CALUMET
Montana Refining, LLC

1900 10th Street NE Great Falls, MT 59404
Phone: 406-761-4100 Main Fax: 406-761-0174 Refinery Building Fax: 406-761-0777 www.calumetspecialty.com

November 10, 2023

Ms. Denise Kirkpatrick
Hazardous Waste Specialist
Montana Department of Environmental Quality
Waste Management Bureau
P.O. Box 200901
Helena, MT 59620-0901

RE: AOC-16 Interim Measure 2nd Quarter 2023 Monitoring Report No. 6

Submitted via Montana File Transfer Service with Hard Copy to follow

Dear Ms. Kirkpatrick

Please find attached Calumet Montana Refining LLC's (CMR) AOC-16 Interim Measure (IM) 2nd Quarter 2023 Monitoring Report (QMR) No. 6 for review and approval. The report documents the operations, maintenance, and monitoring activities completed for the dual phase extraction (DPE) remediation system, passive treatment trench, and light non-aqueous phase liquid (LNAPL) recovery trench between April 2023 and June 2023. In addition, this report presents an evaluation of AOC-16 IM remediation system performance during this period and discusses continued system optimization and monitoring activities.

Please contact me at your earliest convenience if you have any questions.

Sincerely,

Michael Gipson

Mike Gipson
Environmental Specialist

cc: Joe Dauner - CMR

Attachments: AOC-16 Interim Measure 2nd Quarter 2023 Monitoring Report No.6



AOC-16 INTERIM MEASURE 2ND QUARTER 2023 MONITORING REPORT NO. 6

CALUMET MONTANA REFINING, LLC
GREAT FALLS, MONTANA

November 10, 2023

Confidential

TABLE OF CONTENTS

1. Introduction

2. DPE System Operations Summary
2.1 System Runtime
2.1.1 Planned Shutdowns for Routine and Corrective Maintenance
2.1.2 Non-Routine/Unplanned Shutdowns
2.2 System Operation and Monitoring
2.2.1 DPE Influent and Effluent Sampling Results
2.2.2 Groundwater Elevations
2.2.3 Sub-Surface Vacuum
2.2.4 Overall System Performance and Optimization

3. LNAPL Recovery Trench and PTT
3.1 LNAPL Monitoring
3.1.1 Passive LNAPL Skimmer Installation
3.2 Groundwater Monitoring
3.2.1 Monitoring Well Sampling
3.2.2 Groundwater Analytical Results – June 2023
3.2.3 Evaluation of Concentration Trends Over Time

4. Conclusion and Recommendations

5. References

LIST OF FIGURES

Figure 1: AOC-16 Site Layout
Figure 2A-B: DPE system Influent Vapor PID Readings
Figure 3: DPE System Influent Vapor Concentration Trend
Figure 4: Vapor and Liquid Effluent Mass Removal
Figure 5: Groundwater Contours – March 2023
Figure 6: Subsurface Vacuum Readings
Figure 7: DPE System Operational Parameters
Figure 8: SRCO Operational Parameters
Figure 9: Maximum LNAPL Thickness – LNAPL Recovery Wells Q2 2023
Figure 10A-C: Groundwater Concentration Trend Graphs

LIST OF TABLES (ATTACHED)

Table 1: DPE System Operational Data
Table 2: Summary of Analytical Results and Contaminant Mass Removal – Vapor
Table 3: Summary of Analytical Results and Contaminant Mass Removal – Liquid
Table 4: Fluid Level Measurements at AOC-16 Area
Table 5: Fluid Measurements at LNAPL Wells
Table 6: Summary of Groundwater Analytical Results - Petroleum COCs
Table 7: Summary of Groundwater Analytical Results – Field Parameters
Table 8: Summary of Groundwater Analytical Results - Biodegradation Indicators

LIST OF APPENDICES

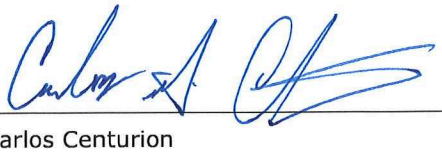
Appendix A: Laboratory Analytical Reports
A1: Dual-Phase Extraction Vapor Analytical Results
A2: Dual-Phase Extraction Effluent Liquid Analytical Results
A3: Passive Treatment Trench Groundwater Analytical Results
Appendix B: Historical Analytical Results and Contaminant Mass Removal - Vapor
Appendix C: Historical Analytical Results and Contaminant Mass Removal - Liquid
Appendix D: Groundwater Sampling Purge Logs

ACRONYMNS AND ABBREVIATIONS

AOC-16	Area of Concern-16
BOD	biochemical oxygen demand
BTEX	benzene, toluene, ethylbenzene, and xylene
CMR	Calumet Montana Refining, LLC
COC	constituent of concern
DEQ-7 HHS	Montana Department of Environmental Quality-7 Human Health Standards
DO	dissolved oxygen
DPE	dual-phase extraction
EPH	extractable petroleum hydrocarbon
gpm	gallons per minute
IM	Interim Measures
in-Hg	inches of mercury
LEL	lower explosive limit
LNAPL	light non-aqueous phase liquid
µg/L	microgram per liter
MDEQ	Montana Department of Environmental Quality
mg/L	milligrams per liter
mL/min	milliliters per minute
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolts
NTu	nephelometric turbidity unit
OM&M	operations, maintenance, and monitoring
ORP	oxidation reduction potential
Pace	Pace Analytical Services, LLC
PID	photoionization detector
PLC	programmable logic controller
PRT	primary recovery trench
PTT	passive treatment trench
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QMR	Quarterly Monitoring Report
RBSL	Risk-Based Screening Levels
RCRA	Resource Conservation Recovery Act
RFI	RCRA Facility Investigation
Ramboll	Ramboll Americas Engineering Solutions, Inc.
ROI	radius of influence
SCFM	standard cubic per minute
SRCO	Self-Recuperative Catalytic Oxidizer
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
WWTP	wastewater treatment plant

SIGNATORY PAGE

I certify under penalty of law that this document and all attachments were prepared under my direct supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: 

Name: Carlos Centurion

Title: VP/Plant Manager – Calumet Montana Refining, LLC

Date: 11/10/23

EXECUTIVE SUMMARY

Ramboll Americas Engineering Solutions, Inc. (Ramboll), on behalf of Calumet Montana Refining, LLC (CMR), has prepared this Area of Concern-16 (AOC-16) Interim Measure (IM) 2nd Quarter 2023 Monitoring Report (QMR) No. 6 to summarize the operations of the AOC-16 Dual Phase Extraction (DPE) system and the Passive Treatment Trench (PTT). This QMR has been prepared in accordance with Section 6.2 of the Operations Maintenance and Monitoring (OM&M) Plan for the AOC-16 IM.

During the 2nd quarter of 2023, the DPE system operated approximately 68% of the available time. The DPE system extracted and discharged approximately 154,834 gallons of total fluids to CMR's wastewater treatment plant (WWTP). During this reporting period the DPE system also removed approximately 6.4 pounds of petroleum vapor. It also removed approximately 1 pound of volatile organic compounds (VOCs), 0.8 pounds of semi-volatile organic compounds (SVOCs), 63 pounds of volatile petroleum hydrocarbons (VPH), and 603 pounds of extractable petroleum hydrocarbons (EPH) in the form of liquid effluent. Initial mass removal rates indicate that the DPE system is accomplishing the AOC-16 IM objectives of recovering free phase Light Non-Aqueous Phase Liquid (LNAPL) mass and reducing the LNAPL within the vadose and saturated zone soil matrix. Due to reductions in contaminant mass recovery compared to previous quarters and reduced flows and manifold vacuums, optimization efforts were conducted to rebalance flow and increase mass recovery.

Quarterly groundwater sampling was conducted at the PTT performance monitoring wells on June 23, 2023. Sampling was conducted at upgradient well MW-41S, PTT well MW-106, and downgradient compliance well MW-105. Samples collected from these monitoring wells were analyzed for petroleum constituents of concern (COCs) – VOCs, SVOCs, VPH, and EPH. Samples from PTT well MW-106 was also analyzed for biodegradation parameters.

The monitoring well upgradient of the passive treatment trench (MW-41S) reported benzene concentrations exceeding the DEQ-7 Human Health Standards – Groundwater (DEQ-7 HHS) and the Risk-Based Screening Levels (RBSLs) of 5 µg/L. Benzene was not detected from monitoring well MW-106 installed within the trench. Monitoring well MW-105 installed downgradient of the passive treatment trench reported benzene at 48 µg/L exceeding the DEQ-7 HHS and RBSL of 5 µg/L. Within the trench (MW-106), TPH and C5-C8 Aliphatics were detected between the method detection limit and reported detection limit at concentrations of 108 µg/L and 85.9 µg/L. The C5-C8 Aliphatics concentration was below the RBSL of 650 µg/L. Downgradient of the PTT (MW-105), the TPH concentration was 1610 ug/L with a C5-C8 Aliphatic concentration of 969 µg/L, just exceeding the RBSL of 650 µg/L. Concentrations of contaminants of concern at the downgradient well MW-105 appear decreasing with time with some seasonal variability.

OM&M of the IM will continue to document the performance of the IM's and will include periodic performance reporting to the Montana Department of Environmental Quality (MDEQ) to ensure the IM objectives are being met. Further investigation/evaluation at the AOC-16 Truck Rack Source Area will be completed as part of the upcoming Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) activities. The results from the RFI and ongoing IM performance monitoring will be evaluated in the Corrective Measures Study to determine if operational modifications are necessary or if a request to the MDEQ to cease recovery and place the DPE system in standby mode is warranted.

1. INTRODUCTION

Ramboll Americas Engineering Solutions, Inc. (Ramboll), on behalf of Calumet Montana Refining, LLC (CMR), has prepared this Area of Concern-16 (AOC-16) Interim Measure (IM) Quarterly Monitoring Report (QMR) No. 6 for the Calumet Great Falls Montana Refining facility located at 1900 10th Street NE, Great Falls, Montana to summarize the second quarter of operations in 2023 (April 1 through June 30, 2023) for the AOC-16 IM remedy selected to address petroleum releases at AOC-16.

The CMR refinery is comprised of 82.7 acres of industrial/refinery operations and office buildings. The refinery produces gasoline, middle distillates, and asphalt for distribution in Washington, Montana, Idaho, and Alberta, Canada. AOC-16, referred to as the "Gasoline and Light Oil Loading Rack" or "truck loading rack," is located within an approximately 7.6-acre parcel to the east of the active refinery and is owned by CMR (Figure 1).

Activities were completed in accordance with the Corrective Action Order on Consent issued to Montana Refining Company, Inc. by the Montana Department of Environmental Quality (MDEQ) to govern the performance of Resource Conservation Recovery Act (RCRA) corrective action activities at the site. In 2016, petroleum related vapors were detected in an offsite residential property along 11th Street NE. The MDEQ issued an IM letter on October 11, 2016, directing CMR to address imminent threats to human health and/or the environment stemming from petroleum release near CMR's Loading Rack (MDEQ, 2016). Immediate action consisting of relocating and filling an existing sanitary sewer to prevent migration of contaminants was undertaken. Between 2016 and 2019, in coordination with the MDEQ, investigation activities were undertaken, and alternative remedies were evaluated to address the petroleum release near the Loading Rack. Ultimately, an IM remedy approach was recommended consisting of dual-phase extraction (DPE) in the existing primary recovery trench (PRT) in the Truck Rack Area and Light non-aqueous phase liquid (LNAPL) recovery and a passive treatment trench (PTT) just north of North River Road.

Construction of the AOC-16 IM remedies commenced in July 2021 and were completed in October 2021 as documented in the *AOC-16 Interim Measures AOC-16 IM Construction Documentation Report* (CMR, 2022). Construction activities included the installation of following IM remedies:

- DPE remediation system in the Truck Rack Area, and
- LNAPL recovery trench and PTT utilizing colloidal activated carbon at an area along North River Road.

Commissioning of the AOC-16 IM was conducted from October 2021 through December 2021 and routine operations of the DPE system commenced on January 1, 2022. A 25-foot LNAPL recovery trench extension was completed between July 25, 2022 and July 29, 2022. Documentation of the extension construction activities were provided in the *AOC-16 IM Construction Documentation Report Addendum 1* (CMR, 2022c).

Corrective action remedial goals were developed as part of the AOC-16 Interim Measures Evaluation Report (CMR, 2019) to protect human health and the environment. The AOC-16 IM goals specific to each treatment area include:

- Truck Rack Area (DPE System)
  - Recover free phase LNAPL mass present in the area south of the Truck Rack to stabilize the LNAPL plume.
  - Reduce LNAPL within the vadose and saturated zone soil matrix to stabilize the dissolved phase plume.
- North River Road Area (LNAPL recovery trench and PTT)
  - Mitigate dissolved phase groundwater impacts migrating from the Truck Rack Area towards the Missouri River.

This AOC-16 IM 2nd Quarter 2023 Monitoring Report No. 6 summarizes the sampling results, operations, and performance monitoring data that were gathered for the AOC-16 IM from April 1, 2023 through June 30, 2023, and presents: 1) system runtime for the DPE System; 2) DPE system operational data; 3) identification of operational problems, the length of any shutdowns, and a summary of actions taken to rectify or prevent these problems; 4) influent vapor and liquid sampling results and estimated contaminant mass removal rates for the DPE system; 5) fluid levels, including LNAPL thickness measurements in the LNAPL recovery trench upgradient of the PTT; and 6) groundwater concentrations of constituents of concern (COC) in the PTT point of compliance well (MW-105) and PTT well (MW-106). The activities outlined in this report were performed in accordance with the Operations, Maintenance, and Monitoring (OM&M) Plan (CMR, 2021b).

2. DPE SYSTEM OPERATIONS SUMMARY

2.1 System Runtime

During the period of April 1, 2023 through June 30, 2023, the DPE system was in operation approximately 68% of the time and extracted and discharged approximately 154,834 gallons of total fluids to CMR's wastewater treatment plant (WWTP). Table provides a summary of operations during this reporting period. A summary of the routine and non-routine system shutdowns is discussed below.

2.1.1 Planned Shutdowns for Routine and Corrective Maintenance

Brief shutdowns of the DPE system were performed to conduct maintenance activities, including filter replacement and level switch cleaning, monthly preventative maintenance, and inspection of equipment.

2.1.2 Non-Routine/Unplanned Shutdowns

A summary of the non-routine system shutdowns for this reporting period is presented below:

- Between April 19, and April 25, 2023, the system was shutdown due to a temporary increase in the facilities' process water discharge to the wastewater treatment plant. The shutdown was initiated to avoid a possible flow capacity exceedance at the WWTP.
- Between May 7, and May 9, the system was shutdown due to clogging at Blower BL2331. Between May 9 and May 16, Blower BL2331 was taken out of service for cleaning while Blower BL2332 continued to operate. Between May 16 and May 18, the system was shutdown to reinstall Blower BL2331.
- On June 14, the system was shutdown to pre-emptively clean Blower BL2332 given the clogging observed at BL2331. Following attempted start-up on June 20, it was determined that repairs to the blower motor were also needed. The system was restarted on June 26.

2.2 System Operation and Monitoring

DPE system performance monitoring and sampling were conducted in accordance with the OM&M Plan (CMR, 2021b and CMR, 2021c) to document system operation effectiveness. It included monitoring of operations data, periodic vapor and effluent sampling to document contaminant mass recovery, monitoring well gauging, and sub-surface vacuum measurements. These parameters are discussed in the following sections.

2.2.1 DPE Influent and Effluent Sampling Results

Monitoring of contaminant mass removal is the primary metric for optimizing DPE system performance and gauging the AOC-16 IM objective of free-phase LNAPL mass recovery and LNAPL plume stabilization.

Vapor

Vapor/air extraction flow rates were continuously monitored and recorded by the system programmable logic controller (PLC) and influent vapor sampling was periodically conducted to evaluate mass removal.

The concentrations of volatile organic compound (VOCs) in the vapor phase were measured periodically on each DPE influent line (DPE-1 through DPE-8) using a photoionization detector (PID) to measure relative vapor concentrations from each DPE well. PID measurements were also collected from sample port SP-301 on the inlet side of the blowers. PID measurements from the DPE wells and SP-301 port are summarized on Figures 2A and 2B. PID readings at all wells have dropped from greater than 400 parts per million (ppm) upon startup in October 2021 to less than 50 ppm in the second quarter of 2023. The highest PID reading during the reporting period were recorded at DPE-2 (41.4 ppm) on May 3, 2023.

Vapor samples were also collected in May and June 2023 from SP-301. The samples were submitted to Pace National Laboratory located in Mount Juliet, Tennessee. Each sample was analyzed for VOCs by the United States Environmental Protection Agency (USEPA) Method TO-15. Analytical results for detected compounds from the influent vapor samples are summarized in Table 2. Laboratory reports are included in Appendix A1. Historical analytical results and mass removal are included in Appendix B. Note that an April vapor sample was collected. However, the canister vacuum was outside the allowable range when received at the lab, so it was not analyzed.

Concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX), n-hexane, and n-heptane in effluent vapor over time are shown on Figure 3. These compounds were selected to evaluate vapor effluent concentration trends as their concentrations were the highest as compared to other VOCs during the start-up sampling. Concentration during the 2nd quarter of 2023 of BTEX, n-hexane, and n-heptane are approximately one to two orders of magnitude less than concentrations in the 4th quarter of 2022 and three to four orders of magnitude less than the concentrations at startup in October 2021. For example, benzene concentrations have decreased from 3,330,000 µg/m3 in October 2021 to 138,000 µg/m^3 in December 2022 to non-detect in June 2023. N-hexane concentrations have decreased from 7,840,000 µg/m^3 in October 2021 to 169,000 µg/m3 in December 2022 to 9,270 µg/m^3 in June 2023. Concentration reductions are likely due to a combination of reduced volatile mass in the subsurface and non-optimal operational conditions such as elevated water table conditions.

The combination of vapor flow rates, system runtime, and vapor VOC concentrations were used to calculate the mass of contaminants removed. During the reporting period, the DPE system removed approximately 6.4 pounds of VOCs in the vapor phase as shown on Figure 4. As noted above, influent vapor concentrations (Table 2 and Figure 3) have dropped one to two orders of magnitude between the 4th quarter of 2022 and the 2nd quarter of 2023.

The post-catalyst outlet temperature on the Recuperative Catalytic Oxidizer (SRCO) unit also serves as a continuous relative indicator of contaminant mass with higher temperatures corresponding to relatively greater contaminant mass. Prior to January 2023 as shown in previous Quarterly Monitoring Reports, the post-catalyst process air temperature consistently exceeded 800 degrees F. During the first quarter of 2023 as noted in the Quarterly Monitoring Report for Q1, the post-catalyst process air temperature during operation dropped below 700 degrees F indicating reduced mass loading to the SRCO unit.

As described in the *AOC-16 Interim Measure 1st Quarter 2023 Monitoring Report No. 5 (CMR, 2023),* periodic flow balancing was performed at the end of March 2023 due to the lower concentrations of contaminants in the monthly analytical air samples, reduced PID readings, and the lower post-catalyst process air temperature, to improve contaminant recovery. This resulted in increased manifold vacuum, liquid flows and an increase in post-catalyst outlet temperature to a temperature greater

than 800 degrees F. Based on these adjustments, DPE-6 and DPE-8 are producing higher flow rates of vapor compared to the other wells, which is likely due to subsurface variability The high flow rates at these wells result in the overall system vacuum being reduced to a level that is less effective for liquid extraction. During this quarter, the manual valves at DPE-6 and DPE-8 were close approximately 75% to reduce flow at these locations and increase recovery at other wellheads.

Influent VOC concentrations as measured through vapor VOC sampling, PID readings at individual wells, and post-catalyst outlet temperature have decreased with time. Periodic flow balancing is recommended to maximize contaminant recovery. Maximizing drawdown throughout the trench to influence the residual contamination in the zone of water table fluctuation is also recommended via partially closing wells that produce higher vapor flow rates such as DPE-6 and DPE-8. It is recommended that the drop tube at DPE-2 be raised approximately 1.5 feet to improve dewatering at this well location.

Liquid

Effluent samples of groundwater were collected from the discharge side of the transfer pump on a monthly basis and submitted to Pace located in West Columbia, South Carolina for analysis of VOCs and semi-volatile organic compounds (SVOCs). Samples were submitted to the Pace National Laboratory located in Mount Juliet, Tennessee for analysis of volatile petroleum hydrocarbons (VPH), and extractable petroleum hydrocarbons (EPHs). Analytical results from the effluent sampling are summarized in Table 3. Laboratory reports are included in Appendix A2. Historical analytical results and mass removals are included in Appendix C.

The combination of fluid recoveries and contaminant concentrations were used to calculate the mass of contaminants removed in the dissolved phase. In the dissolved phase during the reporting period, the DPE system removed approximately 1.0 pounds of VOCs, 0.8 pounds of SVOCs, 63 pounds of VPH, and 603 pounds of EPH.

Separate phase LNAPL recovery is not quantified. Total fluids (combined LNAPL and water) in the effluent are pumped to the refinery's on-site WWTP where oil-water separation occurs. However, visual observations of LNAPL in the DPE system knockout tank (T-23100) sight glass serve as a qualitative indicator of LNAPL recovery. LNAPL was not consistently observed within the knock-out tank sight glass. Prior to this quarter, LNAPL has been consistently observed within the knock-out tank.

As shown on Figure 4, total VOC, SVOC, VPH, and EPH mass removed in the vapor and dissolved phase since DPE system startup in October 2021 and through June 30, 2023, is calculated to be approximately 2,896 pounds, 12 pounds, 205 pounds, and 1,919 pounds, respectively.

2.2.2 Groundwater Elevations

Monitoring wells in AOC-16 area (MW-22, MW-41S, MW-41D, MW-53, MW-57, MW-59S, MW-59D, MW-63, MW-64, MW-102, MW-103, MW-104, MW-105, and MW-106) were gauged in June 2023. The depth to water and if observed, separate-phase LNAPL thickness measurements, were recorded. These measurements are presented in Table 4. Groundwater contours are provided on Figure 5. Groundwater elevations in June 2023 were approximately 1 to 2 feet higher than in March 2023 as reported in the previous quarterly monitoring report.

2.2.3 Sub-Surface Vacuum

Sub-surface vacuum measurements were recorded in June 2023 at two monitoring wells (MW-22 located 26 feet from DPE-3, MW-104 located 13 feet from DPE-3, and 22 feet from DPE-4, and MW-64 MW-64 located 21 feet from DPE-6,). These measurements are shown on Figure 6. Based on the measurements, vacuum was not observed at the adjacent monitoring wells, so the current radius of influence (ROI) appears to be less than 13 feet.

2.2.4 Overall System Performance and Optimization

This section compares the primary design parameters to the observed/measured values during the reporting period to evaluate the system performance. These parameters are discussed in detail in following sections and summarized in Table 1.

Liquid Extraction Rate

The average design flow rate for the DPE system is between 0.25 gallons per minute (gpm) during steady-state operation and 21 gpm during rainfall events. The combination of fluid recoveries and system run time was used to calculate liquid flow rate during the reporting period. The DPE system extracted fluids at an average rate of 1.79 gpm which is within the design flow rate.

Vapor Influent Flow Rate and Applied Vacuum

The design vapor influent flow rate and applied vacuum are 200 standard cubic per minute (SCFM) and 17 inches of mercury (in-Hg), respectively. System flow rate and system vacuum at the header during the reporting period are shown on Figure 7. The vacuum exceeded 15 in-Hg in April and following the cleaning of the blowers in May. Vacuum readings were lower prior to the blower cleaning and when a single blower was operated while the second blower was undergoing maintenance. Flows exceeded 150 SCFM in early April and dropped in May prior to the blower cleaning. Flows in late May and June approached 100 SCFM. Some of the lower vapor flows may be attributable to higher liquid flow rates during these time periods. As noted, clogging/fouling has been identified in the blowers so there is the potential for clogging of well screens and piping that may result in reduced system flows and should be inspected in the near term.

SRCO Performance Monitoring

The SRCO has a design destruction efficiency of 99% per manufacturer's specifications. To show compliance with the air permit, the SRCO pre- and post-catalyst process air temperature is monitored. The pre-catalyst process air temperature must be greater than 650°F to ensure a destruction efficiency of 99%. The SRCO temperature monitoring results during the reporting period is shown on Figure 8. As shown on Figure 8, the pre-catalyst process air temperature was above 650°F while the system was in operation.

Overall, the system is operating as designed. DPE system optimization will be conducted, as needed, based on DPE well vapor concentrations, mass removal, and liquid extraction rates.

3. LNAPL RECOVERY TRENCH AND PTT

3.1 LNAPL Monitoring

The 11 original LNAPL collection wells located in the LNAPL recovery trench and 6 additional LNAPL trench extension collection wells were gauged periodically throughout this reporting period (Figure 1). Fluid levels collected from the LNAPL wells are summarized in Table 5 and on Figure 9. In April, LNAPL was recorded at LNAPL-4, LNAPL-5, LNAPL-6, LNAPL-7, LNAPL-8, LNAPL-10, and LNAPL-11 with a maximum LNAPL thickness of 0.1 feet observed at LNAPL-8. In May and June 2023, 0.01 feet of LNAPL was identified at LNAPL-2 and LNAPL was not identified at any other wells.

3.1.1 Passive LNAPL Skimmer Installation

Passive LNAPL skimmers are deployed in eight recovery wells: LNAPL-2, LNAPL-4, LNAPL-5, LNAPL-6, LNAPL-7, LNAPL-8, LNAPL-10, and LNAPL-11. Passive skimmers are drained periodically and the liquid volume recovered at each location is recorded. During the reporting period, LNAPL was not identified in the skimmers which is consistent with the limited thicknesses observed in the wells, so no LNAPL was recovered from the trench.

Given the continued observed LNAPL thickness in the LNAPL recovery trench (varying from 0 to 0.1 feet during this quarter) passive recovery will be continued.

3.2 Groundwater Monitoring

The primary goal of the PTT is to mitigate dissolved phase groundwater impacts from migrating towards the Missouri River. Quarterly groundwater sampling was conducted on June 27 and June 28, 2023, at upgradient well MW-41S, PTT well MW-106, and compliance well MW-105 (Figure 1).

3.2.1 Monitoring Well Sampling

MW-105 was purged dry on June 27, 2023. The wells recharged over a 24-hour period and a groundwater sample was collected on June 28, 2023. Wells MW-41S and MW-106 were sampled on June 27, and June 28, respectively. During the purging of each well, field measurements were collected for water quality parameters, including dissolved oxygen (DO), pH, specific conductance, temperature, turbidity, and oxidation reduction potential (ORP). The field measurements were recorded every 5 minutes during well purging. The physical and chemical field measurements collected when purging the monitoring wells are summarized in the groundwater sampling logs in Appendix D.

After all the samples were collected, they were sealed, labeled, and placed on ice, pending delivery under chain-of-custody procedures to Pace located in West Columbia, South Carolina. The groundwater samples were analyzed for VOCs (via USEPA Method SW8260D), SVOCs (via USEPA Method SW 8270D) by the Pace South Carolina Laboratory. Samples for analysis of MDEQ VPH (via Method MDEQ VPH), and MDEQ EPH (via Method MDEQ EPH) were analyzed by the Pace National Laboratory located in Mount Juliet, Tennessee. Samples from MW-106 (PTT well) were also analyzed for the following parameters to assess the biodegradation dynamics of the COCs: filtered and unfiltered total iron, total manganese, dissolved iron, and dissolved manganese (via USEPA Method 6020B), sulfate and nitrate (via USEPA Method 9056A), biological oxygen demand (BOD) (via USEPA Method 5210B), alkalinity (via USEPA Method 2320B), methane (via method RSK - 175), and carbon dioxide (via USEPA Method 4500-CO2).

The wells did not yield enough volume to facilitate the collection of a complete set of field duplicate samples or a matrix spike/matrix spike duplicate (MS/MSD) sample. One trip blank was submitted along with each laboratory cooler for quality assurance/quality control (QA/QC) purposes. Methods and procedures for collecting, handling, and analyzing samples are provided in the Quality Assurance Project Plan (QAPP) (CMR, 2018). Treatment and disposal of purge water generated during monitoring well sampling was handled consistent with existing project procedures.

3.2.2 Groundwater Analytical Results – June 2023

The groundwater analytical results for detected compounds from the June 2023 sampling event are provided in Table 6. Previous quarterly groundwater sampling results from October 2021, March 2022, June 2022, August 2022, and March 2023 are also provided in Table 6 for comparison purposes. Analytical compounds that met or exceeded the respective MDEQ -7 HHS (May 2017) and/or MDEQ Tier 1 Groundwater Risk-Based Screening Levels (RBSLs) are bolded and/or shaded, respectively, for reference. Laboratory reports are included in Appendix A3.

The following subsections provide a summary of the analytical parameters detected in the monitoring wells in March 2023 and compare those detections to the DEQ-7 HHS in groundwater and RBSLs.

VOCs

Of the VOCs detected during the June 2023 groundwater sampling event at AOC-16, only benzene was detected above its respective groundwater screening standard.[1]

The monitoring well upgradient of the passive treatment trench (MW-41S) reported benzene at 410 micrograms per liter (µg/L) exceeding the DEQ-7 HHS and RBSL of 5 µg/L. Benzene was not detected from the location (MW-106) installed within the trench. The monitoring well (MW-105) installed downgradient of the passive treatment trench reported benzene at 48 µg/L exceeding the DEQ-7 HHS and RBSL of 5 µg/L.

SVOCs

In June 2023, no SVOCs were detected at concentrations exceeding the DEQ-7 HHS or the RBSLs.

TPH, VPH, and EPH

The upgradient monitoring well (MW-41S) had detectable concentrations of total petroleum hydrocarbons (TPH) via method MTDEQ VPH of 5,860 µg/L with a C5-C8 Aliphatic concentration of 429 µg/L which do not exceed the RBSL of 650 µg/L. Within the trench (MW-106), TPH[2] and C5-C8 Aliphatics were detected between the method detection limit and reported detection limit at concentrations of 108 µg/L and 85.9 µg/L. The C5-C8 Aliphatics concentration was below the RBSL of 650 µg/L. Downgradient of the PTT (MW-105), the TPH concentration was 1610 ug/L with a C5-C8 Aliphatic concentration of 969 µg/L, just exceeding the RBSL of 650 µg/L.

3.2.3 Evaluation of Concentration Trends Over Time

To evaluate concentration trends over time, the concentrations of benzene and TPH were plotted for each of the three passive treatment trench monitoring wells. Baseline sampling data from June 2020 through October 2021 are included on Figures 10A through 10C along with post-remediation data.

[1] All VOC results reported in this section are from USEPA Method 8260B.

[2] TPH analyzed using Method MTDEQ VPH.

This historical data was previously reported in the 2020/2021 Annual Groundwater Sampling Summary Report (CMR, 2021a) and Construction Documentation Report (CMR, 2022). Benzene and C5-C8 Aliphatics were selected as indicator compounds because they were the two compounds that exceed DEQ-7 HHSs and/or RBSLs during the baseline sampling event in October 2021. While there are no DEQ-7 HHSs and RBSLs for TPH, TPH represents a range of hydrocarbons and serves as an overall indicator of contaminant loading to the PTT.

The benzene, C5-C8 Aliphatics and TPH sampling results at upgradient well MW-41S showed the following changes between October 2021 and June 2023:

- Benzene decreased from 1,900 µg/L in October 2021 to 410 µg/L in March 2023.
- TPH has remained relatively consistent with some variability between sampling events with a maximum value of 9,800 µg/L in June 2022 and a minimum value of 3,100 µg/L in March 2022.
- C5-C8 Aliphatic have remained relatively consistent between sampling events with a maximum value of 1,500 µg/L in October 2021 and a minimum value of 392 µg/L in March 2023.

The benzene, C5-C8 Aliphatics and TPH sampling results at well MW-106 located in the PTT showed the following changes between October 2021 and March 2023:

- Benzene has not been detected during any sampling events.
- TPH had not been detected between October 2021 and June 2022, but was detected at concentration of 189 µg/L in August 2022, 108 µg/L in December 2022, and 108 µg/L in June 2023.
- C5-C8 Aliphatic had not been detected between October 2021 and June 2022, but was detected in August 2022 a concentration of 153 µg/L, in December 2022 at a concentration of 80 µg/L, and in June 2023 at a concentration of 85.9 µg/L. Detected results remain less than the RBSL of 650 µg/L.

The benzene, C5-C8 Aliphatics, and TPH sampling results at well MW-105 located downgradient of the PTT showed the following changes between October 2021 and June 2023:

- Benzene has decreased from 250 µg/L in October 2021 to 48 µg/L in March 2023. Trends generally are decreasing with time since the installation of the PTT with some variability between sampling events. Trends may indicate that concentrations are higher in summer months than in winter months but further data collection and analysis is needed to verify this trend.
- TPH appears variable with a maximum concentration of 1,900 µg/L in October 2021 and a minimum concentration 284 µg/L in March 2023. Trends may indicate that concentrations are higher in summer months than in winter months, but further data collection and analysis is needed to verify this trend.
- C5-C8 Aliphatics have decreased from 1,200 µg/L in October 2021 to 969 µg/L in March 2023. Trends generally are decreasing with time since the installation of the PTT with some variability between sampling events. Trends may indicate that concentrations are higher in summer months than in winter months but further data collection and analysis is needed to verify this trend.

Analytical results from groundwater samples collected from monitoring wells located up-gradient, down-gradient and from within the PTT indicate that the concentration of dissolved phase petroleum COCs decreased across the PTT initially meeting the goal of the PTT to mitigate the dissolved phase groundwater impacts from migrating from the Truck Rack to the Missouri River. Concentrations of COCs appear to be decreasing with time at the down-gradient compliance point. Initial trends may

indicate that there is some seasonable variability in concentrations at downgradient well MW-105, but further data collection and analysis is needed to verify this trend.

Biodegradation Parameters

Field parameters including pH, conductivity, turbidity, ORP, and dissolved oxygen are provided in Table 7. Low dissolved oxygen (generally less than 0.5 mg/L) and low or negative ORP values serve as indicators of the presence of reducing conditions. The lower the ORP and DO, the greater the potential for a reducing and anaerobic environment. At the PTT well (MW-106), ORP remained low and constant (ranging between 13 and 47 millivolts [mV]) indicative of reducing conditions. In the down gradient well (MW-105), ORP has been close to zero ranging between -107 and 144 mV indicative of reducing conditions. Dissolved oxygen readings have been variable at both wells. However, dissolved oxygen can be difficult to field measure and elevated dissolved oxygen concentrations, especially when other parameters indicate reducing conditions, can be caused by the introduction of air during the sampling process.

The groundwater analytical results for detected biodegradation parameters from June 2022 sampling event are provided in Table 8. Groundwater sampling results from October 2021, June 2022, and December 2023 are also provided in Table 8 for comparison purposes. Laboratory reports are included in Appendix A3.

As noted above, the PTT remediates groundwater utilizing a two-step process. As groundwater flows through the PTT, hydrocarbons and BTEX will partition from the dissolved phase by adsorption to the activated carbon particles. The contaminants are then anaerobically biodegraded through chemical oxidation stimulated by the added bio-stimulating electron acceptors (nitrate and sulfate). The order that petroleum degrading microbes utilize electron acceptors follows with their redox potential in the following order 1) aerobic degradation; 2) denitrification; 3) manganese reduction; 4) iron reduction; 5) sulfate reduction; and 6) methanogenesis.

Relative to the baseline October 2021 monitoring event, the following parameters indicate ongoing biodegradation within the trench between October 2021 and June 2023 as follows:

- Nitrate concentrations initially decreased from 210,000 µg/L in October 2021 to 4,700 ug/L in June 2022 to 750 ug/L in December 2022. Concentrations have since increased to 19,000 u/L in June 2023. Sulfate concentrations also initially decreased from 2,900,000 µg/L in October 2021 to 210,000 µg/L in June 2022. Since June 2022, sulfate concentrations have remained between 140,000 (December 2022) and 410,000 ug/L in June 2023. This reduction in the amended electron acceptor concentration was expected and serves as a positive indicator that biodegradation is occurring via denitrification and sulfate reduction. While sulfate concentrations have decreased, concentrations remain sufficiently elevated indicating that the amended electron acceptor is still available to continue to promote biodegradation.
- Carbon dioxide is a byproduct of degradation reactions and serves as an indicator of ongoing degradation. Concentrations are variable ranging from a high of 960,000 µg/L in June 2023 to a low of 110,000 µg/L in December 2022. These elevated concentrations serve as a positive indicator of ongoing biodegradation. Trends will continue to be monitored.
- Methane concentrations initially appear to be increasing (5.8 µg/L in October 2021, 62 µg/L in June 2022, 110 µg/L in December 2022, and 71 µg/L in June 2023). Increases in methane concentration are expected when the aquifer reaches methanogenic conditions. Increases in

methane concentrations may serve as an early indicator that methanogenesis is becoming a more dominant biodegradation pathway.

- Both dissolved iron and manganese concentrations appear have increased from system installed. Dissolved iron has increased from 65 µg/L in October 2021 to 1300 µg/L in June 2023. Dissolved manganese has increased from 1400 ug/L µg/L in October 2021 to 2800 µg/L in June 2023. Increased concentrations of iron and manganese in groundwater indicate that iron and manganese reduction is occurring because the reduced forms of these compounds have greater solubility than the oxidized forms. The increases in iron and manganese concentrations indicate that iron and manganese reduction are becoming a more dominant biodegradation pathway.

4. CONCLUSION AND RECOMMENDATIONS

During this reporting period from April 1, 2023 through June 30, 2023, the DPE system operated approximately 68% of the available time. The DPE system extracted and discharged approximately 154,834 gallons of total fluids to CMR's WWTP.

DPE System Performance

Initial mass removal rates indicate that the DPE system in the Truck Rack Area is meeting the AOC-16 IM goals of recovering free phase LNAPL mass and reducing the LNAPL within the vadose and saturated zone soil matrix.

During the reporting period, the DPE system removed approximately 6.4 pounds of VOCs in the vapor phase, and 1.0 pounds of VOCs, 0.8 pounds of SVOCs, 63 pounds of VPH, and 603 pounds of EPH in the liquid phase. Total VOC, SVOC, VPH, and EPH mass removed in the vapor and dissolved phase since DPE system startup in October 2021 and through June 30, 2023, is calculated to be approximately 2,896 pounds, 12 pounds, 205 pounds, and 1,919 pounds, respectively. Total influent vapor VOC concentrations were approximately 3 to 4 orders of magnitude lower than during startup during this quarter. Reductions in contaminant mass recovery may be due to a combination of the submerged DPE wells, reduced manifold vacuum, seasonal fate and transport mechanisms, and reduced contaminant mass present.

The pre-catalyst SRCO temperature remained greater than 650°F during its operation indicating at least 99% destruction efficiency of the extracted petroleum vapors prior to being discharged to the atmosphere.

During operation, maintenance activities will be performed and documented to ensure optimal performance of the system. DPE system optimization will be performed based on trench liquid elevations, DPE well vapor concentrations, mass removal, and liquid extraction rates.

LNAPL Trench Performance

The LNAPL trench installed upgradient of the PTT is successfully recovering and preventing the migration of LNAPL into the PTT.

For more effective LNAPL recovery, CMR deployed passive skimmer in the LNAPL recovery wells with measurable LNAPL in February 2022. LNAPL thicknesses in LNAPL recovery wells were generally lower than previous reporting periods with a maximum thickness of 0.1 feet observed at LNAPL-8. No LNAPL was recovered from the trench via passive skimmers during the reporting period. As this was the first reporting period with limited LNAPL recovery from the trench, continued monitoring and passive recovery are recommended.

PTT Performance

Analytical results from groundwater samples collected from monitoring wells located up-gradient, down-gradient and from within the PTT indicate that the concentration of dissolved phase petroleum COCs decreased across the PTT initially meeting the goal of mitigating the dissolved phase groundwater impacts from migrating from the Truck Rack to the Missouri River. Concentration trends

are decreasing at downgradient performance monitoring well MW-105 with some seasonable variability.

OM&M of the interim measures will continue to document the performance of the IM's and will include periodic performance reporting to the MDEQ to ensure the IM objectives are being met. Further investigation/evaluation of the petroleum impacts at the AOC-16 Truck Rack Area will be completed as part of the upcoming RCRA RFI activities. The results from the RFI and ongoing IM performance monitoring will be evaluated to determine if operational modifications are necessary or if a request to the MDEQ to cease recovery and place the DPE system in standby mode is warranted.

5. REFERENCES

CMR. 2018. Quality Assurance Project Plan (QAPP), Calumet Montana Refinery. November.

CMR. 2021a. 2020/2021 Annual Groundwater Sampling Summary Report. June.

CMR. 2021b. AOC-16 Interim Measure Operations, Maintenance, and Monitoring Plan. October.

CMR. 2021c. AOC-16 Interim Measure Self-Recuperative Catalytic Oxidizer Operations, Maintenance, and Monitoring Plan. October.

CMR. 2022a. AOC-16 IM Construction Documentation Report. March.

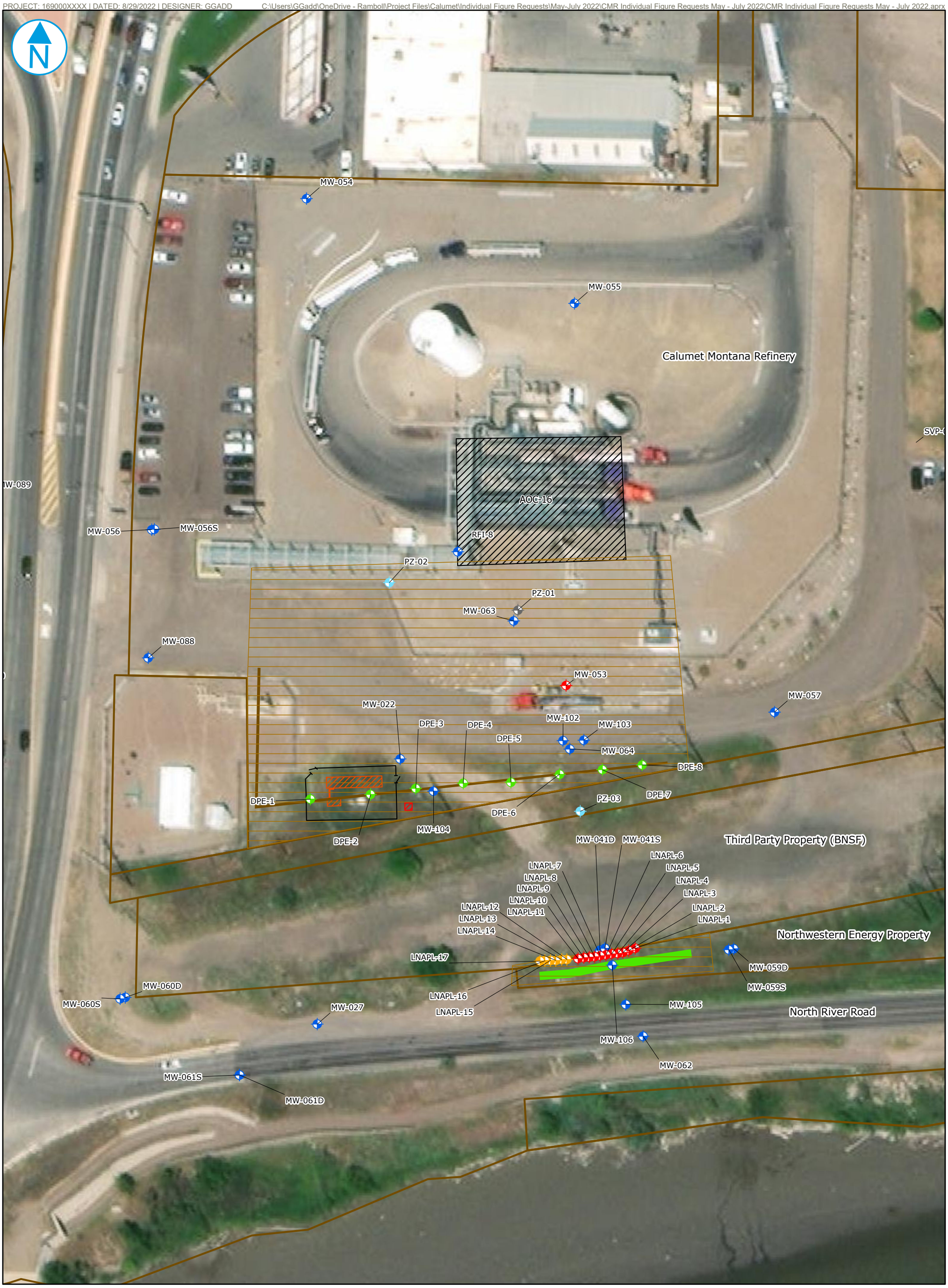
CMR. 2022b. AOC-16 Interim Measures Quarterly Monitoring Report No. 1 (January 1, 2022 to March 31, 2022). July 21.

CMR. 2022c. AOC-16 IM Construction Documentation Report Addendum 1. October.

MDEQ. 2016. Immediate Interim Measures Petroleum Release Near CMR's Loading Rack. October 11.

FIGURES

Figure 1: AOC-16 Site Layout
Figure 2A-B: DPE system Influent Vapor PID Readings
Figure 3: DPE System Influent Vapor Concentration Trend
Figure 4: Vapor and Liquid Effluent Mass Removal
Figure 5: Groundwater Contours – March 2023
Figure 6: Subsurface Vacuum Readings
Figure 7: DPE System Operational Parameters
Figure 8: SRCO Operational Parameters
Figure 9: Maximum LNAPL Thickness – LNAPL Recovery Wells
Figure 10A-C: Groundwater Concentration Trend Graphs



LNAPL Recovery Well - Installed 2022
LNAPL Recovery Well - Installed 2021
DPE Recovery Well - Installed 2021
Abandoned Well
Piezometer
Monitoring Well
DPE Fence

Property Line
Corrective Action
Passive Recovery Trench
Primary Recovery Trench
DPE - CATOX Unit
DPE Transformer
AOC

0 25 50 100 Feet

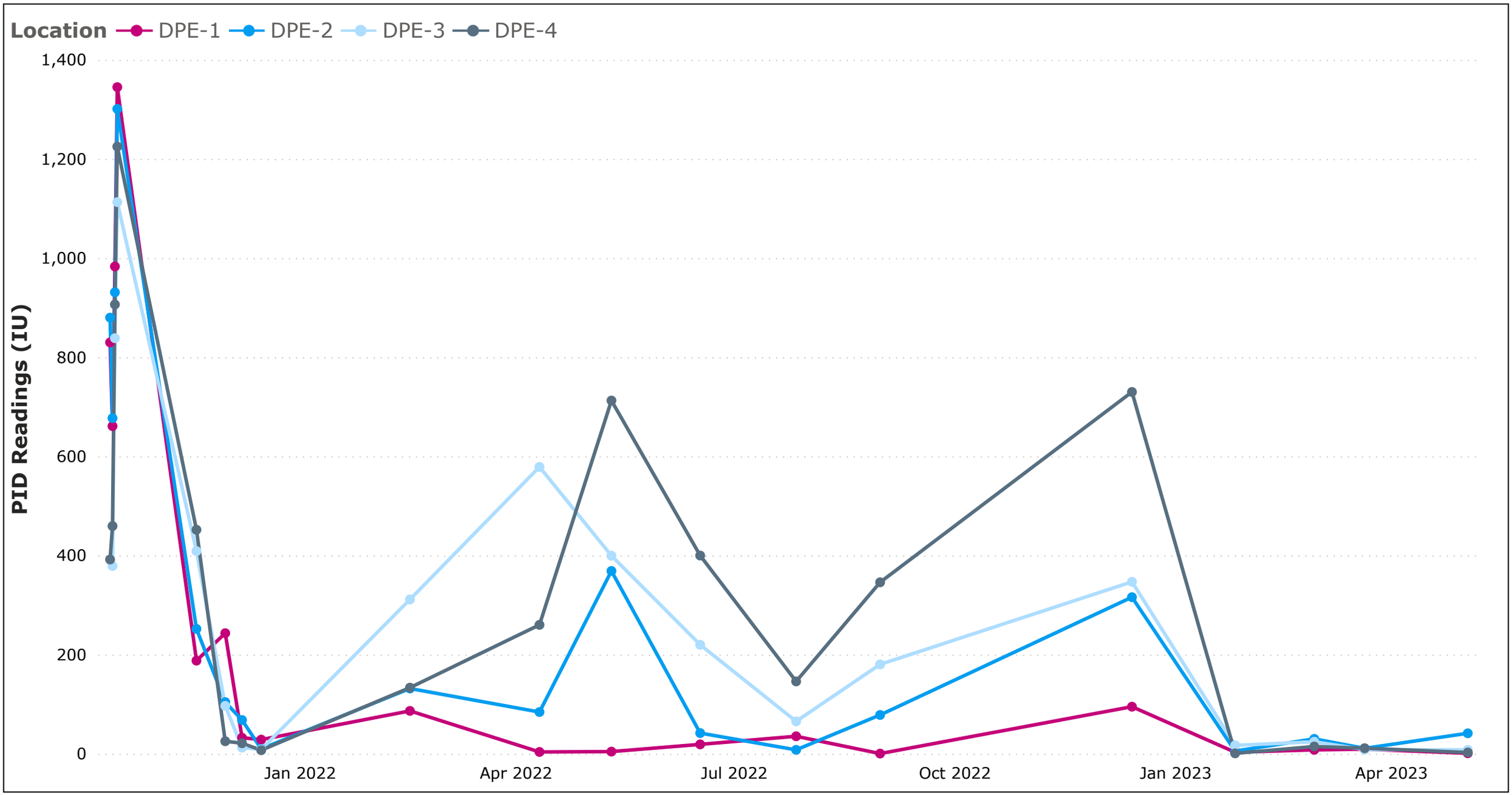
AOC 16 SITE LAYOUT

FIGURE 01

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

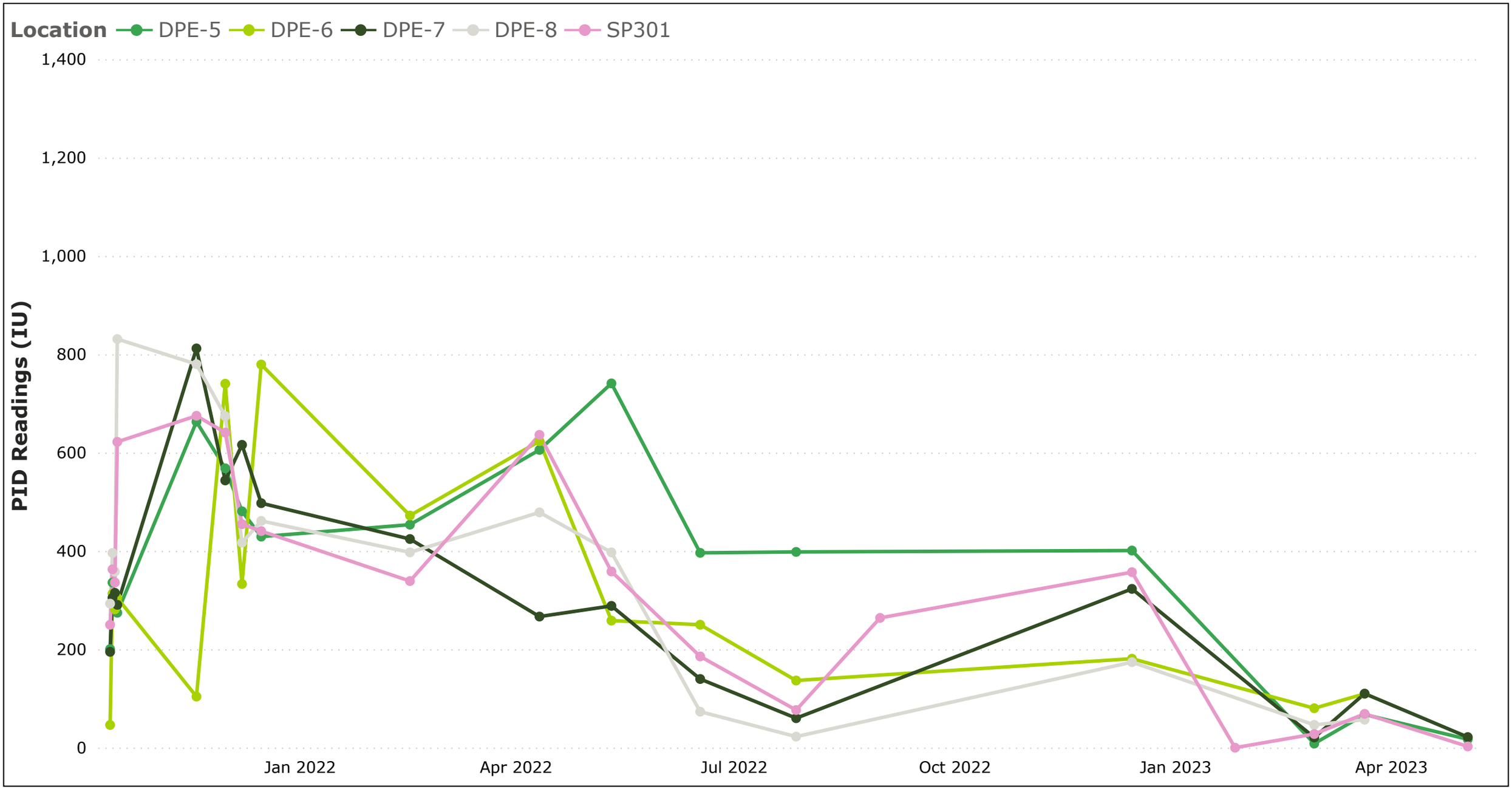
Calumet Montana Refining, LLC
1900 10th Street Northeast
Great Falls, Montana

Figure 2A: DPE system Influent Vapor PID Readings (DPE-1 through DPE-4)



Notes:
IU: Instrument Units
PID: photoionization detector

Figure 2B: DPE system Influent Vapor PID Readings (DPE-5 through DPE-8 and SP-301)



Notes:
IU: Instrument Units
PID: photoionization detector
SP-301 represents combined vapor sample from all 8 DPE wells.

Figure 3: DPE System Influent Vapor Concentration Trend

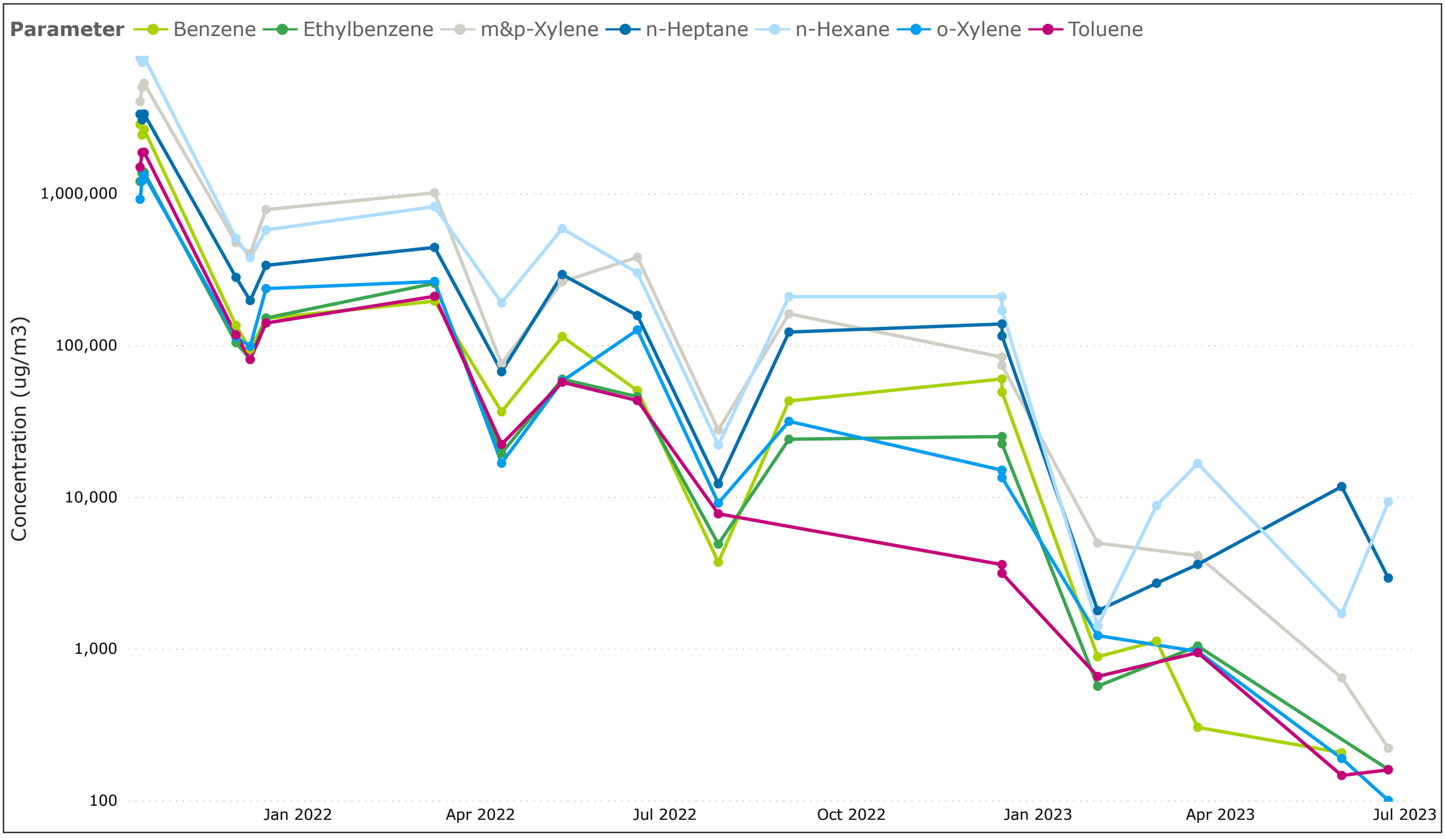
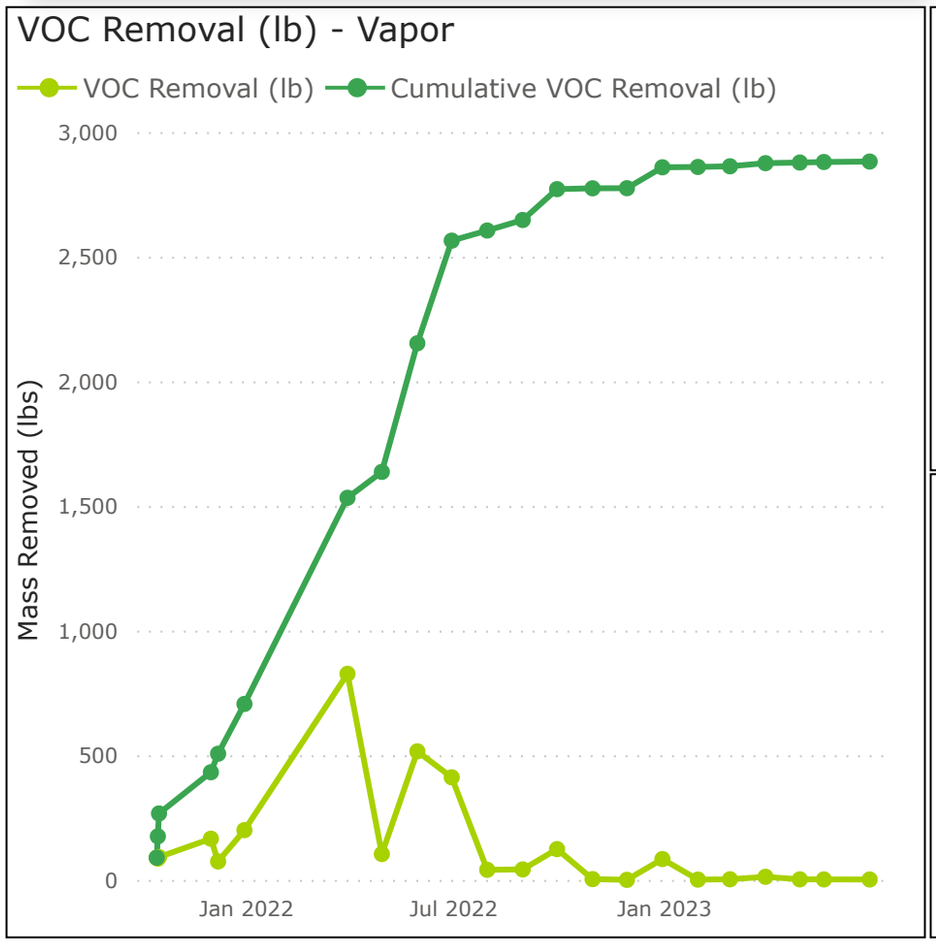
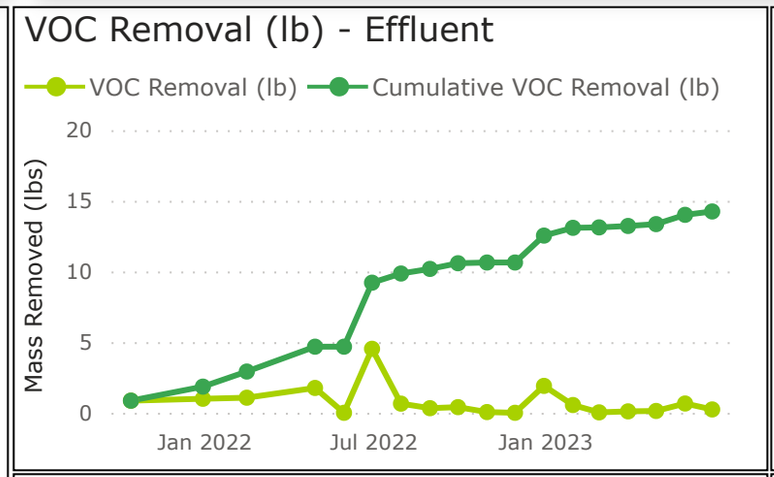


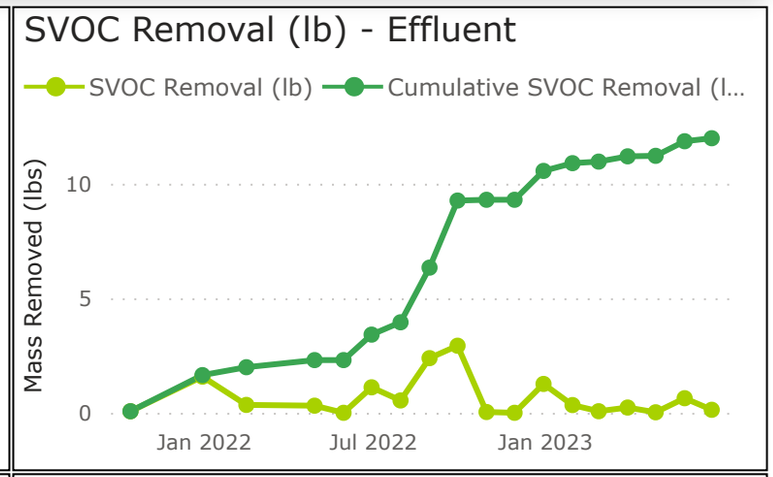
Figure 4: Vapor and Liquid Effluent Mass Removal

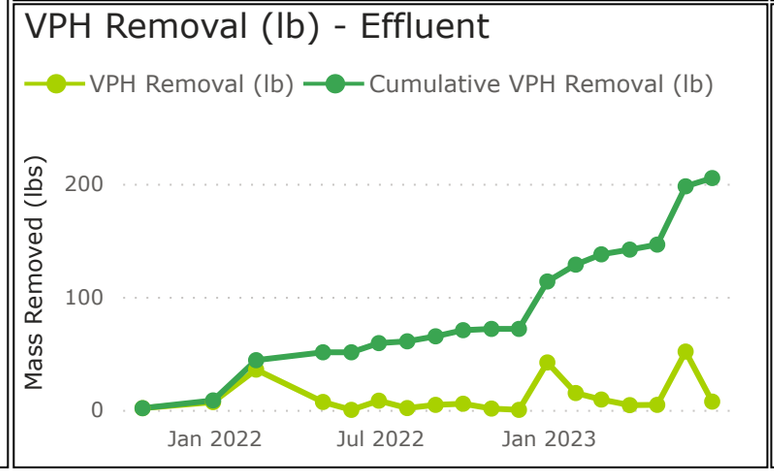
Vapor Mass Removal

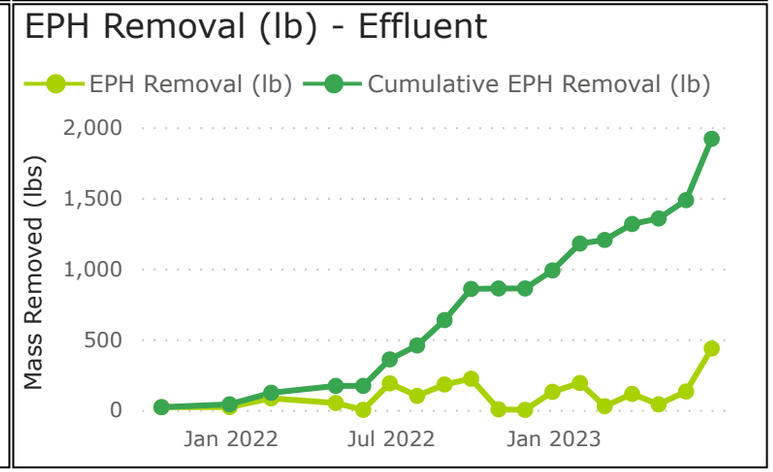


Liquid Effluent Mass Removal





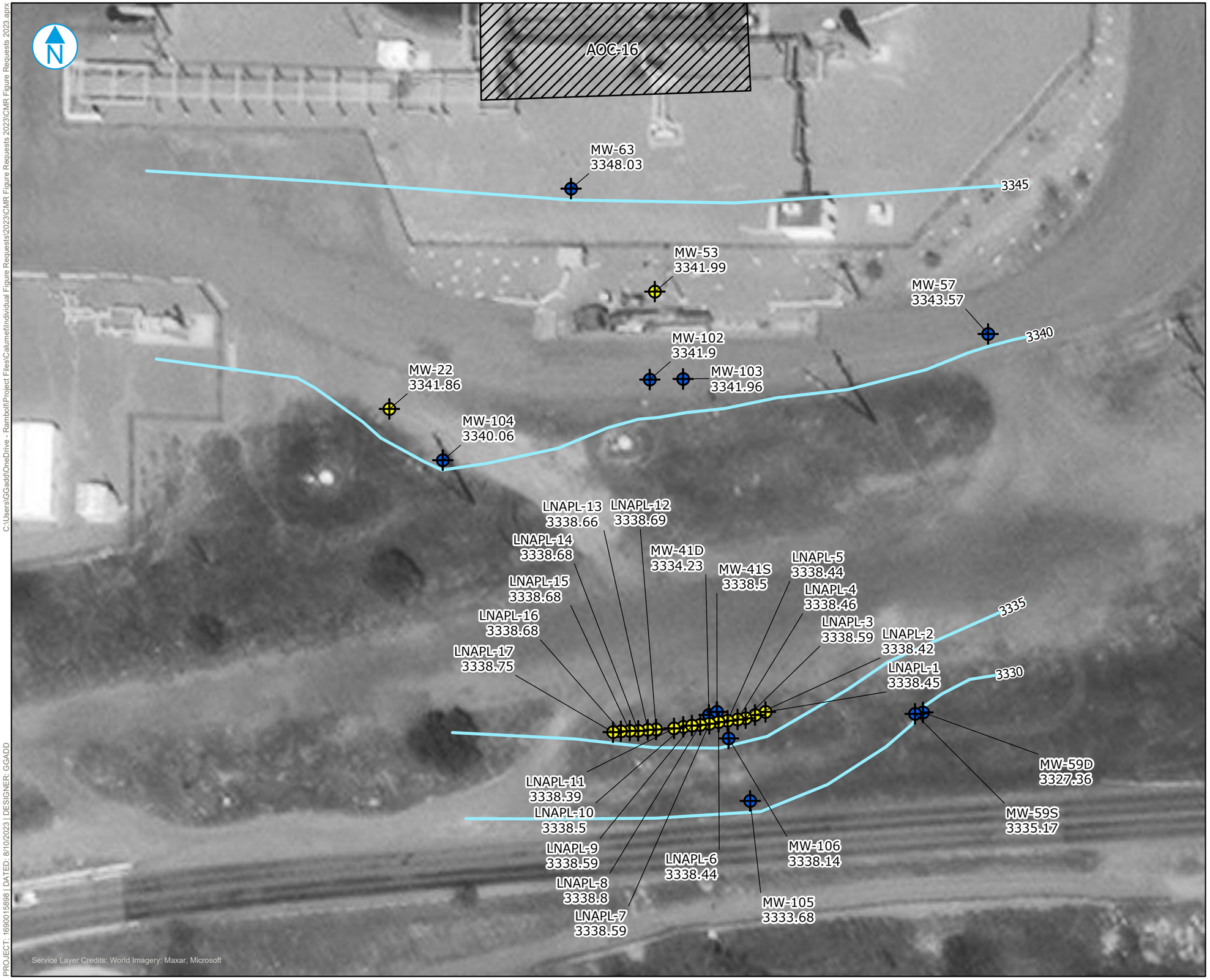




Total VOCs Removed (lbs)	Total SVOCs Removed (lbs)	Total VPHs Removed (lbs)	Total EPHs Removed (lbs)
2,896	12.0	205	1,919

Notes:

- Vapor samples were collected from SP-301. The combination of vapor flow rates, system runtime, and vapor VOC concentrations were used to calculate the mass of contaminants removed.
- Liquid effluent samples were collected from the discharge side of the transfer pump (SP-200). The combination of fluid recoveries and contaminant concentrations were used to calculate the mass of contaminants removed.



Monitoring Well
Recovery Well
Groundwater Contours (5 ft)

0 50 100 Feet

Notes
1) Measurements collected on June 19, 2023
2) The shallow most screen interval at well cluster MW-41S/D was used to generate the potentiometric surface contour map (i.e. MW-41S)

GROUNDWATER CONTOURS - JUNE 2023

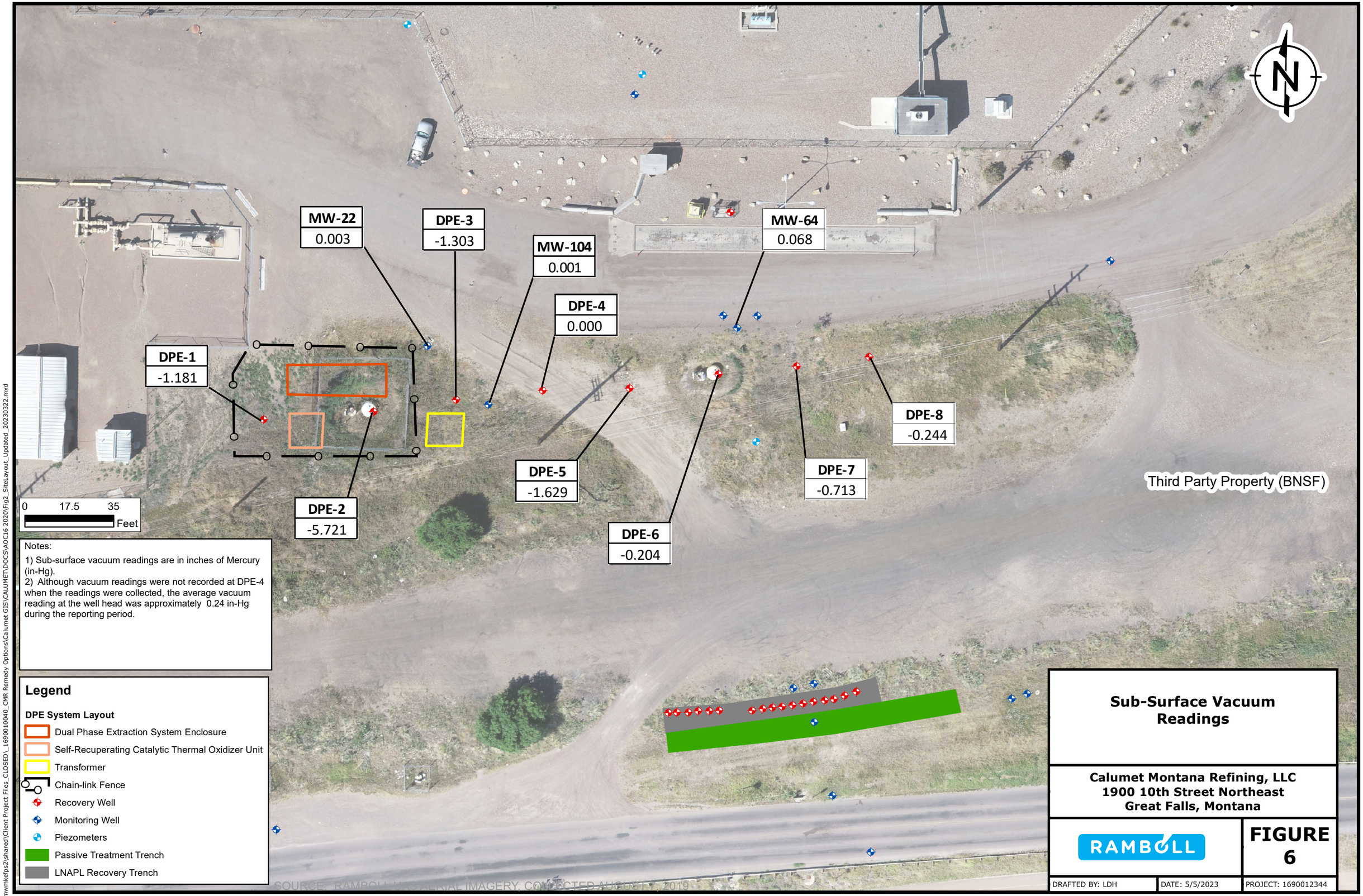
Calumet Montana Refining, LLC
1900 10th Street Northeast
Great Falls, Montana

FIGURE 05

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

C:\Users\GGadd\OneDrive - Ramboll\Project Files\Calumet\Individual Figure Requests\2023\CMR Figure Requests 2023.aprx
PROJECT: 1690015898 | DATED: 8/10/2023 | DESIGNER: GGADD



Notes:

1) Sub-surface vacuum readings are in inches of Mercury (in-Hg).
2) Although vacuum readings were not recorded at DPE-4 when the readings were collected, the average vacuum reading at the well head was approximately 0.24 in-Hg during the reporting period.

Legend

DPE System Layout

- Dual Phase Extraction System Enclosure
- Self-Recuperating Catalytic Thermal Oxidizer Unit
- Transformer
- Chain-link Fence
- Recovery Well
- Monitoring Well
- Piezometers
- Passive Treatment Trench
- LNAPL Recovery Trench

SOURCE: RAMBOLL HISTORICAL IMAGERY, COLLECTED AUGUST 7, 2019

Sub-Surface Vacuum Readings

Calumet Montana Refining, LLC
1900 10th Street Northeast
Great Falls, Montana

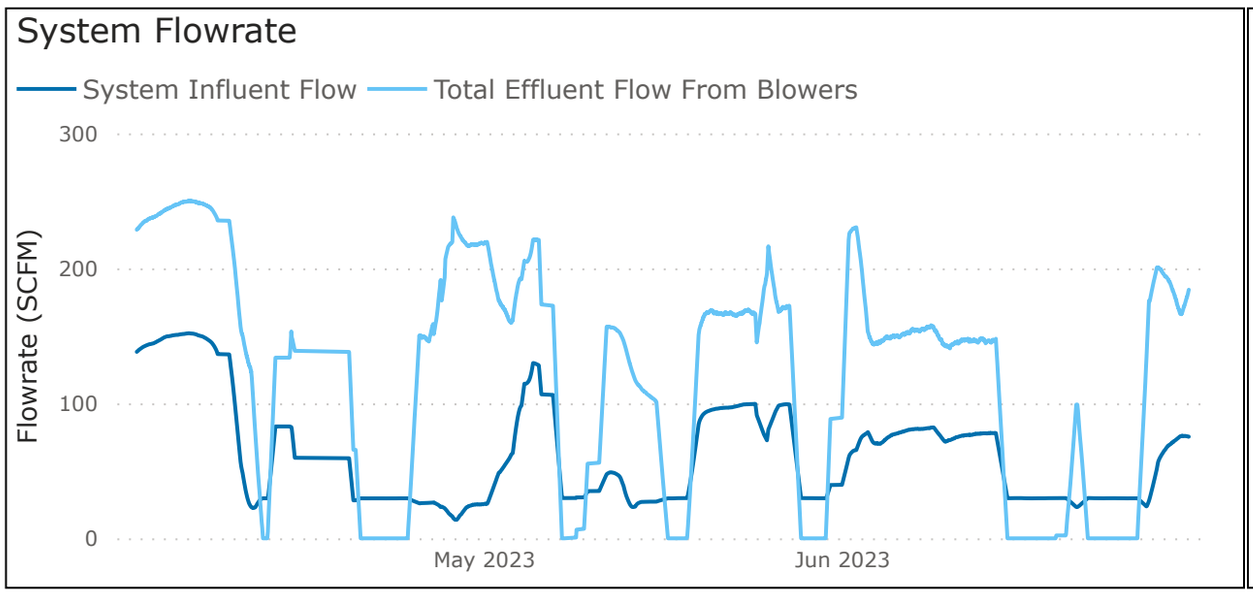
RAMBOLL

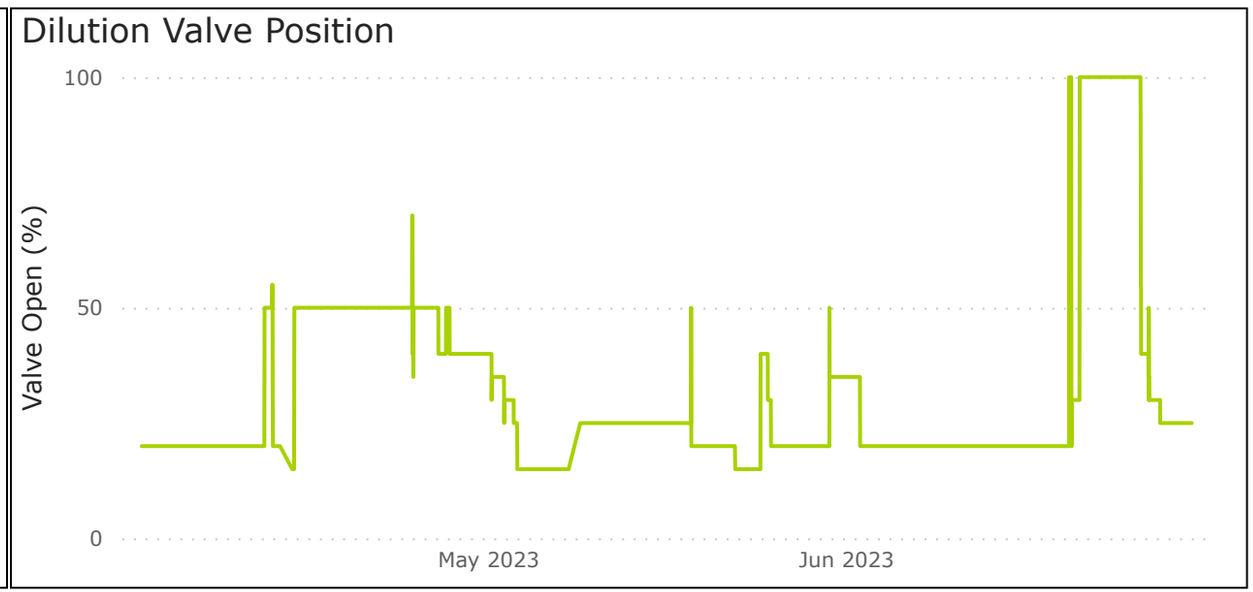
FIGURE 6

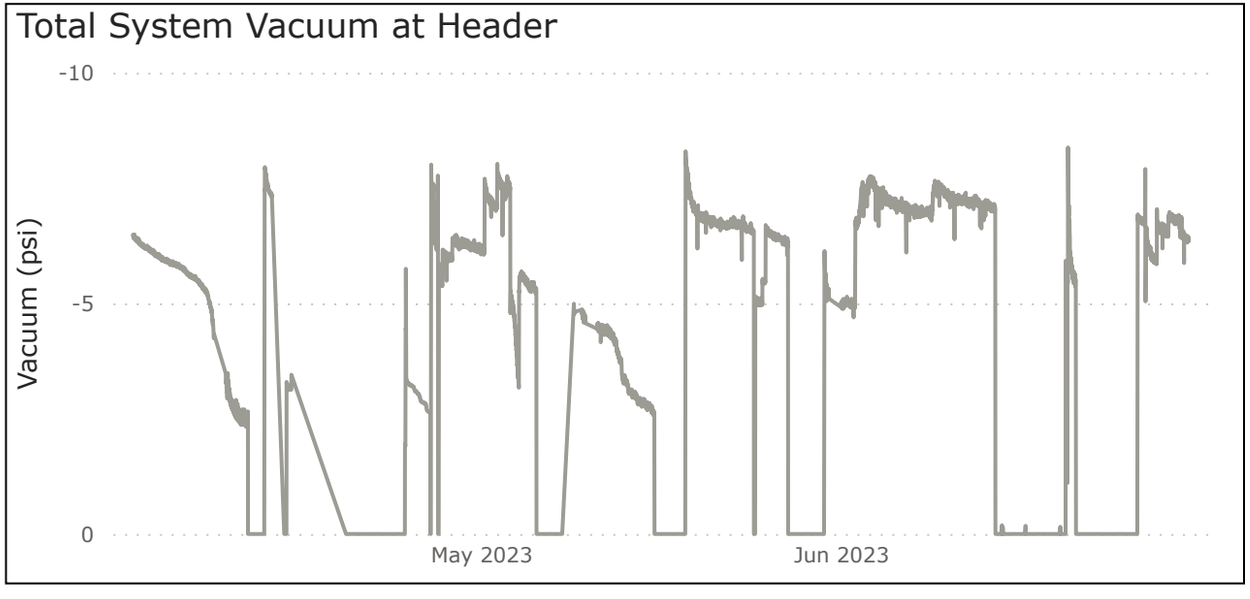
DRAFTED BY: LDH	DATE: 5/5/2023	PROJECT: 1690012344

\\nwmkefps2\shared\Client Project Files_CLOSED_1690010040_CMR Remedy Options\Calumet GIS\CALUMET\DOCS\AOC16 2020\Fig2_SiteLayout_Updated_20230322.mxd

Figure 7: DPE System Operational Parameters





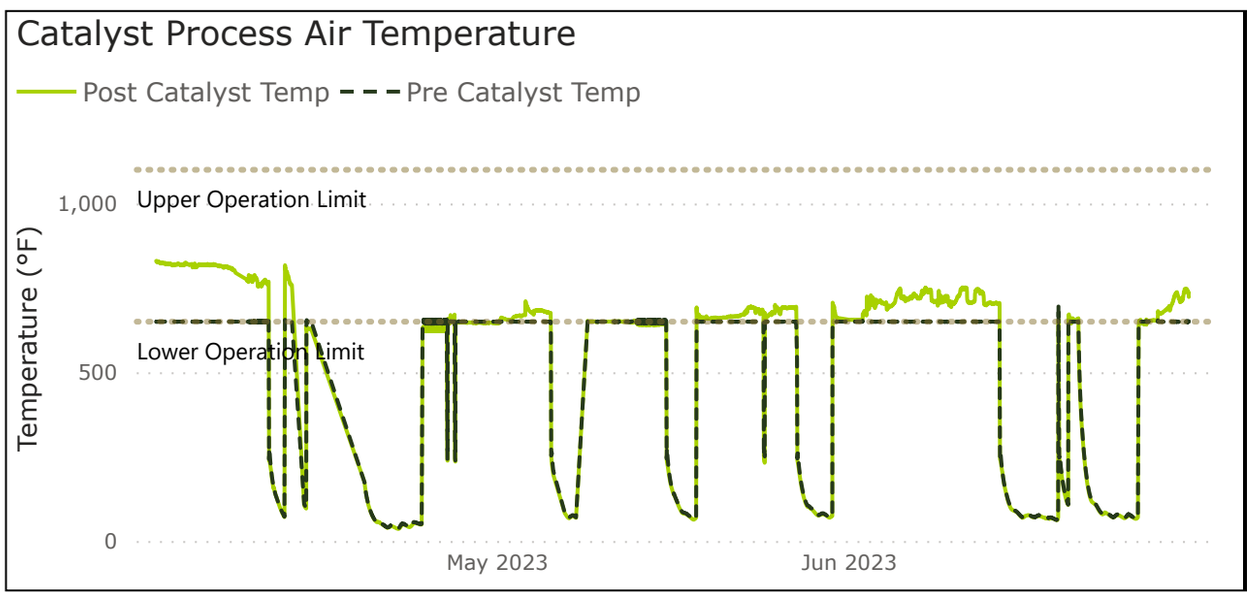


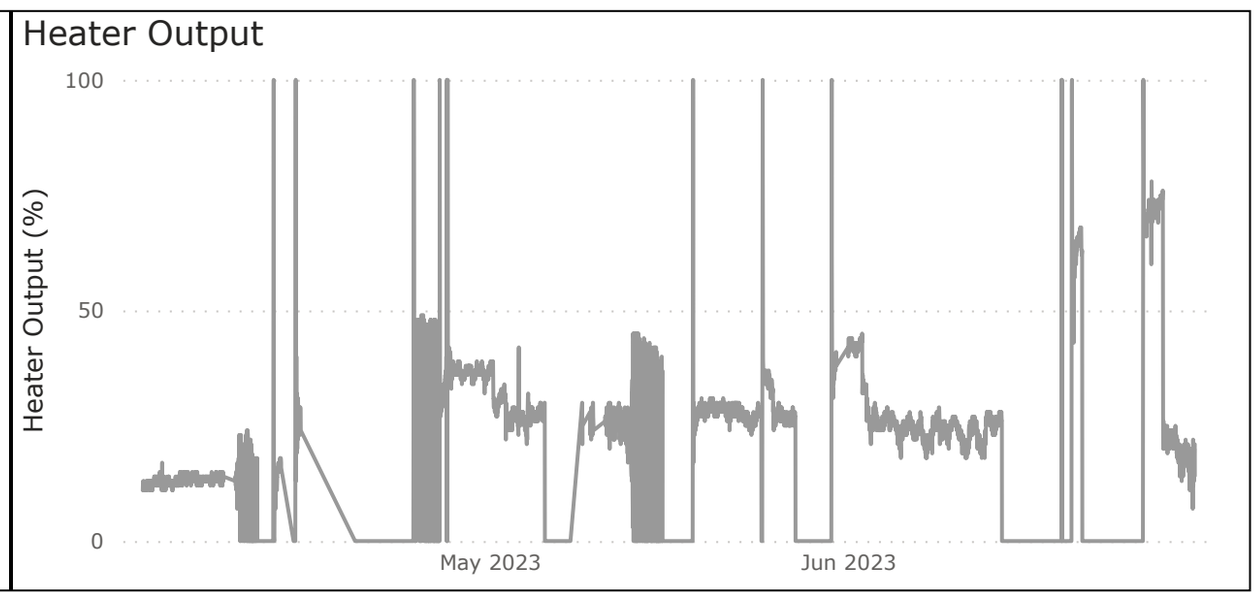
4/1/2023 6/30/2023

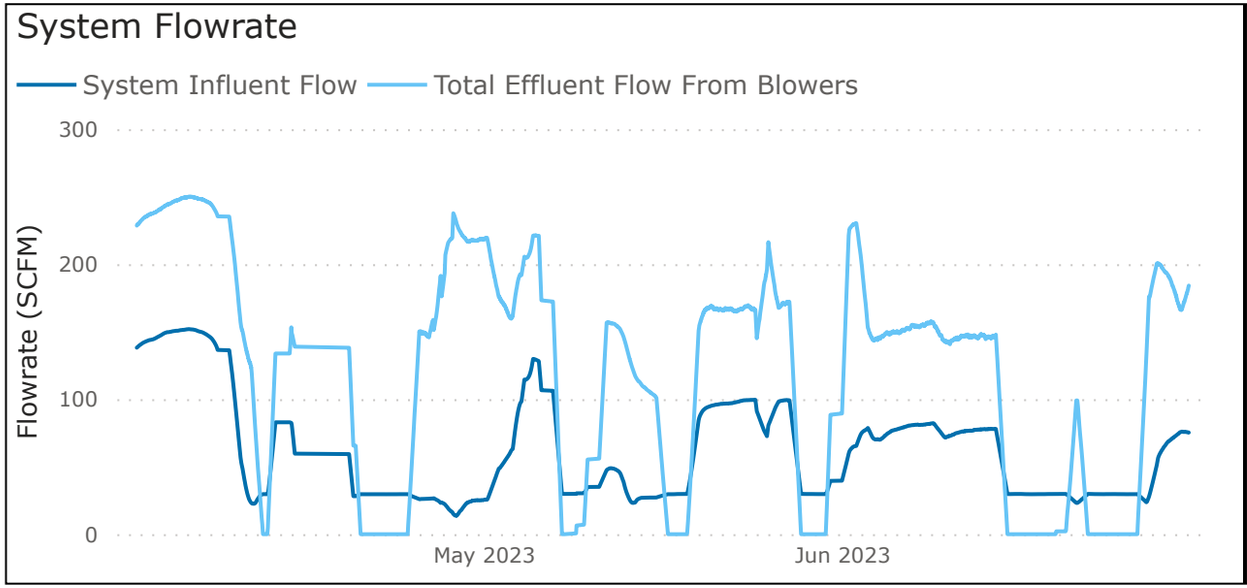
Notes:

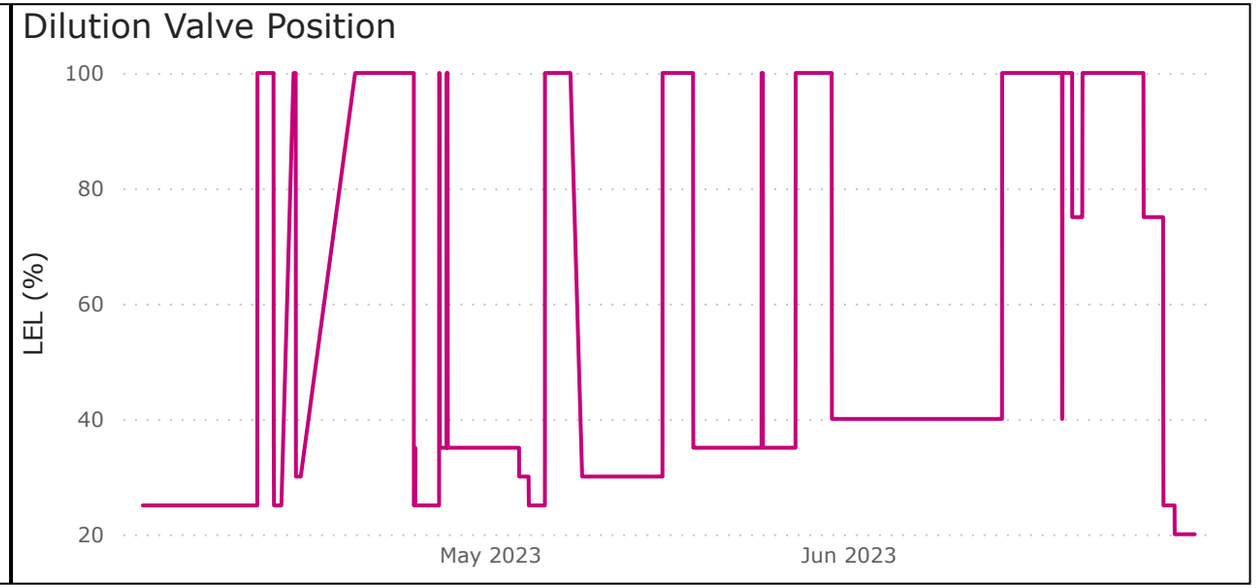
- System flow is from FT-23401 (prior to dilution). Total Flow from blowers is based on readings from FT-23405 and FT-2306.
- Dilution valve position represents FV23904 valve position (% open).
- Total System Vacuum is measured at PT23623.
- LEL meter readings are from AT23904 LEL meter. LEL meter readings are not available from 1/1/2022 - 1/20/2022 due to LEL meter malfunction.

Figure 8: SRCO Operational Parameters







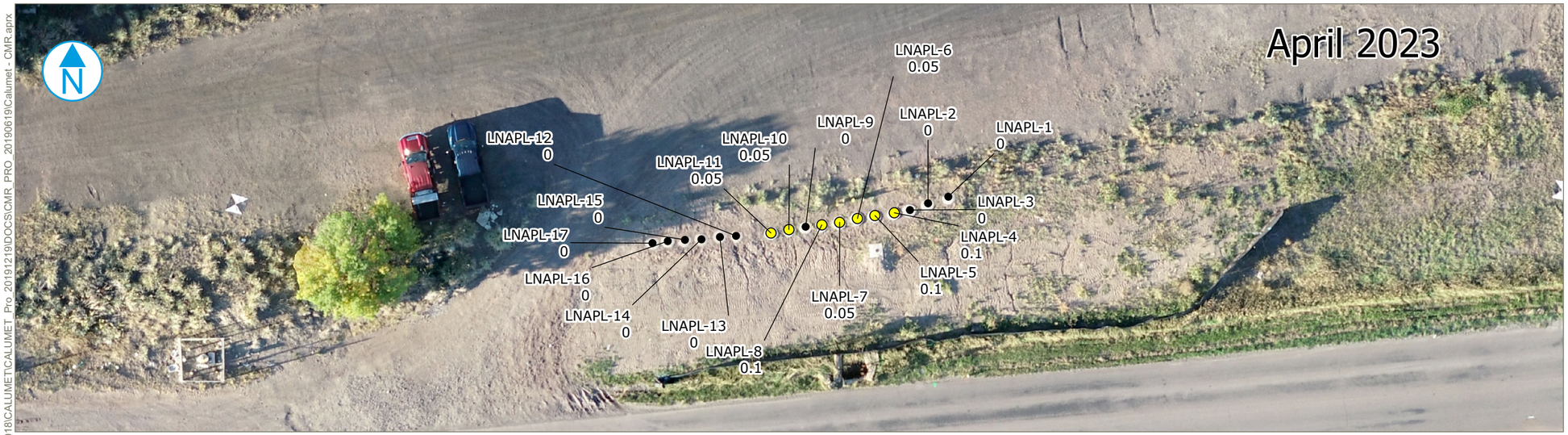


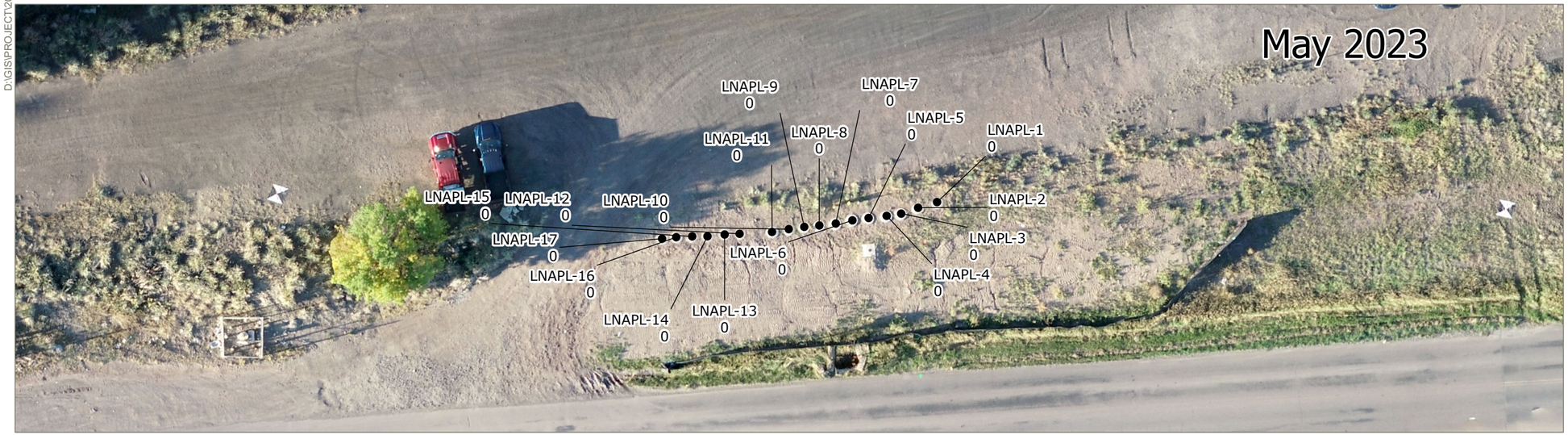
Notes:

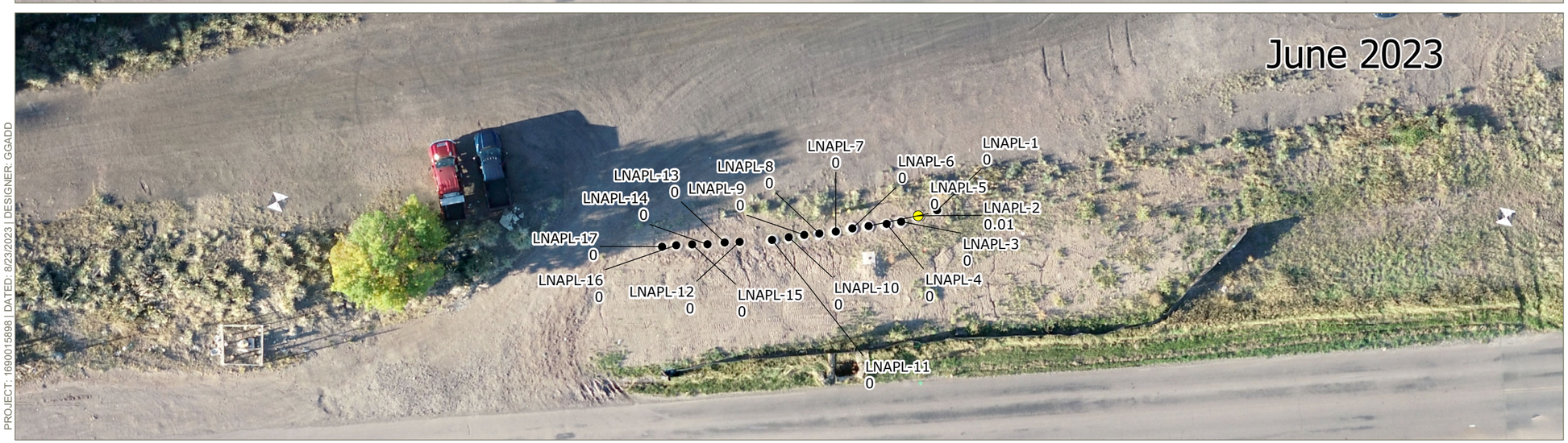
- Post-catalyst process air temperature is based on TT-23702 reading.
- System flow is from FT-23401 (prior to dilution). Total Flow from blowers is based on readings from FT-23405 and FT-2306.
- Heater Output is based on H-2303 and H-2304 readings.
- Heater Output represents % energy supplied by CATOX to maintain catalyst temperature.
- Dilution valve position represents FV23702 valve position (% open).

4/1/2023 6/30/2023

D:\GIS\PROJECT\2018\CALUMET\CALUMET_Pro_20191219\DOCS\CMR_PRO_20190619Calumet - CMR.aprx







PROJECT: 1690015898 | DATED: 8/23/2023 | DESIGNER: GGADD

LNAPL Thickness (ft)

- 0.0
- 0.0 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75

0 30 60 Feet

MAXIMUM LNAPL THICKNESS
LNAPL RECOVERY WELLS
Q2 2023

Calumet Montana Refining, LLC
1900 10th Street Northeast
Great Falls, Montana

FIGURE 09

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

Figure 10A: Groundwater Concentration Trend Graph - Benzene

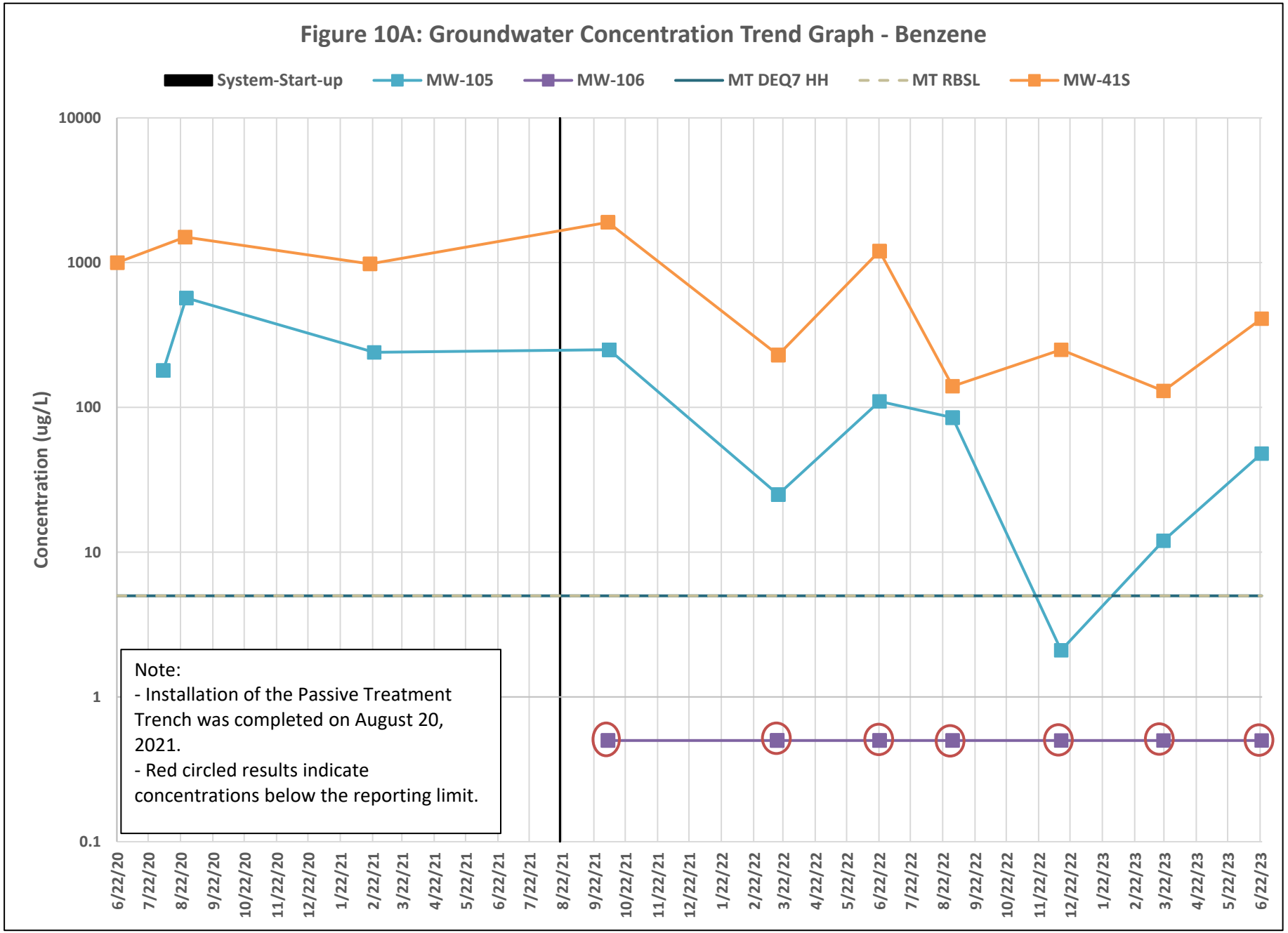


Figure 10B: Groundwater Concentration Trend Graph - C5-C8 Aliphatics

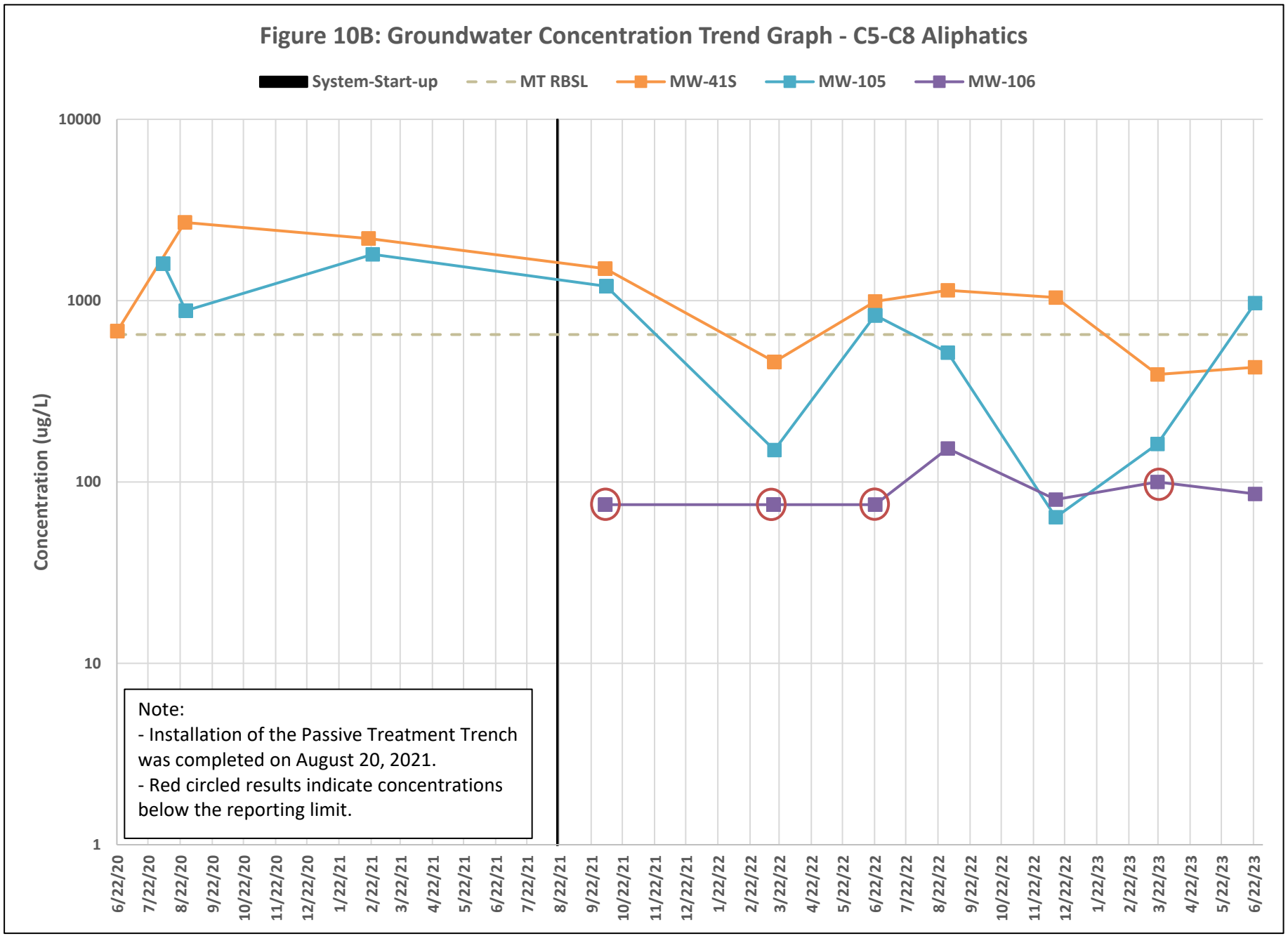
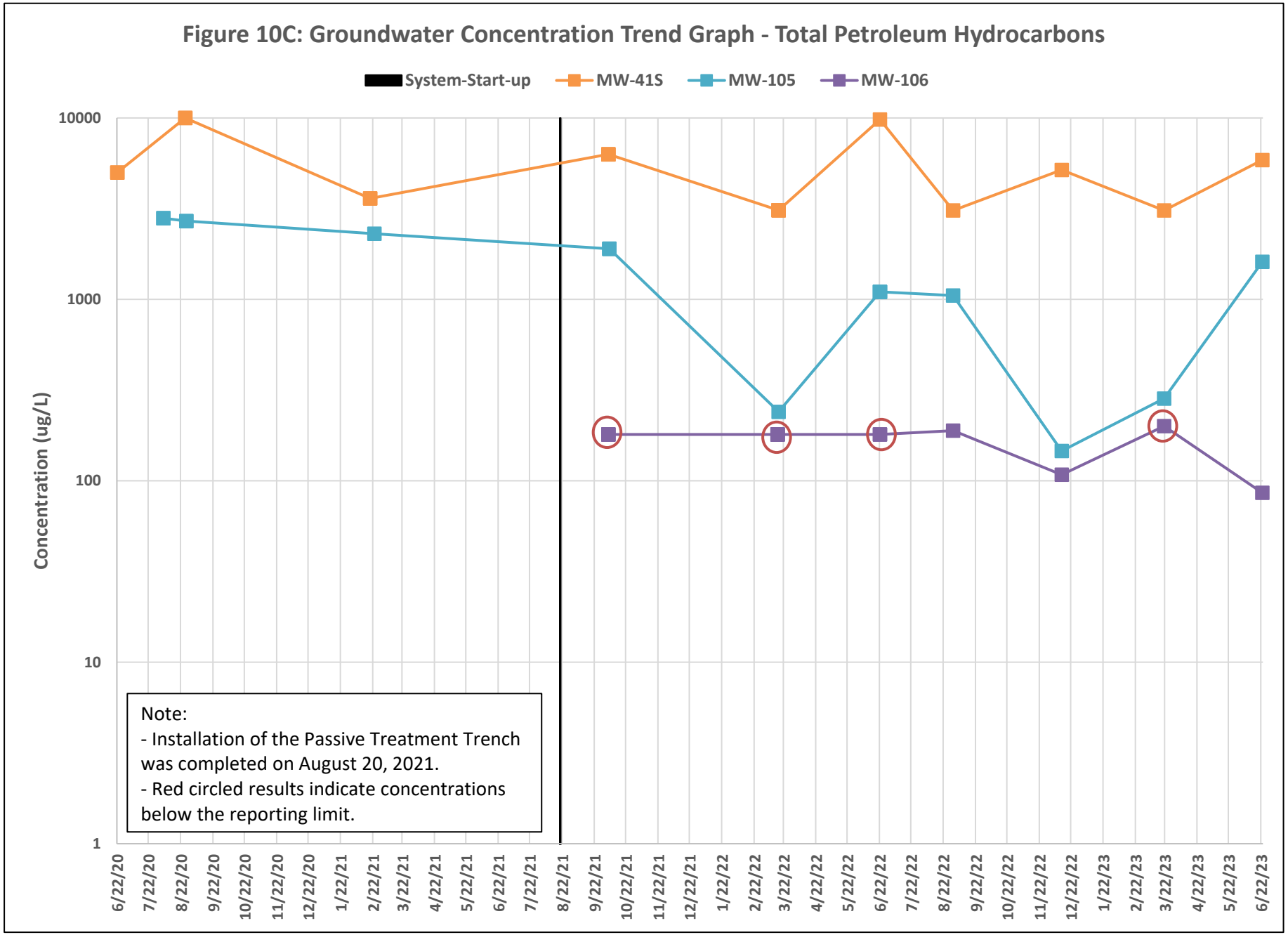


Figure 10C: Groundwater Concentration Trend Graph - Total Petroleum Hydrocarbons



TABLES

Table 1: DPE System Operational Data

Table 2: Summary of Analytical Results and Contaminant Mass Removal – Vapor

Table 3: Summary of Analytical Results and Contaminant Mass Removal – Liquid

Table 4: Fluid Level Measurements at AOC-16 Area

Table 5: Fluid Measurements at LNAPL Wells

Table 6: Summary of Groundwater Analytical Results - Petroleum COCs

Table 7: Summary of Groundwater Analytical Results – Field Parameters

Table 8: Summary of Groundwater Analytical Results – Biodegredation Parameters

Table 1
DPE System Operational Data
Calumet Montana Refining, LLC - Great Falls, Montana

Operational Period	Percent Operational[a]	System Flowrate[b] (SCFM)	Average System Vacuum at Header[c] (in-Hg)	Liquid Extraction Rate (gpm)	Total Fluids Discharged During the Operational Period (gallons)	Total Water Discharged Since Start-up[d] (gallons)	Average Post-Catalyst Process Air Temperature When System is Operational[e] (°F)
Design Values	**--**	**200**	**17**	**0.25 to 21**	**--**	**--**	**>650**
April 1 - 30, 2023	74%	81	10.5	1.06	33,746	401,511	736
May 1 - 31, 2023	69%	75	11.5	1.31	40,122		673
June 1 - 30, 2023	62%	72	13.8	3.01	80,966		702
April 1, 2023 - June 30, 2023	**68%**	**76**	**11.9**	**1.79**	**154,834**		**704**

Notes:
a. Percent operational is calculated using the system run-time hours (as logged by the system PLC) divided by the number of available operational hours in the time period.
b. System flow is from FT-23401 (prior to dilution).
c. Total System Vacuum is measured at PT23623.
d. Commissioning and start-up testing of the DPE system commenced on October 14, 2021.
e. Post-catalyst process air temperature is based on TT-23702 reading.

Abbreviations:
in-Hg = inches of mercury
gpm = gallons per minute
scfm = standard cubic feet per minute

Table 2
Summary of Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		**SP301**		**SP301**		**SP301**	
Ramboll Sample ID		**CMR-SP301-230531**		**CMR-SP301-230531**		**CMR-SP301-290623**	
Sample Date		**4/30/2023**		**5/31/2023**		**6/29/2023**	
Average Blower Flow (scfm)[1]		**81**		**75**		**70**	
Period Operational Time (hrs)[2]		**533**		**510**		**449**	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	1 U	0.00	1 U	0.00	1 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	275 U	0.00	275 U	0.00	1 U	0.00
1,1,2-Trichloroethane	79-00-5	1 U	0.00	1 U	0.00	1 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	2 U	0.00	2 U	0.00	2 U	0.00
1,1-Dichloroethane	75-34-3	1 U	0.00	1 U	0.00	1 U	0.00
1,1-Dichloroethene	75-35-4	1 U	0.00	1 U	0.00	1 U	0.00
1,2,4-Trichlorobenzene	120-82-1	933 U	0.00	933 U	0.00	5 U	0.00
1,2,4-Trimethylbenzene	95-63-6	196 U	0.00	196 U	0.00	4	0.00
1,2-Dibromoethane (EDB)	106-93-4	2 U	0.00	2 U	0.00	2 U	0.00
1,2-Dichlorobenzene	95-50-1	240 U	0.00	240 U	0.00	1 U	0.00
1,2-Dichloroethane	107-06-2	1 U	0.00	1 U	0.00	1 U	0.00
1,2-Dichloropropane	78-87-5	1 U	0.00	1 U	0.00	1 U	0.00
1,3,5-Trimethylbenzene	108-67-8	196 U	0.00	196 U	0.00	2	0.00
1,3-Butadiene	106-99-0	4 U	0.00	4 U	0.00	4 U	0.00
1,3-Dichlorobenzene	541-73-1	240 U	0.00	240 U	0.00	1 U	0.00
1,4-Dichlorobenzene	106-46-7	240 U	0.00	240 U	0.00	1 U	0.00
2-Butanone (MEK)	78-93-3	22	0.00	22	0.00	4 U	0.00
2-Hexanone	591-78-6	5 U	0.00	5 U	0.00	5 U	0.00
2-Propanol	67-63-0	13	0.00	13	0.00	3 U	0.00
4-Ethyltoluene	622-96-8	196 U	0.00	196 U	0.00	1 U	0.00
4-Methyl-2-pentanone (MIBK)	108-10-1	5 U	0.00	5 U	0.00	5 U	0.00
Acetone	67-64-1	3 U	0.00	3 U	0.00	3 U	0.00
Benzene	71-43-2	206	0.03	206	0.03	1 U	0.00
Benzyl chloride	100-44-7	208 U	0.00	208 U	0.00	1 U	0.00
Bromodichloromethane	75-27-4	1 U	0.00	1 U	0.00	1 U	0.00
Bromoform	75-25-2	1,240 U	0.00	1,240 U	0.00	6 U	0.00
Bromomethane	74-83-9	1 U	0.00	1 U	0.00	1 U	0.00
Carbon disulfide	75-15-0	6	0.00	6	0.00	1 U	0.00
Carbon tetrachloride	56-23-5	1 U	0.00	1 U	0.00	1 U	0.00
Chlorobenzene	108-90-7	1 U	0.00	1 U	0.00	1 U	0.00
Chloroethane	75-00-3	1 U	0.00	1 U	0.00	1 U	0.00
Chloroform	67-66-3	1 U	0.00	1 U	0.00	1 U	0.00
Chloromethane	74-87-3	0 U	0.00	0 U	0.00	1	0.00
cis-1,2-Dichloroethene	156-59-2	1 U	0.00	1 U	0.00	1 U	0.00
cis-1,3-Dichloropropene	10061-01-5	1 U	0.00	1 U	0.00	1 U	0.00
Cyclohexane	110-82-7	278	0.05	278	0.04	3,120	0.37
Dibromochloromethane	124-48-1	2 U	0.00	2 U	0.00	2 U	0.00
Dichlorodifluoromethane	75-71-8	3	0.00	3	0.00	2	0.00
Dichlorotetrafluoroethane	76-14-2	1 U	0.00	1 U	0.00	1 U	0.00
Ethanol	64-17-5	60	0.01	60	0.01	13	0.00
Ethyl acetate	141-78-6	-- --	--	-- --	--	-- --	--
Ethylbenzene	100-41-4	173 U	0.00	173 U	0.00	160	0.02
Hexachloro-1,3-butadiene	87-68-3	1,350 U	0.00	1,350 U	0.00	7 U	0.00
m&p-Xylene	179601-23-1	642	0.10	642	0.09	221	0.03
Methylene Chloride	75-09-2	1 U	0.00	1 U	0.00	1 U	0.00
Methyl-tert-butyl ether	1634-04-4	1 U	0.00	1 U	0.00	1 U	0.00
Naphthalene	91-20-3	660 U	0.00	660 U	0.00	3 U	0.00
n-Heptane	142-82-5	11,700	1.90	11,700	1.67	2,920	0.34
n-Hexane	110-54-3	1,700	0.28	1,700	0.24	9,270	1.09
o-Xylene	95-47-6	189	0.03	189	0.03	46	0.01
Propylene	115-07-1	27	0.00	27	0.00	15	0.00
Styrene	100-42-5	170 U	0.00	170 U	0.00	1 U	0.00
Tetrachloroethene	127-18-4	4	0.00	4	0.00	1 U	0.00
Tetrahydrofuran	109-99-9	1 U	0.00	1 U	0.00	1 U	0.00
Toluene	108-88-3	146	0.02	146	0.02	159	0.02
trans-1,2-Dichloroethene	156-60-5	1 U	0.00	1 U	0.00	1 U	0.00
trans-1,3-Dichloropropene	10061-02-6	1 U	0.00	1 U	0.00	1 U	0.00
Trichloroethene	79-01-6	1 U	0.00	1 U	0.00	1 U	0.00
Trichlorofluoromethane	75-69-4	1	0.00	1	0.00	1	0.00
Vinyl acetate	108-05-4	1 U	0.00	1 U	0.00	1 U	0.00
Vinyl chloride	75-01-4	1 U	0.00	1 U	0.00	1 U	0.00
Total VOCs	--	--	2.43	--	2.14	--	1.87
Period Total VOC Mass Removed (lbs)		**2.4**		**2.1**		**1.9**	
Cumulative Total VOC Mass Removed (lbs)[4]		**2,878**		**2,880**		**2,882**	

Notes:
1. Blower flowrate is continuously recorded by the system PLC. Average blower flowrate during the period is used for the calculations
2. Operational time represents system runtime (in hour) for the month during with the sample was taken.
3. Historical analytical results and mass recoveries are included in Appendix B.
4. Cumulative Total VOC Mass Removed represents total mass removed since system start-up (October 2021).
5. Sample collected for April 2023 was received by the lab outside the allowable vacuum range so sample was not analyzed; therefore results from May 2023 were used for mass removal calculations.

U: The analyte was not detected in the sample at the estimated detection limit
VOCs : Volatile Organic Compounds
ug/m^3 : micrograms per cubic meter
Sample Calculation

$$\boldsymbol{Mass\ Removed\ (lb)} = \mathbf{340000}\ \frac{ug}{m^3} \times \mathbf{10^{-6}}\ \frac{g}{ug} \times \frac{1}{453.6}\ \frac{lb}{g} \times \mathbf{41}\ \frac{ft^3}{min} \times \mathbf{0.02832}\ \frac{m^3}{ft^3} \times \mathbf{26}\ \boldsymbol{hr} \times \mathbf{60}\ \frac{min}{hr}$$

Table 2
Summary of Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		**SP301**		**SP301**		**SP301**	
Ramboll Sample ID		**CMR-SP301-230531**		**CMR-SP301-230531**		**CMR-SP301-290623**	
Sample Date		**4/30/2023**		**5/31/2023**		**6/29/2023**	
Average Blower Flow (scfm)[1]		**81**		**75**		**70**	
Period Operational Time (hrs)[2]		**533**		**510**		**449**	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	1 U	0.00	1 U	0.00	1 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	275 U	0.00	275 U	0.00	1 U	0.00
1,1,2-Trichloroethane	79-00-5	1 U	0.00	1 U	0.00	1 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	2 U	0.00	2 U	0.00	2 U	0.00
1,1-Dichloroethane	75-34-3	1 U	0.00	1 U	0.00	1 U	0.00
1,1-Dichloroethene	75-35-4	1 U	0.00	1 U	0.00	1 U	0.00
1,2,4-Trichlorobenzene	120-82-1	933 U	0.00	933 U	0.00	5 U	0.00
1,2,4-Trimethylbenzene	95-63-6	196 U	0.00	196 U	0.00	4	0.00
1,2-Dibromoethane (EDB)	106-93-4	2 U	0.00	2 U	0.00	2 U	0.00
1,2-Dichlorobenzene	95-50-1	240 U	0.00	240 U	0.00	1 U	0.00
1,2-Dichloroethane	107-06-2	1 U	0.00	1 U	0.00	1 U	0.00
1,2-Dichloropropane	78-87-5	1 U	0.00	1 U	0.00	1 U	0.00
1,3,5-Trimethylbenzene	108-67-8	196 U	0.00	196 U	0.00	2	0.00
1,3-Butadiene	106-99-0	4 U	0.00	4 U	0.00	4 U	0.00
1,3-Dichlorobenzene	541-73-1	240 U	0.00	240 U	0.00	1 U	0.00
1,4-Dichlorobenzene	106-46-7	240 U	0.00	240 U	0.00	1 U	0.00
2-Butanone (MEK)	78-93-3	22	0.00	22	0.00	4 U	0.00
2-Hexanone	591-78-6	5 U	0.00	5 U	0.00	5 U	0.00
2-Propanol	67-63-0	13	0.00	13	0.00	3 U	0.00
4-Ethyltoluene	622-96-8	196 U	0.00	196 U	0.00	1 U	0.00
4-Methyl-2-pentanone (MIBK)	108-10-1	5 U	0.00	5 U	0.00	5 U	0.00
Acetone	67-64-1	3 U	0.00	3 U	0.00	3 U	0.00
Benzene	71-43-2	206	0.03	206	0.03	1 U	0.00
Benzyl chloride	100-44-7	208 U	0.00	208 U	0.00	1 U	0.00
Bromodichloromethane	75-27-4	1 U	0.00	1 U	0.00	1 U	0.00
Bromoform	75-25-2	1,240 U	0.00	1,240 U	0.00	6 U	0.00
Bromomethane	74-83-9	1 U	0.00	1 U	0.00	1 U	0.00
Carbon disulfide	75-15-0	6	0.00	6	0.00	1 U	0.00
Carbon tetrachloride	56-23-5	1 U	0.00	1 U	0.00	1 U	0.00
Chlorobenzene	108-90-7	1 U	0.00	1 U	0.00	1 U	0.00
Chloroethane	75-00-3	1 U	0.00	1 U	0.00	1 U	0.00
Chloroform	67-66-3	1 U	0.00	1 U	0.00	1 U	0.00
Chloromethane	74-87-3	0 U	0.00	0 U	0.00	1	0.00
cis-1,2-Dichloroethene	156-59-2	1 U	0.00	1 U	0.00	1 U	0.00
cis-1,3-Dichloropropene	10061-01-5	1 U	0.00	1 U	0.00	1 U	0.00
Cyclohexane	110-82-7	278	0.05	278	0.04	3,120	0.37
Dibromochloromethane	124-48-1	2 U	0.00	2 U	0.00	2 U	0.00
Dichlorodifluoromethane	75-71-8	3	0.00	3	0.00	2	0.00
Dichlorotetrafluoroethane	76-14-2	1 U	0.00	1 U	0.00	1 U	0.00
Ethanol	64-17-5	60	0.01	60	0.01	13	0.00
Ethyl acetate	141-78-6	-- --	--	-- --	--	-- --	--
Ethylbenzene	100-41-4	173 U	0.00	173 U	0.00	160	0.02
Hexachloro-1,3-butadiene	87-68-3	1,350 U	0.00	1,350 U	0.00	7 U	0.00
m&p-Xylene	179601-23-1	642	0.10	642	0.09	221	0.03
Methylene Chloride	75-09-2	1 U	0.00	1 U	0.00	1 U	0.00
Methyl-tert-butyl ether	1634-04-4	1 U	0.00	1 U	0.00	1 U	0.00
Naphthalene	91-20-3	660 U	0.00	660 U	0.00	3 U	0.00
n-Heptane	142-82-5	11,700	1.90	11,700	1.67	2,920	0.34
n-Hexane	110-54-3	1,700	0.28	1,700	0.24	9,270	1.09
o-Xylene	95-47-6	189	0.03	189	0.03	46	0.01
Propylene	115-07-1	27	0.00	27	0.00	15	0.00
Styrene	100-42-5	170 U	0.00	170 U	0.00	1 U	0.00
Tetrachloroethene	127-18-4	4	0.00	4	0.00	1 U	0.00
Tetrahydrofuran	109-99-9	1 U	0.00	1 U	0.00	1 U	0.00
Toluene	108-88-3	146	0.02	146	0.02	159	0.02
trans-1,2-Dichloroethene	156-60-5	1 U	0.00	1 U	0.00	1 U	0.00
trans-1,3-Dichloropropene	10061-02-6	1 U	0.00	1 U	0.00	1 U	0.00
Trichloroethene	79-01-6	1 U	0.00	1 U	0.00	1 U	0.00
Trichlorofluoromethane	75-69-4	1	0.00	1	0.00	1	0.00
Vinyl acetate	108-05-4	1 U	0.00	1 U	0.00	1 U	0.00
Vinyl chloride	75-01-4	1 U	0.00	1 U	0.00	1 U	0.00
Total VOCs	--	--	2.43	--	2.14	--	1.87
Period Total VOC Mass Removed (lbs)		**2.4**		**2.1**		**1.9**	
Cumulative Total VOC Mass Removed (lbs)[4]		**2,878**		**2,880**		**2,882**	

Notes:
1. Blower flowrate is continuously recorded by the system PLC. Average blower flowrate during the period is used for the calculations
2. Operational time represents system runtime (in hour) for the month during with the sample was taken.
3. Historical analytical results and mass recoveries are included in Appendix B.
4. Cumulative Total VOC Mass Removed represents total mass removed since system start-up (October 2021).
5. Sample collected for April 2023 was received by the lab outside the allowable vacuum range so sample was not analyzed; therefore results from May 2023 were used for mass removal calculations.

U: The analyte was not detected in the sample at the estimated detection limit
VOCs : Volatile Organic Compounds
ug/m^3 : micrograms per cubic meter
Sample Calculation

$$\boldsymbol{Mass\ Removed\ (lb)} = \mathbf{340000}\ \frac{ug}{m^3} \times \mathbf{10^{-6}}\ \frac{g}{ug} \times \frac{1}{453.6}\ \frac{lb}{g} \times \mathbf{41}\ \frac{ft^3}{min} \times \mathbf{0.02832}\ \frac{m^3}{ft^3} \times \mathbf{26}\ \boldsymbol{hr} \times \mathbf{60}\ \frac{min}{hr}$$

Table 3
Summary of Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-230503		CMR-SP200-230531		CMR-SP200-290623	
Sample Date		5/3/2023		5/31/2023		6/23/2023	
Effluent Volume (L)*		127,742		151,878		306,490	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs							
1,1,1-TRICHLOROETHANE	71-55-6	ND	--	ND	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	1.9	0.00	ND	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	--	ND	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	--	ND	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	--	ND	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	--	ND	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	--	ND	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	--	ND	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND	--	ND	--
1,4-DIOXANE	123-91-1	ND	--	ND	--	ND	--
2-BUTANONE	78-93-3	18	0.01	ND	--	ND	--
2-HEXANONE	591-78-6	9.8	0.00	ND	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	5	0.00	ND	--	ND	--
ACETONE	67-64-1	45	0.01	ND	--	ND	--
BENZENE	71-43-2	90	0.03	27	0.01	85	0.06
BROMOCHLOROMETHANE	74-97-5	ND	--	ND	--	ND	--
BROMODICHLOROMETHANE	75-27-4	0	0.00	ND	--	ND	--
BROMOFORM	75-25-2	ND	--	ND	--	ND	--
BROMOMETHANE	74-83-9	ND	--	ND	--	ND	--
CARBON DISULFIDE	75-15-0	ND	--	ND	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	--	ND	--	ND	--
CHLOROBENZENE	108-90-7	ND	--	ND	--	ND	--
CHLOROETHANE	75-00-3	ND	--	ND	--	ND	--
CHLOROFORM	67-66-3	ND	--	ND	--	ND	--
CHLOROMETHANE	74-87-3	ND	--	ND	--	ND	--
CIS-1,2-DICHLOROETHENE	156-59-2	ND	--	ND	--	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	--	ND	--	ND	--
CUMENE	98-82-8	3	0.00	17	0.01	9	0.01
CYCLOHEXANE	110-82-7	5	0.00	16	0.01	ND	--
DIBROMOCHLOROMETHANE	124-48-1	ND	--	ND	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	--	ND	--	ND	--
ETHYL BENZENE	100-41-4	29	0.01	78	0.03	101	0.07
M,P-XYLENE	179601-23-1	140	0.04	770	0.26	--	--
METHYL ACETATE	79-20-9	ND	--	ND	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND	--	ND	--
METHYLCYCLOHEXANE	108-87-2	5	0.00	19	0.01	ND	--
METHYLENE CHLORIDE	75-09-2	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	61	0.02	760	0.25	--	--
ORTHO-XYLENE	95-47-6	40	0.01	270	0.09	157	0.11
STYRENE	100-42-5	1	0.00	ND	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	--	ND	--	ND	--
TOLUENE	108-88-3	11	0.00	6	0.00	ND	--
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	--	ND	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	--	ND	--	ND	--
TRICHLOROETHENE	79-01-6	ND	--	ND	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	--	ND	--	ND	--
VINYL CHLORIDE	75-01-4	ND	--	ND	--	ND	--
XYLENES (TOTAL)	1330-20-7	--	--	--	--	--	--
Total VOCs	--	--	**0.13**	--	**0.66**	--	**0.24**
Period Total VOC Mass Removed (lbs)		**0.1**		**0.7**		**0.2**	
Cumulative Total VOC Mass Removed (lbs)		**13.4**		**14.0**		**14.2**	

Table 3
Summary of Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-230503		CMR-SP200-230531		CMR-SP200-290623	
Sample Date		5/3/2023		5/31/2023		6/23/2023	
Effluent Volume (L)*		127,742		151,878		306,490	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs							
1,2,4,5-TETRACHLOROBENZENE	95-94-3	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	120-82-1	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	--	--	--	--	--	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	--	ND	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	--	ND	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	--	ND	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	--	ND	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	ND	--	ND	--	28	0.02
2,4-DINITROPHENOL	51-28-5	ND	--	ND	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	--	ND	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	--	ND	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	--	ND	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	--	ND	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	ND	--	1,200	0.40	80	0.05
2-METHYLPHENOL	95-48-7	ND	--	ND	--	ND	--
2-NITROANILINE	88-74-4	ND	--	ND	--	ND	--
2-NITROPHENOL	88-75-5	ND	--	ND	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	--	ND	--	ND	--
3-NITROANILINE	99-09-2	ND	--	ND	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	--	ND	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	--	ND	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	--	ND	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	--	ND	--	ND	--
4-METHYLPHENOL	106-44-5	22	0.01	ND	--	--	--
4-NITROANILINE	100-01-6	ND	--	ND	--	ND	--
4-NITROPHENOL	100-02-7	ND	--	ND	--	ND	--
ACENAPHTHENE	83-32-9	ND	--	ND	--	ND	--
ACENAPHTHYLENE	208-96-8	ND	--	ND	--	ND	--
ANTHRACENE	120-12-7	ND	--	ND	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	--	ND	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	--	ND	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	--	ND	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	--	ND	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	--	ND	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	--	ND	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	--	ND	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	17	0.00	ND	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	--	ND	--	ND	--
CARBAZOLE	86-74-8	ND	--	ND	--	ND	--
CHRYSENE	218-01-9	ND	--	ND	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	--	ND	--	ND	--
DIBENZOFURAN	132-64-9	ND	--	ND	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	--	ND	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	--	ND	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	--	ND	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	--	ND	--	ND	--
FLUORANTHENE	206-44-0	ND	--	ND	--	ND	--
FLUORENE	86-73-7	ND	--	ND	--	6	0.00
HEXACHLOROBENZENE	118-74-1	ND	--	ND	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	--	ND	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	--	ND	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	--	ND	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	--	ND	--	ND	--
ISOPHORONE	78-59-1	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	ND	--	570	0.19	74	0.05
NITROBENZENE	98-95-3	ND	--	ND	--	ND	--

Table 3
Summary of Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-230503		CMR-SP200-230531		CMR-SP200-290623	
Sample Date		5/3/2023		5/31/2023		6/23/2023	
Effluent Volume (L)*		127,742		151,878		306,490	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	--	ND	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	25	0.01	ND	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	--	ND	--	ND	--
PHENANTHRENE	85-01-8	ND	--	110	0.04	5	0.00
PHENOL	108-95-2	12	0.00	ND	--	ND	--
PYRENE	129-00-0	3	0.00	22	0.01	1	0.00
Total SVOCs	--	--	**0.02**	--	**0.64**	--	**0.13**
Period Total SVOC Mass Removed (lbs)		**0.0**		**0.6**		**0.1**	
Cumulative Total VOC Mass Removed (lbs)		**11.2**		**11.9**		**12.0**	
EPH							
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	22,300	6.28	77,000	25.78	83,500	56.42
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	--	--	--	--	--	--
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	--	--	--	--	--	--
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	99,100	27.91	348,000	116.52	354,000	239.19
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	138,000	38.86	388,000	129.91	643,000	434.46
Total EPHs	--	--	**38.86**	--	**129.91**	--	**434.46**
Period Total EPH Mass Removed (lbs)		**38.9**		**129.9**		**434.5**	
Cumulative Total EPH Mass Removed (lbs)		**1354.2**		**1484.1**		**1918.6**	
VPH							
BENZENE	71-43-2	--	--	--	--	--	--
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	718	0.20	3,690	1.24	ND	--
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	--	--	--	--	--	--
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	8,120	2.29	112,000	37.50	3,790	2.56
ETHYL BENZENE	100-41-4	--	--	--	--	--	--
M,P-XYLENE	179601-23-1	--	--	--	--	--	--
METHYL TERT-BUTYL ETHER	1634-04-4	--	--	--	--	--	--
NAPHTHALENE	91-20-3	--	--	--	--	--	--
ORTHO-XYLENE	95-47-6	--	--	--	--	--	--
TOLUENE	108-88-3	--	--	--	--	--	--
TOTAL PETROLEUM HYDROCARBONS	TPH	15,700	4.42	154,000	51.56	10,800	7.30
Total VPHss	--	--	**4.42**	--	**51.56**	--	**7.30**
Period Total VPH Mass Removed (lbs)		**4.4**		**51.6**		**7.3**	
Cumulative Total VPH Mass Removed (lbs)		**146.2**		**197.7**		**205.0**	

Notes:
*Effluent volumes represent volume extracted during the month which the sample was taken.
1. Historical analytical results and mass recoveries are included in Appendix B.
2. Cumulative Total VOC Mass Removed represents total mass removed since system start-up (October 2021).
3. April 2023 sample was collected on May 3, 2023
Sample Calculation

$$\boldsymbol{Mass\ Removed\ (lb)} = \mathbf{1800}\ \frac{\boldsymbol{ug}}{\boldsymbol{L}} \times \mathbf{10^{-6}}\ \frac{\boldsymbol{g}}{\boldsymbol{ug}} \times \frac{\mathbf{1}}{\mathbf{453.6}}\ \frac{\boldsymbol{lb}}{\boldsymbol{g}} \times \mathbf{21138}\ \boldsymbol{L}$$

Abbreviations:

EPH : Extractable Petroleum Hydrocarbon
ND : Non Detect
SVOCs : Semi-volatile Organic Compounds
ug/L : micrograms per liter
VOCs : Volatile Organic Compounds
VPH : Volatile Petroleum Hydrocarbons

Table 4
Fluid Level Measurements at AOC-16 Area
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)
MW-22	9/29/2021	--	7.12	--
MW-22	10/14/2021	--	7.26	--
MW-22	1/10/2023	--	8.89	--
MW-22	5/31/2023	--	8.01	--
MW-22	6/19/2023	--	6.67	--
MW-41D	8/27/2021	--	11.07	--
MW-41D	9/29/2021	--	10.83	--
MW-41D	10/15/2021	--	10.78	--
MW-41D	12/2/2021	--	10.65	--
MW-41D	1/3/2022	--	10.62	--
MW-41D	2/8/2022	--	10.70	--
MW-41D	2/8/2022	--	10.70	--
MW-41D	3/11/2022	--	10.76	--
MW-41D	4/11/2022	--	10.79	--
MW-41D	6/8/2022	--	10.95	--
MW-41D	7/27/2022	--	10.90	--
MW-41D	9/1/2022	--	10.94	--
MW-41D	1/10/2023	--	10.54	--
MW-41D	3/22/2023	--	10.60	--
MW-41D	5/31/2023	--	10.39	--
MW-41D	6/19/2023	--	10.22	--
MW-41S	8/27/2021	--	8.25	--
MW-41S	9/29/2021	7.85	7.89	0.04
MW-41S	10/5/2021	7.78	7.81	0.03
MW-41S	10/15/2021	--	8.06	--
MW-41S	12/2/2021	--	7.90	--
MW-41S	1/3/2022	--	7.97	--
MW-41S	2/8/2022	--	8.13	--
MW-41S	3/11/2022	--	8.18	--
MW-41S	4/11/2022	--	8.55	--
MW-41S	6/8/2022	--	7.86	--
MW-41S	7/27/2022	--	7.99	--
MW-41S	9/1/2022	--	8.16	--
MW-41S	1/10/2023	--	7.52	--
MW-41S	3/22/2023	--	7.48	--
MW-41S	5/31/2023	--	6.51	--
MW-41S	6/19/2023	--	5.74	--
MW-53	9/29/2021	7.90	8.49	0.59
MW-53	10/14/2021	--	8.26	--
MW-53	11/9/2021	8.54	8.59	0.05
MW-53	12/2/2021	8.83	8.88	0.06
MW-53	1/3/2022	--	9.32	--
MW-53	2/8/2022	9.31	9.32	0.00
MW-53	2/8/2022	9.31	9.32	0.01
MW-53	3/11/2022	9.43	9.44	0.01
MW-53	4/11/2022	--	9.38	--
MW-53	6/8/2022	9.08	10.03	0.95
MW-53	6/8/2022	9.08	10.03	0.95
MW-53	7/27/2022	--	10.23	--
MW-53	9/1/2022	--	9.59	--
MW-53	1/10/2023	--	8.53	--
MW-53	3/22/2023	--	9.00	--
MW-53	5/31/2023	9.36	9.41	0.05
MW-53	6/19/2023	7.99	8.10	0.11

Table 4
Fluid Level Measurements at AOC-16 Area
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)
MW-57	9/29/2021	--	10.29	--
MW-57	10/14/2021	--	10.51	--
MW-57	12/2/2021	--	11.10	--
MW-57	1/3/2022	--	11.27	--
MW-57	2/8/2022	--	11.23	--
MW-57	3/11/2022	--	11.19	--
MW-57	4/11/2022	--	11.06	--
MW-57	6/8/2022	--	10.25	--
MW-57	7/27/2022	--	10.17	--
MW-57	9/1/2022	--	10.07	--
MW-57	1/10/2023	--	9.79	--
MW-57	3/22/2023	--	10.14	--
MW-57	5/31/2023	--	8.62	--
MW-57	6/19/2023	--	7.54	--
MW-59D	9/29/2021	--	12.14	--
MW-59D	10/14/2021	--	12.06	--
MW-59D	12/2/2021	--	12.31	--
MW-59D	2/8/2022	--	12.49	--
MW-59D	2/8/2022	--	12.49	--
MW-59D	3/11/2022	--	12.54	--
MW-59D	4/11/2022	--	12.73	--
MW-59D	6/8/2022	--	12.53	--
MW-59D	7/27/2022	--	12.59	--
MW-59D	9/1/2022	--	12.59	--
MW-59D	1/10/2023	--	12.21	--
MW-59D	3/22/2023	--	12.48	--
MW-59D	5/31/2023	--	13.08	--
MW-59D	6/19/2023	--	12.80	--
MW-59S	9/29/2021	--	6.23	--
MW-59S	10/14/2021	--	6.22	--
MW-59S	12/2/2021	--	6.28	--
MW-59S	2/8/2022	--	6.32	--
MW-59S	3/11/2022	--	6.31	--
MW-59S	4/11/2022	--	6.31	--
MW-59S	6/8/2022	--	6.28	--
MW-59S	7/27/2022	--	6.24	--
MW-59S	9/1/2022	--	6.22	--
MW-59S	1/10/2023	--	6.23	--
MW-59S	3/22/2023	--	6.22	--
MW-59S	5/31/2023	--	6.11	--
MW-59S	6/19/2023	--	4.97	--
MW-63	9/29/2021	--	6.30	--
MW-63	10/14/2021	--	6.40	--
MW-63	11/4/2021	--	6.60	--
MW-63	2/8/2022	--	7.13	--
MW-63	3/11/2022	--	7.23	--
MW-63	4/11/2022	--	7.30	--
MW-63	6/8/2022	--	7.06	--
MW-63	7/27/2022	--	6.68	--
MW-63	9/1/2022	--	6.64	--
MW-63	1/10/2023	--	6.34	--
MW-63	3/22/2023	--	6.48	--
MW-63	5/31/2023	--	5.50	--
MW-63	6/19/2023	--	4.99	

Table 4
Fluid Level Measurements at AOC-16 Area
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)
MW-64	9/29/2021	--	7.76	--
MW-64	10/14/2021	--	8.40	--
MW-64	11/4/2021	--	8.72	--
MW-64	12/2/2021	9.04	9.11	0.07
MW-64	1/3/2022	9.45	10.36	0.91
MW-64	2/8/2022	9.26	10.81	1.55
MW-64	3/11/2022	9.55	10.66	1.11
MW-64	4/11/2022	10.11	10.59	0.48
MW-64	6/8/2022	10.41	10.46	0.06
MW-64	7/27/2022	10.21	10.23	0.02
MW-64	9/1/2022	--	8.97	--
MW-64	1/10/2023	--	8.75	--
MW-64	5/31/2023	--		--
MW-64	6/19/2023	--		--
MW-102	9/29/2021	7.98	8.59	0.61
MW-102	10/14/2021	8.25	8.82	0.57
MW-102	11/4/2021	--	9.02	--
MW-102	12/2/2021	--	8.97	--
MW-102	1/3/2022	9.29	9.33	0.04
MW-102	2/8/2022	--	9.50	--
MW-102	2/8/2022	--	9.50	--
MW-102	3/11/2022	--	10.07	--
MW-102	4/11/2022	--	10.08	--
MW-102	6/8/2022	--	10.22	--
MW-102	7/27/2022	9.99	10.02	0.03
MW-102	9/1/2022	--	8.98	--
MW-102	1/10/2023	--	8.82	--
MW-102	3/22/2023	--	9.96	--
MW-102	5/31/2023	--	8.42	--
MW-102	6/19/2023	--	8.00	--
MW-103	9/29/2021	--	8.04	--
MW-103	10/14/2021	--	8.35	--
MW-103	11/4/2021	--	8.77	--
MW-103	12/2/2021	--	9.32	--
MW-103	1/3/2022	--	9.66	--
MW-103	2/8/2022	--	9.61	--
MW-103	3/11/2022	--	9.87	--
MW-103	4/11/2022	--	9.87	--
MW-103	6/8/2022	--	9.79	--
MW-103	7/27/2022	--	9.66	--
MW-103	9/1/2022	--	9.12	--
MW-103	1/10/2023	--	8.81	--
MW-103	3/22/2023	--	9.60	--
MW-103	5/31/2023	--	8.53	--
MW-103	6/19/2023	--	8.09	--

Table 4
Fluid Level Measurements at AOC-16 Area
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)
MW-104	9/29/2021	6	6.25	0.25
MW-104	10/15/2021	6.1	6.23	0.13
MW-104	12/2/2021	6.62	6.79	0.17
MW-104	1/3/2022	6.75	7.02	0.27
MW-104	2/8/2022	6.83	7.16	0.33
MW-104	2/8/2022	6.83	7.16	0.33
MW-104	3/11/2022	7.13	7.57	0.44
MW-104	4/11/2022	7.38	7.81	0.43
MW-104	6/8/2022	7.86	7.86	0.00
MW-104	7/27/2022	--		--
MW-104	9/1/2022	7.72	7.82	0.10
MW-104	1/10/2023	--	7.37	--
MW-104	3/22/2023	--	6.89	--
MW-104	5/31/2023	--	6.61	--
MW-104	6/19/2023	--	5.79	--
MW-105	9/29/2021	--	5.58	--
MW-105	10/14/2021	--	8.97	--
MW-105	12/2/2021	--	6.67	--
MW-105	1/3/2022	--	5.63	--
MW-105	2/8/2022	--	5.89	--
MW-105	2/8/2022	--	5.92	--
MW-105	3/11/2022	--	5.85	--
MW-105	4/11/2022	--	8.01	--
MW-105	6/8/2022	--	6.06	--
MW-105	7/27/2022	--	6.63	--
MW-105	9/1/2022	--	4.89	--
MW-105	1/10/2023	--	7.50	--
MW-105	3/22/2023	--	5.59	--
MW-105	5/31/2023	--	5.39	--
MW-105	6/19/2023	--	2.94	--
MW-106	9/29/2021	--	6.14	--
MW-106	10/14/2021	--	5.83	--
MW-106	10/20/2021	--	5.71	--
MW-106	11/9/2021	--	5.48	--
MW-106	12/2/2021	--	5.70	--
MW-106	1/3/2022	--	6.19	--
MW-106	2/8/2022	--	5.92	--
MW-106	2/8/2022	--	5.84	--
MW-106	3/11/2022	--	5.80	--
MW-106	4/11/2022	--	5.70	--
MW-106	6/8/2022	--	5.03	--
MW-106	7/27/2022	--	5.40	--
MW-106	9/1/2022	--	5.83	--
MW-106	1/10/2023	--	4.62	--
MW-106	3/22/2023	--	4.60	--
MW-106	5/31/2023	--	3.51	--
MW-106	6/19/2023	--	2.95	--

Notes:

DTP	Depth to Product
DTW	Depth to Water
ft BTOC	Below Top of Casing
LNAPL	light non-aqueous phase liquid
NA	Reading not collected
--	LNAPL was not present

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-1	8/27/2021	--	8.23	--	--
LNAPL-1	9/30/2021	--	6.55	--	--
LNAPL-1	10/5/2021	--	6.44	--	--
LNAPL-1	10/12/2021	--	6.37	--	--
LNAPL-1	10/19/2021	--	6.31	--	--
LNAPL-1	11/9/2021	--	6.24	--	--
LNAPL-1	11/18/2021	--	6.30	--	--
LNAPL-1	12/2/2021	--	6.36	--	--
LNAPL-1	1/3/2022	--	6.50	--	--
LNAPL-1	2/8/2022	--	6.72	--	--
LNAPL-1	5/15/2022	--	5.90	--	--
LNAPL-1	5/22/2022	--	5.90	--	--
LNAPL-1	5/29/2022	--	5.90	--	--
LNAPL-1	6/5/2022	--	5.88	--	--
LNAPL-1	6/12/2022	--	5.90	--	--
LNAPL-1	6/19/2022	--	6.00	--	--
LNAPL-1	6/26/2022	--	6.00	--	--
LNAPL-1	7/3/2022	--	5.46	--	--
LNAPL-1	7/10/2022	--	5.56	--	--
LNAPL-1	7/17/2022	--	5.60	--	--
LNAPL-1	7/31/2022	--	5.92	--	--
LNAPL-1	8/7/2022	--	6.87	--	--
LNAPL-1	8/14/2022	7.00	7.03	0.03	--
LNAPL-1	9/4/2022	--	6.80	--	--
LNAPL-1	9/10/2022	6.80	6.81	0.01	--
LNAPL-1	9/18/2022	7.35	7.37	0.02	--
LNAPL-1	9/25/2022	6.97	7.00	0.03	--
LNAPL-1	10/2/2022	6.58	6.83	0.25	--
LNAPL-1	10/9/2022	6.47	6.92	0.45	--
LNAPL-1	11/14/2022	--	6.22	--	--
LNAPL-1	12/6/2022	--	6.10	--	--
LNAPL-1	2/26/2023	--	5.62	--	--
LNAPL-1	3/5/2023	--	5.98	--	--
LNAPL-1	3/23/2023	--	5.57	--	--
LNAPL-1	4/2/2023	5.58	5.60	0.02	--
LNAPL-1	5/31/2023	--	4.60	--	--
LNAPL-1	6/19/2023	--	3.95	--	--
LNAPL-2	8/27/2021	--	8.18	--	--
LNAPL-2	9/30/2021	--	6.42	--	--
LNAPL-2	10/5/2021	--	6.30	--	--
LNAPL-2	10/12/2021	--	6.22	--	--
LNAPL-2	10/19/2021	--	6.15	--	--
LNAPL-2	11/9/2021	--	6.09	--	--
LNAPL-2	11/18/2021	--	6.15	--	--
LNAPL-2	12/2/2021	--	6.22	--	--
LNAPL-2	1/3/2022	--	6.35	--	--
LNAPL-2	2/8/2022	--	6.57	--	--
LNAPL-2	5/15/2022	--	6.00	--	--
LNAPL-2	5/22/2022	--	5.73	--	--
LNAPL-2	5/29/2022	--	5.75	--	--
LNAPL-2	6/5/2022	--	5.73	--	0.5
LNAPL-2	6/12/2022	--	5.73	--	--
LNAPL-2	6/19/2022	--	5.85	--	0.5
LNAPL-2	6/26/2022	--	5.60	--	--
LNAPL-2	7/3/2022	--	5.42	--	0.8
LNAPL-2	7/10/2022	--	5.55	--	0.6
LNAPL-2	7/17/2022	--	5.41	--	0.7
LNAPL-2	7/31/2022	--	5.70	--	--
LNAPL-2	8/7/2022	--	6.82	--	--
LNAPL-2	8/14/2022	6.91	6.95	0.04	--
LNAPL-2	9/4/2022	6.78	6.79	0.01	0.8
LNAPL-2	9/10/2022	6.62	6.73	0.11	0.8
LNAPL-2	9/18/2022	7.12	7.22	0.1	0.3
LNAPL-2	9/25/2022	--	6.60	--	0.5
LNAPL-2	10/2/2022	6.61	6.70	0.09	0.7
LNAPL-2	10/9/2022	6.30	6.76	0.46	0.5
LNAPL-2	11/14/2022	--	6.07	--	0.5
LNAPL-2	12/6/2022	--	5.95	--	0.3
LNAPL-2	2/26/2023	--	5.40	--	--
LNAPL-2	3/5/2023	--	5.96	--	--

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-2	3/23/2023	--	5.62	--	--
LNAPL-2	4/2/2023	5.54	5.55	0.01	--
LNAPL-2	5/31/2023	--	4.45	--	--
LNAPL-2	6/19/2023	3.77	3.78	0.01	--
LNAPL-3	8/27/2021	--	8.11	--	--
LNAPL-3	9/30/2021	--	6.45	--	--
LNAPL-3	10/5/2021	--	6.31	--	--
LNAPL-3	10/12/2021	--	6.24	--	--
LNAPL-3	10/19/2021	--	6.18	--	--
LNAPL-3	11/9/2021	--	6.10	--	--
LNAPL-3	11/18/2021	--	6.17	--	--
LNAPL-3	12/2/2021	--	6.24	--	--
LNAPL-3	1/3/2022	--	6.38	--	--
LNAPL-3	2/8/2022	--	6.58	--	--
LNAPL-3	5/15/2022	--	5.76	--	--
LNAPL-3	5/22/2022	--	5.74	--	--
LNAPL-3	5/29/2022	--	5.80	--	--
LNAPL-3	6/5/2022	--	5.71	--	--
LNAPL-3	6/12/2022	--	5.78	--	--
LNAPL-3	6/19/2022	--	5.87	--	--
LNAPL-3	6/26/2022	--	5.45	--	--
LNAPL-3	7/3/2022	--	5.31	--	--
LNAPL-3	7/10/2022	--	5.40	--	--
LNAPL-3	7/17/2022	--	5.15	--	--
LNAPL-3	7/31/2022	--	5.80	--	--
LNAPL-3	8/7/2022	--	6.72	--	--
LNAPL-3	8/14/2022	6.71	6.74	0.03	--
LNAPL-3	9/4/2022	--	6.69	--	--
LNAPL-3	9/10/2022	--	6.67	--	--
LNAPL-3	9/18/2022	7.42	7.45	0.03	--
LNAPL-3	9/25/2022	6.74	6.81	0.07	--
LNAPL-3	10/2/2022	6.50	6.58	0.08	--
LNAPL-3	10/9/2022	6.39	6.93	0.54	--
LNAPL-3	11/14/2022	6.08	6.10	0.02	--
LNAPL-3	12/6/2022	5.97	6.00	0.03	--
LNAPL-3	12/11/2022	6.36	6.58	0.22	--
LNAPL-3	12/18/2022	5.86	5.88	0.02	--
LNAPL-3	2/26/2023	5.48	5.49	0.01	--
LNAPL-3	3/5/2023	--	5.97	--	--
LNAPL-3	3/23/2023	--	5.61	--	--
LNAPL-3	4/2/2023	5.39	5.42	0.03	--
LNAPL-3	5/31/2023	--	4.45	--	--
LNAPL-3	6/19/2023	--	3.78	--	--
LNAPL-4	8/27/2021	--	8.15	--	--
LNAPL-4	9/30/2021	--	6.46	--	--
LNAPL-4	10/5/2021	--	6.31	--	--
LNAPL-4	10/12/2021	--	6.24	--	--
LNAPL-4	10/19/2021	--	6.18	--	--
LNAPL-4	11/9/2021	--	6.11	--	--
LNAPL-4	11/18/2021	--	6.18	--	--
LNAPL-4	12/2/2021	--	6.25	--	--
LNAPL-4	1/3/2022	--	6.40	--	--
LNAPL-4	2/8/2022	--	6.59	--	--
LNAPL-4	5/15/2022	--	6.10	--	--
LNAPL-4	5/22/2022	--	5.74	--	--
LNAPL-4	5/29/2022	--	5.90	--	--
LNAPL-4	6/5/2022	--	5.85	--	1.0
LNAPL-4	6/12/2022	--	5.90	--	0.8
LNAPL-4	6/19/2022	5.87	5.89	0.02	0.8
LNAPL-4	6/26/2022	--	5.55	--	--
LNAPL-4	7/3/2022	--	5.42	--	0.8
LNAPL-4	7/10/2022	--	5.50	--	0.7
LNAPL-4	7/17/2022	5.45	5.48	0.03	0.5
LNAPL-4	7/31/2022	5.80	5.82	0.02	0.8
LNAPL-4	8/7/2022	--	6.79	--	0.7
LNAPL-4	8/14/2022	6.81	6.85	0.04	--
LNAPL-4	9/4/2022	6.63	6.88	0.25	0.2
LNAPL-4	9/10/2022	6.64	6.81	0.17	--
LNAPL-4	9/18/2022	7.48	7.52	0.04	0.1
LNAPL-4	9/25/2022	--	6.87	--	0.5

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-4	10/2/2022	6.70	7.05	0.35	0.7
LNAPL-4	10/9/2022	6.36	6.69	0.33	0.8
LNAPL-4	11/14/2022	6.08	6.27	0.19	0.8
LNAPL-4	12/6/2022	5.96	6.03	0.07	0.5
LNAPL-4	12/11/2022	6.43	6.66	0.23	--
LNAPL-4	12/18/2022	5.91	5.92	0.01	--
LNAPL-4	12/25/2022	5.96	5.99	0.03	0.5
LNAPL-4	1/15/2023	5.80	5.82	0.02	1.0
LNAPL-4	1/22/2023	5.88	5.92	0.04	0.6
LNAPL-4	1/30/2023	--	5.39	--	0.6
LNAPL-4	2/5/2023	5.62	5.71	0.09	0.5
LNAPL-4	2/12/2023	5.49	5.51	0.02	1.0
LNAPL-4	2/18/2023	--	5.71	--	0.7
LNAPL-4	2/26/2023	5.49	5.50	0.01	0.1
LNAPL-4	3/5/2023	5.84	5.87	0.03	0.3
LNAPL-4	3/12/2023	--	5.82	--	1.0
LNAPL-4	3/19/2023	--	5.61	--	0.3
LNAPL-4	3/23/2023	--	5.62	--	0.0
LNAPL-4	4/2/2023	5.5	5.51	0.01	0.0
LNAPL-4	4/30/2023	4.30	4.40	0.10	0.0
LNAPL-4	5/31/2023	--	4.41	--	--
LNAPL-4	6/19/2023	--	3.79	--	--
LNAPL-5	8/27/2021	--	8.15	--	--
LNAPL-5	9/30/2021	--	6.49	--	--
LNAPL-5	10/5/2021	--	6.35	--	--
LNAPL-5	10/12/2021	--	6.28	--	--
LNAPL-5	10/19/2021	--	6.22	--	--
LNAPL-5	11/9/2021	--	6.14	--	--
LNAPL-5	11/18/2021	--	6.20	--	--
LNAPL-5	12/2/2021	6.28	6.30	0.02	--
LNAPL-5	12/15/2021	6.32	6.64	0.32	--
LNAPL-5	1/3/2022	6.37	6.78	0.41	--
LNAPL-5	2/8/2022	6.56	7.01	0.45	--
LNAPL-5	3/7/2022	6.60	7.30	0.70	--
LNAPL-5	4/11/2022	6.64	7.32	0.68	--
LNAPL-5	5/15/2022	5.90	5.92	0.02	0.5
LNAPL-5	5/22/2022	--	5.78	--	--
LNAPL-5	5/29/2022	--	5.85	--	--
LNAPL-5	6/5/2022	--	5.81	--	0.5
LNAPL-5	6/12/2022	5.79	5.81	0.02	0.5
LNAPL-5	6/19/2022	5.90	5.93	0.03	0.5
LNAPL-5	6/26/2022	5.45	5.50	0.05	--
LNAPL-5	7/3/2022	--	5.50	--	0.8
LNAPL-5	7/10/2022	--	5.60	--	0.7
LNAPL-5	7/17/2022	5.48	5.49	0.01	0.7
LNAPL-5	7/31/2022	--	5.93	--	0.5
LNAPL-5	8/7/2022	6.78	6.82	0.04	0.8
LNAPL-5	8/14/2022	--		--	--
LNAPL-5	9/4/2022	6.75	7.45	0.70	0.7
LNAPL-5	9/10/2022	6.65	7.45	0.80	0.8
LNAPL-5	9/18/2022	7.00	7.14	0.14	0.1
LNAPL-5	9/25/2022	--	6.49	--	1.0
LNAPL-5	10/2/2022	6.80	7.08	0.28	0.6
LNAPL-5	10/9/2022	6.39	6.75	0.36	0.8
LNAPL-5	11/14/2022	6.12	6.14	0.02	0.8
LNAPL-5	12/6/2022	--	6.02	--	0.5
LNAPL-5	12/25/2022	--	5.98	--	0.5
LNAPL-5	1/15/2023	--	5.93	--	--
LNAPL-5	1/22/2023	5.90	5.91	0.01	0.8
LNAPL-5	1/30/2023	5.39	5.41	0.02	--
LNAPL-5	2/5/2023	--	5.76	--	--
LNAPL-5	2/12/2023	5.53	5.54	0.01	1.0
LNAPL-5	2/18/2023	5.74	5.77	0.03	0.7
LNAPL-5	2/26/2023	5.51	5.53	0.02	--
LNAPL-5	3/5/2023	--	5.95	--	--
LNAPL-5	3/12/2023	5.76	5.78	0.02	--
LNAPL-5	3/19/2023	--	5.71	--	0.3
LNAPL-5	3/23/2023	--	5.60	--	--
LNAPL-5	4/2/2023	--	5.48	--	--
LNAPL-5	4/30/2023	4.20	4.30	0.10	--

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-5	5/31/2023	--	4.41	--	--
LNAPL-5	6/19/2023	--	3.82	--	--
LNAPL-6	8/27/2021	--	8.13	--	--
LNAPL-6	9/30/2021	--	6.61	--	--
LNAPL-6	10/5/2021	--	6.47	--	--
LNAPL-6	10/12/2021	--	6.40	--	--
LNAPL-6	10/19/2021	--	6.33	--	--
LNAPL-6	11/9/2021	--	6.27	--	--
LNAPL-6	11/18/2021	--	6.24	--	--
LNAPL-6	12/2/2021	--	6.41	--	--
LNAPL-6	12/15/2021	--	6.50	--	--
LNAPL-6	1/3/2022	--	6.56	--	--
LNAPL-6	2/8/2022	--	6.78	--	--
LNAPL-6	5/15/2022	5.94	5.95	0.01	--
LNAPL-6	5/22/2022	--	5.93	--	--
LNAPL-6	5/29/2022	--	5.75	--	--
LNAPL-6	6/5/2022	--	5.92	--	--
LNAPL-6	6/12/2022	--	5.93	--	--
LNAPL-6	6/19/2022	--	6.04	--	--
LNAPL-6	6/26/2022	5.45	5.50	0.05	--
LNAPL-6	7/3/2022	5.46	5.48	0.02	--
LNAPL-6	7/10/2022	--	5.61	--	--
LNAPL-6	7/17/2022	5.60	5.61	0.01	--
LNAPL-6	7/31/2022	--	5.92	--	--
LNAPL-6	8/7/2022	6.89	6.91	0.02	0.8
LNAPL-6	8/14/2022	6.90	6.94	0.04	--
LNAPL-6	9/4/2022	6.85	6.88	0.03	--
LNAPL-6	9/10/2022	6.85	6.89	0.04	--
LNAPL-6	9/18/2022	--	7.38	--	--
LNAPL-6	9/25/2022	6.92	7.00	0.08	--
LNAPL-6	10/2/2022	6.68	6.73	0.05	--
LNAPL-6	10/9/2022	6.53	6.85	0.32	--
LNAPL-6	11/14/2022	--	6.25	--	--
LNAPL-6	12/6/2022	--	6.13	--	--
LNAPL-6	12/25/2022	--	6.13	--	--
LNAPL-6	1/15/2023	--	5.97	--	--
LNAPL-6	1/22/2023	--	5.99	--	--
LNAPL-6	1/30/2023	--	5.45	--	--
LNAPL-6	2/5/2023	--	5.53	--	--
LNAPL-6	2/12/2023	--	5.75	--	--
LNAPL-6	2/18/2023	--	5.76	--	--
LNAPL-6	2/26/2023	--	5.65	--	--
LNAPL-6	3/5/2023	5.84	5.87	0.03	0.3
LNAPL-6	3/19/2023	--	5.90	--	--
LNAPL-6	3/23/2023	--	5.64	--	--
LNAPL-6	4/2/2023	5.41	5.45	0.04	--
LNAPL-6	4/30/2023	4.40	4.45	0.05	--
LNAPL-6	5/31/2023	--	4.60	--	--
LNAPL-6	6/19/2023	--	3.83	--	--
LNAPL-7	8/27/2021	--	8.14	--	--
LNAPL-7	9/30/2021	--	6.42	--	--
LNAPL-7	10/5/2021	--	6.29	--	--
LNAPL-7	10/12/2021	--	6.22	--	--
LNAPL-7	10/19/2021	--	6.16	--	--
LNAPL-7	11/9/2021	5.98	5.99	0.01	--
LNAPL-7	11/18/2021	6.18	6.58	0.40	--
LNAPL-7	12/2/2021	6.18	6.58	0.40	--
LNAPL-7	12/15/2021	6.28	6.65	0.38	--
LNAPL-7	1/3/2022	6.32	6.77	0.45	--
LNAPL-7	2/8/2022	6.58	6.75	0.17	--
LNAPL-7	3/7/2022	6.57	7.18	0.61	--
LNAPL-7	4/11/2022	6.53	7.26	0.73	--
LNAPL-7	5/15/2022	5.90	5.91	0.01	0.9
LNAPL-7	5/22/2022	5.73	5.74	0.01	--
LNAPL-7	5/29/2022	--	5.70	--	--
LNAPL-7	6/5/2022	--	5.80	--	0.5
LNAPL-7	6/12/2022	--	5.96	--	0.6
LNAPL-7	6/19/2022	5.85	5.87	0.02	1.0
LNAPL-7	6/26/2022	5.40	5.45	0.05	--
LNAPL-7	7/3/2022	--	5.50	--	0.3

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-7	7/10/2022	--	5.67	--	0.6
LNAPL-7	7/17/2022	--	5.45	--	0.7
LNAPL-7	7/31/2022	--	5.90	--	0.6
LNAPL-7	8/7/2022	6.89	6.95	0.06	--
LNAPL-7	8/14/2022	7.05	7.08	0.03	--
LNAPL-7	9/4/2022	6.75	7.45	0.70	0.3
LNAPL-7	9/10/2022	6.64	7.41	0.77	0.5
LNAPL-7	9/18/2022	6.99	7.11	0.12	0.3
LNAPL-7	9/25/2022	--	6.51	--	0.5
LNAPL-7	10/2/2022	6.75	7.02	0.27	0.5
LNAPL-7	10/9/2022	6.33	6.66	0.33	0.8
LNAPL-7	11/14/2022	6.08	6.10	0.02	0.8
LNAPL-7	12/6/2022	--	5.95	--	1.0
LNAPL-7	12/25/2022	5.93	5.94	0.01	0.8
LNAPL-7	1/15/2023	--	5.38	--	1.0
LNAPL-7	1/22/2023	5.88	5.90	0.02	0.7
LNAPL-7	1/30/2023	--	5.43	--	0.8
LNAPL-7	2/12/2023	--	5.50	--	1.0
LNAPL-7	2/18/2023	--	5.55	--	0.1
LNAPL-7	2/26/2023	--	5.46	--	0.1
LNAPL-7	3/5/2023	5.74	5.76	0.02	0.2
LNAPL-7	3/12/2023	--	5.92	--	1.0
LNAPL-7	3/19/2023	--	5.52	--	0.3
LNAPL-7	3/23/2023	--	5.63	--	--
LNAPL-7	4/2/2023	5.43	5.45	0.02	--
LNAPL-7	4/30/2023	4.50	4.55	0.05	--
LNAPL-7	5/31/2023	--	4.41	--	--
LNAPL-7	6/19/2023	--	3.72	--	--
LNAPL-8	8/27/2021	--	8.10	--	--
LNAPL-8	9/30/2021	--	6.30	--	--
LNAPL-8	10/5/2021	--	6.20	--	--
LNAPL-8	10/12/2021	--	6.11	--	--
LNAPL-8	10/19/2021	--	6.05	--	--
LNAPL-8	11/9/2021	5.88	5.90	0.02	--
LNAPL-8	11/18/2021	6.08	6.43	0.35	--
LNAPL-8	12/2/2021	6.08	6.46	0.38	--
LNAPL-8	12/15/2021	6.18	6.55	0.37	--
LNAPL-8	1/3/2022	6.28	6.37	0.09	--
LNAPL-8	2/8/2022	6.50	6.59	0.09	--
LNAPL-8	2/25/2022	6.47	6.98	0.51	--
LNAPL-8	3/7/2022	6.45	7.10	0.65	--
LNAPL-8	4/11/2022	6.46	7.07	0.61	--
LNAPL-8	5/15/2022	5.82	5.83	0.01	0.6
LNAPL-8	5/22/2022	--	5.65	--	--
LNAPL-8	5/29/2022	5.75	5.80	0.05	--
LNAPL-8	6/5/2022	5.75	5.76	0.01	0.3
LNAPL-8	6/12/2022	--	5.96	--	0.8
LNAPL-8	6/19/2022	5.77	5.80	0.03	--
LNAPL-8	6/26/2022	--	5.40	--	--
LNAPL-8	7/3/2022	--	5.67	--	0.8
LNAPL-8	7/10/2022	--	5.61	--	0.4
LNAPL-8	7/17/2022	--	5.33	--	0.3
LNAPL-8	7/31/2022	--	5.92	--	0.8
LNAPL-8	8/7/2022	6.84	6.88	0.04	0.1
LNAPL-8	8/14/2022	7.21	7.25	0.04	--
LNAPL-8	9/4/2022	6.68	7.25	0.57	--
LNAPL-8	9/10/2022	6.38	7.17	0.79	--
LNAPL-8	9/18/2022	--	6.98	--	--
LNAPL-8	9/25/2022	--	6.28	--	1.0
LNAPL-8	10/2/2022	6.69	6.96	0.27	0.8
LNAPL-8	10/9/2022	6.24	6.57	0.33	0.5
LNAPL-8	11/14/2022	--	6.10	--	0.8
LNAPL-8	12/6/2022	--	5.86	--	1.0
LNAPL-8	12/25/2022	--	5.84	--	0.5
LNAPL-8	1/15/2023	--	5.74	--	--
LNAPL-8	1/22/2023	5.88	5.90	0.02	0.6
LNAPL-8	1/30/2023	--	5.40	--	--
LNAPL-8	2/5/2023	--	5.60	--	0.5
LNAPL-8	2/12/2023	--	5.44	--	--
LNAPL-8	2/18/2023	--	5.43	--	0.8

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-8	2/26/2023	5.37	5.38	0.01	--
LNAPL-8	3/5/2023	5.82	5.84	0.02	0.2
LNAPL-8	3/12/2023	5.83	5.84	0.01	--
LNAPL-8	3/19/2023	--	5.52	--	0.3
LNAPL-8	3/23/2023	5.43	5.44	0.01	--
LNAPL-8	4/2/2023	5.46	5.47	0.01	--
LNAPL-8	4/30/2023	4.30	4.40	0.10	--
LNAPL-8	5/31/2023	--	4.31	--	--
LNAPL-8	6/19/2023	--	3.63	--	--
LNAPL-9	8/27/2021	--	8.09	--	--
LNAPL-9	9/30/2021	--	6.33	--	--
LNAPL-9	10/5/2021	--	6.23	--	--
LNAPL-9	10/12/2021	--	6.16	--	--
LNAPL-9	10/19/2021	6.11	6.12	0.01	--
LNAPL-9	10/22/2021	--	6.12	--	--
LNAPL-9	10/25/2021	--	6.09	--	--
LNAPL-9	10/28/2021	--	6.10	--	--
LNAPL-9	11/4/2021	--	6.15	--	--
LNAPL-9	11/9/2021	6.05	6.09	0.04	--
LNAPL-9	11/18/2021	6.17	6.20	0.04	--
LNAPL-9	12/2/2021	6.17	6.31	0.14	--
LNAPL-9	12/15/2021	6.27	6.40	0.13	--
LNAPL-9	1/3/2022	--	6.42	--	--
LNAPL-9	2/8/2022	--	6.56	--	--
LNAPL-9	5/15/2022	--	5.71	--	--
LNAPL-9	5/22/2022	--	5.70	--	--
LNAPL-9	5/29/2022	--	5.70	--	--
LNAPL-9	6/5/2022	--	5.76	--	--
LNAPL-9	6/12/2022	--	5.72	--	--
LNAPL-9	6/19/2022	5.80	5.82	0.02	--
LNAPL-9	6/26/2022	--	5.40	--	--
LNAPL-9	7/3/2022	--	5.29	--	--
LNAPL-9	7/10/2022	--	5.39	--	--
LNAPL-9	7/17/2022	5.34	5.36	0.02	--
LNAPL-9	7/31/2022	--	5.70	--	--
LNAPL-9	8/7/2022	6.68	6.72	0.04	--
LNAPL-9	8/14/2022	7.70	7.75	0.05	--
LNAPL-9	9/4/2022	6.62	6.76	0.14	--
LNAPL-9	9/10/2022	6.60	6.80	0.20	--
LNAPL-9	9/18/2022	--	6.83	--	--
LNAPL-9	9/25/2022	--	6.67	--	--
LNAPL-9	10/2/2022	6.45	6.75	0.30	--
LNAPL-9	10/9/2022	6.30	6.62	0.32	--
LNAPL-9	11/14/2022	--	6.04	--	--
LNAPL-9	12/6/2022	--	5.91	--	--
LNAPL-9	2/5/2023	--	5.62	0.50	--
LNAPL-9	2/26/2023	--	5.42	--	--
LNAPL-9	3/5/2023	--	5.86	--	--
LNAPL-9	3/23/2023	--	5.45	--	--
LNAPL-9	4/2/2023	5.55	5.58	0.03	--
LNAPL-9	5/31/2023	--	4.36	--	--
LNAPL-9	6/19/2023	--	3.66	--	--
LNAPL-10	8/27/2021	--	8.11	--	--
LNAPL-10	9/30/2021	6.31	6.36	0.05	--
LNAPL-10	10/5/2021	6.14	6.59	0.45	--
LNAPL-10	10/12/2021	6.15	6.64	0.49	--
LNAPL-10	10/14/2021	6.05	6.49	0.44	--
LNAPL-10	10/19/2021	6.05	6.42	0.37	--
LNAPL-10	10/20/2021	6.04	6.22	0.18	--
LNAPL-10	10/21/2021	6.15	6.23	0.08	--
LNAPL-10	10/22/2021	6.09	6.18	0.09	--
LNAPL-10	10/25/2021	6.02	6.18	0.16	--
LNAPL-10	10/28/2021	6.05	6.28	0.23	--
LNAPL-10	11/4/2021	5.98	6.26	0.28	--
LNAPL-10	11/9/2021	6.04	6.35	0.31	--
LNAPL-10	11/18/2021	6.08	6.45	0.38	--
LNAPL-10	12/2/2021	6.09	6.62	0.53	--
LNAPL-10	12/15/2021	6.19	6.64	0.45	--
LNAPL-10	1/3/2022	6.24	6.75	0.51	--
LNAPL-10	2/8/2022	6.47	7.05	0.59	--

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-10	2/25/2022	6.43	7.33	0.90	--
LNAPL-10	3/7/2022	6.47	7.10	0.63	--
LNAPL-10	4/11/2022	6.52	7.19	0.67	--
LNAPL-10	5/15/2022	5.90	5.91	0.01	1.0
LNAPL-10	5/22/2022	5.69	5.70	0.01	--
LNAPL-10	5/29/2022	5.62	5.65	0.03	--
LNAPL-10	6/5/2022	--	5.89	--	1.0
LNAPL-10	6/12/2022	6.00	6.03	0.03	0.8
LNAPL-10	6/19/2022	5.76	6.00	0.24	0.8
LNAPL-10	6/26/2022	--	5.35	--	--
LNAPL-10	7/3/2022	5.45	5.48	0.03	0.8
LNAPL-10	7/10/2022	5.62	5.63	0.01	0.6
LNAPL-10	7/17/2022	5.37	5.39	0.02	0.7
LNAPL-10	7/31/2022	6.00	6.01	0.01	0.8
LNAPL-10	8/7/2022	6.91	7.15	0.24	0.6
LNAPL-10	8/14/2022	7.61	7.80	0.19	--
LNAPL-10	9/4/2022	6.70	7.30	0.60	0.4
LNAPL-10	9/10/2022	6.51	7.21	0.70	0.8
LNAPL-10	9/18/2022	7.08	7.18	0.10	0.3
LNAPL-10	9/25/2022	--	6.34	--	0.5
LNAPL-10	10/2/2022	6.88	7.09	0.21	0.6
LNAPL-10	10/9/2022	6.30	6.61	0.31	0.8
LNAPL-10	11/14/2022	--	6.10	--	0.5
LNAPL-10	12/6/2022	--	5.96	--	1.0
LNAPL-10	12/25/2022	--	5.90	--	0.3
LNAPL-10	1/15/2023	--	5.72	--	1.0
LNAPL-10	1/22/2023	--	5.94	--	0.3
LNAPL-10	1/30/2023	--	5.44	--	0.4
LNAPL-10	2/12/2023	5.60	5.62	0.02	1.0
LNAPL-10	2/18/2023	--	5.47	--	0.7
LNAPL-10	2/26/2023	5.41	5.42	0.01	0.3
LNAPL-10	3/5/2023	--	5.80	--	--
LNAPL-10	3/12/2023	--	5.71	--	1.0
LNAPL-10	3/19/2023	--	5.52	--	0.3
LNAPL-10	3/23/2023	--	5.40	--	--
LNAPL-10	4/2/2023	5.60	5.62	0.02	--
LNAPL-10	4/30/2023	4.30	4.35	0.05	--
LNAPL-10	5/31/2023	--	4.35	--	--
LNAPL-10	6/19/2023	--	3.65	--	--
LNAPL-11	8/27/2021	--	8.20	--	--
LNAPL-11	9/30/2021	--	6.52	--	--
LNAPL-11	10/5/2021	6.29	6.30	0.01	--
LNAPL-11	10/12/2021	--	6.34	--	--
LNAPL-11	10/19/2021	6.22	6.63	0.41	--
LNAPL-11	10/20/2021	6.32	6.35	0.03	--
LNAPL-11	10/21/2021	6.40	6.41	0.01	--
LNAPL-11	10/22/2021	--	6.30	--	--
LNAPL-11	10/25/2021	6.22	6.25	0.03	--
LNAPL-11	10/28/2021	6.25	6.38	0.13	--
LNAPL-11	11/4/2021	6.20	6.40	0.20	--
LNAPL-11	11/9/2021	6.21	6.45	0.24	--
LNAPL-11	11/18/2021	6.26	6.53	0.27	--
LNAPL-11	12/2/2021	6.28	6.68	0.40	--
LNAPL-11	12/15/2021	6.38	6.78	0.41	--
LNAPL-11	1/3/2022	6.42	6.88	0.46	--
LNAPL-11	2/8/2022	6.73	7.29	0.56	--
LNAPL-11	2/25/2022	6.61	7.39	0.78	--
LNAPL-11	3/7/2022	6.63	7.43	0.80	--
LNAPL-11	4/11/2022	6.70	7.43	0.73	--
LNAPL-11	5/15/2022	6.12	6.50	0.38	0.5
LNAPL-11	5/22/2022	--	5.86	--	--
LNAPL-11	5/29/2022	--	5.90	--	--
LNAPL-11	6/5/2022	--	6.09	--	1.0
LNAPL-11	6/12/2022	6.21	6.25	0.04	0.5
LNAPL-11	6/19/2022	5.94	6.18	0.24	0.8
LNAPL-11	6/26/2022	--	5.50	--	--
LNAPL-11	7/3/2022	5.56	5.58	0.02	0.9
LNAPL-11	7/10/2022	--	5.83	--	1.0
LNAPL-11	7/17/2022	5.55	5.57	0.02	0.7
LNAPL-11	7/31/2022	6.10	6.20	0.10	0.5

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-11	8/7/2022	7.15	7.16	0.01	0.7
LNAPL-11	8/14/2022	7.82	7.86	0.04	--
LNAPL-11	9/4/2022	7.19	7.60	0.41	0.7
LNAPL-11	9/10/2022	6.58	7.20	0.62	0.8
LNAPL-11	9/18/2022	7.34	7.38	0.04	0.1
LNAPL-11	9/25/2022	--	6.56	--	0.5
LNAPL-11	10/2/2022	7.21	7.34	0.13	0.7
LNAPL-11	10/9/2022	6.46	6.76	0.30	0.5
LNAPL-11	11/14/2022	--	6.10	--	0.5
LNAPL-11	12/6/2022	--	6.03	--	0.8
LNAPL-11	12/25/2022	--	6.06	--	0.3
LNAPL-11	1/15/2023	--	5.89	--	--
LNAPL-11	1/22/2023	--	6.07	--	0.4
LNAPL-11	1/30/2023	5.56	5.58	0.02	0.5
LNAPL-11	2/12/2023	5.60	5.62	0.02	1.0
LNAPL-11	2/18/2023	5.62	5.65	0.03	0.5
LNAPL-11	2/26/2023	5.58	5.60	0.02	--
LNAPL-11	3/5/2023	--	5.77	--	--
LNAPL-11	3/12/2023	--	5.83	--	--
LNAPL-11	3/19/2023	--	5.63	--	0.3
LNAPL-11	3/23/2023	--	5.49	--	--
LNAPL-11	4/2/2023	5.55	5.56	0.01	--
LNAPL-11	4/30/2023	4.30	4.35	0.05	--
LNAPL-11	5/31/2023	--	4.51	--	--
LNAPL-11	6/19/2023	--	3.81	--	--
LNAPL-12	8/14/2022	--	6.92	--	--
LNAPL-12	8/20/2022	--	6.81	--	--
LNAPL-12	9/4/2022	--	6.71	--	--
LNAPL-12	9/10/2022	--	6.71	--	--
LNAPL-12	9/18/2022	--	6.95	--	--
LNAPL-12	9/25/2022	--	6.85	--	--
LNAPL-12	10/2/2022	--	6.64	--	--
LNAPL-12	10/9/2022	--	6.52	--	--
LNAPL-12	11/14/2022	--	6.12	--	--
LNAPL-12	12/6/2022	--	6.01	--	--
LNAPL-12	2/26/2023	--	5.59	--	--
LNAPL-12	3/5/2023	--	5.81	--	--
LNAPL-12	3/23/2023	--	5.67	--	--
LNAPL-12	4/2/2023	5.60	5.61	0.01	--
LNAPL-12	5/31/2023	--	4.45	--	--
LNAPL-12	6/19/2023	--	3.75	--	--
LNAPL-13	8/14/2022	--	6.88	--	--
LNAPL-13	8/20/2022	--	6.82	--	--
LNAPL-13	9/4/2022	--	6.69	--	--
LNAPL-13	9/10/2022	--	6.70	--	--
LNAPL-13	9/18/2022	--	6.83	--	--
LNAPL-13	9/25/2022	--	6.81	--	--
LNAPL-13	10/2/2022	--	6.62	--	--
LNAPL-13	10/9/2022	--	6.52	--	--
LNAPL-13	11/14/2022	--	6.11	--	--
LNAPL-13	12/6/2022	--	5.98	--	--
LNAPL-13	2/26/2023	--	5.57	--	--
LNAPL-13	3/5/2023	--	5.78	--	--
LNAPL-13	3/23/2023	--	5.54	--	--
LNAPL-13	4/2/2023	5.52	5.56	0.04	--
LNAPL-13	5/31/2023	--	4.45	--	--
LNAPL-13	6/19/2023	--	3.75	--	--
LNAPL-14	8/14/2022	--	6.93	--	--
LNAPL-14	8/20/2022	--	6.85	--	--
LNAPL-14	9/4/2022	--	6.74	--	--
LNAPL-14	9/10/2022	--	6.73	--	--
LNAPL-14	9/18/2022	--	7.13	--	--
LNAPL-14	9/25/2022	--	7.02	--	--
LNAPL-14	10/2/2022	--	6.66	--	--
LNAPL-14	10/9/2022	--	6.55	--	--
LNAPL-14	11/14/2022	--	6.15	--	--
LNAPL-14	12/6/2022	--	6.04	--	--
LNAPL-14	2/26/2023	--	5.62	--	--
LNAPL-14	3/5/2023	--	5.80	--	--
LNAPL-14	3/23/2023	--	5.50	--	--

Table 5
Fluid Level Measurements at LNAPL Wells
Calumet Montana Refining, LLC - Great Falls, Montana

Location	Date	DTP (ft BTOC)	DTW (ft BTOC)	LNAPL Thickness (ft)	Fluid Recovery (gal)
LNAPL-14	4/2/2023	5.58	5.60	0.02	--
LNAPL-14	5/31/2023	--	4.48	--	--
LNAPL-14	6/19/2023	--	3.75	--	--
LNAPL-15	8/14/2022	--	6.93	--	--
LNAPL-15	8/20/2022	--	6.82	--	--
LNAPL-15	9/4/2022	--	6.73	--	--
LNAPL-15	9/10/2022	--	6.72	--	--
LNAPL-15	9/18/2022	--	7.24	--	--
LNAPL-15	9/25/2022	--	6.84	--	--
LNAPL-15	10/2/2022	--	6.65	--	--
LNAPL-15	10/9/2022	--	6.53	--	--
LNAPL-15	11/14/2022	--	6.14	--	--
LNAPL-15	12/6/2022	--	5.99	--	--
LNAPL-15	2/26/2023	--	5.60	--	--
LNAPL-15	3/5/2023	--	5.77	--	--
LNAPL-15	3/23/2023	--	5.49	--	--
LNAPL-15	4/2/2023	5.51	5.55	0.04	--
LNAPL-15	5/31/2023	--	4.45	--	--
LNAPL-15	6/19/2023	--	3.73	--	--
LNAPL-16	8/14/2022	--	6.92	--	--
LNAPL-16	8/20/2022	--	6.83	--	--
LNAPL-16	9/4/2022	--	6.72	--	--
LNAPL-16	9/10/2022	--	6.72	--	--
LNAPL-16	9/18/2022	--	6.91	--	--
LNAPL-16	9/25/2022	--	6.83	--	--
LNAPL-16	10/2/2022	--	6.66	--	--
LNAPL-16	10/9/2022	--	6.52	--	--
LNAPL-16	11/14/2022	--	6.12	--	--
LNAPL-16	12/6/2022	--	5.97	--	--
LNAPL-16	2/26/2023	--	5.60	--	--
LNAPL-16	3/5/2023	--	5.82	--	--
LNAPL-16	3/23/2023	--	5.45	--	--
LNAPL-16	4/2/2023	5.50	5.51	0.01	--
LNAPL-16	5/31/2023	--	4.47	--	--
LNAPL-16	6/19/2023	--	3.73	--	--
LNAPL-17	8/14/2022	--	6.90	--	--
LNAPL-17	8/20/2022	--	6.79	--	--
LNAPL-17	9/4/2022	--	3.73	--	--
LNAPL-17	9/10/2022	--	6.67	--	--
LNAPL-17	9/18/2022	--	6.87	--	--
LNAPL-17	9/25/2022	--	6.95	--	--
LNAPL-17	10/2/2022	--	6.62	--	--
LNAPL-17	10/9/2022	--	6.51	--	--
LNAPL-17	11/14/2022	--	6.10	--	--
LNAPL-17	12/6/2022	--	6.02	--	--
LNAPL-17	12/11/2022	--	6.02	--	--
LNAPL-17	2/26/2023	--	5.57	--	--
LNAPL-17	3/5/2023	--	5.75	--	--
LNAPL-17	3/23/2023	--	6.63	--	--
LNAPL-17	4/2/2023	5.52	5.55	0.03	--
LNAPL-17	5/31/2023	--	4.42	--	--
LNAPL-17	6/19/2023	--	3.64	--	--

Notes:

DTP	Depth to Product
DTW	Depth to Water
ft BTOC	Below Top of Casing
LNAPL	light non-aqueous phase liquid
NA	Reading not collected
--	LNAPL was not present/No LNAPL Recovery

Table 6
Summary of Groundwater Analytical Results - Petroleum COCs
Calumet Montana Refining, LLC - Great Falls, Montana

	Location			MW-041S	MW-041S	MW-041S	MW-041S	MW-041S	MW-041S	MW-041S
	Field Sample ID	Montana DEQ-7 Human Health Standards - Groundwater	Montana DEQ Tier 1 Groundwater RBSLs	CMR-MW41S-211005	CMR-MW141S-220317	MW41S-GW-220622	CMR-MW41S-220831	CMR-MW-41S-221213-L1569525	CMR-MW-415-230321	CMR-MW-41S-270623
	Lab Sample ID(s)			WJ08015-001	XC21009-002	XF23073-001	L1533605-03; XI01059-003	L1569525-03; XL14017-003	YC22023-003	YF29005-005
	Sample Method			Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
	Sample Date			10/5/2021	3/17/2022	6/22/2022	8/31/2022	12/13/2022	3/21/2023	6/27/2023
	Comments									
VOC										
	Acetone			U (80)	76 (20)	HU (80)	88 (4)	35 J (20)	U (20)	40 H (4)
	Benzene	5	5	**1900 (8)**	**230 (2)**	**1200 H (8)**	**140 (0.4)**	**250 (2)**	**130 (0.4)**	**410 (2)**
	Bromoform	80		U (8)	U (2)	HU (8)	U (0.4)	U (2)	U (0.4)	U (2)
	2-Butanone			U (40)	28 J (10)	HU (40)	16 (2)	14 J (10)	U (2)	18 H (2)
	Carbon Disulfide			U (8)	U (2)	HU (8)	4.2 (0.4)	U (2)	U (0.4)	U (2)
	Chloroform	70		U (8)	U (2)	HU (8)	U (0.4)	U (2)	U (0.4)	U (2)
	Chloromethane	600		U (8)	U (2)	HU (8)	U (0.4)	U (2)	U (0.4)	U (2)
	Cumene			14 (8)	U (2)	16 H (8)	0.57 (0.4)	U (2)	0.55 (0.4)	5.6 (2)
	Cyclohexane			110 (8)	15 (2)	22 H (8)	27 (0.4)	33 (2)	18 (2)	17 (2)
	cis-1,2-Dichloroethene	70		U (8)	U (2)	HU (8)	0.48 J (0.4)	U (2)	U (0.4)	U (2)
	Ethyl Benzene	700	700	450 (8)	15 (2)	410 H (8)	21 (0.4)	50 (2)	16 (0.4)	150 (2)
	4-Methyl-2-pentanone			U (40)	U (10)	HU (40)	2.4 J (2)	U (10)	U (2)	U (10)
	Methylcyclohexane			57 J (8)	9.4 J (2)	12 (8)	18 (0.4)	34 (2)	12 (0.4)	15 J (2)
	Methylene Chloride	5		U (8)	U (2)	HU (8)	U (0.4)	U (2)	U (0.4)	U (2)
	Naphthalene	100	100	35 (8)	31 (2)	77 H (8)	3.4 (0.4)	27 (2)	18 (0.4)	35 (2)
	Toluene	1000	1000	270 (8)	44 (2)	180 H (8)	11 (0.4)	9.5 (2)	2.2 (0.4)	3.4 (2)
	1,1,2-Trichloroethane	3		U (8)	U (2)	HU (8)	U (0.4)	U (2)	U (0.4)	U (2)
	m,p-xylene			640 (8)	580 (2)	2000 H (8)	150 (0.4)	730 (2)	320 (2)	470 (2)
	ortho-xylene	10000		200 (8)	300 (2)	750 H (8)	67 (0.4)	300 (2)	150 (2)	150 (2)
	Xylenes (total)	10000	10000	840 (8)	870 (2)	2700 H (8)	220 (0.4)	1000 (2)	460 (2)	630 (2)
SVOC										
	Acenaphthene	70	70	U (0.2)	U (0.8)	U (2)	U (0.04)	U (0.8)	U (0.8)	0.34 J (0.2)
	Benzo(a)anthracene	0.5	0.5	U (0.2)	U (0.8)	U (2)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	Benzo(a)pyrene	0.05	0.05	U (0.35)	U (1.4)	U (3.5)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	Benzo(b)fluoranthene	0.5	0.5	U (0.2)	U (0.8)	U (2)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	Benzo(g,h,i)perylene			U (0.2)	U (0.8)	U (2)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	bis(2-Ethylhexyl)phthalate	6		U (5)	U (40)	U (100)	3.8 BJ (1.5)	U (30)	U (30)	U (7.5)
	Chrysene	50	50	U (0.15)	U (0.6)	U (1.5)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	Diethylphthalate	600		U (2.5)	U (10)	U (25)	U (0.19)	U (3.8)	U (3.8)	U (0.95)
	2,4-Dimethylphenol	100		U (2.4)	**160 (9.6)**	36 J (24)	U (0.15)	**100 (3)**	60 (3)	8.3 (0.75)
	Di-n-butylphthalate	20		U (2.5)	U (10)	U (25)	U (0.42)	U (8.4)	U (8.4)	U (2.1)
	Fluoranthene	20	20	U (0.5)	U (2)	U (5)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	Fluorene	50	50	0.63 BJ (0.15)	U (0.6)	2.3 J (1.5)	U (0.04)	U (0.8)	1.2 (0.8)	0.67 J (0.2)
	Indeno(1,2,3-cd)pyrene	0.5	0.5	U (0.2)	U (0.8)	U (2)	U (0.04)	U (0.8)	U (0.8)	U (0.2)
	1-Methylnaphthalene		11	--	--	--	0.065 J (0.04)	12 (0.8)	14 (0.8)	10 (0.2)
	2-Methylnaphthalene		36	1.7 B (0.2)	7.7 (0.8)	33 (2)	0.11 J (0.04)	6.7 (0.8)	11 (0.8)	12 (0.2)
	2-Methylphenol			U (1.1)	U (4.2)	U (11)	U (0.21)	U (4.2)	U (4.2)	U (1.1)
	Naphthalene	100	100	15 B (0.25)	18 (1)	60 (2.5)	U (0.04)	19 (0.8)	11 (0.8)	15 (0.2)
	Phenanthrene			U (0.3)	U (1.2)	U (3)	U (0.04)	U (0.8)	U (0.8)	0.42 J (0.2)
	Phenol	4000		5.6 (2.5)	15 J (10)	U (25)	U (0.19)	9.1 J (3.8)	U (3.8)	U (0.95)
MTDEQ VPH										
	C5-C8 Aliphatics (Unadjusted)			--	--	--	1460 (33.3)	1050 (33.3)	516 (100)	850 (167)
	C5-C8 Aliphatics		650	1500 (150)	460 J (150)	990 (150)	1140 (33.3)	1040 (33.3)	392 (100)	429 J (167)
	C9-C12 Aliphatics (Unadjusted)			--	--	--	1200 (33.3)	2060 (33.3)	1330 (100)	3100 (167)
	C9-C12 Aliphatics		1400	370 J (150)	730 J (150)	710 J (150)	625 (33.3)	405 (33.3)	456 (100)	U (167)
	C9-C10 Aromatics (Unadjusted)			--	--	--	530 (33.3)	1570 (33.3)	1240 (500)	1910 (167)
	C9-C10 Aromatics		1100	990 (50)	810 (50)	3100 (50)	--	--	--	--
	Volatile Petroleum Hydrocarbons			6300 (350)	3100 (350)	9800 (350)	3190 (66.7)	5170 (66.7)	3090 (1000)	5860 (333)
MTDEQ EPH										
	C19-C36 Aliphatics		1000	--	--	U (100)	--	--	--	--
	C11-C22 Aromatics		1100	--	--	4000 (100)	--	375 (200)	506 (666)	425 J (200)
	C11-C22 Aromatics (unadjusted)			--	--	--	--	375 (200)	506 (666)	425 J (200)
	TPH (Unadjusted)			--	--	--	--	375 (200)	506 (666)	425 J (200)
	TPH (adjusted)			--	--	--	--	375 (200)	506 (666)	425 J (200)
	Petroleum Hydrocarbons (Extractable)			--	--	5700 (2000)	5560 (500)	--	5640 (333)	5490 (100
	Extractable Petroleum Hydrocarbons (Frac)			--	--	5000 B (100)	--	4460 Q (100)	--	

Notes:

1 All concentrations are presented in ug/L (ppb) except where otherwise noted.

2 Only compounds with at least one detection are shown.

3 Concentrations that exceed the Montana DEQ-7 Human Health Standards - Groundwater are **boldfaced**.

4 Concentrations that exceed the Montana DEQ Tier 1 Groundwater RBSLs are underlined.

Abbreviations:

U -- Not Detected.
J -- Estimated Concentration.
B -- Blank Contamination.
( ) -- Detection Limit.
-- -- Not Analyzed.

Table 6
Summary of Groundwater Analytical Results - Petroleum COCs
Calumet Montana Refining, LLC - Great Falls, Montana

Location			MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105
Field Sample ID	Montana DEQ-7 Human Health Standards - Groundwater	Montana DEQ Tier 1 Groundwater RBSLs	CMR-MW105-08052020	CMR-MW105-200827	CMR-MW105-210223	CMR-MW105S-211006	CMR-MW105-220317	MW105-GW-220622	CMR-MW105-220831	CMR-MW-105-221213-L1569525	CMR-MW-105-230321	CMR-MW-105-270623
Lab Sample ID(s)			VH07016-001	VH28044-018	WB25040-009	WJ08015-002	XC21009-003	XF23073-003	L1533605-01; XI01059-001	L1569525-01; XL14017-001	YC22023-001	YF29005-003
Sample Method			Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
Sample Date			8/5/2020	8/27/2020	2/23/2021	10/6/2021	3/17/2022	6/22/2022	8/31/2022	12/13/2022	3/21/2023	6/27/2023
Comments												
VOC												
Acetone			110 (4)	43 J (40)	65 J (40)	58 H (20)	6.8 J (4)	U (4)	77 (4)	8 J (4)	U (4)	21 H (4)
Benzene	5	5	**180 (0.4)**	**570 (4)**	**240 (4)**	**250 H (2)**	**25 (0.4)**	**110 (0.4)**	**85 (0.4)**	2.1 (0.4)	**12 (0.4)**	**48 (0.4)**
Bromoform	80		U (0.4)	U (4)	U (4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
2-Butanone			15 (2)	U (20)	U (20)	17 (2)	U (2)	3 J (2)	U (2)	U (2)	U (2)	3.2 J (2)
Carbon Disulfide			0.56 (0.4)	U (4)	U (4)	HU (2)	U (0.4)	1.4 (0.4)	0.55 (0.4)	5.8 (0.4)	U (0.4)	U (0.4)
Chloroform	70		U (0.4)	U (4)	U (4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Chloromethane	600		29 (0.4)	U (4)	U (4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	1.5 (0.4)
Cumene			4.6 (0.4)	5.4 (4)	5.5 (4)	2.4 (0.4)	U (0.4)	2.9 (0.4)	0.67 (0.4)	U (0.4)	U (0.4)	0.72 (0.4)
Cyclohexane			59 (0.4)	55 J (4)	70 (4)	59 (0.4)	3 (0.4)	50 (0.4)	26 (0.4)	3.4 (0.4)	6.6 (0.4)	9.4 H (0.4)
cis-1,2-Dichloroethene	70		U (0.4)	U (4)	U (4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Ethyl Benzene	700	700	240 (2)	320 (4)	160 (4)	150 (0.4)	20 (0.4)	200 (0.4)	120 (0.4)	7.9 (0.4)	21 (0.4)	15 (0.4)
4-Methyl-2-pentanone			U (2)	U (20)	U (20)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)
Methylcyclohexane			26 (0.4)	17 J (4)	37 J (4)	25 (0.4)	0.85 J (0.4)	14 (0.4)	8.1 (0.4)	0.91 J (0.4)	1.7 (0.4)	3.8 J (0.4)
Methylene Chloride	5		U (0.4)	U (4)	U (4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Naphthalene	100	100	9.4 (0.4)	9.1 (4)	12 (4)	8.5 (0.4)	0.86 (0.4)	4.9 (0.4)	4.9 (0.4)	U (0.4)	0.57 (0.4)	1.5 (0.4)
Toluene	1000	1000	25 (0.4)	42 (4)	15 (4)	14 (0.4)	2 (0.4)	12 (0.4)	9.9 (0.4)	U (0.4)	1.5 (0.4)	2.2 (0.4)
1,1,2-Trichloroethane	3		U (0.4)	U (4)	U (4)	U (0.4)	U (0.4)	U (0.4)	0.51 (0.4)	U (0.4)	U (0.4)	U (0.4)
m,p-xylene			250 (2)	260 (4)	55 (4)	41 (0.4)	6.7 (0.4)	28 (0.4)	12 (0.4)	0.57 (0.4)	3.6 (0.4)	4.7 (0.4)
ortho-xylene	10000		16 (0.4)	20 (4)	5.7 (4)	3.8 (0.4)	2.3 (0.4)	3.9 (0.4)	3.9 (0.4)	0.44 J (0.4)	0.57 (0.4)	1.2 (0.4)
Xylenes (total)	10000	10000	290 (0.4)	280 (4)	61 (4)	45 (0.4)	9 (0.4)	31 (0.4)	16 (0.4)	1 (0.4)	4.1 (0.4)	5.9 (0.4)
SVOC												
Acenaphthene	70	70	--	U (0.2)	0.065 J (0.04)	U (0.4)	U (0.04)	U (0.25)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Benzo(a)anthracene	0.5	0.5	--	U (0.2)	U (0.04)	U (0.4)	U (0.04)	U (0.25)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Benzo(a)pyrene	0.05	0.05	--	U (0.35)	U (0.07)	U (0.7)	U (0.07)	U (0.44)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Benzo(b)fluoranthene	0.5	0.5	--	U (0.2)	U (0.04)	U (0.4)	U (0.04)	U (0.25)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Benzo(g,h,i)perylene			--	U (0.2)	U (0.04)	U (0.4)	U (0.04)	U (0.25)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
bis(2-Ethylhexyl)phthalate	6		--	U (2.5)	U (0.5)	U (20)	U (2)	U (13)	U (30)	U (7.5)	U (7.5)	U (7.5)
Chrysene	50	50	--	U (0.15)	U (0.03)	U (0.3)	U (0.03)	U (0.19)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Diethylphthalate	600		--	U (2.5)	U (0.5)	U (5)	U (0.5)	U (3.1)	U (3.8)	U (0.95)	U (0.95)	U (0.95)
2,4-Dimethylphenol	100		--	U (2.4)	1.1 (0.48)	U (4.8)	0.63 J (0.48)	U (3)	37 (3)	U (0.75)	U (0.75)	U (0.75)
Di-n-butylphthalate	20		--	U (2.5)	U (0.5)	U (5)	U (0.5)	U (3.1)	U (8.4)	U (2.1)	U (2.1)	U (2.1)
Fluoranthene	20	20	--	U (0.5)	U (0.1)	U (1)	U (0.1)	U (0.63)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Fluorene	50	50	--	U (0.15)	0.15 J (0.03)	U (0.3)	U (0.03)	U (0.19)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Indeno(1,2,3-cd)pyrene	0.5	0.5	--	U (0.2)	U (0.04)	U (0.4)	U (0.04)	U (0.25)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
1-Methylnaphthalene		11	--	--	--	--	--	--	1.3 J (0.8)	U (0.2)	U (0.2)	0.73 J (0.2)
2-Methylnaphthalene		36	--	0.77 J (0.2)	2.4 (0.04)	U (0.4)	U (0.04)	U (0.25)	1.9 J (0.8)	U (0.2)	U (0.2)	0.31 J (0.2)
2-Methylphenol			--	U (1.1)	0.24 J (0.21)	U (2.1)	U (0.21)	U (1.3)	U (4.2)	U (1.1)	U (1.1)	U (1.1)
Naphthalene	100	100	--	6.6 (0.25)	6.1 (0.05)	3.1 (0.5)	0.42 (0.05)	2.1 (0.31)	1.5 J (0.8)	U (0.2)	0.23 (0.2)	0.91 (0.2)
Phenanthrene			--	U (0.3)	0.088 J (0.06)	U (0.6)	U (0.06)	U (0.38)	U (0.8)	U (0.2)	U (0.2)	U (0.2)
Phenol	4000		--	U (2.5)	3.4 (0.5)	U (5)	U (0.5)	U (3.1)	U (3.8)	U (0.95)	U (0.95)	1.2 J (0.95)
MTDEQ VPH												
C5-C8 Aliphatics (Unadjusted)			--	--	--	--	--	--	650 (33.3)	63.9 J (33.3)	178 (100)	1050 (33.3)
C5-C8 Aliphatics		650	1600 (15)	880 (75)	1800 (75)	1200 (75)	150 (15)	830 (15)	517 (33.3)	63.9 J (33.3)	162 (100)	969 (33.3)
C9-C12 Aliphatics (Unadjusted)			--	--	--	--	--	--	240 B (33.3)	U (33.3)	106 (100)	377 (33.3)
C9-C12 Aliphatics		1400	180 (15)	200 J (75)	210 J (75)	130 (15)	21 J (15)	37 J (15)	140 B (33.3)	U (33.3)	67.5 (100)	117 (33.3)
C9-C10 Aromatics (Unadjusted)			--	--	--	--	--	--	158 (33.3)	51 J (33.3)	U (100)	185 (33.3)
C9-C10 Aromatics		1100	530 (5)	650 (25)	350 (25)	300 (5)	52 (5)	150 (5)	--	--	--	
Volatile Petroleum Hydrocarbons			2800 (35)	2700 (180)	2300 (180)	1900 (180)	240 (35)	1100 (35)	1050 (66.7)	146 J (66.7)	284 (200)	1610 (66.7)
MTDEQ EPH												
C19-C36 Aliphatics		1000	--	740 (480)	--	--	--	--	--	--	--	
C11-C22 Aromatics		1100	--	U (480)	--	--	--	--	--	--	U (600)	U (200)
C11-C22 Aromatics (unadjusted)			--	--	--	--	--	--	--	--	U (600)	U (200)
TPH (Unadjusted)			--	--	--	--	--	--	--	--	U (600)	U (200)
TPH (adjusted)			--	--	--	--	--	--	--	--	U (600)	U (600)
Petroleum Hydrocarbons (Extractable)			--	1900 (950)	470 (240)	--	--	--	--	--	374 (300)	638 (100)
Extractable Petroleum Hydrocarbons (Frac)			--	880 J (480)	--	--	--	--	--	--	--	

Notes:

1 All concentrations are presented in ug/L (ppb) except where otherwise noted.

2 Only compounds with at least one detection are shown.

3 Concentrations that exceed the Montana DEQ-7 Human Health Standards - Groundwater are **boldfaced**.

4 Concentrations that exceed the Montana DEQ Tier 1 Groundwater RBSLs are underlined.

Abbreviations:

U -- Not Detected.
J -- Estimated Concentration.
B -- Blank Contamination.
( ) -- Detection Limit.
-- -- Not Analyzed.

Table 6
Summary of Groundwater Analytical Results - Petroleum COCs
Calumet Montana Refining, LLC - Great Falls, Montana

Location			MW-106	MW-106	MW-106	MW-106	MW-106	MW-106	MW-106	MW-106	MW-106
Field Sample ID	Montana DEQ-7 Human Health Standards - Groundwater	Montana DEQ Tier 1 Groundwater RBSLs	CMR-MW106-211005	CMR-MW106-220316	MW106-GW-220622	CMR-MW106-220831	CMR-MW-106-221213-L1569525	CMR-DS1-221213	CMR-MW-106-230321	CMR-DUP-1-230321	R-MW-106-280623
Lab Sample ID(s)			WJ08009-001	XC21009-001	XF23073-002	L1533605-02; XI01059-002	L1569525-02; XL14017-002	XL14017-004	YC22023-002	YC22023-004	YF29005-001
Sample Method			Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
Sample Date			10/5/2021	3/16/2022	6/22/2022	8/31/2022	12/13/2022	12/13/2022	3/21/2023	3/21/2023	6/28/2023
Comments								Field Duplicate		Field Duplicate	
VOC											
Acetone			6.9 J (4)	U (4)	U (4)	U (4)	14 (4)	12 (4)	U (4)	U (4)	U (4)
Benzene	5	5	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Bromoform	80		U (0.4)	U (0.4)	U (0.4)	U (0.4)	0.96 (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
2-Butanone			U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)
Carbon Disulfide			U (0.4)	U (0.4)	U (0.4)	U (0.4)	4.2 (0.4)	3.2 (0.4)	U (0.4)	U (0.4)	U (0.4)
Chloroform	70		U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Chloromethane	600		U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Cumene			U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Cyclohexane			U (0.4)	U (0.4)	U (0.4)	7.2 (0.4)	2.8 (0.4)	2.6 (0.4)	U (0.4)	U (0.4)	U (0.4)
cis-1,2-Dichloroethene	70		U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Ethyl Benzene	700	700	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
4-Methyl-2-pentanone			U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)	U (2)
Methylcyclohexane			U (0.4)	U (0.4)	U (0.4)	1.7 J (0.4)	1 J (0.4)	1.1 J (0.4)	U (0.4)	U (0.4)	U (0.4)
Methylene Chloride	5		0.47 J (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	0.49 J (0.4)	U (0.4)	U (0.4)	U (0.4)
Naphthalene	100	100	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Toluene	1000	1000	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
1,1,2-Trichloroethane	3		U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
m,p-xylene			U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
ortho-xylene	10000		U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
Xylenes (total)	10000	10000	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)	U (0.4)
SVOC											
Acenaphthene	70	70	U (0.04)	U (0.04)	U (0.2)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Benzo(a)anthracene	0.5	0.5	U (0.04)	0.084 J (0.04)	U (0.2)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Benzo(a)pyrene	0.05	0.05	U (0.07)	**0.17 J (0.07)**	U (0.35)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Benzo(b)fluoranthene	0.5	0.5	U (0.04)	0.2 (0.04)	U (0.2)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Benzo(g,h,i)perylene			U (0.04)	0.12 J (0.04)	U (0.2)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
bis(2-Ethylhexyl)phthalate	6		U (1)	U (2)	U (10)	2 BJ (1.5)	U (7.5)	--	U (7.5)	--	U (7.5)
Chrysene	50	50	U (0.03)	0.042 J (0.03)	U (0.15)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Diethylphthalate	600		U (0.5)	U (0.5)	U (2.5)	0.21 J (0.19)	U (0.95)	--	U (0.95)	--	U (0.95)
2,4-Dimethylphenol	100		U (0.48)	U (0.48)	U (2.4)	U (0.15)	U (0.75)	--	U (0.75)	--	U (0.75)
Di-n-butylphthalate	20		U (0.5)	U (0.5)	U (2.5)	U (0.42)	U (2.1)	--	U (2.1)	--	U (2.1)
Fluoranthene	20	20	U (0.1)	0.16 J (0.1)	U (0.5)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Fluorene	50	50	U (0.03)	U (0.03)	U (0.15)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Indeno(1,2,3-cd)pyrene	0.5	0.5	U (0.04)	0.15 J (0.04)	U (0.2)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
1-Methylnaphthalene		11	--	--	--	0.061 J (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
2-Methylnaphthalene		36	0.044 BJ (0.04)	U (0.04)	U (0.2)	0.1 J (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
2-Methylphenol			U (0.21)	U (0.21)	U (1.1)	U (0.21)	U (1.1)	--	U (1.1)	--	U (1.1)
Naphthalene	100	100	U (0.05)	U (0.05)	U (0.25)	0.045 J (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Phenanthrene			U (0.06)	U (0.06)	U (0.3)	U (0.04)	U (0.2)	--	U (0.2)	--	U (0.2)
Phenol	4000		U (0.5)	U (0.5)	U (2.5)	U (0.19)	U (0.95)	--	U (0.95)	--	U (0.95)
MTDEQ VPH											
C5-C8 Aliphatics (Unadjusted)			--	--	--	153 (33.3)	80 J (33.3)	--	U (100)	--	85.9 J (33.3)
C5-C8 Aliphatics		650	U (15)	U (15)	U (15)	153 (33.3)	80 J (33.3)	--	U (100)	--	85.9 J (33.3)
C9-C12 Aliphatics (Unadjusted)			--	--	--	36 (33.3)	U (33.3)	--	U (100)	--	U (33.3)
C9-C12 Aliphatics		1400	U (15)	U (15)	U (15)	36 (33.3)	U (33.3)	--	U (100)	--	U (33.3)
C9-C10 Aromatics (Unadjusted)			--	--	--	U (33.3)	U (33.3)	--	U (100)	--	U (33.3)
C9-C10 Aromatics		1100	U (5)	U (5)	U (5)	--	--	--	--	--	--
Volatile Petroleum Hydrocarbons			U (35)	U (35)	U (35)	189 J (66.7)	108 J (66.7)	--	U (200)	--	108 J (66.7)
MTDEQ EPH											
C19-C36 Aliphatics		1000	--	--	U (100)	--	--	--	--	--	--
C11-C22 Aromatics		1100	--	--	U (100)	--	U (200)	--	U (666)	--	U (200)
C11-C22 Aromatics (unadjusted)			--	--	--	--	U (200)	--	U (666)	--	U (200)
TPH (Unadjusted)			--	--	--	--	U (200)	--	U (666)	--	U (200)
TPH (adjusted)			--	--	--	--	U (200)	--	U (666)	--	U (200)
Petroleum Hydrocarbons (Extractable)			U (200)	U (200)	U (200)	U (100)	--	--	U (333)	--	1650 (100)
Extractable Petroleum Hydrocarbons (Frac)			--	--	U (100)	--	U (100)	--	--	--	--

Notes:

1 All concentrations are presented in ug/L (ppb) except where otherwise noted.

2 Only compounds with at least one detection are shown.

3 Concentrations that exceed the Montana DEQ-7 Human Health Standards - Groundwater are **boldfaced**.

4 Concentrations that exceed the Montana DEQ Tier 1 Groundwater RBSLs are underlined.

Abbreviations:

U -- Not Detected.
J -- Estimated Concentration.
B -- Blank Contamination.
( ) -- Detection Limit.
-- -- Not Analyzed.

Table 7
Summary of Groundwater Analytical Results - Field Parameters
Calumet Montana Refining, LLC - Great Falls, Montana

Location	MW-041S	MW-041S	MW-041S	MW-041S	MW-041S	MW-041S	MW-041S
Field Sample ID	CMR-MW41S-211005	CMR-MW141S-220317	MW41S-GW-220622	CMR-MW41S-220831	CMR-MW-41S-221213	CMR-MW-41S-230321	CMR-MW-41S-230627
Sample Method	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
Sample Date	10/5/2021	3/17/2022	6/22/2022	8/31/2022	12/13/2022	3/21/2023	6/27/2023
FIELD PARAMETERS							
Specific Conductivity (Field Analysis)	1.26	0.00	1.40	1.40	1.76	1.22	0.00
Dissolved Oxygen	0.00	5.65	2.99	0.00	8.56	0.76	8.16
Oxidation Reduction Potential	-93	-40	-123	-127	-139	-149	-26
pH (Field Analysis)	7.22	5.32	7	6.34	7.17	7.24	6.22
Turbidity (Field Parameters)	0.8	221.0	55	1.7	78.0	19.0	664.0

Location	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105	MW-105
Field Sample ID	CMR-MW105S-211006	CMR-MW105-220317	MW105-GW-220622	CMR-MW105-220831	CMR-MW-105-221213	CMR-MW-105-230321	CMR-MW-105-230627
Sample Method	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
Sample Date	10/6/2021	3/17/2022	6/22/2022	8/31/2022	12/13/2022	3/21/2023	6/27/2023
FIELD PARAMETERS							
Specific Conductivity (Field Analysis)	1.99	1.98	2.16	2.19	2.25	2.16	0.00
Dissolved Oxygen	0.00	0.00	1.81	0.00	0.00	4.20	8.25
Oxidation Reduction Potential	-107	-81	-113	-53	49	121	144
pH (Field Analysis)	7.57	7.36	7.31	6.10	7.14	7.32	6.30
Turbidity (Field Parameters)	2.7	0	12.9	0	139	0	369

Location	MW-106	MW-106	MW-106	MW-106	MW-106	MW-106	MW-106
Field Sample ID	CMR-MW106-211005	CMR-MW106-220316	MW106-GW-220622	CMR-MW106-220831	CMR-MW-106-221213	CMR-MW-106-230321	CMR-MW-106-230628
Sample Method	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
Sample Date	10/5/2021	3/16/2022	6/22/2022	8/31/2022	12/13/2022	3/21/2023	6/28/2023
FIELD PARAMETERS							
Specific Conductivity (Field Analysis)	6.91	2.01	2.35	2.28	2.29	2.09	0.00
Dissolved Oxygen	0.00	0.02	0.85	0.00	8.16	2.90	9.03
Oxidation Reduction Potential	13	14	17	34	31	39	47
pH (Field Analysis)	8.07	7.50	7.27	6.57	7.54	7.23	6.74
Turbidity (Field Parameters)	3.1	0	101	423	90	0	519

Abbreviations:
NTU -- Nephelometric Turbidity unit,
mg/L -- milligram per liter
mS/cm -- millisiemens per centimeter
mV -- millivolt

Table 8
Summary of Groundwater Analytical Results - Biodegradation Indicators
Calumet Montana Refining, LLC - Great Falls, Montana

Location	MW-105	MW-106	MW-106	MW-106	MW-106
Field Sample ID	MW105-GW-220622	CMR-MW106-211005	MW106-GW-220622	CMR-MW-106-221213	CMR-MW-106-280623
Lab Sample ID	XF23073-003	WJ08009-001	XF23073-002	L1569525-02; XL14017-002	YF29005-001
Sample Method	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
Sample Date	6/22/2022	10/5/2021	6/22/2022	12/13/2022	6/28/2023
Comments					
Attenuation Parameters					
Alkalinity [mg/L CaCO3]	--	500 (20)	830 (20)	120 (20)	1,000 (20)
BOD (Five Day)	--	13,000 (180)	26,000 7 (180)	U (180)	U (180)
Carbon Dioxide	--	470,000 (27000)	810,000 (27000)	110,000 (27000)	960,000 (27000)
Iron	--	65 B (13)	15 J (13)	130 (13)	1,300 (130)
Iron (dissolved)	--	36 J (13)	130 J (130)	U (13)	1,200 (130)
Manganese	--	1,400 (13)	880 (1.3)	1,700 (13)	2,700 (13)
Manganese (dissolved)	--	1,400 (13)	890 (13)	1,500 (13)	2,800 (13)
Nitrate (as N)	--	210,000 (500)	4700 B (5)	750 H (50)	19,000 (20)
Sulfate	--	2,900,000 (25000)	210,000 (13000)	140,000 (250)	410,000 (5000)
Methane	55 B (2.5)	5.8 J (2.5)	62 B (2.5)	110 (2.5)	71 (2.5)

Notes:

1 All concentrations are presented in ug/L (ppb) unless otherwise noted.

Abbreviations:

U -- Not Detected.
J -- Estimated Concentration.
H -- Hold Time Exceeded.
( ) -- Detection Limit.

APPENDIX A
LABORATORY ANALYTICAL REPORTS

A1: Dual-Phase Extraction Vapor Analytical Results

A2: Dual-Phase Extraction Effluent Liquid Analytical Results

A3: Passive Treatment Trench Groundwater Analytical Results

APPENDIX A1

DUAL-PHASE EXTRACTION VAPOR ANALYTICAL RESULTS

Pace Project Number L1621775

Pace Project Number L1631252

ANALYTICAL REPORT

June 08, 2023

Ramboll - Chicago, IL

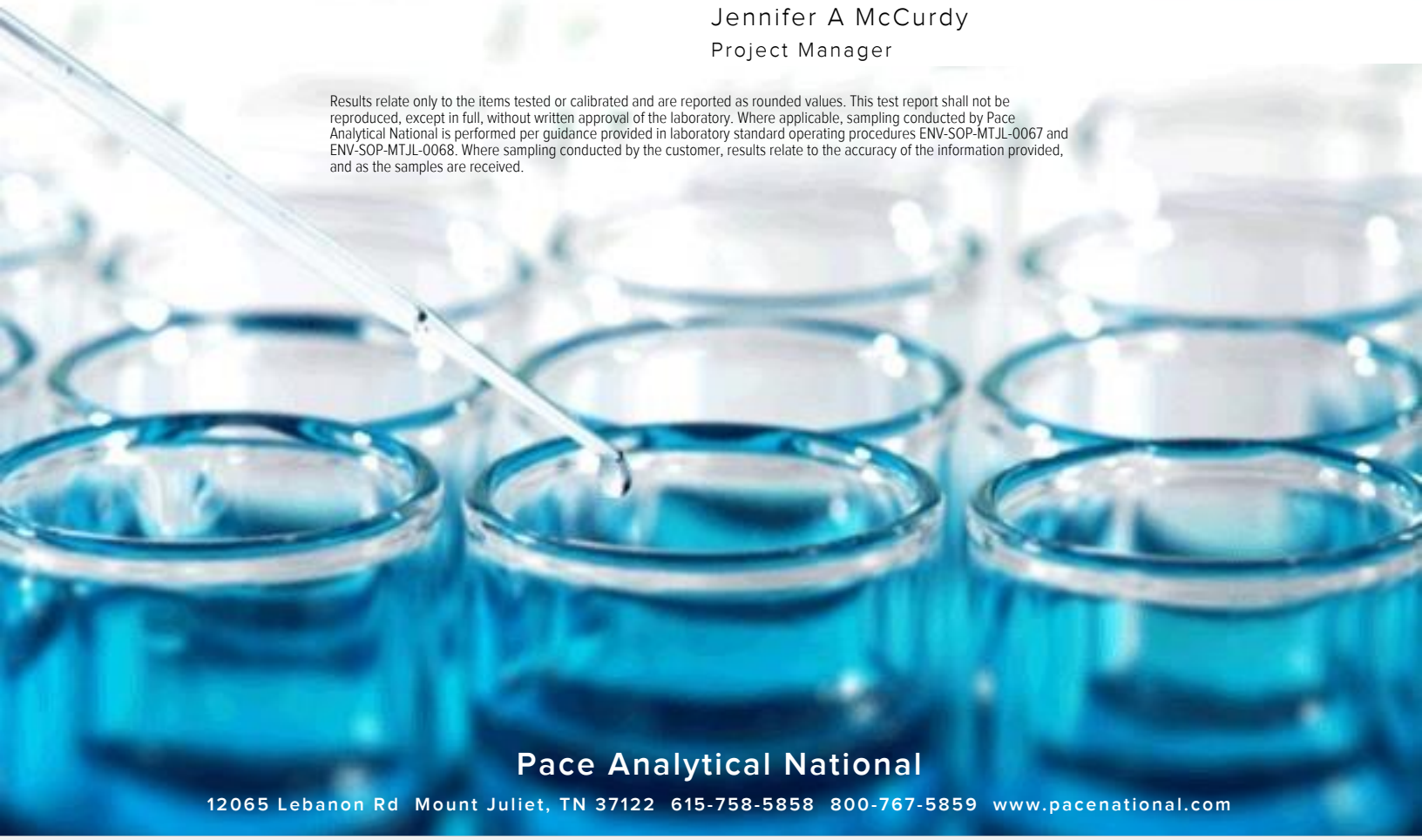
Sample Delivery Group:	L1621775
Samples Received:	06/01/2023
Project Number:	1690029636-002AOC-16
Description:	Calumet Refinery

Report To: Ruta Deshpande
333 West Wacker Drive
Suite 2700
Chicago, IL 60606

Entire Report Reviewed By:

Jennifer A McCurdy
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

CMR-SP301-230531 L1621775-01 5

Qc: Quality Control Summary 7

Volatile Organic Compounds (MS) by Method TO-15 7

Gl: Glossary of Terms 12

Al: Accreditations & Locations 13

Sc: Sample Chain of Custody 14

SAMPLE SUMMARY

CMR-SP301-230531 L1621775-01 Air

Collected by: Eric Poissant
Collected date/time: 05/31/23 16:05
Received date/time: 06/01/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (MS) by Method TO-15	WG2071706	1	06/05/23 18:04	06/05/23 18:04	JAP	Mt. Juliet, TN
Volatile Organic Compounds (MS) by Method TO-15	WG2073174	200	06/07/23 20:10	06/07/23 20:10	AA	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Jennifer A McCurdy
Project Manager

Volatile Organic Compounds (MS) by Method TO-15

Analyte	CAS #	Mol. Wt.	RDL1 ppbv	RDL2 ug/m3	Result ppbv	Result ug/m3	Qualifier	Dilution	Batch
Acetone	67-64-1	58.10	1.25	2.97	ND	ND		1	WG2071706
Allyl chloride	107-05-1	76.53	0.200	0.626	ND	ND		1	WG2071706
Benzene	71-43-2	78.10	40.0	128	64.5	206		200	WG2073174
Benzyl Chloride	100-44-7	127	40.0	208	ND	ND		200	WG2073174
Bromodichloromethane	75-27-4	164	0.200	1.34	ND	ND		1	WG2071706
Bromoform	75-25-2	253	120	1240	ND	ND		200	WG2073174
Bromomethane	74-83-9	94.90	0.200	0.776	ND	ND		1	WG2071706
1,3-Butadiene	106-99-0	54.10	2.00	4.43	ND	ND		1	WG2071706
Carbon disulfide	75-15-0	76.10	0.200	0.622	1.78	5.54		1	WG2071706
Carbon tetrachloride	56-23-5	154	0.200	1.26	ND	ND		1	WG2071706
Chlorobenzene	108-90-7	113	0.200	0.924	ND	ND		1	WG2071706
Chloroethane	75-00-3	64.50	0.200	0.528	ND	ND		1	WG2071706
Chloroform	67-66-3	119	0.200	0.973	ND	ND		1	WG2071706
Chloromethane	74-87-3	50.50	0.200	0.413	ND	ND		1	WG2071706
2-Chlorotoluene	95-49-8	126	40.0	206	ND	ND		200	WG2073174
Cyclohexane	110-82-7	84.20	40.0	138	80.8	278		200	WG2073174
Dibromochloromethane	124-48-1	208	0.200	1.70	ND	ND		1	WG2071706
1,2-Dibromoethane	106-93-4	188	0.200	1.54	ND	ND		1	WG2071706
1,2-Dichlorobenzene	95-50-1	147	40.0	240	ND	ND		200	WG2073174
1,3-Dichlorobenzene	541-73-1	147	40.0	240	ND	ND		200	WG2073174
1,4-Dichlorobenzene	106-46-7	147	40.0	240	ND	ND		200	WG2073174
1,2-Dichloroethane	107-06-2	99	0.200	0.810	ND	ND		1	WG2071706
1,1-Dichloroethane	75-34-3	98	0.200	0.802	ND	ND		1	WG2071706
1,1-Dichloroethene	75-35-4	96.90	0.200	0.793	ND	ND		1	WG2071706
cis-1,2-Dichloroethene	156-59-2	96.90	0.200	0.793	ND	ND		1	WG2071706
trans-1,2-Dichloroethene	156-60-5	96.90	0.200	0.793	ND	ND		1	WG2071706
1,2-Dichloropropane	78-87-5	113	0.200	0.924	ND	ND		1	WG2071706
cis-1,3-Dichloropropene	10061-01-5	111	0.200	0.908	ND	ND		1	WG2071706
trans-1,3-Dichloropropene	10061-02-6	111	0.200	0.908	ND	ND		1	WG2071706
1,4-Dioxane	123-91-1	88.10	0.200	0.721	ND	ND		1	WG2071706
Ethanol	64-17-5	46.10	2.50	4.71	31.6	59.6		1	WG2071706
Ethylbenzene	100-41-4	106	40.0	173	ND	ND		200	WG2073174
4-Ethyltoluene	622-96-8	120	40.0	196	ND	ND		200	WG2073174
Trichlorofluoromethane	75-69-4	137.40	0.200	1.12	0.227	1.28		1	WG2071706
Dichlorodifluoromethane	75-71-8	120.92	0.200	0.989	0.514	2.54		1	WG2071706
1,1,2-Trichlorotrifluoroethane	76-13-1	187.40	0.200	1.53	ND	ND		1	WG2071706
1,2-Dichlorotetrafluoroethane	76-14-2	171	0.200	1.40	ND	ND		1	WG2071706
Heptane	142-82-5	100	40.0	164	2850	11700		200	WG2073174
Hexachloro-1,3-butadiene	87-68-3	261	126	1350	ND	ND		200	WG2073174
n-Hexane	110-54-3	86.20	126	444	482	1700		200	WG2073174
Isopropylbenzene	98-82-8	120.20	40.0	197	ND	ND		200	WG2073174
Methylene Chloride	75-09-2	84.90	0.200	0.694	ND	ND		1	WG2071706
Methyl Butyl Ketone	591-78-6	100	1.25	5.11	ND	ND		1	WG2071706
2-Butanone (MEK)	78-93-3	72.10	1.25	3.69	7.61	22.4		1	WG2071706
4-Methyl-2-pentanone (MIBK)	108-10-1	100.10	1.25	5.12	ND	ND		1	WG2071706
Methyl methacrylate	80-62-6	100.12	0.200	0.819	ND	ND		1	WG2071706
MTBE	1634-04-4	88.10	0.200	0.721	ND	ND		1	WG2071706
Naphthalene	91-20-3	128	126	660	ND	ND		200	WG2073174
2-Propanol	67-63-0	60.10	1.25	3.07	5.14	12.6		1	WG2071706
Propene	115-07-1	42.10	1.25	2.15	15.5	26.7		1	WG2071706
Styrene	100-42-5	104	40.0	170	ND	ND		200	WG2073174
1,1,2,2-Tetrachloroethane	79-34-5	168	40.0	275	ND	ND		200	WG2073174
Tetrachloroethylene	127-18-4	166	0.200	1.36	0.535	3.63		1	WG2071706
Tetrahydrofuran	109-99-9	72.10	0.200	0.590	ND	ND		1	WG2071706
Toluene	108-88-3	92.10	0.500	1.88	38.7	146		1	WG2071706
1,2,4-Trichlorobenzene	120-82-1	181	126	933	ND	ND		200	WG2073174

Volatile Organic Compounds (MS) by Method TO-15

Analyte	CAS #	Mol. Wt.	RDL1 ppbv	RDL2 ug/m3	Result ppbv	Result ug/m3	Qualifier	Dilution	Batch
1,1,1-Trichloroethane	71-55-6	133	0.200	1.09	ND	ND		1	WG2071706
1,1,2-Trichloroethane	79-00-5	133	0.200	1.09	ND	ND		1	WG2071706
Trichloroethylene	79-01-6	131	0.200	1.07	ND	ND		1	WG2071706
1,2,4-Trimethylbenzene	95-63-6	120	40.0	196	ND	ND		200	WG2073174
1,3,5-Trimethylbenzene	108-67-8	120	40.0	196	ND	ND		200	WG2073174
2,2,4-Trimethylpentane	540-84-1	114.22	40.0	187	623	2910		200	WG2073174
Vinyl chloride	75-01-4	62.50	0.200	0.511	ND	ND		1	WG2071706
Vinyl Bromide	593-60-2	106.95	0.200	0.875	ND	ND		1	WG2071706
Vinyl acetate	108-05-4	86.10	0.200	0.704	ND	ND		1	WG2071706
Xylenes, Total	1330-20-7	106.16	120	521	192	834		200	WG2073174
m&p-Xylene	1330-20-7	106	80.0	347	148	642		200	WG2073174
o-Xylene	95-47-6	106	40.0	173	43.6	189		200	WG2073174
(S) 1,4-Bromofluorobenzene	*460-00-4*	*175*	*60.0-140*		*397*		J1		WG2071706
(S) 1,4-Bromofluorobenzene	*460-00-4*	*175*	*60.0-140*		*96.9*				WG2073174

Sample Narrative:

L1621775-01 WG2071706: Surrogate failure due to matrix interference

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3933283-3 06/05/23 09:46

Analyte	MB Result ppbv	MB Qualifier	MB MDL ppbv	MB RDL ppbv
Acetone	U		0.584	1.25
Allyl chloride	U		0.114	0.200
Bromodichloromethane	U		0.0702	0.200
Bromomethane	U		0.0982	0.200
1,3-Butadiene	U		0.104	2.00
Carbon disulfide	U		0.102	0.200
Carbon tetrachloride	U		0.0732	0.200
Chlorobenzene	U		0.0832	0.200
Chloroethane	U		0.0996	0.200
Chloroform	U		0.0717	0.200
Chloromethane	U		0.103	0.200
Dibromochloromethane	U		0.0727	0.200
1,2-Dibromoethane	U		0.0721	0.200
1,2-Dichloroethane	U		0.0700	0.200
1,1-Dichloroethane	U		0.0723	0.200
1,1-Dichloroethene	U		0.0762	0.200
cis-1,2-Dichloroethene	U		0.0784	0.200
trans-1,2-Dichloroethene	U		0.0673	0.200
1,2-Dichloropropane	U		0.0760	0.200
cis-1,3-Dichloropropene	U		0.0689	0.200
trans-1,3-Dichloropropene	U		0.0728	0.200
1,4-Dioxane	U		0.0833	0.200
Ethanol	1.54	J	0.265	2.50
Trichlorofluoromethane	U		0.0819	0.200
Dichlorodifluoromethane	U		0.137	0.200
1,1,2-Trichlorotrifluoroethane	U		0.0793	0.200
1,2-Dichlorotetrafluoroethane	U		0.0890	0.200
Methylene Chloride	0.104	J	0.0979	0.200
Methyl Butyl Ketone	U		0.133	1.25
2-Butanone (MEK)	U		0.0814	1.25
4-Methyl-2-pentanone (MIBK)	U		0.0765	1.25
Methyl methacrylate	U		0.0876	0.200
MTBE	U		0.0647	0.200
2-Propanol	U		0.264	1.25
Propene	U		0.0932	1.25
Tetrachloroethylene	U		0.0814	0.200
Tetrahydrofuran	U		0.0734	0.200
Toluene	U		0.0870	0.500
1,1,1-Trichloroethane	U		0.0736	0.200
1,1,2-Trichloroethane	U		0.0775	0.200

Method Blank (MB)

(MB) R3933283-3 06/05/23 09:46

Analyte	MB Result ppbv	MB Qualifier	MB MDL ppbv	MB RDL ppbv
Trichloroethylene	U		0.0680	0.200
Vinyl chloride	U		0.0949	0.200
Vinyl Bromide	U		0.0852	0.200
Vinyl acetate	U		0.116	0.200
(S) 1,4-Bromofluorobenzene	*107*			*60.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3933283-1 06/05/23 08:46 • (LCSD) R3933283-2 06/05/23 09:17

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	3.75	3.71	3.63	98.9	96.8	70.0-130			2.18	25
Allyl chloride	3.75	3.89	3.91	104	104	70.0-130			0.513	25
Bromodichloromethane	3.75	3.88	3.95	103	105	70.0-130			1.79	25
Bromomethane	3.75	3.94	3.86	105	103	70.0-130			2.05	25
1,3-Butadiene	3.75	3.88	3.82	103	102	70.0-130			1.56	25
Carbon disulfide	3.75	3.92	3.89	105	104	70.0-130			0.768	25
Carbon tetrachloride	3.75	3.82	3.92	102	105	70.0-130			2.58	25
Chlorobenzene	3.75	4.00	3.99	107	106	70.0-130			0.250	25
Chloroethane	3.75	3.89	3.82	104	102	70.0-130			1.82	25
Chloroform	3.75	3.82	3.90	102	104	70.0-130			2.07	25
Chloromethane	3.75	3.94	3.83	105	102	70.0-130			2.83	25
Dibromochloromethane	3.75	4.06	4.11	108	110	70.0-130			1.22	25
1,2-Dibromoethane	3.75	4.08	4.08	109	109	70.0-130			0.000	25
1,2-Dichloroethane	3.75	3.79	3.87	101	103	70.0-130			2.09	25
1,1-Dichloroethane	3.75	3.79	3.84	101	102	70.0-130			1.31	25
1,1-Dichloroethene	3.75	3.81	3.84	102	102	70.0-130			0.784	25
cis-1,2-Dichloroethene	3.75	3.80	3.88	101	103	70.0-130			2.08	25
trans-1,2-Dichloroethene	3.75	3.84	3.84	102	102	70.0-130			0.000	25
1,2-Dichloropropane	3.75	3.85	3.94	103	105	70.0-130			2.31	25
cis-1,3-Dichloropropene	3.75	3.98	4.03	106	107	70.0-130			1.25	25
trans-1,3-Dichloropropene	3.75	4.04	4.05	108	108	70.0-130			0.247	25
1,4-Dioxane	3.75	4.04	3.52	108	93.9	70.0-140			13.8	25
Ethanol	3.75	3.63	3.49	96.8	93.1	55.0-148			3.93	25
Trichlorofluoromethane	3.75	3.88	3.85	103	103	70.0-130			0.776	25
Dichlorodifluoromethane	3.75	4.13	4.00	110	107	64.0-139			3.20	25
1,1,2-Trichlorotrifluoroethane	3.75	3.80	3.87	101	103	70.0-130			1.83	25
1,2-Dichlorotetrafluoroethane	3.75	3.99	3.90	106	104	70.0-130			2.28	25
Methylene Chloride	3.75	3.78	3.82	101	102	70.0-130			1.05	25

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3933283-1 06/05/23 08:46 • (LCSD) R3933283-2 06/05/23 09:17

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Methyl Butyl Ketone	3.75	4.14	3.65	110	97.3	70.0-149			12.6	25
2-Butanone (MEK)	3.75	3.81	3.44	102	91.7	70.0-130			10.2	25
4-Methyl-2-pentanone (MIBK)	3.75	3.98	3.63	106	96.8	70.0-139			9.20	25
Methyl methacrylate	3.75	3.96	3.59	106	95.7	70.0-130			9.80	25
MTBE	3.75	3.81	3.48	102	92.8	70.0-130			9.05	25
2-Propanol	3.75	3.78	3.52	101	93.9	70.0-139			7.12	25
Propene	3.75	3.99	3.84	106	102	64.0-144			3.83	25
Tetrachloroethylene	3.75	3.89	3.94	104	105	70.0-130			1.28	25
Tetrahydrofuran	3.75	3.85	3.53	103	94.1	70.0-137			8.67	25
Toluene	3.75	3.86	3.94	103	105	70.0-130			2.05	25
1,1,1-Trichloroethane	3.75	3.82	3.91	102	104	70.0-130			2.33	25
1,1,2-Trichloroethane	3.75	3.95	3.95	105	105	70.0-130			0.000	25
Trichloroethylene	3.75	3.85	3.91	103	104	70.0-130			1.55	25
Vinyl chloride	3.75	3.99	3.90	106	104	70.0-130			2.28	25
Vinyl Bromide	3.75	3.90	3.88	104	103	70.0-130			0.514	25
Vinyl acetate	3.75	3.41	3.21	90.9	85.6	70.0-130			6.04	25
(S) 1,4-Bromofluorobenzene				*106*	*101*	*60.0-140*				

Method Blank (MB)

(MB) R3934164-2 06/07/23 10:14

Analyte	MB Result ppbv	MB Qualifier	MB MDL ppbv	MB RDL ppbv
Benzene	U		0.0715	0.200
Benzyl Chloride	U		0.0598	0.200
Bromoform	U		0.0732	0.600
2-Chlorotoluene	U		0.0828	0.200
Cyclohexane	U		0.0753	0.200
1,2-Dichlorobenzene	U		0.128	0.200
1,3-Dichlorobenzene	U		0.182	0.200
1,4-Dichlorobenzene	U		0.0557	0.200
Ethylbenzene	U		0.0835	0.200
4-Ethyltoluene	U		0.0783	0.200
Heptane	U		0.104	0.200
Hexachloro-1,3-butadiene	U		0.105	0.630
n-Hexane	U		0.206	0.630
Isopropylbenzene	U		0.0777	0.200
Naphthalene	U		0.350	0.630
Styrene	U		0.0788	0.200
1,1,2,2-Tetrachloroethane	U		0.0743	0.200
1,2,4-Trichlorobenzene	U		0.148	0.630
1,2,4-Trimethylbenzene	U		0.0764	0.200
1,3,5-Trimethylbenzene	U		0.0779	0.200
2,2,4-Trimethylpentane	U		0.133	0.200
Xylenes, Total	U		0.135	0.600
m&p-Xylene	U		0.135	0.400
o-Xylene	U		0.0828	0.200
(S) 1,4-Bromofluorobenzene	*95.4*			*60.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3934164-1 06/07/23 09:37 • (LCSD) R3934164-3 06/07/23 11:18

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	3.75	3.99	4.18	106	111	70.0-130			4.65	25
Benzyl Chloride	3.75	4.23	4.30	113	115	70.0-152			1.64	25
Bromoform	3.75	4.06	4.12	108	110	70.0-130			1.47	25
2-Chlorotoluene	3.75	4.11	4.06	110	108	70.0-130			1.22	25
Cyclohexane	3.75	3.98	3.97	106	106	70.0-130			0.252	25
1,2-Dichlorobenzene	3.75	4.08	4.06	109	108	70.0-130			0.491	25
1,3-Dichlorobenzene	3.75	4.13	4.17	110	111	70.0-130			0.964	25
1,4-Dichlorobenzene	3.75	4.07	4.13	109	110	70.0-130			1.46	25

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3934164-1 06/07/23 09:37 • (LCSD) R3934164-3 06/07/23 11:18

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Ethylbenzene	3.75	4.09	4.14	109	110	70.0-130			1.22	25
4-Ethyltoluene	3.75	4.21	4.23	112	113	70.0-130			0.474	25
Heptane	3.75	4.00	4.05	107	108	70.0-130			1.24	25
Hexachloro-1,3-butadiene	3.75	3.99	3.99	106	106	70.0-151			0.000	25
n-Hexane	3.75	3.90	4.02	104	107	70.0-130			3.03	25
Isopropylbenzene	3.75	4.07	4.09	109	109	70.0-130			0.490	25
Naphthalene	3.75	4.34	4.59	116	122	70.0-159			5.60	25
Styrene	3.75	4.19	4.14	112	110	70.0-130			1.20	25
1,1,2,2-Tetrachloroethane	3.75	4.11	4.20	110	112	70.0-130			2.17	25
1,2,4-Trichlorobenzene	3.75	4.21	4.36	112	116	70.0-160			3.50	25
1,2,4-Trimethylbenzene	3.75	4.14	4.19	110	112	70.0-130			1.20	25
1,3,5-Trimethylbenzene	3.75	4.24	4.25	113	113	70.0-130			0.236	25
2,2,4-Trimethylpentane	3.75	3.98	4.19	106	112	70.0-130			5.14	25
Xylenes, Total	11.3	12.5	12.6	111	112	70.0-130			0.797	25
m&p-Xylene	7.50	8.34	8.42	111	112	70.0-130			0.955	25
o-Xylene	3.75	4.12	4.17	110	111	70.0-130			1.21	25
(S) 1,4-Bromofluorobenzene				*98.7*	*98.1*	*60.0-140*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Ramboll - Chicago, IL

333 West Wacker Drive

Suite 2700

Billing Information:
Ruta Deshpande
333 West Wacker Drive

Suite 2700
Chicago, IL 60606

Report To:
Ruta Deshpande

Email To:
rdeshpande@ramboll.com

Project Description: Calumet Refinery

City/State Collected: Great Falls MT

Please Circle: PT MT CT ET

Phone: **312-288-3854**

Client Project # **1690029636-002AOC-16**

Lab Project # **RAMBOLLCIL-1690029636**

Collected by (print): Eric Toissant

Site/Facility ID #

P.O. # 1690029636-001

Collected by (signature):

Rush? (Lab MUST Be Notified)
___ Same Day ___ Three Day
___ Next Day ___ Five Day
___ Two Day

Date Results Needed

Sample ID	Can #	Flow Cont. #	Collection Date	Collection Time	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final	TO-15 Summa	Rem./Contaminant	Sample # (lab only)
CMR-SI301-230531	2200	02244 5	5/31/23	1605	27	0	X		-01

Analysis

Chain of Custody Page ___ of ___

Pace
PEOPLE ADVANCING SCIENCE
MT JULIET, TN
12065 Lebanon Road Mt Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1621775
J126

Acctnum: **RAMBOLLCIL**
Template: **T224808**
Prelogin: **P992060**
PM: 3828 - Jennifer A McCurdy
PB: SW 5/10/23
Shipped Via: **FedEX Ground**

Sample Receipt Checklist

COC Seal Present/Intact:	Y N	If Applicable	
COC Signed/Accurate:	Y N	VOA Zero Headspace:	Y N
Bottles arrive intact:	Y N	Pres.Correct/Check:	Y N
Correct bottles used:	Y N		
Sufficient volume sent:	Y N		
RAD Screen <0.5 mR/hr:	Y N		

Remarks:

Samples returned via: __ UPS X FedEx __ Courier __ _____

Tracking #

Hold #

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Eric Toissant Ramboll	05/31/23		Fed EX		
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 6/1/23	Time: 0900

Condition: (lab use only)

COC Seal Intact: ___Y ___N ___NA

NCF:

ANALYTICAL REPORT

July 06, 2023

Ramboll - Chicago, IL

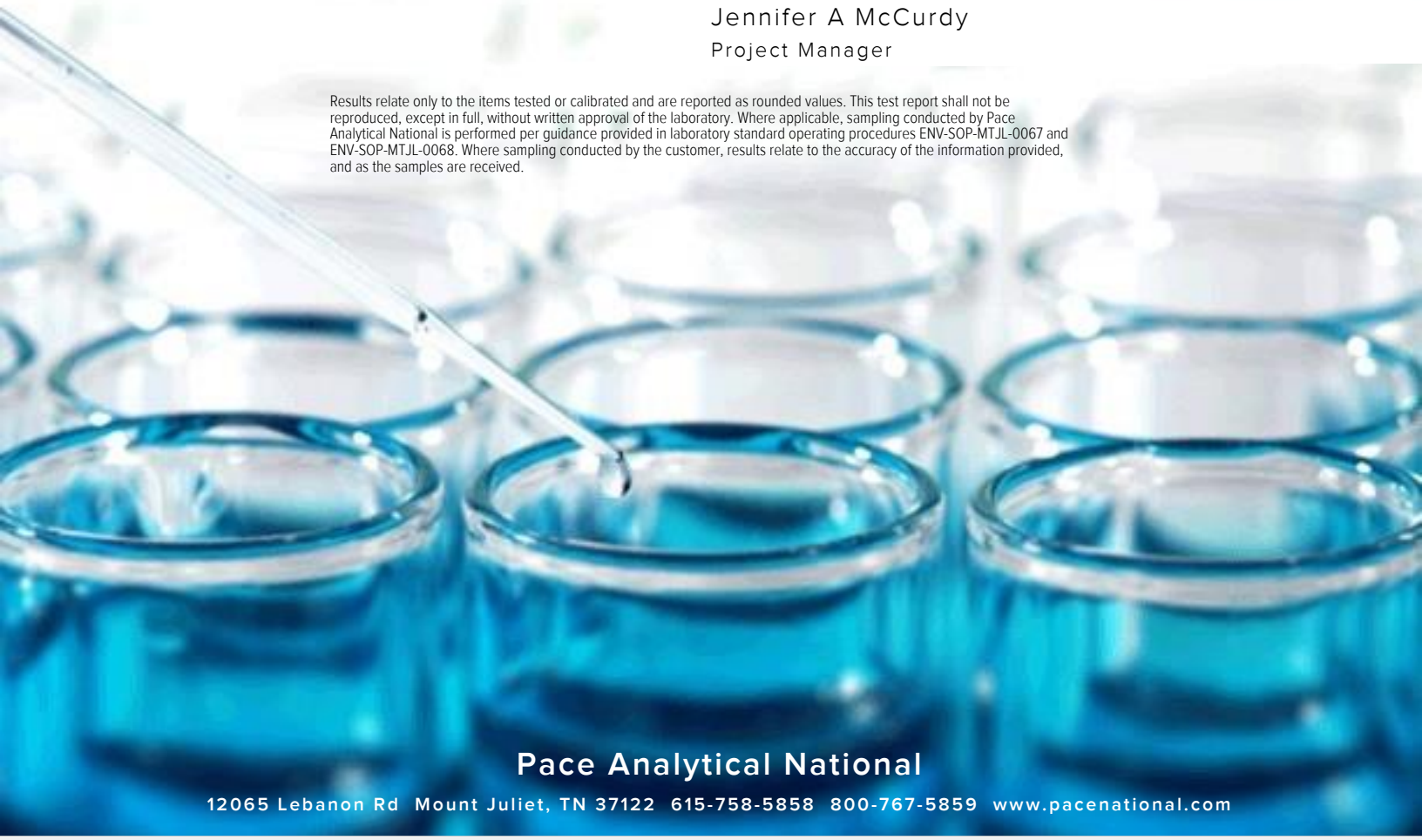
Sample Delivery Group:	L1631252
Samples Received:	06/30/2023
Project Number:	1690029636-002AOC-16
Description:	Calumet Refinery

Report To: Ruta Deshpande
333 West Wacker Drive
Suite 2700
Chicago, IL 60606

Entire Report Reviewed By:

Jennifer A McCurdy
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

CMR-SP301-290623 L1631252-01 5

Qc: Quality Control Summary 7

Volatile Organic Compounds (MS) by Method TO-15 7

Gl: Glossary of Terms 12

Al: Accreditations & Locations 13

Sc: Sample Chain of Custody 14

SAMPLE SUMMARY

CMR-SP301-290623 L1631252-01 Air

Collected by: Sarah Hall
Collected date/time: 06/29/23 11:05
Received date/time: 06/30/23 09:05

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (MS) by Method TO-15	WG2087905	1	07/01/23 09:58	07/01/23 09:58	DBB	Mt. Juliet, TN
Volatile Organic Compounds (MS) by Method TO-15	WG2089383	100	07/04/23 15:54	07/04/23 15:54	JAP	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Jennifer A McCurdy
Project Manager

Volatile Organic Compounds (MS) by Method TO-15

Analyte	CAS #	Mol. Wt.	RDL1 ppbv	RDL2 ug/m3	Result ppbv	Result ug/m3	Qualifier	Dilution	Batch
Acetone	67-64-1	58.10	1.25	2.97	ND	ND		1	WG2087905
Allyl chloride	107-05-1	76.53	0.200	0.626	ND	ND		1	WG2087905
Benzene	71-43-2	78.10	0.200	0.639	ND	ND		1	WG2087905
Benzyl Chloride	100-44-7	127	0.200	1.04	ND	ND		1	WG2087905
Bromodichloromethane	75-27-4	164	0.200	1.34	ND	ND		1	WG2087905
Bromoform	75-25-2	253	0.600	6.21	ND	ND		1	WG2087905
Bromomethane	74-83-9	94.90	0.200	0.776	ND	ND		1	WG2087905
1,3-Butadiene	106-99-0	54.10	2.00	4.43	ND	ND		1	WG2087905
Carbon disulfide	75-15-0	76.10	0.200	0.622	ND	ND		1	WG2087905
Carbon tetrachloride	56-23-5	154	0.200	1.26	ND	ND		1	WG2087905
Chlorobenzene	108-90-7	113	0.200	0.924	ND	ND		1	WG2087905
Chloroethane	75-00-3	64.50	0.200	0.528	ND	ND		1	WG2087905
Chloroform	67-66-3	119	0.200	0.973	ND	ND		1	WG2087905
Chloromethane	74-87-3	50.50	0.200	0.413	0.344	0.711		1	WG2087905
2-Chlorotoluene	95-49-8	126	0.200	1.03	ND	ND		1	WG2087905
Cyclohexane	110-82-7	84.20	20.0	68.9	906	3120		100	WG2089383
Dibromochloromethane	124-48-1	208	0.200	1.70	ND	ND		1	WG2087905
1,2-Dibromoethane	106-93-4	188	0.200	1.54	ND	ND		1	WG2087905
1,2-Dichlorobenzene	95-50-1	147	0.200	1.20	ND	ND		1	WG2087905
1,3-Dichlorobenzene	541-73-1	147	0.200	1.20	ND	ND		1	WG2087905
1,4-Dichlorobenzene	106-46-7	147	0.200	1.20	ND	ND		1	WG2087905
1,2-Dichloroethane	107-06-2	99	0.200	0.810	ND	ND		1	WG2087905
1,1-Dichloroethane	75-34-3	98	0.200	0.802	ND	ND		1	WG2087905
1,1-Dichloroethene	75-35-4	96.90	0.200	0.793	ND	ND		1	WG2087905
cis-1,2-Dichloroethene	156-59-2	96.90	0.200	0.793	ND	ND		1	WG2087905
trans-1,2-Dichloroethene	156-60-5	96.90	0.200	0.793	ND	ND		1	WG2087905
1,2-Dichloropropane	78-87-5	113	0.200	0.924	ND	ND		1	WG2087905
cis-1,3-Dichloropropene	10061-01-5	111	0.200	0.908	ND	ND		1	WG2087905
trans-1,3-Dichloropropene	10061-02-6	111	0.200	0.908	ND	ND		1	WG2087905
1,4-Dioxane	123-91-1	88.10	0.200	0.721	ND	ND		1	WG2087905
Ethanol	64-17-5	46.10	2.50	4.71	7.00	13.2		1	WG2087905
Ethylbenzene	100-41-4	106	0.200	0.867	36.9	160		1	WG2087905
4-Ethyltoluene	622-96-8	120	0.200	0.982	ND	ND		1	WG2087905
Trichlorofluoromethane	75-69-4	137.40	0.200	1.12	0.201	1.13		1	WG2087905
Dichlorodifluoromethane	75-71-8	120.92	0.200	0.989	0.462	2.28		1	WG2087905
1,1,2-Trichlorotrifluoroethane	76-13-1	187.40	0.200	1.53	ND	ND		1	WG2087905
1,2-Dichlorotetrafluoroethane	76-14-2	171	0.200	1.40	ND	ND		1	WG2087905
Heptane	142-82-5	100	20.0	81.8	714	2920		100	WG2089383
Hexachloro-1,3-butadiene	87-68-3	261	0.630	6.73	ND	ND		1	WG2087905
n-Hexane	110-54-3	86.20	63.0	222	2630	9270		100	WG2089383
Isopropylbenzene	98-82-8	120.20	0.200	0.983	0.560	2.75		1	WG2087905
Methylene Chloride	75-09-2	84.90	0.200	0.694	ND	ND		1	WG2087905
Methyl Butyl Ketone	591-78-6	100	1.25	5.11	ND	ND		1	WG2087905
2-Butanone (MEK)	78-93-3	72.10	1.25	3.69	ND	ND		1	WG2087905
4-Methyl-2-pentanone (MIBK)	108-10-1	100.10	1.25	5.12	ND	ND		1	WG2087905
Methyl methacrylate	80-62-6	100.12	0.200	0.819	ND	ND		1	WG2087905
MTBE	1634-04-4	88.10	0.200	0.721	ND	ND		1	WG2087905
Naphthalene	91-20-3	128	0.630	3.30	ND	ND		1	WG2087905
2-Propanol	67-63-0	60.10	1.25	3.07	ND	ND		1	WG2087905
Propene	115-07-1	42.10	1.25	2.15	8.42	14.5		1	WG2087905
Styrene	100-42-5	104	0.200	0.851	ND	ND		1	WG2087905
1,1,2,2-Tetrachloroethane	79-34-5	168	0.200	1.37	ND	ND		1	WG2087905
Tetrachloroethylene	127-18-4	166	0.200	1.36	ND	ND		1	WG2087905
Tetrahydrofuran	109-99-9	72.10	0.200	0.590	ND	ND		1	WG2087905
Toluene	108-88-3	92.10	0.500	1.88	42.3	159		1	WG2087905
1,2,4-Trichlorobenzene	120-82-1	181	0.630	4.66	ND	ND		1	WG2087905

Volatile Organic Compounds (MS) by Method TO-15

Analyte	CAS #	Mol. Wt.	RDL1 ppbv	RDL2 ug/m3	Result ppbv	Result ug/m3	Qualifier	Dilution	Batch
1,1,1-Trichloroethane	71-55-6	133	0.200	1.09	ND	ND		1	WG2087905
1,1,2-Trichloroethane	79-00-5	133	0.200	1.09	ND	ND		1	WG2087905
Trichloroethylene	79-01-6	131	0.200	1.07	ND	ND		1	WG2087905
1,2,4-Trimethylbenzene	95-63-6	120	0.200	0.982	0.879	4.31		1	WG2087905
1,3,5-Trimethylbenzene	108-67-8	120	0.200	0.982	0.378	1.86		1	WG2087905
2,2,4-Trimethylpentane	540-84-1	114.22	0.200	0.934	ND	ND		1	WG2087905
Vinyl chloride	75-01-4	62.50	0.200	0.511	ND	ND		1	WG2087905
Vinyl Bromide	593-60-2	106.95	0.200	0.875	ND	ND		1	WG2087905
Vinyl acetate	108-05-4	86.10	0.200	0.704	ND	ND		1	WG2087905
Xylenes, Total	1330-20-7	106.16	0.600	2.61	61.5	267		1	WG2087905
m&p-Xylene	1330-20-7	106	0.400	1.73	51.0	221		1	WG2087905
o-Xylene	95-47-6	106	0.200	0.867	10.5	45.5		1	WG2087905
(S) 1,4-Bromofluorobenzene	*460-00-4*	*175*	*60.0-140*		*119*				WG2087905
(S) 1,4-Bromofluorobenzene	*460-00-4*	*175*	*60.0-140*		*102*				WG2089383

Method Blank (MB)

(MB) R3944265-3 07/01/23 08:08

Analyte	MB Result ppbv	MB Qualifier	MB MDL ppbv	MB RDL ppbv
Acetone	U		0.584	1.25
Allyl chloride	U		0.114	0.200
Benzene	U		0.0715	0.200
Benzyl Chloride	U		0.0598	0.200
Bromodichloromethane	U		0.0702	0.200
Bromoform	U		0.0732	0.600
Bromomethane	U		0.0982	0.200
1,3-Butadiene	U		0.104	2.00
Carbon disulfide	U		0.102	0.200
Carbon tetrachloride	U		0.0732	0.200
Chlorobenzene	U		0.0832	0.200
Chloroethane	U		0.0996	0.200
Chloroform	U		0.0717	0.200
Chloromethane	U		0.103	0.200
2-Chlorotoluene	U		0.0828	0.200
Dibromochloromethane	U		0.0727	0.200
1,2-Dibromoethane	U		0.0721	0.200
1,2-Dichlorobenzene	U		0.128	0.200
1,3-Dichlorobenzene	U		0.182	0.200
1,4-Dichlorobenzene	U		0.0557	0.200
1,2-Dichloroethane	U		0.0700	0.200
1,1-Dichloroethane	U		0.0723	0.200
1,1-Dichloroethene	U		0.0762	0.200
cis-1,2-Dichloroethene	U		0.0784	0.200
trans-1,2-Dichloroethene	U		0.0673	0.200
1,2-Dichloropropane	U		0.0760	0.200
cis-1,3-Dichloropropene	U		0.0689	0.200
trans-1,3-Dichloropropene	U		0.0728	0.200
1,4-Dioxane	U		0.0833	0.200
Ethanol	U		0.265	2.50
Ethylbenzene	U		0.0835	0.200
4-Ethyltoluene	U		0.0783	0.200
Trichlorofluoromethane	U		0.0819	0.200
Dichlorodifluoromethane	U		0.137	0.200
1,1,2-Trichlorotrifluoroethane	U		0.0793	0.200
1,2-Dichlorotetrafluoroethane	U		0.0890	0.200
Hexachloro-1,3-butadiene	U		0.105	0.630
Isopropylbenzene	U		0.0777	0.200
Methylene Chloride	U		0.0979	0.200
Methyl Butyl Ketone	U		0.133	1.25

Method Blank (MB)

(MB) R3944265-3 07/01/23 08:08

Analyte	MB Result ppbv	MB Qualifier	MB MDL ppbv	MB RDL ppbv
2-Butanone (MEK)	U		0.0814	1.25
4-Methyl-2-pentanone (MIBK)	U		0.0765	1.25
Methyl methacrylate	U		0.0876	0.200
MTBE	U		0.0647	0.200
Naphthalene	U		0.350	0.630
2-Propanol	U		0.264	1.25
Propene	U		0.0932	1.25
Styrene	U		0.0788	0.200
1,1,2,2-Tetrachloroethane	U		0.0743	0.200
Tetrachloroethylene	U		0.0814	0.200
Tetrahydrofuran	U		0.0734	0.200
Toluene	U		0.0870	0.500
1,2,4-Trichlorobenzene	U		0.148	0.630
1,1,1-Trichloroethane	U		0.0736	0.200
1,1,2-Trichloroethane	U		0.0775	0.200
Trichloroethylene	U		0.0680	0.200
1,2,4-Trimethylbenzene	U		0.0764	0.200
1,3,5-Trimethylbenzene	U		0.0779	0.200
2,2,4-Trimethylpentane	U		0.133	0.200
Vinyl chloride	U		0.0949	0.200
Vinyl Bromide	U		0.0852	0.200
Vinyl acetate	U		0.116	0.200
Xylenes, Total	U		0.135	0.600
m&p-Xylene	U		0.135	0.400
o-Xylene	U		0.0828	0.200
(S) 1,4-Bromofluorobenzene	*97.8*			*60.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3944265-1 07/01/23 07:11 • (LCSD) R3944265-2 07/01/23 07:41

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	3.75	3.98	3.89	106	104	70.0-130			2.29	25
Allyl chloride	3.75	3.88	3.82	103	102	70.0-130			1.56	25
Benzene	3.75	4.15	4.05	111	108	70.0-130			2.44	25
Benzyl Chloride	3.75	4.10	3.90	109	104	70.0-152			5.00	25
Bromodichloromethane	3.75	4.16	4.09	111	109	70.0-130			1.70	25
Bromoform	3.75	3.87	3.79	103	101	70.0-130			2.09	25
Bromomethane	3.75	3.82	3.76	102	100	70.0-130			1.58	25

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3944265-1 07/01/23 07:11 • (LCSD) R3944265-2 07/01/23 07:41

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,3-Butadiene	3.75	3.97	3.95	106	105	70.0-130			0.505	25
Carbon disulfide	3.75	3.98	3.86	106	103	70.0-130			3.06	25
Carbon tetrachloride	3.75	4.03	3.92	107	105	70.0-130			2.77	25
Chlorobenzene	3.75	3.97	3.99	106	106	70.0-130			0.503	25
Chloroethane	3.75	3.78	3.71	101	98.9	70.0-130			1.87	25
Chloroform	3.75	3.93	3.93	105	105	70.0-130			0.000	25
Chloromethane	3.75	3.77	3.76	101	100	70.0-130			0.266	25
2-Chlorotoluene	3.75	4.05	4.00	108	107	70.0-130			1.24	25
Dibromochloromethane	3.75	4.21	4.03	112	107	70.0-130			4.37	25
1,2-Dibromoethane	3.75	4.05	3.87	108	103	70.0-130			4.55	25
1,2-Dichlorobenzene	3.75	3.99	3.98	106	106	70.0-130			0.251	25
1,3-Dichlorobenzene	3.75	4.15	4.08	111	109	70.0-130			1.70	25
1,4-Dichlorobenzene	3.75	4.04	3.98	108	106	70.0-130			1.50	25
1,2-Dichloroethane	3.75	4.08	4.11	109	110	70.0-130			0.733	25
1,1-Dichloroethane	3.75	4.06	4.03	108	107	70.0-130			0.742	25
1,1-Dichloroethene	3.75	3.91	3.89	104	104	70.0-130			0.513	25
cis-1,2-Dichloroethene	3.75	4.03	4.00	107	107	70.0-130			0.747	25
trans-1,2-Dichloroethene	3.75	4.00	4.01	107	107	70.0-130			0.250	25
1,2-Dichloropropane	3.75	4.21	4.04	112	108	70.0-130			4.12	25
cis-1,3-Dichloropropene	3.75	4.10	4.12	109	110	70.0-130			0.487	25
trans-1,3-Dichloropropene	3.75	4.03	3.99	107	106	70.0-130			0.998	25
1,4-Dioxane	3.75	3.84	3.78	102	101	70.0-140			1.57	25
Ethanol	3.75	3.80	3.77	101	101	55.0-148			0.793	25
Ethylbenzene	3.75	4.02	4.01	107	107	70.0-130			0.249	25
4-Ethyltoluene	3.75	4.12	4.10	110	109	70.0-130			0.487	25
Trichlorofluoromethane	3.75	3.83	3.88	102	103	70.0-130			1.30	25
Dichlorodifluoromethane	3.75	3.89	3.81	104	102	64.0-139			2.08	25
1,1,2-Trichlorotrifluoroethane	3.75	3.85	3.80	103	101	70.0-130			1.31	25
1,2-Dichlorotetrafluoroethane	3.75	3.86	3.79	103	101	70.0-130			1.83	25
Hexachloro-1,3-butadiene	3.75	3.66	3.74	97.6	99.7	70.0-151			2.16	25
Isopropylbenzene	3.75	4.05	3.94	108	105	70.0-130			2.75	25
Methylene Chloride	3.75	3.77	3.83	101	102	70.0-130			1.58	25
Methyl Butyl Ketone	3.75	4.23	4.11	113	110	70.0-149			2.88	25
2-Butanone (MEK)	3.75	4.04	3.98	108	106	70.0-130			1.50	25
4-Methyl-2-pentanone (MIBK)	3.75	4.22	4.12	113	110	70.0-139			2.40	25
Methyl methacrylate	3.75	4.03	3.94	107	105	70.0-130			2.26	25
MTBE	3.75	3.96	3.91	106	104	70.0-130			1.27	25
Naphthalene	3.75	4.25	4.14	113	110	70.0-159			2.62	25
2-Propanol	3.75	3.78	3.79	101	101	70.0-139			0.264	25
Propene	3.75	4.12	3.99	110	106	64.0-144			3.21	25

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3944265-1 07/01/23 07:11 • (LCSD) R3944265-2 07/01/23 07:41

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Styrene	3.75	4.06	3.96	108	106	70.0-130			2.49	25
1,1,2,2-Tetrachloroethane	3.75	4.22	4.12	113	110	70.0-130			2.40	25
Tetrachloroethylene	3.75	3.86	3.85	103	103	70.0-130			0.259	25
Tetrahydrofuran	3.75	4.25	4.13	113	110	70.0-137			2.86	25
Toluene	3.75	4.09	4.03	109	107	70.0-130			1.48	25
1,2,4-Trichlorobenzene	3.75	4.62	4.51	123	120	70.0-160			2.41	25
1,1,1-Trichloroethane	3.75	3.99	3.90	106	104	70.0-130			2.28	25
1,1,2-Trichloroethane	3.75	3.88	4.03	103	107	70.0-130			3.79	25
Trichloroethylene	3.75	4.19	3.99	112	106	70.0-130			4.89	25
1,2,4-Trimethylbenzene	3.75	4.12	3.97	110	106	70.0-130			3.71	25
1,3,5-Trimethylbenzene	3.75	4.09	4.06	109	108	70.0-130			0.736	25
2,2,4-Trimethylpentane	3.75	4.07	4.03	109	107	70.0-130			0.988	25
Vinyl chloride	3.75	3.83	3.76	102	100	70.0-130			1.84	25
Vinyl Bromide	3.75	3.74	3.79	99.7	101	70.0-130			1.33	25
Vinyl acetate	3.75	3.52	3.84	93.9	102	70.0-130			8.70	25
Xylenes, Total	11.3	12.4	12.1	110	107	70.0-130			2.45	25
m&p-Xylene	7.50	8.26	8.04	110	107	70.0-130			2.70	25
o-Xylene	3.75	4.10	4.03	109	107	70.0-130			1.72	25
(S) 1,4-Bromofluorobenzene				*99.1*	*99.8*	*60.0-140*				

Method Blank (MB)

(MB) R3944599-3 07/04/23 09:12

Analyte	MB Result ppbv	MB Qualifier	MB MDL ppbv	MB RDL ppbv
Cyclohexane	U		0.0753	0.200
Heptane	U		0.104	0.200
n-Hexane	U		0.206	0.630
(S) 1,4-Bromofluorobenzene	*99.9*			*60.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3944599-1 07/04/23 08:15 • (LCSD) R3944599-2 07/04/23 08:45

Analyte	Spike Amount ppbv	LCS Result ppbv	LCSD Result ppbv	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Cyclohexane	3.75	4.18	4.21	111	112	70.0-130			0.715	25
Heptane	3.75	4.14	4.10	110	109	70.0-130			0.971	25
n-Hexane	3.75	4.21	4.14	112	110	70.0-130			1.68	25
(S) 1,4-Bromofluorobenzene				*106*	*106*	*60.0-140*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
	The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Ramboll - Chicago, IL

333 West Wacker Drive

Suite 2700

Billing Information:
Ruta Deshpande
333 West Wacker Drive

Suite 2700
Chicago, IL 60606

Report To:
Ruta Deshpande

Email To:
rdeshpande@ramboll.com

Project Description: Calumet Refinery

City/State Collected: Great Falls, Montana

Please Circle: PT (MT) CT ET

Phone: **312-288-3854**

Client Project # **1690029636-002AOC-16**

Lab Project # **RAMBOLLCIL-169002963**

Collected by (print): Sarah Hall

Site/Facility ID #

P.O. # 1690029636-002

Collected by (signature): SHall

Rush? (Lab MUST Be Notified)
____ Same Day ____ Three Day
____ Next Day ____ Five Day
____ Two Day

Date Results Needed: standard

Sample ID	Can #	Flow Cont. #	Collection Date	Collection Time	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final
CMR-SP301-290623	22151	023311	6/29/23	11:05	28	5

Analysis: TO-15 Summa

Rem./Contaminant	Sample # (lab only)
	01

Sample Receipt Checklist
COC Seal Present/Intact: Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
RAD Screen <0.5 mR/hr: Y N
If Applicable
VOA Zero Headspace: Y N
Pres.Correct/Check: Y N

Remarks:

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE
MT JULIET, TN
12065 Lebanon Road Mt Juliet, TN 37122
Phone: 615-758-5858 Alt: 800-767-5859
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1631252
H070

Acctnum: **RAMBOLLCIL**
Template: **T224808**
Prelogin: **P997145**
PM: **3828 - Jennifer A McCurdy**
PB: LSC 06/06/23
Shipped Via: **FedEX Ground**

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
SHall	6/29/2023	14:30	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)

Samples returned via: __ UPS X FedEx __ Courier __ _____

Tracking # 6040 5547 6287

Date: Time:

Date: Time:

Date: 6/30/23 Time: 0905

Hold #

Condition: (lab use only) U

COC Seal Intact: ____Y ____N ____NA

NCF:

APPENDIX A2

DUAL-PHASE EXTRACTION EFFLUENT LIQUID ANALYTICAL RESULTS

Pace Lot Number YA04012

Pace Lot Number YA01022

Pace Lot Number YA05003

Report of Analysis

Ramboll US Corporation
333 West Wacker Drive
Suite 2700
Chicago, IL 60606
Attention: Ruta Deshpande

Project Name: Calumet (CMR) AOC16

Project Number: 1690024801-002

Lot Number:**YE04012**

Date Completed:06/01/2023

06/01/2023 6:30 AM
Approved and released by:
Project Manager II: **Edward Barnett**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Case Narrative
Ramboll US Corporation
Lot Number: YE04012

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report. Where sampling is conducted by the client, results relate to the accuracy of the information provided, and as the samples are received.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

VOCs

The laboratory control sample (LCS) for analytical batch 75284 exceeded acceptance criteria for the following analytes: Acetone, 2-Butanone, 1,4-Dioxane, 2-Hexanone.

1,4 Dioxane and 2-Hexanone were biased high and were not detected above the LOQ in sample YE04012-001 (CMR-SP200-230503). Acetone and 2-Butanone were detected above the LOQ in this sample; as the sample could not be re-analyzed in hold the initial data has been reported.

These analytes were biased high and were not detected above the LOQ in sampleYE04012-002 (CMR TRIP BLANK).

YE04012-001 (CMR-SP200-230503) (Run 1) (Analysis Batch 75284)
YE04012-002 (CMR TRIP BLANK) (Run 1) (Analysis Batch 75284)

The following sample was received with headspace in the sample vial: YE04012-002 (CMR TRIP BLANK).

YE04012-002 (CMR TRIP BLANK) (Run 1) (Analysis Batch 75284)

Subcontracted Results

EPH and VPH were subcontracted to Pace National for analysis. The results are included after the Pace West Columbia report of analysis.

Sample Summary

Ramboll US Corporation

Lot Number: YE04012

Project Name: Calumet (CMR) AOC16

Project Number: 1690024801-002

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	CMR-SP200-230503	Aqueous	05/03/2023 1210	05/04/2023
002	CMR TRIP BLANK	Aqueous	05/03/2023 1210	05/04/2023

(2 samples)

Detection Summary

Ramboll US Corporation

Lot Number: YE04012

Project Name: Calumet (CMR) AOC16

Project Number: 1690024801-002

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	CMR-SP200-230503	Aqueous	Acetone	8260D	45	L	ug/L	5
001	CMR-SP200-230503	Aqueous	Benzene	8260D	90		ug/L	5
001	CMR-SP200-230503	Aqueous	Bromodichloromethane	8260D	0.49	J	ug/L	5
001	CMR-SP200-230503	Aqueous	2-Butanone (MEK)	8260D	18	L	ug/L	5
001	CMR-SP200-230503	Aqueous	Cyclohexane	8260D	5.1		ug/L	5
001	CMR-SP200-230503	Aqueous	Ethylbenzene	8260D	29		ug/L	5
001	CMR-SP200-230503	Aqueous	2-Hexanone	8260D	9.8	JL	ug/L	5
001	CMR-SP200-230503	Aqueous	Isopropylbenzene	8260D	2.6		ug/L	5
001	CMR-SP200-230503	Aqueous	4-Methyl-2-pentanone	8260D	5.0	J	ug/L	5
001	CMR-SP200-230503	Aqueous	Methylcyclohexane	8260D	4.7	J	ug/L	5
001	CMR-SP200-230503	Aqueous	Naphthalene	8260D	61		ug/L	5
001	CMR-SP200-230503	Aqueous	Styrene	8260D	1.3		ug/L	5
001	CMR-SP200-230503	Aqueous	1,1,2,2-Tetrachloroethane	8260D	1.9		ug/L	5
001	CMR-SP200-230503	Aqueous	Toluene	8260D	11		ug/L	5
001	CMR-SP200-230503	Aqueous	Xylenes (total)	8260D	180		ug/L	6
001	CMR-SP200-230503	Aqueous	m+p - Xylenes	8260D	140		ug/L	6
001	CMR-SP200-230503	Aqueous	o - Xylenes	8260D	40		ug/L	6
001	CMR-SP200-230503	Aqueous	bis(2-Ethylhexyl)phthalate	8270E	17	BJ	ug/L	7
001	CMR-SP200-230503	Aqueous	3+4-Methylphenol	8270E	22		ug/L	8
001	CMR-SP200-230503	Aqueous	N-Nitrosodiphenylamine	8270E	25		ug/L	8
001	CMR-SP200-230503	Aqueous	Phenol	8270E	12		ug/L	8
001	CMR-SP200-230503	Aqueous	Pyrene	8270E	2.6		ug/L	8
002	CMR TRIP BLANK	Aqueous	Acetone	8260D	4.3	JL	ug/L	9

(23 detections)

Volatile Organic Compounds by GC/MS

Client: Ramboll US Corporation
Laboratory ID: YE04012-001
Description: CMR-SP200-230503
Matrix: Aqueous
Date Sampled: 05/03/2023 1210
Project Name: Calumet (CMR) AOC16
Date Received: 05/04/2023
Project Number: 1690024801-002

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	05/15/2023 1833	AMR2		75284

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	67-64-1	8260D	45	L	10	4.0	ug/L	1
Benzene	71-43-2	8260D	90		0.50	0.40	ug/L	1
Bromochloromethane	74-97-5	8260D	ND		0.50	0.40	ug/L	1
Bromodichloromethane	75-27-4	8260D	0.49	J	0.50	0.40	ug/L	1
Bromoform	75-25-2	8260D	ND		0.50	0.40	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		0.50	0.40	ug/L	1
2-Butanone (MEK)	78-93-3	8260D	18	L	10	2.0	ug/L	1
Carbon disulfide	75-15-0	8260D	ND		0.50	0.40	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		0.50	0.40	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		0.50	0.40	ug/L	1
Chloroethane	75-00-3	8260D	ND		0.50	0.40	ug/L	1
Chloroform	67-66-3	8260D	ND		0.50	0.40	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		0.50	0.40	ug/L	1
Cyclohexane	110-82-7	8260D	5.1		0.50	0.40	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		0.50	0.40	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		0.50	0.40	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		0.50	0.40	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		0.50	0.40	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		0.50	0.40	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		0.50	0.40	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		0.50	0.40	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		0.50	0.40	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		0.50	0.40	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND	L	20	13	ug/L	1
Ethylbenzene	100-41-4	8260D	29		0.50	0.40	ug/L	1
2-Hexanone	591-78-6	8260D	9.8	JL	10	2.0	ug/L	1
Isopropylbenzene	98-82-8	8260D	2.6		0.50	0.40	ug/L	1
Methyl acetate	79-20-9	8260D	ND		1.0	0.40	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		0.50	0.40	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	5.0	J	10	2.0	ug/L	1
Methylcyclohexane	108-87-2	8260D	4.7	J	5.0	0.40	ug/L	1
Methylene chloride	75-09-2	8260D	ND		0.50	0.40	ug/L	1
Naphthalene	91-20-3	8260D	61		0.50	0.40	ug/L	1
Styrene	100-42-5	8260D	1.3		0.50	0.41	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	1.9		0.50	0.40	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		0.50	0.40	ug/L	1
Toluene	108-88-3	8260D	11		0.50	0.40	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		1.0	0.42	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Volatile Organic Compounds by GC/MS

Client: Ramboll US Corporation
Laboratory ID: YE04012-001
Description: CMR-SP200-230503
Matrix: Aqueous
Date Sampled: 05/03/2023 1210
Project Name: Calumet (CMR) AOC16
Date Received: 05/04/2023
Project Number: 1690024801-002

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	05/15/2023 1833	AMR2		75284

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		0.50	0.40	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		0.50	0.40	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		0.50	0.40	ug/L	1
Trichloroethene	79-01-6	8260D	ND		0.50	0.40	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		0.50	0.40	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		0.50	0.40	ug/L	1
Xylenes (total)	1330-20-7	8260D	180		1.0	0.40	ug/L	1
m+p - Xylenes	179601-23-1	8260D	140		0.50	0.40	ug/L	1
o - Xylenes	95-47-6	8260D	40		0.50	0.40	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
Bromofluorobenzene		103	70-130
1,2-Dichloroethane-d4		111	70-130
Toluene-d8		102	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: Ramboll US Corporation | Laboratory ID: YE04012-001
Description: CMR-SP200-230503 | Matrix: Aqueous
Date Sampled: 05/03/2023 1210 | Project Name: Calumet (CMR) AOC16
Date Received: 05/04/2023 | Project Number: 1690024801-002

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	10	05/19/2023 1351	JCG	05/08/2023 1220	74682

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	83-32-9	8270E	ND		1.6	0.40	ug/L	1
Acenaphthylene	208-96-8	8270E	ND		1.6	0.40	ug/L	1
Acetophenone	98-86-2	8270E	ND		8.0	2.3	ug/L	1
Anthracene	120-12-7	8270E	ND		1.6	0.40	ug/L	1
Atrazine	1912-24-9	8270E	ND		8.0	2.0	ug/L	1
Benzaldehyde	100-52-7	8270E	ND		40	2.7	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	ND		1.6	0.40	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	ND		1.6	0.40	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	ND		1.6	0.40	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	ND		1.6	0.40	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	ND		1.6	0.40	ug/L	1
1,1'-Biphenyl	92-52-4	8270E	ND		8.0	2.1	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270E	ND		8.0	1.5	ug/L	1
Butyl benzyl phthalate	85-68-7	8270E	ND		40	2.1	ug/L	1
Caprolactam	105-60-2	8270E	ND		40	7.1	ug/L	1
Carbazole	86-74-8	8270E	ND		8.0	0.40	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND		8.0	1.7	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270E	ND		8.0	2.6	ug/L	1
4-Chloroaniline	106-47-8	8270E	ND		8.0	1.3	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND		8.0	0.60	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270E	ND		8.0	1.6	ug/L	1
2-Chloronaphthalene	91-58-7	8270E	ND		8.0	1.5	ug/L	1
2-Chlorophenol	95-57-8	8270E	ND		8.0	1.5	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND		8.0	1.6	ug/L	1
Chrysene	218-01-9	8270E	ND		1.6	0.40	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	ND		1.6	0.40	ug/L	1
Dibenzofuran	132-64-9	8270E	ND		8.0	1.6	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270E	ND		40	8.1	ug/L	1
2,4-Dichlorophenol	120-83-2	8270E	ND		8.0	1.9	ug/L	1
Diethylphthalate	84-66-2	8270E	ND		40	1.9	ug/L	1
Dimethyl phthalate	131-11-3	8270E	ND		40	1.8	ug/L	1
2,4-Dimethylphenol	105-67-9	8270E	ND		8.0	1.5	ug/L	1
Di-n-butyl phthalate	84-74-2	8270E	ND		40	4.2	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND		40	8.9	ug/L	1
2,4-Dinitrophenol	51-28-5	8270E	ND		40	13	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270E	ND		16	3.6	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270E	ND		16	3.4	ug/L	1
Di-n-octylphthalate	117-84-0	8270E	ND		40	4.8	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	17	BJ	40	15	ug/L	1
Fluoranthene	206-44-0	8270E	ND		1.6	0.40	ug/L	1
Fluorene	86-73-7	8270E	ND		1.6	0.40	ug/L	1
Hexachlorobenzene	118-74-1	8270E	ND		8.0	1.5	ug/L	1
Hexachlorobutadiene	87-68-3	8270E	ND		8.0	1.7	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270E	ND		40	11	ug/L	1

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: Ramboll US Corporation | Laboratory ID: YE04012-001
Description: CMR-SP200-230503 | Matrix: Aqueous
Date Sampled: 05/03/2023 1210 | Project Name: Calumet (CMR) AOC16
Date Received: 05/04/2023 | Project Number: 1690024801-002

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	10	05/19/2023 1351	JCG	05/08/2023 1220	74682

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachloroethane	67-72-1	8270E	ND		8.0	1.7	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND		1.6	0.40	ug/L	1
Isophorone	78-59-1	8270E	ND		8.0	2.2	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	ND		1.6	0.40	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	ND		1.6	0.40	ug/L	1
2-Methylphenol	95-48-7	8270E	ND		8.0	2.1	ug/L	1
3+4-Methylphenol	106-44-5	8270E	22		16	4.6	ug/L	1
Naphthalene	91-20-3	8270E	ND		1.6	0.40	ug/L	1
2-Nitroaniline	88-74-4	8270E	ND		16	6.6	ug/L	1
3-Nitroaniline	99-09-2	8270E	ND		16	1.5	ug/L	1
4-Nitroaniline	100-01-6	8270E	ND		16	13	ug/L	1
Nitrobenzene	98-95-3	8270E	ND		8.0	1.7	ug/L	1
2-Nitrophenol	88-75-5	8270E	ND		16	4.4	ug/L	1
4-Nitrophenol	100-02-7	8270E	ND		40	21	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND		8.0	2.8	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	25		8.0	5.0	ug/L	1
Pentachlorophenol	87-86-5	8270E	ND		40	13	ug/L	1
Phenanthrene	85-01-8	8270E	ND		1.6	0.40	ug/L	1
Phenol	108-95-2	8270E	12		8.0	1.9	ug/L	1
Pyrene	129-00-0	8270E	2.6		1.6	0.40	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270E	ND		8.0	1.9	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270E	ND		8.0	2.2	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		91	37-129
2-Fluorophenol		63	24-127
Nitrobenzene-d5		86	38-127
Phenol-d5		84	28-128
Terphenyl-d14		50	10-148
2,4,6-Tribromophenol		130	35-144

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Volatile Organic Compounds by GC/MS

Client: Ramboll US Corporation
Laboratory ID: YE04012-002
Description: CMR TRIP BLANK
Matrix: Aqueous
Date Sampled: 05/03/2023 1210
Project Name: Calumet (CMR) AOC16
Date Received: 05/04/2023
Project Number: 1690024801-002

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	05/15/2023 1243	AMR2		75284

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	67-64-1	8260D	4.3	JL	10	4.0	ug/L	1
Benzene	71-43-2	8260D	ND		0.50	0.40	ug/L	1
Bromochloromethane	74-97-5	8260D	ND		0.50	0.40	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		0.50	0.40	ug/L	1
Bromoform	75-25-2	8260D	ND		0.50	0.40	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		0.50	0.40	ug/L	1
2-Butanone (MEK)	78-93-3	8260D	ND	L	10	2.0	ug/L	1
Carbon disulfide	75-15-0	8260D	ND		0.50	0.40	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		0.50	0.40	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		0.50	0.40	ug/L	1
Chloroethane	75-00-3	8260D	ND		0.50	0.40	ug/L	1
Chloroform	67-66-3	8260D	ND		0.50	0.40	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		0.50	0.40	ug/L	1
Cyclohexane	110-82-7	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		0.50	0.40	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		0.50	0.40	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		0.50	0.40	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		0.50	0.40	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		0.50	0.40	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		0.50	0.40	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		0.50	0.40	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		0.50	0.40	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		0.50	0.40	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND	L	20	13	ug/L	1
Ethylbenzene	100-41-4	8260D	ND		0.50	0.40	ug/L	1
2-Hexanone	591-78-6	8260D	ND	L	10	2.0	ug/L	1
Isopropylbenzene	98-82-8	8260D	ND		0.50	0.40	ug/L	1
Methyl acetate	79-20-9	8260D	ND		1.0	0.40	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		0.50	0.40	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		10	2.0	ug/L	1
Methylcyclohexane	108-87-2	8260D	ND		5.0	0.40	ug/L	1
Methylene chloride	75-09-2	8260D	ND		0.50	0.40	ug/L	1
Naphthalene	91-20-3	8260D	ND		0.50	0.40	ug/L	1
Styrene	100-42-5	8260D	ND		0.50	0.41	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND		0.50	0.40	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		0.50	0.40	ug/L	1
Toluene	108-88-3	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		1.0	0.42	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: Ramboll US Corporation
Laboratory ID: YE04012-002
Description: CMR TRIP BLANK
Matrix: Aqueous
Date Sampled: 05/03/2023 1210
Project Name: Calumet (CMR) AOC16
Date Received: 05/04/2023
Project Number: 1690024801-002

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	05/15/2023 1243	AMR2		75284

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		0.50	0.40	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		0.50	0.40	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		0.50	0.40	ug/L	1
Trichloroethene	79-01-6	8260D	ND		0.50	0.40	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		0.50	0.40	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		0.50	0.40	ug/L	1
Xylenes (total)	1330-20-7	8260D	ND		1.0	0.40	ug/L	1
m+p - Xylenes	179601-23-1	8260D	ND		0.50	0.40	ug/L	1
o - Xylenes	95-47-6	8260D	ND		0.50	0.40	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
Bromofluorobenzene		91	70-130
1,2-Dichloroethane-d4		117	70-130
Toluene-d8		100	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

QC Summary

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ75284-001
Batch: 75284
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acetone	ND		1	10	4.0	ug/L	05/15/2023 1021
Benzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Bromochloromethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Bromodichloromethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Bromoform	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Bromomethane (Methyl bromide)	ND		1	0.50	0.40	ug/L	05/15/2023 1021
2-Butanone (MEK)	ND		1	10	2.0	ug/L	05/15/2023 1021
Carbon disulfide	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Carbon tetrachloride	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Chlorobenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Chloroethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Chloroform	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Chloromethane (Methyl chloride)	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Cyclohexane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Dibromochloromethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,2-Dibromoethane (EDB)	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,2-Dichlorobenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,3-Dichlorobenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,4-Dichlorobenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Dichlorodifluoromethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,1-Dichloroethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,2-Dichloroethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,1-Dichloroethene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
cis-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
trans-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,2-Dichloropropane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
cis-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
trans-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,4-Dioxane	ND		1	20	13	ug/L	05/15/2023 1021
Ethylbenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
2-Hexanone	ND		1	10	2.0	ug/L	05/15/2023 1021
Isopropylbenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Methyl acetate	ND		1	1.0	0.40	ug/L	05/15/2023 1021
Methyl tertiary butyl ether (MTBE)	ND		1	0.50	0.40	ug/L	05/15/2023 1021
4-Methyl-2-pentanone	ND		1	10	2.0	ug/L	05/15/2023 1021
Methylcyclohexane	ND		1	5.0	0.40	ug/L	05/15/2023 1021
Methylene chloride	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Naphthalene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Styrene	ND		1	0.50	0.41	ug/L	05/15/2023 1021
1,1,2,2-Tetrachloroethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Tetrachloroethene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Toluene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	0.42	ug/L	05/15/2023 1021

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ75284-001
Batch: 75284
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
1,2,3-Trichlorobenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,2,4-Trichlorobenzene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,1,1-Trichloroethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
1,1,2-Trichloroethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Trichloroethene	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Trichlorofluoromethane	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Vinyl chloride	ND		1	0.50	0.40	ug/L	05/15/2023 1021
Xylenes (total)	ND		1	1.0	0.40	ug/L	05/15/2023 1021
m+p - Xylenes	ND		1	0.50	0.40	ug/L	05/15/2023 1021
o - Xylenes	ND		1	0.50	0.40	ug/L	05/15/2023 1021

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		95	70-130
1,2-Dichloroethane-d4		116	70-130
Toluene-d8		103	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ75284-002
Batch: 75284
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	100	240	N	1	239	60-140	05/15/2023 0834
Benzene	50	56		1	111	70-130	05/15/2023 0834
Bromochloromethane	50	53		1	105	70-130	05/15/2023 0834
Bromodichloromethane	50	58		1	116	70-130	05/15/2023 0834
Bromoform	50	53		1	106	70-130	05/15/2023 0834
Bromomethane (Methyl bromide)	50	55		1	111	70-130	05/15/2023 0834
2-Butanone (MEK)	100	160	N	1	163	70-130	05/15/2023 0834
Carbon disulfide	50	56		1	112	70-130	05/15/2023 0834
Carbon tetrachloride	50	61		1	121	70-130	05/15/2023 0834
Chlorobenzene	50	56		1	111	70-130	05/15/2023 0834
Chloroethane	50	54		1	108	70-130	05/15/2023 0834
Chloroform	50	55		1	110	70-130	05/15/2023 0834
Chloromethane (Methyl chloride)	50	64		1	128	60-140	05/15/2023 0834
Cyclohexane	50	55		1	111	70-130	05/15/2023 0834
1,2-Dibromo-3-chloropropane (DBCP)	50	56		1	112	70-130	05/15/2023 0834
Dibromochloromethane	50	62		1	124	70-130	05/15/2023 0834
1,2-Dibromoethane (EDB)	50	58		1	116	70-130	05/15/2023 0834
1,2-Dichlorobenzene	50	56		1	112	70-130	05/15/2023 0834
1,3-Dichlorobenzene	50	55		1	110	70-130	05/15/2023 0834
1,4-Dichlorobenzene	50	53		1	107	70-130	05/15/2023 0834
Dichlorodifluoromethane	50	50		1	101	60-140	05/15/2023 0834
1,1-Dichloroethane	50	56		1	111	70-130	05/15/2023 0834
1,2-Dichloroethane	50	56		1	112	70-130	05/15/2023 0834
1,1-Dichloroethene	50	54		1	108	70-130	05/15/2023 0834
cis-1,2-Dichloroethene	50	53		1	106	70-130	05/15/2023 0834
trans-1,2-Dichloroethene	50	54		1	108	70-130	05/15/2023 0834
1,2-Dichloropropane	50	57		1	113	70-130	05/15/2023 0834
cis-1,3-Dichloropropene	50	58		1	116	70-130	05/15/2023 0834
trans-1,3-Dichloropropene	50	61		1	122	70-130	05/15/2023 0834
1,4-Dioxane	500	1000	N	1	208	60-140	05/15/2023 0834
Ethylbenzene	50	55		1	111	70-130	05/15/2023 0834
2-Hexanone	100	130	N	1	131	70-130	05/15/2023 0834
Isopropylbenzene	50	57		1	113	70-130	05/15/2023 0834
Methyl acetate	50	65		1	130	70-130	05/15/2023 0834
Methyl tertiary butyl ether (MTBE)	50	55		1	111	70-130	05/15/2023 0834
4-Methyl-2-pentanone	100	120		1	116	70-130	05/15/2023 0834
Methylcyclohexane	50	54		1	109	70-130	05/15/2023 0834
Methylene chloride	50	56		1	112	70-130	05/15/2023 0834
Naphthalene	50	52		1	105	70-130	05/15/2023 0834
Styrene	50	59		1	119	70-130	05/15/2023 0834
1,1,2,2-Tetrachloroethane	50	60		1	120	70-130	05/15/2023 0834
Tetrachloroethene	50	54		1	108	70-130	05/15/2023 0834
Toluene	50	55		1	110	70-130	05/15/2023 0834
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	57		1	114	70-130	05/15/2023 0834

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ75284-002
Batch: 75284
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	50	51		1	102	70-130	05/15/2023 0834
1,2,4-Trichlorobenzene	50	49		1	99	70-130	05/15/2023 0834
1,1,1-Trichloroethane	50	56		1	111	70-130	05/15/2023 0834
1,1,2-Trichloroethane	50	58		1	116	70-130	05/15/2023 0834
Trichloroethene	50	53		1	105	70-130	05/15/2023 0834
Trichlorofluoromethane	50	51		1	102	70-130	05/15/2023 0834
Vinyl chloride	50	60		1	119	70-130	05/15/2023 0834
Xylenes (total)	100	110		1	111	70-130	05/15/2023 0834
m+p - Xylenes	50	56		1	112	70-130	05/15/2023 0834
o - Xylenes	50	55		1	110	70-130	05/15/2023 0834

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		100	70-130
1,2-Dichloroethane-d4		105	70-130
Toluene-d8		102	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ74682-001
Batch: 74682
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 05/08/2023 1220

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acenaphthene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Acenaphthylene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Acetophenone	ND		1	0.80	0.23	ug/L	05/10/2023 1155
Anthracene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Atrazine	ND		1	0.80	0.20	ug/L	05/10/2023 1155
Benzaldehyde	ND		1	4.0	0.27	ug/L	05/10/2023 1155
Benzo(a)anthracene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Benzo(a)pyrene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Benzo(b)fluoranthene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Benzo(g,h,i)perylene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Benzo(k)fluoranthene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
1,1'-Biphenyl	ND		1	0.80	0.21	ug/L	05/10/2023 1155
4-Bromophenyl phenyl ether	ND		1	0.80	0.15	ug/L	05/10/2023 1155
Butyl benzyl phthalate	ND		1	4.0	0.21	ug/L	05/10/2023 1155
Caprolactam	0.99	J	1	4.0	0.71	ug/L	05/10/2023 1155
Carbazole	ND		1	0.80	0.040	ug/L	05/10/2023 1155
bis (2-Chloro-1-methylethyl) ether	ND		1	0.80	0.17	ug/L	05/10/2023 1155
4-Chloro-3-methyl phenol	ND		1	0.80	0.26	ug/L	05/10/2023 1155
4-Chloroaniline	ND		1	0.80	0.13	ug/L	05/10/2023 1155
bis(2-Chloroethoxy)methane	ND		1	0.80	0.060	ug/L	05/10/2023 1155
bis(2-Chloroethyl)ether	ND		1	0.80	0.16	ug/L	05/10/2023 1155
2-Chloronaphthalene	ND		1	0.80	0.15	ug/L	05/10/2023 1155
2-Chlorophenol	ND		1	0.80	0.15	ug/L	05/10/2023 1155
4-Chlorophenyl phenyl ether	ND		1	0.80	0.16	ug/L	05/10/2023 1155
Chrysene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Dibenzo(a,h)anthracene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Dibenzofuran	ND		1	0.80	0.16	ug/L	05/10/2023 1155
3,3'-Dichlorobenzidine	ND		1	4.0	0.81	ug/L	05/10/2023 1155
2,4-Dichlorophenol	ND		1	0.80	0.19	ug/L	05/10/2023 1155
Diethylphthalate	ND		1	4.0	0.19	ug/L	05/10/2023 1155
Dimethyl phthalate	ND		1	4.0	0.18	ug/L	05/10/2023 1155
2,4-Dimethylphenol	ND		1	0.80	0.15	ug/L	05/10/2023 1155
Di-n-butyl phthalate	0.78	J	1	4.0	0.42	ug/L	05/10/2023 1155
4,6-Dinitro-2-methylphenol	ND		1	4.0	0.89	ug/L	05/10/2023 1155
2,4-Dinitrophenol	ND		1	4.0	1.3	ug/L	05/10/2023 1155
2,4-Dinitrotoluene	ND		1	1.6	0.36	ug/L	05/10/2023 1155
2,6-Dinitrotoluene	ND		1	1.6	0.34	ug/L	05/10/2023 1155
Di-n-octylphthalate	ND		1	4.0	0.48	ug/L	05/10/2023 1155
bis(2-Ethylhexyl)phthalate	1.5	J	1	4.0	1.5	ug/L	05/10/2023 1155
Fluoranthene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Fluorene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Hexachlorobenzene	ND		1	0.80	0.15	ug/L	05/10/2023 1155
Hexachlorobutadiene	ND		1	0.80	0.17	ug/L	05/10/2023 1155
Hexachlorocyclopentadiene	ND		1	4.0	1.1	ug/L	05/10/2023 1155

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ74682-001
Batch: 74682
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 05/08/2023 1220

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Hexachloroethane	ND		1	0.80	0.17	ug/L	05/10/2023 1155
Indeno(1,2,3-c,d)pyrene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Isophorone	ND		1	0.80	0.22	ug/L	05/10/2023 1155
1-Methylnaphthalene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
2-Methylnaphthalene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
2-Methylphenol	ND		1	0.80	0.21	ug/L	05/10/2023 1155
3+4-Methylphenol	ND		1	1.6	0.46	ug/L	05/10/2023 1155
Naphthalene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
2-Nitroaniline	ND		1	1.6	0.66	ug/L	05/10/2023 1155
3-Nitroaniline	ND		1	1.6	0.15	ug/L	05/10/2023 1155
4-Nitroaniline	ND		1	1.6	1.3	ug/L	05/10/2023 1155
Nitrobenzene	ND		1	0.80	0.17	ug/L	05/10/2023 1155
2-Nitrophenol	ND		1	1.6	0.44	ug/L	05/10/2023 1155
4-Nitrophenol	ND		1	4.0	2.1	ug/L	05/10/2023 1155
N-Nitrosodi-n-propylamine	ND		1	0.80	0.28	ug/L	05/10/2023 1155
N-Nitrosodiphenylamine (Diphenylamine)	ND		1	0.80	0.50	ug/L	05/10/2023 1155
Pentachlorophenol	ND		1	4.0	1.3	ug/L	05/10/2023 1155
Phenanthrene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
Phenol	ND		1	0.80	0.19	ug/L	05/10/2023 1155
Pyrene	ND		1	0.16	0.040	ug/L	05/10/2023 1155
2,4,5-Trichlorophenol	ND		1	0.80	0.19	ug/L	05/10/2023 1155
2,4,6-Trichlorophenol	ND		1	0.80	0.22	ug/L	05/10/2023 1155

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		68	37-129
2-Fluorophenol		44	24-127
Nitrobenzene-d5		78	38-127
Phenol-d5		54	28-128
Terphenyl-d14		81	10-148
2,4,6-Tribromophenol		60	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ74682-002
Batch: 74682
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 05/08/2023 1220

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	8.0	6.0		1	74	30-122	05/10/2023 1220
Acenaphthylene	8.0	6.4		1	80	30-130	05/10/2023 1220
Acetophenone	8.0	6.8		1	85	52-125	05/10/2023 1220
Anthracene	8.0	7.0		1	87	30-123	05/10/2023 1220
Atrazine	8.0	6.9		1	86	25-121	05/10/2023 1220
Benzaldehyde	8.0	4.8		1	60	20-115	05/10/2023 1220
Benzo(a)anthracene	8.0	6.5		1	81	40-125	05/10/2023 1220
Benzo(a)pyrene	8.0	6.4		1	80	40-128	05/10/2023 1220
Benzo(b)fluoranthene	8.0	6.8		1	85	30-130	05/10/2023 1220
Benzo(g,h,i)perylene	8.0	5.7		1	72	30-130	05/10/2023 1220
Benzo(k)fluoranthene	8.0	6.8		1	84	30-130	05/10/2023 1220
1,1'-Biphenyl	8.0	5.8		1	73	42-120	05/10/2023 1220
4-Bromophenyl phenyl ether	8.0	6.3		1	79	30-124	05/10/2023 1220
Butyl benzyl phthalate	8.0	7.0		1	87	54-135	05/10/2023 1220
Caprolactam	8.0	7.9		1	98	44-152	05/10/2023 1220
Carbazole	8.0	7.3		1	91	45-101	05/10/2023 1220
bis (2-Chloro-1-methylethyl) ether	8.0	7.1		1	88	42-124	05/10/2023 1220
4-Chloro-3-methyl phenol	8.0	7.4		1	93	30-123	05/10/2023 1220
4-Chloroaniline	8.0	5.7		1	71	12-157	05/10/2023 1220
bis(2-Chloroethoxy)methane	8.0	7.9		1	99	44-127	05/10/2023 1220
bis(2-Chloroethyl)ether	8.0	6.8		1	84	46-120	05/10/2023 1220
2-Chloronaphthalene	8.0	5.7		1	71	46-100	05/10/2023 1220
2-Chlorophenol	8.0	6.7		1	83	50-117	05/10/2023 1220
4-Chlorophenyl phenyl ether	8.0	6.5		1	81	30-121	05/10/2023 1220
Chrysene	8.0	6.3		1	78	30-130	05/10/2023 1220
Dibenzo(a,h)anthracene	8.0	5.5		1	69	30-130	05/10/2023 1220
Dibenzofuran	8.0	5.9		1	74	30-118	05/10/2023 1220
3,3'-Dichlorobenzidine	8.0	1.7		1	22	10-126	05/10/2023 1220
2,4-Dichlorophenol	8.0	6.7		1	84	30-121	05/10/2023 1220
Diethylphthalate	8.0	7.3		1	91	40-125	05/10/2023 1220
Dimethyl phthalate	8.0	7.0		1	88	40-127	05/10/2023 1220
2,4-Dimethylphenol	8.0	7.0		1	88	20-125	05/10/2023 1220
Di-n-butyl phthalate	8.0	7.6		1	95	40-127	05/10/2023 1220
4,6-Dinitro-2-methylphenol	8.0	8.9		1	111	56-128	05/10/2023 1220
2,4-Dinitrophenol	16	13		1	79	11-126	05/10/2023 1220
2,4-Dinitrotoluene	8.0	7.5		1	94	59-127	05/10/2023 1220
2,6-Dinitrotoluene	8.0	7.3		1	91	59-126	05/10/2023 1220
Di-n-octylphthalate	8.0	6.8		1	85	50-136	05/10/2023 1220
bis(2-Ethylhexyl)phthalate	8.0	7.2		1	90	56-128	05/10/2023 1220
Fluoranthene	8.0	7.3		1	92	40-128	05/10/2023 1220
Fluorene	8.0	6.6		1	83	30-124	05/10/2023 1220
Hexachlorobenzene	8.0	6.3		1	79	30-125	05/10/2023 1220
Hexachlorobutadiene	8.0	5.0		1	63	24-110	05/10/2023 1220
Hexachlorocyclopentadiene	40	23		1	57	16-96	05/10/2023 1220

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ74682-002
Batch: 74682
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 05/08/2023 1220

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Hexachloroethane	8.0	5.1		1	64	31-110	05/10/2023 1220
Indeno(1,2,3-c,d)pyrene	8.0	5.5		1	69	30-130	05/10/2023 1220
Isophorone	8.0	7.4		1	93	57-123	05/10/2023 1220
1-Methylnaphthalene	8.0	6.2		1	77	42-126	05/10/2023 1220
2-Methylnaphthalene	8.0	6.6		1	82	40-132	05/10/2023 1220
2-Methylphenol	8.0	7.8		1	97	56-119	05/10/2023 1220
3+4-Methylphenol	8.0	7.0		1	87	53-119	05/10/2023 1220
Naphthalene	8.0	6.3		1	79	30-130	05/10/2023 1220
2-Nitroaniline	8.0	7.6		1	94	60-124	05/10/2023 1220
3-Nitroaniline	8.0	4.9		1	62	43-123	05/10/2023 1220
4-Nitroaniline	8.0	6.3		1	79	30-135	05/10/2023 1220
Nitrobenzene	8.0	6.5		1	81	51-122	05/10/2023 1220
2-Nitrophenol	8.0	6.6		1	82	51-118	05/10/2023 1220
4-Nitrophenol	16	15		1	92	53-130	05/10/2023 1220
N-Nitrosodi-n-propylamine	8.0	7.5		1	94	54-127	05/10/2023 1220
N-Nitrosodiphenylamine (Diphenylamine)	8.0	6.2		1	77	30-123	05/10/2023 1220
Pentachlorophenol	16	13		1	79	42-131	05/10/2023 1220
Phenanthrene	8.0	6.5		1	82	40-123	05/10/2023 1220
Phenol	8.0	6.9		1	87	49-117	05/10/2023 1220
Pyrene	8.0	6.6		1	83	40-126	05/10/2023 1220
2,4,5-Trichlorophenol	8.0	6.3		1	79	30-123	05/10/2023 1220
2,4,6-Trichlorophenol	8.0	6.3		1	79	30-125	05/10/2023 1220

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		70	37-129
2-Fluorophenol		72	24-127
Nitrobenzene-d5		81	38-127
Phenol-d5		78	28-128
Terphenyl-d14		82	10-148
2,4,6-Tribromophenol		71	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 142909

ASmall@Ramboll.com
RDESHPande@Ramboll.com

Client: Calumet Montana Refining	Report to Contact: Mike Gipson	Telephone No. / E-mail: 425-419-8736	Quote No.
Address: 1807 3rd St. NW	Sampler's Signature: X [signature]	Analysis (Attach list if more space is needed)	Page 1 of 1
City: Great Falls; State: MT; Zip Code: 59404	Printed Name: Mike Gipson		Lot # Bar Code (lab use only)
Project Name: Calumet AOC16 System			YE04012
Project No.: 1690024801-002	P.O. No.		

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	G-Grab Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	NaOH/ZnAc	Field Filtered	VOCs 8260	SVOCs 8270	VPH (MT VPH)	EPH (MT EPH)
CMR-SP200-230503	5/3/23	12:10	G	X			~~2~~		1	~~6~~ 6				X	X	X	X
CMR Trip blank	5/3/23	12:10		X						2				X	X	X	X

Turn Around Time Required (Prior lab approval required for expedited TAT.)	Sample Disposal	Possible Hazard Identification	QC Requirements (Specify)
☐ Standard ☐ Rush (Specify)	☐ Return to Client ☒ Disposal by Lab	☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown	

	Date	Time		Date	Time
1. Relinquished by: Mike Gipson	05/03/23	15:45	1. Received by		
2. Relinquished by			2. Received by		
3. Relinquished by			3. Received by		
4. Relinquished by: Fed ex	5/4/23	0940	4. Laboratory received by: [signature]	5/4/23	0940

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) Yes No Ice Pack — Receipt Temp. 3.0 °C — Temp Blank ☐ Y ☒ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

Sample Receipt Checklist (SRC)

Client: CALUMET Cooler Inspected by/date: KNR / 5/04/23 Lot #: YE04012

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other: _____

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

3.0 /3.0 °C NA /NA °C NA /NA °C NA /NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 8 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC and all sample containers?
☑ Yes	☐ No		7. Was collection date & time listed on the COC and all sample containers?
☑ Yes	☐ No		8. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		9. Were tests to be performed listed on the COC?
☑ Yes	☐ No		10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)? _____
☑ Yes	☐ No		11. Was adequate sample volume available?
☑ Yes	☐ No		12. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☑ Yes	☐ No		13. Were all samples containers accounted for? (No missing/excess)
☑ Yes	☐ No	☐ NA	14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	15. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	17. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☑ No	☐ NA	18. Was the quote number listed on the container label? If yes, Quote # _____

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. ☐
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA

Comments:

Qualtrax ID: 56360 Pace® Analytical Services, LLC Page 1 of 1

ANALYTICAL REPORT

May 16, 2023

Pace Analytical - West Columbia, SC

Sample Delivery Group:	L1612943
Samples Received:	05/05/2023
Project Number:	YE04012
Description:	Calumet CMR AOC16
Site:	001
Report To:	Edward T. Barnett 106 Vantage Point Dr. West Columbia, SC 29172

Entire Report Reviewed By:

Nancy McLain
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

CMR-SP200-230503 L1612943-01 5

Qc: Quality Control Summary 6

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH 6

TPH by Method MTDEQ EPH 8

Gl: Glossary of Terms 10

Al: Accreditations & Locations 11

Sc: Sample Chain of Custody 12

CMR-SP200-230503 L1612943-01 GW

	Collected by	Collected date/time	Received date/time
		05/03/23 12:10	05/05/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2057904	5	05/12/23 10:31	05/12/23 10:31	ACG	Mt. Juliet, TN
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2059213	10	05/14/23 00:12	05/14/23 00:12	JAH	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2053600	20	05/10/23 14:19	05/11/23 12:43	TJD	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2058176	10	05/10/23 14:19	05/12/23 11:51	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2058176	20	05/10/23 14:19	05/12/23 11:29	DMG	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Nancy McLain
Project Manager

Project Narrative

Due to multiple preparation procedures, calculated analytes are not reported in the quality control samples for EPH and VPH Methods.

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Unadjusted C5-C8 Aliphatics	793		167	500	5	05/12/2023 10:31	WG2057904
Unadjusted C9-C12 Aliphatics	8540		167	500	5	05/12/2023 10:31	WG2057904
Unadjusted C9-C10 Aromatics	6410		333	1000	10	05/14/2023 00:12	WG2059213
Adjusted C5-C8 Aliphatics	718		167	500	5	05/12/2023 10:31	WG2057904
Adjusted C9-C12 Aliphatics	8120		167	500	5	05/12/2023 10:31	WG2057904
Total VPH	15700		667	2000	10	05/14/2023 00:12	WG2059213
Total Purgeable Hydrocarbons C5-C12	28800		333	1000	5	05/12/2023 10:31	WG2057904
(S) 2,5-Dibromotoluene(FID)	*104*			*70.0-130*		*05/12/2023 10:31*	WG2057904
(S) 2,5-Dibromotoluene(FID)	*137*	J1		*70.0-130*		*05/14/2023 00:12*	WG2059213
(S) 2,5-Dibromotoluene(PID)	*68.3*	J2		*70.0-130*		*05/12/2023 10:31*	WG2057904
(S) 2,5-Dibromotoluene(PID)	*73.2*			*70.0-130*		*05/14/2023 00:12*	WG2059213

TPH by Method MTDEQ EPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
EPH Screen	138000		2000	6000	20	05/11/2023 12:43	WG2053600
Unadjusted C9-C18 Aliphatics	57900		4000	12000	20	05/12/2023 11:29	WG2058176
Unadjusted C19-C36 Aliphatics	18900		4000	12000	20	05/12/2023 11:29	WG2058176
Unadjusted C11-C22 Aromatics	22300		2000	6000	10	05/12/2023 11:51	WG2058176
Unadjusted Total Petroleum Hydrocarbons	99100		2000	6000	10	05/12/2023 11:51	WG2058176
Adjusted C11-C22 Aromatics	22300		2000	6000	10	05/12/2023 11:51	WG2058176
Adjusted Total Petroleum Hydrocarbons	99100		2000	6000	10	05/12/2023 11:51	WG2058176
(S) o-Terphenyl	*0.000*	J7		*40.0-140*		*05/11/2023 12:43*	WG2053600
(S) o-Terphenyl	*54.0*			*40.0-140*		*05/12/2023 11:51*	WG2058176
(S) 1-Chloro-octadecane	*0.000*	J7		*40.0-140*		*05/12/2023 11:29*	WG2058176
(S) 2-Fluorobiphenyl	*168*	J1		*40.0-140*		*05/12/2023 11:51*	WG2058176
(S) 2-Bromonaphthalene	*183*	J1		*40.0-140*		*05/12/2023 11:51*	WG2058176

Sample Narrative:

L1612943-01 WG2058176: Dilution and surrogate failure due to matrix interference.

Method Blank (MB)

(MB) R3924284-3 05/12/23 04:45

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C5-C8 Aliphatics	U		33.3	100
Unadjusted C9-C12 Aliphatics	U		33.3	100
Adjusted C5-C8 Aliphatics	U		33.3	100
Adjusted C9-C12 Aliphatics	U		33.3	100
Total Purgeable Hydrocarbons C5-C12	U		66.7	200
(S) 2,5-Dibromotoluene(FID)	*84.3*			*70.0-130*
(S) 2,5-Dibromotoluene(PID)	*79.1*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3924284-1 05/12/23 02:35 • (LCSD) R3924284-2 05/12/23 03:07

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C5-C8 Aliphatics	1200	1480	1410	123	117	70.0-130			4.84	50
Unadjusted C9-C12 Aliphatics	1400	1630	1560	116	111	70.0-130			4.39	50
Total Purgeable Hydrocarbons C5-C12	2800	3340	3200	119	114	70.0-130			4.28	50
(S) 2,5-Dibromotoluene(FID)				*88.9*	*91.4*	*70.0-130*				
(S) 2,5-Dibromotoluene(PID)				*85.0*	*84.9*	*70.0-130*				

Method Blank (MB)

(MB) R3925064-3 05/13/23 23:16

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C9-C10 Aromatics	U		33.3	100
Total VPH	U		66.7	200
(S) 2,5-Dibromotoluene(FID)	*83.2*			*70.0-130*
(S) 2,5-Dibromotoluene(PID)	*76.7*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3925064-1 05/13/23 19:58 • (LCSD) R3925064-2 05/13/23 21:38

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C10 Aromatics	200	217	215	108	108	70.0-130			0.926	50
Total VPH	2800	3140	3150	112	113	70.0-130			0.318	50
(S) 2,5-Dibromotoluene(FID)				*96.7*	*83.4*	*70.0-130*				
(S) 2,5-Dibromotoluene(PID)				*90.1*	*79.9*	*70.0-130*				

Method Blank (MB)

(MB) R3923879-1 05/11/23 11:30

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
EPH Screen	U		100	300
(S) o-Terphenyl	*104*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3923879-2 05/11/23 11:45 • (LCSD) R3923879-3 05/11/23 12:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
EPH Screen	3100	2630	2830	84.8	91.3	40.0-140			7.33	25
(S) o-Terphenyl				*102*	*104*	*40.0-140*				

Method Blank (MB)

(MB) R3923930-1 05/11/23 21:42

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C9-C18 Aliphatics	U		200	600
Unadjusted C19-C36 Aliphatics	U		200	600
(S) 1-Chloro-octadecane	*91.5*			*40.0-140*

Method Blank (MB)

(MB) R3923930-4 05/11/23 22:48

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C11-C22 Aromatics	U		200	600
(S) o-Terphenyl	*88.1*			*40.0-140*
(S) 2-Fluorobiphenyl	*89.5*			*40.0-140*
(S) 2-Bromonaphthalene	*97.4*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3923930-2 05/11/23 22:04 • (LCSD) R3923930-3 05/11/23 22:26

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C18 Aliphatics	600	425	424	70.8	70.7	40.0-140			0.236	25
Unadjusted C19-C36 Aliphatics	800	797	843	99.6	105	40.0-140			5.61	25
(S) 1-Chloro-octadecane				*83.4*	*84.3*	*40.0-140*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3923930-5 05/11/23 23:10 • (LCSD) R3923930-6 05/11/23 23:32

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C11-C22 Aromatics	1700	1500	1510	88.2	88.8	40.0-140			0.664	25
(S) o-Terphenyl				*85.2*	*86.9*	*40.0-140*				
(S) 2-Fluorobiphenyl				*90.4*	*91.1*	*40.0-140*				
(S) 2-Bromonaphthalene				*96.0*	*97.0*	*40.0-140*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

C192

Chain of Custody

Pace Analytical®
www.pacelabs.com

Workorder: YE04012 Workorder Name: Calumet CMR AOC16 Owner Received Date: 5/4/2023 Results Requested By: 5/18/2023

Report To:	Subcontract To:
Edward T. Barnett	Project # YE04012
Pace Analytical	
106 Vantage Point Drive	Pace National
Columbia SC, 29223	
803-509-8398	
Edward.Barnett@pacelabs.com	

L1612943

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	MA EPH	MA VPH	LAB USE ONLY
1	CMR-SP200-230503	grab	05/03/23 @ 1210	YE04012-001	AQ		X	X	-01
									Environ
									EQUIS
									EDD
									Needed

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	[signature]	5/4/23 1900	[signature]	5-5-23	For all samples - MA EPH and MA VPH
2				0900	Level 2 with J/MDLs
3					screen + fractionated analysis

Cooler Temperature on Receipt 0.4° °C	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM 0.4°ct = 0.4°c FMT-ALL-C-002rev.00 24March2009 Page 1 of 1

Pace Analytical
www.pacelabs.com

Ship to :
Pace National

Phone

INTER_LABORATORY WORK ORDER # YE04012

(To be complete by sending lab)

Sending Project No:	Calumet
Receiving Project No:	
Check Box for Consolidated Invoice:	x
Date Prepared:	4-May
REQUESTED COMPLETION DATE:	18-May

Sending Region	IR77-SC	Sending Project Mgr.	Eddie Barnett
Receiving Region	Pace National	External Client	Ramboll
State of Sample Origin	MI	Q	LV2 w / Js

All questions should be addressed to sending project manager.

L1612943

Requested Reportable Units: ug/L or mg/kg Report Wet or Dry Weight? dry Cert Needed: MI

WORK REQUESTED						
Method Description	**Container Type**	**Quantity of containers**	**Preservative**	**Quantity of Samples**	**Unit Price**	**Amount**
MT VPH	40mL	2	HCL	1	65	65
MT EPH	1L	1	HCL	1	90	90
					TOTAL	155

Special Requirements: Environ EQUIS EDD Needed

Receiving Reqion Department	**Acctg. Code**	**Totals from above**	**Revenue Allocation**	
			Receiving Region (80%)	Client Services Dept. Sending Region (20%)
		65	52	13
		90	72	18
* Custom Revenue Allocation		TOTAL	124	31

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Chain of Custody Included: [x] Yes [ ] No Return Samples to Sending Reguion: [ ] Yes [x] No

Matrix: [ ] Soil [ ] Water [ ] Air [ ] Other (identity) _____

CONFIRMATION OF WORK COMPLETED

Date Completed: _____ Receiving Project Manager: _____

Original sent to the receiving lab - Copy kept at the sending lab.

When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

Report of Analysis

Ramboll US Corporation
333 West Wacker Drive
Suite 2700
Chicago, IL 60606
Attention: Ruta Deshpande

Project Name: Calumet (CMR) AOC16

Project Number: 1690029636-001

Lot Number:**YF01022**

Date Completed:06/28/2023

06/28/2023 12:34 PM
Approved and released by:
Project Manager II: **Edward Barnett**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Case Narrative
Ramboll US Corporation
Lot Number: YF01022

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report. Where sampling is conducted by the client, results relate to the accuracy of the information provided, and as the samples are received.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18, PFAS by Isotope Dilution SOP.

Pace is a DoD/DoE and TNI accredited laboratory; however, Pace is not accredited for PFAS Direct Aqueous Injection or Method D8421.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

VOCs

The laboratory control sample (LCS) for analytical batch 77325 exceeded acceptance criteria for the following analyte: 2-Hexanone. This analyte was biased high and was not detected in the sample affected: YF01022-001.

YF01022-001 (CMR-SP200-230531) (Run 1) (Analysis Batch 77325) Full list VOCs

SVOCs

Sample YF01022-001 (CMR-SP200-230531) has been analyzed at dilution. The dilution caused a surrogate(s) to recover outside of method criteria. No corrective action is required as it is known that dilutions of 5X and greater may impact surrogate recoveries. The associated compounds have been qualified with a “Q” accordingly.

Subcontracted Results

EPH and VPH were subcontracted to Pace National for analysis. The results are included after the Pace report of analysis.

Sample Summary

Ramboll US Corporation

Lot Number: YF01022

Project Name: Calumet (CMR) AOC16

Project Number: 1690029636-001

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	CMR-SP200-230531	Aqueous	05/31/2023 1600	06/01/2023

(1 sample)

Detection Summary

Ramboll US Corporation

Lot Number: YF01022

Project Name: Calumet (CMR) AOC16

Project Number: 1690029636-001

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	CMR-SP200-230531	Aqueous	Benzene	8260D	27		ug/L	5
001	CMR-SP200-230531	Aqueous	Cyclohexane	8260D	16		ug/L	5
001	CMR-SP200-230531	Aqueous	Ethylbenzene	8260D	78		ug/L	5
001	CMR-SP200-230531	Aqueous	Isopropylbenzene	8260D	17		ug/L	5
001	CMR-SP200-230531	Aqueous	Methylcyclohexane	8260D	19	JS	ug/L	5
001	CMR-SP200-230531	Aqueous	Naphthalene	8260D	760	S	ug/L	5
001	CMR-SP200-230531	Aqueous	Toluene	8260D	6.1		ug/L	5
001	CMR-SP200-230531	Aqueous	Xylenes (total)	8260D	1000	S	ug/L	6
001	CMR-SP200-230531	Aqueous	m+p - Xylenes	8260D	770	S	ug/L	6
001	CMR-SP200-230531	Aqueous	o - Xylenes	8260D	270		ug/L	6
001	CMR-SP200-230531	Aqueous	1,1'-Biphenyl	8270E	110	JQ	ug/L	7
001	CMR-SP200-230531	Aqueous	1-Methylnaphthalene	8270E	810	Q	ug/L	8
001	CMR-SP200-230531	Aqueous	2-Methylnaphthalene	8270E	1200	Q	ug/L	8
001	CMR-SP200-230531	Aqueous	Naphthalene	8270E	570	Q	ug/L	8
001	CMR-SP200-230531	Aqueous	Phenanthrene	8270E	110	Q	ug/L	8
001	CMR-SP200-230531	Aqueous	Pyrene	8270E	22	JQ	ug/L	8

(16 detections)

Volatile Organic Compounds by GC/MS

Client: Ramboll US Corporation
Laboratory ID: YF01022-001
Description: CMR-SP200-230531
Matrix: Aqueous
Date Sampled: 05/31/2023 1600
Project Name: Calumet (CMR) AOC16
Date Received: 06/01/2023
Project Number: 1690029636-001

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	10	06/09/2023 2054	JM1		77325

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	67-64-1	8260D	ND	S	100	40	ug/L	1
Benzene	71-43-2	8260D	27		5.0	4.0	ug/L	1
Bromochloromethane	74-97-5	8260D	ND		5.0	4.0	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		5.0	4.0	ug/L	1
Bromoform	75-25-2	8260D	ND	S	5.0	4.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		5.0	4.0	ug/L	1
2-Butanone (MEK)	78-93-3	8260D	ND	S	100	20	ug/L	1
Carbon disulfide	75-15-0	8260D	ND		5.0	4.0	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		5.0	4.0	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		5.0	4.0	ug/L	1
Chloroethane	75-00-3	8260D	ND		5.0	4.0	ug/L	1
Chloroform	67-66-3	8260D	ND		5.0	4.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		5.0	4.0	ug/L	1
Cyclohexane	110-82-7	8260D	16		5.0	4.0	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		5.0	4.0	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		5.0	4.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		5.0	4.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		5.0	4.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		5.0	4.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		5.0	4.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND		5.0	4.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		5.0	4.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		5.0	4.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		5.0	4.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		5.0	4.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		5.0	4.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		5.0	4.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		5.0	4.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		5.0	4.0	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND		200	130	ug/L	1
Ethylbenzene	100-41-4	8260D	78		5.0	4.0	ug/L	1
2-Hexanone	591-78-6	8260D	ND	LS	100	20	ug/L	1
Isopropylbenzene	98-82-8	8260D	17		5.0	4.0	ug/L	1
Methyl acetate	79-20-9	8260D	ND	S	10	4.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		5.0	4.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		100	20	ug/L	1
Methylcyclohexane	108-87-2	8260D	19	JS	50	4.0	ug/L	1
Methylene chloride	75-09-2	8260D	ND		5.0	4.0	ug/L	1
Naphthalene	91-20-3	8260D	760	S	5.0	4.0	ug/L	1
Styrene	100-42-5	8260D	ND		5.0	4.1	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND	S	5.0	4.0	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		5.0	4.0	ug/L	1
Toluene	108-88-3	8260D	6.1		5.0	4.0	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		10	4.2	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Volatile Organic Compounds by GC/MS

Client: Ramboll US Corporation
Laboratory ID: YF01022-001
Description: CMR-SP200-230531
Matrix: Aqueous
Date Sampled: 05/31/2023 1600
Project Name: Calumet (CMR) AOC16
Date Received: 06/01/2023
Project Number: 1690029636-001

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	10	06/09/2023 2054	JM1		77325

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		5.0	4.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		5.0	4.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		5.0	4.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		5.0	4.0	ug/L	1
Trichloroethene	79-01-6	8260D	ND		5.0	4.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		5.0	4.0	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		5.0	4.0	ug/L	1
Xylenes (total)	1330-20-7	8260D	1000	S	10	4.0	ug/L	1
m+p - Xylenes	179601-23-1	8260D	770	S	5.0	4.0	ug/L	1
o - Xylenes	95-47-6	8260D	270		5.0	4.0	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
Bromofluorobenzene		107	70-130
1,2-Dichloroethane-d4		82	70-130
Toluene-d8		96	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: Ramboll US Corporation | Laboratory ID: YF01022-001
Description: CMR-SP200-230531 | Matrix: Aqueous
Date Sampled: 05/31/2023 1600 | Project Name: Calumet (CMR) AOC16
Date Received: 06/01/2023 | Project Number: 1690029636-001

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	200	06/27/2023 1708	JCG	06/06/2023 1524	76963

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	83-32-9	8270E	ND	Q	32	8.0	ug/L	1
Acenaphthylene	208-96-8	8270E	ND	Q	32	8.0	ug/L	1
Acetophenone	98-86-2	8270E	ND	Q	160	46	ug/L	1
Anthracene	120-12-7	8270E	ND	Q	32	8.0	ug/L	1
Atrazine	1912-24-9	8270E	ND	Q	160	40	ug/L	1
Benzaldehyde	100-52-7	8270E	ND	Q	800	54	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	ND	Q	32	8.0	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	ND	Q	32	8.0	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	ND	Q	32	8.0	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	ND	Q	32	8.0	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	ND	Q	32	8.0	ug/L	1
1,1'-Biphenyl	92-52-4	8270E	110	JQ	160	42	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270E	ND	Q	160	30	ug/L	1
Butyl benzyl phthalate	85-68-7	8270E	ND	Q	800	42	ug/L	1
Caprolactam	105-60-2	8270E	ND	Q	800	140	ug/L	1
Carbazole	86-74-8	8270E	ND	Q	160	8.0	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND	Q	160	34	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270E	ND	Q	160	52	ug/L	1
4-Chloroaniline	106-47-8	8270E	ND	Q	160	26	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	Q	160	12	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	Q	160	32	ug/L	1
2-Chloronaphthalene	91-58-7	8270E	ND	Q	160	30	ug/L	1
2-Chlorophenol	95-57-8	8270E	ND	Q	160	30	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND	Q	160	32	ug/L	1
Chrysene	218-01-9	8270E	ND	Q	32	8.0	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	ND	Q	32	8.0	ug/L	1
Dibenzofuran	132-64-9	8270E	ND	Q	160	32	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270E	ND	Q	800	160	ug/L	1
2,4-Dichlorophenol	120-83-2	8270E	ND	Q	160	38	ug/L	1
Diethylphthalate	84-66-2	8270E	ND	Q	800	38	ug/L	1
Dimethyl phthalate	131-11-3	8270E	ND	Q	800	36	ug/L	1
2,4-Dimethylphenol	105-67-9	8270E	ND	Q	160	30	ug/L	1
Di-n-butyl phthalate	84-74-2	8270E	ND	Q	800	84	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	Q	800	180	ug/L	1
2,4-Dinitrophenol	51-28-5	8270E	ND	Q	800	260	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270E	ND	Q	320	72	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270E	ND	Q	320	68	ug/L	1
Di-n-octylphthalate	117-84-0	8270E	ND	Q	800	96	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND	Q	800	300	ug/L	1
Fluoranthene	206-44-0	8270E	ND	Q	32	8.0	ug/L	1
Fluorene	86-73-7	8270E	ND	Q	32	8.0	ug/L	1
Hexachlorobenzene	118-74-1	8270E	ND	Q	160	30	ug/L	1
Hexachlorobutadiene	87-68-3	8270E	ND	Q	160	34	ug/L	1
Hexachlorocyclopentadiene	77-47-4	8270E	ND	Q	800	220	ug/L	1

LOQ = Limit of Quantitation | B = Detected in the method blank | E = Quantitation of compound exceeded the calibration range | DL = Detection Limit | Q = Surrogate failure
ND = Not detected at or above the DL | N = Recovery is out of criteria | P = The RPD between two GC columns exceeds 40% | J = Estimated result < LOQ and ≥ DL | L = LCS/LCSD failure
H = Out of holding time | W = Reported on wet weight basis | S = MS/MSD failure

Semivolatile Organic Compounds by GC/MS

Client: Ramboll US Corporation | Laboratory ID: YF01022-001
Description: CMR-SP200-230531 | Matrix: Aqueous
Date Sampled: 05/31/2023 1600 | Project Name: Calumet (CMR) AOC16
Date Received: 06/01/2023 | Project Number: 1690029636-001

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	200	06/27/2023 1708	JCG	06/06/2023 1524	76963

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachloroethane	67-72-1	8270E	ND	Q	160	34	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND	Q	32	8.0	ug/L	1
Isophorone	78-59-1	8270E	ND	Q	160	44	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	810	Q	32	8.0	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	1200	Q	32	8.0	ug/L	1
2-Methylphenol	95-48-7	8270E	ND	Q	160	42	ug/L	1
3+4-Methylphenol	106-44-5	8270E	ND	Q	320	92	ug/L	1
Naphthalene	91-20-3	8270E	570	Q	32	8.0	ug/L	1
2-Nitroaniline	88-74-4	8270E	ND	Q	320	130	ug/L	1
3-Nitroaniline	99-09-2	8270E	ND	Q	320	30	ug/L	1
4-Nitroaniline	100-01-6	8270E	ND	Q	320	260	ug/L	1
Nitrobenzene	98-95-3	8270E	ND	Q	160	34	ug/L	1
2-Nitrophenol	88-75-5	8270E	ND	Q	320	88	ug/L	1
4-Nitrophenol	100-02-7	8270E	ND	Q	800	420	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	Q	160	56	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND	Q	160	100	ug/L	1
Pentachlorophenol	87-86-5	8270E	ND	Q	800	270	ug/L	1
Phenanthrene	85-01-8	8270E	110	Q	32	8.0	ug/L	1
Phenol	108-95-2	8270E	ND	Q	160	38	ug/L	1
Pyrene	129-00-0	8270E	22	JQ	32	8.0	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270E	ND	Q	160	38	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270E	ND	Q	160	44	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2-Fluorobiphenyl		112	37-129
2-Fluorophenol		41	24-127
Nitrobenzene-d5	N	283	38-127
Phenol-d5	N	237	28-128
Terphenyl-d14		53	10-148
2,4,6-Tribromophenol	N	0.00	35-144

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

QC Summary

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ77325-001
Batch: 77325
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acetone	ND		1	10	4.0	ug/L	06/09/2023 1258
Benzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Bromochloromethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Bromodichloromethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Bromoform	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Bromomethane (Methyl bromide)	ND		1	0.50	0.40	ug/L	06/09/2023 1258
2-Butanone (MEK)	ND		1	10	2.0	ug/L	06/09/2023 1258
Carbon disulfide	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Carbon tetrachloride	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Chlorobenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Chloroethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Chloroform	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Chloromethane (Methyl chloride)	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Cyclohexane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Dibromochloromethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,2-Dibromoethane (EDB)	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,2-Dichlorobenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,3-Dichlorobenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,4-Dichlorobenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Dichlorodifluoromethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,1-Dichloroethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,2-Dichloroethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,1-Dichloroethene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
cis-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
trans-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,2-Dichloropropane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
cis-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
trans-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,4-Dioxane	ND		1	20	13	ug/L	06/09/2023 1258
Ethylbenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
2-Hexanone	ND		1	10	2.0	ug/L	06/09/2023 1258
Isopropylbenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Methyl acetate	ND		1	1.0	0.40	ug/L	06/09/2023 1258
Methyl tertiary butyl ether (MTBE)	ND		1	0.50	0.40	ug/L	06/09/2023 1258
4-Methyl-2-pentanone	ND		1	10	2.0	ug/L	06/09/2023 1258
Methylcyclohexane	ND		1	5.0	0.40	ug/L	06/09/2023 1258
Methylene chloride	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Naphthalene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Styrene	ND		1	0.50	0.41	ug/L	06/09/2023 1258
1,1,2,2-Tetrachloroethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Tetrachloroethene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Toluene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	0.42	ug/L	06/09/2023 1258

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ77325-001
Batch: 77325
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
1,2,3-Trichlorobenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,2,4-Trichlorobenzene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,1,1-Trichloroethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
1,1,2-Trichloroethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Trichloroethene	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Trichlorofluoromethane	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Vinyl chloride	ND		1	0.50	0.40	ug/L	06/09/2023 1258
Xylenes (total)	ND		1	1.0	0.40	ug/L	06/09/2023 1258
m+p - Xylenes	ND		1	0.50	0.40	ug/L	06/09/2023 1258
o - Xylenes	ND		1	0.50	0.40	ug/L	06/09/2023 1258

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		100	70-130
1,2-Dichloroethane-d4		84	70-130
Toluene-d8		94	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ77325-002
Batch: 77325
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	100	95		1	95	60-140	06/09/2023 1209
Benzene	50	49		1	97	70-130	06/09/2023 1209
Bromochloromethane	50	48		1	95	70-130	06/09/2023 1209
Bromodichloromethane	50	52		1	105	70-130	06/09/2023 1209
Bromoform	50	51		1	101	70-130	06/09/2023 1209
Bromomethane (Methyl bromide)	50	52		1	104	70-130	06/09/2023 1209
2-Butanone (MEK)	100	110		1	114	70-130	06/09/2023 1209
Carbon disulfide	50	47		1	94	70-130	06/09/2023 1209
Carbon tetrachloride	50	54		1	108	70-130	06/09/2023 1209
Chlorobenzene	50	49		1	98	70-130	06/09/2023 1209
Chloroethane	50	48		1	96	70-130	06/09/2023 1209
Chloroform	50	50		1	101	70-130	06/09/2023 1209
Chloromethane (Methyl chloride)	50	50		1	101	60-140	06/09/2023 1209
Cyclohexane	50	51		1	102	70-130	06/09/2023 1209
1,2-Dibromo-3-chloropropane (DBCP)	50	48		1	96	70-130	06/09/2023 1209
Dibromochloromethane	50	54		1	109	70-130	06/09/2023 1209
1,2-Dibromoethane (EDB)	50	50		1	100	70-130	06/09/2023 1209
1,2-Dichlorobenzene	50	46		1	93	70-130	06/09/2023 1209
1,3-Dichlorobenzene	50	47		1	95	70-130	06/09/2023 1209
1,4-Dichlorobenzene	50	46		1	92	70-130	06/09/2023 1209
Dichlorodifluoromethane	50	51		1	102	60-140	06/09/2023 1209
1,1-Dichloroethane	50	48		1	96	70-130	06/09/2023 1209
1,2-Dichloroethane	50	48		1	96	70-130	06/09/2023 1209
1,1-Dichloroethene	50	53		1	106	70-130	06/09/2023 1209
cis-1,2-Dichloroethene	50	49		1	97	70-130	06/09/2023 1209
trans-1,2-Dichloroethene	50	48		1	96	70-130	06/09/2023 1209
1,2-Dichloropropane	50	52		1	105	70-130	06/09/2023 1209
cis-1,3-Dichloropropene	50	59		1	117	70-130	06/09/2023 1209
trans-1,3-Dichloropropene	50	50		1	100	70-130	06/09/2023 1209
1,4-Dioxane	500	320		1	65	60-140	06/09/2023 1209
Ethylbenzene	50	53		1	107	70-130	06/09/2023 1209
2-Hexanone	100	130	N	1	132	70-130	06/09/2023 1209
Isopropylbenzene	50	54		1	108	70-130	06/09/2023 1209
Methyl acetate	50	42		1	84	70-130	06/09/2023 1209
Methyl tertiary butyl ether (MTBE)	50	47		1	94	70-130	06/09/2023 1209
4-Methyl-2-pentanone	100	110		1	111	70-130	06/09/2023 1209
Methylcyclohexane	50	50		1	100	70-130	06/09/2023 1209
Methylene chloride	50	50		1	99	70-130	06/09/2023 1209
Naphthalene	50	60		1	119	70-130	06/09/2023 1209
Styrene	50	61		1	122	70-130	06/09/2023 1209
1,1,2,2-Tetrachloroethane	50	44		1	88	70-130	06/09/2023 1209
Tetrachloroethene	50	50		1	100	70-130	06/09/2023 1209
Toluene	50	51		1	101	70-130	06/09/2023 1209
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	50		1	100	70-130	06/09/2023 1209

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ77325-002
Batch: 77325
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	50	61		1	121	70-130	06/09/2023 1209
1,2,4-Trichlorobenzene	50	58		1	116	70-130	06/09/2023 1209
1,1,1-Trichloroethane	50	53		1	106	70-130	06/09/2023 1209
1,1,2-Trichloroethane	50	48		1	95	70-130	06/09/2023 1209
Trichloroethene	50	52		1	104	70-130	06/09/2023 1209
Trichlorofluoromethane	50	55		1	109	70-130	06/09/2023 1209
Vinyl chloride	50	51		1	102	70-130	06/09/2023 1209
Xylenes (total)	100	110		1	106	70-130	06/09/2023 1209
m+p - Xylenes	50	54		1	108	70-130	06/09/2023 1209
o - Xylenes	50	52		1	104	70-130	06/09/2023 1209

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		103	70-130
1,2-Dichloroethane-d4		91	70-130
Toluene-d8		100	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MS

Sample ID: YF01022-001MS
Batch: 77325
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	ND	1000	300	N	10	30	60-140	06/09/2023 2258
Benzene	27	500	490		10	93	70-130	06/09/2023 2258
Bromochloromethane	ND	500	410		10	82	70-130	06/09/2023 2258
Bromodichloromethane	ND	500	480		10	95	70-130	06/09/2023 2258
Bromoform	ND	500	350	N	10	69	70-130	06/09/2023 2258
Bromomethane (Methyl bromide)	ND	500	540		10	109	70-130	06/09/2023 2258
2-Butanone (MEK)	ND	1000	480	N	10	48	70-130	06/09/2023 2258
Carbon disulfide	ND	500	500		10	101	70-130	06/09/2023 2258
Carbon tetrachloride	ND	500	500		10	100	70-130	06/09/2023 2258
Chlorobenzene	ND	500	460		10	92	70-130	06/09/2023 2258
Chloroethane	ND	500	510		10	102	70-130	06/09/2023 2258
Chloroform	ND	500	460		10	92	70-130	06/09/2023 2258
Chloromethane (Methyl chloride)	ND	500	520		10	104	60-140	06/09/2023 2258
Cyclohexane	16	500	430		10	83	70-130	06/09/2023 2258
1,2-Dibromo-3-chloropropane (DBCP)	ND	500	380		10	75	70-130	06/09/2023 2258
Dibromochloromethane	ND	500	430		10	86	70-130	06/09/2023 2258
1,2-Dibromoethane (EDB)	ND	500	390		10	78	70-130	06/09/2023 2258
1,2-Dichlorobenzene	ND	500	400		10	80	70-130	06/09/2023 2258
1,3-Dichlorobenzene	ND	500	390		10	79	70-130	06/09/2023 2258
1,4-Dichlorobenzene	ND	500	380		10	76	70-130	06/09/2023 2258
Dichlorodifluoromethane	ND	500	560		10	112	60-140	06/09/2023 2258
1,1-Dichloroethane	ND	500	440		10	88	70-130	06/09/2023 2258
1,2-Dichloroethane	ND	500	420		10	84	70-130	06/09/2023 2258
1,1-Dichloroethene	ND	500	570		10	113	70-130	06/09/2023 2258
cis-1,2-Dichloroethene	ND	500	440		10	89	70-130	06/09/2023 2258
trans-1,2-Dichloroethene	ND	500	450		10	89	70-130	06/09/2023 2258
1,2-Dichloropropane	ND	500	480		10	97	70-130	06/09/2023 2258
cis-1,3-Dichloropropene	ND	500	500		10	101	70-130	06/09/2023 2258
trans-1,3-Dichloropropene	ND	500	410		10	81	70-130	06/09/2023 2258
1,4-Dioxane	ND	5000	4600		10	91	60-140	06/09/2023 2258
Ethylbenzene	78	500	540		10	92	70-130	06/09/2023 2258
2-Hexanone	ND	1000	670	N	10	67	70-130	06/09/2023 2258
Isopropylbenzene	17	500	440		10	84	70-130	06/09/2023 2258
Methyl acetate	ND	500	250	N	10	50	70-130	06/09/2023 2258
Methyl tertiary butyl ether (MTBE)	ND	500	370		10	74	70-130	06/09/2023 2258
4-Methyl-2-pentanone	ND	1000	700		10	70	70-130	06/09/2023 2258
Methylcyclohexane	19	500	310	N	10	58	70-130	06/09/2023 2258
Methylene chloride	ND	500	490		10	98	70-130	06/09/2023 2258
Naphthalene	760	500	960	N	10	40	70-130	06/09/2023 2258
Styrene	ND	500	550		10	110	70-130	06/09/2023 2258
1,1,2,2-Tetrachloroethane	ND	500	350	N	10	69	70-130	06/09/2023 2258
Tetrachloroethene	ND	500	430		10	86	70-130	06/09/2023 2258
Toluene	6.1	500	480		10	95	70-130	06/09/2023 2258
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	500	500		10	99	70-130	06/09/2023 2258

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MS

Sample ID: YF01022-001MS
Batch: 77325
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	ND	500	500		10	99	70-130	06/09/2023 2258
1,2,4-Trichlorobenzene	ND	500	430		10	87	70-130	06/09/2023 2258
1,1,1-Trichloroethane	ND	500	500		10	101	70-130	06/09/2023 2258
1,1,2-Trichloroethane	ND	500	400		10	80	70-130	06/09/2023 2258
Trichloroethene	ND	500	500		10	100	70-130	06/09/2023 2258
Trichlorofluoromethane	ND	500	630		10	126	70-130	06/09/2023 2258
Vinyl chloride	ND	500	530		10	106	70-130	06/09/2023 2258
Xylenes (total)	1000	1000	1700	N	10	67	70-130	06/09/2023 2258
m+p - Xylenes	770	500	1000	N	10	54	70-130	06/09/2023 2258
o - Xylenes	270	500	670		10	80	70-130	06/09/2023 2258

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		99	70-130
1,2-Dichloroethane-d4		83	70-130
Toluene-d8		99	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ76963-001
Batch: 76963
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/06/2023 1524

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acenaphthene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Acenaphthylene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Acetophenone	ND		1	0.80	0.23	ug/L	06/27/2023 1251
Anthracene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Atrazine	ND		1	0.80	0.20	ug/L	06/27/2023 1251
Benzaldehyde	ND		1	4.0	0.27	ug/L	06/27/2023 1251
Benzo(a)anthracene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Benzo(a)pyrene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Benzo(b)fluoranthene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Benzo(g,h,i)perylene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Benzo(k)fluoranthene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
1,1'-Biphenyl	ND		1	0.80	0.21	ug/L	06/27/2023 1251
4-Bromophenyl phenyl ether	ND		1	0.80	0.15	ug/L	06/27/2023 1251
Butyl benzyl phthalate	ND		1	4.0	0.21	ug/L	06/27/2023 1251
Caprolactam	ND		1	4.0	0.71	ug/L	06/27/2023 1251
Carbazole	ND		1	0.80	0.040	ug/L	06/27/2023 1251
bis (2-Chloro-1-methylethyl) ether	ND		1	0.80	0.17	ug/L	06/27/2023 1251
4-Chloro-3-methyl phenol	ND		1	0.80	0.26	ug/L	06/27/2023 1251
4-Chloroaniline	ND		1	0.80	0.13	ug/L	06/27/2023 1251
bis(2-Chloroethoxy)methane	ND		1	0.80	0.060	ug/L	06/27/2023 1251
bis(2-Chloroethyl)ether	ND		1	0.80	0.16	ug/L	06/27/2023 1251
2-Chloronaphthalene	ND		1	0.80	0.15	ug/L	06/27/2023 1251
2-Chlorophenol	ND		1	0.80	0.15	ug/L	06/27/2023 1251
4-Chlorophenyl phenyl ether	ND		1	0.80	0.16	ug/L	06/27/2023 1251
Chrysene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Dibenzo(a,h)anthracene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Dibenzofuran	ND		1	0.80	0.16	ug/L	06/27/2023 1251
3,3'-Dichlorobenzidine	ND		1	4.0	0.81	ug/L	06/27/2023 1251
2,4-Dichlorophenol	ND		1	0.80	0.19	ug/L	06/27/2023 1251
Diethylphthalate	ND		1	4.0	0.19	ug/L	06/27/2023 1251
Dimethyl phthalate	ND		1	4.0	0.18	ug/L	06/27/2023 1251
2,4-Dimethylphenol	ND		1	0.80	0.15	ug/L	06/27/2023 1251
Di-n-butyl phthalate	ND		1	4.0	0.42	ug/L	06/27/2023 1251
4,6-Dinitro-2-methylphenol	ND		1	4.0	0.89	ug/L	06/27/2023 1251
2,4-Dinitrophenol	ND		1	4.0	1.3	ug/L	06/27/2023 1251
2,4-Dinitrotoluene	ND		1	1.6	0.36	ug/L	06/27/2023 1251
2,6-Dinitrotoluene	ND		1	1.6	0.34	ug/L	06/27/2023 1251
Di-n-octylphthalate	ND		1	4.0	0.48	ug/L	06/27/2023 1251
bis(2-Ethylhexyl)phthalate	ND		1	4.0	1.5	ug/L	06/27/2023 1251
Fluoranthene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Fluorene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Hexachlorobenzene	ND		1	0.80	0.15	ug/L	06/27/2023 1251
Hexachlorobutadiene	ND		1	0.80	0.17	ug/L	06/27/2023 1251
Hexachlorocyclopentadiene	ND		1	4.0	1.1	ug/L	06/27/2023 1251

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ76963-001
Batch: 76963
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/06/2023 1524

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Hexachloroethane	ND		1	0.80	0.17	ug/L	06/27/2023 1251
Indeno(1,2,3-c,d)pyrene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Isophorone	ND		1	0.80	0.22	ug/L	06/27/2023 1251
1-Methylnaphthalene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
2-Methylnaphthalene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
2-Methylphenol	ND		1	0.80	0.21	ug/L	06/27/2023 1251
3+4-Methylphenol	ND		1	1.6	0.46	ug/L	06/27/2023 1251
Naphthalene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
2-Nitroaniline	ND		1	1.6	0.66	ug/L	06/27/2023 1251
3-Nitroaniline	ND		1	1.6	0.15	ug/L	06/27/2023 1251
4-Nitroaniline	ND		1	1.6	1.3	ug/L	06/27/2023 1251
Nitrobenzene	ND		1	0.80	0.17	ug/L	06/27/2023 1251
2-Nitrophenol	ND		1	1.6	0.44	ug/L	06/27/2023 1251
4-Nitrophenol	ND		1	4.0	2.1	ug/L	06/27/2023 1251
N-Nitrosodi-n-propylamine	ND		1	0.80	0.28	ug/L	06/27/2023 1251
N-Nitrosodiphenylamine (Diphenylamine)	ND		1	0.80	0.50	ug/L	06/27/2023 1251
Pentachlorophenol	ND		1	4.0	1.3	ug/L	06/27/2023 1251
Phenanthrene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
Phenol	ND		1	0.80	0.19	ug/L	06/27/2023 1251
Pyrene	ND		1	0.16	0.040	ug/L	06/27/2023 1251
2,4,5-Trichlorophenol	ND		1	0.80	0.19	ug/L	06/27/2023 1251
2,4,6-Trichlorophenol	ND		1	0.80	0.22	ug/L	06/27/2023 1251

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		66	37-129
2-Fluorophenol		43	24-127
Nitrobenzene-d5		73	38-127
Phenol-d5		54	28-128
Terphenyl-d14		76	10-148
2,4,6-Tribromophenol		65	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ76963-002
Batch: 76963
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/06/2023 1524

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	8.0	5.7		1	71	30-122	06/27/2023 1316
Acenaphthylene	8.0	6.1		1	76	30-130	06/27/2023 1316
Acetophenone	8.0	7.3		1	92	52-125	06/27/2023 1316
Anthracene	8.0	6.4		1	80	30-123	06/27/2023 1316
Atrazine	8.0	5.4		1	68	25-121	06/27/2023 1316
Benzaldehyde	8.0	7.7		1	97	20-115	06/27/2023 1316
Benzo(a)anthracene	8.0	6.0		1	74	40-125	06/27/2023 1316
Benzo(a)pyrene	8.0	6.2		1	78	40-128	06/27/2023 1316
Benzo(b)fluoranthene	8.0	6.1		1	77	30-130	06/27/2023 1316
Benzo(g,h,i)perylene	8.0	6.6		1	82	30-130	06/27/2023 1316
Benzo(k)fluoranthene	8.0	6.3		1	79	30-130	06/27/2023 1316
1,1'-Biphenyl	8.0	5.6		1	71	42-120	06/27/2023 1316
4-Bromophenyl phenyl ether	8.0	5.8		1	73	30-124	06/27/2023 1316
Butyl benzyl phthalate	8.0	6.6		1	83	54-135	06/27/2023 1316
Caprolactam	8.0	8.0		1	100	44-152	06/27/2023 1316
Carbazole	8.0	6.4		1	80	45-101	06/27/2023 1316
bis (2-Chloro-1-methylethyl) ether	8.0	7.2		1	90	42-124	06/27/2023 1316
4-Chloro-3-methyl phenol	8.0	7.2		1	90	30-123	06/27/2023 1316
4-Chloroaniline	8.0	2.7		1	34	12-157	06/27/2023 1316
bis(2-Chloroethoxy)methane	8.0	8.1		1	101	44-127	06/27/2023 1316
bis(2-Chloroethyl)ether	8.0	7.4		1	93	46-120	06/27/2023 1316
2-Chloronaphthalene	8.0	5.5		1	69	46-100	06/27/2023 1316
2-Chlorophenol	8.0	7.2		1	90	50-117	06/27/2023 1316
4-Chlorophenyl phenyl ether	8.0	5.8		1	73	30-121	06/27/2023 1316
Chrysene	8.0	6.0		1	76	30-130	06/27/2023 1316
Dibenzo(a,h)anthracene	8.0	6.2		1	77	30-130	06/27/2023 1316
Dibenzofuran	8.0	5.6		1	70	30-118	06/27/2023 1316
3,3'-Dichlorobenzidine	8.0	1.0		1	13	10-126	06/27/2023 1316
2,4-Dichlorophenol	8.0	6.1		1	77	30-121	06/27/2023 1316
Diethylphthalate	8.0	6.2		1	78	40-125	06/27/2023 1316
Dimethyl phthalate	8.0	6.2		1	78	40-127	06/27/2023 1316
2,4-Dimethylphenol	8.0	5.9		1	73	20-125	06/27/2023 1316
Di-n-butyl phthalate	8.0	6.8		1	85	40-127	06/27/2023 1316
4,6-Dinitro-2-methylphenol	8.0	6.3		1	79	56-128	06/27/2023 1316
2,4-Dinitrophenol	16	9.3		1	58	11-126	06/27/2023 1316
2,4-Dinitrotoluene	8.0	6.2		1	78	59-127	06/27/2023 1316
2,6-Dinitrotoluene	8.0	6.4		1	80	59-126	06/27/2023 1316
Di-n-octylphthalate	8.0	6.8		1	85	50-136	06/27/2023 1316
bis(2-Ethylhexyl)phthalate	8.0	7.7		1	96	56-128	06/27/2023 1316
Fluoranthene	8.0	6.3		1	79	40-128	06/27/2023 1316
Fluorene	8.0	5.7		1	72	30-124	06/27/2023 1316
Hexachlorobenzene	8.0	5.5		1	68	30-125	06/27/2023 1316
Hexachlorobutadiene	8.0	4.8		1	60	24-110	06/27/2023 1316
Hexachlorocyclopentadiene	40	20		1	51	16-96	06/27/2023 1316

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ76963-002
Batch: 76963
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/06/2023 1524

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Hexachloroethane	8.0	5.5		1	69	31-110	06/27/2023 1316
Indeno(1,2,3-c,d)pyrene	8.0	6.1		1	76	30-130	06/27/2023 1316
Isophorone	8.0	7.1		1	89	57-123	06/27/2023 1316
1-Methylnaphthalene	8.0	6.2		1	77	42-126	06/27/2023 1316
2-Methylnaphthalene	8.0	6.5		1	81	40-132	06/27/2023 1316
2-Methylphenol	8.0	8.9		1	112	56-119	06/27/2023 1316
3+4-Methylphenol	8.0	7.2		1	90	53-119	06/27/2023 1316
Naphthalene	8.0	6.3		1	79	30-130	06/27/2023 1316
2-Nitroaniline	8.0	6.4		1	80	60-124	06/27/2023 1316
3-Nitroaniline	8.0	3.4		1	43	43-123	06/27/2023 1316
4-Nitroaniline	8.0	5.3		1	67	30-135	06/27/2023 1316
Nitrobenzene	8.0	6.8		1	85	51-122	06/27/2023 1316
2-Nitrophenol	8.0	6.2		1	77	51-118	06/27/2023 1316
4-Nitrophenol	16	10		1	65	53-130	06/27/2023 1316
N-Nitrosodi-n-propylamine	8.0	8.0		1	100	54-127	06/27/2023 1316
N-Nitrosodiphenylamine (Diphenylamine)	8.0	5.0		1	63	30-123	06/27/2023 1316
Pentachlorophenol	16	6.7		1	42	42-131	06/27/2023 1316
Phenanthrene	8.0	6.0		1	75	40-123	06/27/2023 1316
Phenol	8.0	7.3		1	91	49-117	06/27/2023 1316
Pyrene	8.0	6.3		1	79	40-126	06/27/2023 1316
2,4,5-Trichlorophenol	8.0	5.6		1	70	30-123	06/27/2023 1316
2,4,6-Trichlorophenol	8.0	5.2		1	66	30-125	06/27/2023 1316

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		67	37-129
2-Fluorophenol		82	24-127
Nitrobenzene-d5		81	38-127
Phenol-d5		82	28-128
Terphenyl-d14		73	10-148
2,4,6-Tribromophenol		70	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody

and

Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 139234

Client: Calumet Refining LLC	Report to Contact: Mike Gibson, Abby Small-Ramboll	Telephone No. / E-mail: 513 641 8677	Quote No.
Address: 607 3rd St NW	Sampler's Signature: X [signature]	Analysis (Attach list if more space is needed)	Page 1 of 1
City: Great Falls; State: MT; Zip Code: 59404	Printed Name: Eric Poissant		Lot # Bar Code (lab use only): YF01022
Project Name: Calumet Refinery			
Project No.: 16700 29636-001			

Sample ID / Description (Containers for each sample may be combined on one line.)	P.O. No. / Collection Date(s)	Collection Time (Military)	Gallons Collected/Sample	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	NaOH/ZnAc	Field Filtered	VOCs	SVOCs	VPH	EPH						ETB2
CMR-SP200-230531	5/31/23	1600	6	X			X			X				X	X	X	X						

Turn Around Time Required (Prior lab approval required for expedited TAT.)	Sample Disposal	Possible Hazard Identification	QC Requirements (Specify)
☒ Standard ☐ Rush (Specify)	☐ Return to Client ☒ Disposal by Lab	☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown	

	Date	Time		Date	Time
1. Relinquished by: [signature] Ramboll	5/31/23	1620	1. Received by: Fed EX		
2. Relinquished by:			2. Received by:		
3. Relinquished by:			3. Received by:		
4. Relinquished by: Fedex	6/1/23	1020	4. Laboratory received by: [signature]	6/1/23	1020

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on Ice (Circle) Yes No Ice Pack
Receipt Temp 1.4 °C
Temp Blank ☐ Y ☒ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: ME003N2-01

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

Sample Receipt Checklist (SRC)

Client: CALUMET REFINING LLC Cooler Inspected by/date: CDR / 6/1/23 Lot #: YF01022

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☐ Yes	☑ No		1. Were custody seals present on the cooler?
☐ Yes	☐ No	☑ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: NA Chlorine Strip ID: NA Tested by: NA

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

1.4 / 1.4 °C NA / NA °C NA / NA °C NA / NA °C

Method: ☐ Temperature Blank ☑ Against Bottles IR Gun ID: 8 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC and all sample containers?
☑ Yes	☐ No		7. Was collection date & time listed on the COC and all sample containers?
☑ Yes	☐ No		8. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		9. Were tests to be performed listed on the COC?
☑ Yes	☐ No		10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		11. Was adequate sample volume available?
☑ Yes	☐ No		12. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☑ Yes	☐ No		13. Were all samples containers accounted for? (No missing/excess)
☐ Yes	☐ No	☑ NA	14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☐ Yes	☐ No	☑ NA	15. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	17. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☑ Yes	☐ No	☐ NA	18. Was the quote number listed on the container label? If yes, Quote # 21552

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) NA were received incorrectly preserved and were adjusted accordingly in sample receiving with NA mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # NA. ☐
Time of preservation NA. If more than one preservative is needed, please note in the comments below.

Sample(s) NA were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is *no*) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA.

Comments:

ANALYTICAL REPORT

June 15, 2023

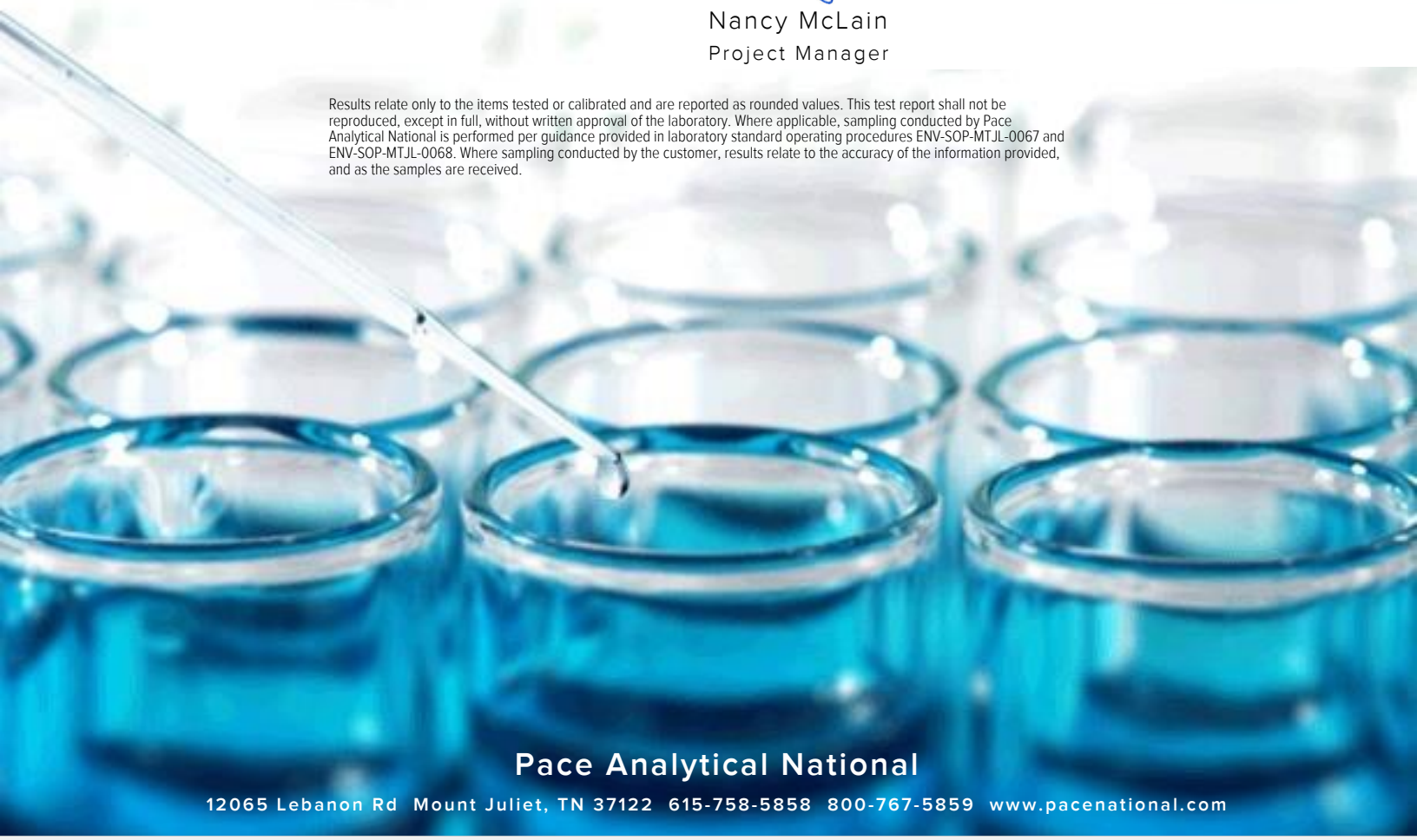
Pace Analytical - West Columbia, SC

Sample Delivery Group:	L1622137
Samples Received:	06/02/2023
Project Number:	YF01022
Description:	Calumet CMR AOC16
Site:	001
Report To:	Edward T. Barnett 106 Vantage Point Dr. West Columbia, SC 29172

Entire Report Reviewed By:

Nancy McLain
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

CMR-SP200-230531 L1622137-01 5

Qc: Quality Control Summary 6

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH 6

TPH by Method MTDEQ EPH 8

Gl: Glossary of Terms 10

Al: Accreditations & Locations 11

Sc: Sample Chain of Custody 12

CMR-SP200-230531 L1622137-01 GW

Collected by	Collected date/time	Received date/time
	05/31/23 16:00	06/02/23 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2072763	100	06/07/23 09:29	06/07/23 09:29	JAH	Mt. Juliet, TN
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2073949	500	06/15/23 08:23	06/15/23 08:23	ADM	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2072096	50	06/07/23 03:44	06/07/23 17:06	TJD	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2073307	20	06/07/23 03:44	06/12/23 15:04	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2073307	50	06/07/23 03:44	06/12/23 13:58	DMG	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Nancy McLain
Project Manager

Project Narrative

Due to multiple preparation procedures, calculated analytes are not reported in the quality control samples for EPH and VPH Methods.

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Unadjusted C5-C8 Aliphatics	3690	J	3330	10000	100	06/07/2023 09:29	WG2072763
Unadjusted C9-C12 Aliphatics	116000		3330	10000	100	06/07/2023 09:29	WG2072763
Unadjusted C9-C10 Aromatics	33900	J T8	16700	50000	500	06/15/2023 08:23	WG2073949
Adjusted C5-C8 Aliphatics	3690	J	3330	10000	100	06/07/2023 09:29	WG2072763
Adjusted C9-C12 Aliphatics	112000		3330	10000	100	06/07/2023 09:29	WG2072763
Total VPH	154000	T8	33300	100000	500	06/15/2023 08:23	WG2073949
Total Purgeable Hydrocarbons C5-C12	374000		6670	20000	100	06/07/2023 09:29	WG2072763
(S) 2,5-Dibromotoluene(FID)	*93.7*			*70.0-130*		*06/07/2023 09:29*	WG2072763
(S) 2,5-Dibromotoluene(FID)	*96.9*			*70.0-130*		*06/15/2023 08:23*	WG2073949
(S) 2,5-Dibromotoluene(PID)	*89.3*			*70.0-130*		*06/07/2023 09:29*	WG2072763
(S) 2,5-Dibromotoluene(PID)	*104*			*70.0-130*		*06/15/2023 08:23*	WG2073949

TPH by Method MTDEQ EPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
EPH Screen	388000		5000	15000	50	06/07/2023 17:06	WG2072096
Unadjusted C9-C18 Aliphatics	220000		10000	30000	50	06/12/2023 13:58	WG2073307
Unadjusted C19-C36 Aliphatics	50500		10000	30000	50	06/12/2023 13:58	WG2073307
Unadjusted C11-C22 Aromatics	77000		4000	12000	20	06/12/2023 15:04	WG2073307
Unadjusted Total Petroleum Hydrocarbons	348000		4000	12000	20	06/12/2023 15:04	WG2073307
Adjusted C11-C22 Aromatics	77000		4000	12000	20	06/12/2023 15:04	WG2073307
Adjusted Total Petroleum Hydrocarbons	348000		4000	12000	20	06/12/2023 15:04	WG2073307
(S) o-Terphenyl	*0.000*	J7		*40.0-140*		*06/07/2023 17:06*	WG2072096
(S) o-Terphenyl	*0.000*	J7		*40.0-140*		*06/12/2023 15:04*	WG2073307
(S) 1-Chloro-octadecane	*0.000*	J7		*40.0-140*		*06/12/2023 13:58*	WG2073307
(S) 2-Fluorobiphenyl	*0.000*	J7		*40.0-140*		*06/12/2023 15:04*	WG2073307
(S) 2-Bromonaphthalene	*0.000*	J7		*40.0-140*		*06/12/2023 15:04*	WG2073307

Method Blank (MB)

(MB) R3934243-3 06/07/23 01:16

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Unadjusted C5-C8 Aliphatics	U		33.3	100
Unadjusted C9-C12 Aliphatics	U		33.3	100
Adjusted C5-C8 Aliphatics	U		33.3	100
Adjusted C9-C12 Aliphatics	U		33.3	100
Total Purgeable Hydrocarbons C5-C12	U		66.7	200
(S) 2,5-Dibromotoluene(FID)	*86.0*			*70.0-130*
(S) 2,5-Dibromotoluene(PID)	*97.9*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3934243-1 06/06/23 23:05 • (LCSD) R3934243-2 06/06/23 23:38

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Unadjusted C5-C8 Aliphatics	1200	1210	1240	101	103	70.0-130			2.45	50
Unadjusted C9-C12 Aliphatics	1400	1410	1480	101	106	70.0-130			4.84	50
Total Purgeable Hydrocarbons C5-C12	2800	2940	3040	105	109	70.0-130			3.34	50
(S) 2,5-Dibromotoluene(FID)				*103*	*87.8*	*70.0-130*				
(S) 2,5-Dibromotoluene(PID)				*116*	*102*	*70.0-130*				

Method Blank (MB)

(MB) R3937219-1 06/14/23 21:59

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C9-C10 Aromatics	U		33.3	100
Total VPH	U		66.7	200
(S) 2,5-Dibromotoluene(FID)	*97.1*			*70.0-130*
(S) 2,5-Dibromotoluene(PID)	*99.2*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3937219-2 06/15/23 09:29 • (LCSD) R3937219-3 06/15/23 10:02

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C10 Aromatics	200	205	205	103	103	70.0-130			0.000	50
Total VPH	2800	2450	2460	87.5	87.9	70.0-130			0.407	50
(S) 2,5-Dibromotoluene(FID)				*103*	*100*	*70.0-130*				
(S) 2,5-Dibromotoluene(PID)				*109*	*110*	*70.0-130*				

Method Blank (MB)

(MB) R3934064-1 06/07/23 16:22

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
EPH Screen	U		100	300
(S) o-Terphenyl	*87.1*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3934064-2 06/07/23 16:37 • (LCSD) R3934064-3 06/07/23 16:52

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
EPH Screen	3100	2660	2670	85.8	86.1	40.0-140			0.375	25
(S) o-Terphenyl				*101*	*96.9*	*40.0-140*				

Method Blank (MB)

(MB) R3934666-1 06/08/23 08:58

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C9-C18 Aliphatics	U		200	600
Unadjusted C19-C36 Aliphatics	U		200	600
(S) 1-Chloro-octadecane	*69.4*			*40.0-140*

Method Blank (MB)

(MB) R3934666-4 06/08/23 10:04

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C11-C22 Aromatics	U		200	600
(S) o-Terphenyl	*69.6*			*40.0-140*
(S) 2-Fluorobiphenyl	*85.6*			*40.0-140*
(S) 2-Bromonaphthalene	*92.5*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3934666-2 06/08/23 09:20 • (LCSD) R3934666-3 06/08/23 09:42

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C18 Aliphatics	600	456	426	76.0	71.0	40.0-140			6.80	25
Unadjusted C19-C36 Aliphatics	800	772	716	96.5	89.5	40.0-140			7.53	25
(S) 1-Chloro-octadecane				*71.4*	*65.8*	*40.0-140*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3934666-5 06/08/23 10:27 • (LCSD) R3934666-6 06/08/23 10:49

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C11-C22 Aromatics	1700	1350	1300	79.4	76.5	40.0-140			3.77	25
(S) o-Terphenyl				*79.4*	*74.6*	*40.0-140*				
(S) 2-Fluorobiphenyl				*86.0*	*85.8*	*40.0-140*				
(S) 2-Bromonaphthalene				*94.8*	*93.9*	*40.0-140*				

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.
T8	Sample(s) received past/too close to holding time expiration.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

H122

Chain of Custody

Pace Analytical
www.pacelabs.com

Workorder: YF01022 Workorder Name: Calumet CMR AOC16 Owner Received Date: 6/1/2023 Results Requested By: 6/14/2023

Report To:	Subcontract To:	Requested Analysis
Edward T. Barnett Pace Analytical 106 Vantage Point Drive Columbia SC, 29223 803-509-8398 Edward.Barnett@pacelabs.com	Project # YF01022 Pace National	

L1122137

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	MA EPH	MA VPH	LAB USE ONLY
1	CMR-SP200-230531	grab	05/31/23 @ 1600	YF01022-001	AQ		X	X	-01
									Environ
									EQUIS
									EDD
									Needed

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	Cirly Fer	6/1/23 1900		6/2/23 0900	For all samples - MA EPH and MA VPH Level 2 with J/MDLs screen + fractionated analysis
2					
3					

Cooler Temperature on Receipt 2.2+0=2.2 °C NSM **Custody Seal** Y or N **Received on Ice** Y or N **Sample Intact** Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Friday, June 17, 2016 11:01:34 AM FMT-ALL-C-002rev.00 24March2009 Page 1 of 1

Sample Receipt Checklist

COC Seal Present/Intact:	Y N	If Applicable	
COC Signed/Accurate:	Y N	VOA Zero Headspace:	Y N
Bottles arrive intact:	Y N	Pres.Correct/Check:	Y N
Correct bottles used:	Y N		
Sufficient volume sent:	Y N		
RAD Screen <0.5 mR/hr:	Y N		

1005 3470 1487

Pace Analytical
www.pacelabs.com

Ship to :
Pace National

Phone

INTER_LABORATORY WORK ORDER # YF01022
(To be complete by sending lab)

Sending Project No:	Calumet
Receiving Project No:	
Check Box for Consolidated Invoice:	x
Date Prepared:	14-Jun
REQUESTED COMPLETION DATE:	18-May

Sending Region	IR77-SC	Sending Project Mgr.	Eddie Barnett
Receiving Region	Pace National	External Client	Ramboll
State of Sample Origin	MI	Q	LV2 w / Js

All questions should be addressed to sending project manager.

Requested Reportable Units: ug/L or mg/kg Report Wet or Dry Weight? dry Cert Needed: MI

WORK REQUESTED						
Method Description	**Container Type**	**Quantity of containers**	**Preservative**	**Quantity of Samples**	**Unit Price**	**Amount**
MT VPH	40mL	2	HCL	1	65	65
MT EPH	1L	1	HCL	1	90	90
					TOTAL	155

Special Requirements: Environ EQUIS EDD Needed

Receiving Reqion Department	**Acctg. Code**	**Totals from above**	**Revenue Allocation**	
			Receiving Region (80%)	Client Services Dept. Sending Region (20%)
		65	52	13
		90	72	18
		TOTAL	124	31

* Custom Revenue Allocation

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Chain of Custody Included: [x] Yes [ ] No Return Samples to Sending Reguion: [ ] Yes [x] No

Matrix: [ ] Soil [ ] Water [ ] Air [ ] Other (identity) _____

CONFIRMATION OF WORK COMPLETED

Date Completed: _____ Receiving Project Manager: _____

Original sent to the receiving lab - Copy kept at the sending lab.

When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

Report of Analysis

Ramboll US Corporation
333 West Wacker Drive
Suite 2700
Chicago, IL 60606
Attention: Ruta Deshpande

Project Name: Calumet (CMR) AOC16

Project Number: 1690029636-002

Lot Number:**YG05003**

Date Completed:07/12/2023

07/12/2023 7:27 AM
Approved and released by:
Project Manager II: **Edward Barnett**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Case Narrative
Ramboll US Corporation
Lot Number: YG05003

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report. Where sampling is conducted by the client, results relate to the accuracy of the information provided, and as the samples are received.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18, PFAS by Isotope Dilution SOP.

Pace is a DoD/DoE and TNI accredited laboratory; however, Pace is not accredited for PFAS Direct Aqueous Injection or Method D8421.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

Subcontracted Results

As the client sent all samples directly to Pace National, all analyses were analyzed/subcontracted to that laboratory.

Sample Summary

Ramboll US Corporation

Lot Number: YG05003

Project Name: Calumet (CMR) AOC16

Project Number: 1690029636-002

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	CMR-SP200-290623	Aqueous	06/29/2023 1000	

(1 sample)

Detection Summary

Ramboll US Corporation

Lot Number: YG05003

Project Name: Calumet (CMR) AOC16

Project Number: 1690029636-002

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page

(0 detections)

QC Summary

Chain of Custody
and
Miscellaneous Documents

ANALYTICAL REPORT

July 12, 2023

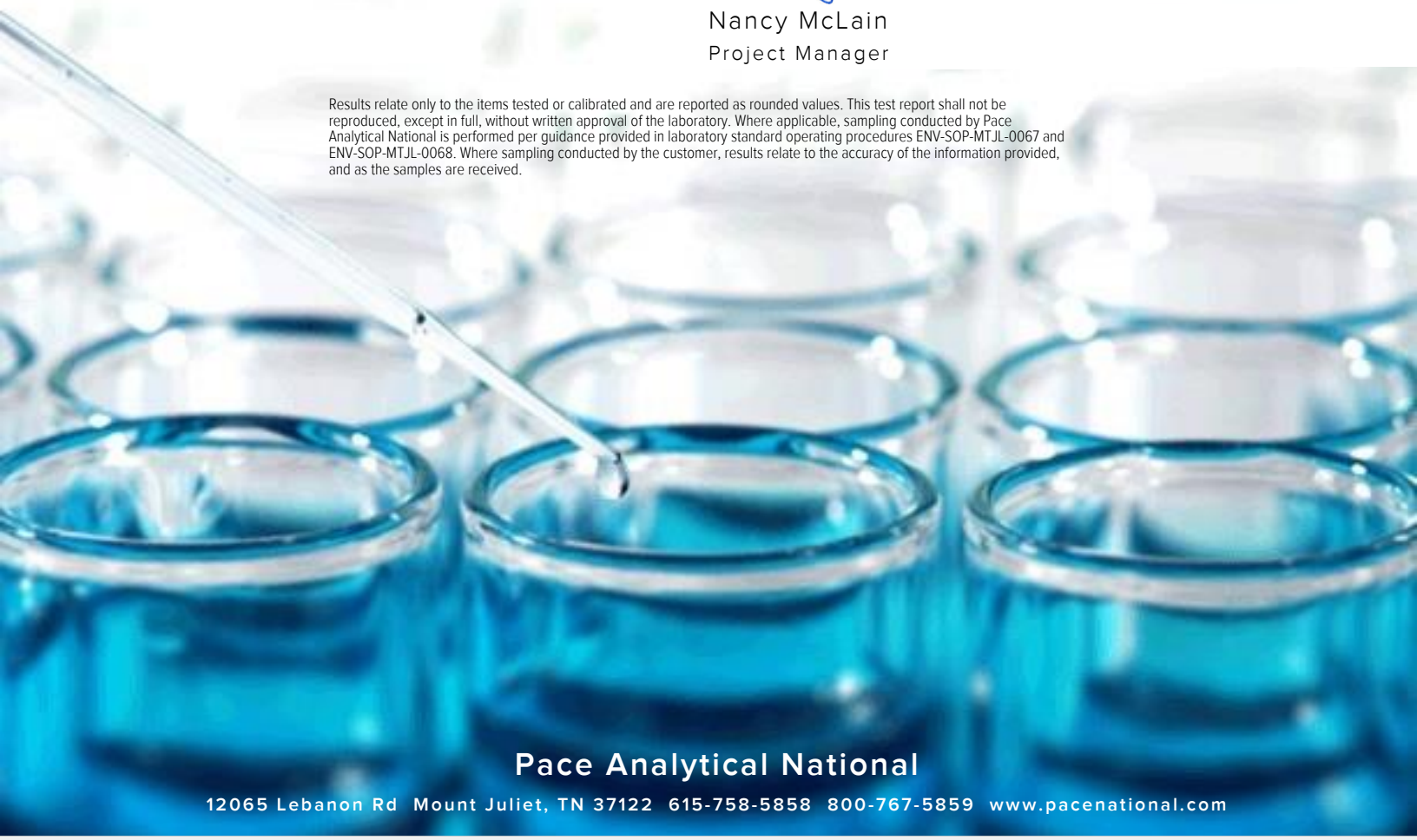
Pace Analytical - West Columbia, SC

Sample Delivery Group:	L1631302
Samples Received:	06/30/2023
Project Number:	YG05003
Description:	Calumet Refinery
Site:	001
Report To:	Edward T. Barnett 106 Vantage Point Dr. West Columbia, SC 29172

Entire Report Reviewed By:

Nancy McLain
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

CMR-SP200-290623 L1631302-01 5

Qc: Quality Control Summary 9

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH 9

Volatile Organic Compounds (GC/MS) by Method 8260D 10

TPH by Method MTDEQ EPH 14

Semi Volatile Organic Compounds (GC/MS) by Method 8270E 17

Gl: Glossary of Terms 24

Al: Accreditations & Locations 25

Sc: Sample Chain of Custody 26

CMR-SP200-290623 L1631302-01 GW

Collected by: Sarah Hall
Collected date/time: 06/29/23 10:00
Received date/time: 06/30/23 09:05

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2091118	50	07/09/23 05:00	07/09/23 05:00	JAH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG2091655	50	07/09/23 20:46	07/09/23 20:46	JBE	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089189	60	07/05/23 07:53	07/05/23 23:41	TJD	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	15	07/05/23 07:53	07/07/23 04:10	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	15	07/05/23 07:53	07/07/23 04:32	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	75	07/05/23 07:53	07/07/23 17:39	HLJ	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270E	WG2089020	10	07/06/23 06:49	07/07/23 08:26	AGW	Mt. Juliet, TN
Semi Volatile Organic Compounds (GC/MS) by Method 8270E	WG2091179	10	07/08/23 09:02	07/10/23 19:50	AGW	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Nancy McLain
Project Manager

Project Narrative

Due to multiple preparation procedures, calculated analytes are not reported in the quality control samples for EPH and VPH Methods.

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Unadjusted C5-C8 Aliphatics	U		1670	5000	50	07/09/2023 05:00	WG2091118
Unadjusted C9-C12 Aliphatics	5090		1670	5000	50	07/09/2023 05:00	WG2091118
Unadjusted C9-C10 Aromatics	5710		1670	5000	50	07/09/2023 05:00	WG2091118
Adjusted C5-C8 Aliphatics	U		1670	5000	50	07/09/2023 05:00	WG2091118
Adjusted C9-C12 Aliphatics	3790	J	1670	5000	50	07/09/2023 05:00	WG2091118
Total VPH	10800		3340	10000	50	07/09/2023 05:00	WG2091118
Total Purgeable Hydrocarbons C5-C12	17500		3340	10000	50	07/09/2023 05:00	WG2091118
(S) 2,5-Dibromotoluene(FID)	*90.9*			*70.0-130*		*07/09/2023 05:00*	WG2091118
(S) 2,5-Dibromotoluene(PID)	*94.7*			*70.0-130*		*07/09/2023 05:00*	WG2091118

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acetone	U	C3	565	2500	50	07/09/2023 20:46	WG2091655
Benzene	84.9		4.71	50.0	50	07/09/2023 20:46	WG2091655
Bromochloromethane	U		6.40	50.0	50	07/09/2023 20:46	WG2091655
Bromodichloromethane	U		6.80	50.0	50	07/09/2023 20:46	WG2091655
Bromoform	U		6.45	50.0	50	07/09/2023 20:46	WG2091655
Bromomethane	U		30.3	250	50	07/09/2023 20:46	WG2091655
Carbon disulfide	U		4.81	50.0	50	07/09/2023 20:46	WG2091655
Carbon tetrachloride	U		6.40	50.0	50	07/09/2023 20:46	WG2091655
Chlorobenzene	U		5.80	50.0	50	07/09/2023 20:46	WG2091655
Chlorodibromomethane	U		7.00	50.0	50	07/09/2023 20:46	WG2091655
Chloroethane	U		9.60	250	50	07/09/2023 20:46	WG2091655
Chloroform	U		5.55	250	50	07/09/2023 20:46	WG2091655
Chloromethane	U		48.0	125	50	07/09/2023 20:46	WG2091655
Cyclohexane	U		9.40	50.0	50	07/09/2023 20:46	WG2091655
1,2-Dibromoethane	U		6.30	50.0	50	07/09/2023 20:46	WG2091655
1,2-Dibromo-3-Chloropropane	U	C3	13.8	250	50	07/09/2023 20:46	WG2091655
1,2-Dichlorobenzene	U		5.35	50.0	50	07/09/2023 20:46	WG2091655
1,3-Dichlorobenzene	U		5.50	50.0	50	07/09/2023 20:46	WG2091655
1,4-Dichlorobenzene	U		6.00	50.0	50	07/09/2023 20:46	WG2091655
Dichlorodifluoromethane	U		18.7	250	50	07/09/2023 20:46	WG2091655
1,1-Dichloroethane	U		5.00	50.0	50	07/09/2023 20:46	WG2091655
1,2-Dichloroethane	U		4.09	50.0	50	07/09/2023 20:46	WG2091655
1,1-Dichloroethene	U		9.40	50.0	50	07/09/2023 20:46	WG2091655
cis-1,2-Dichloroethene	U		6.30	50.0	50	07/09/2023 20:46	WG2091655
trans-1,2-Dichloroethene	U		7.45	50.0	50	07/09/2023 20:46	WG2091655
1,2-Dichloropropane	U		7.45	50.0	50	07/09/2023 20:46	WG2091655
cis-1,3-Dichloropropene	U		5.55	50.0	50	07/09/2023 20:46	WG2091655
trans-1,3-Dichloropropene	U		5.90	50.0	50	07/09/2023 20:46	WG2091655
Ethylbenzene	101		6.85	50.0	50	07/09/2023 20:46	WG2091655
2-Hexanone	U	C3	39.4	500	50	07/09/2023 20:46	WG2091655
Isopropylbenzene	8.73	J	5.25	50.0	50	07/09/2023 20:46	WG2091655
2-Butanone (MEK)	U		59.5	500	50	07/09/2023 20:46	WG2091655
Methylene Chloride	U		21.5	250	50	07/09/2023 20:46	WG2091655
4-Methyl-2-pentanone (MIBK)	U		23.9	500	50	07/09/2023 20:46	WG2091655
Methyl Acetate	U	C3	64.5	1000	50	07/09/2023 20:46	WG2091655
Methyl Cyclohexane	U		33.0	50.0	50	07/09/2023 20:46	WG2091655
Methyl tert-butyl ether	U		5.05	50.0	50	07/09/2023 20:46	WG2091655
Styrene	U		5.90	50.0	50	07/09/2023 20:46	WG2091655
1,1,2,2-Tetrachloroethane	U		6.65	50.0	50	07/09/2023 20:46	WG2091655
Tetrachloroethene	U		15.0	50.0	50	07/09/2023 20:46	WG2091655
Toluene	U		13.9	50.0	50	07/09/2023 20:46	WG2091655
1,2,3-Trichlorobenzene	U	C3	11.5	50.0	50	07/09/2023 20:46	WG2091655

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
1,2,4-Trichlorobenzene	U	C3	24.1	50.0	50	07/09/2023 20:46	WG2091655
1,1,1-Trichloroethane	U		7.45	50.0	50	07/09/2023 20:46	WG2091655
1,1,2-Trichloroethane	U		7.90	50.0	50	07/09/2023 20:46	WG2091655
Trichloroethene	U		9.50	50.0	50	07/09/2023 20:46	WG2091655
Trichlorofluoromethane	U		8.00	250	50	07/09/2023 20:46	WG2091655
1,1,2-Trichlorotrifluoroethane	U		9.00	50.0	50	07/09/2023 20:46	WG2091655
Vinyl chloride	U	J4	11.7	50.0	50	07/09/2023 20:46	WG2091655
o-Xylene	157		8.70	50.0	50	07/09/2023 20:46	WG2091655
m&p-Xylene	442		21.5	100	50	07/09/2023 20:46	WG2091655
Xylenes, Total	599		8.70	150	50	07/09/2023 20:46	WG2091655
1,4-Dioxane	U		1800	5000	50	07/09/2023 20:46	WG2091655
(S) Toluene-d8	*103*			*80.0-120*		*07/09/2023 20:46*	WG2091655
(S) 1,2-Dichloroethane-d4	*113*			*70.0-130*		*07/09/2023 20:46*	WG2091655
(S) 4-Bromofluorobenzene	*102*			*77.0-126*		*07/09/2023 20:46*	WG2091655

Sample Narrative:

L1631302-01 WG2091655: Lowest possible dilution due to sample matrix.

TPH by Method MTDEQ EPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
EPH Screen	643000		6000	18000	60	07/05/2023 23:41	WG2089189
Unadjusted C9-C18 Aliphatics	220000		15000	45000	75	07/07/2023 17:39	WG2089786
Unadjusted C19-C36 Aliphatics	50700		3000	9000	15	07/07/2023 04:10	WG2089786
Unadjusted C11-C22 Aromatics	87200	J3	3000	9000	15	07/07/2023 04:32	WG2089786
Unadjusted Total Petroleum Hydrocarbons	358000		15000	45000	75	07/07/2023 17:39	WG2089786
Adjusted C11-C22 Aromatics	83500		3000	9000	15	07/07/2023 04:32	WG2089786
Adjusted Total Petroleum Hydrocarbons	354000		15000	45000	75	07/07/2023 17:39	WG2089786
(S) o-Terphenyl	*0.000*	J7		*40.0-140*		*07/05/2023 23:41*	WG2089189
(S) o-Terphenyl	*29.4*	J2		*40.0-140*		*07/07/2023 04:32*	WG2089786
(S) 1-Chloro-octadecane	*77.3*			*40.0-140*		*07/07/2023 04:10*	WG2089786
(S) 1-Chloro-octadecane	*463*	J7		*40.0-140*		*07/07/2023 17:39*	WG2089786
(S) 2-Fluorobiphenyl	*285*	J1		*40.0-140*		*07/07/2023 04:32*	WG2089786
(S) 2-Bromonaphthalene	*321*	J1		*40.0-140*		*07/07/2023 04:32*	WG2089786

Sample Narrative:

L1631302-01 WG2089189, WG2089786: Dilution and surrogate failure due to matrix interference.

L1631302-01 WG2089189, WG2089786: Surrogate failure due to matrix interference during extraction procedure.

L1631302-01 WG2089189, WG2089786: Surrogate failure due to matrix interference

Semi Volatile Organic Compounds (GC/MS) by Method 8270E

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Acenaphthene	U		0.886	10.0	10	07/07/2023 08:26	WG2089020
Acenaphthylene	U		0.921	10.0	10	07/07/2023 08:26	WG2089020
Anthracene	U		0.804	10.0	10	07/07/2023 08:26	WG2089020
Acetophenone	U		2.08	100	10	07/07/2023 08:26	WG2089020
Atrazine	U		2.55	100	10	07/07/2023 08:26	WG2089020
Benzaldehyde	U		16.9	100	10	07/07/2023 08:26	WG2089020
Benzo(a)anthracene	U		1.99	10.0	10	07/07/2023 08:26	WG2089020
Benzo(b)fluoranthene	U		1.30	10.0	10	07/07/2023 08:26	WG2089020
Benzo(k)fluoranthene	U		1.20	10.0	10	07/07/2023 08:26	WG2089020
Benzo(g,h,i)perylene	U		1.21	10.0	10	07/07/2023 08:26	WG2089020
Benzo(a)pyrene	U		0.381	10.0	10	07/07/2023 08:26	WG2089020

Semi Volatile Organic Compounds (GC/MS) by Method 8270E

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Biphenyl	8.41	J	7.90	100	10	07/07/2023 08:26	WG2089020
Biphenyl	219	Q	7.90	100	10	07/10/2023 19:50	WG2091179
Bis(2-chlorethoxy)methane	U		1.16	100	10	07/07/2023 08:26	WG2089020
Bis(2-chloroethyl)ether	U		1.37	100	10	07/07/2023 08:26	WG2089020
2,2-Oxybis(1-Chloropropane)	U		2.10	100	10	07/07/2023 08:26	WG2089020
4-Bromophenyl-phenylether	U		0.877	100	10	07/07/2023 08:26	WG2089020
2-Chloronaphthalene	U		0.648	10.0	10	07/07/2023 08:26	WG2089020
4-Chlorophenyl-phenylether	U		0.926	100	10	07/07/2023 08:26	WG2089020
Caprolactam	U		3.09	100	10	07/07/2023 08:26	WG2089020
Carbazole	U	J4	1.11	100	10	07/07/2023 08:26	WG2089020
4-Chloroaniline	U	J4	2.34	100	10	07/07/2023 08:26	WG2089020
Chrysene	U		1.30	10.0	10	07/07/2023 08:26	WG2089020
Dibenz(a,h)anthracene	U		0.644	10.0	10	07/07/2023 08:26	WG2089020
Dibenzofuran	U		0.970	100	10	07/07/2023 08:26	WG2089020
3,3-Dichlorobenzidine	U		2.12	100	10	07/07/2023 08:26	WG2089020
2,4-Dinitrotoluene	U		0.983	100	10	07/07/2023 08:26	WG2089020
2,6-Dinitrotoluene	U		2.50	100	10	07/07/2023 08:26	WG2089020
Fluoranthene	U	J4	1.02	10.0	10	07/07/2023 08:26	WG2089020
Fluorene	6.10	J	0.844	10.0	10	07/07/2023 08:26	WG2089020
Fluorene	129	Q	0.844	10.0	10	07/10/2023 19:50	WG2091179
Hexachlorobenzene	U		0.755	10.0	10	07/07/2023 08:26	WG2089020
Hexachloro-1,3-butadiene	U		0.968	100	10	07/07/2023 08:26	WG2089020
Hexachlorocyclopentadiene	U		0.598	100	10	07/07/2023 08:26	WG2089020
Hexachloroethane	U		1.27	100	10	07/07/2023 08:26	WG2089020
Indeno(1,2,3-cd)pyrene	U	J4	2.79	10.0	10	07/07/2023 08:26	WG2089020
Isophorone	U		1.43	100	10	07/07/2023 08:26	WG2089020
Naphthalene	74.0		1.59	10.0	10	07/07/2023 08:26	WG2089020
Naphthalene	715	Q V3	1.59	10.0	10	07/10/2023 19:50	WG2091179
Nitrobenzene	U		2.97	100	10	07/07/2023 08:26	WG2089020
n-Nitrosodiphenylamine	U		23.7	100	10	07/07/2023 08:26	WG2089020
n-Nitrosodi-n-propylamine	U		2.61	100	10	07/07/2023 08:26	WG2089020
Phenanthrene	5.10	J	1.12	10.0	10	07/07/2023 08:26	WG2089020
Phenanthrene	149	Q V3	1.12	10.0	10	07/10/2023 19:50	WG2091179
Benzylbutyl phthalate	U		7.65	30.0	10	07/07/2023 08:26	WG2089020
Bis(2-ethylhexyl)phthalate	U		8.95	30.0	10	07/07/2023 08:26	WG2089020
Di-n-butyl phthalate	U		4.53	30.0	10	07/07/2023 08:26	WG2089020
Diethyl phthalate	U		2.87	30.0	10	07/07/2023 08:26	WG2089020
Dimethyl phthalate	U		2.60	30.0	10	07/07/2023 08:26	WG2089020
Di-n-octyl phthalate	U		9.32	30.0	10	07/07/2023 08:26	WG2089020
2-Nitroaniline	U		1.02	100	10	07/07/2023 08:26	WG2089020
3-Nitroaniline	U	J4	0.869	100	10	07/07/2023 08:26	WG2089020
4-Nitroaniline	U		0.910	100	10	07/07/2023 08:26	WG2089020
1-Methylnaphthalene	62.5		0.790	10.0	10	07/07/2023 08:26	WG2089020
1-Methylnaphthalene	1000	Q V3	0.790	10.0	10	07/10/2023 19:50	WG2091179
2-Methylnaphthalene	80.4		1.17	10.0	10	07/07/2023 08:26	WG2089020
2-Methylnaphthalene	1650	Q V3	1.17	10.0	10	07/10/2023 19:50	WG2091179
Pyrene	1.24	J	1.07	10.0	10	07/07/2023 08:26	WG2089020
Pyrene	27.0	Q	1.07	10.0	10	07/10/2023 19:50	WG2091179
4-Chloro-3-methylphenol	U	J4	1.31	100	10	07/07/2023 08:26	WG2089020
2-Chlorophenol	U		1.33	100	10	07/07/2023 08:26	WG2089020
2,4-Dichlorophenol	U		1.02	100	10	07/07/2023 08:26	WG2089020
2,4-Dimethylphenol	27.9	J	0.636	100	10	07/07/2023 08:26	WG2089020
2-Methylphenol	U		0.929	100	10	07/07/2023 08:26	WG2089020
3&4-Methyl Phenol	U		1.68	100	10	07/07/2023 08:26	WG2089020
4,6-Dinitro-2-methylphenol	U		11.2	100	10	07/07/2023 08:26	WG2089020
2,4-Dinitrophenol	U		59.3	100	10	07/07/2023 08:26	WG2089020

Semi Volatile Organic Compounds (GC/MS) by Method 8270E

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
2-Nitrophenol	U		1.17	100	10	07/07/2023 08:26	WG2089020
4-Nitrophenol	U		1.43	100	10	07/07/2023 08:26	WG2089020
Pentachlorophenol	U		3.13	100	10	07/07/2023 08:26	WG2089020
Phenol	U		43.3	100	10	07/07/2023 08:26	WG2089020
2,4,5-Trichlorophenol	U		1.09	100	10	07/07/2023 08:26	WG2089020
2,4,6-Trichlorophenol	U		1.00	100	10	07/07/2023 08:26	WG2089020
(S) 2-Fluorophenol	*28.6*			*10.0-120*		*07/07/2023 08:26*	WG2089020
(S) 2-Fluorophenol	*37.4*			*10.0-120*		*07/10/2023 19:50*	WG2091179
(S) Phenol-d5	*22.2*			*10.0-120*		*07/07/2023 08:26*	WG2089020
(S) Phenol-d5	*0.000*	J2		*10.0-120*		*07/10/2023 19:50*	WG2091179
(S) Nitrobenzene-d5	*58.7*			*10.0-127*		*07/07/2023 08:26*	WG2089020
(S) Nitrobenzene-d5	*0.000*	J2		*10.0-127*		*07/10/2023 19:50*	WG2091179
(S) 2-Fluorobiphenyl	*68.8*			*10.0-130*		*07/07/2023 08:26*	WG2089020
(S) 2-Fluorobiphenyl	*0.000*	J2		*10.0-130*		*07/10/2023 19:50*	WG2091179
(S) 2,4,6-Tribromophenol	*74.0*			*10.0-155*		*07/07/2023 08:26*	WG2089020
(S) 2,4,6-Tribromophenol	*98.0*			*10.0-155*		*07/10/2023 19:50*	WG2091179
(S) p-Terphenyl-d14	*69.8*			*10.0-128*		*07/07/2023 08:26*	WG2089020
(S) p-Terphenyl-d14	*68.8*			*10.0-128*		*07/10/2023 19:50*	WG2091179

Sample Narrative:

L1631302-01 WG2089020, WG2091179: Duplicate Analysis performed due to QC failure. Results don't confirm; both analyses reported

Method Blank (MB)

(MB) R3946352-3 07/08/23 19:40

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C5-C8 Aliphatics	U		33.3	100
Unadjusted C9-C12 Aliphatics	U		33.3	100
Unadjusted C9-C10 Aromatics	U		33.3	100
Adjusted C5-C8 Aliphatics	U		33.3	100
Adjusted C9-C12 Aliphatics	U		33.3	100
Total VPH	U		66.7	200
Total Purgeable Hydrocarbons C5-C12	U		66.7	200
(S) 2,5-Dibromotoluene(FID)	*84.6*			*70.0-130*
(S) 2,5-Dibromotoluene(PID)	*87.6*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3946352-1 07/08/23 18:02 • (LCSD) R3946352-2 07/08/23 18:34

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C5-C8 Aliphatics	1200	1030	979	85.8	81.6	70.0-130			5.08	50
Unadjusted C9-C12 Aliphatics	1400	1070	1100	76.4	78.6	70.0-130			2.76	50
Unadjusted C9-C10 Aromatics	200	177	182	88.5	91.0	70.0-130			2.79	50
Total VPH	2800	2280	2260	81.4	80.7	70.0-130			0.881	50
Total Purgeable Hydrocarbons C5-C12	2800	2340	2330	83.6	83.2	70.0-130			0.428	50
(S) 2,5-Dibromotoluene(FID)				*91.1*	*85.9*	*70.0-130*				
(S) 2,5-Dibromotoluene(PID)				*95.2*	*90.3*	*70.0-130*				

Method Blank (MB)

(MB) R3946832-4 07/09/23 13:06

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acetone	U		11.3	50.0
Benzene	U		0.0941	1.00
Bromochloromethane	U		0.128	1.00
Bromodichloromethane	U		0.136	1.00
Bromoform	U		0.129	1.00
Bromomethane	U		0.605	5.00
Carbon disulfide	U		0.0962	1.00
Carbon tetrachloride	U		0.128	1.00
Chlorobenzene	U		0.116	1.00
Chlorodibromomethane	U		0.140	1.00
Chloroethane	U		0.192	5.00
Chloroform	U		0.111	5.00
Chloromethane	U		0.960	2.50
Cyclohexane	U		0.188	1.00
1,2-Dibromoethane	U		0.126	1.00
1,2-Dibromo-3-Chloropropane	U		0.276	5.00
1,2-Dichlorobenzene	U		0.107	1.00
1,3-Dichlorobenzene	U		0.110	1.00
1,4-Dichlorobenzene	U		0.120	1.00
Dichlorodifluoromethane	U		0.374	5.00
1,1-Dichloroethane	U		0.100	1.00
1,2-Dichloroethane	U		0.0819	1.00
1,1-Dichloroethene	U		0.188	1.00
cis-1,2-Dichloroethene	U		0.126	1.00
trans-1,2-Dichloroethene	U		0.149	1.00
1,2-Dichloropropane	U		0.149	1.00
cis-1,3-Dichloropropene	U		0.111	1.00
trans-1,3-Dichloropropene	U		0.118	1.00
Ethylbenzene	U		0.137	1.00
2-Hexanone	U		0.787	10.0
Isopropylbenzene	U		0.105	1.00
2-Butanone (MEK)	U		1.19	10.0
Methylene Chloride	U		0.430	5.00
4-Methyl-2-pentanone (MIBK)	U		0.478	10.0
Methyl Acetate	U		1.29	20.0
Methyl Cyclohexane	U		0.660	1.00
Methyl tert-butyl ether	U		0.101	1.00
Styrene	U		0.118	1.00
1,1,2,2-Tetrachloroethane	U		0.133	1.00
Tetrachloroethene	U		0.300	1.00

Method Blank (MB)

(MB) R3946832-4 07/09/23 13:06

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Toluene	U		0.278	1.00
1,2,3-Trichlorobenzene	U		0.230	1.00
1,2,4-Trichlorobenzene	U		0.481	1.00
1,1,1-Trichloroethane	U		0.149	1.00
1,1,2-Trichloroethane	U		0.158	1.00
Trichloroethene	U		0.190	1.00
Trichlorofluoromethane	U		0.160	5.00
1,1,2-Trichlorotrifluoroethane	U		0.180	1.00
Vinyl chloride	U		0.234	1.00
o-Xylene	U		0.174	1.00
m&p-Xylene	U		0.430	2.00
Xylenes, Total	U		0.174	3.00
1,4-Dioxane	U		36.0	100
(S) Toluene-d8	*105*			*80.0-120*
(S) 1,2-Dichloroethane-d4	*110*			*70.0-130*
(S) 4-Bromofluorobenzene	*95.6*			*77.0-126*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3946832-1 07/09/23 11:38 • (LCSD) R3946832-2 07/09/23 12:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	25.0	18.6	22.8	74.4	91.2	19.0-160			20.3	27
Benzene	5.00	5.47	5.16	109	103	70.0-123			5.83	20
Bromochloromethane	5.00	5.09	5.77	102	115	76.0-122			12.5	20
Bromodichloromethane	5.00	5.15	5.40	103	108	75.0-120			4.74	20
Bromoform	5.00	4.57	4.55	91.4	91.0	68.0-132			0.439	20
Bromomethane	5.00	6.12	6.72	122	134	10.0-160			9.35	25
Carbon disulfide	5.00	4.86	5.50	97.2	110	61.0-128			12.4	20
Carbon tetrachloride	5.00	5.45	5.75	109	115	68.0-126			5.36	20
Chlorobenzene	5.00	5.11	5.08	102	102	80.0-121			0.589	20
Chlorodibromomethane	5.00	4.53	4.79	90.6	95.8	77.0-125			5.58	20
Chloroethane	5.00	6.31	6.48	126	130	47.0-150			2.66	20
Chloroform	5.00	4.96	5.23	99.2	105	73.0-120			5.30	20
Chloromethane	5.00	4.90	5.62	98.0	112	41.0-142			13.7	20
Cyclohexane	5.00	4.86	5.28	97.2	106	71.0-124			8.28	20
1,2-Dibromoethane	5.00	4.84	4.78	96.8	95.6	80.0-122			1.25	20
1,2-Dibromo-3-Chloropropane	5.00	3.51	3.50	70.2	70.0	58.0-134			0.285	20
1,2-Dichlorobenzene	5.00	5.12	5.11	102	102	79.0-121			0.196	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3946832-1 07/09/23 11:38 • (LCSD) R3946832-2 07/09/23 12:00

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
1,3-Dichlorobenzene	5.00	4.71	4.87	94.2	97.4	79.0-120			3.34	20
1,4-Dichlorobenzene	5.00	4.58	5.15	91.6	103	79.0-120			11.7	20
Dichlorodifluoromethane	5.00	5.24	6.13	105	123	51.0-149			15.7	20
1,1-Dichloroethane	5.00	4.46	5.26	89.2	105	70.0-126			16.5	20
1,2-Dichloroethane	5.00	4.82	4.92	96.4	98.4	70.0-128			2.05	20
1,1-Dichloroethene	5.00	4.99	5.47	99.8	109	71.0-124			9.18	20
cis-1,2-Dichloroethene	5.00	4.59	5.32	91.8	106	73.0-120			14.7	20
trans-1,2-Dichloroethene	5.00	4.86	5.47	97.2	109	73.0-120			11.8	20
1,2-Dichloropropane	5.00	5.04	4.65	101	93.0	77.0-125			8.05	20
cis-1,3-Dichloropropene	5.00	5.22	5.05	104	101	80.0-123			3.31	20
trans-1,3-Dichloropropene	5.00	4.80	4.91	96.0	98.2	78.0-124			2.27	20
Ethylbenzene	5.00	5.18	4.68	104	93.6	79.0-123			10.1	20
2-Hexanone	25.0	19.7	17.5	78.8	70.0	67.0-149			11.8	20
Isopropylbenzene	5.00	5.26	5.19	105	104	76.0-127			1.34	20
2-Butanone (MEK)	25.0	20.4	18.7	81.6	74.8	44.0-160			8.70	20
Methylene Chloride	5.00	4.67	5.39	93.4	108	67.0-120			14.3	20
4-Methyl-2-pentanone (MIBK)	25.0	20.2	20.8	80.8	83.2	68.0-142			2.93	20
Methyl Acetate	25.0	16.9	18.7	67.6	74.8	57.0-148			10.1	20
Methyl Cyclohexane	5.00	5.13	5.16	103	103	68.0-126			0.583	20
Methyl tert-butyl ether	5.00	4.20	4.87	84.0	97.4	68.0-125			14.8	20
Styrene	5.00	4.59	4.61	91.8	92.2	73.0-130			0.435	20
1,1,2,2-Tetrachloroethane	5.00	4.51	4.36	90.2	87.2	65.0-130			3.38	20
Tetrachloroethene	5.00	5.54	5.82	111	116	72.0-132			4.93	20
Toluene	5.00	5.08	4.95	102	99.0	79.0-120			2.59	20
1,2,3-Trichlorobenzene	5.00	3.47	3.61	69.4	72.2	50.0-138			3.95	20
1,2,4-Trichlorobenzene	5.00	3.68	4.13	73.6	82.6	57.0-137			11.5	20
1,1,1-Trichloroethane	5.00	5.44	5.55	109	111	73.0-124			2.00	20
1,1,2-Trichloroethane	5.00	4.99	4.87	99.8	97.4	80.0-120			2.43	20
Trichloroethene	5.00	5.97	5.45	119	109	78.0-124			9.11	20
Trichlorofluoromethane	5.00	5.94	6.48	119	130	59.0-147			8.70	20
1,1,2-Trichlorotrifluoroethane	5.00	4.83	5.75	96.6	115	69.0-132			17.4	20
Vinyl chloride	5.00	5.97	7.16	119	143	67.0-131		J4	18.1	20
o-Xylene	5.00	4.78	5.01	95.6	100	80.0-122			4.70	20
m&p-Xylene	10.0	10.4	9.81	104	98.1	80.0-122			5.84	20
Xylenes, Total	15.0	15.2	14.8	101	98.7	79.0-123			2.67	20
(S) Toluene-d8				*105*	*101*	*80.0-120*				
(S) 1,2-Dichloroethane-d4				*109*	*111*	*70.0-130*				
(S) 4-Bromofluorobenzene				*99.9*	*96.4*	*77.0-126*				

Laboratory Control Sample (LCS)

(LCS) R3946832-3 07/09/23 12:22

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
1,4-Dioxane	1000	938	93.8	13.0-160	
(S) Toluene-d8			*103*	*80.0-120*	
(S) 1,2-Dichloroethane-d4			*104*	*70.0-130*	
(S) 4-Bromofluorobenzene			*100*	*77.0-126*	

Method Blank (MB)

(MB) R3945042-1 07/05/23 17:51

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
EPH Screen	U		100	300
(S) o-Terphenyl	*104*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3945042-2 07/05/23 18:06 • (LCSD) R3945042-3 07/05/23 18:21

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
EPH Screen	3100	3140	3370	101	109	40.0-140			7.07	25
(S) o-Terphenyl				*102*	*106*	*40.0-140*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3945659-1 07/06/23 19:14

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C9-C18 Aliphatics	U		200	600
Unadjusted C19-C36 Aliphatics	U		200	600
(S) 1-Chloro-octadecane	*62.4*			*40.0-140*

Method Blank (MB)

(MB) R3945659-4 07/06/23 20:21

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C11-C22 Aromatics	U		200	600
(S) o-Terphenyl	*70.6*			*40.0-140*
(S) 2-Fluorobiphenyl	*74.5*			*40.0-140*
(S) 2-Bromonaphthalene	*73.3*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3945659-2 07/06/23 19:36 • (LCSD) R3945659-3 07/06/23 19:59

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C18 Aliphatics	600	452	419	75.3	69.8	40.0-140			7.58	25
Unadjusted C19-C36 Aliphatics	800	650	703	81.2	87.9	40.0-140			7.83	25
(S) 1-Chloro-octadecane				*66.3*	*71.1*	*40.0-140*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3945659-5 07/06/23 20:43 • (LCSD) R3945659-6 07/06/23 21:06

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C11-C22 Aromatics	1700	1010	1390	59.4	81.8	40.0-140		J3	31.7	25
(S) o-Terphenyl				*55.3*	*73.6*	*40.0-140*				
(S) 2-Fluorobiphenyl				*62.6*	*78.6*	*40.0-140*				
(S) 2-Bromonaphthalene				*58.5*	*73.9*	*40.0-140*				

L1630214-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1630214-03 07/07/23 07:49 • (MS) R3945659-7 07/07/23 08:12 • (MSD) R3945659-8 07/07/23 08:34

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C18 Aliphatics	612	U	257	228	17.0	12.3	1.02	40.0-140	J6	J6	12.0	50
Unadjusted C19-C36 Aliphatics	816	U	416	407	40.3	39.2	1.02	40.0-140		J6	2.19	50
(S) 1-Chloro-octadecane					*28.7*	*24.1*		*40.0-140*	J2	J2		

Sample Narrative:

OS: Surrogate failure due to matrix interference during extraction procedure.

L1630214-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1630214-03 07/07/23 10:50 • (MS) R3945659-9 07/07/23 11:12 • (MSD) R3945659-10 07/07/23 11:59

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Unadjusted C11-C22 Aromatics	1730	U	897	842	49.2	46.0	1.02	40.0-140			6.33	50
(S) o-Terphenyl					*43.6*	*41.3*		*40.0-140*				
(S) 2-Fluorobiphenyl					*81.0*	*80.0*		*40.0-140*				
(S) 2-Bromonaphthalene					*80.6*	*79.4*		*40.0-140*				

Sample Narrative:

OS: Surrogate failure due to matrix interference during extraction procedure.

Method Blank (MB)

(MB) R3946120-2 07/07/23 02:18

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Acenaphthene	U		0.0886	1.00
Acenaphthylene	U		0.0921	1.00
Anthracene	U		0.0804	1.00
Acetophenone	U		0.208	10.0
Atrazine	U		0.255	10.0
Benzaldehyde	U		1.69	10.0
Benzo(a)anthracene	U		0.199	1.00
Benzo(b)fluoranthene	U		0.130	1.00
Benzo(k)fluoranthene	U		0.120	1.00
Benzo(g,h,i)perylene	U		0.121	1.00
Benzo(a)pyrene	U		0.0381	1.00
Biphenyl	U		0.790	10.0
Bis(2-chlorethoxy)methane	U		0.116	10.0
Bis(2-chloroethyl)ether	U		0.137	10.0
2,2-Oxybis(1-Chloropropane)	U		0.210	10.0
4-Bromophenyl-phenylether	U		0.0877	10.0
2-Chloronaphthalene	U		0.0648	1.00
4-Chlorophenyl-phenylether	U		0.0926	10.0
Caprolactam	U		0.309	10.0
Carbazole	U		0.111	10.0
4-Chloroaniline	U		0.234	10.0
Chrysene	U		0.130	1.00
Dibenz(a,h)anthracene	U		0.0644	1.00
Dibenzofuran	U		0.0970	10.0
3,3-Dichlorobenzidine	U		0.212	10.0
2,4-Dinitrotoluene	U		0.0983	10.0
2,6-Dinitrotoluene	U		0.250	10.0
Fluoranthene	U		0.102	1.00
Fluorene	U		0.0844	1.00
Hexachlorobenzene	U		0.0755	1.00
Hexachloro-1,3-butadiene	U		0.0968	10.0
Hexachlorocyclopentadiene	U		0.0598	10.0
Hexachloroethane	U		0.127	10.0
Indeno(1,2,3-cd)pyrene	U		0.279	1.00
Isophorone	U		0.143	10.0
Naphthalene	U		0.159	1.00
Nitrobenzene	U		0.297	10.0
n-Nitrosodiphenylamine	U		2.37	10.0
n-Nitrosodi-n-propylamine	U		0.261	10.0
Phenanthrene	U		0.112	1.00

Method Blank (MB)

(MB) R3946120-2 07/07/23 02:18

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Benzylbutyl phthalate	U		0.765	3.00
Bis(2-ethylhexyl)phthalate	U		0.895	3.00
Di-n-butyl phthalate	U		0.453	3.00
Diethyl phthalate	U		0.287	3.00
Dimethyl phthalate	U		0.260	3.00
Di-n-octyl phthalate	U		0.932	3.00
2-Nitroaniline	U		0.102	10.0
3-Nitroaniline	U		0.0869	10.0
4-Nitroaniline	U		0.0910	10.0
1-Methylnaphthalene	U		0.0790	1.00
2-Methylnaphthalene	U		0.117	1.00
Pyrene	U		0.107	1.00
4-Chloro-3-methylphenol	U		0.131	10.0
2-Chlorophenol	U		0.133	10.0
2,4-Dichlorophenol	U		0.102	10.0
2,4-Dimethylphenol	U		0.0636	10.0
2-Methylphenol	U		0.0929	10.0
3&4-Methyl Phenol	U		0.168	10.0
4,6-Dinitro-2-methylphenol	U		1.12	10.0
2,4-Dinitrophenol	U		5.93	10.0
2-Nitrophenol	U		0.117	10.0
4-Nitrophenol	U		0.143	10.0
Pentachlorophenol	U		0.313	10.0
Phenol	U		4.33	10.0
2,4,5-Trichlorophenol	U		0.109	10.0
2,4,6-Trichlorophenol	U		0.100	10.0
(S) 2-Fluorophenol	*27.1*			*10.0-120*
(S) Phenol-d5	*18.3*			*10.0-120*
(S) Nitrobenzene-d5	*48.7*			*10.0-127*
(S) 2-Fluorobiphenyl	*59.0*			*10.0-130*
(S) 2,4,6-Tribromophenol	*60.0*			*10.0-155*
(S) p-Terphenyl-d14	*63.3*			*10.0-128*

Laboratory Control Sample (LCS)

(LCS) R3946120-1 07/07/23 01:56

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Acenaphthene	50.0	24.8	49.6	41.0-120	
Acenaphthylene	50.0	26.0	52.0	43.0-120	
Anthracene	50.0	24.5	49.0	45.0-120	
Acetophenone	50.0	25.8	51.6	29.0-120	
Atrazine	50.0	22.6	45.2	39.0-141	
Benzaldehyde	50.0	72.1	144	10.0-160	
Benzo(a)anthracene	50.0	26.6	53.2	47.0-120	
Benzo(b)fluoranthene	50.0	25.8	51.6	46.0-120	
Benzo(k)fluoranthene	50.0	25.5	51.0	46.0-120	
Benzo(g,h,i)perylene	50.0	25.8	51.6	48.0-121	
Benzo(a)pyrene	50.0	25.6	51.2	47.0-120	
Biphenyl	50.0	25.0	50.0	38.0-120	
Bis(2-chlorethoxy)methane	50.0	24.0	48.0	33.0-120	
Bis(2-chloroethyl)ether	50.0	25.7	51.4	23.0-120	
2,2-Oxybis(1-Chloropropane)	50.0	25.1	50.2	28.0-120	
4-Bromophenyl-phenylether	50.0	27.7	55.4	45.0-120	
2-Chloronaphthalene	50.0	23.9	47.8	37.0-120	
4-Chlorophenyl-phenylether	50.0	24.6	49.2	44.0-120	
Caprolactam	50.0	5.23	10.5	10.0-120	
Carbazole	50.0	24.9	49.8	51.0-122	J4
4-Chloroaniline	50.0	12.3	24.6	25.0-120	J4
Chrysene	50.0	26.3	52.6	48.0-120	
Dibenz(a,h)anthracene	50.0	26.6	53.2	47.0-120	
Dibenzofuran	50.0	24.7	49.4	44.0-120	
3,3-Dichlorobenzidine	100	46.8	46.8	44.0-120	
2,4-Dinitrotoluene	50.0	27.7	55.4	49.0-124	
2,6-Dinitrotoluene	50.0	25.8	51.6	46.0-120	
Fluoranthene	50.0	24.4	48.8	51.0-120	J4
Fluorene	50.0	24.5	49.0	47.0-120	
Hexachlorobenzene	50.0	29.4	58.8	44.0-120	
Hexachloro-1,3-butadiene	50.0	20.3	40.6	19.0-120	
Hexachlorocyclopentadiene	50.0	9.62	19.2	15.0-120	
Hexachloroethane	50.0	20.7	41.4	15.0-120	
Indeno(1,2,3-cd)pyrene	50.0	22.6	45.2	49.0-122	J4
Isophorone	50.0	22.4	44.8	36.0-120	
Naphthalene	50.0	22.5	45.0	27.0-120	
Nitrobenzene	50.0	24.0	48.0	27.0-120	
n-Nitrosodiphenylamine	50.0	23.9	47.8	47.0-120	
n-Nitrosodi-n-propylamine	50.0	23.3	46.6	31.0-120	
Phenanthrene	50.0	24.2	48.4	46.0-120	

Laboratory Control Sample (LCS)

(LCS) R3946120-1 07/07/23 01:56

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzylbutyl phthalate	50.0	24.1	48.2	43.0-121	
Bis(2-ethylhexyl)phthalate	50.0	23.6	47.2	43.0-122	
Di-n-butyl phthalate	50.0	24.8	49.6	49.0-121	
Diethyl phthalate	50.0	25.7	51.4	48.0-122	
Dimethyl phthalate	50.0	25.4	50.8	48.0-120	
Di-n-octyl phthalate	50.0	22.5	45.0	42.0-125	
2-Nitroaniline	50.0	26.0	52.0	43.0-120	
3-Nitroaniline	50.0	17.7	35.4	38.0-120	J4
4-Nitroaniline	50.0	20.7	41.4	18.0-160	
1-Methylnaphthalene	50.0	22.2	44.4	33.0-120	
2-Methylnaphthalene	50.0	21.9	43.8	33.0-120	
Pyrene	50.0	25.3	50.6	47.0-120	
4-Chloro-3-methylphenol	50.0	17.4	34.8	40.0-120	J4
2-Chlorophenol	50.0	18.4	36.8	25.0-120	
2,4-Dichlorophenol	50.0	20.1	40.2	36.0-120	
2,4-Dimethylphenol	50.0	17.3	34.6	33.0-120	
2-Methylphenol	50.0	15.5	31.0	28.0-120	
3&4-Methyl Phenol	50.0	16.4	32.8	31.0-120	
4,6-Dinitro-2-methylphenol	50.0	32.0	64.0	38.0-138	
2,4-Dinitrophenol	50.0	27.2	54.4	10.0-120	
2-Nitrophenol	50.0	24.5	49.0	31.0-120	
4-Nitrophenol	50.0	8.72	17.4	10.0-120	
Pentachlorophenol	50.0	27.0	54.0	23.0-120	
Phenol	50.0	9.12	18.2	10.0-120	
2,4,5-Trichlorophenol	50.0	26.1	52.2	44.0-120	
2,4,6-Trichlorophenol	50.0	25.3	50.6	42.0-120	
(S) 2-Fluorophenol			*29.2*	*10.0-120*	
(S) Phenol-d5			*19.9*	*10.0-120*	
(S) Nitrobenzene-d5			*50.3*	*10.0-127*	
(S) 2-Fluorobiphenyl			*57.0*	*10.0-130*	
(S) 2,4,6-Tribromophenol			*70.0*	*10.0-155*	
(S) p-Terphenyl-d14			*60.0*	*10.0-128*	

L1631248-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1631248-02 07/07/23 06:16 • (MS) R3946120-3 07/07/23 05:33 • (MSD) R3946120-4 07/07/23 05:54

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Acenaphthene	50.0	U	24.2	27.6	48.4	55.2	1	28.0-120			13.1	25
Acenaphthylene	50.0	U	25.5	29.3	51.0	58.6	1	31.0-121			13.9	25
Anthracene	50.0	U	22.9	26.8	45.8	53.6	1	36.0-120			15.7	23
Acetophenone	50.0	U	24.4	28.6	48.8	57.2	1	20.0-120			15.8	35
Atrazine	50.0	U	21.6	26.0	43.2	52.0	1	39.0-130			18.5	23
Benzaldehyde	50.0	U	64.5	75.8	129	152	1	10.0-160			16.1	40
Benzo(a)anthracene	50.0	U	23.6	28.8	47.2	57.6	1	39.0-120			19.8	23
Benzo(b)fluoranthene	50.0	U	23.0	28.7	46.0	57.4	1	37.0-120			22.1	23
Benzo(k)fluoranthene	50.0	U	22.3	27.6	44.6	55.2	1	37.0-120			21.2	26
Benzo(g,h,i)perylene	50.0	U	22.5	28.1	45.0	56.2	1	37.0-123			22.1	25
Benzo(a)pyrene	50.0	U	22.9	29.1	45.8	58.2	1	37.0-120			23.8	24
Biphenyl	50.0	U	24.0	28.1	48.0	56.2	1	29.0-120			15.7	33
Bis(2-chlorethoxy)methane	50.0	U	22.9	26.7	45.8	53.4	1	17.0-120			15.3	31
Bis(2-chloroethyl)ether	50.0	U	23.8	28.2	47.6	56.4	1	14.0-120			16.9	33
2,2-Oxybis(1-Chloropropane)	50.0	U	23.8	27.3	47.6	54.6	1	18.0-120			13.7	34
4-Bromophenyl-phenylether	50.0	U	26.5	31.5	53.0	63.0	1	37.0-120			17.2	24
2-Chloronaphthalene	50.0	U	23.0	26.7	46.0	53.4	1	29.0-120			14.9	28
4-Chlorophenyl-phenylether	50.0	U	24.7	28.6	49.4	57.2	1	36.0-120			14.6	23
Caprolactam	50.0	U	5.60	8.06	11.2	16.1	1	10.0-120			36.0	40
Carbazole	50.0	U	24.7	28.0	49.4	56.0	1	38.0-127			12.5	21
4-Chloroaniline	50.0	U	8.79	16.6	17.6	33.2	1	10.0-120		J3	61.5	31
Chrysene	50.0	U	23.5	28.6	47.0	57.2	1	38.0-120			19.6	23
Dibenz(a,h)anthracene	50.0	U	23.2	28.9	46.4	57.8	1	36.0-121			21.9	24
Dibenzofuran	50.0	U	24.7	27.9	49.4	55.8	1	32.0-120			12.2	26
3,3-Dichlorobenzidine	100	U	34.1	46.0	34.1	46.0	1	10.0-134			29.7	30
2,4-Dinitrotoluene	50.0	U	27.8	32.3	55.6	64.6	1	39.0-125			15.0	25
2,6-Dinitrotoluene	50.0	U	25.6	30.2	51.2	60.4	1	36.0-120			16.5	27
Fluoranthene	50.0	U	23.6	28.2	47.2	56.4	1	41.0-121			17.8	22
Fluorene	50.0	U	24.4	28.0	48.8	56.0	1	37.0-120			13.7	24
Hexachlorobenzene	50.0	U	26.6	31.9	53.2	63.8	1	35.0-122			18.1	24
Hexachloro-1,3-butadiene	50.0	U	19.6	24.0	39.2	48.0	1	12.0-120			20.2	34
Hexachlorocyclopentadiene	50.0	U	11.1	14.7	22.2	29.4	1	10.0-120			27.9	33
Hexachloroethane	50.0	U	19.9	23.4	39.8	46.8	1	10.0-120			16.2	40
Indeno(1,2,3-cd)pyrene	50.0	U	20.2	25.1	40.4	50.2	1	38.0-125			21.6	24
Isophorone	50.0	U	21.1	24.7	42.2	49.4	1	21.0-120			15.7	27
Naphthalene	50.0	U	21.3	24.5	42.6	49.0	1	10.0-120			14.0	31
Nitrobenzene	50.0	U	22.5	26.2	45.0	52.4	1	12.0-120			15.2	30
n-Nitrosodiphenylamine	50.0	U	22.7	25.8	45.4	51.6	1	37.0-120			12.8	24
n-Nitrosodi-n-propylamine	50.0	U	22.5	26.9	45.0	53.8	1	16.0-120			17.8	30
Phenanthrene	50.0	U	23.7	27.2	47.4	54.4	1	33.0-120			13.8	22

L1631248-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1631248-02 07/07/23 06:16 • (MS) R3946120-3 07/07/23 05:33 • (MSD) R3946120-4 07/07/23 05:54

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzylbutyl phthalate	50.0	U	24.0	28.0	48.0	56.0	1	34.0-126			15.4	24
Bis(2-ethylhexyl)phthalate	50.0	U	20.4	26.2	40.8	52.4	1	33.0-126			24.9	25
Di-n-butyl phthalate	50.0	U	25.1	29.1	50.2	58.2	1	35.0-128			14.8	23
Diethyl phthalate	50.0	U	25.4	29.4	50.8	58.8	1	39.0-125			14.6	24
Dimethyl phthalate	50.0	U	24.6	28.8	49.2	57.6	1	37.0-120			15.7	24
Di-n-octyl phthalate	50.0	U	19.3	25.4	38.6	50.8	1	25.0-135		J3	27.3	26
2-Nitroaniline	50.0	U	24.9	29.8	49.8	59.6	1	33.0-120			17.9	27
3-Nitroaniline	50.0	U	16.9	22.4	33.8	44.8	1	20.0-120		J3	28.0	27
4-Nitroaniline	50.0	U	19.6	23.8	39.2	47.6	1	10.0-160			19.4	26
1-Methylnaphthalene	50.0	U	21.8	24.8	43.6	49.6	1	11.0-120			12.9	27
2-Methylnaphthalene	50.0	U	21.5	24.6	43.0	49.2	1	17.0-120			13.4	28
Pyrene	50.0	U	23.5	27.8	47.0	55.6	1	39.0-120			16.8	22
4-Chloro-3-methylphenol	50.0	U	14.8	17.0	29.6	34.0	1	26.0-120			13.8	27
2-Chlorophenol	50.0	U	14.3	16.8	28.6	33.6	1	18.0-120			16.1	34
2,4-Dichlorophenol	50.0	U	15.0	17.8	30.0	35.6	1	19.0-120			17.1	27
2,4-Dimethylphenol	50.0	U	13.4	16.4	26.8	32.8	1	15.0-120			20.1	28
2-Methylphenol	50.0	U	12.7	14.7	25.4	29.4	1	10.0-120			14.6	30
3&4-Methyl Phenol	50.0	U	13.6	15.6	27.2	31.2	1	10.0-120			13.7	36
4,6-Dinitro-2-methylphenol	50.0	U	25.1	29.8	50.2	59.6	1	10.0-144			17.1	39
2,4-Dinitrophenol	50.0	U	21.7	27.4	43.4	54.8	1	10.0-120			23.2	40
2-Nitrophenol	50.0	U	19.3	22.3	38.6	44.6	1	20.0-120			14.4	30
4-Nitrophenol	50.0	U	7.50	9.16	15.0	18.3	1	10.0-120			19.9	40
Pentachlorophenol	50.0	U	19.7	24.0	39.4	48.0	1	10.0-128			19.7	37
Phenol	50.0	U	7.54	8.64	15.1	17.3	1	10.0-120			13.6	40
2,4,5-Trichlorophenol	50.0	U	19.6	23.4	39.2	46.8	1	33.0-120			17.7	31
2,4,6-Trichlorophenol	50.0	U	17.6	21.7	35.2	43.4	1	26.0-120			20.9	31
(S) 2-Fluorophenol					*22.3*	*25.3*		*10.0-120*				
(S) Phenol-d5					*16.3*	*18.6*		*10.0-120*				
(S) Nitrobenzene-d5					*46.1*	*53.7*		*10.0-127*				
(S) 2-Fluorobiphenyl					*53.9*	*63.1*		*10.0-130*				
(S) 2,4,6-Tribromophenol					*49.4*	*57.5*		*10.0-155*				
(S) p-Terphenyl-d14					*51.4*	*63.3*		*10.0-128*				

Sample Narrative:

OS: Duplicate Analysis performed due to QC failure. Results confirm; reporting in hold data

Method Blank (MB)

(MB) R3946334-2 07/08/23 23:01

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Biphenyl	U		0.790	10.0
Fluorene	U		0.0844	1.00
Naphthalene	U		0.159	1.00
Phenanthrene	0.204	J	0.112	1.00
1-Methylnaphthalene	U		0.0790	1.00
2-Methylnaphthalene	U		0.117	1.00
Pyrene	U		0.107	1.00
(S) 2-Fluorophenol	*32.4*			*10.0-120*
(S) Phenol-d5	*19.7*			*10.0-120*
(S) Nitrobenzene-d5	*70.0*			*10.0-127*
(S) 2-Fluorobiphenyl	*79.4*			*10.0-130*
(S) 2,4,6-Tribromophenol	*74.0*			*10.0-155*
(S) p-Terphenyl-d14	*98.7*			*10.0-128*

Laboratory Control Sample (LCS)

(LCS) R3946334-1 07/08/23 22:39

Analyte	Spike Amount ug/l	LCS Result ug/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Biphenyl	50.0	35.1	70.2	38.0-120	
Fluorene	50.0	36.4	72.8	47.0-120	
Naphthalene	50.0	29.4	58.8	27.0-120	
Phenanthrene	50.0	35.6	71.2	46.0-120	
1-Methylnaphthalene	50.0	31.4	62.8	33.0-120	
2-Methylnaphthalene	50.0	32.5	65.0	33.0-120	
Pyrene	50.0	40.8	81.6	47.0-120	
(S) 2-Fluorophenol			*36.0*	*10.0-120*	
(S) Phenol-d5			*19.8*	*10.0-120*	
(S) Nitrobenzene-d5			*59.5*	*10.0-127*	
(S) 2-Fluorobiphenyl			*72.0*	*10.0-130*	
(S) 2,4,6-Tribromophenol			*77.5*	*10.0-155*	
(S) p-Terphenyl-d14			*85.6*	*10.0-128*	

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
C3	The reported concentration is an estimate. The continuing calibration standard associated with this data responded low. Method sensitivity check is acceptable.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J4	The associated batch QC was outside the established quality control range for accuracy.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.
Q	Sample was prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
V3	The internal standard exhibited poor recovery due to sample matrix interference. The analytical results will be biased high. BDL results will be unaffected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

Company Name/Address:
Pace Analytical - West Columbia, SC

106 Vantage Point Dr.
West Columbia, SC 29172

Billing Information:
PM
106 Vantage Point Dr.
West Columbia, SC 29172
mike.gipson@calumetspecialty.com

Report to:
Cathy Dover

Email To: cathy.dover@pacelabs.com
asmall@ramboll.com

Project Description: Calumet Refinery

City/State Collected: Great Falls, MT

Please Circle: PT MT CT ET

Phone: 406-419-8736

Client Project # 1690029636-002

Lab Project # PACEWCSC-DOVERMT

Collected by (print): Sarah Hall

Site/Facility ID # 001

P.O. #

Collected by (signature): SHall

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed: Standard

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	SVOCs ~~1L Amb Add HCl~~ 250ml Amber No pres. ~~HCl~~	VPHMT ~~40mlAmb HCl~~ 40ml glass HCl	EPH MT 1L Amber HCl	VOCs 40ml glass HCl							Remarks	Sample # (lab only)
						Pres Chk		X	X	+								
CMR-SP200-290623	G	GW	—	6/29/23	10:00	8	X	X	X	X								01
		GW																
		GW																
		GW																
		GW																
		GW																
		GW																
		GW																

Chain of Custody Page 1 of 1

Pace
PEOPLE ADVANCING SCIENCE

MT JULIET, TN

12065 Lebanon Rd Mount Juliet, TN 37122
Submitting a sample via this chain of custody constitutes acknowledgment and acceptance of the Pace Terms and Conditions found at: https://info.pacelabs.com/hubfs/pas-standard-terms.pdf

SDG # L1631201
Tab E155
Acctnum: PACEWCSC
Template: T214939
Prelogin: P945177
PM: 844 - Christi M Wagner
PB:
Shipped Via: FedEX Standard

* Matrix:
SS - Soil **AIR** - Air **F** - Filter
GW - Groundwater **B** - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS X FedEx __ Courier _____

Tracking # 5913 6273 0408

Sample Receipt Checklist
COC Seal Present/Intact: __NP Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
If Applicable
VOA Zero Headspace: Y N
Preservation Correct/Checked: Y N
RAD Screen <0.5 mR/hr: Y N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
SHall	6/29/23	14:30	
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)
			Hana Mwechima

Trip Blank Received: Yes / No
HCL / MeoH
TBR

Temp: °C Bottles Received:
3.0+0=3.0 8

Date: 6-30-23 Time: 0905

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Chain of Custody

Pace Analytical®

Workorder: YG05003 Workorder Name: Calumet Refinery Owner Received Date: 6/30/2023 Results Requested By: 7/7/2023

Report To:	Subcontract To:
Edward T. Barnett	Project #
Pace Analytical	
106 Vantage Point Drive	Pace - National
Columbia SC, 29223	
803-227-2706	
Edward.Barnett@pacelabs.com	

						Preserved Containers					Requested Analysis												
Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	None	HCL				MT VPH	MT EPH	VOC	SVOC									LAB USE ONLY
1	CMR-SP200-290623	grab	06/29/2023 @ 1000	YG05003-001	Aqueous	X	X				X	X	X	X									
2																							
3																							
4																							Environ
5																							EQUIS
6																							EDD
7																							Needed
8																							
9																							
10																							

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1					For all samples - MA EPH and MA VPH Level 2 with J/MDLs screen + fractionated analysis
2					
3					

Cooler Temperature on Receipt _____ °C	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

APPENDIX A3

PASSIVE TREATMENT TRENCH GROUNDWATER ANALYTICAL RESULTS

Pace Lot Number YF29005

Report of Analysis

Ramboll US Corporation
333 West Wacker Drive
Suite 2700
Chicago, IL 60606
Attention: Calumet Refinery GW Sampling

Project Name: Calumet Refinery GW Sampling

Project Number: 1690029636-001

Lot Number:**YF29005**

Date Completed:08/03/2023

08/03/2023 11:44 AM
Approved and released by:
Project Manager II: **Edward Barnett**

The electronic signature above is the equivalent of a handwritten signature.
This report shall not be reproduced, except in its entirety, without the written approval of Pace Analytical Services, LLC.

Pace Analytical Services, LLC (*formerly Shealy Environmental Services, Inc.*)
106 Vantage Point Drive West Columbia, SC 29172
Tel: 803-791-9700 Fax: 803-791-9111 www.pacelabs.com

Case Narrative
Ramboll US Corporation
Lot Number: YF29005

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

All results listed in this report relate only to the samples that are contained within this report. Where sampling is conducted by the client, results relate to the accuracy of the information provided, and as the samples are received.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved The NELAC Institute (TNI) standards, the Pace Analytical Services, LLC ("Pace") Laboratory Quality Manual, standard operating procedures (SOPs), and Pace policies. Any exceptions to the TNI standards, the Laboratory Quality Manual, SOPs or policies are qualified on the results page or discussed below.

Pace is a TNI accredited laboratory; however, the following analyses are currently not listed on our TNI scope of accreditation: Drinking Water: VOC (excluding BTEX, MTBE, Naphthalene, & 1,2-dichloroethane) EPA 524.2, E. coli and Total coliforms SM 9223 B-2004, Solid Chemical Material: TOC Walkley-Black, Biological Tissue: All, Non-Potable Water: SGT-HEM EPA 1664B, Silica EPA 200.7, Boron, Calcium, Silicon, Strontium EPA 200.8, Bicarbonate, Carbonate, and Hydroxide Alkalinity SM 2320 B-2011, SM 9221 C E-2006 & SM 9222D-2006, Strontium SW-846 6010D, VOC SM 6200 B-2011, Fecal Coliform Colilert-18, PFAS by Isotope Dilution SOP.

Pace is a DoD/DoE and TNI accredited laboratory; however, Pace is not accredited for PFAS Direct Aqueous Injection or Method D8421.

If you have any questions regarding this report, please contact the Pace Project Manager listed on the cover page.

Inorganic non-Metals

YF29005-001 and YF29005-002 are associated with a failing CCV. The samples were reanalyzed to confirm the accuracy of initial results and both sets of data have been reported.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 78962) Nitrate - N
YF29005-002 (CMR-MW-105-280623) (Run 1) (Analysis Batch 78962) Nitrate - N

The following Nitrate sample was diluted due to the nature of the sample matrix: YF29005-002. The LOQ has been elevated to reflect the dilution.

YF29005-002 (CMR-MW-105-280623) (Run 2) (Analysis Batch 79069) Nitrate - N

YF29005-001 and YF29005-002 are associated with failing CCVs for Sulfate. The samples were reanalyzed in hold.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 78963) Sulfate
YF29005-002 (CMR-MW-105-280623) (Run 1) (Analysis Batch 78963) Sulfate

The samples in Sulfate batch 79070 are associated with an LOQ that recovered marginally above passing criteria at 151%. The samples were reanalyzed in hold to confirm accurate results.

YF29005-001 (CMR-MW-106-280623) (Run 2) (Analysis Batch 79070) Sulfate
YF29005-002 (CMR-MW-105-280623) (Run 2) (Analysis Batch 79070) Sulfate

The BOD result has been reported as less than the stated value due to oxygen depletion of less than 2.0 mg/l at each sample dilution. The sample was prepared with a standard series of dilutions based on the COD result.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 78896) BOD, 5 day

The G-G associated with the listed BOD sample was out of range at 155.9 mg/L (valid range is 167.5 – 228.5 mg/L). This demonstrates a potential low bias on analytical results. The associated BOD results should be considered estimated.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 78896) BOD, 5 day

VOCs

The following sample was received with headspace in the sample vial: YF29005-001, YF29005-003, YF29005-006.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 79450) Full list VOCs
YF29005-003 (CMR-MW-105-270623) (Run 1) (Analysis Batch 79334) Full list VOCs
YF29005-006 (Trip Blank) (Run 1) (Analysis Batch 79450) Full list VOCs

The laboratory control sample (LCS) for analytical batch 79334 exceeded acceptance criteria for the following analyte: 2-Butanone. This was biased high and was not detected in the sample affected: YF29005-004.

YF29005-004 (Trip Blank) (Run 1) (Analysis Batch 79334) Full list VOCs

The laboratory control sample (LCS) for analytical batch 79450 exceeded acceptance criteria for the following analytes: Acetone, 1,4-Dioxane. These analytes were biased high and were not detected in the samples affected: YF29005-001, YF29005-006.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 79450) Full list VOCs
YF29005-006 (Trip Blank) (Run 1) (Analysis Batch 79450) Full list VOCs

Reanalysis of the following sample was performed outside of the analytical holding time for Acetone, 2-Butanone due to failure in the LCS: YF29005-005. Both sets of data and the associated QC have been reported.

YF29005-005 (CMR-MW-41S-270623) (Run 2) (Analysis Batch 79704) Full list VOCs

Reanalysis of the following sample was performed outside of the analytical holding time for Dichlorodifluoromethane due to failure in the ICV and CCV: YF29005-001. Both sets of data and the associated QC have been reported.

YF29005-001 (CMR-MW-106-280623) (Run 2) (Analysis Batch 80190) Full list VOCs

Reanalysis of the following sample was performed outside of the analytical holding time for Acetone and Cyclohexane due to failure in the CCV: YF29005-003. Both sets of data and the associated QC have been reported.

YF29005-003 (CMR-MW-105-270623) (Run 2) (Analysis Batch 80190) Full list VOCs

The laboratory control sample (LCS) for analytical batch 79450 exceeded acceptance criteria for the following analyte: Dichlorodifluoromethane. This was biased high and was not detected in the samples affected: YF29005-001, YF29005-006.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 79450) Full list VOCs
YF29005-006 (Trip Blank) (Run 1) (Analysis Batch 79450) Full list VOCs

The laboratory control sample (LCS) for analytical batch 79334 exceeded acceptance criteria for the following analyte: Acetone. This was biased high and was not detected in the sample affected: YF29005-004.

YF29005-004 (Trip Blank) (Run 1) (Analysis Batch 79334) Full list VOCs

Metals

The method blank for analytical batch 79938 contained Iron greater than the acceptance criteria. The associated sample, YF29005-001, contained detections for this analyte at concentrations greater than 10X the value found in the method blank; therefore sample results are not impacted. The data has been reported.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 79938) (Prep Batch 79320) ICP-MS Metals

SVOCs

The following samples were diluted due to the nature of the sample matrix: YF29005-001, YF29005-003, YF29005-005. The LOQ has been elevated to reflect the dilution.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 80888) (Prep Batch 78980) TCL SVOCs
YF29005-003 (CMR-MW-105-270623) (Run 1) (Analysis Batch 80888) (Prep Batch 78980) TCL SVOCs
YF29005-005 (CMR-MW-41S-270623) (Run 1) (Analysis Batch 80888) (Prep Batch 78980) TCL SVOCs

The laboratory control sample (LCS) for analytical batch 80888 exceeded control limits for multiple analytes. The associated samples were re-prepared and/or re-analyzed outside holding time with LCS/LCSD. Both sets of data and the associated QC have been reported.

YF29005-001 (CMR-MW-106-280623) (Run 1) (Analysis Batch 80888) (Prep Batch 78980) TCL SVOCs
YF29005-003 (CMR-MW-105-270623) (Run 1) (Analysis Batch 80888) (Prep Batch 78980) TCL SVOCs
YF29005-005 (CMR-MW-41S-270623) (Run 1) (Analysis Batch 80888) (Prep Batch 78980) TCL SVOCs

Subcontracted Results

EPH and VPH were subcontracted to Pace National for analysis. The results are included after the Pace West Columbia report of analysis.

Sample Summary
Ramboll US Corporation
Lot Number: YF29005
Project Name: Calumet Refinery GW Sampling
Project Number: 1690029636-001

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	CMR-MW-106-280623	Aqueous	06/28/2023 1000	06/29/2023
002	CMR-MW-105-280623	Aqueous	06/28/2023 1155	06/29/2023
003	CMR-MW-105-270623	Aqueous	06/27/2023 1525	06/29/2023
004	Trip Blank	Aqueous	06/27/2023	06/29/2023
005	CMR-MW-41S-270623	Aqueous	06/27/2023 1300	06/29/2023
006	Trip Blank	Aqueous	06/28/2023	06/29/2023

(6 samples)

Detection Summary

Ramboll US Corporation

Lot Number: YF29005

Project Name: Calumet Refinery GW Sampling

Project Number: 1690029636-001

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	CMR-MW-106-280623	Aqueous	Alkalinity @ pH 4.5 su	SM 2320B-	1000		mg CaCO3/L	10
001	CMR-MW-106-280623	Aqueous	BOD, 5 day	SM 5210B-	<2.8	16	mg/L	10
001	CMR-MW-106-280623	Aqueous	CO2 (calculation)	SM 4500-CO2	960		mg/L	10
001	CMR-MW-106-280623	Aqueous	Sulfate	9056A	410	S	mg/L	10
001	CMR-MW-106-280623	Aqueous	Nitrate - N	9056A	12	HS	mg/L	10
001	CMR-MW-106-280623	Aqueous	Methane	RSK - 175	71		ug/L	19
001	CMR-MW-106-280623	Aqueous	Dissolved Iron	6020B	1200		ug/L	20
001	CMR-MW-106-280623	Aqueous	Dissolved Manganese	6020B	2800		ug/L	20
001	CMR-MW-106-280623	Aqueous	Iron	6020B	1300	B	ug/L	21
001	CMR-MW-106-280623	Aqueous	Manganese	6020B	2700		ug/L	21
002	CMR-MW-105-280623	Aqueous	Sulfate	9056A	100		mg/L	22
002	CMR-MW-105-280623	Aqueous	Methane	RSK - 175	56		ug/L	23
003	CMR-MW-105-270623	Aqueous	Benzene	8260D	48		ug/L	24
003	CMR-MW-105-270623	Aqueous	2-Butanone (MEK)	8260D	3.2	JL	ug/L	24
003	CMR-MW-105-270623	Aqueous	Chloromethane (Methyl	8260D	1.5		ug/L	24
003	CMR-MW-105-270623	Aqueous	Ethylbenzene	8260D	15		ug/L	24
003	CMR-MW-105-270623	Aqueous	Isopropylbenzene	8260D	0.72		ug/L	24
003	CMR-MW-105-270623	Aqueous	Methylcyclohexane	8260D	3.8	J	ug/L	24
003	CMR-MW-105-270623	Aqueous	Naphthalene	8260D	1.5		ug/L	24
003	CMR-MW-105-270623	Aqueous	Toluene	8260D	2.2		ug/L	24
003	CMR-MW-105-270623	Aqueous	Xylenes (total)	8260D	5.9		ug/L	25
003	CMR-MW-105-270623	Aqueous	m+p - Xylenes	8260D	4.7		ug/L	25
003	CMR-MW-105-270623	Aqueous	o - Xylenes	8260D	1.2		ug/L	25
003	CMR-MW-105-270623	Aqueous	Acetone	8260D	21	H	ug/L	26
003	CMR-MW-105-270623	Aqueous	Cyclohexane	8260D	9.4	H	ug/L	26
003	CMR-MW-105-270623	Aqueous	1-Methylnaphthalene	8270E	0.73	JQL	ug/L	29
003	CMR-MW-105-270623	Aqueous	2-Methylnaphthalene	8270E	0.31	JQ	ug/L	29
003	CMR-MW-105-270623	Aqueous	Naphthalene	8270E	0.91	Q	ug/L	29
003	CMR-MW-105-270623	Aqueous	Phenol	8270E	1.2	JQL	ug/L	29
004	Trip Blank	Aqueous	Acetone	8260D	5.6	JL	ug/L	32
005	CMR-MW-41S-270623	Aqueous	Benzene	8260D	410		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Cyclohexane	8260D	17		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Ethylbenzene	8260D	150		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Isopropylbenzene	8260D	5.6		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Methylcyclohexane	8260D	15	J	ug/L	34
005	CMR-MW-41S-270623	Aqueous	Naphthalene	8260D	35		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Styrene	8260D	4.8		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Toluene	8260D	3.4		ug/L	34
005	CMR-MW-41S-270623	Aqueous	Xylenes (total)	8260D	630		ug/L	35
005	CMR-MW-41S-270623	Aqueous	m+p - Xylenes	8260D	470		ug/L	35
005	CMR-MW-41S-270623	Aqueous	o - Xylenes	8260D	150		ug/L	35
005	CMR-MW-41S-270623	Aqueous	Acetone	8260D	40	H	ug/L	36
005	CMR-MW-41S-270623	Aqueous	2-Butanone (MEK)	8260D	18	H	ug/L	36

Detection Summary (Continued)

Lot Number: YF29005

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
005	CMR-MW-41S-270623	Aqueous	Acenaphthene	8270E	0.34	J	ug/L	38
005	CMR-MW-41S-270623	Aqueous	1,1'-Biphenyl	8270E	1.4	J	ug/L	38
005	CMR-MW-41S-270623	Aqueous	2,4-Dimethylphenol	8270E	8.3		ug/L	38
005	CMR-MW-41S-270623	Aqueous	Fluorene	8270E	0.67	J	ug/L	38
005	CMR-MW-41S-270623	Aqueous	1-Methylnaphthalene	8270E	10	L	ug/L	39
005	CMR-MW-41S-270623	Aqueous	2-Methylnaphthalene	8270E	12		ug/L	39
005	CMR-MW-41S-270623	Aqueous	Naphthalene	8270E	15		ug/L	39
005	CMR-MW-41S-270623	Aqueous	Phenanthrene	8270E	0.42	J	ug/L	39

(51 detections)

Inorganic non-metals

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
2		(Alkalinity @) SM 2320B-2011	1	07/10/2023 2022	TAD		79660
1		(BOD, 5 day) SM 5210B-2016	1	07/04/2023 1813	DAT	06/29/2023 2115	78896
2		(CO2 (calcula) SM 4500-CO2 D	1	07/10/2023 2022	TAD		
1		(Nitrate - N) 9056A	1	06/29/2023 2120	SJL		78962
2		(Nitrate - N) 9056A	5	06/30/2023 1117	SJL		79069
3		(Sulfate) 9056A	5	07/06/2023 1903	SJL		79417

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Alkalinity @ pH 4.5 su		**SM 2320B-2011**	**1000**		**20**	**20**	**mg CaCO3/L**	**2**
BOD, 5 day		**SM 5210B-2016**	**<2.8**	**16**	**2.0**	**0.18**	**mg/L**	**1**
CO2 (calculation)	**124-38-9**	**SM 4500-CO2 D**	**960**		**27**	**27**	**mg/L**	**2**
Sulfate		**9056A**	**410**	**S**	**5.0**	**1.3**	**mg/L**	**3**
Nitrate - N		**9056A**	**19**	**E**	**0.020**	**0.0050**	**mg/L**	**1**
Nitrate - N		**9056A**	**12**	**HS**	**0.10**	**0.025**	**mg/L**	**2**

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/07/2023 1636	AMR2		79450
2	5030B	8260D	1	07/18/2023 0124	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	67-64-1	8260D	ND	L	10	4.0	ug/L	1
Benzene	71-43-2	8260D	ND		0.50	0.40	ug/L	1
Bromochloromethane	74-97-5	8260D	ND		0.50	0.40	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		0.50	0.40	ug/L	1
Bromoform	75-25-2	8260D	ND		0.50	0.40	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		0.50	0.40	ug/L	1
2-Butanone (MEK)	78-93-3	8260D	ND		10	2.0	ug/L	1
Carbon disulfide	75-15-0	8260D	ND		0.50	0.40	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		0.50	0.40	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		0.50	0.40	ug/L	1
Chloroethane	75-00-3	8260D	ND		0.50	0.40	ug/L	1
Chloroform	67-66-3	8260D	ND		0.50	0.40	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		0.50	0.40	ug/L	1
Cyclohexane	110-82-7	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		0.50	0.40	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		0.50	0.40	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		0.50	0.40	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		0.50	0.40	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND	L	0.50	0.40	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		0.50	0.40	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		0.50	0.40	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		0.50	0.40	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		0.50	0.40	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		0.50	0.40	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND	L	20	13	ug/L	1
Ethylbenzene	100-41-4	8260D	ND		0.50	0.40	ug/L	1
2-Hexanone	591-78-6	8260D	ND		10	2.0	ug/L	1
Isopropylbenzene	98-82-8	8260D	ND		0.50	0.40	ug/L	1
Methyl acetate	79-20-9	8260D	ND		1.0	0.40	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		0.50	0.40	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		10	2.0	ug/L	1
Methylcyclohexane	108-87-2	8260D	ND		5.0	0.40	ug/L	1
Methylene chloride	75-09-2	8260D	ND		0.50	0.40	ug/L	1
Naphthalene	91-20-3	8260D	ND		0.50	0.40	ug/L	1
Styrene	100-42-5	8260D	ND		0.50	0.41	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND		0.50	0.40	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		0.50	0.40	ug/L	1
Toluene	108-88-3	8260D	ND		0.50	0.40	ug/L	1

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/07/2023 1636	AMR2		79450
2	5030B	8260D	1	07/18/2023 0124	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		1.0	0.42	ug/L	1
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		0.50	0.40	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		0.50	0.40	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		0.50	0.40	ug/L	1
Trichloroethene	79-01-6	8260D	ND		0.50	0.40	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		0.50	0.40	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		0.50	0.40	ug/L	1
Xylenes (total)	1330-20-7	8260D	ND		1.0	0.40	ug/L	1
m+p - Xylenes	179601-23-1	8260D	ND		0.50	0.40	ug/L	1
o - Xylenes	95-47-6	8260D	ND		0.50	0.40	ug/L	1

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
Bromofluorobenzene		99	70-130	H	117	70-130
1,2-Dichloroethane-d4		97	70-130	H	115	70-130
Toluene-d8		95	70-130	H	110	70-130

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/07/2023 1636	AMR2		79450
2	5030B	8260D	1	07/18/2023 0124	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	67-64-1	8260D	ND	H	10	4.0	ug/L	2
Benzene	71-43-2	8260D	ND	H	0.50	0.40	ug/L	2
Bromochloromethane	74-97-5	8260D	ND	H	0.50	0.40	ug/L	2
Bromodichloromethane	75-27-4	8260D	ND	H	0.50	0.40	ug/L	2
Bromoform	75-25-2	8260D	ND	H	0.50	0.40	ug/L	2
Bromomethane (Methyl bromide)	74-83-9	8260D	ND	H	0.50	0.40	ug/L	2
2-Butanone (MEK)	78-93-3	8260D	ND	H	10	2.0	ug/L	2
Carbon disulfide	75-15-0	8260D	ND	H	0.50	0.40	ug/L	2
Carbon tetrachloride	56-23-5	8260D	ND	H	0.50	0.40	ug/L	2
Chlorobenzene	108-90-7	8260D	ND	H	0.50	0.40	ug/L	2
Chloroethane	75-00-3	8260D	ND	H	0.50	0.40	ug/L	2
Chloroform	67-66-3	8260D	ND	H	0.50	0.40	ug/L	2
Chloromethane (Methyl chloride)	74-87-3	8260D	ND	H	0.50	0.40	ug/L	2
Cyclohexane	110-82-7	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND	H	0.50	0.40	ug/L	2
Dibromochloromethane	124-48-1	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichlorobenzene	95-50-1	8260D	ND	H	0.50	0.40	ug/L	2
1,3-Dichlorobenzene	541-73-1	8260D	ND	H	0.50	0.40	ug/L	2
1,4-Dichlorobenzene	106-46-7	8260D	ND	H	0.50	0.40	ug/L	2
Dichlorodifluoromethane	75-71-8	8260D	ND	H	0.50	0.40	ug/L	2
1,1-Dichloroethane	75-34-3	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichloroethane	107-06-2	8260D	ND	H	0.50	0.40	ug/L	2
1,1-Dichloroethene	75-35-4	8260D	ND	H	0.50	0.40	ug/L	2
cis-1,2-Dichloroethene	156-59-2	8260D	ND	H	0.50	0.40	ug/L	2
trans-1,2-Dichloroethene	156-60-5	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichloropropane	78-87-5	8260D	ND	H	0.50	0.40	ug/L	2
cis-1,3-Dichloropropene	10061-01-5	8260D	ND	H	0.50	0.40	ug/L	2
trans-1,3-Dichloropropene	10061-02-6	8260D	ND	H	0.50	0.40	ug/L	2
1,4-Dioxane	123-91-1	8260D	ND	H	20	13	ug/L	2
Ethylbenzene	100-41-4	8260D	ND	H	0.50	0.40	ug/L	2
2-Hexanone	591-78-6	8260D	ND	H	10	2.0	ug/L	2
Isopropylbenzene	98-82-8	8260D	ND	H	0.50	0.40	ug/L	2
Methyl acetate	79-20-9	8260D	ND	H	1.0	0.40	ug/L	2
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND	H	0.50	0.40	ug/L	2
4-Methyl-2-pentanone	108-10-1	8260D	ND	H	10	2.0	ug/L	2
Methylcyclohexane	108-87-2	8260D	ND	H	5.0	0.40	ug/L	2
Methylene chloride	75-09-2	8260D	ND	H	0.50	0.40	ug/L	2
Naphthalene	91-20-3	8260D	ND	H	0.50	0.40	ug/L	2
Styrene	100-42-5	8260D	ND	H	0.50	0.41	ug/L	2
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND	H	0.50	0.40	ug/L	2
Tetrachloroethene	127-18-4	8260D	ND	H	0.50	0.40	ug/L	2
Toluene	108-88-3	8260D	ND	H	0.50	0.40	ug/L	2

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/07/2023 1636	AMR2		79450
2	5030B	8260D	1	07/18/2023 0124	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND	H	1.0	0.42	ug/L	2
1,2,3-Trichlorobenzene	87-61-6	8260D	ND	H	0.50	0.40	ug/L	2
1,2,4-Trichlorobenzene	120-82-1	8260D	ND	H	0.50	0.40	ug/L	2
1,1,1-Trichloroethane	71-55-6	8260D	ND	H	0.50	0.40	ug/L	2
1,1,2-Trichloroethane	79-00-5	8260D	ND	H	0.50	0.40	ug/L	2
Trichloroethene	79-01-6	8260D	ND	H	0.50	0.40	ug/L	2
Trichlorofluoromethane	75-69-4	8260D	ND	H	0.50	0.40	ug/L	2
Vinyl chloride	75-01-4	8260D	ND	H	0.50	0.40	ug/L	2
Xylenes (total)	1330-20-7	8260D	ND	H	1.0	0.40	ug/L	2
m+p - Xylenes	179601-23-1	8260D	ND	H	0.50	0.40	ug/L	2
o - Xylenes	95-47-6	8260D	ND	H	0.50	0.40	ug/L	2

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
Bromofluorobenzene		99	70-130	H	117	70-130
1,2-Dichloroethane-d4		97	70-130	H	115	70-130
Toluene-d8		95	70-130	H	110	70-130

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1730	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1544	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	83-32-9	8270E	ND	Q	0.80	0.20	ug/L	1
Acenaphthylene	208-96-8	8270E	ND	Q	0.80	0.20	ug/L	1
Acetophenone	98-86-2	8270E	ND	QL	4.0	1.2	ug/L	1
Anthracene	120-12-7	8270E	ND	Q	0.80	0.20	ug/L	1
Atrazine	1912-24-9	8270E	ND	Q	4.0	1.0	ug/L	1
Benzaldehyde	100-52-7	8270E	ND	Q	20	1.4	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	ND	Q	0.80	0.20	ug/L	1
1,1'-Biphenyl	92-52-4	8270E	ND	Q	4.0	1.1	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270E	ND	Q	4.0	0.75	ug/L	1
Butyl benzyl phthalate	85-68-7	8270E	ND	Q	20	1.1	ug/L	1
Caprolactam	105-60-2	8270E	ND	Q	20	3.6	ug/L	1
Carbazole	86-74-8	8270E	ND	Q	4.0	0.20	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND	Q	4.0	0.85	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270E	ND	Q	4.0	1.3	ug/L	1
4-Chloroaniline	106-47-8	8270E	ND	Q	4.0	0.65	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	QL	4.0	0.30	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	QL	4.0	0.80	ug/L	1
2-Chloronaphthalene	91-58-7	8270E	ND	QL	4.0	0.75	ug/L	1
2-Chlorophenol	95-57-8	8270E	ND	QL	4.0	0.75	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND	Q	4.0	0.80	ug/L	1
Chrysene	218-01-9	8270E	ND	Q	0.80	0.20	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	ND	Q	0.80	0.20	ug/L	1
Dibenzofuran	132-64-9	8270E	ND	Q	4.0	0.80	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270E	ND	Q	20	4.1	ug/L	1
2,4-Dichlorophenol	120-83-2	8270E	ND	Q	4.0	0.95	ug/L	1
Diethylphthalate	84-66-2	8270E	ND	Q	20	0.95	ug/L	1
Dimethyl phthalate	131-11-3	8270E	ND	Q	20	0.90	ug/L	1
2,4-Dimethylphenol	105-67-9	8270E	ND	Q	4.0	0.75	ug/L	1
Di-n-butyl phthalate	84-74-2	8270E	ND	Q	20	2.1	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	QL	20	4.5	ug/L	1
2,4-Dinitrophenol	51-28-5	8270E	ND	Q	20	6.6	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270E	ND	QL	8.0	1.8	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270E	ND	QL	8.0	1.7	ug/L	1
Di-n-octylphthalate	117-84-0	8270E	ND	Q	20	2.4	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND	Q	20	7.5	ug/L	1
Fluoranthene	206-44-0	8270E	ND	Q	0.80	0.20	ug/L	1
Fluorene	86-73-7	8270E	ND	Q	0.80	0.20	ug/L	1
Hexachlorobenzene	118-74-1	8270E	ND	Q	4.0	0.75	ug/L	1
Hexachlorobutadiene	87-68-3	8270E	ND	Q	4.0	0.85	ug/L	1

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1730	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1544	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachlorocyclopentadiene	77-47-4	8270E	ND	Q	20	5.5	ug/L	1
Hexachloroethane	67-72-1	8270E	ND	Q	4.0	0.85	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND	Q	0.80	0.20	ug/L	1
Isophorone	78-59-1	8270E	ND	QL	4.0	1.1	ug/L	1
1-Methylnaphthalene	90-12-0	8270E	ND	QL	0.80	0.20	ug/L	1
2-Methylnaphthalene	91-57-6	8270E	ND	Q	0.80	0.20	ug/L	1
2-Methylphenol	95-48-7	8270E	ND	Q	4.0	1.1	ug/L	1
3+4-Methylphenol	106-44-5	8270E	ND	QL	8.0	2.3	ug/L	1
Naphthalene	91-20-3	8270E	ND	Q	0.80	0.20	ug/L	1
2-Nitroaniline	88-74-4	8270E	ND	QL	8.0	3.3	ug/L	1
3-Nitroaniline	99-09-2	8270E	ND	QL	8.0	0.75	ug/L	1
4-Nitroaniline	100-01-6	8270E	ND	Q	8.0	6.6	ug/L	1
Nitrobenzene	98-95-3	8270E	ND	QL	4.0	0.85	ug/L	1
2-Nitrophenol	88-75-5	8270E	ND	QL	8.0	2.2	ug/L	1
4-Nitrophenol	100-02-7	8270E	ND	Q	20	10	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	QL	4.0	1.4	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND	Q	4.0	2.5	ug/L	1
Pentachlorophenol	87-86-5	8270E	ND	Q	20	6.7	ug/L	1
Phenanthrene	85-01-8	8270E	ND	Q	0.80	0.20	ug/L	1
Phenol	108-95-2	8270E	ND	QL	4.0	0.95	ug/L	1
Pyrene	129-00-0	8270E	ND	Q	0.80	0.20	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270E	ND	Q	4.0	0.95	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270E	ND	Q	4.0	1.1	ug/L	1

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
2-Fluorobiphenyl		47	37-129	H	69	37-129
2-Fluorophenol	N	21	24-127	H	32	24-127
Nitrobenzene-d5		75	38-127	H	86	38-127
Phenol-d5		43	28-128	H	59	28-128
Terphenyl-d14		52	10-148	H	82	10-148
2,4,6-Tribromophenol		88	35-144	H	133	35-144

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1730	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1544	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	83-32-9	8270E	ND	H	0.80	0.20	ug/L	2
Acenaphthylene	208-96-8	8270E	ND	H	0.80	0.20	ug/L	2
Acetophenone	98-86-2	8270E	ND	H	4.0	1.2	ug/L	2
Anthracene	120-12-7	8270E	ND	H	0.80	0.20	ug/L	2
Atrazine	1912-24-9	8270E	ND	H	4.0	1.0	ug/L	2
Benzaldehyde	100-52-7	8270E	ND	H	20	1.4	ug/L	2
Benzo(a)anthracene	56-55-3	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(a)pyrene	50-32-8	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(b)fluoranthene	205-99-2	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(g,h,i)perylene	191-24-2	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(k)fluoranthene	207-08-9	8270E	ND	H	0.80	0.20	ug/L	2
1,1'-Biphenyl	92-52-4	8270E	ND	H	4.0	1.1	ug/L	2
4-Bromophenyl phenyl ether	101-55-3	8270E	ND	H	4.0	0.75	ug/L	2
Butyl benzyl phthalate	85-68-7	8270E	ND	H	20	1.1	ug/L	2
Caprolactam	105-60-2	8270E	ND	H	20	3.6	ug/L	2
Carbazole	86-74-8	8270E	ND	H	4.0	0.20	ug/L	2
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND	H	4.0	0.85	ug/L	2
4-Chloro-3-methyl phenol	59-50-7	8270E	ND	H	4.0	1.3	ug/L	2
4-Chloroaniline	106-47-8	8270E	ND	H	4.0	0.65	ug/L	2
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	H	4.0	0.30	ug/L	2
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	H	4.0	0.80	ug/L	2
2-Chloronaphthalene	91-58-7	8270E	ND	H	4.0	0.75	ug/L	2
2-Chlorophenol	95-57-8	8270E	ND	H	4.0	0.75	ug/L	2
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND	H	4.0	0.80	ug/L	2
Chrysene	218-01-9	8270E	ND	H	0.80	0.20	ug/L	2
Dibenzo(a,h)anthracene	53-70-3	8270E	ND	H	0.80	0.20	ug/L	2
Dibenzofuran	132-64-9	8270E	ND	H	4.0	0.80	ug/L	2
3,3'-Dichlorobenzidine	91-94-1	8270E	ND	H	20	4.1	ug/L	2
2,4-Dichlorophenol	120-83-2	8270E	ND	H	4.0	0.95	ug/L	2
Diethylphthalate	84-66-2	8270E	ND	H	20	0.95	ug/L	2
Dimethyl phthalate	131-11-3	8270E	ND	H	20	0.90	ug/L	2
2,4-Dimethylphenol	105-67-9	8270E	ND	H	4.0	0.75	ug/L	2
Di-n-butyl phthalate	84-74-2	8270E	ND	H	20	2.1	ug/L	2
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	H	20	4.5	ug/L	2
2,4-Dinitrophenol	51-28-5	8270E	ND	H	20	6.6	ug/L	2
2,4-Dinitrotoluene	121-14-2	8270E	ND	H	8.0	1.8	ug/L	2
2,6-Dinitrotoluene	606-20-2	8270E	ND	H	8.0	1.7	ug/L	2
Di-n-octylphthalate	117-84-0	8270E	ND	H	20	2.4	ug/L	2
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND	H	20	7.5	ug/L	2
Fluoranthene	206-44-0	8270E	ND	H	0.80	0.20	ug/L	2
Fluorene	86-73-7	8270E	ND	H	0.80	0.20	ug/L	2
Hexachlorobenzene	118-74-1	8270E	ND	H	4.0	0.75	ug/L	2
Hexachlorobutadiene	87-68-3	8270E	ND	H	4.0	0.85	ug/L	2

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1730	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1544	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachlorocyclopentadiene	77-47-4	8270E	ND	H	20	5.5	ug/L	2
Hexachloroethane	67-72-1	8270E	ND	H	4.0	0.85	ug/L	2
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND	H	0.80	0.20	ug/L	2
Isophorone	78-59-1	8270E	ND	H	4.0	1.1	ug/L	2
1-Methylnaphthalene	90-12-0	8270E	ND	H	0.80	0.20	ug/L	2
2-Methylnaphthalene	91-57-6	8270E	ND	H	0.80	0.20	ug/L	2
2-Methylphenol	95-48-7	8270E	ND	H	4.0	1.1	ug/L	2
3+4-Methylphenol	106-44-5	8270E	ND	H	8.0	2.3	ug/L	2
Naphthalene	91-20-3	8270E	ND	H	0.80	0.20	ug/L	2
2-Nitroaniline	88-74-4	8270E	ND	H	8.0	3.3	ug/L	2
3-Nitroaniline	99-09-2	8270E	ND	HL	8.0	0.75	ug/L	2
4-Nitroaniline	100-01-6	8270E	ND	H	8.0	6.6	ug/L	2
Nitrobenzene	98-95-3	8270E	ND	H	4.0	0.85	ug/L	2
2-Nitrophenol	88-75-5	8270E	ND	H	8.0	2.2	ug/L	2
4-Nitrophenol	100-02-7	8270E	ND	H	20	10	ug/L	2
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	H	4.0	1.4	ug/L	2
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND	H	4.0	2.5	ug/L	2
Pentachlorophenol	87-86-5	8270E	ND	H	20	6.7	ug/L	2
Phenanthrene	85-01-8	8270E	ND	H	0.80	0.20	ug/L	2
Phenol	108-95-2	8270E	ND	H	4.0	0.95	ug/L	2
Pyrene	129-00-0	8270E	ND	H	0.80	0.20	ug/L	2
2,4,5-Trichlorophenol	95-95-4	8270E	ND	H	4.0	0.95	ug/L	2
2,4,6-Trichlorophenol	88-06-2	8270E	ND	H	4.0	1.1	ug/L	2

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
2-Fluorobiphenyl		47	37-129	H	69	37-129
2-Fluorophenol	N	21	24-127	H	32	24-127
Nitrobenzene-d5		75	38-127	H	86	38-127
Phenol-d5		43	28-128	H	59	28-128
Terphenyl-d14		52	10-148	H	82	10-148
2,4,6-Tribromophenol		88	35-144	H	133	35-144

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Methane

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1		RSK - 175	1	07/06/2023 1833	JWG		79381

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Methane	**74-82-8**	**RSK - 175**	**71**		**10**	**2.5**	**ug/L**	**1**

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

ICP-MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
2	3005A	6020B	10	07/13/2023 1253	BNW	07/11/2023 1327	79634

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Dissolved Iron	**7439-89-6**	**6020B**	**1200**		**500**	**130**	**ug/L**	**2**
Dissolved Manganese	**7439-96-5**	**6020B**	**2800**		**50**	**13**	**ug/L**	**2**

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

ICP-MS Metals

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-001**

Description: **CMR-MW-106-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1000** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3005A	6020B	10	07/13/2023 1310	BNW	07/11/2023 1032	79320

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Iron	**7439-89-6**	**6020B**	**1300**	**B**	**500**	**130**	**ug/L**	**1**
Manganese	**7439-96-5**	**6020B**	**2700**		**50**	**13**	**ug/L**	**1**

Footnote(s): 1-G:G Lower than valid range 6-D.O. depletion < 2.00 mg/L

LOQ = Limit of Quantitation	B = Detected in the method blank	E = Quantitation of compound exceeded the calibration range	DL = Detection Limit	Q = Surrogate failure
ND = Not detected at or above the DL	N = Recovery is out of criteria	P = The RPD between two GC columns exceeds 40%	J = Estimated result < LOQ and ≥ DL	L = LCS/LCSD failure
H = Out of holding time	W = Reported on wet weight basis			S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Inorganic non-metals

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-002**

Description: **CMR-MW-105-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1155** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1		(Nitrate - N) 9056A	1	06/29/2023 2223	SJL		78962
2		(Nitrate - N) 9056A	5	06/30/2023 1056	SJL		79069
3		(Sulfate) 9056A	1	07/06/2023 2005	SJL		79417

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Sulfate		**9056A**	**100**		**1.0**	**0.25**	**mg/L**	**3**
Nitrate - N		9056A	ND		0.020	0.0050	mg/L	1
Nitrate - N		9056A	ND		0.10	0.025	mg/L	2

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Methane

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-002**

Description: **CMR-MW-105-280623** Matrix: **Aqueous**

Date Sampled: **06/28/2023 1155** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1		RSK - 175	1	07/06/2023 1849	JWG		79381

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Methane	**74-82-8**	**RSK - 175**	**56**		**10**	**2.5**	**ug/L**	**1**

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/06/2023 1442	AMR2		79334
2	5030B	8260D	1	07/18/2023 0149	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	**67-64-1**	**8260D**	**20**	**L**	**10**	**4.0**	**ug/L**	**1**
Benzene	**71-43-2**	**8260D**	**48**		**0.50**	**0.40**	**ug/L**	**1**
Bromochloromethane	74-97-5	8260D	ND		0.50	0.40	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		0.50	0.40	ug/L	1
Bromoform	75-25-2	8260D	ND		0.50	0.40	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		0.50	0.40	ug/L	1
2-Butanone (MEK)	**78-93-3**	**8260D**	**3.2**	**JL**	**10**	**2.0**	**ug/L**	**1**
Carbon disulfide	75-15-0	8260D	ND		0.50	0.40	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		0.50	0.40	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		0.50	0.40	ug/L	1
Chloroethane	75-00-3	8260D	ND		0.50	0.40	ug/L	1
Chloroform	67-66-3	8260D	ND		0.50	0.40	ug/L	1
Chloromethane (Methyl chloride)	**74-87-3**	**8260D**	**1.5**		**0.50**	**0.40**	**ug/L**	**1**
Cyclohexane	**110-82-7**	**8260D**	**8.4**		**0.50**	**0.40**	**ug/L**	**1**
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		0.50	0.40	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		0.50	0.40	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		0.50	0.40	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		0.50	0.40	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		0.50	0.40	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		0.50	0.40	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		0.50	0.40	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		0.50	0.40	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		0.50	0.40	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND		20	13	ug/L	1
Ethylbenzene	**100-41-4**	**8260D**	**15**		**0.50**	**0.40**	**ug/L**	**1**
2-Hexanone	591-78-6	8260D	ND		10	2.0	ug/L	1
Isopropylbenzene	**98-82-8**	**8260D**	**0.72**		**0.50**	**0.40**	**ug/L**	**1**
Methyl acetate	79-20-9	8260D	ND		1.0	0.40	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		0.50	0.40	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		10	2.0	ug/L	1
Methylcyclohexane	**108-87-2**	**8260D**	**3.8**	**J**	**5.0**	**0.40**	**ug/L**	**1**
Methylene chloride	75-09-2	8260D	ND		0.50	0.40	ug/L	1
Naphthalene	**91-20-3**	**8260D**	**1.5**		**0.50**	**0.40**	**ug/L**	**1**
Styrene	100-42-5	8260D	ND		0.50	0.41	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND		0.50	0.40	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		0.50	0.40	ug/L	1
Toluene	**108-88-3**	**8260D**	**2.2**		**0.50**	**0.40**	**ug/L**	**1**

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/06/2023 1442	AMR2		79334
2	5030B	8260D	1	07/18/2023 0149	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		1.0	0.42	ug/L	1
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		0.50	0.40	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		0.50	0.40	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		0.50	0.40	ug/L	1
Trichloroethene	79-01-6	8260D	ND		0.50	0.40	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		0.50	0.40	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		0.50	0.40	ug/L	1
Xylenes (total)	**1330-20-7**	**8260D**	**5.9**		**1.0**	**0.40**	**ug/L**	**1**
m+p - Xylenes	**179601-23-1**	**8260D**	**4.7**		**0.50**	**0.40**	**ug/L**	**1**
o - Xylenes	**95-47-6**	**8260D**	**1.2**		**0.50**	**0.40**	**ug/L**	**1**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
Bromofluorobenzene		92	70-130	H	108	70-130
1,2-Dichloroethane-d4		95	70-130	H	109	70-130
Toluene-d8		98	70-130	H	109	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/06/2023 1442	AMR2		79334
2	5030B	8260D	1	07/18/2023 0149	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	**67-64-1**	**8260D**	**21**	**H**	**10**	**4.0**	**ug/L**	**2**
Benzene	**71-43-2**	**8260D**	**45**	**H**	**0.50**	**0.40**	**ug/L**	**2**
Bromochloromethane	74-97-5	8260D	ND	H	0.50	0.40	ug/L	2
Bromodichloromethane	75-27-4	8260D	ND	H	0.50	0.40	ug/L	2
Bromoform	75-25-2	8260D	ND	H	0.50	0.40	ug/L	2
Bromomethane (Methyl bromide)	74-83-9	8260D	ND	H	0.50	0.40	ug/L	2
2-Butanone (MEK)	**78-93-3**	**8260D**	**5.1**	**HJ**	**10**	**2.0**	**ug/L**	**2**
Carbon disulfide	75-15-0	8260D	ND	H	0.50	0.40	ug/L	2
Carbon tetrachloride	56-23-5	8260D	ND	H	0.50	0.40	ug/L	2
Chlorobenzene	108-90-7	8260D	ND	H	0.50	0.40	ug/L	2
Chloroethane	75-00-3	8260D	ND	H	0.50	0.40	ug/L	2
Chloroform	67-66-3	8260D	ND	H	0.50	0.40	ug/L	2
Chloromethane (Methyl chloride)	74-87-3	8260D	ND	H	0.50	0.40	ug/L	2
Cyclohexane	**110-82-7**	**8260D**	**9.4**	**H**	**0.50**	**0.40**	**ug/L**	**2**
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND	H	0.50	0.40	ug/L	2
Dibromochloromethane	124-48-1	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichlorobenzene	95-50-1	8260D	ND	H	0.50	0.40	ug/L	2
1,3-Dichlorobenzene	541-73-1	8260D	ND	H	0.50	0.40	ug/L	2
1,4-Dichlorobenzene	106-46-7	8260D	ND	H	0.50	0.40	ug/L	2
Dichlorodifluoromethane	75-71-8	8260D	ND	H	0.50	0.40	ug/L	2
1,1-Dichloroethane	75-34-3	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichloroethane	107-06-2	8260D	ND	H	0.50	0.40	ug/L	2
1,1-Dichloroethene	75-35-4	8260D	ND	H	0.50	0.40	ug/L	2
cis-1,2-Dichloroethene	156-59-2	8260D	ND	H	0.50	0.40	ug/L	2
trans-1,2-Dichloroethene	156-60-5	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichloropropane	78-87-5	8260D	ND	H	0.50	0.40	ug/L	2
cis-1,3-Dichloropropene	10061-01-5	8260D	ND	H	0.50	0.40	ug/L	2
trans-1,3-Dichloropropene	10061-02-6	8260D	ND	H	0.50	0.40	ug/L	2
1,4-Dioxane	123-91-1	8260D	ND	H	20	13	ug/L	2
Ethylbenzene	**100-41-4**	**8260D**	**15**	**H**	**0.50**	**0.40**	**ug/L**	**2**
2-Hexanone	591-78-6	8260D	ND	H	10	2.0	ug/L	2
Isopropylbenzene	**98-82-8**	**8260D**	**0.81**	**H**	**0.50**	**0.40**	**ug/L**	**2**
Methyl acetate	79-20-9	8260D	ND	H	1.0	0.40	ug/L	2
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND	H	0.50	0.40	ug/L	2
4-Methyl-2-pentanone	108-10-1	8260D	ND	H	10	2.0	ug/L	2
Methylcyclohexane	**108-87-2**	**8260D**	**3.1**	**HJ**	**5.0**	**0.40**	**ug/L**	**2**
Methylene chloride	75-09-2	8260D	ND	H	0.50	0.40	ug/L	2
Naphthalene	**91-20-3**	**8260D**	**1.7**	**H**	**0.50**	**0.40**	**ug/L**	**2**
Styrene	100-42-5	8260D	ND	H	0.50	0.41	ug/L	2
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND	H	0.50	0.40	ug/L	2
Tetrachloroethene	127-18-4	8260D	ND	H	0.50	0.40	ug/L	2
Toluene	**108-88-3**	**8260D**	**2.1**	**H**	**0.50**	**0.40**	**ug/L**	**2**

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/06/2023 1442	AMR2		79334
2	5030B	8260D	1	07/18/2023 0149	CDA		80190

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND	H	1.0	0.42	ug/L	2
1,2,3-Trichlorobenzene	87-61-6	8260D	ND	H	0.50	0.40	ug/L	2
1,2,4-Trichlorobenzene	120-82-1	8260D	ND	H	0.50	0.40	ug/L	2
1,1,1-Trichloroethane	71-55-6	8260D	ND	H	0.50	0.40	ug/L	2
1,1,2-Trichloroethane	79-00-5	8260D	ND	H	0.50	0.40	ug/L	2
Trichloroethene	79-01-6	8260D	ND	H	0.50	0.40	ug/L	2
Trichlorofluoromethane	75-69-4	8260D	ND	H	0.50	0.40	ug/L	2
Vinyl chloride	75-01-4	8260D	ND	H	0.50	0.40	ug/L	2
Xylenes (total)	**1330-20-7**	**8260D**	**6.7**	**H**	**1.0**	**0.40**	**ug/L**	**2**
m+p - Xylenes	**179601-23-1**	**8260D**	**5.4**	**H**	**0.50**	**0.40**	**ug/L**	**2**
o - Xylenes	**95-47-6**	**8260D**	**1.3**	**H**	**0.50**	**0.40**	**ug/L**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
Bromofluorobenzene		92	70-130	H	108	70-130
1,2-Dichloroethane-d4		95	70-130	H	109	70-130
Toluene-d8		98	70-130	H	109	70-130

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1756	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1610	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	83-32-9	8270E	ND	Q	0.80	0.20	ug/L	1
Acenaphthylene	208-96-8	8270E	ND	Q	0.80	0.20	ug/L	1
Acetophenone	98-86-2	8270E	ND	QL	4.0	1.2	ug/L	1
Anthracene	120-12-7	8270E	ND	Q	0.80	0.20	ug/L	1
Atrazine	1912-24-9	8270E	ND	Q	4.0	1.0	ug/L	1
Benzaldehyde	100-52-7	8270E	ND	Q	20	1.4	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	ND	Q	0.80	0.20	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	ND	Q	0.80	0.20	ug/L	1
1,1'-Biphenyl	92-52-4	8270E	ND	Q	4.0	1.1	ug/L	1
4-Bromophenyl phenyl ether	101-55-3	8270E	ND	Q	4.0	0.75	ug/L	1
Butyl benzyl phthalate	85-68-7	8270E	ND	Q	20	1.1	ug/L	1
Caprolactam	105-60-2	8270E	ND	Q	20	3.6	ug/L	1
Carbazole	86-74-8	8270E	ND	Q	4.0	0.20	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND	Q	4.0	0.85	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270E	ND	Q	4.0	1.3	ug/L	1
4-Chloroaniline	106-47-8	8270E	ND	Q	4.0	0.65	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	QL	4.0	0.30	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	QL	4.0	0.80	ug/L	1
2-Chloronaphthalene	91-58-7	8270E	ND	QL	4.0	0.75	ug/L	1
2-Chlorophenol	95-57-8	8270E	ND	QL	4.0	0.75	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND	Q	4.0	0.80	ug/L	1
Chrysene	218-01-9	8270E	ND	Q	0.80	0.20	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	ND	Q	0.80	0.20	ug/L	1
Dibenzofuran	132-64-9	8270E	ND	Q	4.0	0.80	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270E	ND	Q	20	4.1	ug/L	1
2,4-Dichlorophenol	120-83-2	8270E	ND	Q	4.0	0.95	ug/L	1
Diethylphthalate	84-66-2	8270E	ND	Q	20	0.95	ug/L	1
Dimethyl phthalate	131-11-3	8270E	ND	Q	20	0.90	ug/L	1
2,4-Dimethylphenol	105-67-9	8270E	ND	Q	4.0	0.75	ug/L	1
Di-n-butyl phthalate	84-74-2	8270E	ND	Q	20	2.1	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	QL	20	4.5	ug/L	1
2,4-Dinitrophenol	51-28-5	8270E	ND	Q	20	6.6	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270E	ND	QL	8.0	1.8	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270E	ND	QL	8.0	1.7	ug/L	1
Di-n-octylphthalate	117-84-0	8270E	ND	Q	20	2.4	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND	Q	20	7.5	ug/L	1
Fluoranthene	206-44-0	8270E	ND	Q	0.80	0.20	ug/L	1
Fluorene	86-73-7	8270E	ND	Q	0.80	0.20	ug/L	1
Hexachlorobenzene	118-74-1	8270E	ND	Q	4.0	0.75	ug/L	1
Hexachlorobutadiene	87-68-3	8270E	ND	Q	4.0	0.85	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1756	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1610	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachlorocyclopentadiene	77-47-4	8270E	ND	Q	20	5.5	ug/L	1
Hexachloroethane	67-72-1	8270E	ND	Q	4.0	0.85	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND	Q	0.80	0.20	ug/L	1
Isophorone	78-59-1	8270E	ND	QL	4.0	1.1	ug/L	1
1-Methylnaphthalene	**90-12-0**	**8270E**	**0.73**	**JQL**	**0.80**	**0.20**	**ug/L**	**1**
2-Methylnaphthalene	**91-57-6**	**8270E**	**0.31**	**JQ**	**0.80**	**0.20**	**ug/L**	**1**
2-Methylphenol	95-48-7	8270E	ND	Q	4.0	1.1	ug/L	1
3+4-Methylphenol	106-44-5	8270E	ND	QL	8.0	2.3	ug/L	1
Naphthalene	**91-20-3**	**8270E**	**0.91**	**Q**	**0.80**	**0.20**	**ug/L**	**1**
2-Nitroaniline	88-74-4	8270E	ND	QL	8.0	3.3	ug/L	1
3-Nitroaniline	99-09-2	8270E	ND	QL	8.0	0.75	ug/L	1
4-Nitroaniline	100-01-6	8270E	ND	Q	8.0	6.6	ug/L	1
Nitrobenzene	98-95-3	8270E	ND	QL	4.0	0.85	ug/L	1
2-Nitrophenol	88-75-5	8270E	ND	QL	8.0	2.2	ug/L	1
4-Nitrophenol	100-02-7	8270E	ND	Q	20	10	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	QL	4.0	1.4	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND	Q	4.0	2.5	ug/L	1
Pentachlorophenol	87-86-5	8270E	ND	Q	20	6.7	ug/L	1
Phenanthrene	85-01-8	8270E	ND	Q	0.80	0.20	ug/L	1
Phenol	**108-95-2**	**8270E**	**1.2**	**JQL**	**4.0**	**0.95**	**ug/L**	**1**
Pyrene	129-00-0	8270E	ND	Q	0.80	0.20	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270E	ND	Q	4.0	0.95	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270E	ND	Q	4.0	1.1	ug/L	1

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
2-Fluorobiphenyl		41	37-129	H	53	37-129
2-Fluorophenol	N	20	24-127	H	35	24-127
Nitrobenzene-d5		38	38-127	H	50	38-127
Phenol-d5	N	24	28-128	H	35	28-128
Terphenyl-d14		53	10-148	H	71	10-148
2,4,6-Tribromophenol		72	35-144	H	103	35-144

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1756	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1610	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	83-32-9	8270E	ND	H	0.80	0.20	ug/L	2
Acenaphthylene	208-96-8	8270E	ND	H	0.80	0.20	ug/L	2
Acetophenone	98-86-2	8270E	ND	H	4.0	1.2	ug/L	2
Anthracene	120-12-7	8270E	ND	H	0.80	0.20	ug/L	2
Atrazine	1912-24-9	8270E	ND	H	4.0	1.0	ug/L	2
Benzaldehyde	100-52-7	8270E	ND	H	20	1.4	ug/L	2
Benzo(a)anthracene	56-55-3	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(a)pyrene	50-32-8	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(b)fluoranthene	205-99-2	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(g,h,i)perylene	191-24-2	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(k)fluoranthene	207-08-9	8270E	ND	H	0.80	0.20	ug/L	2
1,1'-Biphenyl	92-52-4	8270E	ND	H	4.0	1.1	ug/L	2
4-Bromophenyl phenyl ether	101-55-3	8270E	ND	H	4.0	0.75	ug/L	2
Butyl benzyl phthalate	85-68-7	8270E	ND	H	20	1.1	ug/L	2
Caprolactam	105-60-2	8270E	ND	H	20	3.6	ug/L	2
Carbazole	86-74-8	8270E	ND	H	4.0	0.20	ug/L	2
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND	H	4.0	0.85	ug/L	2
4-Chloro-3-methyl phenol	59-50-7	8270E	ND	H	4.0	1.3	ug/L	2
4-Chloroaniline	106-47-8	8270E	ND	H	4.0	0.65	ug/L	2
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	H	4.0	0.30	ug/L	2
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	H	4.0	0.80	ug/L	2
2-Chloronaphthalene	91-58-7	8270E	ND	H	4.0	0.75	ug/L	2
2-Chlorophenol	95-57-8	8270E	ND	H	4.0	0.75	ug/L	2
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND	H	4.0	0.80	ug/L	2
Chrysene	218-01-9	8270E	ND	H	0.80	0.20	ug/L	2
Dibenzo(a,h)anthracene	53-70-3	8270E	ND	H	0.80	0.20	ug/L	2
Dibenzofuran	132-64-9	8270E	ND	H	4.0	0.80	ug/L	2
3,3'-Dichlorobenzidine	91-94-1	8270E	ND	H	20	4.1	ug/L	2
2,4-Dichlorophenol	120-83-2	8270E	ND	H	4.0	0.95	ug/L	2
Diethylphthalate	84-66-2	8270E	ND	H	20	0.95	ug/L	2
Dimethyl phthalate	131-11-3	8270E	ND	H	20	0.90	ug/L	2
2,4-Dimethylphenol	105-67-9	8270E	ND	H	4.0	0.75	ug/L	2
Di-n-butyl phthalate	84-74-2	8270E	ND	H	20	2.1	ug/L	2
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	H	20	4.5	ug/L	2
2,4-Dinitrophenol	51-28-5	8270E	ND	H	20	6.6	ug/L	2
2,4-Dinitrotoluene	121-14-2	8270E	ND	H	8.0	1.8	ug/L	2
2,6-Dinitrotoluene	606-20-2	8270E	ND	H	8.0	1.7	ug/L	2
Di-n-octylphthalate	117-84-0	8270E	ND	H	20	2.4	ug/L	2
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND	H	20	7.5	ug/L	2
Fluoranthene	206-44-0	8270E	ND	H	0.80	0.20	ug/L	2
Fluorene	86-73-7	8270E	ND	H	0.80	0.20	ug/L	2
Hexachlorobenzene	118-74-1	8270E	ND	H	4.0	0.75	ug/L	2
Hexachlorobutadiene	87-68-3	8270E	ND	H	4.0	0.85	ug/L	2

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-003**

Description: **CMR-MW-105-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1525** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1756	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1610	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachlorocyclopentadiene	77-47-4	8270E	ND	H	20	5.5	ug/L	2
Hexachloroethane	67-72-1	8270E	ND	H	4.0	0.85	ug/L	2
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND	H	0.80	0.20	ug/L	2
Isophorone	78-59-1	8270E	ND	H	4.0	1.1	ug/L	2
1-Methylnaphthalene	90-12-0	8270E	ND	H	0.80	0.20	ug/L	2
2-Methylnaphthalene	91-57-6	8270E	ND	H	0.80	0.20	ug/L	2
2-Methylphenol	95-48-7	8270E	ND	H	4.0	1.1	ug/L	2
3+4-Methylphenol	106-44-5	8270E	ND	H	8.0	2.3	ug/L	2
Naphthalene	91-20-3	8270E	ND	H	0.80	0.20	ug/L	2
2-Nitroaniline	88-74-4	8270E	ND	H	8.0	3.3	ug/L	2
3-Nitroaniline	99-09-2	8270E	ND	HL	8.0	0.75	ug/L	2
4-Nitroaniline	100-01-6	8270E	ND	H	8.0	6.6	ug/L	2
Nitrobenzene	98-95-3	8270E	ND	H	4.0	0.85	ug/L	2
2-Nitrophenol	88-75-5	8270E	ND	H	8.0	2.2	ug/L	2
4-Nitrophenol	100-02-7	8270E	ND	H	20	10	ug/L	2
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	H	4.0	1.4	ug/L	2
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND	H	4.0	2.5	ug/L	2
Pentachlorophenol	87-86-5	8270E	ND	H	20	6.7	ug/L	2
Phenanthrene	85-01-8	8270E	ND	H	0.80	0.20	ug/L	2
Phenol	108-95-2	8270E	ND	H	4.0	0.95	ug/L	2
Pyrene	129-00-0	8270E	ND	H	0.80	0.20	ug/L	2
2,4,5-Trichlorophenol	95-95-4	8270E	ND	H	4.0	0.95	ug/L	2
2,4,6-Trichlorophenol	88-06-2	8270E	ND	H	4.0	1.1	ug/L	2

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
2-Fluorobiphenyl		41	37-129	H	53	37-129
2-Fluorophenol	N	20	24-127	H	35	24-127
Nitrobenzene-d5		38	38-127	H	50	38-127
Phenol-d5	N	24	28-128	H	35	28-128
Terphenyl-d14		53	10-148	H	71	10-148
2,4,6-Tribromophenol		72	35-144	H	103	35-144

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-004**

Description: **Trip Blank** Matrix: **Aqueous**

Date Sampled: **06/27/2023** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/06/2023 1201	AMR2		79334

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	**67-64-1**	**8260D**	**5.6**	**JL**	**10**	**4.0**	**ug/L**	**1**
Benzene	71-43-2	8260D	ND		0.50	0.40	ug/L	1
Bromochloromethane	74-97-5	8260D	ND		0.50	0.40	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		0.50	0.40	ug/L	1
Bromoform	75-25-2	8260D	ND		0.50	0.40	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		0.50	0.40	ug/L	1
2-Butanone (MEK)	78-93-3	8260D	ND	L	10	2.0	ug/L	1
Carbon disulfide	75-15-0	8260D	ND		0.50	0.40	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		0.50	0.40	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		0.50	0.40	ug/L	1
Chloroethane	75-00-3	8260D	ND		0.50	0.40	ug/L	1
Chloroform	67-66-3	8260D	ND		0.50	0.40	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		0.50	0.40	ug/L	1
Cyclohexane	110-82-7	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		0.50	0.40	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		0.50	0.40	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		0.50	0.40	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		0.50	0.40	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		0.50	0.40	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		0.50	0.40	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		0.50	0.40	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		0.50	0.40	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		0.50	0.40	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND		20	13	ug/L	1
Ethylbenzene	100-41-4	8260D	ND		0.50	0.40	ug/L	1
2-Hexanone	591-78-6	8260D	ND		10	2.0	ug/L	1
Isopropylbenzene	98-82-8	8260D	ND		0.50	0.40	ug/L	1
Methyl acetate	79-20-9	8260D	ND		1.0	0.40	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		0.50	0.40	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		10	2.0	ug/L	1
Methylcyclohexane	108-87-2	8260D	ND		5.0	0.40	ug/L	1
Methylene chloride	75-09-2	8260D	ND		0.50	0.40	ug/L	1
Naphthalene	91-20-3	8260D	ND		0.50	0.40	ug/L	1
Styrene	100-42-5	8260D	ND		0.50	0.41	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND		0.50	0.40	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		0.50	0.40	ug/L	1
Toluene	108-88-3	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		1.0	0.42	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-004**

Description: **Trip Blank** Matrix: **Aqueous**

Date Sampled: **06/27/2023** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/06/2023 1201	AMR2		79334

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		0.50	0.40	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		0.50	0.40	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		0.50	0.40	ug/L	1
Trichloroethene	79-01-6	8260D	ND		0.50	0.40	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		0.50	0.40	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		0.50	0.40	ug/L	1
Xylenes (total)	1330-20-7	8260D	ND		1.0	0.40	ug/L	1
m+p - Xylenes	179601-23-1	8260D	ND		0.50	0.40	ug/L	1
o - Xylenes	95-47-6	8260D	ND		0.50	0.40	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
Bromofluorobenzene		89	70-130
1,2-Dichloroethane-d4		97	70-130
Toluene-d8		98	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	5	07/06/2023 1831	AMR2		79334
2	5030B	8260D	1	07/12/2023 0018	CDA		79704

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	**67-64-1**	**8260D**	**45**	**JL**	**50**	**20**	**ug/L**	**1**
Benzene	**71-43-2**	**8260D**	**410**		**2.5**	**2.0**	**ug/L**	**1**
Bromochloromethane	74-97-5	8260D	ND		2.5	2.0	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		2.5	2.0	ug/L	1
Bromoform	75-25-2	8260D	ND		2.5	2.0	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		2.5	2.0	ug/L	1
2-Butanone (MEK)	**78-93-3**	**8260D**	**16**	**JL**	**50**	**10**	**ug/L**	**1**
Carbon disulfide	75-15-0	8260D	ND		2.5	2.0	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND	S	2.5	2.0	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		2.5	2.0	ug/L	1
Chloroethane	75-00-3	8260D	ND		2.5	2.0	ug/L	1
Chloroform	67-66-3	8260D	ND		2.5	2.0	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		2.5	2.0	ug/L	1
Cyclohexane	**110-82-7**	**8260D**	**17**		**2.5**	**2.0**	**ug/L**	**1**
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		2.5	2.0	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		2.5	2.0	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		2.5	2.0	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		2.5	2.0	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		2.5	2.0	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		2.5	2.0	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND		2.5	2.0	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		2.5	2.0	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		2.5	2.0	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		2.5	2.0	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		2.5	2.0	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		2.5	2.0	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		2.5	2.0	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		2.5	2.0	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		2.5	2.0	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND		100	67	ug/L	1
Ethylbenzene	**100-41-4**	**8260D**	**150**		**2.5**	**2.0**	**ug/L**	**1**
2-Hexanone	591-78-6	8260D	ND		50	10	ug/L	1
Isopropylbenzene	**98-82-8**	**8260D**	**5.6**		**2.5**	**2.0**	**ug/L**	**1**
Methyl acetate	79-20-9	8260D	ND		5.0	2.0	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		2.5	2.0	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		50	10	ug/L	1
Methylcyclohexane	**108-87-2**	**8260D**	**15**	**J**	**25**	**2.0**	**ug/L**	**1**
Methylene chloride	75-09-2	8260D	ND		2.5	2.0	ug/L	1
Naphthalene	**91-20-3**	**8260D**	**35**		**2.5**	**2.0**	**ug/L**	**1**
Styrene	**100-42-5**	**8260D**	**4.8**		**2.5**	**2.1**	**ug/L**	**1**
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND		2.5	2.0	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		2.5	2.0	ug/L	1
Toluene	**108-88-3**	**8260D**	**3.4**		**2.5**	**2.0**	**ug/L**	**1**

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	5	07/06/2023 1831	AMR2		79334
2	5030B	8260D	1	07/12/2023 0018	CDA		79704

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		5.0	2.1	ug/L	1
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		2.5	2.0	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		2.5	2.0	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		2.5	2.0	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		2.5	2.0	ug/L	1
Trichloroethene	79-01-6	8260D	ND		2.5	2.0	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		2.5	2.0	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		2.5	2.0	ug/L	1
Xylenes (total)	**1330-20-7**	**8260D**	**630**		**5.0**	**2.0**	**ug/L**	**1**
m+p - Xylenes	**179601-23-1**	**8260D**	**470**		**2.5**	**2.0**	**ug/L**	**1**
o - Xylenes	**95-47-6**	**8260D**	**150**		**2.5**	**2.0**	**ug/L**	**1**

Surrogate	Run 1 Q	Run 1 % Recovery	Run 1 Acceptance Limits	Run 2 Q	Run 2 % Recovery	Run 2 Acceptance Limits
Bromofluorobenzene		91	70-130	H	109	70-130
1,2-Dichloroethane-d4		95	70-130	H	115	70-130
Toluene-d8		94	70-130	H	101	70-130

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	5	07/06/2023 1831	AMR2		79334
2	5030B	8260D	1	07/12/2023 0018	CDA		79704

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	**67-64-1**	**8260D**	**40**	**H**	**10**	**4.0**	**ug/L**	**2**
Benzene	**71-43-2**	**8260D**	**450**	**HE**	**0.50**	**0.40**	**ug/L**	**2**
Bromochloromethane	74-97-5	8260D	ND	H	0.50	0.40	ug/L	2
Bromodichloromethane	75-27-4	8260D	ND	H	0.50	0.40	ug/L	2
Bromoform	75-25-2	8260D	ND	H	0.50	0.40	ug/L	2
Bromomethane (Methyl bromide)	74-83-9	8260D	ND	H	0.50	0.40	ug/L	2
2-Butanone (MEK)	**78-93-3**	**8260D**	**18**	**H**	**10**	**2.0**	**ug/L**	**2**
Carbon disulfide	**75-15-0**	**8260D**	**0.49**	**HJ**	**0.50**	**0.40**	**ug/L**	**2**
Carbon tetrachloride	56-23-5	8260D	ND	H	0.50	0.40	ug/L	2
Chlorobenzene	108-90-7	8260D	ND	H	0.50	0.40	ug/L	2
Chloroethane	75-00-3	8260D	ND	H	0.50	0.40	ug/L	2
Chloroform	67-66-3	8260D	ND	H	0.50	0.40	ug/L	2
Chloromethane (Methyl chloride)	74-87-3	8260D	ND	HL	0.50	0.40	ug/L	2
Cyclohexane	**110-82-7**	**8260D**	**33**	**H**	**0.50**	**0.40**	**ug/L**	**2**
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND	H	0.50	0.40	ug/L	2
Dibromochloromethane	124-48-1	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichlorobenzene	95-50-1	8260D	ND	H	0.50	0.40	ug/L	2
1,3-Dichlorobenzene	541-73-1	8260D	ND	H	0.50	0.40	ug/L	2
1,4-Dichlorobenzene	106-46-7	8260D	ND	H	0.50	0.40	ug/L	2
Dichlorodifluoromethane	75-71-8	8260D	ND	HL	0.50	0.40	ug/L	2
1,1-Dichloroethane	75-34-3	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichloroethane	**107-06-2**	**8260D**	**0.40**	**HJ**	**0.50**	**0.40**	**ug/L**	**2**
1,1-Dichloroethene	75-35-4	8260D	ND	H	0.50	0.40	ug/L	2
cis-1,2-Dichloroethene	156-59-2	8260D	ND	H	0.50	0.40	ug/L	2
trans-1,2-Dichloroethene	156-60-5	8260D	ND	H	0.50	0.40	ug/L	2
1,2-Dichloropropane	78-87-5	8260D	ND	H	0.50	0.40	ug/L	2
cis-1,3-Dichloropropene	10061-01-5	8260D	ND	H	0.50	0.40	ug/L	2
trans-1,3-Dichloropropene	10061-02-6	8260D	ND	H	0.50	0.40	ug/L	2
1,4-Dioxane	123-91-1	8260D	ND	H	20	13	ug/L	2
Ethylbenzene	**100-41-4**	**8260D**	**170**	**H**	**0.50**	**0.40**	**ug/L**	**2**
2-Hexanone	591-78-6	8260D	ND	H	10	2.0	ug/L	2
Isopropylbenzene	**98-82-8**	**8260D**	**6.2**	**H**	**0.50**	**0.40**	**ug/L**	**2**
Methyl acetate	79-20-9	8260D	ND	H	1.0	0.40	ug/L	2
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND	H	0.50	0.40	ug/L	2
4-Methyl-2-pentanone	108-10-1	8260D	ND	H	10	2.0	ug/L	2
Methylcyclohexane	**108-87-2**	**8260D**	**18**	**H**	**5.0**	**0.40**	**ug/L**	**2**
Methylene chloride	75-09-2	8260D	ND	H	0.50	0.40	ug/L	2
Naphthalene	**91-20-3**	**8260D**	**43**	**H**	**0.50**	**0.40**	**ug/L**	**2**
Styrene	100-42-5	8260D	ND	H	0.50	0.41	ug/L	2
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND	H	0.50	0.40	ug/L	2
Tetrachloroethene	127-18-4	8260D	ND	H	0.50	0.40	ug/L	2
Toluene	**108-88-3**	**8260D**	**3.7**	**H**	**0.50**	**0.40**	**ug/L**	**2**

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	5	07/06/2023 1831	AMR2		79334
2	5030B	8260D	1	07/12/2023 0018	CDA		79704

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND	H	1.0	0.42	ug/L	2
1,2,3-Trichlorobenzene	87-61-6	8260D	ND	H	0.50	0.40	ug/L	2
1,2,4-Trichlorobenzene	120-82-1	8260D	ND	H	0.50	0.40	ug/L	2
1,1,1-Trichloroethane	71-55-6	8260D	ND	H	0.50	0.40	ug/L	2
1,1,2-Trichloroethane	79-00-5	8260D	ND	H	0.50	0.40	ug/L	2
Trichloroethene	79-01-6	8260D	ND	H	0.50	0.40	ug/L	2
Trichlorofluoromethane	75-69-4	8260D	ND	H	0.50	0.40	ug/L	2
Vinyl chloride	75-01-4	8260D	ND	H	0.50	0.40	ug/L	2
Xylenes (total)	**1330-20-7**	**8260D**	**720**	**H**	**1.0**	**0.40**	**ug/L**	**2**
m+p - Xylenes	**179601-23-1**	**8260D**	**540**	**HE**	**0.50**	**0.40**	**ug/L**	**2**
o - Xylenes	**95-47-6**	**8260D**	**180**	**H**	**0.50**	**0.40**	**ug/L**	**2**

Surrogate	Q	Run 1 % Recovery	Acceptance Limits	Q	Run 2 % Recovery	Acceptance Limits
Bromofluorobenzene		91	70-130	H	109	70-130
1,2-Dichloroethane-d4		95	70-130	H	115	70-130
Toluene-d8		94	70-130	H	101	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1821	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1636	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	**83-32-9**	**8270E**	**0.34**	**J**	**0.80**	**0.20**	**ug/L**	**1**
Acenaphthylene	208-96-8	8270E	ND		0.80	0.20	ug/L	1
Acetophenone	98-86-2	8270E	ND	L	4.0	1.2	ug/L	1
Anthracene	120-12-7	8270E	ND		0.80	0.20	ug/L	1
Atrazine	1912-24-9	8270E	ND		4.0	1.0	ug/L	1
Benzaldehyde	100-52-7	8270E	ND		20	1.4	ug/L	1
Benzo(a)anthracene	56-55-3	8270E	ND		0.80	0.20	ug/L	1
Benzo(a)pyrene	50-32-8	8270E	ND		0.80	0.20	ug/L	1
Benzo(b)fluoranthene	205-99-2	8270E	ND		0.80	0.20	ug/L	1
Benzo(g,h,i)perylene	191-24-2	8270E	ND		0.80	0.20	ug/L	1
Benzo(k)fluoranthene	207-08-9	8270E	ND		0.80	0.20	ug/L	1
1,1'-Biphenyl	**92-52-4**	**8270E**	**1.4**	**J**	**4.0**	**1.1**	**ug/L**	**1**
4-Bromophenyl phenyl ether	101-55-3	8270E	ND		4.0	0.75	ug/L	1
Butyl benzyl phthalate	85-68-7	8270E	ND		20	1.1	ug/L	1
Caprolactam	105-60-2	8270E	ND		20	3.6	ug/L	1
Carbazole	86-74-8	8270E	ND		4.0	0.20	ug/L	1
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND		4.0	0.85	ug/L	1
4-Chloro-3-methyl phenol	59-50-7	8270E	ND		4.0	1.3	ug/L	1
4-Chloroaniline	106-47-8	8270E	ND		4.0	0.65	ug/L	1
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	L	4.0	0.30	ug/L	1
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	L	4.0	0.80	ug/L	1
2-Chloronaphthalene	91-58-7	8270E	ND	L	4.0	0.75	ug/L	1
2-Chlorophenol	95-57-8	8270E	ND	L	4.0	0.75	ug/L	1
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND		4.0	0.80	ug/L	1
Chrysene	218-01-9	8270E	ND		0.80	0.20	ug/L	1
Dibenzo(a,h)anthracene	53-70-3	8270E	ND		0.80	0.20	ug/L	1
Dibenzofuran	132-64-9	8270E	ND		4.0	0.80	ug/L	1
3,3'-Dichlorobenzidine	91-94-1	8270E	ND		20	4.1	ug/L	1
2,4-Dichlorophenol	120-83-2	8270E	ND		4.0	0.95	ug/L	1
Diethylphthalate	84-66-2	8270E	ND		20	0.95	ug/L	1
Dimethyl phthalate	131-11-3	8270E	ND		20	0.90	ug/L	1
2,4-Dimethylphenol	**105-67-9**	**8270E**	**8.3**		**4.0**	**0.75**	**ug/L**	**1**
Di-n-butyl phthalate	84-74-2	8270E	ND		20	2.1	ug/L	1
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	L	20	4.5	ug/L	1
2,4-Dinitrophenol	51-28-5	8270E	ND		20	6.6	ug/L	1
2,4-Dinitrotoluene	121-14-2	8270E	ND	L	8.0	1.8	ug/L	1
2,6-Dinitrotoluene	606-20-2	8270E	ND	L	8.0	1.7	ug/L	1
Di-n-octylphthalate	117-84-0	8270E	ND		20	2.4	ug/L	1
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND		20	7.5	ug/L	1
Fluoranthene	206-44-0	8270E	ND		0.80	0.20	ug/L	1
Fluorene	**86-73-7**	**8270E**	**0.67**	**J**	**0.80**	**0.20**	**ug/L**	**1**
Hexachlorobenzene	118-74-1	8270E	ND		4.0	0.75	ug/L	1
Hexachlorobutadiene	87-68-3	8270E	ND		4.0	0.85	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1821	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1636	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachlorocyclopentadiene	77-47-4	8270E	ND		20	5.5	ug/L	1
Hexachloroethane	67-72-1	8270E	ND		4.0	0.85	ug/L	1
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND		0.80	0.20	ug/L	1
Isophorone	78-59-1	8270E	ND	L	4.0	1.1	ug/L	1
1-Methylnaphthalene	**90-12-0**	**8270E**	**10**	**L**	**0.80**	**0.20**	**ug/L**	**1**
2-Methylnaphthalene	**91-57-6**	**8270E**	**12**		**0.80**	**0.20**	**ug/L**	**1**
2-Methylphenol	95-48-7	8270E	ND		4.0	1.1	ug/L	1
3+4-Methylphenol	106-44-5	8270E	ND	L	8.0	2.3	ug/L	1
Naphthalene	**91-20-3**	**8270E**	**15**		**0.80**	**0.20**	**ug/L**	**1**
2-Nitroaniline	88-74-4	8270E	ND	L	8.0	3.3	ug/L	1
3-Nitroaniline	99-09-2	8270E	ND	L	8.0	0.75	ug/L	1
4-Nitroaniline	100-01-6	8270E	ND		8.0	6.6	ug/L	1
Nitrobenzene	98-95-3	8270E	ND	L	4.0	0.85	ug/L	1
2-Nitrophenol	88-75-5	8270E	ND	L	8.0	2.2	ug/L	1
4-Nitrophenol	100-02-7	8270E	ND		20	10	ug/L	1
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	L	4.0	1.4	ug/L	1
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND		4.0	2.5	ug/L	1
Pentachlorophenol	87-86-5	8270E	ND		20	6.7	ug/L	1
Phenanthrene	**85-01-8**	**8270E**	**0.42**	**J**	**0.80**	**0.20**	**ug/L**	**1**
Phenol	108-95-2	8270E	ND	L	4.0	0.95	ug/L	1
Pyrene	129-00-0	8270E	ND		0.80	0.20	ug/L	1
2,4,5-Trichlorophenol	95-95-4	8270E	ND		4.0	0.95	ug/L	1
2,4,6-Trichlorophenol	88-06-2	8270E	ND		4.0	1.1	ug/L	1

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
2-Fluorobiphenyl		43	37-129	H	64	37-129
2-Fluorophenol		24	24-127	H	34	24-127
Nitrobenzene-d5		47	38-127	H	61	38-127
Phenol-d5		42	28-128	H	51	28-128
Terphenyl-d14		50	10-148	H	78	10-148
2,4,6-Tribromophenol		85	35-144	H	133	35-144

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1821	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1636	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acenaphthene	**83-32-9**	**8270E**	**0.63**	**HJ**	**0.80**	**0.20**	**ug/L**	**2**
Acenaphthylene	208-96-8	8270E	ND	H	0.80	0.20	ug/L	2
Acetophenone	98-86-2	8270E	ND	H	4.0	1.2	ug/L	2
Anthracene	120-12-7	8270E	ND	H	0.80	0.20	ug/L	2
Atrazine	1912-24-9	8270E	ND	H	4.0	1.0	ug/L	2
Benzaldehyde	100-52-7	8270E	ND	H	20	1.4	ug/L	2
Benzo(a)anthracene	56-55-3	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(a)pyrene	50-32-8	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(b)fluoranthene	205-99-2	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(g,h,i)perylene	191-24-2	8270E	ND	H	0.80	0.20	ug/L	2
Benzo(k)fluoranthene	207-08-9	8270E	ND	H	0.80	0.20	ug/L	2
1,1'-Biphenyl	92-52-4	8270E	ND	H	4.0	1.1	ug/L	2
4-Bromophenyl phenyl ether	101-55-3	8270E	ND	H	4.0	0.75	ug/L	2
Butyl benzyl phthalate	85-68-7	8270E	ND	H	20	1.1	ug/L	2
Caprolactam	105-60-2	8270E	ND	H	20	3.6	ug/L	2
Carbazole	86-74-8	8270E	ND	H	4.0	0.20	ug/L	2
bis (2-Chloro-1-methylethyl) ether	108-60-1	8270E	ND	H	4.0	0.85	ug/L	2
4-Chloro-3-methyl phenol	59-50-7	8270E	ND	H	4.0	1.3	ug/L	2
4-Chloroaniline	106-47-8	8270E	ND	H	4.0	0.65	ug/L	2
bis(2-Chloroethoxy)methane	111-91-1	8270E	ND	H	4.0	0.30	ug/L	2
bis(2-Chloroethyl)ether	111-44-4	8270E	ND	H	4.0	0.80	ug/L	2
2-Chloronaphthalene	91-58-7	8270E	ND	H	4.0	0.75	ug/L	2
2-Chlorophenol	95-57-8	8270E	ND	H	4.0	0.75	ug/L	2
4-Chlorophenyl phenyl ether	7005-72-3	8270E	ND	H	4.0	0.80	ug/L	2
Chrysene	218-01-9	8270E	ND	H	0.80	0.20	ug/L	2
Dibenzo(a,h)anthracene	53-70-3	8270E	ND	H	0.80	0.20	ug/L	2
Dibenzofuran	132-64-9	8270E	ND	H	4.0	0.80	ug/L	2
3,3'-Dichlorobenzidine	91-94-1	8270E	ND	H	20	4.1	ug/L	2
2,4-Dichlorophenol	120-83-2	8270E	ND	H	4.0	0.95	ug/L	2
Diethylphthalate	84-66-2	8270E	ND	H	20	0.95	ug/L	2
Dimethyl phthalate	131-11-3	8270E	ND	H	20	0.90	ug/L	2
2,4-Dimethylphenol	**105-67-9**	**8270E**	**21**	**H**	**4.0**	**0.75**	**ug/L**	**2**
Di-n-butyl phthalate	84-74-2	8270E	ND	H	20	2.1	ug/L	2
4,6-Dinitro-2-methylphenol	534-52-1	8270E	ND	H	20	4.5	ug/L	2
2,4-Dinitrophenol	51-28-5	8270E	ND	H	20	6.6	ug/L	2
2,4-Dinitrotoluene	121-14-2	8270E	ND	H	8.0	1.8	ug/L	2
2,6-Dinitrotoluene	606-20-2	8270E	ND	H	8.0	1.7	ug/L	2
Di-n-octylphthalate	117-84-0	8270E	ND	H	20	2.4	ug/L	2
bis(2-Ethylhexyl)phthalate	117-81-7	8270E	ND	H	20	7.5	ug/L	2
Fluoranthene	206-44-0	8270E	ND	H	0.80	0.20	ug/L	2
Fluorene	**86-73-7**	**8270E**	**1.0**	**H**	**0.80**	**0.20**	**ug/L**	**2**
Hexachlorobenzene	118-74-1	8270E	ND	H	4.0	0.75	ug/L	2
Hexachlorobutadiene	87-68-3	8270E	ND	H	4.0	0.85	ug/L	2

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-005**

Description: **CMR-MW-41S-270623** Matrix: **Aqueous**

Date Sampled: **06/27/2023 1300** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	3520C	8270E	5	07/26/2023 1821	JCG	06/30/2023 1230	78980
2	3520C	8270E	5	08/02/2023 1636	JCG	07/31/2023 1127	81267

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Hexachlorocyclopentadiene	77-47-4	8270E	ND	H	20	5.5	ug/L	2
Hexachloroethane	67-72-1	8270E	ND	H	4.0	0.85	ug/L	2
Indeno(1,2,3-c,d)pyrene	193-39-5	8270E	ND	H	0.80	0.20	ug/L	2
Isophorone	78-59-1	8270E	ND	H	4.0	1.1	ug/L	2
1-Methylnaphthalene	**90-12-0**	**8270E**	**15**	**H**	**0.80**	**0.20**	**ug/L**	**2**
2-Methylnaphthalene	**91-57-6**	**8270E**	**13**	**H**	**0.80**	**0.20**	**ug/L**	**2**
2-Methylphenol	95-48-7	8270E	ND	H	4.0	1.1	ug/L	2
3+4-Methylphenol	106-44-5	8270E	ND	H	8.0	2.3	ug/L	2
Naphthalene	**91-20-3**	**8270E**	**18**	**H**	**0.80**	**0.20**	**ug/L**	**2**
2-Nitroaniline	88-74-4	8270E	ND	H	8.0	3.3	ug/L	2
3-Nitroaniline	99-09-2	8270E	ND	HL	8.0	0.75	ug/L	2
4-Nitroaniline	100-01-6	8270E	ND	H	8.0	6.6	ug/L	2
Nitrobenzene	98-95-3	8270E	ND	H	4.0	0.85	ug/L	2
2-Nitrophenol	88-75-5	8270E	ND	H	8.0	2.2	ug/L	2
4-Nitrophenol	100-02-7	8270E	ND	H	20	10	ug/L	2
N-Nitrosodi-n-propylamine	621-64-7	8270E	ND	H	4.0	1.4	ug/L	2
N-Nitrosodiphenylamine (Diphenylamine)	86-30-6	8270E	ND	H	4.0	2.5	ug/L	2
Pentachlorophenol	87-86-5	8270E	ND	H	20	6.7	ug/L	2
Phenanthrene	**85-01-8**	**8270E**	**0.50**	**HJ**	**0.80**	**0.20**	**ug/L**	**2**
Phenol	108-95-2	8270E	ND	H	4.0	0.95	ug/L	2
Pyrene	129-00-0	8270E	ND	H	0.80	0.20	ug/L	2
2,4,5-Trichlorophenol	95-95-4	8270E	ND	H	4.0	0.95	ug/L	2
2,4,6-Trichlorophenol	88-06-2	8270E	ND	H	4.0	1.1	ug/L	2

Surrogate	Q	Run 1 % Recovery	Run 1 Acceptance Limits	Q	Run 2 % Recovery	Run 2 Acceptance Limits
2-Fluorobiphenyl		43	37-129	H	64	37-129
2-Fluorophenol		24	24-127	H	34	24-127
Nitrobenzene-d5		47	38-127	H	61	38-127
Phenol-d5		42	28-128	H	51	28-128
Terphenyl-d14		50	10-148	H	78	10-148
2,4,6-Tribromophenol		85	35-144	H	133	35-144

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-006**

Description: **Trip Blank** Matrix: **Aqueous**

Date Sampled: **06/28/2023** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/07/2023 1250	AMR2		79450

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
Acetone	67-64-1	8260D	ND	L	10	4.0	ug/L	1
Benzene	71-43-2	8260D	ND		0.50	0.40	ug/L	1
Bromochloromethane	74-97-5	8260D	ND		0.50	0.40	ug/L	1
Bromodichloromethane	75-27-4	8260D	ND		0.50	0.40	ug/L	1
Bromoform	75-25-2	8260D	ND		0.50	0.40	ug/L	1
Bromomethane (Methyl bromide)	74-83-9	8260D	ND		0.50	0.40	ug/L	1
2-Butanone (MEK)	78-93-3	8260D	ND		10	2.0	ug/L	1
Carbon disulfide	75-15-0	8260D	ND		0.50	0.40	ug/L	1
Carbon tetrachloride	56-23-5	8260D	ND		0.50	0.40	ug/L	1
Chlorobenzene	108-90-7	8260D	ND		0.50	0.40	ug/L	1
Chloroethane	75-00-3	8260D	ND		0.50	0.40	ug/L	1
Chloroform	67-66-3	8260D	ND		0.50	0.40	ug/L	1
Chloromethane (Methyl chloride)	74-87-3	8260D	ND		0.50	0.40	ug/L	1
Cyclohexane	110-82-7	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	8260D	ND		0.50	0.40	ug/L	1
Dibromochloromethane	124-48-1	8260D	ND		0.50	0.40	ug/L	1
1,2-Dibromoethane (EDB)	106-93-4	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichlorobenzene	95-50-1	8260D	ND		0.50	0.40	ug/L	1
1,3-Dichlorobenzene	541-73-1	8260D	ND		0.50	0.40	ug/L	1
1,4-Dichlorobenzene	106-46-7	8260D	ND		0.50	0.40	ug/L	1
Dichlorodifluoromethane	75-71-8	8260D	ND	L	0.50	0.40	ug/L	1
1,1-Dichloroethane	75-34-3	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloroethane	107-06-2	8260D	ND		0.50	0.40	ug/L	1
1,1-Dichloroethene	75-35-4	8260D	ND		0.50	0.40	ug/L	1
cis-1,2-Dichloroethene	156-59-2	8260D	ND		0.50	0.40	ug/L	1
trans-1,2-Dichloroethene	156-60-5	8260D	ND		0.50	0.40	ug/L	1
1,2-Dichloropropane	78-87-5	8260D	ND		0.50	0.40	ug/L	1
cis-1,3-Dichloropropene	10061-01-5	8260D	ND		0.50	0.40	ug/L	1
trans-1,3-Dichloropropene	10061-02-6	8260D	ND		0.50	0.40	ug/L	1
1,4-Dioxane	123-91-1	8260D	ND	L	20	13	ug/L	1
Ethylbenzene	100-41-4	8260D	ND		0.50	0.40	ug/L	1
2-Hexanone	591-78-6	8260D	ND		10	2.0	ug/L	1
Isopropylbenzene	98-82-8	8260D	ND		0.50	0.40	ug/L	1
Methyl acetate	79-20-9	8260D	ND		1.0	0.40	ug/L	1
Methyl tertiary butyl ether (MTBE)	1634-04-4	8260D	ND		0.50	0.40	ug/L	1
4-Methyl-2-pentanone	108-10-1	8260D	ND		10	2.0	ug/L	1
Methylcyclohexane	108-87-2	8260D	ND		5.0	0.40	ug/L	1
Methylene chloride	75-09-2	8260D	ND		0.50	0.40	ug/L	1
Naphthalene	91-20-3	8260D	ND		0.50	0.40	ug/L	1
Styrene	100-42-5	8260D	ND		0.50	0.41	ug/L	1
1,1,2,2-Tetrachloroethane	79-34-5	8260D	ND		0.50	0.40	ug/L	1
Tetrachloroethene	127-18-4	8260D	ND		0.50	0.40	ug/L	1
Toluene	108-88-3	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8260D	ND		1.0	0.42	ug/L	1

LOQ = Limit of Quantitation
B = Detected in the method blank
E = Quantitation of compound exceeded the calibration range
DL = Detection Limit
Q = Surrogate failure
ND = Not detected at or above the DL
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
J = Estimated result < LOQ and ≥ DL
L = LCS/LCSD failure
H = Out of holding time
W = Reported on wet weight basis
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Volatile Organic Compounds by GC/MS

Client: **Ramboll US Corporation** Laboratory ID: **YF29005-006**

Description: **Trip Blank** Matrix: **Aqueous**

Date Sampled: **06/28/2023** Project Name: **Calumet Refinery GW**

Date Received: **06/29/2023** Project Number: **1690029636-001**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1	5030B	8260D	1	07/07/2023 1250	AMR2		79450

Parameter	CAS Number	Analytical Method	Result	Q	LOQ	DL	Units	Run
1,2,3-Trichlorobenzene	87-61-6	8260D	ND		0.50	0.40	ug/L	1
1,2,4-Trichlorobenzene	120-82-1	8260D	ND		0.50	0.40	ug/L	1
1,1,1-Trichloroethane	71-55-6	8260D	ND		0.50	0.40	ug/L	1
1,1,2-Trichloroethane	79-00-5	8260D	ND		0.50	0.40	ug/L	1
Trichloroethene	79-01-6	8260D	ND		0.50	0.40	ug/L	1
Trichlorofluoromethane	75-69-4	8260D	ND		0.50	0.40	ug/L	1
Vinyl chloride	75-01-4	8260D	ND		0.50	0.40	ug/L	1
Xylenes (total)	1330-20-7	8260D	ND		1.0	0.40	ug/L	1
m+p - Xylenes	179601-23-1	8260D	ND		0.50	0.40	ug/L	1
o - Xylenes	95-47-6	8260D	ND		0.50	0.40	ug/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
Bromofluorobenzene		102	70-130
1,2-Dichloroethane-d4		96	70-130
Toluene-d8		96	70-130

LOQ = Limit of Quantitation
ND = Not detected at or above the DL
H = Out of holding time
B = Detected in the method blank
N = Recovery is out of criteria
W = Reported on wet weight basis
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
DL = Detection Limit
J = Estimated result < LOQ and ≥ DL
Q = Surrogate failure
L = LCS/LCSD failure
S = MS/MSD failure

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

QC Summary

Inorganic non-metals - BOD Blank and GGA

Batch: 78896
Analytical Method: SM 5210B-2016

Matrix: Aqueous
SCF: 1.0
SCF Range: 0.6 - 1.0

Sample ID	Depl	Avg. Depl	Result (mg/L)	Avg. Result (mg/L)	Q	Limit	Prep Date	Analysis Date
YQ78896-041 (Blank)	0				1	0.2	06/29/2023 2042	07/04/2023 1748
YQ78896-141 (Blank)	0.16				1	0.2	06/29/2023 2042	07/04/2023 1748
YQ78896-241 (Blank)	0.12	0.09			1	0.2	06/29/2023 2042	07/04/2023 1748
YQ78896-035 (GGA)			143		1	167.5-228.5	06/29/2023 2049	07/04/2023 1758
YQ78896-135 (GGA)			165		1	167.5-228.5	06/29/2023 2049	07/04/2023 1758
YQ78896-235 (GGA)			159.5	155.9	1	167.5-228.5	06/29/2023 2049	07/04/2023 1757

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MB

Sample ID: YQ78962-001
Batch: 78962
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Nitrate - N	ND		1	0.020	0.0050	mg/L	06/29/2023 1135

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - LCS

Sample ID: YQ78962-002
Batch: 78962
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Nitrate - N	0.80	0.82		1	102	80-120	06/29/2023 1216

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MS

Sample ID: YF29005-001MS
Batch: 78962
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Sample Amount (mg/L)	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Nitrate - N	19	0.40	19	E	1	84	80-120	06/29/2023 2141

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MSD

Sample ID: YF29005-001MD
Batch: 78962
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Sample Amount (mg/L)	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Nitrate - N	19	0.40	19	E	1	80	0.077	80-120	20	06/29/2023 2202

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MB

Sample ID: YQ79069-001
Batch: 79069
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Nitrate - N	ND		1	0.020	0.0050	mg/L	06/30/2023 0932

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - LCS

Sample ID: YQ79069-002
Batch: 79069
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Nitrate - N	0.80	0.84		1	105	80-120	06/30/2023 1014

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MS

Sample ID: YF29005-001MS
Batch: 79069
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Sample Amount (mg/L)	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Nitrate - N	12	0.40	12	N	5	37	80-120	06/30/2023 1137

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MSD

Sample ID: YF29005-001MD
Batch: 79069
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Sample Amount (mg/L)	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Nitrate - N	12	0.40	12	N	5	27	0.34	80-120	20	06/30/2023 1158

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MB

Sample ID: YQ79417-001
Batch: 79417
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Sulfate	ND		1	1.0	0.25	mg/L	07/06/2023 1800

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - LCS

Sample ID: YQ79417-002
Batch: 79417
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Sulfate	20	20		1	101	80-120	07/06/2023 1842

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MS

Sample ID: YF29005-001MS
Batch: 79417
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Sample Amount (mg/L)	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Sulfate	410	50	480	N	5	156	80-120	07/06/2023 1923

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - MSD

Sample ID: YF29005-001MD
Batch: 79417
Analytical Method: 9056A
Matrix: Aqueous

Parameter	Sample Amount (mg/L)	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Sulfate	410	50	460		5	103	5.7	80-120	20	07/06/2023 1944

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - LCS

Sample ID: YQ79660-002
Batch: 79660
Analytical Method: SM 2320B-2011
Matrix: Aqueous

Parameter	Spike Amount (mg CaCO3/L)	Result (mg CaCO3/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Alkalinity @ pH 4.5 su	1000	1000		1	100	90-110	07/10/2023 2022

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Inorganic non-metals - Duplicate

Sample ID: YF29005-001DU
Batch: 79660
Analytical Method: SM 2320B-2011
Matrix: Aqueous

Parameter	Sample Amount (mg CaCO3/L)	Result (mg CaCO3/L)	Q	Dil	% RPD	%RPD Limit	Analysis Date
Alkalinity @ pH 4.5 su	1000	1100		1	4.9	20	07/10/2023 2022

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ79334-001
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acetone	ND		1	10	4.0	ug/L	07/06/2023 1034
Benzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Bromochloromethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Bromodichloromethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Bromoform	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Bromomethane (Methyl bromide)	ND		1	0.50	0.40	ug/L	07/06/2023 1034
2-Butanone (MEK)	ND		1	10	2.0	ug/L	07/06/2023 1034
Carbon disulfide	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Carbon tetrachloride	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Chlorobenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Chloroethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Chloroform	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Chloromethane (Methyl chloride)	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Cyclohexane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Dibromochloromethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,2-Dibromoethane (EDB)	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,2-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,3-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,4-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Dichlorodifluoromethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,1-Dichloroethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,2-Dichloroethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,1-Dichloroethene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
cis-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
trans-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,2-Dichloropropane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
cis-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
trans-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,4-Dioxane	ND		1	20	13	ug/L	07/06/2023 1034
Ethylbenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
2-Hexanone	ND		1	10	2.0	ug/L	07/06/2023 1034
Isopropylbenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Methyl acetate	ND		1	1.0	0.40	ug/L	07/06/2023 1034
Methyl tertiary butyl ether (MTBE)	ND		1	0.50	0.40	ug/L	07/06/2023 1034
4-Methyl-2-pentanone	ND		1	10	2.0	ug/L	07/06/2023 1034
Methylcyclohexane	ND		1	5.0	0.40	ug/L	07/06/2023 1034
Methylene chloride	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Naphthalene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Styrene	ND		1	0.50	0.41	ug/L	07/06/2023 1034
1,1,2,2-Tetrachloroethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Tetrachloroethene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Toluene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	0.42	ug/L	07/06/2023 1034

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ79334-001
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
1,2,3-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,2,4-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,1,1-Trichloroethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
1,1,2-Trichloroethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Trichloroethene	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Trichlorofluoromethane	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Vinyl chloride	ND		1	0.50	0.40	ug/L	07/06/2023 1034
Xylenes (total)	ND		1	1.0	0.40	ug/L	07/06/2023 1034
m+p - Xylenes	ND		1	0.50	0.40	ug/L	07/06/2023 1034
o - Xylenes	ND		1	0.50	0.40	ug/L	07/06/2023 1034

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		91	70-130
1,2-Dichloroethane-d4		95	70-130
Toluene-d8		100	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ79334-002
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	100	150	N	1	151	60-140	07/06/2023 0904
Benzene	50	50		1	100	70-130	07/06/2023 0904
Bromochloromethane	50	49		1	98	70-130	07/06/2023 0904
Bromodichloromethane	50	48		1	96	70-130	07/06/2023 0904
Bromoform	50	50		1	100	70-130	07/06/2023 0904
Bromomethane (Methyl bromide)	50	47		1	94	70-130	07/06/2023 0904
2-Butanone (MEK)	100	140	N	1	143	70-130	07/06/2023 0904
Carbon disulfide	50	47		1	94	70-130	07/06/2023 0904
Carbon tetrachloride	50	57		1	114	70-130	07/06/2023 0904
Chlorobenzene	50	47		1	94	70-130	07/06/2023 0904
Chloroethane	50	48		1	96	70-130	07/06/2023 0904
Chloroform	50	47		1	93	70-130	07/06/2023 0904
Chloromethane (Methyl chloride)	50	53		1	105	60-140	07/06/2023 0904
Cyclohexane	50	36		1	72	70-130	07/06/2023 0904
1,2-Dibromo-3-chloropropane (DBCP)	50	51		1	102	70-130	07/06/2023 0904
Dibromochloromethane	50	50		1	100	70-130	07/06/2023 0904
1,2-Dibromoethane (EDB)	50	52		1	104	70-130	07/06/2023 0904
1,2-Dichlorobenzene	50	46		1	93	70-130	07/06/2023 0904
1,3-Dichlorobenzene	50	48		1	96	70-130	07/06/2023 0904
1,4-Dichlorobenzene	50	45		1	89	70-130	07/06/2023 0904
Dichlorodifluoromethane	50	47		1	93	60-140	07/06/2023 0904
1,1-Dichloroethane	50	49		1	97	70-130	07/06/2023 0904
1,2-Dichloroethane	50	47		1	94	70-130	07/06/2023 0904
1,1-Dichloroethene	50	48		1	96	70-130	07/06/2023 0904
cis-1,2-Dichloroethene	50	50		1	99	70-130	07/06/2023 0904
trans-1,2-Dichloroethene	50	51		1	101	70-130	07/06/2023 0904
1,2-Dichloropropane	50	49		1	99	70-130	07/06/2023 0904
cis-1,3-Dichloropropene	50	49		1	98	70-130	07/06/2023 0904
trans-1,3-Dichloropropene	50	46		1	91	70-130	07/06/2023 0904
1,4-Dioxane	500	580		1	117	60-140	07/06/2023 0904
Ethylbenzene	50	49		1	98	70-130	07/06/2023 0904
2-Hexanone	100	110		1	107	70-130	07/06/2023 0904
Isopropylbenzene	50	49		1	97	70-130	07/06/2023 0904
Methyl acetate	50	56		1	112	70-130	07/06/2023 0904
Methyl tertiary butyl ether (MTBE)	50	50		1	101	70-130	07/06/2023 0904
4-Methyl-2-pentanone	100	110		1	110	70-130	07/06/2023 0904
Methylcyclohexane	50	48		1	97	70-130	07/06/2023 0904
Methylene chloride	50	49		1	98	70-130	07/06/2023 0904
Naphthalene	50	48		1	97	70-130	07/06/2023 0904
Styrene	50	51		1	101	70-130	07/06/2023 0904
1,1,2,2-Tetrachloroethane	50	49		1	98	70-130	07/06/2023 0904
Tetrachloroethene	50	48		1	96	70-130	07/06/2023 0904
Toluene	50	49		1	98	70-130	07/06/2023 0904
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	50		1	99	70-130	07/06/2023 0904

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ79334-002
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	50	46		1	92	70-130	07/06/2023 0904
1,2,4-Trichlorobenzene	50	48		1	95	70-130	07/06/2023 0904
1,1,1-Trichloroethane	50	50		1	101	70-130	07/06/2023 0904
1,1,2-Trichloroethane	50	47		1	94	70-130	07/06/2023 0904
Trichloroethene	50	47		1	95	70-130	07/06/2023 0904
Trichlorofluoromethane	50	51		1	103	70-130	07/06/2023 0904
Vinyl chloride	50	51		1	102	70-130	07/06/2023 0904
Xylenes (total)	100	97		1	97	70-130	07/06/2023 0904
m+p - Xylenes	50	49		1	97	70-130	07/06/2023 0904
o - Xylenes	50	49		1	97	70-130	07/06/2023 0904

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		98	70-130
1,2-Dichloroethane-d4		95	70-130
Toluene-d8		105	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MS

Sample ID: YF29005-005MS
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	45	500	550		5	101	60-140	07/06/2023 1854
Benzene	410	250	660		5	100	70-130	07/06/2023 1854
Bromochloromethane	ND	250	270		5	108	70-130	07/06/2023 1854
Bromodichloromethane	ND	250	260		5	102	70-130	07/06/2023 1854
Bromoform	ND	250	230		5	92	70-130	07/06/2023 1854
Bromomethane (Methyl bromide)	ND	250	240		5	95	70-130	07/06/2023 1854
2-Butanone (MEK)	16	500	610		5	120	70-130	07/06/2023 1854
Carbon disulfide	ND	250	280		5	112	70-130	07/06/2023 1854
Carbon tetrachloride	ND	250	330	N	5	134	70-130	07/06/2023 1854
Chlorobenzene	ND	250	260		5	103	70-130	07/06/2023 1854
Chloroethane	ND	250	260		5	106	70-130	07/06/2023 1854
Chloroform	ND	250	260		5	105	70-130	07/06/2023 1854
Chloromethane (Methyl chloride)	ND	250	270		5	106	60-140	07/06/2023 1854
Cyclohexane	17	250	240		5	88	70-130	07/06/2023 1854
1,2-Dibromo-3-chloropropane (DBCP)	ND	250	250		5	99	70-130	07/06/2023 1854
Dibromochloromethane	ND	250	250		5	99	70-130	07/06/2023 1854
1,2-Dibromoethane (EDB)	ND	250	270		5	106	70-130	07/06/2023 1854
1,2-Dichlorobenzene	ND	250	250		5	99	70-130	07/06/2023 1854
1,3-Dichlorobenzene	ND	250	260		5	104	70-130	07/06/2023 1854
1,4-Dichlorobenzene	ND	250	240		5	96	70-130	07/06/2023 1854
Dichlorodifluoromethane	ND	250	260		5	103	60-140	07/06/2023 1854
1,1-Dichloroethane	ND	250	280		5	112	70-130	07/06/2023 1854
1,2-Dichloroethane	ND	250	250		5	102	70-130	07/06/2023 1854
1,1-Dichloroethene	ND	250	300		5	119	70-130	07/06/2023 1854
cis-1,2-Dichloroethene	ND	250	280		5	112	70-130	07/06/2023 1854
trans-1,2-Dichloroethene	ND	250	290		5	117	70-130	07/06/2023 1854
1,2-Dichloropropane	ND	250	280		5	113	70-130	07/06/2023 1854
cis-1,3-Dichloropropene	ND	250	240		5	97	70-130	07/06/2023 1854
trans-1,3-Dichloropropene	ND	250	220		5	89	70-130	07/06/2023 1854
1,4-Dioxane	ND	2500	2900		5	115	60-140	07/06/2023 1854
Ethylbenzene	150	250	430		5	111	70-130	07/06/2023 1854
2-Hexanone	ND	500	520		5	102	70-130	07/06/2023 1854
Isopropylbenzene	5.6	250	280		5	111	70-130	07/06/2023 1854
Methyl acetate	ND	250	290		5	115	70-130	07/06/2023 1854
Methyl tertiary butyl ether (MTBE)	ND	250	270		5	107	70-130	07/06/2023 1854
4-Methyl-2-pentanone	ND	500	580		5	115	70-130	07/06/2023 1854
Methylcyclohexane	15	250	310		5	117	70-130	07/06/2023 1854
Methylene chloride	ND	250	300		5	119	70-130	07/06/2023 1854
Naphthalene	35	250	290		5	104	70-130	07/06/2023 1854
Styrene	4.8	250	290		5	113	70-130	07/06/2023 1854
1,1,2,2-Tetrachloroethane	ND	250	250		5	101	70-130	07/06/2023 1854
Tetrachloroethene	ND	250	280		5	111	70-130	07/06/2023 1854
Toluene	3.4	250	280		5	110	70-130	07/06/2023 1854
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	250	300		5	120	70-130	07/06/2023 1854

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MS

Sample ID: YF29005-005MS
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	ND	250	240		5	95	70-130	07/06/2023 1854
1,2,4-Trichlorobenzene	ND	250	240		5	97	70-130	07/06/2023 1854
1,1,1-Trichloroethane	ND	250	300		5	119	70-130	07/06/2023 1854
1,1,2-Trichloroethane	ND	250	250		5	99	70-130	07/06/2023 1854
Trichloroethene	ND	250	270		5	109	70-130	07/06/2023 1854
Trichlorofluoromethane	ND	250	290		5	114	70-130	07/06/2023 1854
Vinyl chloride	ND	250	290		5	115	70-130	07/06/2023 1854
Xylenes (total)	630	500	1200		5	107	70-130	07/06/2023 1854
m+p - Xylenes	470	250	740		5	106	70-130	07/06/2023 1854
o - Xylenes	150	250	430		5	108	70-130	07/06/2023 1854

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		102	70-130
1,2-Dichloroethane-d4		99	70-130
Toluene-d8		108	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MSD

Sample ID: YF29005-005MD
Batch: 79334
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Acetone	45	500	580		5	107	5.0	60-140	20	07/06/2023 1917
Benzene	410	250	650		5	95	1.6	70-130	20	07/06/2023 1917
Bromochloromethane	ND	250	270		5	107	0.94	70-130	20	07/06/2023 1917
Bromodichloromethane	ND	250	260		5	103	1.0	70-130	20	07/06/2023 1917
Bromoform	ND	250	240		5	97	4.3	70-130	20	07/06/2023 1917
Bromomethane (Methyl bromide)	ND	250	240		5	96	1.1	70-130	20	07/06/2023 1917
2-Butanone (MEK)	16	500	640		5	125	4.0	70-130	20	07/06/2023 1917
Carbon disulfide	ND	250	280		5	113	0.75	70-130	20	07/06/2023 1917
Carbon tetrachloride	ND	250	340	N	5	135	0.75	70-130	20	07/06/2023 1917
Chlorobenzene	ND	250	260		5	104	1.2	70-130	20	07/06/2023 1917
Chloroethane	ND	250	260		5	106	0.31	70-130	20	07/06/2023 1917
Chloroform	ND	250	260		5	106	0.65	70-130	20	07/06/2023 1917
Chloromethane (Methyl chloride)	ND	250	260		5	105	1.0	60-140	20	07/06/2023 1917
Cyclohexane	17	250	230		5	84	3.8	70-130	20	07/06/2023 1917
1,2-Dibromo-3-chloropropane (DBCP)	ND	250	250		5	100	0.66	70-130	20	07/06/2023 1917
Dibromochloromethane	ND	250	260		5	102	3.3	70-130	20	07/06/2023 1917
1,2-Dibromoethane (EDB)	ND	250	280		5	110	3.6	70-130	20	07/06/2023 1917
1,2-Dichlorobenzene	ND	250	250		5	100	1.1	70-130	20	07/06/2023 1917
1,3-Dichlorobenzene	ND	250	260		5	105	1.4	70-130	20	07/06/2023 1917
1,4-Dichlorobenzene	ND	250	240		5	97	1.0	70-130	20	07/06/2023 1917
Dichlorodifluoromethane	ND	250	260		5	105	1.8	60-140	20	07/06/2023 1917
1,1-Dichloroethane	ND	250	280		5	112	0.26	70-130	20	07/06/2023 1917
1,2-Dichloroethane	ND	250	250		5	101	1.1	70-130	20	07/06/2023 1917
1,1-Dichloroethene	ND	250	300		5	120	0.69	70-130	20	07/06/2023 1917
cis-1,2-Dichloroethene	ND	250	280		5	112	0.56	70-130	20	07/06/2023 1917
trans-1,2-Dichloroethene	ND	250	290		5	117	0.093	70-130	20	07/06/2023 1917
1,2-Dichloropropane	ND	250	280		5	111	1.6	70-130	20	07/06/2023 1917
cis-1,3-Dichloropropene	ND	250	250		5	98	1.2	70-130	20	07/06/2023 1917
trans-1,3-Dichloropropene	ND	250	230		5	92	3.5	70-130	20	07/06/2023 1917
1,4-Dioxane	ND	2500	3000		5	120	4.1	60-140	20	07/06/2023 1917
Ethylbenzene	150	250	440		5	114	1.5	70-130	20	07/06/2023 1917
2-Hexanone	ND	500	550		5	108	5.4	70-130	20	07/06/2023 1917
Isopropylbenzene	5.6	250	290		5	112	0.44	70-130	20	07/06/2023 1917
Methyl acetate	ND	250	280		5	112	3.0	70-130	20	07/06/2023 1917
Methyl tertiary butyl ether (MTBE)	ND	250	270		5	108	1.6	70-130	20	07/06/2023 1917
4-Methyl-2-pentanone	ND	500	580		5	117	1.3	70-130	20	07/06/2023 1917
Methylcyclohexane	15	250	310		5	116	0.68	70-130	20	07/06/2023 1917
Methylene chloride	ND	250	290		5	117	2.3	70-130	20	07/06/2023 1917
Naphthalene	35	250	290		5	104	0.27	70-130	20	07/06/2023 1917
Styrene	4.8	250	290		5	115	1.8	70-130	20	07/06/2023 1917
1,1,2,2-Tetrachloroethane	ND	250	260		5	103	1.2	70-130	20	07/06/2023 1917
Tetrachloroethene	ND	250	280		5	113	1.2	70-130	20	07/06/2023 1917
Toluene	3.4	250	280		5	112	1.4	70-130	20	07/06/2023 1917
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	250	300		5	119	1.1	70-130	20	07/06/2023 1917

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MSD

Sample ID: YF29005-005MD
Batch: 79334
Analytical Method: 8260D
Matrix: Aqueous
Prep Method: 5030B

Parameter	Sample Amount (ug/L)	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
1,2,3-Trichlorobenzene	ND	250	250		5	99	3.9	70-130	20	07/06/2023 1917
1,2,4-Trichlorobenzene	ND	250	250		5	102	4.3	70-130	20	07/06/2023 1917
1,1,1-Trichloroethane	ND	250	300		5	120	0.87	70-130	20	07/06/2023 1917
1,1,2-Trichloroethane	ND	250	250		5	100	0.64	70-130	20	07/06/2023 1917
Trichloroethene	ND	250	270		5	110	0.40	70-130	20	07/06/2023 1917
Trichlorofluoromethane	ND	250	280		5	114	0.31	70-130	20	07/06/2023 1917
Vinyl chloride	ND	250	290		5	115	0.12	70-130	20	07/06/2023 1917
Xylenes (total)	630	500	1200		5	110	1.2	70-130	20	07/06/2023 1917
m+p - Xylenes	470	250	740		5	109	1.2	70-130	20	07/06/2023 1917
o - Xylenes	150	250	430		5	110	1.2	70-130	20	07/06/2023 1917

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		105	70-130
1,2-Dichloroethane-d4		97	70-130
Toluene-d8		109	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ79450-001
Batch: 79450
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acetone	ND		1	10	4.0	ug/L	07/07/2023 1028
Benzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Bromochloromethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Bromodichloromethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Bromoform	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Bromomethane (Methyl bromide)	ND		1	0.50	0.40	ug/L	07/07/2023 1028
2-Butanone (MEK)	ND		1	10	2.0	ug/L	07/07/2023 1028
Carbon disulfide	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Carbon tetrachloride	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Chlorobenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Chloroethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Chloroform	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Chloromethane (Methyl chloride)	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Cyclohexane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Dibromochloromethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,2-Dibromoethane (EDB)	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,2-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,3-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,4-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Dichlorodifluoromethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,1-Dichloroethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,2-Dichloroethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,1-Dichloroethene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
cis-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
trans-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,2-Dichloropropane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
cis-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
trans-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,4-Dioxane	ND		1	20	13	ug/L	07/07/2023 1028
Ethylbenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
2-Hexanone	ND		1	10	2.0	ug/L	07/07/2023 1028
Isopropylbenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Methyl acetate	ND		1	1.0	0.40	ug/L	07/07/2023 1028
Methyl tertiary butyl ether (MTBE)	ND		1	0.50	0.40	ug/L	07/07/2023 1028
4-Methyl-2-pentanone	ND		1	10	2.0	ug/L	07/07/2023 1028
Methylcyclohexane	ND		1	5.0	0.40	ug/L	07/07/2023 1028
Methylene chloride	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Naphthalene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Styrene	ND		1	0.50	0.41	ug/L	07/07/2023 1028
1,1,2,2-Tetrachloroethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Tetrachloroethene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Toluene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	0.42	ug/L	07/07/2023 1028

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ79450-001
Batch: 79450
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
1,2,3-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,2,4-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,1,1-Trichloroethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
1,1,2-Trichloroethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Trichloroethene	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Trichlorofluoromethane	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Vinyl chloride	ND		1	0.50	0.40	ug/L	07/07/2023 1028
Xylenes (total)	ND		1	1.0	0.40	ug/L	07/07/2023 1028
m+p - Xylenes	ND		1	0.50	0.40	ug/L	07/07/2023 1028
o - Xylenes	ND		1	0.50	0.40	ug/L	07/07/2023 1028

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		102	70-130
1,2-Dichloroethane-d4		96	70-130
Toluene-d8		95	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ79450-002
Batch: 79450
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	100	150	N	1	151	60-140	07/07/2023 0839
Benzene	50	50		1	100	70-130	07/07/2023 0839
Bromochloromethane	50	50		1	100	70-130	07/07/2023 0839
Bromodichloromethane	50	51		1	102	70-130	07/07/2023 0839
Bromoform	50	44		1	89	70-130	07/07/2023 0839
Bromomethane (Methyl bromide)	50	57		1	114	70-130	07/07/2023 0839
2-Butanone (MEK)	100	110		1	115	70-130	07/07/2023 0839
Carbon disulfide	50	53		1	106	70-130	07/07/2023 0839
Carbon tetrachloride	50	52		1	104	70-130	07/07/2023 0839
Chlorobenzene	50	48		1	96	70-130	07/07/2023 0839
Chloroethane	50	60		1	120	70-130	07/07/2023 0839
Chloroform	50	50		1	100	70-130	07/07/2023 0839
Chloromethane (Methyl chloride)	50	64		1	127	60-140	07/07/2023 0839
Cyclohexane	50	53		1	105	70-130	07/07/2023 0839
1,2-Dibromo-3-chloropropane (DBCP)	50	52		1	105	70-130	07/07/2023 0839
Dibromochloromethane	50	52		1	105	70-130	07/07/2023 0839
1,2-Dibromoethane (EDB)	50	49		1	97	70-130	07/07/2023 0839
1,2-Dichlorobenzene	50	50		1	99	70-130	07/07/2023 0839
1,3-Dichlorobenzene	50	48		1	96	70-130	07/07/2023 0839
1,4-Dichlorobenzene	50	47		1	93	70-130	07/07/2023 0839
Dichlorodifluoromethane	50	79	N	1	158	60-140	07/07/2023 0839
1,1-Dichloroethane	50	51		1	102	70-130	07/07/2023 0839
1,2-Dichloroethane	50	50		1	101	70-130	07/07/2023 0839
1,1-Dichloroethene	50	51		1	103	70-130	07/07/2023 0839
cis-1,2-Dichloroethene	50	52		1	103	70-130	07/07/2023 0839
trans-1,2-Dichloroethene	50	50		1	101	70-130	07/07/2023 0839
1,2-Dichloropropane	50	48		1	96	70-130	07/07/2023 0839
cis-1,3-Dichloropropene	50	55		1	109	70-130	07/07/2023 0839
trans-1,3-Dichloropropene	50	47		1	93	70-130	07/07/2023 0839
1,4-Dioxane	500	880	N	1	176	60-140	07/07/2023 0839
Ethylbenzene	50	48		1	97	70-130	07/07/2023 0839
2-Hexanone	100	94		1	94	70-130	07/07/2023 0839
Isopropylbenzene	50	51		1	103	70-130	07/07/2023 0839
Methyl acetate	50	51		1	103	70-130	07/07/2023 0839
Methyl tertiary butyl ether (MTBE)	50	57		1	113	70-130	07/07/2023 0839
4-Methyl-2-pentanone	100	96		1	96	70-130	07/07/2023 0839
Methylcyclohexane	50	53		1	105	70-130	07/07/2023 0839
Methylene chloride	50	53		1	107	70-130	07/07/2023 0839
Naphthalene	50	56		1	113	70-130	07/07/2023 0839
Styrene	50	50		1	100	70-130	07/07/2023 0839
1,1,2,2-Tetrachloroethane	50	49		1	98	70-130	07/07/2023 0839
Tetrachloroethene	50	49		1	97	70-130	07/07/2023 0839
Toluene	50	48		1	96	70-130	07/07/2023 0839
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	52		1	105	70-130	07/07/2023 0839

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ79450-002
Batch: 79450
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	50	53		1	107	70-130	07/07/2023 0839
1,2,4-Trichlorobenzene	50	53		1	106	70-130	07/07/2023 0839
1,1,1-Trichloroethane	50	52		1	104	70-130	07/07/2023 0839
1,1,2-Trichloroethane	50	47		1	94	70-130	07/07/2023 0839
Trichloroethene	50	49		1	99	70-130	07/07/2023 0839
Trichlorofluoromethane	50	58		1	116	70-130	07/07/2023 0839
Vinyl chloride	50	61		1	122	70-130	07/07/2023 0839
Xylenes (total)	100	100		1	101	70-130	07/07/2023 0839
m+p - Xylenes	50	49		1	98	70-130	07/07/2023 0839
o - Xylenes	50	51		1	103	70-130	07/07/2023 0839

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		90	70-130
1,2-Dichloroethane-d4		94	70-130
Toluene-d8		92	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ79704-001
Batch: 79704
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acetone	ND		1	10	4.0	ug/L	07/11/2023 2306
Benzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Bromochloromethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Bromodichloromethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Bromoform	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Bromomethane (Methyl bromide)	ND		1	0.50	0.40	ug/L	07/11/2023 2306
2-Butanone (MEK)	ND		1	10	2.0	ug/L	07/11/2023 2306
Carbon disulfide	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Carbon tetrachloride	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Chlorobenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Chloroethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Chloroform	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Chloromethane (Methyl chloride)	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Cyclohexane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Dibromochloromethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,2-Dibromoethane (EDB)	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,2-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,3-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,4-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Dichlorodifluoromethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,1-Dichloroethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,2-Dichloroethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,1-Dichloroethene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
cis-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
trans-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,2-Dichloropropane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
cis-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
trans-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,4-Dioxane	ND		1	20	13	ug/L	07/11/2023 2306
Ethylbenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
2-Hexanone	ND		1	10	2.0	ug/L	07/11/2023 2306
Isopropylbenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Methyl acetate	ND		1	1.0	0.40	ug/L	07/11/2023 2306
Methyl tertiary butyl ether (MTBE)	ND		1	0.50	0.40	ug/L	07/11/2023 2306
4-Methyl-2-pentanone	ND		1	10	2.0	ug/L	07/11/2023 2306
Methylcyclohexane	ND		1	5.0	0.40	ug/L	07/11/2023 2306
Methylene chloride	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Naphthalene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Styrene	ND		1	0.50	0.41	ug/L	07/11/2023 2306
1,1,2,2-Tetrachloroethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Tetrachloroethene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Toluene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	0.42	ug/L	07/11/2023 2306

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ79704-001
Batch: 79704
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
1,2,3-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,2,4-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,1,1-Trichloroethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
1,1,2-Trichloroethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Trichloroethene	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Trichlorofluoromethane	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Vinyl chloride	ND		1	0.50	0.40	ug/L	07/11/2023 2306
Xylenes (total)	ND		1	1.0	0.40	ug/L	07/11/2023 2306
m+p - Xylenes	ND		1	0.50	0.40	ug/L	07/11/2023 2306
o - Xylenes	ND		1	0.50	0.40	ug/L	07/11/2023 2306

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		114	70-130
1,2-Dichloroethane-d4		108	70-130
Toluene-d8		103	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ79704-002
Batch: 79704
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	100	120		1	120	60-140	07/11/2023 2120
Benzene	50	51		1	101	70-130	07/11/2023 2120
Bromochloromethane	50	48		1	96	70-130	07/11/2023 2120
Bromodichloromethane	50	50		1	100	70-130	07/11/2023 2120
Bromoform	50	44		1	88	70-130	07/11/2023 2120
Bromomethane (Methyl bromide)	50	56		1	113	70-130	07/11/2023 2120
2-Butanone (MEK)	100	110		1	111	70-130	07/11/2023 2120
Carbon disulfide	50	43		1	87	70-130	07/11/2023 2120
Carbon tetrachloride	50	50		1	99	70-130	07/11/2023 2120
Chlorobenzene	50	48		1	96	70-130	07/11/2023 2120
Chloroethane	50	51		1	102	70-130	07/11/2023 2120
Chloroform	50	50		1	100	70-130	07/11/2023 2120
Chloromethane (Methyl chloride)	50	73	N	1	146	60-140	07/11/2023 2120
Cyclohexane	50	51		1	101	70-130	07/11/2023 2120
1,2-Dibromo-3-chloropropane (DBCP)	50	45		1	90	70-130	07/11/2023 2120
Dibromochloromethane	50	49		1	99	70-130	07/11/2023 2120
1,2-Dibromoethane (EDB)	50	50		1	100	70-130	07/11/2023 2120
1,2-Dichlorobenzene	50	46		1	92	70-130	07/11/2023 2120
1,3-Dichlorobenzene	50	48		1	97	70-130	07/11/2023 2120
1,4-Dichlorobenzene	50	48		1	96	70-130	07/11/2023 2120
Dichlorodifluoromethane	50	78	N	1	156	60-140	07/11/2023 2120
1,1-Dichloroethane	50	53		1	105	70-130	07/11/2023 2120
1,2-Dichloroethane	50	50		1	101	70-130	07/11/2023 2120
1,1-Dichloroethene	50	44		1	89	70-130	07/11/2023 2120
cis-1,2-Dichloroethene	50	48		1	96	70-130	07/11/2023 2120
trans-1,2-Dichloroethene	50	49		1	98	70-130	07/11/2023 2120
1,2-Dichloropropane	50	54		1	108	70-130	07/11/2023 2120
cis-1,3-Dichloropropene	50	53		1	105	70-130	07/11/2023 2120
trans-1,3-Dichloropropene	50	52		1	104	70-130	07/11/2023 2120
1,4-Dioxane	500	430		1	86	60-140	07/11/2023 2120
Ethylbenzene	50	49		1	99	70-130	07/11/2023 2120
2-Hexanone	100	110		1	112	70-130	07/11/2023 2120
Isopropylbenzene	50	49		1	97	70-130	07/11/2023 2120
Methyl acetate	50	56		1	112	70-130	07/11/2023 2120
Methyl tertiary butyl ether (MTBE)	50	50		1	100	70-130	07/11/2023 2120
4-Methyl-2-pentanone	100	110		1	108	70-130	07/11/2023 2120
Methylcyclohexane	50	51		1	102	70-130	07/11/2023 2120
Methylene chloride	50	43		1	87	70-130	07/11/2023 2120
Naphthalene	50	43		1	85	70-130	07/11/2023 2120
Styrene	50	50		1	100	70-130	07/11/2023 2120
1,1,2,2-Tetrachloroethane	50	53		1	106	70-130	07/11/2023 2120
Tetrachloroethene	50	47		1	94	70-130	07/11/2023 2120
Toluene	50	50		1	99	70-130	07/11/2023 2120
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	42		1	85	70-130	07/11/2023 2120

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ79704-002
Batch: 79704
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	50	41		1	82	70-130	07/11/2023 2120
1,2,4-Trichlorobenzene	50	42		1	83	70-130	07/11/2023 2120
1,1,1-Trichloroethane	50	48		1	95	70-130	07/11/2023 2120
1,1,2-Trichloroethane	50	48		1	97	70-130	07/11/2023 2120
Trichloroethene	50	46		1	92	70-130	07/11/2023 2120
Trichlorofluoromethane	50	54		1	107	70-130	07/11/2023 2120
Vinyl chloride	50	65		1	130	70-130	07/11/2023 2120
Xylenes (total)	100	97		1	97	70-130	07/11/2023 2120
m+p - Xylenes	50	49		1	98	70-130	07/11/2023 2120
o - Xylenes	50	48		1	96	70-130	07/11/2023 2120

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		101	70-130
1,2-Dichloroethane-d4		103	70-130
Toluene-d8		94	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ80190-001
Batch: 80190
Analytical Method: 8260D
Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acetone	ND		1	10	4.0	ug/L	07/17/2023 1925
Benzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Bromochloromethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Bromodichloromethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Bromoform	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Bromomethane (Methyl bromide)	ND		1	0.50	0.40	ug/L	07/17/2023 1925
2-Butanone (MEK)	ND		1	10	2.0	ug/L	07/17/2023 1925
Carbon disulfide	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Carbon tetrachloride	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Chlorobenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Chloroethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Chloroform	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Chloromethane (Methyl chloride)	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Cyclohexane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,2-Dibromo-3-chloropropane (DBCP)	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Dibromochloromethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,2-Dibromoethane (EDB)	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,2-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,3-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,4-Dichlorobenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Dichlorodifluoromethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,1-Dichloroethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,2-Dichloroethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,1-Dichloroethene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
cis-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
trans-1,2-Dichloroethene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,2-Dichloropropane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
cis-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
trans-1,3-Dichloropropene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,4-Dioxane	ND		1	20	13	ug/L	07/17/2023 1925
Ethylbenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
2-Hexanone	ND		1	10	2.0	ug/L	07/17/2023 1925
Isopropylbenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Methyl acetate	ND		1	1.0	0.40	ug/L	07/17/2023 1925
Methyl tertiary butyl ether (MTBE)	ND		1	0.50	0.40	ug/L	07/17/2023 1925
4-Methyl-2-pentanone	ND		1	10	2.0	ug/L	07/17/2023 1925
Methylcyclohexane	ND		1	5.0	0.40	ug/L	07/17/2023 1925
Methylene chloride	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Naphthalene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Styrene	ND		1	0.50	0.41	ug/L	07/17/2023 1925
1,1,2,2-Tetrachloroethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Tetrachloroethene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Toluene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,1,2-Trichloro-1,2,2-Trifluoroethane	ND		1	1.0	0.42	ug/L	07/17/2023 1925

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - MB

Sample ID: YQ80190-001
Batch: 80190
Analytical Method: 8260D
Matrix: Aqueous
Prep Method: 5030B

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
1,2,3-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,2,4-Trichlorobenzene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,1,1-Trichloroethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
1,1,2-Trichloroethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Trichloroethene	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Trichlorofluoromethane	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Vinyl chloride	ND		1	0.50	0.40	ug/L	07/17/2023 1925
Xylenes (total)	ND		1	1.0	0.40	ug/L	07/17/2023 1925
m+p - Xylenes	ND		1	0.50	0.40	ug/L	07/17/2023 1925
o - Xylenes	ND		1	0.50	0.40	ug/L	07/17/2023 1925

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		104	70-130
1,2-Dichloroethane-d4		99	70-130
Toluene-d8		106	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ80190-002
Batch: 80190
Analytical Method: 8260D

Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acetone	100	120		1	119	60-140	07/17/2023 1743
Benzene	50	50		1	100	70-130	07/17/2023 1743
Bromochloromethane	50	52		1	105	70-130	07/17/2023 1743
Bromodichloromethane	50	53		1	106	70-130	07/17/2023 1743
Bromoform	50	60		1	119	70-130	07/17/2023 1743
Bromomethane (Methyl bromide)	50	49		1	99	70-130	07/17/2023 1743
2-Butanone (MEK)	100	110		1	105	70-130	07/17/2023 1743
Carbon disulfide	50	56		1	111	70-130	07/17/2023 1743
Carbon tetrachloride	50	54		1	107	70-130	07/17/2023 1743
Chlorobenzene	50	50		1	100	70-130	07/17/2023 1743
Chloroethane	50	53		1	105	70-130	07/17/2023 1743
Chloroform	50	50		1	101	70-130	07/17/2023 1743
Chloromethane (Methyl chloride)	50	49		1	99	60-140	07/17/2023 1743
Cyclohexane	50	51		1	102	70-130	07/17/2023 1743
1,2-Dibromo-3-chloropropane (DBCP)	50	54		1	107	70-130	07/17/2023 1743
Dibromochloromethane	50	56		1	112	70-130	07/17/2023 1743
1,2-Dibromoethane (EDB)	50	51		1	102	70-130	07/17/2023 1743
1,2-Dichlorobenzene	50	49		1	98	70-130	07/17/2023 1743
1,3-Dichlorobenzene	50	50		1	99	70-130	07/17/2023 1743
1,4-Dichlorobenzene	50	50		1	100	70-130	07/17/2023 1743
Dichlorodifluoromethane	50	56		1	112	60-140	07/17/2023 1743
1,1-Dichloroethane	50	51		1	103	70-130	07/17/2023 1743
1,2-Dichloroethane	50	50		1	100	70-130	07/17/2023 1743
1,1-Dichloroethene	50	54		1	108	70-130	07/17/2023 1743
cis-1,2-Dichloroethene	50	50		1	101	70-130	07/17/2023 1743
trans-1,2-Dichloroethene	50	51		1	102	70-130	07/17/2023 1743
1,2-Dichloropropane	50	52		1	103	70-130	07/17/2023 1743
cis-1,3-Dichloropropene	50	55		1	110	70-130	07/17/2023 1743
trans-1,3-Dichloropropene	50	48		1	95	70-130	07/17/2023 1743
1,4-Dioxane	500	660		1	132	60-140	07/17/2023 1743
Ethylbenzene	50	52		1	105	70-130	07/17/2023 1743
2-Hexanone	100	100		1	104	70-130	07/17/2023 1743
Isopropylbenzene	50	52		1	104	70-130	07/17/2023 1743
Methyl acetate	50	55		1	110	70-130	07/17/2023 1743
Methyl tertiary butyl ether (MTBE)	50	56		1	112	70-130	07/17/2023 1743
4-Methyl-2-pentanone	100	110		1	106	70-130	07/17/2023 1743
Methylcyclohexane	50	55		1	111	70-130	07/17/2023 1743
Methylene chloride	50	52		1	104	70-130	07/17/2023 1743
Naphthalene	50	44		1	88	70-130	07/17/2023 1743
Styrene	50	52		1	104	70-130	07/17/2023 1743
1,1,2,2-Tetrachloroethane	50	51		1	103	70-130	07/17/2023 1743
Tetrachloroethene	50	52		1	104	70-130	07/17/2023 1743
Toluene	50	50		1	100	70-130	07/17/2023 1743
1,1,2-Trichloro-1,2,2-Trifluoroethane	50	49		1	98	70-130	07/17/2023 1743

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Volatile Organic Compounds by GC/MS - LCS

Sample ID: YQ80190-002
Batch: 80190
Analytical Method: 8260D
Matrix: Aqueous
Prep Method: 5030B

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
1,2,3-Trichlorobenzene	50	41		1	82	70-130	07/17/2023 1743
1,2,4-Trichlorobenzene	50	41		1	82	70-130	07/17/2023 1743
1,1,1-Trichloroethane	50	54		1	108	70-130	07/17/2023 1743
1,1,2-Trichloroethane	50	50		1	100	70-130	07/17/2023 1743
Trichloroethene	50	51		1	103	70-130	07/17/2023 1743
Trichlorofluoromethane	50	54		1	109	70-130	07/17/2023 1743
Vinyl chloride	50	51		1	102	70-130	07/17/2023 1743
Xylenes (total)	100	100		1	102	70-130	07/17/2023 1743
m+p - Xylenes	50	51		1	102	70-130	07/17/2023 1743
o - Xylenes	50	51		1	102	70-130	07/17/2023 1743

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		102	70-130
1,2-Dichloroethane-d4		100	70-130
Toluene-d8		99	70-130

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ78980-001
Batch: 78980
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/30/2023 1230

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acenaphthene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Acenaphthylene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Acetophenone	ND		1	0.80	0.23	ug/L	07/26/2023 1224
Anthracene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Atrazine	ND		1	0.80	0.20	ug/L	07/26/2023 1224
Benzaldehyde	ND		1	4.0	0.27	ug/L	07/26/2023 1224
Benzo(a)anthracene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Benzo(a)pyrene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Benzo(b)fluoranthene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Benzo(g,h,i)perylene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Benzo(k)fluoranthene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
1,1'-Biphenyl	ND		1	0.80	0.21	ug/L	07/26/2023 1224
4-Bromophenyl phenyl ether	ND		1	0.80	0.15	ug/L	07/26/2023 1224
Butyl benzyl phthalate	ND		1	4.0	0.21	ug/L	07/26/2023 1224
Caprolactam	**1.2**	**J**	**1**	**4.0**	**0.71**	**ug/L**	**07/26/2023 1224**
Carbazole	ND		1	0.80	0.040	ug/L	07/26/2023 1224
bis (2-Chloro-1-methylethyl) ether	ND		1	0.80	0.17	ug/L	07/26/2023 1224
4-Chloro-3-methyl phenol	ND		1	0.80	0.26	ug/L	07/26/2023 1224
4-Chloroaniline	ND		1	0.80	0.13	ug/L	07/26/2023 1224
bis(2-Chloroethoxy)methane	ND		1	0.80	0.060	ug/L	07/26/2023 1224
bis(2-Chloroethyl)ether	ND		1	0.80	0.16	ug/L	07/26/2023 1224
2-Chloronaphthalene	ND		1	0.80	0.15	ug/L	07/26/2023 1224
2-Chlorophenol	ND		1	0.80	0.15	ug/L	07/26/2023 1224
4-Chlorophenyl phenyl ether	ND		1	0.80	0.16	ug/L	07/26/2023 1224
Chrysene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Dibenzo(a,h)anthracene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Dibenzofuran	ND		1	0.80	0.16	ug/L	07/26/2023 1224
3,3'-Dichlorobenzidine	ND		1	4.0	0.81	ug/L	07/26/2023 1224
2,4-Dichlorophenol	ND		1	0.80	0.19	ug/L	07/26/2023 1224
Diethylphthalate	ND		1	4.0	0.19	ug/L	07/26/2023 1224
Dimethyl phthalate	ND		1	4.0	0.18	ug/L	07/26/2023 1224
2,4-Dimethylphenol	ND		1	0.80	0.15	ug/L	07/26/2023 1224
Di-n-butyl phthalate	**0.50**	**J**	**1**	**4.0**	**0.42**	**ug/L**	**07/26/2023 1224**
4,6-Dinitro-2-methylphenol	ND		1	4.0	0.89	ug/L	07/26/2023 1224
2,4-Dinitrophenol	ND		1	4.0	1.3	ug/L	07/26/2023 1224
2,4-Dinitrotoluene	ND		1	1.6	0.36	ug/L	07/26/2023 1224
2,6-Dinitrotoluene	ND		1	1.6	0.34	ug/L	07/26/2023 1224
Di-n-octylphthalate	ND		1	4.0	0.48	ug/L	07/26/2023 1224
bis(2-Ethylhexyl)phthalate	**1.6**	**J**	**1**	**4.0**	**1.5**	**ug/L**	**07/26/2023 1224**
Fluoranthene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Fluorene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Hexachlorobenzene	ND		1	0.80	0.15	ug/L	07/26/2023 1224
Hexachlorobutadiene	ND		1	0.80	0.17	ug/L	07/26/2023 1224
Hexachlorocyclopentadiene	ND		1	4.0	1.1	ug/L	07/26/2023 1224

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ78980-001
Batch: 78980
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/30/2023 1230

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Hexachloroethane	ND		1	0.80	0.17	ug/L	07/26/2023 1224
Indeno(1,2,3-c,d)pyrene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Isophorone	ND		1	0.80	0.22	ug/L	07/26/2023 1224
1-Methylnaphthalene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
2-Methylnaphthalene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
2-Methylphenol	ND		1	0.80	0.21	ug/L	07/26/2023 1224
3+4-Methylphenol	ND		1	1.6	0.46	ug/L	07/26/2023 1224
Naphthalene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
2-Nitroaniline	ND		1	1.6	0.66	ug/L	07/26/2023 1224
3-Nitroaniline	ND		1	1.6	0.15	ug/L	07/26/2023 1224
4-Nitroaniline	ND		1	1.6	1.3	ug/L	07/26/2023 1224
Nitrobenzene	ND		1	0.80	0.17	ug/L	07/26/2023 1224
2-Nitrophenol	ND		1	1.6	0.44	ug/L	07/26/2023 1224
4-Nitrophenol	ND		1	4.0	2.1	ug/L	07/26/2023 1224
N-Nitrosodi-n-propylamine	ND		1	0.80	0.28	ug/L	07/26/2023 1224
N-Nitrosodiphenylamine (Diphenylamine)	ND		1	0.80	0.50	ug/L	07/26/2023 1224
Pentachlorophenol	ND		1	4.0	1.3	ug/L	07/26/2023 1224
Phenanthrene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
Phenol	ND		1	0.80	0.19	ug/L	07/26/2023 1224
Pyrene	ND		1	0.16	0.040	ug/L	07/26/2023 1224
2,4,5-Trichlorophenol	ND		1	0.80	0.19	ug/L	07/26/2023 1224
2,4,6-Trichlorophenol	ND		1	0.80	0.22	ug/L	07/26/2023 1224

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		45	37-129
2-Fluorophenol		24	24-127
Nitrobenzene-d5		56	38-127
Phenol-d5		37	28-128
Terphenyl-d14		68	10-148
2,4,6-Tribromophenol		50	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ78980-002
Batch: 78980
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/30/2023 1230

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	8.0	3.4		1	42	30-122	07/26/2023 1613
Acenaphthylene	8.0	3.7		1	46	30-130	07/26/2023 1613
Acetophenone	8.0	3.9	N	1	49	52-125	07/26/2023 1613
Anthracene	8.0	4.4		1	55	30-123	07/26/2023 1613
Atrazine	8.0	4.8		1	60	25-121	07/26/2023 1613
Benzaldehyde	8.0	2.7		1	34	20-115	07/26/2023 1613
Benzo(a)anthracene	8.0	5.5		1	69	40-125	07/26/2023 1613
Benzo(a)pyrene	8.0	4.6		1	58	40-128	07/26/2023 1613
Benzo(b)fluoranthene	8.0	5.3		1	66	30-130	07/26/2023 1613
Benzo(g,h,i)perylene	8.0	5.9		1	74	30-130	07/26/2023 1613
Benzo(k)fluoranthene	8.0	4.7		1	58	30-130	07/26/2023 1613
1,1'-Biphenyl	8.0	3.3		1	42	42-120	07/26/2023 1613
4-Bromophenyl phenyl ether	8.0	3.9		1	48	30-124	07/26/2023 1613
Butyl benzyl phthalate	8.0	6.2		1	78	54-135	07/26/2023 1613
Caprolactam	8.0	5.4		1	67	44-152	07/26/2023 1613
Carbazole	8.0	5.1		1	64	45-101	07/26/2023 1613
bis (2-Chloro-1-methylethyl) ether	8.0	3.7		1	47	42-124	07/26/2023 1613
4-Chloro-3-methyl phenol	8.0	3.5		1	44	30-123	07/26/2023 1613
4-Chloroaniline	8.0	2.6		1	32	12-157	07/26/2023 1613
bis(2-Chloroethoxy)methane	8.0	3.5	N	1	43	44-127	07/26/2023 1613
bis(2-Chloroethyl)ether	8.0	3.4	N	1	43	46-120	07/26/2023 1613
2-Chloronaphthalene	8.0	3.2	N	1	41	46-100	07/26/2023 1613
2-Chlorophenol	8.0	3.5	N	1	44	50-117	07/26/2023 1613
4-Chlorophenyl phenyl ether	8.0	3.5		1	43	30-121	07/26/2023 1613
Chrysene	8.0	5.4		1	67	30-130	07/26/2023 1613
Dibenzo(a,h)anthracene	8.0	4.7		1	58	30-130	07/26/2023 1613
Dibenzofuran	8.0	3.6		1	45	30-118	07/26/2023 1613
3,3'-Dichlorobenzidine	8.0	1.9		1	23	10-126	07/26/2023 1613
2,4-Dichlorophenol	8.0	3.2		1	40	30-121	07/26/2023 1613
Diethylphthalate	8.0	4.8		1	61	40-125	07/26/2023 1613
Dimethyl phthalate	8.0	4.4		1	55	40-127	07/26/2023 1613
2,4-Dimethylphenol	8.0	4.4		1	55	20-125	07/26/2023 1613
Di-n-butyl phthalate	8.0	6.3		1	79	40-127	07/26/2023 1613
4,6-Dinitro-2-methylphenol	8.0	4.2	N	1	52	56-128	07/26/2023 1613
2,4-Dinitrophenol	16	7.5		1	47	11-126	07/26/2023 1613
2,4-Dinitrotoluene	8.0	4.4	N	1	54	59-127	07/26/2023 1613
2,6-Dinitrotoluene	8.0	3.9	N	1	49	59-126	07/26/2023 1613
Di-n-octylphthalate	8.0	5.5		1	68	50-136	07/26/2023 1613
bis(2-Ethylhexyl)phthalate	8.0	6.6		1	82	56-128	07/26/2023 1613
Fluoranthene	8.0	5.2		1	65	40-128	07/26/2023 1613
Fluorene	8.0	3.7		1	47	30-124	07/26/2023 1613
Hexachlorobenzene	8.0	4.1		1	51	30-125	07/26/2023 1613
Hexachlorobutadiene	8.0	2.8		1	35	24-110	07/26/2023 1613
Hexachlorocyclopentadiene	40	10		1	25	16-96	07/26/2023 1613

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ78980-002
Batch: 78980
Analytical Method: 8270E

Matrix: Aqueous
Prep Method: 3520C
Prep Date: 06/30/2023 1230

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Hexachloroethane	8.0	2.7		1	33	31-110	07/26/2023 1613
Indeno(1,2,3-c,d)pyrene	8.0	4.6		1	58	30-130	07/26/2023 1613
Isophorone	8.0	3.8	N	1	47	57-123	07/26/2023 1613
1-Methylnaphthalene	8.0	3.2	N	1	40	42-126	07/26/2023 1613
2-Methylnaphthalene	8.0	3.5		1	43	40-132	07/26/2023 1613
2-Methylphenol	8.0	4.5		1	56	56-119	07/26/2023 1613
3+4-Methylphenol	8.0	3.4	N	1	42	53-119	07/26/2023 1613
Naphthalene	8.0	3.3		1	42	30-130	07/26/2023 1613
2-Nitroaniline	8.0	3.5	N	1	44	60-124	07/26/2023 1613
3-Nitroaniline	8.0	2.5	N	1	32	43-123	07/26/2023 1613
4-Nitroaniline	8.0	3.8		1	47	30-135	07/26/2023 1613
Nitrobenzene	8.0	3.5	N	1	44	51-122	07/26/2023 1613
2-Nitrophenol	8.0	3.4	N	1	43	51-118	07/26/2023 1613
4-Nitrophenol	16	8.7		1	54	53-130	07/26/2023 1613
N-Nitrosodi-n-propylamine	8.0	4.1	N	1	51	54-127	07/26/2023 1613
N-Nitrosodiphenylamine (Diphenylamine)	8.0	3.8		1	48	30-123	07/26/2023 1613
Pentachlorophenol	16	7.9		1	49	42-131	07/26/2023 1613
Phenanthrene	8.0	4.3		1	54	40-123	07/26/2023 1613
Phenol	8.0	3.3	N	1	42	49-117	07/26/2023 1613
Pyrene	8.0	5.4		1	68	40-126	07/26/2023 1613
2,4,5-Trichlorophenol	8.0	3.3		1	41	30-123	07/26/2023 1613
2,4,6-Trichlorophenol	8.0	3.5		1	44	30-125	07/26/2023 1613

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		39	37-129
2-Fluorophenol		31	24-127
Nitrobenzene-d5		42	38-127
Phenol-d5		39	28-128
Terphenyl-d14		70	10-148
2,4,6-Tribromophenol		52	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ81267-001
Batch: 81267
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 07/31/2023 1127

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Acenaphthene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Acenaphthylene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Acetophenone	ND		1	0.80	0.23	ug/L	08/02/2023 1336
Anthracene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Atrazine	ND		1	0.80	0.20	ug/L	08/02/2023 1336
Benzaldehyde	ND		1	4.0	0.27	ug/L	08/02/2023 1336
Benzo(a)anthracene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Benzo(a)pyrene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Benzo(b)fluoranthene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Benzo(g,h,i)perylene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Benzo(k)fluoranthene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
1,1'-Biphenyl	ND		1	0.80	0.21	ug/L	08/02/2023 1336
4-Bromophenyl phenyl ether	ND		1	0.80	0.15	ug/L	08/02/2023 1336
Butyl benzyl phthalate	ND		1	4.0	0.21	ug/L	08/02/2023 1336
Caprolactam	ND		1	4.0	0.71	ug/L	08/02/2023 1336
Carbazole	ND		1	0.80	0.040	ug/L	08/02/2023 1336
bis (2-Chloro-1-methylethyl) ether	ND		1	0.80	0.17	ug/L	08/02/2023 1336
4-Chloro-3-methyl phenol	ND		1	0.80	0.26	ug/L	08/02/2023 1336
4-Chloroaniline	ND		1	0.80	0.13	ug/L	08/02/2023 1336
bis(2-Chloroethoxy)methane	ND		1	0.80	0.060	ug/L	08/02/2023 1336
bis(2-Chloroethyl)ether	ND		1	0.80	0.16	ug/L	08/02/2023 1336
2-Chloronaphthalene	ND		1	0.80	0.15	ug/L	08/02/2023 1336
2-Chlorophenol	ND		1	0.80	0.15	ug/L	08/02/2023 1336
4-Chlorophenyl phenyl ether	ND		1	0.80	0.16	ug/L	08/02/2023 1336
Chrysene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Dibenzo(a,h)anthracene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Dibenzofuran	ND		1	0.80	0.16	ug/L	08/02/2023 1336
3,3'-Dichlorobenzidine	ND		1	4.0	0.81	ug/L	08/02/2023 1336
2,4-Dichlorophenol	ND		1	0.80	0.19	ug/L	08/02/2023 1336
Diethylphthalate	ND		1	4.0	0.19	ug/L	08/02/2023 1336
Dimethyl phthalate	ND		1	4.0	0.18	ug/L	08/02/2023 1336
2,4-Dimethylphenol	ND		1	0.80	0.15	ug/L	08/02/2023 1336
Di-n-butyl phthalate	ND		1	4.0	0.42	ug/L	08/02/2023 1336
4,6-Dinitro-2-methylphenol	ND		1	4.0	0.89	ug/L	08/02/2023 1336
2,4-Dinitrophenol	ND		1	4.0	1.3	ug/L	08/02/2023 1336
2,4-Dinitrotoluene	ND		1	1.6	0.36	ug/L	08/02/2023 1336
2,6-Dinitrotoluene	ND		1	1.6	0.34	ug/L	08/02/2023 1336
Di-n-octylphthalate	ND		1	4.0	0.48	ug/L	08/02/2023 1336
bis(2-Ethylhexyl)phthalate	ND		1	4.0	1.5	ug/L	08/02/2023 1336
Fluoranthene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Fluorene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Hexachlorobenzene	ND		1	0.80	0.15	ug/L	08/02/2023 1336
Hexachlorobutadiene	ND		1	0.80	0.17	ug/L	08/02/2023 1336
Hexachlorocyclopentadiene	ND		1	4.0	1.1	ug/L	08/02/2023 1336

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS - MB

Sample ID: YQ81267-001
Batch: 81267
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 07/31/2023 1127

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Hexachloroethane	ND		1	0.80	0.17	ug/L	08/02/2023 1336
Indeno(1,2,3-c,d)pyrene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Isophorone	ND		1	0.80	0.22	ug/L	08/02/2023 1336
1-Methylnaphthalene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
2-Methylnaphthalene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
2-Methylphenol	ND		1	0.80	0.21	ug/L	08/02/2023 1336
3+4-Methylphenol	ND		1	1.6	0.46	ug/L	08/02/2023 1336
Naphthalene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
2-Nitroaniline	ND		1	1.6	0.66	ug/L	08/02/2023 1336
3-Nitroaniline	ND		1	1.6	0.15	ug/L	08/02/2023 1336
4-Nitroaniline	ND		1	1.6	1.3	ug/L	08/02/2023 1336
Nitrobenzene	ND		1	0.80	0.17	ug/L	08/02/2023 1336
2-Nitrophenol	ND		1	1.6	0.44	ug/L	08/02/2023 1336
4-Nitrophenol	ND		1	4.0	2.1	ug/L	08/02/2023 1336
N-Nitrosodi-n-propylamine	ND		1	0.80	0.28	ug/L	08/02/2023 1336
N-Nitrosodiphenylamine (Diphenylamine)	ND		1	0.80	0.50	ug/L	08/02/2023 1336
Pentachlorophenol	ND		1	4.0	1.3	ug/L	08/02/2023 1336
Phenanthrene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
Phenol	ND		1	0.80	0.19	ug/L	08/02/2023 1336
Pyrene	ND		1	0.16	0.040	ug/L	08/02/2023 1336
2,4,5-Trichlorophenol	ND		1	0.80	0.19	ug/L	08/02/2023 1336
2,4,6-Trichlorophenol	ND		1	0.80	0.22	ug/L	08/02/2023 1336

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		74	37-129
2-Fluorophenol		47	24-127
Nitrobenzene-d5		70	38-127
Phenol-d5		59	28-128
Terphenyl-d14		100	10-148
2,4,6-Tribromophenol		105	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ81267-002
Batch: 81267
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 07/31/2023 1127

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Acenaphthene	8.0	5.0		1	63	30-122	08/02/2023 1401
Acenaphthylene	8.0	5.6		1	70	30-130	08/02/2023 1401
Acetophenone	8.0	5.6		1	71	52-125	08/02/2023 1401
Anthracene	8.0	5.8		1	72	30-123	08/02/2023 1401
Atrazine	8.0	4.9		1	61	25-121	08/02/2023 1401
Benzaldehyde	8.0	4.7		1	58	20-115	08/02/2023 1401
Benzo(a)anthracene	8.0	6.0		1	75	40-125	08/02/2023 1401
Benzo(a)pyrene	8.0	5.3		1	66	40-128	08/02/2023 1401
Benzo(b)fluoranthene	8.0	6.2		1	78	30-130	08/02/2023 1401
Benzo(g,h,i)perylene	8.0	7.1		1	89	30-130	08/02/2023 1401
Benzo(k)fluoranthene	8.0	5.3		1	66	30-130	08/02/2023 1401
1,1'-Biphenyl	8.0	5.0		1	63	42-120	08/02/2023 1401
4-Bromophenyl phenyl ether	8.0	5.8		1	73	30-124	08/02/2023 1401
Butyl benzyl phthalate	8.0	5.8		1	73	54-135	08/02/2023 1401
Caprolactam	8.0	5.9		1	73	44-152	08/02/2023 1401
Carbazole	8.0	4.1		1	51	45-101	08/02/2023 1401
bis (2-Chloro-1-methylethyl) ether	8.0	6.1		1	77	42-124	08/02/2023 1401
4-Chloro-3-methyl phenol	8.0	6.4		1	80	30-123	08/02/2023 1401
4-Chloroaniline	8.0	3.5		1	43	12-157	08/02/2023 1401
bis(2-Chloroethoxy)methane	8.0	5.4		1	68	44-127	08/02/2023 1401
bis(2-Chloroethyl)ether	8.0	5.0		1	63	46-120	08/02/2023 1401
2-Chloronaphthalene	8.0	5.1		1	64	46-100	08/02/2023 1401
2-Chlorophenol	8.0	5.7		1	72	50-117	08/02/2023 1401
4-Chlorophenyl phenyl ether	8.0	5.5		1	68	30-121	08/02/2023 1401
Chrysene	8.0	5.8		1	72	30-130	08/02/2023 1401
Dibenzo(a,h)anthracene	8.0	5.9		1	73	30-130	08/02/2023 1401
Dibenzofuran	8.0	5.4		1	68	30-118	08/02/2023 1401
3,3'-Dichlorobenzidine	8.0	1.5		1	19	10-126	08/02/2023 1401
2,4-Dichlorophenol	8.0	5.9		1	73	30-121	08/02/2023 1401
Diethylphthalate	8.0	6.1		1	76	40-125	08/02/2023 1401
Dimethyl phthalate	8.0	6.0		1	75	40-127	08/02/2023 1401
2,4-Dimethylphenol	8.0	6.7		1	84	20-125	08/02/2023 1401
Di-n-butyl phthalate	8.0	6.1		1	76	40-127	08/02/2023 1401
4,6-Dinitro-2-methylphenol	8.0	5.1		1	63	56-128	08/02/2023 1401
2,4-Dinitrophenol	16	9.0		1	56	11-126	08/02/2023 1401
2,4-Dinitrotoluene	8.0	5.9		1	74	59-127	08/02/2023 1401
2,6-Dinitrotoluene	8.0	5.8		1	73	59-126	08/02/2023 1401
Di-n-octylphthalate	8.0	5.3		1	67	50-136	08/02/2023 1401
bis(2-Ethylhexyl)phthalate	8.0	6.0		1	76	56-128	08/02/2023 1401
Fluoranthene	8.0	5.8		1	73	40-128	08/02/2023 1401
Fluorene	8.0	5.5		1	69	30-124	08/02/2023 1401
Hexachlorobenzene	8.0	7.1		1	88	30-125	08/02/2023 1401
Hexachlorobutadiene	8.0	5.1		1	64	24-110	08/02/2023 1401
Hexachlorocyclopentadiene	40	16		1	40	16-96	08/02/2023 1401

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCS

Sample ID: YQ81267-002
Batch: 81267
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 07/31/2023 1127

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Hexachloroethane	8.0	4.4		1	55	31-110	08/02/2023 1401
Indeno(1,2,3-c,d)pyrene	8.0	5.6		1	70	30-130	08/02/2023 1401
Isophorone	8.0	5.7		1	71	57-123	08/02/2023 1401
1-Methylnaphthalene	8.0	5.2		1	65	42-126	08/02/2023 1401
2-Methylnaphthalene	8.0	5.5		1	69	40-132	08/02/2023 1401
2-Methylphenol	8.0	5.9		1	73	56-119	08/02/2023 1401
3+4-Methylphenol	8.0	5.7		1	71	53-119	08/02/2023 1401
Naphthalene	8.0	5.2		1	66	30-130	08/02/2023 1401
2-Nitroaniline	8.0	5.2		1	64	60-124	08/02/2023 1401
3-Nitroaniline	8.0	3.1	N	1	38	43-123	08/02/2023 1401
4-Nitroaniline	8.0	3.7		1	46	30-135	08/02/2023 1401
Nitrobenzene	8.0	5.3		1	66	51-122	08/02/2023 1401
2-Nitrophenol	8.0	5.3		1	67	51-118	08/02/2023 1401
4-Nitrophenol	16	13		1	83	53-130	08/02/2023 1401
N-Nitrosodi-n-propylamine	8.0	5.6		1	70	54-127	08/02/2023 1401
N-Nitrosodiphenylamine (Diphenylamine)	8.0	5.5		1	68	30-123	08/02/2023 1401
Pentachlorophenol	16	10		1	62	42-131	08/02/2023 1401
Phenanthrene	8.0	5.7		1	71	40-123	08/02/2023 1401
Phenol	8.0	5.4		1	67	49-117	08/02/2023 1401
Pyrene	8.0	5.7		1	71	40-126	08/02/2023 1401
2,4,5-Trichlorophenol	8.0	5.5		1	69	30-123	08/02/2023 1401
2,4,6-Trichlorophenol	8.0	6.2		1	77	30-125	08/02/2023 1401

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		66	37-129
2-Fluorophenol		62	24-127
Nitrobenzene-d5		66	38-127
Phenol-d5		68	28-128
Terphenyl-d14		84	10-148
2,4,6-Tribromophenol		101	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Semivolatile Organic Compounds by GC/MS - LCSD

Sample ID: YQ81267-003
Batch: 81267
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 07/31/2023 1127

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Acenaphthene	8.0	5.7		1	72	13	30-122	40	08/02/2023 1427
Acenaphthylene	8.0	6.4		1	80	13	30-130	40	08/02/2023 1427
Acetophenone	8.0	6.3		1	79	11	52-125	40	08/02/2023 1427
Anthracene	8.0	6.3		1	79	9.4	30-123	40	08/02/2023 1427
Atrazine	8.0	5.2		1	64	5.0	25-121	40	08/02/2023 1427
Benzaldehyde	8.0	4.6		1	57	1.9	20-115	40	08/02/2023 1427
Benzo(a)anthracene	8.0	6.4		1	79	5.9	40-125	40	08/02/2023 1427
Benzo(a)pyrene	8.0	5.7		1	71	8.2	40-128	40	08/02/2023 1427
Benzo(b)fluoranthene	8.0	6.8		1	85	8.9	30-130	40	08/02/2023 1427
Benzo(g,h,i)perylene	8.0	7.8		1	97	8.5	30-130	40	08/02/2023 1427
Benzo(k)fluoranthene	8.0	5.7		1	71	6.9	30-130	40	08/02/2023 1427
1,1'-Biphenyl	8.0	5.9		1	73	15	42-120	40	08/02/2023 1427
4-Bromophenyl phenyl ether	8.0	6.4		1	80	9.0	30-124	40	08/02/2023 1427
Butyl benzyl phthalate	8.0	6.3		1	79	8.0	54-135	40	08/02/2023 1427
Caprolactam	8.0	6.5		1	81	11	44-152	40	08/02/2023 1427
Carbazole	8.0	4.2		1	52	2.0	45-101	40	08/02/2023 1427
bis (2-Chloro-1-methylethyl) ether	8.0	7.1		1	88	14	42-124	40	08/02/2023 1427
4-Chloro-3-methyl phenol	8.0	6.9		1	86	7.6	30-123	40	08/02/2023 1427
4-Chloroaniline	8.0	2.5		1	31	32	12-157	40	08/02/2023 1427
bis(2-Chloroethoxy)methane	8.0	6.0		1	74	9.1	44-127	40	08/02/2023 1427
bis(2-Chloroethyl)ether	8.0	5.7		1	72	13	46-120	40	08/02/2023 1427
2-Chloronaphthalene	8.0	5.8		1	72	12	46-100	40	08/02/2023 1427
2-Chlorophenol	8.0	6.2		1	78	8.2	50-117	40	08/02/2023 1427
4-Chlorophenyl phenyl ether	8.0	6.1		1	76	11	30-121	40	08/02/2023 1427
Chrysene	8.0	6.3		1	79	8.6	30-130	40	08/02/2023 1427
Dibenzo(a,h)anthracene	8.0	6.3		1	79	7.0	30-130	40	08/02/2023 1427
Dibenzofuran	8.0	6.1		1	77	12	30-118	40	08/02/2023 1427
3,3'-Dichlorobenzidine	8.0	1.6		1	20	8.1	10-126	40	08/02/2023 1427
2,4-Dichlorophenol	8.0	6.4		1	80	9.0	30-121	40	08/02/2023 1427
Diethylphthalate	8.0	6.7		1	84	9.9	40-125	40	08/02/2023 1427
Dimethyl phthalate	8.0	6.8		1	85	11	40-127	40	08/02/2023 1427
2,4-Dimethylphenol	8.0	6.9		1	87	3.5	20-125	40	08/02/2023 1427
Di-n-butyl phthalate	8.0	6.5		1	81	6.5	40-127	40	08/02/2023 1427
4,6-Dinitro-2-methylphenol	8.0	5.6		1	70	9.7	56-128	40	08/02/2023 1427
2,4-Dinitrophenol	16	10		1	63	10	11-126	40	08/02/2023 1427
2,4-Dinitrotoluene	8.0	6.6		1	82	11	59-127	40	08/02/2023 1427
2,6-Dinitrotoluene	8.0	6.7		1	83	13	59-126	40	08/02/2023 1427
Di-n-octylphthalate	8.0	5.7		1	71	6.0	50-136	40	08/02/2023 1427
bis(2-Ethylhexyl)phthalate	8.0	6.1		1	76	1.0	56-128	40	08/02/2023 1427
Fluoranthene	8.0	6.3		1	78	6.7	40-128	40	08/02/2023 1427
Fluorene	8.0	6.1		1	76	11	30-124	40	08/02/2023 1427
Hexachlorobenzene	8.0	7.6		1	95	7.4	30-125	40	08/02/2023 1427
Hexachlorobutadiene	8.0	5.6		1	70	9.5	24-110	40	08/02/2023 1427
Hexachlorocyclopentadiene	40	19		1	48	19	16-96	40	08/02/2023 1427

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Semivolatile Organic Compounds by GC/MS - LCSD

Sample ID: YQ81267-003
Batch: 81267
Analytical Method: 8270E
Matrix: Aqueous
Prep Method: 3520C
Prep Date: 07/31/2023 1127

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Hexachloroethane	8.0	4.8		1	60	9.1	31-110	40	08/02/2023 1427
Indeno(1,2,3-c,d)pyrene	8.0	6.1		1	76	8.1	30-130	40	08/02/2023 1427
Isophorone	8.0	6.3		1	79	11	57-123	40	08/02/2023 1427
1-Methylnaphthalene	8.0	5.7		1	71	9.3	42-126	40	08/02/2023 1427
2-Methylnaphthalene	8.0	6.2		1	78	12	40-132	40	08/02/2023 1427
2-Methylphenol	8.0	6.6		1	82	11	56-119	40	08/02/2023 1427
3+4-Methylphenol	8.0	6.2		1	77	8.3	53-119	40	08/02/2023 1427
Naphthalene	8.0	5.8		1	72	9.3	30-130	40	08/02/2023 1427
2-Nitroaniline	8.0	5.8		1	73	12	60-124	40	08/02/2023 1427
3-Nitroaniline	8.0	3.3	N	1	42	8.2	43-123	40	08/02/2023 1427
4-Nitroaniline	8.0	3.8		1	48	3.3	30-135	40	08/02/2023 1427
Nitrobenzene	8.0	5.9		1	74	12	51-122	40	08/02/2023 1427
2-Nitrophenol	8.0	5.9		1	73	9.1	51-118	40	08/02/2023 1427
4-Nitrophenol	16	14		1	86	3.3	53-130	40	08/02/2023 1427
N-Nitrosodi-n-propylamine	8.0	6.4		1	80	13	54-127	40	08/02/2023 1427
N-Nitrosodiphenylamine (Diphenylamine)	8.0	5.5		1	69	0.33	30-123	40	08/02/2023 1427
Pentachlorophenol	16	11		1	72	14	42-131	40	08/02/2023 1427
Phenanthrene	8.0	6.0		1	76	6.0	40-123	40	08/02/2023 1427
Phenol	8.0	6.0		1	74	9.8	49-117	40	08/02/2023 1427
Pyrene	8.0	6.2		1	78	8.8	40-126	40	08/02/2023 1427
2,4,5-Trichlorophenol	8.0	5.9		1	73	6.0	30-123	40	08/02/2023 1427
2,4,6-Trichlorophenol	8.0	6.8		1	85	9.7	30-125	40	08/02/2023 1427

Surrogate	Q	% Rec	Acceptance Limit
2-Fluorobiphenyl		72	37-129
2-Fluorophenol		61	24-127
Nitrobenzene-d5		69	38-127
Phenol-d5		70	28-128
Terphenyl-d14		84	10-148
2,4,6-Tribromophenol		105	35-144

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Pace Analytical Services, LLC *(formerly Shealy Environmental Services, Inc.)*
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.pacelabs.com

Methane - MB

Sample ID: YQ79381-001
Batch: 79381
Analytical Method: RSK - 175
Matrix: Aqueous

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Methane	ND		1	10	2.5	ug/L	07/06/2023 1157

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Methane - LCS

Sample ID: YQ79381-002
Batch: 79381
Analytical Method: RSK - 175
Matrix: Aqueous

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Methane	300	280		1	96	70-130	07/06/2023 1116

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

ICP-MS Metals - MB

Sample ID: YQ79320-001
Batch: 79320
Analytical Method: 6020B

Matrix: Aqueous
Prep Method: 3005A
Prep Date: 07/11/2023 1032

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Iron	**41**	**J**	**1**	**50**	**13**	**ug/L**	**07/13/2023 1258**
Manganese	ND		1	5.0	1.3	ug/L	07/13/2023 1258

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

ICP-MS Metals - LCS

Sample ID: YQ79320-002
Batch: 79320
Analytical Method: 6020B

Matrix: Aqueous
Prep Method: 3005A
Prep Date: 07/11/2023 1032

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Iron	1000	1100		1	107	80-120	07/13/2023 1304
Manganese	100	99		1	99	80-120	07/13/2023 1304

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

ICP-MS - MB

Sample ID: YQ79634-001
Batch: 79634
Analytical Method: 6020B

Matrix: Aqueous
Prep Method: 3005A
Prep Date: 07/11/2023 1327

Parameter	Result	Q	Dil	LOQ	DL	Units	Analysis Date
Dissolved Iron	ND		1	50	13	ug/L	07/13/2023 1236
Dissolved Manganese	ND		1	5.0	1.3	ug/L	07/13/2023 1236

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

ICP-MS - LCS

Sample ID: YQ79634-002
Batch: 79634
Analytical Method: 6020B

Matrix: Aqueous
Prep Method: 3005A
Prep Date: 07/11/2023 1327

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	%Rec Limit	Analysis Date
Dissolved Iron	1000	1100		1	107	80-120	07/13/2023 1242
Dissolved Manganese	100	100		1	101	80-120	07/13/2023 1242

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

ICP-MS - LCSD

Sample ID: YQ79634-003
Batch: 79634
Analytical Method: 6020B

Matrix: Aqueous
Prep Method: 3005A
Prep Date: 07/11/2023 1327

Parameter	Spike Amount (ug/L)	Result (ug/L)	Q	Dil	% Rec	% RPD	%Rec Limit	% RPD Limit	Analysis Date
Dissolved Iron	1000	1000		1	105	1.4	80-120	20	07/13/2023 1247
Dissolved Manganese	100	100		1	103	1.7	80-120	20	07/13/2023 1247

LOQ = Limit of Quantitation
DL = Detection Limit
ND = Not detected at or above the DL
J = Estimated result < LOQ and ≥ DL
* = RSD is out of criteria
N = Recovery is out of criteria
P = The RPD between two GC columns exceeds 40%
+ = RPD is out of criteria

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

Chain of Custody
and
Miscellaneous Documents

Pace Analytical®

PACE ANALYTICAL SERVICES, LLC
106 Vantage Point Drive • West Columbia, SC 29172
Telephone No. 803-791-9700 Fax No. 803-791-9111
www.pacelabs.com

Number 149562

asmall@ramboll.com

Client: Calumet Montana Refinery
Address: 1807 3rd St NW
City: Great Falls | State: MT | Zip Code: 59404
Project Name: Calumet Refinery GW Sampling
Project No.: 1690029636-001
P.O. No.:

Report to Contact: Mike Gipson
Sampler's Signature: X Shall
Printed Name: Sarah Hall

Telephone No. / E-mail: mike.gipson@calumetspecialty.com
Analysis (Attach list if more space is needed): see Attached
Quote No.:
Page 1 of 1

YF29005

Sample ID / Description (Containers for each sample may be combined on one line.)	Collection Date(s)	Collection Time (Military)	G=Grab C=Composite	Matrix: Aqueous	Matrix: Solid	Matrix: Non-Aqueous	No of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	NaOH/Zn	Fuel Filtered	VOC (8260)	SVOC (8270)	EPH (MH EPH)	VPH (MH VPH)	Metals (iron + 6020B Manganese) Total	Dissolved Metals (6020B Iron + Manganese) FF	Alkalinity/CO2 (2320B)	Sulfate + Nitrate (9056A)	BOD (5210B)	Remarks / Cooler I.D.
CMR-MW-106-280623	06/28/2023	10:00	G	X			5		12	9			1	X	X	X	X	X	X	X	X	X	large cooler
CMR-MW-105-280623	06/28/2023	11:55	G	X			1			2											X		small cooler see attached analysis list - dissolved gasses
CMR-MW-105-270623	06/27/2023	~~13:00~~ 15:25	G	X			2			7				X	X	X	X						small cooler
Trip Blank	06/27/2023	—	—	X						2				X									large cooler
CMR-MW-41S-270623	06/27/2023	13:00	G	X			2			7				X	X	X	X						large cooler
Trip Blank	06/28/2023	—	—	X						2				X									large cooler

Turn Around Time Required (Prior lab approval required for expedited TAT.): X Standard ☐ Rush (Specify)

Sample Disposal: ☐ Return to Client X Disposal by Lab

Possible Hazard Identification: X Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished by: Sarah Hall Shall Ramboll	06/28/2023	14:30	1. Received by: Fed Ex	06/28/2023	15:00
2. Relinquished by:			2. Received by:		
3. Relinquished by:			3. Received by:		
4. Relinquished by: Fedex	6.29.23	930	4. Laboratory received by: [signature]	6.29.23	930

Note: All samples are retained for four weeks from receipt unless other arrangements are made.

LAB USE ONLY
Received on ice (Circle): Yes No Ice Pack
Receipt Temp. 1.6 °C 4.2°C
Temp Blank ☑ Y ☐ N

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK Field/Client Copy

Document Number: ME003N2-01

DC#_Title: ENV-FRM-WCOL-0286 v02_Samples Receipt Checklist (SRC)
Effective Date: 8/2/2022

Sample Receipt Checklist (SRC)

Client: CALUMET Cooler Inspected by/date: KDRW / 06/29/2023 Lot #: Yf29005

Means of receipt: ☐ Pace ☐ Client ☐ UPS ☑ FedEx ☐ Other:

☑ Yes	☐ No		1. Were custody seals present on the cooler?
☑ Yes	☐ No	☐ NA	2. If custody seals were present, were they intact and unbroken?

pH Strip ID: 22-2593 Chlorine Strip ID: NA Tested by: KDRW

Original temperature upon receipt / Derived (Corrected) temperature upon receipt %Solid Snap-Cup ID: NA

1.6 / 1.6 °C 4.2 / 4.2 °C NA / NA °C NA / NA °C

Method: ☑ Temperature Blank ☐ Against Bottles IR Gun ID: 8 IR Gun Correction Factor: 0 °C

Method of coolant: ☑ Wet Ice ☐ Ice Packs ☐ Dry Ice ☐ None

☑ Yes	☐ No	☐ NA	3. Were all coolers received at or below 6.0°C? If no, was Project Manager notified? PM was Notified by: phone / email / face-to-face (circle one).
☑ Yes	☐ No	☐ NA	4. Is the commercial courier's packing slip attached to this form?
☑ Yes	☐ No		5. Were proper custody procedures (relinquished/received) followed?
☑ Yes	☐ No		6. Were sample IDs listed on the COC and all sample containers?
☑ Yes	☐ No		7. Was collection date & time listed on the COC and all sample containers?
☑ Yes	☐ No		8. Did all container label information (ID, date, time) agree with the COC?
☑ Yes	☐ No		9. Were tests to be performed listed on the COC?
☑ Yes	☐ No		10. Did all samples arrive in the proper containers for each test and/or in good condition (unbroken, lids on, etc.)?
☑ Yes	☐ No		11. Was adequate sample volume available?
☑ Yes	☐ No		12. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
☐ Yes	☑ No		13. Were all samples containers accounted for? (No missing/excess)
☐ Yes	☑ No	☐ NA	14. Were VOA, 8015C and RSK-175 samples free of bubbles >"pea-size" (¼"or 6mm in diameter) in any of the VOA vials?
☑ Yes	☐ No	☐ NA	15. Were all DRO/metals/nutrient samples received at a pH of < 2?
☐ Yes	☐ No	☑ NA	16. Were all cyanide samples received at a pH > 12 and sulfide samples received at a pH > 9?
☐ Yes	☐ No	☑ NA	17. Were all applicable NH_3/TKN/cyanide/phenol/625.1/608.3 (< 0.5mg/L) samples free of residual chlorine?
☐ Yes	☑ No	☐ NA	18. Was the quote number listed on the container label? If yes, Quote #

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)

Sample(s) _____ were received incorrectly preserved and were adjusted accordingly in sample receiving with _____mL of circle one: H2SO4, HNO3, HCl, NaOH using SR # _____. ☐
Time of preservation _____. If more than one preservative is needed, please note in the comments below.

Sample(s) BOTH SETS OF TRIP BLANKS were received with bubbles >6 mm in diameter.

Samples(s) NA were received with TRC > 0.5 mg/L (If #19 is ***no***) and were adjusted accordingly in sample receiving with sodium thiosulfate ($Na_2S_2O_3$) with Unique ID: NA.

Comments: SAMPLE 1 RECEIVED 2 EXTRA HCL VIALS FOR DISSOLVED GASES

Qualtrax ID: 56360 Pace® Analytical Services, LLC Page 1 of 1

COC # 149502

Analysis list continued

- Dissolved Gassed - Methane (RSK-175), Carbon Dioxide (EPA 4500-CO2)

ANALYTICAL REPORT

July 09, 2023

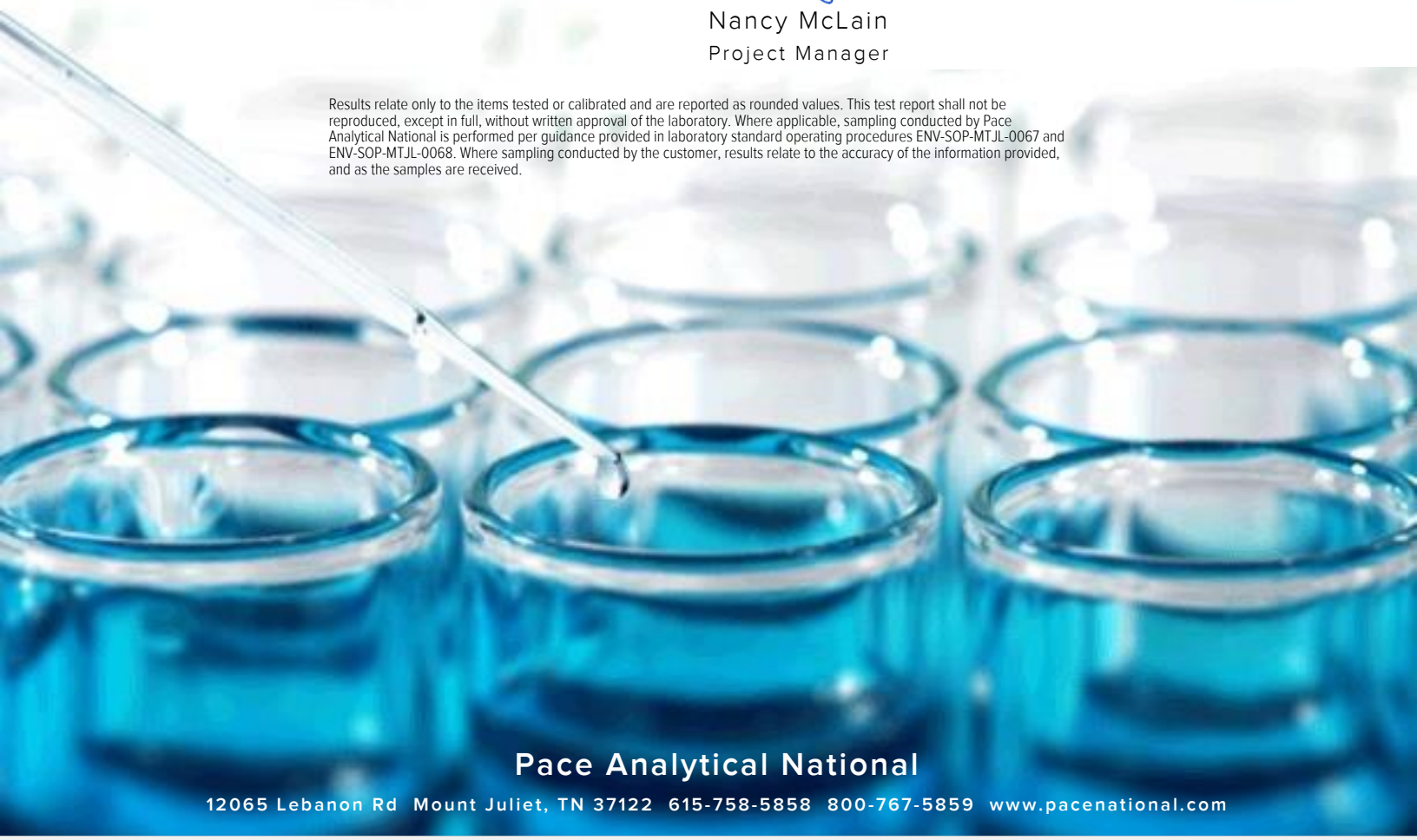
Pace Analytical - West Columbia, SC

Sample Delivery Group:	L1631460
Samples Received:	06/30/2023
Project Number:	YF29005
Description:	Calumet Refinery GW Sam
Site:	001
Report To:	Edward T. Barnett 106 Vantage Point Dr. West Columbia, SC 29172

Entire Report Reviewed By:

Nancy McLain
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National
12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

CMR-MW-106-280623 L1631460-01 5

CMR-MW-105-270623 L1631460-02 6

CMR-MW-41S-270623 L1631460-03 7

Qc: Quality Control Summary 8

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH 8

TPH by Method MTDEQ EPH 9

Gl: Glossary of Terms 12

Al: Accreditations & Locations 13

Sc: Sample Chain of Custody 14

CMR-MW-106-280623 L1631460-01 GW

Collected by	Collected date/time	Received date/time
	06/28/23 10:00	06/30/23 09:05

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2091118	1	07/09/23 02:16	07/09/23 02:16	JAH	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089189	1	07/05/23 07:53	07/05/23 18:35	TJD	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	1	07/05/23 07:53	07/06/23 21:28	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	1	07/05/23 07:53	07/07/23 00:48	DMG	Mt. Juliet, TN

CMR-MW-105-270623 L1631460-02 GW

Collected by	Collected date/time	Received date/time
	06/27/23 15:25	06/30/23 09:05

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2091118	1	07/09/23 02:48	07/09/23 02:48	JAH	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089189	1	07/05/23 07:53	07/05/23 18:50	TJD	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	1	07/05/23 07:53	07/06/23 21:50	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	1	07/05/23 07:53	07/07/23 01:11	DMG	Mt. Juliet, TN

CMR-MW-41S-270623 L1631460-03 GW

Collected by	Collected date/time	Received date/time
	06/27/23 13:00	06/30/23 09:05

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Petroleum Hydrocarbons by Method MTDEQ VPH	WG2091118	5	07/09/23 05:32	07/09/23 05:32	JAH	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089189	1	07/05/23 07:53	07/05/23 19:05	TJD	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	1	07/05/23 07:53	07/06/23 22:12	DMG	Mt. Juliet, TN
TPH by Method MTDEQ EPH	WG2089786	1	07/05/23 07:53	07/07/23 01:33	DMG	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Nancy McLain
Project Manager

Project Narrative

Due to multiple preparation procedures, calculated analytes are not reported in the quality control samples for EPH and VPH Methods.

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Unadjusted C5-C8 Aliphatics	85.9	J	33.3	100	1	07/09/2023 02:16	WG2091118
Unadjusted C9-C12 Aliphatics	U		33.3	100	1	07/09/2023 02:16	WG2091118
Unadjusted C9-C10 Aromatics	U		33.3	100	1	07/09/2023 02:16	WG2091118
Adjusted C5-C8 Aliphatics	85.9	J	33.3	100	1	07/09/2023 02:16	WG2091118
Adjusted C9-C12 Aliphatics	U		33.3	100	1	07/09/2023 02:16	WG2091118
Total VPH	85.9	J	66.7	200	1	07/09/2023 02:16	WG2091118
Total Purgeable Hydrocarbons C5-C12	108	J	66.7	200	1	07/09/2023 02:16	WG2091118
(S) 2,5-Dibromotoluene(FID)	*90.8*			*70.0-130*		*07/09/2023 02:16*	WG2091118
(S) 2,5-Dibromotoluene(PID)	*95.1*			*70.0-130*		*07/09/2023 02:16*	WG2091118

TPH by Method MTDEQ EPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
EPH Screen	1650		100	300	1	07/05/2023 18:35	WG2089189
Unadjusted C9-C18 Aliphatics	U		200	600	1	07/06/2023 21:28	WG2089786
Unadjusted C19-C36 Aliphatics	U		200	600	1	07/06/2023 21:28	WG2089786
Unadjusted C11-C22 Aromatics	U	J3	200	600	1	07/07/2023 00:48	WG2089786
Unadjusted Total Petroleum Hydrocarbons	U		200	600	1	07/06/2023 21:28	WG2089786
Adjusted C11-C22 Aromatics	U		200	600	1	07/07/2023 00:48	WG2089786
Adjusted Total Petroleum Hydrocarbons	U		200	600	1	07/06/2023 21:28	WG2089786
(S) o-Terphenyl	*75.1*			*40.0-140*		*07/05/2023 18:35*	WG2089189
(S) o-Terphenyl	*49.3*			*40.0-140*		*07/07/2023 00:48*	WG2089786
(S) 1-Chloro-octadecane	*16.6*	J2		*40.0-140*		*07/06/2023 21:28*	WG2089786
(S) 2-Fluorobiphenyl	*71.6*			*40.0-140*		*07/07/2023 00:48*	WG2089786
(S) 2-Bromonaphthalene	*71.7*			*40.0-140*		*07/07/2023 00:48*	WG2089786

Sample Narrative:

L1631460-01 WG2089786: Surrogate failure due to matrix interference during extraction procedure.

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Unadjusted C5-C8 Aliphatics	1050		33.3	100	1	07/09/2023 02:48	WG2091118
Unadjusted C9-C12 Aliphatics	377		33.3	100	1	07/09/2023 02:48	WG2091118
Unadjusted C9-C10 Aromatics	185		33.3	100	1	07/09/2023 02:48	WG2091118
Adjusted C5-C8 Aliphatics	969		33.3	100	1	07/09/2023 02:48	WG2091118
Adjusted C9-C12 Aliphatics	117		33.3	100	1	07/09/2023 02:48	WG2091118
Total VPH	1610		66.7	200	1	07/09/2023 02:48	WG2091118
Total Purgeable Hydrocarbons C5-C12	1520		66.7	200	1	07/09/2023 02:48	WG2091118
(S) 2,5-Dibromotoluene(FID)	*94.3*			*70.0-130*		*07/09/2023 02:48*	WG2091118
(S) 2,5-Dibromotoluene(PID)	*99.5*			*70.0-130*		*07/09/2023 02:48*	WG2091118

TPH by Method MTDEQ EPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
EPH Screen	638		100	300	1	07/05/2023 18:50	WG2089189
Unadjusted C9-C18 Aliphatics	U		200	600	1	07/06/2023 21:50	WG2089786
Unadjusted C19-C36 Aliphatics	U		200	600	1	07/06/2023 21:50	WG2089786
Unadjusted C11-C22 Aromatics	U	J3	200	600	1	07/07/2023 01:11	WG2089786
Unadjusted Total Petroleum Hydrocarbons	U		200	600	1	07/06/2023 21:50	WG2089786
Adjusted C11-C22 Aromatics	U		200	600	1	07/07/2023 01:11	WG2089786
Adjusted Total Petroleum Hydrocarbons	U		200	600	1	07/06/2023 21:50	WG2089786
(S) o-Terphenyl	*81.1*			*40.0-140*		*07/05/2023 18:50*	WG2089189
(S) o-Terphenyl	*56.4*			*40.0-140*		*07/07/2023 01:11*	WG2089786
(S) 1-Chloro-octadecane	*28.8*	J2		*40.0-140*		*07/06/2023 21:50*	WG2089786
(S) 2-Fluorobiphenyl	*77.4*			*40.0-140*		*07/07/2023 01:11*	WG2089786
(S) 2-Bromonaphthalene	*78.2*			*40.0-140*		*07/07/2023 01:11*	WG2089786

Sample Narrative:

L1631460-02 WG2089786: Surrogate failure due to matrix interference during extraction procedure.

Volatile Petroleum Hydrocarbons by Method MTDEQ VPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Unadjusted C5-C8 Aliphatics	850		167	500	5	07/09/2023 05:32	WG2091118
Unadjusted C9-C12 Aliphatics	3100		167	500	5	07/09/2023 05:32	WG2091118
Unadjusted C9-C10 Aromatics	1910		167	500	5	07/09/2023 05:32	WG2091118
Adjusted C5-C8 Aliphatics	429	J	167	500	5	07/09/2023 05:32	WG2091118
Adjusted C9-C12 Aliphatics	U		167	500	5	07/09/2023 05:32	WG2091118
Total VPH	5860		333	1000	5	07/09/2023 05:32	WG2091118
Total Purgeable Hydrocarbons C5-C12	6400		333	1000	5	07/09/2023 05:32	WG2091118
(S) 2,5-Dibromotoluene(FID)	*84.8*			*70.0-130*		*07/09/2023 05:32*	WG2091118
(S) 2,5-Dibromotoluene(PID)	*89.4*			*70.0-130*		*07/09/2023 05:32*	WG2091118

TPH by Method MTDEQ EPH

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
EPH Screen	5490		100	300	1	07/05/2023 19:05	WG2089189
Unadjusted C9-C18 Aliphatics	U		200	600	1	07/06/2023 22:12	WG2089786
Unadjusted C19-C36 Aliphatics	U		200	600	1	07/06/2023 22:12	WG2089786
Unadjusted C11-C22 Aromatics	425	J J3	200	600	1	07/07/2023 01:33	WG2089786
Unadjusted Total Petroleum Hydrocarbons	425	J	200	600	1	07/06/2023 22:12	WG2089786
Adjusted C11-C22 Aromatics	425	J	200	600	1	07/07/2023 01:33	WG2089786
Adjusted Total Petroleum Hydrocarbons	425	J	200	600	1	07/06/2023 22:12	WG2089786
(S) o-Terphenyl	*65.9*			*40.0-140*		*07/05/2023 19:05*	WG2089189
(S) o-Terphenyl	*45.1*			*40.0-140*		*07/07/2023 01:33*	WG2089786
(S) 1-Chloro-octadecane	*21.3*	J2		*40.0-140*		*07/06/2023 22:12*	WG2089786
(S) 2-Fluorobiphenyl	*75.8*			*40.0-140*		*07/07/2023 01:33*	WG2089786
(S) 2-Bromonaphthalene	*77.8*			*40.0-140*		*07/07/2023 01:33*	WG2089786

Sample Narrative:

L1631460-03 WG2089786: Surrogate failure due to matrix interference during extraction procedure.

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3946352-3 07/08/23 19:40

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Unadjusted C5-C8 Aliphatics	U		33.3	100
Unadjusted C9-C12 Aliphatics	U		33.3	100
Unadjusted C9-C10 Aromatics	U		33.3	100
Adjusted C5-C8 Aliphatics	U		33.3	100
Adjusted C9-C12 Aliphatics	U		33.3	100
Total VPH	U		66.7	200
Total Purgeable Hydrocarbons C5-C12	U		66.7	200
(S) 2,5-Dibromotoluene(FID)	*84.6*			*70.0-130*
(S) 2,5-Dibromotoluene(PID)	*87.6*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3946352-1 07/08/23 18:02 • (LCSD) R3946352-2 07/08/23 18:34

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Unadjusted C5-C8 Aliphatics	1200	1030	979	85.8	81.6	70.0-130			5.08	50
Unadjusted C9-C12 Aliphatics	1400	1070	1100	76.4	78.6	70.0-130			2.76	50
Unadjusted C9-C10 Aromatics	200	177	182	88.5	91.0	70.0-130			2.79	50
Total VPH	2800	2280	2260	81.4	80.7	70.0-130			0.881	50
Total Purgeable Hydrocarbons C5-C12	2800	2340	2330	83.6	83.2	70.0-130			0.428	50
(S) 2,5-Dibromotoluene(FID)				*91.1*	*85.9*	*70.0-130*				
(S) 2,5-Dibromotoluene(PID)				*95.2*	*90.3*	*70.0-130*				

Method Blank (MB)

(MB) R3945042-1 07/05/23 17:51

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
EPH Screen	U		100	300
(S) o-Terphenyl	*104*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3945042-2 07/05/23 18:06 • (LCSD) R3945042-3 07/05/23 18:21

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
EPH Screen	3100	3140	3370	101	109	40.0-140			7.07	25
(S) o-Terphenyl				*102*	*106*	*40.0-140*				

Method Blank (MB)

(MB) R3945659-1 07/06/23 19:14

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Unadjusted C9-C18 Aliphatics	U		200	600
Unadjusted C19-C36 Aliphatics	U		200	600
(S) 1-Chloro-octadecane	*62.4*			*40.0-140*

Method Blank (MB)

(MB) R3945659-4 07/06/23 20:21

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	ug/l		ug/l	ug/l
Unadjusted C11-C22 Aromatics	U		200	600
(S) o-Terphenyl	*70.6*			*40.0-140*
(S) 2-Fluorobiphenyl	*74.5*			*40.0-140*
(S) 2-Bromonaphthalene	*73.3*			*40.0-140*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3945659-2 07/06/23 19:36 • (LCSD) R3945659-3 07/06/23 19:59

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Unadjusted C9-C18 Aliphatics	600	452	419	75.3	69.8	40.0-140			7.58	25
Unadjusted C19-C36 Aliphatics	800	650	703	81.2	87.9	40.0-140			7.83	25
(S) 1-Chloro-octadecane				*66.3*	*71.1*	*40.0-140*				

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3945659-5 07/06/23 20:43 • (LCSD) R3945659-6 07/06/23 21:06

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	ug/l	ug/l	ug/l	%	%	%			%	%
Unadjusted C11-C22 Aromatics	1700	1010	1390	59.4	81.8	40.0-140		J3	31.7	25
(S) o-Terphenyl				*55.3*	*73.6*	*40.0-140*				
(S) 2-Fluorobiphenyl				*62.6*	*78.6*	*40.0-140*				
(S) 2-Bromonaphthalene				*58.5*	*73.9*	*40.0-140*				

L1630214-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1630214-03 07/07/23 07:49 • (MS) R3945659-7 07/07/23 08:12 • (MSD) R3945659-8 07/07/23 08:34

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Unadjusted C9-C18 Aliphatics	612	U	257	228	17.0	12.3	1.02	40.0-140	J6	J6	12.0	50
Unadjusted C19-C36 Aliphatics	816	U	416	407	40.3	39.2	1.02	40.0-140		J6	2.19	50
(S) 1-Chloro-octadecane					*28.7*	*24.1*		*40.0-140*	J2	J2		

Sample Narrative:

OS: Surrogate failure due to matrix interference during extraction procedure.

L1630214-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1630214-03 07/07/23 10:50 • (MS) R3945659-9 07/07/23 11:12 • (MSD) R3945659-10 07/07/23 11:59

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Unadjusted C11-C22 Aromatics	1730	U	897	842	49.2	46.0	1.02	40.0-140			6.33	50
(S) o-Terphenyl					*43.6*	*41.3*		*40.0-140*				
(S) 2-Fluorobiphenyl					*81.0*	*80.0*		*40.0-140*				
(S) 2-Bromonaphthalene					*80.6*	*79.4*		*40.0-140*				

Sample Narrative:

OS: Surrogate failure due to matrix interference during extraction procedure.

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

A201

Chain of Custody 100334702965

Pace Analytical
www.pacelabs.com

Workorder: YF29005 Workorder Name: Calumet Refinery GW Sam Owner Received Date: 6/29/2023 Results Requested By: 7/12/2023

Report To:	Subcontract To:
Edward T. Barnett	Project # YF29005
Pace Analytical	
106 Vantage Point Drive	Pace National
Columbia SC, 29223	
803-509-8398	
Edward.Barnett@pacelabs.com	

L1631460

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers					Requested Analysis: MA EPH	Requested Analysis: MA VPH	LAB USE ONLY
1	CMR-MW-106-280623	grab	06/28/23 @ 1000	YF29005-001	AQ						X	X	-01
2	CMR-MW-105-270623	grab	06/27/23 @ 1525	YF29005-003	AQ						X	X	-02
3	CMR-MW-41S-270623	grab	06/27/23 @ 1300	YF29005-005	AQ						X	X	-03
													Environ
													EQUIS
													EDD
													Needed

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	Carly Rue	6/29/23 1900	Alexa Mitchell	6/30/23 0845	For all samples - MA EPH and MA VPH Level 2 with J/MDLs screen + fractionated analysis
2					
3					

Cooler Temperature on Receipt 0.9+0=.9 °C	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Sample Receipt Checklist

COC Seal Present/Intact:	Y N	If Applicable	
COC Signed/Accurate:	Y N	VOA Zero Headspace:	Y N
Bottles arrive intact:	Y N	Pres.Correct/Check:	Y N
Correct bottles used:	Y N		
Sufficient volume sent:	Y N		
RAD Screen <0.5 mR/hr:	Y N	0.9+0=.9	

L1631460

Pace Analytical
www.pacelabs.com

Ship to :
Pace National

Phone

INTER_LABORATORY WORK ORDER # YF29005

(To be complete by sending lab)

Sending Project No:	Calumet
Receiving Project No:	
Check Box for Consolidated Invoice:	x
Date Prepared:	12-Jul
REQUESTED COMPLETION DATE:	5-Apr

Sending Region	IR77-SC	Sending Project Mgr.	Eddie Barnett
Receiving Region	Pace National	External Client	Ramboll
State of Sample Origin	MI	Q	LV2 w / Js

All questions should be addressed to sending project manager.

Requested Reportable Units: ug/L or mg/kg Report Wet or Dry Weight?: dry Cert Needed: MI

WORK REQUESTED						
Method Description	Container Type	Quantity of containers	Preservative	Quantity of Samples	Unit Price	Amount
MT VPH	40mL	6	HCL	3	65	195
MT EPH	1L	6	HCL	3	90	270
					TOTAL	465

Special Requirements: Environ EQUIS EDD Needed

Receiving Reqion Department	Acctg. Code	Totals from above	Revenue Allocation	
			Receiving Region (80%)	Client Services Dept. Sending Region (20%)
		195	156	39
		270	216	54
* Custom Revenue Allocation		TOTAL	372	93

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Chain of Custody Included: [x] Yes [ ] No Return Samples to Sending Reguion: [ ] Yes [x] No

Matrix: [ ] Soil [ ] Water [ ] Air [ ] Other (identity) _____

CONFIRMATION OF WORK COMPLETED

Date Completed: _____ Receiving Project Manager: _____

Original sent to the receiving lab - Copy kept at the sending lab.

When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

APPENDIX B

HISTORICAL ANALYTICAL RESULTS AND CONTAMINANT MASS REMOVAL - VAPOR

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-211015		CMR-SP301-211016		CMR-SP301-211017	
Sample Date		10/15/2021		10/16/2021		10/17/2021	
Blower Flow (scfm)		41		41		41	
Period Operational Time (hrs)		26		24		24	
Notes							
VOCs	CAS No.	Result (ug/m^3)	Mass (lb)	Result (ug/m^3)	Mass (lb)	Result (ug/m^3)	Mass (lb)
1,1,1-Trichloroethane	71-55-6	18,100 U	0.00	18,600 U	0.00	19,600 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	22,800 U	0.00	23,400 U	0.00	24,700 U	0.00
1,1,2-Trichloroethane	79-00-5	9,040 U	0.00	9,290 U	0.00	9,800 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	25,400 U	0.00	26,100 U	0.00	27,600 U	0.00
1,1-Dichloroethane	75-34-3	13,400 U	0.00	13,800 U	0.00	14,500 U	0.00
1,1-Dichloroethene	75-35-4	13,100 U	0.00	13,500 U	0.00	14,200 U	0.00
1,2,4-Trichlorobenzene	120-82-1	123,000 U	0.00	126,000 U	0.00	133,000 U	0.00
1,2,4-Trimethylbenzene	95-63-6	340,000	1.36	471,000	1.73	562,000	2.07
1,2-Dibromoethane (EDB)	106-93-4	12,700 U	0.00	13,100 U	0.00	13,800 U	0.00
1,2-Dichlorobenzene	95-50-1	49,800 U	0.00	51,200 U	0.00	54,100 U	0.00
1,2-Dichloroethane	107-06-2	13,400 U	0.00	13,800 U	0.00	14,500 U	0.00
1,2-Dichloropropane	78-87-5	15,300 U	0.00	15,700 U	0.00	16,600 U	0.00
1,3,5-Trimethylbenzene	108-67-8	179,000	0.71	225,000	0.83	272,000	1.00
1,3-Butadiene	106-99-0	7,330 U	0.00	7,530 U	0.00	7,950 U	0.00
1,3-Dichlorobenzene	541-73-1	49,800 U	0.00	51,200 U	0.00	54,100 U	0.00
1,4-Dichlorobenzene	106-46-7	49,800 U	0.00	51,200 U	0.00	54,100 U	0.00
2-Butanone (MEK)	78-93-3	48,800 U	0.00	50,200 U	0.00	53,000 U	0.00
2-Hexanone	591-78-6	67,700 U	0.00	69,600 U	0.00	73,500 U	0.00
2-Propanol	67-63-0	40,700 U	0.00	41,900 U	0.00	44,200 U	0.00
4-Ethyltoluene	622-96-8	171,000	0.68	222,000	0.82	257,000	0.95
4-Methyl-2-pentanone (MIBK)	108-10-1	88,300	0.35	81,400	0.30	84,900	0.31
Acetone	67-64-1	98,300 U	0.00	101,000 U	0.00	107,000 U	0.00
Benzene	71-43-2	2,850,000 E	11.36	2,430,000 E	8.94	2,640,000 E	9.71
Benzyl chloride	100-44-7	42,800 U	0.00	44,000 U	0.00	46,500 U	0.00
Bromodichloromethane	75-27-4	22,100 U	0.00	22,800 U	0.00	24,000 U	0.00
Bromoform	75-25-2	85,500 U	0.00	87,900 U	0.00	92,700 U	0.00
Bromomethane	74-83-9	12,800 U	0.00	13,200 U	0.00	13,900 U	0.00
Carbon disulfide	75-15-0	10,300 U	0.00	10,600 U	0.00	11,200 U	0.00
Carbon tetrachloride	56-23-5	20,800 U	0.00	21,400 U	0.00	22,600 U	0.00
Chlorobenzene	108-90-7	15,200 U	0.00	15,700 U	0.00	16,500 U	0.00
Chloroethane	75-00-3	8,730 U	0.00	8,970 U	0.00	9,470 U	0.00
Chloroform	67-66-3	8,080 U	0.00	8,300 U	0.00	8,760 U	0.00
Chloromethane	74-87-3	6,840 U	0.00	7,030 U	0.00	7,420 U	0.00
cis-1,2-Dichloroethene	156-59-2	13,100 U	0.00	13,500 U	0.00	14,200 U	0.00
cis-1,3-Dichloropropene	10061-01-5	37,600 U	0.00	38,700 U	0.00	40,800 U	0.00
Cyclohexane	110-82-7	28,500 U	0.00	29,300 U	0.00	30,900 U	0.00
Dibromochloromethane	124-48-1	28,200 U	0.00	29,000 U	0.00	30,600 U	0.00
Dichlorodifluoromethane	75-71-8	16,400 U	0.00	16,900 U	0.00	17,800 U	0.00
Dichlorotetrafluoroethane	76-14-2	23,100 U	0.00	23,800 U	0.00	25,100 U	0.00
Ethanol	64-17-5	31,300 U	0.00	32,100 U	0.00	33,900 U	0.00
Ethyl acetate	141-78-6	11,900 U	0.00	12,300 U	0.00	12,900 U	0.00
Ethylbenzene	100-41-4	1,200,000	4.78	1,360,000	5.00	1,380,000	5.08
Hexachloro-1,3-butadiene	87-68-3	88,200 U	0.00	90,700 U	0.00	95,700 U	0.00
m&p-Xylene	179601-23-1	4,030,000	16.06	5,010,000	18.43	5,310,000	19.54
Methylene Chloride	75-09-2	57,500 U	0.00	59,100 U	0.00	62,400 U	0.00
Methyl-tert-butyl ether	1634-04-4	59,600 U	0.00	61,300 U	0.00	64,700 U	0.00
Naphthalene	91-20-3	43,300 U	0.00	44,500 U	0.00	47,000 U	0.00
n-Heptane	142-82-5	3,330,000 E	13.27	3,060,000 E	11.26	3,340,000 E	12.29
n-Hexane	110-54-3	7,840,000 E	31.25	7,320,000 E	26.93	7,900,000 E	29.07
o-Xylene	95-47-6	916,000	3.65	1,210,000	4.45	1,320,000	4.86
Propylene	115-07-1	14,200 U	0.00	14,600 U	0.00	15,500 U	0.00
Styrene	100-42-5	14,100 U	0.00	14,500 U	0.00	15,300 U	0.00
Tetrachloroethene	127-18-4	11,200 U	0.00	11,500 U	0.00	12,200 U	0.00
Tetrahydrofuran	109-99-9	9,770 U	0.00	10,000 U	0.00	10,600 U	0.00
Toluene	108-88-3	1,490,000	5.94	1,860,000	6.84	1,870,000	6.88
trans-1,2-Dichloroethene	156-60-5	13,100 U	0.00	13,500 U	0.00	14,200 U	0.00
trans-1,3-Dichloropropene	10061-02-6	37,600 U	0.00	38,700 U	0.00	40,800 U	0.00
Trichloroethene	79-01-6	17,800 U	0.00	18,300 U	0.00	19,300 U	0.00
Trichlorofluoromethane	75-69-4	18,600 U	0.00	19,100 U	0.00	20,100 U	0.00
Vinyl acetate	108-05-4	11,700 U	0.00	12,000 U	0.00	12,600 U	0.00
Vinyl chloride	75-01-4	4,230 U	0.00	4,350 U	0.00	4,590 U	0.00
Total VOCs	--	--	89.42	--	85.54	--	91.74
Period Total VOC Mass Removed (lbs)		**89.4**		**85.5**		**91.7**	
Cumulative Total VOC Mass Removed (lbs)		**89**		**175**		**267**	

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-2		CMR-SP301-211201		CMR-SP301-211208	
Sample Date		11/19/2021		12/1/2021		12/8/2021	
Blower Flow (scfm)		41		56		65	
Period Operational Time (hrs)		--		283		144	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	158 R	0.00	9,290 U	0.00	9,800 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	199 R	0.00	11,700 U	0.00	12,400 U	0.00
1,1,2-Trichloroethane	79-00-5	79 R	0.00	4,650 U	0.00	4,900 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	222 R	0.00	13,100 U	0.00	13,800 U	0.00
1,1-Dichloroethane	75-34-3	117 R	0.00	6,890 U	0.00	7,270 U	0.00
1,1-Dichloroethene	75-35-4	115 R	0.00	6,750 U	0.00	7,120 U	0.00
1,2,4-Trichlorobenzene	120-82-1	1,070 R	0.00	63,100 U	0.00	66,600 U	0.00
1,2,4-Trimethylbenzene	95-63-6	7,720 R	0.00	49,600	2.95	50,300	1.76
1,2-Dibromoethane (EDB)	106-93-4	111 R	0.00	6,540 U	0.00	6,900 U	0.00
1,2-Dichlorobenzene	95-50-1	435 R	0.00	25,600 U	0.00	27,000 U	0.00
1,2-Dichloroethane	107-06-2	117 R	0.00	6,890 U	0.00	7,270 U	0.00
1,2-Dichloropropane	78-87-5	134 R	0.00	7,860 U	0.00	8,290 U	0.00
1,3,5-Trimethylbenzene	108-67-8	3,310 R	0.00	27,100	1.61	27,900	0.98
1,3-Butadiene	106-99-0	64 R	0.00	3,770 U	0.00	3,970 U	0.00
1,3-Dichlorobenzene	541-73-1	435 R	0.00	25,600 U	0.00	27,000 U	0.00
1,4-Dichlorobenzene	106-46-7	435 R	0.00	25,600 U	0.00	27,000 U	0.00
2-Butanone (MEK)	78-93-3	427 R	0.00	25,100 U	0.00	26,500 U	0.00
2-Hexanone	591-78-6	592 R	0.00	34,800 U	0.00	36,700 U	0.00
2-Propanol	67-63-0	356 R	0.00	20,900 U	0.00	22,100 U	0.00
4-Ethyltoluene	622-96-8	1,180 R	0.00	26,600	1.58	26,700	0.93
4-Methyl-2-pentanone (MIBK)	108-10-1	592 R	0.00	34,800 U	0.00	36,700 U	0.00
Acetone	67-64-1	859 R	0.00	50,600 U	0.00	53,300 U	0.00
Benzene	71-43-2	51 R	0.00	135,000	8.04	94,100	3.29
Benzyl chloride	100-44-7	374 R	0.00	22,000 U	0.00	23,200 U	0.00
Bromodichloromethane	75-27-4	193 R	0.00	11,400 U	0.00	12,000 U	0.00
Bromoform	75-25-2	747 R	0.00	43,900 U	0.00	46,400 U	0.00
Bromomethane	74-83-9	112 R	0.00	6,600 U	0.00	6,970 U	0.00
Carbon disulfide	75-15-0	90 R	0.00	5,300 U	0.00	5,590 U	0.00
Carbon tetrachloride	56-23-5	182 R	0.00	10,700 U	0.00	11,300 U	0.00
Chlorobenzene	108-90-7	133 R	0.00	7,840 U	0.00	8,270 U	0.00
Chloroethane	75-00-3	76 R	0.00	11,200 U	0.00	11,800 U	0.00
Chloroform	67-66-3	71 R	0.00	4,150 U	0.00	4,380 U	0.00
Chloromethane	74-87-3	60 R	0.00	3,520 U	0.00	3,710 U	0.00
cis-1,2-Dichloroethene	156-59-2	115 R	0.00	6,750 U	0.00	7,120 U	0.00
cis-1,3-Dichloropropene	10061-01-5	328 R	0.00	19,300 U	0.00	20,400 U	0.00
Cyclohexane	110-82-7	3,940 R	0.00	945,000	56.27	687,000	24.03
Dibromochloromethane	124-48-1	246 R	0.00	14,500 U	0.00	15,300 U	0.00
Dichlorodifluoromethane	75-71-8	144 R	0.00	8,450 U	0.00	8,920 U	0.00
Dichlorotetrafluoroethane	76-14-2	202 R	0.00	11,900 U	0.00	12,500 U	0.00
Ethanol	64-17-5	273 R	0.00	16,100 U	0.00	17,000 U	0.00
Ethyl acetate	141-78-6	104 R	0.00	6,140 U	0.00	6,470 U	0.00
Ethylbenzene	100-41-4	1,520 R	0.00	104,000	6.19	80,800	2.83
Hexachloro-1,3-butadiene	87-68-3	771 R	0.00	45,400 U	0.00	47,900 U	0.00
m&p-Xylene	179601-23-1	7,210 R	0.00	475,000	28.28	401,000	14.02
Methylene Chloride	75-09-2	502 R	0.00	29,600 U	0.00	31,200 U	0.00
Methyl-tert-butyl ether	1634-04-4	520 R	0.00	30,600 U	0.00	32,300 U	0.00
Naphthalene	91-20-3	378 R	0.00	44,600 U	0.00	47,100 U	0.00
n-Heptane	142-82-5	847 R	0.00	280,000	16.67	197,000	6.89
n-Hexane	110-54-3	274 R	0.00	507,000	30.19	377,000	13.19
o-Xylene	95-47-6	4,140 R	0.00	113,000	6.73	98,400	3.44
Propylene	115-07-1	124 R	0.00	7,320 U	0.00	7,730 U	0.00
Styrene	100-42-5	308 R	0.00	7,250 U	0.00	7,650 U	0.00
Tetrachloroethene	127-18-4	98 R	0.00	5,770 U	0.00	6,090 U	0.00
Tetrahydrofuran	109-99-9	85 R	0.00	5,020 U	0.00	5,300 U	0.00
Toluene	108-88-3	352 R	0.00	117,000	6.97	80,500	2.82
trans-1,2-Dichloroethene	156-60-5	115 R	0.00	6,750 U	0.00	7,120 U	0.00
trans-1,3-Dichloropropene	10061-02-6	328 R	0.00	19,300 U	0.00	20,400 U	0.00
Trichloroethene	79-01-6	78 R	0.00	4,570 U	0.00	4,820 U	0.00
Trichlorofluoromethane	75-69-4	162 R	0.00	9,540 U	0.00	10,100 U	0.00
Vinyl acetate	108-05-4	102 R	0.00	5,990 U	0.00	6,320 U	0.00
Vinyl chloride	75-01-4	37 R	0.00	4,350 U	0.00	4,590 U	0.00
Total VOCs	--	--	0.00	--	165.48	--	74.17
Period Total VOC Mass Removed (lbs)		**0.0**		**165.5**		**74.2**	
Cumulative Total VOC Mass Removed (lbs)		**267**		**432**		**506**	

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-211216		CMR-SP301-220216		CMR-SP301-110309	
Sample Date		12/31/2021		2/16/2022		3/9/2022	
Blower Flow (scfm)		61		66		70	
Period Operational Time (hrs)		334		--		949	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	46,400 U	0.00	3 R	0.00	12,300 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	23,400 U	0.00	4 R	0.00	15,500 U	0.00
1,1,2-Trichloroethane	79-00-5	46,400 U	0.00	2 R	0.00	6,160 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	26,100 U	0.00	4 R	0.00	17,300 U	0.00
1,1-Dichloroethane	75-34-3	13,800 U	0.00	2 R	0.00	9,130 U	0.00
1,1-Dichloroethene	75-35-4	13,500 U	0.00	2 R	0.00	8,940 U	0.00
1,2,4-Trichlorobenzene	120-82-1	253,000 U	0.00	41 R	0.00	167,000 U	0.00
1,2,4-Trimethylbenzene	95-63-6	121,000	9.22	378 R	0.00	50,700	12.63
1,2-Dibromoethane (EDB)	106-93-4	26,200 U	0.00	2 R	0.00	8,670 U	0.00
1,2-Dichlorobenzene	95-50-1	51,200 U	0.00	8 R	0.00	34,000 U	0.00
1,2-Dichloroethane	107-06-2	13,800 U	0.00	2 R	0.00	9,130 U	0.00
1,2-Dichloropropane	78-87-5	39,300 U	0.00	3 R	0.00	10,400 U	0.00
1,3,5-Trimethylbenzene	108-67-8	75,900	5.79	218 R	0.00	43,300	10.79
1,3-Butadiene	106-99-0	7,530 U	0.00	1 R	0.00	4,990 U	0.00
1,3-Dichlorobenzene	541-73-1	51,200 U	0.00	8 R	0.00	34,000 U	0.00
1,4-Dichlorobenzene	106-46-7	102,000 U	0.00	8 R	0.00	34,000 U	0.00
2-Butanone (MEK)	78-93-3	50,200 U	0.00	16 R	0.00	33,300 U	0.00
2-Hexanone	591-78-6	69,600 U	0.00	11 R	0.00	46,200 U	0.00
2-Propanol	67-63-0	41,900 U	0.00	7 R	0.00	27,700 U	0.00
4-Ethyltoluene	622-96-8	51,900	3.96	41 R	0.00	32,200	8.02
4-Methyl-2-pentanone (MIBK)	108-10-1	69,600 U	0.00	11 R	0.00	46,200 U	0.00
Acetone	67-64-1	101,000 U	0.00	37 R	0.00	67,000 U	0.00
Benzene	71-43-2	150,000	11.44	4 R	0.00	195,000	48.57
Benzyl chloride	100-44-7	88,100 U	0.00	7 R	0.00	29,200 U	0.00
Bromodichloromethane	75-27-4	22,800 U	0.00	4 R	0.00	15,100 U	0.00
Bromoform	75-25-2	176,000 U	0.00	14 R	0.00	58,300 U	0.00
Bromomethane	74-83-9	13,200 U	0.00	2 R	0.00	8,760 U	0.00
Carbon disulfide	75-15-0	10,600 U	0.00	2 R	0.00	7,020 U	0.00
Carbon tetrachloride	56-23-5	21,400 U	0.00	4 R	0.00	14,200 U	0.00
Chlorobenzene	108-90-7	15,700 U	0.00	3 R	0.00	10,400 U	0.00
Chloroethane	75-00-3	8,970 U	0.00	2 R	0.00	5,950 U	0.00
Chloroform	67-66-3	8,300 U	0.00	1 R	0.00	5,500 U	0.00
Chloromethane	74-87-3	17,600 U	0.00	1 R	0.00	4,660 U	0.00
cis-1,2-Dichloroethene	156-59-2	13,500 U	0.00	2 R	0.00	8,940 U	0.00
cis-1,3-Dichloropropene	10061-01-5	38,700 U	0.00	6 R	0.00	25,600 U	0.00
Cyclohexane	110-82-7	29,300 U	0.00	5 R	0.00	19,400 U	0.00
Dibromochloromethane	124-48-1	29,000 U	0.00	5 R	0.00	19,200 U	0.00
Dichlorodifluoromethane	75-71-8	16,900 U	0.00	3 R	0.00	11,200 U	0.00
Dichlorotetrafluoroethane	76-14-2	23,800 U	0.00	4 R	0.00	15,800 U	0.00
Ethanol	64-17-5	32,100 U	0.00	8 R	0.00	21,300 U	0.00
Ethyl acetate	141-78-6	12,300 U	0.00	2 R	0.00	8,130 U	0.00
Ethylbenzene	100-41-4	151,000	11.51	29 R	0.00	256,000	63.76
Hexachloro-1,3-butadiene	87-68-3	90,700 U	0.00	15 R	0.00	60,100 U	0.00
m&p-Xylene	179601-23-1	783,000	59.70	186 R	0.00	1,010,000	251.57
Methylene Chloride	75-09-2	59,100 U	0.00	10 R	0.00	39,200 U	0.00
Methyl-tert-butyl ether	1634-04-4	61,300 U	0.00	10 R	0.00	40,600 U	0.00
Naphthalene	91-20-3	44,500 U	0.00	15 R	0.00	29,500 U	0.00
n-Heptane	142-82-5	336,000	25.62	19 R	0.00	441,000	109.84
n-Hexane	110-54-3	575,000	43.84	12 R	0.00	819,000	204.00
o-Xylene	95-47-6	236,000	17.99	148 R	0.00	263,000	65.51
Propylene	115-07-1	14,600 U	0.00	2 R	0.00	9,710 U	0.00
Styrene	100-42-5	14,500 U	0.00	6 R	0.00	9,610 U	0.00
Tetrachloroethene	127-18-4	11,500 U	0.00	2 R	0.00	7,650 U	0.00
Tetrahydrofuran	109-99-9	10,000 U	0.00	132 R	0.00	6,660 U	0.00
Toluene	108-88-3	140,000	10.67	13 R	0.00	210,000	52.31
trans-1,2-Dichloroethene	156-60-5	33,700 U	0.00	2 R	0.00	8,940 U	0.00
trans-1,3-Dichloropropene	10061-02-6	38,700 U	0.00	6 R	0.00	25,600 U	0.00
Trichloroethene	79-01-6	18,300 U	0.00	2 R	0.00	6,060 U	0.00
Trichlorofluoromethane	75-69-4	19,100 U	0.00	3 R	0.00	12,700 U	0.00
Vinyl acetate	108-05-4	12,000 U	0.00	2 R	0.00	7,950 U	0.00
Vinyl chloride	75-01-4	21,700 U	0.00	1 R	0.00	2,890 U	0.00
Total VOCs	--	--	199.73	--	0.00	--	826.99
Period Total VOC Mass Removed (lbs)		**199.7**		**0.0**		**827.0**	
Cumulative Total VOC Mass Removed (lbs)		**706**		**706**		**1,533**	

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-2022411		CMR-SP301-220511		CMR-SP301-220617	
Sample Date		4/11/2022		5/11/2022		6/17/2022	
Blower Flow (scfm)		102		128		172	
Period Operational Time (hrs)		632		742		517	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	1,680 U	0.00	6,520 U	0.00	13,000 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	2,120 U	0.00	8,230 U	0.00	16,500 U	0.00
1,1,2-Trichloroethane	79-00-5	842 U	0.00	3,260 U	0.00	6,520 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	2,370 U	0.00	9,170 U	0.00	18,300 U	0.00
1,1-Dichloroethane	75-34-3	1,250 U	0.00	4,840 U	0.00	9,670 U	0.00
1,1-Dichloroethene	75-35-4	1,220 U	0.00	4,740 U	0.00	9,470 U	0.00
1,2,4-Trichlorobenzene	120-82-1	11,400 U	0.00	44,300 U	0.00	88,600 U	0.00
1,2,4-Trimethylbenzene	95-63-6	2,310	0.56	9,770	3.48	68,600	22.79
1,2-Dibromoethane (EDB)	106-93-4	1,180 U	0.00	4,590 U	0.00	9,180 U	0.00
1,2-Dichlorobenzene	95-50-1	4,640 U	0.00	18,000 U	0.00	36,000 U	0.00
1,2-Dichloroethane	107-06-2	1,250 U	0.00	4,840 U	0.00	9,670 U	0.00
1,2-Dichloropropane	78-87-5	1,420 U	0.00	5,520 U	0.00	11,000 U	0.00
1,3,5-Trimethylbenzene	108-67-8	2,090	0.50	10,000	3.56	55,200	18.34
1,3-Butadiene	106-99-0	683 U	0.00	2,640 U	0.00	5,290 U	0.00
1,3-Dichlorobenzene	541-73-1	4,640 U	0.00	18,000 U	0.00	36,000 U	0.00
1,4-Dichlorobenzene	106-46-7	4,640 U	0.00	18,000 U	0.00	36,000 U	0.00
2-Butanone (MEK)	78-93-3	4,550 U	0.00	17,600 U	0.00	35,300 U	0.00
2-Hexanone	591-78-6	6,310 U	0.00	24,400 U	0.00	48,900 U	0.00
2-Propanol	67-63-0	3,790 U	0.00	14,700 U	0.00	29,400 U	0.00
4-Ethyltoluene	622-96-8	3,790 U	0.00	14,700 U	0.00	29,400 U	0.00
4-Methyl-2-pentanone (MIBK)	108-10-1	6,310 U	0.00	24,400 U	0.00	48,900 U	0.00
Acetone	67-64-1	9,160 U	0.00	35,500 U	0.00	71,000 U	0.00
Benzene	71-43-2	36,400	8.77	114,000	40.58	50,200	16.68
Benzyl chloride	100-44-7	3,990 U	0.00	15,500 U	0.00	30,900 U	0.00
Bromodichloromethane	75-27-4	2,060 U	0.00	7,990 U	0.00	16,000 U	0.00
Bromoform	75-25-2	7,960 U	0.00	30,800 U	0.00	61,700 U	0.00
Bromomethane	74-83-9	1,200 U	0.00	4,640 U	0.00	9,270 U	0.00
Carbon disulfide	75-15-0	960 U	0.00	3,720 U	0.00	7,440 U	0.00
Carbon tetrachloride	56-23-5	1,940 U	0.00	7,520 U	0.00	15,000 U	0.00
Chlorobenzene	108-90-7	1,420 U	0.00	5,500 U	0.00	11,000 U	0.00
Chloroethane	75-00-3	813 U	0.00	7,880 U	0.00	6,300 U	0.00
Chloroform	67-66-3	752 U	0.00	2,910 U	0.00	5,830 U	0.00
Chloromethane	74-87-3	637 U	0.00	2,470 U	0.00	4,940 U	0.00
cis-1,2-Dichloroethene	156-59-2	1,220 U	0.00	4,740 U	0.00	9,470 U	0.00
cis-1,3-Dichloropropene	10061-01-5	3,500 U	0.00	13,600 U	0.00	27,100 U	0.00
Cyclohexane	110-82-7	2,650 U	0.00	10,300 U	0.00	20,600 U	0.00
Dibromochloromethane	124-48-1	2,620 U	0.00	10,200 U	0.00	20,300 U	0.00
Dichlorodifluoromethane	75-71-8	1,530 U	0.00	5,930 U	0.00	11,900 U	0.00
Dichlorotetrafluoroethane	76-14-2	2,150 U	0.00	8,340 U	0.00	16,700 U	0.00
Ethanol	64-17-5	2,910 U	0.00	11,300 U	0.00	22,600 U	0.00
Ethyl acetate	141-78-6	1,110 U	0.00	4,310 U	0.00	8,610 U	0.00
Ethylbenzene	100-41-4	19,400	4.68	59,700	21.25	45,800	15.22
Hexachloro-1,3-butadiene	87-68-3	8,220 U	0.00	31,800 U	0.00	63,700 U	0.00
m&p-Xylene	179601-23-1	75,500	18.20	262,000	93.25	380,000	126.25
Methylene Chloride	75-09-2	5,350 U	0.00	20,700 U	0.00	41,500 U	0.00
Methyl-tert-butyl ether	1634-04-4	5,550 U	0.00	21,500 U	0.00	43,000 U	0.00
Naphthalene	91-20-3	4,030 U	0.00	15,600 U	0.00	31,300 U	0.00
n-Heptane	142-82-5	66,900	16.12	292,000	103.93	157,000	52.16
n-Hexane	110-54-3	190,000	45.79	587,000	208.93	300,000	99.67
o-Xylene	95-47-6	16,700	4.02	58,000	20.64	126,000	41.86
Propylene	115-07-1	1,330 U	0.00	5,140 U	0.00	10,300 U	0.00
Styrene	100-42-5	1,310 U	0.00	5,090 U	0.00	10,200 U	0.00
Tetrachloroethene	127-18-4	1,050 U	0.00	4,050 U	0.00	13,000	4.32
Tetrahydrofuran	109-99-9	910 U	0.00	3,530 U	0.00	7,050 U	0.00
Toluene	108-88-3	22,200	5.35	57,000	20.29	43,200	14.35
trans-1,2-Dichloroethene	156-60-5	1,220 U	0.00	4,740 U	0.00	9,470 U	0.00
trans-1,3-Dichloropropene	10061-02-6	3,500 U	0.00	13,600 U	0.00	27,100 U	0.00
Trichloroethene	79-01-6	828 U	0.00	3,210 U	0.00	6,420 U	0.00
Trichlorofluoromethane	75-69-4	1,730 U	0.00	6,700 U	0.00	13,400 U	0.00
Vinyl acetate	108-05-4	1,090 U	0.00	4,210 U	0.00	8,410 U	0.00
Vinyl chloride	75-01-4	394 U	0.00	3,060 U	0.00	3,060 U	0.00
Total VOCs	--	--	103.99	--	515.90	--	411.66
Period Total VOC Mass Removed (lbs)		**104.0**		**515.9**		**411.7**	
Cumulative Total VOC Mass Removed (lbs)		**1,637**		**2,153**		**2,565**	

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-220727		CMR-SP301-083122		CMR-SP301-083122	
Sample Date		7/27/2022		8/31/2022		9/30/2022[4]	
Blower Flow (scfm)		155		37		76	
Period Operational Time (hrs)		715		506		720	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	1,490 U	0.00	10,700 U	0.00	10,700 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	1,880 U	0.00	13,500 U	0.00	13,500 U	0.00
1,1,2-Trichloroethane	79-00-5	746 U	0.00	5,370 U	0.00	5,370 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	2,100 U	0.00	15,100 U	0.00	15,100 U	0.00
1,1-Dichloroethane	75-34-3	1,110 U	0.00	7,960 U	0.00	7,960 U	0.00
1,1-Dichloroethene	75-35-4	1,080 U	0.00	7,800 U	0.00	7,800 U	0.00
1,2,4-Trichlorobenzene	120-82-1	10,100 U	0.00	73,000 U	0.00	73,000 U	0.00
1,2,4-Trimethylbenzene	95-63-6	3,710	1.54	9,670 U	0.00	9,670 U	0.00
1,2-Dibromoethane (EDB)	106-93-4	1,050 U	0.00	7,560 U	0.00	7,560 U	0.00
1,2-Dichlorobenzene	95-50-1	4,110 U	0.00	29,600 U	0.00	29,600 U	0.00
1,2-Dichloroethane	107-06-2	1,110 U	0.00	7,960 U	0.00	7,960 U	0.00
1,2-Dichloropropane	78-87-5	1,260 U	0.00	9,090 U	0.00	9,090 U	0.00
1,3,5-Trimethylbenzene	108-67-8	2,610	1.08	10,100	0.71	10,100	2.08
1,3-Butadiene	106-99-0	605 U	0.00	4,350 U	0.00	4,350 U	0.00
1,3-Dichlorobenzene	541-73-1	4,110 U	0.00	29,600 U	0.00	29,600 U	0.00
1,4-Dichlorobenzene	106-46-7	4,110 U	0.00	29,600 U	0.00	29,600 U	0.00
2-Butanone (MEK)	78-93-3	4,030 U	0.00	29,000 U	0.00	29,000 U	0.00
2-Hexanone	591-78-6	5,590 U	0.00	40,300 U	0.00	40,300 U	0.00
2-Propanol	67-63-0	3,360 U	0.00	24,200 U	0.00	24,200 U	0.00
4-Ethyltoluene	622-96-8	3,360 U	0.00	24,200 U	0.00	24,200 U	0.00
4-Methyl-2-pentanone (MIBK)	108-10-1	5,590 U	0.00	40,300 U	0.00	40,300 U	0.00
Acetone	67-64-1	8,120 U	0.00	58,400 U	0.00	58,400 U	0.00
Benzene	71-43-2	3,710	1.54	42,900	3.02	42,900	8.84
Benzyl chloride	100-44-7	3,530 U	0.00	25,400 U	0.00	25,400 U	0.00
Bromodichloromethane	75-27-4	1,830 U	0.00	13,200 U	0.00	13,200 U	0.00
Bromoform	75-25-2	7,060 U	0.00	50,800 U	0.00	50,800 U	0.00
Bromomethane	74-83-9	1,060 U	0.00	7,630 U	0.00	7,630 U	0.00
Carbon disulfide	75-15-0	851 U	0.00	6,130 U	0.00	6,130 U	0.00
Carbon tetrachloride	56-23-5	1,720 U	0.00	12,400 U	0.00	12,400 U	0.00
Chlorobenzene	108-90-7	1,260 U	0.00	9,060 U	0.00	9,060 U	0.00
Chloroethane	75-00-3	720 U	0.00	5,190 U	0.00	5,190 U	0.00
Chloroform	67-66-3	667 U	0.00	4,800 U	0.00	4,800 U	0.00
Chloromethane	74-87-3	564 U	0.00	4,060 U	0.00	4,060 U	0.00
cis-1,2-Dichloroethene	156-59-2	1,080 U	0.00	7,800 U	0.00	7,800 U	0.00
cis-1,3-Dichloropropene	10061-01-5	3,100 U	0.00	22,400 U	0.00	22,400 U	0.00
Cyclohexane	110-82-7	2,350 U	0.00	16,900 U	0.00	16,900 U	0.00
Dibromochloromethane	124-48-1	2,330 U	0.00	16,700 U	0.00	16,700 U	0.00
Dichlorodifluoromethane	75-71-8	1,360 U	0.00	9,770 U	0.00	9,770 U	0.00
Dichlorotetrafluoroethane	76-14-2	1,910 U	0.00	13,700 U	0.00	13,700 U	0.00
Ethanol	64-17-5	2,580 U	0.00	18,600 U	0.00	18,600 U	0.00
Ethyl acetate	141-78-6	985 U	0.00	7,090 U	0.00	7,090 U	0.00
Ethylbenzene	100-41-4	4,890	2.03	24,000	1.69	24,000	4.94
Hexachloro-1,3-butadiene	87-68-3	7,280 U	0.00	52,400 U	0.00	52,400 U	0.00
m&p-Xylene	179601-23-1	27,600	11.44	161,000	11.33	161,000	33.17
Methylene Chloride	75-09-2	4,740 U	0.00	34,200 U	0.00	34,200 U	0.00
Methyl-tert-butyl ether	1634-04-4	4,920 U	0.00	35,400 U	0.00	35,400 U	0.00
Naphthalene	91-20-3	4,490	1.86	25,700 U	0.00	25,700 U	0.00
n-Heptane	142-82-5	12,200	5.06	122,000	8.58	122,000	25.14
n-Hexane	110-54-3	22,000	9.12	209,000	14.70	209,000	43.06
o-Xylene	95-47-6	9,100	3.77	31,500	2.22	31,500	6.49
Propylene	115-07-1	1,180 U	0.00	8,470 U	0.00	8,470 U	0.00
Styrene	100-42-5	1,160 U	0.00	8,380 U	0.00	8,380 U	0.00
Tetrachloroethene	127-18-4	926 U	0.00	6,670 U	0.00	6,670 U	0.00
Tetrahydrofuran	109-99-9	806 U	0.00	5,810 U	0.00	5,810 U	0.00
Toluene	108-88-3	7,740	3.21	7,410 U	0.00	7,410 U	0.00
trans-1,2-Dichloroethene	156-60-5	1,080 U	0.00	7,800 U	0.00	7,800 U	0.00
trans-1,3-Dichloropropene	10061-02-6	3,100 U	0.00	22,400 U	0.00	22,400 U	0.00
Trichloroethene	79-01-6	734 U	0.00	5,280 U	0.00	5,280 U	0.00
Trichlorofluoromethane	75-69-4	1,530 U	0.00	11,000 U	0.00	11,000 U	0.00
Vinyl acetate	108-05-4	2,400 U	0.00	17,300 U	0.00	17,300 U	0.00
Vinyl chloride	75-01-4	349 U	0.00	2,520 U	0.00	2,520 U	0.00
Total VOCs	--	--	40.64	--	42.25	--	123.72
Period Total VOC Mass Removed (lbs)		**40.6**		**42.2**		**123.7**	
Cumulative Total VOC Mass Removed (lbs)		**2,605**		**2,648**		**2,771**	

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301		SP301
Ramboll Sample ID		CMR-SP301-221214		CMR-SP301-221214		CMR-SP301-221214		CMR-DS3-221214
Sample Date		10/31/2022		11/30/2022		12/14/2022		12/14/2022
Blower Flow (scfm)		22		11		88		--
Period Operational Time (hrs)		75		20		469		--
Notes								Field Duplicate
VOCs	CAS No.	Result (ug/m^3)	Mass (lb)	Result (ug/m^3)	Mass (lb)	Result (ug/m^3)	Mass (lb)	Result (ug/m^3)
1,1,1-Trichloroethane	71-55-6	4,310 U	0.00	4,310 U	0.00	4,310 U	0.00	2,810 U
1,1,2,2-Tetrachloroethane	79-34-5	5,430 U	0.00	5,430 U	0.00	5,430 U	0.00	3,550 U
1,1,2-Trichloroethane	79-00-5	2,150 U	0.00	2,150 U	0.00	2,150 U	0.00	1,410 U
1,1,2-Trichlorotrifluoroethane	76-13-1	6,050 U	0.00	6,050 U	0.00	6,050 U	0.00	3,960 U
1,1-Dichloroethane	75-34-3	3,190 U	0.00	3,190 U	0.00	3,190 U	0.00	2,090 U
1,1-Dichloroethene	75-35-4	3,130 U	0.00	3,130 U	0.00	3,130 U	0.00	2,040 U
1,2,4-Trichlorobenzene	120-82-1	29,200 U	0.00	29,200 U	0.00	29,200 U	0.00	19,100 U
1,2,4-Trimethylbenzene	95-63-6	5,870	0.04	5,870	0.00	5,870	0.90	3,400
1,2-Dibromoethane (EDB)	106-93-4	3,030 U	0.00	3,030 U	0.00	3,030 U	0.00	1,980 U
1,2-Dichlorobenzene	95-50-1	11,900 U	0.00	11,900 U	0.00	11,900 U	0.00	7,760 U
1,2-Dichloroethane	107-06-2	3,190 U	0.00	3,190 U	0.00	3,190 U	0.00	2,090 U
1,2-Dichloropropane	78-87-5	3,640 U	0.00	3,640 U	0.00	3,640 U	0.00	2,380 U
1,3,5-Trimethylbenzene	108-67-8	5,060	0.03	5,060	0.00	5,060	0.78	3,240
1,3-Butadiene	106-99-0	1,750 U	0.00	1,750 U	0.00	1,750 U	0.00	1,140 U
1,3-Dichlorobenzene	541-73-1	11,900 U	0.00	11,900 U	0.00	11,900 U	0.00	7,760 U
1,4-Dichlorobenzene	106-46-7	11,900 U	0.00	11,900 U	0.00	11,900 U	0.00	7,760 U
2-Butanone (MEK)	78-93-3	11,600 U	0.00	11,600 U	0.00	11,600 U	0.00	7,610 U
2-Hexanone	591-78-6	16,100 U	0.00	16,100 U	0.00	16,100 U	0.00	10,500 U
2-Propanol	67-63-0	9,700 U	0.00	9,700 U	0.00	9,700 U	0.00	6,340 U
4-Ethyltoluene	622-96-8	9,700 U	0.00	9,700 U	0.00	9,700 U	0.00	6,340 U
4-Methyl-2-pentanone (MIBK)	108-10-1	16,100 U	0.00	16,100 U	0.00	16,100 U	0.00	10,500 U
Acetone	67-64-1	23,400 U	0.00	23,400 U	0.00	23,400 U	0.00	15,300 U
Benzene	71-43-2	59,900	0.37	59,900	0.05	59,900	9.21	49,100
Benzyl chloride	100-44-7	10,200 U	0.00	10,200 U	0.00	10,200 U	0.00	6,670 U
Bromodichloromethane	75-27-4	5,270 U	0.00	5,270 U	0.00	5,270 U	0.00	3,450 U
Bromoform	75-25-2	20,400 U	0.00	20,400 U	0.00	20,400 U	0.00	13,300 U
Bromomethane	74-83-9	3,060 U	0.00	3,060 U	0.00	3,060 U	0.00	2,000 U
Carbon disulfide	75-15-0	2,460 U	0.00	2,460 U	0.00	2,460 U	0.00	1,610 U
Carbon tetrachloride	56-23-5	4,960 U	0.00	4,960 U	0.00	4,960 U	0.00	3,250 U
Chlorobenzene	108-90-7	3,630 U	0.00	3,630 U	0.00	3,630 U	0.00	2,370 U
Chloroethane	75-00-3	2,080 U	0.00	2,080 U	0.00	2,080 U	0.00	1,360 U
Chloroform	67-66-3	1,920 U	0.00	1,920 U	0.00	1,920 U	0.00	1,260 U
Chloromethane	74-87-3	1,630 U	0.00	1,630 U	0.00	1,630 U	0.00	1,070 U
cis-1,2-Dichloroethene	156-59-2	3,130 U	0.00	3,130 U	0.00	3,130 U	0.00	2,040 U
cis-1,3-Dichloropropene	10061-01-5	8,960 U	0.00	8,960 U	0.00	8,960 U	0.00	5,860 U
Cyclohexane	110-82-7	6,790 U	0.00	6,790 U	0.00	6,790 U	0.00	4,440 U
Dibromochloromethane	124-48-1	6,710 U	0.00	6,710 U	0.00	6,710 U	0.00	4,390 U
Dichlorodifluoromethane	75-71-8	3,920 U	0.00	3,920 U	0.00	3,920 U	0.00	2,560 U
Dichlorotetrafluoroethane	76-14-2	5,510 U	0.00	5,510 U	0.00	5,510 U	0.00	3,600 U
Ethanol	64-17-5	7,450 U	0.00	7,450 U	0.00	7,450 U	0.00	4,870 U
Ethyl acetate	141-78-6	2,840 U	0.00	2,840 U	0.00	2,840 U	0.00	1,860 U
Ethylbenzene	100-41-4	25,000	0.16	25,000	0.02	25,000	3.85	22,400
Hexachloro-1,3-butadiene	87-68-3	21,000 U	0.00	21,000 U	0.00	21,000 U	0.00	13,700 U
m&p-Xylene	179601-23-1	83,500	0.52	83,500	0.07	83,500	12.84	73,500
Methylene Chloride	75-09-2	13,700 U	0.00	13,700 U	0.00	13,700 U	0.00	8,950 U
Methyl-tert-butyl ether	1634-04-4	14,200 U	0.00	14,200 U	0.00	14,200 U	0.00	9,280 U
Naphthalene	91-20-3	10,300 U	0.00	10,300 U	0.00	10,300 U	0.00	6,750 U
n-Heptane	142-82-5	138,000	0.86	138,000	0.11	138,000	21.23	115,000
n-Hexane	110-54-3	209,000	1.30	209,000	0.17	209,000	32.15	169,000
o-Xylene	95-47-6	15,000	0.09	15,000	0.01	15,000	2.31	13,400
Propylene	115-07-1	3,390 U	0.00	3,390 U	0.00	3,390 U	0.00	2,220 U
Styrene	100-42-5	3,360 U	0.00	3,360 U	0.00	3,360 U	0.00	2,200 U
Tetrachloroethene	127-18-4	2,670 U	0.00	2,670 U	0.00	2,670 U	0.00	1,750 U
Tetrahydrofuran	109-99-9	2,330 U	0.00	2,330 U	0.00	2,330 U	0.00	1,520 U
Toluene	108-88-3	3,580	0.02	3,580	0.00	3,580	0.55	3,140
trans-1,2-Dichloroethene	156-60-5	3,130 U	0.00	3,130 U	0.00	3,130 U	0.00	2,040 U
trans-1,3-Dichloropropene	10061-02-6	8,960 U	0.00	8,960 U	0.00	8,960 U	0.00	5,860 U
Trichloroethene	79-01-6	2,120 U	0.00	2,120 U	0.00	2,120 U	0.00	1,380 U
Trichlorofluoromethane	75-69-4	4,420 U	0.00	4,420 U	0.00	4,420 U	0.00	2,890 U
Vinyl acetate	108-05-4	2,780 U	0.00	2,780 U	0.00	2,780 U	0.00	1,820 U
Vinyl chloride	75-01-4	1,010 U	0.00	1,010 U	0.00	1,010 U	0.00	659 U
Total VOCs	--	--	3.40	--	0.45	--	83.81	--
Period Total VOC Mass Removed (lbs)		**3.4**		**0.4**		**83.8**		**--**
Cumulative Total VOC Mass Removed (lbs)		**2,775**		**2,775**		**2,859**		**--**

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-230130		CMR-SP301-230228		CMR-SP301-230321	
Sample Date		1/30/2023		2/28/2023		3/21/2023	
Blower Flow (scfm)		44		105		147	
Period Operational Time (hrs)		703		534		734	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	78 U	0.00	1,340 U	0.00	1 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	99 U	0.00	1,690 U	0.00	1 U	0.00
1,1,2-Trichloroethane	79-00-5	39 U	0.00	671 U	0.00	1 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	110 U	0.00	1,890 U	0.00	2 U	0.00
1,1-Dichloroethane	75-34-3	58 U	0.00	996 U	0.00	1 U	0.00
1,1-Dichloroethene	75-35-4	57 U	0.00	975 U	0.00	1 U	0.00
1,2,4-Trichlorobenzene	120-82-1	532 U	0.00	9,120 U	0.00	5 U	0.00
1,2,4-Trimethylbenzene	95-63-6	114	0.01	1,210 U	0.00	491 U	0.00
1,2-Dibromoethane (EDB)	106-93-4	55 U	0.00	945 U	0.00	2 U	0.00
1,2-Dichlorobenzene	95-50-1	216 U	0.00	3,700 U	0.00	1 U	0.00
1,2-Dichloroethane	107-06-2	58 U	0.00	996 U	0.00	1 U	0.00
1,2-Dichloropropane	78-87-5	66 U	0.00	1,140 U	0.00	1 U	0.00
1,3,5-Trimethylbenzene	108-67-8	144	0.02	1,210 U	0.00	388	0.16
1,3-Butadiene	106-99-0	32 U	0.00	544 U	0.00	4 U	0.00
1,3-Dichlorobenzene	541-73-1	216 U	0.00	3,700 U	0.00	1 U	0.00
1,4-Dichlorobenzene	106-46-7	216 U	0.00	3,700 U	0.00	1 U	0.00
2-Butanone (MEK)	78-93-3	212 U	0.00	3,630 U	0.00	4 U	0.00
2-Hexanone	591-78-6	293 U	0.00	5,030 U	0.00	5 U	0.00
2-Propanol	67-63-0	176 U	0.00	3,020 U	0.00	7	0.00
4-Ethyltoluene	622-96-8	176 U	0.00	3,020 U	0.00	205	0.08
4-Methyl-2-pentanone (MIBK)	108-10-1	293 U	0.00	5,030 U	0.00	5 U	0.00
Acetone	67-64-1	426 U	0.00	7,310 U	0.00	33	0.01
Benzene	71-43-2	884	0.10	1,120	0.24	303	0.12
Benzyl chloride	100-44-7	185 U	0.00	3,180 U	0.00	1 U	0.00
Bromodichloromethane	75-27-4	96 U	0.00	1,650 U	0.00	1 U	0.00
Bromoform	75-25-2	370 U	0.00	6,350 U	0.00	6 U	0.00
Bromomethane	74-83-9	56 U	0.00	954 U	0.00	1 U	0.00
Carbon disulfide	75-15-0	45 U	0.00	766 U	0.00	12	0.00
Carbon tetrachloride	56-23-5	90 U	0.00	1,550 U	0.00	1 U	0.00
Chlorobenzene	108-90-7	66 U	0.00	1,130 U	0.00	1 U	0.00
Chloroethane	75-00-3	38 U	0.00	648 U	0.00	1 U	0.00
Chloroform	67-66-3	35 U	0.00	600 U	0.00	1 U	0.00
Chloromethane	74-87-3	30 U	0.00	508 U	0.00	0 U	0.00
cis-1,2-Dichloroethene	156-59-2	57 U	0.00	975 U	0.00	1 U	0.00
cis-1,3-Dichloropropene	10061-01-5	163 U	0.00	2,790 U	0.00	1 U	0.00
Cyclohexane	110-82-7	123 U	0.00	2,120 U	0.00	8,020	3.24
Dibromochloromethane	124-48-1	122 U	0.00	2,090 U	0.00	2 U	0.00
Dichlorodifluoromethane	75-71-8	71 U	0.00	1,220 U	0.00	2	0.00
Dichlorotetrafluoroethane	76-14-2	100 U	0.00	1,720 U	0.00	1 U	0.00
Ethanol	64-17-5	212	0.02	2,320 U	0.00	35	0.01
Ethyl acetate	141-78-6	52 U	0.00	887 U	0.00	-- --	--
Ethylbenzene	100-41-4	566	0.07	1,070 U	0.00	1,040	0.42
Hexachloro-1,3-butadiene	87-68-3	382 U	0.00	6,560 U	0.00	7 U	0.00
m&p-Xylene	179601-23-1	4,970	0.57	2,140 U	0.00	-- --	--
Methylene Chloride	75-09-2	249 U	0.00	4,270 U	0.00	1 U	0.00
Methyl-tert-butyl ether	1634-04-4	258 U	0.00	4,430 U	0.00	1 U	0.00
Naphthalene	91-20-3	188 U	0.00	3,220 U	0.00	3 U	0.00
n-Heptane	142-82-5	1,780	0.21	2,700	0.57	3,590	1.45
n-Hexane	110-54-3	1,410	0.16	8,780	1.85	16,600	6.70
o-Xylene	95-47-6	1,220	0.14	1,070 U	0.00	958	0.39
Propylene	115-07-1	62 U	0.00	1,060 U	0.00	2 U	0.00
Styrene	100-42-5	61 U	0.00	1,050 U	0.00	1 U	0.00
Tetrachloroethene	127-18-4	49 U	0.00	833 U	0.00	1 U	0.00
Tetrahydrofuran	109-99-9	42 U	0.00	726 U	0.00	1 U	0.00
Toluene	108-88-3	656	0.08	927 U	0.00	942 U	0.00
trans-1,2-Dichloroethene	156-60-5	57 U	0.00	975 U	0.00	1 U	0.00
trans-1,3-Dichloropropene	10061-02-6	163 U	0.00	2,790 U	0.00	1 U	0.00
Trichloroethene	79-01-6	39 U	0.00	660 U	0.00	1 U	0.00
Trichlorofluoromethane	75-69-4	80 U	0.00	1,380 U	0.00	1 U	0.00
Vinyl acetate	108-05-4	51 U	0.00	866 U	0.00	1 U	0.00
Vinyl chloride	75-01-4	18 U	0.00	314 U	0.00	1 U	0.00
Total VOCs	--	--	1.38	--	2.65	--	12.59
Period Total VOC Mass Removed (lbs)		**1.4**		**2.7**		**12.6**	
Cumulative Total VOC Mass Removed (lbs)		**2,860**		**2,863**		**2,876**	

Appendix B
Historical Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP301		SP301		SP301	
Ramboll Sample ID		CMR-SP301-230531		CMR-SP301-230531		CMR-SP301-290623	
Sample Date		4/30/2023		5/31/2023		6/29/2023	
Blower Flow (scfm)		81		75		70	
Period Operational Time (hrs)		533		510		449	
Notes							
VOCs	**CAS No.**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**	**Result (ug/m^3)**	**Mass (lb)**
1,1,1-Trichloroethane	71-55-6	1 U	0.00	1 U	0.00	1 U	0.00
1,1,2,2-Tetrachloroethane	79-34-5	275 U	0.00	275 U	0.00	1 U	0.00
1,1,2-Trichloroethane	79-00-5	1 U	0.00	1 U	0.00	1 U	0.00
1,1,2-Trichlorotrifluoroethane	76-13-1	2 U	0.00	2 U	0.00	2 U	0.00
1,1-Dichloroethane	75-34-3	1 U	0.00	1 U	0.00	1 U	0.00
1,1-Dichloroethene	75-35-4	1 U	0.00	1 U	0.00	1 U	0.00
1,2,4-Trichlorobenzene	120-82-1	933 U	0.00	933 U	0.00	5 U	0.00
1,2,4-Trimethylbenzene	95-63-6	196 U	0.00	196 U	0.00	4	0.00
1,2-Dibromoethane (EDB)	106-93-4	2 U	0.00	2 U	0.00	2 U	0.00
1,2-Dichlorobenzene	95-50-1	240 U	0.00	240 U	0.00	1 U	0.00
1,2-Dichloroethane	107-06-2	1 U	0.00	1 U	0.00	1 U	0.00
1,2-Dichloropropane	78-87-5	1 U	0.00	1 U	0.00	1 U	0.00
1,3,5-Trimethylbenzene	108-67-8	196 U	0.00	196 U	0.00	2	0.00
1,3-Butadiene	106-99-0	4 U	0.00	4 U	0.00	4 U	0.00
1,3-Dichlorobenzene	541-73-1	240 U	0.00	240 U	0.00	1 U	0.00
1,4-Dichlorobenzene	106-46-7	240 U	0.00	240 U	0.00	1 U	0.00
2-Butanone (MEK)	78-93-3	22	0.00	22	0.00	4 U	0.00
2-Hexanone	591-78-6	5 U	0.00	5 U	0.00	5 U	0.00
2-Propanol	67-63-0	13	0.00	13	0.00	3 U	0.00
4-Ethyltoluene	622-96-8	196 U	0.00	196 U	0.00	1 U	0.00
4-Methyl-2-pentanone (MIBK)	108-10-1	5 U	0.00	5 U	0.00	5 U	0.00
Acetone	67-64-1	3 U	0.00	3 U	0.00	3 U	0.00
Benzene	71-43-2	206	0.03	206	0.03	1 U	0.00
Benzyl chloride	100-44-7	208 U	0.00	208 U	0.00	1 U	0.00
Bromodichloromethane	75-27-4	1 U	0.00	1 U	0.00	1 U	0.00
Bromoform	75-25-2	1,240 U	0.00	1,240 U	0.00	6 U	0.00
Bromomethane	74-83-9	1 U	0.00	1 U	0.00	1 U	0.00
Carbon disulfide	75-15-0	6	0.00	6	0.00	1 U	0.00
Carbon tetrachloride	56-23-5	1 U	0.00	1 U	0.00	1 U	0.00
Chlorobenzene	108-90-7	1 U	0.00	1 U	0.00	1 U	0.00
Chloroethane	75-00-3	1 U	0.00	1 U	0.00	1 U	0.00
Chloroform	67-66-3	1 U	0.00	1 U	0.00	1 U	0.00
Chloromethane	74-87-3	0 U	0.00	0 U	0.00	1	0.00
cis-1,2-Dichloroethene	156-59-2	1 U	0.00	1 U	0.00	1 U	0.00
cis-1,3-Dichloropropene	10061-01-5	1 U	0.00	1 U	0.00	1 U	0.00
Cyclohexane	110-82-7	278	0.05	278	0.04	3,120	0.37
Dibromochloromethane	124-48-1	2 U	0.00	2 U	0.00	2 U	0.00
Dichlorodifluoromethane	75-71-8	3	0.00	3	0.00	2	0.00
Dichlorotetrafluoroethane	76-14-2	1 U	0.00	1 U	0.00	1 U	0.00
Ethanol	64-17-5	60	0.01	60	0.01	13	0.00
Ethyl acetate	141-78-6	-- --	--	-- --	--	-- --	--
Ethylbenzene	100-41-4	173 U	0.00	173 U	0.00	160	0.02
Hexachloro-1,3-butadiene	87-68-3	1,350 U	0.00	1,350 U	0.00	7 U	0.00
m&p-Xylene	179601-23-1	642	0.10	642	0.09	221	0.03
Methylene Chloride	75-09-2	1 U	0.00	1 U	0.00	1 U	0.00
Methyl-tert-butyl ether	1634-04-4	1 U	0.00	1 U	0.00	1 U	0.00
Naphthalene	91-20-3	660 U	0.00	660 U	0.00	3 U	0.00
n-Heptane	142-82-5	11,700	1.90	11,700	1.67	2,920	0.34
n-Hexane	110-54-3	1,700	0.28	1,700	0.24	9,270	1.09
o-Xylene	95-47-6	189	0.03	189	0.03	46	0.01
Propylene	115-07-1	27	0.00	27	0.00	15	0.00
Styrene	100-42-5	170 U	0.00	170 U	0.00	1 U	0.00
Tetrachloroethene	127-18-4	4	0.00	4	0.00	1 U	0.00
Tetrahydrofuran	109-99-9	1 U	0.00	1 U	0.00	1 U	0.00
Toluene	108-88-3	146	0.02	146	0.02	159	0.02
trans-1,2-Dichloroethene	156-60-5	1 U	0.00	1 U	0.00	1 U	0.00
trans-1,3-Dichloropropene	10061-02-6	1 U	0.00	1 U	0.00	1 U	0.00
Trichloroethene	79-01-6	1 U	0.00	1 U	0.00	1 U	0.00
Trichlorofluoromethane	75-69-4	1	0.00	1	0.00	1	0.00
Vinyl acetate	108-05-4	1 U	0.00	1 U	0.00	1 U	0.00
Vinyl chloride	75-01-4	1 U	0.00	1 U	0.00	1 U	0.00
Total VOCs	--	--	2.43	--	2.14	--	1.87
Period Total VOC Mass Removed (lbs)		**2.4**		**2.1**		**1.9**	
Cumulative Total VOC Mass Removed (lbs)		**2,878**		**2,880**		**2,882**	

Appendix B
Summary of Analytical Results and Contaminant Mass Removal - Vapor
Calumet Montana Refining, LLC - Great Falls, Montana

1. Blower flowrate is continuously recorded by the system PLC. Average blower flowrate during the period is used for the calculations
2. Operational time during system start-up and comissioning (October, 2021 through December 2021) is the number of hours the system operated between each sampling event. Opertational time during the standard system opration (beginning January 2022) represents system runtime (in hour) for the month during with the sample was taken.
3. Results from November 19, 2021 and February 16, 2022 appear anomalously low as PID readings from these two events were consistent with PID readings from the other sampling events. Therfore, these results were rejected.
4. Sample was not collected during September 2022, therefore results from August 2022 were used for mass removal calculations.
5. Sample was not collected during October 2022 and November 2022, therefore results from December 2022 were used for mass removal calculations.
6. Sample collected for April 2023 was received by the lab outside the allowable vacuum range so sample was not analyzed; therefore results from May 2023 were used for mass removal calculations.

E: Analyte concentration exceeded the calibration range. The reported result is estimated

R: Result rejected

U: The analyte was not detected in the sample at the estimated detection limit

VOCs : Volatile Organic Compounds

ug/m^3 : micrograms per cubic meter

Sample Calculation

$$\boldsymbol{Mass\ Removed\ (lb) = 340000\ \frac{ug}{m^3} \times 10^{-6}\ \frac{g}{ug} \times \frac{1}{453.6}\ \frac{lb}{g} \times 41\ \frac{ft^3}{min} \times 0.02832\ \frac{m^3}{ft^3} \times 26\ hr \times 60\ \frac{min}{hr}}$$

APPENDIX C

HISTORICAL ANALYTICAL RESULTS AND CONTAMINANT MASS REMOVAL - LIQUID

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-211015		CMR-SP200-211208		CMR-SP200-220216	
Sample Date		10/15/2021		12/8/2021		2/16/2022	
Effluent Volume (L)*		21,138		43,176		80,754	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs							
1,1,1-TRICHLOROETHANE	71-55-6	ND	--	ND	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	ND	--	ND	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	--	ND	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	--	ND	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	--	ND	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	--	ND	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	--	ND	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	--	ND	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND	--	ND	--
1,4-DIOXANE	123-91-1	ND	--	ND	--	ND	--
2-BUTANONE	78-93-3	ND	--	ND	--	ND	--
2-HEXANONE	591-78-6	ND	--	ND	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	ND	--	ND	--	ND	--
ACETONE	67-64-1	ND	--	ND	--	ND	--
BENZENE	71-43-2	2,300	0.11	350	0.03	420	0.07
BROMOCHLOROMETHANE	74-97-5	ND	--	ND	--	ND	--
BROMODICHLOROMETHANE	75-27-4	ND	--	ND	--	ND	--
BROMOFORM	75-25-2	ND	--	ND	--	ND	--
BROMOMETHANE	74-83-9	ND	--	ND	--	ND	--
CARBON DISULFIDE	75-15-0	ND	--	ND	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	--	ND	--	ND	--
CHLOROBENZENE	108-90-7	ND	--	ND	--	ND	--
CHLOROETHANE	75-00-3	ND	--	ND	--	ND	--
CHLOROFORM	67-66-3	ND	--	ND	--	ND	--
CHLOROMETHANE	74-87-3	ND	--	ND	--	ND	--
CIS-1,2-DICHLOROETHENE	156-59-2	ND	--	79	0.01	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	--	ND	--	ND	--
CUMENE	98-82-8	ND	--	130	0.01	ND	--
CYCLOHEXANE	110-82-7	160	0.01	72	0.01	ND	--
DIBROMOCHLOROMETHANE	124-48-1	ND	--	ND	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	--	ND	--	ND	--
ETHYL BENZENE	100-41-4	1,100	0.05	730	0.07	450	0.08
M,P-XYLENE	179601-23-1	5,100	0.24	5,400	0.51	3,200	0.57
METHYL ACETATE	79-20-9	ND	--	ND	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND	--	ND	--
METHYLCYCLOHEXANE	108-87-2	71	0.00	43	0.00	ND	--
METHYLENE CHLORIDE	75-09-2	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	290	0.01	1,500	0.14	460	0.08
ORTHO-XYLENE	95-47-6	1,400	0.07	1,800	0.17	1,100	0.20
STYRENE	100-42-5	ND	--	ND	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	--	ND	--	ND	--
TOLUENE	108-88-3	1,500	0.07	330	0.03	370	0.07
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	--	ND	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	--	ND	--	ND	--
TRICHLOROETHENE	79-01-6	ND	--	ND	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	--	ND	--	ND	--
VINYL CHLORIDE	75-01-4	ND	--	ND	--	ND	--
XYLENES (TOTAL)	1330-20-7	6,500	0.30	--	--	--	--
Total VOCs	--	**--**	**0.86**	**--**	**0.99**	**--**	**1.07**
Period Total VOC Mass Removed (lbs)		**0.9**		**1.0**		**1.1**	
Cumulative Total VOC Mass Removed (lbs)		**0.9**		**1.9**		**2.9**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-211015		CMR-SP200-211208		CMR-SP200-220216	
Sample Date		10/15/2021		12/8/2021		2/16/2022	
Effluent Volume (L)*		21,138		43,176		80,754	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs							
1,2,4,5-TETRACHLOROBENZENE	95-94-3	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND	--	ND	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	--	ND	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	ND	--	ND	--	ND	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	--	ND	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	--	ND	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	--	ND	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	ND	--	ND	--	590	0.11
2,4-DINITROPHENOL	51-28-5	ND	--	ND	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	--	ND	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	--	ND	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	--	ND	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	--	ND	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	710	0.03	9,700	0.92	710	0.13
2-METHYLPHENOL	95-48-7	ND	--	ND	--	ND	--
2-NITROANILINE	88-74-4	ND	--	ND	--	ND	--
2-NITROPHENOL	88-75-5	ND	--	ND	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	--	ND	--	ND	--
3-NITROANILINE	99-09-2	ND	--	ND	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	--	ND	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	--	ND	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	--	ND	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	--	ND	--	ND	--
4-METHYLPHENOL	106-44-5	ND	--	ND	--	ND	--
4-NITROANILINE	100-01-6	ND	--	ND	--	ND	--
4-NITROPHENOL	100-02-7	ND	--	ND	--	ND	--
ACENAPHTHENE	83-32-9	ND	--	ND	--	14	0.00
ACENAPHTHYLENE	208-96-8	38	0.00	ND	--	ND	--
ANTHRACENE	120-12-7	ND	--	ND	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	--	ND	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	--	ND	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	--	ND	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	--	ND	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	--	ND	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	--	ND	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	--	ND	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	ND	--	ND	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	--	ND	--	ND	--
CARBAZOLE	86-74-8	ND	--	ND	--	ND	--
CHRYSENE	218-01-9	ND	--	ND	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	--	ND	--	ND	--
DIBENZOFURAN	132-64-9	ND	--	ND	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	--	ND	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	--	ND	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	--	ND	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	--	ND	--	ND	--
FLUORANTHENE	206-44-0	ND	--	ND	--	ND	--
FLUORENE	86-73-7	30	0.00	360	0.03	ND	--
HEXACHLOROBENZENE	118-74-1	ND	--	ND	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	--	ND	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	--	ND	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	--	ND	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	--	ND	--	ND	--
ISOPHORONE	78-59-1	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	610	0.03	5,800	0.55	560	0.10
NITROBENZENE	98-95-3	ND	--	ND	--	ND	--

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-211015		CMR-SP200-211208		CMR-SP200-220216	
Sample Date		10/15/2021		12/8/2021		2/16/2022	
Effluent Volume (L)*		21,138		43,176		80,754	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	--	ND	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	ND	--	ND	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	--	ND	--	ND	--
PHENANTHRENE	85-01-8	48	0.00	610	0.06	53	0.01
PHENOL	108-95-2	ND	--	ND	--	ND	--
PYRENE	129-00-0	12	0.00	110	0.01	7	0.00
Total SVOCs	--	**--**	**0.07**	**--**	**1.58**	**--**	**0.34**
Period Total SVOC Mass Removed (lbs)		**0.1**		**1.6**		**0.3**	
Cumulative Total VOC Mass Removed (lbs)		**0.1**		**1.6**		**2.0**	
EPH							
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	89,000	4.15	32,000	3.05	81,000	14.42
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	50,000	2.33	28,000	2.67	55,000	9.79
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	190,000	8.85	130,000	12.37	320,000	56.97
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	330,000	15.38	--	--	460,000	81.89
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	410,000	19.11	210,000	19.99	460,000	81.89
Total EPHs	--	**--**	**19.11**	**--**	**19.99**	**--**	**81.89**
Period Total EPH Mass Removed (lbs)		**19.1**		**20.0**		**81.9**	
Cumulative Total EPH Mass Removed (lbs)		**19.1**		**39.1**		**121.0**	
VPH							
BENZENE	71-43-2	1,800	0.08	230	0.02	480	0.09
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	3,900	0.18	2,600	0.25	12,000	2.14
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	9,300	0.43	40,000	3.81	88,000	15.67
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	9,400	0.44	26,000	2.47	130,000	23.14
ETHYL BENZENE	100-41-4	990	0.05	650	0.06	1,200	0.21
M,P-XYLENE	179601-23-1	4,100	0.19	4,100	0.39	5,900	1.05
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	510	0.02	2,300	0.22	5,200	0.93
ORTHO-XYLENE	95-47-6	1,300	0.06	1,700	0.16	2,200	0.39
TOLUENE	108-88-3	1,100	0.05	300	0.03	530	0.09
TOTAL PETROLEUM HYDROCARBONS	TPH	32,000	1.49	72,000	6.85	200,000	35.61
Total VPHss	--	**--**	**1.49**	**--**	**6.85**	**--**	**35.61**
Period Total VPH Mass Removed (lbs)		**1.5**		**6.9**		**35.6**	
Cumulative Total VPH Mass Removed (lbs)		**1.5**		**8.3**		**44.0**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-220411		CMR-SP200-220517		CMR-SP200-220617	
Sample Date		4/11/2022		5/17/2022		6/17/2022	
Effluent Volume (L)*		137,543		0		126,978	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs							
1,1,1-TRICHLOROETHANE	71-55-6	ND	--	ND R	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	ND	--	ND R	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	--	ND R	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	--	ND R	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	--	ND R	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	--	ND R	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	--	ND R	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND R	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	--	ND R	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	--	ND R	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND R	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	--	ND R	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	--	ND R	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND R	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND R	--	ND	--
1,4-DIOXANE	123-91-1	ND	--	ND R	--	ND	--
2-BUTANONE	78-93-3	ND	--	ND R	--	ND	--
2-HEXANONE	591-78-6	ND	--	ND R	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	ND	--	ND R	--	ND	--
ACETONE	67-64-1	ND	--	ND R	--	100	0.03
BENZENE	71-43-2	540	0.16	310 R	--	120	0.03
BROMOCHLOROMETHANE	74-97-5	ND	--	ND R	--	ND	--
BROMODICHLOROMETHANE	75-27-4	ND	--	ND R	--	ND	--
BROMOFORM	75-25-2	ND	--	ND R	--	ND	--
BROMOMETHANE	74-83-9	ND	--	ND R	--	ND	--
CARBON DISULFIDE	75-15-0	ND	--	ND R	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	--	ND R	--	ND	--
CHLOROBENZENE	108-90-7	ND	--	ND R	--	ND	--
CHLOROETHANE	75-00-3	ND	--	ND R	--	ND	--
CHLOROFORM	67-66-3	ND	--	ND R	--	ND	--
CHLOROMETHANE	74-87-3	ND	--	ND R	--	ND	--
CIS-1,2-DICHLOROETHENE	156-59-2	ND	--	ND R	--	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	--	ND R	--	ND	--
CUMENE	98-82-8	ND	--	ND R	--	99	0.03
CYCLOHEXANE	110-82-7	ND	--	ND R	--	320	0.09
DIBROMOCHLOROMETHANE	124-48-1	ND	--	ND R	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	--	ND R	--	ND	--
ETHYL BENZENE	100-41-4	590	0.18	340 R	--	660	0.18
M,P-XYLENE	179601-23-1	3,200	0.97	2,600 R	--	8,200	2.30
METHYL ACETATE	79-20-9	ND	--	ND R	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND R	--	ND	--
METHYLCYCLOHEXANE	108-87-2	ND	--	ND R	--	340	0.10
METHYLENE CHLORIDE	75-09-2	ND	--	ND R	--	ND	--
NAPHTHALENE	91-20-3	510	0.15	280 R	--	3,200	0.90
ORTHO-XYLENE	95-47-6	960	0.29	800 R	--	2,900	0.81
STYRENE	100-42-5	ND	--	ND R	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	--	ND R	--	ND	--
TOLUENE	108-88-3	ND	--	170 R	--	240	0.07
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	--	ND R	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	--	ND R	--	ND	--
TRICHLOROETHENE	79-01-6	ND	--	ND R	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	--	ND R	--	ND	--
VINYL CHLORIDE	75-01-4	ND	--	ND R	--	ND	--
XYLENES (TOTAL)	1330-20-7	--	--	-- R	--	--	--
Total VOCs	--	**--**	**1.76**	**--**	**0.00**	**--**	**4.53**
Period Total VOC Mass Removed (lbs)		**1.8**		**0.0**		**4.5**	
Cumulative Total VOC Mass Removed (lbs)		**4.7**		**4.7**		**9.2**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-220411		CMR-SP200-220517		CMR-SP200-220617	
Sample Date		4/11/2022		5/17/2022		6/17/2022	
Effluent Volume (L)*		137,543		0		126,978	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs							
1,2,4,5-TETRACHLOROBENZENE	95-94-3	ND	--	ND R	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND R	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND R	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND R	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND R	--	ND	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	--	ND R	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	ND	--	ND R	--	ND	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	--	ND R	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	--	ND R	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	--	ND R	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	270	0.08	ND R	--	ND	--
2,4-DINITROPHENOL	51-28-5	ND	--	ND R	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	--	ND R	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	--	ND R	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	--	ND R	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	--	ND R	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	340	0.10	20,000 R	--	2,400	0.67
2-METHYLPHENOL	95-48-7	ND	--	ND R	--	ND	--
2-NITROANILINE	88-74-4	ND	--	ND R	--	ND	--
2-NITROPHENOL	88-75-5	ND	--	ND R	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	--	ND R	--	ND	--
3-NITROANILINE	99-09-2	ND	--	ND R	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	--	ND R	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	--	ND R	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	--	ND R	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	--	ND R	--	ND	--
4-METHYLPHENOL	106-44-5	ND	--	ND R	--	ND	--
4-NITROANILINE	100-01-6	ND	--	ND R	--	ND	--
4-NITROPHENOL	100-02-7	ND	--	ND R	--	ND	--
ACENAPHTHENE	83-32-9	ND	--	380 R	--	93	0.03
ACENAPHTHYLENE	208-96-8	ND	--	ND R	--	ND	--
ANTHRACENE	120-12-7	ND	--	ND R	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	--	ND R	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	--	ND R	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	--	ND R	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	--	ND R	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	--	ND R	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	--	ND R	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	--	ND R	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	ND	--	ND R	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	--	ND R	--	ND	--
CARBAZOLE	86-74-8	ND	--	ND R	--	ND	--
CHRYSENE	218-01-9	ND	--	ND R	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	--	ND R	--	ND	--
DIBENZOFURAN	132-64-9	ND	--	ND R	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	--	ND R	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	--	ND R	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	--	ND R	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	--	ND R	--	ND	--
FLUORANTHENE	206-44-0	ND	--	ND R	--	ND	--
FLUORENE	86-73-7	13	0.00	910 R	--	130	0.04
HEXACHLOROBENZENE	118-74-1	ND	--	ND R	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	--	ND R	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	--	ND R	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	--	ND R	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	--	ND R	--	ND	--
ISOPHORONE	78-59-1	ND	--	ND R	--	ND	--
NAPHTHALENE	91-20-3	330	0.10	12,000 R	--	1,100	0.31
NITROBENZENE	98-95-3	ND	--	ND R	--	ND	--

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-220411		CMR-SP200-220517		CMR-SP200-220617	
Sample Date		4/11/2022		5/17/2022		6/17/2022	
Effluent Volume (L)*		137,543		0		126,978	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	--	ND R	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	ND	--	ND R	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	--	ND R	--	ND	--
PHENANTHRENE	85-01-8	22	0.01	1,500 R	--	250	0.07
PHENOL	108-95-2	47	0.01	ND R	--	ND	--
PYRENE	129-00-0	3	0.00	230 R	--	ND	--
Total SVOCs	--	**--**	**0.31**	**--**	**0.00**	**--**	**1.11**
Period Total SVOC Mass Removed (lbs)		**0.3**		**0.0**		**1.1**	
Cumulative Total VOC Mass Removed (lbs)		**2.3**		**2.3**		**3.4**	
EPH							
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	56,000	16.98	740,000 R	--	530,000	148.36
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	17,000	5.15	660,000 R	--	37,000	10.36
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	87,000	26.38	3,700,000 R	--	240,000	67.18
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	160,000	48.52	5,100,000 R	--	810,000	226.75
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	160,000	48.52	5,900,000 R	--	670,000	187.56
Total EPHs	--	**--**	**48.52**	**--**	**0.00**	**--**	**187.56**
Period Total EPH Mass Removed (lbs)		**48.5**		**0.0**		**187.6**	
Cumulative Total EPH Mass Removed (lbs)		**169.5**		**169.5**		**357.1**	
VPH							
BENZENE	71-43-2	430	0.13	330 R	--	58	0.02
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	1,500	0.45	2,600 R	--	1,300	0.36
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	9,400	2.85	29,000 R	--	20,000	5.60
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	6,800	2.06	28,000 R	--	8,600	2.41
ETHYL BENZENE	100-41-4	600	0.18	510 R	--	110	0.03
M,P-XYLENE	179601-23-1	3,200	0.97	3,200 R	--	1,300	0.36
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND R	--	ND	--
NAPHTHALENE	91-20-3	470	0.14	1,600 R	--	1,300	0.36
ORTHO-XYLENE	95-47-6	1,000	0.30	1,100 R	--	550	0.15
TOLUENE	108-88-3	300	0.09	180 R	--	52	0.01
TOTAL PETROLEUM HYDROCARBONS	TPH	23,000	6.97	56,000 R	--	29,000	8.12
Total VPHss	--	**--**	**6.97**	**--**	**0.00**	**--**	**8.12**
Period Total VPH Mass Removed (lbs)		**7.0**		**0.0**		**8.1**	
Cumulative Total VPH Mass Removed (lbs)		**50.9**		**50.9**		**59.0**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-220727		CMR-SP200-220830		CMR-SP200-220830	
Sample Date		7/27/2022		8/30/2022		9/30/2022	
Effluent Volume (L)*		76,011		31,926		39,179	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs							
1,1,1-TRICHLOROETHANE	71-55-6	ND	--	ND	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	ND	--	ND	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	--	ND	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	--	ND	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	--	ND	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	--	ND	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	--	ND	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	--	ND	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND	--	ND	--
1,4-DIOXANE	123-91-1	ND	--	ND	--	ND	--
2-BUTANONE	78-93-3	ND	--	26	0.00	26	0.00
2-HEXANONE	591-78-6	ND	--	ND	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	ND	--	ND	--	ND	--
ACETONE	67-64-1	ND	--	91	0.01	91	0.01
BENZENE	71-43-2	19	0.00	94	0.01	94	0.01
BROMOCHLOROMETHANE	74-97-5	ND	--	ND	--	ND	--
BROMODICHLOROMETHANE	75-27-4	ND	--	ND	--	ND	--
BROMOFORM	75-25-2	ND	--	ND	--	ND	--
BROMOMETHANE	74-83-9	ND	--	ND	--	ND	--
CARBON DISULFIDE	75-15-0	ND	--	ND	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	--	ND	--	ND	--
CHLOROBENZENE	108-90-7	ND	--	ND	--	ND	--
CHLOROETHANE	75-00-3	ND	--	0	0.00	0	0.00
CHLOROFORM	67-66-3	ND	--	ND	--	ND	--
CHLOROMETHANE	74-87-3	ND	--	0	0.00	0	0.00
CIS-1,2-DICHLOROETHENE	156-59-2	ND	--	ND	--	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	--	ND	--	ND	--
CUMENE	98-82-8	22	0.00	58	0.00	58	0.01
CYCLOHEXANE	110-82-7	49	0.01	170	0.01	170	0.01
DIBROMOCHLOROMETHANE	124-48-1	ND	--	ND	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	--	ND	--	ND	--
ETHYL BENZENE	100-41-4	95	0.02	330	0.02	330	0.03
M,P-XYLENE	179601-23-1	1,900	0.32	2,500	0.18	2,500	0.22
METHYL ACETATE	79-20-9	ND	--	ND	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND	--	ND	--
METHYLCYCLOHEXANE	108-87-2	50	0.01	220	0.02	220	0.02
METHYLENE CHLORIDE	75-09-2	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	960	0.16	350	0.02	350	0.03
ORTHO-XYLENE	95-47-6	740	0.12	780	0.05	780	0.07
STYRENE	100-42-5	ND	--	ND	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	--	ND	--	ND	--
TOLUENE	108-88-3	34	0.01	24	0.00	24	0.00
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	--	ND	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	--	ND	--	ND	--
TRICHLOROETHENE	79-01-6	ND	--	ND	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	--	ND	--	ND	--
VINYL CHLORIDE	75-01-4	ND	--	ND	--	ND	--
XYLENES (TOTAL)	1330-20-7	--	--	--	--	--	--
Total VOCs	--	**--**	**0.65**	**--**	**0.33**	**--**	**0.40**
Period Total VOC Mass Removed (lbs)		**0.6**		**0.3**		**0.4**	
Cumulative Total VOC Mass Removed (lbs)		**9.9**		**10.2**		**10.6**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-220727		CMR-SP200-220830		CMR-SP200-220830	
Sample Date		7/27/2022		8/30/2022		9/30/2022	
Effluent Volume (L)*		76,011		31,926		39,179	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs							
1,2,4,5-TETRACHLOROBENZENE	95-94-3	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	120-82-1	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	--	--	--	--	--	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	--	ND	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	--	ND	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	--	ND	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	--	ND	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	ND	--	ND	--	ND	--
2,4-DINITROPHENOL	51-28-5	ND	--	ND	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	--	ND	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	--	ND	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	--	ND	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	--	ND	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	2,000	0.34	21,000	1.48	21,000	1.81
2-METHYLPHENOL	95-48-7	ND	--	ND	--	ND	--
2-NITROANILINE	88-74-4	ND	--	ND	--	ND	--
2-NITROPHENOL	88-75-5	ND	--	ND	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	--	ND	--	ND	--
3-NITROANILINE	99-09-2	ND	--	ND	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	--	ND	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	--	ND	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	--	ND	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	--	ND	--	ND	--
4-METHYLPHENOL	106-44-5	ND	--	ND	--	ND	--
4-NITROANILINE	100-01-6	ND	--	ND	--	ND	--
4-NITROPHENOL	100-02-7	ND	--	ND	--	ND	--
ACENAPHTHENE	83-32-9	ND	--	ND	--	ND	--
ACENAPHTHYLENE	208-96-8	ND	--	ND	--	ND	--
ANTHRACENE	120-12-7	ND	--	ND	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	--	ND	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	--	ND	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	--	ND	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	--	ND	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	--	ND	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	--	ND	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	--	ND	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	ND	--	ND	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	--	ND	--	ND	--
CARBAZOLE	86-74-8	ND	--	ND	--	ND	--
CHRYSENE	218-01-9	ND	--	ND	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	--	ND	--	ND	--
DIBENZOFURAN	132-64-9	ND	--	ND	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	--	ND	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	--	ND	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	--	ND	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	--	ND	--	ND	--
FLUORANTHENE	206-44-0	ND	--	ND	--	ND	--
FLUORENE	86-73-7	110	0.02	1,100	0.08	1,100	0.10
HEXACHLOROBENZENE	118-74-1	ND	--	ND	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	--	ND	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	--	ND	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	--	ND	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	--	ND	--	ND	--
ISOPHORONE	78-59-1	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	830	0.14	9,800	0.69	9,800	0.85
NITROBENZENE	98-95-3	ND	--	ND	--	ND	--

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-220727		CMR-SP200-220830		CMR-SP200-220830	
Sample Date		7/27/2022		8/30/2022		9/30/2022	
Effluent Volume (L)*		76,011		31,926		39,179	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	--	ND	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	ND	--	ND	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	--	ND	--	ND	--
PHENANTHRENE	85-01-8	230	0.04	2,000	0.14	2,000	0.17
PHENOL	108-95-2	ND	--	ND	--	ND	--
PYRENE	129-00-0	44	0.01	ND	--	ND	--
Total SVOCs	--	**--**	**0.54**	**--**	**2.39**	**--**	**2.93**
Period Total SVOC Mass Removed (lbs)		**0.5**		**2.4**		**2.9**	
Cumulative Total VOC Mass Removed (lbs)		**4.0**		**6.3**		**9.3**	
EPH							
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	120,000	20.11	--	--	--	--
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	80,000	13.41	--	--	--	--
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	340,000	56.97	--	--	--	--
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	540,000	90.49	--	--	--	--
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	590,000	98.87	2,550,000	179.48	2,550,000	220.25
Total EPHs	--	**--**	**98.87**	**--**	**179.48**	**--**	**220.25**
Period Total EPH Mass Removed (lbs)		**98.9**		**179.5**		**220.3**	
Cumulative Total EPH Mass Removed (lbs)		**455.9**		**635.4**		**855.7**	
VPH							
BENZENE	71-43-2	ND	--	--	--	--	--
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	ND	--	2,860	0.20	2,860	0.25
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	5,700	0.96	--	--	--	--
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	4,300	0.72	29,500	2.08	29,500	2.55
ETHYL BENZENE	100-41-4	ND	--	--	--	--	--
M,P-XYLENE	179601-23-1	310	0.05	--	--	--	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	--	--	--	--
NAPHTHALENE	91-20-3	550	0.09	--	--	--	--
ORTHO-XYLENE	95-47-6	160	0.03	--	--	--	--
TOLUENE	108-88-3	ND	--	--	--	--	--
TOTAL PETROLEUM HYDROCARBONS	TPH	9,500	1.59	62,800	4.42	62,800	5.42
Total VPHss	--	**--**	**1.59**	**--**	**4.42**	**--**	**5.42**
Period Total VPH Mass Removed (lbs)		**1.6**		**4.4**		**5.4**	
Cumulative Total VPH Mass Removed (lbs)		**60.6**		**65.1**		**70.5**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-221214		CMR-SP200-221214		CMR-SP200-221214	
Sample Date		10/31/2022		11/30/2022		12/14/2022	
Effluent Volume (L)*		4,319		17		159,877	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs							
1,1,1-TRICHLOROETHANE	71-55-6	ND	--	ND	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	ND	--	ND	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	--	ND	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	--	ND	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	--	ND	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	--	ND	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	--	ND	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	--	ND	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND	--	ND	--
1,4-DIOXANE	123-91-1	ND	--	ND	--	ND	--
2-BUTANONE	78-93-3	ND	--	ND	--	ND	--
2-HEXANONE	591-78-6	ND	--	ND	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	ND	--	ND	--	ND	--
ACETONE	67-64-1	ND	--	ND	--	ND	--
BENZENE	71-43-2	200	0.00	200	0.00	200	0.07
BROMOCHLOROMETHANE	74-97-5	ND	--	ND	--	ND	--
BROMODICHLOROMETHANE	75-27-4	ND	--	ND	--	ND	--
BROMOFORM	75-25-2	ND	--	ND	--	ND	--
BROMOMETHANE	74-83-9	ND	--	ND	--	ND	--
CARBON DISULFIDE	75-15-0	ND	--	ND	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	--	ND	--	ND	--
CHLOROBENZENE	108-90-7	ND	--	ND	--	ND	--
CHLOROETHANE	75-00-3	ND	--	ND	--	ND	--
CHLOROFORM	67-66-3	ND	--	ND	--	ND	--
CHLOROMETHANE	74-87-3	ND	--	ND	--	ND	--
CIS-1,2-DICHLOROETHENE	156-59-2	ND	--	ND	--	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	--	ND	--	ND	--
CUMENE	98-82-8	81	0.00	81	0.00	81	0.03
CYCLOHEXANE	110-82-7	190	0.00	190	0.00	190	0.07
DIBROMOCHLOROMETHANE	124-48-1	ND	--	ND	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	--	ND	--	ND	--
ETHYL BENZENE	100-41-4	490	0.00	490	0.00	490	0.17
M,P-XYLENE	179601-23-1	2,700	0.03	2,700	0.00	2,700	0.95
METHYL ACETATE	79-20-9	ND	--	ND	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND	--	ND	--
METHYLCYCLOHEXANE	108-87-2	240	0.00	240	0.00	240	0.08
METHYLENE CHLORIDE	75-09-2	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	890	0.01	890	0.00	890	0.31
ORTHO-XYLENE	95-47-6	590	0.01	590	0.00	590	0.21
STYRENE	100-42-5	ND	--	ND	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	--	ND	--	ND	--
TOLUENE	108-88-3	22	0.00	22	0.00	22	0.01
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	--	ND	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	--	ND	--	ND	--
TRICHLOROETHENE	79-01-6	ND	--	ND	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	--	ND	--	ND	--
VINYL CHLORIDE	75-01-4	ND	--	ND	--	ND	--
XYLENES (TOTAL)	1330-20-7	--	--	--	--	--	--
Total VOCs	--	**--**	**0.05**	**--**	**0.00**	**--**	**1.90**
Period Total VOC Mass Removed (lbs)		**0.1**		**0.0**		**1.9**	
Cumulative Total VOC Mass Removed (lbs)		**10.6**		**10.6**		**12.5**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-221214		CMR-SP200-221214		CMR-SP200-221214	
Sample Date		10/31/2022		11/30/2022		12/14/2022	
Effluent Volume (L)*		4,319		17		159,877	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs							
1,2,4,5-TETRACHLOROBENZENE	95-94-3	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	120-82-1	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	--	--	--	--	--	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	--	ND	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	--	ND	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	--	ND	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	--	ND	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	ND	--	ND	--	ND	--
2,4-DINITROPHENOL	51-28-5	ND	--	ND	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	--	ND	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	--	ND	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	--	ND	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	--	ND	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	2,000	0.02	2,000	0.00	2,000	0.70
2-METHYLPHENOL	95-48-7	ND	--	ND	--	ND	--
2-NITROANILINE	88-74-4	ND	--	ND	--	ND	--
2-NITROPHENOL	88-75-5	ND	--	ND	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	--	ND	--	ND	--
3-NITROANILINE	99-09-2	ND	--	ND	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	--	ND	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	--	ND	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	--	ND	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	--	ND	--	ND	--
4-METHYLPHENOL	106-44-5	ND	--	ND	--	ND	--
4-NITROANILINE	100-01-6	ND	--	ND	--	ND	--
4-NITROPHENOL	100-02-7	ND	--	ND	--	ND	--
ACENAPHTHENE	83-32-9	51	0.00	51	0.00	51	0.02
ACENAPHTHYLENE	208-96-8	ND	--	ND	--	ND	--
ANTHRACENE	120-12-7	ND	--	ND	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	--	ND	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	--	ND	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	--	ND	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	--	ND	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	--	ND	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	--	ND	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	--	ND	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	ND	--	ND	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	--	ND	--	ND	--
CARBAZOLE	86-74-8	ND	--	ND	--	ND	--
CHRYSENE	218-01-9	ND	--	ND	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	--	ND	--	ND	--
DIBENZOFURAN	132-64-9	ND	--	ND	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	--	ND	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	--	ND	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	--	ND	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	--	ND	--	ND	--
FLUORANTHENE	206-44-0	ND	--	ND	--	ND	--
FLUORENE	86-73-7	170	0.00	170	0.00	170	0.06
HEXACHLOROBENZENE	118-74-1	ND	--	ND	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	--	ND	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	--	ND	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	--	ND	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	--	ND	--	ND	--
ISOPHORONE	78-59-1	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	1,100	0.01	1,100	0.00	1,100	0.39
NITROBENZENE	98-95-3	ND	--	ND	--	ND	--

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-221214		CMR-SP200-221214		CMR-SP200-221214	
Sample Date		10/31/2022		11/30/2022		12/14/2022	
Effluent Volume (L)*		4,319		17		159,877	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	--	ND	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	ND	--	ND	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	--	ND	--	ND	--
PHENANTHRENE	85-01-8	220	0.00	220	0.00	220	0.08
PHENOL	108-95-2	ND	--	ND	--	ND	--
PYRENE	129-00-0	34	0.00	34	0.00	34	0.01
Total SVOCs	--	**--**	**0.03**	**--**	**0.00**	**--**	**1.26**
Period Total SVOC Mass Removed (lbs)		**0.0**		**0.0**		**1.3**	
Cumulative Total VOC Mass Removed (lbs)		**9.3**		**9.3**		**10.6**	
EPH							
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	103,000	0.98	103,000	0.00	103,000	36.30
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	50,100	0.48	50,100	0.00	50,100	17.66
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	264,000	2.51	264,000	0.01	264,000	93.05
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	417,000	3.97	417,000	0.02	417,000	146.98
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	362,000	3.45	362,000	0.01	362,000	127.59
Total EPHs	--	**--**	**3.45**	**--**	**0.01**	**--**	**127.59**
Period Total EPH Mass Removed (lbs)		**3.4**		**0.0**		**127.6**	
Cumulative Total EPH Mass Removed (lbs)		**859.1**		**859.1**		**986.7**	
VPH							
BENZENE	71-43-2	--	--	--	--	--	--
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	ND	--	ND	--	ND	--
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	--	--	--	--	--	--
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	42,500	0.40	42,500	0.00	42,500	14.98
ETHYL BENZENE	100-41-4	--	--	--	--	--	--
M,P-XYLENE	179601-23-1	--	--	--	--	--	--
METHYL TERT-BUTYL ETHER	1634-04-4	--	--	--	--	--	--
NAPHTHALENE	91-20-3	--	--	--	--	--	--
ORTHO-XYLENE	95-47-6	--	--	--	--	--	--
TOLUENE	108-88-3	--	--	--	--	--	--
TOTAL PETROLEUM HYDROCARBONS	TPH	119,000	1.13	119,000	0.00	119,000	41.94
Total VPHss	--	**--**	**1.13**	**--**	**0.00**	**--**	**41.94**
Period Total VPH Mass Removed (lbs)		**1.1**		**0.0**		**41.9**	
Cumulative Total VPH Mass Removed (lbs)		**71.6**		**71.6**		**113.6**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200	SP200		SP200		SP200	
Ramboll Sample ID		CMR-DS2-	CMR-SP200-230126		CMR-SP200-230228		CMR-SP200-230321	
Sample Date		12/14/2022	1/26/2023		2/28/2023		3/21/2023	
Effluent Volume (L)*		--	88,291		48,336		89,975	
Notes		Field Duplicate						
Analyte	**CAS No.**	**Result (ug/L)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs								
1,1,1-TRICHLOROETHANE	71-55-6	ND	ND	--	ND	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	ND	ND	--	ND	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	ND	--	ND	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	ND	--	ND	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	ND	--	ND	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	ND	--	ND	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	ND	--	ND	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	ND	--	ND	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	ND	--	ND	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	ND	--	ND	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	ND	--	ND	--	ND	--
1,4-DIOXANE	123-91-1	ND	ND	--	ND	--	ND	--
2-BUTANONE	78-93-3	ND	ND	--	ND	--	ND	--
2-HEXANONE	591-78-6	ND	ND	--	ND	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	ND	ND	--	ND	--	ND	--
ACETONE	67-64-1	ND	40	0.01	ND	--	ND	--
BENZENE	71-43-2	180	23	0.00	6	0.00	21	0.00
BROMOCHLOROMETHANE	74-97-5	ND	ND	--	ND	--	ND	--
BROMODICHLOROMETHANE	75-27-4	ND	ND	--	ND	--	ND	--
BROMOFORM	75-25-2	ND	5	0.00	ND	--	ND	--
BROMOMETHANE	74-83-9	ND	ND	--	ND	--	ND	--
CARBON DISULFIDE	75-15-0	ND	ND	--	ND	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	ND	--	ND	--	ND	--
CHLOROBENZENE	108-90-7	ND	ND	--	ND	--	ND	--
CHLOROETHANE	75-00-3	ND	ND	--	ND	--	ND	--
CHLOROFORM	67-66-3	ND	ND	--	ND	--	ND	--
CHLOROMETHANE	74-87-3	ND	ND	--	ND	--	ND	--
CIS-1,2-DICHLOROETHENE	156-59-2	ND	ND	--	ND	--	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	ND	--	ND	--	ND	--
CUMENE	98-82-8	21	15	0.00	ND	--	ND	--
CYCLOHEXANE	110-82-7	53	39	0.01	ND	--	ND	--
DIBROMOCHLOROMETHANE	124-48-1	ND	ND	--	ND	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	ND	--	ND	--	ND	--
ETHYL BENZENE	100-41-4	210	34	0.01	ND	--	37	0.01
M,P-XYLENE	179601-23-1	1,000	1,000	0.19	100	0.01	240	0.05
METHYL ACETATE	79-20-9	ND	ND	--	ND	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	ND	--	ND	--	ND	--
METHYLCYCLOHEXANE	108-87-2	52	44	0.01	ND	--	ND	--
METHYLENE CHLORIDE	75-09-2	ND	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	270	1,300	0.25	130	0.01	110	0.02
ORTHO-XYLENE	95-47-6	250	310	0.06	48	0.01	81	0.02
STYRENE	100-42-5	ND	ND	--	ND	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	ND	--	ND	--	ND	--
TOLUENE	108-88-3	ND	15	0.00	ND	--	20	0.00
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	ND	--	ND	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	ND	--	ND	--	ND	--
TRICHLOROETHENE	79-01-6	ND	ND	--	ND	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	ND	--	ND	--	ND	--
VINYL CHLORIDE	75-01-4	ND	ND	--	ND	--	ND	--
XYLENES (TOTAL)	1330-20-7	--	--	--	--	--	--	--
Total VOCs	--	**--**	**--**	**0.55**	**--**	**0.03**	**--**	**0.10**
Period Total VOC Mass Removed (lbs)		**--**	**0.5**		**0.03**		**0.10**	
Cumulative Total VOC Mass Removed (lbs)		**--**	**13.1**		**13.1**		**13.2**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200	SP200		SP200		SP200	
Ramboll Sample ID		CMR-DS2-	CMR-SP200-230126		CMR-SP200-230228		CMR-SP200-230321	
Sample Date		12/14/2022	1/26/2023		2/28/2023		3/21/2023	
Effluent Volume (L)*		--	88,291		48,336		89,975	
Notes		Field Duplicate						
Analyte	**CAS No.**	**Result (ug/L)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs								
1,2,4,5-TETRACHLOROBENZENE	95-94-3	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	120-82-1	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	--	--	--	--	--	--	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	ND	--	ND	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	ND	--	ND	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	ND	--	ND	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	ND	--	ND	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	ND	ND	--	ND	--	450	0.09
2,4-DINITROPHENOL	51-28-5	ND	ND	--	ND	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	ND	--	ND	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	ND	--	ND	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	ND	--	ND	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	ND	--	ND	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	2,000	1,100	0.21	390	0.04	440	0.09
2-METHYLPHENOL	95-48-7	ND	ND	--	ND	--	ND	--
2-NITROANILINE	88-74-4	ND	ND	--	ND	--	ND	--
2-NITROPHENOL	88-75-5	ND	ND	--	ND	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	ND	--	ND	--	ND	--
3-NITROANILINE	99-09-2	ND	ND	--	ND	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	ND	--	ND	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	ND	--	ND	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	ND	--	ND	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	ND	--	ND	--	ND	--
4-METHYLPHENOL	106-44-5	ND	ND	--	ND	--	ND	--
4-NITROANILINE	100-01-6	ND	ND	--	ND	--	ND	--
4-NITROPHENOL	100-02-7	ND	ND	--	ND	--	ND	--
ACENAPHTHENE	83-32-9	ND	ND	--	10	0.00	ND	--
ACENAPHTHYLENE	208-96-8	ND	ND	--	ND	--	ND	--
ANTHRACENE	120-12-7	ND	ND	--	ND	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	ND	--	ND	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	ND	--	ND	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	ND	--	ND	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	ND	--	ND	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	ND	--	ND	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	ND	--	ND	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	ND	--	ND	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	ND	ND	--	ND	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	ND	--	ND	--	ND	--
CARBAZOLE	86-74-8	ND	ND	--	ND	--	ND	--
CHRYSENE	218-01-9	ND	ND	--	ND	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	ND	--	ND	--	ND	--
DIBENZOFURAN	132-64-9	ND	ND	--	ND	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	ND	--	ND	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	ND	--	ND	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	ND	--	ND	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	ND	--	ND	--	ND	--
FLUORANTHENE	206-44-0	ND	14	0.00	ND	--	ND	--
FLUORENE	86-73-7	110	ND	--	29	0.00	ND	--
HEXACHLOROBENZENE	118-74-1	ND	ND	--	ND	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	ND	--	ND	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	ND	--	ND	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	ND	--	ND	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	ND	--	ND	--	ND	--
ISOPHORONE	78-59-1	ND	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	1,000	460	0.09	160	0.02	220	0.04
NITROBENZENE	98-95-3	ND	ND	--	ND	--	ND	--

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200	SP200		SP200		SP200	
Ramboll Sample ID		CMR-DS2-	CMR-SP200-230126		CMR-SP200-230228		CMR-SP200-230321	
Sample Date		12/14/2022	1/26/2023		2/28/2023		3/21/2023	
Effluent Volume (L)*		--	88,291		48,336		89,975	
Notes		Field Duplicate						
Analyte	**CAS No.**	**Result (ug/L)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	ND	--	ND	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	ND	ND	--	ND	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	ND	--	ND	--	ND	--
PHENANTHRENE	85-01-8	210	130	0.03	45	0.00	40	0.01
PHENOL	108-95-2	ND	ND	--	ND	--	ND	--
PYRENE	129-00-0	33	32	0.01	8	0.00	9	0.00
Total SVOCs	--	--	--	**0.34**	--	**0.07**	--	**0.23**
Period Total SVOC Mass Removed (lbs)		--	**0.3**		**0.1**		**0.2**	
Cumulative Total VOC Mass Removed (lbs)		--	**10.9**		**11.0**		**11.2**	
EPH								
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	--	209,000	40.68	49,500	5.27	92,500	18.35
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	--	--	--	--	--	--	--
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	--	--	--	--	--	--	--
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	--	713,000	138.78	200,000	21.31	560,000	111.08
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	--	977,000	190.17	240,000	25.57	569,000	112.87
Total EPHs	--	--	--	**190.17**	--	**25.57**	--	**112.87**
Period Total EPH Mass Removed (lbs)		--	**190.2**		**25.6**		**112.9**	
Cumulative Total EPH Mass Removed (lbs)		--	**1176.9**		**1202.5**		**1315.3**	
VPH								
BENZENE	71-43-2	--	--	--	--	--	--	--
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	7,480	1,690	0.33	ND	--	894	0.18
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	--	--	--	--	--	--	--
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	65,500	38,400	7.47	42,000	4.48	10,500	2.08
ETHYL BENZENE	100-41-4	--	--	--	--	--	--	--
M,P-XYLENE	179601-23-1	--	--	--	--	--	--	--
METHYL TERT-BUTYL ETHER	1634-04-4	--	--	--	--	--	--	--
NAPHTHALENE	91-20-3	--	--	--	--	--	--	--
ORTHO-XYLENE	95-47-6	--	--	--	--	--	--	--
TOLUENE	108-88-3	--	--	--	--	--	--	--
TOTAL PETROLEUM HYDROCARBONS	TPH	163,000	76,500	14.89	85,600	9.12	21,100	4.19
Total VPHss	--	--	--	**14.89**	--	**9.12**	--	**4.19**
Period Total VPH Mass Removed (lbs)		--	**14.9**		**9.1**		**4.2**	
Cumulative Total VPH Mass Removed (lbs)		--	**128.4**		**137.6**		**141.8**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-230503		CMR-SP200-230531		CMR-SP200-290623	
Sample Date		5/3/2023		5/31/2023		6/23/2023	
Effluent Volume (L)*		127,742		151,878		306,490	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
VOCs							
1,1,1-TRICHLOROETHANE	71-55-6	ND	--	ND	--	ND	--
1,1,2,2-TETRACHLOROETHANE	79-34-5	1.9	0.00	ND	--	ND	--
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1	ND	--	ND	--	ND	--
1,1,2-TRICHLOROETHANE	79-00-5	ND	--	ND	--	ND	--
1,1-DICHLOROETHANE	75-34-3	ND	--	ND	--	ND	--
1,1-DICHLOROETHENE	75-35-4	ND	--	ND	--	ND	--
1,2,3-TRICHLOROBENZENE	87-61-6	ND	--	ND	--	ND	--
1,2,4-TRICHLOROBENZENE	120-82-1	ND	--	ND	--	ND	--
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	ND	--	ND	--	ND	--
1,2-DIBROMOETHANE	106-93-4	ND	--	ND	--	ND	--
1,2-DICHLOROBENZENE	95-50-1	ND	--	ND	--	ND	--
1,2-DICHLOROETHANE	107-06-2	ND	--	ND	--	ND	--
1,2-DICHLOROPROPANE	78-87-5	ND	--	ND	--	ND	--
1,3-DICHLOROBENZENE	541-73-1	ND	--	ND	--	ND	--
1,4-DICHLOROBENZENE	106-46-7	ND	--	ND	--	ND	--
1,4-DIOXANE	123-91-1	ND	--	ND	--	ND	--
2-BUTANONE	78-93-3	18	0.01	ND	--	ND	--
2-HEXANONE	591-78-6	9.8	0.00	ND	--	ND	--
4-METHYL-2-PENTANONE	108-10-1	5	0.00	ND	--	ND	--
ACETONE	67-64-1	45	0.01	ND	--	ND	--
BENZENE	71-43-2	90	0.03	27	0.01	85	0.06
BROMOCHLOROMETHANE	74-97-5	ND	--	ND	--	ND	--
BROMODICHLOROMETHANE	75-27-4	0	0.00	ND	--	ND	--
BROMOFORM	75-25-2	ND	--	ND	--	ND	--
BROMOMETHANE	74-83-9	ND	--	ND	--	ND	--
CARBON DISULFIDE	75-15-0	ND	--	ND	--	ND	--
CARBON TETRACHLORIDE	56-23-5	ND	--	ND	--	ND	--
CHLOROBENZENE	108-90-7	ND	--	ND	--	ND	--
CHLOROETHANE	75-00-3	ND	--	ND	--	ND	--
CHLOROFORM	67-66-3	ND	--	ND	--	ND	--
CHLOROMETHANE	74-87-3	ND	--	ND	--	ND	--
CIS-1,2-DICHLOROETHENE	156-59-2	ND	--	ND	--	ND	--
CIS-1,3-DICHLOROPROPENE	10061-01-5	ND	--	ND	--	ND	--
CUMENE	98-82-8	3	0.00	17	0.01	9	0.01
CYCLOHEXANE	110-82-7	5	0.00	16	0.01	ND	--
DIBROMOCHLOROMETHANE	124-48-1	ND	--	ND	--	ND	--
DICHLORODIFLUOROMETHANE	75-71-8	ND	--	ND	--	ND	--
ETHYL BENZENE	100-41-4	29	0.01	78	0.03	101	0.07
M,P-XYLENE	179601-23-1	140	0.04	770	0.26	--	--
METHYL ACETATE	79-20-9	ND	--	ND	--	ND	--
METHYL TERT-BUTYL ETHER	1634-04-4	ND	--	ND	--	ND	--
METHYLCYCLOHEXANE	108-87-2	5	0.00	19	0.01	ND	--
METHYLENE CHLORIDE	75-09-2	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	61	0.02	760	0.25	--	--
ORTHO-XYLENE	95-47-6	40	0.01	270	0.09	157	0.11
STYRENE	100-42-5	1	0.00	ND	--	ND	--
TETRACHLOROETHENE	127-18-4	ND	--	ND	--	ND	--
TOLUENE	108-88-3	11	0.00	6	0.00	ND	--
TRANS-1,2-DICHLOROETHENE	156-60-5	ND	--	ND	--	ND	--
TRANS-1,3-DICHLOROPROPENE	10061-02-6	ND	--	ND	--	ND	--
TRICHLOROETHENE	79-01-6	ND	--	ND	--	ND	--
TRICHLOROFLUOROMETHANE	75-69-4	ND	--	ND	--	ND	--
VINYL CHLORIDE	75-01-4	ND	--	ND	--	ND	--
XYLENES (TOTAL)	1330-20-7	--	--	--	--	--	--
Total VOCs	--	**--**	**0.13**	**--**	**0.66**	**--**	**0.24**
Period Total VOC Mass Removed (lbs)		**0.13**		**0.66**		**0.24**	
Cumulative Total VOC Mass Removed (lbs)		**13.4**		**14.0**		**14.2**	

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-230503		CMR-SP200-230531		CMR-SP200-290623	
Sample Date		5/3/2023		5/31/2023		6/23/2023	
Effluent Volume (L)*		127,742		151,878		306,490	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
SVOCs							
1,2,4,5-TETRACHLOROBENZENE	95-94-3	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	120-82-1	--	--	--	--	--	--
1,2-DICHLOROBENZENE	95-50-1	--	--	--	--	--	--
1,3-DICHLOROBENZENE	541-73-1	--	--	--	--	--	--
1,4-DICHLOROBENZENE	106-46-7	--	--	--	--	--	--
2,2'-OXYBIS(1-CHLOROPROPANE)	108-60-1	ND	--	ND	--	ND	--
2,3,4,6-TETRACHLOROPHENOL	58-90-2	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	95-95-4	ND	--	ND	--	ND	--
2,4,6-TRICHLOROPHENOL	88-06-2	ND	--	ND	--	ND	--
2,4-DICHLOROPHENOL	120-83-2	ND	--	ND	--	ND	--
2,4-DIMETHYLPHENOL	105-67-9	ND	--	ND	--	28	0.02
2,4-DINITROPHENOL	51-28-5	ND	--	ND	--	ND	--
2,4-DINITROTOLUENE	121-14-2	ND	--	ND	--	ND	--
2,6-DINITROTOLUENE	606-20-2	ND	--	ND	--	ND	--
2-CHLORONAPHTHALENE	91-58-7	ND	--	ND	--	ND	--
2-CHLOROPHENOL	95-57-8	ND	--	ND	--	ND	--
2-METHYLNAPHTHALENE	91-57-6	ND	--	1,200	0.40	80	0.05
2-METHYLPHENOL	95-48-7	ND	--	ND	--	ND	--
2-NITROANILINE	88-74-4	ND	--	ND	--	ND	--
2-NITROPHENOL	88-75-5	ND	--	ND	--	ND	--
3,3'-DICHLOROBENZIDINE	91-94-1	ND	--	ND	--	ND	--
3-NITROANILINE	99-09-2	ND	--	ND	--	ND	--
4,6-DINITRO-2-METHYLPHENOL	534-52-1	ND	--	ND	--	ND	--
4-BROMOPHENYL-PHENYL ETHER	101-55-3	ND	--	ND	--	ND	--
4-CHLORO-3-METHYLPHENOL	59-50-7	ND	--	ND	--	ND	--
4-CHLOROPHENYL-PHENYL ETHER	7005-72-3	ND	--	ND	--	ND	--
4-METHYLPHENOL	106-44-5	22	0.01	ND	--	--	--
4-NITROANILINE	100-01-6	ND	--	ND	--	ND	--
4-NITROPHENOL	100-02-7	ND	--	ND	--	ND	--
ACENAPHTHENE	83-32-9	ND	--	ND	--	ND	--
ACENAPHTHYLENE	208-96-8	ND	--	ND	--	ND	--
ANTHRACENE	120-12-7	ND	--	ND	--	ND	--
BENZO(A)ANTHRACENE	56-55-3	ND	--	ND	--	ND	--
BENZO(A)PYRENE	50-32-8	ND	--	ND	--	ND	--
BENZO(B)FLUORANTHENE	205-99-2	ND	--	ND	--	ND	--
BENZO(G,H,I)PERYLENE	191-24-2	ND	--	ND	--	ND	--
BENZO(K)FLUORANTHENE	207-08-9	ND	--	ND	--	ND	--
BIS(2-CHLOROETHOXY)METHANE	111-91-1	ND	--	ND	--	ND	--
BIS(2-CHLOROETHYL) ETHER	111-44-4	ND	--	ND	--	ND	--
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	17	0.00	ND	--	ND	--
BUTYLBENZYLPHTHALATE	85-68-7	ND	--	ND	--	ND	--
CARBAZOLE	86-74-8	ND	--	ND	--	ND	--
CHRYSENE	218-01-9	ND	--	ND	--	ND	--
DIBENZ(A,H)ANTHRACENE	53-70-3	ND	--	ND	--	ND	--
DIBENZOFURAN	132-64-9	ND	--	ND	--	ND	--
DIETHYLPHTHALATE	84-66-2	ND	--	ND	--	ND	--
DIMETHYLPHTHALATE	131-11-3	ND	--	ND	--	ND	--
DI-N-BUTYLPHTHALATE	84-74-2	ND	--	ND	--	ND	--
DI-N-OCTYLPHTHALATE	117-84-0	ND	--	ND	--	ND	--
FLUORANTHENE	206-44-0	ND	--	ND	--	ND	--
FLUORENE	86-73-7	ND	--	ND	--	6	0.00
HEXACHLOROBENZENE	118-74-1	ND	--	ND	--	ND	--
HEXACHLOROBUTADIENE	87-68-3	ND	--	ND	--	ND	--
HEXACHLOROCYCLOPENTADIENE	77-47-4	ND	--	ND	--	ND	--
HEXACHLOROETHANE	67-72-1	ND	--	ND	--	ND	--
INDENO(1,2,3-CD)PYRENE	193-39-5	ND	--	ND	--	ND	--
ISOPHORONE	78-59-1	ND	--	ND	--	ND	--
NAPHTHALENE	91-20-3	ND	--	570	0.19	74	0.05
NITROBENZENE	98-95-3	ND	--	ND	--	ND	--

Confidential

Appendix C
Historical Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Location		SP200		SP200		SP200	
Ramboll Sample ID		CMR-SP200-230503		CMR-SP200-230531		CMR-SP200-290623	
Sample Date		5/3/2023		5/31/2023		6/23/2023	
Effluent Volume (L)*		127,742		151,878		306,490	
Notes							
Analyte	**CAS No.**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**	**Result (ug/L)**	**Mass (lb)**
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	ND	--	ND	--	ND	--
N-NITROSODIPHENYLAMINE	86-30-6	25	0.01	ND	--	ND	--
PENTACHLOROPHENOL	87-86-5	ND	--	ND	--	ND	--
PHENANTHRENE	85-01-8	ND	--	110	0.04	5	0.00
PHENOL	108-95-2	12	0.00	ND	--	ND	--
PYRENE	129-00-0	3	0.00	22	0.01	1	0.00
Total SVOCs	--	**--**	**0.02**	**--**	**0.64**	**--**	**0.13**
Period Total SVOC Mass Removed (lbs)		**0.0**		**0.6**		**0.1**	
Cumulative Total VOC Mass Removed (lbs)		**11.2**		**11.9**		**12.0**	
EPH							
C11 THROUGH C22 AROMATIC HYDROCARBONS	C11-C22-AROM	22,300	6.28	77,000	25.78	83,500	56.42
C19 THROUGH C36 ALIPHATIC HYDROCARBONS	C19-C36-ALIP	--	--	--	--	--	--
C9 THROUGH C18 ALIPHATIC HYDROCARBONS	C09-C18-ALIP	--	--	--	--	--	--
TOTAL EXTRACTABLE HYDROCARBON (POST FRACTIONATION)	68334-30-5S	99,100	27.91	348,000	116.52	354,000	239.19
TOTAL EXTRACTABLE HYDROCARBON	68334-30-5E	138,000	38.86	388,000	129.91	643,000	434.46
Total EPHs	--	**--**	**38.86**	**--**	**129.91**	**--**	**434.46**
Period Total EPH Mass Removed (lbs)		**38.9**		**129.9**		**434.5**	
Cumulative Total EPH Mass Removed (lbs)		**1354.2**		**1484.1**		**1918.6**	
VPH							
BENZENE	71-43-2	--	--	--	--	--	--
C5 THROUGH C8 ALIPHATIC HYDROCARBONS (ADJUSTED)	C05-C08-ALIP-J	718	0.20	3,690	1.24	ND	--
C9 THROUGH C10 AROMATIC HYDROCARBONS	C09-C10-AROM	--	--	--	--	--	--
C9 THROUGH C12 ALIPHATIC HYDROCARBONS (ADJUSTED)	C09-C12-ALIP-J	8,120	2.29	112,000	37.50	3,790	2.56
ETHYL BENZENE	100-41-4	--	--	--	--	--	--
M,P-XYLENE	179601-23-1	--	--	--	--	--	--
METHYL TERT-BUTYL ETHER	1634-04-4	--	--	--	--	--	--
NAPHTHALENE	91-20-3	--	--	--	--	--	--
ORTHO-XYLENE	95-47-6	--	--	--	--	--	--
TOLUENE	108-88-3	--	--	--	--	--	--
TOTAL PETROLEUM HYDROCARBONS	TPH	15,700	4.42	154,000	51.56	10,800	7.30
Total VPHss	--	**--**	**4.42**	**--**	**51.56**	**--**	**7.30**
Period Total VPH Mass Removed (lbs)		**4.4**		**51.6**		**7.3**	
Cumulative Total VPH Mass Removed (lbs)		**146.2**		**197.7**		**205.0**	

Confidential

Table 3
Summary of Analytical Results and Contaminant Mass Removal - Liquid
Calumet Montana Refining, LLC - Great Falls, Montana

Notes:

*Effluent volumes represent volume of groundwater extracted during the start-up (October 2021), commissioning (November 2021 - December 2021), and first quarter of standard operation (January 2022 - March 2022). Effluent volumes beginning April 2022 represent volume extracted during the month which the sample was taken.

1. Results from May 17, 2022 appear anomalously high and separate phase non-aqueous phase liquid was identified in the sampling jar; therefore, these results do not appear representative of dissolved phase concentrations and were rejected. Due to the rejected May 2022 results, the effluent volume associated with the April 2022 sampling event represents the volume recovered from April 1, 2022 - May 15, 2022 and effluent volume associated with the June 17, 2022 sampling event represents the volume recovered from May 16, 2022 through June 30, 2022.

2. Sample was not collected during September 2022, therefore results from August 2022 were used for mass removal calculations.

3. Sample was not collected during October 2022 and November 2022, therefore results from December 2022 were used for mass removal calculations.

4. April 2023 sample was collected on May 3, 2023

Sample Calculation

$$\boldsymbol{Mass\ Removed\ (lb) = 1800\ \frac{ug}{L} \times 10^{-6}\ \frac{g}{ug}\ \times \frac{1}{453.6}\ \frac{lb}{g} \times 21138\ L}$$

Abbreviations:

EPH : Extractable Petroleum Hydrocarbon
ND : Non Detect
SVOCs : Semi-volatile Organic Compounds
ug/L : micrograms per liter
VOCs : Volatile Organic Compounds
VPH : Volatile Petroleum Hydrocarbons

Confidential

APPENDIX D
GROUNDWATER SAMPLING PURGE LOGS

RAMBOLL

Calumet Montana Refinery, LLC
Great Falls, Montana

Low Flow Groundwater Sampling Field Log

Monitoring Well - **MW-41S**

Sampling Information

Date (MM/DD/YY) - **June 27, 2023**
Personnel - **Sarah Hall**
Weather - **Sunny, high 70s**
Sampling Device - **Geotech Peristaltic Pump**

Pump on - **12:00**
Pump off - **13:38**

Well Information

Well Casing PID - **--** ppm
Well Diameter - **2** inch
Screened Zone - **4 - 14** ft BGS

Measured Depth to Bottom - **16.54** ft BTOC
Depth to LNAPL - **-** ft BTOC
Depth to Water - **6.72** ft BTOC
Depth to Pump Intake - **14.3** ft BTOC

Well Evacuation Data

Stabilization Criteria			± 0.1 SU	± 3 %	± 10 % < 5 NTU	N/A	± 10 mV	± 10 % <0.5 mg/L	0.3 ft	
Time	**Vol.** L	**Rate** ml/min	**pH** Std	**Cond.** ms/cm	**Turb.** NTU	**Temp.** C	**ORP** mV	**DO** mg/L	**DTW** ft	**Appearance or Comments**
12:05	1.5	300	6.62	0.000	661.00	28.25	-60	11.04	6.72	Clear/slightly yellow,
12:10	3.0	300	6.40	0.001	667.00	28.46	-74	10.51	6.83	Clear/slightly yellow,
12:15	4.5	300	6.27	0.001	594.00	29.15	-80	9.60	7.20	Clear/slightly yellow,
12:20	6.0	300	6.17	0.000	603.00	29.69	-73	9.21	7.44	Clear/slightly yellow,
12:25	7.5	300	6.09	0.000	643.00	30.83	-51	8.77	7.89	Clear/slightly yellow,
12:30	9.0	300	6.02	0.000	643.00	30.96	-46	8.71	8.02	Clear/slightly yellow,
12:35	10.5	300	6.05	0.000	649.00	31.22	-43	8.65	8.08	Clear/slightly yellow,
12:40	12.0	300	6.16	0.000	664.00	32.11	-25	12.66	8.50	Clear/slightly yellow,
12:45	13.5	300	6.19	0.000	661.00	32.51	-17	8.42	8.72	Clear/slightly yellow,
12:50	15.0	300	6.24	0.000	663.00	32.86	-17	8.24	8.96	Clear/slightly yellow,
12:55	16.5	300	6.22	0.000	664.00	33.22	-26	8.16	9.26	Clear/slightly yellow,
13:00	***SAMPLE***	300	6.22	0.00	664.00	33.22	-26	8.16	9.26	Clear/slightly yellow,

Notes / Sample Information

Appearance at Start - **Clear/slightly yellow, l**
Appearance After Purging - **Clear/slightly yellow, l**

Sample ID - **CMR-MW-41S-270623**
Sample Time - **13:00**

Total Volume Purged - **16.5** L
Purge Rate - **300** ml/min

Additional Sample -
Additional Sample ID -

Analysis - VOCs (8260);
VPH (Montana VPH);
Modified Skinner Metals (6020B/7471B);
SVOCs (8270);
EPH (Montana EPH)

Equipment Information

Multi-Gas Meter / PID # - **NA**
Water Quality Meter # - **Horiba**

Oil / Water Interface Probe # - **Heron SN: 01-7468**
Peristaltic Pump # - **GeoPump CAL-1, SN: MI8004784**

Notes

RAMBOLL

Calumet Montana Refinery, LLC
Great Falls, Montana

Low Flow Groundwater Sampling Field Log

Monitoring Well - **MW-105**

Sampling Information

Date (MM/DD/YY) - **June 27, 2023**
Personnel - **Sarah Hall**
Weather - **Partly cloudy, 70s, light rain around 15:20**
Sampling Device - **Geotech Peristaltic Pump**

6/27/2023
Pump on - **14:40**
Pump off - **15:58**

Well Information

Well Casing PID - **--** ppm
Well Diameter - **2** inch
Screened Zone - **5 - 10** ft BGS

Measured Depth to Bottom - **9.90** ft BTOC
Depth to LNAPL - **-** ft BTOC
Depth to Water - **3.13** ft BTOC
Depth to Pump Intake - **7.7** ft BTOC

Well Evacuation Data

Stabilization Criteria			± 0.1 SU	± 3 %	± 10 % < 5 NTU	N/A	± 10 mV	± 10 % <0.5 mg/L	0.3 ft	
Time	**Vol.** L	**Rate** ml/min	**pH** Std	**Cond.** ms/cm	**Turb.** NTU	**Temp.** C	**ORP** mV	**DO** mg/L	**DTW** ft	**Appearance or Comments**
14:45	1.3	250	6.56	0.000	339.00	31.16	112	8.97	3.13	Slightly cloudy, slight
14:50	2.5	250	6.50	0.000	348.00	31.09	124	8.92	4.77	Slightly cloudy, slight
14:55	3.8	250	6.27	0.000	363.00	30.83	142	8.75	5.28	Clear, slight hydroca
15:00	5.0	250	6.29	0.000	366.00	30.71	144	8.69	5.29	Clear, slight hydroca
15:05	6.3	250	6.30	0.000	367.00	30.50	146	8.61	5.43	Clear, slight hydroca
15:10	7.5	250	6.31	0.000	366.00	30.26	147	9.10	5.80	Clear, slight hydroca
15:15	8.8	250	6.32	0.000	364.00	29.96	150	8.80	6.19	Clear, slight hydroca
15:20	10.0	250	6.26	0.000	362.00	29.65	152	8.60	6.48	Clear, slight hydroca
15:25	11.3	250	6.30	0.000	369.00	29.42	144	8.25	6.64	Clear, slight hydroca
15:30	***SAMPLE***	250	6.30	0.00	369.00	29.42	144	8.25	6.64	Clear, slight hydroca

Notes / Sample Information

Appearance at Start - **Slightly cloudy, slight**
Appearance After Purging - **Clear, slight hydrocar**

Total Volume Purged - **113.0** L
Purge Rate - **250** ml/min

Sample ID - CMR-MW-105-270623
Sample Time - 15:25

Additional Sample -
Additional Sample ID - CMR-MW-105-280623 (bio samples)

Analysis - VOCs (8260);
VPH (Montana VPH);
Modified Skinner Metals (6020B/7471B);
SVOCs (8270);
EPH (Montana EPH)

Equipment Information

Multi-Gas Meter / PID # - **NA**
Water Quality Meter # - **Horiba**

Oil / Water Interface Probe # - **Heron SN: 01-7468**
Peristaltic Pump # - **GeoPump CAL-1, SN: MI8004784**

Notes **6/27/2023 - samples collected starting at 15:25, well ran dry at 15:58. Remaining samples to be collected 6/28/2023. 6/28/2023 - DTW 9.05 ft. Pump on 11:55, pump off 12:12 well ran dry. Collected samples at 11:55 for VOCs, SVOCs, EPH, VPH, dissolved gasses, and SO4 and anion-nitrate. Did NOT collect samples for BOD, alkalinity, metals, or dissolved metals.**

RAMBOLL

Calumet Montana Refinery, LLC
Great Falls, Montana

Low Flow Groundwater Sampling Field Log

Monitoring Well - **MW-106**

Sampling Information

Date (MM/DD/YY) - **June 28, 2023**
Personnel - **Sarah Hall**
Weather - **Partly cloudy, 70s, intermittent rain**
Sampling Device - **Geotech Peristaltic Pump**

Pump on - **9:18**
Pump off - **11:00**

Well Information

Well Casing PID - **--** ppm
Well Diameter - **#N/A** inch
Screened Zone - **#N/A** ft BGS

Measured Depth to Bottom - **12.38** ft BTOC
Depth to LNAPL - **-** ft BTOC
Depth to Water - **3.28** ft BTOC
Depth to Pump Intake - **10.2** ft BTOC

Well Evacuation Data

Stabilization Criteria			± 0.1 SU	± 3 %	± 10 % < 5 NTU	N/A	± 10 mV	± 10 % <0.5 mg/L	0.3 ft	
Time	**Vol.** L	**Rate** ml/min	**pH** Std	**Cond.** ms/cm	**Turb.** NTU	**Temp.** C	**ORP** mV	**DO** mg/L	**DTW** ft	**Appearance or Comments**
9:20	1.3	250	7.16	0.000	597.00	18.78	39	11.86	3.28	Clear, no odor or she
9:25	2.5	250	6.96	0.000	577.00	19.18	59	10.75	3.56	Clear, no odor or she
9:30	3.8	250	6.86	0.000	569.00	19.47	62	10.41	3.63	Clear, no odor or she
9:35	5.0	250	6.79	0.000	556.00	19.85	56	9.92	3.81	Clear, no odor or she
9:40	6.3	250	6.75	0.000	547.00	20.18	51	9.59	3.87	Clear, no odor or she
9:45	7.5	250	6.74	0.000	538.00	20.47	49	9.46	4.01	Clear, no odor or she
9:50	8.8	250	6.73	0.000	529.00	20.68	48	9.22	4.16	Clear, no odor or she
9:55	10.0	250	6.74	0.000	519.00	20.97	47	9.03	4.21	Clear, no odor or she
10:00	***SAMPLE***	250	6.74	0.00	519.00	20.97	47	9.03	4.21	Clear, no odor or she

Notes / Sample Information

Appearance at Start - **Clear, no odor or shee**
Appearance After Purging - **Clear, no odor or shee**

Sample ID - CMR-MW-106-280623
Sample Time - 10:00

Total Volume Purged - **10.0** L
Purge Rate - **250** ml/min

Additional Sample -
Additional Sample ID -

Analysis - VOCs (8260);
VPH (Montana VPH);
Modified Skinner Metals (6020B/7471B);
SVOCs (8270);
EPH (Montana EPH)

Equipment Information

Multi-Gas Meter / PID # - **NA**
Water Quality Meter # - **Horiba**

Oil / Water Interface Probe # - **Heron SN: 01-7468**
Peristaltic Pump # - **GeoPump CAL-1, SN: MI8004784**

Notes