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DATE: June 1, 2016

TO: Michael Hoppe, U.S. EPA/ERT Work Assignment Manager

THROUGH: [REDACTED] SERAS Program Manager *OK*

FROM: [REDACTED] SERAS Task Leader *JS*

SUBJECT: BONAIR AVENUE VAPOR INTRUSION SITE, HATBORO, PA
WORK ASSIGNMENT #SER00290 – TRIP REPORT

BACKGROUND

The Environmental Protection Agency/Environmental Response Team (EPA/ERT) issued Work Assignment (WA) Number SERAS-290 to Lockheed Martin under the Scientific, Engineering, Response and Analytical Services (SERAS) contract to conduct a sub-slab soil gas, indoor air, and ambient air sampling event as part of a vapor intrusion investigation along Bonair Avenue, located in Hatboro, Montgomery County, Pennsylvania, PA (Site).

Several EPA Superfund Cleanup Sites, including Raymark, Inc. (located approximately 500 feet east/southeast of the Site) and Fischer & Porter Company (located approximately 1.25 miles northeast of the Site), are located in the vicinity of the Site. The potential for adverse indoor air impacts associated with groundwater contamination, consisting of trichloroethylene (TCE) and several other volatile organic compounds (VOCs), suspected of being associated with the EPA Superfund Cleanup Sites is the primary driver for the vapor intrusion investigation at the Site. A previous vapor intrusion study was conducted in 2013 that indicated the potential may exist for vapor intrusion to occur in residential properties downgradient from the Superfund sites. The September 2014 Fourth Five-Year Review Report for the Raymark Superfund Site, Montgomery County, Pennsylvania prepared by EPA recommended an expansion of the VI study to other residences in vicinity of Bonair Avenue, which are located above the shallow groundwater plume. The data generated from this sampling event aligns with the recommendations of the latest Five-Year Review for the Raymark Superfund Site, and the data will assist EPA Region 3 personnel in determining if a potential for an adverse indoor air impact exists at the Site.

OBSERVATIONS AND ACTIVITIES

SERAS personnel mobilized to the Site on April 5, 2016. Upon arrival at the Site, each residence being investigated had a sub-slab soil gas sampling port installed, or if a port was previously installed, the port was inspected for usability. Additionally, each residence was assigned a unique (property) identifier, and a pre-sampling walkthrough was conducted at each residence to identify and document potential indoor air background sources. Identified potential indoor air background sources were removed prior to initiation of sample collection at each residence. Equipment was prepared for the collection of sub-slab soil gas, indoor air and ambient air samples using SUMMA® canisters and restrictor orifices that were individually certified clean to 20 part per trillion by volume (pptv).

The April 2016 scope of work included the evaluation of sub-slab soil gas, indoor air and ambient air quality at residential properties on Bonair Avenue. Activities included the collection of 24-hour time-weighted sub-slab soil gas, indoor air and ambient air samples using SUMMA® canisters. All SUMMA® canister samples were analyzed for a reduced analyte list of ten VOCs.

The VOCs of interest for sub-slab soil gas, indoor air, and ambient air samples collected in SUMMA® canisters were 1,2-dichloroethane (1,2-DCE), 1,4-dichlorobenzene, benzene, carbon disulfide, carbon tetrachloride, chloroform, dichlorodifluoromethane (Freon 12), ethylbenzene, tetrachloroethene (PCE), and TCE. All samples collected using SUMMA® canisters were shipped to the ALS Environmental laboratory in Simi Valley, California (ALS) for analysis per US EPA Method TO-15, *“Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) and American Society for Testing and Materials (ASTM) D5504-12, Standard Test Method for Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence* for carbon disulfide.

Collection and Analysis of Air Samples using SUMMA® Canisters

Table 1 contains a summary of the April 2016 sampling locations. A total of three properties were sampled during this mobilization.

On April 5, 2016, two sub-slab soil gas sampling ports were inspected for usability at Property 5. In addition, two sub-slab soil gas sampling ports were installed at Property 3 and one sub-slab soil gas sampling port was installed at Property 4. All of these properties were sampled on April 7, 2016.

A collocated indoor air and a collocated ambient air sample were collected in conjunction with sub-slab soil gas and indoor air samples. All samples were collected using SUMMA® canisters equipped with restrictive orifices set at an approximate flow rate of 3.5 milliliters per minute (mL/min) to collect between four to five liters of air during each 24-hour sampling period.

After the 24-hour sampling period had elapsed, the sub-slab soil gas, indoor air and ambient air samples collected in SUMMA® canisters were retrieved from each property and properly documented in accordance with SERAS Standard Operating Procedure (SOP) #1704, *SUMMA® Canister Sampling*.

Sixteen samples collected using SUMMA® canisters and one SUMMA® canister designated as a trip blank were delivered under Chain of Custody (COC) to ALS and analyzed in accordance with EPA Method TO-15 and ASTM Test Method D5504-12.

SERAS Quality Assurance Group personnel validated the final laboratory data for all air samples collected in SUMMA® canisters and issued an Analytical Report dated May 2016. The Analytical Report indicates that the data (i.e., SUMMA® canister data) is definitive in nature. Usability of definitive data is evaluated by a group independent from the group who is conducting the sampling or the analyses. Data qualifiers and reasons for qualification are outlined in the case narrative of the Analytical Report. The COC records and definitive data for sub-slab soil gas, indoor air, and outdoor ambient air samples collected using SUMMA® canisters can be found in the Analytical Report, SERAS-290-DAR-051616, located in Appendix A.

RESULTS

Tables 2a-2c presents the summary of results for VOC analysis of samples collected using SUMMA® canisters in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Tables 3a-3c presents the summary of results for VOC analysis of

samples collected using SUMMA® canisters in parts per billion by volume (ppbv). Sub-slab soil and indoor air vapor intrusion screening levels were based on EPA's Regional Screening Levels (RSLs).

Table 4 presents the summary of results for VOC analysis above the RSLs in $\mu\text{g}/\text{m}^3$. Of the five sub-slab soil gas samples collected using SUMMA® canisters, TCE was detected at a concentration exceeding the soil gas RSL Properties 3, 4, and the front sub-slab soil gas sample at Property 5. Chloroform was detected at a concentration exceeding the soil gas RSL at both sub-slab locations in Property 3. Carbon tetrachloride was detected at a concentration exceeding the soil gas RSL at the rear sub-slab location in Property 3, and 1,2-DCE was detected at a concentration exceeding the soil gas RSL at the front sub-slab location in Property 3. Benzene, 1,4-dichlorobenzene, carbon disulfide, Freon 12, ethylbenzene, and PCE were not detected at concentrations above the soil gas RSLs.

The concentrations of benzene, carbon tetrachloride and chloroform exceeded the indoor air RSLs in the basement and first floor samples collected from Property 3. At Property 4, 1,2-DCE, benzene and chloroform exceeded the indoor air RSLs in the basement and first floor. TCE was detected at a concentration exceeding the indoor air RSLs in both basement air samples collected at Property 4. Additionally, carbon tetrachloride was detected at a concentration above the indoor air RSL in the collocated basement sample and the first floor sample collected from Property 4. The concentrations of 1,2-DCE, benzene, carbon tetrachloride, chloroform and ethylbenzene exceeded the indoor air RSLs in the basement and first floor samples collected from Property 5.

Benzene, carbon tetrachloride and chloroform were detected at a concentration exceeding the indoor air RSLs in both ambient air samples.

The SUMMA® canister sampling worksheets used during the April 2016 sampling event can be found in Appendix B, Air Sampling Worksheets.

FUTURE ACTIVITIES

There are no additional activities scheduled at this time.

cc: Central File - WA # SERAS-290 (w/attachment)
Electronic File - I:/Archive/SERAS/290/D/TR/060116
[REDACTED], SERAS Program Manager (cover page only)

TABLES
Meadowbrook Avenue Vapor Intrusion Site
Hatboro, Pennsylvania
June 2016

Table 1
Sample Summary - April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Sample Number	Location	Sub Location	Sample Type	SUMMA® Number	Flow Contoller Number	Remarks
290-0001	Property 5	Front SS	Sub-Slab	AS00617	FCA00851	Port toward the front of the property, closest to the street
290-0002	Property 5	Rear SS	Sub-Slab	SC01913	FCA000057	Port toward the rear of the property
290-0003	Property 5	BS1	Indoor Air	AS00187	FCA00082	Table located near Front SS
290-0004	Property 5	BS2-CO	Indoor Air	AC02128	FCA00758	Collocated
290-0005	Property 5	FF	Indoor Air	AS01102	FCA00858	Chest table in dining room
290-0006	Property 5	AMB1	Ambient Air	AS00776	FCA00718	Front Porch
290-0007	Property 5	AMB2	Ambient Air	AS02118	FCA00824	Collocated
290-0008	Property 4	SS	Sub-Slab	AC02134	FCA00971	Collected in laundry room
290-0009	Property 4	BS1	Indoor Air	AC01036	FCA00256	Top of container
290-0010	Property 4	BS2-CO	Indoor Air	SC01766	FCA00327	Collocated
290-0011	Property 4	FF	Indoor Air	AC01830	FCA00659	Glass shelf inbetween living and dining room
290-0012	Property 3	Front SS	Sub-Slab	SC01626	FCA00528	Port toward the front of the property, closest to the street
290-0013	Property 3	Rear SS	Sub-Slab	SSC00318	FCA00632	Port toward the rear of the property/closest to the oil tank
290-0014	Property 3	BS1	Indoor Air	AS00475	FCA00873	Table located near Rear SS
290-0015	Property 3	BS2-CO	Indoor Air	AC00655	FC2ZA51SK	*ALS flow controller label illegable, Serial Number Used/Collocated
290-0016	Property 3	FF	Indoor Air	SSC00003	FCA300077	Living room floor
290-0017	Trip Blank	Trip Blank	Blank	AS00884	N/A	

Notes and Acronyms:

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

AMB - Ambient

N/A- Not Applicable

Table 2a
SUMMA Canister Sample Results in $\mu\text{g}/\text{m}^3$ - April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Property 3

Sample Number	Sub-Slab Soil Vapor Intrusion Screening Level	Indoor Air Vapor Intrusion Screening Level	290-0012	290-0013	290-0014	290-0015	290-0016
Sub-Location			Front SS	Rear SS	BS1	BS2-CO	FF
Sample Type			Sub-Slab	Sub-Slab	Indoor Air	Indoor Air	Indoor Air
Result Units	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
1,2-Dichloroethane	3.6	0.11	21	0.077	0.096	0.094	0.083
1,4-Dichlorobenzene	8.5	0.26	0.099	0.065	0.051	0.046 U	0.064
Benzene	12	0.36	0.67	1.0	0.51	0.55	0.46
Carbon disulfide	24000	730	14 U	19 U	13 U	14 U	14 U
Carbon tetrachloride	16	0.47	3.2	28	0.54	0.53	0.61
Chloroform	4.1	0.12	9.9	7.3	0.17 U	0.18 U	0.18
Dichlorodifluoromethane	3500	100	2.4	2.6	2.3	2.3	2.3
Ethylbenzene	37	1.1	0.35	0.25 U	0.41	0.56	0.33
Tetrachloroethene	360	11	5.2	23	0.15	0.16	0.12
Trichloroethene	16	0.48	140	2100	0.42	0.30	0.17

Notes and Acronyms:

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

$\mu\text{g}/\text{m}^3$ - Micrograms per cubic meter

U - Analyte was not detected at a concentration above the laboratory reporting listed.

Table 2b
SUMMA Canister Sample Results in $\mu\text{g}/\text{m}^3$ - April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Property 4

Sample Number	Sub-Slab Soil Vapor Intrusion Screening Level	Indoor Air Vapor Intrusion Screening Level	290-0008	290-0009	290-0010	290-0011
Sub-Location			SS	BS1	BS2-CO	FF
Sample Type			Sub-Slab	Indoor Air	Indoor Air	Indoor Air
Result Units	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
1,2-Dichloroethane	3.6	0.11	0.085	0.34	0.34	1.5
1,4-Dichlorobenzene	8.5	0.26	0.047 U	0.081	0.079	0.24
Benzene	12	0.36	0.39	0.51	0.43	0.48
Carbon disulfide	24000	730	15 U	14 U	14 U	15 U
Carbon tetrachloride	16	0.47	7.2	0.40	0.52	0.52
Chloroform	4.1	0.12	0.80	0.25	0.24	0.99
Dichlorodifluoromethane	3500	100	2.7	2.2	2.2	2.1
Ethylbenzene	37	1.1	0.38	0.29	0.33	0.30
Tetrachloroethene	360	11	34	0.27	0.18	0.15
Trichloroethene	16	0.48	880	0.66	0.57	0.23

Notes and Acronyms:

1. Analyte concentrations exceeding the Regional Screening Level (RSL) are presented in bold and shaded gray.

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

$\mu\text{g}/\text{m}^3$ - Micrograms per cubic meter

U - Analyte was not detected at a concentration above the laboratory reporting listed.

Table 2c
SUMMA Canister Sample Results in µg/m³
- April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Property 5

Sample Number	Sub-Slab Soil Vapor Intrusion Screening Level	Indoor Air Vapor Intrusion Screening Level	290-0001	290-0002	290-0003	290-0004	290-0005	290-0006	290-0007
Sub-Location			Front SS	Rear SS	BS1	BS2-CO	FF	AMB1	AMB2-CO
Sample Type			Sub-Slab	Sub-Slab	Indoor Air	Indoor Air	Indoor Air	Ambient Air	Ambient Air
Result Units	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³
1,2-Dichloroethane	3.6	0.11	0.17	0.37	0.34	0.36	0.46	0.074	0.072
1,4-Dichlorobenzene	8.5	0.26	0.050 U	0.046 U	0.048 U	0.043 U	0.065 U	0.044 U	0.050
Benzene	12	0.36	2.8	3.9	1.7	1.7	2.1	0.57	0.51
Carbon disulfide	24000	730	15 U	14 U	15 U	13 U	20 U	14 U	14 U
Carbon tetrachloride	16	0.47	0.74	0.55	0.57	0.56	0.56	0.51	0.53
Chloroform	4.1	0.12	0.56	0.25	0.22	0.19	0.50	0.18 U	0.18 U
Dichlorodifluoromethane	3500	100	2.8	3.7	2.4	2.3	2.3	2.3	2.3
Ethylbenzene	37	1.1	0.20 U	2.0	1.6	1.7	1.7	0.19	0.18
Tetrachloroethene	360	11	7.8	1.9	0.16	0.14	0.19	0.13	0.12
Trichloroethene	16	0.48	31	0.69	0.049	0.053	0.065 U	0.044 U	0.046 U

Notes and Acronyms:

1. Analyte concentrations exceeding the Regional Screening Level (RSL) are presented in bold and shaded gray.

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

ug/m³ - Micrograms per cubic meter

U - Analyte was not detected at a concentration above the laboratory reporting listed.

Table 3a
SUMMA Canister Sample Results in ppbv - April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Property 3

Sample Number	Sub-Slab Soil Vapor Intrusion Screening Level	Indoor Air Vapor Intrusion Screening Level	290-0012	290-0013	290-0014	290-0015	290-0016
Sub-Location			Front SS	Rear SS	BS1	BS2-CO	FF
Sample Type			Sub-Slab	Sub-Slab	Indoor Air	Indoor Air	Indoor Air
Result Units	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
1,2-Dichloroethane	0.89	0.02	5.2	0.019	0.024	0.023	0.021
1,4-Dichlorobenzene	1.41	0.04	0.016	0.011	0.0084	0.0077 U	0.011
Benzene	3.76	0.11	0.21	0.31	0.16	0.17	0.14
Carbon disulfide	7706.98	234.42	4.5 U	6.2 U	4.3 U	4.6 U	4.4 U
Carbon tetrachloride	2.54	0.07	0.51	4.4	0.086	0.084	0.096
Chloroform	0.84	0.02	2.0	1.5	0.035 U	0.038 U	0.036
Dichlorodifluoromethane	831.47	23.76	0.49	0.52	0.46	0.47	0.46
Ethylbenzene	8.52	0.25	0.081	0.057 U	0.095	0.13	0.077
Tetrachloroethene	53.07	1.62	0.77	3.4	0.021	0.023	0.018
Trichloroethene	2.98	0.09	25	390	0.079	0.056	0.032

Notes and Acronyms:

1. Analyte concentrations exceeding the Regional Screening Level (RSL) are presented in bold and shaded gray.

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

ppbv = parts per billion by volume

U - Analyte was not detected at a concentration above the laboratory reporting listed.

Table 3b
SUMMA Canister Sample Results in ppbv - April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Property 4

Sample Number	Sub-Slab Soil Vapor Intrusion Screening Level	Indoor Air Vapor Intrusion Screening Level	290-0008	290-0009	290-0010	290-0011
Sub-Location			SS	BS1	BS2-CO	FF
Sample Type			Sub-Slab	Indoor Air	Indoor Air	Indoor Air
Result Units			ppbv	ppbv	ppbv	ppbv
1,2-Dichloroethane	0.89	0.02	0.021	0.084	0.085	0.38
1,4-Dichlorobenzene	1.41	0.04	0.0078 U	0.013	0.013	0.039
Benzene	3.76	0.11	0.12	0.16	0.14	0.15
Carbon disulfide	7706.98	234.42	4.7 U	4.6 U	4.5 U	4.7 U
Carbon tetrachloride	2.54	0.07	1.1	0.063	0.083	0.082
Chloroform	0.84	0.02	0.16	0.050	0.050	0.20
Dichlorodifluoromethane	831.47	23.76	0.55	0.45	0.44	0.42
Ethylbenzene	8.52	0.25	0.088	0.067	0.076	0.069
Tetrachloroethene	53.07	1.62	5.1	0.040	0.027	0.023
Trichloroethene	2.98	0.09	160	0.12	0.11	0.042

Notes and Acronyms:

1. Analyte concentrations exceeding the Regional Screening Level (RSL) are presented in bold and shaded gray.

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

ppbv = parts per billion by volume

U - Analyte was not detected at a concentration above the laboratory reporting listed.

Table 3c
SUMMA Canister Sample Results in ppbv - April 2016
Bonair Avenue Vapor Intrusion Site
Hatboro, PA
June 2016

Property 5

Sample Number	Sub-Slab Soil Vapor Intrusion Screening Level	Indoor Air Vapor Intrusion Screening Level	290-0001	290-0002	290-0003	290-0004	290-0005	290-0006	290-0007
Sub-Location			Front SS	Rear SS	BS1	BS2-CO	FF	AMB1	AMB2-CO
Sample Type			Sub-Slab	Sub-Slab	Indoor Air	Indoor Air	Indoor Air	Ambient Air	Ambient Air
Result Units	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
1,2-Dichloroethane	0.89	0.02	0.043	0.092	0.084	0.088	0.11	0.018	0.018
1,4-Dichlorobenzene	1.41	0.04	0.0083 U	0.0076 U	0.0079 U	0.0071 U	0.011 U	0.0074 U	0.0083
Benzene	3.76	0.11	0.89	1.2	0.53	0.52	0.65	0.18	0.16
Carbon disulfide	7706.98	234.42	5.0 U	4.6 U	4.8 U	4.3 U	6.5 U	4.4 U	4.6 U
Carbon tetrachloride	2.54	0.07	0.12	0.088	0.091	0.090	0.090	0.082	0.083
Chloroform	0.84	0.02	0.11	0.051	0.044	0.040	0.10	0.036 U	0.038 U
Dichlorodifluoromethane	831.47	23.76	0.57	0.74	0.48	0.47	0.47	0.46	0.46
Ethylbenzene	8.52	0.25	0.046 U	0.47	0.38	0.39	0.40	0.044	0.042
Tetrachloroethene	53.07	1.62	1.1	0.29	0.024	0.021	0.028	0.020	0.018
Trichloroethene	2.98	0.09	5.9	0.13	0.0092	0.0099	0.012 U	0.0082 U	0.0086 U

Notes and Acronyms:

1. Analyte concentrations exceeding the Regional Screening Level (RSL) are presented in bold and shaded gray.

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

ppbv = parts per billion by volume

U - Analyte was not detected at a concentration above the laboratory reporting listed.

Table 4
RSL Exceedance Table
SUMMA Canister Sample Results in $\mu\text{g}/\text{m}^3$ - April 2016
Bonair Avenue Site
June 2016

Location	Sub-Location	Sample #	Analyte	Results (µg/m³)		RSL (µg/m³)
Property 3	Front SS	290-0012	1,2-Dichloroethane	21		3.6
			Chloroform	9.9		4.1
			Trichloroethene	140		16
	Rear SS	290-0013	Carbon tetrachloride	28		16
			Chloroform	7.3		4.1
			Trichloroethene	2100		16
	BS1	290-0014	Benzene	0.51		0.36
			Carbon tetrachloride	0.54		0.47
			Chloroform	0.17		0.12
	BS2-CO	290-0015	Benzene	0.55		0.36
			Carbon tetrachloride	0.53		0.47
			Chloroform	0.18		0.12
	FF	290-0016	Benzene	0.46		0.36
			Carbon tetrachloride	0.61		0.47
			Chloroform	0.18		0.12
Property 4	SS	290-0008	Trichloroethene	880		16
	BS1	290-0009	1,2-Dichloroethane	0.34		0.11
			Benzene	0.51		0.36
			Chloroform	0.25		0.12
			Trichloroethene	0.66		16
	BS2-CO	290-0010	1,2-Dichloroethane	0.34		0.11
			Benzene	0.43		0.36
			Carbon tetrachloride	0.52		0.47
			Chloroform	0.24		0.12
			Trichloroethene	0.57		16
	FF	290-0011	1,2-Dichloroethane	1.5		0.11
			Benzene	0.48		0.36
			Carbon tetrachloride	0.52		0.47
			Chloroform	0.99		0.12

Notes and Acronyms:

RSL - Regional Screening Level

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

AMB - Ambient

$\mu\text{g}/\text{m}^3$ - Micrograms per cubic meter

Table 4
RSL Exceedance Table
SUMMA Canister Sample Results in $\mu\text{g}/\text{m}^3$ - April 2016
Bonair Avenue Site
June 2016

Location	Sub-Location	Sample #	Analyte	Results ($\mu\text{g}/\text{m}^3$)	RSL ($\mu\text{g}/\text{m}^3$)
Property 5	Front SS	290-0001	Trichloroethene	31	1.3
	BS1	290-0003	1,2-Dichloroethane	0.34	0.11
			Benzene	1.7	0.36
			Carbon tetrachloride	0.57	0.47
			Chloroform	0.22	0.12
			Ethylbenzene	1.6	1.1
	BS2-CO	290-0004	1,2-Dichloroethane	0.36	0.11
			Benzene	1.7	0.36
			Carbon tetrachloride	0.56	0.47
			Chloroform	0.19	0.12
			Ethylbenzene	1.7	1.1
	FF	290-0005	1,2-Dichloroethane	0.46	0.11
			Benzene	2.1	0.36
			Carbon tetrachloride	0.56	0.47
			Chloroform	0.5	0.12
			Ethylbenzene	1.7	1.1
	AMB1	290-0006	Benzene	0.57	0.36
			Carbon tetrachloride	0.51	0.47
			Chloroform	0.18	0.12
	AMB2	290-0007	Benzene	0.51	0.36
			Carbon tetrachloride	0.53	0.47
			Chloroform	0.18	0.12

Notes and Acronyms:

RSL - Regional Screening Level

SS - Sub-slab soil gas

BS - Basement

CO - Co-located

FF - First Floor

AMB - Ambient

$\mu\text{g}/\text{m}^3$ - Micrograms per cubic meter

APPENDIX A
SUMMA® Sampling Work Sheet
Bonair Avenue Vapor Intrusion Site
Hatboro, Pennsylvania
June 2016



EPA/Environmental Response Team
Scientific, Engineering, Response and Analytical Services
Lockheed Martin Corp., Edison, NJ
U.S. EPA Contract No. EP-W-09-031



SUMMA Sampling Work Sheet

Site: BOWAZER AVE

WA# 290

Sampler: [REDACTED]

U.S. EPA/ERT WAM: HOPPE

Date Start: 4/7/16 Date Stop: 4/8/16

SERAS Task Leader: [REDACTED]

PROPERTIES

Sample #	Location	Sub-Location	Matrix	Summa #	Orifice ID	Analysis/ Method	Start Pressure	Flow Rate (Start)	Time/(Start)	Time/(Stop)	End Pressure
290-0001	FRONT SS		SOIL GAS	AS00617	FLA00851	TO 15/TG6 ASTM D5541	-30	-2.8	933	925	-12
290-0002	REAR SS		SOIL GAS	AS00651	FLA00853		-30	-2.7	937	927	-10
290-0003	BS1		Amb Air	AS00871	FLA00082		-30	-2.7	939	928	-11.5
0004	BS2		Amb Air	AL02123	FLA00758		-30	-2.8	939	928	-9
0005	FF		IA	AS01102	FLA00858		-30	-2.9	943	930	-16.5
0006	AMB1		AIR	AS00776	FLA00718		-30	-2.6	950	932	-11.5
0007	AMB2		AIR	AS02118	FLA00824		-30	-2.7	950	932	-11.5

MET Station on Site?: Y ☒

Flow meter: 014416 6/00/16

NIST Gauge#: 36 T241

NIST Gauge#: 36

MULTIPLE SOURCES OF BENZENE PRODUCTS WITHIN BASEMENT (GENERATOR, SNOW BLOWER, WOOD WACKER)
 36 SS



EPA/Environmental Response Team
Scientific, Engineering, Response and Analytical Services
Lockheed Martin Corp., Edison, NJ
U.S. EPA Contract No. EP-W-09-031



SUMMA Sampling Work Sheet

Site: BONAFER AVE

WA# 290

Sampler: [REDACTED]

U.S. EPA/ERT WAM: HOPPE

Date Start: 4/7/15

Date Stop: 4/8/16

PROPERTY #1

SERAS Task Leader: [REDACTED]

Sample #	Location	Sub-Location	Matrix	Summa #	Orifice ID	Analysis/ Method	Start Pressure	Flow Rate (Start)	Time/(Start)	Time/(Stop)	End Pressure
0008	SS		SOIL GAS	AL02134	FLA00971	To 15 TSPs ASTM D5504	-30	-2.6	1050	1050	-11
0009	BS1		FA	AL01036	FLA00266	↓	-30	-2.7	1052	1050	-11
0010	BS2		IA	SL01766	FLA00327		-30	-2.6	1052	1050	-10.5
0011	FF		FA	AL01830	FLA00659		-30	-2.6	1056	1052	-11

MET Station on Site?: Y / N	Flow meter:	NIST Gauge#:	NIST Gauge#:
-----------------------------	-------------	--------------	--------------

(PROP #1)



EPA/Environmental Response Team
Scientific, Engineering, Response and Analytical Services
Lockheed Martin Corp., Edison, NJ
U.S. EPA Contract No. EP-W-09-031



SUMMA Sampling Work Sheet

Site: BOWATER AVE

WA# 290

Sampler: [REDACTED]

U.S. EPA/ERT WAM: HOPPE

Date Start: 4/7/16

Date Stop: 4/8/16

SERAS Task Leader: [REDACTED]

PROPERTY 3

Sample #	Location	Sub-Location	Matrix	Summa #	Orifice ID	Analysis/ Method	Start Pressure	Flow Rate (Start)	Time/(Start)	Time/(Stop)	End Pressure
0012	F SS		SOIL GAS	SL01626	FLA0528	TO 15 TCS ASTM D5504	-30	-2.8	1028	1028	-10
0013	R SS		SOIL GAS	SSC 60318	FLA00632		-30	-3.2	1030	1030	-16
0014	BS 1		FA	AS00475	FLA00673		-30	-2.8	1031	1030	-8
0015	BS 2		FA	AL00656	FL22ASIS/KK	SNA	-30	-2.8	1031	1030	-10.5
0016	FF		FA	SL00003	FL300077		-30	-2.8	1034	1032	-9
17	TRP										-29.5

MET Station on Site?: Y / N	Flow meter:	NIST Gauge#:	NIST Gauge#:
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UJT TANK FIBS

* ALS # NOT LEGALABLE

APPENDIX B
Final Analytical Report
Bonair Avenue Vapor Intrusion Site
Hatboro, Pennsylvania
June 2016

ANALYTICAL REPORT

Prepared by
Lockheed Martin Information Systems and Global Services/Environmental Services
Scientific, Engineering, Response and Analytical Services

Bonair Avenue VI
Hatboro, PA

May 2016

EPA Work Assignment No. SERAS-290
LOCKHEED MARTIN Work Order SER00290
EPA Contract No. EP-W-09-031

Submitted to
M. Hoppe
EPA-ERT
2890 Woodbridge Avenue
Edison, NJ 08837

QA/QC Officer

5/16/16
Date

Analysis by:
ALS Labs

Program Manager

5/16/16
Date

Prepared by/Validated by:



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Appendices will be furnished on request.





TESTING LABORATORIES INFORMATION

Analysis of Volatile Organic Compounds in Air by EPA Method TO15, *Determination of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters and Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)*, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second edition, January 1999.

Analysis of Carbon Disulfide by ALS SOP: VOA-S307M_SCD, *"Analysis of Reduced Sulfur Compounds in a Gaseous Matrix by Gas Chromatography with Sulfur Chemiluminescence Detection."*

ALS Laboratory
2655 Park Center Dr., Suite A
Simi Valley, CA 93065

All analyses were performed according to NELAP-approved quality assurance program. The test results meet the requirements of the current NELAP standards, where applicable, except as noted in the laboratory case narrative provided. Results are intended to be considered in their entirety and apply only to those analyzed and reported herein.

ALS Laboratory is certified by the New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009 for VOCs by EPA TO-15 and carbon disulfide by ASTM D5504-12 in air.

REPORT OF LABORATORY ANALYSIS

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Detailed Sample Information

<u>ALS Sample #</u>	<u>Field Sample #</u>
P1601936-01	290-0001
P1601936-02	290-0002
P1601936-03	290-0003
P1601936-04	290-0004
P1601936-05	290-0005
P1601936-06	290-0006
P1601936-07	290-0007
P1601936-08	290-0008
P1601936-09	290-0009
P1601936-10	290-0010
P1601936-11	290-0011
P1601936-12	290-0012
P1601936-13	290-0013
P1601936-14	290-0014
P1601936-15	290-0015
P1601936-16	290-0016
P1601936-17	290-0017

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Introduction

SERAS personnel, in response to WA# SERAS-290, provided analytical support for environmental samples collected from the Bonair Avenue VI Site in Hatboro, PA as described in the following table. The support also included QA/QC, data review and preparation of an analytical report containing analytical and QA/QC results.

Chain of Custody #	Number of Samples	Sampling Date	Date Received	Date Analyzed	Matrix	Analysis/ Method	Laboratory	Data Package
3-040816-143612-0001	2	4/8/16	04/13/16	04/15/16 through 04/18/16	Soil Gas	VOC/ EPA Method TO-15	ALS Global	AB 042
	2				Air			
3-040816-151148-0002	1				Soil Gas			
	3				Air			
3-040816-151940-0003	1				Soil Gas			
	3				Air			
3-040816-152954-0004	1				Soil Gas			
	3				Air			
3-040816-153114-0005	1				Trip Blank			
3-040816-143612-0001	2				04/14/16 through 04/15/16			
	2	Air						
3-040816-151148-0002	1	Soil Gas						
	3	Air						
3-040816-151940-0003	1	Soil Gas						
	3	Air						
3-040816-152954-0004	1	Soil Gas						
	3	Air						
3-040816-153114-0005	1	Trip Blank						

Case Narrative

Sampling was conducted as per the site-specific Quality Assurance Project Plan (QAPP) and analyzed by the analytical methods as stated in the QAPP. The laboratory reported the data to two significant figures. Any other representation of the data is the responsibility of the user. Data were validated using a Stage 4 validation done manually (S4VM) in accordance with the "Guidance for Labeling Externally Validated Data for Superfund Use." All data validation flags have been inserted into the results tables.

Volatile Organic Compounds in Air Package AB 042

The laboratory reporting limit (RL) of chloroform was above the project screening level (PSL) for samples 290-0006, 290-0007, 290-0014 and 290-0015. These samples may contain this compound at concentrations





above the method detection limit (MDL) and below the RL.

The laboratory recorded pressure of the trip blank (290-0017) indicates a possible leakage of this sample in the field or in transit resulting in the following compounds being detected above the RL: dichlorodifluoromethane, 1,2-dichloroethane, benzene, trichloroethene, tetrachloroethene and ethyl benzene. Professional judgment was used to not qualify the associated samples.

Carbon disulfide in Air Package AB 043

The data package was examined and found to be acceptable.

The results presented in this report only relate to the samples analyzed. All results are intended to be considered in their entirety. The Environmental Response Team/Scientific, Engineering, Response and Analytical Services laboratory is not responsible for utilization of less than the complete report.

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Summary of Abbreviations

Summary of Abbreviations

BFB	Bromofluorobenzene
BS	Blank Spike
BSD	Blank Spike Duplicate
°C	Degree Centigrade
COC	Chain of Custody
conc	concentration
cont	continued
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins (PCDD) and Polychlorinated dibenzofurans (PCDF)
DFTPP	Decafluorotriphenylphosphine
EMPC	Estimated maximum possible concentration
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/ Mass Spectrometry
Hg-CVAA	Mercury-Cold Vapor Atomic Absorption
ICP-AES	Inductively Coupled Plasma- Atomic Emission Spectroscopy
ID	Identification
IS	Internal Standard
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MDA	Minimum Detectable Activity
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Molecular Weight
NA	Not Applicable or Not Available
NAD	Normalized Absolute Difference
NC	Not Calculated
NR	Not Requested/Not Reported
% D	Percent Difference
% R	Percent Recovery
SOP	Standard Operating Procedure
PCB	Polychlorinated Biphenyl
PDS	Post Digestion Spike
Percent RSD	Percent Relative Standard Deviation
ppbv	parts per billion by volume
ppm	parts per million
pptv	parts per trillion by volume
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RL	Reporting Limit
RPD	Relative Percent Difference
S4VM	Stage 4 validation done manually
SIM	Selected Ion Monitoring
SERAS	Scientific Engineering Response and Analytical Services
TIC	Tentatively Identified Compound
TCLP	Toxicity Characteristic Leaching Procedure
SVOC	Semi Volatile Organic Compound
VOC	Volatile Organic Compound
*	Value exceeds the acceptable QC limits

m ³	cubic meter	g	gram	kg	kilogram	L	liter
µg	microgram	µL	microliter	mg	milligram	mL	milliliter
ng	nanogram	pg	picogram	pCi	picocurie	σ	sigma

Data Validation Flags

J	Value is estimated	R	Rejected or Value is unusable
J+	Value is estimated high	U	Not detected
J-	Value is estimated low	UJ	Not detected and RL is estimated

Rev. 01/01/15, YRM

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SERAS-290-DAR-051616



3
AR100162



Table 1.1a Results of the Analysis for VOC (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Page 1 of 2

Laboratory Sample Number	P160415-MB	P1601936-001	P1601936-002	P1601936-003
Sample Number	Method Blank	290-0001	290-0002	290-0003
Sample Location	4/15/2016	Property 5	Property 5	Property 5
Sublocation		Front SS	Rear SS	BS1

Analyte	Result ppbv	RL ppbv	Result ppbv	RL ppbv	Result ppbv	RL ppbv	Result ppbv	RL ppbv
Dichlorodifluoromethane (CFC 12)	U	0.020	0.57	0.040	0.74	0.037	0.48	0.038
Chloroform	U	0.020	0.11	0.041	0.051	0.037	0.044	0.039
1,2-Dichloroethane	U	0.0062	0.043	0.012	0.092	0.011	0.084	0.012
Benzene	U	0.023	0.89	0.047	1.2	0.043	0.53	0.045
Carbon Tetrachloride	U	0.0040	0.12	0.0079	0.088	0.0073	0.091	0.0076
Trichloroethene (TCE)	U	0.0047	5.9	0.0093	0.13	0.0085	0.0092	0.0088
Tetrachloroethene	U	0.0037	1.1	0.0073	0.29	0.0067	0.024	0.0070
Ethylbenzene	U	0.023	U	0.046	0.47	0.042	0.38	0.044
1,4-Dichlorobenzene	U	0.0042	U	0.0083	U	0.0076	U	0.0079

Table 1.1a (cont) Results of the Analysis for VOC (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Laboratory Sample Number	P1601936-004	P1601936-005	P1601936-006	P1601936-007
Sample Number	290-0004	290-0005	290-0006	290-0007
Sample Location	Property 5	Property 5	Property 5	Property 5
Sublocation	BS2	FF	AMB1	AMB2

Analyte	Result ppbV	RL ppbV	Result ppbV	RL ppbV	Result ppbV	RL ppbV	Result ppbV	RL ppbV
Dichlorodifluoromethane (CFC 12)	0.47	0.034	0.47	0.053	0.46	0.036	0.46	0.037
Chloroform	0.040	0.035	0.10	0.053	U	0.036	U	0.038
1,2-Dichloroethane	0.088	0.011	0.11	0.016	0.018	0.011	0.018	0.011
Benzene	0.52	0.040	0.65	0.061	0.18	0.042	0.16	0.043
Carbon Tetrachloride	0.090	0.0068	0.090	0.010	0.082	0.0070	0.083	0.0073
Trichloroethene (TCE)	0.0099	0.0079	U	0.012	U	0.0082	U	0.0086
Tetrachloroethene	0.021	0.0063	0.028	0.0096	0.020	0.0065	0.018	0.0068
Ethylbenzene	0.39	0.039	0.40	0.060	0.044	0.041	0.042	0.042
1,4-Dichlorobenzene	U	0.0071	U	0.011	U	0.0074	0.0083	0.0077

Table 1.1a (cont) Results of the Analysis for VOC (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Laboratory Sample Number	P1601936-008	P1601936-009	P1601936-010	P1601936-011
Sample Number	290-0008	290-0009	290-0010	290-0011
Sample Location	Property 4	Property 4	Property 4	Property 4
Sublocation	SS	BS1	BS2	FF

Analyte	Result ppbV	RL ppbV	Result ppbV	RL ppbV	Result ppbV	RL ppbV	Result ppbV	RL ppbV
Dichlorodifluoromethane (CFC 12)	0.55	0.038	0.45	0.037	0.44	0.037	0.42	0.038
Chloroform	0.16	0.039	0.050	0.038	0.050	0.037	0.20	0.039
1,2-Dichloroethane	0.021	0.012	0.084	0.011	0.085	0.011	0.38	0.012
Benzene	0.12	0.044	0.16	0.043	0.14	0.043	0.15	0.044
Carbon Tetrachloride	1.1	0.0075	0.063	0.0074	0.083	0.0072	0.082	0.0075
Trichloroethene (TCE)	160	0.087	0.12	0.0086	0.11	0.0084	0.042	0.0088
Tetrachloroethene	5.1	0.0069	0.040	0.0068	0.027	0.0067	0.023	0.0070
Ethylbenzene	0.088	0.043	0.067	0.043	0.076	0.042	0.069	0.044
1,4-Dichlorobenzene	U	0.0078	0.013	0.0077	0.013	0.0075	0.039	0.0079

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Table 1.1a (cont) Results of the Analysis for VOC (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Page 2 of 2

Laboratory Sample Number	P1601936-012	P1601936-013	P1601936-014	P1601936-015
Sample Number	290-0012	290-0013	290-0014	290-0015
Sample Location	Property 3	Property 3	Property 3	Property 3
Sublocation	Front SS	Rear SS	BS1	BS2

Analyte	Result ppbV	RL ppbV	Result ppbV	RL ppbV	Result ppbV	RL ppbV	Result ppbV	RL ppbV
Dichlorodifluoromethane (CFC 12)	0.49	0.036	0.52	0.050	0.46	0.035	0.47	0.037
Chloroform	2.0	0.036	1.5	0.051	U	0.035	U	0.038
1,2-Dichloroethane	5.2	0.011	0.019	0.015	0.024	0.011	0.023	0.011
Benzene	0.21	0.042	0.31	0.058	0.16	0.040	0.17	0.043
Carbon Tetrachloride	0.51	0.0071	4.4	0.0099	0.086	0.0068	0.084	0.0073
Trichloroethene (TCE)	25	0.083	390	0.46	0.079	0.0080	0.056	0.0086
Tetrachloroethene	0.77	0.0066	3.4	0.0092	0.021	0.0063	0.023	0.0068
Ethylbenzene	0.081	0.041	U	0.057	0.095	0.039	0.13	0.042
1,4-Dichlorobenzene	0.016	0.0074	0.011	0.010	0.0084	0.0071	U	0.0077

Table 1.1a (cont) Results of the Analysis for VOC (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Laboratory Sample Number	P1601936-016	P1601936-017
Sample Number	290-0016	290-0017
Sample Location	Property 3	Trip Blank
Sublocation	FF	

Analyte	Result ppbV	RL ppbV	Result ppbV	RL ppbV
Dichlorodifluoromethane (CFC 12)	0.46	0.035	0.021	0.020
Chloroform	0.036	0.036	U	0.020
1,2-Dichloroethane	0.021	0.011	0.0096	0.0062
Benzene	0.14	0.041	0.031	0.023
Carbon Tetrachloride	0.096	0.0069	U	0.0040
Trichloroethene (TCE)	0.032	0.0081	0.032	0.0047
Tetrachloroethene	0.018	0.0064	0.027	0.0037
Ethylbenzene	0.077	0.04	0.22	0.023
1,4-Dichlorobenzene	0.011	0.0072	U	0.0042





Table 1.1b Results of the Analysis for VOC ($\mu\text{g}/\text{m}^3$) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Page 1 of 2

Laboratory Sample Number	P160415-MB	P1601936-001	P1601936-002	P1601936-003
Sample Number	Method Blank	290-0001	290-0002	290-0003
Sample Location	4/15/2016	Property 5	Property 5	Property 5
Sublocation		Front SS	Rear SS	BS1

Analyte	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3
Dichlorodifluoromethane (CFC	U	0.10	2.8	0.20	3.7	0.18	2.4	0.19
Chloroform	U	0.10	0.56	0.20	0.25	0.18	0.22	0.19
1,2-Dichloroethane	U	0.025	0.17	0.050	0.37	0.046	0.34	0.048
Benzene	U	0.075	2.8	0.15	3.9	0.14	1.7	0.14
Carbon Tetrachloride	U	0.025	0.74	0.050	0.55	0.046	0.57	0.048
Trichloroethene (TCE)	U	0.025	31	0.050	0.69	0.046	0.049	0.048
Tetrachloroethene	U	0.025	7.8	0.050	1.9	0.046	0.16	0.048
Ethylbenzene	U	0.10	U	0.20	2.0	0.18	1.6	0.19
1,4-Dichlorobenzene	U	0.025	U	0.050	U	0.046	U	0.048

Table 1.1b (cont) Results of the Analysis for VOC ($\mu\text{g}/\text{m}^3$) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Laboratory Sample Number	P1601936-004	P1601936-005	P1601936-006	P1601936-007
Sample Number	290-0004	290-0005	290-0006	290-0007
Sample Location	Property 5	Property 5	Property 5	Property 5
Sublocation	BS2	FF	AMB1	AMB2

Analyte	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3
Dichlorodifluoromethane (CFC	2.3	0.17	2.3	0.26	2.3	0.18	2.3	0.18
Chloroform	0.19	0.17	0.50	0.26	U	0.18	U	0.18
1,2-Dichloroethane	0.36	0.043	0.46	0.065	0.074	0.044	0.072	0.046
Benzene	1.7	0.13	2.1	0.20	0.57	0.13	0.51	0.14
Carbon Tetrachloride	0.56	0.043	0.56	0.065	0.51	0.044	0.53	0.046
Trichloroethene (TCE)	0.053	0.043	U	0.065	U	0.044	U	0.046
Tetrachloroethene	0.14	0.043	0.19	0.065	0.13	0.044	0.12	0.046
Ethylbenzene	1.7	0.17	1.7	0.26	0.19	0.18	0.18	0.18
1,4-Dichlorobenzene	U	0.043	U	0.065	U	0.044	0.050	0.046

Table 1.1b (cont) Results of the Analysis for VOC ($\mu\text{g}/\text{m}^3$) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Laboratory Sample Number	P1601936-008	P1601936-009	P1601936-010	P1601936-011
Sample Number	290-0008	290-0009	290-0010	290-0011
Sample Location	Property 4	Property 4	Property 4	Property 4
Sublocation	SS	BS1	BS2	FF

Analyte	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3
Dichlorodifluoromethane (CFC	2.7	0.19	2.2	0.19	2.2	0.18	2.1	0.19
Chloroform	0.80	0.19	0.25	0.19	0.24	0.18	0.99	0.19
1,2-Dichloroethane	0.085	0.047	0.34	0.046	0.34	0.045	1.5	0.047
Benzene	0.39	0.14	0.51	0.14	0.43	0.14	0.48	0.14
Carbon Tetrachloride	7.2	0.047	0.40	0.046	0.52	0.045	0.52	0.047
Trichloroethene (TCE)	880	0.47	0.66	0.046	0.57	0.045	0.23	0.047
Tetrachloroethene	34	0.047	0.27	0.046	0.18	0.045	0.15	0.047
Ethylbenzene	0.38	0.19	0.29	0.19	0.33	0.18	0.30	0.19
1,4-Dichlorobenzene	U	0.047	0.081	0.046	0.079	0.045	0.24	0.047

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Table 1.1b (cont) Results of the Analysis for VOC ($\mu\text{g}/\text{m}^3$) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Page 2 of 2

Laboratory Sample Number	P1601936-012		P1601936-013		P1601936-014		P1601936-015	
Sample Number	290-0012		290-0013		290-0014		290-0015	
Sample Location	Property 3		Property 3		Property 3		Property 3	
Sublocation	Front SS		Rear SS		BS1		BS2	
Analyte	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3
Dichlorodifluoromethane (CFC	2.4	0.18	2.6	0.25	2.3	0.17	2.3	0.18
Chloroform	9.9	0.18	7.3	0.25	U	0.17	U	0.18
1,2-Dichloroethane	21	0.045	0.077	0.062	0.096	0.043	0.094	0.046
Benzene	0.67	0.13	1.0	0.19	0.51	0.13	0.55	0.14
Carbon Tetrachloride	3.2	0.045	28	0.062	0.54	0.043	0.53	0.046
Trichloroethene (TCE)	140	0.45	2100	2.5	0.42	0.043	0.30	0.046
Tetrachloroethene	5.2	0.045	23	0.062	0.15	0.043	0.16	0.046
Ethylbenzene	0.35	0.18	U	0.25	0.41	0.17	0.56	0.18
1,4-Dichlorobenzene	0.099	0.045	0.065	0.062	0.051	0.043	U	0.046

Table 1.1b (cont) Results of the Analysis for VOC ($\mu\text{g}/\text{m}^3$) in Air
WA# SERAS-290 Bonair Avenue VI

Method EPA Method TO-15 SIM

Laboratory Sample Number	P1601936-016		P1601936-017	
Sample Number	290-0016		290-0017	
Sample Location	Property 3		Trip Blank	
Sublocation	FF			
Analyte	Result ug/m3	RL ug/m3	Result ug/m3	RL ug/m3
Dichlorodifluoromethane (CFC	2.3	0.17	0.10	0.10
Chloroform	0.18	0.17	U	0.10
1,2-Dichloroethane	0.083	0.044	0.039	0.025
Benzene	0.46	0.13	0.099	0.075
Carbon Tetrachloride	0.61	0.044	U	0.025
Trichloroethene (TCE)	0.17	0.044	0.17	0.025
Tetrachloroethene	0.12	0.044	0.19	0.025
Ethylbenzene	0.33	0.17	0.94	0.10
1,4-Dichlorobenzene	0.064	0.044	U	0.025





Table 1.2a Results of the Analysis for CS₂ (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Page 1 of 2

Laboratory Sample Number	P160414-MB	P1601936-003	P1601936-004	P1601936-006
Sample Number	Method Blank 1	290-0003	290-0004	290-0006
Sample Location	4/14/2016	Property 5	Property 5	Property 5
Sublocation		BS1	BS2	AMB1
Analyte	Result ppbv	RL ppbv	Result ppbv	RL ppbv
Carbon Disulfide	U	2.5	U	4.8
			U	4.3
			U	4.4

Table 1.2a (cont) Results of the Analysis for CS₂ (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Laboratory Sample Number	P1601936-008	P1601936-010	P1601936-012	P1601936-013
Sample Number	290-0008	290-0010	290-0012	290-0013
Sample Location	Property 4	Property 4	Property 3	Property 3
Sublocation	SS	BS2	Front SS	Rear SS
Analyte	Result ppbv	RL ppbv	Result ppbv	RL ppbv
Carbon Disulfide	U	4.7	U	4.5
			U	4.5
			U	6.2

Table 1.2a (cont) Results of the Analysis for CS₂ (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Laboratory Sample Number	P160414-MB	P1601936-014	P1601936-015	P1601936-016
Sample Number	Method Blank 2	290-0014	290-0015	290-0016
Sample Location	4/14/2016	Property 3	Property 3	Property 3
Sublocation		BS1	BS2	FF
Analyte	Result ppbv	RL ppbv	Result ppbv	RL ppbv
Carbon Disulfide	U	2.5	U	4.3
			U	4.6
			U	4.4





Table 1.2a (cont) Results of the Analysis for CS₂ (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Page 2 of 2

Laboratory Sample Number	P1601936-017		P160415-MB		P1601936-001		P1601936-002	
Sample Number	290-0017		Method Blank		290-0001		290-0002	
Sample Location	Trip Blank		4/15/2016		Property 5		Property 5	
Sublocation					Front SS		Rear SS	
	Result	RL	Result	RL	Result	RL	Result	RL
Analyte	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
Carbon Disulfide	U	2.5	U	2.5	U	5.0	U	4.6

Table 1.2a (cont) Results of the Analysis for CS₂ (ppbv) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Laboratory Sample Number	P1601936-005		P1601936-007		P1601936-009		P1601936-011	
Sample Number	290-0005		290-0007		290-0009		290-0011	
Sample Location	Property 5		Property 5		Property 4		Property 4	
Sublocation	FF		AMB2		BS1		FF	
	Result	RL	Result	RL	Result	RL	Result	RL
Analyte	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
Carbon Disulfide	U	6.5	U	4.6	U	4.6	U	4.7





Table 1.2b Results of the Analysis for CS₂ (µg/m³) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Page 1 of 2

Laboratory Sample Number	P160414-MB	P1601936-003	P1601936-004	P1601936-006
Sample Number	Method Blank 1	290-0003	290-0004	290-0006
Sample Location	4/14/2016	Property 5	Property 5	Property 5
Sublocation		BS1	BS2	AMB1
Analyte	Result ug/m ³	RL ug/m ³	Result ug/m ³	RL ug/m ³
Carbon Disulfide	U	7.8	U	15
			U	13
			U	14

Table 1.2b (cont) Results of the Analysis for CS₂ (µg/m³) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Laboratory Sample Number	P1601936-008	P1601936-010	P1601936-012	P1601936-013
Sample Number	290-0008	290-0010	290-0012	290-0013
Sample Location	Property 4	Property 4	Property 3	Property 3
Sublocation	SS	BS2	Front SS	Rear SS
Analyte	Result ug/m ³	RL ug/m ³	Result ug/m ³	RL ug/m ³
Carbon Disulfide	U	15	U	14
			U	14
			U	19

Table 1.2b (cont) Results of the Analysis for CS₂ (µg/m³) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Laboratory Sample Number	P160414-MB	P1601936-014	P1601936-015	P1601936-016
Sample Number	Method Blank 2	290-0014	290-0015	290-0016
Sample Location	4/14/2016	Property 3	Property 3	Property 3
Sublocation		BS1	BS2	FF
Analyte	Result ug/m ³	RL ug/m ³	Result ug/m ³	RL ug/m ³
Carbon Disulfide	U	7.8	U	13
			U	14
			U	14

Table 1.2b (cont) Results of the Analysis for CS₂ (µg/m³) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Laboratory Sample Number	P1601936-017	P160415-MB	P1601936-001	P1601936-002
Sample Number	290-0017	Method Blank	290-0001	290-0002
Sample Location	Trip Blank	4/15/2016	Property 5	Property 5
Sublocation			Front SS	Rear SS
Analyte	Result ug/m ³	RL ug/m ³	Result ug/m ³	RL ug/m ³
Carbon Disulfide	U	7.8	U	7.8
			U	15
			U	14

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Table 1.2b (cont) Results of the Analysis for CS₂ (µg/m³) in Air
WA# SERAS-290 Bonair Avenue VI

ALS SOP: VOA-S307M_SCD

Page 2 of 2

Laboratory Sample Number	P1601936-005		P1601936-007		P1601936-009		P1601936-011	
Sample Number	290-0005		290-0007		290-0009		290-0011	
Sample Location	Property 5		Property 5		Property 4		Property 4	
Sublocation	FF		AMB2		BS1		FF	
Analyte	Result	RL	Result	RL	Result	RL	Result	RL
	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
Carbon Disulfide	U	20	U	14	U	14	U	15

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Table 2.1 Results of the LCS Analysis for VOC in Air
WA# SERAS-290 Bonair Avenue VI

Page 1 of 1

Sample ID: LCS 04/15/16

Analyte	LCS Spike $\mu\text{g}/\text{m}^3$	LCS Recovered $\mu\text{g}/\text{m}^3$	LCS % Recovery	QC Limits % Recovery
Dichlorodifluoromethane (CFC 12)	3.76	3.14	84	60-119
Chloroform	4.48	3.70	83	68-112
1,2-Dichloroethane	4.28	3.76	88	64-116
Benzene	4.52	4.30	95	67-113
Carbon Tetrachloride	4.60	3.66	80	70-116
Trichloroethene (TCE)	4.32	3.33	77	70-112
Tetrachloroethene	4.04	3.20	79	67-114
Ethylbenzene	4.36	3.44	79	71-127
1,4-Dichlorobenzene	4.16	3.33	80	63-126

Sample ID: LCS 04/18/16

Analyte	LCS Spike $\mu\text{g}/\text{m}^3$	LCS Recovered $\mu\text{g}/\text{m}^3$	LCS % Recovery	QC Limits % Recovery
Dichlorodifluoromethane (CFC 12)	3.76	3.44	91	60-119
Chloroform	4.48	4.27	95	68-112
1,2-Dichloroethane	4.28	4.18	98	64-116
Benzene	4.52	4.64	103	67-113
Carbon Tetrachloride	4.60	4.09	89	70-116
Trichloroethene (TCE)	4.32	3.73	86	70-112
Tetrachloroethene	4.04	3.59	89	67-114
Ethylbenzene	4.36	3.93	90	71-127
1,4-Dichlorobenzene	4.16	4.04	97	63-126



Table 2.2 Results of the Duplicate Analysis for VOC in Air
WA# SERAS-290 Bonair Avenue VI

Sample ID: 290-0004

Page 1 of 1

Analyte	Initial Analysis ppbv	Duplicate Analysis ppbv	RPD	QC Limits RPD
Dichlorodifluoromethane (CFC 12)	0.465	0.480	3	25
Chloroform	0.0399	0.0419	5	25
1,2-Dichloroethane	0.0878	0.0870	0.8	25
Benzene	0.522	0.519	0.6	25
Carbon Tetrachloride	0.0898	0.0896	0.2	25
Trichloroethene (TCE)	0.00986	0.00989	0.2	25
Tetrachloroethene	0.0213	0.0213	0	25
Ethylbenzene	0.386	0.396	2	25
1,4-Dichlorobenzene	U	U	NC	25





Table 2.3 Results of the LCS Analysis for Carbon Disulfide in Air
WA# SERAS-290 Bonair Avenue VI

Page 1 of 1

Sample ID: LCS1 04/14/2016

Analyte	LCS Spike Added ppbv	LCS Spike Recovered ppbv	LCS % Recovery	QC Limits % Recovery
Methyl Mercaptan	1000	1100	110	57-140

Sample ID: LCS2 04/14/2016

Analyte	LCS Spike Added ppbv	LCS Spike Recovered ppbv	LCS % Recovery	QC Limits % Recovery
Methyl Mercaptan	1000	998	100	57-140

Sample ID: LCS 04/15/2016

Analyte	LCS Spike Added ppbv	LCS Spike Recovered ppbv	LCS % Recovery	QC Limits % Recovery
Methyl Mercaptan	1000	984	98	57-140



USEPA

DateShipped: 4/8/2016

CarrierName:

AirbillNo:

CHAIN OF CUSTODY RECORD

Site #: 290

No: 3-040816-143612-0001

Cooler #:

Lab: ALS Laboratory Group - Salt Lake City

Lab Phone: 801-266-7700

Lab #	Sample #	Location	Sub Location	Analyses	Matrix	Numb Cont	Pump #	OrificeID	Stop Pressure	Lab QC	Stop_Date	Stop_Time
①	290-0001	Property 5	Front SS	TO-15, PCE, TCE+ ASTM D5504, Carbon disulfide	Soil Gas	1	AS00617	FCA00851	-12	N	4/8/2016	9:25:00 AM
②	290-0002	Property 5	Rear SS	TO-15, PCE, TCE+ ASTM D5504, Carbon disulfide	Soil Gas	1	SC01913	FCA000057	-10	N	4/8/2016	9:27:00 AM
③	290-0003	Property 5	BS1	TO-15, PCE, TCE+ ASTM D5504, Carbon disulfide	Air	1	AS00187	FCA00082	-11.5	N	4/8/2016	9:28:00 AM
④	290-0004	Property 5	BS2	TO-15, PCE, TCE+ ASTM D5504, Carbon disulfide	Air	1	AC02128	FCA00758	-9	N	4/8/2016	9:28:00 AM
SSS												

Special Instructions:

QA by PTS

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES FOR ANALYSIS	LOCKWOOD MARTEN / SERAS	4/8/16 15:12			
	FDRX			4/13/16 0910	

SERAS-290-DAR-051616

015

AR100174

AirbillNo:**Site #: 290**

Cooler #:

Lab Phone: 801-266-7700

[illegible]

Special Instructions:	SAMPLES TRANSFERRED FROM CHAIN OF CUSTODY #
-----------------------	--

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES FOR ANALYSIS	[Redacted] / [Redacted] / [Redacted]	4/18/16 1530/1538			
	FAALX		[Redacted]	4/13/16 0910	

Airbill No:

Site #: 290

Lab Phone: 801-266-7700

[illegible]

Special Instructions:	SAMPLES TRANSFERRED FROM
QA BY RLS	CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES FOR ANALYSES	[REDACTED] OLKINSON MARION SOLAS	4/6/16 1543	[REDACTED]		
	[REDACTED] #2000			4/13/16 0910	

USEPA

DateShipped: 4/8/2016

CarrierName:

AirbillNo:

CHAIN OF CUSTODY RECORD

Site #: 290

No: 3-040816-153114-0005

Cooler #:

Lab: ALS Laboratory Group - Salt Lake City

Lab Phone: 801-266-7700

Lab #	Sample #	Location	Sub Location	Analyses	Matrix	Numb Cont	Pump #	OrificeID	Stop Pressure	Lab QC	Stop_Date	Stop_Time
① ②	290-0017	Trip Blank	-	TO-15, PCE, TCE+ ASTM D5504, Carbon disulfide	Blank	1	A500884		-29.5	N	4/8/2016	10:36:00 AM
SJS												

Special Instructions:

QA BY PJS

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by (Signature and Organization)	Date/Time	Received by (Signature and Organization)	Date/Time	Sample Condition Upon Receipt
ALL SAMPLES FOR ANALYSIS	LOCKWOOD / BERAS MARTIN	4/8/16 1544			
	PJS			4/13/16 0910	

SERAS-290-DAR-051616

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AR100178

LOCKHEED MARTIN

Lockheed Martin Information Systems & Global Solutions (IS&GS - Civil)
Environmental Services SERAS
2890 Woodbridge Avenue, Building 209 Annex
Edison, NJ 08837-3679
Telephone: 732-321-4200, Facsimile: 732-494-4021

ALS USA, Inc. .
2655 Park Center Drive Suite A
Simi Valley CA 93065

Attn: [REDACTED]

April 1, 2016

As per Lockheed Martin / SERAS BPA# 4102338634 for Project 0-290, please analyze the following:

Analysis/Method	Matrix	# of samples
Analysis VOA/TO-15 See attached compound list at 0.020 ppbv RL	Summa	20
Carbon Disulfide in the same canister as TO-15 by ASTM D5504	Summa	20
Rental of summas/flow controllers with flow controller adjusted to collect samples over a 24-hour period. Individually Certified.	N/A	20
Data package: Level four full documentation with csv file. See checklist for EDD requirements		

The samples are expected to arrive at your laboratory on or about April 8th, 2016. Preliminary sample and QC result tables plus a signed copy of our Chain of Custody must be sent to SERAS 10 business days after each batch of samples. The complete data package is due 15 business days after receipt of the samples. The complete data package must include all items on the deliverables checklist. **The laboratory must provide documentation for individual summa canister and flow controller certification.**

All sample and QC results must be summarized in a csv file. Units must be in ppbv and ug/m3 in the electronic deliverable. See checklist for EDD fields needed. **The summa canisters and preset orifices must arrive @ SERAS at or before April 4, 2016. The flow controllers must have 1/4 inch fittings.** Please contact [REDACTED] for all technical questions.

Sincerely,

[REDACTED]
Analytical Support Chemist
Lockheed Martin / SERAS Project

Compound List for 0-060

	RL	RL
Compound	ppbv	µg/m3
1,2-Dichloroethane	0.020	0.081
1,4-Dichlorobenzene	0.020	0.120
Benzene	0.020	0.064
Carbon Tetrachloride	0.020	0.126
Chloroform	0.020	0.098
Dichlorodifluoromethane (Freon 12)	0.05	0.247
Ethylbenzene	0.020	0.087
Tetrachloroethene	0.020	0.136
Trichloroethene	0.020	0.107

WA# _____ Laboratory Report No. _____

Deliverable Checklist for GC/MS Analyses

**All the following information must be included in the data package.
(Please check all blanks and submit the list together with the report)**

Legible print on all pages of report, including instrument and raw data printouts. *Reports should also be paginated.*

- _____ Case narrative including the method numbers, any method modifications, all anomalies and problems (including reasons for manual integration peak integration).
- _____ Chain of custody (signed with date of receipt).
- _____ Sample extraction and preparation logs (including initial volume/weight, final volume, dilution factor, solvent and standard lot #s and all re-extractions).
- _____ Formulations of the spike solutions (surrogate, calibration standards, LCS, matrix spike, tune and internal standards), including certifications, initial and final formulations, lot# with concentrations, expiration dates and volumes used.
- _____ Worksheet of % solid or % moisture.
- _____ Analysis logs for all instruments used including documentation of all std lot #s used. (For VOA analysis, the sample size used for analysis must be clearly documented)
- _____ Tabulated sample and method blank results, solids based on dry weight, TO-15 results must be in ppbv and ug/m3 (including the duplicate analysis results and a per sample Reporting Limit based on the lowest calibration std, taking into account dilutions, sample weight, extraction volumes, and % solids). Results in the EDD must be in the same order as raw data.

Tuning and Mass Calibration

(for all instruments used for analyses, dilutions, and initial/continuing calibrations)

_____ Summary table _____ Ion chromatogram _____ Spectrum _____ Mass listing

Initial Calibration Data - in order by instrument, if more than one instrument used

- _____ Analysis logs including all lots #'s of tune and initial calibration standards
- _____ Summary table of calibration avg. RF and %RSD results including regression equations (NOT forced through zero) for all analytes.
- _____ Chromatograms for all calibration standards for all analytes requested.
- _____ Quantitation reports for all calibration standards for all analytes requested.
- _____ If the ICAL std. that the reporting limit is based on (lowest standard) is manually integrated then the analyst must manually review all sample analysis for the compound(s).

**Continuing Calibration Verification (CCV) Data - in order by instrument, if more than one instrument used
(continuing calibration for sample dilution should also be submitted)**

- _____ Analysis logs including all lots #'s of tune and CCV calibration standards
- _____ Summary table of % difference of relative response factors or % recovery of CCV stds.
- _____ Ion chromatograms
- _____ Quantitation reports (including all areas for all manually integrated peaks)
- _____ Internal standard area summary table for all Method Blanks, sample/dilution analyses, LCS and MS/MSDs
- _____ All lots #'s of tune and CCV standards are documented.
- _____ Printouts initiated by the analyst of all manual integrations with integration lines clearly identified.

Method Blank and Sample Data - In chronological order (for VOA, each 12-hour period, for each GC/MS system)

_____ Result summary table (including reporting limits) to three significant figures.

_____ Surrogate percent recovery and internal standard area summary table

_____ Ion Chromatograms

_____ Quantitation reports and target compound spectra, which should include:

_____ Raw target compound spectra

_____ Enhanced or background subtracted spectra

_____ Laboratory generated target compound standard spectra

_____ Printouts initiated by the analyst of all manual integrations with integration lines clearly identified.

_____ Tabulated results for Tentatively Identified Compounds (TIC), if applicable, including GC/MS library search spectra for each TIC.

Matrix Spike/Matrix Spike Duplicate Data (if required by the method or specifically requested)

_____ Tabulated spike recovery results formatted as follows: (Solids should be reported on dry weight basis)

Sample Result	Spike Added		Concentration		% Recovery		RPD	QC Limits	
	MS	MSD	MS	MSD	MS	MSD		% Rec.	RPD

_____ Ion Chromatograms

_____ Quantitation reports

Electronic Data Deliverable

_____ Provide a pdf file for the entire data package.

_____ Provide electronic deliverable in tab delimited .csv file.

_____ Electronic compound list should be in the same order as hard copy report.

_____ Column headers must be formatted as follows: Samp_No , Location, SubLocation, Matrix, Analyte, Result, Result_Units, Result_Qualifier, Analytical_Method, Reporting_Limit, Reporting_Limit_Units, Analysis, Percent_Solids, WA_No, QC_Type, Spike_Amount, Spike_Amount_Units, Date_Analyzed, Results_Type_Code, Percent_Recovery, Percent_Recovery_Limits, Percent_RPD, Percent_RPD_Limits, Percent_Solids, Percent_Lipids and QAFlag

Signature _____

Date _____