



March 27, 2019

Alberta Environment and Parks (AEP)
Monitoring Branch
11th Floor Oxbridge Place
9820-106 Street
Edmonton, Alberta
T5K 2J6

RE: Annual Ambient Air Monitoring Report (IAM-00010348-2019)
Calendar year 2019
Clean Harbors Canada, Inc. Approval 10348-03-00

To whom it may concern:

Clean Harbors Canada, Inc. (Clean Harbors) is presenting this Annual Ambient Air Monitoring Report, which was prepared by GHD Limited (Consultant), for the 2019 calendar year to Alberta Environment and Parks (AEP). The Clean Harbors Ryley Industrial Waste Management Facility (Facility) is located in SE 09-050-17 W4M near Ryley, Alberta.

This ambient air-monitoring program at the Facility is conducted in accordance with the requirements outlined in the Facility's Environmental Protection and Enhancement Act (EPEA) Approval, Approval Number: 10348-02-00 (Approval). As part of the Approval requirements, the Facility submitted a Proposal for a new Ambient Air Monitoring Program, which was subsequently approved on June 24, 2009 by the AEP (formally AENV). Operating under the Approval and the approved proposal, Clean Harbors operates two ambient air-monitoring stations: AEP Station ID 00010348-I-1 and AEP Station ID 00010348-C-1. There have been no changes to the monitoring locations, monitoring methods or significant changes to monitoring equipment during the 2019 calendar year.

During the 2019 calendar year, the meteorological station (AEP Station ID 00010348-C-1) operated at 98.81 percent annual uptime, which is above the 90 percent uptime threshold required by the Air Monitoring Directive, 2016. For January 2019, Clean Harbors reported a non-compliance event for the wind monitoring station, where the station operated at an uptime of 86.8 percent. This instance was reported to the AEP under the reference No.: 349140. This event is described in full in the following report.

During the 2019 calendar year, for the Particulate Matter < 10 microns (PM₁₀) station (AEP Station ID 00010348-I-1), Clean Harbors reported non-compliance events in January 2019 (Reference No.: 349679). This event is described in full in the following report.

During the 2019 calendar year, Clean Harbors reported one non-compliance event in December 2019 (Reference No.: 352691) for the VOC and TNMOC station (AEP Station ID 00010348-I-1). This event is described in full in the following report.

Included in this report are the following:

- Summary of the ambient air monitoring program undertaken at the Facility for 2019
- Summary of AMD Electronic Transfer System Submittals
- Results for Particulate Matter \leq 10 microns (PM₁₀) reported in ug/m³
- Results for water-soluble cations; metals or anions if the PM₁₀ results were >50 ug/m³



- Results for Total Non-Methane Organic Compounds (TNMOC) and Volatile Organic Compounds (VOC)
- 5-year average plots for measured compounds outlined in the approval
- Annual wind rose and monthly uptime summary
- Any sampling issues or data issues that occurred during the 2019 calendar year

Should there be any questions and comments regarding this report, please do not hesitate to contact the undersigned.

A handwritten signature in blue ink that reads "Stan Yuha". The signature is written in a cursive, flowing style.

Yours truly,

CLEAN HARBORS CANADA INC.

Stan Yuha

Facility Manager
Ryley Facility



Alberta Environment and Parks (AEP) 2019 Annual Ambient Air Monitoring Report (IAM-00010348-2018)

Approval Number: 10348-03-00
Ryley Facility, Alberta

Clean Harbors
Environmental Services Inc.

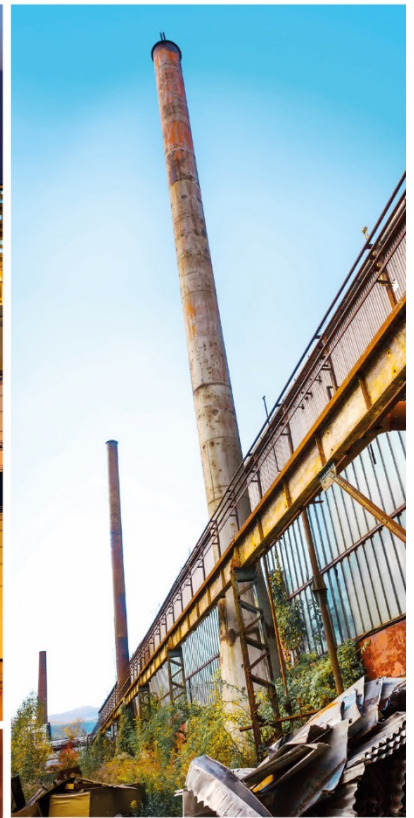




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1. Introduction

1.1 Background

GHD Limited (GHD), on behalf of Clean Harbors Canada (Clean Harbors), is presenting to Alberta Environment and Parks (AEP) the Annual Clean Harbors Ambient Air Monitoring Report for the 2019 calendar year. The Clean Harbors Ryley Industrial Waste Management Facility (Facility) is located in SE 09-050-17 W4M near Ryley, Alberta. Figure 1 presents the site location and air monitoring station location map.

The ambient air monitoring program at the Facility is conducted in accordance with the requirements outlined in the Facility's Environmental Protection and Enhancement Act (EPEA) Approval, Approval Number: 10348-03-00 (Approval). As part of the Approval requirements, the Facility submitted a proposal for a new ambient air monitoring program, which was subsequently approved on June 24, 2009 by the AEP (formally AENV).

1.2 Contact Information

As required by AMD Chapter 9, Section 2, contact information is provided for the following Facility personnel and Contractors that assisted with the performance of the Facility's Air Monitoring Program.

Name: Mr. Stan Yuha
Title: Plant Manager
Company: Clean Harbors
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Name: Mr. Trevor Lewis
Title: Field Technician
Company: GHD Limited
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1.3 Summary of Electronic Transfer System (ETS) Submittals

The “Alberta Environment and Parks (AEP) 2019 Annual Ambient Air Monitoring Report for Approval Number: 10348-03-00” for the Clean Harbors, Ryley Alberta Facility was submitted to the ETS as IAM-00010348-2019.pdf, by March 31, 2019.

1.4 Monitoring Locations and Methodology

Clean Harbors undertakes ambient air monitoring at three locations to assess ambient air quality at and around the Facility. These locations include two AEP mandated stations; AEP Station ID 00010348-I-1 and AEP Station ID 00010348-C-1 and one voluntary ambient air monitoring station. The locations of the air monitoring stations are identified on Figure 1.

A full description of the monitoring locations and methodology for the AEP mandated air monitoring program is outlined in Section 1.4.

In addition to the two AEP mandated stations, Clean Harbors operates a voluntary air monitoring program for the Village of Ryley. The voluntary air monitoring program utilizes a hi-volume sampler station located at the same location as AEP Station ID 00010348-C-1, and an additional hi-volume sampler/meteorological station that is located at the Ryley School and is described in Section 1.4.2.

1.4.1 Clean Harbors AEP Mandated Air Monitoring Program

The intermittent monitoring station, known as the Ryley Lift Station (AEP Station ID 00010348-I-1), is located on Secondary Road 854, approximately 350 metres southeast of the Facility. At this location, samples are collected and analyzed for the following: particulate matter less than or equal to 10 micrometers (μm) in diameter (PM_{10}), volatile organic compounds (VOCs), and total non-methane organic compounds (TNMOC). Additionally, PM_{10} samples that exceed 50 micrograms per cubic metre ($50 \mu\text{g}/\text{m}^3$) are analyzed for a target list of metals, anions, and cations. Sampling is conducted every 12-days as required by the Facility’s Approval.

The second station, located on the roof of the administration building at the Facility (AEP Station ID 00010348-C-1), is a continuous meteorological station that collects wind speed and wind direction data.



1.4.1.1 PM₁₀ Sampling Station (AEP Station ID 00010348-I-1)

PM₁₀ is sampled over a 24-hour period at a volumetric flow rate of 16.7 litres per minute. PM₁₀ samples are collected on a Teflon® filter using a federal reference method (FRM) sampler called a Partisol air sampler. Calibration of the Partisol sampler is conducted and documented on a quarterly basis. The filter samples are collected and sent to InnoTech Alberta (Laboratory) under chain of custody procedures. The filters are analyzed gravimetrically utilizing laboratory method AC-029. Should it be determined that the PM₁₀ threshold of 50 µg/m³ is exceeded, the laboratory would proceed with the metal analysis using accepted methodology. The following is a list of the metal parameters that are analyzed when the PM₁₀ threshold is exceeded.

Table 1.1 Metal Parameters

Parameter	CAS No.
Particulate Matter (PM ₁₀)	Not available
Antimony	7440-36-0
Arsenic	7440-38-2
Beryllium	7440-41-4
Cadmium	7440-43-9
Chromium	7440-47-3
Cobalt	7440-48-4
Copper	7440-50-8
Lead	7439-92-1
Manganese	7439-96-5
Mercury	7439-97-6
Nickel	7440-02-0
Silver	7782-49-2
Thallium	7440-28-0
Tin	7440-31-5
Ammonia-N	Not available
Calcium Ion	Not available
Chloride	Not available
Magnesium Ion	Not available
Nitrate	Not available
Potassium Ion	Not available
Sodium Ion	Not available
Sulphate	Not available



1.4.1.2 Volatile Organic Compound (VOC) and Total Non-Methane Organic Compound (TNMOC) Station (AEP Station ID 00010348-I-1)

For VOC and TNMOC sampling and analysis, 6 litre evacuated SUMMA® canisters are used to collect the sample over a 24-hour period. Flow controllers and pressure gauges supplied by the laboratory are used to maintain a constant sample flowrate over the 24-hour sampling period. The VOC analysis is conducted utilizing laboratory method AC-058 by gas chromatography mass spectrometry. The TNMOC analysis is conducted utilizing laboratory method NA-028 by gas chromatography flame ionization detector. The following is a list of VOCs that are analyzed:

Table 1.2 VOCs

Compound	CAS No.	Compound	CAS No.
1,2,3-Trimethylbenzene	526-73-8	Isoprene	78-79-5
1,2,4-Trimethylbenzene	95-63-6	Isopropylbenzene	98-82-8
1,3,5-Trimethylbenzene	108-67-8	m, p-Xylene	108-38-3/ 106-42-3
1-Butene/Isobutylene	106-98-9	m-Diethylbenzene	141-93-5
1-Hexene/2-Methyl-1-pentene	592-41-6	Methylcyclohexane	108-87-2
1-Pentene	109-67-1	Methylcyclopentane	96-37-7
2,2,4-Trimethylpentane	540-84-1	m-Ethyltoluene	620-14-4
2,2-Dimethylbutane	75-83-2	n-Butane	106-97-8
2,3,4-Trimethylpentane	565-75-3	n-Decane	124-18-5
2,3-Dimethylbutane	79-29-8	n-Dodecane	112-40-3
2,3-Dimethylpentane	565-59-3	n-Heptane	142-82-5
2,4-Dimethylpentane	108-08-7	n-Hexane	110-54-3
2-Methylheptane	592-27-8	n-Nonane	111-84-2
2-Methylhexane	591-76-4	n-Octane	111-65-9
2-Methylpentane	107-83-5	n-Pentane	109-66-0
3-Methylheptane	589-81-1	n-Propylbenzene	103-65-1
3-Methylhexane	589-34-4	n-Undecane	1120-21-4
3-Methylpentane	96-14-0	o-Ethyltoluene	611-14-3
Benzene	71-43-2	o-Xylene	95-47-6
cis-2-Butene	590-18-1	p-Ethyltoluene	622-96-8
cis-2-Pentene	627-20-3	Styrene	100-42-5
Cyclohexane	110-82-7	Toluene	108-88-3
Cyclopentane	287-92-3	trans-2-Butene	624-64-6
Ethylbenzene	100-41-4	trans-2-Pentene	646-04-8
Isobutane	75-28-5	p-Diethylbenzene	105-05-5
Isopentane	78-78-4		



Meteorological Station (AEP Station ID 00010348-C-1)

Clean Harbors operates a RM Young 05305-10A meteorological station at the Facility. The meteorological station continuously collects wind speed and wind direction at the site. Reporting for this station is conducted on a monthly and annual basis where 24-hour wind speed and wind direction, wind class frequency distribution and wind roses are presented. As part of the Approval Clean Harbors is also required to ensure that operation of the station is maintained at no less than 90 percent uptime. The uptime data is also presented on a monthly and annual basis.

1.4.2 Clean Harbors Voluntary Air Monitoring Program

Clean Harbors operates two hi-volume sampler stations that collect total particulate matter. One hi-volume sampler station is located on the roof of the administration building at the Facility, near the AEP Station ID 00010348-C-1, and is intended to collect background ambient air data. The second hi-volume sampler station is located at the Ryley School with a meteorological station and is intended to collect sample data. The samples collected are measured gravimetrically for total particulate and then analyzed for metals by the laboratory when the particulate weight is greater than 50 mg. The two air monitoring stations are configured such that the stations only collect air samples when the wind direction is oriented in a north-east to south-west direction and the wind speed is greater than 5 km/hour. The objective of the voluntary program is to determine airborne particulates from landfill operations that could potentially impact the Village of Ryley.

The results of this voluntary air monitoring program are communicated in a letter presented to the Village of Ryley on an annual basis.

2. Results and Discussions

The following section presents the results from the ambient air monitoring program that was conducted by Clean Harbors in 2019. Where applicable, comparisons were made to Alberta Ambient Air Quality Objectives (AAAQO) for parameters that had 24-hour average objectives and annual objectives. These parameters include m,p,o-xylene, hexane, toluene and benzene. For all other parameters, AAAQO have not been established limits or the limits have averaging periods other than 24-hours or annual.

2.1 Meteorological Data for Wind Speed and Direction (AEP Station ID 00010348-C-1) Results and Discussion

In accordance with the Approval, the Facility is required to collect wind data continuously when operations are occurring at the Facility. In 2019, the wind station collected 98.81 percent of usable data. Appendix A presents the wind data that was collected and also wind rose plots. As illustrated in the wind rose and frequency distribution chart for 2019, the predominant wind direction is from the West, which is consistent with historical information and data.

The 2019 annual wind rose and frequency distribution chart is presented in Appendix A.



2.1.1 Meteorological Data Verification, Validation and Uptime

In the 2019 calendar year, the meteorological station had an annual uptime of 98.81 percent, above the 90 percent uptime required. The station maintained an uptime above 90 percent for 11 of the 12-months in the calendar year. For the month of January, the uptime for the station was 86.8 percent. This contravention is described below.

2.1.1.1 Meteorological Station Issues

In January of 2019, the meteorological station experienced multiple power losses spanning from Friday January 4, 2019 until Tuesday January 15, 2019 resulting in multiple episodes of data loss. The electrical issue regarding the power supply circuit was thought to have been fixed on multiple occasions without success until the outlet was split into two individual circuits in order for the air monitoring equipment to operate correctly. This resolved the electrical issues and resulted in the wind station to be in working order. This non-compliance event was reported to the AEP on February 5, 2019 under the reference No.: 349140.

2.2 PM₁₀ Monitoring Station (AEP Station ID 00010348-I-1) Results and Discussion

In 2019, 31 samples were collected for PM₁₀ analysis at 12-day intervals. One sample was discarded and is described in Section 2.2.1.

The PM₁₀ samples in 2019 had a minimum concentration of 0.17 µg/m³, a maximum concentration of 35.28 µg/m³, and an average concentration of 12.18 µg/m³. There is currently no AAAQO is specified for PM₁₀ over a 24-hour or 1-hour averaging period, however, the Facility is required to analyze for metals should the PM₁₀ concentration exceed 50 µg/m³. Metal results are discussed in Section 2.3. The 2019 test results from the PM₁₀ monitoring are presented in Table 1 and include maximum, minimum, and average values for the reporting period. The previous 5-year averages for PM₁₀ concentrations can be found in Appendix C.

The Partisol sampling instrument was calibrated on a quarterly basis in 2019. The quarterly calibration records are included in Appendix B.

2.2.1 PM₁₀ Sampling Issues

On February 8, 2019 (Test 698) the Partisol air sampler experienced a power failure which caused the total sample time to be less than 24-hours. Clean Harbors discarded this test. After Clean Harbors investigated this issue, it was discovered the screen was not producing a display due to the extreme cold weather, so the power failure was not noticed during the retrieval of sample 698. The power failure appears to have happened between 17:25 on February 7 to 00:10 on February 8. It was operational from 00:10 to 00:40 on February 8, then without power from February 8 at 12:40 am to 13:05 on February 9. After 13:05 on February 9 the power was restored. This non-compliance event was reported to AEP on February 19, 2019 under reference No.: 349679.



2.3 Metal Concentrations

As the concentrations of PM₁₀ for all samples collected in 2019 were below 50 µg/m³, analysis for metal ions was not conducted on any PM₁₀ samples during the reporting period.

2.4 VOC and TNMOC Station (AEP Station ID 00010348-I-1) Results and Discussion

In 2019, 31 samples were collected for VOC and TNMOC analysis at 12-day intervals. One sample was deemed invalid and is described in Section 2.4.1.

There are three VOC parameters that have corresponding AAAQO with 24-hour averaging periods including o,p,m-xylene, hexane and toluene. There is one VOC parameter (benzene) that has a corresponding annual AAAQO. The annual AAAQO for benzene is 0.9 ppbv. The annual result for benzene samples at the lift station was 0.2 ppbv.

The 2019 sample results from the VOC and TNMOC monitoring are presented in Table 2 and include maximum, minimum, and average values. The previous 5-year averages for VOC and TNMOC parameters can be found in Appendix C.

2.4.1 VOC and TMNOC Sampling Issues

On December 29, 2019 (Test 725) the VOC and TMNOC sampling system had a non-compliance event due to an operator error. The control valve on the sample canister did not appear to close after the 24-hour sampling period. This caused the total sample time for test 725 to be estimated at 56-hours and resulted in the canister vacuum to equal approximately 0 inHg. When tested, the control valve seemed to be in good working order. Clean Harbors is unable to confirm, but it is suspected the incident may have been caused by a programming error, which caused the valve to not close. The data was still sent to the lab for analysis, but the data is considered to be invalid due to failing QA/QC protocols. This non-compliance event was reported to the AEP on January 2, 2020 under reference No.: 352691.

2.5 Dust Suppression Activities

In 2019, Clean Harbors did not conduct dust suppression activities at the Facility using leachate spread on the surface of the active landfill.



3. Certification

Per the requirements of AMD, Chapter 9, the following certification is provided for the 2019 Annual Ambient Air Monitoring Report.

"I certify that I have reviewed and verified this report and that the information is complete, accurate and representative of the monitoring results, reporting timeframe and the specified analysis, summarization and reporting requirements."

A handwritten signature in blue ink that reads "Stan Yuha". The signature is written in a cursive, flowing style.

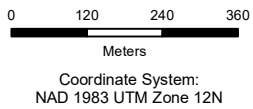
Stan Yuha

Plant Manager/Report Certifier

Figure



Image Source: © (2020) Google. Image Acquisition Date: 09/17/2019.



CLEAN HARBORS CANADA, INC.
RANGE ROAD 854, RYLEY, ALBERTA

11114644
Mar 27, 2020

SITE LOCATION AND AIR MONITORING LOCATION MAP FIGURE 1

Tables

Table 1
2019 Calendar Year
PM₁₀ Analytical Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.

Date	Parameter Units	PM ₁₀ µg/m ³ ⁽¹⁾⁽²⁾	Particulate Weight mg
19/01/03	695	4.304	0.102
19/01/15	696	3.900	0.099
19/01/27	697	0.170	0.000
19/02/08	698	Sample Discarded	Sample Discarded
19/02/20	699	8.950	0.220
19/03/04	700	11.700	0.303
19/03/16	701	10.330	0.252
19/03/28	702	9.340	0.225
19/04/09	703	19.570	0.460
19/04/21	704	10.470	0.250
19/05/03	705	16.570	0.400
19/05/15	706	4.660	0.110
19/05/27	707	32.260	0.730
19/06/08	708	17.450	0.410
19/06/20	709	3.260	0.075
19/07/02	710	14.220	0.327
19/07/14	711	13.510	0.304
19/07/26	712	17.560	0.395
19/08/07	713	13.290	0.303
19/08/19	714	10.390	0.239
19/08/31	715	8.970	0.209
19/09/12	716	7.330	0.170
19/09/24	717	35.280	0.815
19/10/06	718	17.170	0.400
19/10/18	719	18.660	0.431
19/10/30	720	25.140	0.611
19/11/11	721	8.570	0.221
19/11/23	722	4.850	0.113
19/12/05	723	7.863	0.195
19/12/17	724	7.407	0.180
19/12/29	725	2.308	0.057
	Maximum	35.28	0.82
	Minimum	0.17	0.00
	Average	12.18	0.29

Note:

(1) Alberta Ambient Air Quality Objectives do not currently provide an objective for PM₁₀.

(2) In accordance with the Facility's Approval, PM₁₀ samples that exceed 50 µg/m³ are analyzed for a target list of metals, anions, and cations.

Table 2
2019 Calendar Year
VOC and TNMOC Analytical Results
AEP Station ID 00010348-I-1
Clean Harbors Canada, Inc.

Parameter	Units	Test ID	Date																											Maximum	Minimum ⁽³⁾	Average ⁽⁴⁾				
			19/01/03	19/01/15	19/01/27	19/02/08	19/02/20	19/03/04	19/03/16	19/03/28	19/04/09	19/04/21	19/05/03	19/05/15	19/05/27	19/06/08	19/06/20	19/07/02	19/07/14	19/07/26	19/08/07	19/08/19	19/08/31	19/09/12	19/09/24	19/10/06	19/10/18	19/10/30	19/11/11				19/11/23	19/12/05	19/12/17	19/12/29
			695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725 ⁽⁵⁾			
	AAAQO ⁽¹⁾⁽²⁾																																			
1,2,3-Trimethylbenzene	ppbv	-	0.18	0.24	< 0.07	< 0.07	< 0.07	0.09	< 0.07	< 0.07	< 0.12	< 0.07	< 0.07	< 0.07	< 0.08	0.11	< 0.05	0.09	< 0.08	< 0.08	< 0.08	< 0.08	< 0.05	< 0.08	0.25	< 0.08	0.11	< 0.07	< 0.07	< 0.08	< 0.09	0.13	< 0.07	0.25	0.05	0.10
1,2,4-Trimethylbenzene	ppbv	-	1.22	0.51	0.16	0.17	0.16	0.39	< 0.07	< 0.07	< 0.12	< 0.07	< 0.07	< 0.12	< 0.08	0.31	< 0.05	0.49	0.10	< 0.08	< 0.08	< 0.08	< 0.05	< 0.08	0.98	< 0.08	0.19	< 0.07	< 0.08	< 0.08	< 0.09	0.18	< 0.07	1.22	0.05	0.21
1,3,5-Trimethylbenzene	ppbv	-	0.47	0.10	0.11	0.13	< 0.03	0.04	< 0.03	< 0.03	< 0.05	< 0.03	< 0.03	< 0.03	< 0.03	0.11	< 0.02	< 0.02	0.25	< 0.03	< 0.03	< 0.02	< 0.03	0.43	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03	< 0.03	0.47	0.02	0.08	
1-Butene/Isobutylene	ppbv	-	0.32	0.31	1.28	< 0.03	0.31	0.29	0.33	1.36	8.65	2.34	0.20	2.30	0.22	4.39	0.40	< 0.02	0.09	< 0.03	0.28	2.25	1.11	1.29	1.61	0.06	0.52	0.47	0.62	0.79	< 0.04	0.21	0.05	8.65	0.02	1.07
1-Hexene/2-Methyl-1-pentene	ppbv	-	0.27	< 0.03	0.15	0.18	< 0.03	< 0.03	< 0.03	< 0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.02	< 0.02	< 0.03	< 0.02	< 0.02	< 0.03	0.31	< 0.03	< 0.02	< 0.03	< 0.03	< 0.03	0.23	< 0.03	< 0.03	< 0.03	0.15	< 0.03	0.31	0.02	0.07	
1-Pentene	ppbv	-	0.18	0.14	0.09	0.16	< 0.01	< 0.01	< 0.01	0.06	< 0.02	0.07	0.05	< 0.01	< 0.02	0.17	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	0.06	< 0.01	< 0.01	0.09	0.09	0.07	0.07	0.18	0.01	0.05
2,2,4-Trimethylpentane	ppbv	-	0.29	0.15	0.95	0.32	0.07	0.21	< 0.01	0.20	0.23	0.06	0.73	0.05	0.18	0.10	< 0.01	0.15	0.12	< 0.02	0.32	< 0.02	0.13	< 0.02	0.18	< 0.02	0.11	< 0.01	< 0.01	0.09	0.12	0.10	0.09	0.95	0.01	0.17
2,2-Dimethylbutane	ppbv	-	0.19	0.08	0.09	0.07	0.03	< 0.01	< 0.01	< 0.01	< 0.02	0.05	< 0.01	< 0.01	< 0.02	0.11	< 0.01	< 0.01	0.13	< 0.02	0.07	< 0.02	< 0.01	< 0.02	0.14	< 0.02	0.10	< 0.01	0.11	< 0.02	0.08	0.02	0.04	0.19	0.01	0.05
2,3,4-Trimethylpentane	ppbv	-	0.18	0.11	0.11	0.08	< 0.01	< 0.01	< 0.01	< 0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	0.15	< 0.01	< 0.01	< 0.02	0.05	< 0.02	< 0.01	< 0.02	0.14	< 0.02	0.15	< 0.01	< 0.01	0.12	0.05	0.08	0.08	0.18	0.01	0.05	
2,3-Dimethylbutane	ppbv	-	0.25	0.14	0.11	0.17	0.05	0.03	< 0.03	< 0.03	< 0.05	< 0.03	0.06	< 0.03	< 0.03	0.18	< 0.02	0.07	0.17	0.04	0.20	0.20	0.11	0.15	0.89	< 0.03	0.14	0.11	0.08	0.08	0.10	0.10	0.06	0.89	0.02	0.12
2,3-Dimethylpentane	ppbv	-	0.31	0.14	0.10	0.21	0.04	0.12	< 0.03	< 0.03	< 0.05	0.05	0.07	0.06	0.13	0.14	< 0.02	0.17	0.13	< 0.03	0.15	< 0.03	0.07	< 0.03	0.09	< 0.03	0.09	0.06	0.06	0.06	0.06	0.31	0.02	0.09		
2,4-Dimethylpentane	ppbv	-	0.23	0.11	0.06	0.12	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.01	0.19	0.03	< 0.02	0.11	< 0.01	0.39	0.09	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.18	< 0.02	0.11	0.08	0.08	< 0.02	0.11	0.07	0.56	0.01	0.10	
2-Methylheptane	ppbv	-	0.56	0.18	0.14	0.29	0.04	0.11	< 0.01	0.08	< 0.02	< 0.01	0.19	0.03	< 0.02	0.11	< 0.01	0.39	0.09	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.18	< 0.02	0.11	0.08	0.08	< 0.02	0.11	0.07	0.56	0.01	0.10	
2-Methylhexane	ppbv	-	0.65	0.17	0.15	0.36	0.19	0.19	< 0.01	0.07	< 0.02	0.07	0.26	0.09	0.18	0.12	< 0.01	0.30	0.11	< 0.02	< 0.02	0.13	0.07	< 0.02	0.13	< 0.02	0.13	0.05	0.05	0.06	0.07	0.08	0.65	0.01	0.13	
2-Methylpentane	ppbv	-	1.11	0.22	0.41	0.66	0.72	0.47	0.13	0.10	< 0.02	0.06	0.34	0.24	0.20	0.42	< 0.01	0.54	0.17	0.15	0.13	0.18	0.12	0.11	8.02	0.19	0.35	0.20	0.19	0.14	0.20	0.16	0.23	8.02	0.01	0.53
3-Methylheptane	ppbv	-	0.37	0.14	0.12	0.27	< 0.03	0.03	< 0.03	0.13	< 0.05	< 0.03	0.13	< 0.03	< 0.03	0.14	< 0.02	0.21	0.19	< 0.03	0.20	< 0.02	< 0.03	0.26	< 0.03	0.11	0.09	0.11	0.06	0.12	0.12	0.1	0.37	0.02	0.11	
3-Methylhexane	ppbv	-	0.57	0.20	0.16	0.47	0.21	0.24	< 0.03	0.04	< 0.05	< 0.03	0.14	0.05	0.11	0.19	< 0.02	0.41	0.16	< 0.03	0.23	0.21	0.11	0.08	0.18	< 0.03	0.17	0.07	0.09	0.10	0.09	0.05	0.09	0.57	0.02	0.15
3-Methylpentane	ppbv	-	0.77	0.19	0.94	0.68	0.42	0.29	0.04	0.20	0.18	0.07	0.68	0.12	0.21	0.26	< 0.01	0.42	0.18	0.08	0.30	0.19	0.17	0.08	4.06	< 0.02	0.27	0.16	0.17	0.08	0.17	0.13	0.14	4.06	0.01	0.38
Benzene	ppbv	0.9	0.83	0.25	0.38	0.42	0.31	0.38	0.16	0.15	0.34	0.09	0.32	0.10	< 0.02	0.32	< 0.01	0.46	0.25	< 0.02	0.24	0.39	0.17	0.23	0.28	< 0.02	0.18	0.11	0.13	0.14	0.11	0.16	0.24	0.83	0.01	0.23
cis-2-Butene	ppbv	-	0.13	0.11	0.51	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	< 0.03	< 0.03	< 0.03	< 0.03	0.18	< 0.02	< 0.02	< 0.03	0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	1.09	< 0.03	< 0.03	1.09	0.02	0.09
cis-2-Pentene	ppbv	-	0.16	0.10	0.05	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.05	0.58	< 0.03	< 0.03	< 0.03	< 0.03	< 0.02	< 0.02	< 0.03	0.07	< 0.03	< 0.03	< 0.02	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03	0.05	0.58	0.02	0.06
Cyclohexane	ppbv	-	1.06	0.32	0.32	0.71	0.22	0.16	< 0.03	0.10	0.09	0.14	0.31	0.08	0.27	0.18	< 0.02	0.63	0.27	< 0.03	0.17	0.13	0.21	0.14	0.18	< 0.03	0.33	0.13	0.14	0.13	0.07	0.24	1.06	0.02	0.22	
Cyclohexane	ppbv	-	0.25	0.13	0.07	0.16	0.13	0.03	< 0.01	0.07	< 0.02	< 0.01	0.06	0.12	< 0.02	0.19	< 0.01	0.14	0.17	< 0.02	0.10	0.17	0.09	< 0.02	0.17	< 0.02	0.13	0.08	0.09	0.07	0.05	0.05	0.07	0.25	0.01	0.09
Ethylbenzene	ppbv	-	2.30	0.81	0.94	1.04	0.31	0.78	< 0.01	0.19	< 0.02	0.08	0.37	0.15	< 0.02	0.34	< 0.01	0.56	0.19	< 0.02	< 0.02	< 0.01	< 0.02	0.36	< 0.02	0.29	0.18	< 0.01	0.24	< 0.02	0.26	< 0.01	2.30	0.01	0.32	
Isobutane	ppbv	-	1.06	0.59	1.81	2.31	12.50	1.32	0.98	0.69	1.71	0.96	0.73	2.06	0.44	3.90	0.83	1.33	2.69	0.50	3.14	0.66	1.79	2.00	2.00	0.55	1.49	1.12	1.39	1.09	1.45	1.28	2.26	12.50	0.44	1.81
Isopentane	ppbv	-	2.01	0.45	1.54	2.33	2.87	0.97	0.52	0.26	0.32	0.23	0.51	0.42	0.47	1.40	0.30	0.67	0.27	0.20	0.70	0.40	0.32	0.33	0.79	0.44	0.73	0.39	0.46	0.31	0.64	0.58	0.94	2.87	0.20	0.73
Isoprene	ppbv	-	0.07	0.10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	0.08	< 0.01	< 0.01	< 0.02	0.17	< 0.01	< 0.01	0.25	0.36	0.22	0.21	0.09	0.13	0.11	< 0.02	< 0.01	< 0.01	0.14	0.12	< 0.02	0.05	0.07	0.36	0.01	0.08
Isopropylbenzene	ppbv	-	0.06	0.07	0.04	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.01	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	0.11	< 0.02	< 0.01	< 0.01	< 0.02	< 0.02	< 0.01	0.11	0.02	0.11	0.02	0.02
m,p-Xylene	ppbv	161	11.00	2.24	1.76	3.66	1.17	2.53	< 0.04	0.11	0.15	0.19	1.39	0.52	< 0.05	0.57	0.33	2.28	0.50	< 0.05	< 0.04	< 0.05	0.33	< 0.05	1.05	< 0.05	0.62	0.22	< 0.04	0.25	< 0.05	0.31	0.24	11.00	0.04	1.05
m-Diethylbenzene	ppbv	-	0.07	0.13	< 0.06	< 0.05	< 0.06	< 0.05	< 0.06	< 0.09	< 0.06	< 0.05	< 0.06	< 0.06	< 0.04	< 0.04	< 0.06	< 0.07	< 0.06	< 0.06	< 0.04	< 0.06	< 0.06	0.23	< 0.06	< 0.06	< 0.06	< 0.06	< 0.07	0.29	< 0.06	0.29	0.04	0.08		
Methylcyclohexane	ppbv	-	0.72	0.22	0.14	0.19	0.14	0.24	< 0.11	< 0.11	< 0.11	< 0.11	<																							

**2019 Calendar Year
 Meteorological Station Uptime Summary
 AEP Station ID 00010348-C-1
 Clean Harbors Canada, Inc.**

Reporting Month	Hours Expected	Hours Reported	% Uptime
January	744	646	86.8%
February	672	672	100.0%
March	744	742	99.7%
April	720	720	100.0%
May	744	742	99.7%
June	720	718	99.7%
July	744	744	100.0%
August	744	744	100.0%
September	720	720	100.0%
October	744	744	100.0%
November	720	720	100.0%
December	744	744	100.0%
Total	8760	8656	98.81%

Note:

The meteorological station monitors wind speed and direction.

Appendices

Appendix A

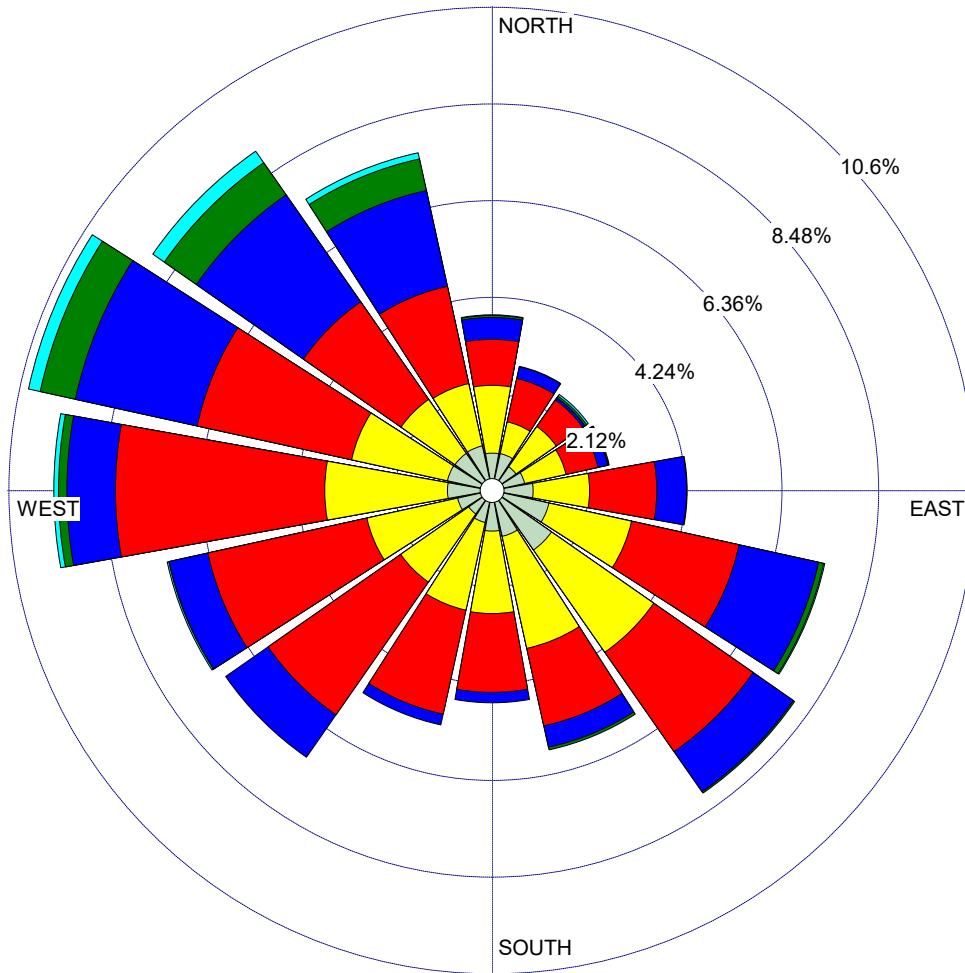
Annual Wind Rose

WIND ROSE PLOT:

**Wind Rose - 2019, Annual
Clean Harbors, Ryley, Alberta**

DISPLAY:

**Wind Speed
Direction (blowing from)**



WIND SPEED
(m/s)

- >= 11.10
- 8.80 - 11.10
- 5.70 - 8.80
- 3.60 - 5.70
- 2.10 - 3.60
- 0.50 - 2.10

Calms: 0.54%

COMMENTS:

Source: Clean Harbors (Ryley) on-site meteorological station.

DATA PERIOD:

**Start Date: 1/1/2019 - 00:00
End Date: 12/31/2019 - 23:00**

COMPANY NAME:

Clean Harbors

MODELER:

GHD

CALM WINDS:

0.54%

TOTAL COUNT:

8656 hrs.

AVG. WIND SPEED:

4.16 m/s

DATE:

1/22/2020

PROJECT NO.:

11114644-007-03



Frequency Distribution Report: Ryley, Alberta - 2019 Summary									
Direction	Angle	Wind Speed (m/s) and Number of Occurrences						%	Total Occurrences by Direction
		< 0.5	0.5 to < 1.5	1.5 to < 2.5	2.5 to < 3.5	3.5 to < 4.5	>= 4.5		
North	> 337.5 - 22.5	8	71	161	153	99	274	8.7%	766
Northeast	> 22.5 - 67.5	2	58	104	101	69	83	4.8%	417
East	> 67.5 - 112.5	3	80	142	140	133	254	8.6%	752
Southeast	> 112.5 - 157.5	8	95	275	299	251	459	15.8%	1387
South	> 157.5 - 202.5	9	69	169	242	202	163	9.7%	854
Southwest	> 202.5 - 247.5	4	54	131	228	323	484	14.0%	1224
West	> 247.5 - 292.5	6	70	183	311	390	669	18.6%	1629
Northwest	> 292.5 - 337.5	7	71	179	173	209	988	18.6%	1627
Missing/Invalid Hours								1.2%	104
Total Occurrences by Speed		47	568	1344	1647	1676	3374		8760
Occurrences by %		0.5%	6.5%	15.3%	18.8%	19.1%	38.5%	100.00%	

Appendix B

Quarterly Calibration Records for Partisol



Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: March 22, 2019

Clean Harbors

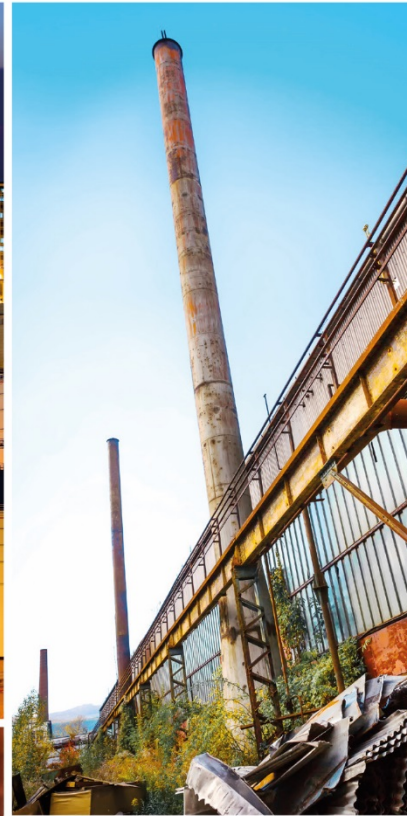
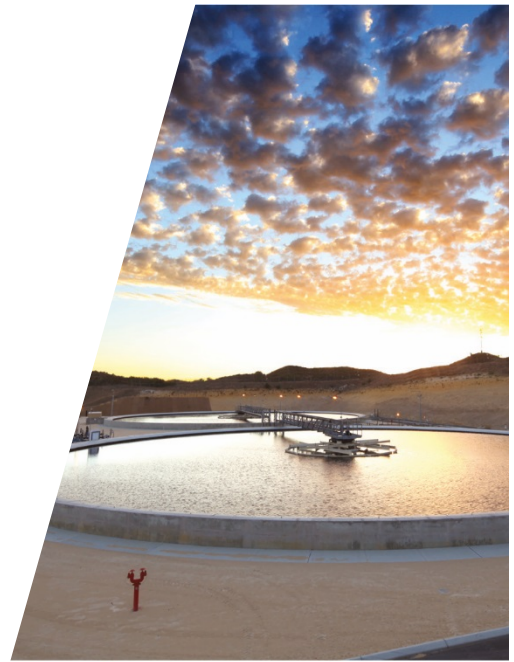




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1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on March 22, 2019. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM₁₀) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1) which is southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive, 2015 (AMD). Siting location, ambient pressure, ambient temperature, filter temperature, leakage rate and flow rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the current Partisol sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.



Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler.	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute.	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants.	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, of the AMD. Table 3.2 of this report compares the reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	0.9	.81	.09	±2%	Pass
Barometric Pressure (mmHg)	698	704.6	6.6	±10 mmHg	Pass
Filter Temperature (°C)	2.0	2.05	.05	±2%	Pass
Flow	16.7 L/min	16.3 L/min	0.4 L/min	±1 L/min	Pass

3.3 Leak Check Result (AEP Station ID 00010348-I-1)

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4 of the AMD.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.



3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

GHD recommends opening and cleaning PM₁₀ sampling inlet prior to next sampling event.

All of Which is Respectfully Submitted,

GHD

A handwritten signature in blue ink, appearing to read 'Brandon Lawrence', is written in a cursive style.

Brandon Lawrence, QSTI

Appendices

Appendix A

Quarterly Audit Form



GHD Quarterly Audit Form

Date	3/22/2019	Weather Cond.:	Calm/2.0°C
Owner	Clean Harbors	Start Time:	8:15
Station Name	Ryley Lift Station	End Time:	8:45
Parameter	PM 10	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		Sampler Data	
Make/Model:	R & P Partisol FRM 2000	Temperature:	2°C
Unit ID:	Ryley Lift Station	Pressure:	698
S/N:	200FB209860905	Flow Set Point:	16.7

GHD Reference Standards				
	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9555-P	1551A EX	Series 475
Serial Number:	FRM1218	9555P0838016	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	3/7/2018	9/14/2017	9/14/2017

Audit Data	Sampler Data	Reference Data	Difference	Pass/Fail
Ambient Temperature ($\pm 2\%$)	0.9	0.81	0.09	Pass
Barometric Pressure (± 10 mmHg)	698	704.6	6.60	Pass
Filter Temperature ($\pm 2\%$)	2.0	2.05	0.05	Pass
Flow (± 1.0 litres/minute)	16.7	16.3	0.40	Pass

Leak Check					
Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	-13.50	-11.00	-2.50	Pass	in.HG
Leak check was performed in automatic mode, sampler indicated:			Pass @ 51 mmHg/min		

As Found/As Left	Yes/No	As Found	As Left	Pass/Fail
Did the ambient temperature require adjustment?	No	0.9	0.9	Pass
Did the barometric pressure require adjustment?	No	698	698	Pass
Did the filter temperature require adjustment?	No	2.0	2.0	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments	
Partisol sampler was very dirty with some moisture build up in the inlet. GHD cleaned and dried the sampler.	

Flow Equation						
Set Point	Actual Flow (Q_{act})	Absolute Difference	Pass/Fail	Manometer (DH)	4.03 "H2O	
(lpm)	(lpm)	(lpm)	(± 1 lpm)	Actual Temp (T_{act})	275.15 °K	2.0°C
16.7	16.3	0.4	Pass	Actual Pres (P_{act})	0.931 bar	
				Actual Pres (P_{act})	27.48 inHg	

FTS Linear Regression Constants

(m_{flo}) = 0.4452

(b_{flo}) = 0.4430

$$Q_{act} = m_{flo} \times \frac{\sqrt{\Delta H \times T_{act}}}{P_{act}} + b_{flo}$$

Appendix B

Calibration Certificates



ITM INSTRUMENTS INC.

TORONTO

16975 Leslie Street
Newmarket, ON L3Y 9A1
Tel: (905) 952-3750
Fax: (905) 952-3751

MONTRÉAL

20800 Boul. Industriel
Ste-Anne-de-Bellevue, QC H9X 0A1
Tel: (514) 457-7280
Fax: (514) 457-4329

CALGARY

#209, 4615 112 Ave SE
Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C232934-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**

Serial: **3520009**

Unit ID: **N/A**

Calibration Date

Calibration Date: **18-Sep-2018**

Due Date: **18-Sep-2019**

Calibration Conditions

Temperature: **22.8°C**

Humidity: **33 %**

Barometric Pressure: **N/A**

General Information

Remark: **N/A**

Standards Used

<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0080	Burns Engineering	12001-A-12-6-2-A	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2018	11-Apr-2019
CAL0223	Ametek	RTC-158B	10-Sep-2018	10-Mar-2020

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

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Test Results

Procedure: Fluke Stik Thermometer /RTC-158B,1502,PRT Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
0.030 °C		0.06 °C	-0.02 °C	0.08 °C	Pass	8.3e-003 °C
25.003 °C		25.04 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.765 °C		99.77 °C	99.72 °C	99.81 °C	Pass	1.0e-002 °C
149.558 °C		149.60 °C	149.51 °C	149.61 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT



Pine Environmental Services LLC

4911-99 Street NW
Edmonton, AB T6E 4Y1
Office: 780-643-2680
Fax: 780-468-3050

Pine Environmental Services, Inc.

Instrument ID 19221
Description Velocity Meter
Calibrated 3/21/2019 11:10:11AM

Manufacturer Tsi
Model Number 9565-P
Serial Number/ Lot Number 9565P1148025
Location Edmonton
Department

State Certified
Status Pass
Temp °C 22
Humidity % 20

Calibration Specifications

Group # 1
Group Name Functional, pressure test and download
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration

<u>Test Standard ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number / Lot Number</u>	<u>(As Of Cal Entry Date)</u> <u>Next Cal Date / Last Cal Date/ Expiration Date</u> <u>Opened Date</u>
-------------------------	--------------------	---------------------	---------------------	-----------------------------------	--

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Matt Lehnert

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT



Pine Environmental Services LLC

4911-99 Street NW
Edmonton, AB T6E 4Y1
Office: 780-643-2680
Fax: 780-468-3050

Pine Environmental Services, Inc.

Instrument ID 25251
Description TSI Velocity Probe 964
Calibrated 3/21/2019 11:10:58AM

Manufacturer Tsi	State Certified
Model Number 964	Status Pass
Serial Number/ Lot Number P08130044	Temp °C 22
Location Edmonton	Humidity % 20
Department	

Calibration Specifications

Group # 1
Group Name Functional, Pressure test and Download
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration

<u>Test Standard ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Serial Number / Lot Number</u>	<u>(As Of Cal Entry Date)</u>	
					<u>Last Cal Date/ Opened Date</u>	<u>Next Cal Date / Expiration Date</u>

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Luc Robert

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

INSTRUMENT CALIBRATION REPORT



Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 19221
 Description TSI 9565P VelociCalc
 Calibrated 6/25/2018

Manufacturer TSI	Classification
Model Number 9565P	Status pass
Serial Number 9565P1148025	Frequency Yearly EOM
Location New Jersey	Department Lab
Temp 76	Humidity 35

Calibration Specifications

<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
Group # 1				Range Acc % 0.0000			
Group Name Barometric Pressure				Reading Acc % 2.0000			
Stated Accy Pct of Reading				Plus/Minus 0.000			
30.000 / 29.920	inHg	29.920	inHg	29.900	29.920	0.00%	Pass
Group # 2				Range Acc % 0.0000			
Group Name Differential Pressure				Reading Acc % 1.0000			
Stated Accy Pct of Reading				Plus/Minus 0.00			
-4.00 / -4.00	inH2O	-4.00	inH2O	-4.03	-4.03	0.75%	Pass
4.00 / 4.00	inH2O	4.00	inH2O	4.02	4.02	0.50%	Pass
8.00 / 8.00	inH2O	8.00	inH2O	8.06	8.06	0.75%	Pass
12.00 / 12.00	inH2O	12.00	inH2O	12.08	12.08	0.67%	Pass

Test Instruments Used During the Calibration

<u>Test Instrument ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Serial Number</u>	<u>(As Of Cal Entry Date)</u>	
				<u>Last Cal Date</u>	<u>Next Cal Date</u>
DWYER 477AV-1	Dwyer 477AV-1 Digital Manometer	Dwyer	005PM2	8/30/2017	8/30/2018
OMEGA HX93AC/DP25- E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	9/15/2016	9/15/2018

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated David Galego

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C232934-00-01

Unit Identification

Manufacturer: **Dwyer**
 Model: **475-0-FM**
 Description: **Digital Manometer**

Serial: **N/A**
 Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **17-Sep-2018**
 Due Date: **17-Sep-2019**

Calibration Conditions

Temperature: **21.8°C**
 Humidity: **33 %**
 Barometric Pressure: **N/A**

General Information

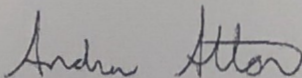
Remark: **N/A**

Standards Used

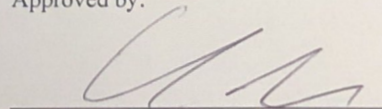
<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0224	Fluke	750P01	16-Apr-2018	16-Oct-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*



Approved by:





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Test Results

Procedure: Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01 Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
Tolerance used (additive if more than one listed):						
0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date: 05/17/2016
 Ambient Temp, °K: 295.5
 Amb Press, Atm: 1.0000

Orifice # FRM1218-
 Pri Std # LFE774300
 Manometer # FRM1218

By:
 Chk:

Std ΔH (inH ₂ O)	Manometer ΔH (inH ₂ O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
2.56	2.56	12.683	12.688	-0.04
2.05	2.05	11.390	11.401	-0.10

**Manometer ΔH vs Act Flow
 Linear Regression Results:**
 m_{flo} = 0.4452
 b_{flo} = 0.4430
 r² = 1.0000

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
 ΔH = manometer reading, inches of water
 T_{act} = ambient temperature, °K
 P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300} \right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
 P_{sea} = Sea Level Atmospheric Pressure
 E = Site elevation, feet

Airmetrics

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about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Brandon Lawrence
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403.538.8605

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Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: June 12, 2019

Clean Harbors

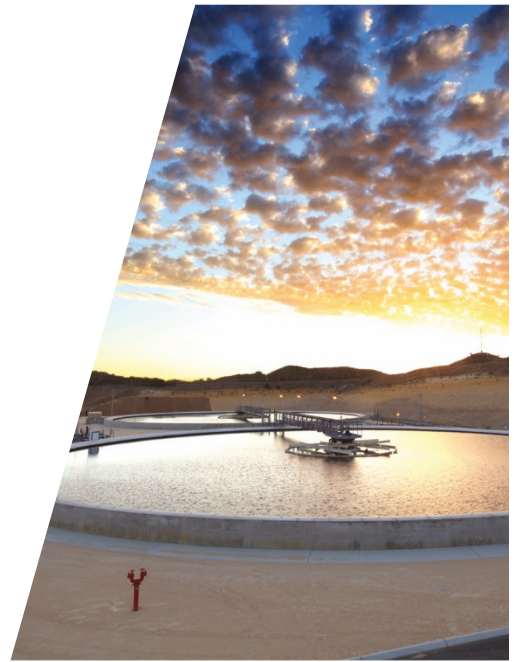




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Appendix B	Calibration Certificates



1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on June 12, 2019. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM₁₀) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1) which is southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive, 2015 (AMD). Siting location, ambient pressure, ambient temperature, filter temperature, leakage rate and flow rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the current Partisol sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.



Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler.	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute.	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants.	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, of the AMD. Table 3.2 of this report compares the reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	25.3	25.7	0.4	±2%	Pass
Barometric Pressure (mmHg)	702	702.5	0.5	±10 mmHg	Pass
Filter Temperature (°C)	27.9	28.1	0.2	±2%	Pass
Flow	16.7 L/min	16.2 L/min	0.5 L/min	±1 L/min	Pass

3.3 Leak Check Result (AEP Station ID 00010348-I-1)

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4 of the AMD.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.



3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

GHD recommends opening and cleaning PM₁₀ sampling inlet prior to next sampling event.

Appendices

Appendix A

Quarterly Audit Form



GHD Quarterly Audit Form

Date	6/12/2019	Weather Cond.:	Sunny/Windy
Owner	Clean Harbors	Start Time:	12:00
Station Name	Ryley Lift Station	End Time:	12:40
Parameter	PM ₁₀	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		Sampler Data	
Make/Model:	R & P Partisol FRM 2000	Temperature:	25°C
Unit ID:	Ryley Lift Station	Pressure:	702
S/N:	200FB209860905	Flow Set Point:	16.7

GHD Reference Standards				
	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9555-P	1551A EX	Series 475
Serial Number:	FRM1218	9555P0838016	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	3/7/2018	9/14/2017	9/14/2017

Audit Data					
	Sampler Data	Reference Data	Difference	Pass/Fail	
Ambient Temperature (±2 %)	25.3	25.7	0.40	Pass	
Barometric Pressure (±10 mmHg)	702	702.5	0.50	Pass	
Filter Temperature (± 2%)	27.9	28.1	0.20	Pass	
Flow (±1.0 litres/minute)	16.7	16.2	0.50	Pass	

Leak Check					
Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	15.00	13.00	2.00	Pass	in.HG
Leak check was performed in automatic mode, sampler indicated:			Pass @ 51 mmHg/min		

As Found/As Left	Yes/No	As Found	As Left	Pass/Fail
Did the ambient temperature require adjustment?	No	25.3	25.3	Pass
Did the barometric pressure require adjustment?	No	702	702	Pass
Did the filter temperature require adjustment?	No	27.9	27.9	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments
Partisol sampler was very dirty with some moisture build up in the inlet. GHD cleaned and dried the sampler.

Flow Equation						
Set Point	Actual Flow (<i>Qact</i>)	Absolute Difference	Pass/Fail	Manometer (<i>DH</i>)	3.95 "H2O	
(lpm)	(lpm)	(lpm)	(± 1 lpm)	Actual Temp (<i>Tact</i>)	298.85 °K	25.7°C
16.7	16.2	0.5	Pass	Actual Pres (<i>Pact</i>)	0.937 bar	
				Actual Pres (<i>Pact</i>)	27.66 inHg	

FTS Linear Regression Constants

(*mflo*) = 0.4452

(*bflo*) = 0.4430

$$Q_{act} = m_{flo} \times \frac{\sqrt{\Delta H \times T_{act}}}{P_{act}} + b_{flo}$$

Appendix B

Calibration Certificates



ITM INSTRUMENTS INC.

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www.itm.com - information@itm.com

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: **C232934-00-02**

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**

Serial: **3520009**

Unit ID: **N/A**

Calibration Date

Calibration Date: **18-Sep-2018**

Due Date: **18-Sep-2019**

Calibration Conditions

Temperature: **22.8°C**

Humidity: **33 %**

Barometric Pressure: **N/A**

General Information

Remark: **N/A**

Standards Used

<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0080	Burns Engineering	12001-A-12-6-2-A	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2018	11-Apr-2019
CAL0223	Ametek	RTC-158B	10-Sep-2018	10-Mar-2020

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:

Certificate: **C232934-00-02**

Asset: **ITM0003735**

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Fax: (403) 248-5194

www.itm.com - information@itm.com

Test Results

Procedure: Fluke Stik Thermometer /RTC-158B,1502,PRT Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
0.030 °C		0.06 °C	-0.02 °C	0.08 °C	Pass	8.3e-003 °C
25.003 °C		25.04 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.765 °C		99.77 °C	99.72 °C	99.81 °C	Pass	1.0e-002 °C
149.558 °C		149.60 °C	149.51 °C	149.61 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT



Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 15314
Description TSI 9565-P VelociCalc
Calibrated 1/24/2019

Manufacturer TSI	Classification
Model Number 9565-P	Status pass
Serial Number 9565P1545007	Frequency Yearly
Location New Jersey	Department Lab
Temp 71	Humidity 31

Calibration Specifications

Group # 1	Range Acc % 0.0000
Group Name Differential Pressure	Reading Acc % 1.0000
Stated Accy Pct of Reading	Plus/Minus 0.000

<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
-4.000 / -4.000	inHg	-4.000	inHg	-4.030	-4.030	0.75%	Pass
4.000 / 4.090	inHg	4.090	inHg	4.120	4.120	0.73%	Pass
8.000 / 8.160	inHg	8.160	inHg	8.230	8.230	0.86%	Pass
12.000 / 12.040	inHg	12.040	inHg	12.130	12.130	0.75%	Pass

Group # 2	Range Acc % 0.0000
Group Name Barometric Pressure	Reading Acc % 0.0000
Stated Accy Pct of Reading	Plus/Minus 2.000

<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
30.000 / 29.210	inHg	29.210	inHg	29.170	29.210	0.00%	Pass

Test Instruments Used During the Calibration

<u>Test Instrument ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Serial Number</u>	<u>(As Of Cal Entry Date)</u>	
				<u>Last Cal Date</u>	<u>Next Cal Date</u>
DWYER 477AV	Dwyer 477AV-000 Digital Manometer	Dwyer	005TRQ	9/21/2018	9/21/2019
DWYER 477AV-1	Dwyer 477AV-1 Digital Manometer	Dwyer	005PM2	9/21/2018	9/21/2019
DWYER 477AV-3	Dwyer 477AV-3 Digital Manometer	Dwyer	005PM1	9/21/2018	9/21/2019
OMEGA HX93AC/DP25-E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	10/11/2018	10/11/2020
OMEGA PX02K1-16A5T/DP25-E-A	Omega PX02K1-16A5T/DP25-E-A	Omega Engineering	168377/8375030	10/11/2018	10/11/2020
OMEGA WT4401-D	Omega WT4401-D	Omega Engineering	101105	10/11/2018	10/11/2020

Notes about this calibration

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C232934-00-01

Unit Identification

Manufacturer: **Dwyer**
 Model: **475-0-FM**
 Description: **Digital Manometer**

Serial: **N/A**
 Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **17-Sep-2018**
 Due Date: **17-Sep-2019**

Calibration Conditions

Temperature: **21.8°C**
 Humidity: **33 %**
 Barometric Pressure: **N/A**

General Information

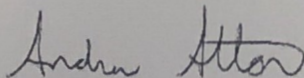
Remark: **N/A**

Standards Used

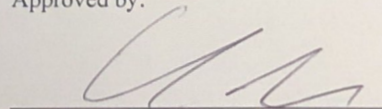
<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0224	Fluke	750P01	16-Apr-2018	16-Oct-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*



Approved by:





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 Fax: (403) 248-5194

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Test Results

Procedure: Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01 Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
Tolerance used (additive if more than one listed):						
0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date: 05/17/2016
 Ambient Temp, °K: 295.5
 Amb Press, Atm: 1.0000

Orifice # FRM1218-
 Pri Std # LFE774300
 Manometer # FRM1218

By:
 Chk:

Std ΔH (inH ₂ O)	Manometer ΔH (inH ₂ O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
2.56	2.56	12.683	12.688	-0.04
2.05	2.05	11.390	11.401	-0.10

**Manometer ΔH vs Act Flow
 Linear Regression Results:**
 m_{flo} = 0.4452
 b_{flo} = 0.4430
 r² = 1.0000

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
 ΔH = manometer reading, inches of water
 T_{act} = ambient temperature, °K
 P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300} \right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
 P_{sea} = Sea Level Atmospheric Pressure
 E = Site elevation, feet

Airmetrics

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about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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Brandon.lawrence@ghd.com
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Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: August 28, 2019

Clean Harbors

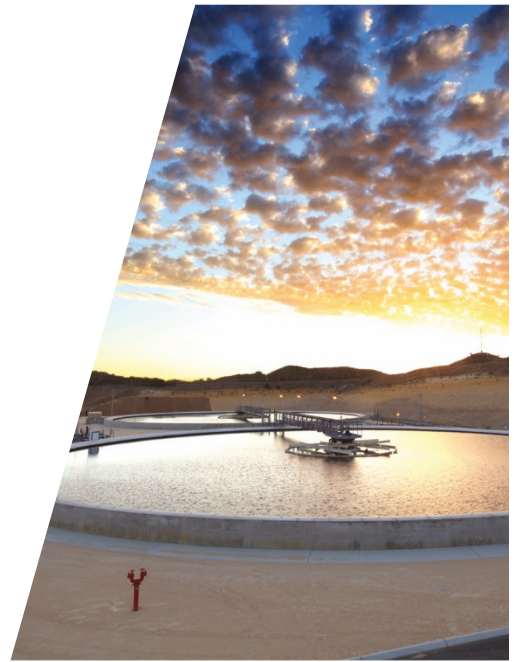




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1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on August 26, 2019. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM₁₀) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1) which is southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive, 2015 (AMD). Siting location, ambient pressure, ambient temperature, filter temperature, leakage rate and flow rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the current Partisol sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.



Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler.	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute.	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants.	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, of the AMD. Table 3.2 of this report compares the reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	18.6	18.9	0.3	±2%	Pass
Barometric Pressure (mmHg)	700	702	2.0	±10 mmHg	Pass
Filter Temperature (°C)	21.5	21.4	0.1	±2%	Pass
Flow	16.7 L/min	16.3 L/min	0.5 L/min	±1 L/min	Pass

3.3 Leak Check Result (AEP Station ID 00010348-I-1)

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4 of the AMD.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.



3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

GHD recommends opening and cleaning PM₁₀ sampling inlet prior to next sampling event.

All of Which is Respectfully Submitted,

GHD

A handwritten signature in blue ink, appearing to read 'Brandon Lawrence', is written in a cursive style.

Brandon Lawrence, QSTI

Appendices

Appendix A

Quarterly Audit Forms



TE-5170V Sampler Calibration Worksheet (Using G-Factor)

Site and Calibration Information

Site	Calibration Orifice
Location: Facility Sampler	Make: Tisch Environmental
Date: Aug 28, 2019	Model: TE-5028A
Tech.: T.Lewis	Serial: 1203
Sampler: TE-5170V	Qa Slope (m): 0.96368
Serial #: P8580 TSP VFC	Qa Int (b): -0.00652
VFC G-Factor: 0.09095235	Calibration due date: 28/11/2020

Ambient Conditions

Temp (deg F): 65.5	Barometric Press (in Hg): 27.58
Ta (deg K): 292	Pa (mm Hg): 700.5
Ta (deg C): 18.6	

Calibration Information

Run Number	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Calculated m3/min	% of Diff
1	3.24	1.212	5.35	9.985	0.986	1.279	5.53
2	3.22	1.208	6.78	12.653	0.982	1.274	5.46
3	3.08	1.182	7.88	14.706	0.979	1.270	7.45
4	2.98	1.163	8.33	15.546	0.978	1.268	9.12
5	2.91	1.149	9.70	18.103	0.974	1.263	9.92

Calculate Total Air Volume Using G-Factor

Enter Average Temperature During Sampling Duration (Deg F)	65.50
Average Temperature During Sampling Duration (Deg K)	291.61
Enter Average Barometric Pressure During Sampling Duration (In Hg)	27.58
Average Barometric Pressure During Sampling (mm Hg)	700.53
Enter Clean Filter Sampler Inches of Water	3.45
Enter Dirty Filter Sampler Inches of Water	3.45
Average Filter Sampler (mm Hg)	6.44
Enter Total Runtime in Hours (xx.xx)	0.25
	Po/Pa : 0.991
	Calculated Flow Rate (m3/min): 1.286
	Total Flow (m3): 19.29

Calculations

$$\text{Calibrator Flow (Qa)} = 1/\text{Slope} * (\text{SQRT}(\text{H2O} * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Pressure Ratio (Po/Pa)} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Difference} = (\text{Look Up Flow} - \text{Calibrator Flow}) / \text{Calibrator Flow} * 100$$

NOTE: Ensure calibration orifice has been certified within 12 months of use



TE-5170V Sampler Calibration Worksheet (Using G-Factor)

Site and Calibration Information

Site	Calibration Orifice
Location: Ryley School Sampler	Make: Tisch Environmental
Date: Aug 28, 2019	Model: TE-5028A
Tech.: Trevor Lewis	Serial: 1203
Sampler: TE-5170V	Qa Slope (m): 0.96368
Serial #: P8581 TSP VFC	Qa Int (b): -0.00652
VFC G-Factor: 0.090677198	Calibration due date: 28/11/2020

Ambient Conditions

Temp (deg F): 65.5	Barometric Press (in Hg): 27.50
Ta (deg K): 292	Pa (mm Hg): 698.5
Ta (deg C): 18.6	

Calibration Information

Run Number	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Calculated m3/min	% of Diff
1	3.20	1.206	5.13	9.574	0.986	1.279	6.05
2	3.14	1.195	6.54	12.205	0.983	1.274	6.61
3	3.05	1.178	7.53	14.053	0.980	1.271	7.90
4	2.95	1.158	8.60	16.050	0.977	1.267	9.32
5	2.92	1.152	9.60	17.916	0.974	1.263	9.63

Calculate Total Air Volume Using G-Factor

Enter Average Temperature During Sampling Duration (Deg F)	65.50
Average Temperature During Sampling Duration (Deg K)	291.61
Enter Average Barometric Pressure During Sampling Duration (In Hg)	27.50
Average Barometric Pressure During Sampling (mm Hg)	698.50
Enter Clean Filter Sampler Inches of Water	3.45
Enter Dirty Filter Sampler Inches of Water	3.45
Average Filter Sampler (mm Hg)	6.44
Enter Total Runtime in Hours (xx.xx)	0.25
	Po/Pa : 0.991
	Calculated Flow Rate (m3/min): 1.286
	Total Flow (m3): 19.28

Calculations

$$\text{Calibrator Flow (Qa)} = 1/\text{Slope} * (\text{SQRT}(\text{H2O} * (\text{Ta}/\text{Pa})) - \text{Intercept})$$

$$\text{Pressure Ratio (Po/Pa)} = 1 - \text{Pf}/\text{Pa}$$

$$\% \text{ Difference} = (\text{Look Up Flow} - \text{Calibrator Flow}) / \text{Calibrator Flow} * 100$$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Appendix B

Calibration Certificates



ITM INSTRUMENTS INC.

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Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

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Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C232934-00-02

Unit Identification

Manufacturer: **Fluke**
Model: **1551A Ex**
Description: **Stik Thermometer**

Serial: **3520009**

Unit ID: **N/A**

Calibration Date

Calibration Date: **18-Sep-2018**

Due Date: **18-Sep-2019**

Calibration Conditions

Temperature: **22.8°C**

Humidity: **33 %**

Barometric Pressure: **N/A**

General Information

Remark: **N/A**

Standards Used

<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0080	Burns Engineering	12001-A-12-6-2-A	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2018	11-Apr-2019
CAL0223	Ametek	RTC-158B	10-Sep-2018	10-Mar-2020

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*

Approved by:



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Test Results

Procedure: Fluke Stik Thermometer /RTC-158B,1502,PRT Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
0.030 °C		0.06 °C	-0.02 °C	0.08 °C	Pass	8.3e-003 °C
25.003 °C		25.04 °C	24.95 °C	25.05 °C	Pass	8.8e-003 °C
99.765 °C		99.77 °C	99.72 °C	99.81 °C	Pass	1.0e-002 °C
149.558 °C		149.60 °C	149.51 °C	149.61 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT



Advanced Labs, Inc.

Pine Environmental Services, Inc

Instrument ID 19821
Description TSI 9565P VelociCalc
Calibrated 4/9/2019

Manufacturer TSI	Classification
Model Number 9565P	Status pass
Serial Number 9565P1232015	Frequency Yearly EOM
Location New Jersey	Department Lab
Temp 75	Humidity 30

Calibration Specifications

Group # 1				Range Acc %	0.0000		
Group Name Barometric Pressure				Reading Acc %	2.0000		
Stated Accy Pct of Reading				Plus/Minus	0.000		
<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
30.000 / 29.420	inHg	29.420	inHg	29.430	29.420	0.00%	Pass
Group # 2				Range Acc %	0.0000		
Group Name Differential Pressure				Reading Acc %	1.0000		
Stated Accy Pct of Reading				Plus/Minus	0.00		
<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
-4.00 / -4.00	inH2O	-4.00	inH2O	-4.03	-4.03	0.75%	Pass
4.00 / 4.00	inH2O	4.00	inH2O	4.03	4.03	0.75%	Pass
8.00 / 8.00	inH2O	8.00	inH2O	8.06	8.06	0.75%	Pass
12.00 / 12.00	inH2O	12.00	inH2O	12.07	12.07	0.58%	Pass

Test Instruments Used During the Calibration

<u>Test Instrument ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Serial Number</u>	<u>(As Of Cal Entry Date)</u>	
				<u>Last Cal Date</u>	<u>Next Cal Date</u>
DWYER 477AV-1	Dwyer 477AV-1 Digital Manometer	Dwyer	005PM2	9/21/2018	9/21/2019
OMEGA HX93AC/DP25- E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	10/11/2018	10/11/2020

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated David Galego

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C232934-00-01

Unit Identification

Manufacturer: **Dwyer**
 Model: **475-0-FM**
 Description: **Digital Manometer**

Serial: **N/A**
 Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **17-Sep-2018**
 Due Date: **17-Sep-2019**

Calibration Conditions

Temperature: **21.8°C**
 Humidity: **33 %**
 Barometric Pressure: **N/A**

General Information

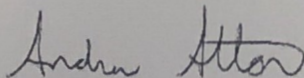
Remark: **N/A**

Standards Used

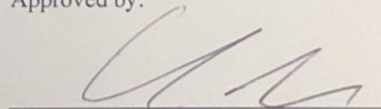
<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0224	Fluke	750P01	16-Apr-2018	16-Oct-2018

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*



Approved by:





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 Calgary, AB T2C 5J3
 Tel: (403) 272-9332
 Fax: (403) 248-5194

www.itm.com - information@itm.com

Test Results

Procedure: Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01 Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
Tolerance used (additive if more than one listed):						
0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1 inH2O		1 inH2O	1 inH2O	1 inH2O	Pass	5.8e+000 inH2O
2 inH2O		2 inH2O	2 inH2O	2 inH2O	Pass	5.8e+000 inH2O
4 inH2O		4 inH2O	4 inH2O	4 inH2O	Pass	5.8e+000 inH2O
6 inH2O		6 inH2O	6 inH2O	6 inH2O	Pass	5.8e+000 inH2O
8 inH2O		8 inH2O	8 inH2O	8 inH2O	Pass	5.8e+000 inH2O
10 inH2O		10 inH2O	10 inH2O	10 inH2O	Pass	5.8e+000 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date: 05/17/2016
 Ambient Temp, °K: 295.5
 Amb Press, Atm: 1.0000

Orifice # FRM1218-
 Pri Std # LFE774300
 Manometer # FRM1218

By:
 Chk:

Std ΔH (inH ₂ O)	Manometer ΔH (inH ₂ O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
4.39	4.39	16.490	16.479	0.07
3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
2.56	2.56	12.683	12.688	-0.04
2.05	2.05	11.390	11.401	-0.10

**Manometer ΔH vs Act Flow
 Linear Regression Results:**
 m_{flo} = 0.4452
 b_{flo} = 0.4430
 r² = 1.0000

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
 ΔH = manometer reading, inches of water
 T_{act} = ambient temperature, °K
 P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300} \right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
 P_{sea} = Sea Level Atmospheric Pressure
 E = Site elevation, feet

Airmetrics

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about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Brandon Lawrence
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403.538.8605

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Quarterly Audit Partisol FRM Model 2000

Clean Harbors
50114 Range Rd. 173
Ryley, Alberta T0B 4A0
Quarterly Audit Date: December 18, 2019

Clean Harbors

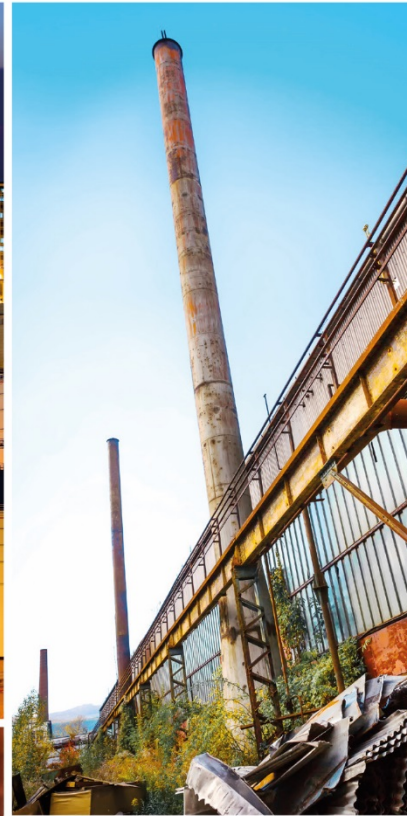
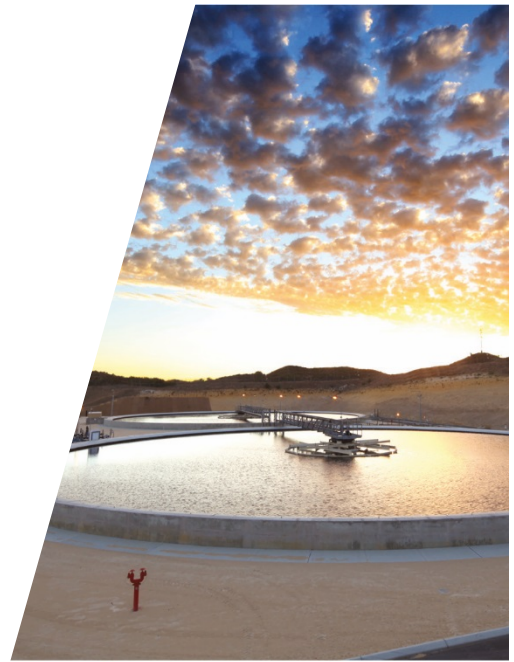




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1. Introduction

GHD Limited (GHD) was retained by Clean Harbors to conduct a Quarterly Audit at 50114 Range Road 173 Ryley, Alberta (Facility) on December 18, 2019. The Quarterly Audit was conducted on the Partisol FRM 2000 Particulate Matter less than 10 microns (PM₁₀) Sampler (Partisol Sampler), located on the roof of the Ryley Lift Station (AEP Station ID 00010348-I-1), which is southeast of the Facility. The coordinates of the lift station are 53.297961, -112.416076.

2. Audit Procedure

The Partisol Sampler was audited in accordance with the instrument manual and the Alberta Air Monitoring Directive, 2015 (AMD). Siting location, ambient pressure, ambient temperature, filter temperature, leakage rate and flow rate were audited, as well as overall instrument condition to ensure compliance with the instrument manual and the AMD. Below is a summary of the tasks performed on the Partisol Sampler:

- Siting Location Audit
- Ambient Pressure Audit
- Ambient Temperature Audit
- Filter Temperature Audit
- Leakage Rate Audit
- Flow Rate Audit
- Instrument Condition and Recommendations

GHD verified all of these parameters using calibrated reference instruments. GHD reference instruments either have National Institute of Standards and Technology (NIST) Traceable Certifications, current manufacturer certification, or were verified by a primary standard. The GHD quarterly audit field form can be found in Appendix A. All calibrations and certifications can be found in Appendix B.

3. Audit Results

3.1 Siting Location Audit Results (AEP Station ID 00010348-I-1)

The siting location of the Partisol Sampler meets the requirements of Chapter 3, of the AMD. Table 3.1 of this report compares the AMD Siting Requirements for Intermittent Samplers versus the current Partisol sampler location.

- The current coordinates of the Partisol Sampler are 53.297961, -112.416076.
- The distance from the nearest roadway is 21 m.



Table 3.1 AMD Requirements vs. Current Partisol Sampler Location

Site Characteristics	AMD Requirements	Current Location	Specification
Sampler Inlet-height above ground (abg)	Minimum 2 m, Maximum 15 m	Meets Requirement	4.63 m abg
Other Requirements	a. Distance from an obstacle greater than 2.5 times the height of the obstacle above the sampler.	Meets Requirement	>2.5 times
	b. At least 2 m from any other samplers or inlets with flow rates greater than 200 litres (L) per minute,	Meets Requirement	None
	Or at least 1 m apart from any other samplers or inlets with flow rates less than or equal of 200 L per minute.	Meets Requirement	None
	c. Unrestricted air flow in three to four wind quadrants.	Meets Requirement	4/4 Unrestricted Quadrants

3.2 Pressure and Temperature Audit Results (AEP Station ID 00010348-I-1)

The pressure and temperature audit results of the Partisol Sampler meet the requirements of Chapter 4, of the AMD. Table 3.2 of this report compares the reference results versus the Partisol Sampler readings.

Table 3.2 Reference Results vs. Partisol Sampler Readings

Parameter	Partisol	Reference	Difference	Limit	Pass/Fail
Ambient Temperature (°C)	-5.0	-4.9	0.1	±2%	Pass
Barometric Pressure (mmHg)	697	696	1	±10 mmHg	Pass
Filter Temperature (°C)	-2.0	-2.04	0.04	±2%	Pass
Flow	16.7 L/min	16.6 L/min	0.1 L/min	±1 L/min	Pass

3.3 Leak Check Result (AEP Station ID 00010348-I-1)

The Partisol firmware performs leak checks in automatic mode and indicates either a "pass" or "fail" based on a pressure drop off -4 mmHg per minute. The Partisol Sampler passed the requirements of Chapter 4 of the AMD.

3.4 Flow Audit (AEP Station ID 00010348-I-1)

The flow audit results of the Partisol Sampler meet the requirements of Chapter 4 of the AMD, refer to Table 3.2.



3.5 Instrument Condition and Recommendations (AEP Station ID 00010348-I-1)

The Partisol Sampler was visually and functionally inspected on the audit day. Audit recommendations and instrument conditions are listed below:

- Liquid crystal display screen is functioning.
- Filter exchange cabinet has been cleaned.
- Ventilation fan filters are clean.
- Filter exchange mechanism is operating normally.
- Filter v-seals are in good condition.
- Ambient temperature and pressure sensor wires in good condition.
- Main power connection wire in good condition.

3.5.1 Recommendations

GHD recommends opening and cleaning PM₁₀ sampling inlet prior to next sampling event.

Appendices

Appendix A

Quarterly Audit Form



GHD Quarterly Audit Form

Date	12/18/2019	Weather Cond.:	Sunny/Calm
Owner	Clean Harbors	Start Time:	11:40
Station Name	Ryley Lift Station	End Time:	12:10
Parameter	PM ₁₀	Performed By:	Trevor Lewis

Partisol FRM Model 2000 Identification		Sampler Data	
Make/Model:	R & P Partisol FRM 2000	Temperature:	-5.5°C
Unit ID:	Ryley Lift Station	Pressure:	697 mmHg
S/N:	200FB209860905	Flow Set Point:	16.7

GHD Reference Standards				
	Flow	Pressure	Temperature	Manometer
Make:	AirMetrics	TSI	Fluke	Dwyer
Model:	FRM	9565-P	1551A EX	Series 475
Serial Number:	FRM1218	9565P1324039	3520009	MAN-CAL-001
Calibration Date:	5/17/2016	3/15/2019	10/8/2019	10/8/2019

Audit Data	Sampler Data	Reference Data	Difference	Pass/Fail
Ambient Temperature (±2 %)	-5.0	-4.9	0.10	Pass
Barometric Pressure (±10 mmHg)	697	696	1.00	Pass
Filter Temperature (± 2%)	-2.0	-2.04	0.04	Pass
Flow (±1.0 litres/minute)	16.7	16.6	0.10	Pass

Leak Check					
Pressure Drop	Initial Pressure	Final Pressure	Pressure Drop	Pass/Fail	
(-4 mmHg / minute)	14.00	14.00	0.00	Pass	in.HG
Leak check was performed in automatic mode, sampler indicated:			Pass @ 5 mmHg/min		

As Found/As Left	Yes/No	As Found	As Left	Pass/Fail
Did the ambient temperature require adjustment?	No	-5.0	-5.0	Pass
Did the barometric pressure require adjustment?	No	697	697	Pass
Did the filter temperature require adjustment?	No	-2.0	-2.0	Pass
Did the flow audit require adjustment?	No	16.7	16.7	Pass

Comments
Partisol sampler was moderately dirty, GHD cleaned the sampler.

Flow Equation						
Set Point	Actual Flow (Qact)	Absolute Difference	Pass/Fail	Manometer (DH)	4.5 "H2O	
(lpm)	(lpm)	(lpm)	(± 1 lpm)	Actual Temp (Tact)	268.15 °K	-5.0°C
				Actual Pres (Pact)	0.928 bar	
				Actual Pres (Pact)	27.40 inHg	
16.7	16.6	0.1	Pass			
FTS Linear Regression Constants						
(mflo) =	0.4452	$Q_{act} = m_{flo} \times \frac{\sqrt{\Delta H \times T_{act}}}{P_{act}} + b_{flo}$				
(bflo) =	0.4430					

Appendix B

Calibration Certificates

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C299060-00-02

Unit Identification

Manufacturer: **Fluke**
 Model: **1551A Ex**
 Description: **Stik Thermometer**

Serial: **3520009**
 Unit ID: **THM-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
 Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **22.1°C**
 Humidity: **26 %**
 Barometric Pressure: **N/A**

General Information

Remark: **N/A**

Standards Used

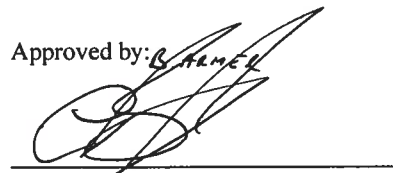
<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0080	Burns Engineering	12001-A-12-6-2-A	4-Jun-2018	4-Jun-2021
CAL0124	Hart Scientific	1502A	11-Apr-2019	11-Apr-2020
CAL0223	Ametek	RTC-158B	2-Apr-2019	2-Oct-2020

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*



Approved by: *[Signature]*





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#209, 4615 112 Ave SE
Calgary, AB T2C 5J3
Tel: (403) 272-9332
Fax: (403) 248-5194

www.itm.com - information@itm.com

Test Results

Procedure: Fluke Stik Thermometer /RTC-158B,1502,PRT Rev: 1.0

Data Type: As Found Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
-0.058 °C		-0.08 °C	-0.11 °C	-0.01 °C	Pass	8.3e-003 °C
25.024 °C		24.98 °C	24.97 °C	25.07 °C	Pass	8.8e-003 °C
100.289 °C		100.26 °C	100.24 °C	100.34 °C	Pass	1.0e-002 °C
150.471 °C		150.45 °C	150.42 °C	150.52 °C	Pass	1.2e-002 °C

INSTRUMENT CALIBRATION REPORT



Pine Environmental Services, Inc

Instrument ID 29813
Description 19806
Calibrated 3/15/2019

Manufacturer TSI
Model Number 9565-P
Serial Number 9565P1324039
Location New Jersey
Temp 73

Classification
Status pass
Frequency Yearly EOM
Department Lab
Humidity 34

Calibration Specifications

Group # 1				Range Acc %	0.0000		
Group Name Differential Pressure				Reading Acc %	1.0000		
Stated Accy Pct of Reading				Plus/Minus	0.00		
<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
-4.00 / -4.00	inH2O	-4.00	inH2O	-4.03	-4.03	0.75%	Pass
4.00 / 4.00	inH2O	4.00	inH2O	4.04	4.04	1.00%	Pass
8.00 / 8.00	inH2O	8.00	inH2O	8.06	8.06	0.75%	Pass
12.00 / 12.00	inH2O	12.00	inH2O	12.07	12.07	0.58%	Pass

Group # 2				Range Acc %	0.0000		
Group Name Barometric Pressure				Reading Acc %	1.0000		
Stated Accy Pct of Reading				Plus/Minus	0.00		
<u>Nom In Val / In Val</u>	<u>In Type</u>	<u>Out Val</u>	<u>Out Type</u>	<u>Fnd As</u>	<u>Lft As</u>	<u>Dev%</u>	<u>Pass/Fail</u>
30.00 / 29.72	inHg	29.72	inHg	29.71	29.71	-0.03%	Pass

Test Instruments Used During the Calibration

<u>Test Instrument ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Serial Number</u>	<u>(As Of Cal Entry Date)</u>	
				<u>Last Cal Date</u>	<u>Next Cal Date</u>
DWYER 477AV-1	Dwyer 477AV-1 Digital Manometer	Dwyer	005PM2	9/21/2018	9/21/2019
OMEGA HX93AC/DP25- E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	10/11/2018	10/11/2020

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated David Galego

**Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the
 manufacture's specifications using NIST traceable standards, or is derived from accepted values of
 physical constants.**

INSTRUMENT CALIBRATION REPORT



Pine Environmental Services, Inc

Instrument ID 24685
Description TSI 964 Probe
Calibrated 4/12/2019

Test Instruments Used During the Calibration

<u>Test Instrument ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Serial Number</u>	<u>(As Of Cal Entry Date)</u>	
				<u>Last Cal Date</u>	<u>Next Cal Date</u>
MICHELL DM-509-TX-01	Relative Humidity Meter	Michell	273296	9/17/2018	9/17/2019
OMEGA HX93AC/DP25- E	Omega HX93AC/DP25-E	Omega Engineering	1010368 035025 035026	10/11/2018	10/11/2020
OMEGA PX02K1-16A5T /DP25-E-A	Omega PX02K1-16A5T/DP25-E-A	Omega Engineering	168377/8375030	10/11/2018	10/11/2020
OMEGA WT4401-D	Omega WT4401-D	Omega Engineering	101105	10/11/2018	10/11/2020

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated David Galego

Advanced Labs, Inc. hereby certifies that this instrument is calibrated and functions to meet the manufacture's specifications using NIST traceable standards, or is derived from accepted values of physical constants.

Calibration Certificate

Customer: *GHD Ltd.*

Certificate: C299060-00-01

Unit Identification

Manufacturer: **Dwyer**
 Model: **475-0-FM**
 Description: **Digital Manometer**

Serial: **N/A**
 Unit ID: **MAN-CAL-001**

Calibration Date

Calibration Date: **8-Oct-2019**
 Due Date: **8-Oct-2020**

Calibration Conditions

Temperature: **21.5°C**
 Humidity: **27 %**
 Barometric Pressure: **N/A**

General Information

Remark: **N/A**

Standards Used

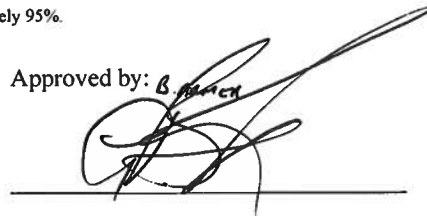
<u>Unit ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
CAL0224	Fluke	750P01	5-Jul-2019	5-Jan-2020

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of $k=2$ corresponding to a confidence level of approximately 95%.

Calibrated by: *A. Atton*



Approved by: *B. [Signature]*





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Test Results

Procedure: Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01 Rev: 1.1

Data Type: As Found Results: Fail

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
Tolerance used (additive if more than one listed): 0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1.000 inH2O		1.007 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.033 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.032 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.077 inH2O	5.950 inH2O	6.050 inH2O	Fail	1.6e-002 inH2O
8.000 inH2O		8.089 inH2O	7.950 inH2O	8.050 inH2O	Fail	1.6e-002 inH2O
10.000 inH2O		10.113 inH2O	9.950 inH2O	10.050 inH2O	Fail	1.6e-002 inH2O

Test Results

Procedure: Pressure Gauge 10.00 IN.W.C 0.5% FS /750P01 Rev: 1.1

Data Type: As Left Results: Pass

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower Limit</u>	<u>Upper Limit</u>	<u>Test Status</u>	<u>Exp Uncert</u>
Results Run: 2.00						
Tolerance used (additive if more than one listed): 0.5% of full scale						
UUT is set to the nominal value, Reading is the actual pressure read by the system instrument.						
1.000 inH2O		0.997 inH2O	0.950 inH2O	1.050 inH2O	Pass	1.6e-002 inH2O
2.000 inH2O		2.001 inH2O	1.950 inH2O	2.050 inH2O	Pass	1.6e-002 inH2O
4.000 inH2O		4.005 inH2O	3.950 inH2O	4.050 inH2O	Pass	1.6e-002 inH2O
6.000 inH2O		6.007 inH2O	5.950 inH2O	6.050 inH2O	Pass	1.6e-002 inH2O
8.000 inH2O		7.999 inH2O	7.950 inH2O	8.050 inH2O	Pass	1.6e-002 inH2O
10.000 inH2O		9.996 inH2O	9.950 inH2O	10.050 inH2O	Pass	1.6e-002 inH2O

NIST Traceable Transfer Standard Calibration

Calibration Date: 05/17/2016
 Ambient Temp, °K: 295.5
 Amb Press, Atm: 1.0000

Orifice # FRM1218-
 Pri Std # LFE774300
 Manometer # FRM1218

By:
 Chk:

Std ΔH (inH ₂ O)	Manometer ΔH (inH ₂ O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
6.67	6.67	20.179	20.209	-0.15
5.86	5.86	18.988	18.970	0.09
5.10	5.10	17.733	17.727	0.03
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3.73	3.73	15.233	15.224	0.06
3.12	3.12	13.964	13.962	0.02
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**Manometer ΔH vs Act Flow
 Linear Regression Results:**
 m_{flo} = 0.4452
 b_{flo} = 0.4430
 r² = 1.0000

* all points must be within ± 2%

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The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
 ΔH = manometer reading, inches of water
 T_{act} = ambient temperature, °K
 P_{act} = ambient pressure, atmospheres

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300} \right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
 P_{sea} = Sea Level Atmospheric Pressure
 E = Site elevation, feet

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about GHD

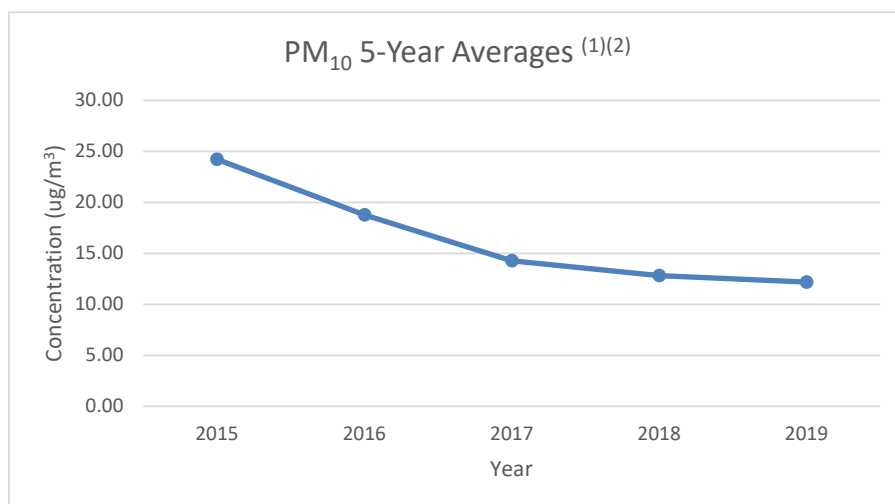
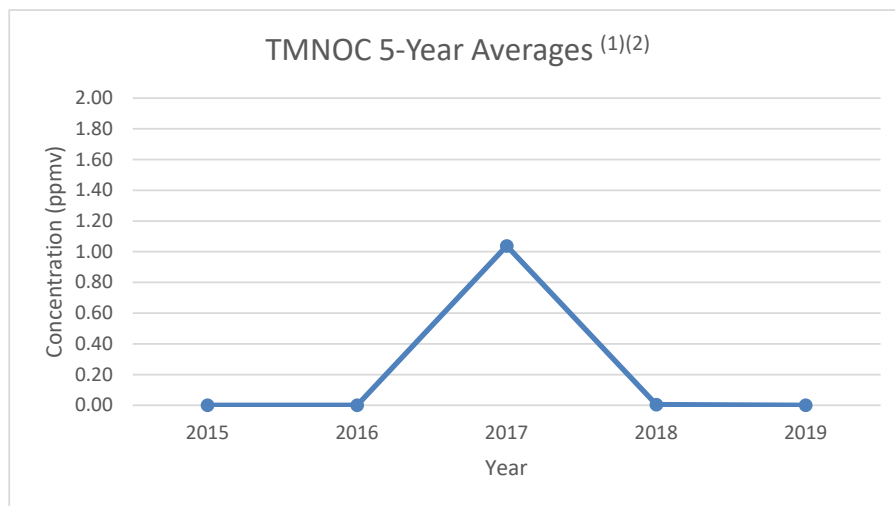
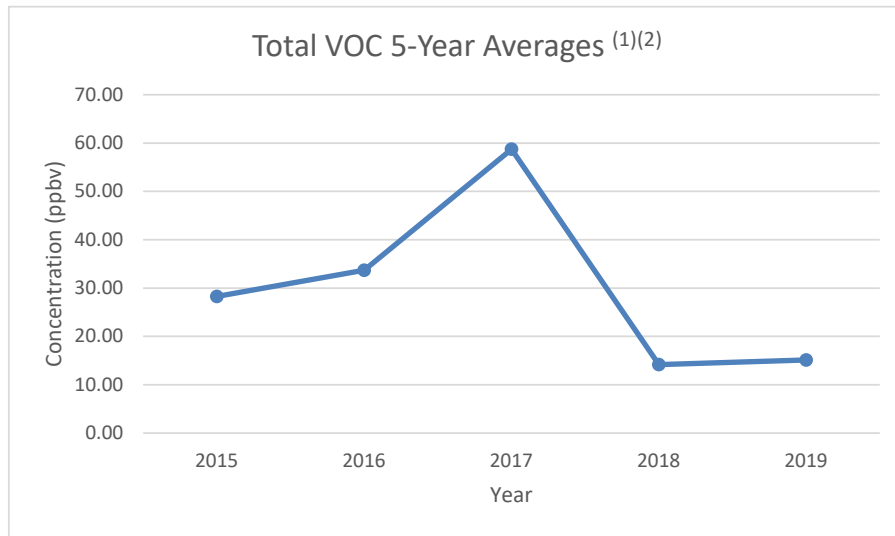
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Appendix C

5 Year Averages for PM₁₀, VOC and TNMOC Concentrations



Notes:

- (1) All values under the lab method detection limit from 2015-2018 were reported as zero, as per the AMD.
- (2) Values under the lab method detection limit from 2019 onward were reported as the lab detection limit



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