

# Bellwether District Air Monitoring Plan

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3144 Passyunk Avenue, Philadelphia, Pennsylvania

*Prepared for*

Philadelphia Energy Solutions Refining and Marketing LLC  
c/o Hilco Redevelopment Partners  
2929 Arch Street, Suite 1650  
Philadelphia, Pennsylvania 19104

*Prepared by*

Terraphase Engineering Inc.  
252 W. Swamp Road, Suite 35  
Doylestown, Pennsylvania 18901

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## Acronyms and Abbreviations

$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
AEGLs	acute exposure guideline levels
EPA	Environmental Protection Agency
PESRM	Philadelphia Energy Solutions Refining and Marketing LLC
PID	photoionization detector
Plan	<i>Air Monitoring Plan</i>
PM	particulate matter
PM-10	particulate matter with a diameter of 10 micrometers or less
Site	3144 Passyunk Avenue, Philadelphia, Pennsylvania
Terraphase	Terraphase Engineering Inc.
VOC	volatile organic compound



# 1 Introduction

On behalf of Philadelphia Energy Solutions Refining and Marketing LLC (PESRM), Terraphase has prepared this *Air Monitoring Plan* (Plan) that details the monitoring of volatile organic compounds (VOC) and particulates (i.e., respirable dust) in support of the planned earthwork at the Bellwether District located at 3144 Passyunk Avenue in Philadelphia, Pennsylvania (Site).

## 1.1 Background

The Site was formerly operated as a petroleum refinery between 1860 and 2019. Soil and groundwater investigation and remediation activities have been ongoing at the Site for decades. Known soil contaminants at the Site include various VOCs, various semivolatile organic compounds, and lead.

## 1.2 Purpose and Objective

During implementation of the Plan, measures will be taken by earthwork and construction contractors to identify and provide effective and timely mitigation measures to minimize potential fugitive dust and VOC emissions at the Site.

The principal purpose of the Plan is to establish a dust and VOC monitoring program that will be implemented during earthwork activities at the Site. The objectives of the Plan include:

- Develop project action levels for perimeter dust and VOC levels;
- Establish a real-time monitoring program that provides real-time notifications if dust or VOC levels begin to increase during the work;
- Summarize the protocols to be followed if dust or VOC levels begin to approach project action levels; and
- Establish recordkeeping and reporting.

Implementation of this Plan will be performed in conjunction with contractor dust and vapor mitigation plans.



## 2 Action Levels

Terraphase calculated site-specific dust and VOC action levels as described in this section.

### 2.1 Dust Action Level

To calculate a site-specific, risk-based dust action level for the Site, risk calculations were performed by Terraphase with the assumption that a child would be present immediately adjacent to the Site for 8 hours per day, 5 days per week, for 10 years during earthwork. The dust concentration was assumed to be equal to the Pennsylvania Ambient Air Quality Standard and United States Environmental Protection Agency (EPA) National Ambient Air Quality Standard of 150 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).<sup>1</sup> Terraphase used a conservative estimate of the mean concentration (i.e., the 95 percent upper confidence limit (UCL) on the mean) for each constituent in soil at the Site to model dust concentrations. The dust calculations are provided in Appendix A. The child receptor cancer and non-cancer risk estimates, based on these conservative exposure assumptions, are well below the Land Recycling and Environmental Remediation Standards Act cancer and non-cancer risk limits.<sup>2</sup> Based on the results, a level of 150  $\mu\text{g}/\text{m}^3$  for particulate matter (PM) with a diameter of 10 micrometers or less (PM-10) on a 24-hour average, was chosen as the project dust action level.

### 2.2 VOC Action Levels

To determine the site-specific action level for VOCs, Terraphase referenced the EPA acute exposure guideline levels (AEGLs).<sup>3</sup> AEGLs represent threshold levels for the general public, designed to protect susceptible subpopulations to exposure to airborne chemicals such as infants, children, the elderly, and persons with asthma or other illnesses. EPA calculates AEGLs for five short exposure periods (10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours) at three different severity levels, dictated by the severity of the toxic effects. Level 1 is the least severe (notable discomfort/irritation but not disabling or irreversible). A summary of all Level 1 AEGLs for chemicals detected in soil samples collected at the Site is provided in Appendix B. A total VOC level of 4.6 parts per million based on an 8-hour average was chosen as the VOC action level for the project. This is the lowest Level 1 AEGL for chemicals detected in soil samples collected at the Site, including benzene.

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<sup>1</sup> <https://www.dep.pa.gov/Business/Air/BAQ/PollutantTopics/Pages/Ambient-Standards.aspx> and <https://www.epa.gov/naaqs>, respectively

<sup>2</sup> <https://www.legis.state.pa.us/WU01/LI/LI/US/PDF/1995/0/0002..PDF>

<sup>3</sup> <https://www.epa.gov/aegl>



## 3 Air Monitoring Procedures

Earthwork activities will begin in the approximately 447-acre central portion of the Site referred to as Industrial Phase I. Six weather-proof monitoring stations have been set up along the perimeter of the Industrial Phase I area, as shown on Figure 1, for baseline data collection. The location and number of monitoring stations may be adjusted as work proceeds in coordination with active work areas. The monitors are equipped with telemetry and data logging software, solar panels, and batteries. The data system will be set up to notify Terraphase team members and PESRM representatives when action levels are approached.

### 3.1 Dust Monitoring

PM concentrations will be monitored at the six perimeter monitoring stations, measuring PM-10 continuously and reporting 15-minute, time-weighted averages.<sup>4</sup> The monitors will be programmed to provide notification to Terraphase and PESRM when the dust level of 150  $\mu\text{g}/\text{m}^3$  is exceeded for any 15-minute, time-weighted average.

### 3.2 VOC Monitoring

VOC concentrations will be monitored continuously at the six perimeter monitoring stations. The VOC monitoring will be performed using a photoionization detector (PID)<sup>5</sup>. The PIDs will collect VOC readings continuously during earthwork activities, and report 15-minute, time-weighted averages. The PIDs will be programmed to provide notification to Terraphase and PESRM when the VOC level of 4.6 is exceeded for any 15-minute, time-weighted average.

## 4 Corrective Measures

If 15-minute time-weighted averages for dust or VOCs are sustained above their respective action levels, Terraphase will notify PESRM, who will notify the contractors working on site. Dust and/or vapor mitigation control measures will then be adjusted by the on-site contractors. The 15-minute, time-weighted average notification will allow for prompt adjustment to dust and/or vapor mitigation measures so that the 24-hour time-weighted action levels are not exceeded.

Corrective measures may include, but are not limited to, increasing the frequency of dust and/or vapor control measures, modifying dust and vapor control procedures, changing material management/removal procedures, choosing alternative equipment or methods, and/or stopping work. Pending implementation of corrective actions, Terraphase will recheck perimeter air monitoring levels to determine if the corrective measures were effective.

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<sup>4</sup> NextPM sensor manufactured by Tera Sensor.

<sup>5</sup> 10.6-electron volt lamp photoionization detector manufactured by IonScience



## 5 Recordkeeping and Reporting

Monthly reports summarizing the prior month's dust and VOC monitoring results and corrective actions (if any) will be prepared. Monthly dust and VOC monitoring reports will be uploaded to the project website.

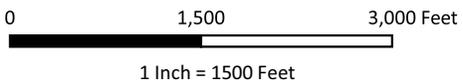


# Figure

- 1 Air Monitoring Locations



N:\GIS\Proj\044.001\_PESRM-PES\GIS\OGIS\_OGr and GPKG\Main Branch\20230111\OGZ322\_P044.001\_Hilo.ogr Air Monitoring - Locations Map 2021-03-26T15:56:13.000



**Legend**

 Air Monitoring Locations

**SAFETY FIRST**



CLIENT: Philadelphia Energy Solutions Refining and Marketing LLC

PROJECT: Bellwether District Air Monitoring

PROJECT NUMBER: P069.001

**Air Monitoring Locations**

**FIGURE 1**

# Appendix A

## Dust Calculations



# Respirable Particulate Air Concentration (PM<sub>10</sub>) Action Level

Terraphase Engineering Inc. (Terraphase) has determined that meeting a respirable particulate air concentration (PM<sub>10</sub>) of 150 ug/m<sup>3</sup> at the fence line of the former Philadelphia Energy Solutions Refinery (the Facility) will be protective of off-facility receptors (including sensitive receptors). The details of these calculations are presented in **Attachment 1**.

In order to support this determination, conservative risk calculations were performed assuming inhalation exposure of a residential receptor (i.e., a child, 0-10 years old) to PM<sub>10</sub> in air at the property boundary as the result of dust emissions from the Facility during site redevelopment (i.e., from earthmoving, or from windblown dust). The residential child was assumed to be at the property boundary 8 hours/day, 250 days/year (i.e., 5 days/week for 50 weeks), for 10 years.

The constituent-specific excess cancer risk<sup>1</sup> is calculated as follows:

$$Risk = C_{air} \cdot URF \cdot \frac{ET \cdot EF \cdot ED}{AT_c}$$

Where, C<sub>air</sub> is the constituent-specific concentration in air (mg/m<sup>3</sup>), URF is the chemical specific unit risk factor (m<sup>3</sup>/mg), ET is the exposure time (hours/day), EF is the exposure frequency (days/year), ED is the exposure duration (years), and AT<sub>c</sub> is the cancer averaging time (hours).

The constituent-specific noncancer hazard quotient (HQ) is calculated as follows:

$$HQ = \frac{C_{air}}{RfC} \cdot \frac{ET \cdot EF \cdot ED}{AT_{nc}}$$

Where, RfC is the chemical-specific reference concentration (mg/m<sup>3</sup>) and AT<sub>nc</sub> is the noncancer averaging time (hours).

In order to calculate C<sub>air</sub> due to emissions from the Facility, a conservative estimate of the mean concentration<sup>2</sup> for each constituent<sup>3</sup> in soil at the Facility was used. Specifically, the constituent-specific concentrations in air as a result of fugitive dust emissions can be calculated as follows:

$$C_{air} = C_{Soil} \cdot PM_{10} \cdot CF$$

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<sup>1</sup> As recommended by USEPA (2005), age dependent adjustment factors (ADAFs) are used to adjust toxicity values for carcinogens with a mutagenic mode of action to assess potential exposures of residents. For a resident aged 0-2 years, an ADAF of 10 is used. For a resident aged 2-10 years, an ADAF of 3 is used.

<sup>2</sup> 95 percent upper confidence limit (UCL) on the mean

<sup>3</sup> Estimates of the mean concentration were used for each constituent except for naphthalene, for which the maximum detected concentration was used. ProUCL did not recommend a 95 percent UCL on the mean for naphthalene and so the maximum detected concentration was conservatively used instead.



Where,  $C_{\text{soil}}$  is the constituent concentration in soil (mg/kg),  $PM_{10}$  is the average  $PM_{10}$  concentration due to fugitive dust emissions ( $\mu\text{g}/\text{m}^3$ ), and CF is a conversion factor ( $10^{-9}$  kg/ $\mu\text{g}$ ).

The cancer (i.e., URF) and noncancer (i.e., RfC) inhalation toxicity values are compiled from USEPA's hierarchy of sources (USEPA 2003). Assuming an average  $PM_{10}$  concentration of  $150 \mu\text{g}/\text{m}^3$  at the fence line during the resident child's exposure period results in an estimated cumulative cancer risk of  $8 \times 10^{-8}$  and noncancer hazard index (HI) of 0.04. These estimates are below the risk management goals used by the Pennsylvania Department of Environmental Protection (PADEP) for determining when risk management action would be warranted (i.e., a cumulative excess cancer risk greater than  $1 \times 10^{-4}$  and a noncancer HI greater than 1) indicating that the use of this  $PM_{10}$  concentration as an action level is protective.

With regards to lead exposure, assuming a conservative estimate of the average lead concentration in soil across the Facility (1,150 mg/kg) results in an estimated lead concentration in air of  $0.17 \mu\text{g}/\text{m}^3$ . This is close to the National Ambient Air Quality Standard (NAAQS) for lead in air of  $0.15 \mu\text{g}/\text{m}^3$  which is based upon a rolling 3-month average exposure concentration. This demonstrates, that using a  $PM_{10}$  concentration of  $150 \mu\text{g}/\text{m}^3$  at the fence line as an action level would be protective as long as the average concentration at the fence line does not exceed this level over a 3-month period.

## References

- United States Environmental Protection Agency (USEPA). 2003. Office of Solid Waste and Emergency Response (OSWER). Human Health Toxicity Values in Superfund Risk Assessments. OSWER Directive 92857.7-53. December.
- USEPA. 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. EPA/630/R 03/003F. March.
- USEPA. 2009. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). USEPA/540/R/070/002. January.
- USEPA. 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120. February 6.



# Attachment 1

Risk and Hazard Quotient Calculations for Soil Particulate  
Inhalation Exposure of Fenceline Resident Age 0-10 to  
Soil



**Appendix A  
Attachment 1**

**Risk and Hazard Quotient Calculations for Soil Particulate Inhalation Exposure of Fenceline Resident Age 0-10 to Soil**

Philadelphia Energy Solutions Refining & Marketing LLC (PESRM) Philadelphia Refining Complex, Philadelphia, Pennsylvania

Chem Group	Chemical	CASRN	Cancer Class	ADAF	C <sub>soil</sub> (mg/kg)	C <sub>air</sub> (mg/m <sup>3</sup> )	Cancer			Noncancer	
							URF (mg/m <sup>3</sup> ) <sup>-1</sup>	f <sub>inh</sub>	Risk	RfC (mg/m <sup>3</sup> )	HQ
VOC	Benzene	71-43-2	A	N	4.65E+01	6.98E-06	7.8E-03		1.8E-09	3.0E-02	5.3E-05
VOC	Cumene	98-82-8	D	N	2.65E+02	3.97E-05				4.0E-01	2.3E-05
VOC	1,2-Dibromoethane	106-93-4	LC	N	5.37E-04	8.06E-11	6.0E-01		1.6E-12	9.0E-03	2.0E-09
VOC	1,2-Dichloroethane	107-06-2	B2	N	6.65E-04	9.97E-11	2.6E-02		8.5E-14	7.0E-03	3.3E-09
VOC	Ethyl Benzene	100-41-4	D	N	7.46E+00	1.12E-06				1.0E+00	2.6E-07
VOC	Methyl tert-butyl ether	1634-04-4	C	N	3.73E-01	5.60E-08	2.6E-04		4.7E-13	3.0E+00	4.3E-09
VOC	Toluene	108-88-3	ID	N	3.01E+01	4.51E-06				5.0E+00	2.1E-07
VOC	1,2,4-Trimethylbenzene	95-63-6	ID	N	1.75E+01	2.62E-06				6.0E-02	1.0E-05
VOC	1,3,5-Trimethylbenzene	108-67-8	ID	N	6.41E+00	9.62E-07				6.0E-02	3.7E-06
VOC	Xylenes (total)	1330-20-7	ID	N	5.21E+01	7.81E-06				1.0E-01	1.8E-05
SVOC	Anthracene	120-12-7	ID	N	1.96E+00	2.93E-07					
SVOC	Benzo(a)anthracene	56-55-3	B2	Y	2.63E+00	3.95E-07	6.0E-02	1	3.4E-09		
SVOC	Benzo(a)pyrene	50-32-8	HC	Y	2.29E+00	3.44E-07	6.0E-01	1	3.0E-08	2.0E-06	3.9E-02
SVOC	Benzo(b)fluoranthene	205-99-2	B2	Y	2.66E+00	3.98E-07	6.0E-02	1	3.4E-09		
SVOC	Benzo(g,h,i)perylene	191-24-2	D	N	1.41E+00	2.12E-07					
SVOC	Chrysene	218-01-9	B2	Y	3.17E+00	4.75E-07	6.0E-04	1	4.1E-11		
SVOC	Ethanol	64-17-5		N						1.9E+01	
SVOC	Fluorene	86-73-7	D	N	4.40E+00	6.60E-07					
SVOC	Indeno(1,2,3-cd)pyrene	193-39-5	B2	Y	1.52E+00	2.28E-07	6.0E-02	1	2.0E-09		
SVOC	Naphthalene	91-20-3	C	N	2.19E+02	3.29E-05	3.4E-02		3.6E-08	3.0E-03	2.5E-03
SVOC	Phenanthrene	85-01-8	D	N	7.97E+00	1.20E-06					
SVOC	Pyrene	129-00-0	NC	N	4.88E+00	7.32E-07					
SVOC	Tetraethylene Glycol	112-60-7		N							
INORG	Lead	7439-92-1	B2	N	1.15E+03	1.73E-04					

Cumulative Risk/HI:

8E-08

4E-02

**Notes:**

The concentration of particulates in the air is assumed to be no more than the former annual National Ambient Air Quality Standards (NAAQS) for PM<sub>10</sub> of 150 ug/m<sup>3</sup>.

f<sub>inh</sub> is the fraction of the inhalation toxicity value that USEPA identified as having a mutagenic mode of action.

**Exposure Factors**

Exposure Time	ET	8	hours/day
Exposure Frequency	EF	250	days/year
Exposure Duration	ED	10	years
Averaging Time (Cancer)	AT <sub>c</sub>	613,200	hours
Averaging Time (Noncancer)	AT <sub>nc</sub>	87,600	hours

# Appendix B

## Acute Exposure Guideline Levels (AEGLs)



**Appendix B****Acute Exposure Guideline Levels (AEGL)**

Philadelphia Energy Solutions Refining &amp; Marketing LLC (PESRM) Philadelphia Refining Complex, Philadelphia, Pennsylvania

Chem Group	Chemical	CASRN	10 min (ppmv)	30 min (ppmv)	60 min (ppmv)	4 hr (ppmv)	8 hr AEGL (ppmv)
VOC	Benzene	71-43-2	130	73	52	18	9
VOC	Cumene	98-82-8	50	50	50	50	50
VOC	1,2-Dibromoethane	106-93-4	52	26	17	7.1	4.6
VOC	1,2-Dichloroethane	107-06-2	--	--	--	--	--
VOC	Ethyl Benzene	100-41-4	33	33	33	33	33
VOC	Methyl tert-butyl ether	1634-04-4	50	50	50	50	50
VOC	Toluene	108-88-3	67	67	67	67	67
VOC	1,2,4-Trimethylbenzene	95-63-6	180	180	140	90	45
VOC	1,3,5-Trimethylbenzene	108-67-8	180	180	140	90	45
VOC	Xylenes (total)	1330-20-7	130	130	130	130	130
SVOC	Naphthalene	91-20-3	--	--	--	--	--

**Minimum:**                      33                      26                      17                      7.1                      4.6

**Notes:**

1. United States Environmental Protection Agency AEGLs
  2. AEGL Level 1 is used, which is dictated by notable discomfort, irritation, or certain asymptomatic non-sensory effects
- hr = hours  
min = minutes  
ppmv = parts per million by volume  
SVOC = semivolatile organic compounds  
VOC = volatile organic compounds