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March 29, 2019

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Dear Young Chang:

NECCO PARK 2018 ANNUAL REPORT

This document is the *Remedial Action Post-Construction Monitoring 2018 Annual Report* for the Chemours Necco Park Hydraulic Controls System (HCS), Groundwater Treatment Facility (GWTF), and landfill cap.

This thirteenth annual report for the Necco Park Remedy has been prepared pursuant to Administrative Order (AO) Index No. II CERCLA-98-0215 dated September 28, 1998, issued by United States Environmental Protection Agency (USEPA). This report describes hydraulic and chemistry monitoring conducted in 2018 as required by the *Long-Term Groundwater Monitoring Plan,* dated April 2005 for the DuPont Necco Park Site located in Niagara Falls, New York, and subsequent revisions (2010 and 2012), including the 5-year monitored natural attenuation sampling and analysis.

Construction and start-up of the HCS and GWTF was substantially complete on April 5, 2005. Thereafter, the systems have been operated in accordance with the Operations and Maintenance Plan (O&M Plan). HCS operation uptime for 2018 was 88.0%. Excluding scheduled downtime for planned maintenance, HCS uptime for 2018 was 92.9%. The groundwater elevations, geochemical results, and DNAPL monitoring indicate HCS continues to be effective at controlling source area groundwater at the Chemours Necco Park site. Furthermore, the results indicated monitored natural attenuation remains actively degrading the site compounds.

Please call me at (716) 221-4723 if you have any questions or comments regarding this submittal.

Sincerely,

Chemours

Paul F. Mazierski
Project Director

Enc. 2018 Annual Report

cc: Stanley Radon/NYSDEC
Mary McIntosh/NYSDEC
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PARSONS

Remedial Action Post-Construction Monitoring 2018 Annual Report

NECCO Park
Niagara Falls, New York

Prepared for:

THE CHEMOURS FC LLC
CORPORATE REMEDIATION GROUP

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March 2019

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ACRONYMS

Acronym	Definition / Description
AOA	Analysis of Alternatives
BFBT	Blast-fractured bedrock trench
cis-DCE	cis-1,2-dichloroethene
CMMP	Cap Maintenance and Monitoring Plan
CRG	DuPont Corporate Remediation Group
CVOC	Chlorinated Volatile Organic Compounds
DDR	Data deliverable review
DNAPL	Dense non-aqueous phase liquid
DuPont	E. I. du Pont de Nemours and Company
gpm	Gallon(s) per minute
GWTF	Groundwater Treatment Facility
HCBD	Hexachlorobutadiene
HCS	Hydraulic controls system
HDPE	High-density polyethylene
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LTGMP	Long-Term Groundwater Monitoring Plan
MDL	Method detection limit
µg/l	Micrograms per liter
MNA	Monitored natural attenuation
MS	Matrix spike
MSD	Matrix spike duplicate
Necco Park	DuPont Necco Park Site
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and maintenance
PDI	Pre-design investigation
POTW	Publicly-owned treatment works
PQL	Practical quantitation limit
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance and Project Plan
RPD	Relative percent difference
SAMP	Sampling, Analysis, and Monitoring Plan
SAR	Source area report
SFR	Subsurface formation repair
SIU	Significant Industrial User
SOW	(Necco Park) Statement of Work
SVOC	Semi-volatile organic compound

Acronym	Definition / Description
TCE	Trichloroethene
TIC	Tentatively identified compound
TVOC	Total volatile organic compound
USEPA	United States Environmental Protection Agency
VC	Vinyl chloride
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This Remedial Action Post-Construction Monitoring 2018 Annual Report has been prepared pursuant to Administrative Order Index No. II-CERCLA-98-0215 issued by United States Environmental Protection Agency (USEPA) on September 28, 1998. This is the fourteenth such report and describes hydraulic and chemistry monitoring conducted in 2018 at the Necco Park Site in Niagara Falls, New York. Monitoring activities were conducted in accordance with the agency approved Long-Term Groundwater Monitoring Plan (LTGMP) dated April 2005 (DuPont Corporate Remediation Group [CRG] 2005a), and subsequent agency approved revisions (USEPA, 2011, 2015, and 2016).

The Necco Park Remedial Action consists of an upgraded cap over the landfill and a groundwater hydraulic control system (HCS). The HCS includes a network of five groundwater recovery wells and a groundwater treatment facility (GWTF). Construction and startup of the HCS and GWTF was substantially complete on April 5, 2005. Thereafter, the systems have been operated in accordance with the Operations and Maintenance Plan (DuPont CRG 2005b). HCS operation uptime for 2018 was 88.0%. Excluding scheduled downtime for planned maintenance, HCS uptime for 2018 was 92.9%. Summaries of system operations and hydraulic head data were previously provided to the USEPA and the New York State Department of Environmental Conservation in the 2018 Quarterly Data Packages (Parsons 2018a, 2018b, 2018c, and 2019). This Annual Report provides a detailed evaluation of system effectiveness with respect to the performance standards presented in the Necco Park Statement of Work.

Hydraulic monitoring data from 2018 show that, overall, the HCS has maintained hydraulic control of the source area in the A- through F-Zones. Improved hydraulic control in the upper bedrock in the western portion of the site began in fourth quarter 2008 when a combined blast-fractured bedrock trench and a new B/C-Zone recovery well (RW-11) were put into operation. Well RW-11 was installed to replace recovery well RW-10 which exhibited diminished hydraulic efficiency after startup in 2005.

Two recovery well rehabilitation events were completed in B/C-Zone recovery wells during 2018 using high pressure jetting and vacuum technique developed with National Vacuum, Inc. during 2012-2013. The spring well rehabilitation occurred April 16 through 19 and the fall event occurred September 20 through 24. Both events had a typical modest removal of sediments and maintenance of flow rate. The flow at RW-5 remains at an increased rate (approximately 3 – 6 gpm), when compared with the 2005 – 2015 average as the result of more thorough well cleaning in the Fall 2015, thereby demonstrating that the significant improvement on well yield has been maintained.

In accordance with the LTGMP (DuPont CRG 2005a), annual groundwater sampling began in 2008 after three years of biannual sampling had been conducted. In 2010, a revised sampling program was accepted by USEPA to focus on key locations on an annual basis and intermittently (every 5 years) sample the original 2005 program. In 2012, USEPA agreed removal of AT wells from the program, sampling VOCs only in the treatment process, and other minor program changes (such as the elimination of drawdown maps in annual reports). In 2015, USEPA approved to reductions in the DNAPL monitoring program. In 2016, the USEPA approved a request by Chemours CRG to end the requirement of 10% independent data validation of the groundwater data while QA/QC continues to include in-house data review. The original LTGMP and MNA programs were last completed in 2013, were completed again in 2018 as documented in this report and are scheduled to be completed next in 2023, on the five-year schedule.

The 2018 groundwater sampling results continue to show an overall decrease in concentrations of total volatile organic compounds (TVOCs) for all flow zones compared to historical results, including those sampled in the 5-year program. The 2018 results indicate:

- Five of the seven A-Zone wells sampled were 2 micrograms per liter or less TVOCs and the other wells were 104.6 micrograms per liter (137A) and 93.4 micrograms per liter (D-11).
- TVOC concentrations at key source area limit wells in the B and C zones, such as 137B, 150B, 172B, and 145C continue to have stable/decreased concentrations and/or declining trends.
- Decreasing or stable TVOC concentrations are apparent in the D/E/F zones at key source area limit wells such as 136F, 146E, and 146F. Three of the five F-zone wells sampled in 2018 resulted in the lowest TVOC concentration observed at the well locations.
- Overall, the TVOC concentrations are decreasing for all groundwater flow zones at the outer portions of the source area and in the downgradient far-field. In the few cases where there were increasing TVOC trends, the concentrations were within historical range, near the source area / a recovery well, or represented increases in degradation products.

DNAPL was monitored every month throughout 2018. As approved by the USEPA, a reduced list of wells was monitored monthly and semi-annually beginning in June 2015 with the full list of wells to be monitored once every two years (USEPA June 11, 2015 and USEPA August 12, 2015). No measurable DNAPL was observed in any of the wells throughout 2018 and therefore, no DNAPL was removed. A total of 8,818 gallons of DNAPL has been removed since initiation of the recovery program in 1989.

The 2018 groundwater elevations, geochemical results and DNAPL monitoring indicated the HCS continues to be effective at controlling source area groundwater at the Chemours Necco Park site through 2018. Groundwater potentiometric contour maps depict a capture zone encompassing the source area in the B-, C-, D-, E- and F-Zones, and vertical gradient downward from the A to the B zone were maintained. Overall, the TVOC concentrations were decreasing for all groundwater flow zones in the source area and far-field. It is recommended that the long-term monitoring program continue in its current form, including the revisions from approved by the USEPA in 2011 and 2016.

Data on chlorinated ethenes in Necco Park is consistent with lines of evidence required for natural attenuation of contaminants (USEPA, Monitored Natural Attenuation Directive, 1999). Analytical results from 2018, such as concentrations of degradation products and geochemical conditions, continue to support the recommendation that MNA assessments be conducted every five years. The next MNA monitoring event is scheduled for 2023 and another full MNA analysis will be completed then.

1.0 INTRODUCTION

1.1 Site Location

The 24-acre Chemours Necco Park inactive industrial waste disposal site is located approximately 1.5 miles north of the Niagara River in a predominantly industrial area of Niagara Falls, New York (Figure 1-1).

1.2 Source Area Remedial Action Documentation and Reporting

The approved remedy for the Necco Park Site included construction of the Bedrock and Overburden Source Area Hydraulic Controls System (HCS) and the Landfill Cap Upgrade. Completion of the remedy and compliance with the performance standards described in the Statement of Work (SOW) are documented in the Remedial Action Report (DuPont Corporate Remediation Group [CRG] 2007). This 2018 Annual Report presents hydraulic and chemical monitoring results from the fourteenth year of operation of the hydraulic controls. In addition, this 2018 Annual Report includes historical groundwater chemistry results for assessment of groundwater quality trends.

2.0 HCS OPERATIONS SUMMARY

The Necco Park groundwater Operations and Maintenance (O&M) Plan (DuPont CRG 2005b), in conjunction with vendor O&M Manuals, describes normal operation and shutdown procedures, emergency shutdown procedures, alarm conditions, trouble-shooting, and preventative maintenance procedures for the HCS and the Groundwater Treatment Facility (GWTF). This section of the report summarizes 2018 HCS operations.

2.1 Operational Summary

Operational information for the HCS is provided in the 2018 Quarterly Data Packages (Parsons 2018a, 2018b, 2018c, and 2019) and summarized in the table below.

Period	HCS Uptime (%)	HCS Uptime [excluding scheduled maintenance downtime] (%)	Groundwater Treated (Gallons)	DNAPL[1] Removed (Gallons)
1Q18	93.8	93.8	3,894,096	0
2Q18	80.8	96.9	3,314,346	0
3Q18	82.9	88.2	3,081,012	0
4Q18	92.7	92.7	3,259,882	0
2018 Total	**87.6**	**92.9**	**13,549,336**	**0**

[1]DNAPL – dense non-aqueous phase liquid

A summary of monthly groundwater quantities and uptime for each recovery well is provided in Table 2-1.

The HCS remained operational throughout 2018, averaging 87.6% total system uptime through December 31, 2018 with three scheduled maintenance outage and two unscheduled outages described below. Excluding scheduled downtime for planned maintenance, HCS uptime for 2018 was 92.9%. GWTF downtime was minimized by continuously monitoring operating conditions and implementing mechanical and procedural changes to the process equipment and the Honeywell Experion® PKS (Process Knowledge System) process control system.

There were three reportable scheduled maintenance activities in 2018. Between May 14 and May 22 all pumping wells were shut down for tank cleaning and visual inspection. The wells were down for 213 hours. Between June 5 and June 9, the system was down for stack cleaning and inspection for 73 hours. Between September 18 and 24 recovery well rehabilitation and preventive maintenance was completed with RW-5 down for 143.5 hours and RW-11 down for 117 hours. There were two reportable unscheduled down time events in 2018. Both were the result of local power outages. All recovery wells were down between May 5 and 7 for 63 hours, and July 7 through 12 for 117 hours.

On nine occasions in 2018, individual well(s) were down for greater than 48 hours. Eight of the shutdowns were unscheduled and one was scheduled. The unscheduled individual downtimes were as follows:

- RW-4, RW-5, and RW-11 were down February 3 to 11 for 87.5 hours due to a low pH interlock in tank 102.
- RW-5 was down March 24 to 26 for 56 hours and again September 1 to 4 for 71 hours due to a pump failure.
- RW-9 was down April 1 through 3 for 60.6 hours and again September 1 through 4 for 61 hours due to a level probe malfunction.
- RW-4 was down from June 29 through July 2 for 61.5 hours due to a flow meter malfunction.
- RW-8 was down from August 3 through 6 for 65 hours due to a flow meter malfunction.
- Between October 14 and 16, RW-5 was down for 72 hours due to a faulty pH probe, RW-8 was down for 57 hours due to a flow meter transducer malfunction, and RW-11 was down for 71 hours due to failure of the variable speed drive.

The single scheduled well shutdown in 2018 included:

- RW-5 was down April 16 to 19 for 66 hours for well rehabilitation.

The following table summarizes HCS reportable downtime in 2018 by component malfunction and scheduled maintenance:

Reason	Contributing Downtime %	Comments
Process component malfunction	7.1%	Unexpected process-related downtime as a result of alarms and interlocks.
Scheduled maintenance shutdowns and system upgrades/inspections	5.3%	Routine inspections, interlock verification, preventative maintenance, equipment inspection and mechanical upgrades to process-related infrastructure.

HCS downtime is considered reportable when any recovery well is not operating for a period of more than 48 consecutive hours (DuPont letter to USEPA, January 27, 2012).

2.2 GWTF Process Sampling

In accordance with the Sampling, Analysis and Monitoring Plan (SAMP), quarterly process sampling is conducted to assess the effectiveness of the treatment system in removing volatile organic compounds (VOCs) from groundwater. Two influent samples are collected, one from the B/C-Zone influent tank and one from the D/E/F-Zone influent tank. One effluent sample is collected from the combined effluent tank. Beginning in 2012 and as approved by USEPA, these process samples are analyzed for VOCs only. Semi-volatile organic compound (SVOC) monitoring will be conducted as needed if significant changes occur to the hydraulic or chemical load observed during routine process monitoring or if there is a change in an operations condition (e.g. change in pump intake elevation). A summary of results for the process sampling conducted in 2018 is provided in Table 2-2.

2.3 Sewer Sampling Summary

Significant Industrial User (SIU) permit #76 with the City of Niagara Falls publicly-owned treatment works (POTW) regulates the treated groundwater effluent discharged from Necco Park. Results from the quarterly sampling conducted at the permitted discharge point (MS#1) are used to determine POTW compliance There were no exceedances of the permit limits in 2018.

2.4 Recovery Well Rehabilitations and Maintenance

Two rehabilitation events were completed in B/C-Zone recovery wells during 2018 using high pressure jetting and vacuum technique developed with National Vacuum, Inc. during 2012-2013. This technique allows for safer removal of the sediments, improved pressure control, and allows larger quantities of water to be withdrawn at a high pumping rate (i.e. over-pumping). The spring well rehabilitation occurred April 16 through 19 and the fall event occurred September 20 through 24. Both events had a typical modest removal of sediments and maintenance of flow rate. The flow at RW-5 remains at an increased rate (approximately 3 – 6 gpm), when compared with the 2005 – 2015 average as the result of more thorough well cleaning in the Fall 2015, thereby demonstrating that the significant improvement on well yield has been maintained.

Well painting, labeling and protective casing repairs were performed in 2018 as part of continual site monitoring well maintenance. Six concrete pads around wells were replaced or repaired, 34 well casings were painted and/or re-labeled, one J-plug was replaced, and two locks were replaced.

3.0 HCS PERFORMANCE

3.1 Hydraulic Head Monitoring

Potentiometric surface maps based on water level elevations are the primary evidence of groundwater control. Supporting lines of evidence are well hydrographs and groundwater chemistry changes. Sections 3.1 and 3.2 discuss the results of hydraulic head monitoring and the associated potentiometric maps and hydrographs. Section 3.3 discusses the groundwater chemistry.

Groundwater hydraulic head measurements are used to evaluate control of groundwater in the overburden and bedrock groundwater flow zones by the HCS at Necco Park. Monitoring and recovery well locations are shown in Figure 3-1. Depth-to-water measurements and measuring point elevation data are used to calculate the elevation of groundwater and to generate hydrographs that show groundwater elevation trends in individual monitoring wells (Table 3-1). Hydrographs and potentiometric surface-contour maps included in this report (Figures 3-8 and 3-10 through 3-14) were selected from maps prepared and presented in the 2018 Quarterly Data Packages.

3.2 Hydraulic Control Assessment

Assessment of hydraulic control is described for each relevant bedrock zone in the following sections.

3.2.1 A-Zone

The overburden materials comprising the A-Zone are generally characterized by high clay content and low hydraulic conductivity. Groundwater flow in the A-Zone is primarily downward to the more transmissive fractured bedrock, as expected in this low permeability formation.

The hydrographs in Figure 3-2 demonstrate the long-term drawdown from groundwater extraction in context of the seasonal variability. Decreases in water elevations from pre-startup are due to the combined effect of the impermeable landfill cap and continuous downgradient groundwater extraction from the recovery wells. The decreasing hydrographs represent long-term drawdown in an unconfined low-permeability unit and storage depletion. The water content of the unit continued to decrease by reductions in infiltration from the cap and groundwater recovery in the underlining water bearing unit (B Zone). While there are fluctuations in the hydrographs, the overall trend is a clear decrease in the water elevations compared to pre-startup. In a few cases, there is an increasing trend from the originally large drawdown observed; however, these remain well below static conditions (approximately 2 -3 feet).

Figures 3-8 and 3-9 present A-Zone potentiometric surface contours and vertical gradient maps. The potentiometric map demonstrated that the groundwater flow was toward the capture systems. The cones of depression surrounding recovery wells RW-5 and RW-11 are significant, ranging from 3 to 4 feet of closed contours in the A-Zone (Figure 3-8). The 2018 water levels in the area of RW-11 suggest the well rehabilitations have helped sustain a large cone of depression around this location in the A-Zone.

Vertical gradients were downward (negative) between the A/B-Zones as presented in Table 3-2 (2018 average gradients) and shown in Figure 3-9 (December 7, 2018 gradients). These gradients demonstrate that the predominant flow potential is downward; therefore, the horizontal flow (i.e. to the south) is insignificant.

3.2.2 B and C Bedrock Water-Bearing Zones

Groundwater flow directions in the B-Zone and C-Zone were consistent throughout 2018 (Figure 3-10). Hydraulic controls in the B-Zone and C-Zone were maintained throughout 2018, which is attributable to high recovery well up time and well pumping rates. Additionally, long-term monitoring demonstrates the continuation of capture zone improvements in the area of RW-11. The improvements were the result of installation and maintenance of the BFBT and the hybrid recovery well RW-11. Increases in yield at RW-5 during the Fall of 2015 have been maintained as well as the increased capture zone.

B-Zone

Groundwater elevation hydrographs, along with potentiometric surface contour maps, illustrate the hydraulic effects of the HCS in the B-Zone. RW-4, RW-5 and RW-11 have induced inward (toward the recovery wells) hydraulic gradients over a large area (Figures 3-3 and 3-10), capturing site groundwater in the source area. Figure 3-3 is a plot of well hydrographs from B-Zone wells in the area near and surrounding RW-11. This plot demonstrates the improved effectiveness of capturing groundwater from installation of the BFBT and RW-11.

Primary evidence of groundwater control is observed in the potentiometric contour map provided in Figure 3-10. The contour map demonstrates large cones of depression established for each of the recovery wells. As mentioned in the well rehabilitation section above, the Fall 2015 rehabilitation at RW-5 created significant improvements in flow and mass removal.

C-Zone

Groundwater elevation hydrographs and potentiometric surface-contour maps illustrate the hydraulic effects of the HCS in the C-Zone (Figures 3-4 and 3-11). The C-Zone influence attributed to RW-4, RW-5, and RW-11 extends north to wells 115C, 123C, and 159C, and west to 136C. The southern extent of influence extends to well 137C and is obscured by the CECOS Landfills between the recovery wells and monitoring wells 150C, 160C and 168C. Beginning in 2008, hydraulic control in the C-Zone was improved significantly with the rehabilitation of RW-5 and the start-up of RW-11. The annual rehabilitations of these recovery wells is a preventative action taken prior to well loss; therefore, the effect is relatively small in the short-term scale of one year.

After the Fall 2015 rehabilitation at RW-5, significant improvements in flow and mass removal were observed including with a wider cone of depression in the C-zone. This resulted in a less pronounced depression immediately surrounding RW-5 in the C-zone maps (compared with previous years) because of an improved connection to the aquifer (Figure 3-11). However, connectivity analysis conducted in 2016 (Parsons, 2016) demonstrated that a set point ranging from 563 to 565 in RW-5 resulted in drawdown of greater than 5 feet in the recovery well. Similarly, at 162C (approximately 70 feet east of RW-5) greater than 4 feet of drawdown was observed. This verified the large drawdown in the C-Zone as noted in the past reports.

3.2.3 D, E, and F Bedrock Water-Bearing Zones

Groundwater elevation hydrographs and potentiometric surface-contour maps illustrate the effectiveness of the HCS in maintaining hydraulic control in the D-, E-, and F-Zones (Figures 3-5 through 3-7 and 3-12 through 3-14). The hydrographs clearly indicate the

initial and sustained drawdown of groundwater elevation in the recovery wells and the surrounding monitoring wells. Potentiometric maps demonstrate the consistent cone of depression and that associated hydraulic gradients were toward the recovery wells throughout 2018, indicating the HCS is effectively controlling groundwater migration. This is further demonstrated in the spatial relationship of the source area depiction and the flow patterns depicted in Figures 3-12 through 3-14.

3.3 Groundwater Chemistry Monitoring

3.3.1 Background

Extensive monitoring has been conducted at Necco Park dating back to the early 1980s. Monitoring includes (but is not limited to) pre-design investigations, remedial investigations, geologic investigation, analysis of remedial alternatives, and source area investigations. Groundwater monitoring continues to meet the following objectives as defined in the SOW:

- Monitor reductions in aqueous chemistry in zone-specific source area wells as a consequence of the hydraulic control from recovery well pumping;
- Monitor the far-field groundwater chemistry to determine if the recovery system is controlling off-site migration of chemical constituents associated with the Necco Park site;
- Monitor for the presence of DNAPL;
- Monitor natural attenuation and intrinsic bioremediation in the source area and far-field; and
- Continue to evaluate the overall effectiveness of the remedial action.

The first annual status report following completion of hydraulic control elements of the Necco Park remedy (2005 Annual Report) included an extensive discussion of the first monitoring results and how these results compared to source area criteria introduced in the 1995 Analysis of Alternatives (AOA) report (DuPont Environmental Remediation Services 1995). This 2018 report provides an update of groundwater chemistry trends in relation to the long-term remedy for groundwater as well as an update of data relevant to the Source Area Criteria. The Source Area Criteria are provided in Table 3-3, with the 2018 results and comparison to criteria provided in Tables 3-4 and 3-5.

Monitoring completed in 2018 represents the fourteenth year of LTGMP performance monitoring and the eleventh year of annual-only sampling. In accordance with the Long-Term Groundwater Monitoring Plan (LTGMP) (DuPont CRG 2005a), chemical monitoring was conducted on a semi-annual basis during the first three years of system operation. Sampling has been annual since the beginning of the fourth year of system operation, with modifications to the number of wells sampled. In 2010, DuPont proposed to reduce the number of wells monitored annually based on existing data showing either very low concentrations or concentrations decreasing over time. USEPA agreed to the changes in a letter dated July 16, 2010, but required that the full list of wells be sampled on a three- or five-year schedule to monitor source area groundwater chemistry trends. The full list of wells was last sampled during the 2013 annual sampling event, and the full well list was again sampled in 2018. The full well list is scheduled to be sampled next in 2023. The list of wells used for long-term monitoring is included in Table 3-6. Figure 3-1 provides a well location map.

3.3.2 Sample Collection and Analysis

The annual sampling event was completed between October 9 and December 26, 2018. TestAmerica of Amherst, New York, completed sampling with oversight by Parsons for Chemours. Samples and associated quality assurance/quality control (QA/QC) samples were analyzed by TestAmerica Laboratories located in North Canton, Ohio.

As described in the Necco Park SAMP, groundwater sampling was conducted using USEPA low-flow sampling methodology and air-driven bladder pumps equipped with disposable Teflon© bladders. The pumps were fitted with dedicated Teflon©-lined high-density polyethylene (HDPE) tubing.

Samples were collected at 54 monitoring well locations during the 2018 annual event. The well locations are listed in Table 3-6. Analytical indicator parameters are listed in Table 3-7. Analytical results for the sampling event conducted in 2018 are provided as Appendix A. For reporting purposes, the results are discussed as total VOCs (TVOCs). This is consistent with historic reporting where TVOCs are indicator compounds used to assess groundwater contamination and trends over time. Results for the respective flow zones are discussed below.

3.3.3 Source Areas Delineation

The 2018 groundwater sampling results have been compared to the same historically employed criterion to evaluate source area limits. Consistent with the AOA, any location where DNAPL was observed at least once was included in the source area. Groundwater chemistry data for the 2018 sampling event was also compared to solubility criteria to evaluate source area extent. Consistent with previous assessments, these included effective solubility for a given compound and one percent of a given compound's pure-phase solubility.

Calculated solubility criteria for DNAPL compounds evaluated during this study are presented in Table 3-3. A comparison of 2005 through 2018 data to the effective solubility and one percent of pure-phase solubility criteria are provided in Tables 3-4 and 3-5, respectively. Refinement of the monitoring program reduced the number of well comparisons from 2010 through 2012 in Table 3-4.

A discussion of the source area results by flow zone is provided below. It should be noted that some of the wells which are within the source area are sampled in the 5 year cycle and are not sampled annually.

A-Zone

The A-Zone source area has been defined as the Necco Park property and a limited area south of the property line. The A-Zone source limits have not changed from those provided with the 100% design submittal. The 2018 sample results indicate no exceedance of the solubility criteria. There has been only one exceedance of the solubility criteria since long term monitoring began: the 2005 first round results for well D-11 reported HCBD above the one percent solubility criteria.

Semi-annual DNAPL observations conducted at A-Zone well location 131A in 2018 indicated that no DNAPL was present. The most recent DNAPL observation at an A-Zone well was at well 131A in May 2006. This well is located on the landfill.

Groundwater flow in the A-Zone is predominantly downward to the B-Zone. Therefore, hydraulic control of the upper bedrock groundwater flow will capture flow from the A-

Zone. As discussed in Section 3.3, the installation of the BFBT and recovery well RW-11 (November 2008) enhanced the degree of A-Zone hydraulic control. Based on the results of the 2018 source area criteria and DNAPL monitoring, the system is effective in controlling the A-Zone source area.

B/C-Zone

The B/C-Zone source limits have not changed from those provided with the 100% design submittal. The results indicated no exceedances of the effective solubility criteria. However, the refined sampling program reduced the frequency of some of the wells that typically exceed the criteria. One B well (171B) that did exceed the criteria in the past, was part of the sampling program in 2018. This well did not exceed the effective solubility criteria in 2018. One C-Zone well (136C) exceeded the solubility criteria for tetrachloroethene (PCE) in 2013 and was sampled again in 2018 under the five-year schedule but was below the criteria in 2018.

Two wells in the B/C-Zone exceeded the more conservative one percent criteria in 2018 (172B). At 172B hexachlorobutadiene (HCBD) concentration was 63 µg/L which is above the 20 µg/L criteria. Exceedances of the one percent solubility criteria at well location 172B for HCBD represent the spatial limit of the B-Zone source area. As discussed in Section 3.5, TVOC concentrations have significantly decreased since 2002 at location 172B. While well 136B had exceeded the one percent solubility criteria from 2012 to 2014, the concentrations in 2015 through 2018 were below the criteria. Historic exceedance of the one percent solubility criteria at well location 136B for PCE represents the western edge of the limit of the B-Zone source area. TVOC concentrations have been steadily declined to below 1,000 micrograms per liter (µg/l) from near 3,000 µg/l in 2012. Well 136C exceeded the one percent criteria for PCE (1,500 µg/l) with a result of 4,000 µg/l in 2018. This location has typically exceeded the one percent criteria in the past for PCE.

The frequency of observed DNAPL in B/C-Zone wells has decreased over the course of the monitoring program. In 2018, no measurable DNAPL was observed during monthly or semi-annual DNAPL monitoring.

Results of the source area criteria analysis and DNAPL monitoring suggests that operation of recovery wells RW-4, RW-5, and RW-11 has achieved and maintained control of the B/C-Zone.

D/E/F-Zone

Three of the 22 wells sampled in 2018 exceeded the effective solubility criteria in the D/E/F wells. Well 105D exceeded the criteria for carbon tetrachloride (40,000 µg/l) at 45,000 µg/l. Well 137D exceeded the criteria for TCE (44,000 µg/l) at 65,000 µg/l. Well 139D exceeded the 0.22 µg/l criteria for hexachlorobenzene at an estimated 0.22 µg/l). Wells 105D, 137D, and 139D are within the limits of the landfill. Four of the 22 wells exceeded the more conservative one percent pure-phase criteria. Well 105D exceeded the criteria for TCE (11,000 µg/l) at 33,000 µg/l, PCE (1,500) at 4,200, and carbon tetrachloride (8,000 µg/l) at 45,000. Well 137D exceeded criteria for TCE at 65,000 µg/l and PCE at 4,400 µg/l. Well 139D exceeded the criteria for hexachlorobenzene (0.11 µg/l) at an estimated 5.2 and HCBD was estimated at 150 µg/l in 2018 at 165E. 165E is within the limit of the D/E/F-Zone source area and had exceeded the one percent pure-phase criteria (20 µg/l) since 2007, except for 2016.

Source zone criteria comparison analysis conducted during 2018 confirms that the operation of recovery wells RW-8 and RW-9 has achieved and maintained source control of the D/E/F-Zone.

3.4 Groundwater Chemistry Results and Trends

An analysis of 2018 chemistry results and trends has been completed to assess the effectiveness of the HCS and previous groundwater pumping system in reducing organic compound concentrations in groundwater. TVOC concentrations versus time plots for A-Zone overburden and B- through F-Zone bedrock monitoring wells are presented in Appendix B.

In general, operation of the HCS and the previous groundwater recovery system, combined with the presence of the landfill cap and Subsurface Formation Repair (SFR), have contributed to an overall trend of declining TVOC concentrations in the A-Zone overburden and bedrock fractures zones. More recently, TVOC concentration decreases at several near source area and far-field wells are significant and coincide strongly with the onset of HCS operations in April 2005, thereby demonstrating the effectiveness of containments and remediation of site groundwater. Natural attenuation processes are also contributing to the reduction in chemical mass in the bedrock fracture zones.

A-Zone Overburden

Results from the seven LTGMP A-Zone wells indicate TVOC concentrations are all 2 μg/l or less, except for wells D-11 and 137A. Sampling results for well 137A (104.55 μg/l) represents the location of the highest reported A-Zone TVOCs. Well D-11 was near this upper range at 93.4 μg/l, while other locations well locations were significantly lower: D-9 (0.8 μg/L), D-13 (1.31 μg/L), 145A (2 μg/L), 146AR (1.57 μg/L), and 150A (0.34 μg/L). The result of 1.31 μg/L TVOCs at well D-13 is the lowest result observed at this location. The 2018 results are consistent with historical results in that they show no significant off-site horizontal chemical migration in the overburden.

Three of the four annual wells used to monitor the A-Zone (145A, 146AR, and 150A) exhibit near consistently low (<5 μg/l) TVOC concentrations with no true discernable trend. These three wells have been less than 5 μg/l since 2007 or earlier.

Closer to the landfill, well 137A has shown the greatest decline of the A-Zone wells with concentrations ranging close to 1,200 μg/l in 2005 to as low as 100.2 μg/l in 2009. A downward trend between 2005 and 2013 is evident at 137A, and suggests groundwater extraction in the RW-10/RW-11 area has effectively controlled offsite groundwater flow in this location.

The three wells near the southern edge of the landfill sampled in 2018 (D-9, D-11, and D-13) were all last sampled in 2013. Well D-9 has shown three orders of magnitude in decline from the year 2000 results and has been below 4 μg/L TVOC since 2005. Well D-11 has been below a high value of 750 μg/L TVOC (in 2006) and the analytical results do not indicate either an increasing or decreasing trend over time. Well D-13 has been below a high value of 45 μg/L TVOC (in 2005) and appears to indicate a decreasing trend since 2005 even as the 2013 TVOC results were slightly greater than the previous few years that the well was sampled. In 2018, D-13 decreased from the elevated 2013 result and was the lowest observed at this location (1.31 μg/l). These 2018 results are

consistent with historical results in that they demonstrate an insignificant downgradient plume in the overburden.

B-Zone

Results from the fourteen LTGMP B-Zone wells indicate TVOC concentrations were consistent with previous years with decreases in TVOC over time, thereby demonstrating effective groundwater capture by the recovery wells (Appendix B). Results were generally below 2,000 μg/l; with two exceptions (111B and 168B), which are source area wells. TVOC concentrations at seven of the locations were below 50 μg/l. Six of the fourteen wells exhibit large decreases in TVOC over time, thereby demonstrating effective groundwater capture by the recovery wells.

Within the source area, well 111B has demonstrated an order of magnitude decline in TVOC concentrations from approximately 250,000 μg/l in 1996 to 14,934 μg/l in 2018. This well is located immediately north of the RW-11 and the BFBT.

Source area limit wells 171B and 172B show a continued overall TVOC declining trend. Well 171B has decreased 3 orders of magnitude since 2002 to 141.47 μg/l, while 172B has decreased two orders of magnitude to 1,917 μg/l during a similar timeframe. Additionally, the concentrations suggest that there is an active natural attenuation component to the VOCs, as biogenic degradation compounds including cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC) dominate TVOC results at these well locations. The trend towards increased degradation compounds coupled with an absence of source area constituents is evident at well location 171B based on the 2007 through 2018 VOC results. Additionally, well 145B, just outside the source area in the southeast corner, also provides evidence of hydraulic control as concentrations have decreased significantly. Concentrations were over 30,000 μg/l in 2006 and have decreased to 1,500 μg/l or lower for the last five years with the 2018 result of 3.12 μg/l being the lowest observed at this location. This represents a decrease of four orders of magnitude in the TVOC concentration at well 145B.

Far-field wells 146B and 150B also demonstrate the effectiveness of the groundwater control system. Concentrations have decreased by one order of magnitude at both wells since 2000. In 2018, the TVOC concentration at 146B was the lowest observed at this location at 24.69 μg/l.

Five B-Zone wells (136B, 137B, 139B, 151B, and 168B) have no apparent well-defined decreasing trend but remain within historical ranges. At locations 136B, which is at the southwestern edge of the source area, there is a slight overall declining trend in the data and a more robust declining trend in the data between 2012 and 2018. The 2018 result at 136B (899.4 μg/l) is the lowest since 2005. At well 168B (southern edge of the source area), the TVOC concentrations are within the 2000 through 2012 range, but appeared to be increasing between 2005 and 2012, then decreasing between 2012 and 2018. Due to the high concentrations, this trend may not be meaningful. Future monitoring results will indicate if these trends continue. At well 137B, along the southern source area boundary, there appears to be a slight overall decreasing trend in the data, with the early data to 2010 slightly unstable then from 2011 to 2018 the data is very stable with a strong decreasing trend during this time period. TVOC concentrations at 137B have ranged from 271.1 μg/l to 2,112 μg/l and were 310.4 μg/l in 2018, the lowest observed since 2009. TVOC concentrations at 139B have ranged from 1,323.7 μg/l in 2007 to 3.84 μg/l in 2018, the lowest TVOC concentration observed at 139B. Well 139B is in the source area and is west of pumping well RW-4. Well 151B is a farfield well and has had

concentrations of TVOC range from not detected to 8.4 μg/l. The 2018 TVOC concentration at 151B was 0.49 μg/l, the lowest since 2006.

Well 153B, a side gradient well, now on a five-year sampling schedule was below the analytical detection limits between 2005 and 2008, less than 2 μg/l in 2009 and 2013 and was below the analytical detection limits again in 2018. Well 149B, downgradient of the CECCOS secure landfill cells, now also on a five-year sampling schedule, has relatively low concentrations but an increasing trend was indicated between 2005 and 2013 with TVOC concentrations increasing from 16.2 μg/l in 2009 to 47.8 μg/l in 2013. In 2018 this trend was broken with TVOCs being below the analytical detection limits, the lowest result at this location.

C-Zone

Results from the ten C-Zone wells analyzed for long term trends indicate TVOC concentrations are consistent with previous long-term monitoring results and source area is controlled.

Well 105C is within the source area and directly upgradient of RW-11. This location had the highest concentrations of the C-Zone wells (as it typical) at 168,170 μg/l, during the 2018 sampling event. While TVOC concentrations had declined annually between 2005 and 2009, an uptick was observed in 2013, the concentrations returned to a lower level in 2018.

Wells 136C, 137C, 145C, and 168C are used to delineate the C-Zone source area limit. These wells had TVOC concentrations in 2018 between 3.27 μg/l and 4,870 μg/l. Well 136C does not have a defined TVOC trend and concentrations have ranged from 4,050 μg/l to 6,979 μg/l. At well 137C a decreasing trend from 2005 to 2018 is evident. TVOC concentrations have dropped an order of magnitude from over 65,000 μg/l in 2005 to 440 μg/l the lowest observed at this location in 2018. This is the second sampling event in a row that well 137C has had the lowest observed TVOC concentration. At 145C concentrations were lowest in the record for the sixth year in a row, and a decreasing trend has become evident. Since this is a source area well, it is expected to take an extended period for concentrations to decline. At downgradient well 168C, the concentration initially decreased after 2005 start-up but later increased to a 10,000 to 15,000 μg/l range. The concentrations have been slightly decreasing again since 2010. In 2018, a significant decline was observed to 216.9 μg/l, the lowest observed TVOC concentration at 168C to date.

Well 141C had TVOC concentrations between below the detection limits and 2 μg/l between 2005 and 2009 but jumped to 116.16 μg/l in 2013. In 2018, well 141C dropped significantly from the 2013 TVOC concentration but not to previous levels at 37.58 μg/l.

Wells 146C, 149C, 150C, and 151C are downgradient of the source area under ambient groundwater flow conditions, and therefore they are key locations to understand groundwater flow with respect to plume behavior. TVOC concentrations at 146C were over 20 μg/l prior to 2006; however, the concentrations decreased between 2006 and 2013 to below 15 μg/l. Concentrations between 2014 and 2018 increased to between 50 μg/l and 76 μg/l with the 2018 concentration of 50.9 μg/l near the bottom of this range. TVOC concentrations at well 149C show a seemingly increasing trend between 2005 and 2013; however, concentrations are low with TVOC concentrations in 2018 at 0.95 μg/l. At location 150C, concentrations had decreased by 95% since sampling began, from near 250 μg/l to below 15 μg/l in 2010 and 2012. However, the TVOC results for

2013 and 2014 show a marked increase to 463.3 μg/l and 2,352 μg/l. Since 2014, TVOC concentrations have decreased each year, with the concentration in 2018 the lowest observed to date (3.74 μg/l). Most of VOCs at 150C are attributed to DCE and VC. Well 151C showed the greatest TVOC declines between 2000 (11,150 μg/l) and 2005 (18.5 μg/l). Between 2006 and 2013 TVOC concentrations stabilized between 8 and 22 μg/l. In 2018, TVOCs were below the analytical detection limits, the lowest at 151C to date. Steep declines in 150C, 151C, and 146C are readily apparent in the 2005 through 2006 period. This suggests that the groundwater recovery system is capturing the source area plume and reducing downgradient concentrations.

D-Zone

Results from the eleven D-Zone wells indicate TVOC concentrations are generally low and/or declining over time at these monitoring locations.

Four of the eleven wells sampled were within the D-Zone source area: 105D, 137D, 139D, and 165D. While the plot of 105D appears to show an increasing TVOC trend, the concentrations in this source area range up to 1,218,560 μg/l therefore this trend in insignificant. Well 137D does not show a clear long-term trend but TVOC concentrations at this location have been unstable, ranging from below 5,000 μg/l to over 250,000 μg/l. Well 139D has shown a decrease in TVOC concentrations from 36,410 μg/l in 2000 to between 1,000 and 3,000 μg/l in 2006 through 2013. In 2018, TVOCs decreased further to 27.21 μg/l, three orders of magnitude decrease and the lowest observed at this location. Well 165D had TVOC concentrations of 12.03 μg/l in 2018, which have been declining since the peak of approximately 1,600 μg/l in May 2006.

TVOC concentrations at far-field wells (123D, 136D, 145D, 147D, 148D, 149D, and 156D) ranged from below detection limits (149D) to 1,436 μg/l (145D). At well 123D, just north of the D-Zone source area, TVOC concentrations significantly decreased from 427 μg/l to stabilize at less than 15 μg/l between 2005 and 2018. At wells 136D and 145D, the concentrations have continued to decline since the historical concentrations as high as approximately 3,000 μg/l. In 2018, the TVOC concentrations in wells 136D and 145D have decreases to 483.2 μg/l and 1,436.3 μg/l, respectively. At far field well 147D, TVOC concentrations have shown a steady decrease over time from 394 μg/l in 1996 to approximately 91.2 μg/l in 2018, the lowest observed at this location to date. This is the third sampling event in a row that the lowest TVOC concentrations have been observed at 147D. At far field well 148D, the concentrations remained low at approximately 4 μg/l and within the range of concentrations from 1996 to present. There is an upward trend in TVOC concentrations at 148D from 2000 to 2018, however, due to the low concentrations (< 5 μg/l) there is little meaning to the trend. At far field well location 149D, TVOC concentrations were below the analytical detection limits in 2018. TVOC concentrations at 149D have not exceeded 5 μg/l. At far field well 156D TVOC concentrations have shown a decrease from 6.9 μg/l in 2000 to below 2 μg/l since 2008.

Consistent with previous long-term monitoring results, biogenic degradation compounds including cis-DCE and VC dominate TVOC results for wells 123D,136D, 145D, 147D, 148D, 149D, 156D, and 165D (see Section 3.5 for more details on MNA). Furthermore monitoring has shown hydraulic control from the HCS extends beyond the D/E/F-Zone source area limits, and concentrations in D-Zone wells demonstrate that the HCS is effectively controlling groundwater flow as designed.

E-Zone

Results from the six E-Zone wells (136E, 146E, 150E, 156E, 165E) indicate TVOC concentrations were below 3,000 μg/l, with the exception of the two wells within the E-Zone source area (146E at 4,688 μg/l and 165E at 26,580 μg/l). All E-Zone groundwater monitoring locations are stable or on a declining trend. Degradation products including cis-DCE and VC dominate TVOC results for all the E-Zone wells. As discussed in Section 3.5, the presence of these degradation compounds is indicative of the occurrence of active natural attenuation processes.

Well 165E is a source area well and has shown an increasing TVOC trend between 2006 and 2011 however, the 2012 and 2013 TVOC results have possibly indicated the beginning of a declining trend. The TVOC concentrations are high (now typically between 25,180 and 26,580 μg/l, 2017 and 2018), therefore the significance of any potential trend is difficult to identify. This well is located within the source area and less than 100 feet up-/side-gradient to RW-9. It is likely that the effectiveness of capture on the E-Zone at RW-5 is related to the increasing concentrations, as expected in this type of capture scenario.

TVOC results for well 146E located, at the edge of the source area limits, have been trending lower, with concentrations typically over 10,000 μg/l prior to 2009 and between 3,500 and 6,300 μg/l between 2009 and 2014. In 2015 the TVOC concentration at 146E increased to 11,566 μg/l from 3,531 μg/l in 2014. 2016 TVOC concentrations increased again to 14,169 μg/l. The 2018 TVOC result of 4,688 μg/l is lower than the previous three years and in the range of the TVOC concentrations observed between 2009 and 2014 at well 146E. Even with the TVOC increases observed the in the 2015 and 2016 sampling events, the overall trend for TVOCs continues to be declining. Well 150E also located near, but outside, the source area limits has maintained initial decreases observed in 1996, with concentrations ranging from 6,590 μg/l (1996) to 388 μg/l (2015) and typically between 500 and 1,500 μg/l in recent years.

At 136E, which is outside the source area but only 200 feet (approximately) west of RW-8 there was a spike in concentrations to 8,110 μg/l in 1998, but since then the concentration have declined to as low as 27.29 μg/l (2008), with the 2018 TVOC result of 96.81 μg/l.

Well 145E is in the far field to the southeast of the site and has shown declining TVOC concentrations. The 2018 TVOC analytical result (167.7 μg/l) is the lowest observed at 145E. Well 156E is also in the far field, to the northwest of the site and TVOC concentrations here have shown a decline over time. The 2018 TVOC result at this location was 0.49 μg/l. TVOC concentrations here have been as high as 14 μg/l in 2000.

Groundwater concentrations in E-Zone wells demonstrate that the HCS is effectively controlling groundwater flow as designed.

F-Zone

Results from the five F-Zone wells indicate TVOC concentrations ranged from 0.91 μg/L to 8,459 μg/l, and all five locations showed decreasing trends. Three of the five wells (136F, 147F, and 150F) showed the lowest TVOC concentration in 2018 for their location. Wells 136F and 150F had showed the lowest TVOC concentration in five of the

last six years. Similar to the results from the E-Zone wells TVOC, results for all the F-Zone wells are mostly dominated by biogenic degradation compounds cis-DCE and VC.

In 2018 TVOC concentrations at well 146F, at the edge of the F-Zone source area have decreased from a high of 36,700 μg/l in 2000 to 8,459 μg/l in 2018. TVOC concentrations at near source well 136F have also steadily declined since HCS startup from 8,348 μg/l (2005) to 5.93 μg/l (2018), the lowest observed TVOC concentration at 136F to date. TVOC concentrations at location 150F have shown a steady trend lower since 1998, with concentrations decreasing from initially over 4,500 μg/l to 254.6 μg/l in 2018, the lowest observed TVOC concentration at this location to date.

Far field wells 147F and 156F continued a decreasing trend of TVOC concentrations in 2018. TVOC concentrations at 147F have been below 10 μg/l since 2005, down from TVOC concentrations in the thousands in 1996 and 1997. In 2018, the TVOC concentration at 147F was the lowest observed at this location to date at 0.91 μg/l (an average of the sample and duplicate, 0.97 μg/l and 0.86 μg/l). TVOC concentrations at 156F have decreased from in the thousands μg/l (in 2000 and prior), to the hundreds between 2005 and 2006, and have been less than 100 μg/l since 2006. TVOC concentrations at 156F have been below 20 μg/l since 2009 and the 2018 result of 11.7 μg/l is the lowest since June 2005.

TVOC concentrations have apparently decreased at these F-Zone locations in response to the startup of the HCS, which indicates that the HCS is effectively controlling groundwater flow as designed.

G-Zone

Results for wells 147G1, 147G2, and 147G3 indicate an overall trend of declining TVOC since 2005. Biodegradation daughter compounds dominate TVOCs reported at these locations. A short-term increase at these locations in 2005 was followed by declining TVOC concentrations from 2006 through 2018. In 2018, well 147G2 had the lowest TVOC concentration to date at this location for the second year in a row and 147G1 had the lowest since 2005.

3.5 Monitored Natural Attenuation (MNA) Assessment

This section focuses on natural attenuation of chlorinated solvents ethenes via anaerobic biodegradation in groundwater at the Necco Park Site. Primary constituents of concern are tetrachloroethene (PCE) and trichloroethene (TCE). Degradation products, including three isomers of dichloroethene (DCE) – cis-DCE, trans-DCE, and 1,1-DCE – and VC are also present in the groundwater.

Necco Park was one of the first sites in the country studied to identify active anaerobic dechlorination to ethene, in fact the USEPA scoring techniques used in this analysis (1998) references the study completed at Necco (Lee et al, 1993). As such, monitored natural attenuation is an effective remedy in the source area and the far field, as this report and previous annual reports demonstrate.

3.5.1 MNA Background

One of the requirements of the Record of Decision (ROD) for the Necco Park Source Area Operable Unit was to further characterize groundwater in the far-field area. As defined in the ROD, the far-field is the area outside the source area where chemical constituents generally attributable to the Necco Park site have been found to have

contaminated groundwater. The annual reports from 2005 through 2018 confirmed that concentrations of the target constituents (PCE, TCE and reduced byproducts) decrease as groundwater flows south and west away from the Necco Park site. Additionally, in many wells, historic TVOC results showed significant reduction in target constituents over time. These results are consistent with a published reference showing active anaerobic microbial degradation transforming PCE and TCE to cis-DCE, VC and ultimately ethene in all zones (Lee et al, 1993).

The first MNA assessment as part of the routine monitoring program for this site is contained in the 2005 Annual Report. The 2005 report presented data on the concentrations of chlorinated solvents in the groundwater and DNA results indicating the presence of a microbial population competent for degrading chlorinated ethenes. The three recognized lines of evidence for monitored natural attenuation of contaminants are as follows (USEPA, 1999):

- Reduction of contaminant concentrations over time or distance,
- Geochemical data that demonstrate conditions favorable for contaminant destruction, and
- Microbiological data from field or microcosm studies that directly demonstrate the occurrence of a natural attenuation process and its ability to degrade contaminants of concern.

Based on past and present sampling results, all three of these lines of evidence are observable at Necco Park. With regard to chlorinated degradation, additional evidence is found in the creation of degradation products DCE, VC, ethene and ethane (USEPA, 1998), which is considered part of the first line of evidence (i.e. reduction of concentrations). Elevated presence of *Dehalococcoides sp*. was identified in each zone, including far field locations in 2005-2008 indicating that the key microbes for complete degradation of chlorinated ethenes are present at elevated population levels. Without change to geochemical conditions it is expected these populations remain active.

Details of the Necco Park MNA monitoring program are presented in the *Long Term Groundwater Monitoring Plan* (CRG, 2005b). The MNA monitoring wells were sampled for a full suite of MNA parameters in 2000 and from the period of 2006 through 2009, 2013, and again in 2018. The documentation of MNA has been provided in the previous Annual Reports for the accompanying MNA data set. The following sections provide a full discussion of MNA in the B/C-Zone and the D/E/F-Zone. Appendix C provides the time series molar concentrations for tracking trends, and Appendix A provides the 2018 groundwater sampling results which help support the analysis.

3.5.2 B/C Zone Results

The results of the MNA monitoring program for the 13 B/C-Zone wells are shown in the figures in Appendix C. For each of the B/C-Zone wells, the data from the sampling events are plotted as a function of time so that concentration trends are apparent. Concentrations are plotted in millimoles (molar equivalents) so that the relationships between parent compounds and daughter compounds (degradation products) are comparable on a molar basis. Observations of data trends, along with select data from the most recent sampling event in parts per billion (ppb), are posted on the left side of

the figures. The wells listed in each of these tables are arranged in the order of Upgradient, Source Area then Downgradient/Side-gradient. They are discussed below in that order. Following these line of evidence presented above, each area of the site is evaluated. In cases where the concentrations are low (near or below MCLs) then the discussion is simplified.

Upgradient B/C-Zone Wells

Upgradient B/C-Zone wells, 141B and 141C exhibited very low to moderate concentrations of CVOCs in 2018. The concentrations were at very low levels at 141B, with total CVOCs of 1.1 µg/L in 2018, and were slightly higher at 141C with total CVOCs of 37.6 µg/L. In 2018, minor ethene/ethane concentrations were observed at 141B (38 µg/L) and 141C (58 µg/L) compared to typically lower concentrations near the detection limit.

Source Area B/C-Zone Wells

As part of the analysis, wells 111B, 137B, 139B, and 137C are analyzed for MNA parameters and represent source area conditions. Well 105C was not sampled in 2018 as the well was dry and is not included in the MNA analysis.

Primary Evidence – Degradation Compounds

All source area wells demonstrated declining chlorinated ethene levels from 2000 to 2018. In the source area B/C-Zone wells, total chlorinated ethene levels decreased on average by about 75%. In well 111B, the predominant chlorinated ethene species are the daughter products cis-DCE and VC. All wells, with the exception of 139B, exhibited moderate or good production in the ultimate daughter products, ethene / ethane.

Secondary Evidence – Geochemical Conditions

Geochemical conditions conducive to reductive dechlorination support the primary evidence that natural attenuation is active in the Source Area. All of the wells in the B/C zone have a deeply negative ORP values (all less than -176) indicating strongly anaerobic conditions. Dissolved oxygen, nitrate and sulfate are reduced demonstrating that the biological processes of iron, sulfate reduction and methanogenesis (both processes occurring under low redox conditions) are active. Concentrations of methane in most of the source wells are elevated indicating deeply anaerobic conditions in the source area. PH is generally between 6 and 9 which is conducive to biological degradation, with the exception of 137B and 137C, where pH was 9.03 and 9.25, respectively. However, these concentrations are anomalous in historical context. Furthermore, total VOC concentrations are low (306 µg/L for 137B and 404 µg/L for 137C) relative to source area concentrations.

Downgradient / Side-gradient B/C-Zone Wells

Primary Evidence – Degradation Compounds

There are five downgradient wells (145B, 145C, 149C, 151B, and 151C) and one side-gradient well (153B) in the B/C zone. The side-gradient well (153B) has had consistently very low levels of chlorinated ethenes (<0.26 and less for each chlorinated parameter), and therefore is not discussed herein. Figures in Appendix C provide the time series plots and 2018 concentrations.

At far-field well 145B concentrations have readily decreased from the 2006-2007 period after system start up. Total CVOCs decreased from 1429 µg/L in 2013 to 3.1 µg/L in 2018. The dominate species of CVOCs are cis-DCE and VC, indicating strong biodegradation. Since 2006, the concentration of cis-DCE, in particular, has decreased such that cis-DCE concentrations are similar in molar equivalent as VC. Ethene and ethane production has decreased significantly since 2013: ethene and ethane were 77 µg/L in 2013 and 1.7 µg/L in 2018. In the past the concentrations were as high as approximately 3,000 µg/L. The previously high values of ethene and ethane followed by the large decrease in CVOC concentrations further support strong anaerobic biodegradation.

At 145C concentrations have decreased over time and the predominant species are degradation products (cis-DCE and VC) indicating degradation of CVOCs. Concentrations of ethene / ethane following a similar decreasing trend as cis-DCE and VC indicate the decrease in CVOCs concentrations produced lower ethene / ethane.

At location 149C all CVOCS in 2018 were low (below the USEPA MCL). The concentrations of ethene / ethane decreased from 2013 (32.4 µg/L) to 2018 (3 µg/L). In conjunction with decreasing CVOCs indicate that bioremediation has occurred.

Two of the downgradient wells (151B and 151C) and the side gradient well (153B), exhibited very low levels of chlorinated ethenes during the 2018 sampling. These wells are characterized mainly by reductive dechlorination daughter products cis-DCE and VC all of which were 0.256 ug/L and below.

Secondary Evidence – Geochemical Conditions

All B/C zone wells had strongly negative ORP levels (with the exception of 145B and 151B), elevated DO, depleted nitrate and reduced sulfate. Methane concentrations have decreased from 2013 to an average of 87.5 µg/L) in 2018. Average TOC for these wells was 2.5 mg/L indicating a decreasing carbon source supporting the microbiology. Additionally, the pH of all B/C zone wells were between 6 and 9. These conditions are indicative of environments which have undergone natural attenuation through sequential dechlorination.

Downgradient and Side-gradient Percent reductions

In order to demonstrate the effectiveness of MNA in the downgradient and side gradient area, percent reductions were calculated for the three of the 5 B/C-Zone downgradient and side gradient MNA wells. Two wells (151B and 149C) were omitted due to the low concentrations. Table 3-9 provides the results of percent reduction from 2000-2005 molar TVOC average to 2018 molar TVOC average in downgradient and side-gradient wells. The reductions in moles ranged from 91.4% to 99.9%, with an average of 97% in this approximate 13 year span. At location 151C concentrations have significantly decreased to non-detection. These reductions indicate that the far-field B/C plume is retracting and degrading due to the source area control and the strong monitored natural attenuations capacity of the groundwater system.

3.5.3 D/E/F-Zone Results

The results of the MNA monitoring program in all of the D/E/F-Zone wells are shown in the figures in Appendix C and discussed below.

Source Area D/E/F-Zone Wells

Primary Evidence – Degradation Compounds

There are three source area wells (137D, 139D, and 165D) in the D/E/F zone that are part of the MNA analysis. At each location there is indication that the MNA is active in the D/E/F source area.

At source area location 137D there was an increase in CVOC concentrations from 2013-2018. The total CVOC concentration in 2018 is comparable to historical CVOC concentrations at this location. Ethene / ethane concentrations were 401 µg/L indicating active natural attenuation and completion of the biological degradation pathway.

At source area location 139D concentrations remained significantly lower than the 2000 – 2005 period before recovery wells RW-8 and RW-9 were activated. The primary compounds are PCE (4.5 µg/L in 2018), TCE (2.4 µg/L in 2018), and cDCE (16 µg/L in 2018) which is indicative of the source area groundwater. There was moderate ethene / ethane production with concentrations at 13.4 µg/L in 2018, indicating active natural attenuation and completion of the degradation pathway.

At source area location 165D, which is near the source area boundary, concentrations continued a steep decreased from 2005 when the recovery wells RW-8 and RW-9 were activated. At this well, which is considered a source area well due to previously high concentrations, the CVOCs have decreased to 12.03 µg/L and lower. The primary compounds are VC and cis-DCE indicating source area is no longer in this area and biodegradation is strong. Ethene / ethane concentrations were 166 µg/L which is relatively significant when compared to the low concentrations of the CVOCs (12.03 µg/L and less). This indicated that along the source area boundary, where CVOCs were once migrating downgradient creating the plume, the groundwater recovery system has re-direct the groundwater flow across the source area boundary toward the recovery well. This provides evidence that source control is a clear way to further improve downgradient groundwater and enhance MNA recovery.

Secondary evidence

With some exceptions, all D/E/F source area MNA wells had strongly negative ORP levels, low DO, and low nitrate. ORP ranged from -96 to -428 with an average of -251 mV and DO was below 0.8 mg/L in each location, with the exception of 137D (11.3 mg/L DO in 2018) The pH of all D/E/F source area wells was between 7 and 8 in 2018. These conditions are indicative of conditions favorable to natural attenuation through sequential dechlorination.

Downgradient D/E/F-Zone Wells

Primary Evidence – Degradation Compounds

There are eleven downgradient and side-gradient wells (136D, 147D, 148D, 149D, 156D, 136E, 145E, 146E, 156E, 146F, and 150F) included in the MNA analysis. Overall the decreasing concentrations, conversions from primary to degradation products, ethene production and geochemical conditions demonstrates that MNA is readily occurring in the far-field and side gradient areas. Figures in Appendix C provide the time series plots and 2018 concentrations.

At well 136D, which is downgradient but directly adjacent to the source area, the concentrations are primarily cis-DCE and VC and all CVOCs have decreased since the 2000-2006 period prior to source area control. The molar concentrations ratio of cis-DCE to vinyl chloride have inverted indicating that cis-DCE is degrading to VC. Furthermore, there has historically been a strong ethene / ethane component with moles of ethene and ethane exceeding TVOCs for most of 2007 – 2009, and near equivalent

ethene / ethane with total CVOCs in 2013. Ethene/ethane concentrations have decreased in 2018 (2.6 µg/L in 2018), indicating a slower rate of degradation. Of importance, primary compounds (PCE and TCE) have decreased by over 2 orders of magnitude from 2000 – 2018.

At well 147D, located in the far-field, concentrations of PCE and TCE are depleted to below detection limits. Concentrations in total moles of CVOCs are decreasing over time and there is a clear inversion of moles of cis-DCE and VC. Cis-DCE concentrations have decreased to below the USEPA MCL of 70 µg/L, and VC increased and then decreased to 39 µg/L in 2013.

At well 148D, also located in the far-field, concentrations of CVOCs have remained steady at 4.4 µg/L, and all concentrations are below the USEPA MCLs. Ethene / ethane concentrations are relatively high 54.5 µg/L compared with the very low concentrations of CVOCs. This indicates that there is a strong natural attenuation activity upgradient and the biological degradation processes are preventing CVOCs from reaching this well.

At well 149D, located side gradient from the source area, the CVOC concentrations are all below the USEPA MCLs and concentrations of ethene/ethane are below detection limits.

At well 156D, located downgradient and away from the site, CVOC concentrations have been low through the monitoring period (Total CVOCs approximately 6 µg/L in 2000), however there has been an observable decreasing trend. In 2018 the trend continued and total CVOCs were 0.59 µg/L.

At well 136E, located near the source area boundary, concentrations have decreased since 2005 from approximately 91 µg/L to 33 µg/L. Throughout the sampling period 2000 to 2018 there has been a strong ethene / ethane signal with concentrations ranging from 146.9 to 1,113 µg/L. This indicates a strong source of CVOCs is degrading from nearby creating the ethene and ethane (either upgradient or from diffusing from bedrock).

At well 145E, located side gradient, concentrations of total CVOCs have steadily decreased throughout the monitoring period. TCE has decreased to below detection limit of 0.2 µg/L, and degradation products are the main component. Since 2000 there has been a clear inversion on moles of cis-DCE and VC, without VC accumulation, indicating strong biological degradation. Ethene concentrations have exceeded the molar equivalent of CVOCs providing strong indication of degradation pathway completion.

At well 146E, downgradient but near the source area, concentrations of total CVOCs have decreased over the monitoring period, furthermore TCE has significantly decreased, and cis-DCE has decreased to below VC molar concentrations. Ethene concentrations have exceeded the molar equivalent of CVOCs providing strong indication of degradation pathway completion.

At well 156E located in the far-field concentrations have decreased by more than an order of magnitude since 2000 to less than 0.5 µg/L.

At well 146F, downgradient but near the source area, concentrations have steadily decreased during the monitoring period. TCE has decreased by more than an order of magnitude and concentrations of cis-DCE and VC have been historically inverting, which provide a clear indication that MNA is an active process.

At well 150F, located side gradient, there has been a steady decrease in Total CVOCs (from approximately 3,390 µg/L to 255 µg/L) during the monitoring period. There has also been a clear inversion of cis-DCE to VC molar ratio, without VC accumulation, all of which indicates a strong biological degradation. Ethene / ethane production (up to 470 µg/L), including moles of ethene/ethane exceeding TVOCs in 2018, provide evidence that the degradation pathway is complete.

Secondary evidence

With few exceptions, all D/E/F downgradient and side gradient MNA wells had strongly negative ORP levels, depleted DO, and depleted nitrate. ORP ranged from +20 in 136D to -447 mV in 146E, with an average of approximately of -166 mV. DO concentrations ranged from 0.4 mg/L in 149D to 12.9 mg/L at 136D, and nitrate was < 1 mg/L. PH ranged from 6.05 to 7.94. These conditions are indicative of conditions favorable to natural attenuation through anaerobic sequential dechlorination.

Downgradient and Side-gradient Percent reductions

In order to demonstrate the effectiveness of MNA in the downgradient and side gradient area, percent reductions were calculated for the eleven MNA wells. Table 3-10 provides the results of percent reduction from 2000-2005 molar TVOC average to 2013-2018 molar TVOC average. The reductions in moles ranged from 43% to 96%, with an average of 71% in approximately 13 years. Two of the eleven far-field wells were below MCLs with no trend, therefore a percent reduction was not calculated. At three of the wells the concentrations have decreased to below or near MCLs during the monitoring period. These reductions indicate that the far-field plume is retracting and degrading due to the source area control and the strong monitored natural attenuations capacity of the groundwater system.

3.6 DNAPL Monitoring and Recovery

As described in the LTGMP and the DNAPL Monitoring and Recovery Plan, monitoring for the occurrence of DNAPL has been conducted routinely at the Necco Park site since the early 1980s. An active recovery and monitoring program was instituted in 1989 to remove free-phase DNAPL from monitoring and groundwater recovery wells. The historically established monitoring program was modified based on results of the Pre-design Investigations. In 2015, the USEPA agreed to a request from Chemours to reduce the number of wells monitored monthly and semi-annually for DNAPL. However, the USEPA requested that once every two years, the full list of DNAPL wells are checked. The revised monitoring schedule began in June 2015. The 2018 monthly DNAPL monitoring results are summarized in Table 3-12.

In 2018, no measurable DNAPL was identified during any of the monthly, semi-annual, or biennial monitoring and therefore, no DNAPL was removed in 2018. A total of approximately 8,818 gallons of DNAPL have been recovered since the program was put in place.

3.7 Quality Control/Quality Assurance

The 2018 annual groundwater samples were submitted to TestAmerica Laboratories in North Canton, Ohio, for all chemical analyses. In accordance with the LTGMP and consistent with previous years, QA/QC procedures included in-house data review. In previous years through 2016, 10% independent validation of the data was completed by Environmental Standards, Inc., of Valley Forge, Pennsylvania. On July 30, 2015,

Chemours proposed to eliminate the 10% validation based on 10 years of no instances when significant data qualification or rejection of data occurred as a result of findings from the 10% full validation that wasn't also identified by the 100% CDRP. The USEPA approved the proposed reduction in a letter dated October 19, 2016. All other provisions of the QAPP remain unchanged.

3.7.1 Sample Collection

All samples were collected in accordance with the scope and technical requirements defined in the project Work Plan and Quality Assurance Project Plan (DuPont CRG 2005c). Samples were submitted in seventeen delivery groups received at the laboratories between September 10 and December 27, 2018. Based on laboratory receipt records, all samples were received in satisfactory condition, properly preserved, and within USEPA holding time and temperature requirements. Field QC samples collected during the sampling round included four field duplicate pairs, eight daily equipment blank samples, and seventeen trip blanks (volatile organics).

In-House Data Collection

The quality of the data set was evaluated by the AECOM Analytical Data Quality Management Group using the analytical results provided in hard-copy contract laboratory protocol-type data packages in conjunction with an automated data evaluation of the electronic data deliverables (the Chemours Data Review [DVM] process described below). The laboratory data packages presented a review of the QA/QC procedures conducted by the laboratory and included case narratives identifying any significant issues associated with sample receipt, preparation, and analysis.

The electronic data was processed through an automated program developed by Chemours, referred to as the DVM, where a series of checks were performed on the data, essentially resulting in a summary level validation. The data were evaluated against holding time criteria, checked for laboratory blank, equipment blank, and trip blank contamination, and assessed against the following:

- Matrix spike(MS)/matrix spike duplicate (MSD) recoveries
- Relative percent differences (RPDs) between MS/MSD samples
- Laboratory control sample (LCS)/control sample duplicate (LCSD) recoveries
- RPDs between LCS/LCSD
- RPDs between laboratory replicates
- Surrogate spike recoveries
- RPDs between field duplicate samples

The DVM also applied the following data qualifiers to analysis results, as warranted:

DEFAULT QUALIFIERS

Qualifier	Definition
B	Not detected substantially above the level reported in the laboratory or field blanks.
R	Unusable result. Analyte may or may not be present in the sample.

Qualifier	Definition
J	Analyte present. Reported value may not be accurate or precise.
UJ	Not detected. Reporting limit may not be accurate or precise.

All sample analyses were completed within the USEPA recommended holding times. Several target volatiles and methane were detected at trace levels in the laboratory method blanks, equipment blanks, and trip blanks. Well samples with detections in the same range as the associated trip blanks and method blanks (<10x) were B qualified during the data review process and may not be representative of actual environmental conditions. Equipment blank detections were not evaluated via the automated review process since the electronic data for the blanks was not received concurrently with the sample data.

A number of samples required dilutions for analysis of volatiles, semi-volatiles, and dissolved gases due to the levels of target compounds and/or non-target interferences. As a result, the reporting limits for the affected samples are elevated, and in some cases, the sample surrogate recoveries could not be determined (diluted out) or were recovered outside of the laboratory control window.

The laboratory reported that the preserved 40 ml vials for samples from 141C and 111B had measured pH values greater than 2 when the volatiles and dissolved gases analyses were initiated. No additional vials were available for comparison, so the analysis was completed and reported.

The semi-volatile analysis included a target tentatively identified compound reported as TIC 1. All positive results reported for TIC 1 have been J qualified as estimated concentrations.

The laboratory instrumentation cannot separate 3-methylphenol and 4-methylphenol under the chromatographic conditions used for sample analysis. The results reported represent the combined total of both semi-volatile compounds.

Sample 137A was re-extracted and reanalyzed for semi-volatiles past the holding time to confirm noncompliant surrogate recoveries in the initial analysis. Detections reported for this sample were J qualified and non-detects were UJ qualified due to possible low bias.

Samples 146F, 139D, and a duplicate were reanalyzed for dissolved gases past the holding time because the initial concentrations were above the calibration range of the instrument. The methane results reported for these samples were J qualified due to possible low bias.

Except as noted above, all analyses for organics were completed within the 14-day USEPA holding time guidance for preserved volatiles and dissolved gases. The semi-volatiles analyses met the USEPA holding time guidance of 7 days from collection for extraction, and 40 days of collection for analysis for aqueous samples.

Nitrate/nitrite nitrogen was detected at low levels in several of the laboratory method blanks. As listed on the DVM Narrative, the nitrate/nitrite detections in a number of the associated well samples were B-qualified during the data review process and may not be representative of the actual environmental conditions.

Due to instrument difficulties in the TAL-North Canton laboratory, the nitrate/nitrite nitrogen analyses for all samples collected on November 16, 2018 and later were completed at the TAL Pittsburgh laboratory.

Several matrix spikes were recovered outside the laboratory control limits for nitrate/nitrite nitrogen and sulfide. The associated samples results were J qualified as estimated detections.

There was insufficient sample volume available for the laboratory to include project-specific matrix spikes with all sample prep groups for all analyses. Matrix spikes were prepared and analyzed as available, and laboratory control spikes/spike duplicates were also analyzed with each sample group and used for determining compliance with QC limits.

Evaluation of the Relative Percent Difference (%RPD) between field duplicate pairs generally compared very well for the four pairs collected in this program. Some analytes in the sample from 136E and its field duplicate exceeded the RPD criteria and were J qualified during data review. These analytes included TCE, cis-1,2-dichloroethene, 1,1,2,2- tetrachloroethane, VC, 1,1,2-trichloroethane, chloroform, 2,4,5-trichlorophenol, methane, ethane, methane, iron, manganese, and total organic carbon.

All samples were collected in accordance with the scope and technical requirements defined in the project Work Plan and Quality Assurance Project Plan (DuPont CRG 2005c). Samples were submitted in seventeen delivery groups received at the laboratories between September 10 and December 27, 2018. Based on laboratory receipt records, all samples were properly preserved, and within USEPA holding time and temperature requirements. Field QC samples collected during the sampling round included four field duplicate pairs, eight daily equipment blank samples, and 17 trip blanks (volatile organics). All samples were received in satisfactory condition.

4.0 CAP MAINTENANCE

The cap was substantially completed in 2005, and all remedial items were completed by August 2006. A lawn maintenance contractor maintains both the landfill cap and ditch vegetation. Landfill cap maintenance activities are conducted in accordance with the Cap Maintenance and Monitoring Plan (CMMP). Results of the landfill cap maintenance inspection conducted on October 30, 2018 are provided in Appendix E. No leachate seeps or settlement was identified, and all aspects of the landfill that were inspected were found acceptable.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Hydraulic Control Effectiveness

5.1.1 Conclusions

The HCS continues to be effective at controlling source area groundwater at the Necco Park site. The following observations support this conclusion:

- Water levels in the A-Zone continue a long-term decreasing trend due to the in-place remedial measures including the impermeable landfill cap and groundwater pumping. The A-Zone is dewatering vertically from the hydraulic depression created by the HCS. This is evident in vertical gradients, drawdown calculations, and time series plots of water level elevations.
- Groundwater potentiometric contour maps depict a capture zone encompassing the source area in the B-, C-, D-, E- and F-Zones.

The addition of RW-11 continues to be an improvement in A-, B-, and C-Zone hydraulic control in the southwestern part of the site. Furthermore, increases in well yield at RW-5 in Fall 2015 increased capture in the A, B and C around this well.

5.1.2 Recommendations

Based on the site history, years of monitoring, and observations made in 2018, the following procedures are recommended:

- Continue to rrehabilitate RW-4, RW-5, RW-11, as necessary, on a semi-annual.

5.2 Groundwater Chemistry Monitoring

5.2.1 Conclusions

The 2018 and historical chemistry monitoring results indicate the following:

- Overall, the TVOC concentrations are decreasing for all groundwater flow zones in the source area and far-field. In the very few locations where there were increasing trends of TVOC, the concentrations were within historical range or inside the source area near a recovery well.
- Analytical results for 2018 would not change the A-Zone and B/C-Zone source area limits as delineated in the SAR.
- Analytical results for 2018 (including well 146E) support the 2005 Annual Report conclusion of a reduced source area limit for the D/E/F-Zone as delineated in the SAR based on the analytical results from well 146E.
- Results from groundwater sampling events completed since HCS startup show that the HCS is effectively controlling zone-specific source areas.

5.2.2 Recommendations

The 2018 sampling results represent the 17th groundwater sampling event in the long-term monitoring program. It is recommended that the long-term monitoring program continue in its current form, including the revisions from 2010, 2011, and 2016.

5.3 MNA Conclusions and Recommendations

5.3.1 Conclusions

Data regarding chlorinated ethenes in Necco Park are consistent with lines of evidence required for natural attenuation of contaminants (USEPA, Monitored Natural Attenuation Directive, 1999). Specifically, the results summarized above and in the 2018 report continue to show the following:

- Contaminant concentrations in groundwater decrease along flowpaths from the source area to the down gradient zone.
- Geochemical conditions are indicative of low redox conditions required for reductive dechlorination.
- Previous results (2005-2008) confirmed the presence of bacteria with the ability to complete dechlorination of chlorinated ethenes to ethane. The continued evidence of natural attenuation of chlorinated solvents is consistent with the presence of these organisms.

Overall, the observed stable to decreasing trends in total chlorinated solvents and the presence of dechlorinated intermediates (cis-DCE, VC and ethene) strongly supports the interpretation that natural attenuation of chlorinated ethenes continues to occur at this site.

5.3.2 Recommendations

Analytical results from 2018, such as concentrations of degradation products and geochemical conditions, continue to support the recommendation that MNA assessments be conducted every five years. The continuation of MNA monitoring every five years is adequate to provide relevant data that will impact the remedy that is currently in place. The next MNA monitoring event is scheduled for 2023.

5.4 DNAPL Monitoring and Recovery

5.4.1 Conclusions

Results of the 2018 DNAPL monitoring and historical recovery efforts indicate the following:

- Monitoring for the presence of DNAPL was completed monthly during 2018.
- No measurable DNAPL was identified in 2018 during any of the monthly or semi-annual monitoring; therefore, no DNAPL was removed in 2018.
- Approximately 8,818 gallons of DNAPL have been recovered since the recovery program was initiated in 1989.
- As approved by the USEPA, a revised list of wells was monitored monthly and semi-annually beginning in June 2015. The full list of well previously checked for DNAPL is monitored once every two years and in 2017 there was no observable DNAPL at these locations.

5.4.2 Recommendation

Continue DNAPL monitoring as revised and approved by the USEPA in 2015 and recover DNAPL where encountered.

5.5 Landfill Cap

5.5.1 Conclusions and Recommendations

With establishment of a continuous vegetative cover, the landfill cap construction is complete and is maintained in accordance with the CMMP. In 2018, no repairs to the landfill cap were necessary and the cap was appropriately maintained. The landfill cap inspection was completed on October 30, 2018.

6.0 REFERENCES

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TABLES

Table 2-1

HCS Recovery Well Performance Summary - 2018

Remedial Action Post-Construction Monitoring - 2018 Annual Report

Chemours Necco Park, Niagara Falls, New York

	B/C-ZONE						D/E/F-ZONE			
	RW-4		RW-5		RW-11		RW-8		RW-9	
	Total Gallons Pumped	Uptime°	Total Gallons Pumped	Uptime°	Total Gallons Pumped	Uptime°	Total Gallons Pumped	Uptime°	Total Gallons Pumped	Uptime°
January	20,315	93.16%	261,087	88.53%	267,965	92.63%	392,940	98.10%	465,375	98.10%
February	26,916	85.82%	193,469	83.53%	234,573	87.37%	359,071	99.43%	395,191	97.83%
March	35,098	98.28%	210,964	89.66%	357,038	99.83%	339,650	98.33%	334,444	96.71%
April	35,877	98.40%	177,369	73.37%	275,462	99.99%	410,595	99.99%	431,775	90.46%
May	26,429	58.84%	156,333	60.47%	178,522	63.37%	254,038	66.01%	279,008	67.02%
June	28,692	87.88%	186,536	85.79%	220,683	88.08%	309,722	89.60%	343,305	89.61%
July	17,464	74.74%	127,515	73.53%	245,985	78.68%	269,041	79.46%	318,939	86.81%
August	18,484	92.22%	152,705	89.85%	288,767	95.94%	229,253	70.63%	399,654	96.95%
September	26,109	89.70%	117,318	79.60%	186,550	70.30%	310,995	93.00%	372,233	90.60%
October	23,517	90.99%	175,198	84.83%	244,286	85.00%	273,907	84.40%	391,875	95.30%
November	21,558	95.30%	181,653	88.10%	325,502	95.39%	275,407	96.39%	245,800	96.40%
December	24,374	95.94%	206,809	88.25%	314,786	94.99%	317,359	100.00%	237,851	100.00%
2018 TOTAL / AVG.	304,833	88.4%	2,146,956	82.1%	3,140,119	87.6%	3,741,978	89.6%	4,215,450	92.1%
2017	187,283	82.1%	2,408,465	74.8%	2,841,144	85.7%	4,198,265	91.8%	4,192,719	91.8%
2016	233,743	83.7%	2,270,861	74.6%	2,422,531	82.1%	4,508,452	87.6%	3,191,504	87.6%
2015	274,254	77.0%	2,000,841	75.1%	1,668,783	77.4%	4,470,155	82.9%	3,563,902	82.8%
2014	290,476	95.7%	1,889,388	88.4%	2,155,520	91.6%	5,653,830	98.0%	4,301,449	98.1%
2013	433,801	92.5%	1,005,124	89.3%	3,367,369	84.4%	5,680,340	94.4%	5,250,524	93.8%
2012	475,401	94.9%	1,221,900	88.8%	3,538,799	85.4%	5,135,229	97.7%	4,774,110	97.7%
2011	115,439	90.7%	1,380,257	84.6%	2,772,890	85.8%	4,587,729	96.7%	4,763,517	97.1%
2010	144,749	90.3%	1,437,736	86.1%	3,327,973	86.0%	4,091,555	90.8%	4,772,745	90.6%
2009	106,849	93.7%	1,447,179	88.7%	5,585,699	90.8%	4,639,060	97.8%	4,397,025	97.6%
2008	103,262	90.9%	1,101,634	71.4%	1,149,746**	69.0%	3,680,999	96.9%	6,210,570	96.2%
2007	109,853	95.1%	1,391,339	83.6%	362,994*	92.6%	3,857,693	96.2%	5,506,023	95.9%
2006	92,358	90.0%	2,184,288	93.9%	701,579*	87.8%	4,581,348	95.0%	5,236,043	94.4%
2005	70,814	94.0%	1,966,338	93.0%	799,663*	95.0%	2,950,786	93.0%	3,881,318	93.0%

°Time taken for routine maintenance was not calculated as down-time

*RW-10

** RW-10 and RW-11 Combination

Table 2-2
GWTF Process Sampling Results - 2018
Remedial Acton Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

General Water Quality Analyte		B/C INFLUENT				D/E/F INFLUENT				COMBINED EFFLUENT			
		3/6/2018	5/30/2018	8/22/2018	12/7/2018	3/6/2018	5/30/2018	8/22/2018	12/7/2018	3/6/2018	5/30/2018	8/22/2018	12/7/2018
Field Parameters													
SPECIFIC CONDUCTANCE	µmhos/cm	6433	7226	5260	6208	4450	4700	3557	4476	4388	6472	3656	777
TEMPERATURE	°C	11.9	15.4	19.2	10.7	12.3	14.8	16	12.1	13.9	15.3	16.8	11
COLOR	ns	clear	none	black tint	slight tint	lt grey	none	clear	none	clear	none	clear	none
ODOR	ns	yes	yes	yes	yes	yes	yes	yes	none	yes	yes	yes	yes
PH	std units	6.28	5.49	5.85	5.43	7.24	6.87	6.89	6.97	7.94	6.21	6.89	7.84
REDOX	mv	-171	-84	-123	-73	-235	-196	-206	165	-228	-141	-178	91
TURBIDITY	ntu	6.5	33.0	29.5	6	36.4	11.9	0.7	19.3	13.8	14	1.7	6
Volatile Organics													
1,1,2,2-TETRACHLOROETHANE	µg/l	4700	4300	4300	3700	1400	1400	1200	1200	1100	120	1200	110 J
1,1,2-TRICHLOROETHANE	µg/l	2500	2500	2500	2700	2300	2100	2000	2000	470	44	790	44 J
1,1-DICHLOROETHENE	µg/l	<450	500	320	500	<220	310	310	310 J	<14	<1.2	74	<0.38
1,2-DICHLOROETHANE	µg/l	600 J	590	470	540	<250	160 J	150 J	210 J	36 J	3.6 J	98	3.1
CARBON TETRACHLORIDE	µg/l	7500	6300	6300	7000	850	790	880	820	<18	<1.6	890	<0.52
CHLOROFORM	µg/l	18000	15000	15000	17000	2700	2400	2300	2900	150	23	2700	23
CIS-1,2-DICHLOROETHENE	µg/l	11000	10000	7000	9800	11000	9400	9300	9700	180	14	2200	14
METHYLENE CHLORIDE	µg/l	3600	4500	2600	4000	4700	5200	4000	4700	130	16 J	950	12
TETRACHLOROETHENE	µg/l	10000	7600	8900	8700	740 J	650	760	620	17 J	1.7 J	1400	1.6 J
TRANS-1,2-DICHLOROETHENE	µg/l	<480	490	320	490 J	680 J	750	680	650	<15	<1.2	120	<0.38
TRICHLOROETHENE	µg/l	15000	11000	12000	13000	4000	3700	3900	3800	50	4.2 J	2300	3.4
VINYL CHLORIDE	µg/l	2700	3100	2200	2700	1600	1900	2200	1400	<23	<1.3	500	<0.4
TOTAL VOLATILES	µg/l	**75,600**	**65,880**	**61,910**	**70,130**	**29,970**	**28,760**	**27,680**	**28,310**	**2,133**	**227**	**13,222**	**211**

< and ND = Non detect at stated reporting limit
J= Analyte present. Reported value may not be precise.

TABLE 3-1
Quarterly Hydaulic Monitoring Locations

Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

Well ID	Zone	Well ID	Zone	Well ID	Zone
53	A	159B	B	203D	D
111A	A	160B	B	RW-8	D/E/F
117A	A	161B	B	RW-9	D/E/F
119A	A	163B	B	202D	D
123A	A	167B	B	129E	E
129A	A	168B	B	136E	E
131A	A	169B	B	142E	E
137A	A	170B	B	145E	E
139A	A	171B	B	146E	E
140A	A	172B	B	150E	E
145A	A	201B	B	163E	E
146AR	A	BZTW-1	B	164E	E
150A	A	BZTW-2	B	165E	F
159A	A	BZTW-4	B	202E	E
163A	A	D-23	B	203E	F
168A	A	PZ-B	B	112F	F
173A	A	D-10	B/C	123F	F
174A	A	D-14	B/C	129F	F
175A	A	RW-5	B/C	130F	F
176A	A	RW-4	B/C	136F	F
178A	A	RW-11	B/C	145F	F
179A	A	105C	C	146F	F
184A	A	115C	C	148F	F
185A	A	123C	C	150F	F
186A	A	129C	C	163F	F
187A	A	130C	C	164F	F
188A	A	136C	C	165F	F
189A	A	137C	C	202F	F
190A	A	138C	C	203F	F
191A	A	139C	C	136G	G
192A	A	141C	C	TRW-6	B/C
193A	A	145C	C	TRW-7	B/C
194A	A	146C	C	PZ-205B	B
D-9	A	149C	C		
D-11	A	150C	C		
RDB-3	A	151C	C		
RDB-5	A	159C	C		
D-13	A	160C	C		
PZ-A	A	161C	C		
168A	A	162C	C		
102B	B	168C	C		
111B	B	204C	C		
112B	B	105D	D		
116B	B	111D	D		
118B	B	115D	D		
119B	B	123D	D		
120B	B	129D	D		
123B	B	130D	D		
129B	B	136D	D		
130B	B	137D	D		
136B	B	139D	D		
137B	B	145D	D		
138B	B	148D	D		
139B	B	149D	D		
145B	B	158D	D		
146B	B	159D	D		
149B	B	163D	D		
150B	B	164D	D		
151B	B	165D	D		

Notes: 1. Well 204C installed in 2008 to replace 112C. Water levels began in 1Q09.
2. Piezometers PZ-A, PZ-B, and 168A installed in 2008.
3. All AT zone wells were eliminated from the hydraulic monitoring program on consent from USEPA letter dated 01/27/2012.
4. PZ-205B installed in 2015.

Table 3-2
2018 Average A-Zone to B-Zone Vertical Gradients
Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

Well Pair		A	B	C	D	
		2015 Average A-Zone Head	2015 Average B-Zone Head	A-Zone Mid-Point of Well Screen	B-Zone Fracture Elevation[1]	Vertical Gradtient[2,3] (B-A) / (C-D)
111A	111B	572.54	571.79	573.94	561.80	-0.06
119A	119B	573.89	572.54	571.63	556.90	-0.09
129A	129B	573.91	570.87	570.10	557.80	-0.25
137A	137B	572.27	571.09	570.10	561.30	-0.13
145A	145B	572.05	569.49	564.19	546.30	-0.14
150A	150B	572.00	570.57	564.69	553.18	-0.12
159A	159B	577.22	572.11	580.62	562.90	-0.29
163A	163B	573.46	573.30	572.49	564.96	-0.02
168A	168B	572.13	566.54	555.22	544.90	-0.54

Notes:
1) A B-Zone fracture was not observed in the 145B borehole, therefore the midpoint of the open hole was used.
2) Unitless (ft/ft).
3) Negative values indicate a downward (from A-Zone to B-Zone) gradient.
4) Average gradients were used to better reflect typical vertical gradients at the site.

Table 3-3
DNAPL Components and Solubility Criteria Values
Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

Contaminant	Mole Fraction in DNAPL (%)	Pure-Phase Solubility (µg/l)	One-Percent Pure-Phase Solubility (µg/l)	Effective Solubility (µg/l)
Hexachlorobutadiene	59	2,000	20	1,180
Hexachloroethane	9	50,000	500	4,500
Hexachlorobenzene	2	11	0.11	0.22
Carbon tetrachloride	5	800,000	8,000	40,000
Chloroform	1	8,000,000	80,000	80,000
Tetrachloroethene	3	150,000	1,500	4,500
1,1,2,2-Tetrachloroethane	5	2,900,000	29,000	145,000
Trichloroethene	4	1,100,000	11,000	44,000

Table 3-4
Effective Solubility Concentration Exceedances for DNAPL Compounds - 2005 through 2018 Annual Sampling
Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

Well ID	Flow Zone	Analyte	Criteria (ppb)	2005		2006		2007		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
				1st Event	2nd Event	1st Event	2nd Event	1st Event	2nd Event											
171B	B	Hexachlorobutadiene	1,180	2,100	BC	BC	BC	NS	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
		Hexachlorobenzene	0.22	BC	4.0	31 J	3.4 J	NS	1.4 J	BC	< 0.4	< 2.5	<0.95	BC	BC	< 0.41	< 0.32	< 0.41	0.48 J	BC
105C	C	Carbon Tetrachloride	40,000	NS	NS	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	NS
		Hexachlorobutadiene	1,180	1,700	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Chloroform	80,000	BC	180,000	NS	120,000	NS	90,000	82,000	BC	NS	NS	NS	100,000	NS	NS	NS	NS	NS
		Tetrachloroethene	4,500	32,000	35,000	NS	36,000	NS	37,000 J	32,000	13,000	NS	NS	NS	24,000	NS	NS	NS	NS	NS
		Trichloroethene	44,000	280,000	190,000	NS	190,000	NS	160,000	140,000	74,000	NS	NS	NS	190,000	NS	NS	NS	NS	NS
136C	C	Tetrachloroethene	4,500	4,100	3,600	3,300	3,100	5,200	3,800	14,800	5,600	NS	NS	NS	5,300	NS	NS	NS	NS	BC
137C	C	Tetrachloroethene	4,500	8,500	22,000	NS	7,900	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC
105D	D	Carbon Tetrachloride	40,000	150,000	83,000	NS	170,000	NS	190,000	BC	200,000	NS	NS	NS	360,000	NS	NS	NS	NS	45,000
		Chloroform	80,000	98,000	35,000	NS	80,000	NS	90,000	96,000	120,000	NS	NS	NS	160,000	NS	NS	NS	NS	BC
		Tetrachloroethene	4,500	12,000	57,000	NS	11,000	NS	13,000 J	12,000	16,000	NS	NS	NS	22,000	NS	NS	NS	NS	BC
		Trichloroethene	44,000	120,000	51,000	NS	110,000	NS	120,000	130,000	180,000	NS	NS	NS	250,000	NS	NS	NS	NS	BC
137D	D	Tetrachloroethene	4,500	5,100	4,900	NS	BC	NS	7,200	5,300 J	4,700	NS	NS	NS	BC	NS	NS	NS	NS	BC
		Trichloroethene	44,000	64,000	76,000	NS	BC	NS	91,000	70,000	76,000	NS	NS	NS	BC	NS	NS	NS	NS	65,000
		Hexachlorobenzene	0.22	3.0	11.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
139D	D	Hexachlorobenzene	0.22	38 J	11 J	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	5.2 J
		Hexachlorobutadiene	1,180	1,200	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	BC

BC: Below Criteria
NS: Not Sampled
"<" = compound not identified above the detection limit.

Table 3-5

1% of Pure-Phase Solubility Concentration Exceedances for DNAPL Compounds - 2005 through 2018 Annual Sampling

Remedial Action Post-Construction Monitoring - 2018 Annual Report

Chemours Necco Park, Niagara Falls, New York

Well ID	Flow Zone	Analyte	Criteria (ppb)	2005		2006		2007		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
				1st Event	2nd Event	1st Event	2nd Event	1st Event	2nd Event											
D-11	A	Hexachlorobutadiene	20	29	BC	BC	BC	BC	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC
136B	B	Tetrachloroethene	1,500	BC	BC	BC	BC	BC	BC	1,500	1,600	BC	BC	2,000	1,500	1,500	BC	BC	BC	BC
139B	B	Tetrachloroethene	1,500	NS	NS	NS	2000 J	NS	4,600	3,100	3,200	NS	NS	NS	2,900	NS	NS	NS	NS	BC
		Hexachlorobutadiene	20	78	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		1,1,2,2-Tetrachlorethane	29000	NS	NS	NS	29,000	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC
171B	B	Hexachlorobutadiene	20	2,100	130	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
		Hexachlorobenzene	0.11	BC	4.0	3.1 J	3.4 J	BC	1.4 J	BC	< 0.4	< 0.5	<0.95	BC	BC	<0.41	<0.32	<0.41	<0.45	<0.18
172B	B	Hexachlorobutadiene	20	140	89	140 J	110	BC	110	54	170	210	20	130	45	120	53	48	79	63
		Tetrachloroethene	1,500	1,800	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
105C	C	Hexachlorobutadiene	20	1,700	BC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Carbon Tetrachloride	8,000	25,000	BC	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	NS
		Chloroform	80,000	250,000	180,000	NS	120,000	NS	90,000	82,000	BC	NS	NS	NS	100,000	NS	NS	NS	NS	NS
		Tetrachloroethene	1,500	32,000	35,000	NS	36,000	NS	37,000 J	32,000 J	13,000	NS	NS	NS	24,000	NS	NS	NS	NS	NS
		Trichloroethene	11,000	280,000	190,000	NS	190,000	NS	160,000	140,000	74,000	NS	NS	NS	190,000	NS	NS	NS	NS	NS
136C	C	Tetrachloroethene	1,500	4,100	3,600	3,300	3,100	5,200	3,800	4,800	5,600	NS	NS	NS	5,300	NS	NS	NS	NS	4,000
137C	C	Tetrachloroethene	1,500	8,500	22,000	NS	7,900	NS	2,200	2,700	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC
		Trichloroethene	11,000	BC	19,000	NS	16,000	NS	20,000	70,000	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC
168C	C	Hexachlorobutadiene	20	330	64.0	54 J	NS	44 J	BC	BC	NS	<27	21 J	BC	BC	BC	BC	BC	BC	BC
105D	D	Hexachlorobutadiene	20	95.0	BC	NS	NS	NS	NS	NS	N/S	NS	NS	NS	NS	NS	NS	NS	NS	NS
		Carbon Tetrachloride	8,000	150,000	83,000	NS	170,000	NS	190,000	190,000	200,000	NS	NS	NS	360,000	NS	NS	NS	NS	45,000
		Chloroform	80,000	98,000	BC	NS	80,000	NS	90,000	96,000	120,000	NS	NS	NS	160,000	NS	NS	NS	NS	BC
		Tetrachloroethene	1,500	12,000	5,700	NS	11,000	NS	13,000 J	12,000 J	16,000	NS	NS	NS	22,000	NS	NS	NS	NS	4,200
		1,1,2,2-Tetrachlorethane	29,000	NS	NS	NS	88,000	NS	79,000	76,000	79,000	NS	NS	NS	100,000	NS	NS	NS	NS	BC
		Trichloroethene	11,000	120,000	51,000	NS	110,000	NS	120,000	130,000	180,000	NS	NS	NS	250,000	NS	NS	NS	NS	33,000
137D	D	Tetrachloroethene	1,500	5,100	4,900	NS	BC	NS	7,200	5,300	4,700	NS	NS	NS	BC	NS	NS	NS	NS	4,400
		Trichloroethene	11,000	64,000	76,000	NS	27,000	NS	91,000	70,000	76,000	NS	NS	NS	BC	NS	NS	NS	NS	65,000
139D	D	Hexachlorobenzene	0.11	38.0	11.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	5.2 J
		Tetrachloroethene	1,500	1,900	BC	NS	BC	NS	BC	BC	BC	NS	NS	NS	BC	NS	NS	NS	NS	BC
165E	E	Hexachlorobutadiene	20	27.0	BC	32 J	46 J	BC	45 J	91 J	44 J	79 J	26 J	130 J	65 J	130 J	34 J	<5.1	140 J	150 J
		Tetrachloroethene	1,500	BC	BC	BC	BC	BC	BC	BC	BC	2,000	BC	BC	BC	BC	BC	BC	BC	BC
		Trichloroethene	11,000	BC	BC	BC	BC	BC	BC	BC	BC	11,000	12,000	12,000	BC	BC	BC	BC	BC	BC

BC: Below Criteria
NS: Not
"<" = compound not identified above the detection limit.

Table 3-6
Chemical Monitoring List
Long-Term Monitoring
Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

MONITORING WELL	ZONE	MONITORING WELL	ZONE
137A	A	151C	C
145A	A	168C	C
146AR	A	105D	D
150A	A	123D	D
D-9	A	136D	D
D-11	A	137D	D
D-13	A	139D	D
111B	B	145D	D
136B	B	147D	D
137B	B	148D	D
139B	B	149D	D
141B	B	156D	D
145B*	B	165D	D
146B	B	136E	E
149B	B	145E	E
150B	B	146E	E
151B	B	150E	E
153B	B	156E	E
168B	B	165E	E
171B	B	136F	F
172B	B	146F	F
136C	C	147F	F
137C	C	150F*	F
141C	C	156F	F
145C*	C	147G1	G1
146C*	C	147G2	G2
149C	C	147G3	G3
150C*	C		

*Well does not meet bedrock zone water bearing criteria ($k<10^{-4}$ cm/sec).

Table 3-7
Indicator Parameter List
Long-Term Groundwater Monitoring
Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park

Inorganic and General Water Quality Parameters	Volatile Organic Compounds	Semivolatile Organic Compounds
pH*	Vinyl chloride	Hexachloroethane
Specific conductivity*	1,1-dichloroethene	Hexachlorobutadiene
Temperature*	Trans-1,2-dichloroethene	Phenol
Turbidity*	Cis-1,2-dichloroethene	2,4,6-trichlorophenol
Dissolved oxygen *	Chloroform	2,4,5-trichlorophenol
Redox potential*	Carbon tetrachloride	Pentachlorophenol
Chloride	1,2-dichloroethane	Hexachlorobenzene
Dissolved barium	Trichloroethene	4-methlyphenol
	1,1,2-trichloroethane	TIC-1
	Tetrachloroethene	
	1,1,2,2-tetrachloroethane	

*Field parameter

Table 3-12
2018 DNAPL Recovery Summary
Remedial Action Post-Construction Monitoring - 2018 Annual Report
Chemours Necco Park, Niagara Falls, New York

Well ID	Frequency	29-Jan		28-Feb		29-Mar		27-Apr		30-May		29-Jun		30-Jul		30-Aug		28-Sep		26-Oct		28-Nov		31-Dec	
		FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS	FT	GALS
RW-4	Monthly	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
RW-5	Monthly	0.0		trace		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
RW-11	Monthly	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
204C	Monthly	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
VH-129C	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-131A	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-139C	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-161B	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-161C	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
VH-171B	Semi-annually	na		na		na		0.0		na		na		na		na		na		0.0		na		na	
RW-6	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
RW-7	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
PZ-A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-117A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-123A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-129A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-190A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
D-23	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
PZ-B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-160B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-167B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-168B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-169B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-170B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-172B	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-160C	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-162C	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-168C	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
VH-139A	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
CECOS52SR	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
CECOS18SR	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	
CECOS-53	Biennial	na		na		na		na		na		na		na		na		na		na		na		na	

na - not applicable/not taken due to reduction in scope, approved by USEPA (June 11, 2015 and August 12, 2015)
GALS - gallons purged

TABLE 3-9
Summary of Percent Reduction of TVOCs in
Downgradient and Side-Gradient B/C Zone Locations

Well ID	Percent reduction since construction of GWRS	Comment
145B	91%	
151B	NA	Total CVOCs range 0.5 - 8.36 ug/L and no trend in concentrations
145C	100%	
149C	NA	Total CVOCs range 0 - 26 ug/l and no trend in concentrations.
151C	100%	
Average	97%	

TABLE 3-10
Summary of Percent Reduction Degradation in Downgradient and Side-Gradient D/E/F Zone Locations

Well ID	Percent reduction since construction of GWRS	Comment
136D	57%	
147D	43%	Degraded to only VC above MCL
148D	NA	At or near detection levels and no trend
149D	NA	At or near detection levels and no trend
156D	76%	Decreased to TVOCs 0.59 ug/L
136E	72%	TVOCs slighly increased in 2018 (20.04 ug/L)
145E	91%	TVOCs decreased to 165 ug/L in 2018
146E	46%	
156E	96%	
146F	68%	
150F	86%	
Average	71%	

FIGURES

PARSONS

40 La Riviere Dr, Suite 350
Buffalo, NY 14202
(716) 541-0730

Created by: JWS	Date: 03-29-11
Checked by: RBP	Date: 03-29-11
Approved by: DDT	Date: 03-29-11
Project Manager: DDT	Date: 03-29-11
Job number: 445356.02020	

FIGURE 1-1
SITE LOCATION MAP
NECCO PARK
NIAGARA FALLS, NY

U:/Necco/HydroGeo/Mapping/gis/Necco_Site_location_map.srf

PARSONS

40 LA RIVIERE DR., SUITE 350
BUFFALO, NY 14202
(716) 541-0752

Created by: EFG	Date: 02-12-2018
Checked by: RBP	Date: 02-12-2018
Project Manager: Eric Felter	Date: 02-12-2018
Project Number: 450860.02023	

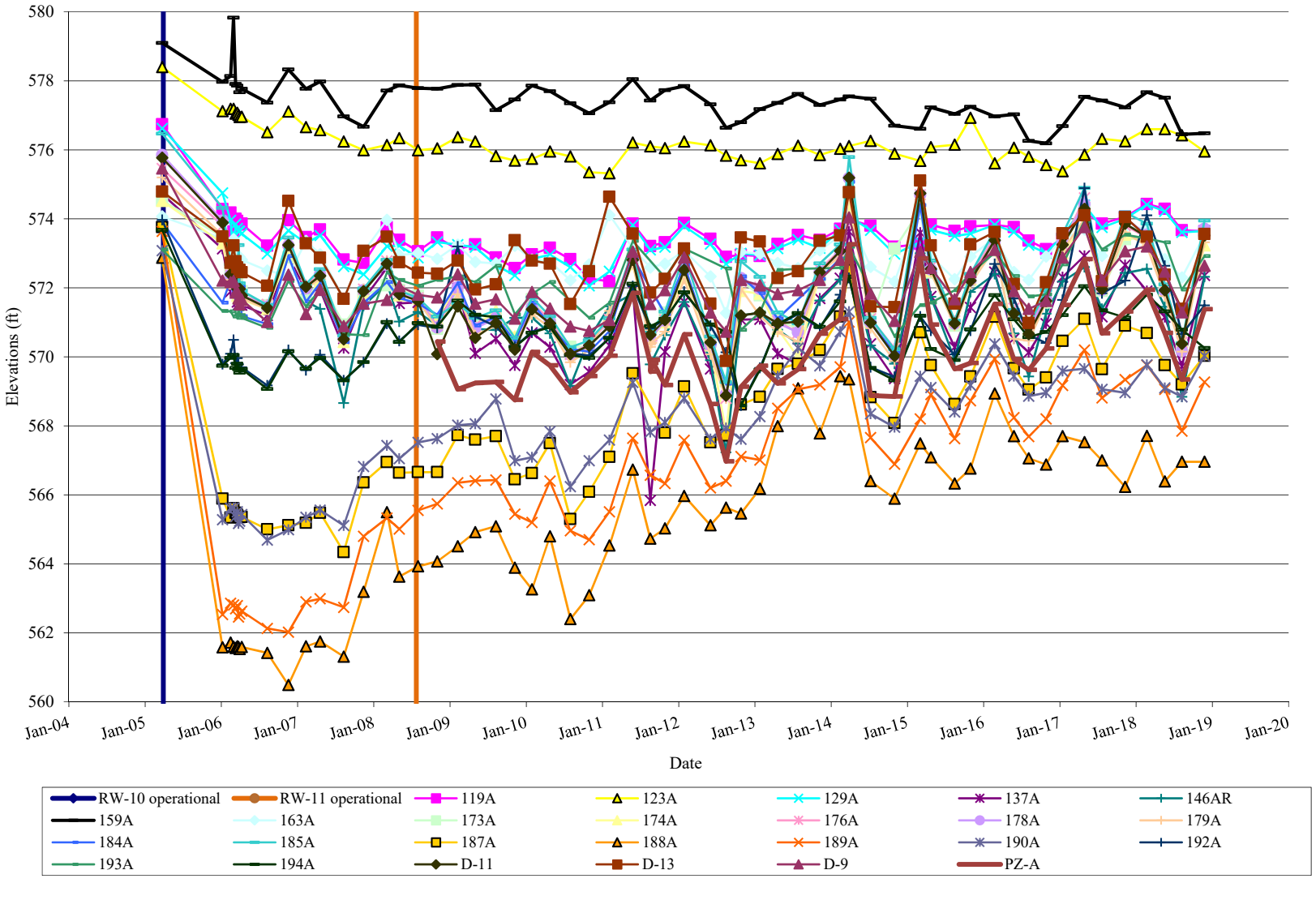
U:\Necco\hydrogeo\Maps\gis\Abandoned_Wells_TVOC.mxd

LEGEND

- RECOVERY WELLS
- ANNUAL SAMPLING WELLS
- 5 YEAR SAMPLING WELLS
- MONITORING WELL
- RAIL ROADS
- GROUT CURTAIN

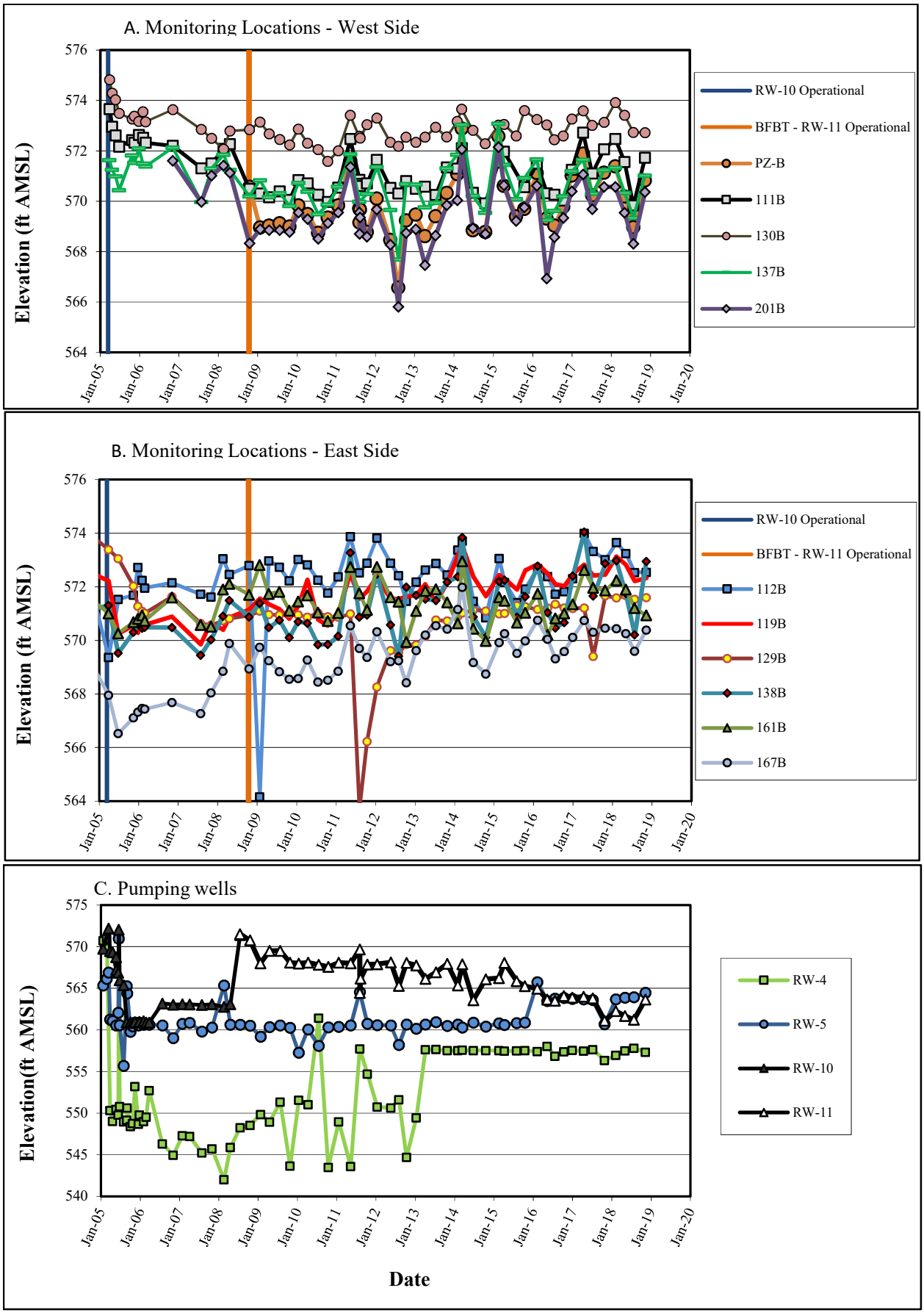
FIGURE 3-1
WELL AND PIEZOMETER LOCATIONS
CHEMOURS NECCO PARK SITE
NIAGARA FALLS, NY

Figure 3-2
Select A-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2018
Chemours Necco Park



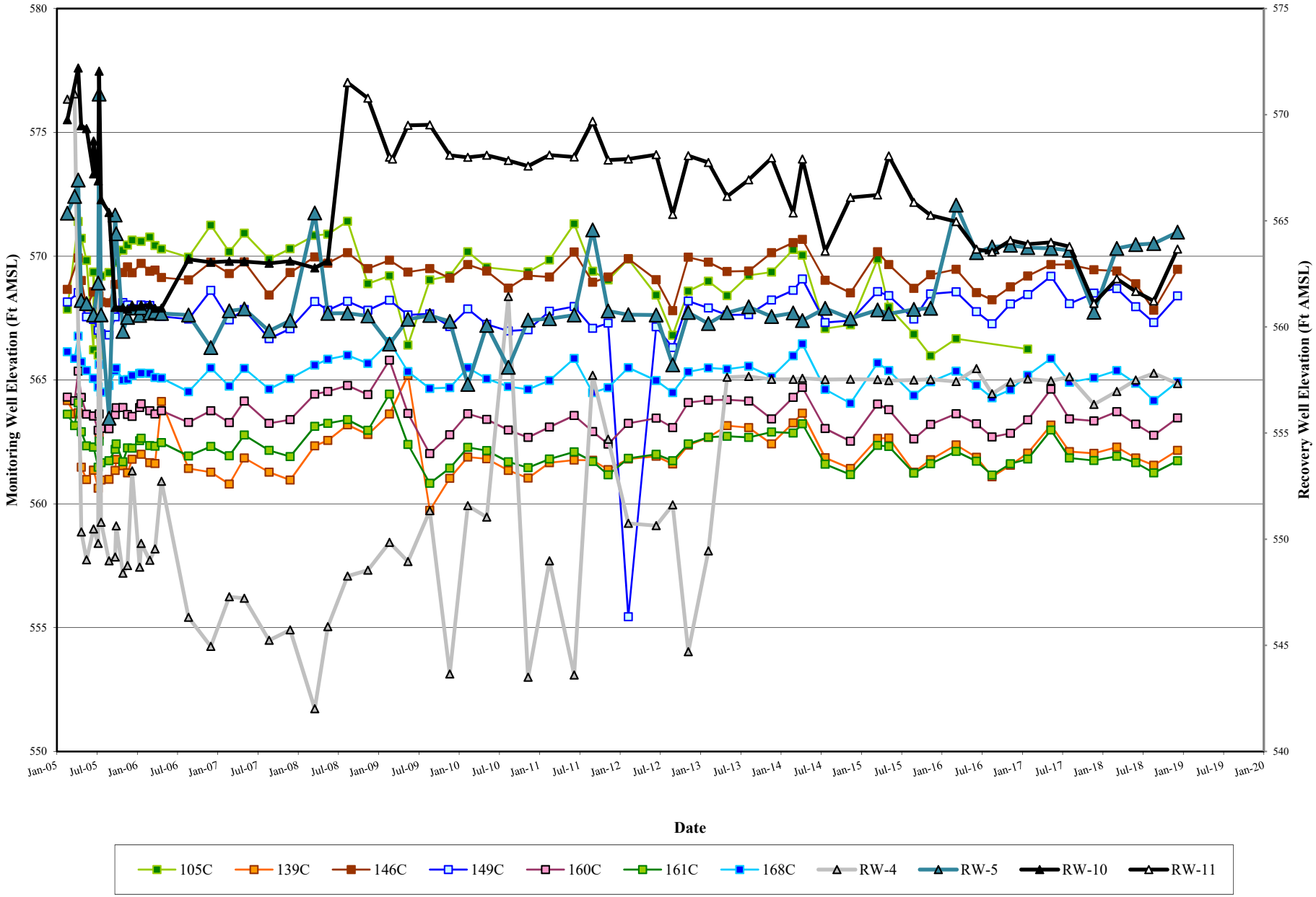
Necco 2018 A Zone Water Elev Trends.xlsx

Figure 3-3
Select B-Zone Monitoring Wells
Groundwater Elevations 2005 through 2018
Chemours Necco Park



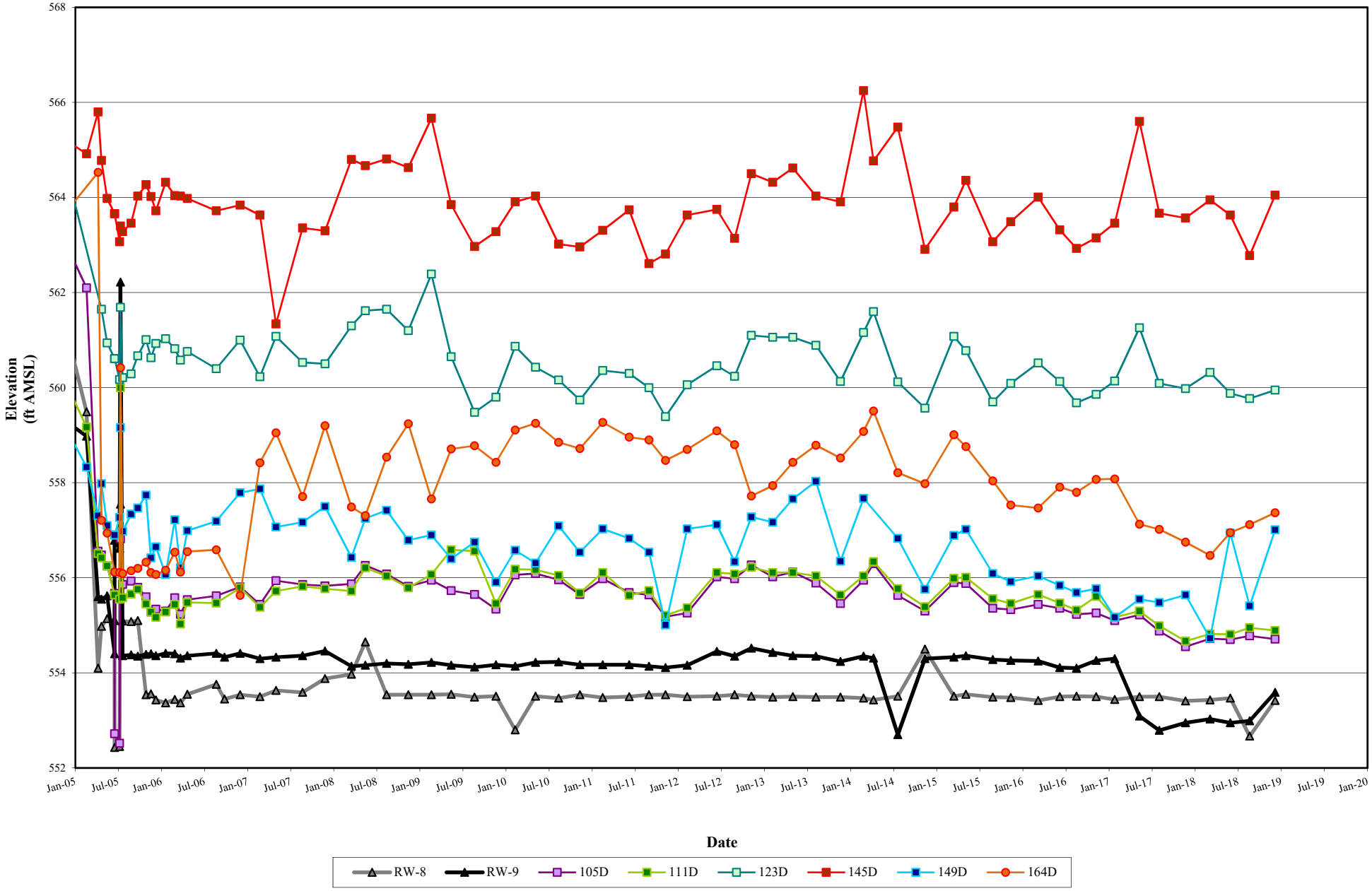
Necco 2018 B Zone Water Elev Trends.xlsx

Figure 3-4
Select C-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2018
Chemours Necco Park



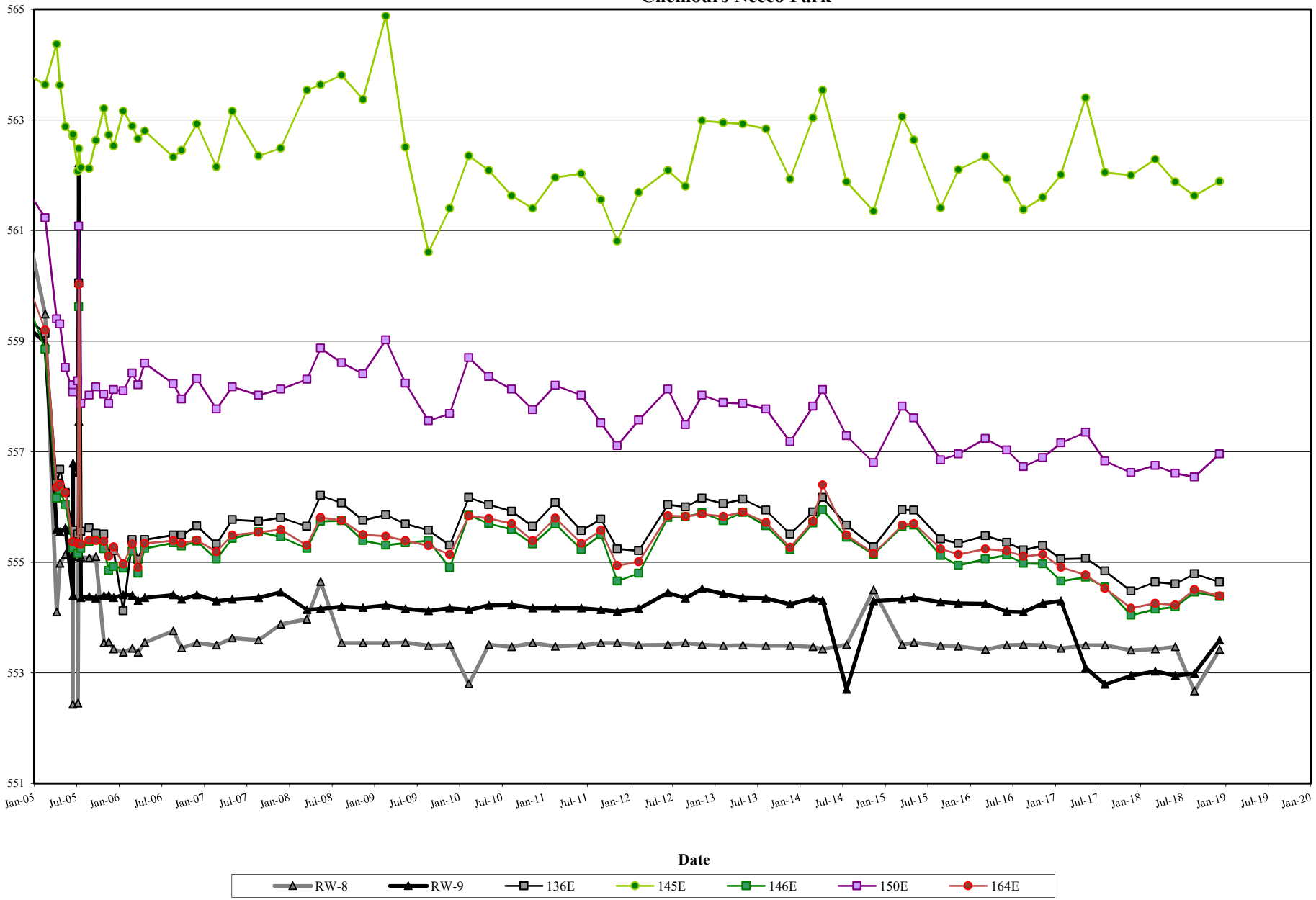
Necco 2018 C Zone Water Elev Trends.xlsx

Figure 3-5
Select D-Zone Monitoring Wells
Groundwater Elevations 2005 through 2018
Chemours Necco Park



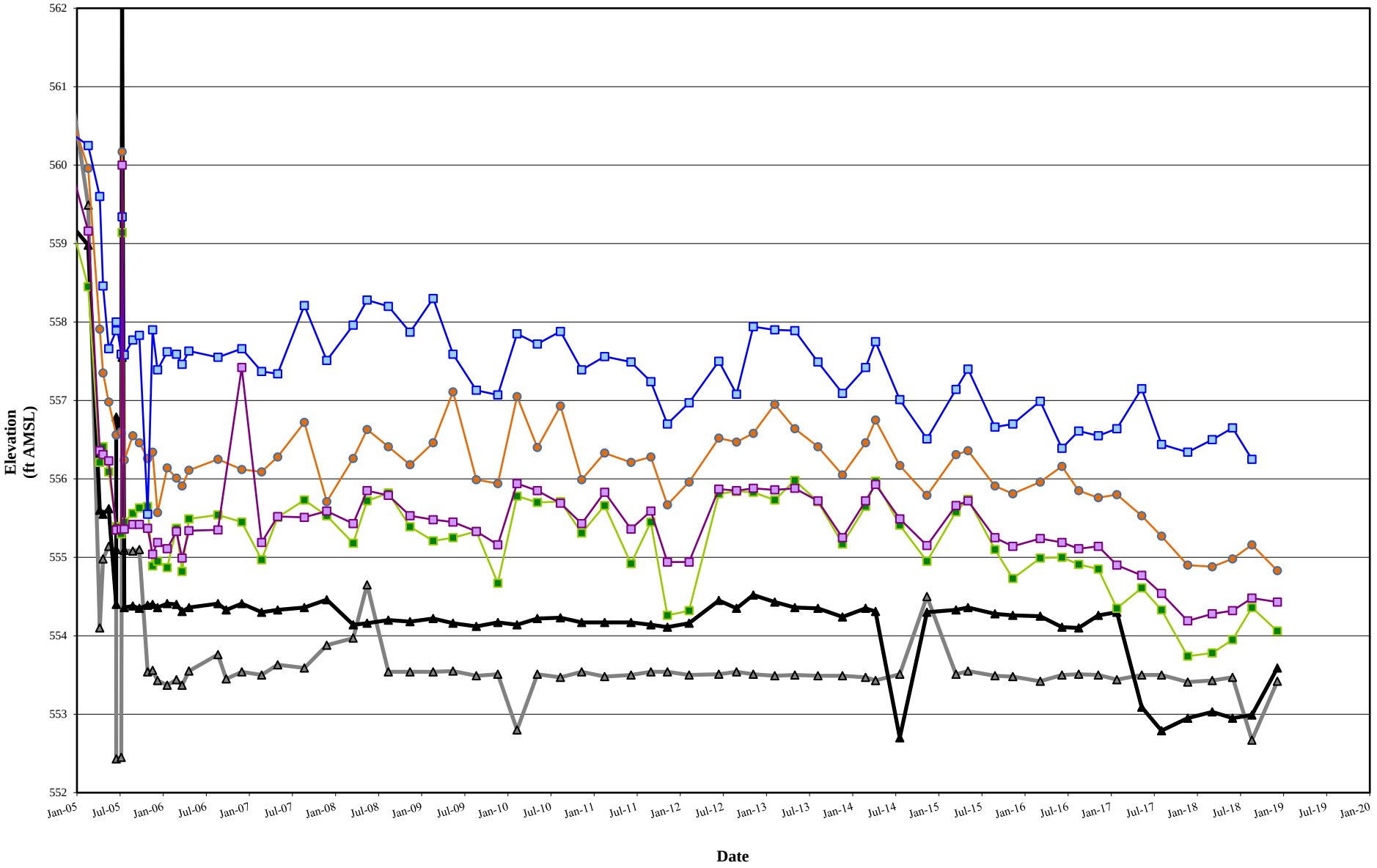
Necco 2018 D Zone Water Elev Trends.xlsx

Figure 3-6
Select E-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2018
Chemours Necco Park



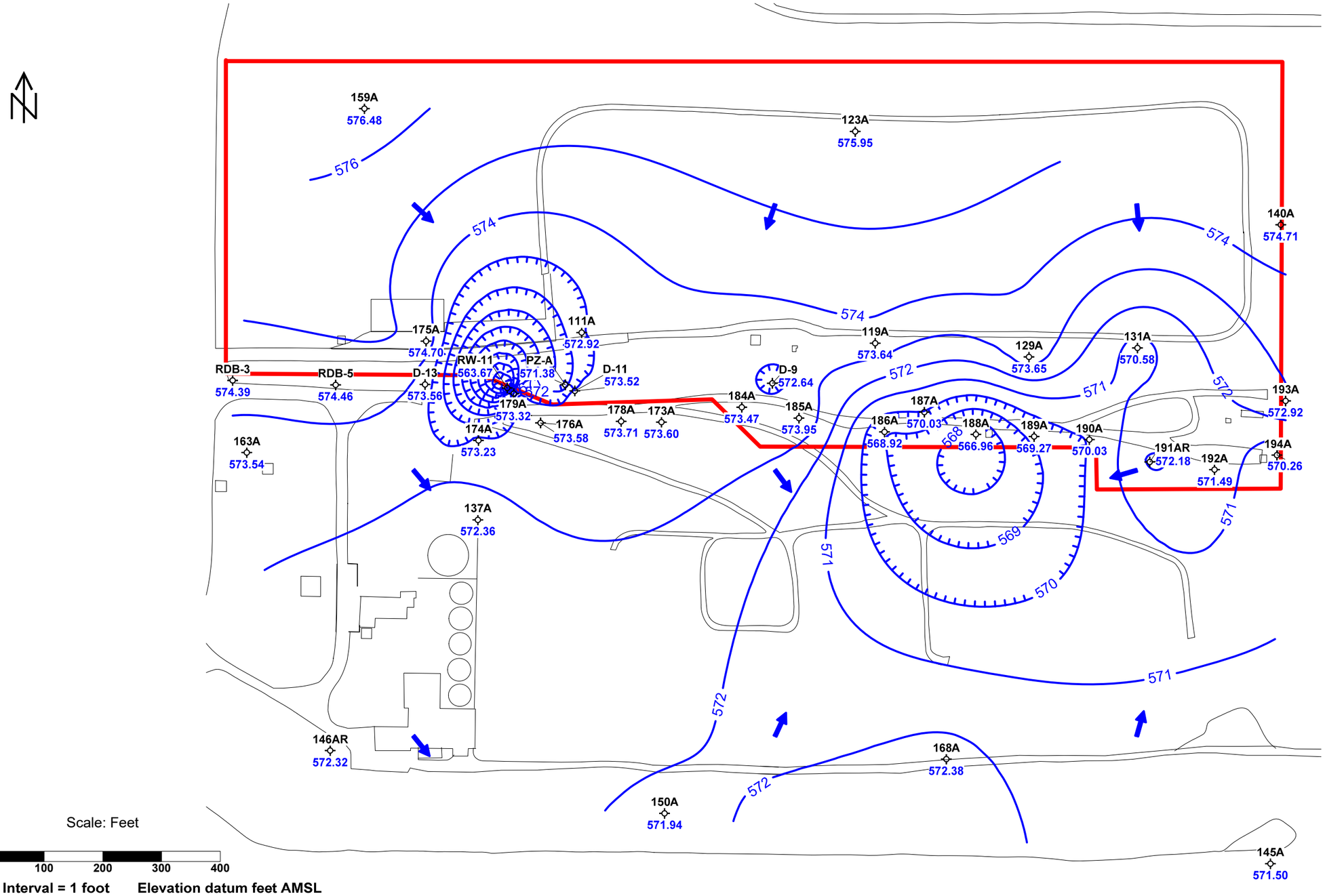
Necco 2018 E Zone Water Elev Trends.xlsx

Figure 3-7
Select F-Zone Monitoring Wells
Groundwater Elevations 2005 Through 2018
Chemours Necco Park



Note:
Value for 150F was anomalous and omitted from the hydrograph as it was 3 feet lower than typical range.

Necco 2018 F Zone Water Elev Trends.xlsx



Scale: Feet

0 100 200 300 400

Contour Interval = 1 foot **Elevation datum feet AMSL**

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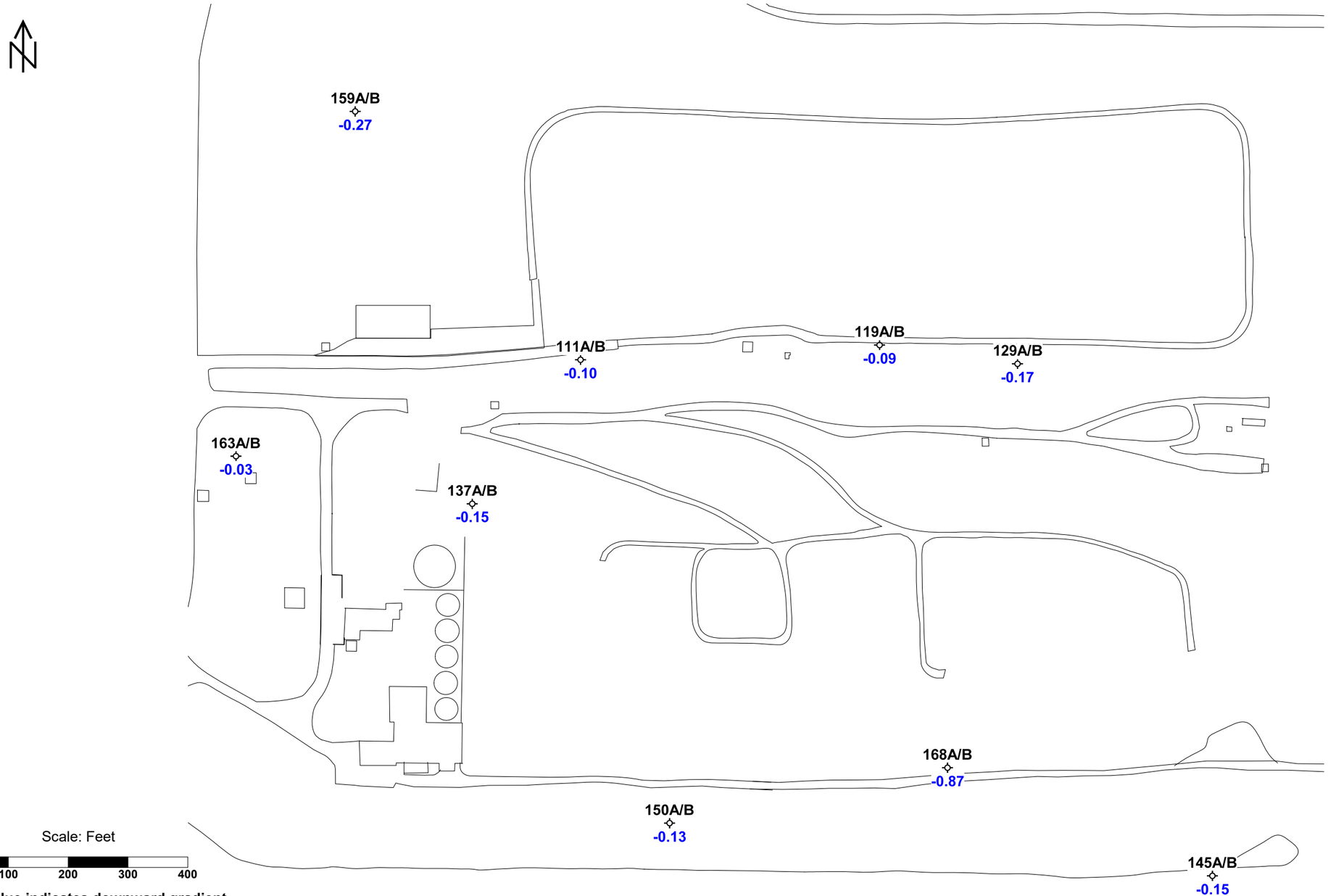
Buffalo, NY 14202
(716) 541-0730

Created by: RBP	Date: 01-02-19
Checked by: JWS	Date: 01-07-19
Project Manager: EAF	Date: 01-07-19
Job number: 450860.02023	

LEGEND

- 3B — Well ID
- Monitoring Well
- Pumping Well
- Potentiometric Contour
- Structure
- Road
- Source Area Extent

Figure 3-8
Potentiometric Surface Map
Chemours Necco Park: A-Zone
December 7, 2018



Negative value indicates downward gradient

Elevation datum feet AMSL

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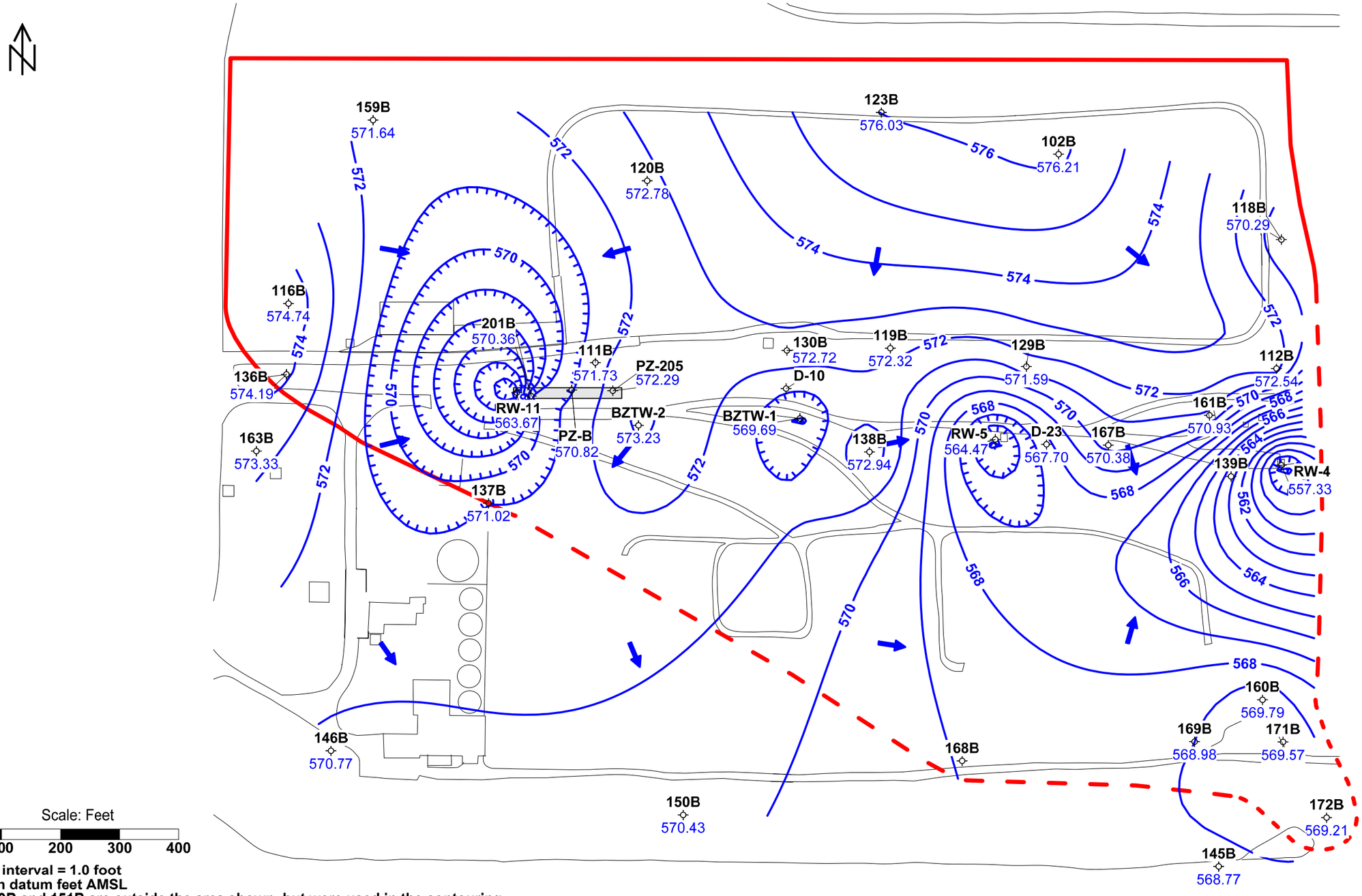
LEGEND

150A/B	Well ID		Structure
	Monitoring Well		Road
	Pumping Well	-0.10	Vertical Hydraulic Gradient

Figure 3-9
Vertical Gradient: A-Zone to B-Zone
Chemours Necco Park
December 7, 2018

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2018-12-07 NEC Contour Tool/2018-12-07 - ABvgrad - F3.srf



Scale: Feet

0 100 200 300 400

Contour interval = 1.0 foot
Elevation datum feet AMSL
Wells 149B and 151B are outside the area shown, but were used in the contouring.
Wells 139B, 168B, 170B, D-10, TRW-6, and TRW-7 were not used in the contouring.

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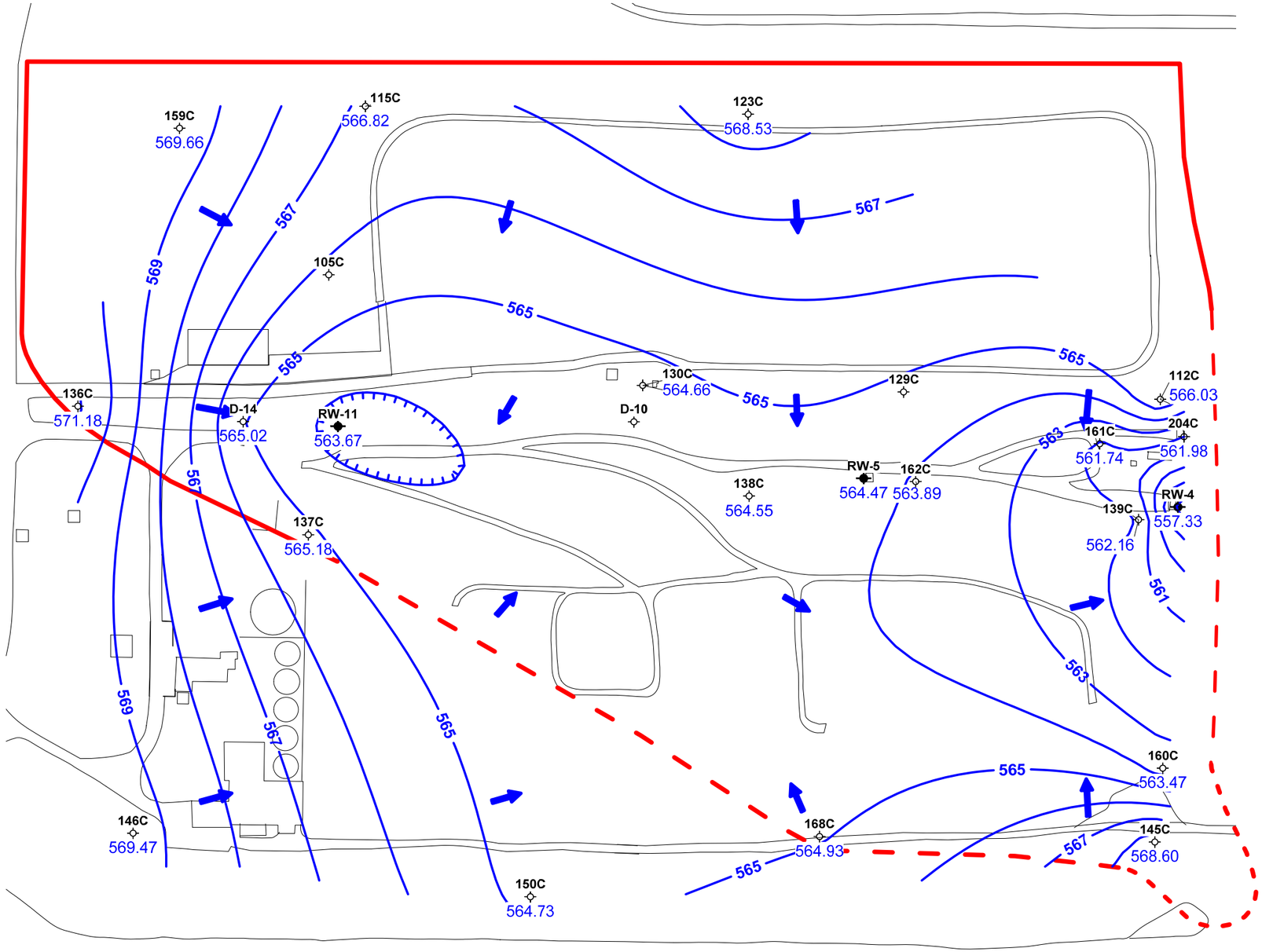
Job number: 450860.02023	

LEGEND

- 3B — Well ID
- Monitoring Well
- Pumping Well
- Potentiometric Contour
- Structure
- Road
- Source Area Extent
- Approximate Location of Bedrock Fractured Blast Trench

Figure 3-10
Potentiometric Surface Map
Chemours Necco Park: B-Zone
December 7, 2018



Scale: Feet

0 100 200 300 400

Contour interval = 1.0 foot
Elevation datum feet AMSL

Wells 149C and 151C are outside the area shown, but were used in the contouring.
The water levels for 129C and D-10 were erroneously high and were not used in the contouring.

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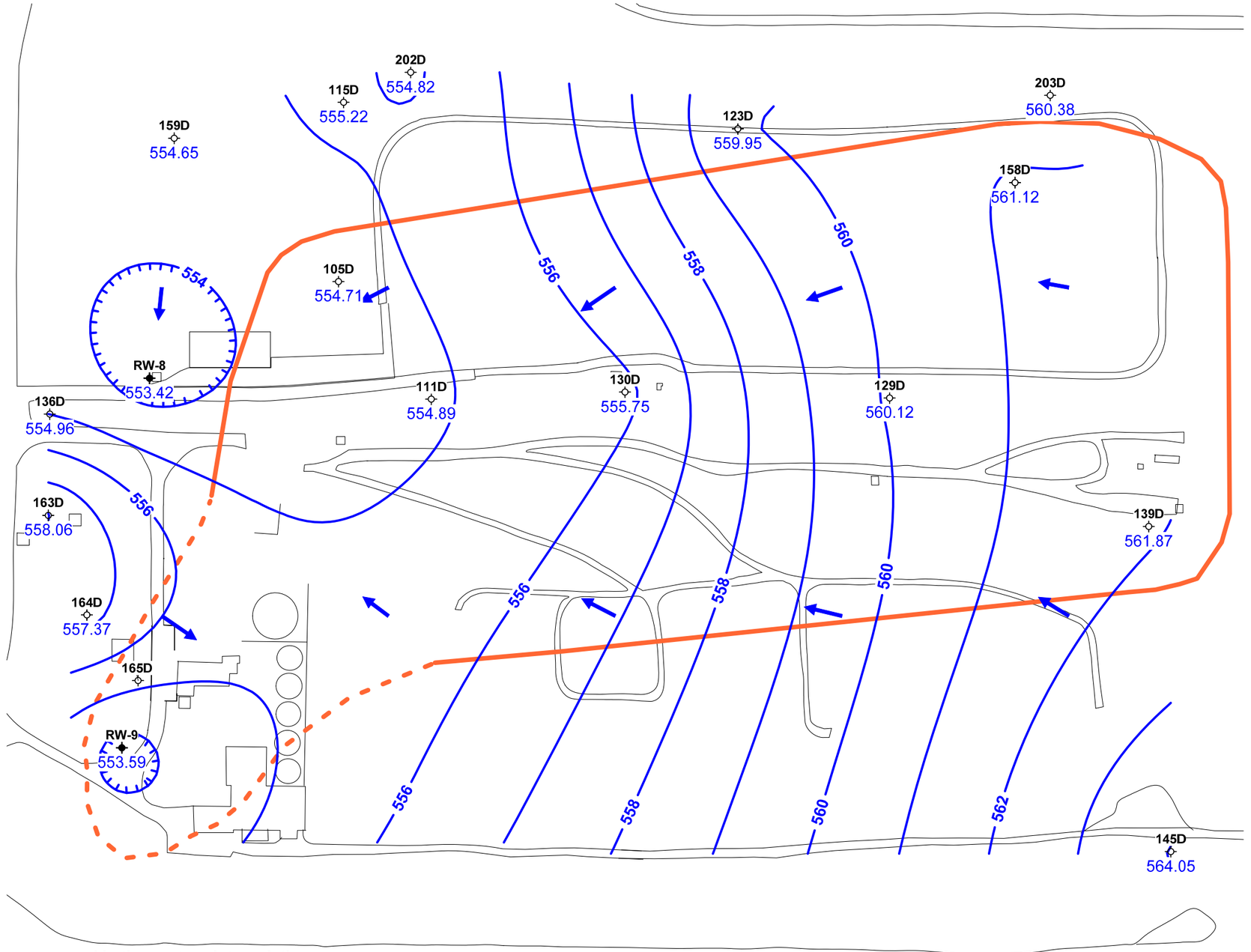
Job number: 450860.02023	

LEGEND

- 3B — Well ID
- Monitoring Well
- Pumping Well
- Potentiometric Contour
- Structure
- Road
- Source Area Extent

Figure 3-11
Potentiometric Surface Map
Chemours Necco Park: C-Zone
December 7, 2018



Scale: Feet

0 100 200 300 400

Contour interval = 1.0 feet

Well 149D, located outside the map area, was used in the contour interpolation.
Well 148D located downgradient was not used in the interpolation.
Well 165D was not used in the contour interpolation.

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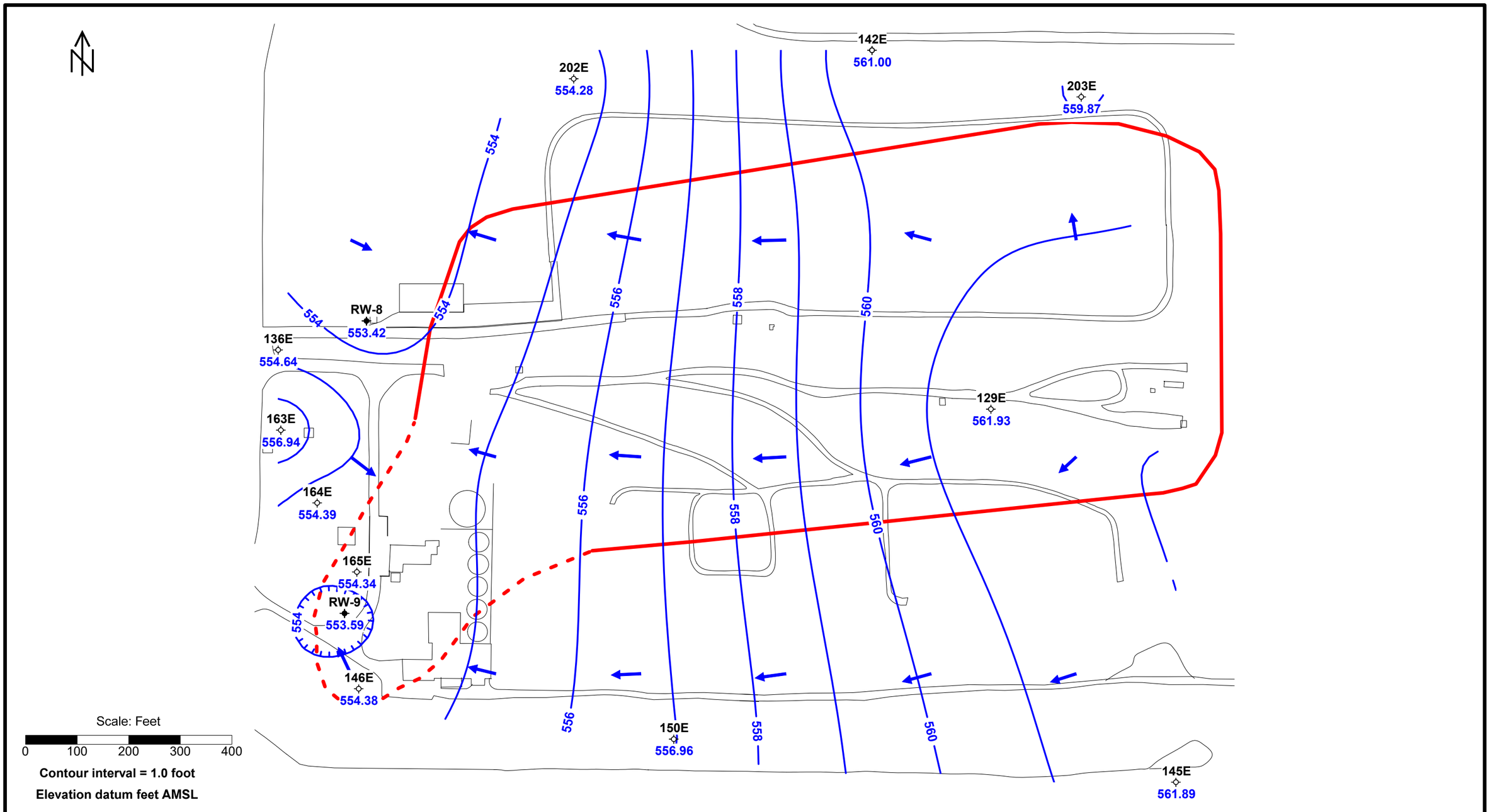
Project Manager: EAF	Date: 01-07-19
Job number: 450860.02023	

LEGEND

- 3B — Well ID
- Monitoring Well
- Pumping Well
- Potentiometric Contour
- Structure
- Road
- Source Area Extent

Figure 3-12
Potentiometric Surface Map
Chemours Necco Park: D-Zone
December 7, 2018

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2018-12-07 NEC Contour Tool/2018-12-07 - PZ D - F9.srf



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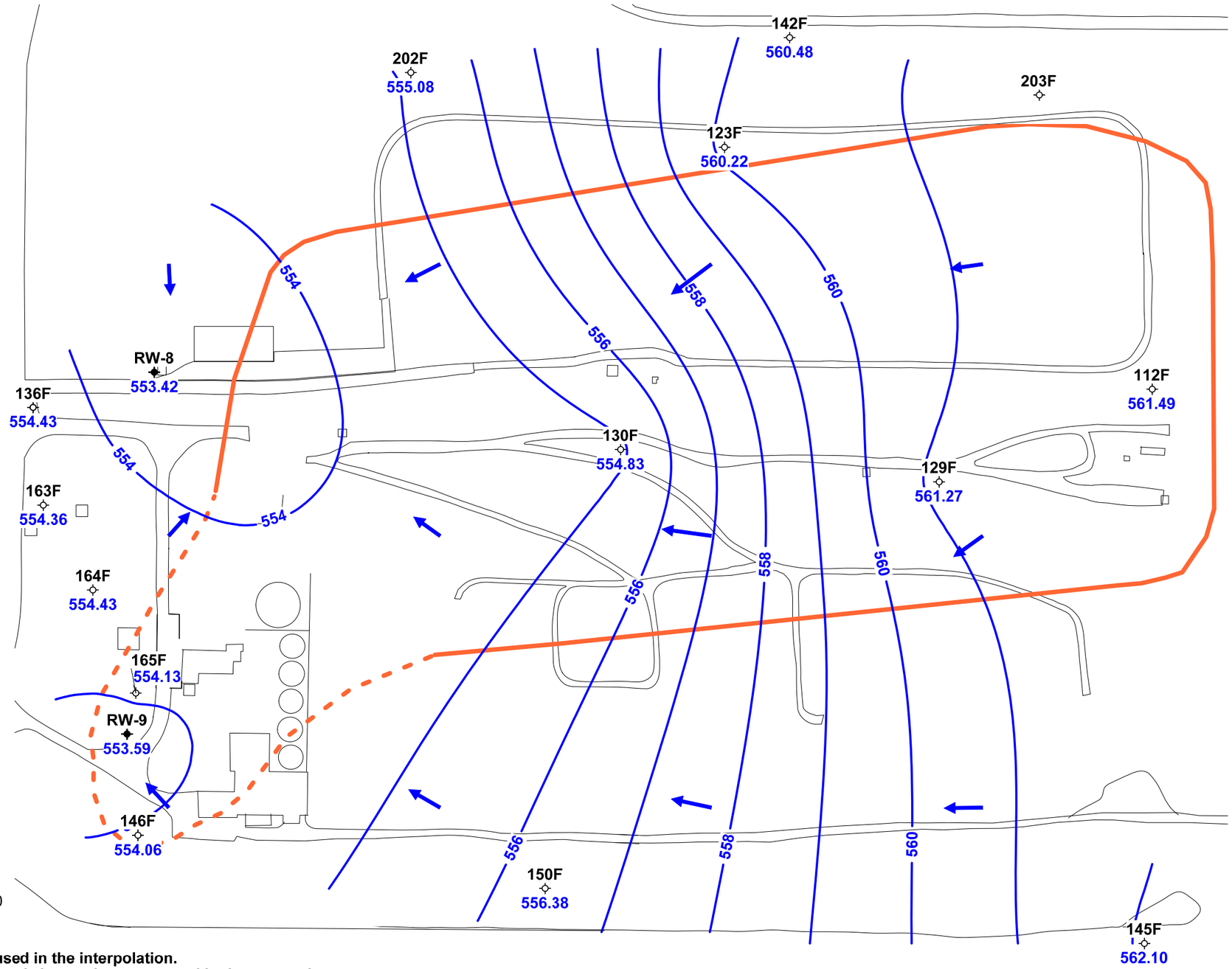
Checked by: JWS	Date: 01-07-19
Project Manager: EAF	Date: 01-07-19
Job number: 450860.02023	

LEGEND

- 3B — Well ID
- Monitoring Well
- Pumping Well
- Potentiometric Contour
- Structure
- Road
- Source Area Extent

Figure 3-13
Potentiometric Surface Map
Chemours Necco Park: E-Zone
December 7, 2018

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2018-12-07 NEC Contour Tool/2018-12-07 - PZ E - F11.srf



Scale: Feet

0 100 200 300 400

Contour interval = 0.5 foot
Elevation datum feet AMSL
148F located downgradient was not used in the interpolation.
The water level for 203F was anomalously low and was not used in the contouring.
The water level for 150F was 3 feet lower than typical. The value used for the contours was calculated by extrapolating the previous 9 quarters (3Q2016-3Q2018) to 12/7/18.

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Project Manager: EAF	Date: 01-07-19
Job number: 450860.02023	

LEGEND

- 3B — Well ID
- Monitoring Well
- Pumping Well
- Potentiometric Contour
- Structure
- Road
- Source Area Extent

Figure 3-14
Potentiometric Surface Map
Chemours Necco Park: F-Zone
December 7, 2018

//nybuf03fs01/Dupont$/Necco/HydroGeo/Hydro/GW_contours/2018-12-07 NEC Contour Tool/2018-12-07 - PZ F - F13.srf

APPENDIX A
2018 ANNUAL GROUNDWATER SAMPLING RESULTS

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	105D	111B	123D	136B	136C	136D	136D	136E	136E
	Date	15-Nov-18	15-Nov-18	24-Oct-18	06-Nov-18	08-Nov-18	05-Nov-18	07-Dec-18	08-Nov-18	08-Nov-18
Parameter Name	**Units**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**	**DUP**
Field Parameter										
Color	NONE	--	Yellow	--	--	--	--	Black	Black	Black
Depth to water	Feet	--	14.55	32.19	7.78	15.92	26.84	24.89	25.63	25.63
Disspolved oxygen	MG/L	--	2.17	0.33	2.71	0.72	0.75	12.89	5.41	5.41
Odor	NONE	--	--	--	--	--	--	--	--	--
Oxidation Reduction Potential	MV	--	-219	-368	-303	-146	-244	20	-123	-123
pH	STD UNITS	--	7.03	7.3	7.38	8.91	7.21	7.44	7.27	7.27
Specific Conductance	UMHOS/CM	--	33600	3100	2210	13280	12830	1215	1471	1471
Temperature	DEGREES C	--	10.03	9.82	14.65	13.83	12.44	7.14	12.24	12.24
Turbidity	NTU	--	7.6	2.85	7	5.95	19.6	5.1	250	250
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	15000	<65	<0.13	<1.3	<13	<1.3	--	2.3 J	8.6 J
1,1,2-Trichloroethane	UG/L	41000	82 J	<0.09	<0.9	<9	2.6 J	--	3 J	8.8 J
1,1-Dichloroethene	UG/L	480 J	<95	0.74 J	<1.9	<19	3.3 J	--	<0.38	<0.38
1,2-Dichloroethane	UG/L	1700	270 J	<0.21	<2.1	<21	3.4 J	--	7.3	7.9
Carbon Tetrachloride	UG/L	45000	<130	<0.26	<2.6	<26	<2.6	--	<0.52	<0.52
Chloroform	UG/L	21000	<65	<0.13	<1.3	<13	1.8 J	--	0.44 J	5 J
cis-1,2 Dichloroethene	UG/L	2200	300 J	1.9	650	120	170	--	5.9 J	51 J
Tetrachloroethene	UG/L	4200	<75	0.18 J	170	4000	<1.5	--	<0.3	0.71 J
trans-1,2-Dichloroethene	UG/L	790 J	200 J	0.3 J	5.4 J	<19	5.8 J	--	2.3	3.5
Trichloroethene	UG/L	33000	82 J	2.3	49	750	6.3 J	--	0.84 J	3.5 J
Vinyl Chloride	UG/L	800 J	14000	0.78 J	25	<20	290	--	11 J	7.8 J
TVOCs		165170	14934	6.2	899.4	4870	483.2		33.08	96.81
MNA Parameters										
Ethane	UG/L	39	57	--	--	--	--	<0.1	3.2 J	<0.1
Ethene	UG/L	890	10000	--	--	--	--	2.6	210 J	100 J
Methane	UG/L	810	13000	--	--	--	--	<0.17	96 J	32 J
Propane	UG/L	1.5	2.7	--	--	--	--	<0.38	<0.38	<0.38
Alkalinity, Total	UG/L	350000	1600000	--	--	--	--	100000	210000	230000
Hydrogen Sulfide	UG/L	<5800	<5800	--	--	--	--	10000	26000	32000
Nitrate/Nitrite Nitrogen	UG/L	42 J	87 J	--	--	--	--	95 B	44 J	33 J
Sulfate	UG/L	200000	<17000	--	--	--	270000	--	340000	340000
Sulfide	UG/L	<5800	<5800	--	--	--	--	9500	24000 J	30000 J
Total Organic Carbon	UG/L	830000	3200000	--	--	--	--	4000	19000 J	32000 J
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	--	--	<2	280	1400 J	7.7 J	--	31 J	<5.3
2,4,6-Trichlorophenol	UG/L	--	--	<1.8	30 J	530 J	<1.7	--	4.8 J	<4.8
3- And 4- Methylphenol	UG/L	--	--	9.1 J	1.6 J	<37	<0.18	--	0.72 J	<0.51
Hexachlorobenzene	UG/L	--	--	<0.16	<0.88	<31	<0.15	--	<0.31	<0.43
Hexachlorobutadiene	UG/L	--	--	<0.54	<3	<100	<0.52	--	1.7 J	<1.4
Hexachloroethane	UG/L	--	--	<0.39	<2.1	<76	<0.38	--	<0.76	<1.1
Pentachlorophenol	UG/L	--	--	<3.1	450	13000	<3	--	<6	<8.3
Phenol	UG/L	--	--	9.4 J	<0.7	<25	<0.12	--	<0.25	<0.34
Tentativley Identified Compound	UG/L	--	--	6.4 J	--	--	4.4 J	--	13 J	6.1 J
Inorganics										
Barium	UG/L	--	--	9.6 J	74 J	41 J	36 J	--	50 J	43 J
Chloride	UG/L	5300000	13000000	290000	190000	130000	180000	--	210000	200000
Iron	UG/L	590000	820000	--	--	--	2400	--	1700 J	450 J
Manganese	UG/L	3800	5300	--	--	--	230	--	240 J	160 J

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	136F	137A	137B	137C	137D	139B	139D	139D	141B
	Date	05-Nov-18	16-Nov-18	16-Nov-18	16-Nov-18	16-Nov-18	19-Nov-18	19-Nov-18	19-Nov-18	30-Oct-18
Parameter Name	**Units**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**	**DUP**	**FS**
Field Parameter										
Color	NONE	--	--	--	--	--	Tan	--	--	--
Depth to water	Feet	26.42	6.97	8.82	9.86	14.38	5.85	23.88	23.88	7.52
Disspolved oxygen	MG/L	--	0.68	0.48	0.95	11.38	2.18	0.72	0.72	0.35
Odor	NONE	--	--	--	--	--	--	--	--	--
Oxidation Reduction Potential	MV	-169	-540	-198	-258	-428	-176	-96	-96	-286
pH	STD UNITS	7.82	9.72	9.03	9.25	7.09	7.01	7.81	7.81	8.1
Specific Conductance	UMHOS/CM	764	4570	6040	4580	7090	723	1508	1508	3520
Temperature	DEGREES C	12.65	12.24	12.39	12.79	10.76	11.02	11.79	11.79	11.96
Turbidity	NTU	9.8	7.5	3.4	5.95	4.65	7.3	4.9	4.9	9.15
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.13	<0.26	<0.52	<0.65	350 J	0.2 J	<0.13	<0.13	<0.13
1,1,2-Trichloroethane	UG/L	<0.09	<0.18	<0.36	1.3 J	7200	<0.09	0.3 J	0.32 J	<0.09
1,1-Dichloroethene	UG/L	0.19 J	5	11	8.2	2800	<0.19	1.1	1.3	<0.19
1,2-Dichloroethane	UG/L	1.8	1.3 J	2.9 J	2.5 J	<420	<0.21	0.62 J	0.6 J	<0.21
Carbon Tetrachloride	UG/L	<0.26	<0.52	<1	8.7	<520	<0.26	<0.26	<0.26	<0.26
Chloroform	UG/L	<0.13	0.95 J	1.3 J	24	53000	0.14 J	0.29 J	0.28 J	<0.13
cis-1,2 Dichloroethene	UG/L	0.53 J	24	80	130	14000	0.4 J	15	16	<0.16
Tetrachloroethene	UG/L	0.23 J	25	68	83	4400	1.5	3.8	4.5	0.39 J
trans-1,2-Dichloroethene	UG/L	0.38 J	2.3	6.2	6.7	2500	<0.19	0.39 J	0.42 J	<0.19
Trichloroethene	UG/L	0.6 J	34	98	130	65000	1.6	2.2	2.4	0.23 J
Vinyl Chloride	UG/L	2.2	12	43	46	4400	<0.2	2.4	2.5	0.48 J
TVOCs		5.93	104.55	310.4	440.4	153650	3.84	26.1	28.32	1.1
MNA Parameters										
Ethane	UG/L	--	--	69	67	51	<0.1	5.3	5.2	35
Ethene	UG/L	--	--	110	110	350	<0.11	6 J	8.2 J	3
Methane	UG/L	--	--	3400	3200	2300	2.3 B	3400 J	3700	1900
Propane	UG/L	--	--	2.4	2.4	4.3	<0.38	<0.38	<0.38	<0.38
Alkalinity, Total	UG/L	--	--	1000000	830000	500000	330000	4100 J	4100 J	74000
Hydrogen Sulfide	UG/L	--	--	<580	3500	54000	1300	<580	<580	3100
Nitrate/Nitrite Nitrogen	UG/L	--	--	65 J	52 J	30 J	110	110	55 J	<31
Sulfate	UG/L	--	--	13000	37000	1000000	91000	5600	8500	990000
Sulfide	UG/L	--	--	<580	3300	51000	1300	<580	<580	2900
Total Organic Carbon	UG/L	--	--	27000	150000	24000	6400	5100	4900	10000
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	<1.9	2.6 J	20	--	--	--	--	<2	--
2,4,6-Trichlorophenol	UG/L	1.9 J	<1.9 UJ	2.2 J	--	--	--	--	2.3 J	--
3- And 4- Methylphenol	UG/L	0.3 J	9.7 J	16 J	--	--	--	--	0.21 J	--
Hexachlorobenzene	UG/L	<0.16	<0.17 UJ	<0.16	--	--	--	--	5.2 J	--
Hexachlorobutadiene	UG/L	<0.53	1.9 J	3.2 J	--	--	--	--	<0.55	--
Hexachloroethane	UG/L	<0.39	<0.42 UJ	<0.39	--	--	--	--	<0.4	--
Pentachlorophenol	UG/L	<3	<3.3 UJ	5.8 J	--	--	--	--	<3.2	--
Phenol	UG/L	0.4 J	39 J	46 J	--	--	--	--	<0.13	--
Tentativley Identified Compound	UG/L	1.4 J	17 J	23 J	--	--	--	--	--	--
Inorganics										
Barium	UG/L	6.9 J	2500	3200	--	--	--	--	78 J	--
Chloride	UG/L	230000	270000	460000	380000	1600000	6700	480000	490000	740000
Iron	UG/L	--	--	<26	<26	360	2200	65 J	47 J	<26
Manganese	UG/L	--	--	<2.1	<2.1	10 J	160	240	240	3.9 J

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	141C	145A	145B	145C	145D	145E	146AR	146B	146C
	Date	29-Oct-18	24-Oct-18	15-Nov-18	07-Dec-18	29-Oct-18	29-Oct-18	30-Oct-18	08-Nov-18	08-Nov-18
Parameter Name	Units	FS	FS	FS	FS	FS	FS	FS	FS	FS
Field Parameter										
Color	NONE	--	--	--	--	--	--	--	--	--
Depth to water	Feet	9.45	7.7	1.82	7.11	15.8	15.92	8.05	6.45	--
Disspolved oxygen	MG/L	0.15	1.9	3.76	8.1	0.62	0.67	2.44	3.93	--
Odor	NONE	--	--	--	--	--	--	--	--	--
Oxidation Reduction Potential	MV	-360	-270	30	-120	-383	-3.94	-122	-409	--
pH	STD UNITS	9.52	6.4	6.58	6.85	7.07	6.75	7.46	8.94	--
Specific Conductance	UMHOS/CM	10430	7520	153	2030	30900	12760	1286	870	--
Temperature	DEGREES C	13.47	11.63	12.55	7.92	11.15	10.26	14.01	13.27	--
Turbidity	NTU	6.83	0.1	7.6	3.8	9.82	--	2.34	3.85	--
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.13	<0.13	<0.13	<0.13	<1.6	<0.26	<0.13	<0.13	<0.13
1,1,2-Trichloroethane	UG/L	<0.09	<0.09	<0.09	<0.09	2.8 J	<0.18	<0.09	<0.09	<0.09
1,1-Dichloroethene	UG/L	0.36 J	<0.19	<0.19	<0.19	7.1 J	<0.38	<0.19	3	2.1
1,2-Dichloroethane	UG/L	0.71 J	<0.21	<0.21	<0.21	9.5 J	3.1	<0.21	<0.21	<0.21
Carbon Tetrachloride	UG/L	<0.26	<0.26	<0.26	<0.26	<3.3	<0.52	<0.26	<0.26	<0.26
Chloroform	UG/L	<0.13	<0.13	<0.13	<0.13	<1.6	<0.26	<0.13	<0.13	<0.13
cis-1,2 Dichloroethene	UG/L	1.6	0.47 J	1.9	2	560	63	0.27 J	15	19
Tetrachloroethene	UG/L	18	<0.15	<0.15	<0.15	<1.9	<0.3	<0.15	<0.15	<0.15
trans-1,2-Dichloroethene	UG/L	0.21 J	0.44 J	<0.19	<0.19	6.9 J	1.6 J	<0.19	0.99 J	5
Trichloroethene	UG/L	6.9	0.22 J	0.22 J	0.27 B	<1.3	<0.2	<0.1	1.6	1.8
Vinyl Chloride	UG/L	9.8	0.87 J	1	1	850	100	1.3	4.1	23
TVOCs		37.58	2	3.12	3.27	1436.3	167.7	1.57	24.69	50.9
MNA Parameters										
Ethane	UG/L	22	--	1.7	<0.1	--	340	--	--	--
Ethene	UG/L	36	--	<0.11	<0.11	--	1800	--	--	--
Methane	UG/L	12000	--	28	19	--	4000	--	--	--
Propane	UG/L	<0.38	--	2	<0.38	--	12	--	--	--
Alkalinity, Total	UG/L	1500000	--	52000	80000	--	21000	--	--	--
Hydrogen Sulfide	UG/L	4200	--	<580	<580	--	<580	--	--	--
Nitrate/Nitrite Nitrogen	UG/L	50	--	41 J	88 B	--	34 J	--	--	--
Sulfate	UG/L	120000	--	450000	450000	--	<17000	--	--	--
Sulfide	UG/L	3900	--	<580	<580	--	<580	--	--	--
Total Organic Carbon	UG/L	100000	--	1300	1500	--	51000	--	--	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	--	<2	<1.9	<2	<9.7	<4	2 J	22	2.8 J
2,4,6-Trichlorophenol	UG/L	--	<1.8	<1.7	<1.8	<8.8	<3.6	<1.8	4.7 J	4.4 J
3- And 4- Methylphenol	UG/L	--	<0.19	<0.19	<0.19	14 J	5.8 J	<0.19	3 J	0.74 J
Hexachlorobenzene	UG/L	--	<0.16	<0.16	<0.16	<0.79	<0.33	<0.16	<0.15	<0.16
Hexachlorobutadiene	UG/L	--	<0.54	<0.53	<0.54	<2.7	<1.1	<0.55	<0.52	<0.53
Hexachloroethane	UG/L	--	<0.39	<0.38	<0.39	<1.9	<0.8	<0.4	<0.38	<0.39
Pentachlorophenol	UG/L	--	<3.1	<3	<3.1	<15	<6.3	<3.1	27 J	<3
Phenol	UG/L	--	<0.13	<0.12	<0.13	14 J	0.81 J	<0.13	<0.12	<0.13
Tentativley Identified Compound	UG/L	--	--	--	1.2 J	700 J	120 J	0.32 J	2.3 J	8.9 J
Inorganics										
Barium	UG/L	--	74 J	12000	31 J	550	32000	9.6 J	13 J	28 J
Chloride	UG/L	2000000	2100000	400000	400000	12000000	4800000	270000	140000	170000
Iron	UG/L	46 J	--	480000	5300	--	180000	--	--	--
Manganese	UG/L	<2.1	--	3100	590	--	11000	--	--	--

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	146E	146E	146F	146F	146F	147D	147D	147D	147F
	Date	08-Nov-18	07-Dec-18	06-Nov-18	19-Nov-18	19-Nov-18	22-Oct-18	19-Nov-18	26-Dec-18	22-Oct-18
Parameter Name	Units	FS	FS	FS	FS	DUP	FS	FS	FS	FS
Field Parameter										
Color	NONE	--	--	Black	--	--	--	--	--	--
Depth to water	Feet	22.51	22.11	20.52	22.43	22.43	--	25.82	30.3	36.81
Disspolved oxygen	MG/L	3.65	2.91	5.92	19.3	19.3	--	4.55	1.31	0.77
Odor	NONE	--	--	Strong	--	--	--	--	--	--
Oxidation Reduction Potential	MV	-447	-345	-210	-397	-397	--	-276	--	-218
pH	STD UNITS	6.97	6.52	7	6.85	6.85	--	7.4	7.37	6.68
Specific Conductance	UMHOS/CM	2970	3050	10200	41	41	--	2140	2060	2710
Temperature	DEGREES C	11.51	9.59	12.1	11.32	11.32	--	12.07	11.03	12.72
Turbidity	NTU	2.12	2.41	1.94	1.1	1.1	--	8.7	--	5.68
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	36 J	--	<11	--	<52	<0.33	--	--	<0.13
1,1,2-Trichloroethane	UG/L	55 J	--	27 J	--	<36	<0.23	--	--	<0.09
1,1-Dichloroethene	UG/L	<38	--	270	--	420	<0.48	--	--	<0.19
1,2-Dichloroethane	UG/L	<42	--	<17	--	<84	<0.53	--	--	<0.21
Carbon Tetrachloride	UG/L	<52	--	<22	--	<100	<0.65	--	--	<0.26
Chloroform	UG/L	60 J	--	62 J	--	120 J	<0.33	--	--	<0.13
cis-1,2 Dichloroethene	UG/L	400	--	5300	--	8500	50	--	--	0.54 J
Tetrachloroethene	UG/L	<30	--	<12	--	<60	<0.38	--	--	<0.15
trans-1,2-Dichloroethene	UG/L	240	--	340	--	460	2.2 J	--	--	<0.19
Trichloroethene	UG/L	97 J	--	160	--	300 J	<0.25	--	--	0.11 B
Vinyl Chloride	UG/L	3800	--	2300	--	1700	39	--	--	0.32 J
TVOCs		4688		8459		11500	91.2			0.97
MNA Parameters										
Ethane	UG/L	--	26	--	36	28	--	--	<0.1	--
Ethene	UG/L	--	2700	--	55 J	38 J	--	--	<0.11	--
Methane	UG/L	--	2400	--	4700 J	4400 J	--	--	79	--
Propane	UG/L	--	2	--	<0.38	<0.38	--	--	<0.38	--
Alkalinity, Total	UG/L	--	260000	--	700000	710000	--	210000	--	--
Hydrogen Sulfide	UG/L	--	58000	--	310000	370000	--	710 J	--	--
Nitrate/Nitrite Nitrogen	UG/L	--	66 B	--	68 J	84 J	--	37 B	--	--
Sulfate	UG/L	770000	--	1200000	--	1300000	--	1200000	--	--
Sulfide	UG/L	--	55000	--	290000	350000	--	670 J	--	--
Total Organic Carbon	UG/L	--	22000	--	84000	95000	--	1700	--	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	150	--	200	--	190	<2	--	--	<1.9
2,4,6-Trichlorophenol	UG/L	24 J	--	24 J	--	50 J	<1.8	--	--	<1.8
3- And 4- Methylphenol	UG/L	19 J	--	30 J	--	45 J	<0.19	--	--	<0.19
Hexachlorobenzene	UG/L	<0.7	--	<0.44	--	<1.6	<0.16	--	--	<0.16
Hexachlorobutadiene	UG/L	7.5 J	--	<1.5	--	<5.4	<0.54	--	--	<0.53
Hexachloroethane	UG/L	<1.7	--	<1.1	--	<4	<0.39	--	--	<0.39
Pentachlorophenol	UG/L	<13	--	<8.4	--	<31	<3.1	--	--	<3
Phenol	UG/L	<0.56	--	79	--	150	<0.13	--	--	<0.13
Tentativley Identified Compound	UG/L	130 J	--	970 J	--	980 J	--	--	--	0.4 J
Inorganics										
Barium	UG/L	45 J	--	50 J	--	37 J	19 J	--	--	24 J
Chloride	UG/L	540000	--	4200000	--	4200000	83000	--	--	170000
Iron	UG/L	160 J	--	240	--	100 J	590	--	--	--
Manganese	UG/L	170	--	2300	--	580	36	--	--	--

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	147F	147G1	147G2	147G3	148D	149B	149C	149D	149D
	Date	22-Oct-18	22-Oct-18	23-Oct-18	24-Oct-18	09-Oct-18	15-Nov-18	11-Oct-18	30-Oct-18	05-Nov-18
Parameter Name	Units	DUP	FS	FS	FS	FS	FS	FS	FS	
Field Parameter										
Color	NONE	--	--	--	--	Black tint	--	--	--	--
Depth to water	Feet	36.81	--	26.9	37.19	11.45	1.89	5.48	--	6.71
Disspolved oxygen	MG/L	0.77	--	0.47	0.72	3.09	3.78	0.76	--	0.4
Odor	NONE	--	--	--	--	Strong	--	--	--	--
Oxidation Reduction Potential	MV	-218	--	-328	-318	-250	31	-148	--	-26
pH	STD UNITS	6.68	--	7.62	6.49	7.94	6.58	7.12	--	7.61
Specific Conductance	UMHOS/CM	2710	--	3380	8460	1350	153	166	--	508
Temperature	DEGREES C	12.72	--	12.3	12.3	14.3	12.91	19.97	--	12.81
Turbidity	NTU	5.68	--	0.8	2.66	1.2	7.6	5.94	--	19.7
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.13	0.28 J	<1.3	37 J	<0.13	<0.13	<0.13	<0.13	--
1,1,2-Trichloroethane	UG/L	<0.09	1.9	<0.9	27 J	<0.09	<0.09	<0.09	<0.09	--
1,1-Dichloroethene	UG/L	<0.19	<0.19	<1.9	<24	<0.19	<0.19	<0.19	<0.19	--
1,2-Dichloroethane	UG/L	<0.21	9	43	65 J	<0.21	<0.21	<0.21	<0.21	--
Carbon Tetrachloride	UG/L	<0.26	<0.26	<2.6	<33	<0.26	<0.26	<0.26	<0.26	--
Chloroform	UG/L	<0.13	0.99 J	<1.3	22 J	<0.13	<0.13	<0.13	<0.13	--
cis-1,2 Dichloroethene	UG/L	0.46 J	1.1	7.5 J	80 J	1.9	<0.16	0.52 J	<0.16	--
Tetrachloroethene	UG/L	<0.15	<0.15	<1.5	<19	0.79 J	<0.15	<0.15	<0.15	--
trans-1,2-Dichloroethene	UG/L	<0.19	23	29	230	0.33 J	<0.19	<0.19	<0.19	--
Trichloroethene	UG/L	0.16 B	1.1	1.6 J	<13	1.4	<0.1	<0.1	<0.1	--
Vinyl Chloride	UG/L	0.23 J	11	370	2400	<0.2	<0.2	0.43 J	<0.2	--
TVOCs		0.85	48.37	451.1	2861	4.42	0	0.95	0	
MNA Parameters										
Ethane	UG/L	--	--	--	--	48	--	<0.1	<0.1	--
Ethene	UG/L	--	--	--	--	6.5	--	3	<0.11	--
Methane	UG/L	--	--	--	--	460	--	83	2.6	--
Propane	UG/L	--	--	--	--	21	--	<0.38	<0.38	--
Alkalinity, Total	UG/L	--	--	--	--	51000	--	67000	25000	--
Hydrogen Sulfide	UG/L	--	--	--	--	31000	--	3100	2100	--
Nitrate/Nitrite Nitrogen	UG/L	--	--	--	--	43 B	--	230	200	--
Sulfate	UG/L	--	--	--	--	180000	--	39000	150000	--
Sulfide	UG/L	--	--	--	--	29000	--	2900	1900	--
Total Organic Carbon	UG/L	--	--	--	--	17000	--	6300	5700	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	<1.9	<2	10	<2	<3.8	<2	<1.9	<2.1	--
2,4,6-Trichlorophenol	UG/L	<1.8	<1.8	<1.9	<1.8	<3.4	<1.8	<1.7	<1.9	--
3- And 4- Methylphenol	UG/L	<0.19	<0.19	<0.2	<0.19	41	<0.19	<0.18	<0.2	--
Hexachlorobenzene	UG/L	<0.16	<0.16	<0.17	<0.16	<0.31	<0.16	<0.15	<0.17	--
Hexachlorobutadiene	UG/L	<0.53	<0.54	<0.57	<0.55	<1	<0.54	<0.52	<0.57	--
Hexachloroethane	UG/L	<0.39	<0.4	<0.41	<0.4	<0.75	<0.4	<0.38	<0.41	--
Pentachlorophenol	UG/L	<3	<3.1 UJ	<3.2	<3.1	<5.9	<3.1	<3	<3.2	--
Phenol	UG/L	<0.13	<0.13	<0.13	<0.13	16 J	<0.13	<0.12	<0.13	--
Tentativley Identified Compound	UG/L	0.32 J	5.8 J	11 J	44 J	--	--	--	--	--
Inorganics										
Barium	UG/L	23 J	--	6.5 J	15 J	34 J	420	14 J	12 J	--
Chloride	UG/L	180000	640000	1000000	2300000	330000	9500	11000	64000	--
Iron	UG/L	--	--	--	--	<26	--	380	<26	--
Manganese	UG/L	--	--	--	--	<2.1	--	59	28	--

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	150A	150B	150C	150E	150F	150F	151B	151B	151C
	Date	24-Oct-18	06-Nov-18	30-Oct-18	06-Nov-18	06-Nov-18	05-Dec-18	11-Oct-18	11-Nov-18	11-Oct-18
Parameter Name	**Units**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**	**FS**		**FS**
Field Parameter										
Color	NONE	--	Black	--	--	--	--	--	--	--
Depth to water	Feet	--	5.59	--	--	--	21.89	--	18.67	6.19
Disspolved oxygen	MG/L	--	0.7	--	--	--	3.62	--	0.62	0.66
Odor	NONE	--	--	--	--	--	--	--	--	--
Oxidation Reduction Potential	MV	--	-500	--	--	--	-30	--	0.62	-214
pH	STD UNITS	--	9.21	--	--	--	6.05	--	6.38	7.45
Specific Conductance	UMHOS/CM	--	--	--	--	--	23100	--	473	380
Temperature	DEGREES C	--	12.92	--	--	--	10.14	--	20.04	17.05
Turbidity	NTU	--	1.94	--	--	--	--	--	54.2	5.72
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.13	<0.52	<0.13	<1.6	<1.1	--	<0.13	--	<0.13
1,1,2-Trichloroethane	UG/L	<0.09	<0.36	<0.09	<1.1	<0.75	--	<0.09	--	<0.09
1,1-Dichloroethene	UG/L	<0.19	3 J	0.27 J	28	<1.6	--	<0.19	--	<0.19
1,2-Dichloroethane	UG/L	<0.21	<0.84	<0.21	<2.6	<1.7	--	<0.21	--	<0.21
Carbon Tetrachloride	UG/L	<0.26	<1	<0.26	<3.3	<2.2	--	<0.26	--	<0.26
Chloroform	UG/L	<0.13	<0.52	<0.13	28	<1.1	--	<0.13	--	<0.13
cis-1,2 Dichloroethene	UG/L	0.34 J	110	1.4	990	4.6 J	--	0.26 J	--	<0.16
Tetrachloroethene	UG/L	<0.15	5.4	<0.15	<1.9	<1.2	--	<0.15	--	<0.15
trans-1,2-Dichloroethene	UG/L	<0.19	5.5	0.63 J	46	<1.6	--	<0.19	--	<0.19
Trichloroethene	UG/L	<0.1	11	0.34 J	71	<0.83	--	<0.1	--	<0.1
Vinyl Chloride	UG/L	<0.2	23	1.1	460	250	--	0.23 J	--	<0.2
TVOCs		0.34	157.9	3.74	1623	254.6		0.49		0
MNA Parameters										
Ethane	UG/L	--	--	--	--	--	320	2.5	--	--
Ethene	UG/L	--	--	--	--	--	150	<0.11	--	--
Methane	UG/L	--	--	--	--	--	5500	220	--	--
Propane	UG/L	--	--	--	--	--	5.2	<0.38	--	--
Alkalinity, Total	UG/L	--	--	--	--	--	43000	14000	--	--
Hydrogen Sulfide	UG/L	--	--	--	--	--	<5800	17000	--	--
Nitrate/Nitrite Nitrogen	UG/L	--	--	--	--	--	130 B	<31	--	--
Sulfate	UG/L	--	--	--	--	1400000	--	54000	--	--
Sulfide	UG/L	--	--	--	--	--	<5800	16000	--	--
Total Organic Carbon	UG/L	--	--	--	--	--	160000	1000	--	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	<1.9	26	3.6 J	<14	<21	--	<1.9	--	<1.9
2,4,6-Trichlorophenol	UG/L	<1.7	4.7 J	<1.9	<13	<19	--	<1.7	--	<1.7
3- And 4- Methylphenol	UG/L	<0.18	7.8 J	0.31 J	27 J	17 J	--	<0.18	--	<0.18
Hexachlorobenzene	UG/L	<0.15	<0.17	<0.17	<1.1	<1.7	--	<0.15	--	<0.15
Hexachlorobutadiene	UG/L	<0.52	<0.57	<0.56	<3.9	<5.7	--	<0.52	--	<0.52
Hexachloroethane	UG/L	<0.38	<0.42	<0.41	<2.8	<4.2	--	<0.38	--	<0.38
Pentachlorophenol	UG/L	<3	17 J	<3.2	<22	<33	--	<3	--	<3
Phenol	UG/L	<0.12	17	<0.13	150	39 J	--	<0.12	--	<0.12
Tentativley Identified Compound	UG/L	--	36 J	60 J	4200 J	3700 J	--	--	--	--
Inorganics										
Barium	UG/L	50 J	230	38 J	63 J	52 J	--	62 J	--	66 J
Chloride	UG/L	140000	430000	1100000	7200000	9100000	--	93000	--	5200
Iron	UG/L	--	--	--	--	290000	--	390	--	--
Manganese	UG/L	--	--	--	--	4400	--	34	--	--

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	153B	156D	156E	156F	165D	165D	165E	168B	168C
	Date	29-Oct-18	23-Oct-18	23-Oct-18	15-Nov-18	30-Oct-18	05-Nov-18	05-Nov-18	05-Nov-18	05-Nov-18
Parameter Name	Units	FS	FS	FS	FS	FS		FS	FS	FS
Field Parameter										
Color	NONE	--	--	--	--	--	--	--	--	--
Depth to water	Feet	3.72	--	41.69	41.62	--	17.32	--	12.72	--
Disspolved oxygen	MG/L	0.91	--	0.44	0.85	--	0.46	--	1.98	0.99
Odor	NONE	--	--	--	--	--	--	--	Yes	--
Oxidation Reduction Potential	MV	-241	--	-313	135	--	-230	--	--	-310
pH	STD UNITS	7.11	--	7.72	7.7	--	7.72	--	6.8	6.84
Specific Conductance	UMHOS/CM	1021	--	754	590	--	1580	--	33400	28000
Temperature	DEGREES C	11.53	--	13.12	8.56	--	12.9	--	12.28	12.03
Turbidity	NTU	--	--	3.3	3.5	--	4.91	--	9.7	4.65
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.13	<0.13	<0.13	<0.13	<0.13	--	1300	<52	<1.6
1,1,2-Trichloroethane	UG/L	<0.09	<0.09	<0.09	0.33 J	<0.09	--	1100	<36	9.6 J
1,1-Dichloroethene	UG/L	<0.19	<0.19	<0.19	<0.19	0.94 J	--	240 J	210 J	3.3 J
1,2-Dichloroethane	UG/L	<0.21	<0.21	<0.21	0.3 J	0.7 J	--	170 J	490	16
Carbon Tetrachloride	UG/L	<0.26	<0.26	<0.26	<0.26	<0.26	--	340 J	<100	<3.3
Chloroform	UG/L	<0.13	<0.13	<0.13	0.57 J	<0.13	--	1700	<52	<1.6
cis-1,2 Dichloroethene	UG/L	<0.16	0.21 J	<0.16	1.4	3.4	--	16000	18000	120
Tetrachloroethene	UG/L	<0.15	<0.15	<0.15	1.4	<0.15	--	170 J	<60	<1.9
trans-1,2-Dichloroethene	UG/L	<0.19	<0.19	<0.19	<0.19	0.55 J	--	360 J	200 J	<2.4
Trichloroethene	UG/L	<0.1	<0.1	<0.1	4.5	0.34 J	--	2100	170 J	<1.3
Vinyl Chloride	UG/L	<0.2	0.38 J	0.49 J	3.2	6.1	--	3100	16000	68
TVOCs		0	0.59	0.49	11.7	12.03		26580	35070	216.9
MNA Parameters										
Ethane	UG/L	5.9	1.8	<0.1	--	6.1	--	--	--	--
Ethene	UG/L	<0.11	<0.11	<0.11	--	160	--	--	--	--
Methane	UG/L	25	220	59	--	380	--	--	--	--
Propane	UG/L	<0.38	<0.38	<0.38	--	<0.38	--	--	--	--
Alkalinity, Total	UG/L	83000	260000	15000	--	29000	--	--	--	--
Hydrogen Sulfide	UG/L	<580	<580	<580	--	2300	--	--	--	--
Nitrate/Nitrite Nitrogen	UG/L	94	34 J	270	--	<31	--	--	--	--
Sulfate	UG/L	300000	910000	130000	--	27000	--	--	--	--
Sulfide	UG/L	<580	<580	<580	--	2100	--	--	--	--
Total Organic Carbon	UG/L	5900	2500	1100	--	7300	--	--	--	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	--	<1.9	<2	<2	25	--	1400	<19	<20
2,4,6-Trichlorophenol	UG/L	--	<1.8	<1.8	<1.8	3.5 J	--	130 J	<18	<18
3- And 4- Methylphenol	UG/L	--	<0.19	<0.19	<0.19	2.1 J	--	11 J	160 J	8.4 J
Hexachlorobenzene	UG/L	--	<0.16	<0.16	<0.16	<0.16	--	<8.2	<1.6	<1.6
Hexachlorobutadiene	UG/L	--	<0.53	<0.54	6.3 J	<0.55	--	150 J	<5.3	<5.5
Hexachloroethane	UG/L	--	<0.39	<0.4	<0.4	<0.4	--	21 J	<3.9	<4
Pentachlorophenol	UG/L	--	<3	<3.1	<3.2	<3.2	--	<160	<30	<32
Phenol	UG/L	--	<0.13	<0.13	<0.13	0.68 J	--	<6.5	100	19 J
Tentativley Identified Compound	UG/L	--	--	--	--	8.3 J	--	180 J	4000 J	2300 J
Inorganics										
Barium	UG/L	--	35 J	2.9 J	13 J	11 J	--	76 J	320	160 J
Chloride	UG/L	120000	390000	140000	230000	310000	--	490000	13000000	11000000
Iron	UG/L	340	1700	<26	--	110 J	--	--	--	--
Manganese	UG/L	77	77	9.5 J	--	39	--	--	--	--

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	171B	172B	D-11	D-13	D-9	EB	TB	TB	TB
	Date	16-Nov-18	19-Nov-18	15-Nov-18	09-Oct-18	11-Oct-18	20-Nov-18	04-Oct-18	11-Oct-18	22-Oct-18
Parameter Name	**Units**	**FS**	**FS**	**FS**	**FS**	**FS**	**EB**	**TB**	**TB**	**TB**
Field Parameter										
Color	NONE	--	--	--	Clear	--	--	--	--	--
Depth to water	Feet	10.21	8.15	6.55	6.54	--	--	--	--	--
Disspolved oxygen	MG/L	3.27	7.08	2.03	1.06	--	--	--	--	--
Odor	NONE	--	--	--	Mild	--	--	--	--	--
Oxidation Reduction Potential	MV	-224	-249	-115	-108	--	--	--	--	--
pH	STD UNITS	7.06	7.14	8.72	6.71	--	--	--	--	--
Specific Conductance	UMHOS/CM	15800	9.11	2030	1540	--	--	--	--	--
Temperature	DEGREES C	10.08	11.81	11.47	17.16	--	--	--	--	--
Turbidity	NTU	6.7	3.4	1.2	1	--	--	--	--	--
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.52	230	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
1,1,2-Trichloroethane	UG/L	2.5 J	15 J	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1-Dichloroethene	UG/L	<0.76	<7.6	3.4	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19
1,2-Dichloroethane	UG/L	1.1 J	<8.4	0.85 J	<0.21	0.61 J	<0.21	<0.21	<0.21	<0.21
Carbon Tetrachloride	UG/L	<1	<10	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26
Chloroform	UG/L	<0.52	58	0.25 J	0.3 J	<0.13	<0.13	<0.13	<0.13	<0.13
cis-1,2 Dichloroethene	UG/L	67	890	32	0.33 J	0.19 J	<0.16	<0.16	<0.16	<0.16
Tetrachloroethene	UG/L	1.1 J	74	14	0.3 J	<0.15	<0.15	<0.15	<0.15	<0.15
trans-1,2-Dichloroethene	UG/L	16	200	1.9	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19
Trichloroethene	UG/L	0.77 B	160	25	0.38 J	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl Chloride	UG/L	53	290	16	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TVOCs		141.47	1917	93.4	1.31	0.8	0	0	0	0
MNA Parameters										
Ethane	UG/L	--	--	--	--	--	<0.1	<0.1	<0.1	--
Ethene	UG/L	--	--	--	--	--	<0.11	<0.11	<0.11	--
Methane	UG/L	--	--	--	--	--	<0.17	2.2	<0.17	--
Propane	UG/L	--	--	--	--	--	<0.38	<0.38	<0.38	--
Alkalinity, Total	UG/L	--	--	--	--	--	<2600	--	--	--
Hydrogen Sulfide	UG/L	--	--	--	--	--	<580	--	--	--
Nitrate/Nitrite Nitrogen	UG/L	--	--	--	--	--	210	--	--	--
Sulfate	UG/L	--	--	--	--	--	<350	--	--	--
Sulfide	UG/L	--	--	--	--	--	<580	--	--	--
Total Organic Carbon	UG/L	--	--	--	--	--	160 J	--	--	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	<2.2	<4.1	1.9 J	<1.9	<1.9	<1.9	--	--	--
2,4,6-Trichlorophenol	UG/L	<2	<3.7	<1.7	<1.7	<1.7	<1.7	--	--	--
3- And 4- Methylphenol	UG/L	<0.21	0.52 J	1.1 J	<0.18	2.5 J	<0.18	--	--	--
Hexachlorobenzene	UG/L	<0.18	<0.33	<0.16	<0.15	<0.15	<0.15	--	--	--
Hexachlorobutadiene	UG/L	2.2 J	63	1.2 J	<0.52	<0.52	<0.52	--	--	--
Hexachloroethane	UG/L	<0.44	4.7 J	<0.38	<0.38	<0.38	<0.38	--	--	--
Pentachlorophenol	UG/L	<3.4	<6.3	<3	<3	<3	<3	--	--	--
Phenol	UG/L	<0.14	<0.26	3.3 J	<0.12	<0.12	<0.12	--	--	--
Tentativley Identified Compound	UG/L	470 J	18 J	8.4 J	--	--	--	--	--	--
Inorganics										
Barium	UG/L	39 J	21 J	1200	90 J	100 J	1.5 J	--	--	--
Chloride	UG/L	5900000	2800000	550000	140000	2500000	390 J	--	--	--
Iron	UG/L	--	--	--	--	--	<26	--	--	--
Manganese	UG/L	--	--	--	--	--	<2.1	--	--	--

< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

APPENDIX A
2018 Analytical Results - Monitoring Wells

	Location	TB	TB	TB	TB	TB	TB	TB	TB	TB
	Date	23-Oct-18	24-Oct-18	29-Oct-18	30-Oct-18	05-Nov-18	06-Nov-18	08-Nov-18	15-Nov-18	16-Nov-18
Parameter Name	**Units**	**TB**	**TB**	**TB**	**TB**	**TB**	**TB**	**TB**	**TB**	**TB**
Field Parameter										
Color	NONE	--	--	--	--	--	--	--	--	--
Depth to water	Feet	--	--	--	--	--	--	--	--	--
Disspolved oxygen	MG/L	--	--	--	--	--	--	--	--	--
Odor	NONE	--	--	--	--	--	--	--	--	--
Oxidation Reduction Potential	MV	--	--	--	--	--	--	--	--	--
pH	STD UNITS	--	--	--	--	--	--	--	--	--
Specific Conductance	UMHOS/CM	--	--	--	--	--	--	--	--	--
Temperature	DEGREES C	--	--	--	--	--	--	--	--	--
Turbidity	NTU	--	--	--	--	--	--	--	--	--
Volatile Organics										
1,1,2,2-Tetrachloroethane	UG/L	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
1,1,2-Trichloroethane	UG/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
1,1-Dichloroethene	UG/L	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19
1,2-Dichloroethane	UG/L	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21
Carbon Tetrachloride	UG/L	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26	<0.26
Chloroform	UG/L	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13
cis-1,2 Dichloroethene	UG/L	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
Tetrachloroethene	UG/L	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
trans-1,2-Dichloroethene	UG/L	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19	<0.19
Trichloroethene	UG/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2 J
Vinyl Chloride	UG/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TVOCs		0	0	0	0	0	0	0	0	0
MNA Parameters										
Ethane	UG/L	<0.1	--	<0.1	<0.1	--	--	<0.1	<0.1	<0.1
Ethene	UG/L	<0.11	--	<0.11	<0.11	--	--	<0.11	<0.11	<0.11
Methane	UG/L	<0.17	--	<0.17	<0.17	--	--	<0.17	1.5	<0.17
Propane	UG/L	<0.38	--	<0.38	<0.38	--	--	<0.38	<0.38	<0.38
Alkalinity, Total	UG/L	--	--	--	--	--	--	--	--	--
Hydrogen Sulfide	UG/L	--	--	--	--	--	--	--	--	--
Nitrate/Nitrite Nitrogen	UG/L	--	--	--	--	--	--	--	--	--
Sulfate	UG/L	--	--	--	--	--	--	--	--	--
Sulfide	UG/L	--	--	--	--	--	--	--	--	--
Total Organic Carbon	UG/L	--	--	--	--	--	--	--	--	--
Semivolatile Organics										
2,4,5-Trichlorophenol	UG/L	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	UG/L	--	--	--	--	--	--	--	--	--
3- And 4- Methylphenol	UG/L	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	UG/L	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	UG/L	--	--	--	--	--	--	--	--	--
Hexachloroethane	UG/L	--	--	--	--	--	--	--	--	--
Pentachlorophenol	UG/L	--	--	--	--	--	--	--	--	--
Phenol	UG/L	--	--	--	--	--	--	--	--	--
Tentativley Identified Compound	UG/L	--	--	--	--	--	--	--	--	--
Inorganics										
Barium	UG/L	--	--	--	--	--	--	--	--	--
Chloride	UG/L	--	--	--	--	--	--	--	--	--
Iron	UG/L	--	--	--	--	--	--	--	--	--
Manganese	UG/L	--	--	--	--	--	--	--	--	--

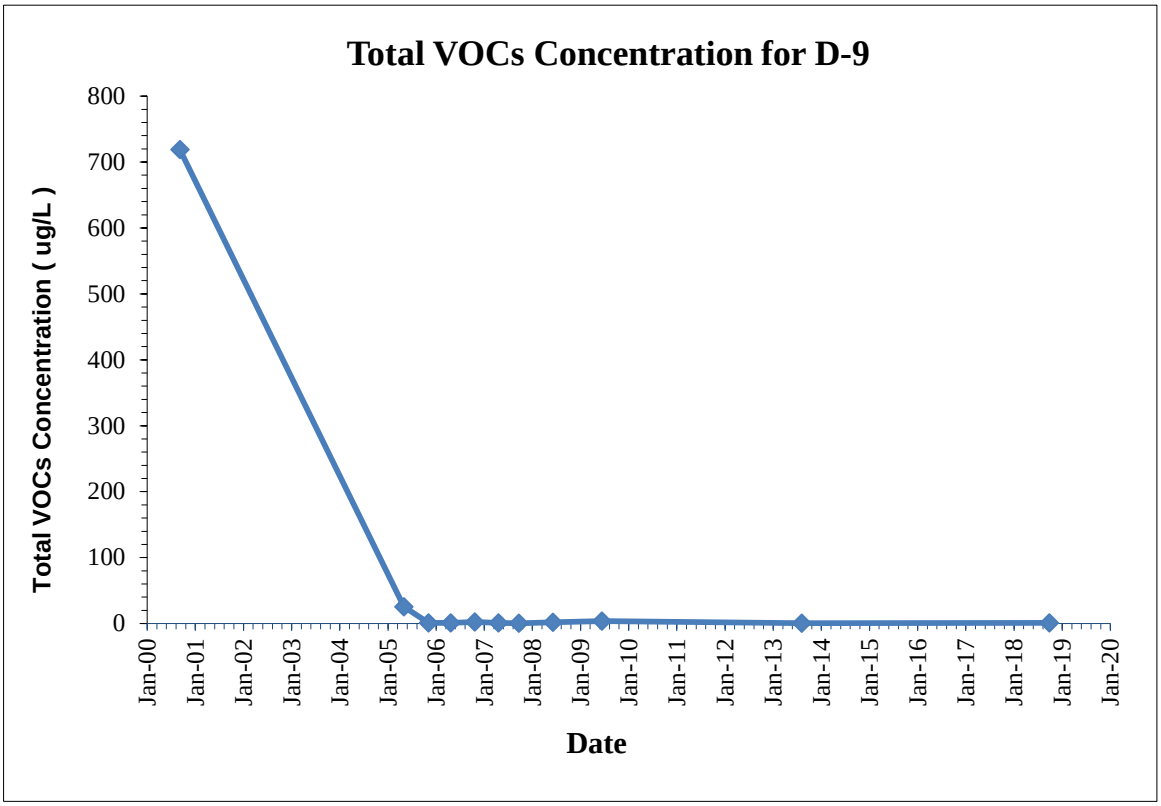
< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

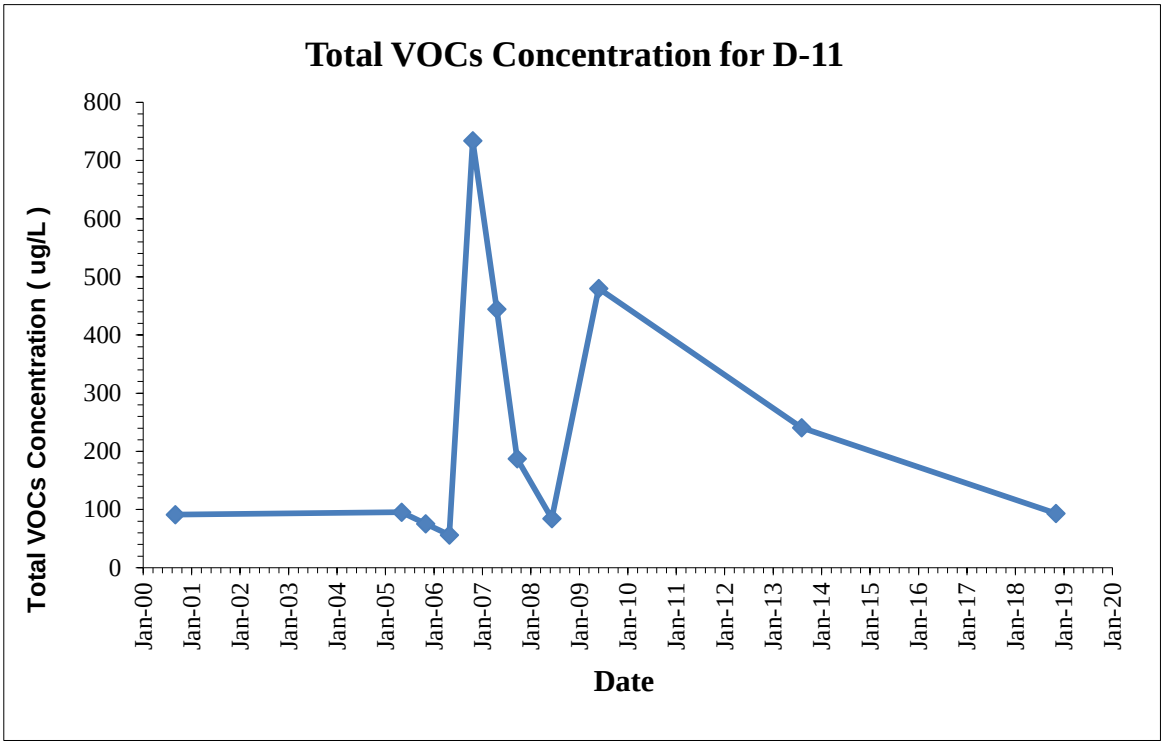
APPENDIX A
2018 Analytical Results - Monitoring Wells

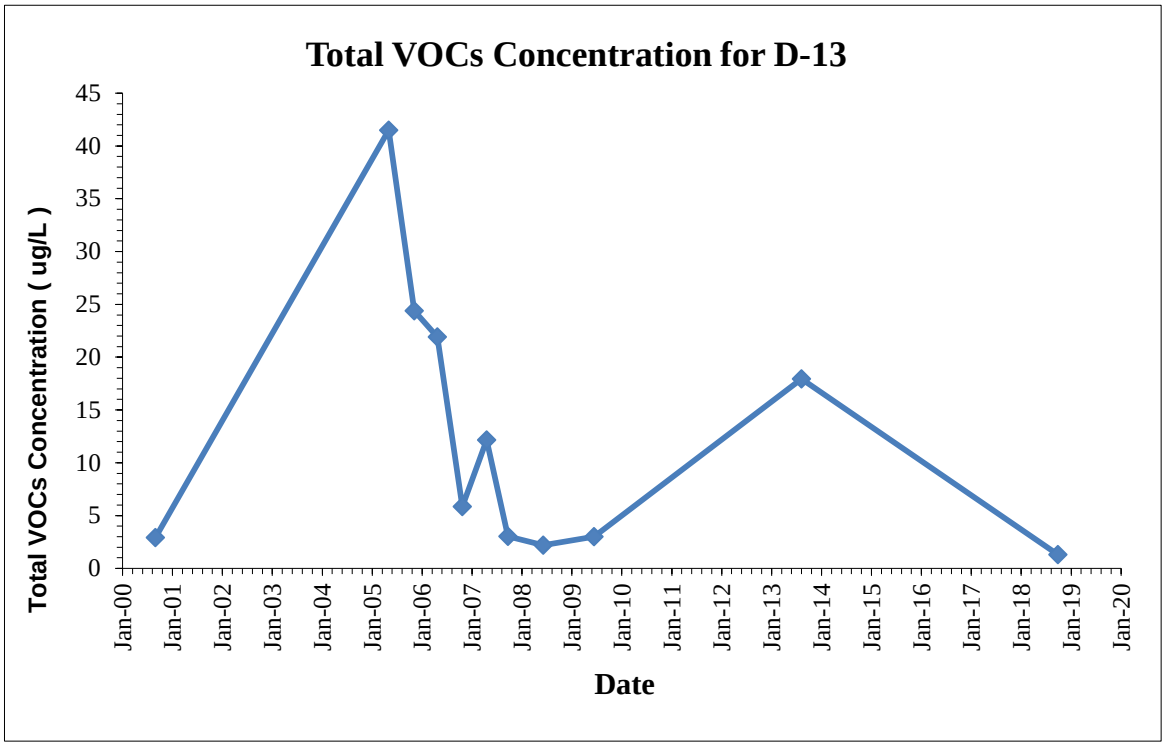
	Location	TB	TB	TB	TB	TB
	Date	19-Nov-18	20-Nov-18	05-Dec-18	07-Dec-18	26-Dec-18
Parameter Name	**Units**	**TB**	**TB**	**TB**	**TB**	**TB**
Field Parameter						
Color	NONE	--	--	--	--	--
Depth to water	Feet	--	--	--	--	--
Disspolved oxygen	MG/L	--	--	--	--	--
Odor	NONE	--	--	--	--	--
Oxidation Reduction Potential	MV	--	--	--	--	--
pH	STD UNITS	--	--	--	--	--
Specific Conductance	UMHOS/CM	--	--	--	--	--
Temperature	DEGREES C	--	--	--	--	--
Turbidity	NTU	--	--	--	--	--
Volatile Organics						
1,1,2,2-Tetrachloroethane	UG/L	<0.13	<0.13	--	<0.13	--
1,1,2-Trichloroethane	UG/L	<0.09	<0.09	--	<0.09	--
1,1-Dichloroethene	UG/L	<0.19	<0.19	--	<0.19	--
1,2-Dichloroethane	UG/L	<0.21	<0.21	--	<0.21	--
Carbon Tetrachloride	UG/L	<0.26	<0.26	--	<0.26	--
Chloroform	UG/L	<0.13	<0.13	--	<0.13	--
cis-1,2 Dichloroethene	UG/L	<0.16	<0.16	--	<0.16	--
Tetrachloroethene	UG/L	<0.15	<0.15	--	<0.15	--
trans-1,2-Dichloroethene	UG/L	<0.19	<0.19	--	<0.19	--
Trichloroethene	UG/L	<0.1	<0.1	--	0.11 J	--
Vinyl Chloride	UG/L	<0.2	<0.2	--	<0.2	--
TVOCs		0	0		0	
MNA Parameters						
Ethane	UG/L	<0.1	<0.1	<0.1	<0.1	<0.1
Ethene	UG/L	<0.11	<0.11	<0.11	<0.11	<0.11
Methane	UG/L	2.7	<0.17	<0.17	<0.17	<0.17
Propane	UG/L	<0.38	<0.38	<0.38	<0.38	<0.38
Alkalinity, Total	UG/L	--	--	--	--	--
Hydrogen Sulfide	UG/L	--	--	--	--	--
Nitrate/Nitrite Nitrogen	UG/L	--	--	--	--	--
Sulfate	UG/L	--	--	--	--	--
Sulfide	UG/L	--	--	--	--	--
Total Organic Carbon	UG/L	--	--	--	--	--
Semivolatile Organics						
2,4,5-Trichlorophenol	UG/L	--	--	--	--	--
2,4,6-Trichlorophenol	UG/L	--	--	--	--	--
3- And 4- Methylphenol	UG/L	--	--	--	--	--
Hexachlorobenzene	UG/L	--	--	--	--	--
Hexachlorobutadiene	UG/L	--	--	--	--	--
Hexachloroethane	UG/L	--	--	--	--	--
Pentachlorophenol	UG/L	--	--	--	--	--
Phenol	UG/L	--	--	--	--	--
Tentativley Identified Compound	UG/L	--	--	--	--	--
Inorganics						
Barium	UG/L	--	--	--	--	--
Chloride	UG/L	--	--	--	--	--
Iron	UG/L	--	--	--	--	--
Manganese	UG/L	--	--	--	--	--

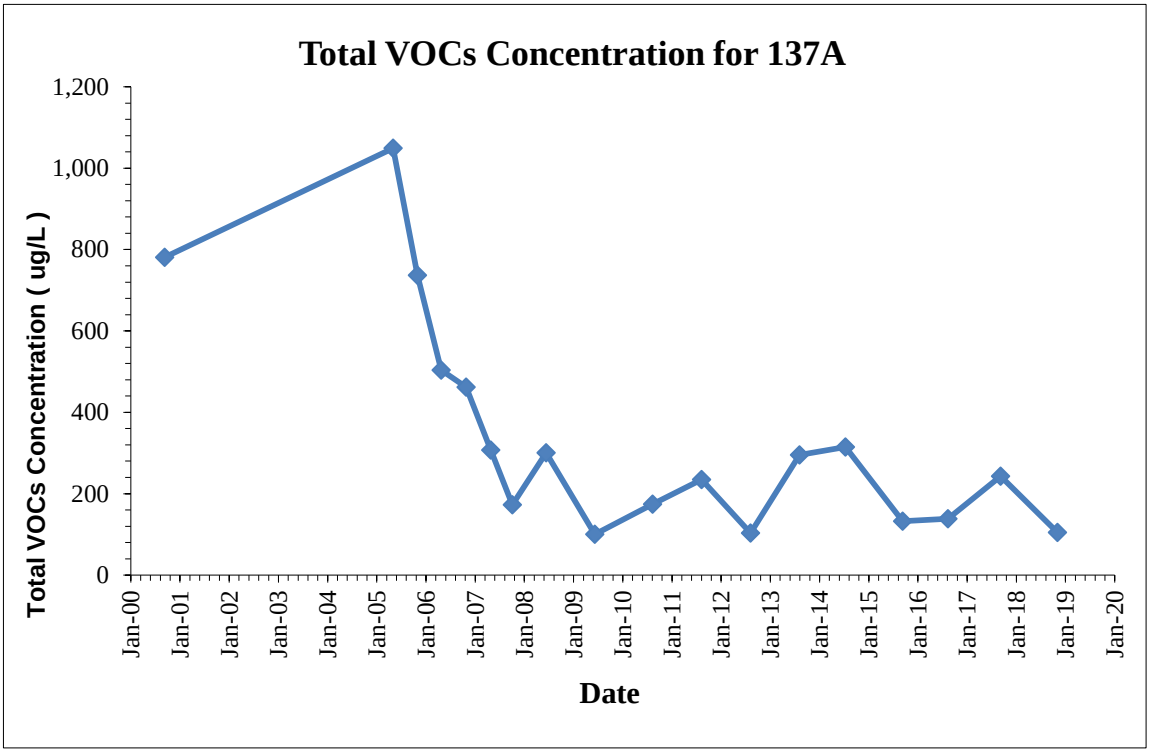
< Non detect at stated reporting limit. J Estimated concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
UJ Undetected-estimated reporting l

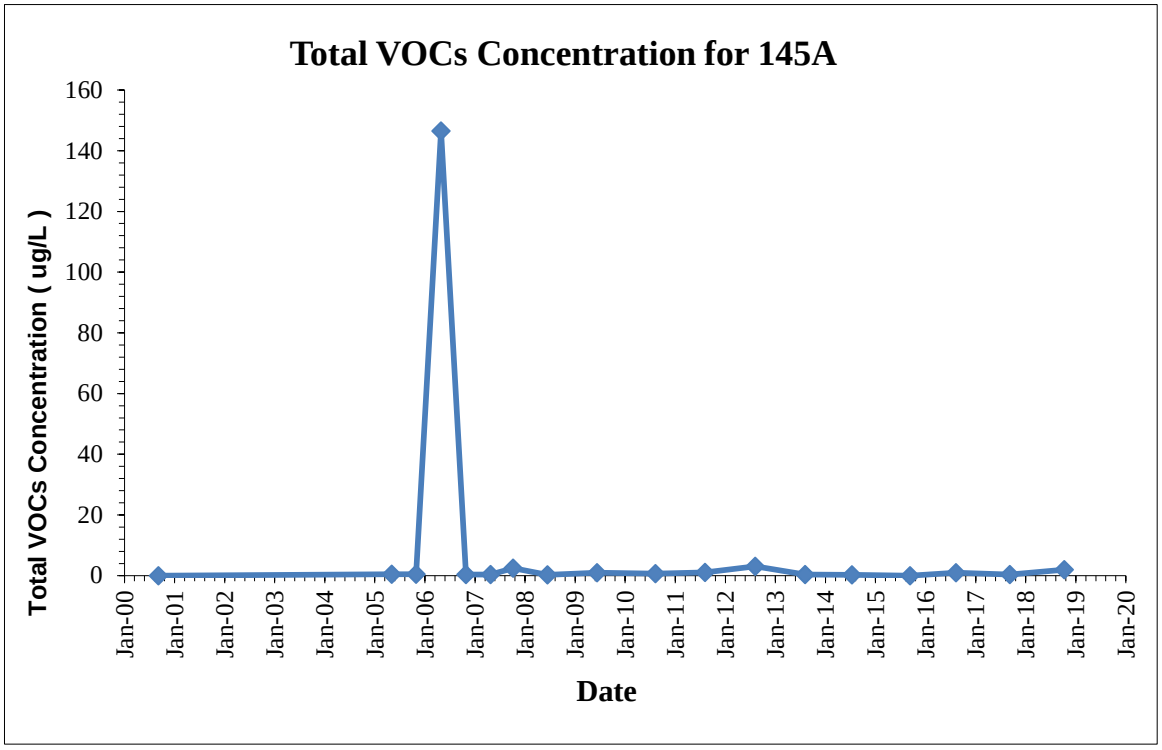
APPENDIX B
TVOC TREND PLOTS

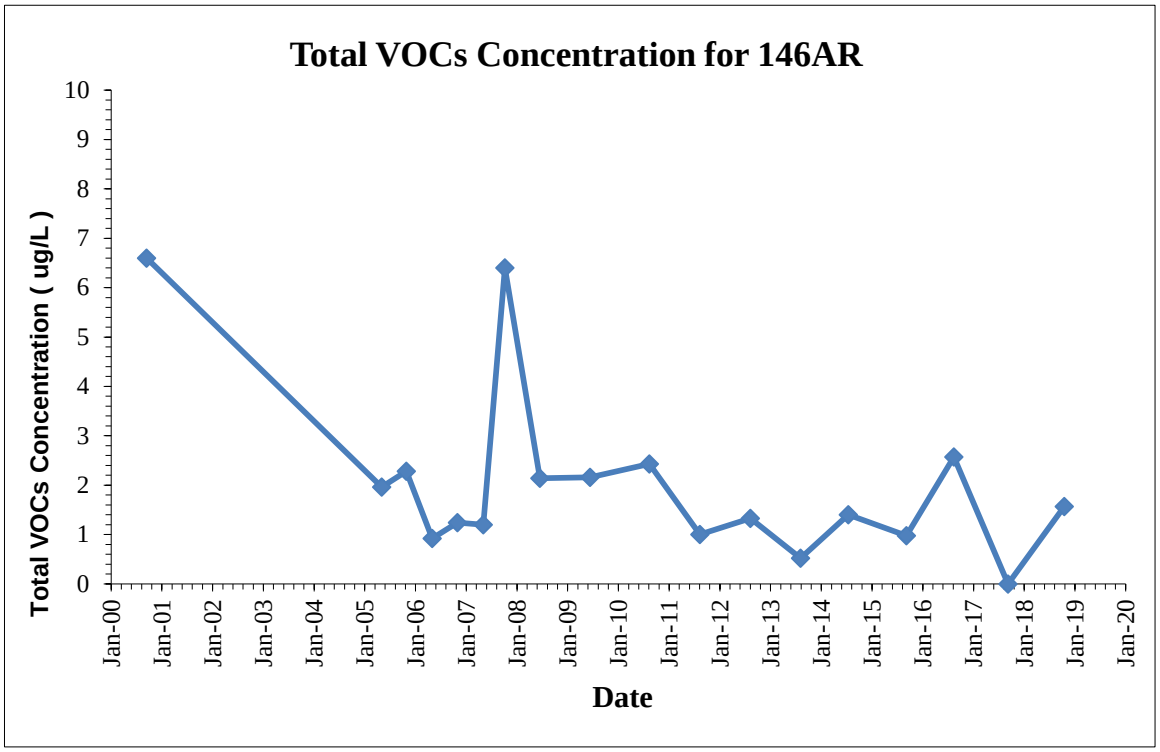

Total VOCs Concentration for D-9
Total VOCs Concentration (ug/L)
800
700
600
500
400
300
200
100
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

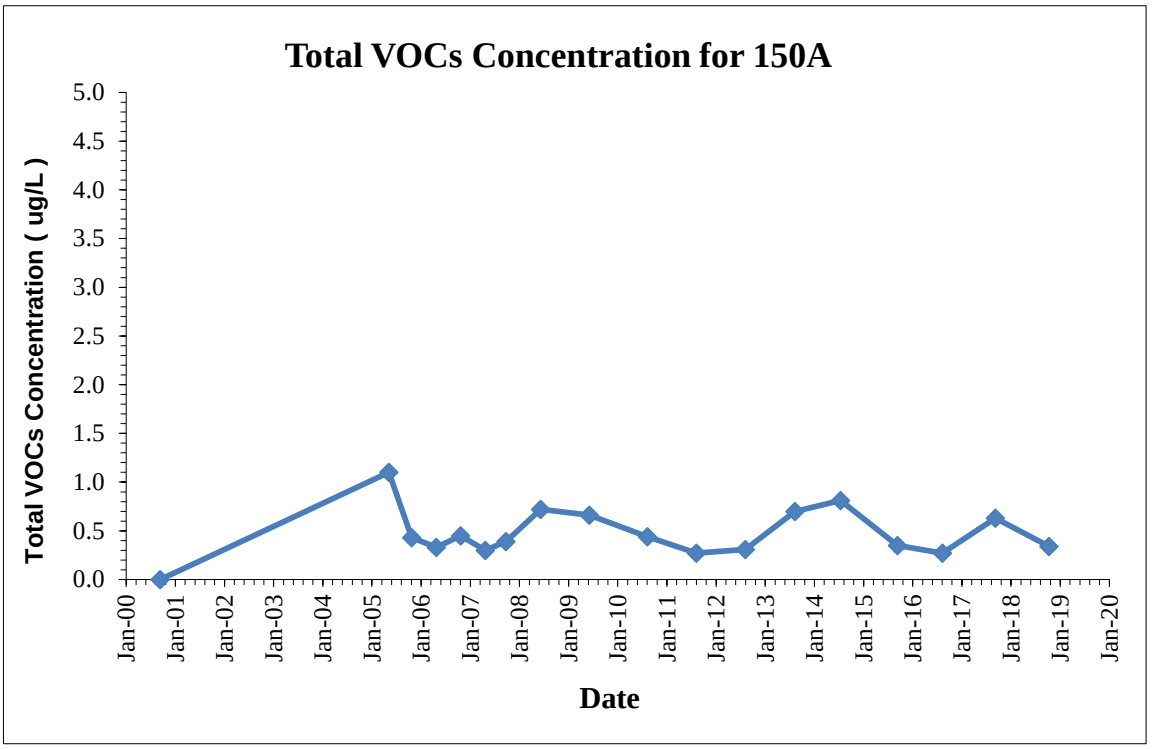

Total VOCs Concentration for D-11
Total VOCs Concentration (ug/L)
800
700
600
500
400
300
200
100
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

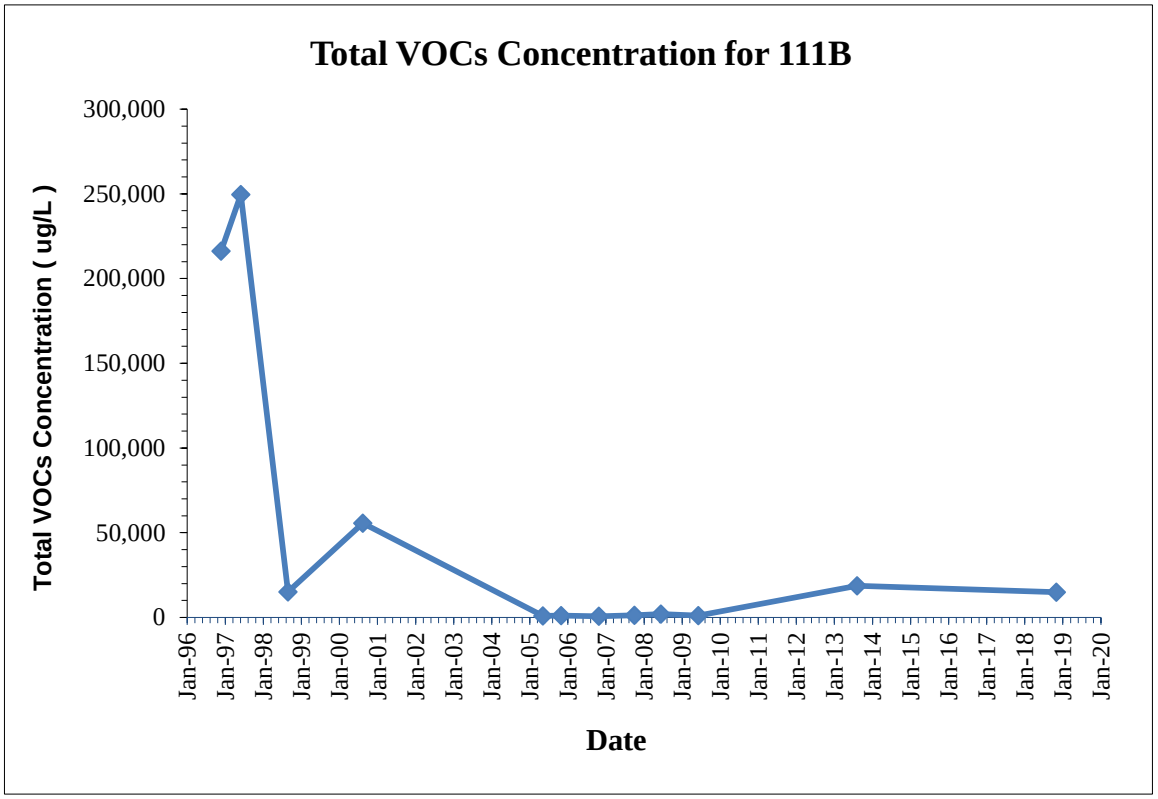

Total VOCs Concentration for D-13
Total VOCs Concentration (ug/L)
45
40
35
30
25
20
15
10
5
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 137A
Total VOCs Concentration (ug/L)
1,200
1,000
800
600
400
200
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 145A
Total VOCs Concentration (ug/L)
160
140
120
100
80
60
40
20
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 146AR
Total VOCs Concentration (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 150A
Total VOCs Concentration (ug/L)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 111B
Total VOCs Concentration (ug/L)
300,000
250,000
200,000
150,000
100,000
50,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
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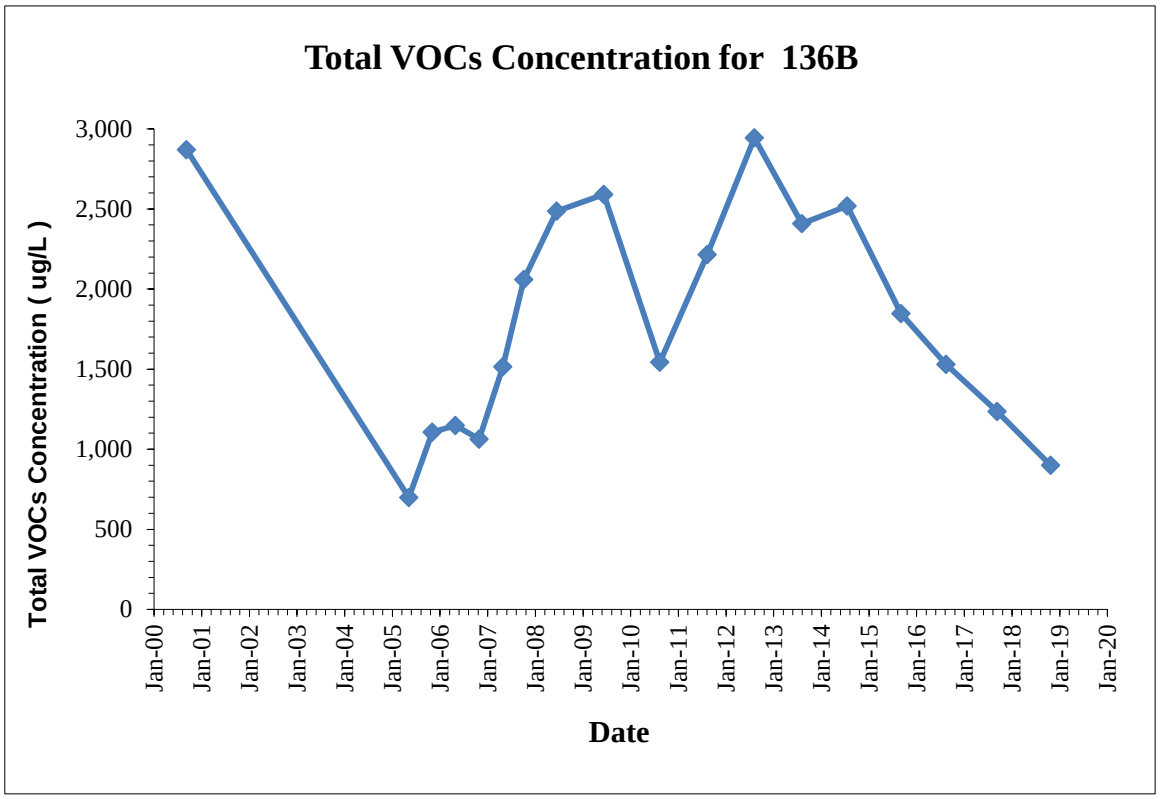
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 136B
Total VOCs Concentration (ug/L)
3,000
2,500
2,000
1,500
1,000
500
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
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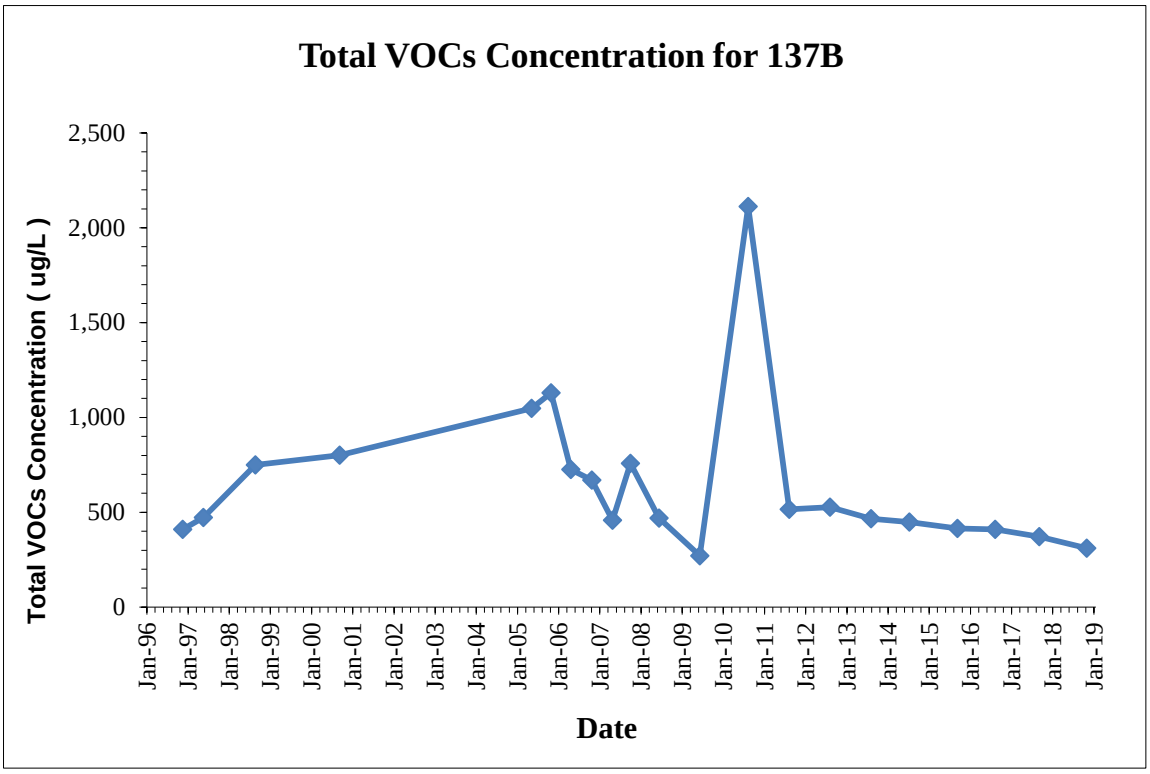
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 137B
Total VOCs Concentration (ug/L)
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
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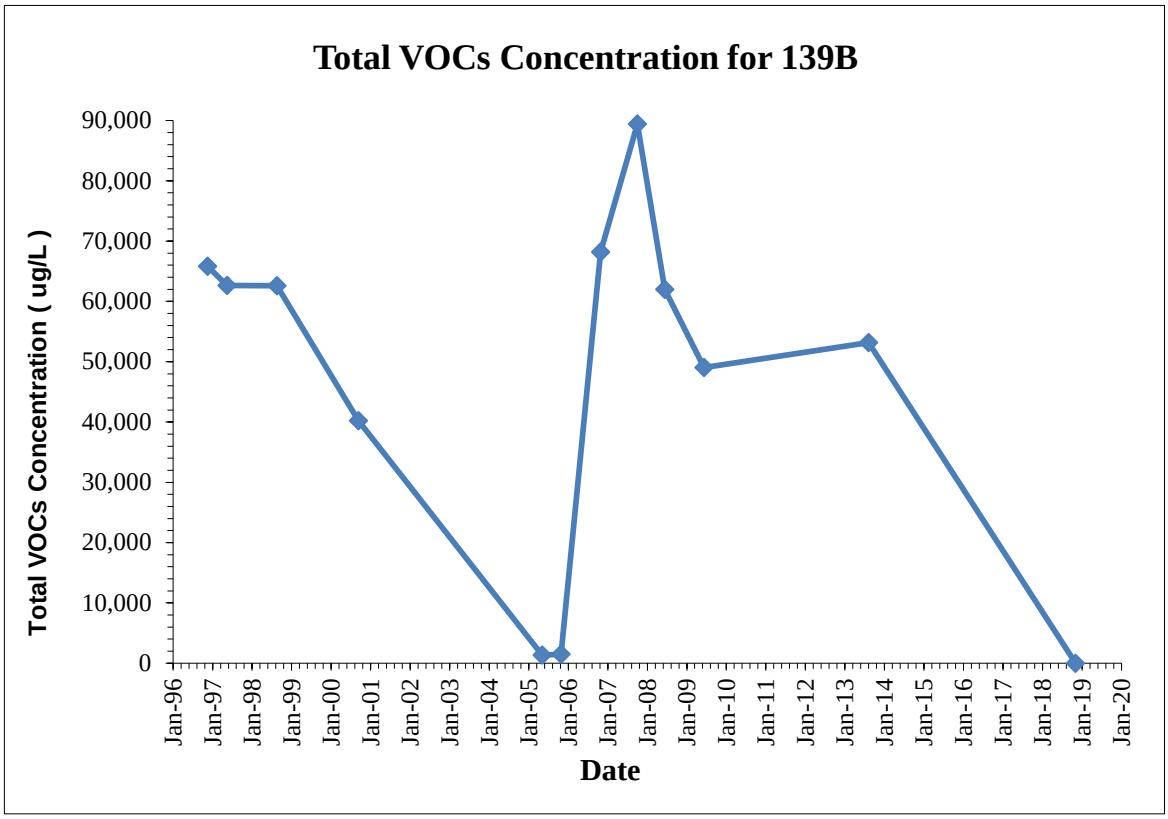
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Date


Total VOCs Concentration for 139B
Total VOCs Concentration (ug/L)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
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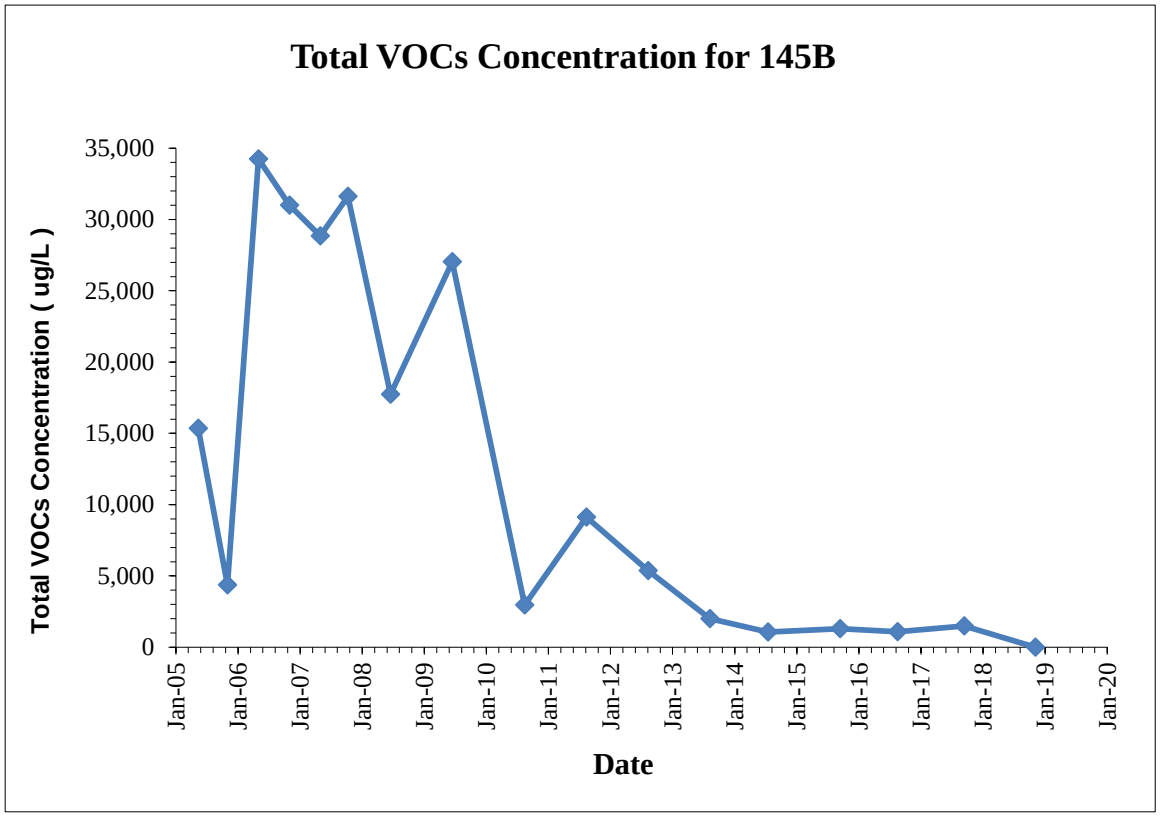
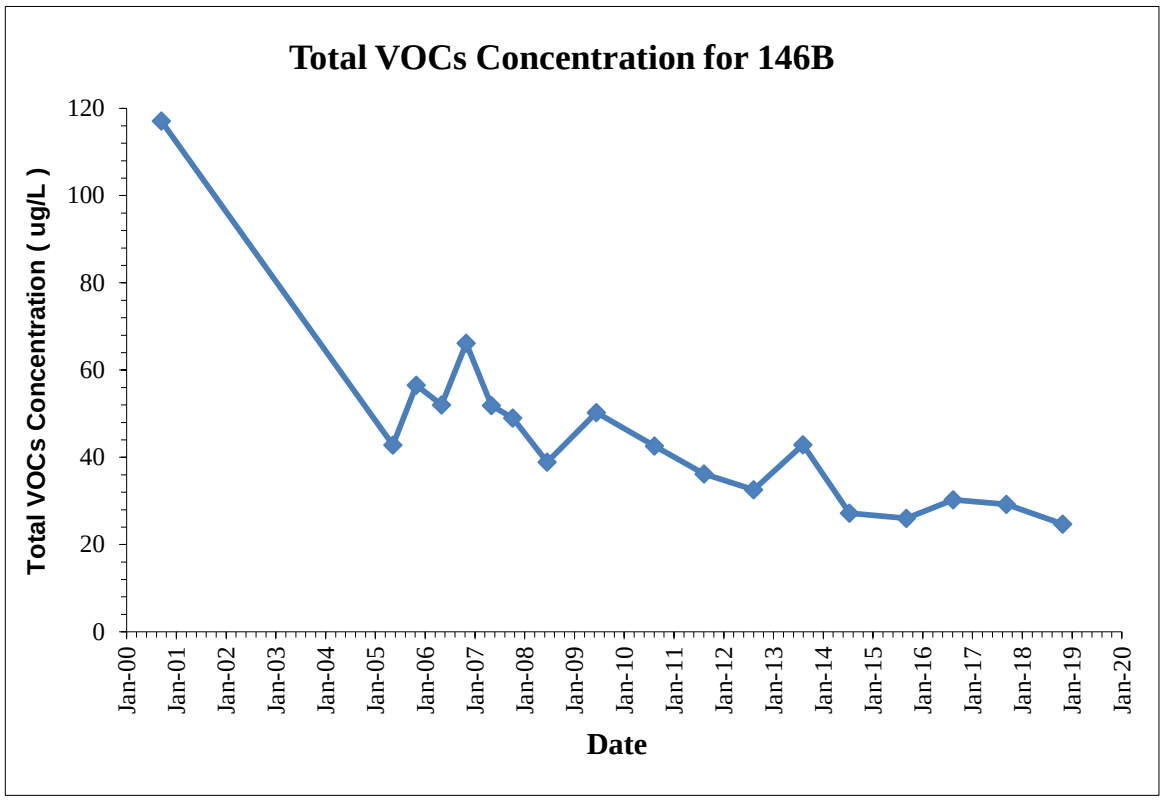
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 145B
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 146B
Total VOCs Concentration (ug/L)
120
100
80
60
40
20
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
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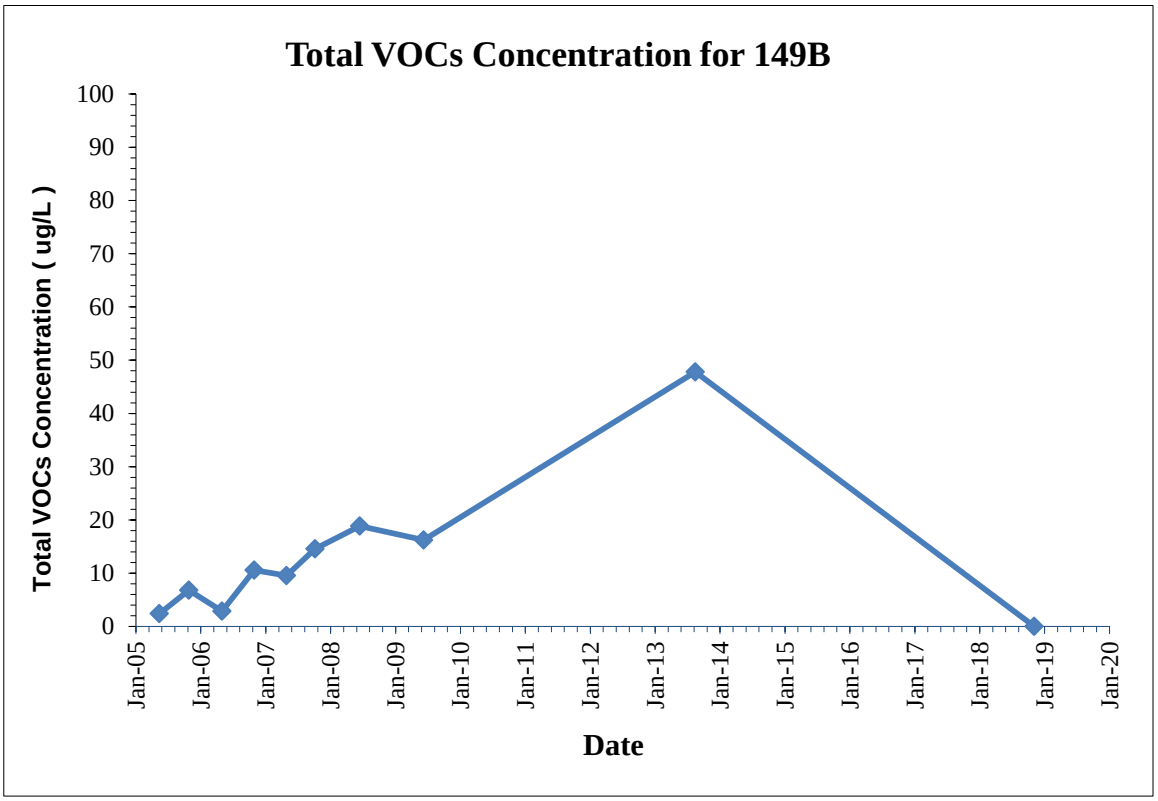
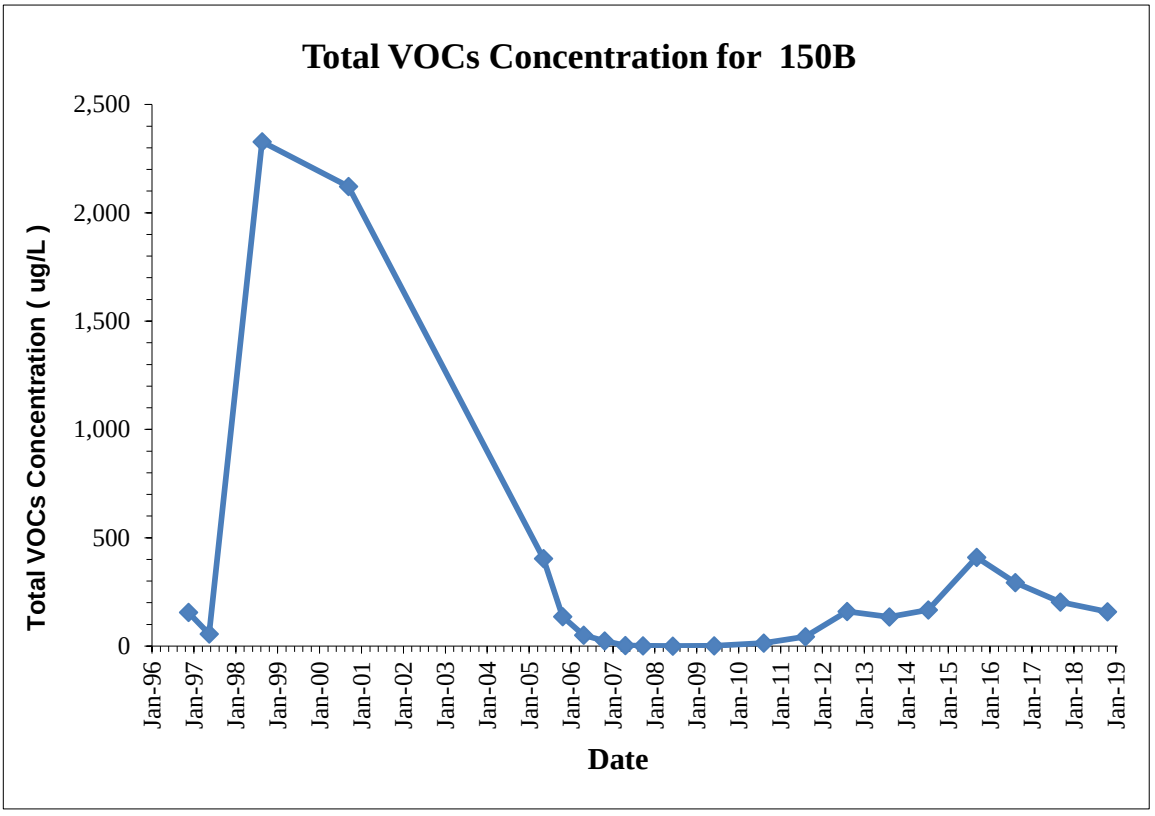
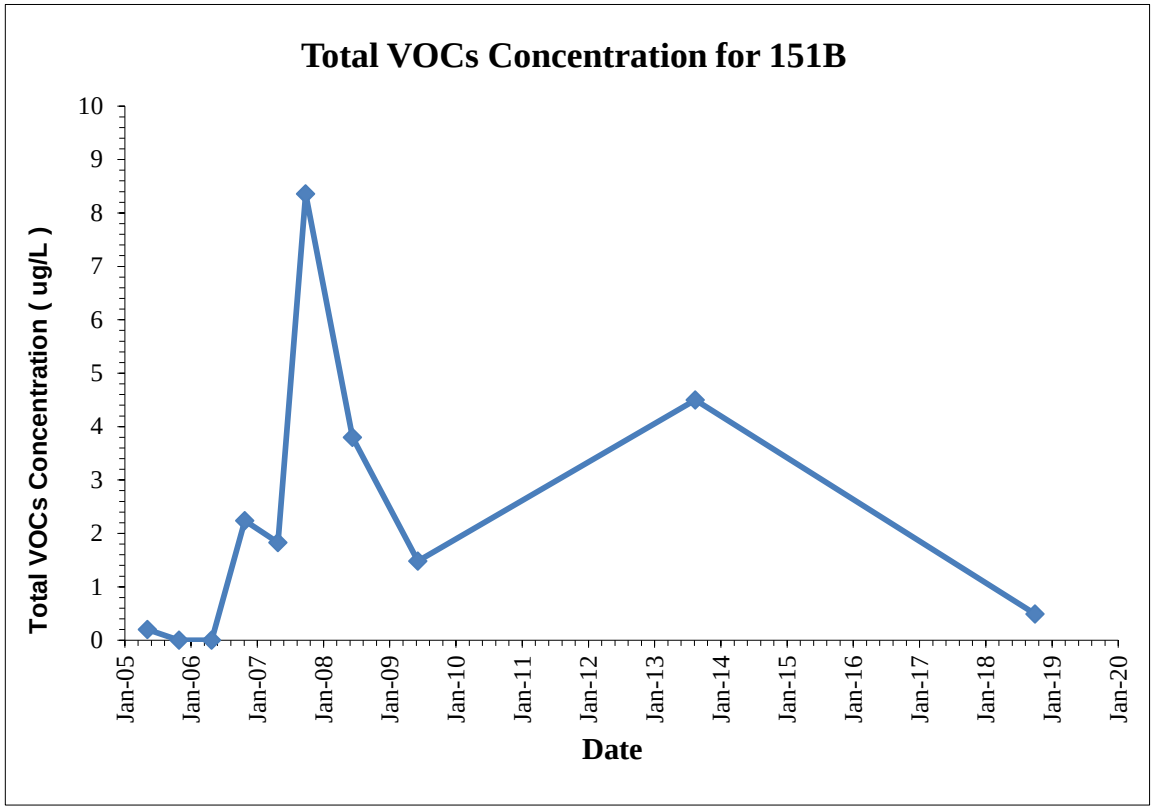
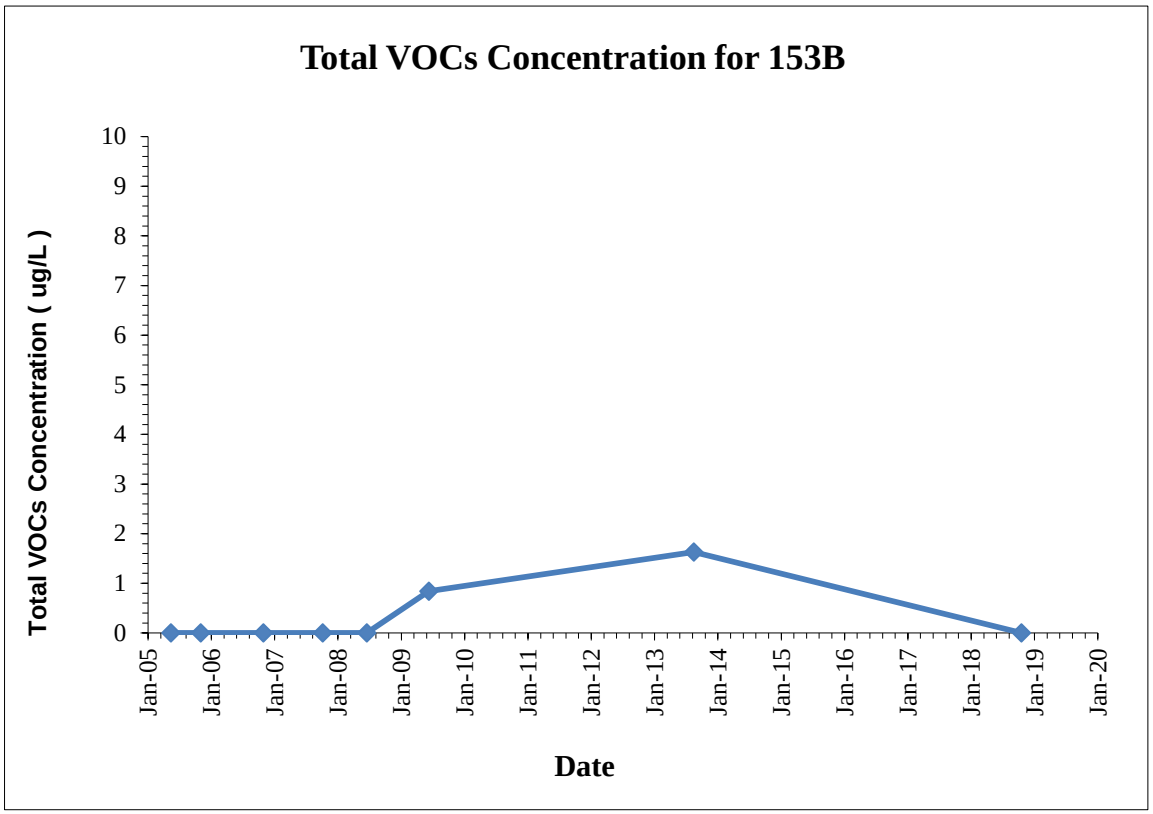
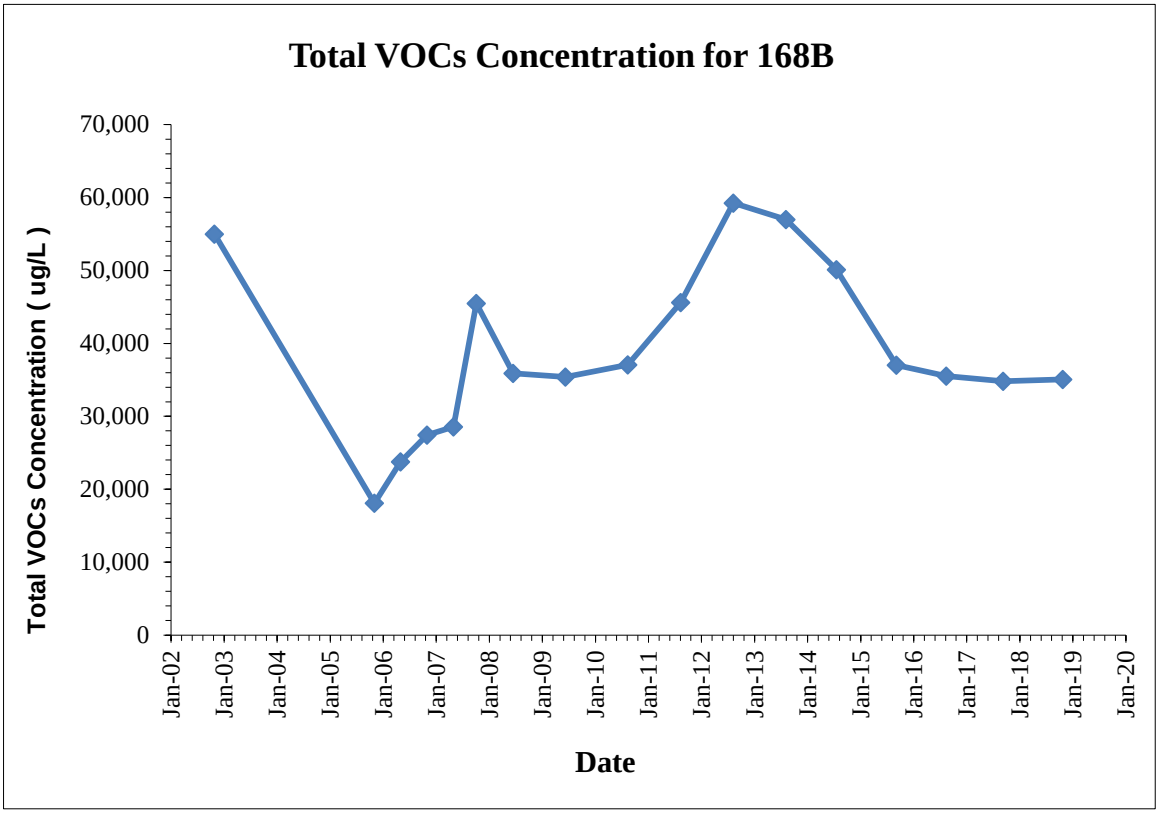
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

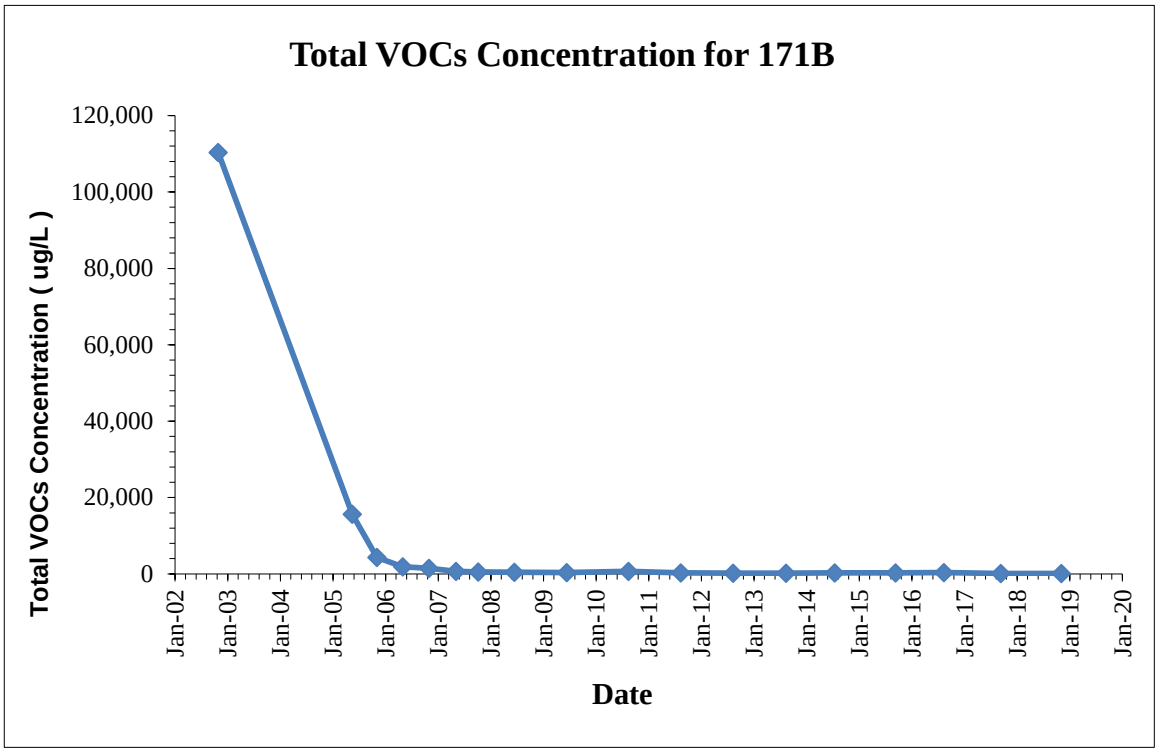

Total VOCs Concentration for 149B
Total VOCs Concentration (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

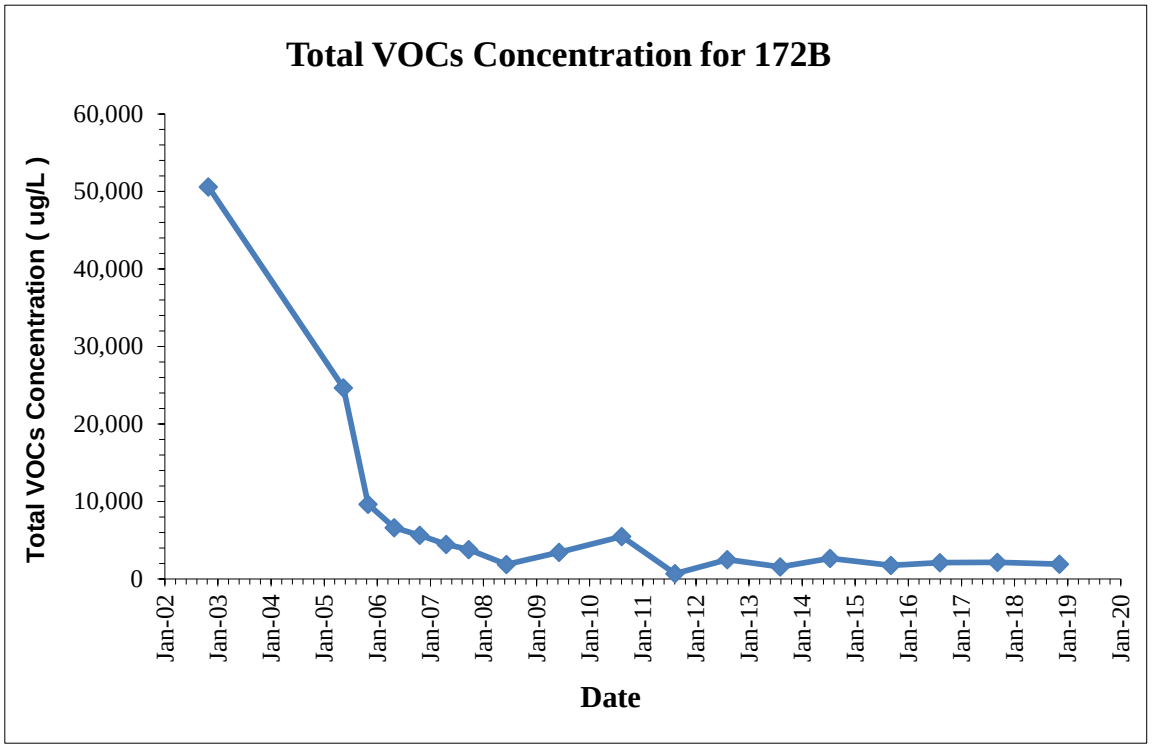

Total VOCs Concentration for 150B
Total VOCs Concentration (ug/L)
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Date

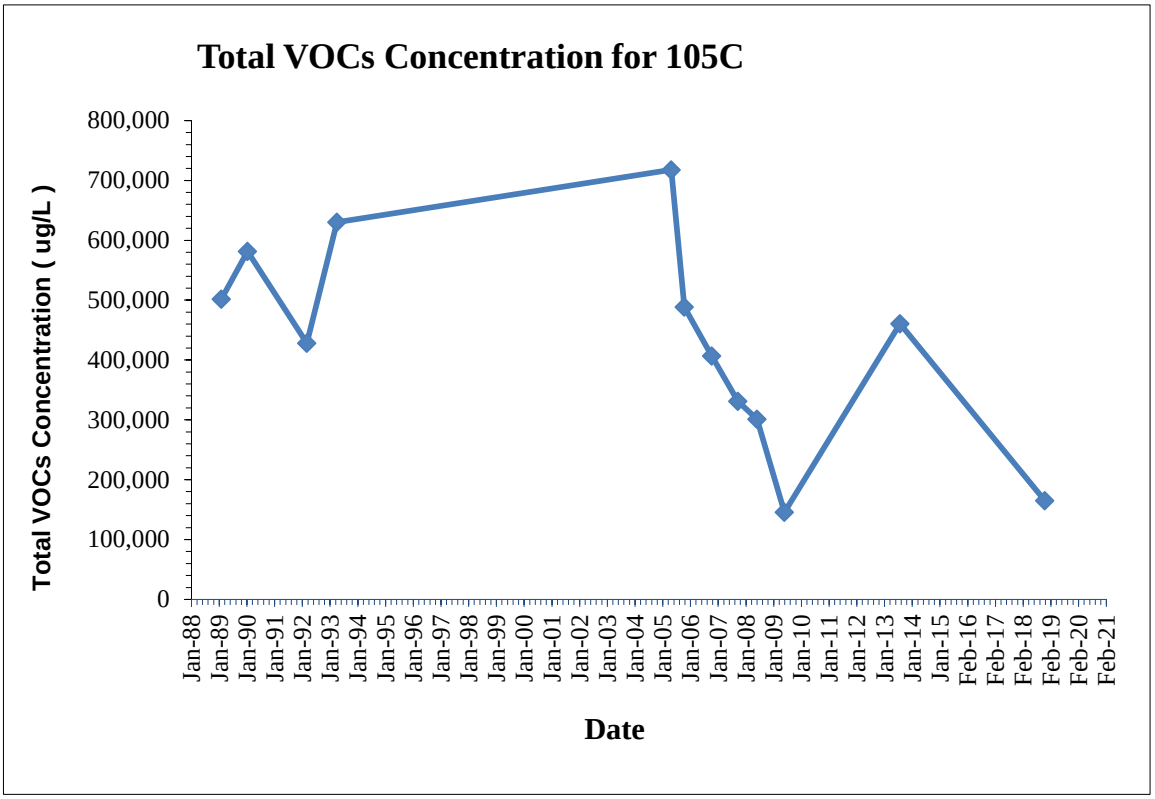

Total VOCs Concentration for 151B
Total VOCs Concentration (ug/L)
0
1
2
3
4
5
6
7
8
9
10
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 153B
Total VOCs Concentration (ug/L)
0
1
2
3
4
5
6
7
8
9
10
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 168B
Total VOCs Concentration (ug/L)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 171B
Total VOCs Concentration (ug/L)
120,000
100,000
80,000
60,000
40,000
20,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 172B
Total VOCs Concentration (ug/L)
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 105C
Total VOCs Concentration (ug/L)
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Jan-88
Jan-89
Jan-90
Jan-91
Jan-92
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
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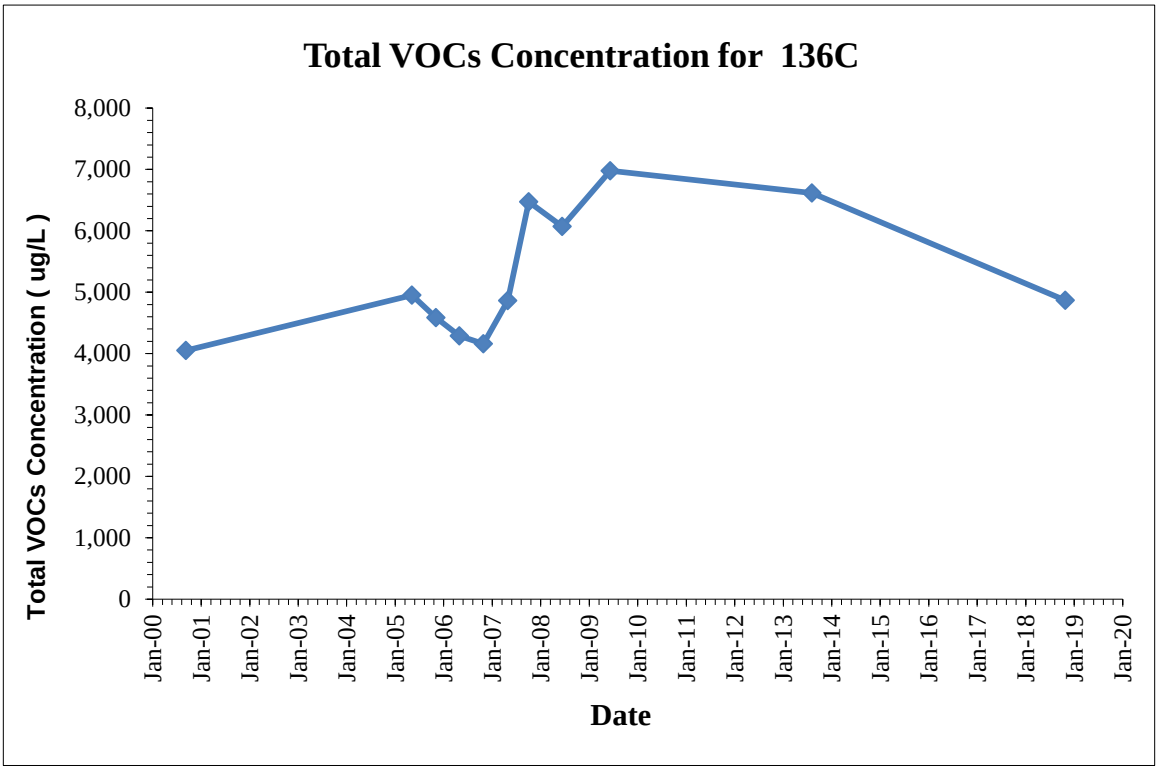
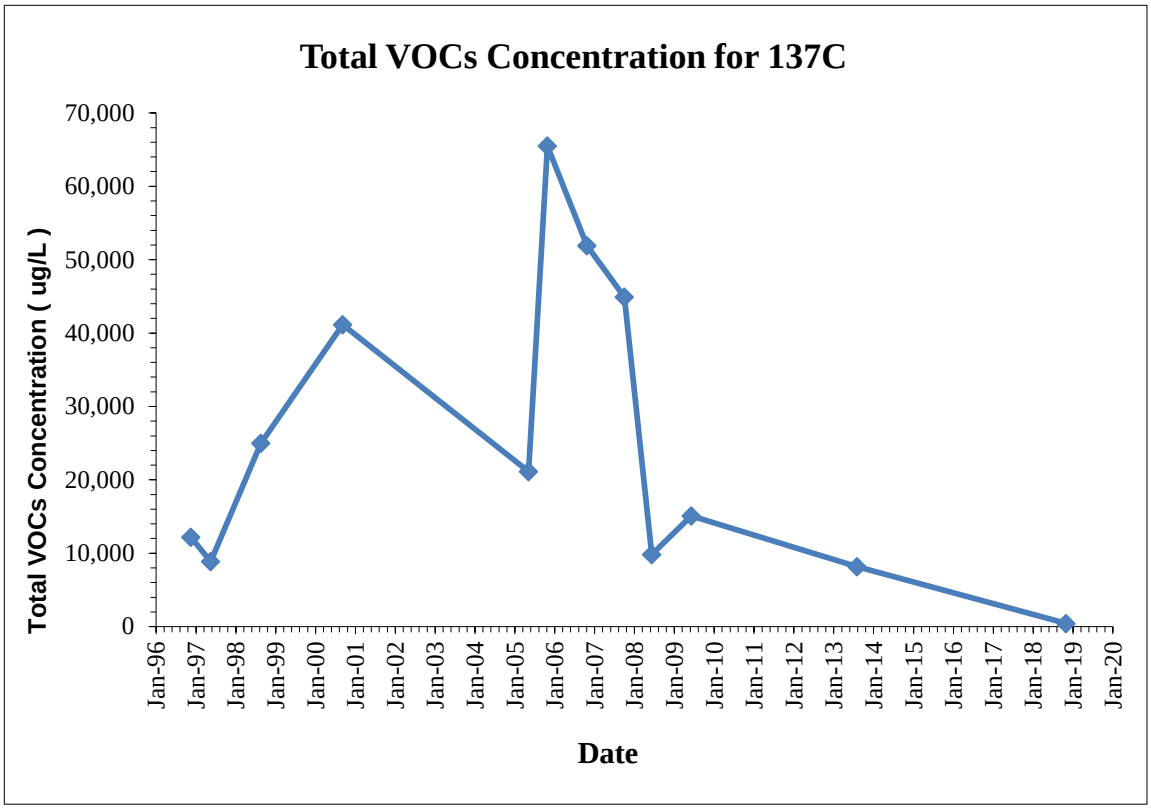
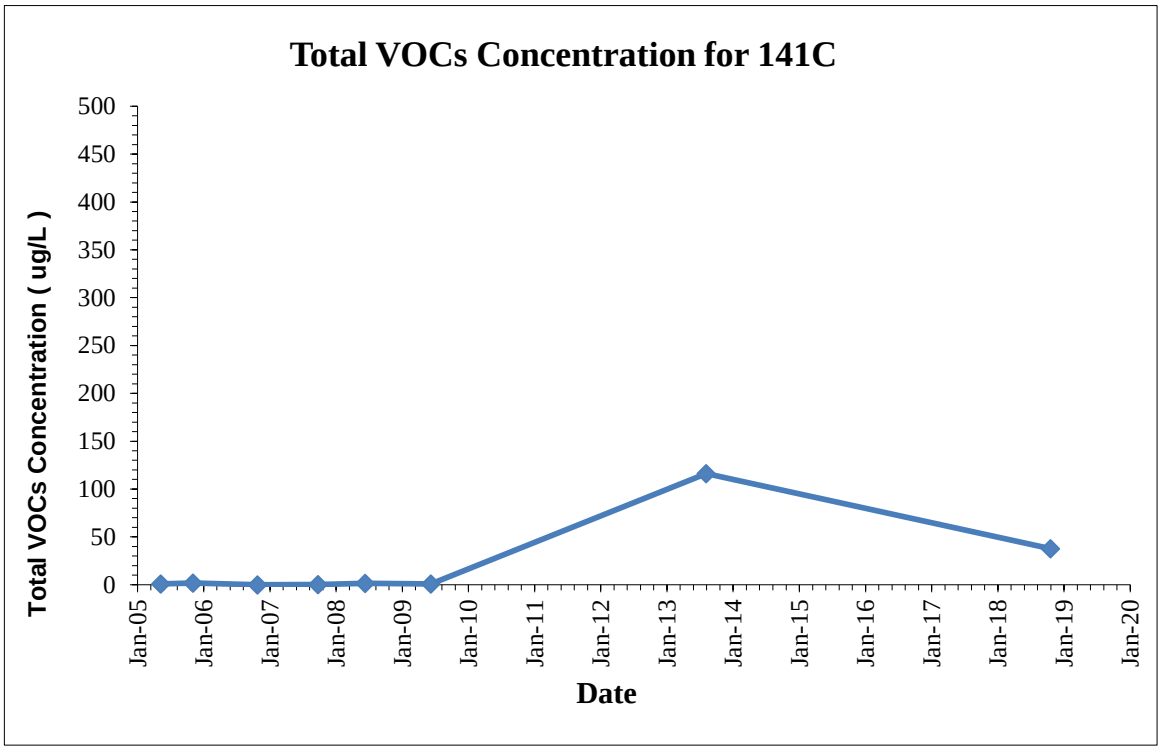
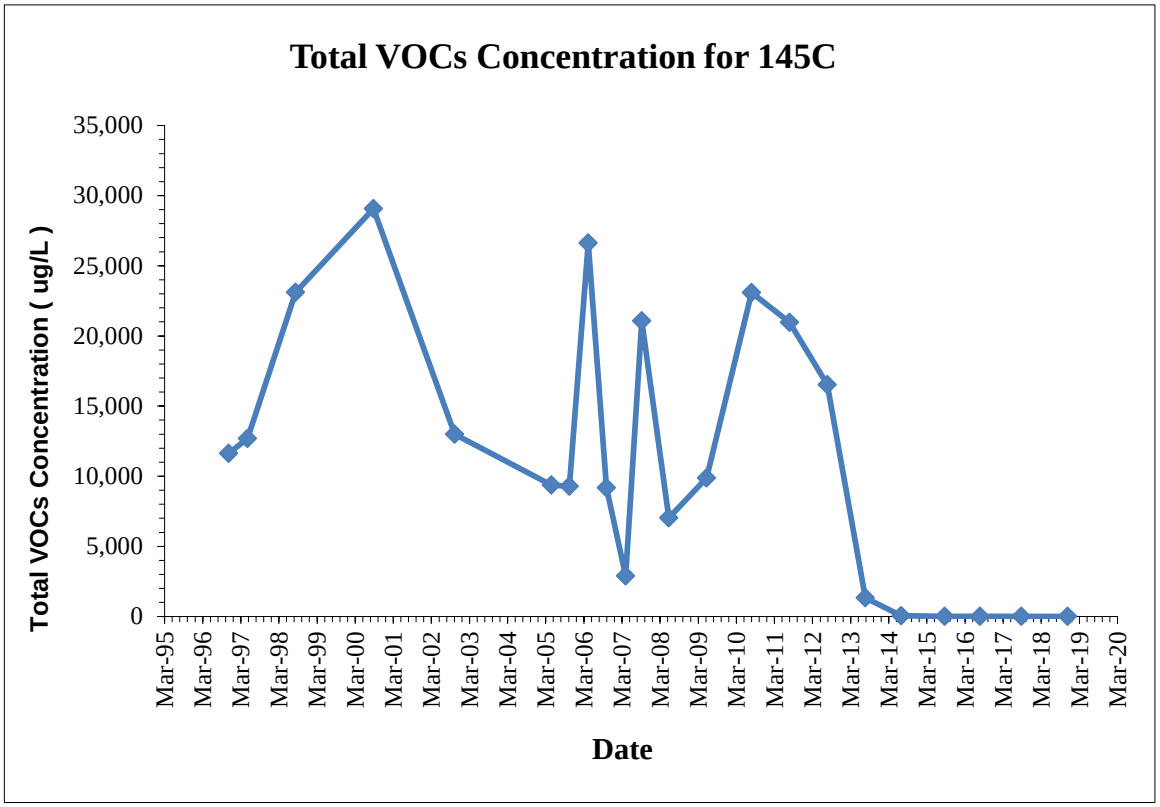
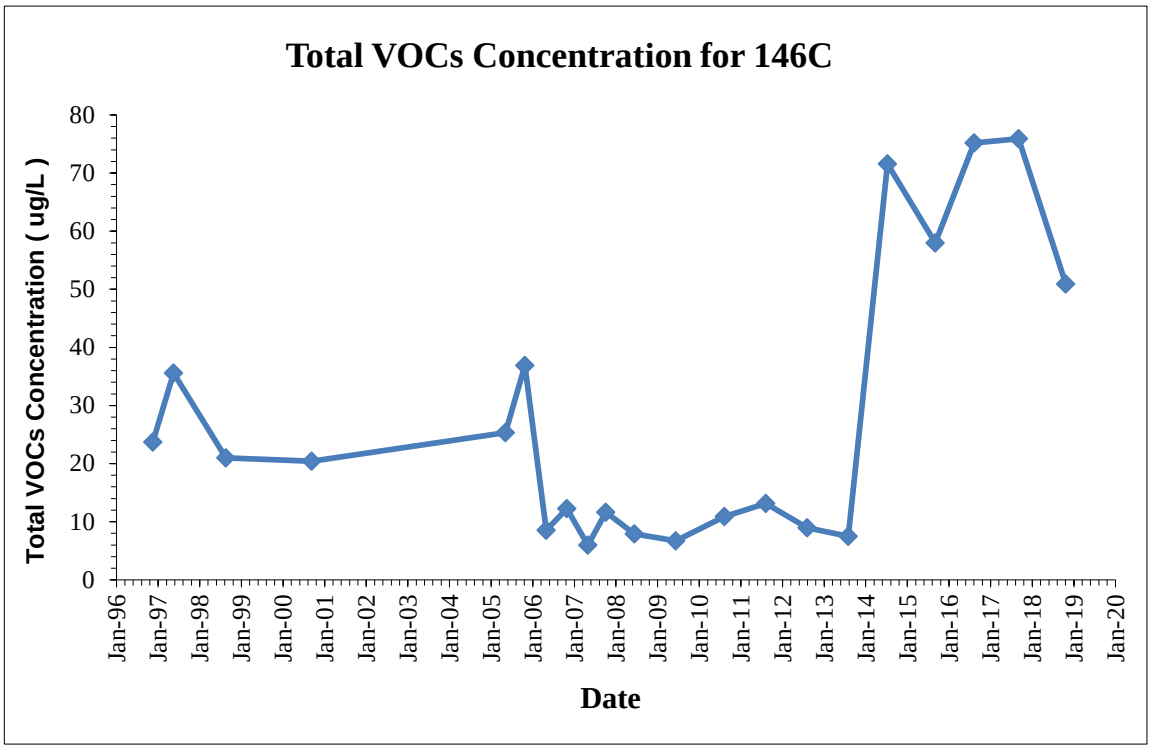
Jan-14
Jan-15
Feb-16
Feb-17
Feb-18
Feb-19
Feb-20
Feb-21
Date

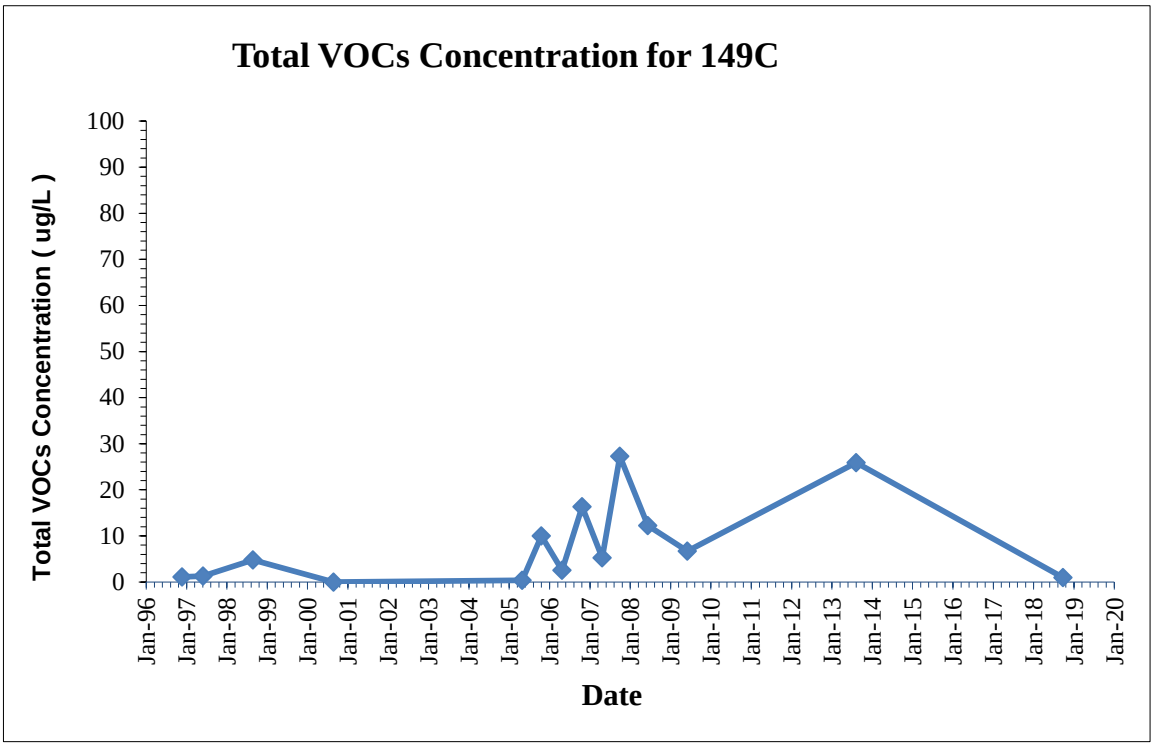

Total VOCs Concentration for 136C
Total VOCs Concentration (ug/L)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

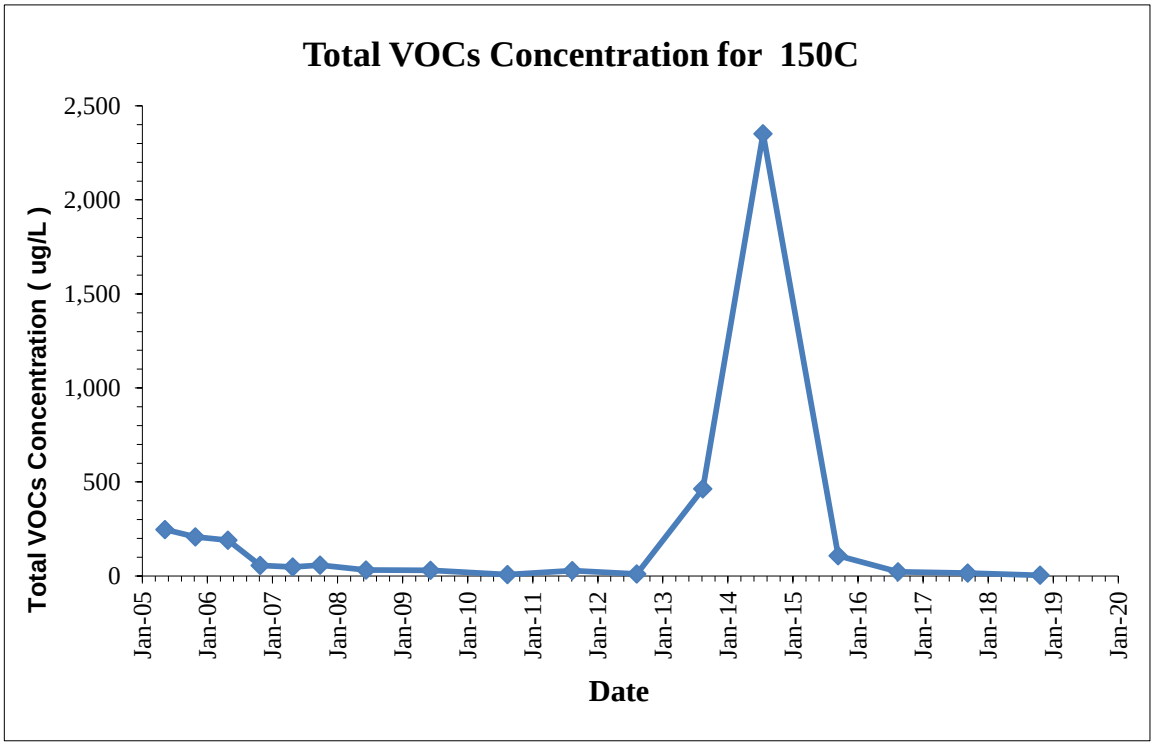

Total VOCs Concentration for 137C
Total VOCs Concentration (ug/L)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

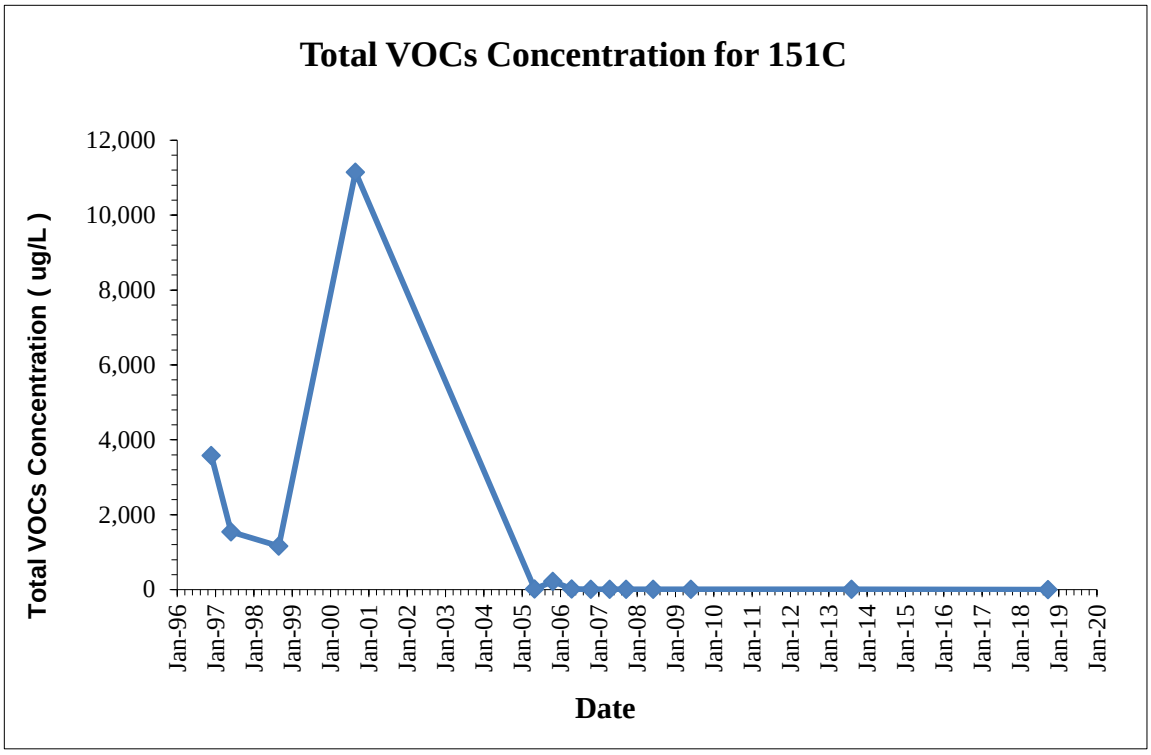

Total VOCs Concentration for 141C
Total VOCs Concentration (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

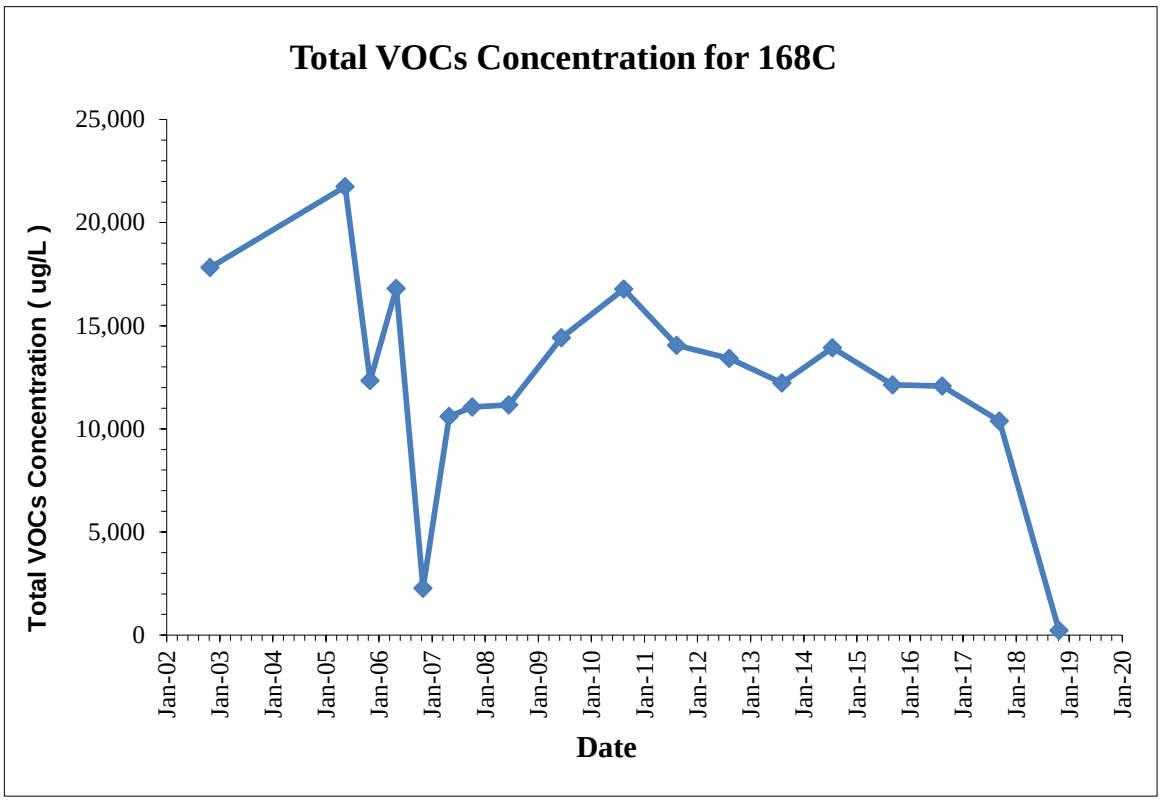

Total VOCs Concentration for 145C
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Mar-95
Mar-96
Mar-97
Mar-98
Mar-99
Mar-00
Mar-01
Mar-02
Mar-03
Mar-04
Mar-05
Mar-06
Mar-07
Mar-08
Mar-09
Mar-10
Mar-11
Mar-12
Mar-13
Mar-14
Mar-15
Mar-16
Mar-17
Mar-18
Mar-19
Mar-20
Date

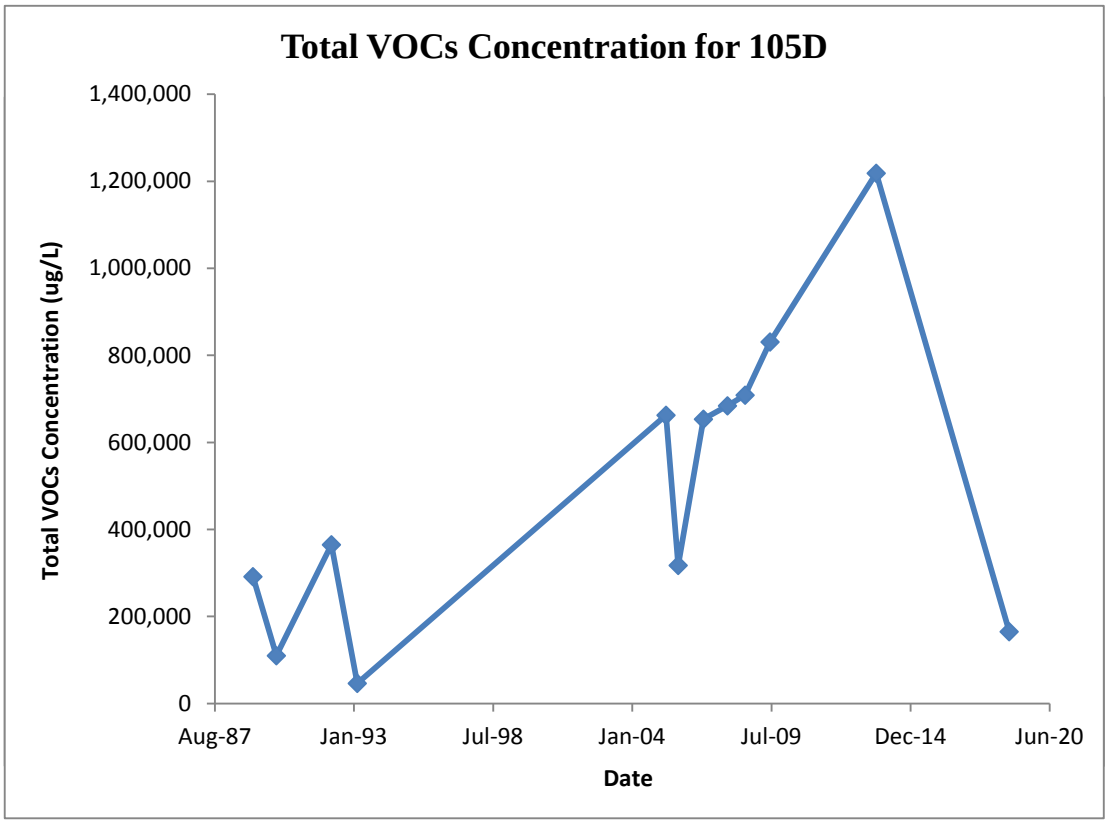

Total VOCs Concentration for 146C
Total VOCs Concentration (ug/L)
80
70
60
50
40
30
20
10
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

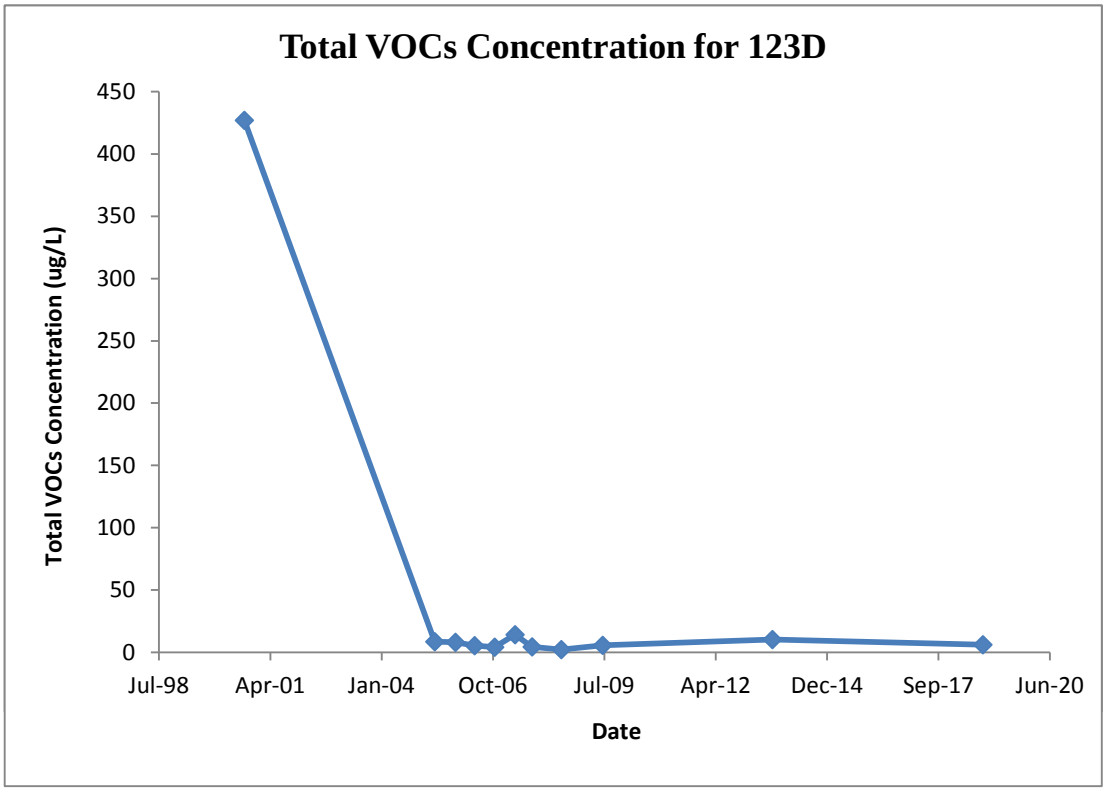

Total VOCs Concentration for 149C
Total VOCs Concentration (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

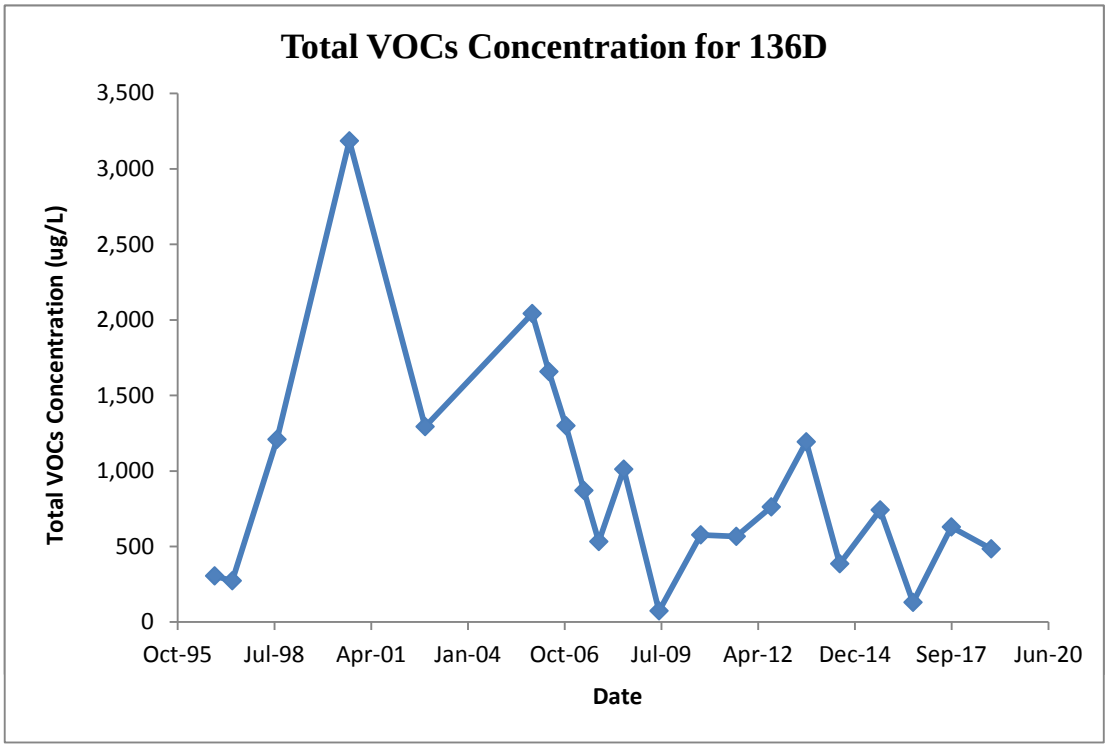

Total VOCs Concentration for 150C
Total VOCs Concentration (ug/L)
2,500
2,000
1,500
1,000
500
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

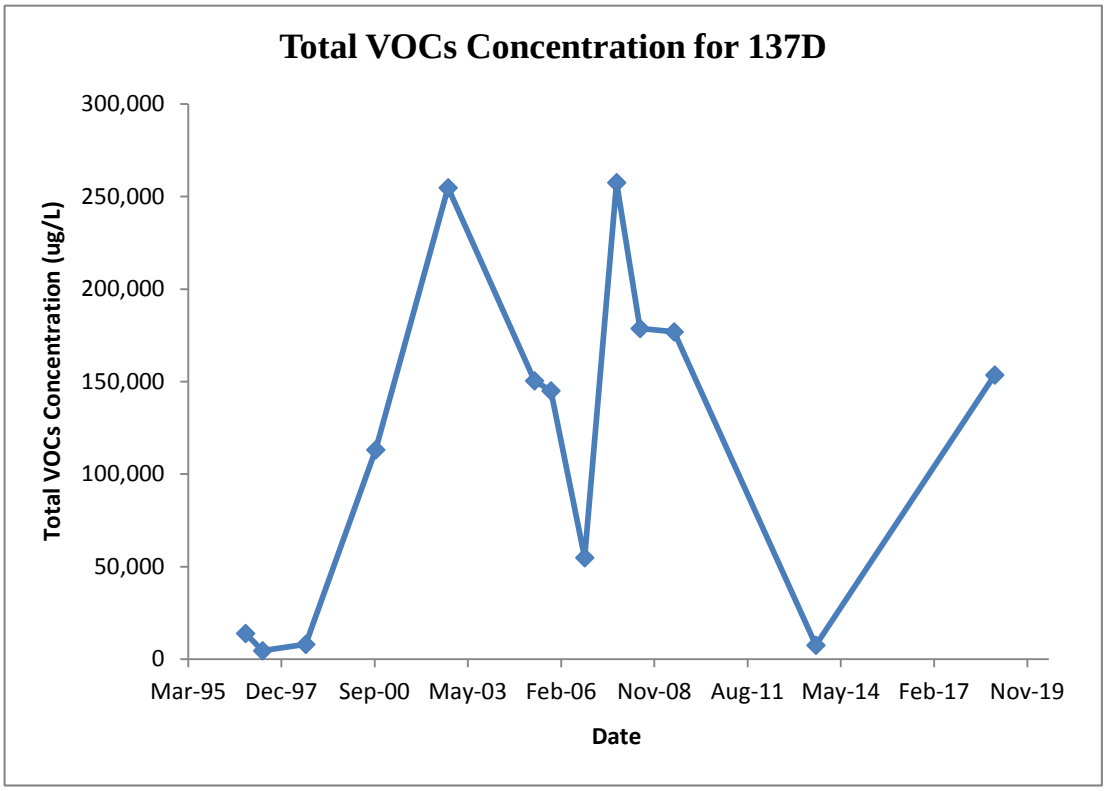

Total VOCs Concentration for 151C
Total VOCs Concentration (ug/L)
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

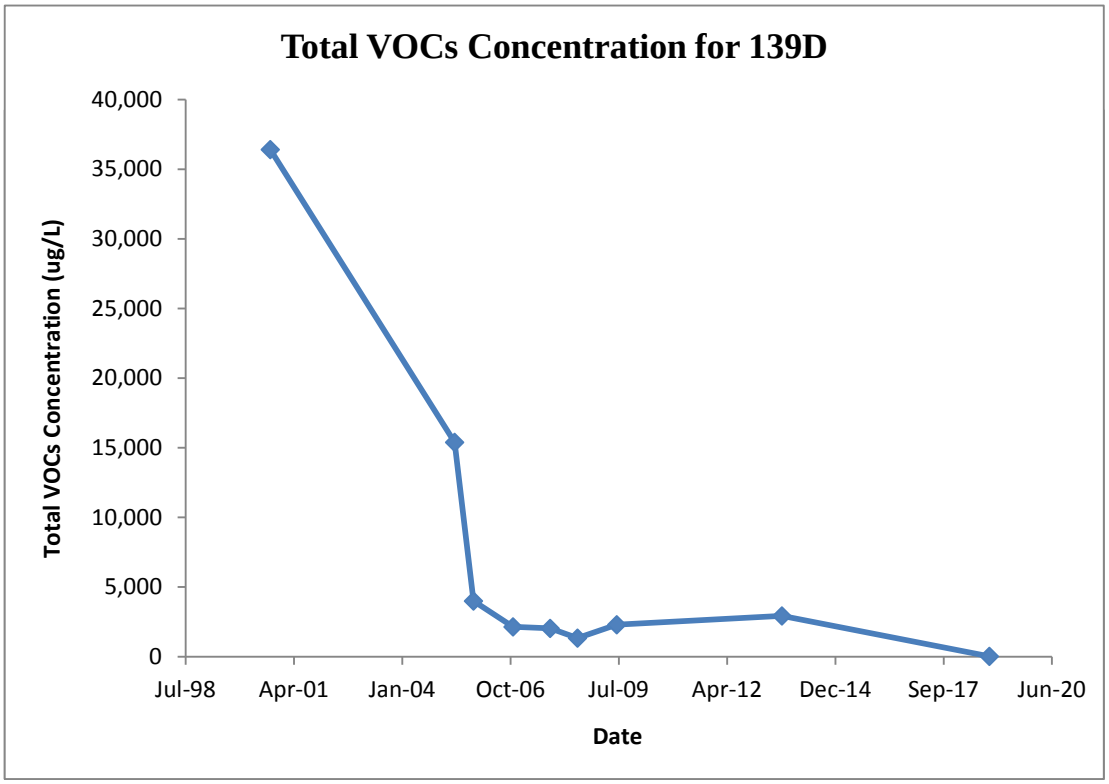

Total VOCs Concentration for 168C
Total VOCs Concentration (ug/L)
25,000
20,000
15,000
10,000
5,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

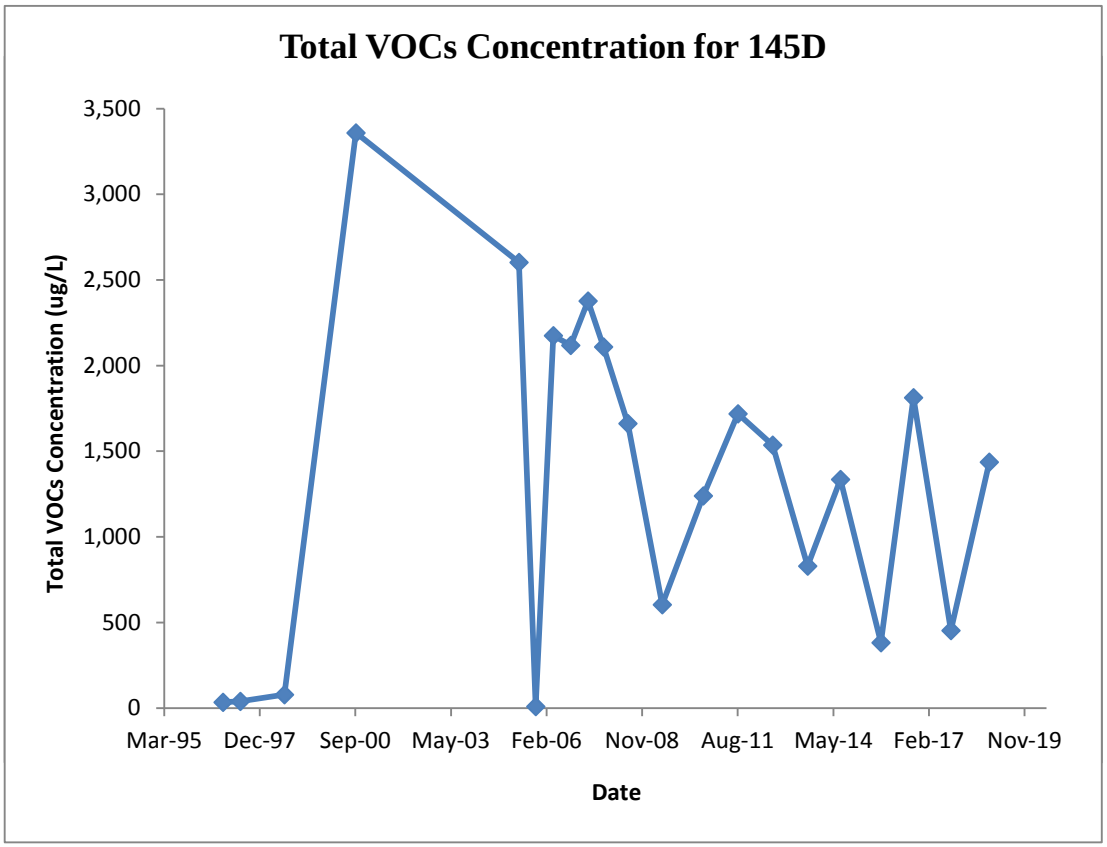

Total VOCs Concentration for 105D
Total VOCs Concentration (ug/L)
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Aug-87
Jan-93
Jul-98
Jan-04
Jul-09
Dec-14
Jun-20
Date

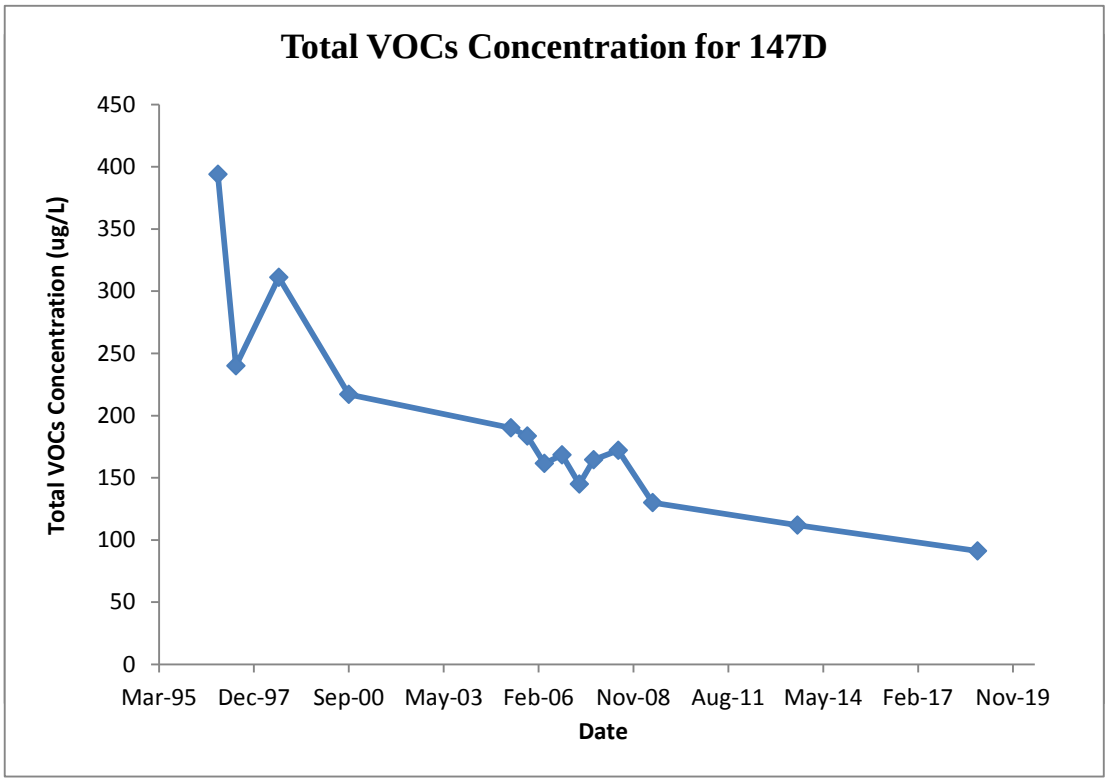

Total VOCs Concentration for 123D
Total VOCs Concentration (ug/L)
450
400
350
300
250
200
150
100
50
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Date

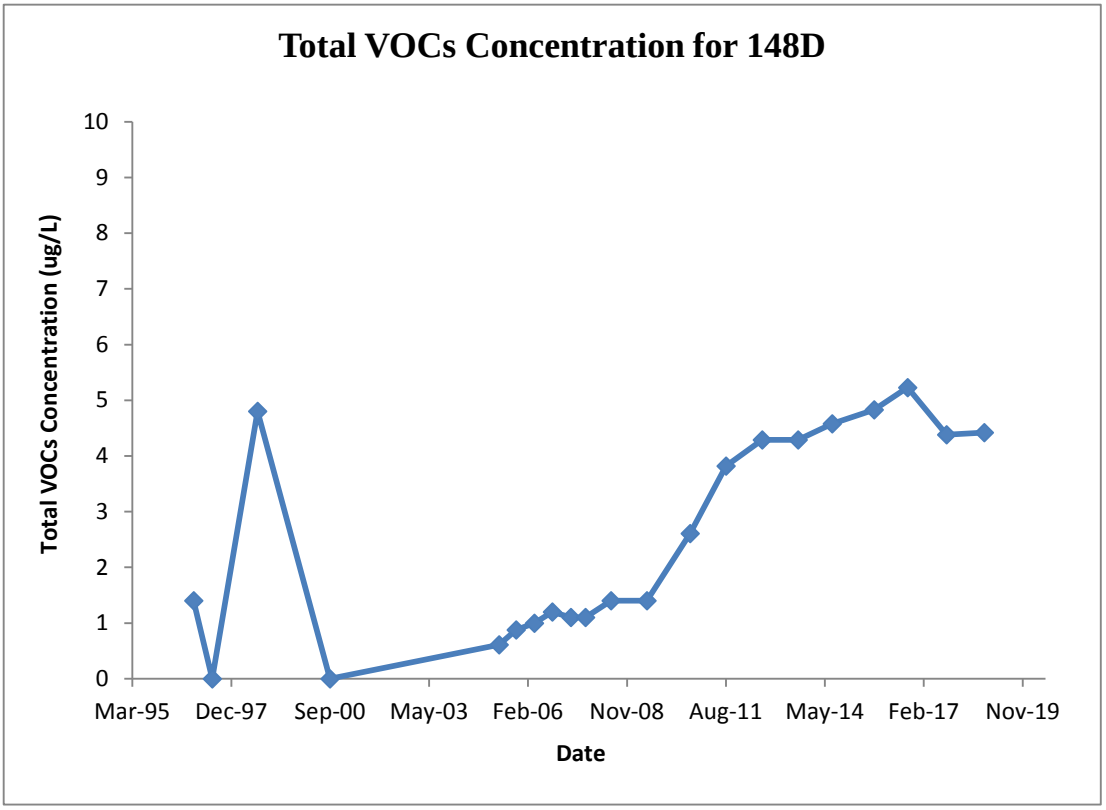

Total VOCs Concentration for 136D
Total VOCs Concentration (ug/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Oct-95
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Date

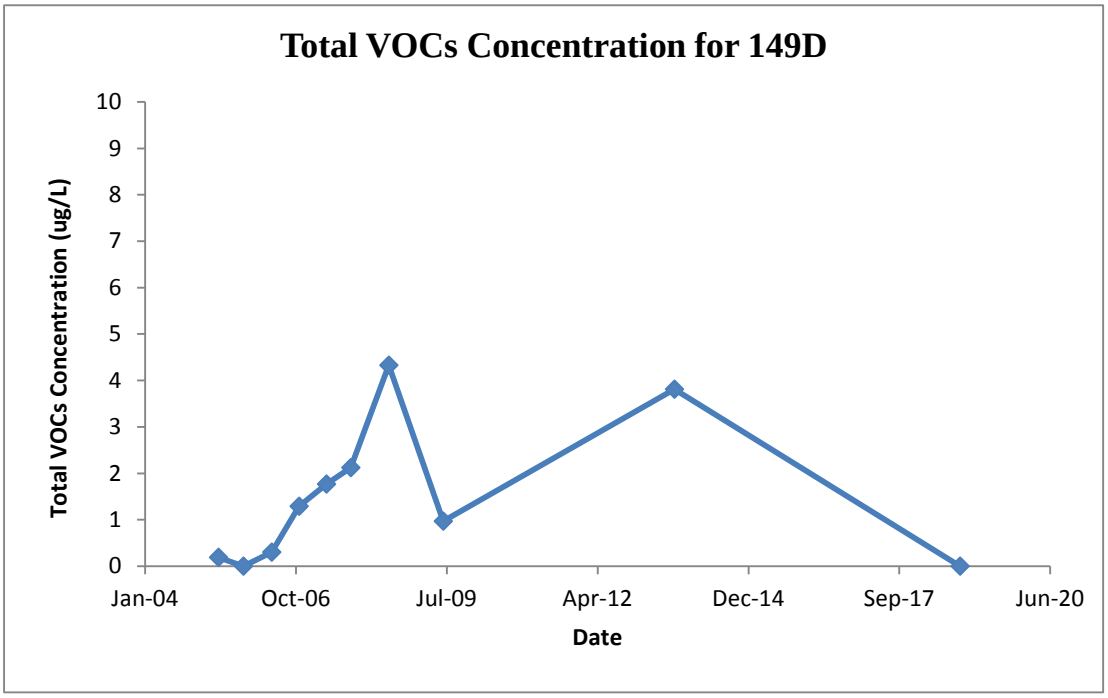

Total VOCs Concentration for 137D
Total VOCs Concentration (ug/L)
300,000
250,000
200,000
150,000
100,000
50,000
0
Mar-95
Dec-97
Sep-00
May-03
Feb-06
Nov-08
Aug-11
May-14
Feb-17
Nov-19
Date

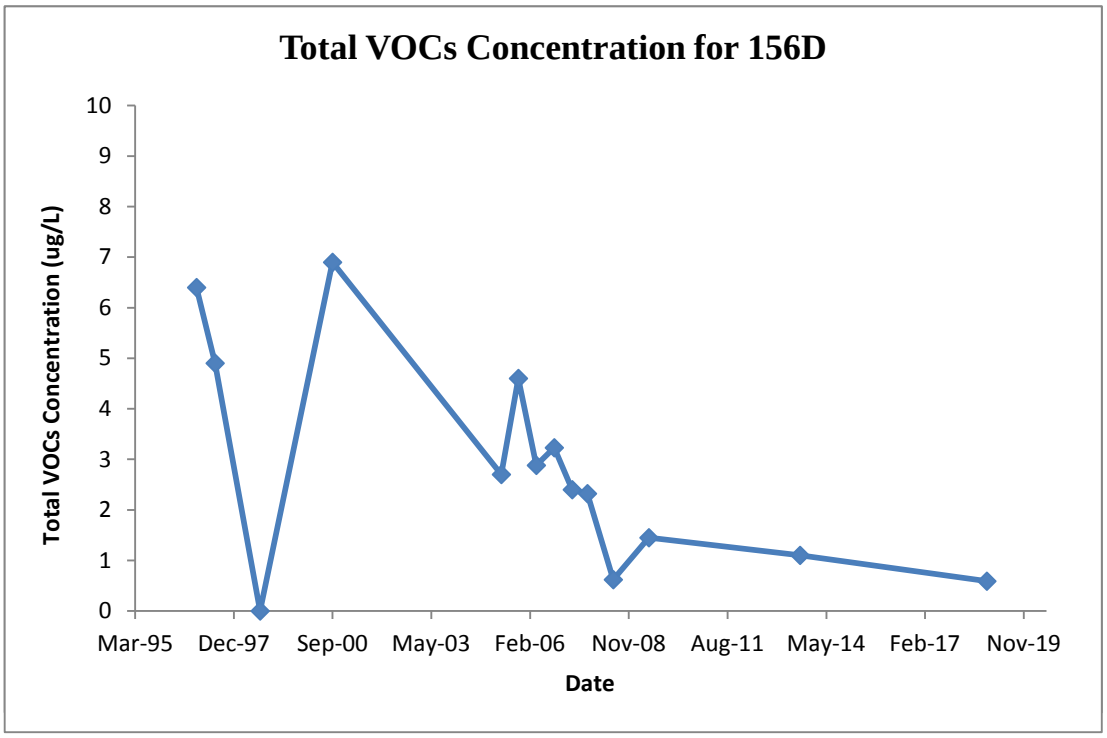

Total VOCs Concentration for 139D
Total VOCs Concentration (ug/L)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jul-98
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Date

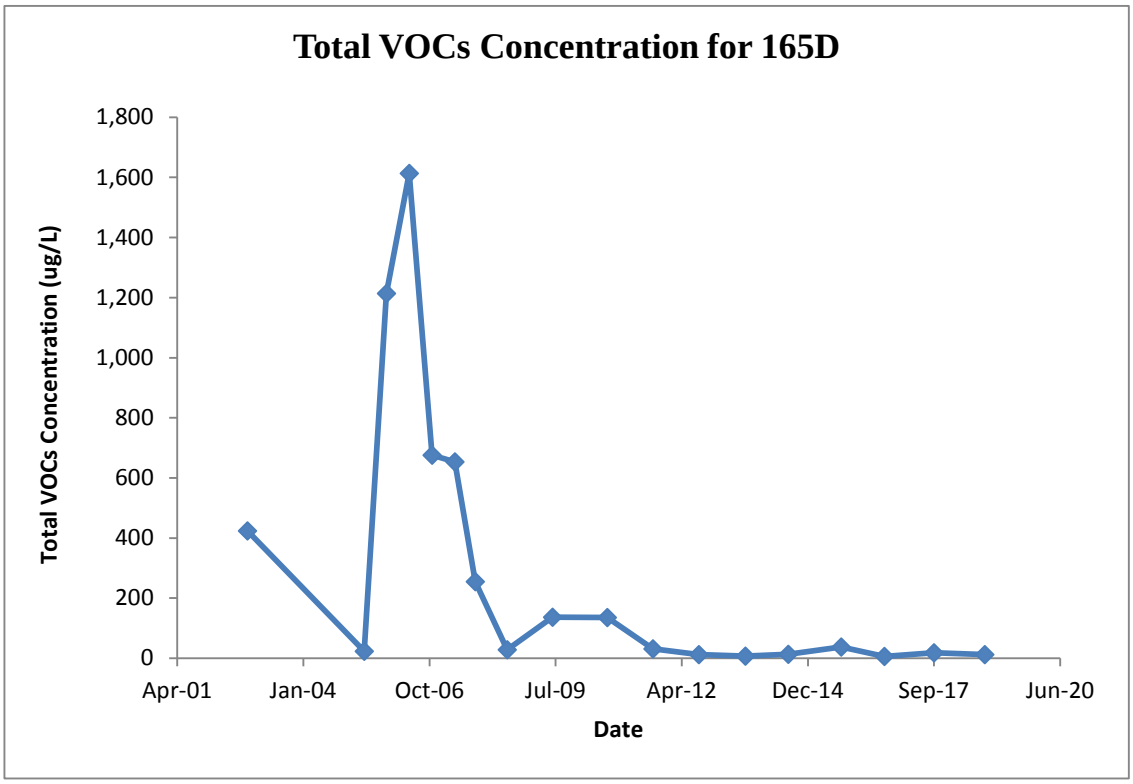

Total VOCs Concentration for 145D
Total VOCs Concentration (ug/L)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Mar-95
Dec-97
Sep-00
May-03
Feb-06
Nov-08
Aug-11
May-14
Feb-17
Nov-19
Date

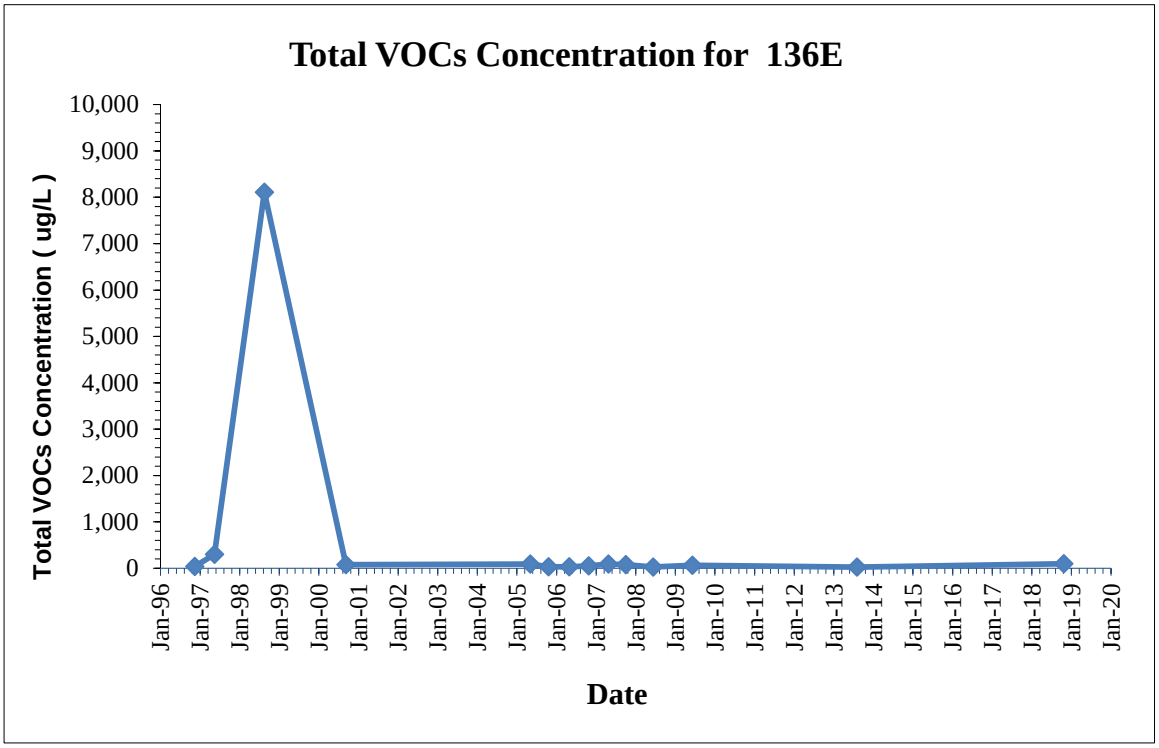

Total VOCs Concentration for 147D
Total VOCs Concentration (ug/L)
450
400
350
300
250
200
150
100
50
0
Mar-95
Dec-97
Sep-00
May-03
Feb-06
Nov-08
Aug-11
May-14
Feb-17
Nov-19
Date

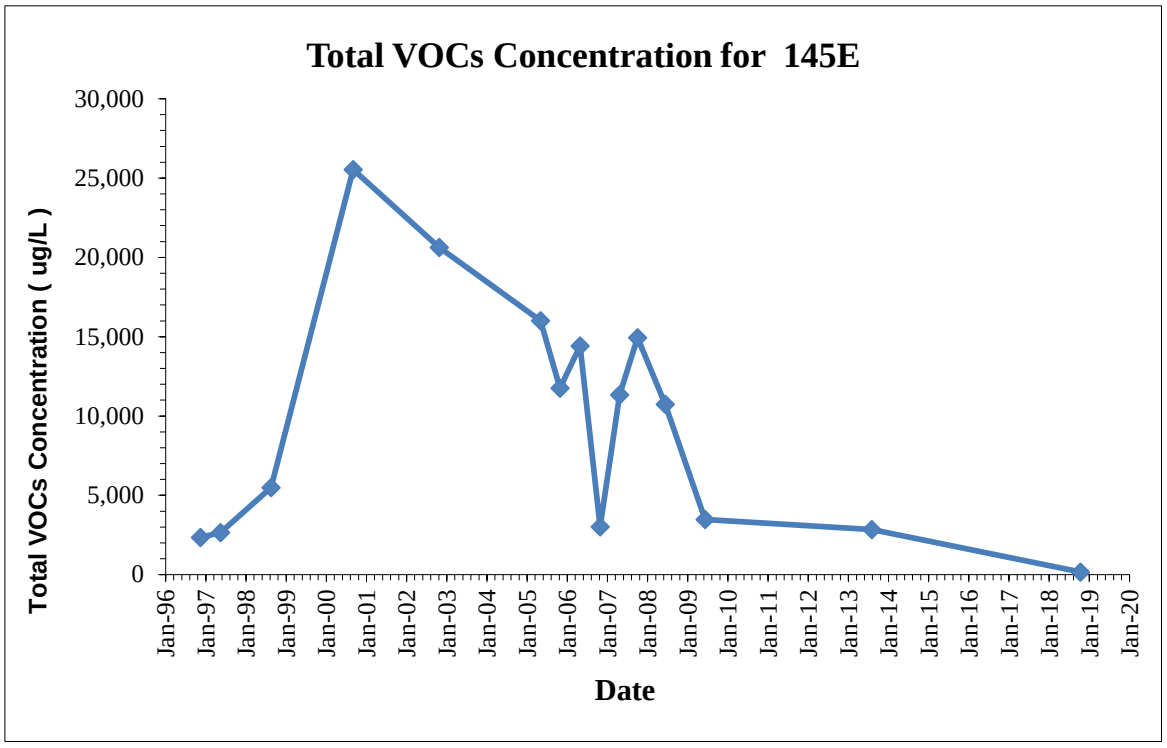

Total VOCs Concentration for 148D
Total VOCs Concentration (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Mar-95
Dec-97
Sep-00
May-03
Feb-06
Nov-08
Aug-11
May-14
Feb-17
Nov-19
Date

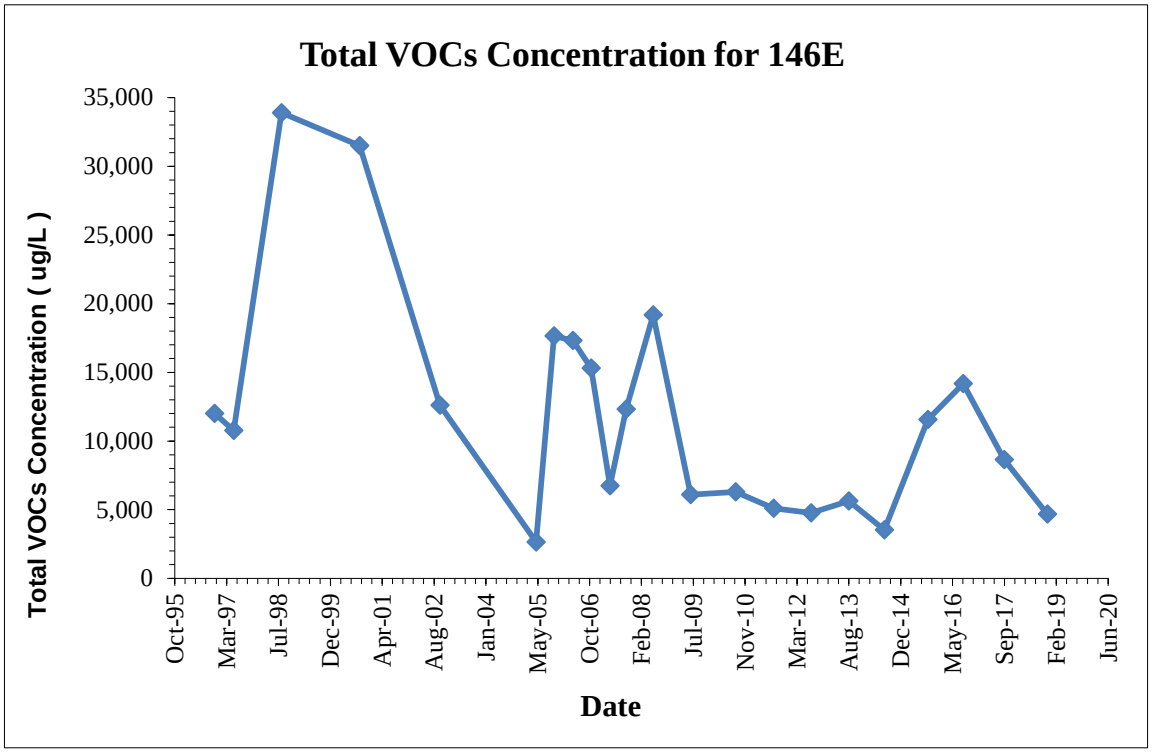

Total VOCs Concentration for 149D
Total VOCs Concentration (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Date

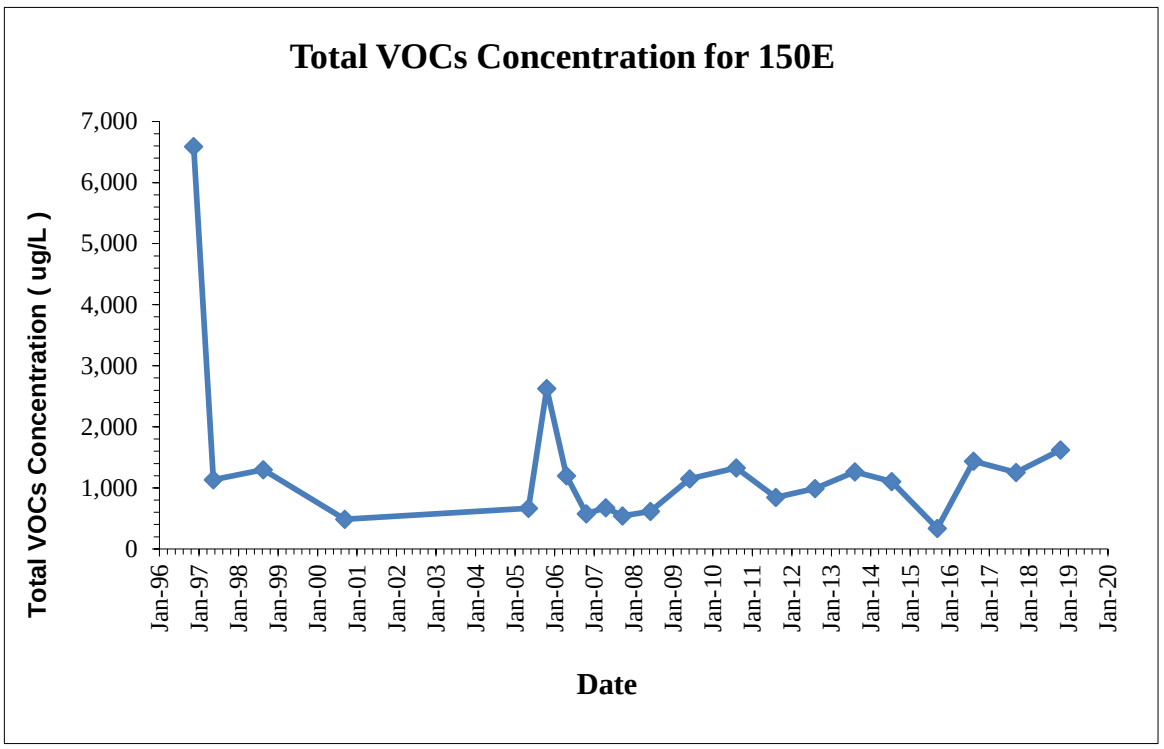

Total VOCs Concentration for 156D
Total VOCs Concentration (ug/L)
10
9
8
7
6
5
4
3
2
1
0
Mar-95
Dec-97
Sep-00
May-03
Feb-06
Nov-08
Aug-11
May-14
Feb-17
Nov-19
Date

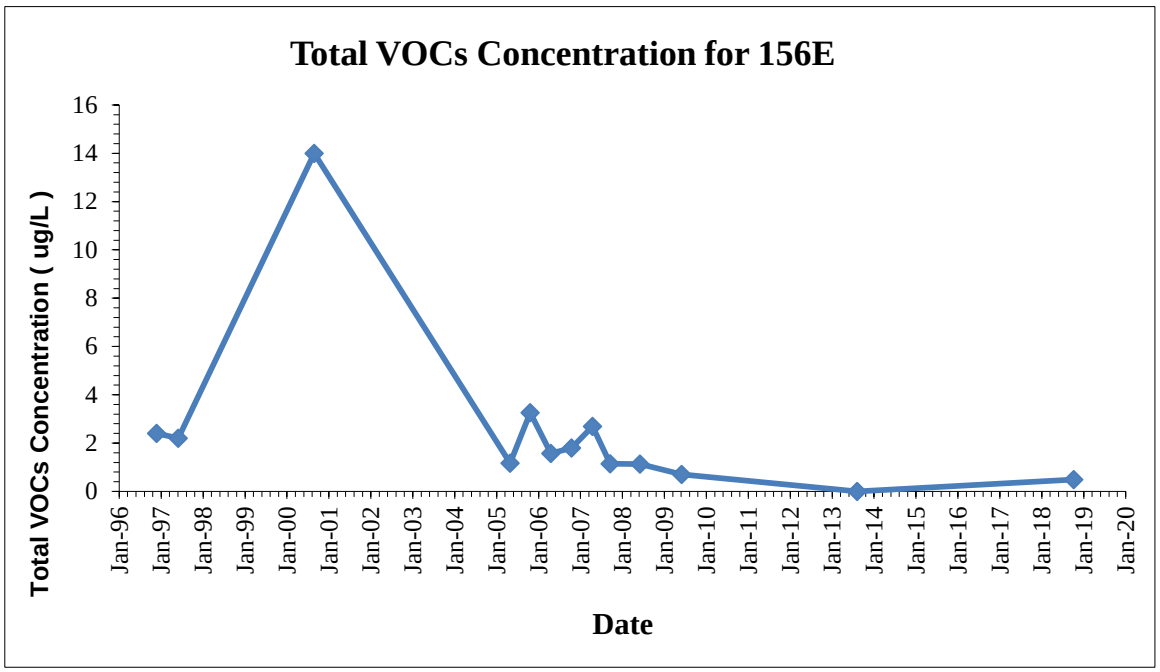

Total VOCs Concentration for 165D
Total VOCs Concentration (ug/L)
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Apr-01
Jan-04
Oct-06
Jul-09
Apr-12
Dec-14
Sep-17
Jun-20
Date

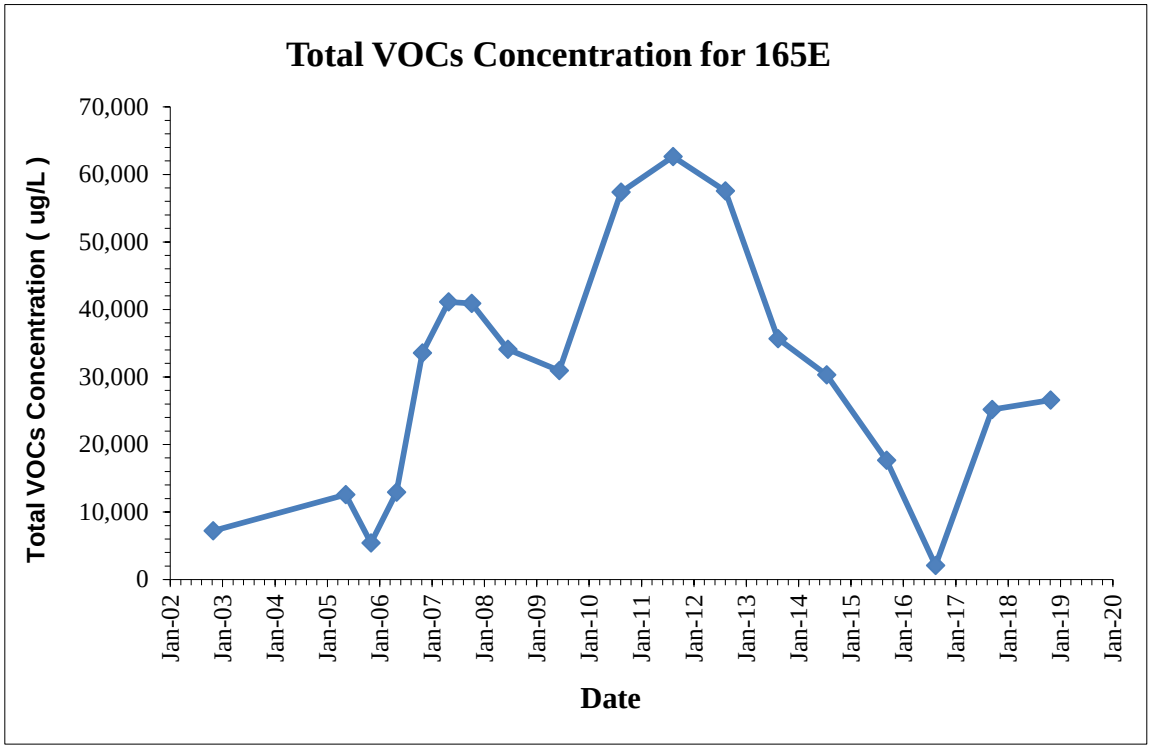

Total VOCs Concentration for 136E
Total VOCs Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

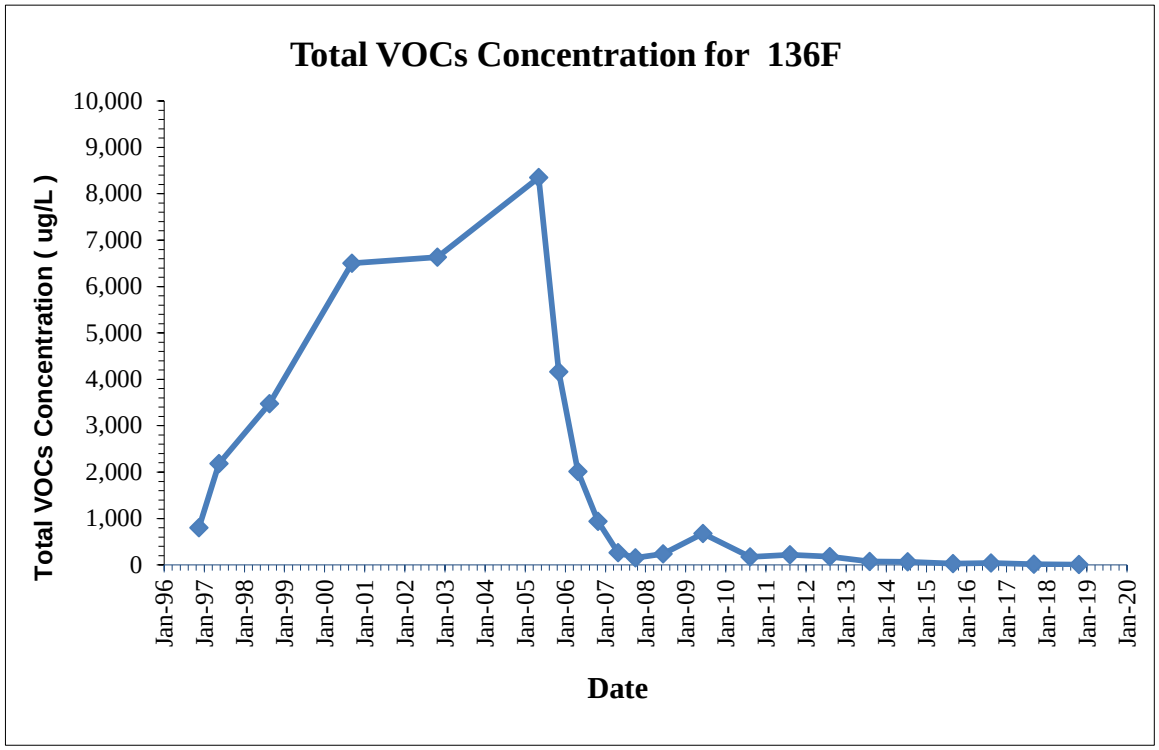

Total VOCs Concentration for 145E
Total VOCs Concentration (ug/L)
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 146E
Total VOCs Concentration (ug/L)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Oct-95
Mar-97
Jul-98
Dec-99
Apr-01
Aug-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Mar-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Jun-20
Date


Total VOCs Concentration for 150E
Total VOCs Concentration (ug/L)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 156E
Total VOCs Concentration (ug/L)
16
14
12
10
8
6
4
2
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 165E
Total VOCs Concentration (ug/L)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 136F
Total VOCs Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
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Jan-12
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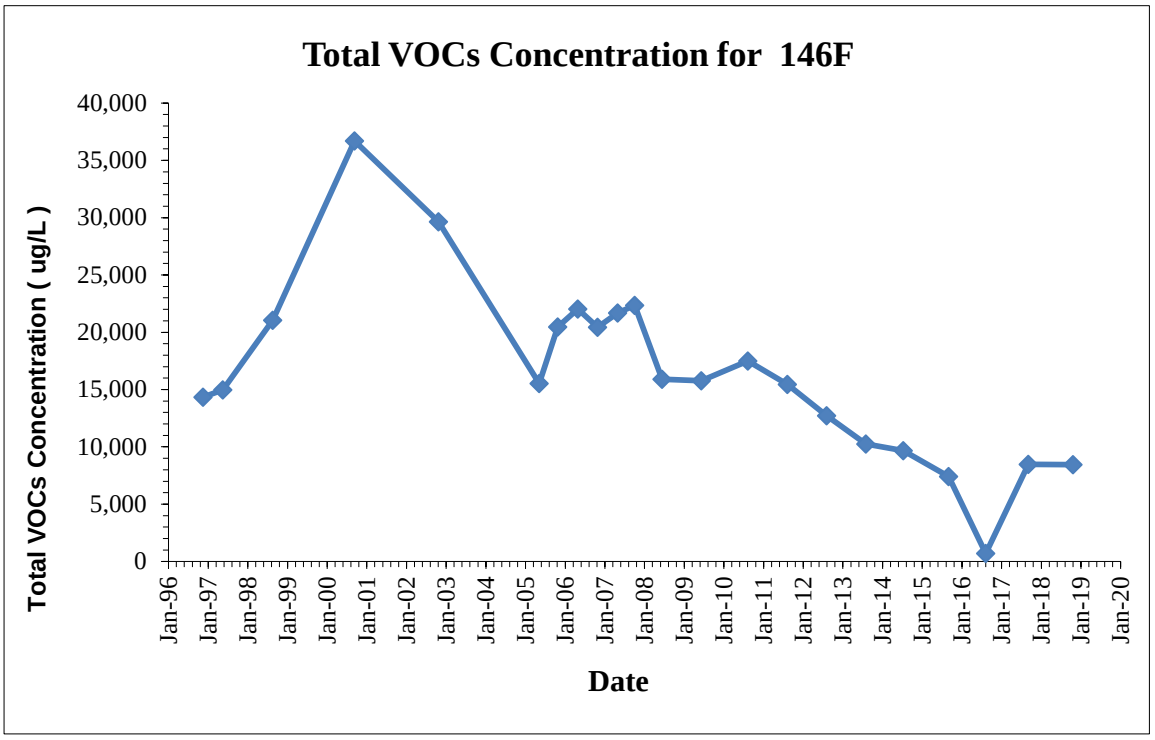
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 146F
Total VOCs Concentration (ug/L)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
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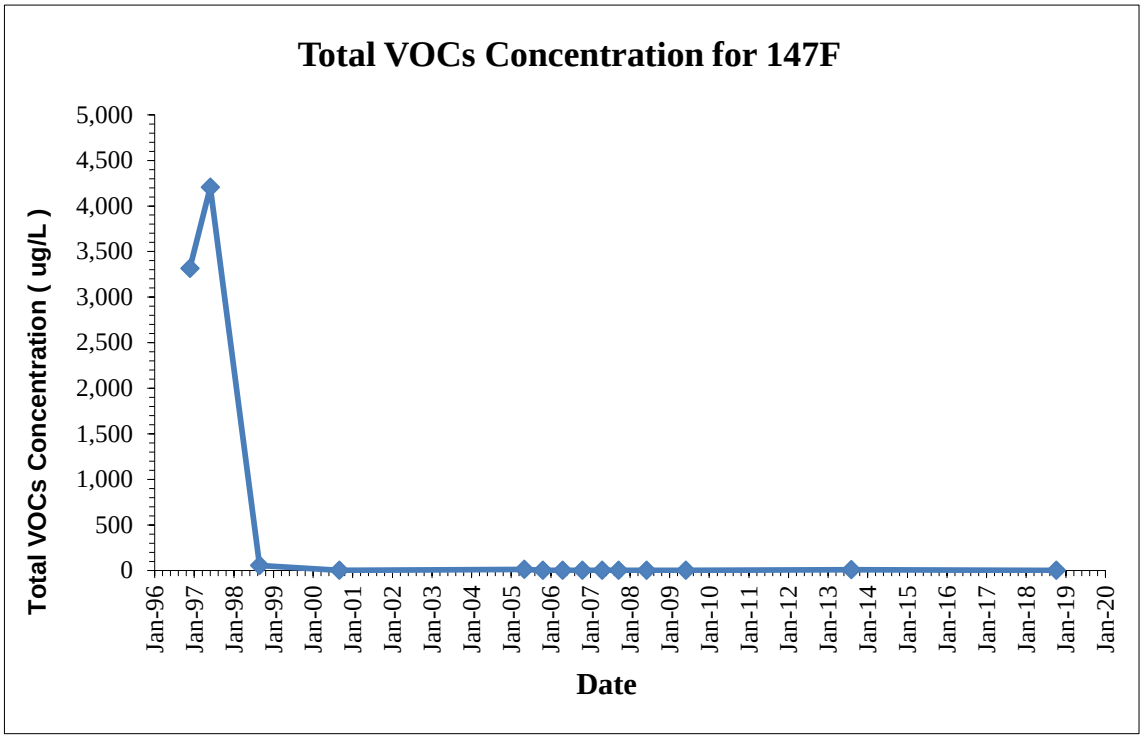
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 147F
Total VOCs Concentration (ug/L)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
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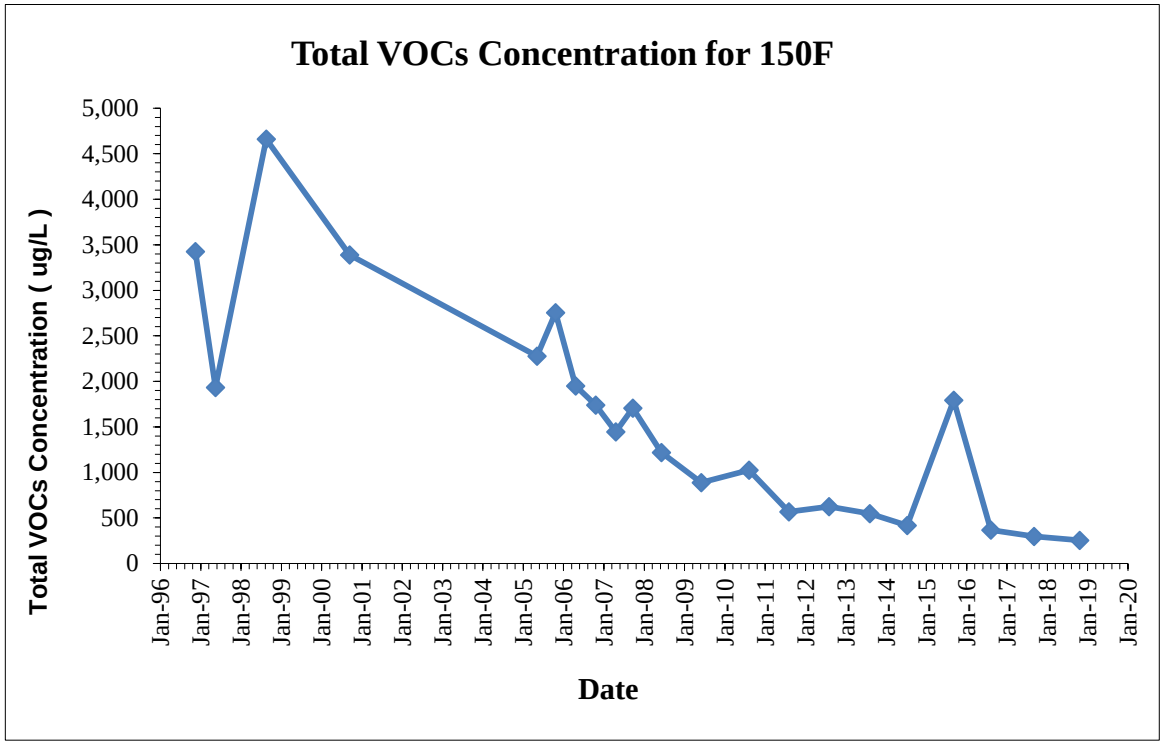
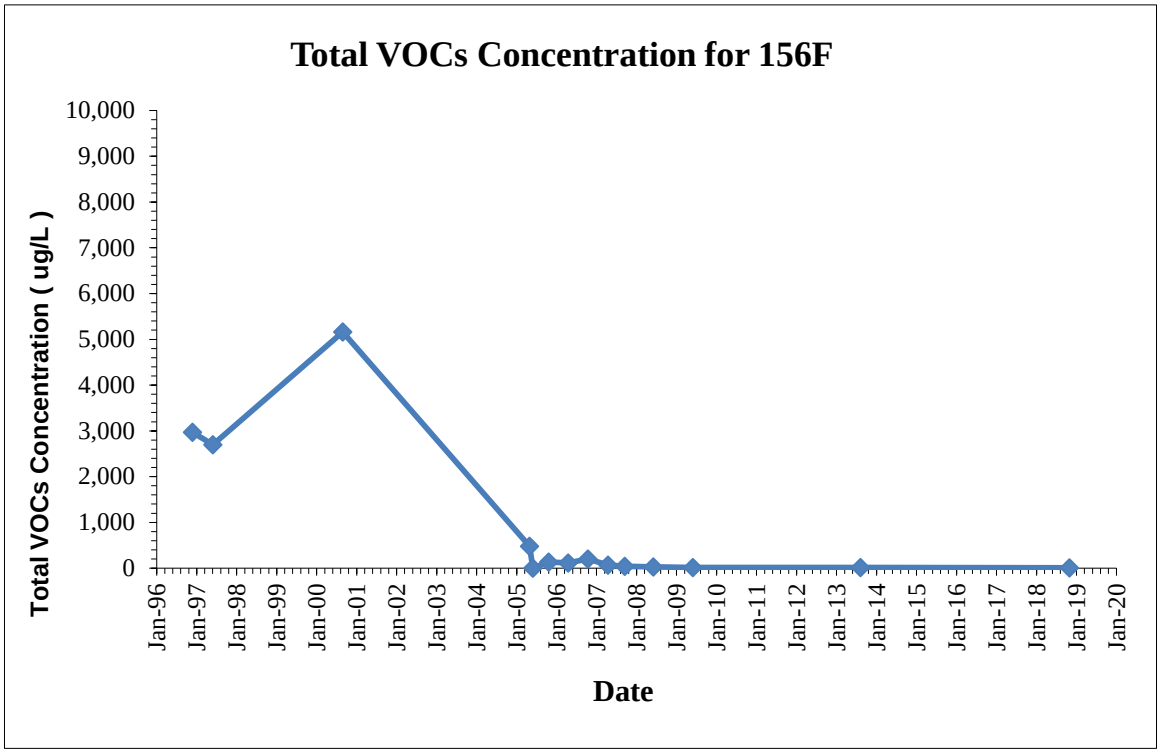
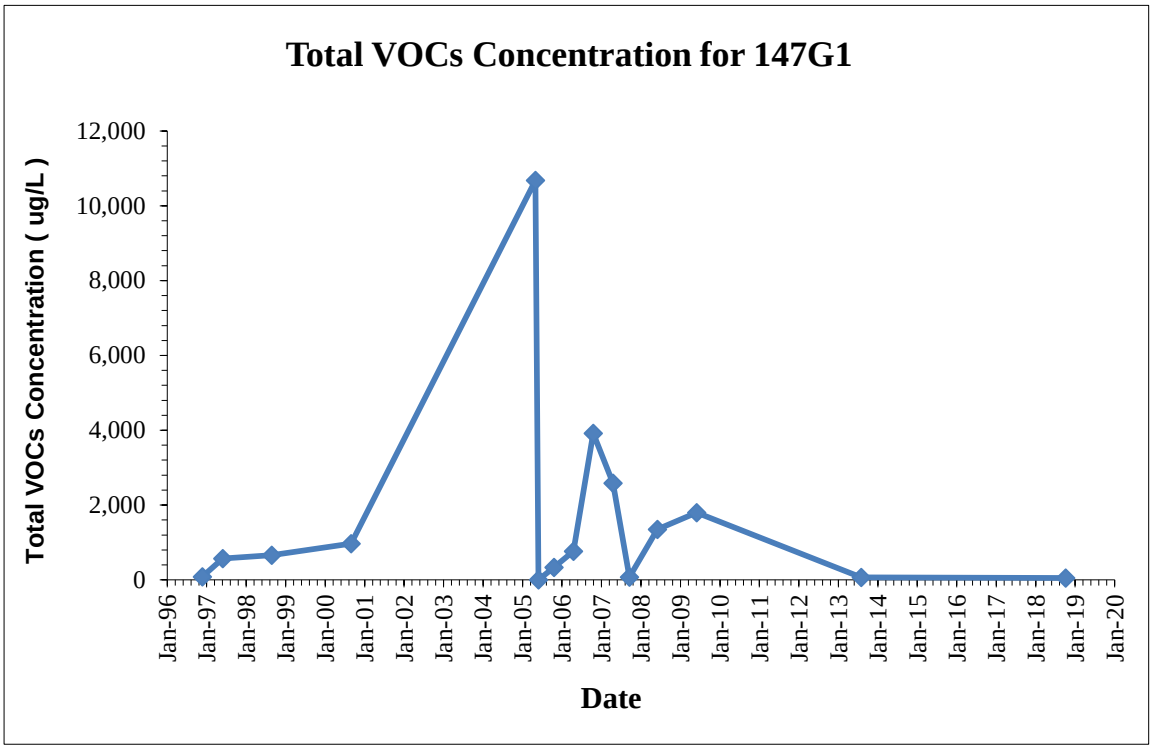
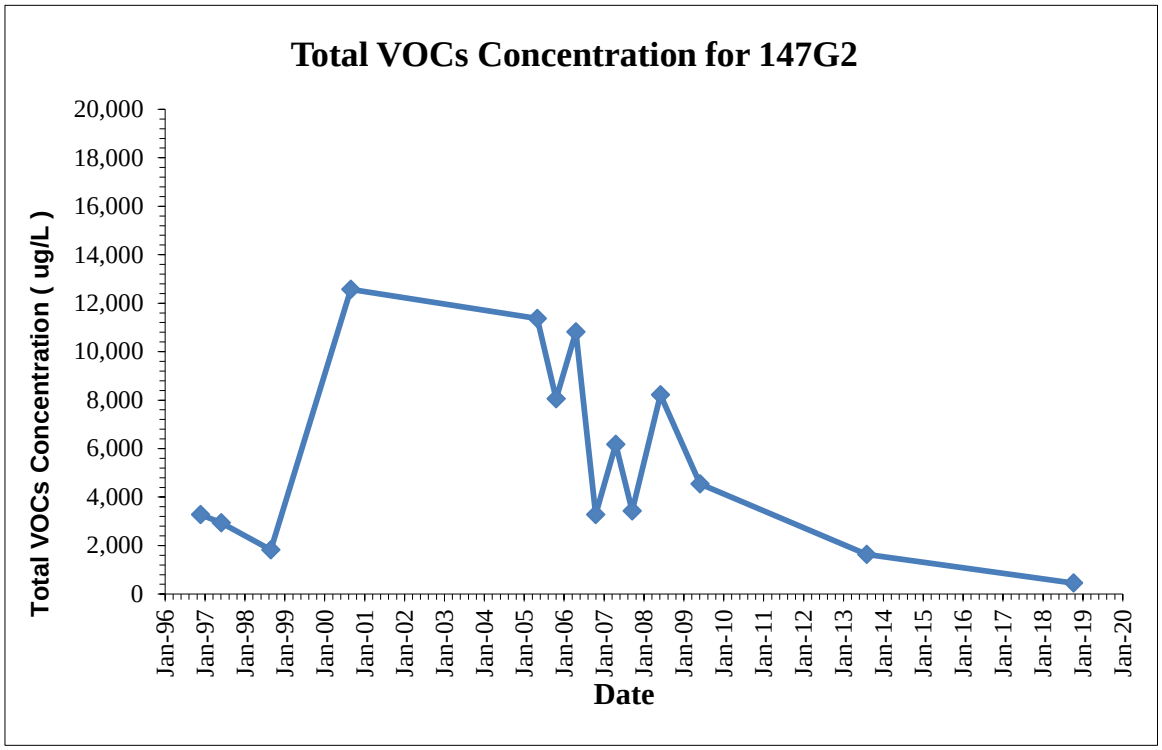
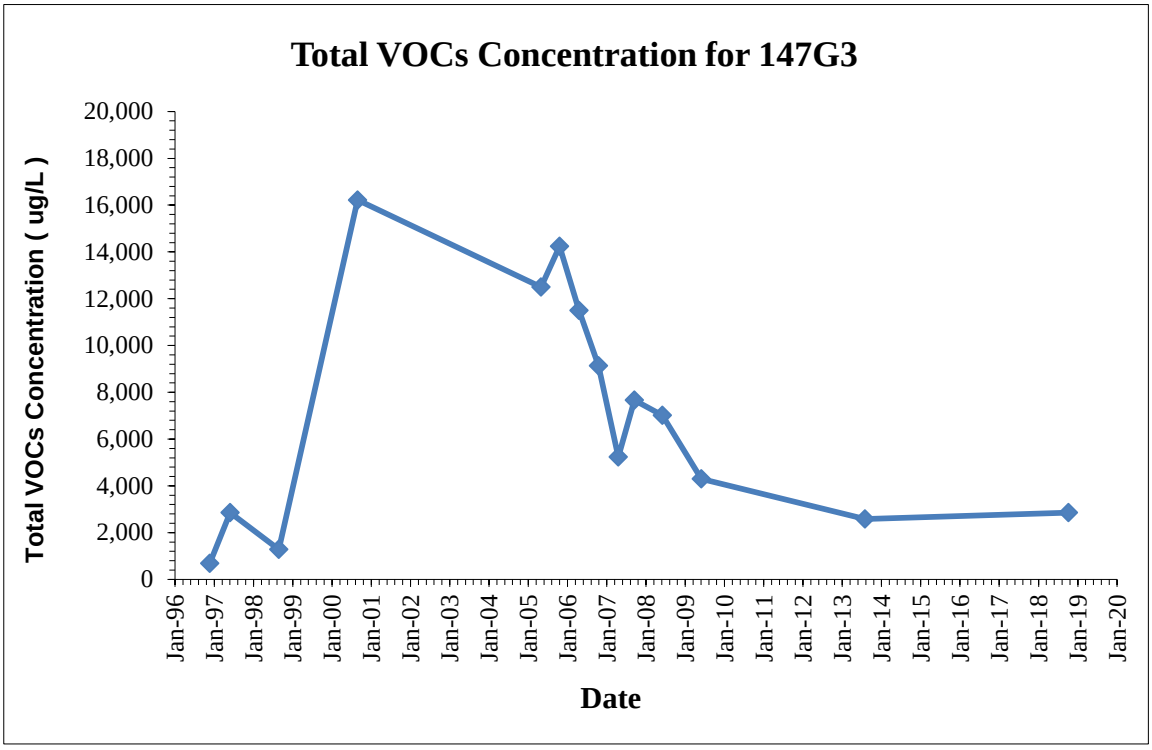
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 150F
Total VOCs Concentration (ug/L)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 156F
Total VOCs Concentration (ug/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 147G1
Total VOCs Concentration (ug/L)
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 147G2
Total VOCs Concentration (ug/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date


Total VOCs Concentration for 147G3
Total VOCs Concentration (ug/L)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
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Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Date

APPENDIX C

MONITORED NATURAL ATTENUATION CONCENTRATION PLOTS

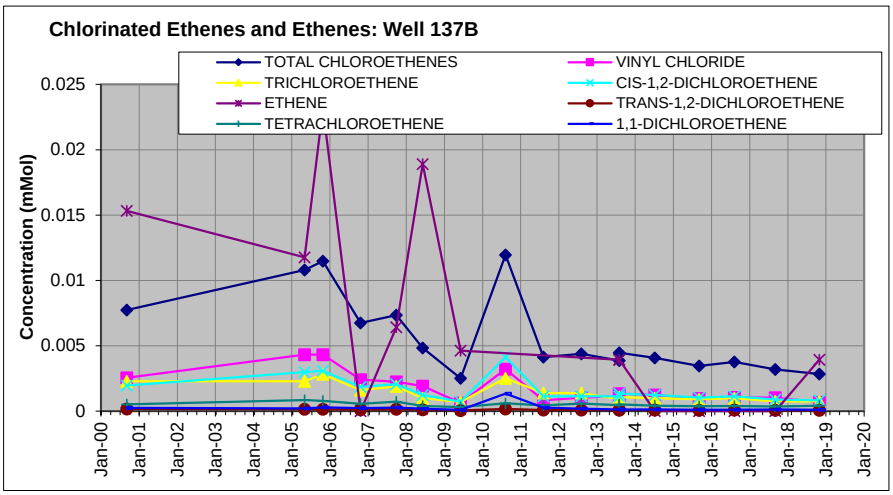
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
DuPont Necco Park

WELL 137B

Monitoring Well Summary

- Source area
- Decrease of Total Chlorinated from Ethenes 2005-2018
- Mostly TCE, cDCE, VC
- Significant ethene Production
- Inversion of moles of TCE and DCE/VC

2018 Sample Results	(ppb)
PCE	68
TCE	98
Cis- 1,2 DCE	80
VC	43
Trans-1,2 DCE	6.2
1,1-DCE	11
TOTAL	**306**

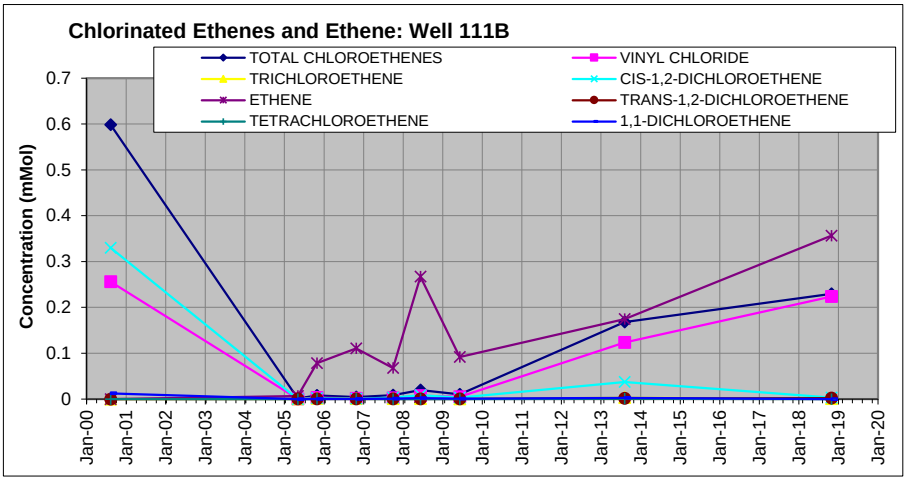


WELL 111B

Monitoring Well Summary

- Source area
- Increase in Total Chlorinated
- Ethenes 2005-2009 due to mostly cDCE, VC
- Moderate increase in 1,1- DCE from 2005-2013, decreasing in 2018.
- Ethene production greater than other VOCs
- Inversion of DCE and VC over time

2018 Sample Results	(ppb)
PCE	<75
TCE	82 J
Cis- 1,2 DCE	300 J
VC	14000
Trans-1,2 DCE	200 J
1,1-DCE	<95
TOTAL	**14582**

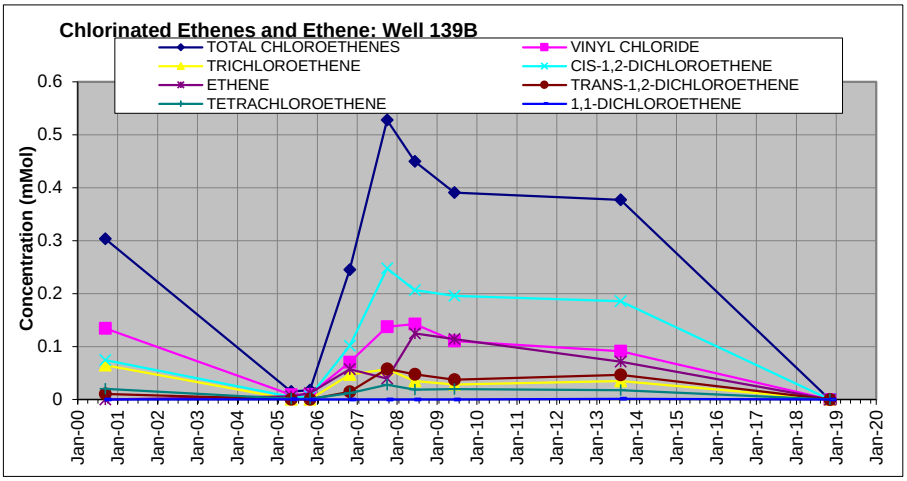


WELL 139B

Monitoring Well Summary

- Source area - adjacent to RW-4
- NAPL observed in 1992
- Apparent increase in Total Chlorinated Ethenes from 2005-2009, large decrease from 2013-2018.
- Mostly cDCE, VC, TCE, tDCE, PCE
- Notable ethene production in past sample

2018 Sample Results	(ppb)
PCE	1.5
TCE	1.6
Cis- 1,2 DCE	0.4
VC	<0.2
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**4**



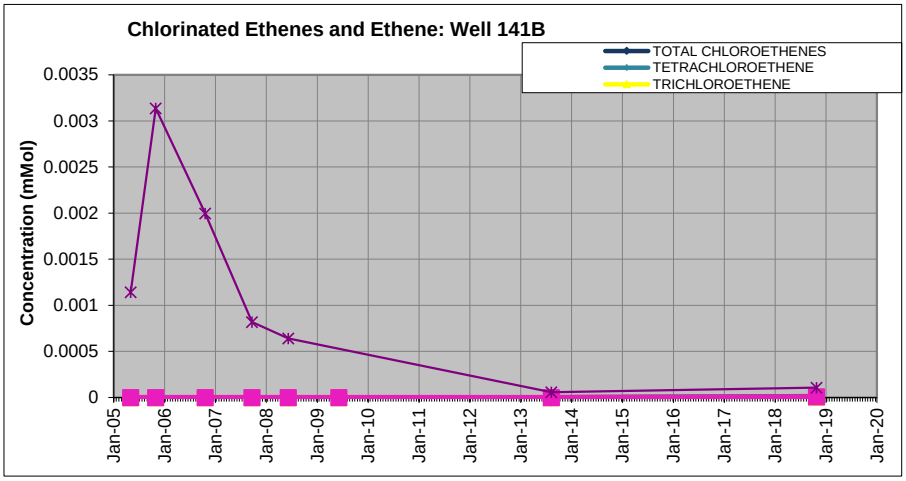
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
DuPont Necco Park

WELL 141B

Monitoring Well Summary

- Upgradient Well
- Chlorinated Ethenes detected for first time in 2018 includes low concedntrations (<0.5 ppb) of PCE, TCE, and VC.
- Moderate Ethene production

2018 Sample Results	(ppb)
PCE	0.39 J
TCE	0.23
Cis- 1,2 DCE	<0.16
VC	0.48 J
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**1.1**

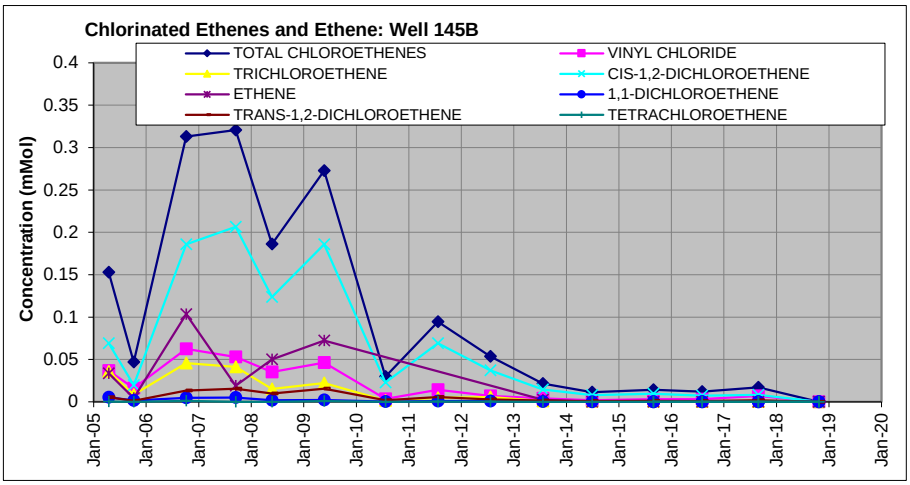


WELL 145B

Monitoring Well Summary

- Down gradient Well
- Decrease in Total CVOCs - plume retraction
- Mostly degradation product cDCE

2018 Sample Results	(ppb)
PCE	<0.15
TCE	0.22 J
Cis- 1,2 DCE	1.9
VC	1
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**3**

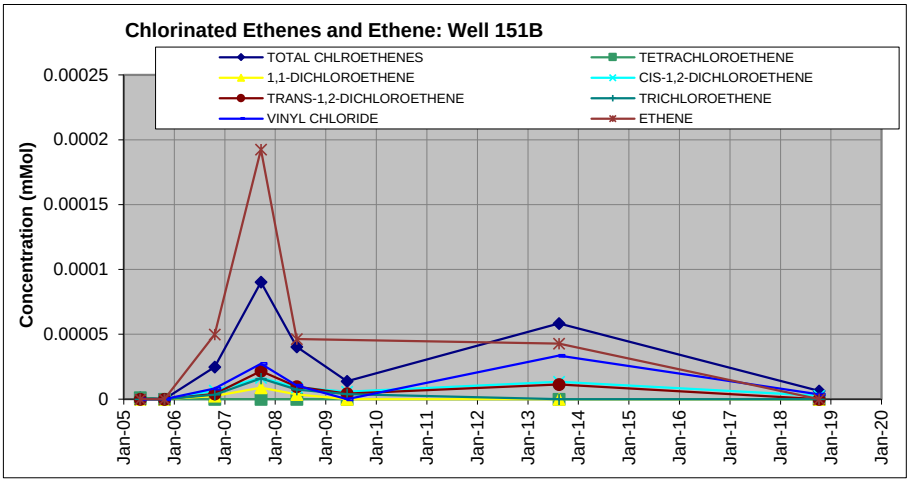


WELL 151B

Monitoring Well Summary

- Far downgradient well
- Below or near MCL
- Mostly low conc. of VC, TCE, tDCE,cDCE
- Detections of only cDCE and VC in 2018

2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	0.26
VC	0.23
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.49**



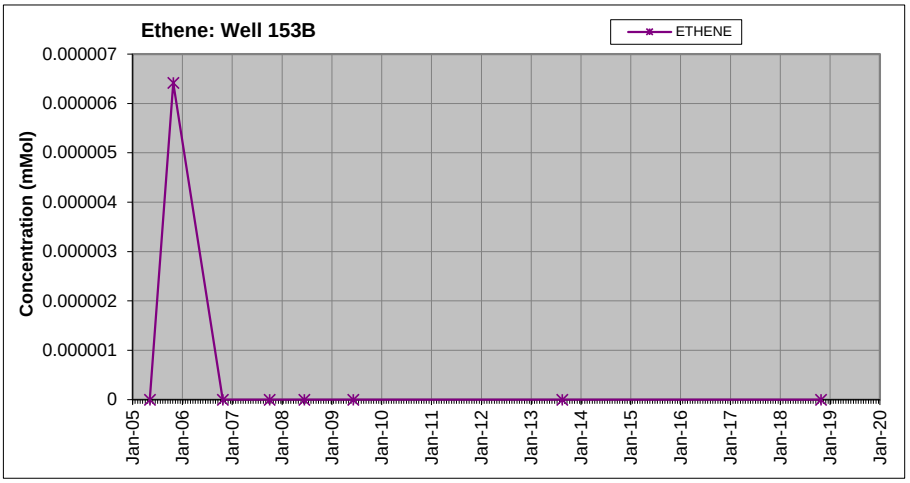
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
DuPont Necco Park

WELL 153B

Monitoring Well Summary

- East side gradient well
- No Chlorinated Ethenes detected

2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	<0.16
VC	<0.2
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.00**

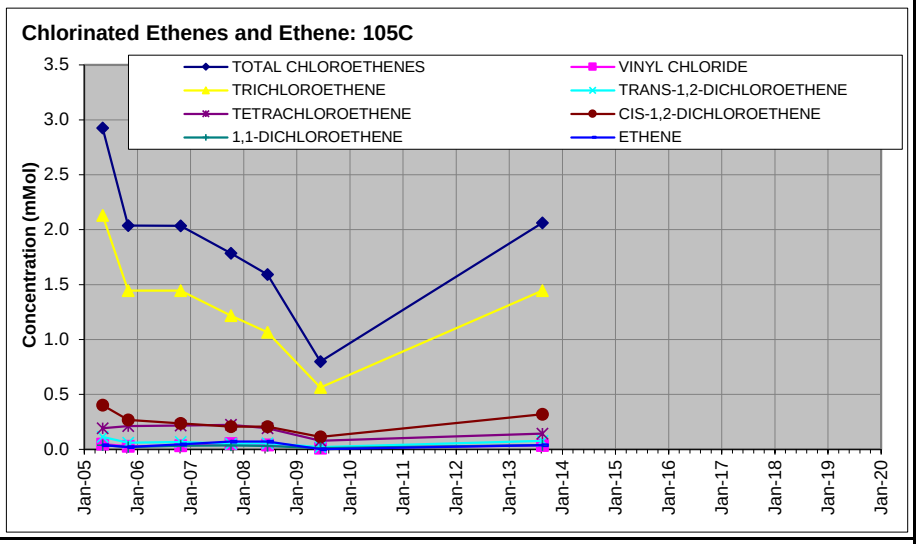


WELL 105C

Monitoring Well Summary

- Source area
- DNAPL observed in 1992
- Well was dry in 2018 and could not be sampled.
- Previous results exceed effective solubility and 1% absolute solubility for: PCE, TCE, CF
- Slight decrease Total Chlorinated
- Ethene production in past samples

2013 Sample Results	(ppb)
PCE	24,000
TCE	190,000
Cis- 1,2 DCE	31,000
VC	2,200
Trans-1,2 DCE	7,400
1,1-DCE	3,800
TOTAL	**258,400**

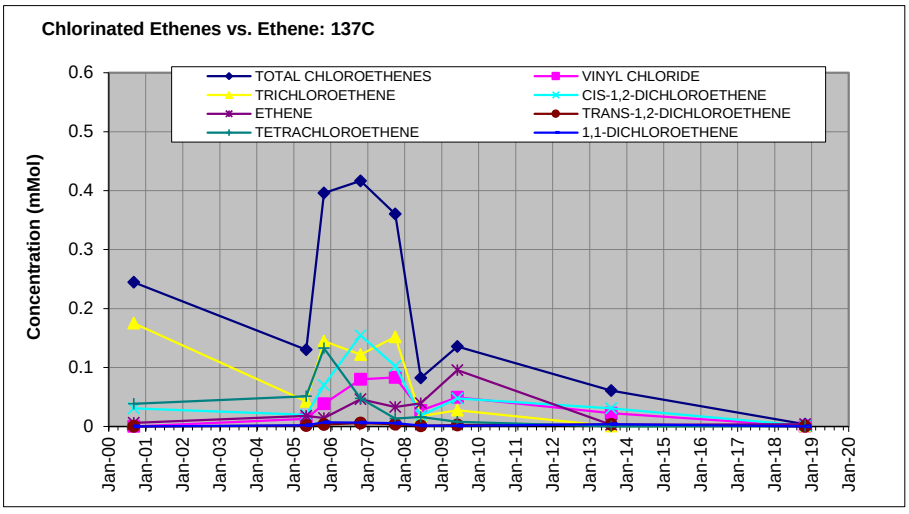


WELL: 137C

Monitoring Well Summary

- Source area
- Inversion of TCE and degradation products
- Decreasing Total CVOCs, large decrease from 2013-2018
- Ethene production
- Greater than two orders of magnitude decrease in TCE.

2018 Sample Results	(ppb)
PCE	83
TCE	130
Cis- 1,2 DCE	130
VC	46
Trans-1,2 DCE	6.7
1,1-DCE	8.2
TOTAL	**404**



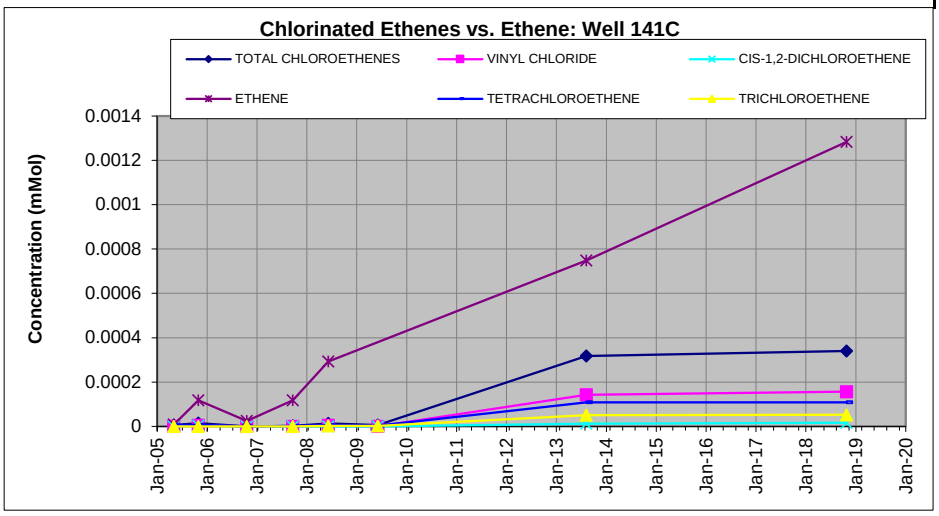
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 141C

Monitoring Well Summary

· Upgradient
· Low conc. of VC, TCE, PCE - near MCL
· Increasing Ethene production

2018 Sample Results	(ppb)
PCE	18
TCE	6.90
Cis- 1,2 DCE	1.6
VC	9.8
Trans-1,2 DCE	0.21 J
1,1-DCE	0.36 J
TOTAL	**36.87**

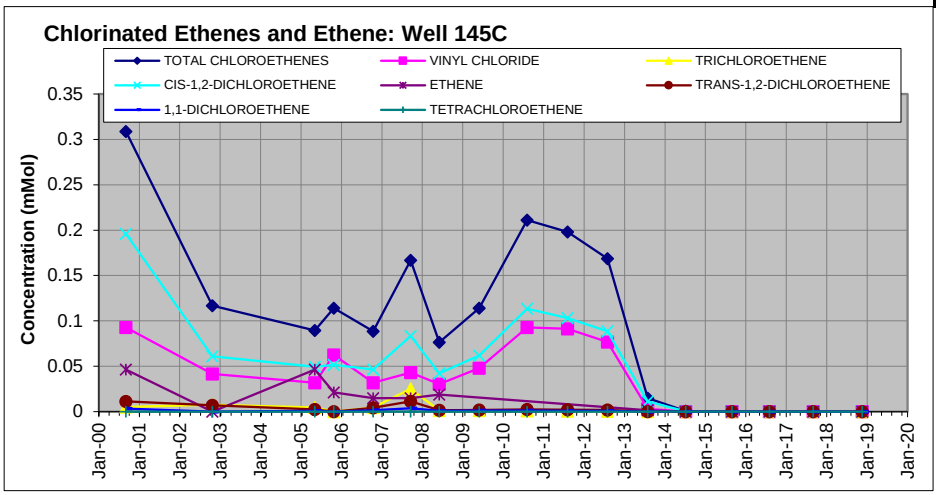


WELL: 145C

Monitoring Well Summary

· Downgradient
· Near Source Boundary
· Decrease in Total Chlorinated Ethenes
· Mostly cDCE and VC
· Decreasing ethene production

2018 Sample Results	(ppb)
PCE	<0.15
TCE	0.27 J
Cis- 1,2 DCE	2
VC	1
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**3**

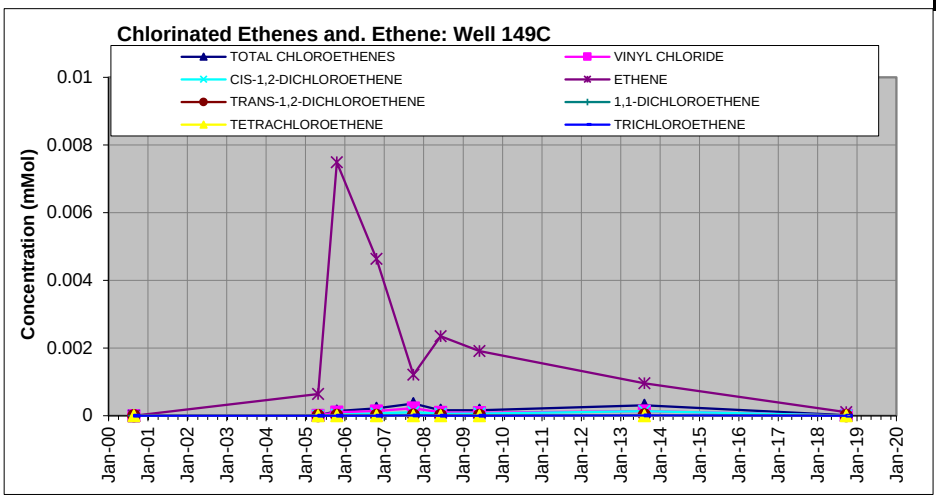


WELL: 149C

Monitoring Well Summary

· Downgradient
· Low Total CVOCs - near MCL
· cDCE, VC only detected
· Decreasing ethene production

2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	0.52 J
VC	0.43 J
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.95**



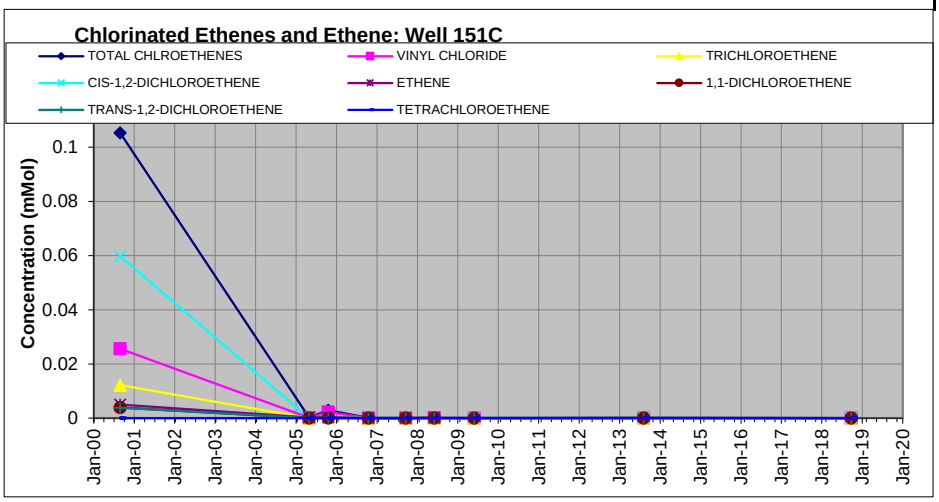
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 151C

Monitoring Well Summary

- Far downgradient
- Declining Total CVOCs - all non-detect in 2018

2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	<0.16
VC	<0.2
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0**

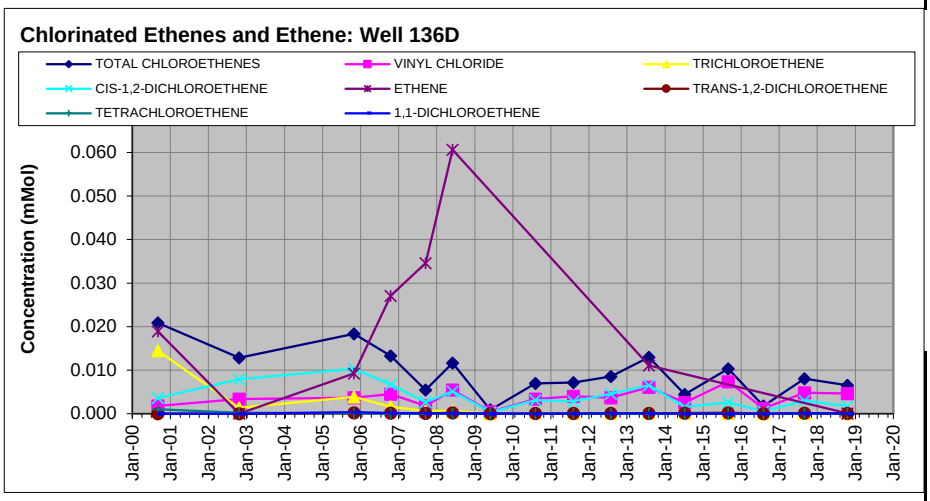


WELL: 136D

Monitoring Well Summary

- Near downgradient well
- Inversion of TCE and degradation product since 2000
- Mostly cDCE, VC
- Decreasing ethene production

2018 Sample Results	(ppb)
PCE	<1.5
TCE	6.3 J
Cis- 1,2 DCE	170
VC	290
Trans-1,2 DCE	5.8 J
1,1-DCE	3.3 J
TOTAL	**475**

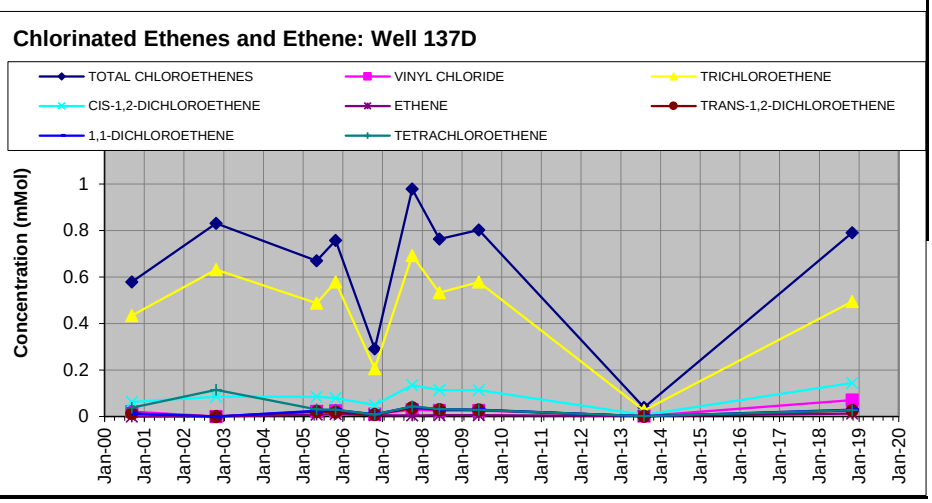


WELL: 137D

Monitoring Well Summary

- Source area
- Exceeded 1% solubility for PCE, TCE except in 2013
- Decreasing Total CVOCs

2018 Sample Results	(ppb)
PCE	4,400
TCE	65,000
Cis- 1,2 DCE	14,000
VC	4,400
Trans-1,2 DCE	2,500
1,1-DCE	2,800
TOTAL	**93,100**



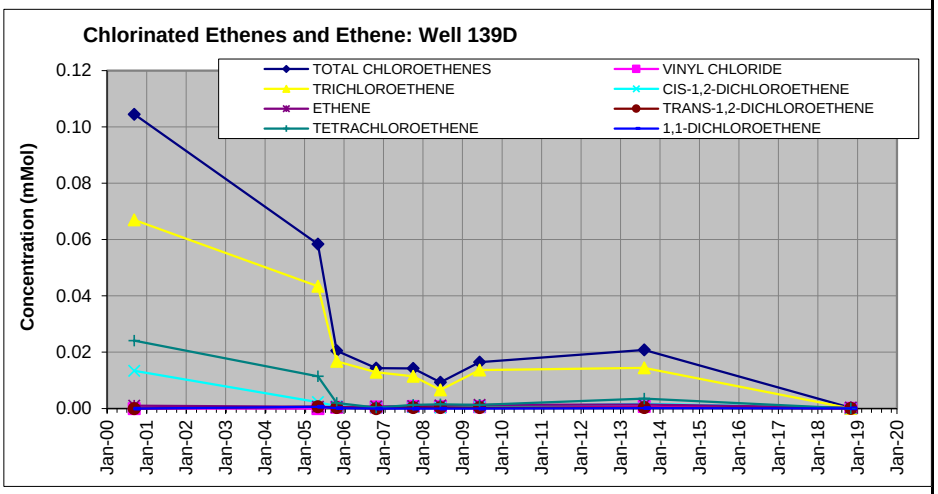
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 139D

Monitoring Well Summary

- Source area
- DNAPL observed 1992
- Strong Decrease in Total CVOCs
- Mostly TCE and PCE in 2013 to mostly cDCE in 2018
- Weak ethene production

2018 Sample Results	(ppb)
PCE	4.5
TCE	2.4
Cis- 1,2 DCE	16
VC	2.5
Trans-1,2 DCE	0.42 J
1,1-DCE	1.3
TOTAL	**27**

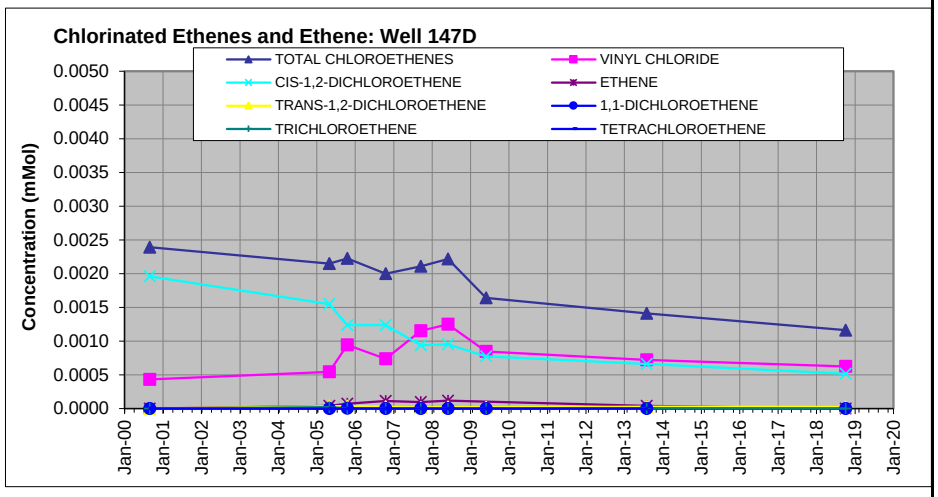


WELL: 147D

Monitoring Well Summary

- Far downgradient
- Decreasing Total CVOCs from 2000-2018
- Mostly cDCE, VC - inversion of DCE and VC
- Steady DCE reduction
- Weak ethene production

2018 Sample Results	(ppb)
PCE	<0.38
TCE	<0.25
Cis- 1,2 DCE	50
VC	39
Trans-1,2 DCE	2.2 J
1,1-DCE	<0.48
TOTAL	**91**

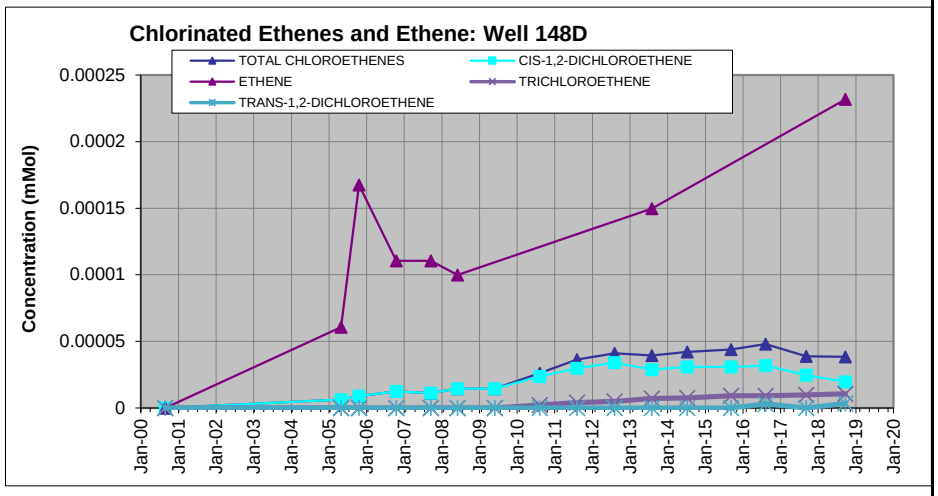


WELL: 148D

Monitoring Well Summary

- Downgradient - below MCL
- Slightly increasing Total Chlorinated, still very low
- Notable ethene / ethane production, increasing from 2000-2018
- Mostly cDCE

2018 Sample Results	(ppb)
PCE	0.79 J
TCE	1.40
Cis- 1,2 DCE	1.9
VC	<0.2
Trans-1,2 DCE	0.33 J
1,1-DCE	<0.19
TOTAL	**4.4**



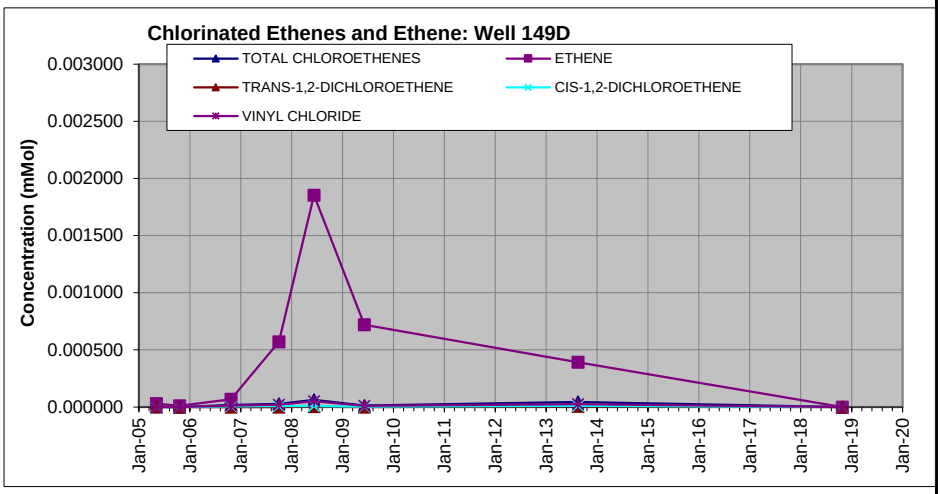
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 149D

Monitoring Well Summary

- Side gradient - below MCL
- Non-detect in 2018
- Historically mostly VC and cDCE
- Weak Ethene production, non-detect in 2018

2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	<0.16
VC	<0.2
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.00**

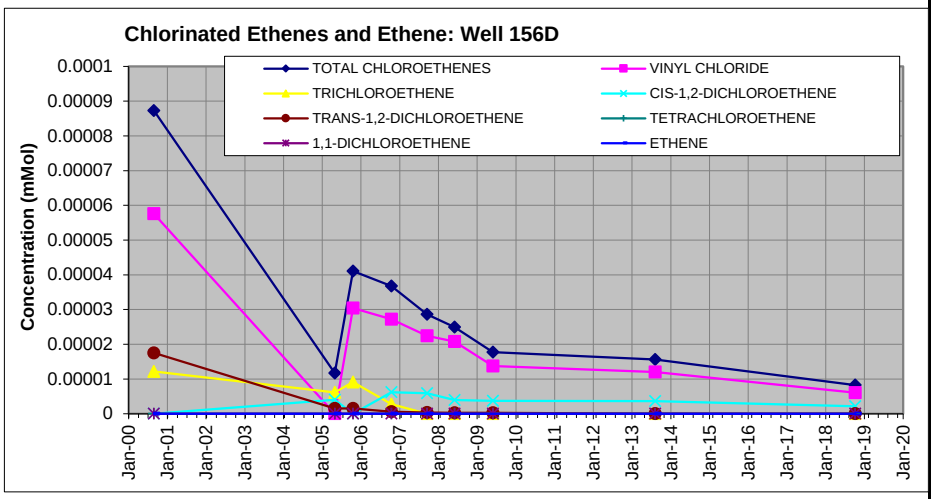


WELL: 156D

Monitoring Well Summary

- Far downgradient - below MCLs
- Decrease Total Chlorinated Ethenes
- Mostly cDCE and VC
- Inversion of TCE and cDCE noted in 2006
- Plume retraction

2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	0.21 J
VC	0.38 J
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.59**

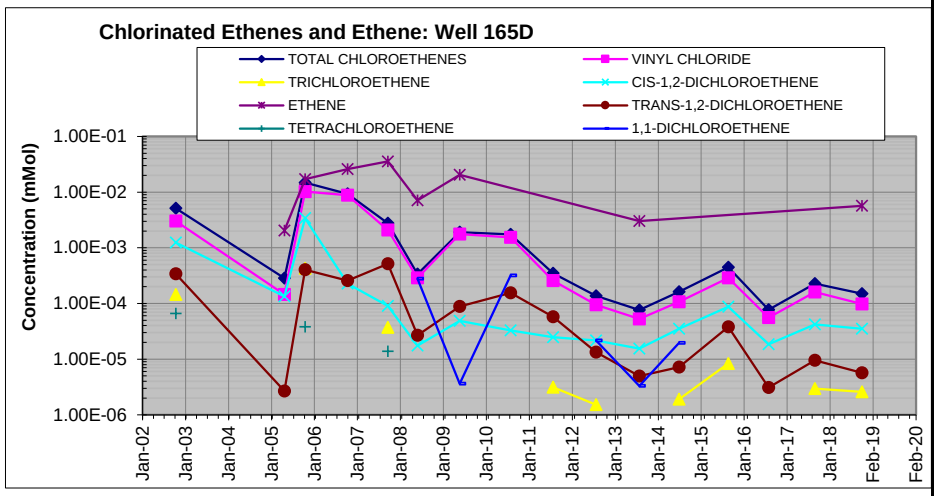


WELL: 165D

Monitoring Well Summary

- Source area
- Near source boundary
- Decreasing Total CVOCs by over an order of magnitude
- Plume retraction to near MCLs
- Moderate ethene production
- Primarily VC
- Y-axis is log scale (gaps in chart represent 0 values)

2018 Sample Results	(ppb)
PCE	<0.15
TCE	0.34 J
Cis- 1,2 DCE	3.4
VC	6.1
Trans-1,2 DCE	0.55 J
1,1-DCE	0.94 J
TOTAL	**11.3**



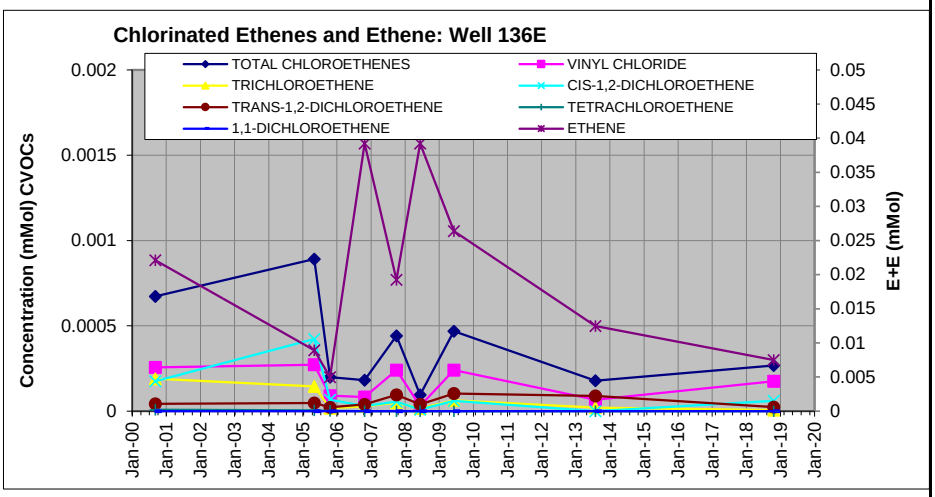
Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 136E

Monitoring Well Summary

- Near downgradient
- Decrease in Total CVOCs
- Near MCLs
- Strong ethene production

2018 Sample Results	(ppb)
PCE	<0.3
TCE	0.84 J
Cis- 1,2 DCE	5.9 J
VC	11 J
Trans-1,2 DCE	2.3
1,1-DCE	<0.38
TOTAL	**20.04**

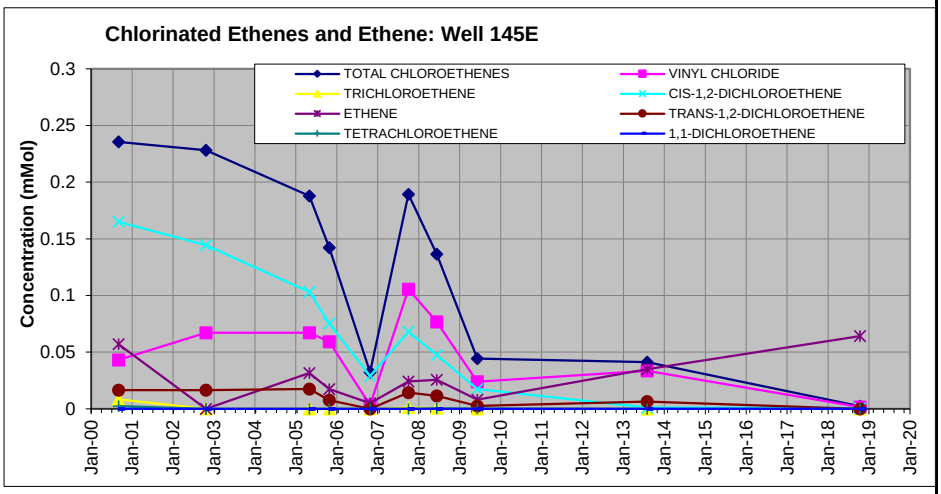


WELL: 145E

Monitoring Well Summary

- Side gradient
- Strong decrease in Total CVOCs- 2 orders of magnitude from 2000-2018
- Inversion of DCE and VC
- Strong ethene production

2018 Sample Results	(ppb)
PCE	<0.3
TCE	<0.2
Cis- 1,2 DCE	63
VC	100
Trans-1,2 DCE	1.6 J
1,1-DCE	<3.8
TOTAL	**165**

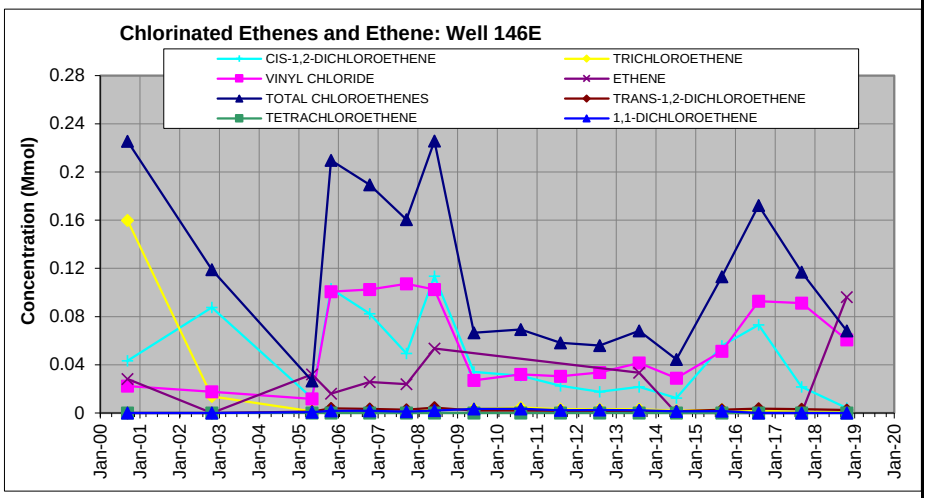


WELL: 146E

Monitoring Well Summary

- Downgradient
- Near source boundary
- Decrease in Total Chlorinated Ethenes 2008-2018
- Primarily VC and cDCE, but also inversion
- Good Ethene production

2018 Sample Results	(ppb)
PCE	<30
TCE	97 J
Cis- 1,2 DCE	400
VC	3800
Trans-1,2 DCE	240
1,1-DCE	<38
TOTAL	**4537**

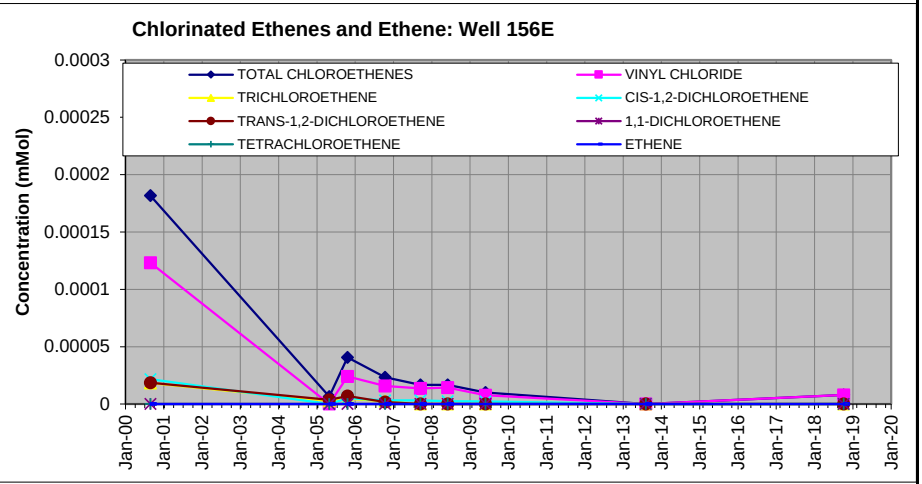


Appendix C: Chlorinated Ethenes and Ethene
Bedrock Wells
Necco Park

WELL: 156E

Monitoring Well Summary
· Far downgradient
· DecreaseTotal Chlorinated Ethenes 2000-2018
· Below MCLs

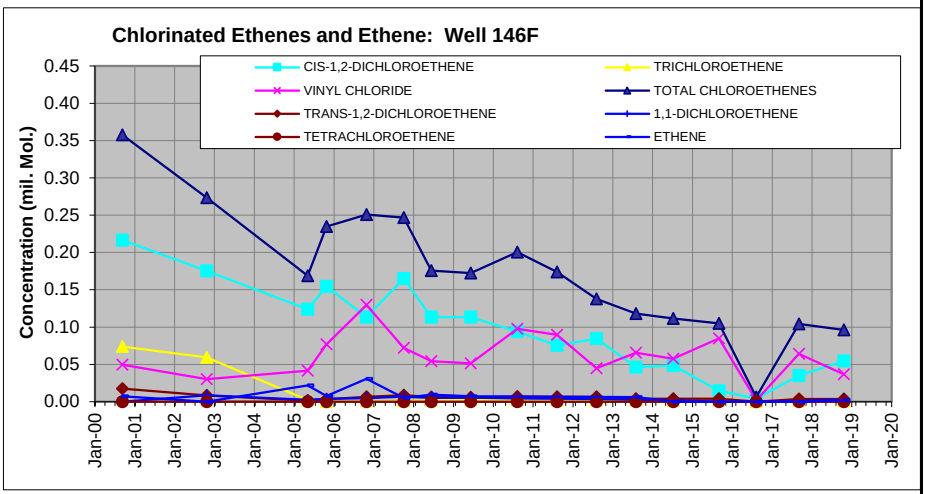
2018 Sample Results	(ppb)
PCE	<0.15
TCE	<0.1
Cis- 1,2 DCE	<0.16
VC	0.49 J
Trans-1,2 DCE	<0.19
1,1-DCE	<0.19
TOTAL	**0.49**



WELL: 146F

Monitoring Well Summary
· Downgradient
· Near source boundary
· Decreases in Total CVOCs 2000-2018
· Primarily cDCE, VC, inversion of DCE and VC

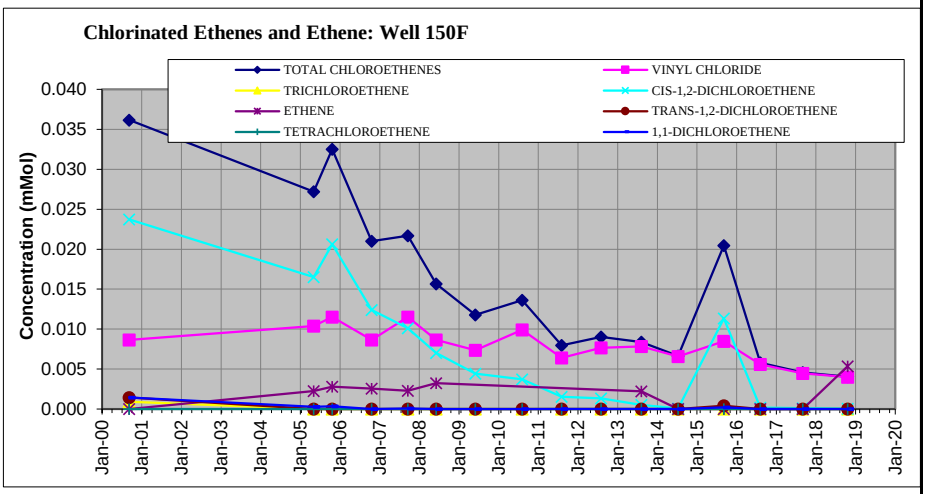
2018 Sample Results	(ppb)
PCE	<12
TCE	160
Cis- 1,2 DCE	5300
VC	2300
Trans-1,2 DCE	340
1,1-DCE	270
TOTAL	**8370**



WELL: 150F

Monitoring Well Summary
· Sidegradient
· Strong decrease in Total CVOCs
· Inversion of DCE and VC
· Strong ethene production

2018 Sample Results	(ppb)
PCE	<1.2
TCE	<0.83
Cis- 1,2 DCE	4.6 J
VC	250
Trans-1,2 DCE	<1.6
1,1-DCE	<1.6
TOTAL	**255**



APPENDIX D

LANDFILL CAP INSPECTION RESULTS (OCTOBER 2018)

EXHIBIT A
CAP AND SURFACE WATER DRAINAGE
INSPECTION CHECKLIST
NECCO PARK

DATE: 10-30-18
INSPECTOR: Gerald Shepard
WITNESSES: Not Required

EMERGENCY CONTACT: Timothy J. Pezzino

Phone # 716-923-1111

CONDITION: (Check) (Not Acceptable or Not Present require comments below)

	Acceptable	Not Acceptable	Present	Not Present	Remarks
1) Vegetative Cover, Ditches, Culverts	X				
a) Sediment Build-Up/Debris	X				
b) Pooling or Ponding	X				
c) Slope Integrity	X				
d) Overall Adequacy	X				
e) Culvert Condition	X				
2) Access Roads	X				
3) Landfill Cover System					
a) Erosion Damage	X				
b) Leachate Seeps				X	
c) Settlement				X	
d) Stone Aprons	X				
e) Vegetation	X				
f) Animal Burrows			X		See Below
4) Slope Stability					
a) Landfill Top Soil	X				
b) Landfill Side Slope	X				
5) Gas Vents	X				
6) Monitoring Wells	X				

COMMENTS:
DESCRIPTION OF CONDITION: 3B) No Leachate Seeps Present
3C) No Settling on Landfill Cap or Side Slopes
3F) Very Small Mice and Mole Burrows on Landfill and Side Slopes

DESCRIPTION OF CONCERN: 3F) Small Mice and Mole burrows pose no Risk to Cap Integrity At this time

DESCRIPTION OF REMEDY:

EXHIBIT B
CAP AND SURFACE WATER DRAINAGE
MAINTENANCE CHECKLIST
NECCO PARK

DATE: 10-30-18
INSPECTOR: Gerad Shepard
WITNESSES: Not Required

EMERGENCY CONTACT: Timothy J. Pezzino
Phone # 716-923-1111

Maintenance Performed (Check)	Item	Performed by:	Remarks
	1) Vegetative Cover:		
	a) Seeding		
	b) Fertilizing		
	c) Topsoil Replaced		
	d) Removal of Undesirable Vegetation		
	2) Drainage Ditches		
	a) Sediment Removal		
	b) Fill		
	c) Regrading		
	d) Stone Apron Repair		
	e) Vegetative Cover Placement		
	f) Liner Replacement		
	3) Access Road		
	a) Excavation		
	b) Fill		
	c) Grading		
	d) Stone Paving		
	4) Landfill Cap		
	a) Excavation		
	b) Cover Materials		
	- topsoil		
	- barrier protection layer		
	- drainage composite		
	- geomembrane		
	- geotextile		
	c) Testing		
	d) Barrier Protection Layer		
X	e) Vegetative Cover	Contractor-Moncon	Oct 8-2018
	5) Gas Vents		
	- Pipes		
	- Bedding and Adjacent Media		
	6) Other		

DESCRIPTION OF MAINTENANCE ACTIVITIES: 4E) Brush hogged And Line Trimmed Landfill cap, Side Slopes, and Ditch Surrounding Landfill Oct 8-2018