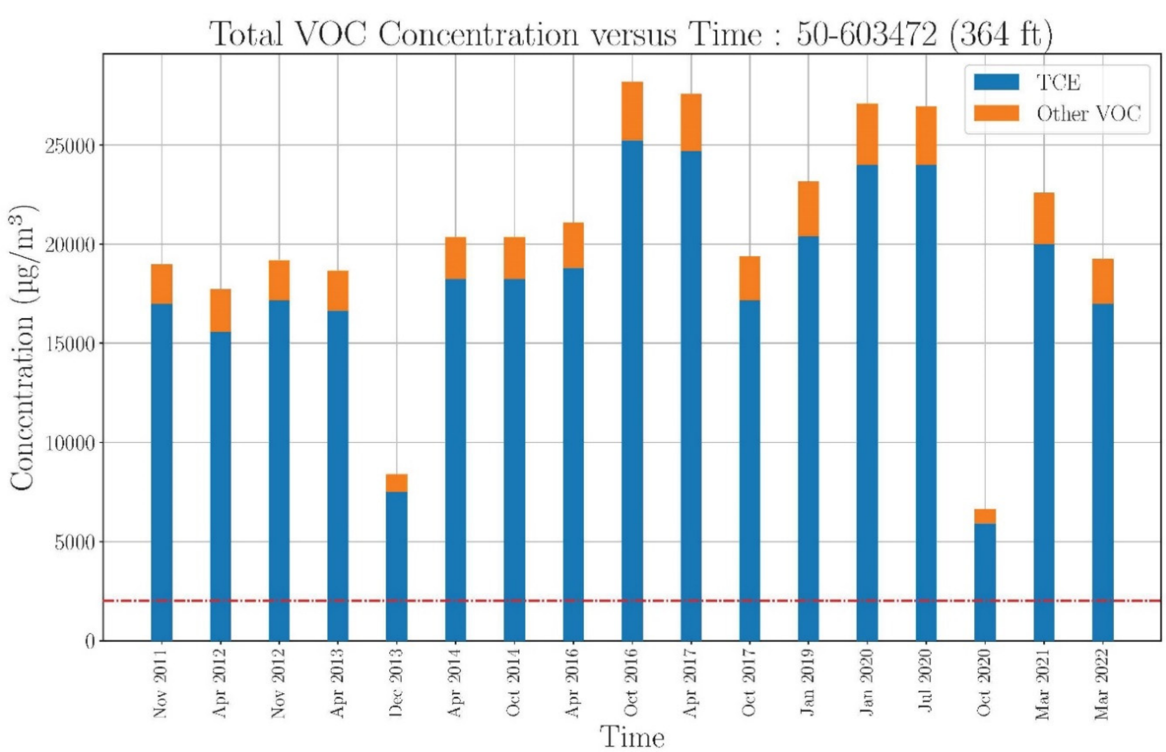
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-15 TCE concentration versus depth and time at borehole 50-603472



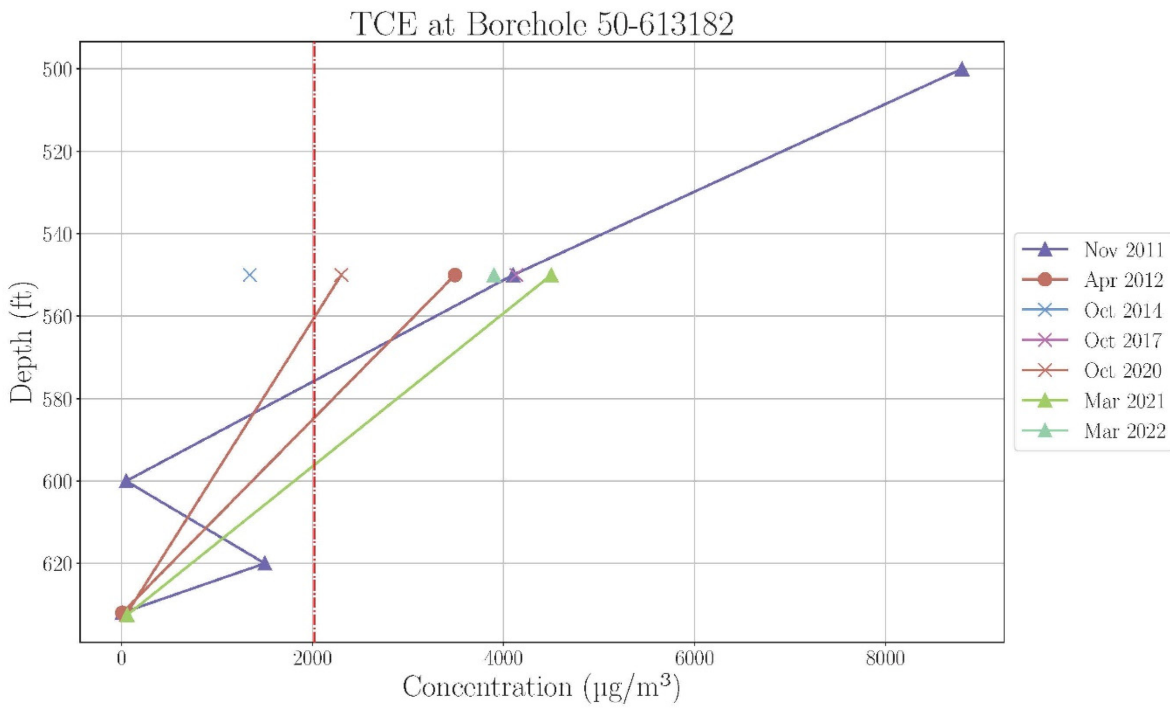
Note: Dashed red line is the 2020-μg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-16 Total VOC concentration at 146 ft bgs at borehole 50-603472 over time



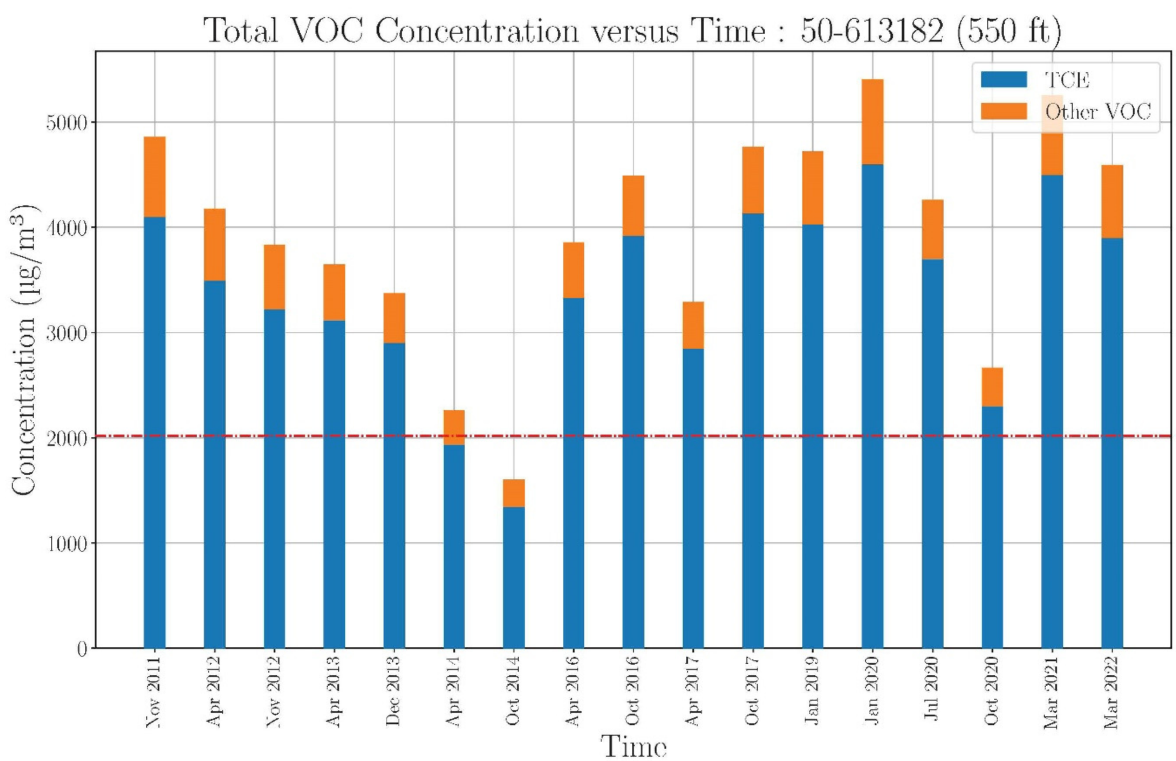
Note: Dashed red line is the 2020-μg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-17 Total VOC concentration at 364 ft bgs at borehole 50-603472 over time



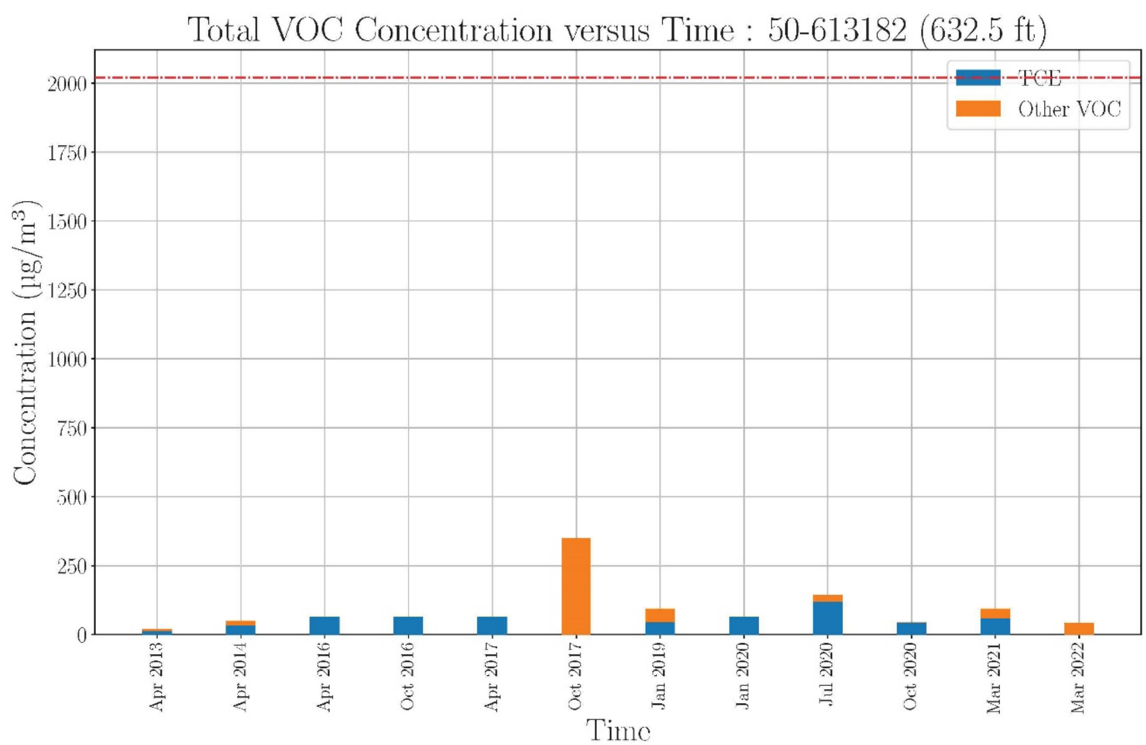
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-18 TCE concentration versus depth and time at borehole 50-613182



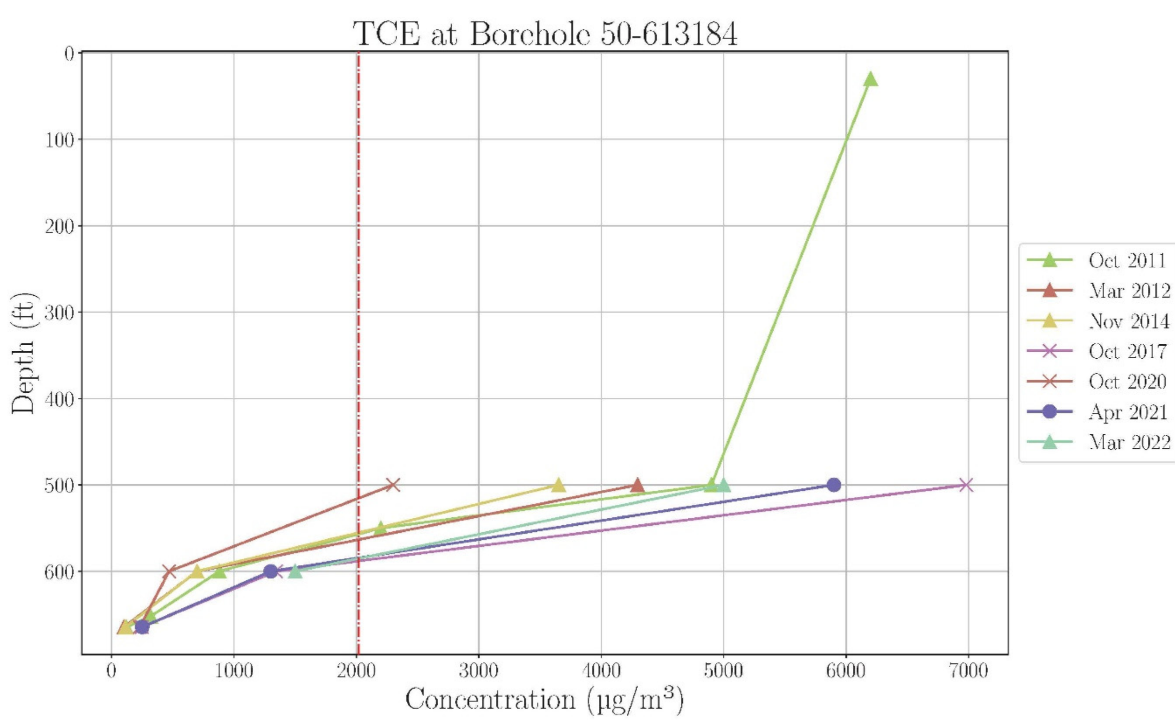
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-19 Total VOC concentration at 550 ft bgs at borehole 50-613182 over time



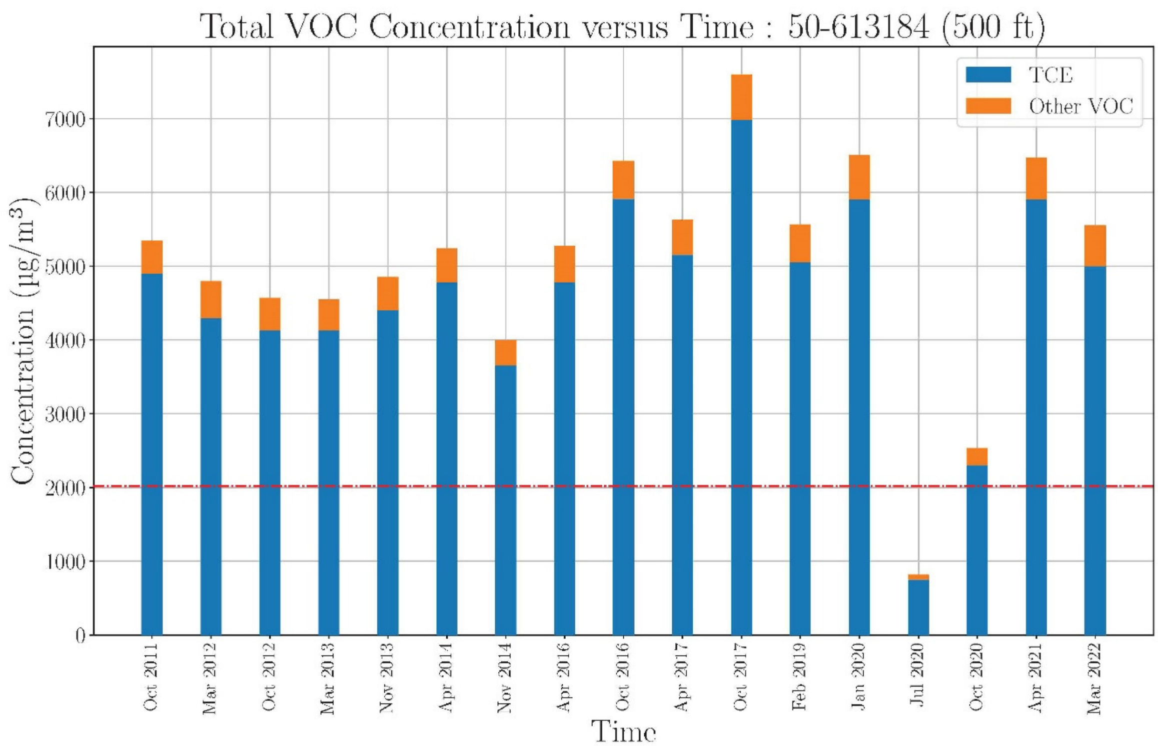
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-20 Total VOC concentration at 632.5 ft bgs at borehole 50-613182 over time



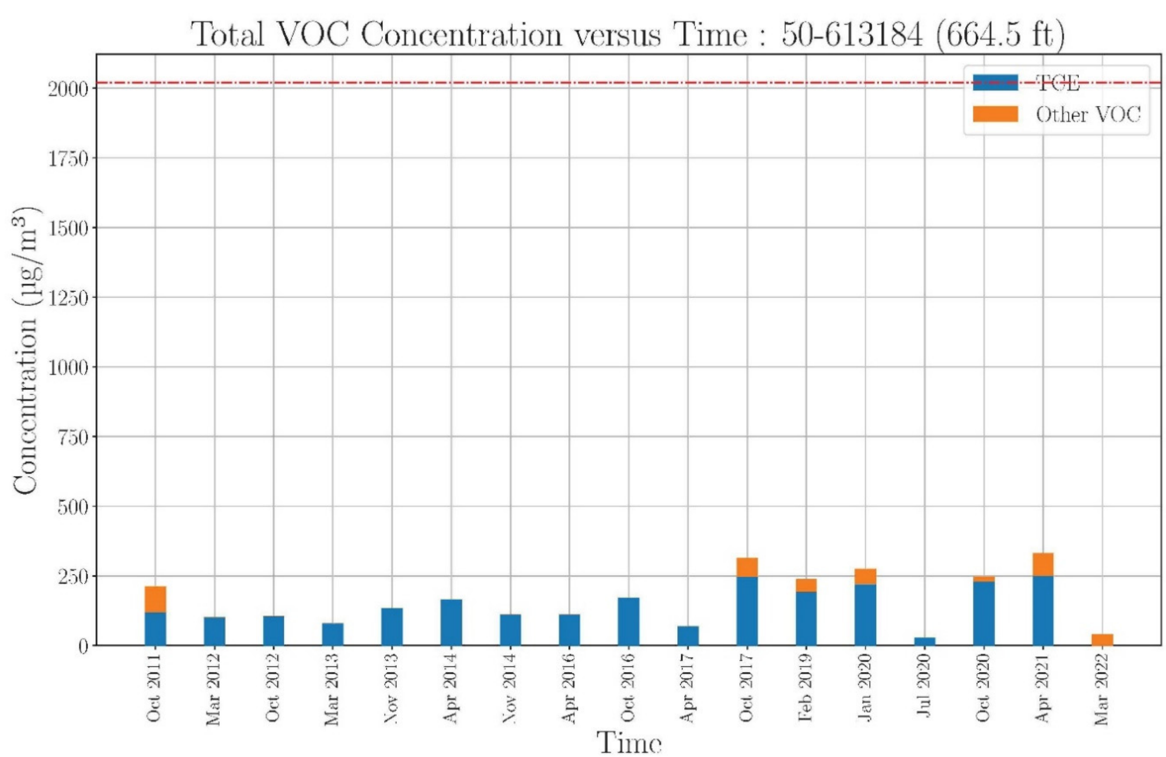
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-21 TCE concentration versus depth and time at borehole 50-613184



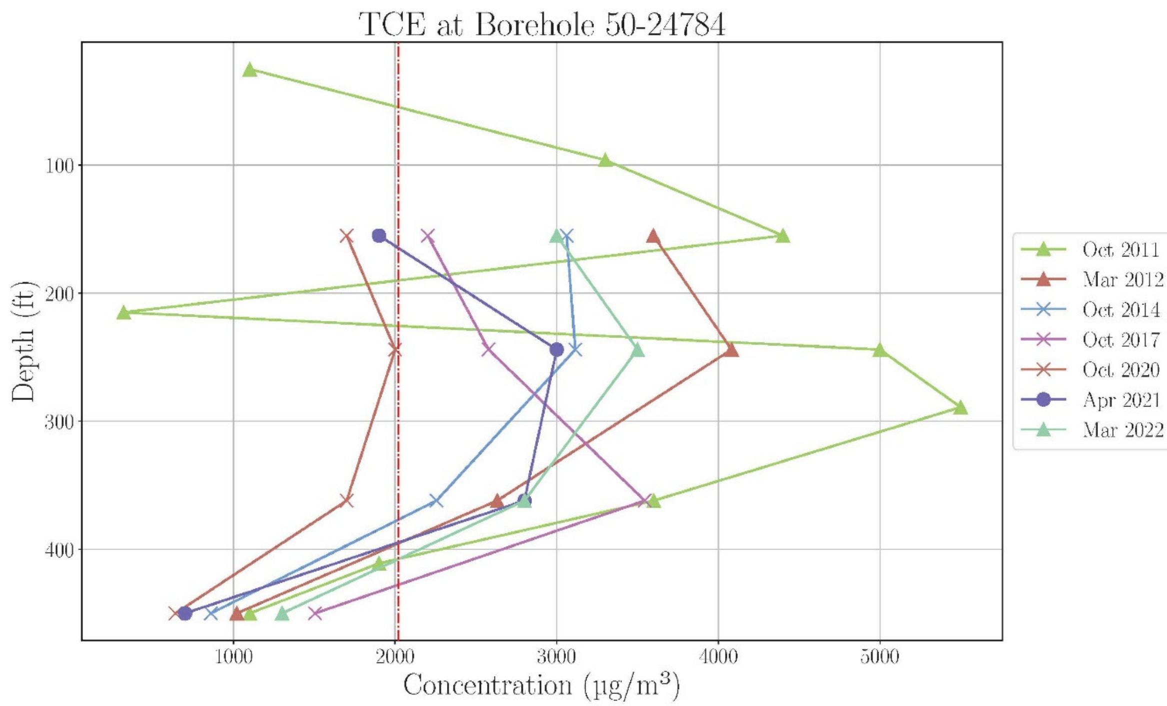
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-22 Total VOC concentration at 500 ft bgs at borehole 50-613184 over time



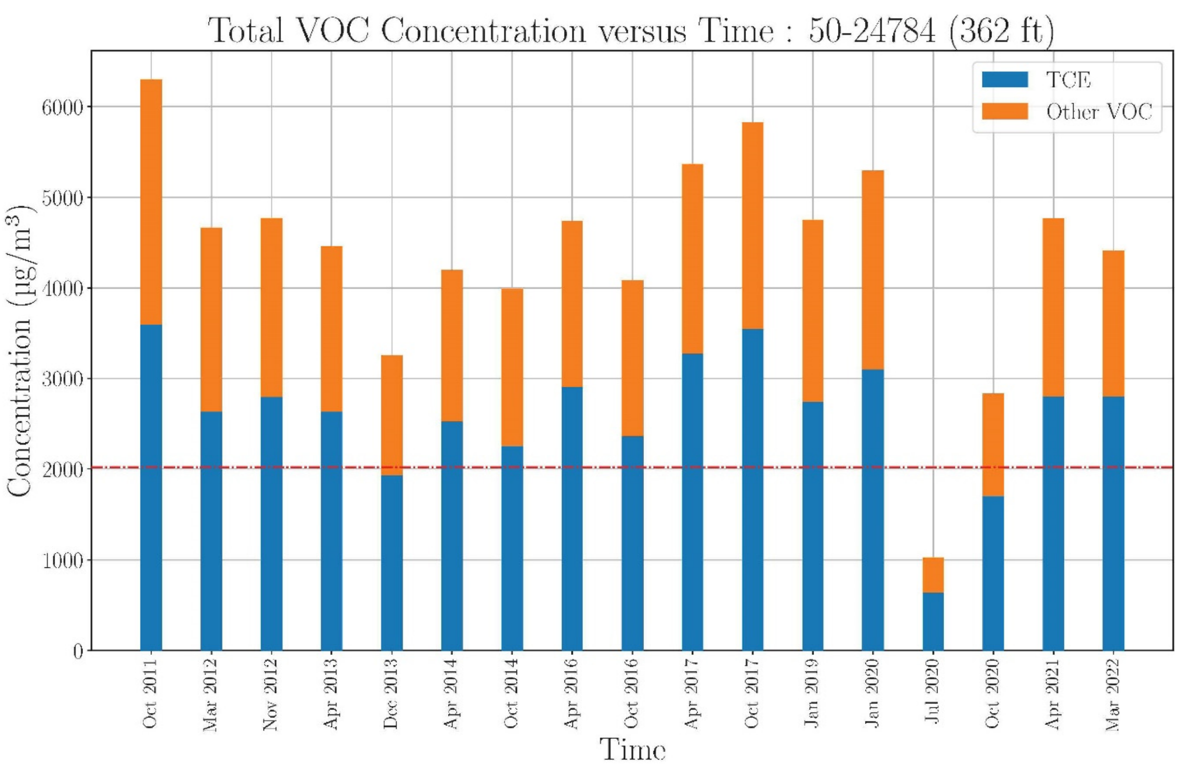
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-23 Total VOC concentration at 664.5 ft bgs at borehole 50-613184 over time



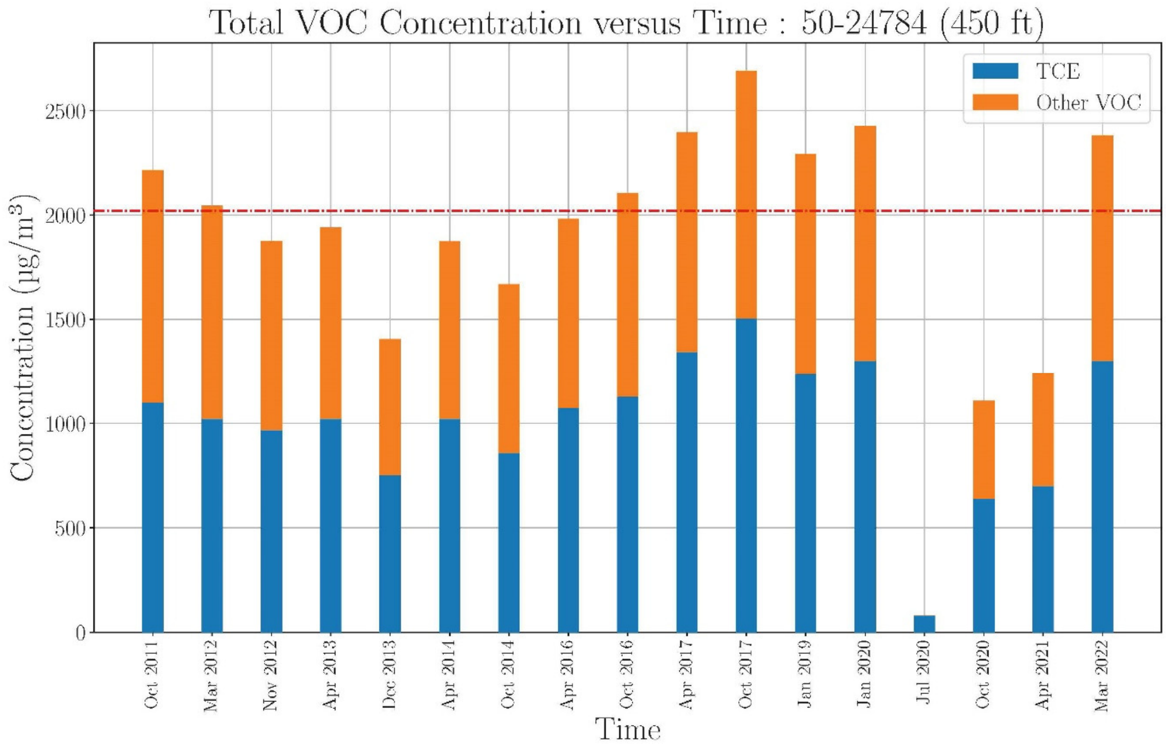
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-1 TCE concentration versus depth and time at borehole 50-24784



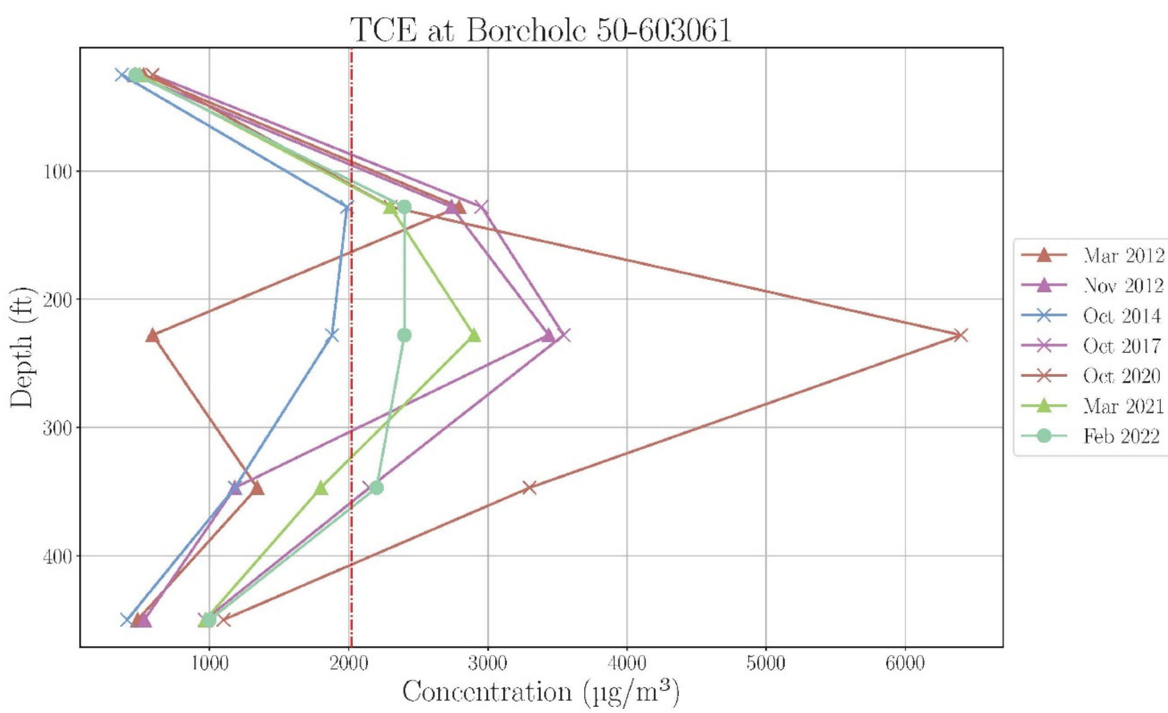
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-2 Total VOC concentration at 362 ft bgs at borehole 50-24784 over time



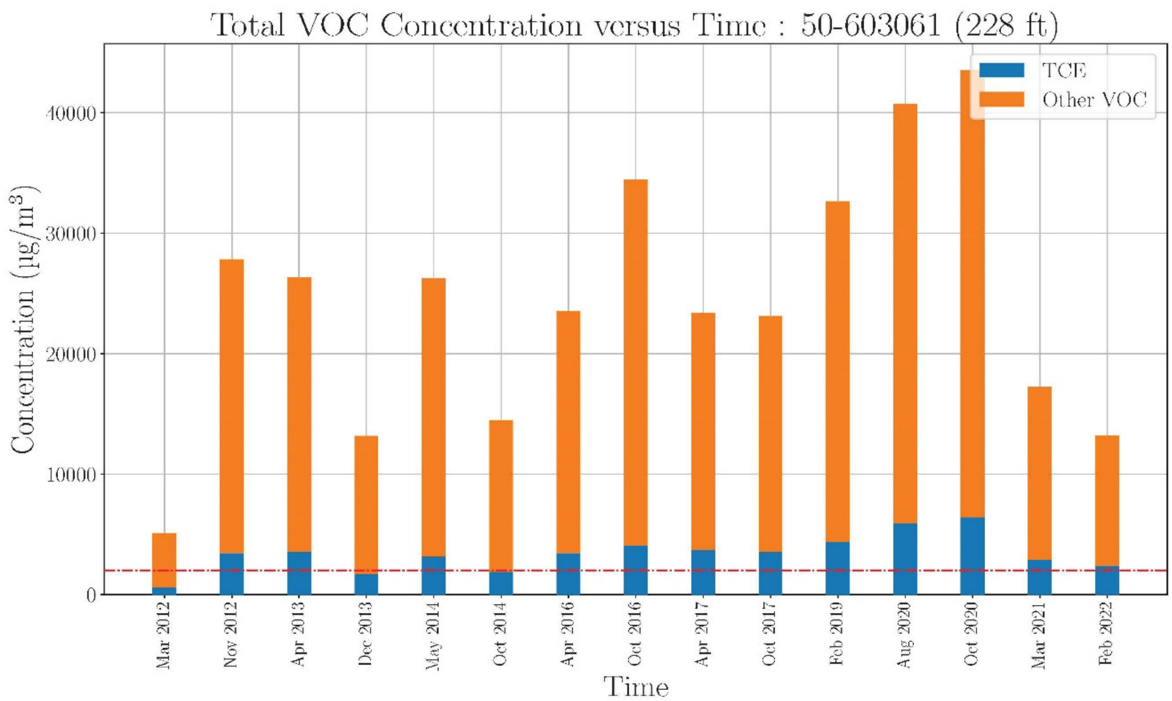
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-4.0-3 Total VOC concentration at 450 ft bgs at borehole 50-24784 over time



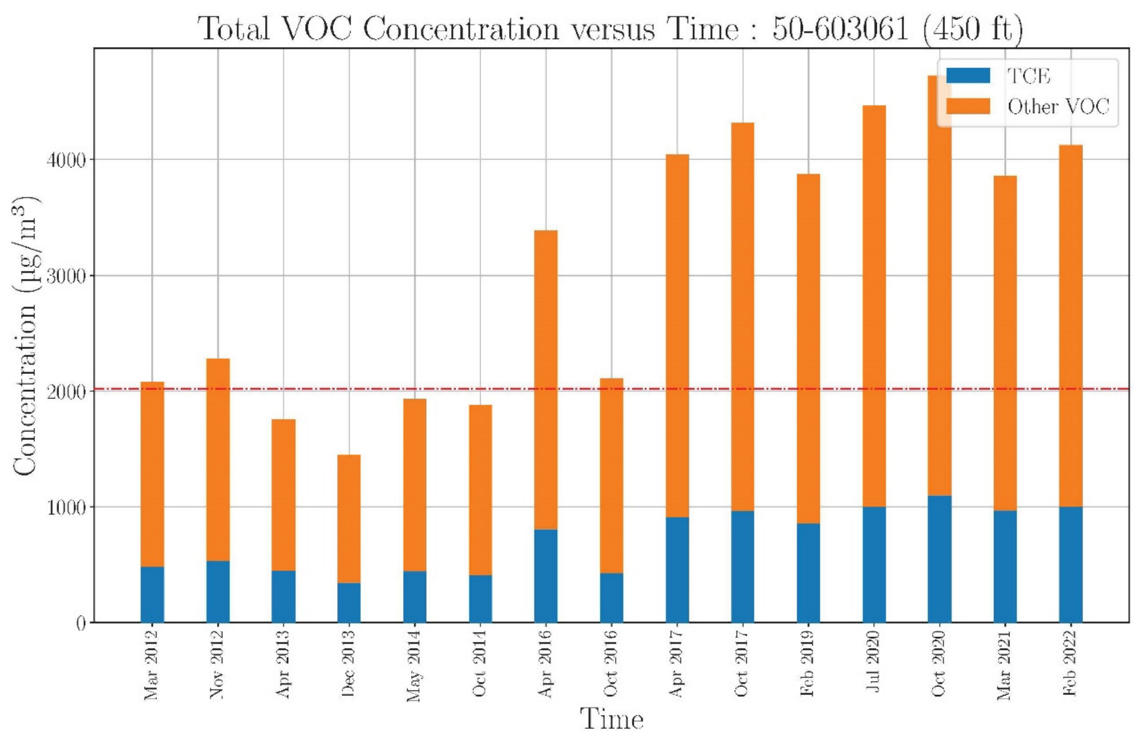
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-4.0-4 TCE concentration versus depth and time at borehole 50-603061



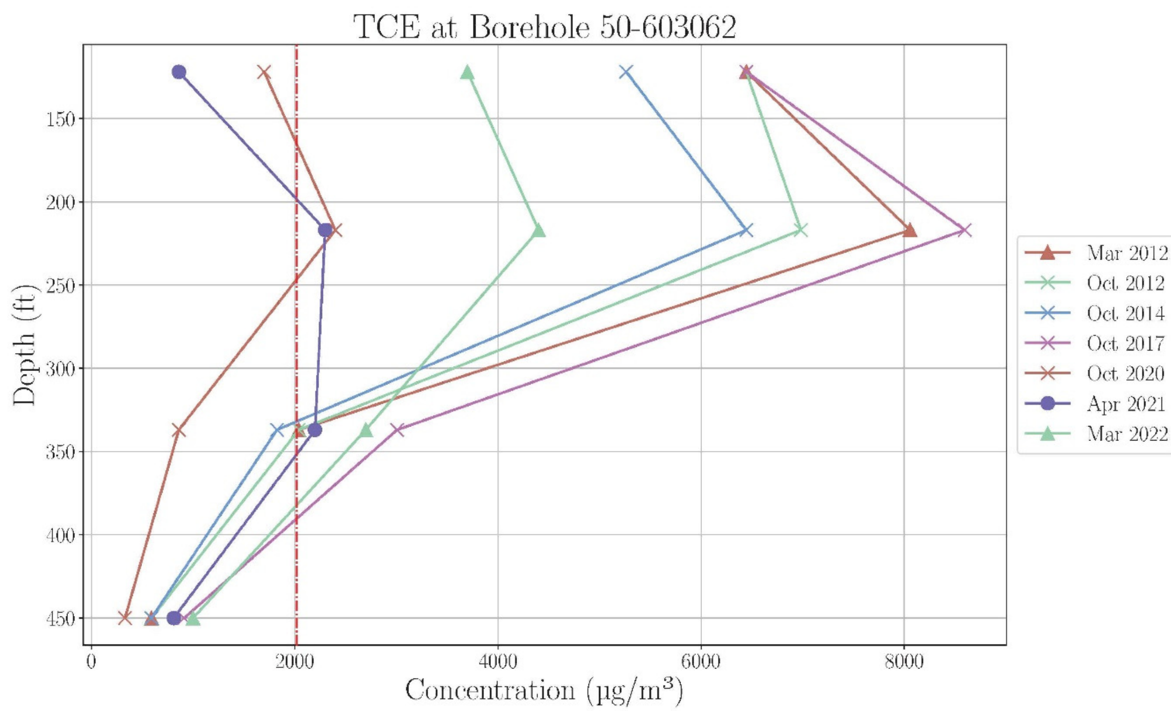
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-5 Total VOC concentration at 228 ft bgs at borehole 50-603061 over time



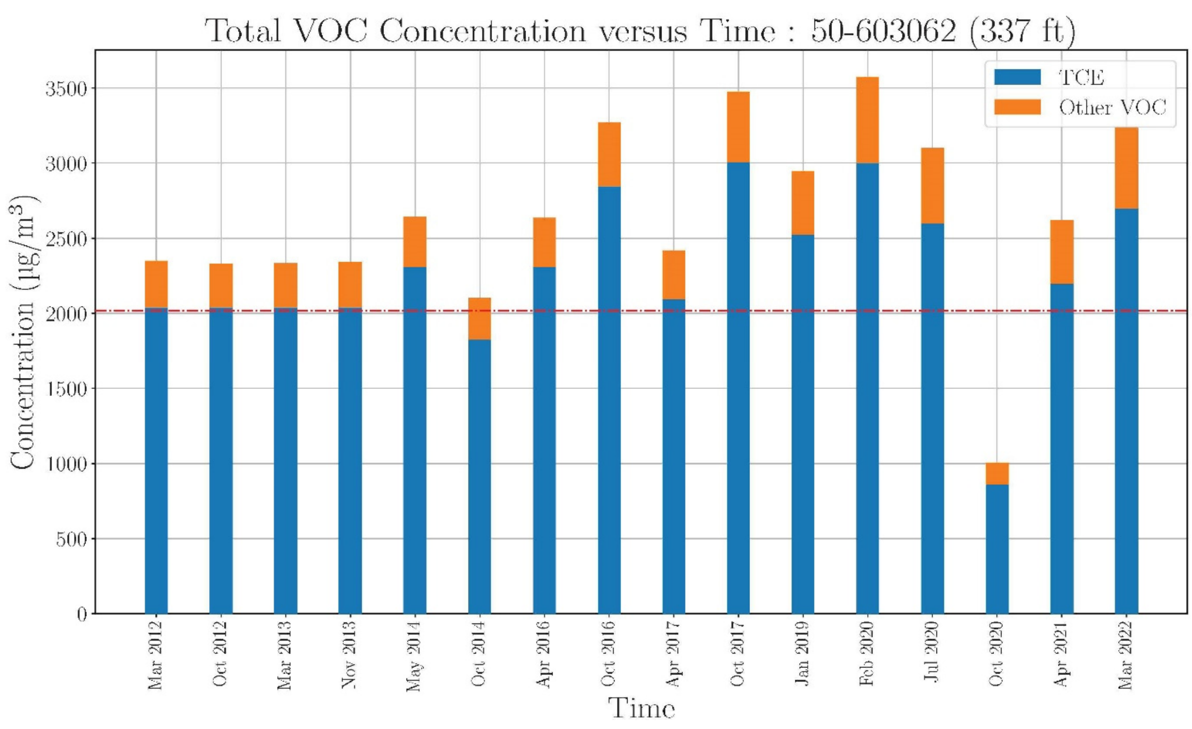
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-6 Total VOC concentration at 450 ft bgs at borehole 50-603061 over time



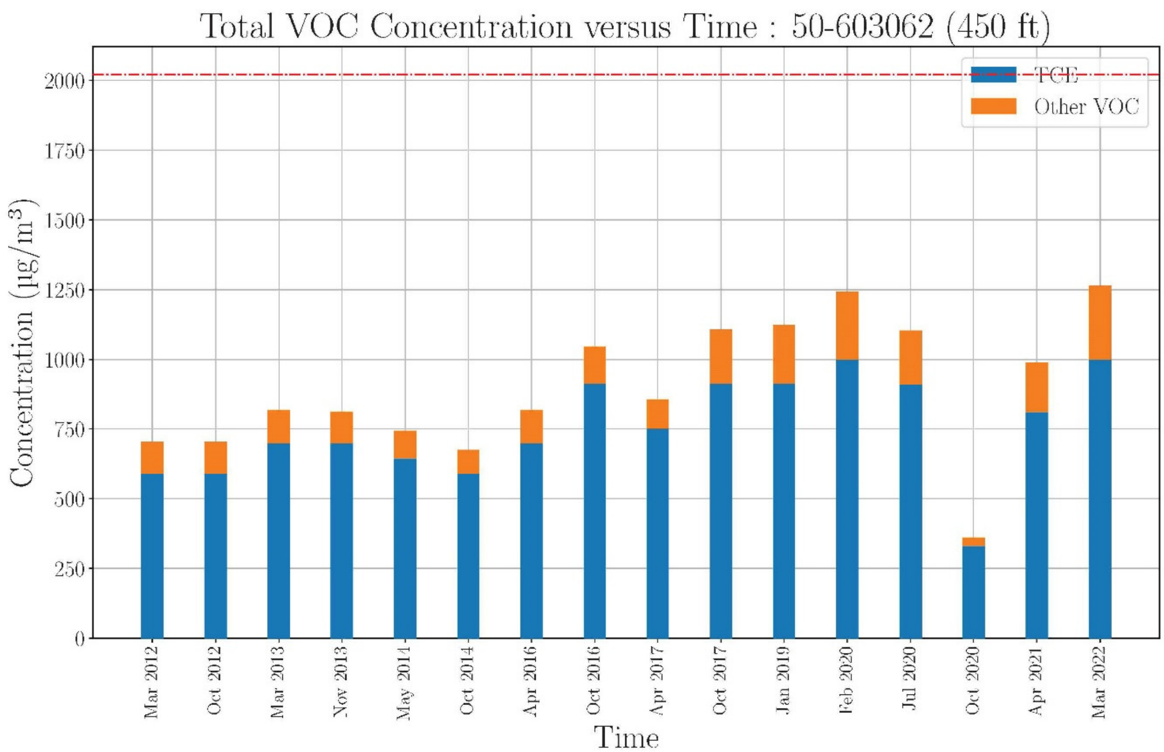
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-7 TCE concentration versus depth and time at borehole 50-603062



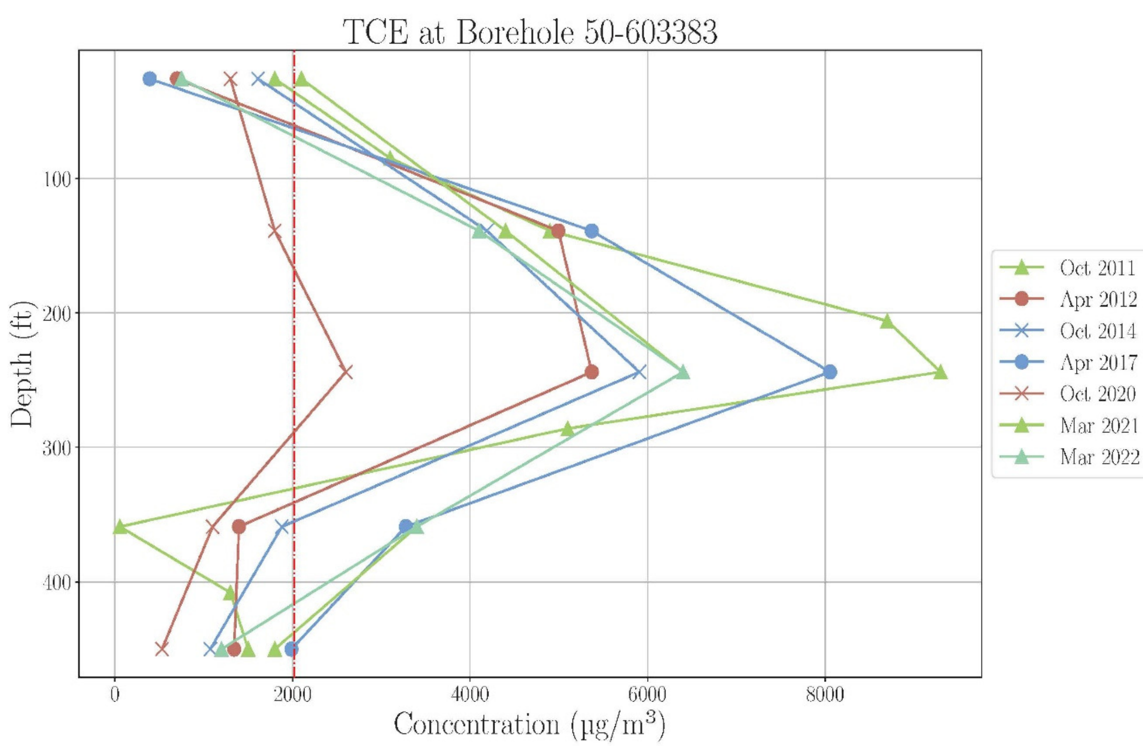
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-8 Total VOC concentration at 337 ft bgs at borehole 50-603062 over time



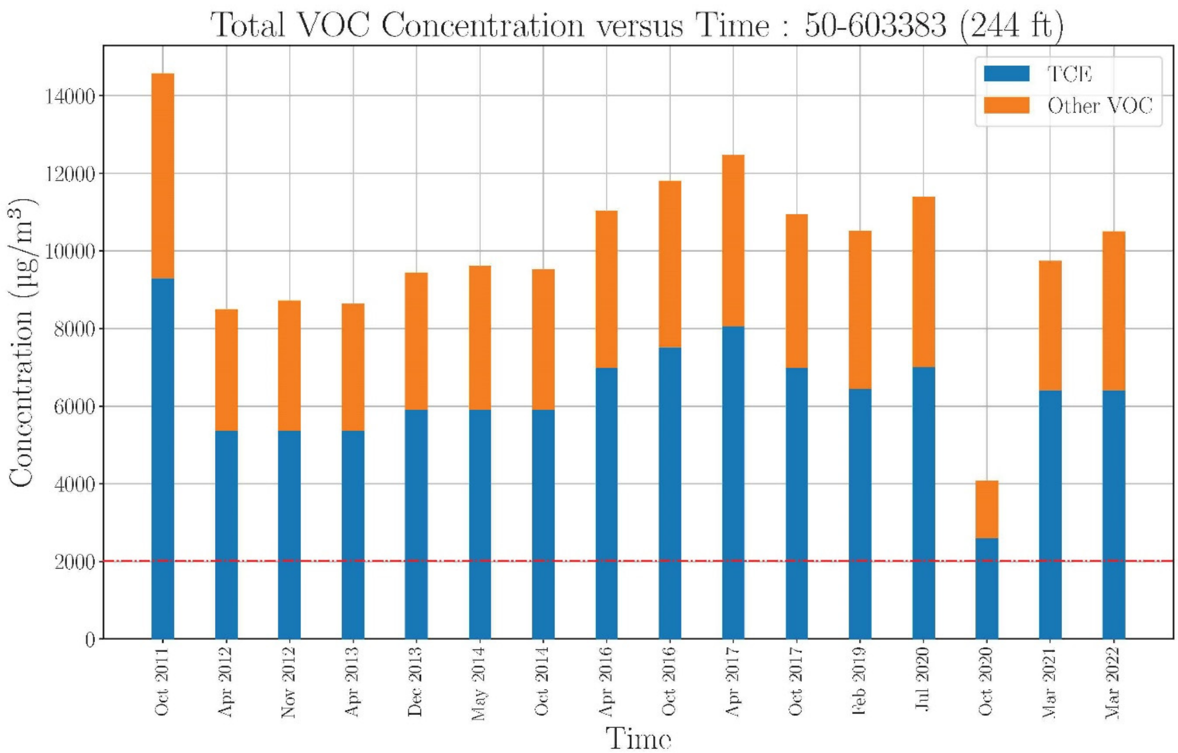
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-4.0-9 Total VOC concentration at 450 ft bgs at borehole 50-603062 over time



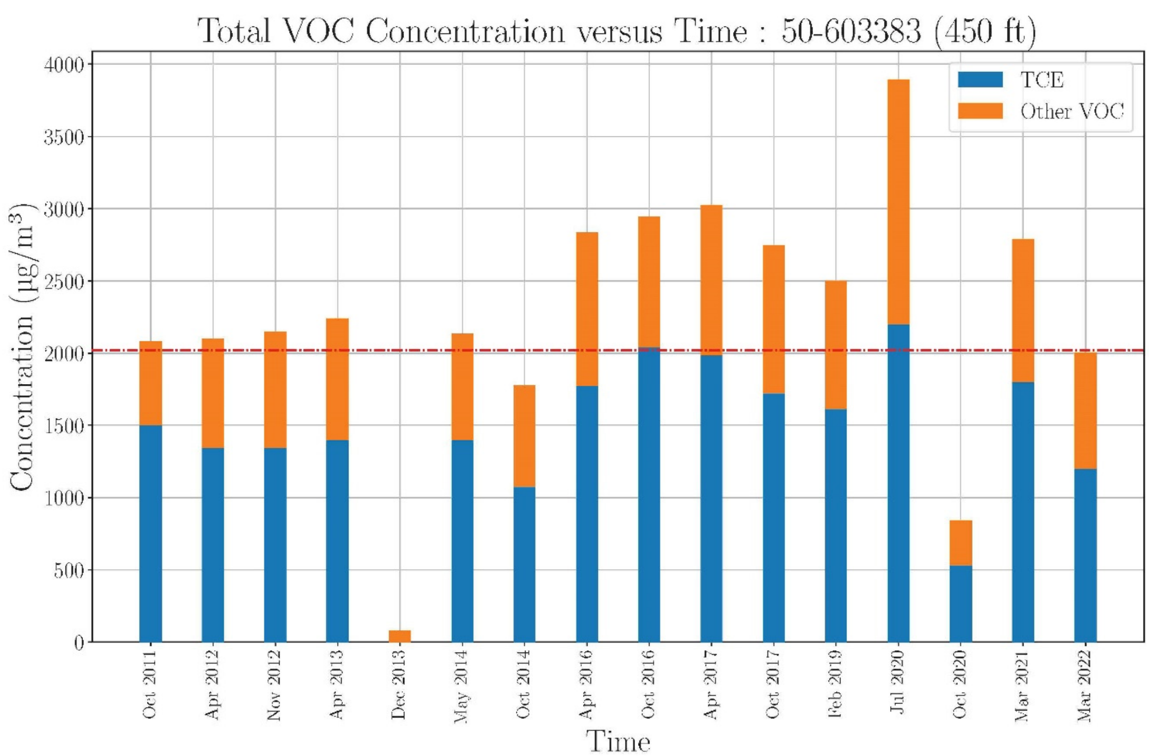
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-4.0-10 TCE concentration versus depth and time at borehole 50-603383



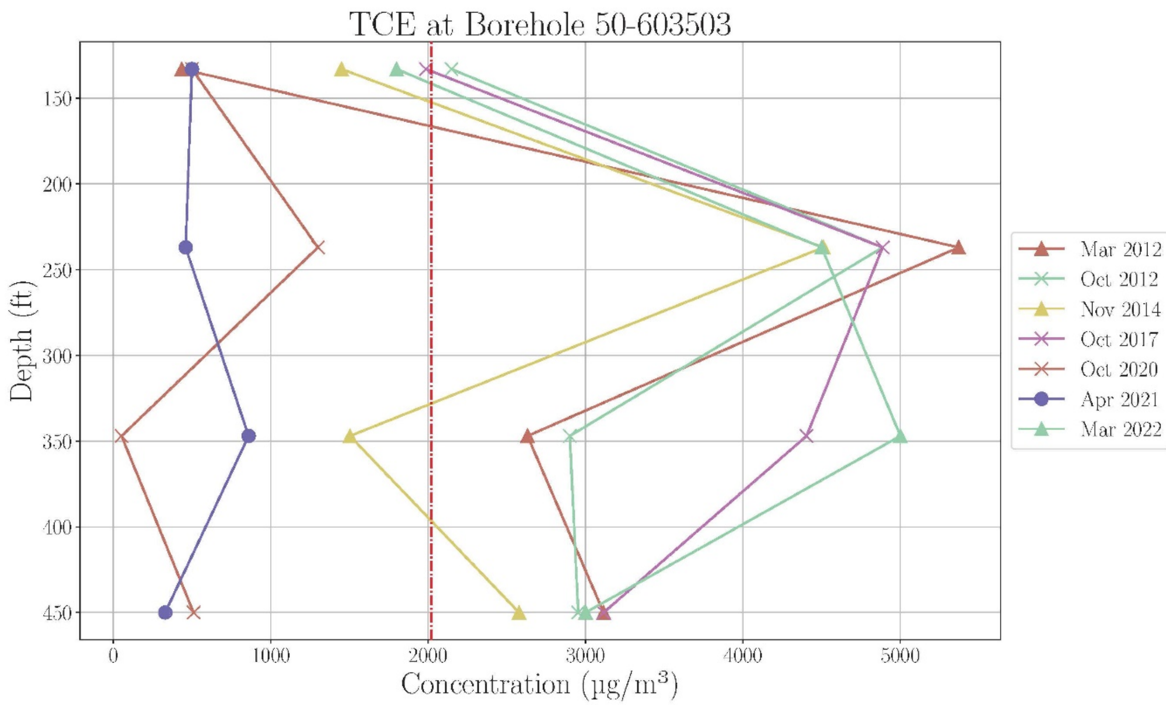
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-4.0-11 Total VOC concentration at 244 ft bgs at borehole 50-603383 over time



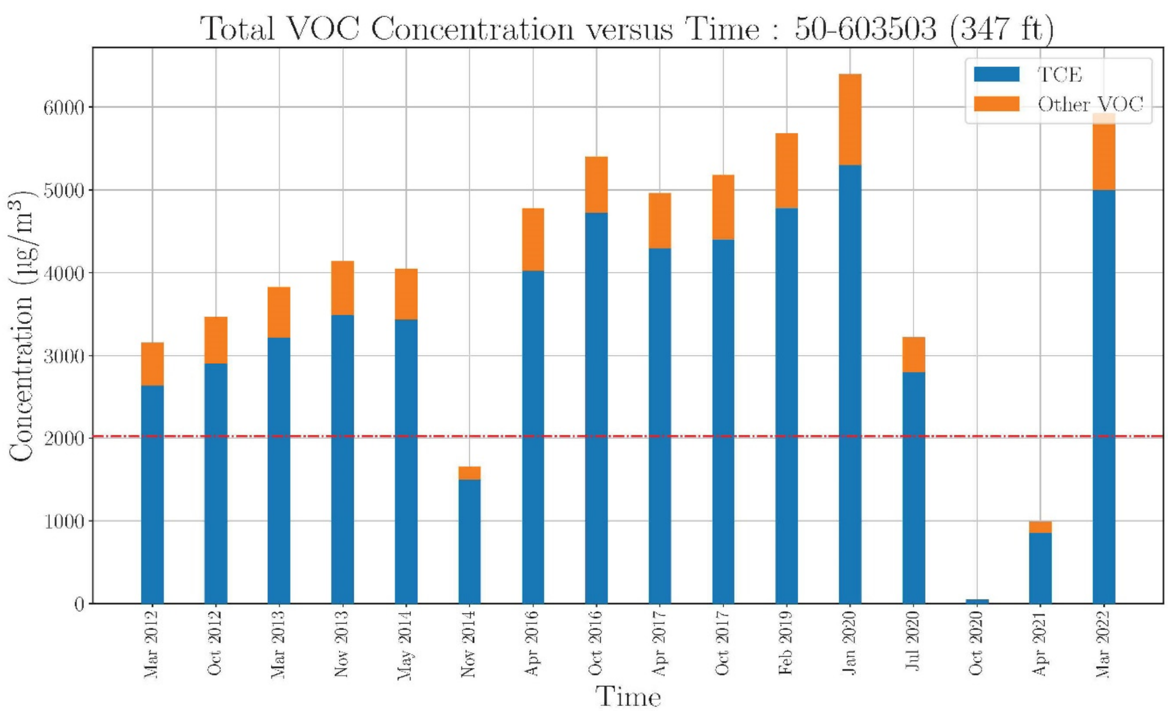
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-4.0-12 Total VOC concentration at 450 ft bgs at borehole 50-603383 over time



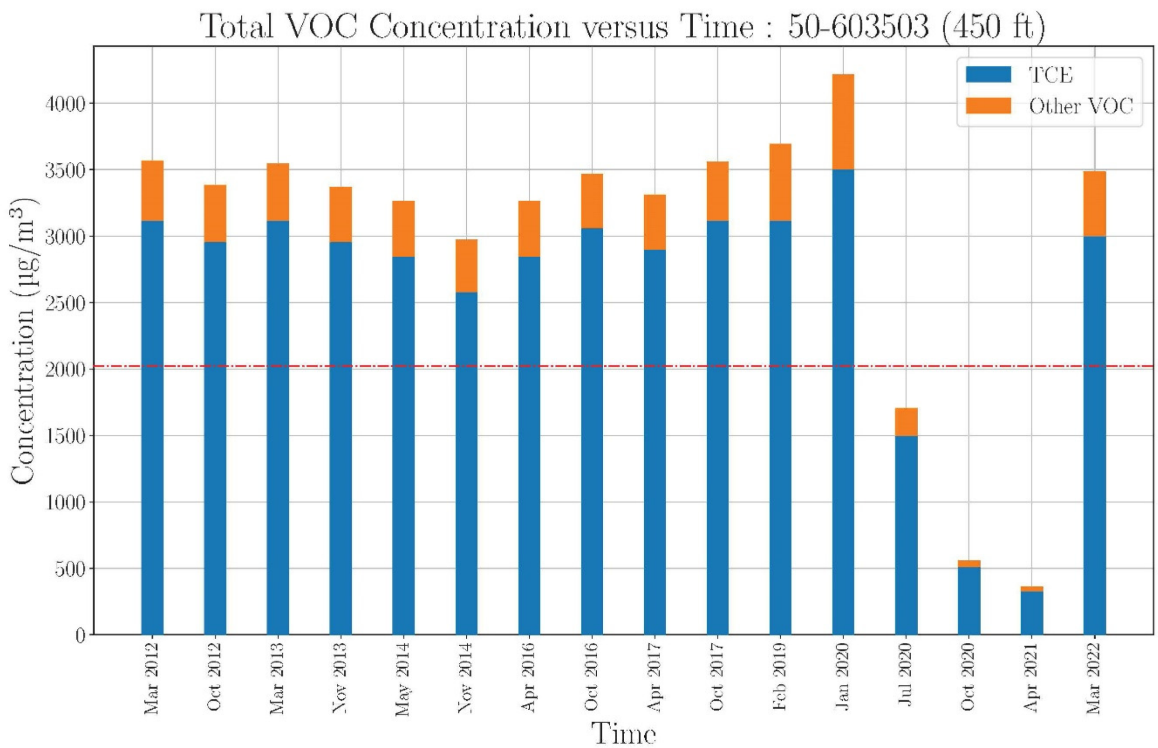
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-13 TCE concentration versus depth and time at borehole 50-603503



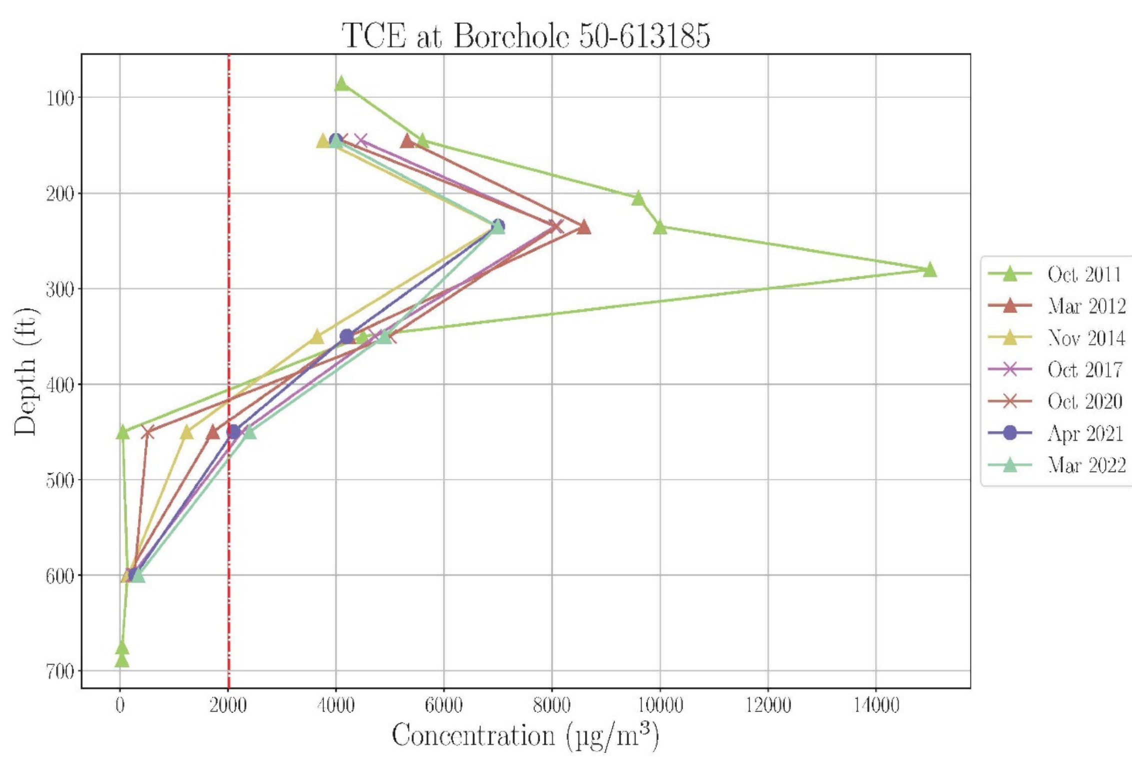
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-14 Total VOC concentration at 347 ft bgs at borehole 50-603503 over time



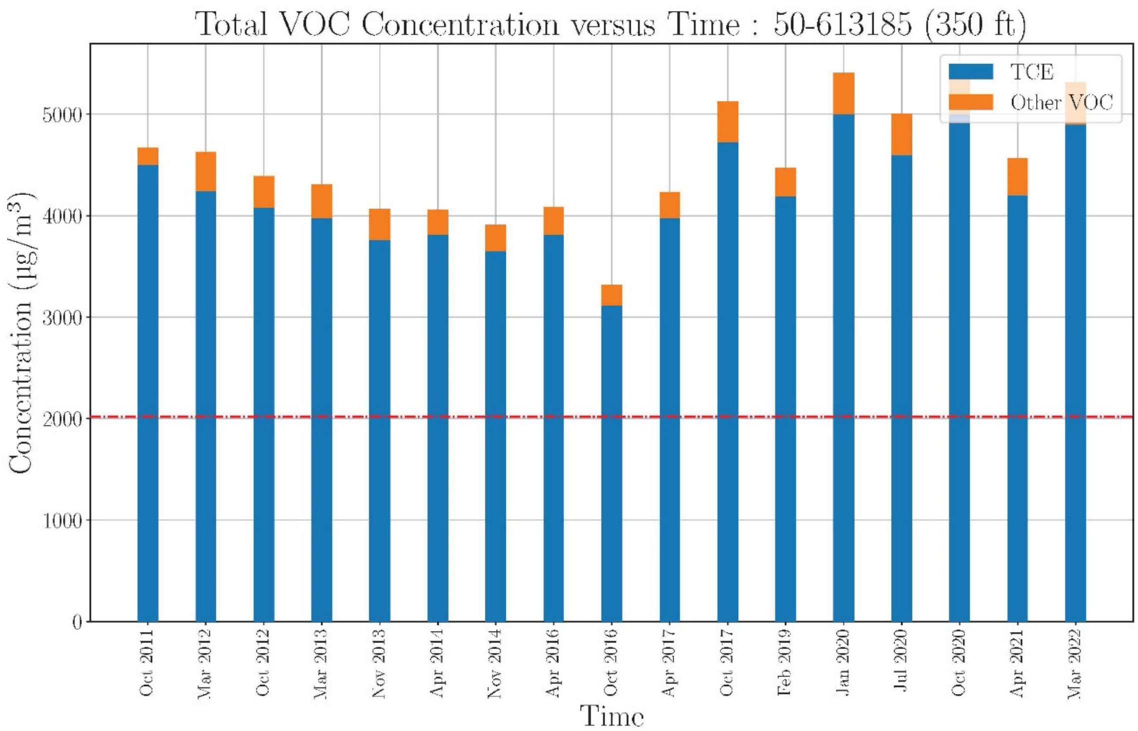
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-15 Total VOC concentration at 450 ft bgs at borehole 50-603503 over time



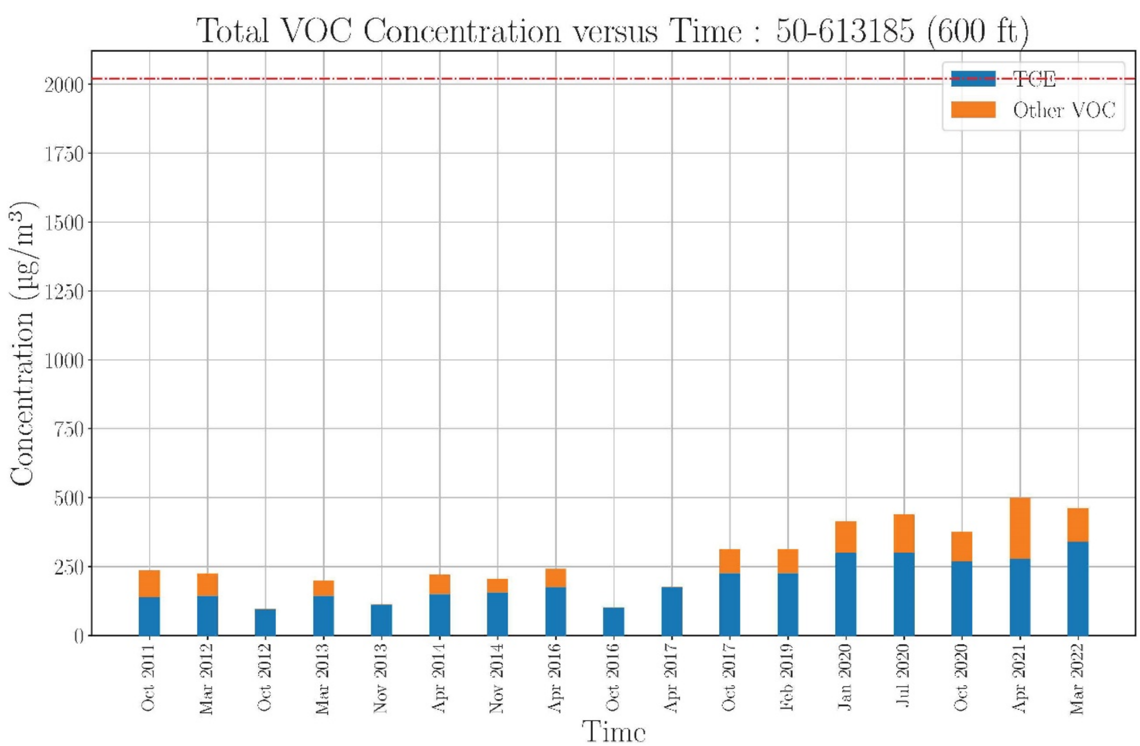
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-16 TCE concentration versus depth and time at borehole 50-613185



Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-17 Total VOC concentration at 350 ft bgs at borehole 50-613185 over time



Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-4.0-18 Total VOC concentration at 600 ft bgs at borehole 50-613185 over time

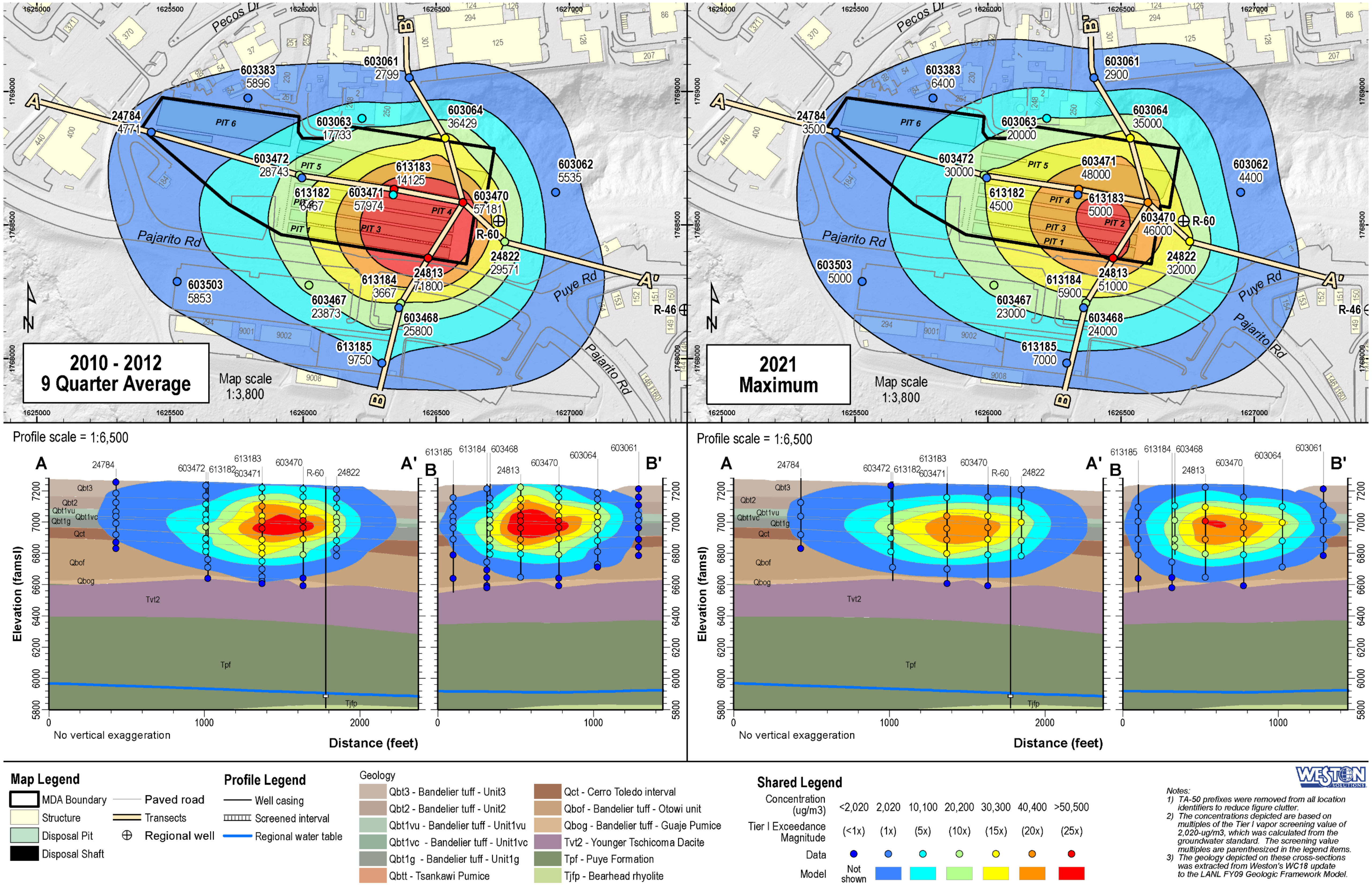


Figure D-5.0-1 Lateral and vertical extent of the MDA C TCE plume, baseline (2010–2012 average) versus 2020 maximum measured concentration at each sample port

Table D-1.0-1
Boreholes at MDA C

Borehole	Deepest Port (ft)	Plume Core/ Intermediate/Periphery
50-24784	450	Edge
50-24813	600	Core
50-24822	450	Core
50-603061	450	Core
50-603062	450	Edge
50-603063	450	Intermediate
50-603064	500	Core
50-603383	450	Edge
50-603467	600	Intermediate
50-603468/50-613184	664.5	Intermediate
50-603470	650	Intermediate
50-603471/50-613183	642.5	Core
50-603472/50-613182	632.5	Intermediate
50-603503	450	Edge
50-613185	600	Edge