SoundEarth Strategies, Inc.
2811 Fairview Avenue East, Suite 2000
Seattle, Washington 98102

SUPPLEMENTAL VAPOR INTRUSION ASSESSMENT WORK PLAN

Property:
Troy Laundry Property
300 Boren Avenue North and
399 Fairview Avenue North
Seattle, Washington

Report Date:
February 12, 2019

Prepared for:
Washington State Department of Ecology
Toxics Cleanup Program
Northwest Regional Office
3190 160th Avenue Southeast
Bellevue, Washington

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Prepared for:

Washington State Department of Ecology
Toxics Cleanup Program, Northwest Regional Office
3190 160th Avenue Southeast
Bellevue, Washington 98008

Troy Laundry Property
300 Boren Avenue North and
399 Fairview Avenue North
Seattle, Washington 98109

Project No.: 0731-004

Prepared by:

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Thomas Cammarata, LG, LHG
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February 12, 2019

SoundEarth Strategies

TABLE OF CONTENTS

1.0 INTRODUCTION

On behalf of Touchstone SLU LLC and TB TS/RELP LLC (Touchstone), SoundEarth Strategies, Inc. (SoundEarth) has prepared this Supplemental Vapor Intrusion Assessment Work Plan (Supplemental Work Plan) to describe air quality sampling that SoundEarth will conduct at the Troy Laundry Property located at 300 Boren Avenue North and 399 Fairview Avenue North in Seattle, Washington (Property; Figure 1). The vapor intrusion assessment work is being conducted following a request by the Washington State Department of Ecology (Ecology) pursuant to their authority under Agreed Order No. DE 8996 (the Agreed Order) and the First Amendment of the Agreed Order between Touchstone and Ecology.

An Interim Action Plan (IAP; SoundEarth 2013) was approved as a conceptual plan by Ecology on October 10, 2013. An Engineering Design Report (EDR; SoundEarth 2014) was prepared to include details necessary to implement the IAP. Ecology approved the EDR on March 4, 2014. The interim action, including the ongoing vapor intrusion assessment work, is being conducted in accordance with the IAP and EDR.

The vapor intrusion assessment is being conducted in general accordance with the following Ecology and US Environmental Protection Agency (EPA) guidance documents:

- Draft *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*, dated October 2009 and updated in February 2016
- Ecology's *Updated Process for Initially Assessing the Potential for Petroleum Vapor Intrusion (Implementation Memorandum #14)*, dated March 2016
- EPA's *Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites*, dated June 2015 (EPA 2015a)
- EPA's *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from the Subsurface Vapor Sources to Indoor Air*, dated June 2015 (EPA 2015b)

1.1 PURPOSE

The objective of this Supplemental Work Plan is to provide Ecology with the proposed air quality sampling locations, laboratory analytical methods, quality assurance/quality control procedures, and schedule for the proposed air quality sampling event. The Supplemental Work Plan describes additional air quality samples to be collected at the Property in response to Ecology comments on the Troy Laundry Property Vapor Intrusion Assessment Report prepared by SoundEarth and dated June 22, 2018 (SoundEarth 2018b). The purposes of the second air quality sampling event are as follows:

- To determine how temporally representative the previous air sample results in the P1 and P5 parking levels were.
- To collect representative air sample in the shaft of the elevator which travels inside the building between the P1 to P5 parking levels.
- To evaluate indoor air quality in two P5 parking level stairways located on the northside of the parking level and located on the southside of the parking level.
- To evaluate the indoor air quality in two P1 parking level stairways located on the northside of the parking level and the southside of the parking level. The southside stairway exits into the building ground floor lobby.

The goal for indoor air at the Property is for concentrations of chlorinated volatile organic compounds (CVOCs) to be below cleanup levels at the point of compliance as presented in the IAP. The points of compliance for indoor air will be the standard point of compliance per Washington Administrative Code chapter 173-340-750(6), which is ambient air throughout the Property.

The air sampling conducted in March 2018 met the cleanup levels for indoor air at the Property. If results from additional air sampling conducted in accordance with the Supplemental Work Plan also meet the indoor air cleanup levels, no further indoor air sampling will be required.

2.0 BACKGROUND

In March 2018, SoundEarth collected 18 indoor air samples (IA01 through IA16 and IA19 and IA20) and one outdoor air sample (OA01) at the Property. The samples were collected from five parking levels (P1 through P5), stairways in the P1 and P5 levels, and in the elevator shaft at the P5 level. Analytical results for the indoor and outdoor air samples collected in March 2018 indicated the following:

- Concentrations of CVOCs and air-phase hydrocarbons (APHs) in the indoor and outdoor air samples were less than the Washington State Model Toxics Control Act (MTCA) Modified Method B Indoor Air Commercial Land Use Cleanup Remediation Levels, and also below the more stringent MTCA Method B Indoor Air Cleanup Levels, as presented in Table 1 of the Vapor Intrusion Assessment Report (SoundEarth 2018b). Concentrations of CVOCs were as follows:
  - Of the 15 indoor air samples collected, 13 did not contain concentrations of CVOCs above laboratory reporting limits.
  - Only two indoor air samples had concentrations of tetrachloroethene (PCE) above laboratory reporting limits: IA02 and IA20. Both concentrations of PCE are less than the MTCA Modified Method B Indoor Air Remediation Levels and also below the more stringent MTCA Method B Indoor Air Cleanup Level.
  - Trichloroethene (TCE) concentrations were reported at 0.27 micrograms per cubic meter ($\mu g/m^3$) and 0.34 $\mu g/m^3$ for indoor air samples IA02 and IA20, respectively.
  - Cis-1,2-dichloroethene (cis-1,2-DCE) and trans-1,2-dichloroethene (trans-1,2-DCE) concentrations were not reported above their laboratory reporting limits of 0.2 $\mu g/m^3$.
  - Vinyl chloride (VC) concentrations were not reported above the laboratory reporting limit of 0.13 $\mu g/m^3$, except for indoor air sample IA20 which had a VC concentration of 0.13 $\mu g/m^3$.
- Concentrations of APHs in the indoor and outdoor air samples were less than the MTCA Modified Method B Indoor Air Remediation Levels, as presented in Table 2 of the Vapor Intrusion Assessment Report (SoundEarth 2018b). Concentrations of APHs were as follows:
  - APHs were detected in all the indoor and the outdoor air samples collected.
  - Concentrations of APHs (EC5–8 aliphatics) were detected in the indoor and outdoor air samples above the laboratory reporting limits. Concentrations of EC5–8 aliphatics ranged from 49 $\mu g/m^3$ to 140 $\mu g/m^3$. The highest concentration was detected in indoor air sample IA13 collected on the east wall of the P3 parking level.

- Concentrations of APHs (EC9–12 aliphatics) ranged in concentration less than the laboratory reporting limit of 35 µg/m^3 to 47 µg/m^3. The highest concentration was detected in indoor air sample IA20 collected on the interior stairwell of the P1 parking garage level.
- Concentrations of APHs (EC9–10 aromatic) were not reported above the laboratory reporting limit of 0.25 µg/m^3.

A detailed discussion of the March 2018 air sampling event and previous environmental investigation at the Property is presented in the Vapor Intrusion Assessment Report (SoundEarth 2018b).

2.1 BUILDING DESCRIPTION

The Property has been redeveloped with two office towers: one 12-story tower (South Tower) and one 13-story tower (North Tower). The new structures include approximately 810,000 square feet of office space; 1,500 square feet of street-level retail space; public open space between the two towers; and a five-level underground parking garage to accommodate up to 1,120 vehicles, underlying and servicing both towers. The South Tower occupancy began September 13, 2016, and the North Tower occupancy began August 1, 2017. A detailed description of parking levels and elevators servicing the parking garage and the operation of air exchange system in the parking garage levels is presented in the Vapor Intrusion Assessment Work Plan (VI Work Plan), prepared by SoundEarth and dated January 25, 2018 (SoundEarth 2018a).

3.0 PROPOSED SCOPE OF WORK

The proposed scope of work for the Tier II assessment includes conducting a building survey and collecting air quality samples. The scope of work will be conducted in general accordance with Ecology's draft *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*.

3.1 BUILDING SURVEY

Prior to collecting air quality samples, SoundEarth will complete a building survey of the South Tower and parking garage to evaluate the potential volatile organic compound sources or materials that may contribute to background indoor air contamination. Due to the size of the building, the building survey will focus on anticipated areas of sample collection, mainly the parking levels. SoundEarth will complete a Building Survey Form documenting the findings of the building survey. The Building Survey Form is presented in Appendix B of the VI Work Plan (SoundEarth 2018a). Previously available information about the building, building materials, and HVAC systems will be noted and confirmed during the survey. Select building plans and HVAC designs are included in Appendix A of the VI Work Plan (SoundEarth 2018a).

3.2 BUILDING OPERATING CONDITIONS DURING VAPOR INTRUSION SAMPLING

The building was designed to ensure that the elevator shafts do not act as a conduit for vapor intrusion from the parking garage to the occupied building. Specifically, the HVAC systems for the South Tower and North Tower are designed to have elevator lobbies at a positive pressure relative to the elevator shaft to mitigate any garage exhaust (or other vapors) from entering occupied space (Appendix A of the VI Work Plan; SoundEarth 2018a).

During the VI sampling event, employees and cars will not be allowed in the parking levels and stairways in order to avoid introducing unknown sources of CVOCs which could create sample results that are biased high.

In the parking levels and stairways, SoundEarth will simulate normal operating conditions during the VI sampling event as follows:

3.2.1 Stairway - 1

To simulate normal operating conditions during the VI sampling event, the facilities manager will open and close the stairway door on Stairway - 1 two times per hour from 8 a.m. to 6 p.m. on the day of the VI sampling event. The frequency for opening and closing the doors is based on the data collected in Stairway - 1 in South Tower Lobby P1 parking level during normal occupancy on November 13, 2018 and between the hours of 8 a.m. to 6 p.m., which demonstrated that the stairway was used twice in the morning and was not used in the afternoon. Stairway usage data is presented in Appendix A.

3.2.2 Stairway - 4

To simulate normal operating conditions during VI sampling event, the facilities manager will to open and close the stairway door on Stairway - 4 four times per hour from 8 a.m .to 6 p.m. on the day of the VI sampling event. The frequency for opening and closing the doors is based on data collected in Stairway - 4 (which exits to Harrison Street P1 parking level) during normal occupancy on November 13, 2018 and between the hours of 8 a.m. to 6 p.m., which demonstrated that the stairway had one and one-half uses per hour in the afternoon.

3.2.3 Exhaust Fan

To simulate normal operation of the exhaust fans in the parking levels during the VI sampling event, the building engineer will ramp up the exhaust fans in each parking level manually to simulate the normal operation during a typical work week. Based on garage fan use logs, all garage fans operate 24-hours per day 7-days a week at 15 hertz. The fans ramp up when the carbon monoxide sensors detect elevated levels. As shown in Appendix A, data logs for the garage fans indicate the pattern of when elevated carbon monoxide levels occur in the parking levels.

3.3 INDOOR AIR SAMPLING LOCATIONS

Indoor air sample locations have been selected to address the potential of vapor intrusion from the groundwater exceedances beneath the building and soil concentrations in the building sidewalls.

SoundEarth will collect six indoor air samples (IA21 through IA25) during the sampling event (Table 1 of this Supplemental Work Plan). The proposed indoor air sample locations are shown in Figures 2 and 3 and are described below:

- Four indoor air samples will be collected on the P5 parking level. The samples will be collected as follows:
  - IA21, located in Stairway - 4.
  - IA22, located within the elevator shaft. The samples will be collected during the weekday and weekend to simulate normal elevator function. SoundEarth will collect one sample in the elevator shaft.

- IA23, located in Stairway - 1 adjacent to the elevator.

- Two indoor air samples will be collected on the P1 parking level. The samples will be collected as follows:
  - IA24, located in Stairway - 4.
  - IA25, located in Stairway - 1 leading to the lobby just outside the door connecting the stairway to the lobby (above the garage).
- SoundEarth will collect one outdoor air samples (OA02) from the exterior of the building. The sample will be collected upwind at street level outside the southwest corner of the building (Figure 3).

SoundEarth will collect indoor air sampling on a weekend for all the samples except IA22, which will be collected during normal weekday business hours and on the weekend over a period of 21 days. For the weekend sampling event, the parking levels will be closed to minimize interference from unknown sources of CVOCs. The facilities managers will simulate garage exhaust, air exchanges, and stairway use typical for weekday operations during the VI sampling event. The sampling will occur in February 2019 on a day when the outdoor ambient temperature is on average for a 24-hour sample interval less than 40 degrees Fahrenheit. Each indoor air sample and the outdoor air sample collected with a SUMMA canister will be fitted with a particulate filter to minimize interference associated with particulate matter from the parking levels.

Friedman & Bruya, Inc. (F&B) of Seattle, Washington, will provide 6-liter, individually certified SUMMA canisters for the air samples. The SUMMA canisters for indoor air samples will be fitted with individually certified flow controllers calibrated by the laboratory for an approximate 24-hour sample collection. The SUMMA canisters will be placed at the height of approximately 6 feet to approximate a potential worker's breathing level. The SUMMA canister will be placed 3 to 5 feet from any nearby wall. For samples collected in the stairways, the stairways will not be cleaned for 2 weeks before sampling to avoid false positive results due to the presence of potential CVOCs in cleaning products. Indoor air sample IA22 will be collected within the bottom of the elevator shaft, using a Waterloo Membrane Sampler (WMS) provided by SiREM.

3.4 AMBIENT AIR SAMPLING

One outdoor ambient air sample will be collected during the sampling event. The ambient air sample will be collected on the street level to establish an outdoor background level. F&B will provide a 6-liter, individually certified SUMMA canister for the outdoor air sample. The SUMMA canister for the ambient air sample will be fitted with an individually certified flow controller calibrated by the laboratory for an approximate 24-hour sample collection. The WMS to be installed in the elevator shaft is a permeation-type passive sampler for monitoring time-weighted average concentrations of volatile organic compound vapors. The WMS will be installed in the elevator shaft for 14 days. A description of the WMS is presented in Appendix B.

3.5 SAMPLE IDENTIFICATION

SoundEarth will label canister with a prefix and two-digit numbers indicating its type, along with the date of sample collection. For example, sample identification IA02-20181230 would identify the second indoor

air sample was collected on November 30, 2018. SoundEarth personnel will document each sample in field notes, photographs, and on a site plan.

3.6 LABORATORY ANALYSIS AND RESULTS

Air samples will be submitted to F&B, under standard chain-of-custody protocols, for laboratory analysis. The chain-of-custody form will include unique sample identifications, dates and times of sample collection, and initial and final vacuum readings for each SUMMA canister. The air samples will be analyzed for CVOCs (PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and VC). The specific analysis for each sample is listed in Table 2 of this Supplemental Work Plan.

Indoor air concentrations will initially be compared to the MTCA Method B indoor air screening cleanup levels as presented in Ecology Cleanup Levels and Risk Calculation (CLARC) data tables and MTCA Modified Method B Indoor Air Commercial Land Use Cleanup Remediation Levels (RELs). The MTCA Method B indoor cleanup levels and RELs for the CVOCs are presented in Table 2 of this Supplemental Work Plan. The full calculations for the modified cleanup levels are provided in Appendix C of the VI Work Plan.

4.0 SCHEDULE

The air quality sampling will occur after Ecology review and approval of this Supplemental Work Plan. The air quality sampling is tentatively scheduled for the third weekend of February. The sampling will occur in February 2019, over a 24-hour period, when the average outdoor ambient temperature is less than 40 degrees Fahrenheit.

5.0 QUALITY ASSURANCE PLAN

Quality assurance and quality control procedures for the interim action are described in the Quality Assurance Project Plan presented in Appendix D of the VI Work Plan.

6.0 LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report are derived, in part, from data gathered by others, and from conditions evaluated when services were performed, and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We do not warrant and are not responsible for the accuracy or validity of work performed by others, nor from the impacts of changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the use of segregated portions of this report.

7.0 REFERENCES

SoundEarth Strategies, Inc. (SoundEarth). 2013. *Interim Action Plan, Troy Laundry Property, 307 Fairview Avenue North, Seattle, Washington.* August 21.

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FIGURES

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TROY LAUNDRY PROPERTY
307 FAIRVIEW AVENUE NORTH
SEATTLE, WASHINGTON
SOUNDEARTH PROJECT #0731-004

FIGURE □
PROPERTY LOCATION MAP

6/9/2015

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\FIGURE 1\0731-004-04_FIG 1_F.DWG

1/30/2019

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2018\INDOOR AIR\SUPPLEMENT VI WORK PLAN\0731-004_2018_P5_PEL.DWG

LEGEND

- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- MONITORING WELL
- INJECTION WELL
- INDOOR AIR SAMPLING LOCATION (MARCH 2018)
- PROPOSED INDOOR AIR SAMPLING LOCATION
- EXHAUST VENT

BRAVEHORSE TAVERN

AMAZON BUILDING

SOUTH LAKE UNION HOTEL LLC

MW26

HARRISON STREET

STAIRWAY - 4

STAIRWAY - 1

IA01 IA02 IA03 IA04 IA05 IA06 IA07 IA21 IA22 IA23

MW04 MW17 MW18 MW19 MW20 MW21 MW22 MW23 MW24 MW25

IW91

BOREN AVENUE NORTH

FAIRVIEW AVENUE

THOMAS STREET

N

0 25 50

APPROXIMATE SCALE IN FEET

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TROY LAUNDRY PROPERTY
307 FAIRVIEW AVENUE NORTH
SEATTLE, WASHINGTON
SOUNDEARTH PROJECT #0731-004

FIGURE 2
PARKING GARAGE LEVEL P5 - PROPOSED INDOOR AIR SAMPLE LOCATIONS

1/30/2019

P:\0731 TOUCHSTONE\0731-004 TROY LAUNDRY\TECHNICAL\CAD\2018\INDOOR AIRSUPPLEMENT VI WORK PLAN\0731-004_2018_P1_PEL.DWG

LEGEND

- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- INDOOR AIR SAMPLING LOCATION (MARCH 2018)
- OUTDOOR AIR SAMPLING LOCATION (MARCH 2018)
- PROPOSED INDOOR AIR SAMPLING LOCATION
- PROPOSED OUTDOOR AIR SAMPLING LOCATION
- EXHAUST VENT

N

0 25 50

APPROXIMATE SCALE IN FEET

HARRISON STREET

THOMAS STREET

FAIRVIEW AVENUE

BOREN AVENUE NORTH

BRAVEHORSE TAVERN

AMAZON BUILDING

SOUTH LAKE UNION HOTEL LLC

OA01 OA02 IA20 IA24 IA25 IA19

STAIRWAY - 4

STAIRWAY - 1

EXHAUST AIR SHAFT

FAR AREA LINE

PROPERTY LINE

BORDEN INVESTMENT BUILDING

BUILDING ENGINEERS OFFICE

WORKSHOP

GENERATOR

GARAGE RAMP ENTRY

AREAWAY

PASSAGEWAY

SCL SWITCH VAULT

STORAGE

TSER NORTH

WATER DETENTION

NORTH TOWER AND GARAGE WATER SERVICE

SOUTH TOWER AND GARAGE WATER SERVICE

BERTH 1 BERTH 2 BERTH 3 BERTH 4 BERTH 5 BERTH 6 BERTH 7 BERTH 8

LOADING BERTH

RECYCLE

TRASH

BIKE STORAGE

MENS LOCKER

WOMENS LOCKER

LOCKER ROOM

BREAK ROOM

MAIN ELECTRICAL

FUTURE ELECTRICAL

EMERGENCY ELECTRICAL

FUTURE SCL NETWORK VAULT

SCL LRD VAULT

ELEV. LOBBY

ELEV PIT

ELEC

PARKING

MECH

CHAIN LINK DOOR AT LEVEL P1 ONLY

DIAGONAL CONCRETE FOUNDATION WALL TYPICAL THIS LOCATION AT ALL P-LEVELS

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TROY LAUNDRY PROPERTY
307 FAIRVIEW AVENUE NORTH
SEATTLE, WASHINGTON
SOUNDEARTH PROJECT #0731-004

FIGURE 3
PARKING GARAGE LEVEL P1 - PROPOSED INDOOR AIR SAMPLE LOCATIONS

TABLES

Table 1
Indoor Air Sample Locations and Analyses
Troy Laundry Property
300 Boren Avenue North and
399 Fairview Avenue North
Seattle, Washington

Sample ID	Building Floor Location	Sample Location	Indoor Air Analysis[(1)]
IA21	Parking Level P5	Stairway - 4	CVOCs
IA22	Parking Level P5	Elevator Shaft	CVOCs
IA23	Parking Level P5	Stairway - 1	CVOCs
IA24	Parking Level P1	Stairway - 4	CVOCs
IA25	Parking Level P1	Stairway - 1 (just outside the door connecting the stairway to the lobby above the garage)	CVOCs
OA02	Outside	Downwind North Side	CVOCs

NOTE:

[(1)]CVOCs analyzed by EPA Method TO-15.

CVOC = chlorinated volatile organic compound

EPA = U.S. Environmental Protection Agency

IA = indoor air

OA = outdoor air

Table 2
Indoor Air Cleanup Levels for Proposed Analytes
Troy Laundry Property
300 Boren Avenue North and
399 Fairview Avenue North
Seattle, Washington

Proposed Analyte List	MTCA Method B Indoor Air Cleanup Level[1] ($\mu g/m^3$)	Modified MTCA Method B Indoor Air Remediation Level[2] ($\mu g/m^3$)
Tetrachloroethene	9.62	323.08
Trichloroethene	0.37	20.49
cis 1,2-Dichloroethene	NE	NE
trans 1,2-Dichloroethene	NE	NE
Vinyl Chloride	0.28	9.55

NOTES:

(1)MTCA Method B Cancer, Washington State Department of Ecology Cleanup Level and Risk Assessment Database.

(2)Remediation levels modified for commercial worker exposure in the parking garage. Assumes 1 hour of exposure, 5 days a week, for 52 weeks a year.

(3)$\mu g/m^3$ = micrograms per cubic meter

MTCA = Washington State Model Toxics Control Act

NE = not established

APPENDIX A

STAIRWAY USE AND PARKING LEVEL EXHAUST FAN USE DATA

Troy Block

Seattle Washington

Garage Stairwell usage survey

STAIR 1 - LEVEL 1 EXITING INTO SOUTH TOWER LOBBY

DATE: 11/13/2018

TIME PERIOD	COUNT	TOTAL
8:00 AM - 8:30 AM	2	2
8:30 AM - 9:00 AM	0	0
9:00 AM - 9:30 AM	1	1
9:30 AM - 10:00 AM	1	1
	GRAND TOTAL TWO HOUR PERIOD	4

TIME PERIOD	COUNT	TOTAL
4:00 PM - 4:30 PM	0	0
4:30PM - 5:00 PM	0	0
5:00 PM - 5:30 PM	0	0
5:30 PM - 6:00 PM	0	0
	GRAND TOTAL TWO HOUR PERIOD	0

Survey completed by: Star Protection Agency, Officers Abebu & Elmi

PRINT NAME & TITLE

Date: 11/13/2018

Troy Block

Seattle Washington

Garage Stairwell usage survey

STAIR 4 - LEVEL P1 EXITING TO HARRISON STREET

DATE: 11/13/2018

TIME PERIOD	COUNT	TOTAL
8:00 AM - 8:30 AM	4	4
8:30 AM - 9:00 AM	1	1
9:00 AM - 9:30 AM	1	1
9:30 AM - 10:00 AM	2	2
	GRAND TOTAL TWO HOUR PERIOD	8

TIME PERIOD	COUNT	TOTAL
4:00 PM - 4:30 PM	0	0
4:30PM - 5:00 PM	1	1
5:00 PM - 5:30 PM	1	1
5:30 PM - 6:00 PM	1	1
	GRAND TOTAL TWO HOUR PERIOD	3

Survey completed by: Star Protection Agency, Officers Nwakonobi & Safi

PRINT NAME & TITLE

Date: 11/13/2018

Date-Time	GEF-P1-1 Fan Speed (No Units)
11/7/2018 10:10	15
11/7/2018 10:15	15.1
11/7/2018 10:20	15.1
11/7/2018 10:25	15.1
11/7/2018 10:30	15
11/7/2018 10:35	15.1
11/7/2018 10:40	15.1
11/7/2018 10:45	15.1
11/7/2018 10:50	15
11/7/2018 10:55	15
11/7/2018 11:00	15.1
11/7/2018 11:05	15.1
11/7/2018 11:10	15.1
11/7/2018 11:15	15.1
11/7/2018 11:20	15.1
11/7/2018 11:25	15.1
11/7/2018 11:30	15.1
11/7/2018 11:35	15.1
11/7/2018 11:40	15.1
11/7/2018 11:45	15.1
11/7/2018 11:50	15.1
11/7/2018 11:55	15.1
11/7/2018 12:00	15.1
11/7/2018 12:05	15.1
11/7/2018 12:10	15
11/7/2018 12:15	15
11/7/2018 12:20	15.1
11/7/2018 12:25	15.1
11/7/2018 12:30	15.1
11/7/2018 12:35	15.1
11/7/2018 12:40	15.1
11/7/2018 12:45	15.1
11/7/2018 12:50	15.1
11/7/2018 12:55	15
11/7/2018 13:00	15.1
11/7/2018 13:05	15.1
11/7/2018 13:10	15
11/7/2018 13:15	15.1
11/7/2018 13:20	15.1
11/7/2018 13:25	15.1
11/7/2018 13:30	15.1
11/7/2018 13:35	15.1
11/7/2018 13:40	15.1
11/7/2018 13:45	15
11/7/2018 13:50	15.1
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11/7/2018 14:05	15.1
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11/7/2018 14:15	15
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11/7/2018 15:00	15.1
11/7/2018 15:05	15.1
11/7/2018 15:10	15.1
11/7/2018 15:15	15.1
11/7/2018 15:20	15.1
11/7/2018 15:25	15.1
11/7/2018 15:30	15.1
11/7/2018 15:35	15.1
11/7/2018 15:40	15.1
11/7/2018 15:45	15.1
11/7/2018 15:50	15.1
11/7/2018 15:55	15
11/7/2018 16:00	15.1
11/7/2018 16:05	15.1
11/7/2018 16:10	15.1
11/7/2018 16:15	15.1
11/7/2018 16:20	15.1
11/7/2018 16:25	15.1
11/7/2018 16:30	15.1
11/7/2018 16:35	15.1
11/7/2018 16:40	15.1
11/7/2018 16:45	15.1
11/7/2018 16:50	15.1
11/7/2018 16:55	15.1
11/7/2018 17:00	15.1
11/7/2018 17:05	15
11/7/2018 17:10	15
11/7/2018 17:15	15.1
11/7/2018 17:20	15.1
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11/8/2018 9:55	15.1
11/8/2018 10:00	15.1
11/8/2018 10:05	15.1

Date-Time	GEF-P2-1 Fan Speed (No Units)
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11/7/2018 10:20	15
11/7/2018 10:25	15
11/7/2018 10:30	15
11/7/2018 10:35	15
11/7/2018 10:40	15
11/7/2018 10:45	15
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11/7/2018 11:15	15
11/7/2018 11:20	15
11/7/2018 11:25	15
11/7/2018 11:30	15
11/7/2018 11:35	15
11/7/2018 11:40	28.8
11/7/2018 11:45	15
11/7/2018 11:50	15
11/7/2018 11:55	15
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11/7/2018 12:35	15
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11/7/2018 13:10	15
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11/7/2018 17:25	15
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11/7/2018 17:55	15
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11/7/2018 18:05	15
11/7/2018 18:10	15
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11/7/2018 18:20	28.7

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11/7/2018 22:50	15
11/7/2018 22:55	15
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11/8/2018 0:10	15
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11/8/2018 0:20	15
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11/8/2018 1:05	15
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11/8/2018 1:20	15
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11/8/2018 2:30	15
11/8/2018 2:35	15
11/8/2018 2:40	15.4
11/8/2018 2:45	15
11/8/2018 2:50	15
11/8/2018 2:55	15
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Date-Time	GEF-P2-2 Fan Speed (No Units)
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11/7/2018 10:45	15
11/7/2018 10:50	15
11/7/2018 10:55	15
11/7/2018 11:00	15
11/7/2018 11:05	15
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11/7/2018 11:20	15
11/7/2018 11:25	15
11/7/2018 11:30	15
11/7/2018 11:35	15
11/7/2018 11:40	28.8
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11/7/2018 12:05	15
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11/7/2018 14:40	15
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11/7/2018 14:55	15

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11/7/2018 19:35	15
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11/7/2018 22:55	15
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Date-Time	GEF-P3-1 Fan Speed (No Units)
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Date-Time	GEF-P3-2 Fan Speed (No Units)
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Date-Time	GEF-P4-2 Fan Speed (No Units)
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Date-Time	GEF-P5-1 Fan Speed (No Units)
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11/7/2018 23:55	15
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Date-Time	GEF-P5-2 Fan Speed (No Units)
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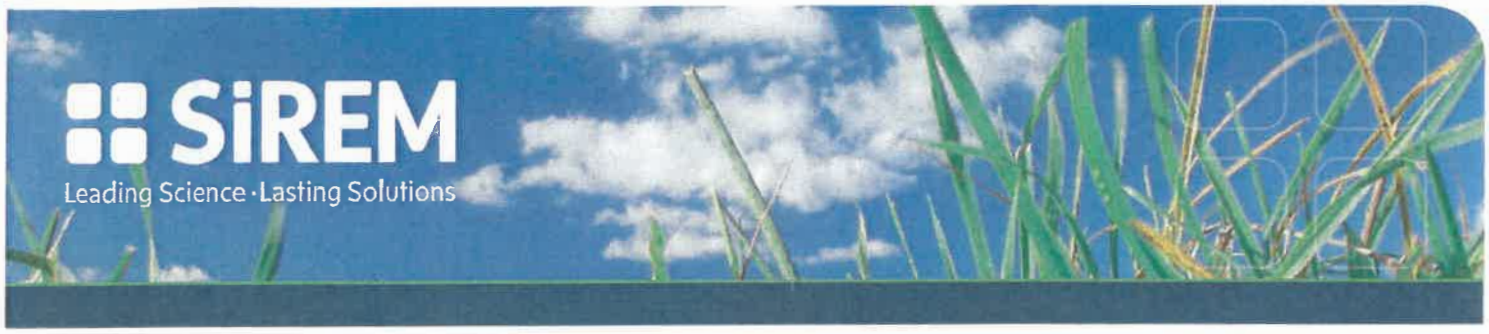
APPENDIX B

WATERLOO MEMBRANE SAMPLER SPECIFICATIONS



WATERLOO MEMBRANE SAMPLER™

The Waterloo Membrane Sampler™ (WMS™) for Monitoring VOC Vapor Concentrations

The Waterloo Membrane Sampler™ (WMS™) is a passive permeation sampler for monitoring time-weighted average concentrations of volatile organic compound (VOC) vapors. Originally developed at the University of Waterloo nearly a decade ago, this technology has undergone years of pure and applied research and has been available for commercial use since 2010 through SiREM Laboratories.

The design incorporates a polydimethylsiloxane (PDMS) membrane across the face of a vial filled with a sorbent medium. VOC vapors partition into and permeate through the membrane. The sorbent then traps the vapors, and the mass of each compound is determined by GC/MS. The uptake rate has been experimentally measured for many common VOCs and can easily be calculated for other compounds because it is directly proportional to the retention index, a property that is readily available in the scientific literature. Thus, you can use the WMS™ sampler to measure time-weighted average concentrations for virtually any VOC.

Cost-effective sampling and analysis for VOCs in indoor air, outdoor air, vent-pipes and quantitative passive sub-slab and soil vapor sampling

The WMS™ sampler offers several advantages compared to conventional air sampling methods:

- Lower cost
- Simpler sampling protocols
- Lower reporting limits without a premium price
- Longer time-integrated samples (less temporal variability)
- Very small size (discrete to deploy, and easy to ship)

Furthermore, the WMS™ sampler provides significant benefits compared to other quantitative passive air samplers:

- Predictable uptake rates for less common compounds
- Ability to measure Total Petroleum Hydrocarbons/Gasoline Range Organics
- Minimal effect of moisture (good for subsurface monitoring)
- Insensitive to wind velocity (good for outdoor and vent-pipe monitoring)
- Ability to modify uptake rate to avoid starvation effect for soil vapor monitoring
- Small diameter (easy to put in vent-pipes or sub-slab probes)
- Competitive pricing

WMS™ Sampler in a glass overpack for shipping

WMS™ Sampler collecting an indoor sample

WMS™ Sampler being deployed for sub-slab gas sampling

siremlab.com

Equation 1

$$C = \frac{M}{t \times UR}$$

Equation 2

$$t = \frac{M_{LOQ}}{C_{RL} \times UR}$$

For more information contact
Hester Groenevelt
toll free: 1-866-251-1747
direct: (519) 515-0853
hgroenevelt@siremlab.com

siremlab.com

Determination of Concentration (Equation 1)

Concentrations in the sampled air are calculated according to Equation 1, where:

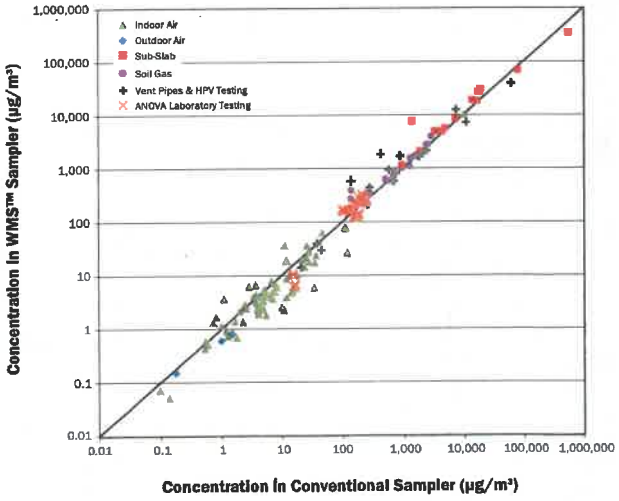
C = concentration in sampled air (µg/m³)
M = mass on sampler (picograms)
t = sampling time (min)
UR = known analyte-specific uptake rate (mL/min)

Reporting Limits and Sampling Time (Equation 2)

The sampling time required to meet a desired reporting limit can be calculated using Equation 2, where:

t = sampling time required to achieve the reporting limit (min)
M_{LOQ} = minimum mass on sampler that analytical method can measure (picograms)
C_{RL} = reporting limit required (µg/m³)
UR = known analyte-specific uptake rate (mL/min)

Example Correlation Between Waterloo Membrane Sampler™ and Active Sampler



The WMS™ sampler results compare very well to "conventional" sampling results (Summa canisters, US EPA's Trace Atmospheric Gas Analysis (TAGA) unit, or active sorbent tubes) over at least six orders of magnitude including indoor air, outdoor air and soil gas sampling.

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