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DEPARTMENT OF ENERGY

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

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NMED Hazardous Waste Bureau

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May 16, 2023

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

Subject: Submittal of the Periodic Monitoring Report for 2022 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 2022 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 2022.

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

Digitally signed by ARTURO DURAN
Date: 2023.05.11 08:00:11 -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 2022 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50 (EM2023-0053)

cc (letter with CD/DVD enclosure[s]):
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May 2023
EM2023-0053

Periodic Monitoring Report for 2022 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50

N3B Los Alamos

EM2023-0053

Periodic Monitoring Report for 2022 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50

May 2023

Responsible program director:

Printed Name	Signature	Title	Organization	Date
Brenda Bowlby		Program Director	RCRA Remediation Program	5/4/2023

Responsible N3B representative:

Printed Name	Signature	Title	Organization	Date
Troy Thomson		Program Manager	N3B Environmental Remediation Program	5/4/2023

Responsible DOE EM-LA representative:

Printed Name	Signature	Title	Organization	Date
Arturo Q. Duran	ARTURO DURAN Digitally signed by ARTURO DURAN Date: 2023.05.11 08:00:36 -06'00'	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	

EXECUTIVE SUMMARY

This periodic monitoring report (PMR) summarizes vapor-monitoring activities conducted for calendar year 2022 at Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, in 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 submitted to NMED on June 30, 2021.

Vapor monitoring in the first round of sampling was conducted from June 2 through June 28, 2022. 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 8 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 September 12 through September 30, 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 24 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, 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.

Tritium was detected in 39 of 80 samples in the first sampling round and 36 of 80 samples during the second round, with the range of detected activities spanning almost 4 orders of magnitude. 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 was noted, but activities have trended downward in recent sampling events. Continued monitoring will confirm this trend.

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1.0 INTRODUCTION

This periodic monitoring report (PMR) presents the results of vapor-monitoring activities conducted for calendar year 2022 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 tricholoroethene (TCE) are analyzed in section 5 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 92% of the VOC vapor samples collected at MDA C in 2022 showing concentrations above detection limits. TCE was also the VOC most frequently detected above the Tier I pore-gas screening levels (SLs), with 73% of all 2022 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 2016 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 2022 occurred in June 2022 and the second in September 2022. (Because of contract delays, the second round of 2021 sampling occurred in late February to mid-March 2022, pushing the first round of 2022 sampling back to June). 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 both rounds of sampling, field screening was performed using a MiniRAE multi-gas detector equipped with a 10.6-eV photoionization detector (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 June 2 through June 28, 2022, while vapor monitoring in the second round of sampling was conducted from September 12 through September 30, 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 and both rounds of tritium sampling 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 906.0.
- 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 June 2022, the Swagelok pressure gauge for the SUMMA canisters malfunctioned, and accurate pressure measurements could not be obtained (Table 2.1-1). The pressure gauge failed while VOC samples were being collected at wells 50-24813 and 50-603467. VOC samples at these two wells were still collected to prevent delays during this sampling event.

No deviations were encountered during the second sampling round in September 2022.

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 2022, 702484) 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:

$$H' = \frac{C_{air}}{C_{water}}$$ **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 SL (SL_{pgI}) as follows:

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

where SL_{pgI} = the Tier I pore-gas SL (µg/m^3),

H' = the dimensionless Henry's law constant,

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 be true only 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 because of 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 because of 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 November 2022 “NMED Risk Assessment Guidance for Site Investigations and Remediation Volume 1, Soil Screening Guidance for Human Health Risk Assessments” (NMED 2022, 702484). 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 2022 vapor-monitoring data. Four VOCs [methylene chloride; 2-propanol; 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 2022 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 June 2 through June 28, 2022, and from September 12 through September 30, 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 2022 MDA C vapor-monitoring data. All validated analytical results from 2022 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 2022 VOC Pore-Gas Results

Validated VOC analytical results from the first and second 2022 sampling rounds are presented in Tables 5.1-1 and 5.1-2, respectively. Twenty-two VOCs were detected in subsurface pore gas. The VOC screening evaluation identified four VOCs (methylene chloride; 2-propanol; 1,1,2-TCA; and TCE) in MDA C pore gas at concentrations exceeding Tier I pore-gas SLs. There were only four 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. 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 68 of 80 samples during the first round and 79 of 80 samples during the second round and was the VOC detected at the highest concentration. TCE was detected at a concentration of 73,000 µg/m^3 in borehole location 50-24813 at 241 ft bgs during the first round and at 63,400 µg/m^3 in the same borehole location and depth during the second round.

The 2012 MDA C CME 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) (LANL 2012, 222830). 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 and are discussed in detail in Appendix D, which also includes plume maps, vertical profiles, and time-series trends. 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 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 39 of 80 samples in the first round and 36 of 80 samples during the second round at activities ranging from 290 to 2.59×10^6 pCi/L. The maximum tritium activity in both rounds was detected at borehole location 50-603470 at a depth of 83 ft bgs. The maximum tritium activity from October 2011 through September 2022 was generally detected at this sampling port, although the maximum was occasionally detected at location 50-603383 at a depth of 139 ft bgs. Plots of tritium activities versus time in boreholes 50-603383 at 139 ft bgs and 50-603470 at 83 ft bgs are shown in Figure 5.2-1. Although the data exhibit considerable variability, a decrease in activities has historically been occurring at a rate consistent with tritium's half-life.

The maximum tritium activity in deep sampling ports (i.e., 450 ft bgs or greater) was detected at location 50-603383 at 450 ft bgs in both sampling rounds (199,768 pCi/L in the first round and 193,703 pCi/L in the second round). These results are consistent with previous sampling, and tritium activities at this port have decreased over time since early 2010 (maximum activity of 742,303 pCi/L in the first 2010 sampling round) (Figure 5.2-2). Tritium was not detected in most of the other deep sampling ports and, with one exception, detected activities in other deep ports were at least an order of magnitude less than those detected at location 50-603383. Tritium activities detected in the three deep ports (450 ft bgs, 550 ft bgs, and 632.5 ft bgs) at colocated boreholes 50-603472 and 50-613182 in the second round of sampling ranged from 20,083 pCi/L to 52,964 pCi/L. These results were not consistent with previous results and ranged from 36 times to more than 138 times higher than the results from the first round of sampling. Future monitoring will determine whether the increase observed in the second round is anomalous or reflects a trend.

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

The VOC results from the 2022 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, 22 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.

- Methylene chloride exceeded the Tier I SL in 2 samples in the first round and 3 samples in the second round.
- TCE, which exceeded the Tier I SL in 53 samples in the first round and 64 samples in the second round, is the only contaminant to consistently exceed its SL.
- Propanol[2-] 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.

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 methylene chloride was 450 ft bgs at two locations (50-24813 and 50-603470). The maximum concentration from these two 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 2-propanol, at 664.5 ft bgs at location 50-613184, was less than the Tier I SL. The deepest detection of 2-propanol greater than the Tier I SL was 244 ft bgs at location 50-24784.
- The deepest detection of 1,1,2-TCA, at 288 ft bgs at location 50-603471, 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 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 360 ft bgs at location 50-603471.
- 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.

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 2022 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 68 of 80 samples in the first round and 79 of 80 samples in the second round. The remaining VOCs are below Tier I SLs, with the exception of 3 VOCs detected in 1 to 3 wells at concentrations generally less than a factor of 2 above their conservative SLs.
- VOC measurements over the last 12 years 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 290 to 2,529,220 pCi/L, with a general decreasing trend consistent with radioactive decay.

7.0 REFERENCES 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 2022. "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 2022, 702484)

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.

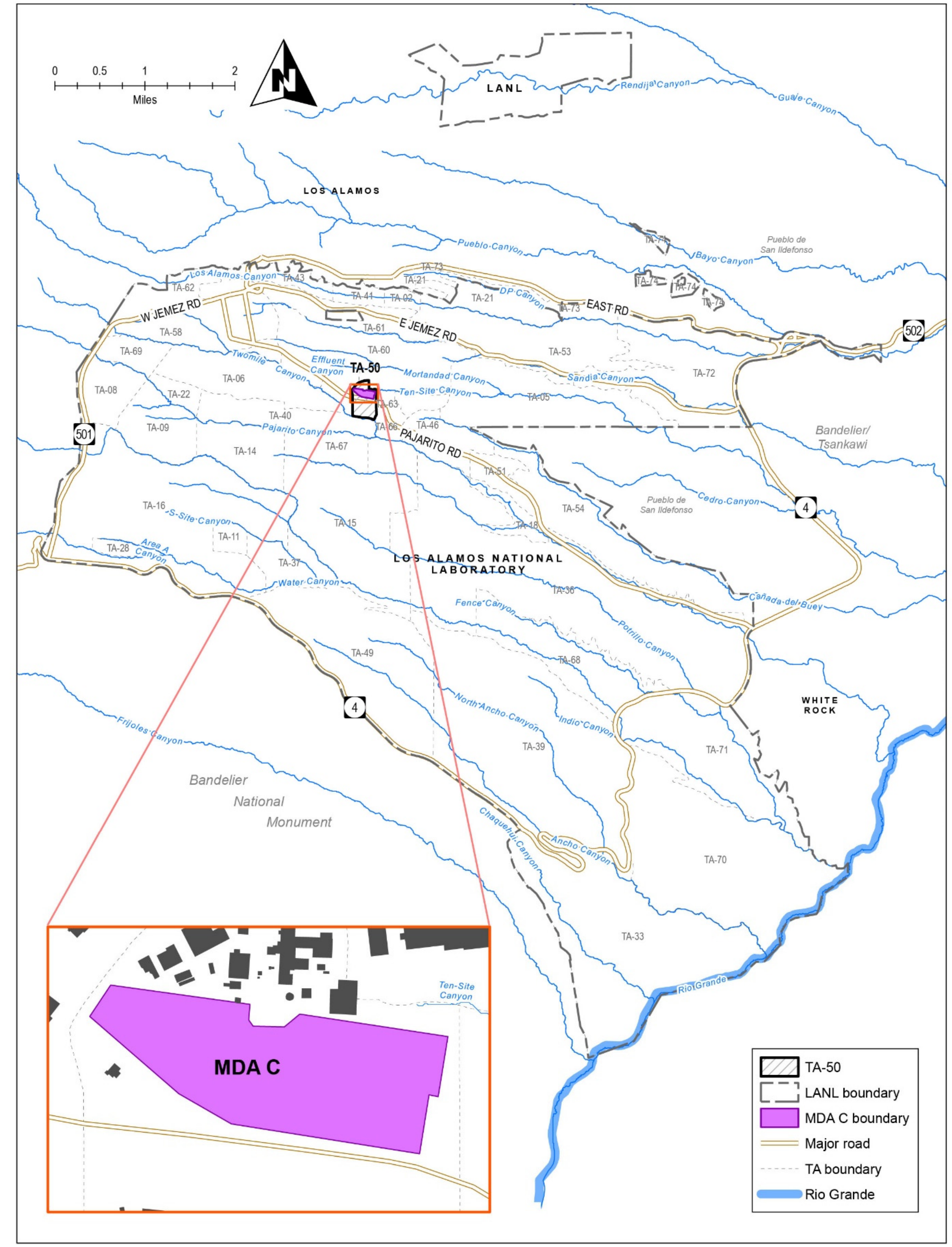


Figure 1.1-1 Location of MDA C in TA-50 with respect to Laboratory technical areas and surrounding landholdings

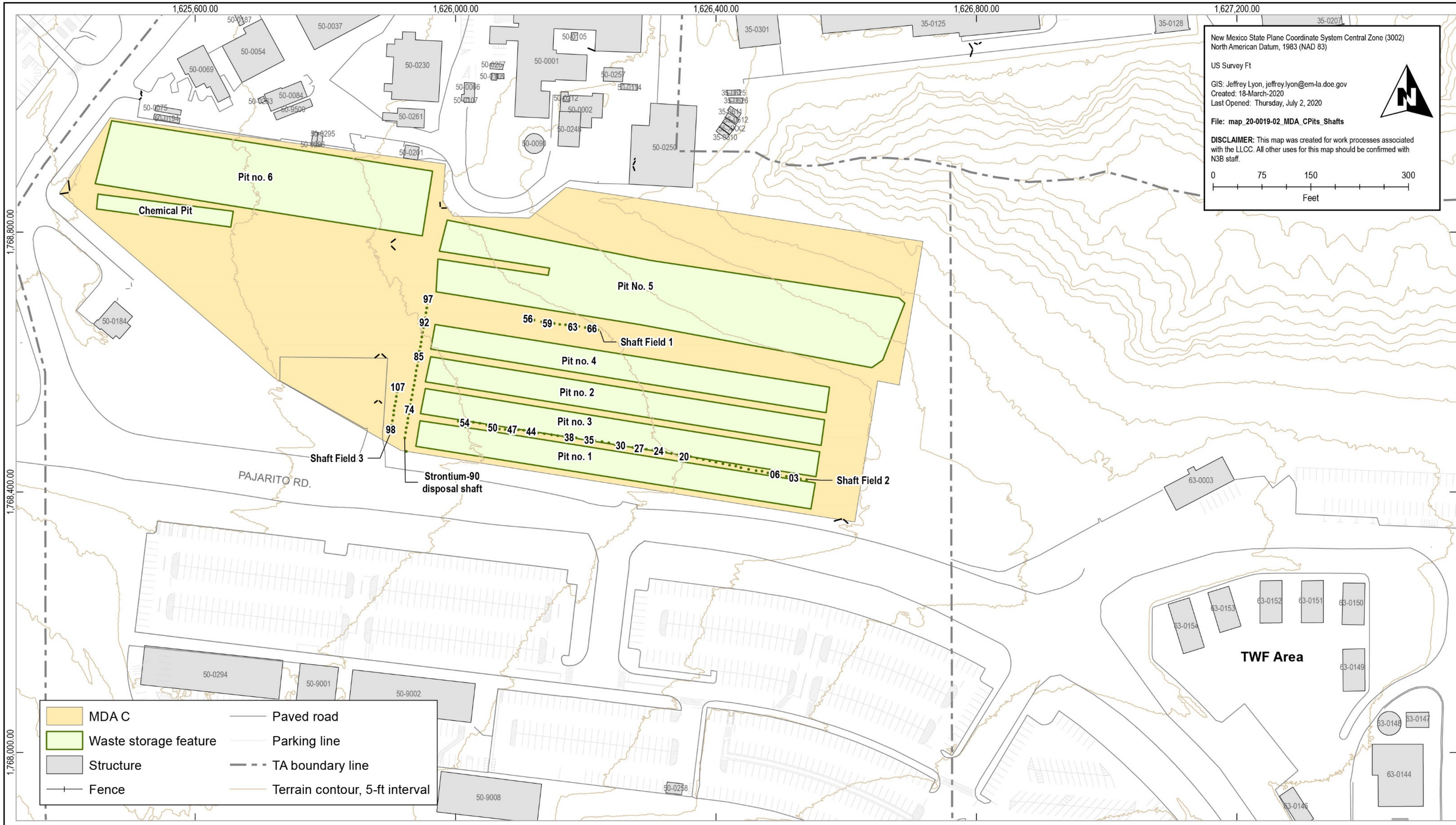


Figure 1.1-2 Location of MDA C pits and shafts

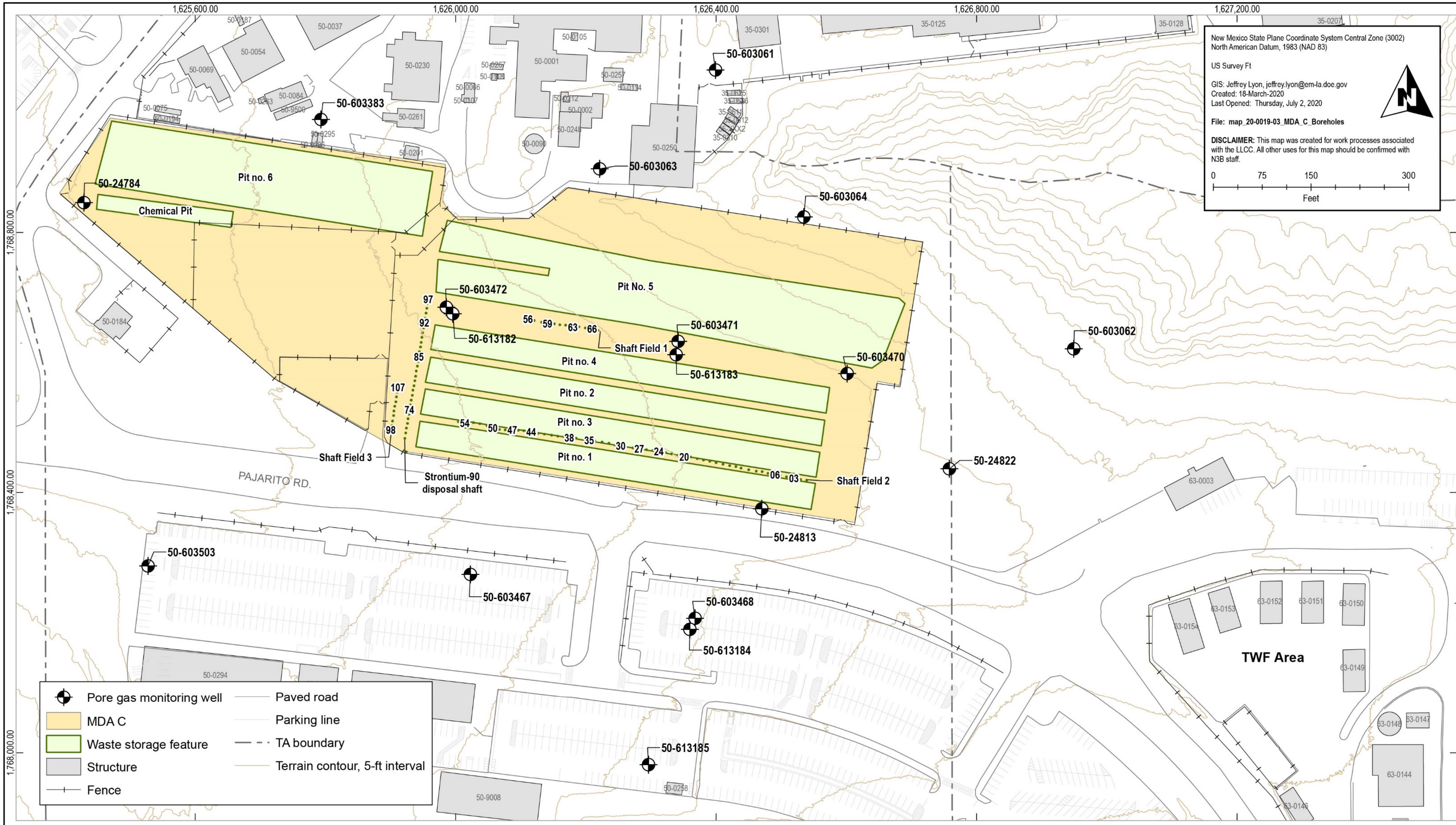


Figure 1.1-3 Location of MDA C monitoring boreholes

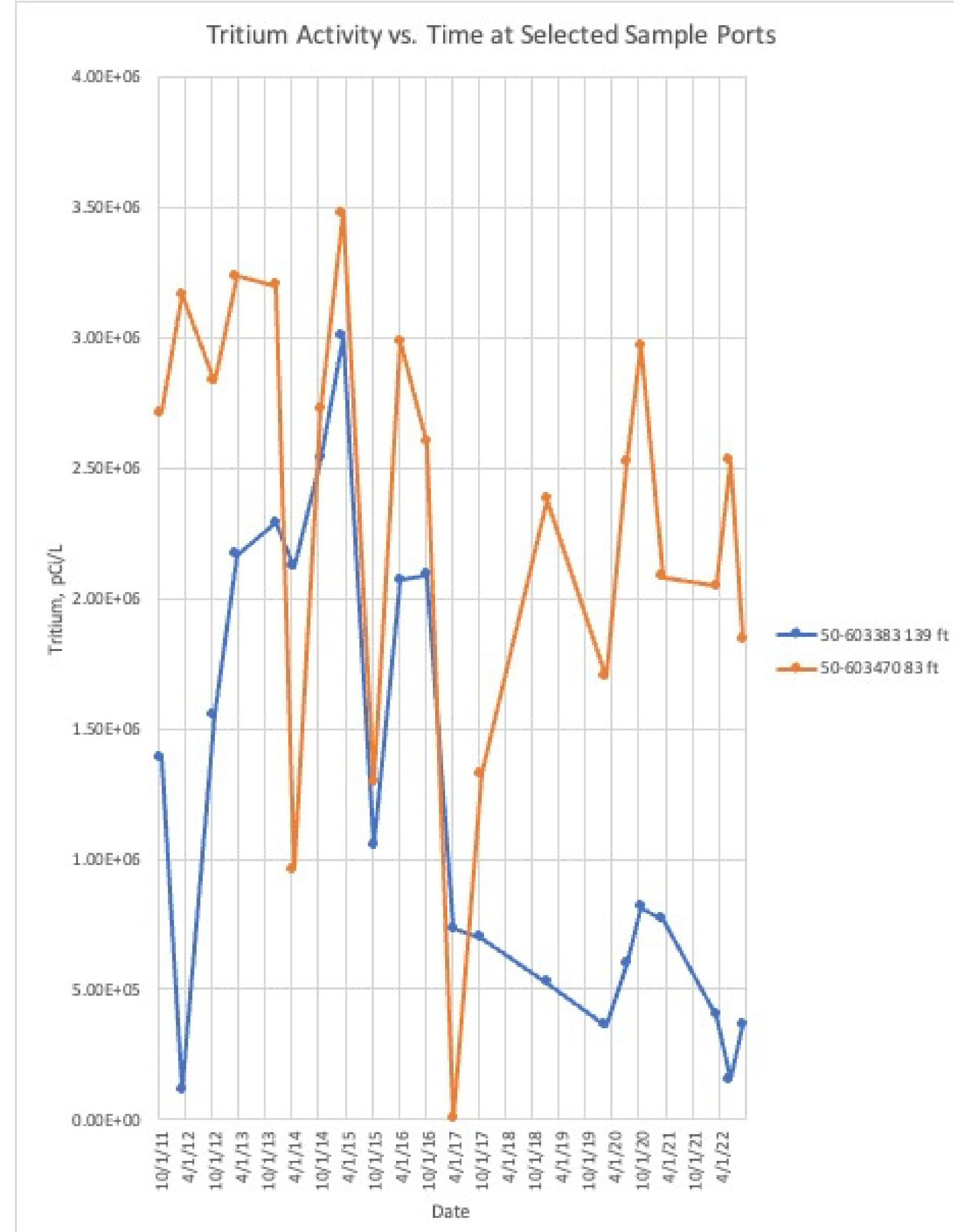


Figure 5.2-1 Tritium activity versus time for boreholes 50-603470 and 50-603383

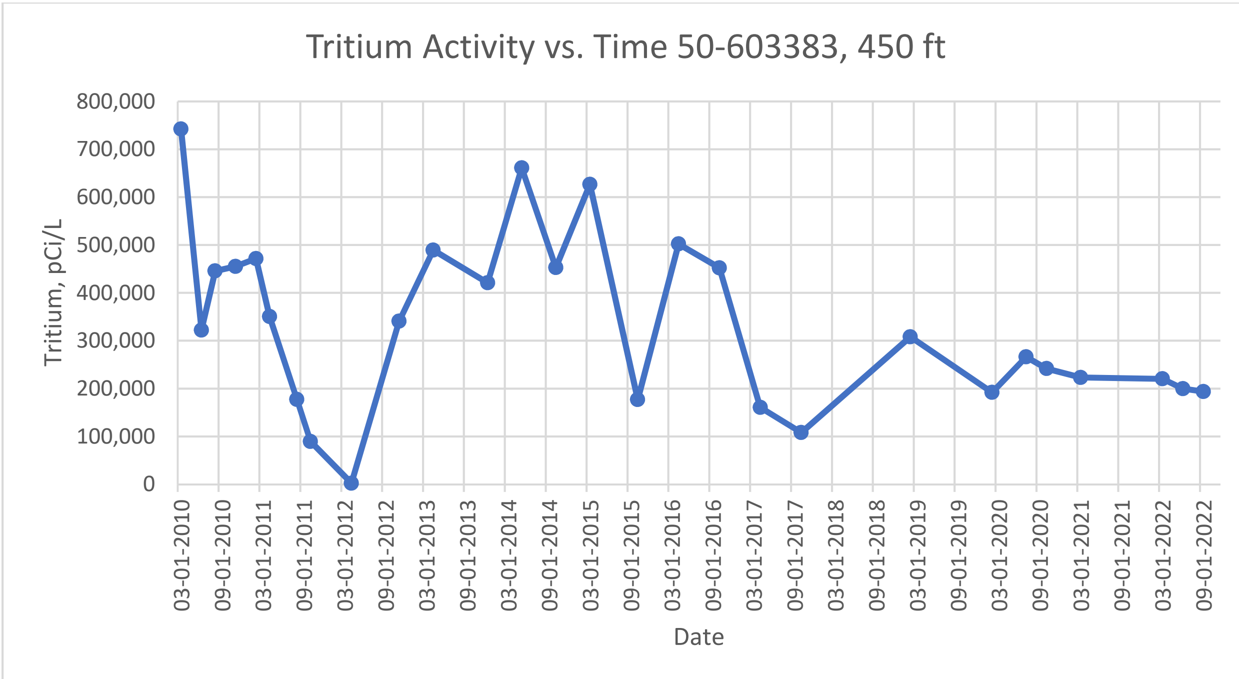


Figure 5.2-2 Tritium activity versus time for borehole 50-603383, 450 ft bgs

Table 2.0-1
2022 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 2022 Sampling Requirements Deviations

Borehole	Port	Deviation	Cause
50-24813	25	SUMMA cannister pressure was not measured at beginning and end of VOC sample collection.	Failure of Swagelok pressure gauge
	150		
	241		
	358		
	450		
	600		
50-60467	143		
	244		
	244 (FD)		
	360		
	500		
	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 ($\mu g/m^3$)
Acetone	0.00144	14,100	NMED Tap Water[b]	20,300
Benzene	0.228	5	NM GW[c]	1140
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
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
Ethanol	na[e]	na	na	na
Methylene chloride	0.133	5	NM GW	665
Propanol[2-]	0.000331	410	EPA Tap Water[f]	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-]	0.705	200	NM GW	141,000
Trichloroethane[1,1,2-]	0.0338	5	NM GW	169
Trichloroethene	0.404	5	NM GW	2020
Trichlorofluoromethane	3.98	1140	NMED Tap Water	4,540,000

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 2022, 702484) or the EPA regional screening tables (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).

[b] Screening level from NMED 2022, 702484.

[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] na = Not available.

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

Table 3.1-2
Screening of VOCs Detected in Pore Gas during First 2022 Sampling Round at MDA C

VOC	Maximum Pore-Gas Concentration (µg/m³)	Tier I Pore-Gas SL (µg/m³)	Tier I Potential for Groundwater Impact[a]
Acetone	582	20,300	No
Benzene	13.5	1140	No
Carbon disulfide	44.8	478,000	No
Carbon tetrachloride	1300	5650	No
Chloroform	2100	12,000	No
Dichlorodifluoromethane	820	2,780,000	No
Dichloroethane[1,1-]	64.7	5750	No
Dichloroethane[1,2-]	184	242	No
Dichloroethene[1,1-]	614	7490	No
Dichloroethene[cis-1,2-]	511	11,700	No
Dichloropropane[1,2-]	385	580	No
Ethanol	16.1	na[b]	na
Methylene chloride	1340	665	Yes
Propanol[2-]	154	136	Yes
Tetrachloroethene	1740	3630	No
Trichloro-1,2,2-trifluoroethane[1,1,2-]	10,800	1,190,000,000	No
Trichloroethane[1,1,1-]	1540	141,000	No
Trichloroethane[1,1,2-]	186	169	Yes
Trichloroethene	73,000	2020	Yes
Trichlorofluoromethane	46.5	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.

[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 2022 Sampling Round at MDA C

VOC	Maximum Pore-Gas Concentration (µg/m³)	Tier I Pore-Gas SL (µg/m³)	Tier I Potential for Groundwater Impact*
Acetone	66	20,300	No
Benzene	14.4	1140	No
Carbon disulfide	80.3	478,000	No
Carbon tetrachloride	1440	5650	No
Chlorobenzene	29.3	12,800	No
Chloroform	2460	12,000	No
Dichlorodifluoromethane	870	2,780,000	No
Dichloroethane[1,1-]	73.2	5750	No
Dichloroethane[1,2-]	159	242	No
Dichloroethene[1,1-]	1100	7490	No
Dichloroethene[cis-1,2-]	630	11,700	No
Dichloropropane[1,2-]	390	580	No
Methylene chloride	819	665	Yes
Propanol[2-]	29.7	136	No
Tetrachloroethene	1740	3630	No
Toluene	6.82	272,000	No
Trichloro-1,2,2-trifluoroethane[1,1,2-]	14,400	1,190,000,000	No
Trichloroethane[1,1,1-]	2090	141,000	No
Trichloroethane[1,1,2-]	181	169	Yes
Trichloroethene	63,400	2020	Yes
Trichlorofluoromethane	56	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 2022 VOC Pore-Gas Detected Results at MDA C (in µg/m³)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**478,000**	**5650**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**
MD50-22-249659	50-24784 P155	155	—[b]	—	—	146	321	78.6	—	—	—	—	52.6
MD50-22-249661	50-24784 P244	244	—	—	—	162	102	79.6	—	—	—	—	32.3 (J)
MD50-22-249663	50-24784 P362	362	—	—	—	282	32.6 (J)	150	—	—	—	—	—
MD50-22-249665	50-24784 P450	450	—	—	—	219	—	122	—	—	—	—	—
MD50-22-249671	50-24813 P25	25	—	—	—	673	600	85.5	—	—	—	35.7 (J)	—
MD50-22-249667	50-24813 P150	150	—	—	—	912	2100	321	—	79.3	12.4 (J)	362	67.4
MD50-22-249669	50-24813 P241	241	51 (J)	—	—	1300	1750	781	—	32.2 (J)	—	511	47.1 (J)
MD50-22-249673	50-24813 P358	358	—	—	—	836	600	820	—	—	—	212	—
MD50-22-249675	50-24813 P450	450	—	—	—	497	177	638	—	—	—	68.9	—
MD50-22-249677	50-24813 P600	600	—	—	—	172	—	344	—	—	—	—	—
MD50-22-249683	50-24822 P25	25	—	—	—	—	178 (J+)	—	—	—	—	—	—
MD50-22-249679	50-24822 P142	142	—	—	—	251 (J+)	417 (J+)	—	—	—	—	68.2 (J)	—
MD50-22-249681	50-24822 P235	235	—	—	—	—	361 (J+)	—	—	—	—	52.7 (J)	—
MD50-22-249685	50-24822 P351	351	—	—	—	289 (J+)	—	—	—	—	—	37.6 (J)	—
MD50-22-249687	50-24822 P450	450	—	—	—	188 (J+)	—	—	—	—	—	—	—
MD50-22-249693	50-603061 P25	25	—	—	—	—	13.5 (J)	190	—	—	126	—	—
MD50-22-249689	50-603061 P128	128	—	—	—	—	—	—	—	—	—	—	—
MD50-22-249691	50-603061 P228	228	—	—	—	—	—	—	—	—	72.9 (J)	—	—
MD50-22-249697	50-603061 P450	450	—	—	—	46.4 (J)	—	118 (J)	—	—	78.1 (J)	—	—
MD50-22-249699	50-603062 P122	122	—	—	—	42.3 (J)	67.3	170	—	—	13.3 (J)	—	—
MD50-22-249701	50-603062 P217	217	—	—	—	55.1 (J)	58.6 (J)	209	—	—	21.7 (J)	—	—
MD50-22-249703	50-603062 P337	337	—	—	—	42 (J)	—	174	—	—	—	—	—
MD50-22-249705	50-603062 P450	450	—	—	—	—	—	89.5	—	—	—	—	—
MD50-22-249711	50-603063 P25	25	48.4 (J)	—	—	29.7 (J)	31.7 (J)	107	—	—	10.4 (J)	—	—
MD50-22-249707	50-603063 P128	128	—	—	—	153	270	298	55.4	—	200	27.6 (J)	—
MD50-22-249709	50-603063 P228	228	71.5 (J)	—	26.7 (J)	349	540	433	64.7	—	317	117	49.9 (J)
MD50-22-249713	50-603063 P347	347	—	—	—	314	303	344	23.3 (J)	—	99.1	52.7	25.1 (J)
MD50-22-249715	50-603063 P450	450	49.4 (J)	—	—	202	141	276	19.1 (J)	—	20.7 (J)	—	—

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**478,000**	**5650**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**
MD50-22-249717	50-603064 P113	113	—	—	—	96.8 (J)	412	250 (J)	—	—	270	—	—
MD50-22-249719	50-603064 P214	214	—	—	—	287	556	540	—	—	614	189	29.7 (J)
MD50-22-249721	50-603064 P332	332	—	—	—	204	91.7	448	—	—	187	33.9 (J)	—
MD50-22-249723	50-603064 P500	500	—	—	—	76.1 (J)	—	232	—	—	14.6 (J)	—	—
MD50-22-249729	50-603383 P26	26	—	—	—	—	—	26.6 (J)	—	—	—	—	—
MD50-22-249725	50-603383 P139	139	—	—	—	184	157	233	18.8 (J)	—	47.2	36.3 (J)	228
MD50-22-249727	50-603383 P244	244	—	—	—	311	166	299	21.4 (J)	—	60.6	58.6	385
MD50-22-249731	50-603383 P359	359	—	—	—	284	38.2 (J)	236	—	—	26.9 (J)	18.8 (J)	49.9
MD50-22-249733	50-603383 P450	450	46.3 (J)	—	—	241	16.8 (J)	215	—	—	15.1 (J)	—	19.6 (J)
MD50-22-249735	50-603467 P143	143	51.5 (J)	—	—	263	413	131	—	—	—	73.7	15.1 (J)
MD50-22-249737	50-603467 P244	244	—	6 (J)	—	485	566	256	—	—	—	138	27 (J)
MD50-22-249739	50-603467 P360	360	—	—	—	347	348	191	—	—	—	91.1	13.5 (J)
MD50-22-249741	50-603467 P500	500	—	—	—	248	74.2	215	—	—	—	22 (J)	—
MD50-22-249743	50-603467 P600	600	61 (J)	—	—	152	62	159	—	—	—	18.3 (J)	—
MD50-22-249745	50-603468 P142	142	—	—	—	104 (J+)	206 (J)	52.4 (J)	—	—	—	36.1 (J)	—
MD50-22-249747	50-603468 P233	233	—	—	—	573 (J+)	410 (J)	287 (J)	—	—	—	96.3 (J)	—
MD50-22-249749	50-603468 P354	354	—	—	—	673 (J+)	335 (J)	392 (J)	—	—	—	88 (J)	—
MD50-22-249751	50-603468 P403	403	—	—	—	609 (J+)	202 (J)	433 (J)	—	—	—	79.2 (J)	—
MD50-22-249763	50-603470 P83	83	50.1 (J)	—	—	122	517	81.1	—	—	—	63.8	15.9 (J)
MD50-22-249753	50-603470 P203	203	—	8.46 (J)	—	342	908	457	—	20.3 (J)	40 (J)	246	42.5 (J)
MD50-22-249755	50-603470 P278	278	—	9.96 (J)	—	526	834	726	—	—	45.2	268	30 (J)
MD50-22-249757	50-603470 P351	351	—	—	—	458	385	722	—	—	32.9 (J)	149	—
MD50-22-249759	50-603470 P450	450	—	—	—	308	114	628	—	—	18.6 (J)	48.3	—
MD50-22-249761	50-603470 P650	650	—	—	—	—	—	54.9 (J)	—	—	—	—	—
MD50-22-249765	50-603471	UNK[c]	—	—	—	931 (J+)	991 (J+)	99.8 (J)	—	103 (J)	—	100 (J)	43.9 (J)
MD50-22-249775	50-603471 P90	90	—	—	—	518 (J+)	991	48.6 (J)	6.19 (J)	184	—	39.1 (J)	18 (J)
MD50-22-249767	50-603471 P209	209	—	—	—	221 (J+)	527 (J+)	61.3 (J)	—	73.2 (J)	—	72.1 (J)	35.3 (J)
MD50-22-249769	50-603471 P288	288	—	13.5 (J)	—	940	1420	578	11.6 (J)	49.3	39.6 (J)	400	61.4
MD50-22-249771	50-603471 P360	360	—	10.2 (J)	44.8 (J)	704	717	638	—	—	24.2 (J)	234	16.3 (J)
MD50-22-249773	50-603471 P450	450	—	—	—	415 (J+)	590 (J+)	80.1 (J)	—	—	—	108 (J)	—
MD50-22-249779	50-603472 P27	27	—	—	—	18 (J)	133	18.6 (J)	—	—	—	—	—
MD50-22-249777	50-603472 P146	146	582 (J+)	—	—	39.7 (J)	137	22.5 (J)	—	—	—	25.7 (J)	21.2 (J)

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**478,000**	**5650**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**
MD50-22-249781	50-603472 P292	292	—	—	—	144	237	112	—	—	—	71.3	25.9 (J)
MD50-22-249783	50-603472 P364	364	—	—	—	—	—	—	—	—	—	—	—
MD50-22-249785	50-603472 P450	450	—	—	—	—	—	—	—	—	—	—	—
MD50-22-249787	50-603503 P133	133	59.6 (J)	—	—	48.1 (J)	88.8	34 (J)	—	—	—	—	23 (J)
MD50-22-249789	50-603503 P237	237	—	—	—	86.8	108	64.7	—	—	—	23.9 (J)	35.2 (J)
MD50-22-249791	50-603503 P347	347	—	—	—	118	63.4	92.4	—	—	—	—	13.3 (J)
MD50-22-249793	50-603503 P450	450	—	—	—	89.3	22.6 (J)	83	—	—	—	—	—
MD50-22-249795	50-613182 P550	550	—	—	—	—	—	—	—	—	—	—	—
MD50-22-249797	50-613182 P632.5	632.5	—	—	—	—	—	—	—	—	—	—	—
MD50-22-249799	50-613183 P550	550	—	—	—	197 (J+)	—	327	—	—	—	—	—
MD50-22-249801	50-613183 P642.5	642.5	—	—	—	8.68 (J+)	—	16.1 (J)	—	—	—	—	—
MD50-22-249803	50-613184 P500	500	—	—	—	20.8 (J+)	4.51 (J)	18.9 (J)	—	—	—	—	—
MD50-22-249805	50-613184 P600	600	—	—	—	76.7 (J+)	—	145	—	—	—	—	—
MD50-22-249807	50-613184 P664.5	664.5	—	—	—	13.9 (J+)	4.73 (J)	25.7 (J)	—	—	—	—	—
MD50-22-249809	50-613185 P145	145	—	—	—	79.2	96.1	81.1	—	—	—	—	—
MD50-22-249811	50-613185 P235	235	46.1 (J)	—	—	140	105	140	—	—	—	35.9 (J)	—
MD50-22-249813	50-613185 P350	350	—	—	—	124	25.1 (J)	161	—	—	—	—	—
MD50-22-249815	50-613185 P450	450	46.8 (J)	—	—	76.1	—	107	—	—	—	—	—
MD50-22-249817	50-613185 P600	600	—	—	—	—	—	16.7 (J)	—	—	—	—	—

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Ethanol	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane
Tier I Pore Gas SL[a]			**na[d]**	**665**	**136**	**3630**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**
MD50-22-249659	50-24784 P155	155	—	—	—	1740 (J+)	123	29.7 (J)	—	2700 (J+)	—
MD50-22-249661	50-24784 P244	244	—	—	154	1210 (J+)	69.5 (J)	19.7 (J)	—	2230 (J+)	—
MD50-22-249663	50-24784 P362	362	—	—	—	1200 (J+)	67.3 (J)	—	—	2450 (J+)	—
MD50-22-249665	50-24784 P450	450	—	—	—	524 (J+)	—	—	—	1110 (J+)	—
MD50-22-249671	50-24813 P25	25	—	—	25.1 (J)	307	—	—	30.8 (J)	7200	—
MD50-22-249667	50-24813 P150	150	—	145 (J)	25.3 (J)	561	42.2 (J)	—	186	33,000	—
MD50-22-249669	50-24813 P241	241	—	341	—	895	109	16 (J)	36.6 (J)	73,000	31.5 (J)
MD50-22-249673	50-24813 P358	358	—	50 (J)	62.4 (J)	639	88.8 (J)	—	—	54,200	35.7 (J)
MD50-22-249675	50-24813 P450	450	—	126 (J)	—	348	42.8 (J)	—	—	30,300	28.9 (J)
MD50-22-249677	50-24813 P600	600	—	—	—	62.6 (J)	—	—	—	5210	—
MD50-22-249683	50-24822 P25	25	—	—	—	—	—	12.8 (J)	—	—	—
MD50-22-249679	50-24822 P142	142	—	122 (J)	—	—	—	28.7 (J)	—	—	—
MD50-22-249681	50-24822 P235	235	—	183 (J)	—	—	—	48.5 (J)	—	—	—
MD50-22-249685	50-24822 P351	351	—	102 (J)	—	—	—	—	—	—	28.9 (J)
MD50-22-249687	50-24822 P450	450	—	—	—	—	—	—	—	—	21 (J)
MD50-22-249693	50-603061 P25	25	—	—	—	127	5760	528	—	518	—
MD50-22-249689	50-603061 P128	128	—	—	—	—	260	—	—	—	—
MD50-22-249691	50-603061 P228	228	—	—	—	—	1160	152 (J)	—	291	—
MD50-22-249697	50-603061 P450	450	—	—	—	—	2340	60 (J)	—	902	—
MD50-22-249699	50-603062 P122	122	—	—	29.5 (J)	54.4 (J)	581	47.1 (J)	—	6120	—
MD50-22-249701	50-603062 P217	217	—	—	35.6 (J)	52.4 (J)	712	52.6 (J)	—	7500	—
MD50-22-249703	50-603062 P337	337	—	—	44.2 (J)	—	312	—	—	2820	—
MD50-22-249705	50-603062 P450	450	—	—	—	—	81.2 (J)	—	—	892	—
MD50-22-249711	50-603063 P25	25	—	—	—	302	1600	134	—	1190	—
MD50-22-249707	50-603063 P128	128	—	—	39.6 (J)	963	4040	412	—	7950	28.7 (J)

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Ethanol	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane
Tier I Pore Gas SL[a]			**na[d]**	**665**	**136**	**3630**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**
MD50-22-249709	50-603063 P228	228	—	—	78.4 (J)	1650	5330	514	—	23,000	40.9 (J)
MD50-22-249713	50-603063 P347	347	—	—	—	1040	1880	88.3	—	18,700	34.2 (J)
MD50-22-249715	50-603063 P450	450	—	—	—	455	498	15.3 (J)	—	9720	—
MD50-22-249717	50-603064 P113	113	—	—	—	377	4860	769	—	13,100	—
MD50-22-249719	50-603064 P214	214	—	365	—	643	10,800	1540	—	34,300	41 (J)
MD50-22-249721	50-603064 P332	332	—	—	—	263	4920	236	—	15,100	35.1 (J)
MD50-22-249723	50-603064 P500	500	—	—	—	42.8 (J)	531	—	—	2350	—
MD50-22-249729	50-603383 P26	26	—	—	—	101	67.7 (J)	—	—	242	—
MD50-22-249725	50-603383 P139	139	—	—	23.5 (J)	1280	942	116	—	5010	30.2 (J)
MD50-22-249727	50-603383 P244	244	—	58.7 (J)	—	1650	888	137	—	6870	34.9 (J)
MD50-22-249731	50-603383 P359	359	—	—	—	820	367	46.2 (J)	—	3630	—
MD50-22-249733	50-603383 P450	450	—	—	—	516	191	14.8 (J)	—	2400	—
MD50-22-249735	50-603467 P143	143	—	—	39.8 (J)	338	—	—	14.6 (J)	11,000	—
MD50-22-249737	50-603467 P244	244	—	88.9 (J)	—	685	—	—	—	23,300	—
MD50-22-249739	50-603467 P360	360	—	—	26.8 (J)	626	—	—	—	20,700	—
MD50-22-249741	50-603467 P500	500	—	—	—	317	—	—	—	10,500	—
MD50-22-249743	50-603467 P600	600	—	—	—	269	—	—	—	7460	—
MD50-22-249745	50-603468 P142	142	—	—	—	172 (J)	—	—	—	6820	—
MD50-22-249747	50-603468 P233	233	—	305 (J)	—	396 (J)	—	—	—	19,300	—
MD50-22-249749	50-603468 P354	354	—	210 (J)	—	427 (J)	—	—	—	22,100	—
MD50-22-249751	50-603468 P403	403	—	162 (J)	—	355 (J)	—	—	—	19,200	—
MD50-22-249763	50-603470 P83	83	—	—	26.5 (J)	488	167	28.5 (J)	64.9	7200	—
MD50-22-249753	50-603470 P203	203	—	427	—	537	804	97.1	16.7 (J)	35,900	—
MD50-22-249755	50-603470 P278	278	—	642	—	573	1080	85.1	—	50,400	38.6 (J)
MD50-22-249757	50-603470 P351	351	—	375	31.7 (J)	416	950	43.6 (J)	—	40,200	41.4 (J)
MD50-22-249759	50-603470 P450	450	—	126 (J)	—	224	433	—	—	22,900	32.5 (J)
MD50-22-249761	50-603470 P650	650	—	—	—	—	—	—	—	182	—
MD50-22-249765	50-603471	UNK[c]	—	94.1 (J)	—	592 (J+)	168 (J)	—	78.5 (J)	8700 (J+)	—
MD50-22-249775	50-603471 P90	90	—	24.8 (J)	—	401 (J+)	75.3 (J)	—	26.7 (J)	3750 (J+)	6.96 (J)

Table 5.1-1 (continued)

Sample ID	Location ID	Depth (ft bgs)	Ethanol	Methylene Chloride	Propanol[2-]	Tetrachloroethene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trichlorofluoromethane
Tier I Pore Gas SL[a]			**na[d]**	**665**	**136**	**3630**	**1,190,000,000**	**141,000**	**169**	**2020**	**4,540,000**
MD50-22-249767	50-603471 P209	209	—	166 (J)	—	—	87.3 (J)	—	52.2 (J)	11,000 (J+)	—
MD50-22-249769	50-603471 P288	288	—	1340	—	935 (J+)	630	60.5 (J+)	14.5 (J)	39,100	39.2 (J)
MD50-22-249771	50-603471 P360	360	—	726	—	820 (J+)	479	—	—	35,300	46.5 (J)
MD50-22-249773	50-603471 P450	450	—	—	—	—	108 (J)	—	—	24,300 (J+)	—
MD50-22-249779	50-603472 P27	27	—	—	25.5 (J)	278	28 (J)	23.3 (J)	—	1500 (J+)	—
MD50-22-249777	50-603472 P146	146	—	97.2 (J)	105 (J)	183	—	—	—	2590 (J+)	—
MD50-22-249781	50-603472 P292	292	—	378	—	428	46.6 (J)	—	—	8750	—
MD50-22-249783	50-603472 P364	364	—	—	32.9 (J)	—	—	—	—	—	—
MD50-22-249785	50-603472 P450	450	—	—	31.4 (J)	—	—	—	—	—	—
MD50-22-249787	50-603503 P133	133	—	—	—	321	71.1 (J)	—	—	1700	—
MD50-22-249789	50-603503 P237	237	—	84.7 (J)	23.4 (J)	485	54.2 (J)	—	—	4000	—
MD50-22-249791	50-603503 P347	347	—	51 (J)	—	466	34.2 (J)	—	—	4840	—
MD50-22-249793	50-603503 P450	450	—	—	—	278	—	—	—	3110	—
MD50-22-249795	50-613182 P550	550	—	—	38.8 (J)	—	—	—	—	—	—
MD50-22-249797	50-613182 P632.5	632.5	—	—	26 (J)	—	—	—	—	—	—
MD50-22-249799	50-613183 P550	550	—	—	—	—	20.9 (J)	—	—	4470 (J+)	27.5 (J)
MD50-22-249801	50-613183 P642.5	642.5	—	—	—	—	2.36 (J)	—	—	—	—
MD50-22-249803	50-613184 P500	500	9.74 (J)	—	11.6 (J)	15.9 (J)	—	—	—	822	2.41 (J)
MD50-22-249805	50-613184 P600	600	—	—	12.7 (J)	19.7 (J)	—	—	—	1070	7.02 (J)
MD50-22-249807	50-613184 P664.5	664.5	16.1 (J)	—	27.8 (J)	9.76 (J)	—	—	—	182 (J+)	—
MD50-22-249809	50-613185 P145	145	—	—	—	81.3	—	—	—	3520	—
MD50-22-249811	50-613185 P235	235	—	65.6 (J)	45 (J)	129	—	—	—	6770	—
MD50-22-249813	50-613185 P350	350	—	—	—	82	—	—	—	4430	—
MD50-22-249815	50-613185 P450	450	—	—	34.9 (J)	40.9 (J)	—	—	—	2010	—
MD50-22-249817	50-613185 P600	600	—	—	—	—	—	—	—	78.9	—

Notes: 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] UNK = Port depth is not labeled and is unknown.

[d] na = Not available.

Table 5.1-2
Second Round 2022 VOC Pore-Gas Detected Results at MDA C (in µg/m³)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**478,000**	**5650**	**12,800**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**
MD50-22-241827	50-24784 P155	155	—[b]	—	—	131	—	311	61.8	—	—	—	—	61.4
MD50-22-241829	50-24784 P244	244	—	—	—	185	—	131	85	—	—	—	—	45.6 (J)
MD50-22-241831	50-24784 P362	362	—	—	—	312	—	39.6 (J)	150	—	—	—	—	—
MD50-22-241833	50-24784 P450	450	—	—	—	246	—	—	147	—	—	—	—	—
MD50-22-241839	50-24813 P25	25	—	—	—	723	—	722	91.9	—	—	—	34.9 (J)	—
MD50-22-241835	50-24813 P150	150	—	—	—	1040	—	2460	312	—	87.4	19.2 (J)	444	58.7
MD50-22-241837	50-24813 P241	241	—	—	—	1440	—	2100	845	—	31.3 (J)	13.1 (J)	630	52.6 (J)
MD50-22-241841	50-24813 P358	358	—	—	—	849	—	659	860	—	—	—	266	—
MD50-22-241843	50-24813 P450	450	—	8.88 (J)	—	567	—	207	697	—	—	—	78.1	—
MD50-22-241845	50-24813 P600	600	—	—	—	194	—	—	372	—	—	—	—	—
MD50-22-241851	50-24822 P25	25	—	—	—	61.8 (J)	—	195	76.6	—	—	—	—	—
MD50-22-241847	50-24822 P142	142	—	—	—	236	—	547	337	—	—	—	116	—
MD50-22-241849	50-24822 P235	235	—	9.93 (J)	48.5 (J)	385	—	595	647	—	—	13 (J)	166	—
MD50-22-241853	50-24822 P351	351	—	7.98 (J)	—	282	—	210	613	—	—	—	74.5	—
MD50-22-241855	50-24822 P450	450	—	—	—	192	—	59	451	—	—	—	19.1 (J)	—
MD50-22-241861	50-603061 P25	25	—	—	—	—	—	17.4 (J)	210	—	—	143	—	—
MD50-22-241857	50-603061 P128	128	—	—	—	—	—	26.6 (J)	68.2	—	—	315	—	—
MD50-22-241859	50-603061 P228	228	—	—	—	92.4	—	52.7	215	19.7 (J)	—	1100	—	—
MD50-22-241863	50-603061 P347	347	—	—	64.1 (J)	113	—	18.3 (J)	247	—	—	412	—	—
MD50-22-241865	50-603061 P450	450	—	—	—	76.7	—	16.9 (J)	164	—	—	132	—	—
MD50-22-241867	50-603062 P122	122	—	—	—	48.7 (J)	—	75.1	170	—	—	16.4 (J)	—	—
MD50-22-241869	50-603062 P217	217	—	—	—	69.2	—	61.5	231	—	—	26.5 (J)	18.3 (J)	—
MD50-22-241871	50-603062 P337	337	—	—	—	49.4 (J)	—	14.4 (J)	186	—	—	—	—	—
MD50-22-241873	50-603062 P450	450	—	—	—	25.3 (J)	—	—	110	—	—	—	—	—
MD50-22-241879	50-603063 P25	25	—	—	—	28.3 (J)	—	31.2 (J)	104	—	—	13.3 (J)	—	—
MD50-22-241875	50-603063 P128	128	—	—	—	161	—	294	286	68	—	221	32.6 (J)	—
MD50-22-241877	50-603063 P228	228	—	—	—	328	—	566	403	73.2	—	376	141	57.7 (J)
MD50-22-241881	50-603063 P347	347	—	—	—	348	—	373	383	30.8 (J)	—	132	66.2	23.3 (J)
MD50-22-241883	50-603063 P450	450	—	—	—	208	—	152	296	26 (J)	—	26.1 (J)	—	—
MD50-22-241885	50-603064 P113	113	—	—	—	101	—	500	164	—	—	267	137	29 (J)
MD50-22-241887	50-603064 P214	214	—	8.46 (J)	—	278	—	532	483	—	—	531	218	17.9 (J)

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Dissulfide	Carbon Tetrachloride	Chlorobenzene	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**478,00**	**5650**	**12,800**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**
MD50-22-241889	50-603064 P332	332	—	—	—	245	—	108	475	—	—	216	47.2	—
MD50-22-241891	50-603064 P500	500	—	—	—	76.1	—	—	212	—	—	14.5 (J)	—	—
MD50-22-241897	50-603383 P26	26	—	—	—	98.7	15.6 (J)	83.4	235	—	—	24.2 (J)	—	41.2 (J)
MD50-22-241893	50-603383 P139	139	—	—	—	199	29.3 (J)	199	279	24.3 (J)	—	61	45.6	213
MD50-22-241895	50-603383 P244	244	48.4 (J)	—	—	370	19.3 (J)	209	336	29.3 (J)	—	80.4	64.2	390
MD50-22-241899	50-603383 P359	359	—	—	—	324	12.2 (J)	53.7 (J)	290	—	—	38.8 (J)	19.5 (J)	78.1
MD50-22-241901	50-603383 P450	450	—	—	—	257	—	26.4 (J)	242	—	—	26.3 (J)	—	20.3 (J)
MD50-22-241903	50-603467 P143	143	—	—	—	388	—	517	233	—	—	—	114	22.7 (J)
MD50-22-241905	50-603467 P244	244	—	—	—	460	—	595	242	—	—	—	152	21.3 (J)
MD50-22-241907	50-603467 P360	360	—	—	—	381	—	356	237	—	—	—	99.5	—
MD50-22-241909	50-603467 P500	500	—	—	—	287	—	108	240	—	—	—	26.2 (J)	—
MD50-22-241911	50-603467 P600	600	—	—	—	201	—	65.4	184	—	—	—	—	—
MD50-22-241913	50-603468 P142	142	—	—	—	172	—	244	213	—	—	—	49.1	—
MD50-22-241915	50-603468 P233	233	—	—	—	463	—	542	310	—	—	—	166	—
MD50-22-241917	50-603468 P354	354	—	5.4 (J)	—	390	—	315	304	—	—	—	108	—
MD50-22-241919	50-603468 P403	403	—	5.75 (J)	—	450	—	268	409	—	—	—	97.5	—
MD50-22-241921	50-603470 P203	203	—	—	—	138	—	551	94.4	—	16.9 (J)	—	70.5	17.5 (J)
MD50-22-241923	50-603470 P278	278	—	8.72 (J)	—	381	—	1080	478	—	19 (J)	54.7	289	25.7 (J)
MD50-22-241925	50-603470 P351	351	—	14.4 (J)	—	524	—	961	687	—	—	52.3	307	27 (J)
MD50-22-241927	50-603470 P450	450	66 (J)	13.3 (J)	—	575	—	500	870	—	—	43.6	193	—
MD50-22-241929	50-603470 P650	650	—	—	—	282	—	117	540	—	—	16.4 (J)	48.3	—
MD50-22-241931	50-603470 P83	83	—	—	—	—	—	—	—	—	—	—	—	—
MD50-22-244103	50-603471	UNK[c]	—	—	—	824	—	1200	102	—	95.5	15.9 (J)	129	53.6
MD50-22-241941	50-603471 P90	90	—	—	—	534	—	1270	69.2	—	159	—	93.5	34.9 (J)
MD50-22-241933	50-603471 P209	209	—	11.3 (J)	—	654	—	1090	540	—	47.7 (J)	27.6 (J)	338	52.6 (J)
MD50-22-241935	50-603471 P288	288	—	9.67 (J)	—	588	—	849	383	—	24.6 (J)	28.4 (J)	237	40.8 (J)
MD50-22-241937	50-603471 P360	360	—	11.1 (J)	—	723	—	712	657	—	—	31.5 (J)	237	20 (J)
MD50-22-241939	50-603471 P450	450	—	—	—	375	—	399	342	—	—	15.2 (J)	125	—
MD50-22-241943	50-603472 P146	146	—	—	—	18.6 (J)	—	142	22.6 (J)	—	—	—	—	11.2 (J)
MD50-22-241945	50-603472 P27	27	—	—	—	133	—	406	81.5	—	36.9 (J)	—	76.5	64.7
MD50-22-241947	50-603472 P292	292	—	—	—	303	—	387	173	—	—	10.7 (J)	118	42.2 (J)
MD50-22-241949	50-603472 P364	364	—	—	—	433	—	255	326	—	—	12.8 (J)	91.5	—

Table 5.1-2 (continued)

Sample ID	Location ID	Depth (ft bgs)	Acetone	Benzene	Carbon Dissulfide	Carbon Tetrachloride	Chlorobenzene	Chloroform	Dichlorodifluoromethane	Dichloroethane[1,1-]	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Dichloropropane[1,2-]
Tier I Pore Gas SL[a]			**20,300**	**1140**	**478,00**	**5650**	**12,800**	**12,000**	**2,780,000**	**5750**	**242**	**7490**	**11,700**	**580**
MD50-22-241951	50-603472 P450	450	—	—	—	230	—	63.9	208	—	—	—	20.9 (J)	—
MD50-22-241953	50-603503 P133	133	—	—	—	50.7 (J)	—	90.3	26.3 (J)	—	—	—	—	25.4 (J)
MD50-22-241955	50-603503 P237	237	—	—	—	97.5	—	141	67.2	—	—	—	29.5 (J)	41.5 (J)
MD50-22-241957	50-603503 P347	347	—	—	80.3 (J)	136	—	74.7	108	—	—	—	26.8 (J)	14.4 (J)
MD50-22-241959	50-603503 P450	450	—	—	—	103	—	23.3 (J)	83	—	—	—	—	—
MD50-22-241961	50-613182 P550	550	—	—	—	37.2 (J)	—	—	49.9 (J)	—	—	—	—	—
MD50-22-241963	50-613182 P632.5	632.5	—	—	—	230	—	13.4 (J)	455	—	—	—	—	—
MD50-22-241967	50-613183 P550	550	—	—	—	—	—	—	25.4 (J)	—	—	—	—	—
MD50-22-241971	50-613184 P500	500	—	—	—	181	—	15.8 (J)	252	—	—	—	—	—
MD50-22-241973	50-613184 P600	600	—	—	—	79.8	—	—	152	—	—	—	—	—
MD50-22-241975	50-613184 P664.5	664.5	—	—	—	20 (J)	—	—	39.9 (J)	—	—	—	—	—
MD50-22-241977	50-613185 P145	145	—	—	—	—	—	92.7	—	—	—	—	18.8 (J)	—
MD50-22-241979	50-613185 P235	235	—	—	—	—	—	110	—	—	—	—	32.2 (J)	—
MD50-22-241981	50-613185 P350	350	—	—	—	162 (J)	—	31.2 (J)	—	—	—	—	—	—
MD50-22-241983	50-613185 P450	450	—	—	—	—	—	—	—	—	—	—	—	—
MD50-22-241985	50-613185 P600	600	—	—	—	32.2 (J)	—	—	72.2 (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**
MD50-22-257987	50-24784 P155	155	—	—	1740	—	109	27.9 (J)	—	2910 (J+)	—
MD50-22-257988	50-24784 P244	244	—	—	1430	—	77.4 (J)	24 (J)	—	2890	—
MD50-22-257989	50-24784 P362	362	—	—	1310	—	75.7 (J)	18.6 (J)	—	2810	—
MD50-22-257990	50-24784 P450	450	—	—	586	—	28.7 (J)	—	—	1300	—
MD50-22-257993	50-24813 P25	25	—	—	291	—	—	—	36.9 (J)	6870	—
MD50-22-257991	50-24813 P150	150	155 (J)	—	494	—	41.1 (J)	—	181	29,800	—
MD50-22-257992	50-24813 P241	241	396	—	810	—	123	16.9 (J)	40.9 (J)	63,400	38.4 (J)
MD50-22-257994	50-24813 P358	358	62.8 (J)	—	561	—	82.7 (J)	—	—	49,400	39.4 (J)
MD50-22-257995	50-24813 P450	450	161 (J)	—	319	—	44.2 (J)	—	—	28,400	35 (J)
MD50-22-257996	50-24813 P600	600	—	—	61.3 (J)	—	—	—	—	5120	—
MD50-22-257999	50-24822 P25	25	—	—	102	—	46.3 (J)	—	—	4380	—
MD50-22-257997	50-24822 P142	142	178	—	200	—	172	32.4 (J)	—	19,200	—
MD50-22-257998	50-24822 P235	235	329	—	252	—	286	39.2 (J)	—	31,600	29.1 (J)
MD50-22-258000	50-24822 P351	351	160 (J)	—	155	—	175	—	—	22,500	30.2 (J)
MD50-22-258001	50-24822 P450	450	43 (J)	—	71.8	—	78.9 (J)	—	—	11,700	—
MD50-22-258020	50-603061 P25	25	—	—	136	—	5650	556	—	521	—
MD50-22-258018	50-603061 P128	128	—	—	117	—	4100	531	—	730	—
MD50-22-258019	50-603061 P228	228	46.2 (J)	—	270	—	14,400	2090	—	3740	—
MD50-22-258021	50-603061 P347	347	—	—	163	—	9110	633	—	2350	26.4 (J)
MD50-22-258022	50-603061 P450	450	—	—	53.8 (J)	—	3080	76.3	—	1070	—
MD50-22-258023	50-603062 P122	122	—	—	47 (J)	—	622	58.9	—	6070	—
MD50-22-258024	50-603062 P217	217	—	—	47.9 (J)	—	774	61.6	—	7840	—
MD50-22-258025	50-603062 P337	337	—	—	—	—	341	—	—	3150	—
MD50-22-258026	50-603062 P450	450	—	—	—	—	103	—	—	1010	—
MD50-22-258029	50-603063 P25	25	—	—	321	—	1490	150	—	1170	—
MD50-22-258027	50-603063 P128	128	—	—	922	—	3900	428	—	7730	34.1 (J)
MD50-22-258028	50-603063 P228	228	—	—	1530	—	5240	500	—	22,000	56 (J)
MD50-22-258030	50-603063 P347	347	—	—	1040	—	1930	97.1	—	19,000	41.3 (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**
MD50-22-258031	50-603063 P450	450	—	—	449	—	531	18.8 (J)	—	9560	33.5 (J)
MD50-22-258032	50-603064 P113	113	86.4 (J)	29.7 (J)	335	—	4280	823	—	13,400	—
MD50-22-258033	50-603064 P214	214	304	—	467	—	9730	1440	—	26,000	37.6 (J)
MD50-22-258034	50-603064 P332	332	55.5 (J)	—	293	—	5000	244	—	16,000	41.4 (J)
MD50-22-258035	50-603064 P500	500	—	—	38.6 (J)	—	509	—	—	2220	—
MD50-22-258038	50-603383 P26	26	—	—	659	—	800	88.9	—	1840	40.7 (J)
MD50-22-258036	50-603383 P139	139	54.2 (J)	—	1130	—	1080	140	—	4750	40.9 (J)
MD50-22-258037	50-603383 P244	244	84 (J)	—	1650	—	1000	154	—	7090	39.3 (J)
MD50-22-258039	50-603383 P359	359	—	—	922	—	460	66	—	4000	30.3 (J)
MD50-22-258040	50-603383 P450	450	—	—	493	—	329	36.6 (J)	—	2380	—
MD50-22-258043	50-603467 P143	143	—	—	321	—	—	—	19.5 (J)	12,000	—
MD50-22-258044	50-603467 P244	244	82.6 (J)	—	606	—	—	—	—	20,200	—
MD50-22-258045	50-603467 P360	360	—	—	577	—	—	—	—	19,000	—
MD50-22-258046	50-603467 P500	500	—	—	364	—	—	—	—	12,000	—
MD50-22-258047	50-603467 P600	600	—	—	247	—	—	—	—	6870	—
MD50-22-258048	50-603468 P142	142	—	—	167	—	—	—	—	7460	—
MD50-22-258049	50-603468 P233	233	307	—	359	—	—	—	—	22,000	—
MD50-22-258050	50-603468 P354	354	173	—	310	—	—	—	—	18,600	—
MD50-22-258051	50-603468 P403	403	162	—	313	—	—	—	—	20,800	—
MD50-22-258057	50-603470 P83	83	—	—	491	—	165	25.4 (J)	64.9	6820	—
MD50-22-258052	50-603470 P203	203	493	—	521	—	840	107	18.8 (J)	34,600	28.9 (J)
MD50-22-258053	50-603470 P278	278	715	—	531	—	1030	93.8	—	44,900	41 (J)
MD50-22-258054	50-603470 P351	351	472	—	443	—	942	55.6 (J)	—	42,900	53.7 (J)
MD50-22-258055	50-603470 P450	450	128 (J)	—	170	—	381	17.7 (J)	—	17,800	34.7 (J)
MD50-22-258056	50-603470 P650	650	—	—	—	—	—	—	—	59.6	—
MD50-22-258058	50-603471	UNK[c]	123 (J)	—	667	—	191	31.8 (J)	82.3	13,200	—
MD50-22-258063	50-603471 P90	90	54.5 (J)	—	509	—	119	23 (J)	41.8 (J)	8540	—
MD50-22-258059	50-603471 P209	209	178	—	956	—	410	34.2 (J)	25.3 (J)	42,000	38 (J)
MD50-22-258060	50-603471 P288	288	819	—	628	—	384	29.9 (J)	—	29,100	—

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**
MD50-22-258061	50-603471 P360	360	743	—	779	—	516	33.6 (J)	—	36,300	51.1 (J)
MD50-22-258062	50-603471 P450	450	182	—	497	—	171	16 (J)	—	21,200	—
MD50-22-258065	50-603472 P27	27	—	—	295	—	32.1 (J)	30.8 (J)	—	1580	—
MD50-22-258064	50-603472 P146	146	264	—	526	—	83.5	19 (J)	22.8 (J)	8490	—
MD50-22-258066	50-603472 P292	292	507	—	990	—	98.8	19.1 (J)	—	16,600	—
MD50-22-258067	50-603472 P364	364	358	—	1090	—	107	22.7 (J)	—	20,300	41 (J)
MD50-22-258068	50-603472 P450	450	88.9 (J)	—	447	—	39.4 (J)	—	—	9240	—
MD50-22-258069	50-603503 P133	133	—	—	291	—	77.4 (J)	—	—	1660 (J+)	—
MD50-22-258070	50-603503 P237	237	104 (J)	—	474	—	54.9 (J)	—	—	4520	—
MD50-22-258071	50-603503 P347	347	72.9 (J)	—	490	—	43 (J)	—	—	5090	—
MD50-22-258072	50-603503 P450	450	—	—	299	—	—	—	—	3400 (J+)	—
MD50-22-258073	50-613182 P550	550	—	—	44.5 (J)	—	—	—	—	860	—
MD50-22-258075	50-613183 P550	550	—	—	129	—	34.2 (J)	—	—	5960	37.3 (J)
MD50-22-258076	50-613183 P642.5	642.5	—	—	—	—	—	—	—	230	—
MD50-22-258077	50-613184 P500	500	—	—	106	6.82 (J)	—	—	—	5960	—
MD50-22-258078	50-613184 P600	600	—	—	23.9 (J)	—	—	—	—	1420	—
MD50-22-258079	50-613184 P664.5	664.5	—	—	—	—	—	—	—	270	—
MD50-22-258080	50-613185 P145	145	—	—	72.5 (J)	—	—	—	—	3900 (J)	—
MD50-22-258081	50-613185 P235	235	75.3 (J)	—	135	—	—	—	—	7500 (J)	—
MD50-22-258082	50-613185 P350	350	—	—	86.8	—	—	—	—	5100 (J)	—
MD50-22-258083	50-613185 P450	450	—	—	48.4 (J)	—	—	—	—	2560 (J)	—
MD50-22-258084	50-613185 P600	600	—	—	—	—	—	—	—	335 (J)	—

Notes: 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] UNK = 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 2022 Sampling Round

Field Sample ID	Location ID	Depth (ft bgs)	Analytical Result (pCi/L)
MD50-22-249658	50-24784 P155	155	342
MD50-22-249660	50-24784 P244	244	290
MD50-22-249666	50-24813 P150	150	60,685
MD50-22-249668	50-24813 P241	241	716
MD50-22-249672	50-24813 P358	358	4326
MD50-22-249688	50-603061 P128	128	910
MD50-22-249690	50-603061 P228	228	1481
MD50-22-249694	50-603061 P347	347	933
MD50-22-249696	50-603061 P450	450	688
MD50-22-249710	50-603063 P25	25	5867
MD50-22-249706	50-603063 P128	128	1072
MD50-22-249708	50-603063 P228	228	1025
MD50-22-249712	50-603063 P347	347	837
MD50-22-249714	50-603063 P450	450	455
MD50-22-249718	50-603064 P214	214	553
MD50-22-249720	50-603064 P332	332	1262
MD50-22-249728	50-603383 P26	26	123,297
MD50-22-249724	50-603383 P139	139	153,751
MD50-22-249726	50-603383 P244	244	410,911
MD50-22-249730	50-603383 P359	359	50,771
MD50-22-249732	50-603383 P450	450	199,768
MD50-22-249762	50-603470 P83	83	2,529,220
MD50-22-249754	50-603470 P278	278	1853
MD50-22-249760	50-603470 P650	650	7999
MD50-22-249764	50-603471	UNK*	40,741
MD50-22-249774	50-603471 P90	90	10,431
MD50-22-249766	50-603471 P209	209	10,866
MD50-22-249768	50-603471 P288	288	9615
MD50-22-249770	50-603471 P360	360	7496
MD50-22-249772	50-603471 P450	450	4273
MD50-22-249778	50-603472 P27	27	1,566,420
MD50-22-249776	50-603472 P146	146	614
MD50-22-249780	50-603472 P292	292	1606
MD50-22-249782	50-603472 P364	364	1300
MD50-22-249784	50-603472 P450	450	719
MD50-22-249786	50-603503 P133	133	835
MD50-22-249788	50-603503 P237	237	816
MD50-22-249794	50-613182 P550	550	393
MD50-22-249796	50-613182 P632.5	632.5	551

Note: Data qualifiers are defined in Appendix A.

* UNK= 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 2022 Sampling Round

Field Sample ID	Location ID	Depth (ft bgs)	Analytical Result (pCi/L)
MD50-22-257871	50-24784 P155	155	1451
MD50-22-257872	50-24784 P244	244	1210
MD50-22-257873	50-24784 P362	362	555
MD50-22-257875	50-24813 P150	150	60,744
MD50-22-257876	50-24813 P241	241	873
MD50-22-257878	50-24813 P358	358	595
MD50-22-257883	50-24822 P25	25	1168
MD50-22-257881	50-24822 P142	142	910
MD50-22-257887	50-603061 P228	228	1894
MD50-22-257889	50-603061 P347	347	1530
MD50-22-257890	50-603061 P450	450	799
MD50-22-257891	50-603062 P122	122	63,704
MD50-22-257896	50-603063 P228	228	872
MD50-22-257898	50-603063 P347	347	1049
MD50-22-257901	50-603064 P214	214	750
MD50-22-257902	50-603064 P332	332	1503
MD50-22-257906	50-603383 P26	26	162,698
MD50-22-257904	50-603383 P139	139	363,095
MD50-22-257905	50-603383 P244	244	254,583
MD50-22-257907	50-603383 P359	359	154,203
MD50-22-257908	50-603383 P450	450	193,703
MD50-22-257923	50-603470 P83	83	1,842,120
MD50-22-257922	50-603470 P650	650	850
MD50-22-257924	50-603471	UNK*	13,152
MD50-22-257929	50-603471 P90	90	13,007
MD50-22-257925	50-603471 P209	209	6594
MD50-22-257926	50-603471 P288	288	6137
MD50-22-257927	50-603471 P360	360	1472
MD50-22-257928	50-603471 P450	450	2156
MD50-22-257931	50-603472 P27	27	1,778,490
MD50-22-257930	50-603472 P146	146	381
MD50-22-257932	50-603472 P292	292	18,427
MD50-22-257934	50-603472 P450	450	52,964
MD50-22-257935	50-603503 P133	133	708
MD50-22-257939	50-613182 P550	550	35,241
MD50-22-257940	50-613182 P632.5	632.5	20,083

Note: Data qualifiers are defined in Appendix A.

* UNK = 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
CLP	Contract Laboratory Program
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
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
SMO	Sample Management Office
SOP	standard operating procedure
SWMU	solid waste management unit
TA	technical area
TCA	trichloroethane
TCE	trichloroethene
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 2022 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, Table B-1.0-3 lists the field-screening data, and Table B-1.0-4 presents weights of tritium samples.

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 standard liters per minute 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 MiniRAE 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 both rounds of sampling, field screening was performed using a MiniRAE multi-gas detector equipped with a 10.6-eV photoionization detector 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 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.” 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. Weights of tritium samples are presented in Table B-1.0-4.

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. 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 2022 Sampling

Borehole ID	Sampling Port Depth (ft bgs[a])	Analyte	Result First Round	Result Second Round
50-24784	155	CO_2 (ppmv)	10,000	7000
		O_2 (%)	19.9	20.4
		VOC (ppmv)	1.5	1.7
	244	CO_2 (ppmv)	7000	6000
		O_2 (%)	20.1	20.4
		VOC (ppmv)	1.4	2.1
	362	CO2 (ppmv)	6000	5000
		O_2 (%)	19.9	20.4
		VOC (ppmv)	1.4	1.8
	450	CO_2 (ppmv)	5000	4000
		O_2 (%)	20.1	20.4
		VOC (ppmv)	0.7	0.9
50-24813	25	CO2 (ppmv)	15,000	14,000
		O_2 (%)	18.9	18.4
		VOC (ppmv)	2.4	2.7
	150	CO_2 (ppmv)	15,000	12,000
		O_2 (%)	18.9	19.2
		VOC (ppmv)	10.1	16.4

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)	11,000	9000
		O_2 (%)	19.1	19.5
		VOC (ppmv)	20.0	24.2
	358	CO_2 (ppmv)	8000	7000
		O_2 (%)	19.4	20.0
		VOC (ppmv)	15.5	24.4
	450	CO_2 (ppmv)	6000	6000
		O_2 (%)	19.5	20.3
		VOC (ppmv)	9.4	12.4
	600	CO_2 (ppmv)	4000	5000
		O_2 (%)	19.7	20.5
		VOC (ppmv)	2.0	2.9
50-24822	25	CO_2 (ppmv)	13,000	15,000
		O_2 (%)	19.4	18.5
		VOC (ppmv)	1.7	1.7
	142	CO_2 (ppmv)	12,000	11,000
		O_2 (%)	19.2	19.1
		VOC (ppmv)	6.9	9.5
	235	CO_2 (ppmv)	10,000	10,000
		O_2 (%)	19.2	19.1
		VOC (ppmv)	10.4	16.6
	351	CO_2 (ppmv)	7000	8000
		O_2 (%)	19.7	19.3
		VOC (ppmv)	6.7	11.5
	450	CO_2 (ppmv)	5000	7000
		O_2 (%)	20.1	19.3
		VOC (ppmv)	3.5	5.9
50-603061	25	CO_2 (ppmv)	41,000	47,000
		O_2 (%)	17.1	15.6
		VOC (ppmv)	0.4	0.5
	128	CO_2 (ppmv)	4000	14,000
		O_2 (%)	20.5	19.1
		VOC (ppmv)	0.3	0.8
	228	CO_2 (ppmv)	2000	13,000
		O_2 (%)	20.7	19.1
		VOC (ppmv)	0.5	3.0
	347	CO_2 (ppmv)	0	9000
		O_2 (%)	20.9	19.3
		VOC (ppmv)	0.2	1.8

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)	2000	6000
		O_2 (%)	20.1	19.7
		VOC (ppmv)	0.3	0.8
50-603062	122	CO_2 (ppmv)	10,000	8000
		O_2 (%)	19.5	19.4
		VOC (ppmv)	2.0	3.0
	217	CO_2 (ppmv)	8000	7000
		O_2 (%)	20.1	19.4
		VOC (ppmv)	2.5	4.6
	337	CO_2 (ppmv)	6000	9000
		O_2 (%)	20.2	19.4
		VOC (ppmv)	1.3	1.8
	450	CO_2 (ppmv)	4000	4000
		O_2 (%)	20.4	19.6
		VOC (ppmv)	0.6	0.6
50-603063	25	CO_2 (ppmv)	21,000	26,000
		O_2 (%)	18.3	17.6
		VOC (ppmv)	0.6	0.6
	128	CO_2 (ppmv)	14,000	18,000
		O_2 (%)	19.0	18.5
		VOC (ppmv)	2.0	4.7
	228	CO_2 (ppmv)	11,000	16,000
		O_2 (%)	19.2	18.8
		VOC (ppmv)	5.0	14.2
	347	CO_2 (ppmv)	8000	10,000
		O_2 (%)	19.5	19.3
		VOC (ppmv)	4.3	11.8
	450	CO_2 (ppmv)	5000	8000
		O_2 (%)	19.7	19.4
		VOC (ppmv)	2.1	6.1
50-603064	113	CO_2 (ppmv)	13,000	10,000
		O_2 (%)	19.3	20.0
		VOC (ppmv)	6.0	8.6
	214	CO_2 (ppmv)	12,000	12,000
		O_2 (%)	19.2	19.3
		VOC (ppmv)	10.2	17.8

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)	9000	9000
		O_2 (%)	19.4	19.3
		VOC (ppmv)	5.0	9.3
	500	CO_2 (ppmv)	5000	6000
		O_2 (%)	19.7	19.8
		VOC (ppmv)	1.4	1.4
50-603383	26	CO_2 (ppmv)	9000	25,000
		O_2 (%)	20.2	17.5
		VOC (ppmv)	0.2	1.0
	139	CO_2 (ppmv)	13,000	18,000
		O_2 (%)	19.3	18.1
		VOC (ppmv)	1.7	2.7
	244	CO_2 (ppmv)	10,000	14,000
		O_2 (%)	19.5	18.7
		VOC (ppmv)	1.4	4.2
	359	CO_2 (ppmv)	5000	8000
		O_2 (%)	20.1	19.1
		VOC (ppmv)	1.4	2.6
	450	CO_2 (ppmv)	4000	8000
		O_2 (%)	20.2	19.3
		VOC (ppmv)	1.0	1.6
50-603467	143	CO_2 (ppmv)	10,000	10,000
		O_2 (%)	20.4	19.4
		VOC (ppmv)	2.6	5.2
	244	CO_2 (ppmv)	7000	9000
		O_2 (%)	20.4	19.4
		VOC (ppmv)	5.0	11.1
	360	CO_2 (ppmv)	4000	7000
		O_2 (%)	20.7	19.7
		VOC (ppmv)	4.1	12.5
	500	CO_2 (ppmv)	2000	5000
		O_2 (%)	20.9	19.9
		VOC (ppmv)	2.0	6.3
	600	CO_2 (ppmv)	2000	5000
		O_2 (%)	20.9	20.1
		VOC (ppmv)	1.4	3.7
50-603468	142	CO_2 (ppmv)	7000	11,000
		O_2 (%)	20.2	18.5
		VOC (ppmv)	2.2	3.5

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)	12,000	10,000
		O_2 (%)	18.9	18.5
		VOC (ppmv)	6.8	12.5
	354	CO_2 (ppmv)	9000	7000
		O_2 (%)	19.2	19.1
		VOC (ppmv)	7.8	10.7
	403	CO_2 (ppmv)	7000	6000
		O_2 (%)	19.3	19.1
		VOC (ppmv)	7.3	13.7
50-603470	83	CO_2 (ppmv)	9000	8000
		O_2 (%)	20.1	19.8
		VOC (ppmv)	2.2	3.1
	203	CO_2 (ppmv)	7000	9000
		O_2 (%)	20.2	19.5
		VOC (ppmv)	9.2	19.8
	278	CO_2 (ppmv)	9000	10,000
		O_2 (%)	19.7	19.3
		VOC (ppmv)	12.9	30.4
	351	CO_2 (ppmv)	9000	9000
		O_2 (%)	19.5	19.2
		VOC (ppmv)	10.9	27.4
	450	CO_2 (ppmv)	5000	7000
		O_2 (%)	20.2	19.5
		VOC (ppmv)	6.1	12.8
	650	CO_2 (ppmv)	4000	1000
		O_2 (%)	19.9	20.9
		VOC (ppmv)	0.5	1.1
50-603471	90	CO_2 (ppmv)	12,000	12,000
		O_2 (%)	19.7	18.7
		VOC (ppmv)	1.3	5.0
	209	CO_2 (ppmv)	3000	10,000
		O_2 (%)	20.9	19.1
		VOC (ppmv)	4.1	26.5
	288	CO_2 (ppmv)	11,000	9000
		O_2 (%)	19.9	19.5
		VOC (ppmv)	14.7	19.4
	360	CO_2 (ppmv)	11,000	10,000
		O_2 (%)	19.7	19.2
		VOC (ppmv)	11.5	22.5

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)	6000	7000
		O_2 (%)	20.7	20.0
		VOC (ppmv)	10.0	13.0
	Unknown[b]	CO_2 (ppmv)	9000	9000
		O_2 (%)	20.4	19.5
		VOC (ppmv)	3.3	6.3
50-603472	27	CO_2 (ppmv)	2000	6000
		O_2 (%)	20.9	20.2
		VOC (ppmv)	0.2	0.4
	146	CO_2 (ppmv)	1000	7000
		O_2 (%)	20.9	20.2
		VOC (ppmv)	0.4	4.1
	292	CO_2 (ppmv)	0	7000
		O_2 (%)	20.9	20.2
		VOC (ppmv)	0.2	8.8
	364	CO_2 (ppmv)	0	9000
		O_2 (%)	20.9	19.4
		VOC (ppmv)	0.1	11.5
	450	CO_2 (ppmv)	0	6000
		O_2 (%)	20.9	20.0
		VOC (ppmv)	0.1	5.1
50-603503	133	CO_2 (ppmv)	6000	7000
		O_2 (%)	20.7	20.4
		VOC (ppmv)	0.6	0.9
	237	CO_2 (ppmv)	5000	6000
		O_2 (%)	20.9	20.6
		VOC (ppmv)	1.3	1.9
	347	CO_2 (ppmv)	3000	4000
		O_2 (%)	20.9	20.8
		VOC (ppmv)	1.4	1.9
	450	CO_2 (ppmv)	2000	3000
		O_2 (%)	20.9	20.8
		VOC (ppmv)	1.0	1.2

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)	0	3000
		O_2 (%)	20.9	20.4
		VOC (ppmv)	0.2	0.7
	632.5	CO_2 (ppmv)	0	2000
		O_2 (%)	20.9	20.9
		VOC (ppmv)	0.2	0.3
50-613183	550	CO_2 (ppmv)	5000	5000
		O_2 (%)	20.4	20.7
		VOC (ppmv)	2.1	2.6
	642.5	CO_2 (ppmv)	4000	6000
		O_2 (%)	20.7	20.9
		VOC (ppmv)	0.6	0.6
50-613184	500	CO_2 (ppmv)	3000	3000
		O_2 (%)	20.6	19.6
		VOC (ppmv)	1.4	3.3
	600	CO_2 (ppmv)	2000	3000
		O_2 (%)	20.6	19.8
		VOC (ppmv)	0.5	0.9
	664.5	CO_2 (ppmv)	1000	3000
		O_2 (%)	20.4	20.0
		VOC (ppmv)	0.2	0.3
50-613185	145	CO_2 (ppmv)	17,000	18,000
		O_2 (%)	18.5	18.3
		VOC (ppmv)	1.4	1.4
	235	CO_2 (ppmv)	10,000	10,000
		O_2 (%)	19.2	19.1
		VOC (ppmv)	2.6	3.5
	350	CO_2 (ppmv)	5000	6000
		O_2 (%)	19.9	19.5
		VOC (ppmv)	1.7	2.5
	450	CO_2 (ppmv)	2000	5000
		O_2 (%)	20.7	19.8
		VOC (ppmv)	0.5	1.2
	600	CO_2 (ppmv)	1000	5000
		O_2 (%)	20.9	20.0
		VOC (ppmv)	0.0	0.1

[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.

Table B-1.0-4
Weights of Tritium Samples

Borehole ID	Sampling Port Depth (ft bgs*)	Weight of Tritium Sample (g)	
		First Round	Second Round
50-24784	155	6	20
	244	7	21
	362	7	11
	450	5	5
50-24813	25	7	27
	150	8	20
	241	8	23
	358	5	15
	450	8	12
	600	5	25
50-24822	25	9	8
	142	10	5
	235	12	8
	351	9	8
	450	9	11
50-603061	25	6	6
	128	5	5
	228	6	5
	347	7	6
	450	5	5
50-603062	122	5	6
	217	25	6
	337	10	5
	450	5	6
50-603063	25	14	10
	128	9	9
	228	6	8
	347	12	8
	450	9	5
50-603064	113	9	5
	214	8	7
	332	6	8
	500	7	9
50-603383	26	14	6
	139	6	10
	244	6	7
	359	5.4	7
	450	14.41	7

Table B-1.0-4 (continued)

Borehole ID	Sampling Port Depth (ft bgs*)	Weight of Tritium Sample (g)	
		First Round	Second Round
50-603467	143	7	5
	244	7	9
	360	6	6
	500	5	7
	600	5	5
50-603468	142	9	5
	233	10	8
	354	9	7
	403	5	7
50-603470	83	12	27
	203	5	25
	278	11	24
	351	15	26
	450	15	21
	600	5	21
50-603471	90	19	20
	209	14	18
	288	14	17
	360	13	5
	450	18	11
	Unknown	14	5
50-603472	27	23	20
	146	22	23
	292	27	17
	364	22	10
	450	25	12
50-603503	133	5	5
	237	6	5
	347	6	6
	450	8	5
50-613182	550	25	16
	632.5	27	5
50-613183	550	18	15
	642.5	19	14
50-613184	500	7	10
	600	5	7
	664.5	8	8

Table B-1.0-4 (continued)

Borehole ID	Sampling Port Depth (ft bgs*)	Weight of Tritium Sample (g)	
		First Round	Second Round
50-613185	145	6	12
	235	6	6
	350	5	5
	450	6	6
	600	5	7

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, in 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, 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 2022 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 96 samples (80 regular samples, 8 FBs, and 8 FDs) were collected and analyzed for tritium. In the second 2022 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 2022. 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 Laboratory 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 "Department of Defense (DoD) Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories," the EPA "Superfund CLP National Functional Guidelines for Data Review," and the American National Standards Institute/American Nuclear Society 41.5: "Verification and Validation of Radiological Data for use in Waste Management and Environmental Remediation."

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 DVD 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 of 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 (five boreholes) is located where maximum total VOC concentrations have been greater than 30,000 $\mu g/m^3$.
- The intermediate part of the plume (seven 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 (six 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.

Samples for the 2022 vapor monitoring report were collected in June 2022 and September 2022. Samples were also collected in March 2022, but these samples are associated with the 2021 vapor monitoring report. Vapor monitoring in the two rounds of 2022 sampling (June and September) 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 22 VOCs detected in subsurface vapor. The VOC Tier I screening evaluation identified 4 VOCs [methylene chloride; 2-propanol; TCE; and 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. Propanol[2-] 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 the first round and 3 of 80 samples in the second round. TCE exceeded the Tier I SL in 53 of 80 samples in the first round and 64 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 2022, 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 four 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. 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 September 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 2022 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 six 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, 50-603470, 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 six core boreholes, TCE is only a minor contributor to total VOCs instead of being the major contributor (borehole 50-603061 is discussed in section D-4.2).

Peak concentrations in the core of the VOC plume have decreased since 2011. Data from November 2011 to September 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), 50-603470 (Figures D-2.0-14 through D-2.0-17), 50-603471 (Figures D-2.0-18 through D-2.0-20), and 50-613183 (Figures D-2.0-21 through D-2.0-23) share several common aspects:

- Shallow ports (less than 100 ft bgs) in boreholes 50-24813 and 50-603471 continue to show an overall drop in TCE 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, D-2.0-14, and D-2.0-18) are on the order of 30,000 µg/m^3 to 60,000 µg/m^3 in recent sampling events.
- The peak TCE and total VOC 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-2.0-8, D-2.0-9, D-2.0-12, D-2.0-16, D-2.0-19, and D-2.0-20), although some depths at boreholes 50-24813 and 50-24822 showed slight increases from March 2022. Boreholes 50-603471 (Figures D-2.0-19 and D-2.0-20) and 50-613183 (Figures D-2.0-22 and D-2.0-23) had unusually low concentrations of TCE in July 2020, but October 2020 concentrations returned to historical levels and have decreased gradually since then. Figures D-2.0-5 and D-2.0-20 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. There are no consistent trends in borehole 50-603471 at 450 ft bgs. 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 50–7000-µg/m^3 total VOC range, show no clear trends with time (Figures D-2.0-6, D-2.0-17, D-2.0-22, and D-2.0-23).

- Borehole 50-24822 has a port at 235 ft bgs (Figure D-2.0-9) 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 (Figure D-2.0-8). However, total VOC concentration from October 2020 increased. Concentrations decreased again in April 2021, March 2022, and September 2022; further monitoring will determine whether this trend continues. Results from 450 ft bgs (Figure D-2.0-10) show no consistent trends. The anomalously low results for June 2022 for borehole 50-24822 (Figures D-2.0-8 through D-2.0-10) were due to elevated detection limits.

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 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. The highest TCE concentrations for this borehole have been at a depth of 235 ft bgs. Concentrations of TCE and total VOCs over time at depths of 142, 235, 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 235 ft bgs and show no consistent trends over time at 450 ft bgs. The results from June 2022 are anomalously low, significantly outside the range of previously detected concentrations, and reflect nondetected TCE results with elevated detection limits (9880 µg/m^3 to 23,000 µg/m^3).

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 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-2.0-14. 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 μg/m^3 in November 2011 to approximately 45,000 μg/m^3 in September 2022.

Concentrations of TCE and total VOCs over time at depths of 83, 278, and 650 ft bgs are shown in Figures D-2.0-15, D-2.0-16, and D-2.0-17, respectively. These results show a decrease with time at both 83 and 278 ft bgs, while at 650 ft bgs there was not a definite trend other than an initial decrease in total VOCs. At this deepest port, the ratios of TCE/total VOCs have generally been 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 μg/m^3.

D-2.5 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-2.0-18. Since March 2012, the highest TCE concentrations for this borehole have been at a depth of 288 ft bgs. 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-2.0-18). Subsequent measurements show a trend toward lower peak values of TCE, with the most recent concentrations on the order of 40,000 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-2.0-19 and D-2.0-20, respectively. Concentrations at 288 ft bgs for 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-2.0-20). 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 50-613183 over time is shown in Figure D-2.0-21. 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-2.0-22 and D-2.0-23, respectively. Concentrations of TCE appear to be nearly stable through time at 642.5 ft bgs (Figure D-2.0-23), while increases in concentrations are seen at 550 ft bgs (Figure D-2.0-22).

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-2.0-19, D-2.0-20, and D-2.0-22). The anomalous nondetected TCE result from June 2022 at 642.5 ft bgs (Figure D-2.0-23) is due to a high detection limit (135 μg/m^3).

D-3.0 PLUME INTERMEDIATE BOREHOLE DATA

Data from plume intermediate boreholes (50-603063, 50-603467, 50-603468, 50-603472, 50-613182, and 50-613184) are shown in Figures D-3.0-1 through D-3.0-19. 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 and increased slightly in June 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 50-613182 at 550 ft bgs had been gradually increasing, but this trend reversed itself in the July and October 2020 sampling events, then increased again in March 2021 and March 2022, and decreased substantially in June 2022 and September 2022 (Figure D-3.0-15). Similar results were seen for 632.5 ft bgs (Figure D-3.0-16). Continued monitoring will determine whether this trend continues.
- Concentrations in borehole 50-613184 at 550 and 664.5 ft bgs have remained relatively constant over time except for several anomalously low results (Figures D-3.0-18 and D-3.0-19).

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 2017, when the maximum concentrations were at 347 ft bgs. These results show 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 and have remained relatively constant. Very little evidence of change is seen at 450 ft bgs; the lowest concentration of TCE (3300 µg/m^3) was found in the October 2020 sampling event, but concentrations rebounded in March 2021 and later sampling events (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. All results for January 2020, other than 143 ft bgs and 600 ft bgs, appear anomalously low and inconsistent with results from all other sampling rounds. 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 substantial variability between sampling events, but appear to be increasing in the most recent events. Results from January 2020 for 500 ft bgs 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 (Figure D-3.0-8). 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 µg/m^3 during the first and second sampling events in 2020 (July and October), and then rebounded in April 2021 and subsequent events. 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-3.0-17. 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-3.0-18 and D-3.0-19, 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 April 2021, March 2022, and September 2022 (Figure D-3.0-18). 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-3.0-19). The results for July 2020, October 2020, and June 2022 for 500 ft bgs and July 2020 and March 2022 for 664.5 ft bgs appear anomalously low and outside the range of previously reported results.

D-3.4 Boreholes 50-603472 and 50-613182

Borehole 50-603472 is 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-3.0-11. The maximum TCE concentrations have generally been at 292 ft bgs. Concentrations at this depth have shown no consistent trend with time since 2012. Concentrations of TCE and total VOCs over time at depths of 146 and 364 ft bgs are shown in Figures D-3.0-12 and D-3.0-13, 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 and June 2022 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-3.0-14. 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-3.0-15 and D-3.0-16, respectively. TCE concentrations at borehole 50-613182 have been relatively constant at around

4000 μg/m^3 at 550 ft bgs since April 2016, aside from results from October 2020, June 2022, and September 2022, which appear anomalously low (Figure D-3.0-15). 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 μg/m^3 (Figure D-3.0-16).

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 generally less than 10,000 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 TCE is only a minor contributor to total VOCs instead of being the major contributor.

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 of both TCE and total VOCs at 228 ft bgs have generally increased with time to a maximum in October 2020, followed by sharp reductions in March 2021, February 2022, and June 2022. Concentrations rebounded in September 2022 to values similar to those before 2019. The results from June 2022 are anomalously low and outside the range of concentrations at all other sampling events. 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 337 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 337 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 VOCs at these depths are increasing gradually with time, although with some variability. Note that the TCE and total VOC concentrations are unusually low in October 2020 for both depths and December 2013 for 450 ft bgs, 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 April 2016 and were at the next lower port at 347 ft bgs for subsequent sampling events. 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, June 2022, and September 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, June 2022, and September 2022 (Figure D-4.0-15). Note that the TCE and total VOC concentrations are unusually low in October 2020 and April 2021 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. Results from June 2022 at 600 ft bgs are anomalously low and beyond the range of concentrations at all other sampling events.

D-5.0 PLUME TRENDS

Changes in plume concentrations through time from 2010 to 2022 support a conceptual model of migration of VOCs, 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 2022, 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 Figures D-3.0-2 and D-3.0-3 show shifts in the depth of peak concentrations that are not persistent. At many locations, the results from July 2020, October 2020, and/or June 2022 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-2.0-6, D-2.0-8, D-2.0-9, D-2.0-10, D-2.0-13, D-2.0-15, D-2.0-16, D-2.0-18, D-2.0-19, D-3.0-6, D-3.0-8, D-3.0-9, D-3.0-10, D-3.0-16, D-3.0-17, D-3.0-19, D-3.0-22, D-3.0-23, D-4.0-2, D-4.0-3, D-4.0-5, D-4.0-8, D-4.0-9, D-4.0-11, D-4.0-12, 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 2022 (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 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 submitted to NMED on June 30, 2021.

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).

Behar, H.R., E.E. Snyder, S. Marczak, L.J. Salazar, B. Rappe, G.F. Fordham, S.P. Chu, D.M. Strobridge, K.H. Birdsell, T.A. Miller, K.C. Rich, and P.H. Stauffer, February 2019. "An Investigation of Plume Response to Soil Vapor Extraction and Hypothetical Drum Failure," *Vadose Zone Journal,* Vol. 18, No. 1. (Behar et al. 2019, 700854)

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)

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)

Stauffer, P., K. Birdsell, and W. Rice, March 7–11, 2011. "3-D Model Validation in Support of Site Closure, Material Disposal Area L, Los Alamos, NM," Paper 11545, Waste Management 2011 Conference, March 7–11, 2011, Phoenix, AZ. (Stauffer et al. 2011, 255584)

Stauffer, P.H., K.H. Birdsell, M.S. Witkowski, and J.K. Hopkins, 2005. "Vadose Zone Transport of 1,1,1-Trichloroethane: Conceptual Model Validation through Numerical Simulation," *Vadose Zone Journal,* Vol. 4, pp. 760–773. (Stauffer et al. 2005, 090537)

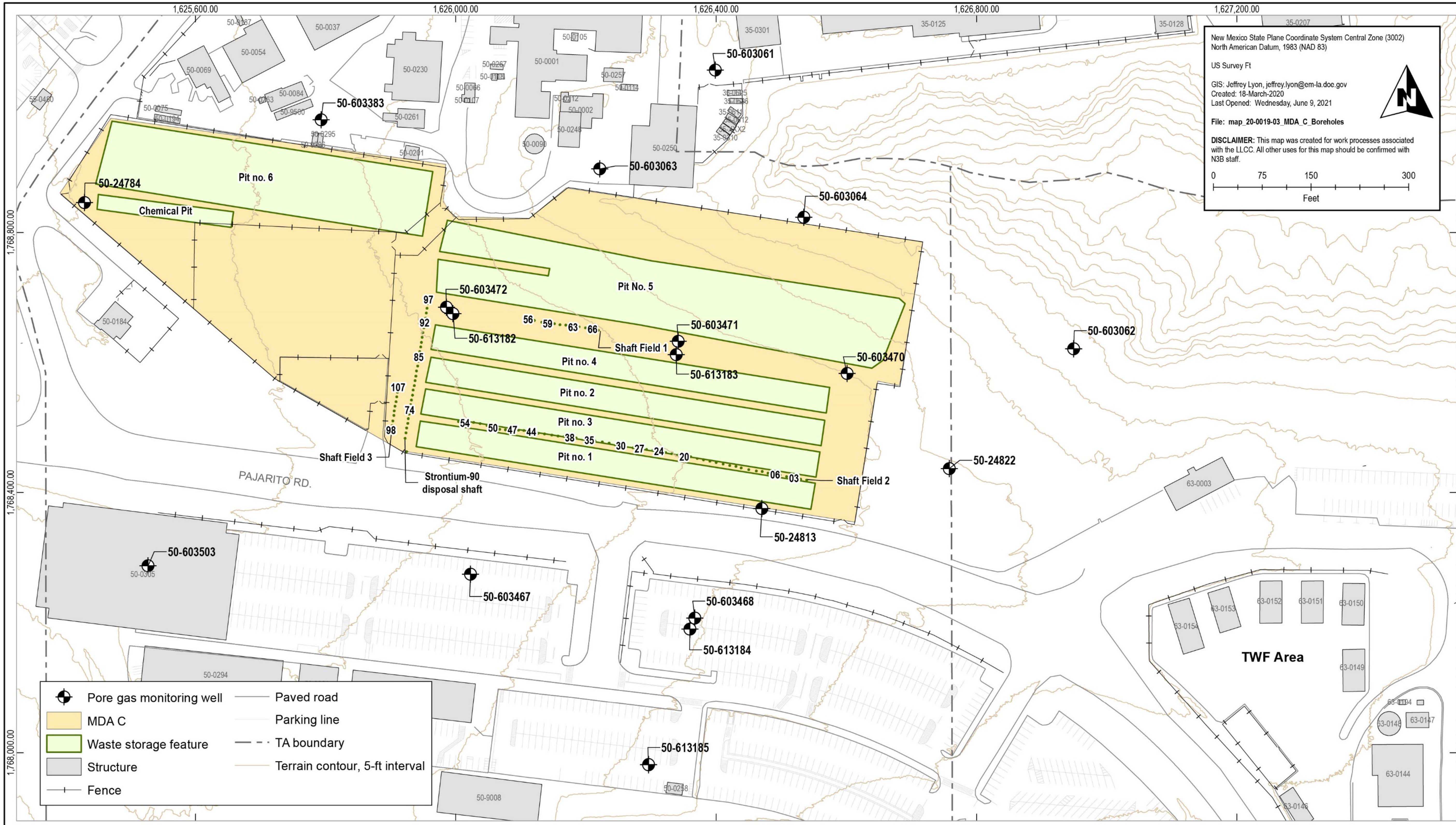


Figure D-1.0-1 Location of MDA C monitoring boreholes

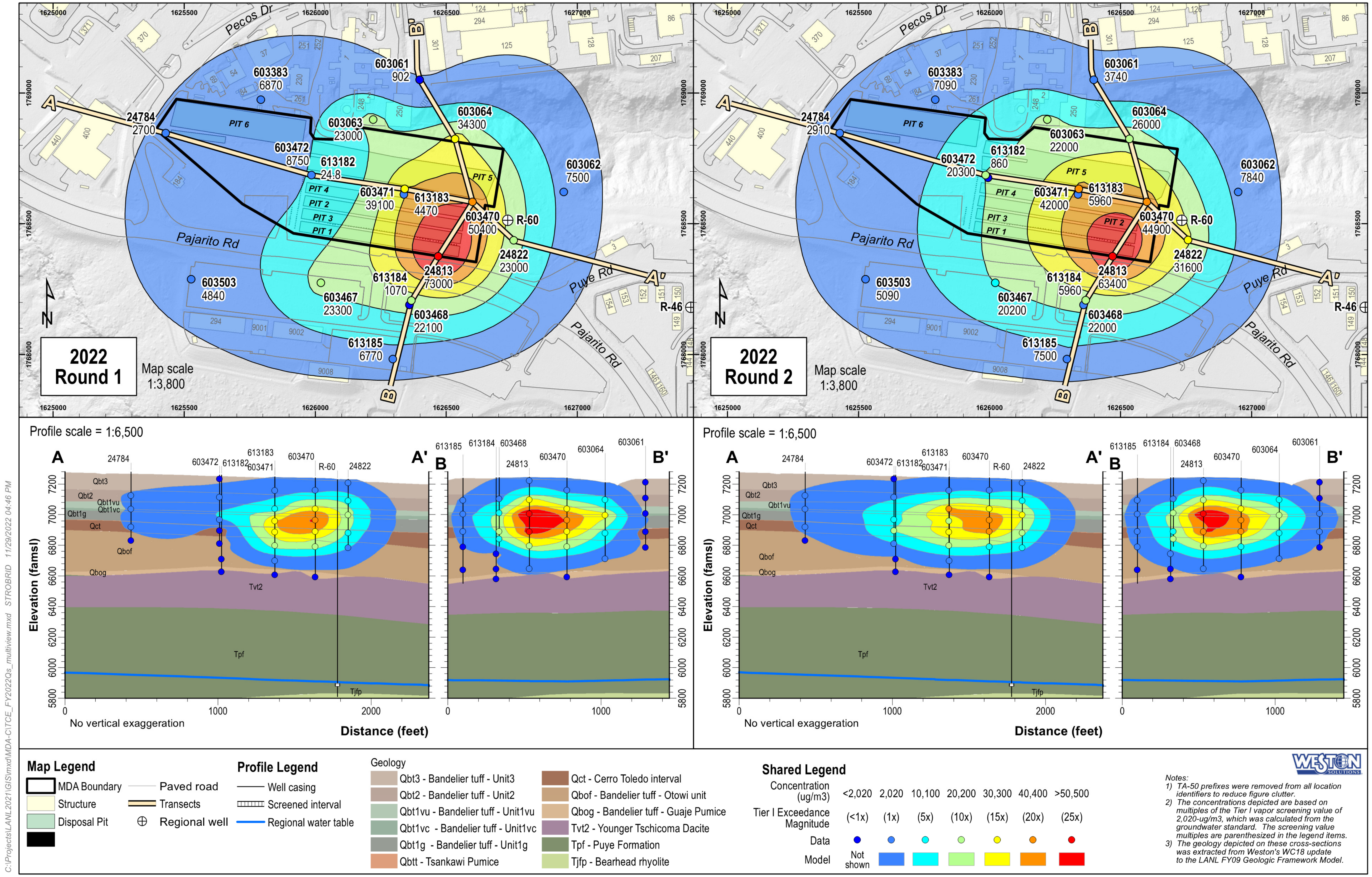
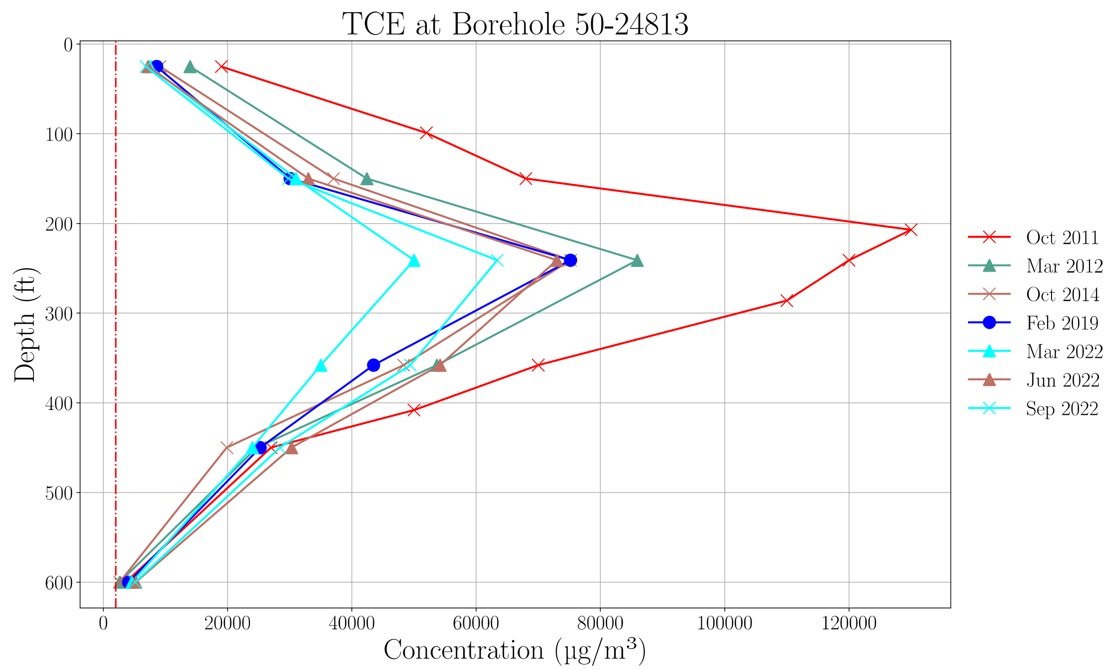
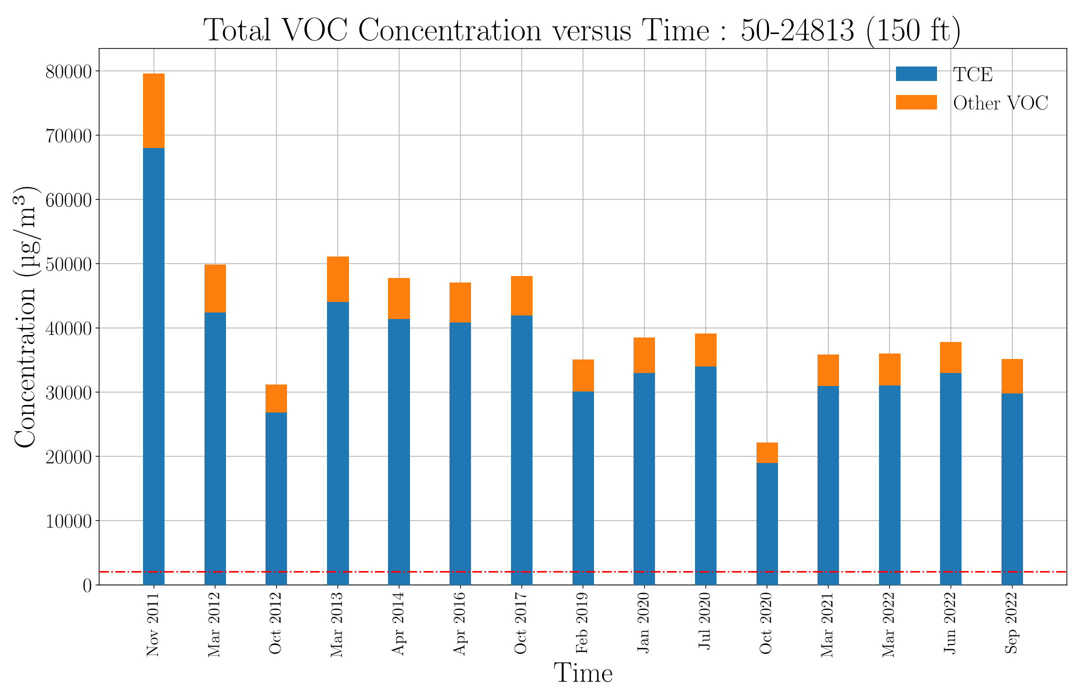


Figure D-1.0-2 Lateral and vertical extent of the MDA C TCE plume. First 2022 sampling round shown on the left and second 2022 sampling round shown on the right.



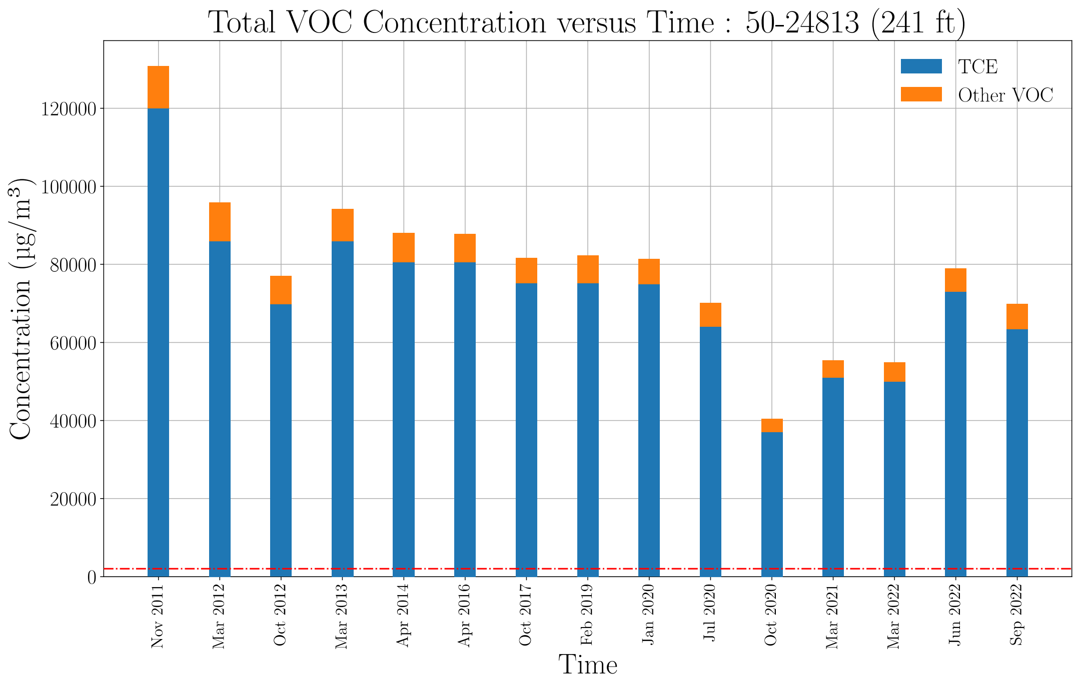
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

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



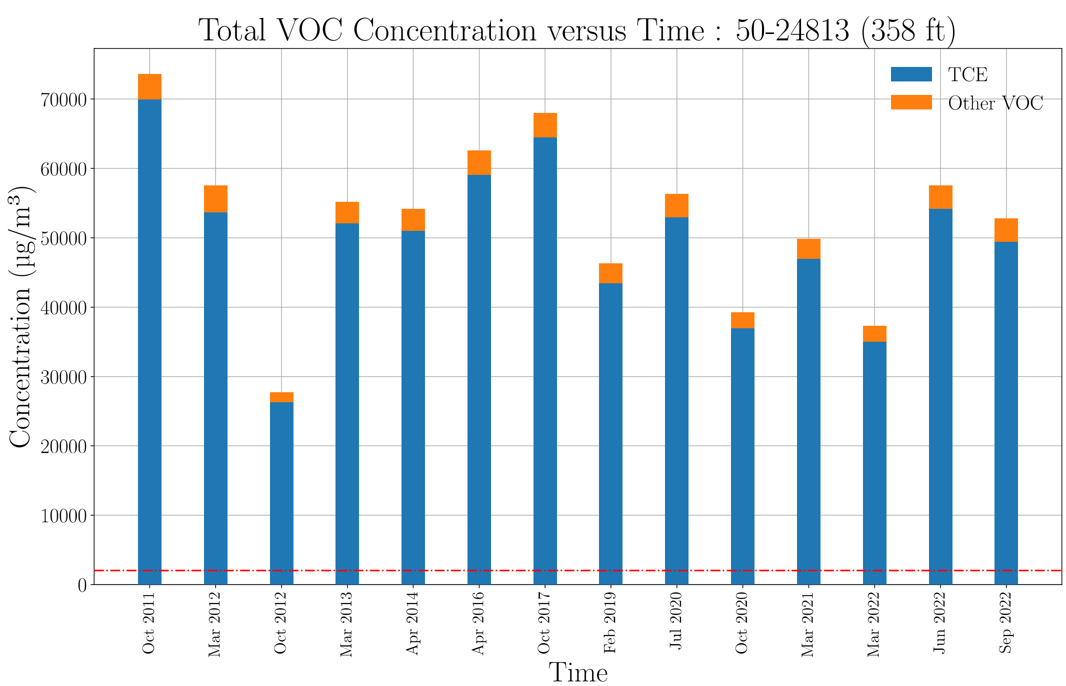
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

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



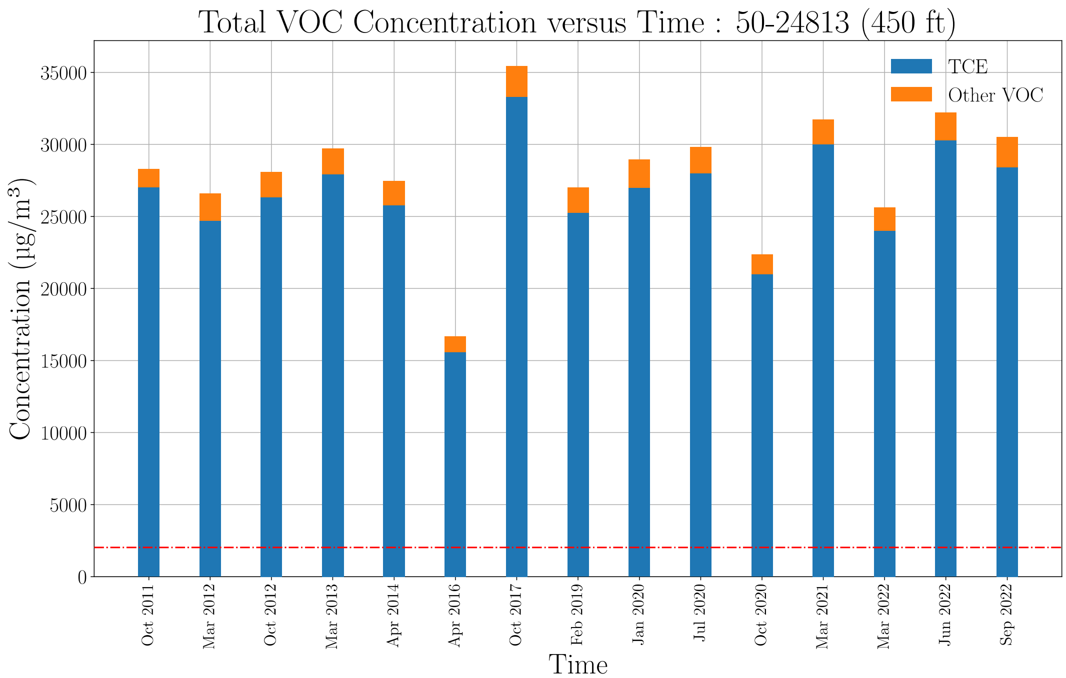
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



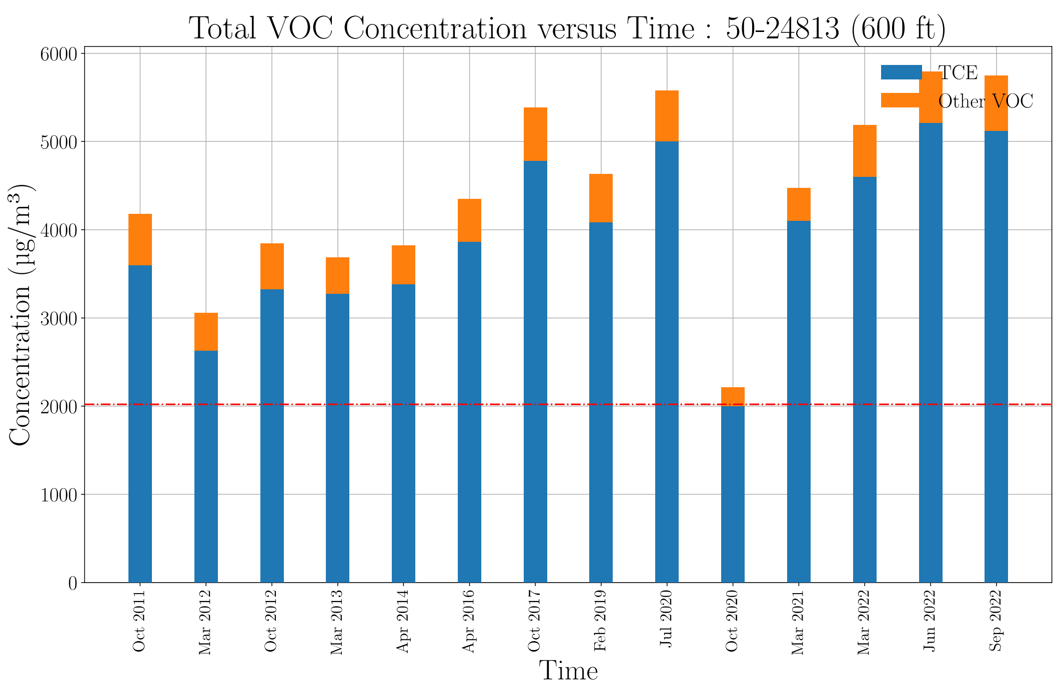
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



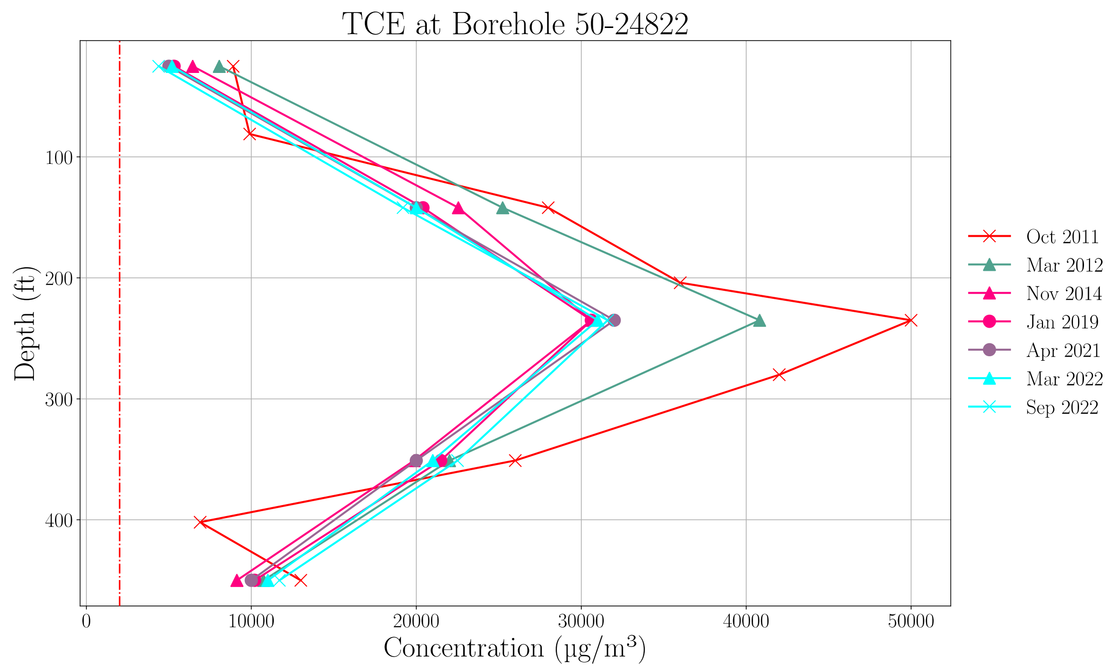
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



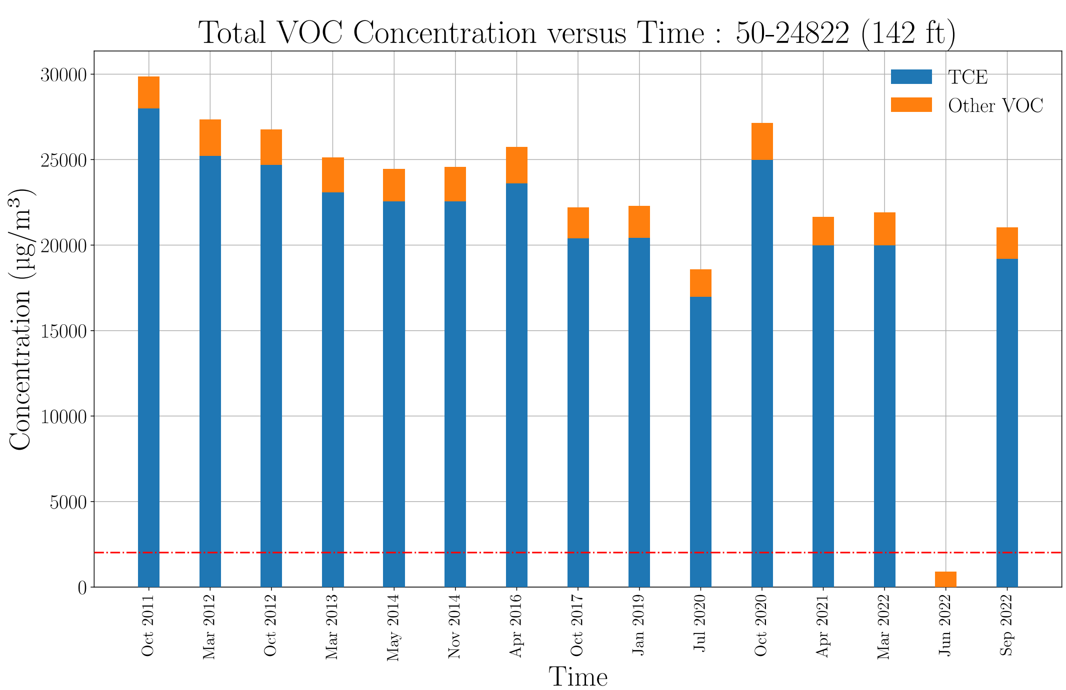
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



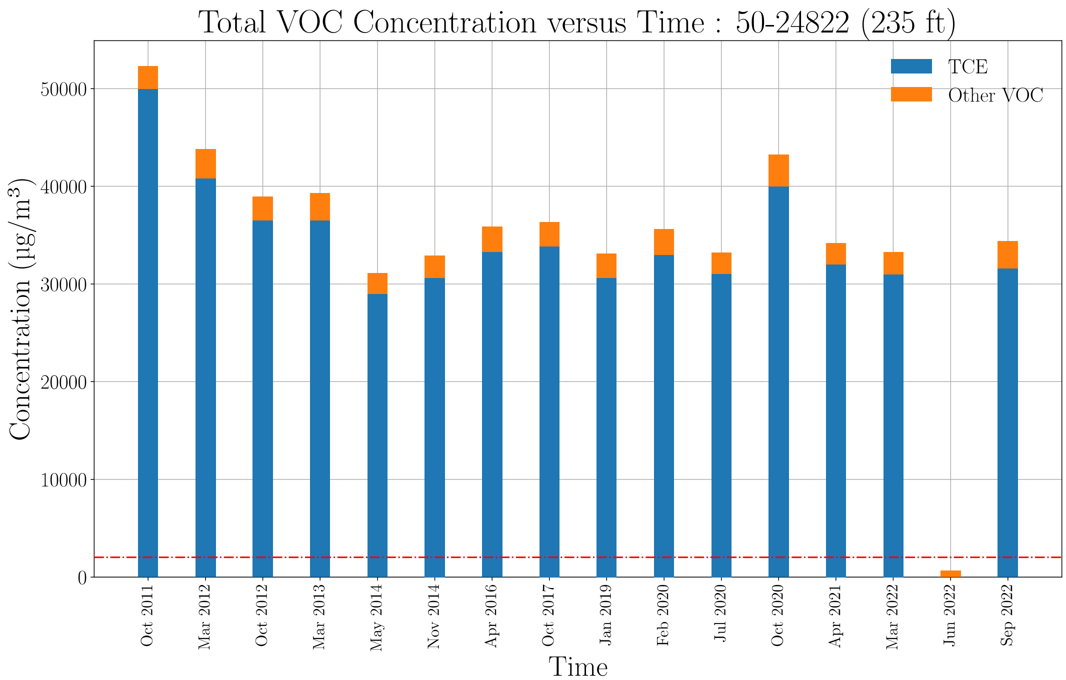
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



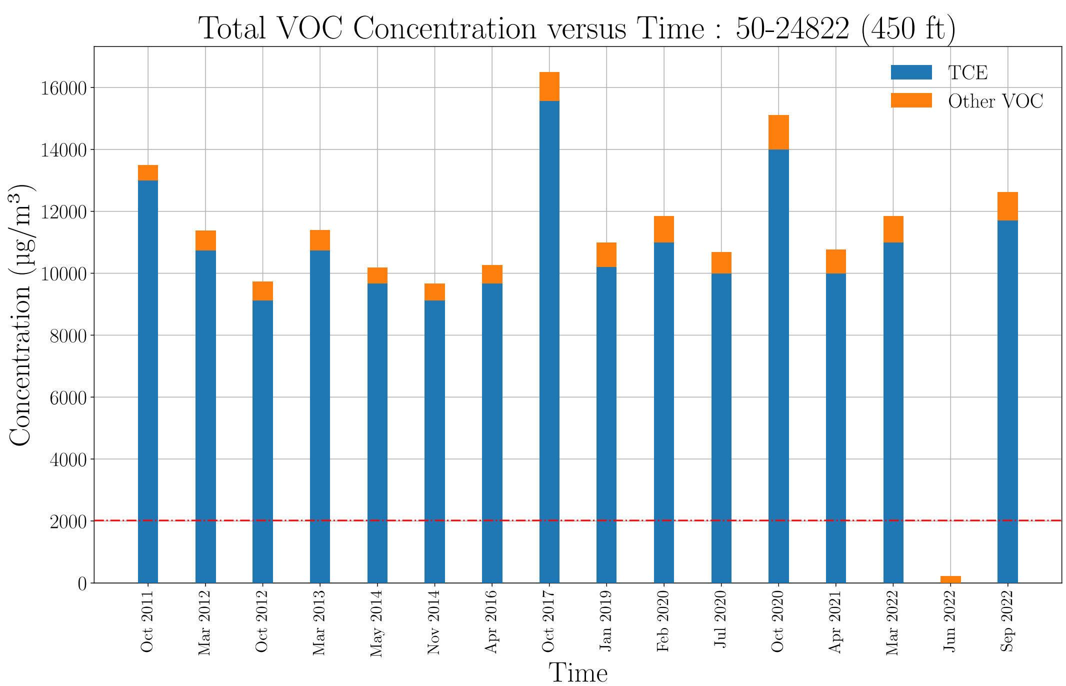
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



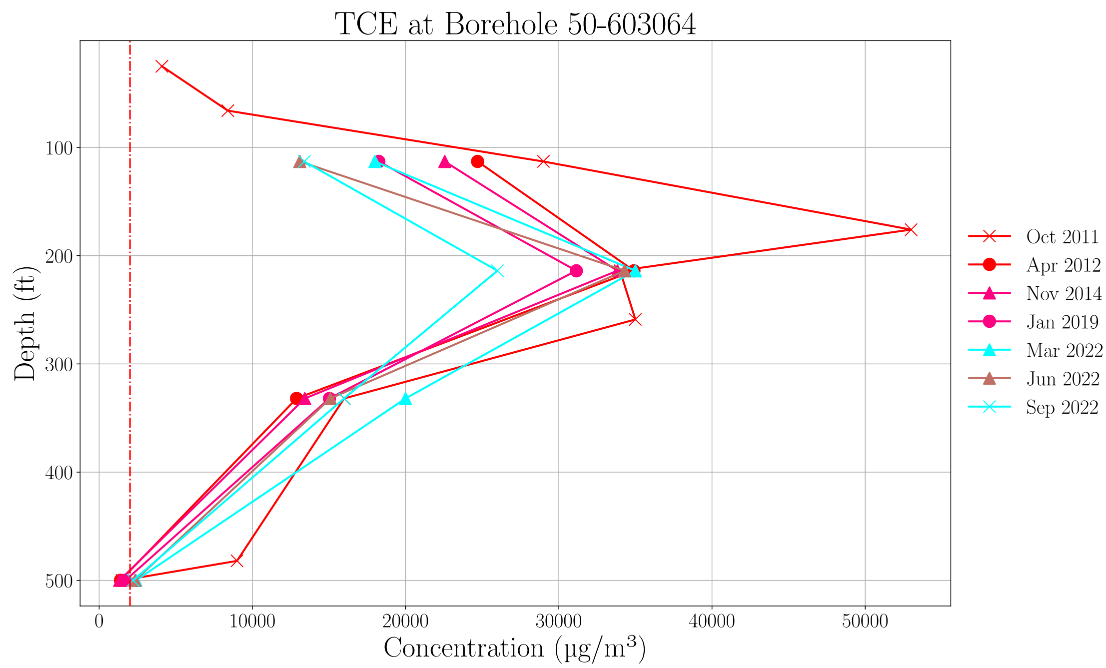
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

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



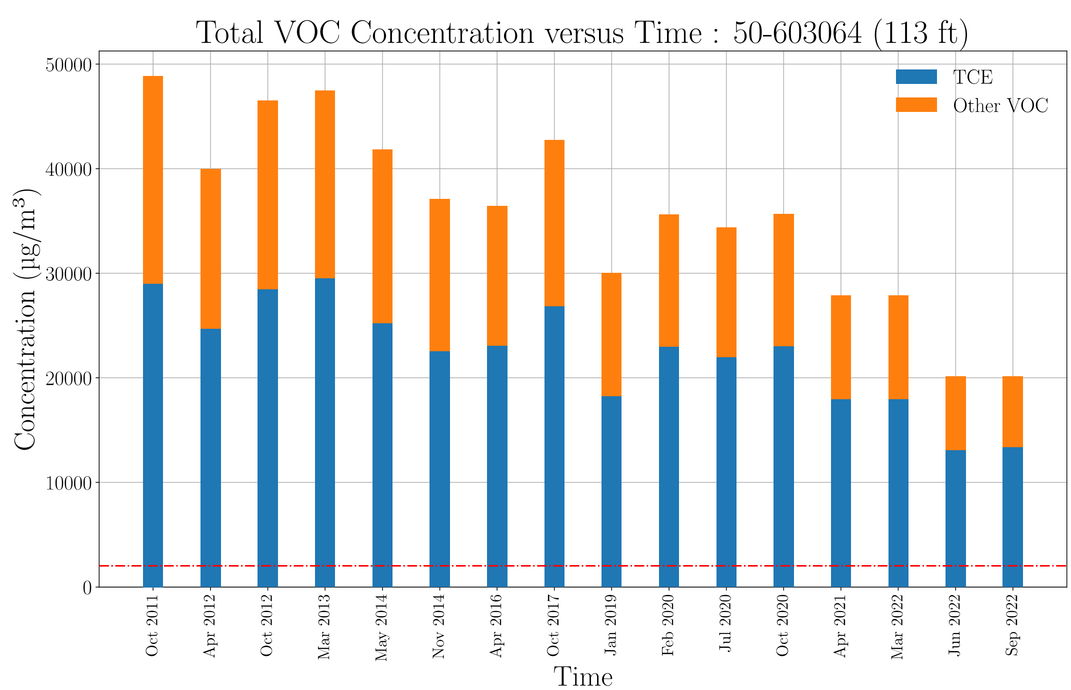
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

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



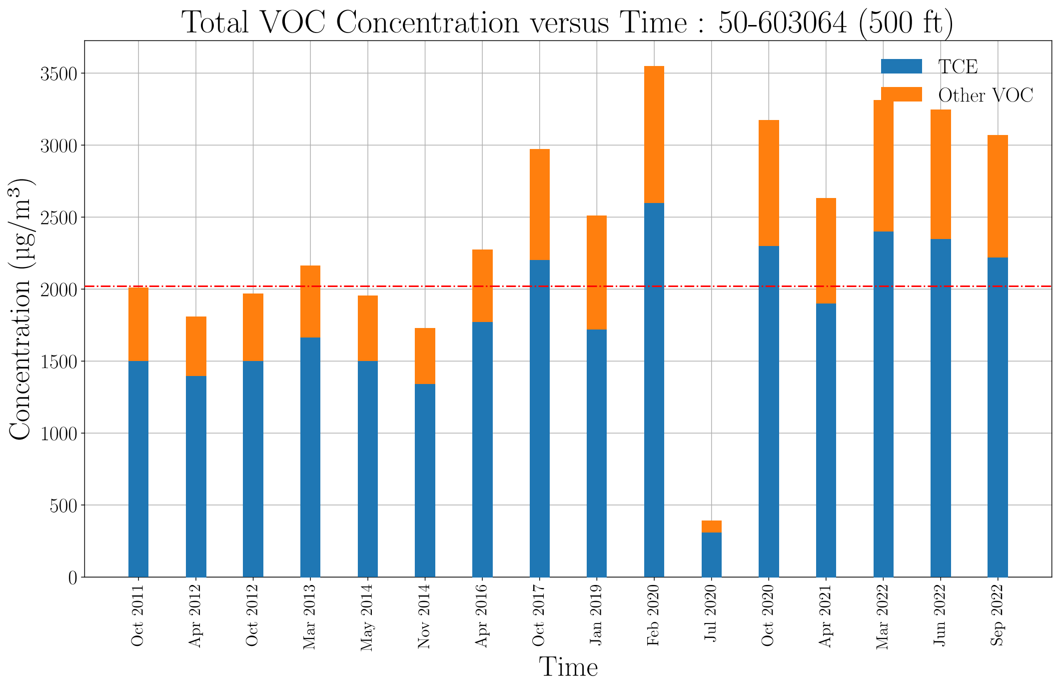
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



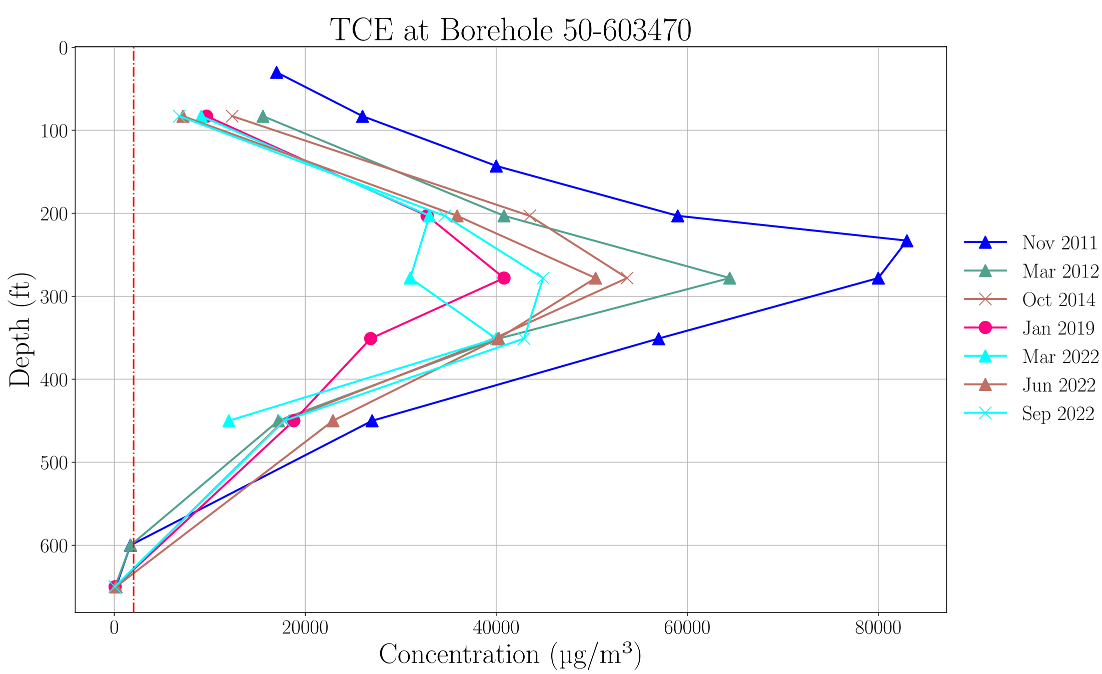
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



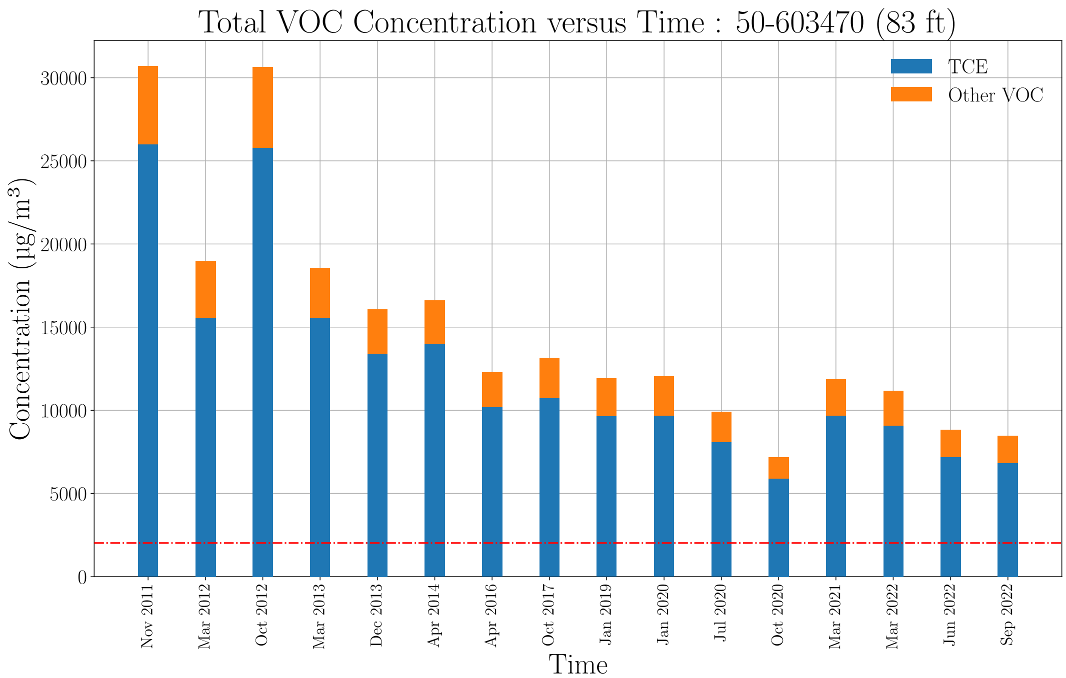
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



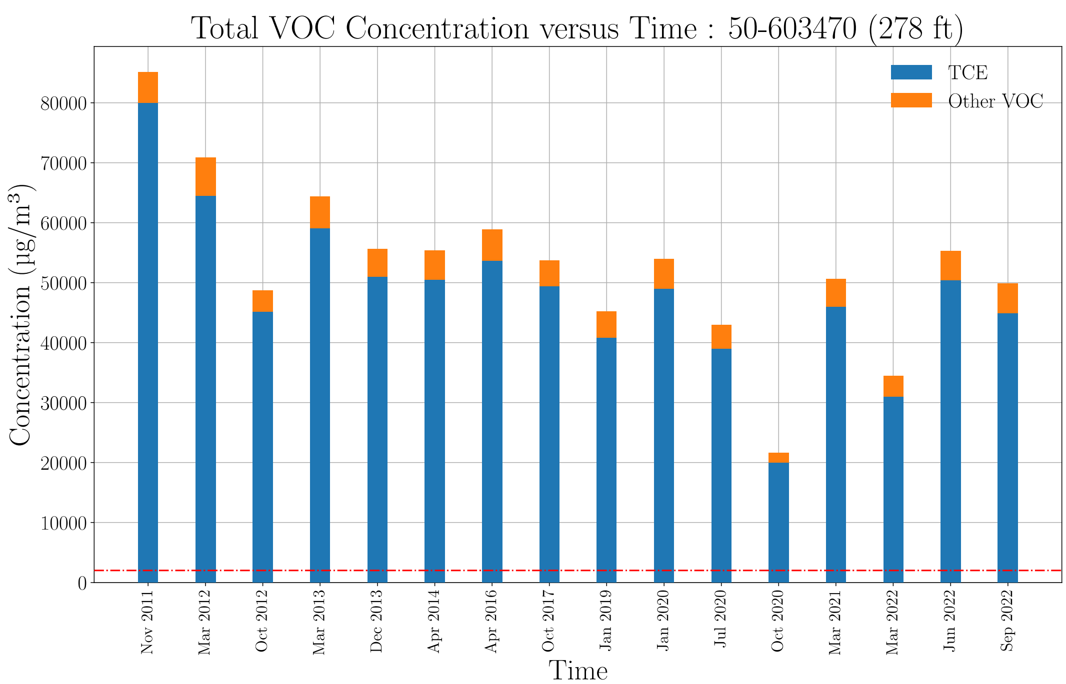
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-14 TCE concentration versus depth and time at borehole 50-603470



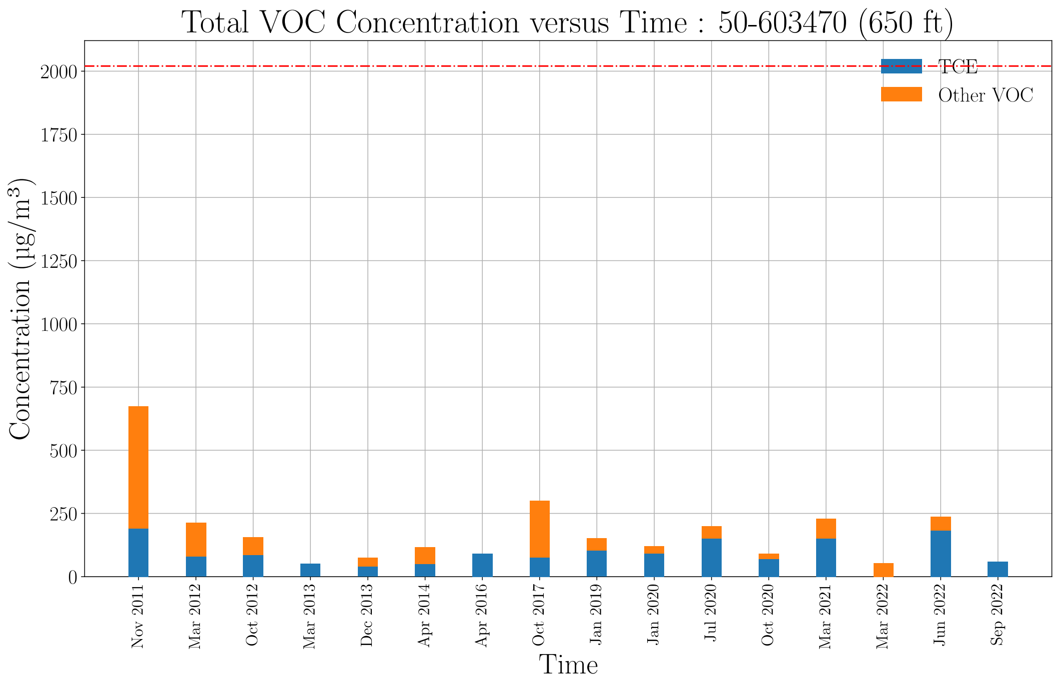
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-15 Total VOC concentration at 83 ft bgs at borehole 50-603470 over time



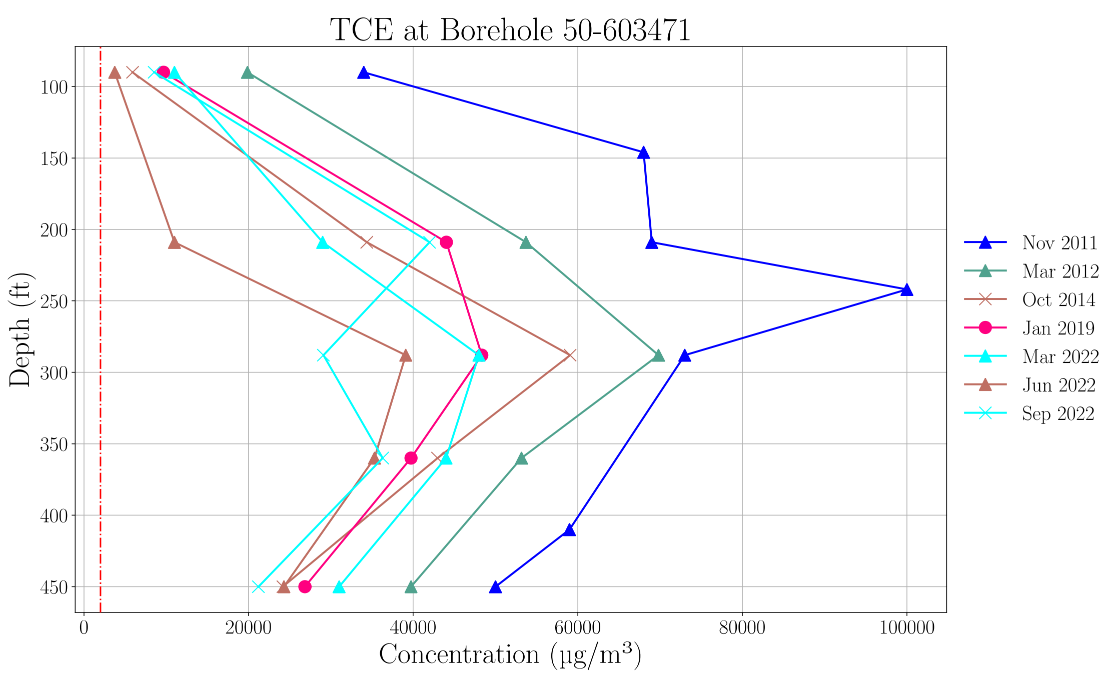
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-16 Total VOC concentration at 278 ft bgs at borehole 50-603470 over time



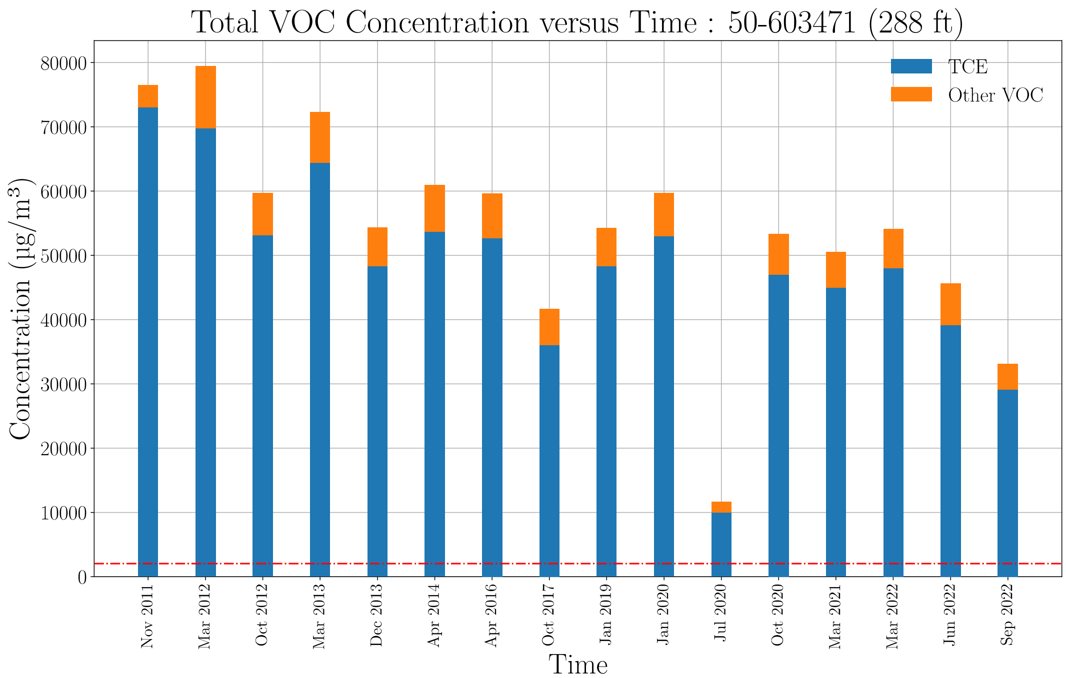
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-17 Total VOC concentration at 650 ft bgs at borehole 50-603470 over time



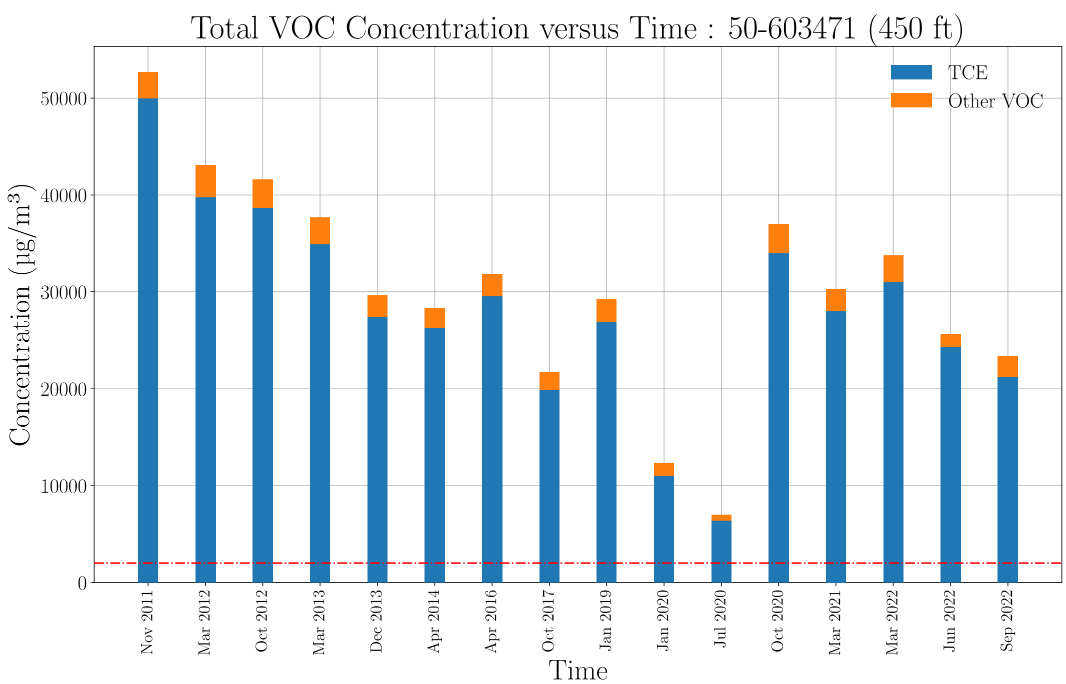
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-18 TCE concentration versus depth and time at borehole 50-603471



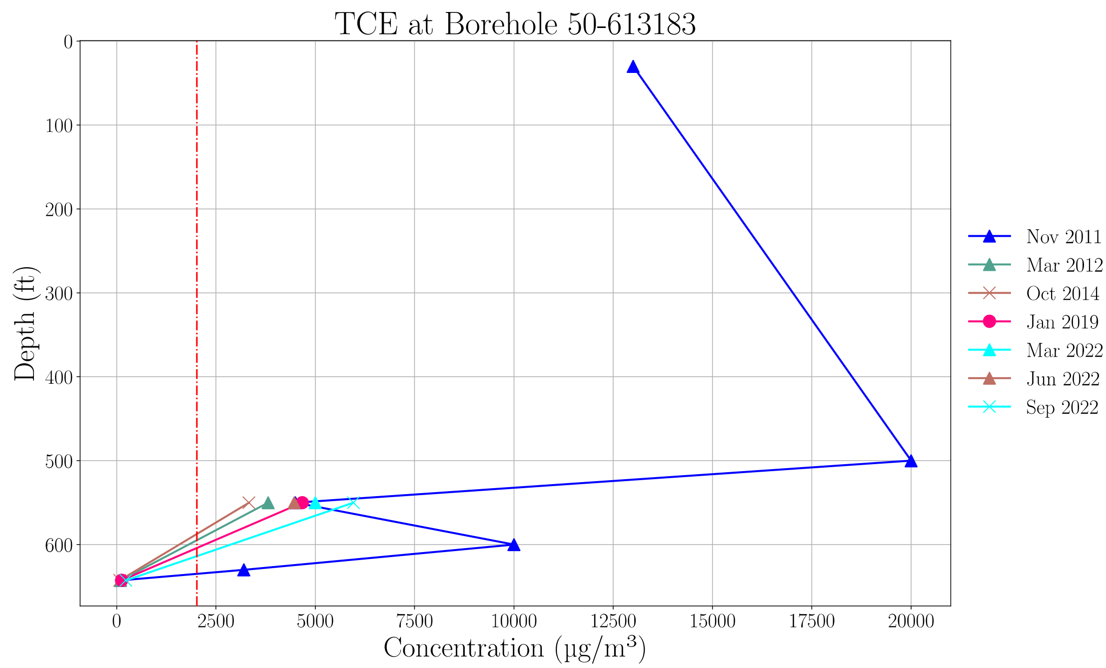
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-19 Total VOC concentration at 288 ft bgs at borehole 50-603471 over time



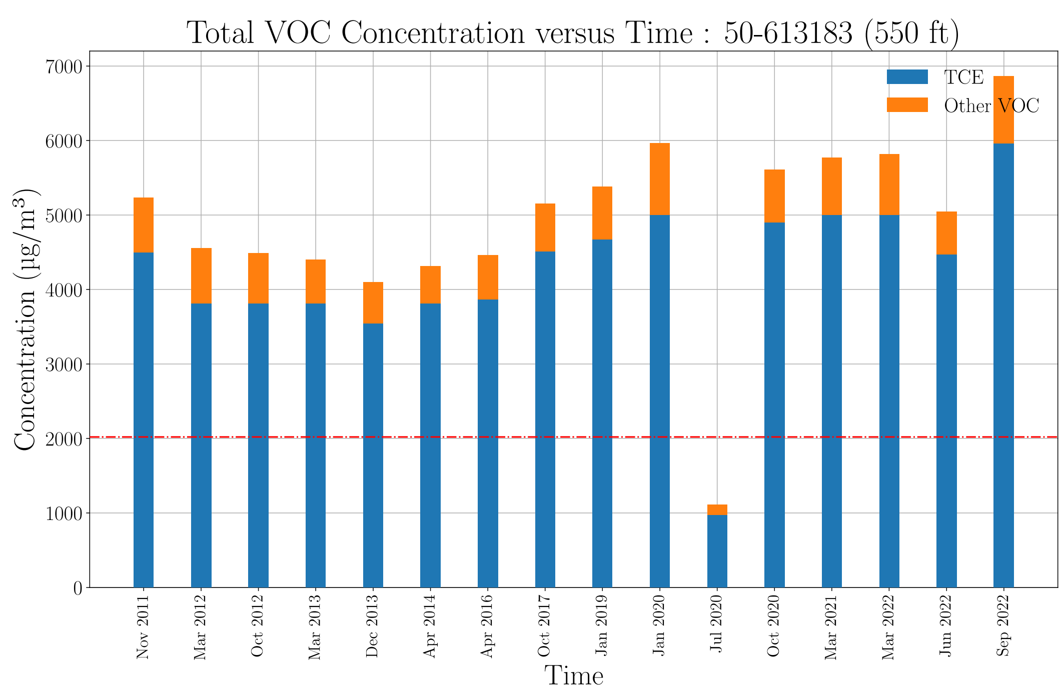
Note: Dashed red line is the 2020-μg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-20 Total VOC concentration at 450 ft bgs at borehole 50-603471 over time



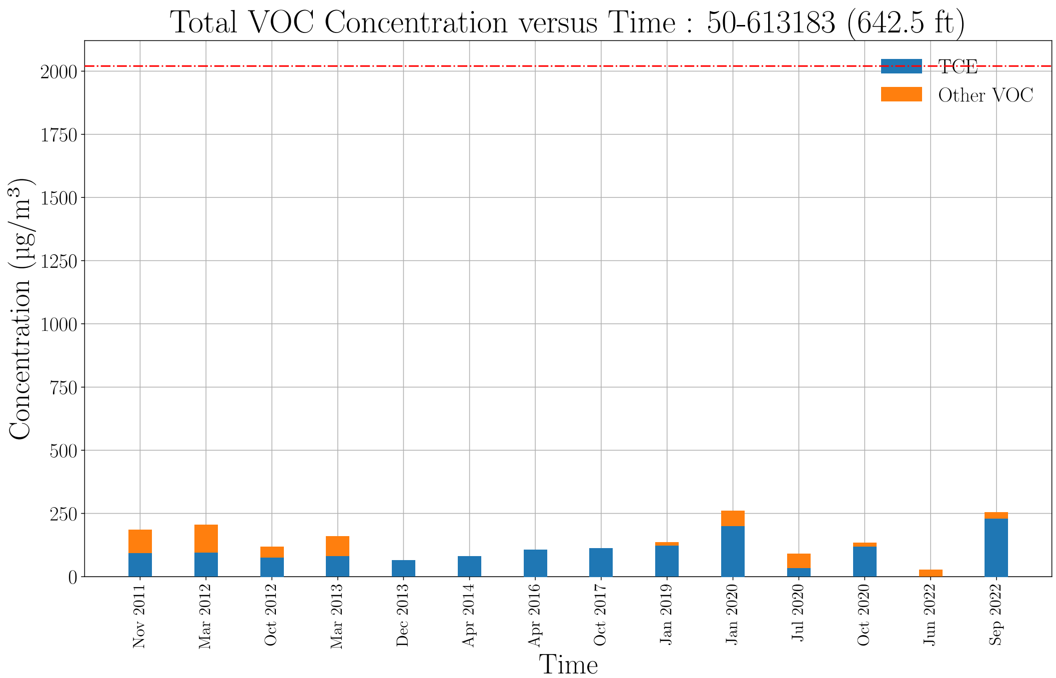
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-21 TCE concentration versus depth and time at borehole 50-613183



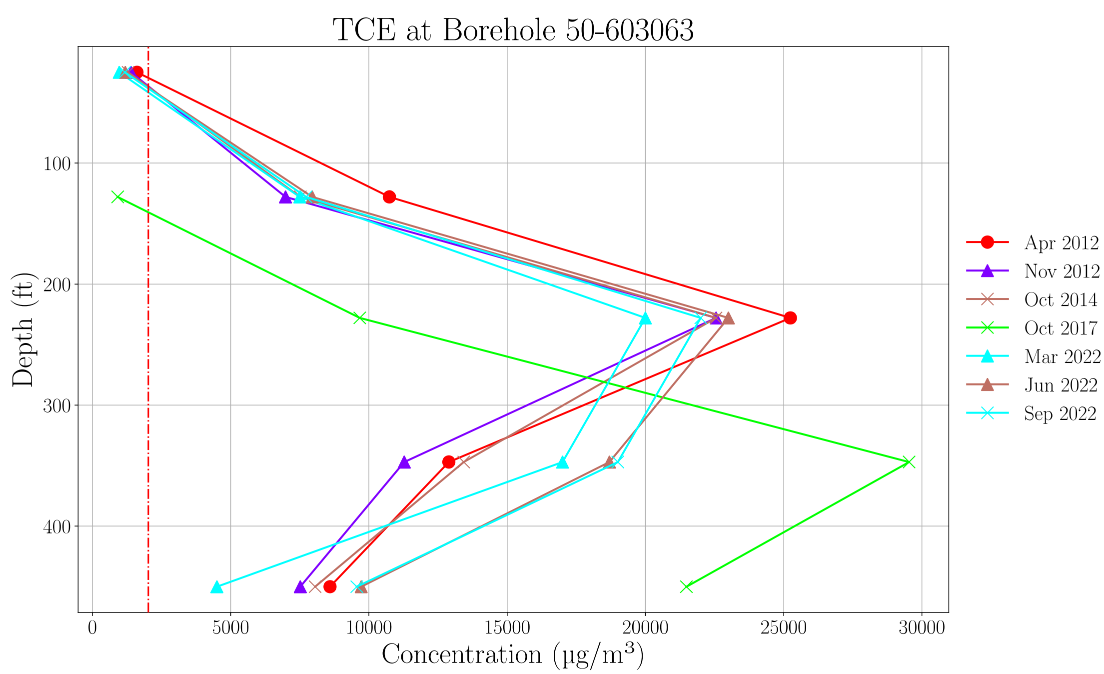
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-2.0-22 Total VOC concentration at 550 ft bgs at borehole 50-613183 over time



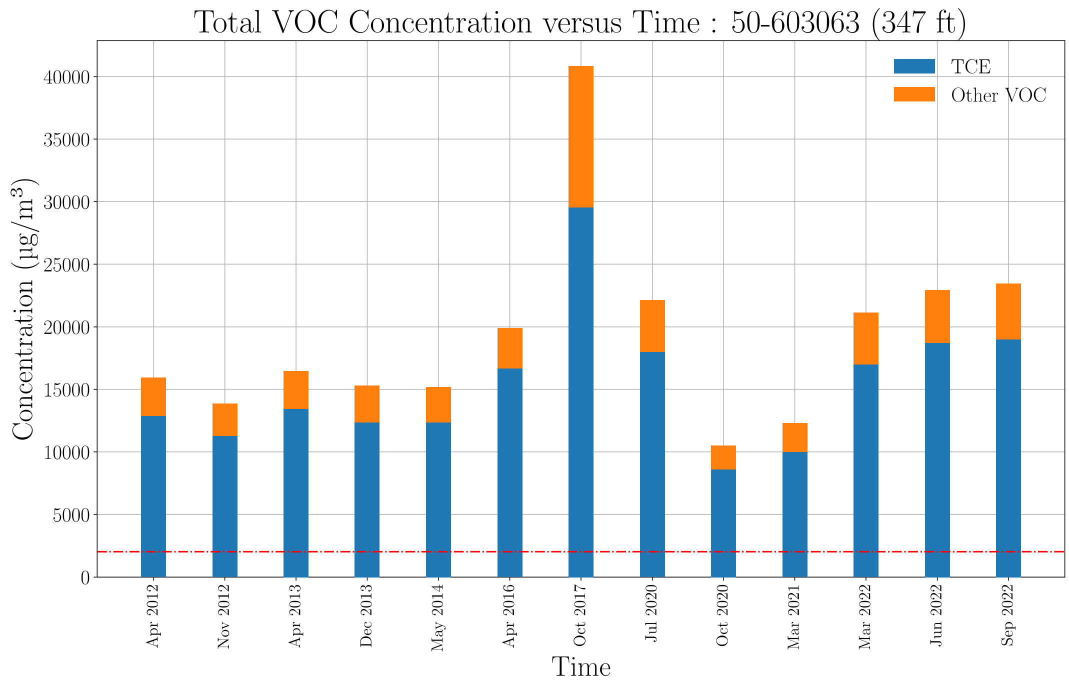
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-2.0-23 Total VOC concentration at 642.5 ft bgs at borehole 50-613183 over time



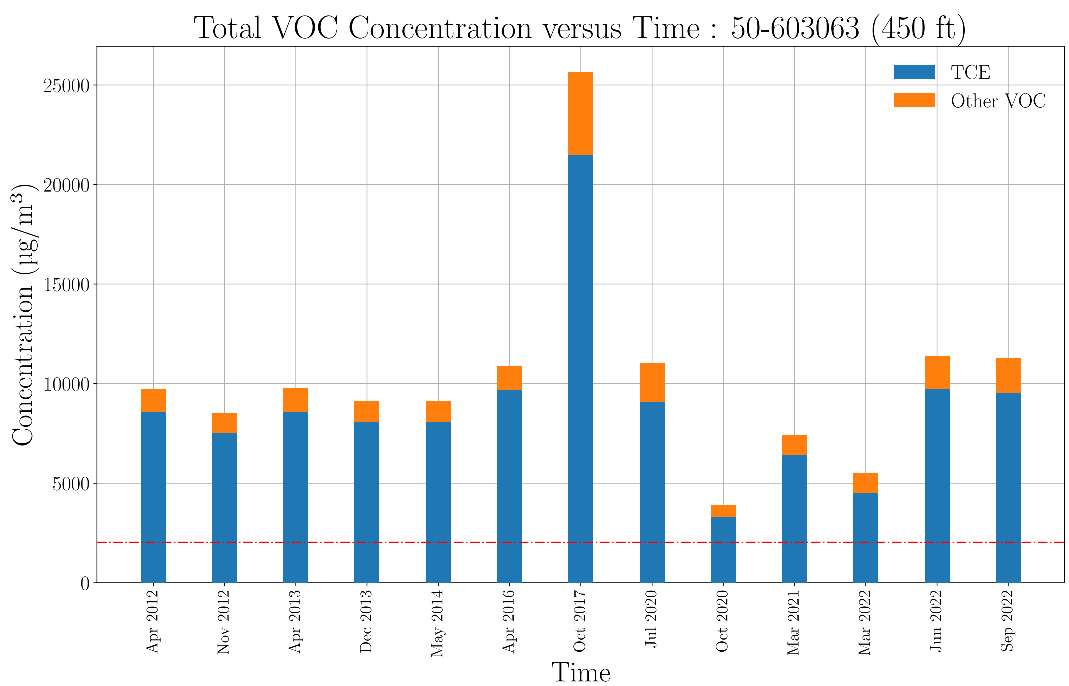
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

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



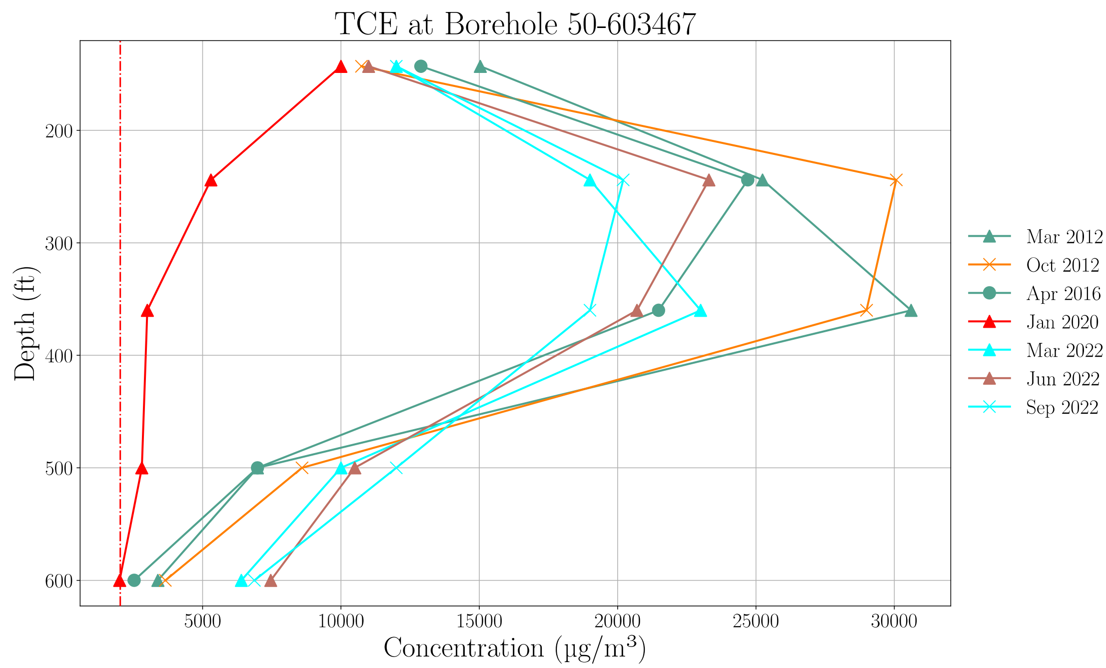
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



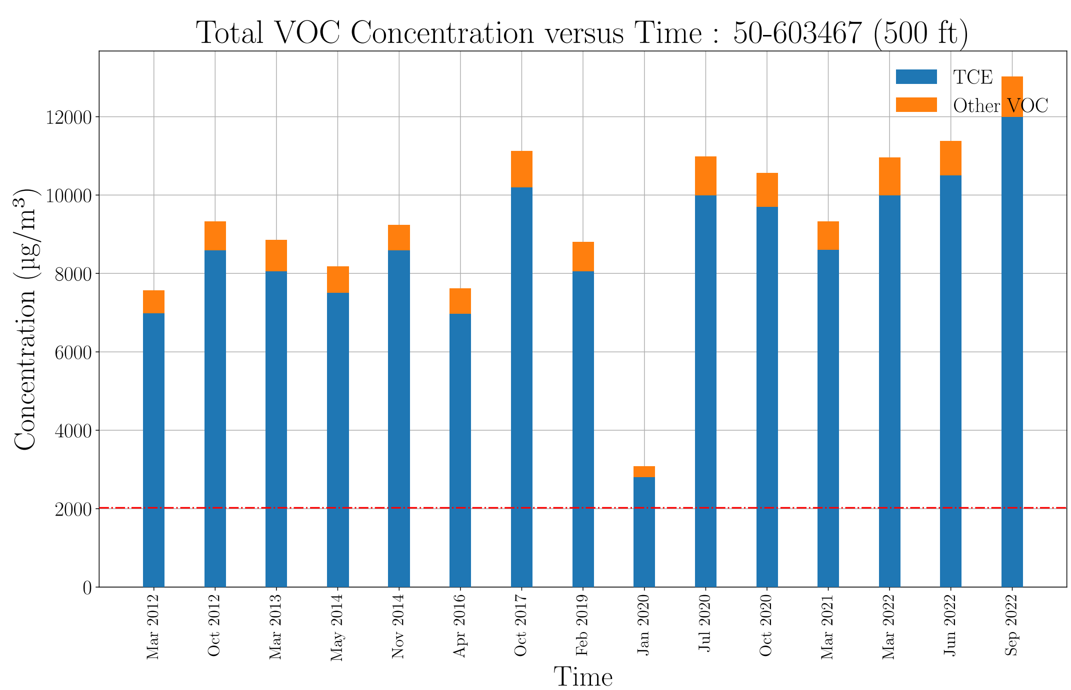
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



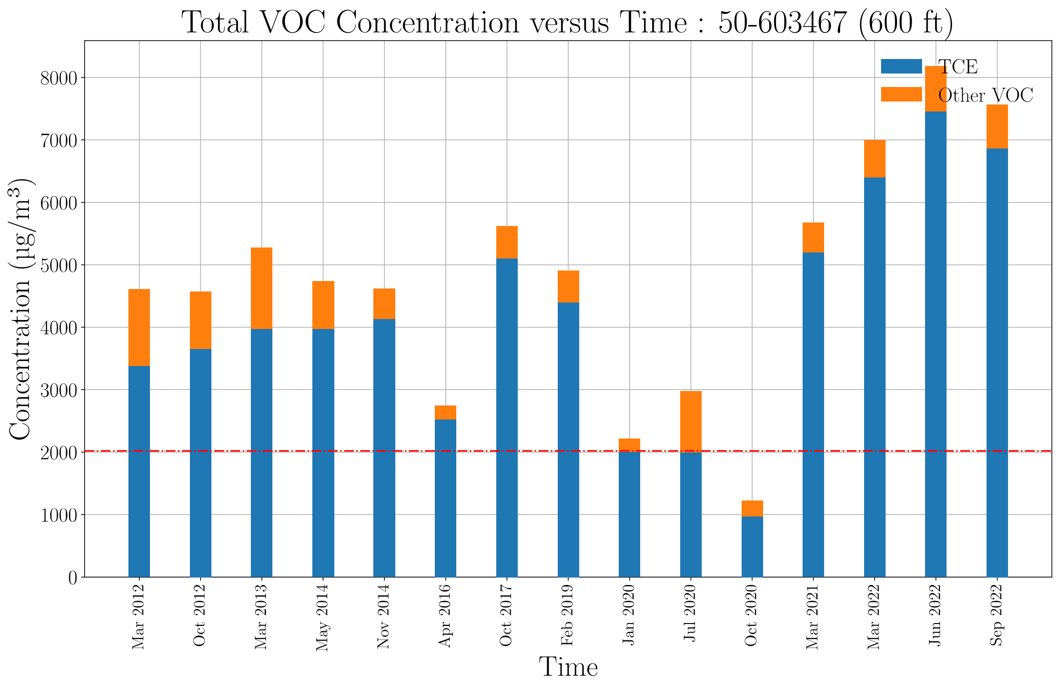
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



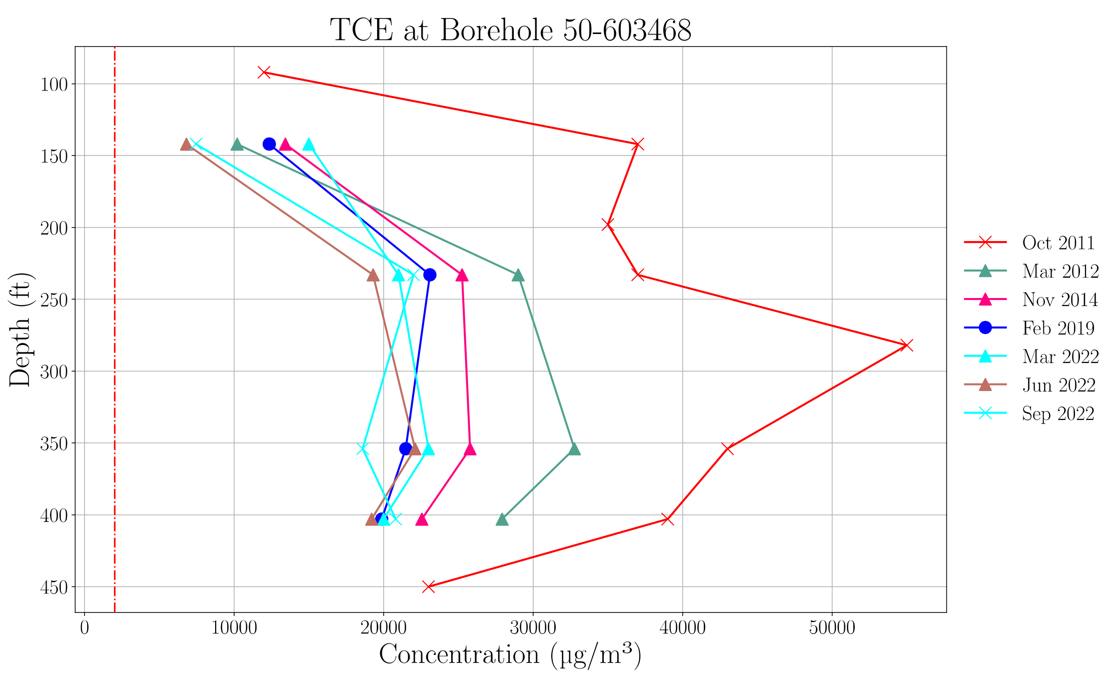
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



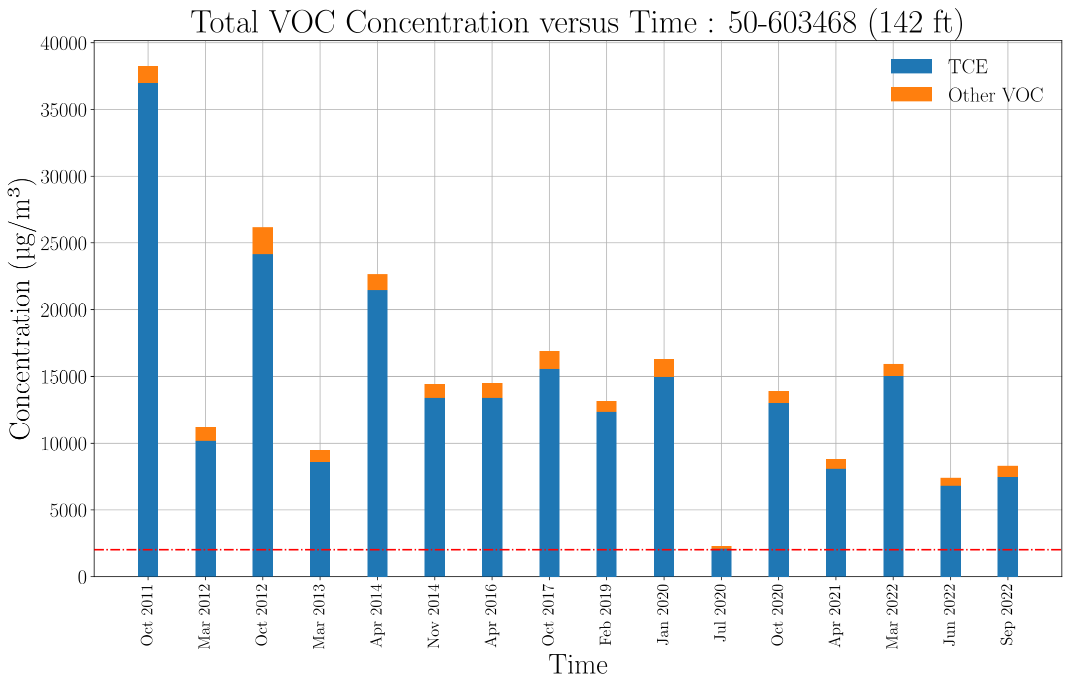
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



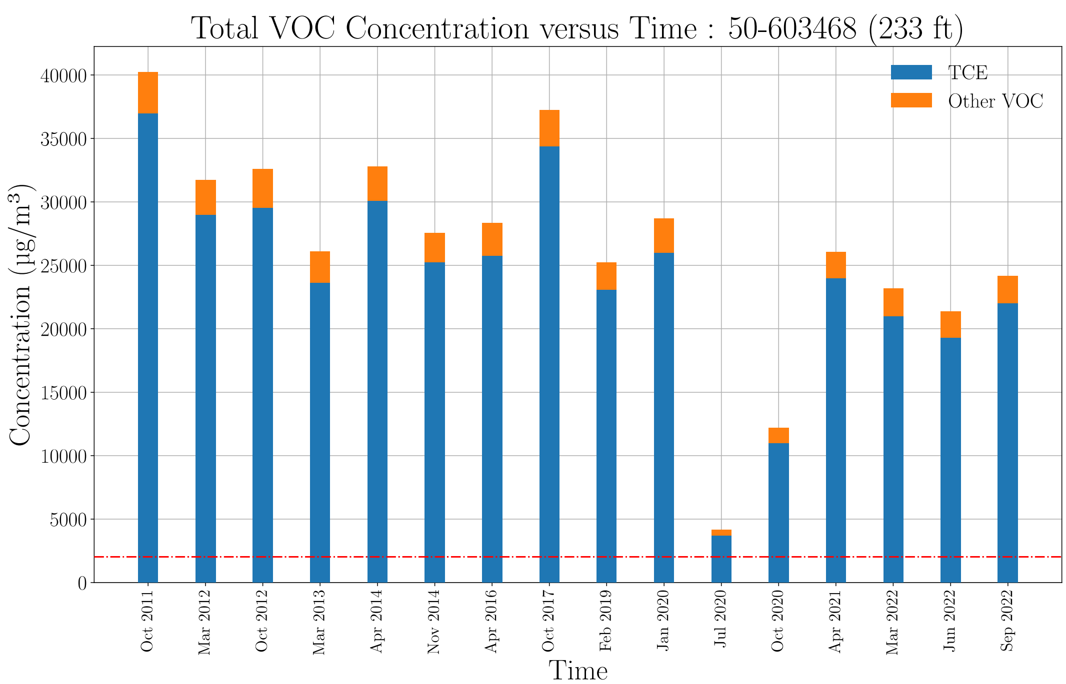
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



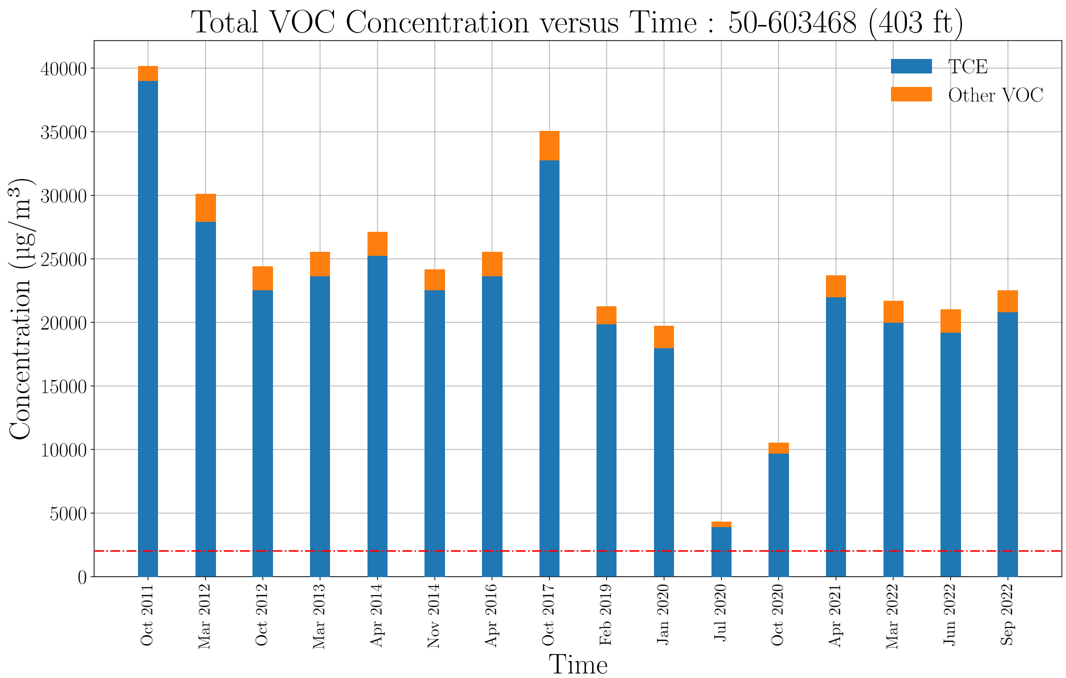
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



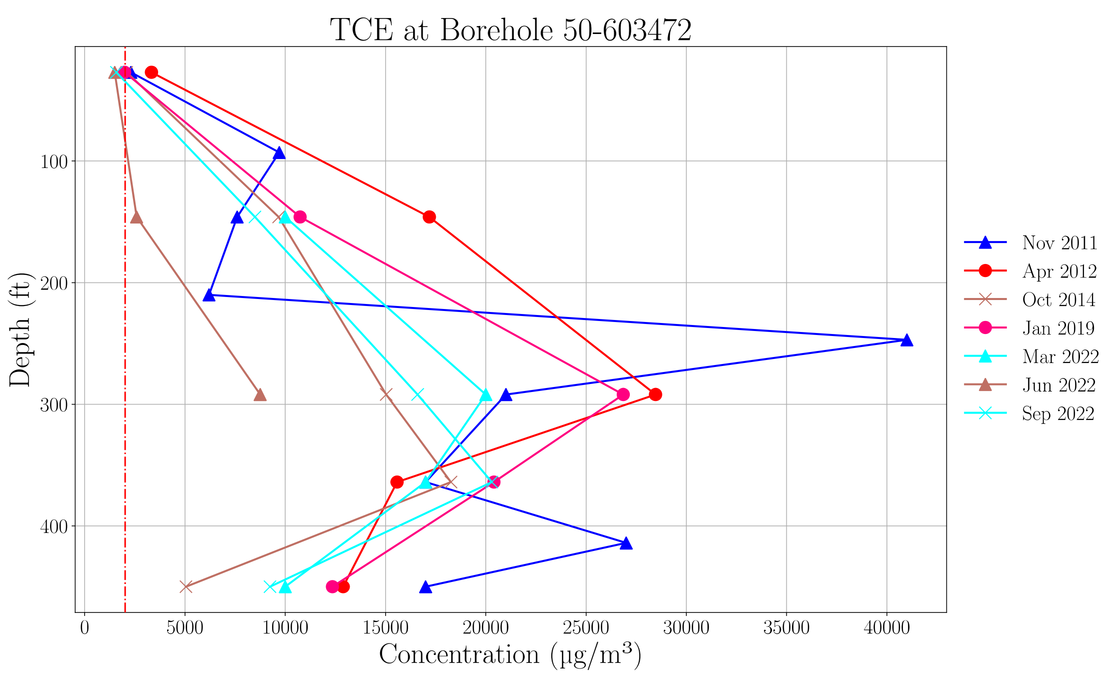
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



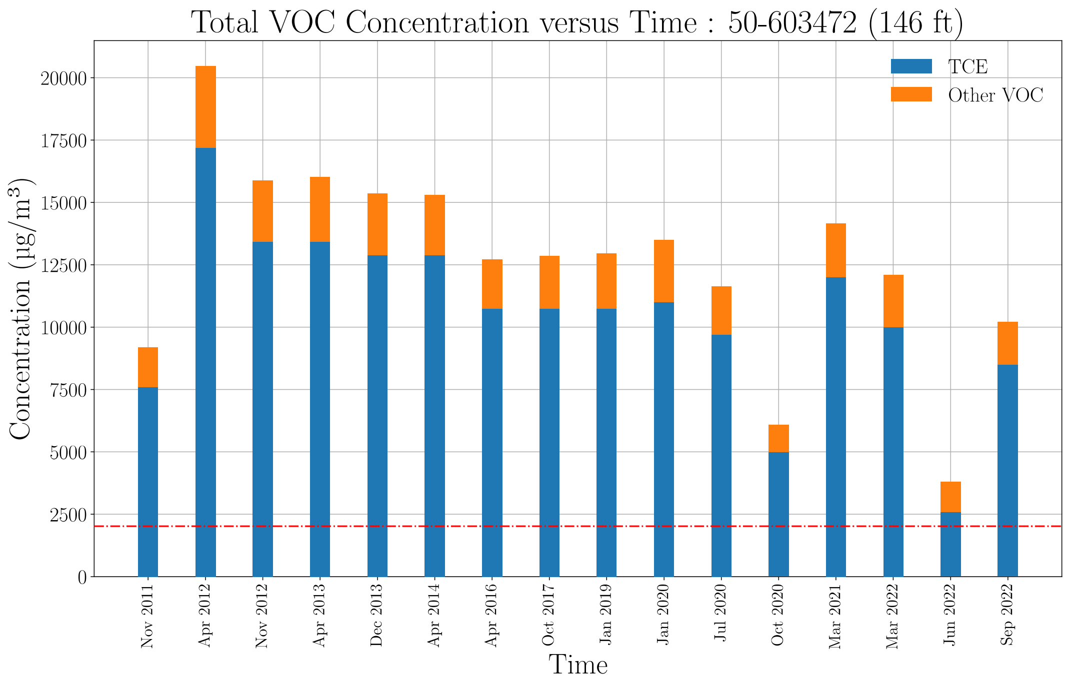
Note: Dashed red line is the 2020-μg/m^3 Tier I pore-gas SL for TCE.

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



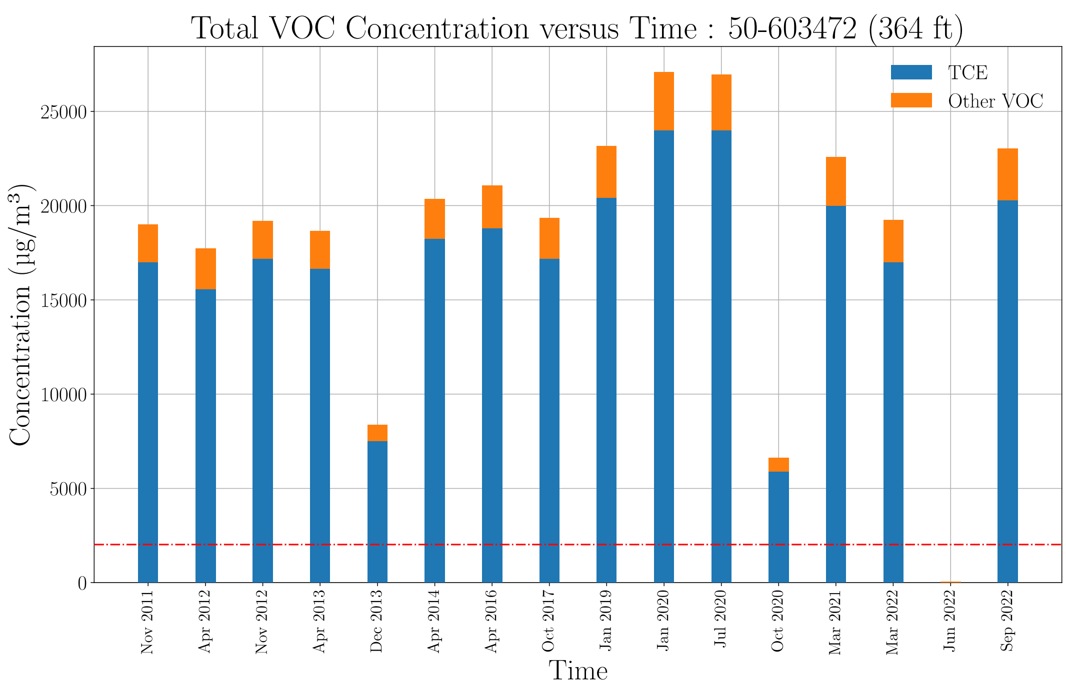
Note: Dashed red line is the 2020-μg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-11 TCE concentration versus depth and time at borehole 50-603472



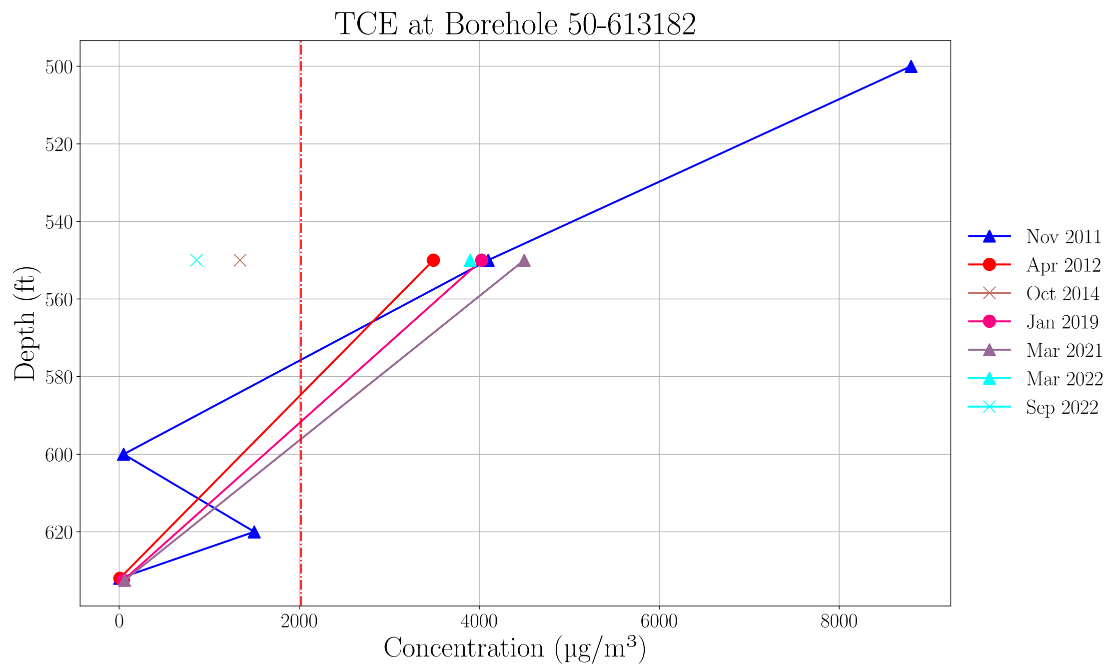
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-12 Total VOC concentration at 146 ft bgs at borehole 50-603472 over time



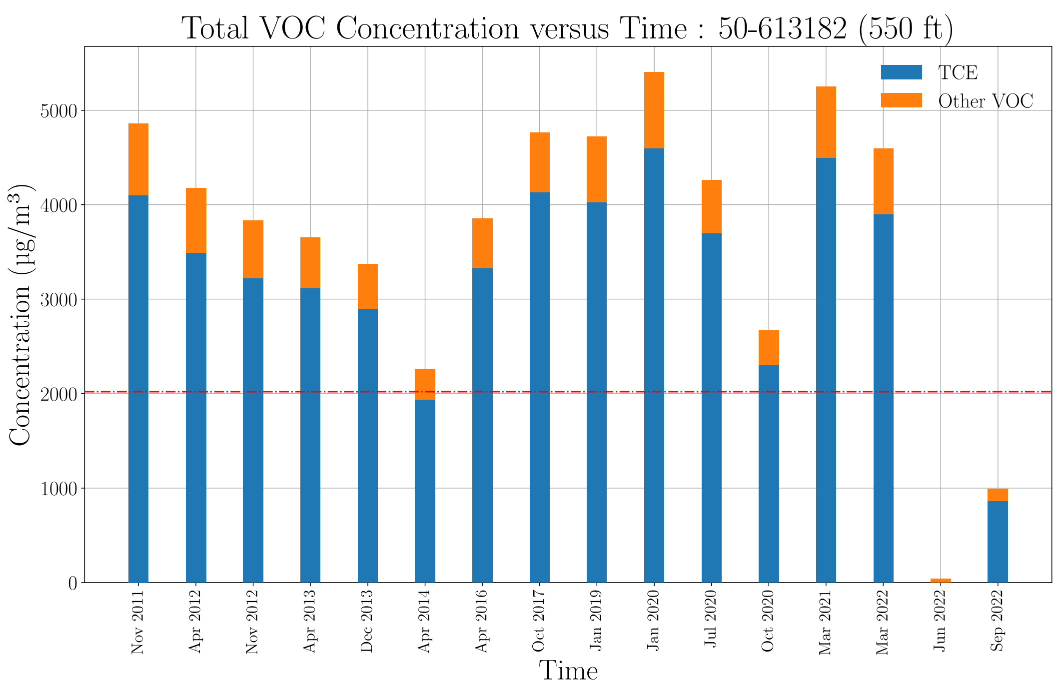
Note: Dashed red line is the 2020-µg/m^3 Tier I pore-gas SL for TCE.

Figure D-3.0-13 Total VOC concentration at 364 ft bgs at borehole 50-603472 over time



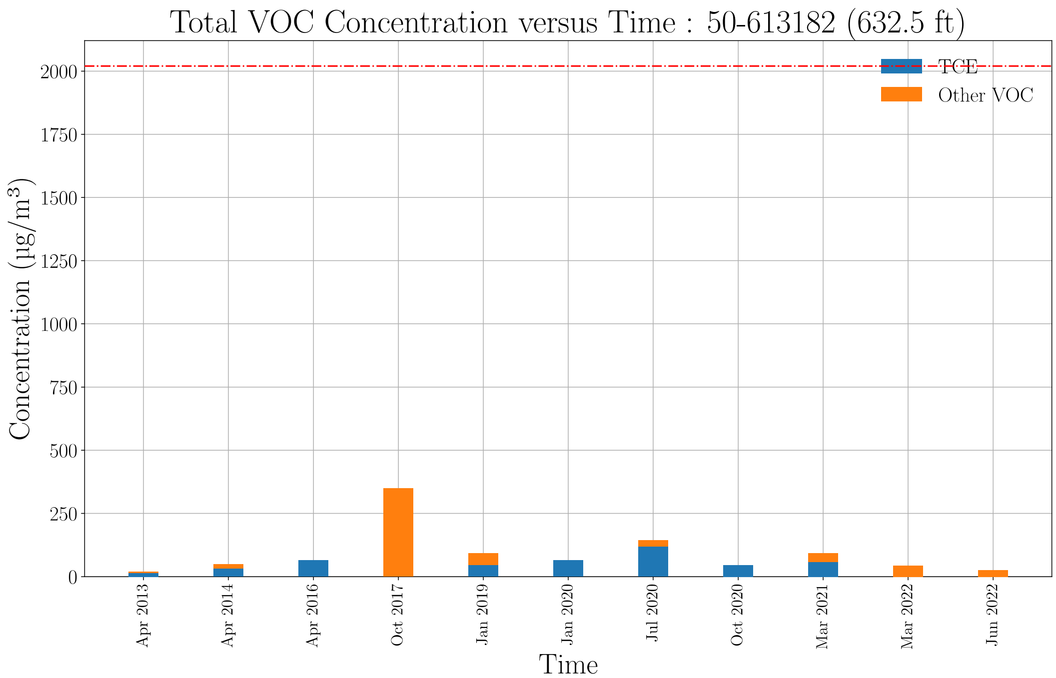
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-14 TCE concentration versus depth and time at borehole 50-613182



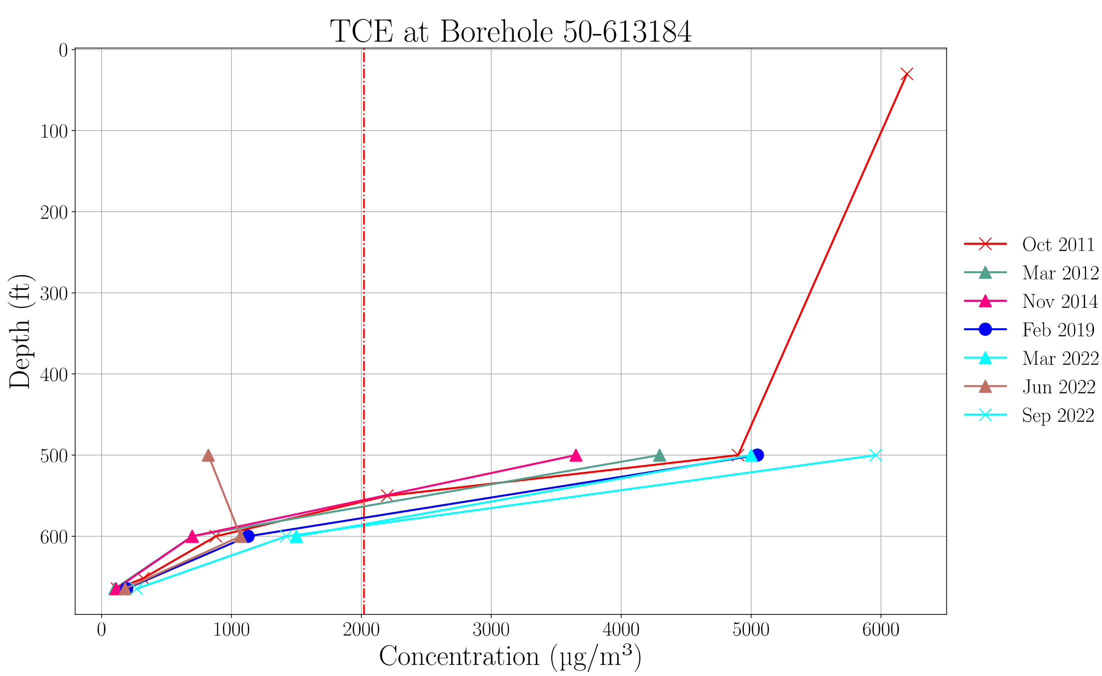
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-15 Total VOC concentration at 550 ft bgs at borehole 50-613182 over time



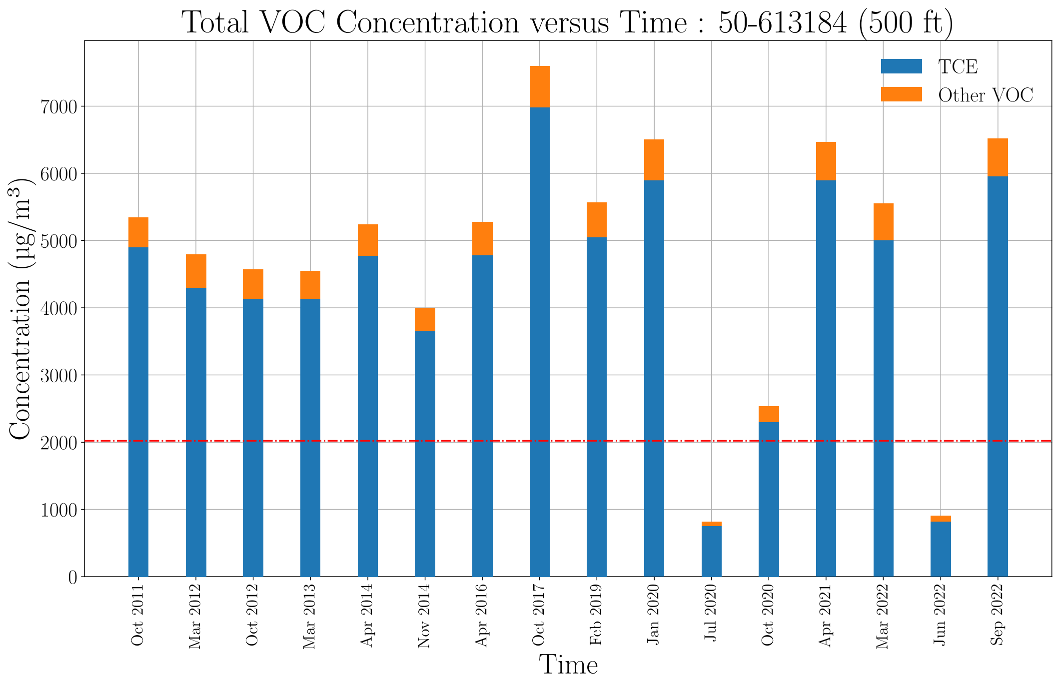
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-16 Total VOC concentration at 632.5 ft bgs at borehole 50-613182 over time



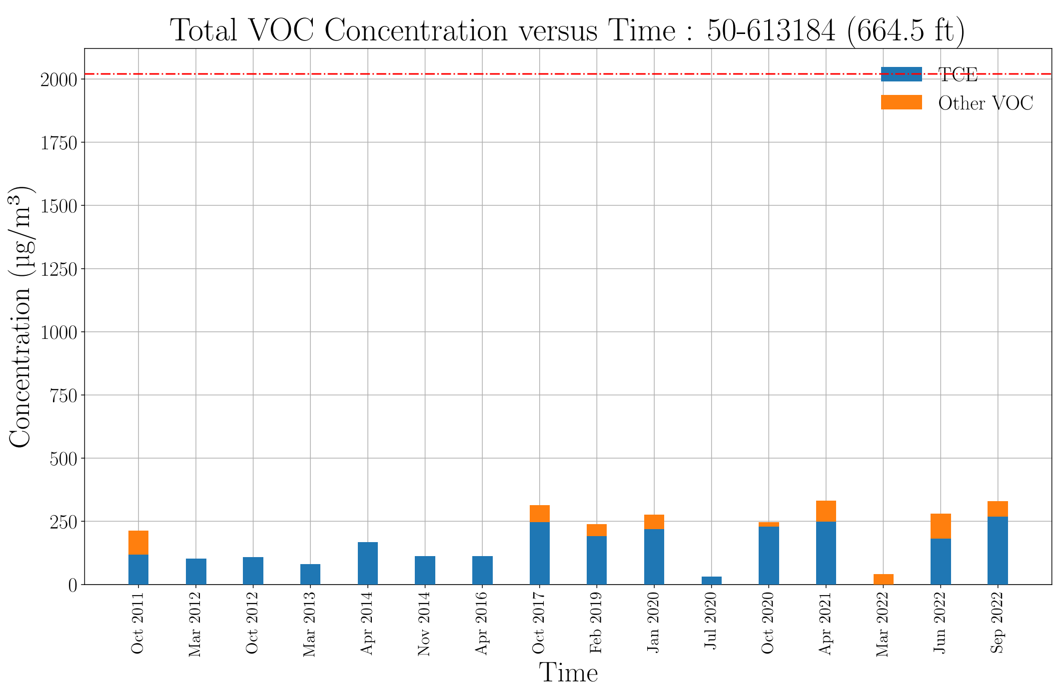
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-17 TCE concentration versus depth and time at borehole 50-613184



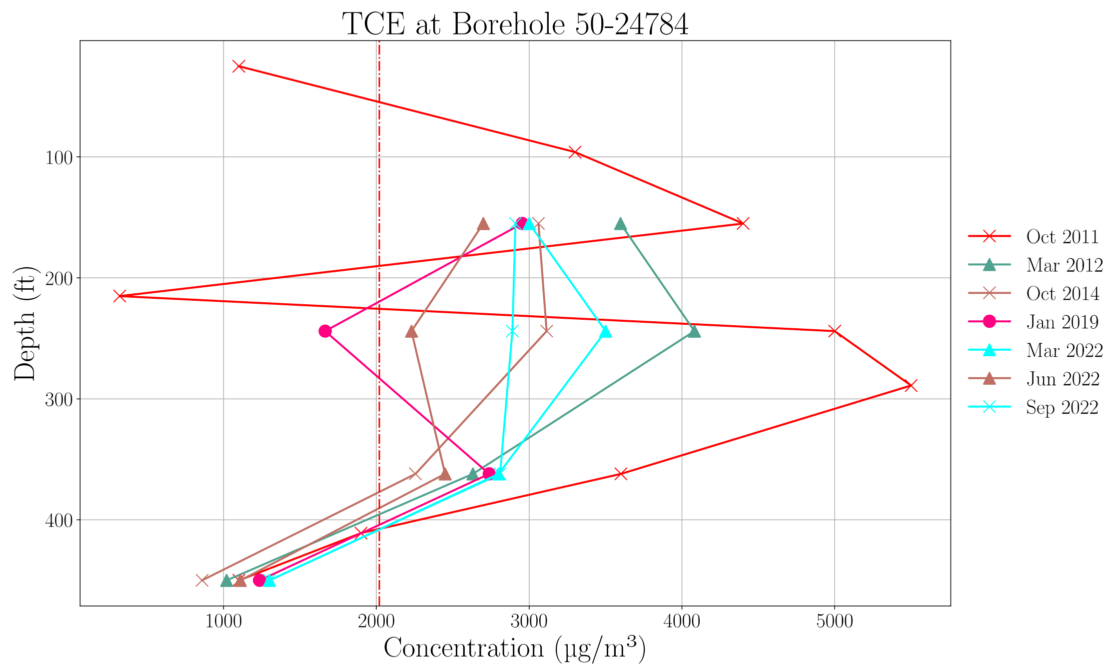
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-18 Total VOC concentration at 500 ft bgs at borehole 50-613184 over time



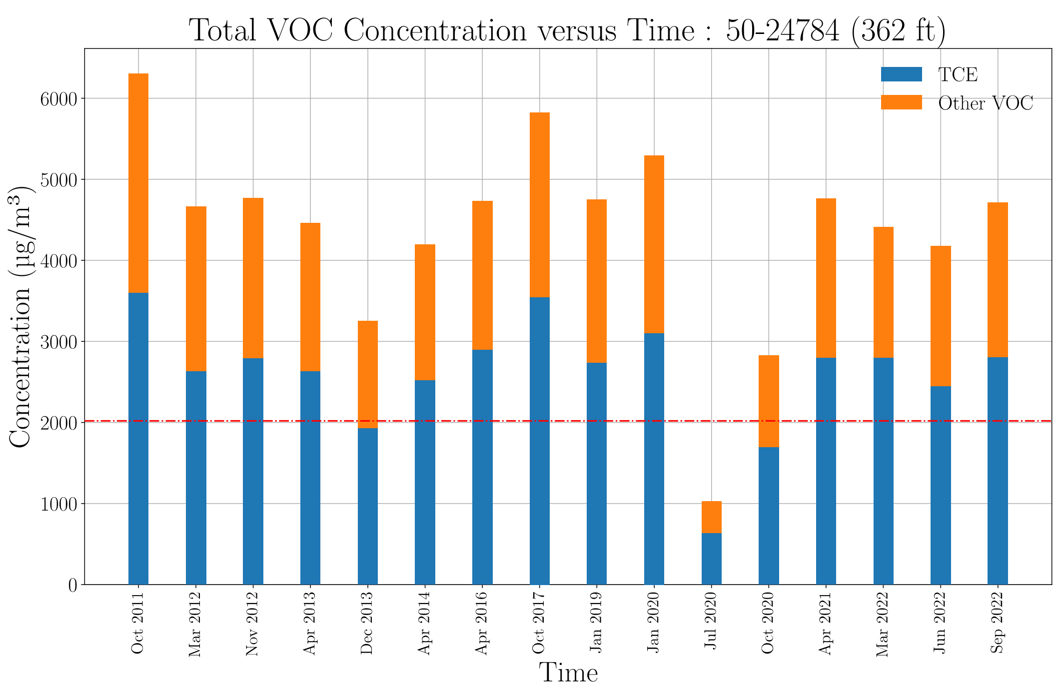
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

Figure D-3.0-19 Total VOC concentration at 664.5 ft bgs at borehole 50-613184 over time



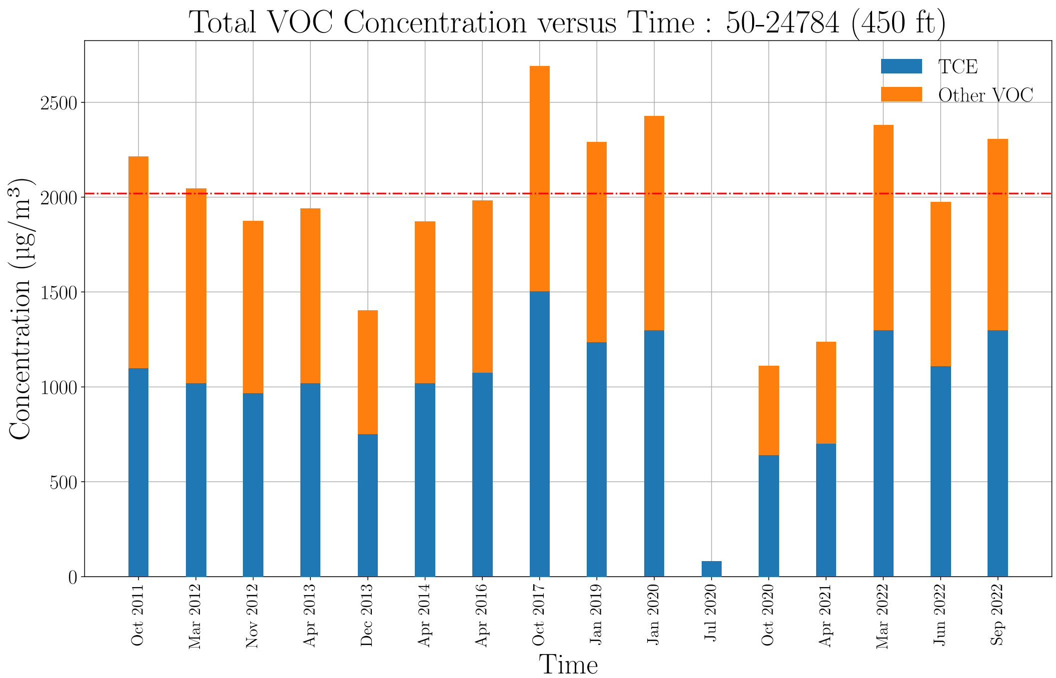
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



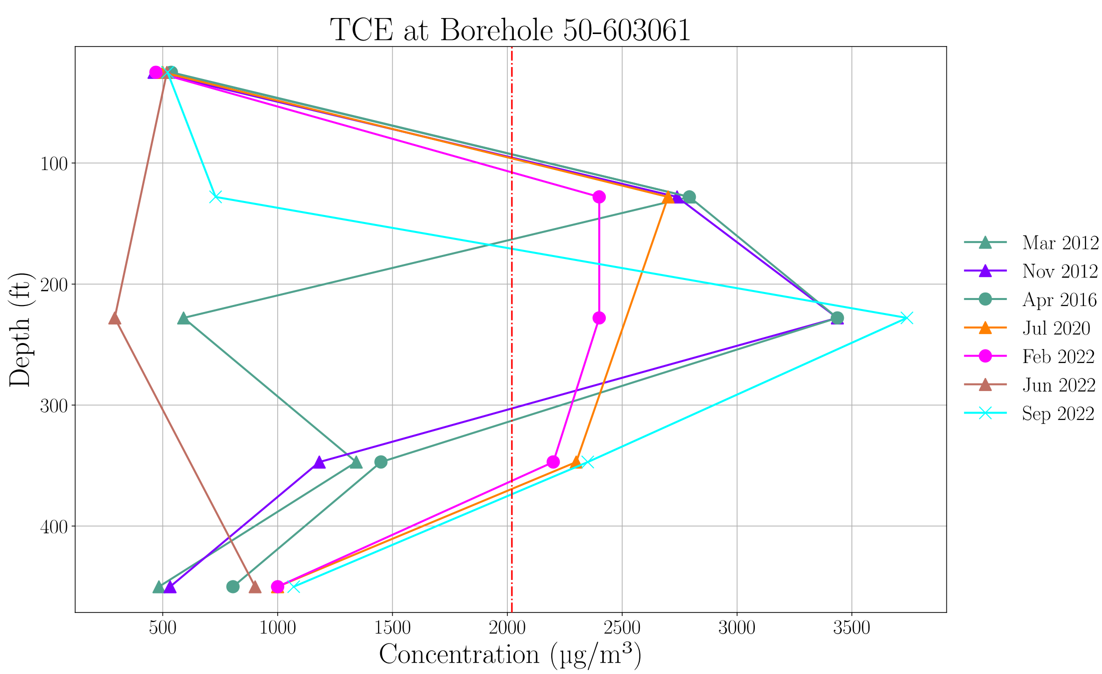
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



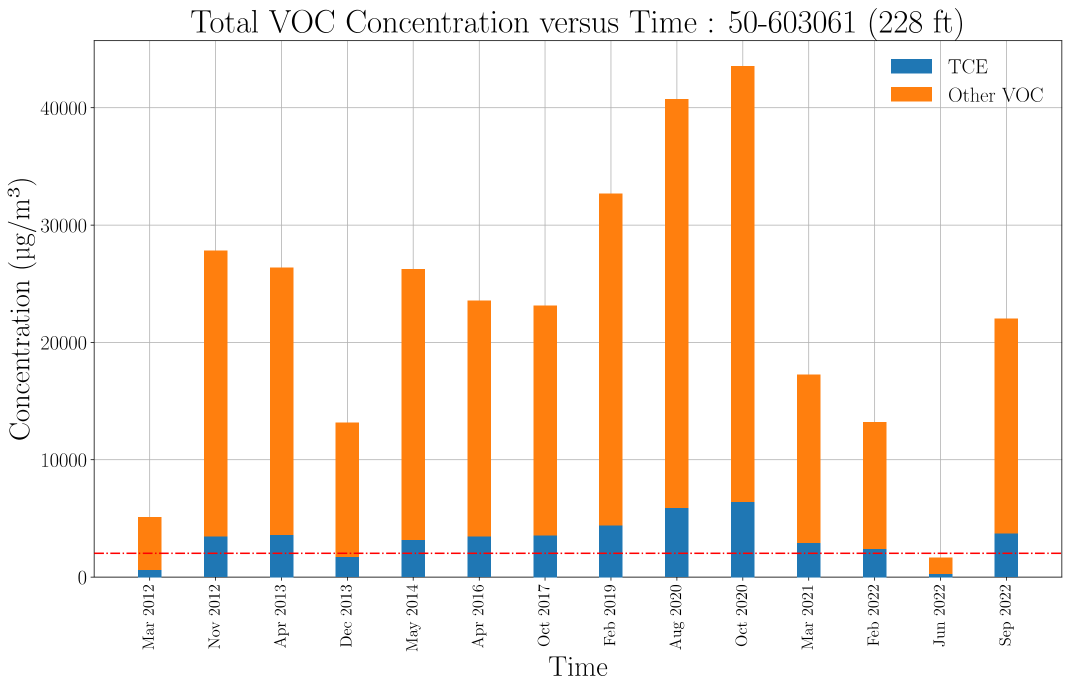
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



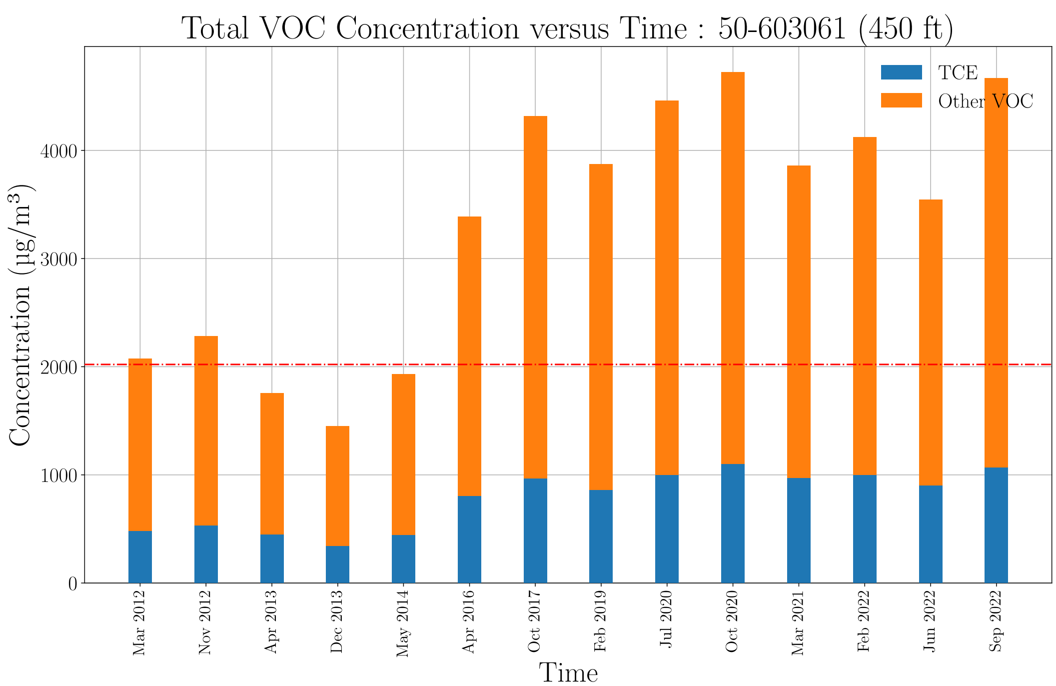
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



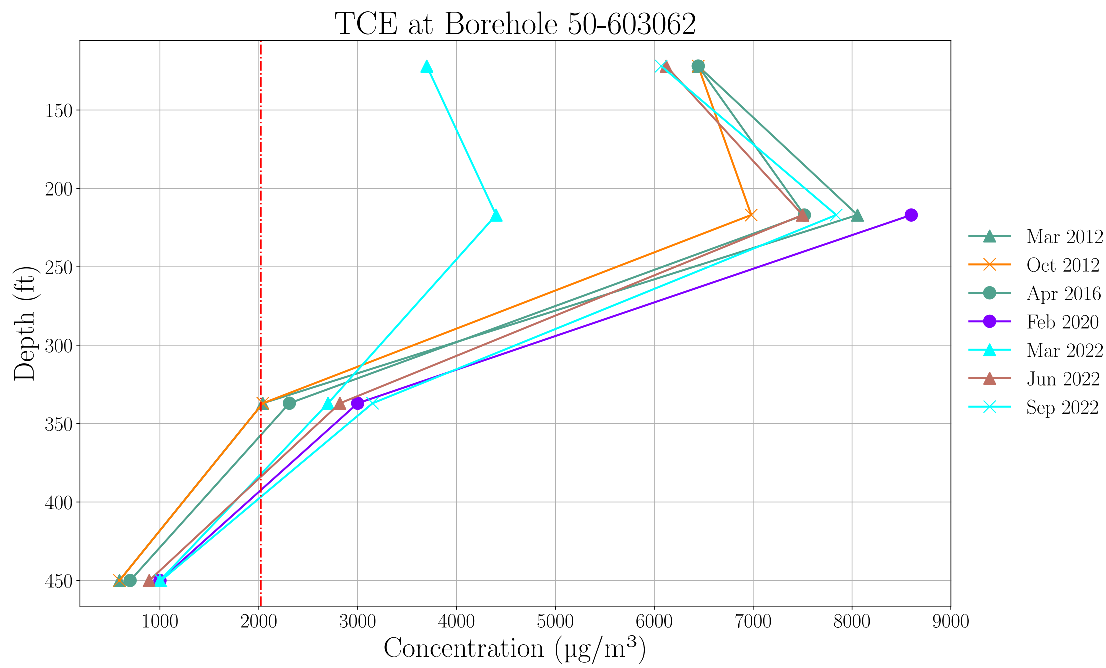
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



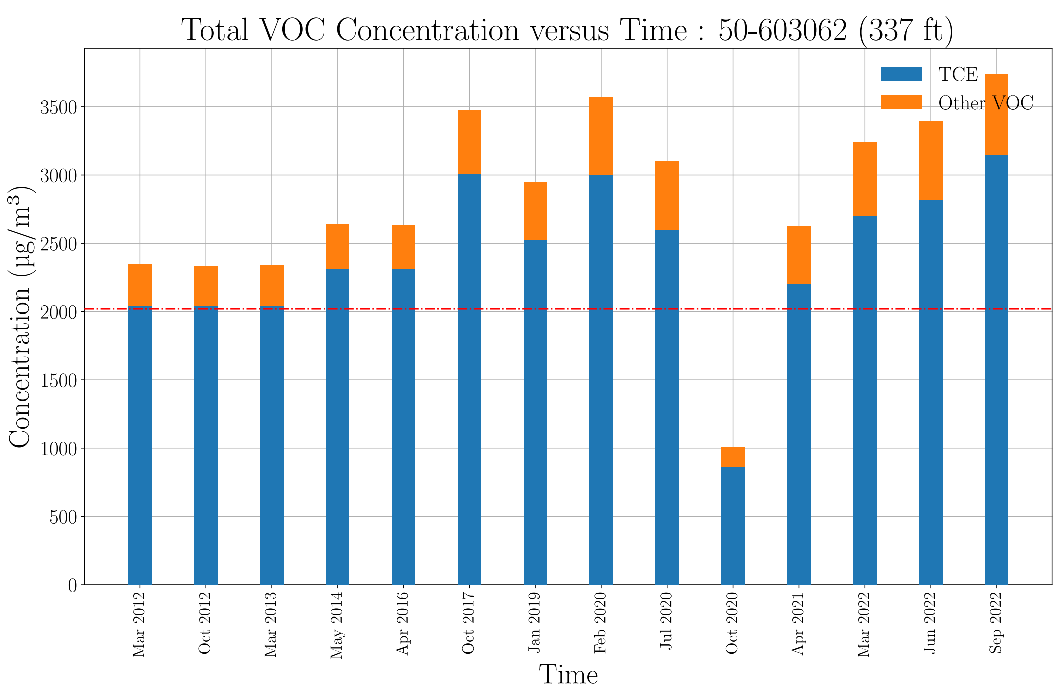
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



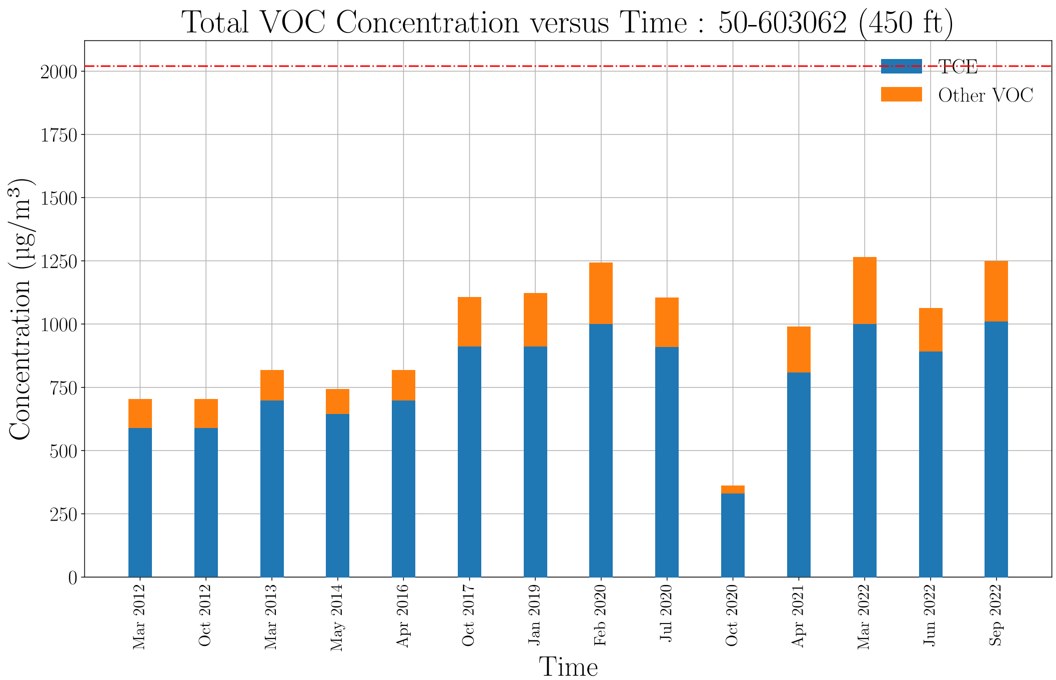
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



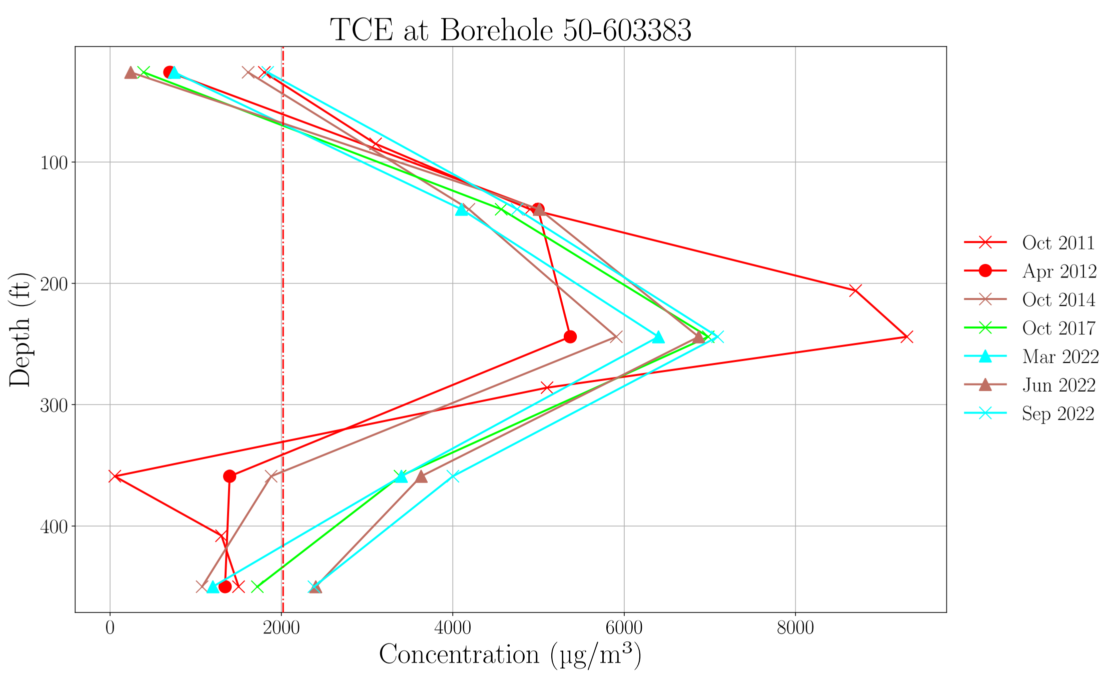
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



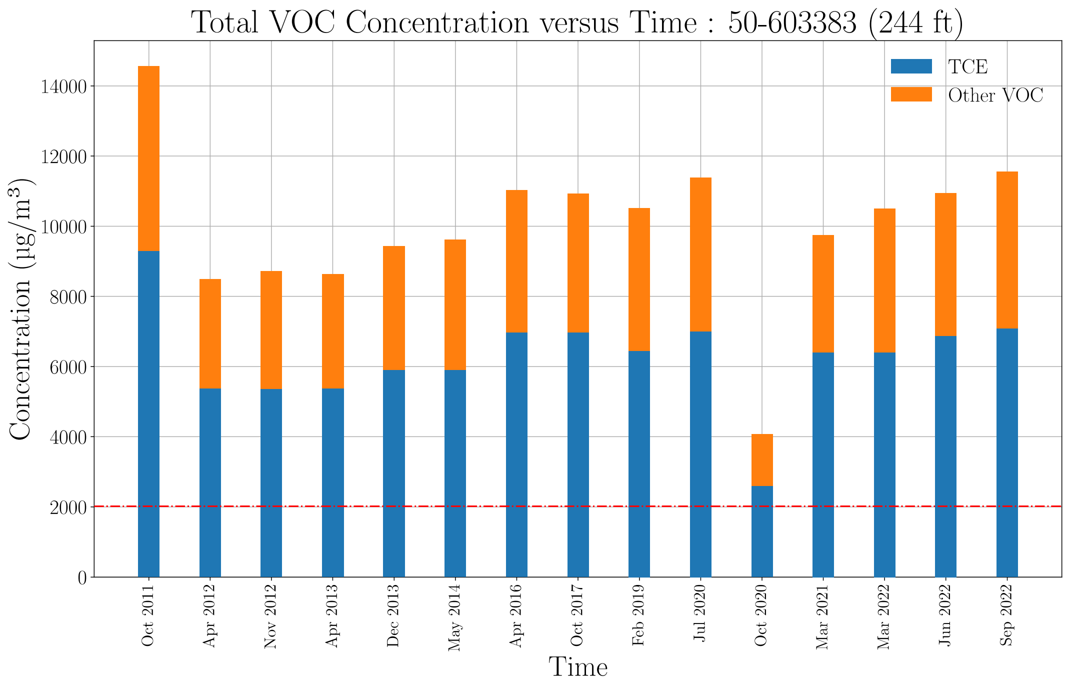
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



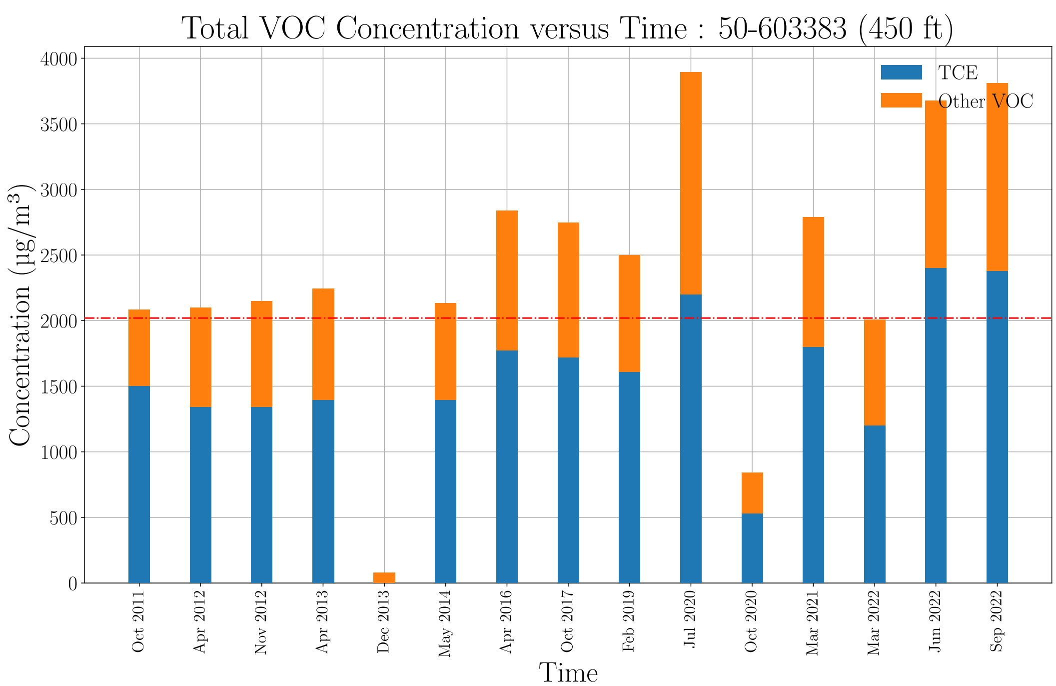
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



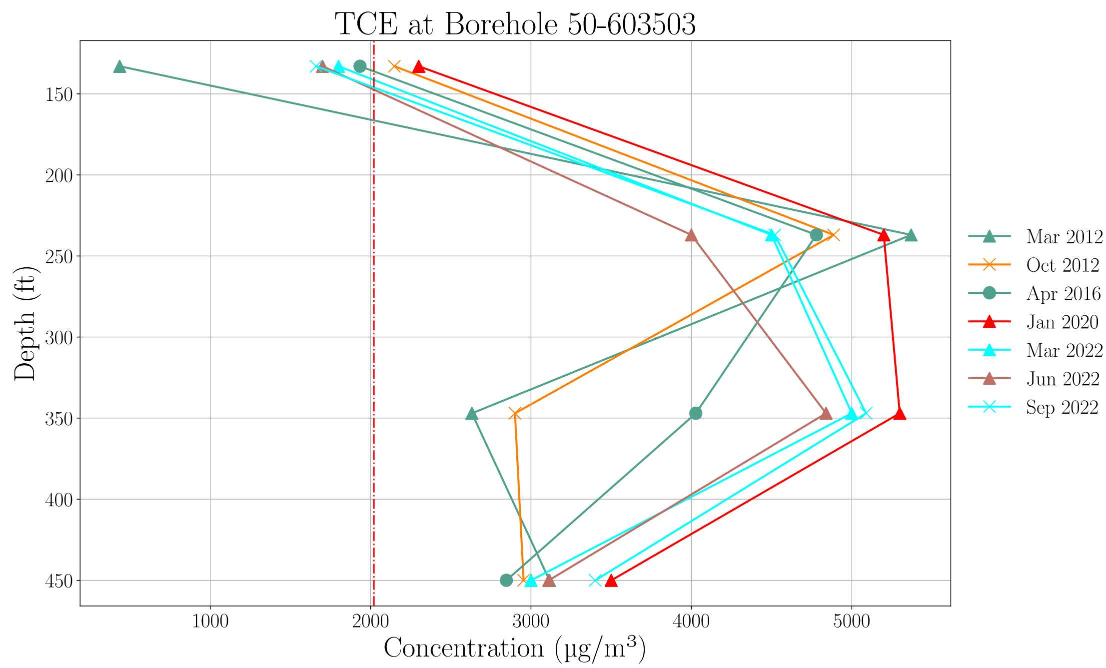
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



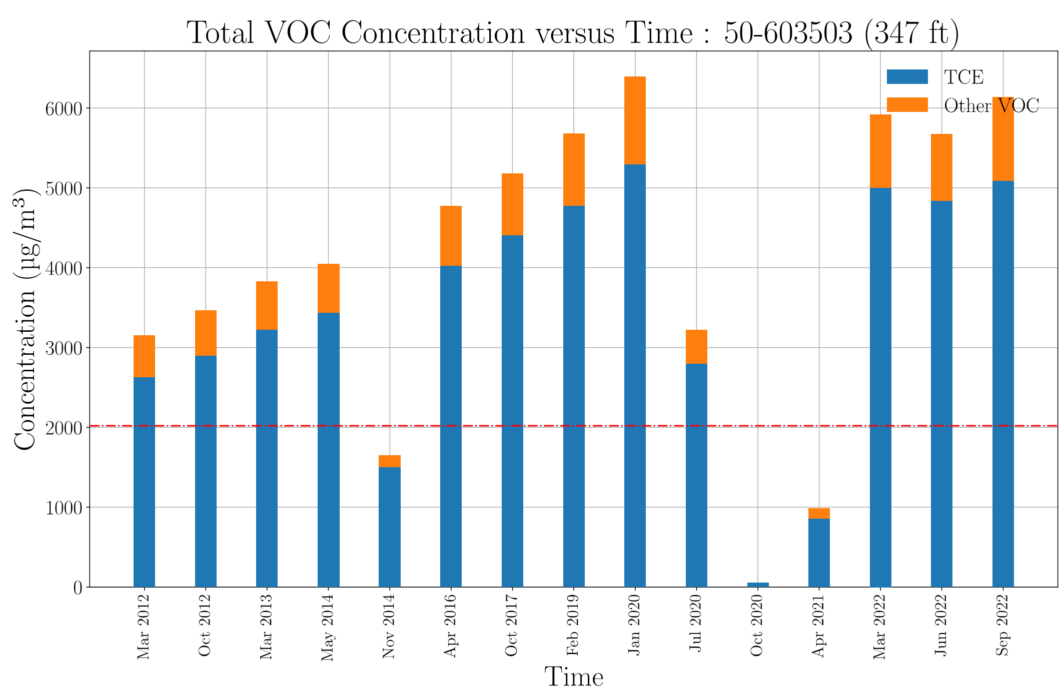
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



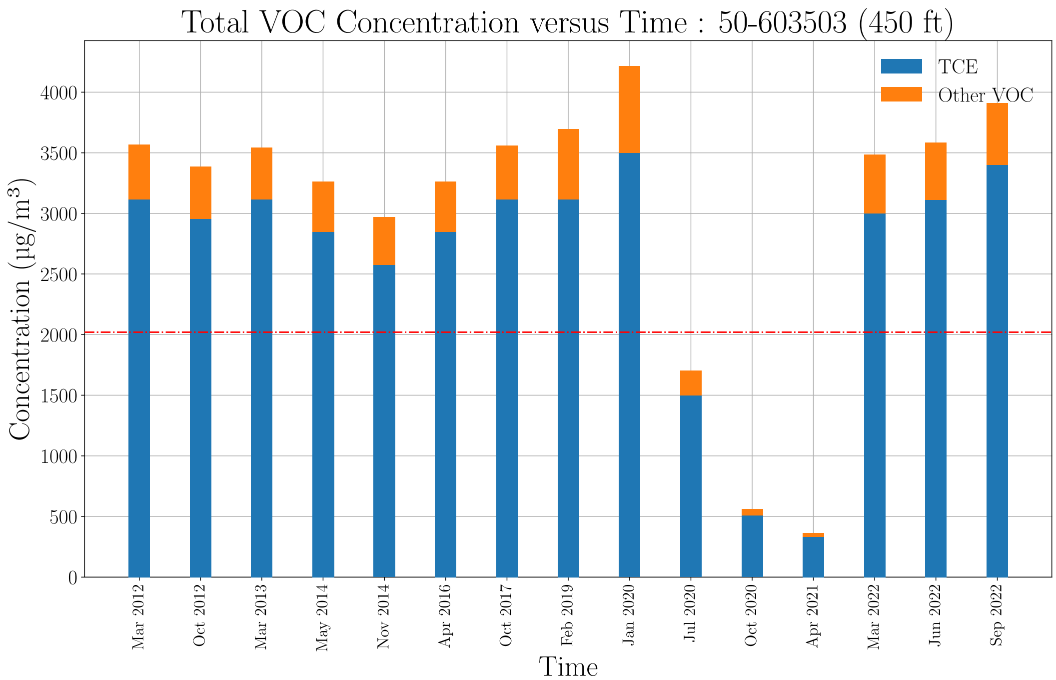
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



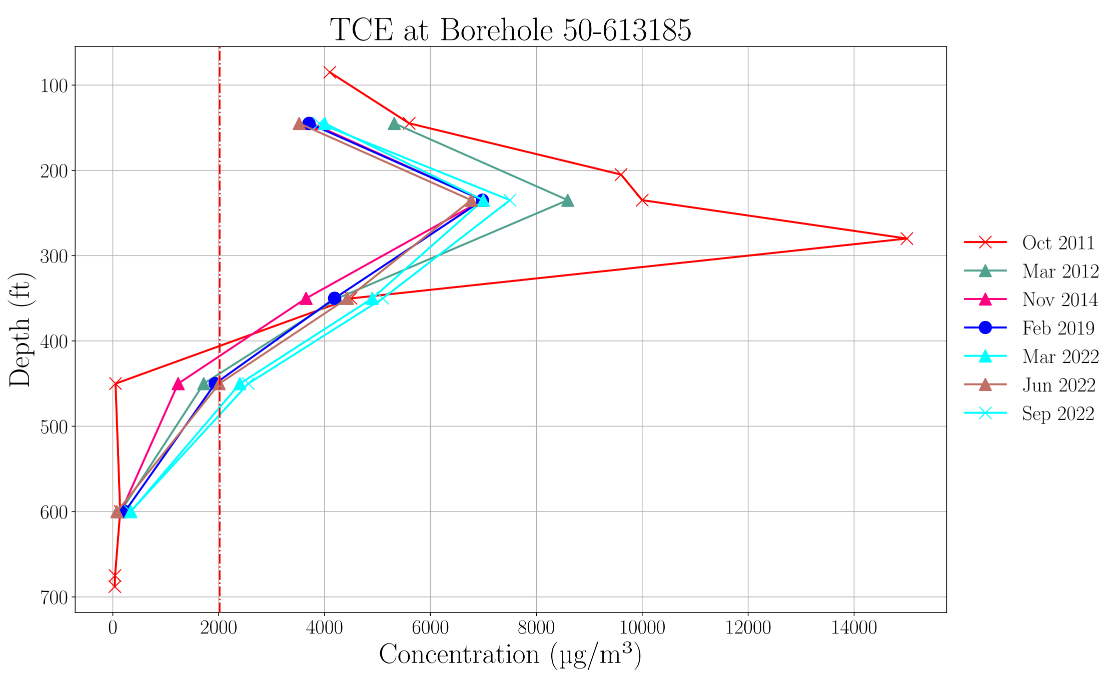
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



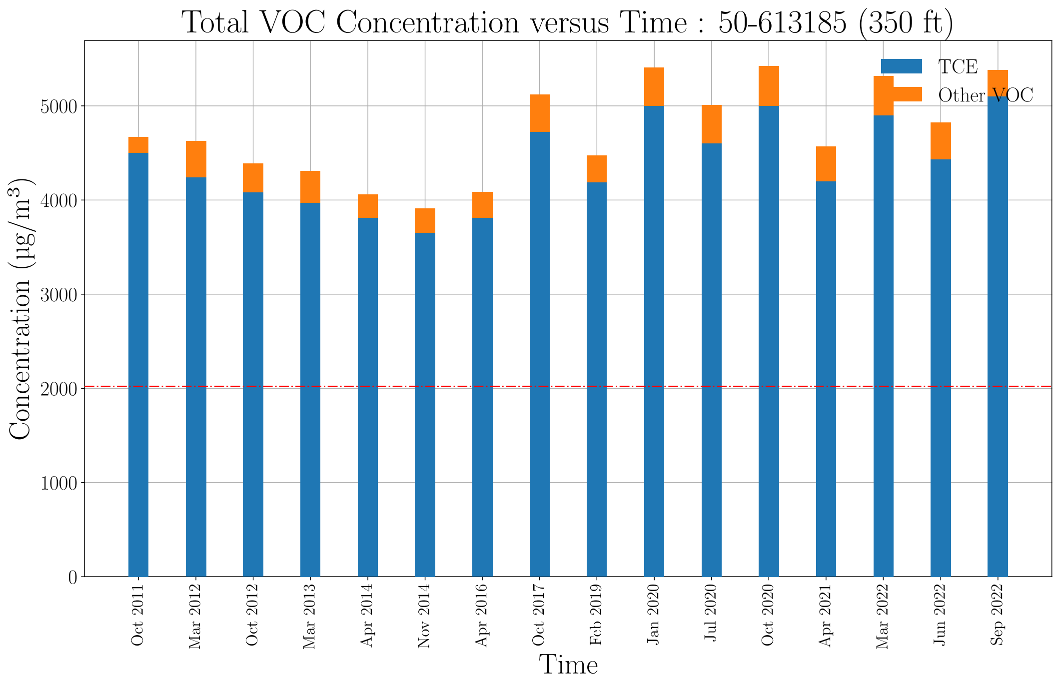
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



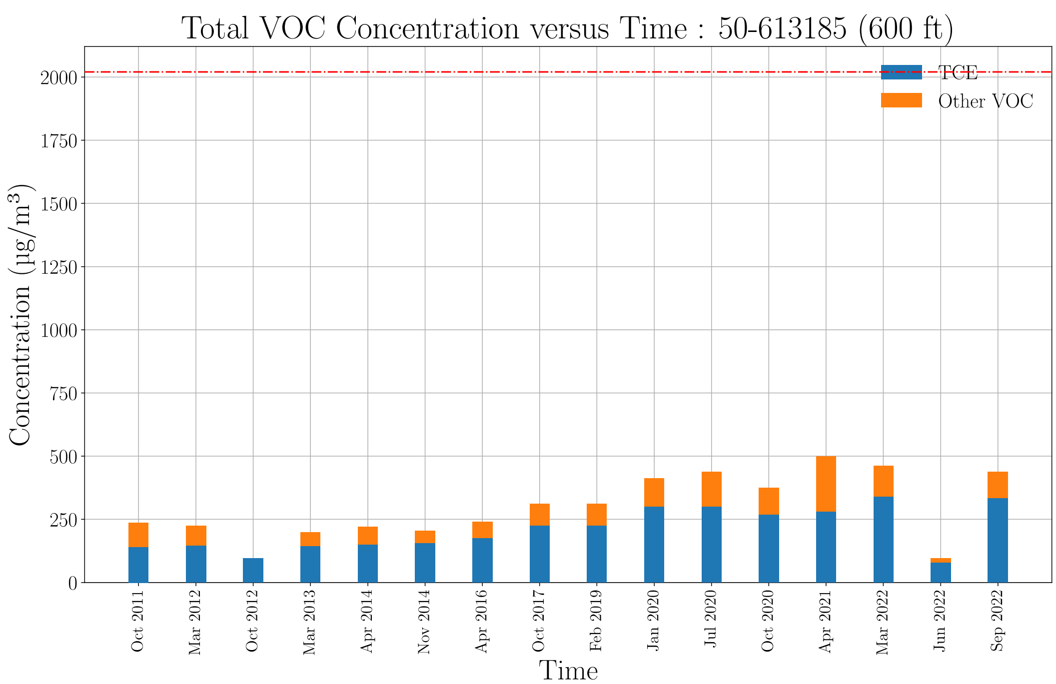
Note: Dashed red line is the 2020-µg/m³ Tier I pore-gas SL for TCE.

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



Note: Dashed red line is the 2020-µg/m^3 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/m^3 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

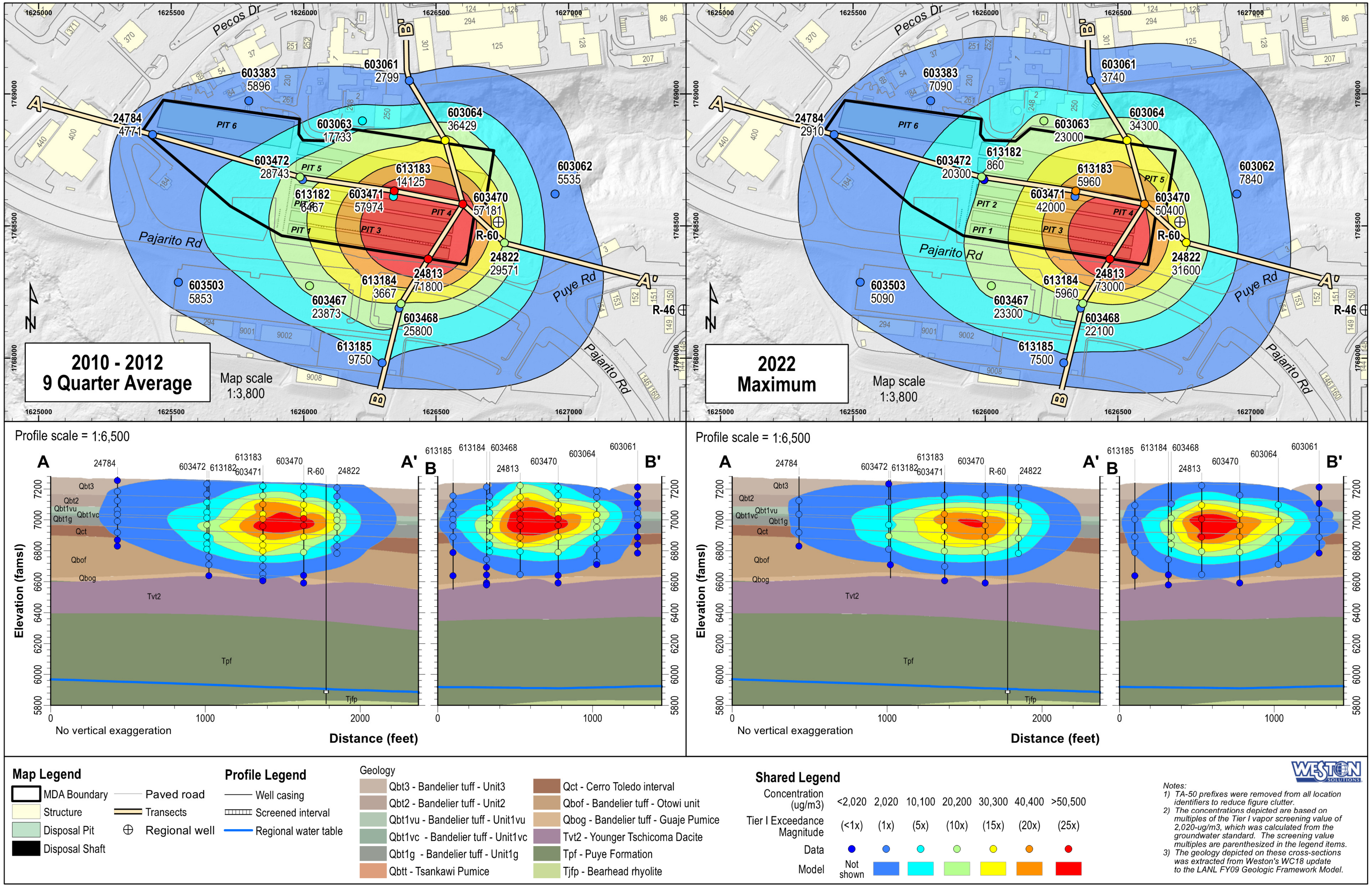


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Figure D-5.0-1 Lateral and vertical extent of the MDA C TCE plume, baseline (2010–2012 average) versus 2022 maximum measured concentration at each sample port

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	Edge
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	Core
50-603471/50-613183	642.5	Core
50-603472/50-613182	632.5	Intermediate
50-603503	450	Edge
50-613185	600	Edge

Appendix E

Analytical Suites and Results, Field Forms, and
Analytical Reports (on DVD included with this document)

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Submittal of the Periodic Monitoring Report for 2022 Vapor-Sampling Activities at Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50</td><td>☒ No restrictions
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☐ Copyrighted</td></tr>
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