



April 2, 2009

Dennis Harwood  
ADEC Technical Services and Risk Assessment  
555 Cordova Street  
Anchorage, AK 99501

PCE indoor  
air level →

**Subject: Vapor Intrusion Data Summary Report; 4<sup>th</sup> and Gambell Site; Anchorage, Alaska; NTP 18-9028-13-61**

Dear Mr. Harwood:

This submittal contains tables and figures of data collected during vapor intrusion assessments at four buildings in March 2009 for the 4<sup>th</sup> and Gambell site. The samples were collected and analyzed in accordance with the procedures outlined in *Vapor Intrusion Assessment, Work Plan, 4th and Gambell, February 2009*.

Attachment 1 contains analytical data tables for the vapor intrusion assessments. Attachment 2 presents figures, which also contain pertinent analytical data. The laboratory data reports for the samples are included as Attachment 3. Finally, Attachment 4 contains a quality assurance review of the laboratory data reports.

Formal reporting and interpretation of data will be performed following the completion of another round of sampling in May 2009; however, the following provides a synopsis of data quality and findings for each building:

- Quality Assurance Review – The air analytical results met data quality indicators for completeness, precision, and accuracy; however, the trip blank did have reportable concentrations of chloromethane, ethanol, acetone, 2-propanol, methylene chloride, hexane, 2-butanone, cyclohexane, benzene, heptanes, toluene, ethylbenzene, and xylenes. Samples with reportable concentrations of the previously listed analytes at less than ten times the concentration reported in the trip blank have had the results changed to non-detect (ND) at the reported concentration and are flagged "B."
- 1710 East 3<sup>rd</sup> Avenue – An indoor air sample was collected at location IA-1; an outdoor air sample was collected at location AA-1; and a soil gas sample was collected at SG-1. The indoor air concentration of benzene in the sample from location IA-1 exceeded the Environmental Protection Agency (EPA) target indoor air concentration (TIAC) and was more than ten times the reported concentration in the trip blank. However, benzene was not detected in the soil gas sample; therefore its presence is may be due to background and/or ambient sources. Tetrachloroethene (PCE) was detected just below the TIAC in the primary indoor air sample and just above the TIAC in the duplicate indoor air sample. In addition, given PCE was detected in the soil gas sample and not detected in the outdoor air sample, the vapor intrusion pathway probably

- is complete for the compound. Numerous other compounds were detected in the indoor air sample at concentrations less than TIACs. Tetrahydrofuran, a common industrial solvent, also was detected in the soil gas sample, but the compound was not detected in the indoor air sample.
- 1720 East 3<sup>rd</sup> Avenue – An indoor air sample was collected at location IA-2; an outdoor air sample was collected at location AA-1; and a soil gas sample was collected at SG-2. PCE was the only compound that exceeded a TIAC. In addition, PCE was detected at an elevated concentration in the soil gas sample, which indicates that the vapor intrusion likely is complete for the compound. Numerous other compounds were detected in the indoor air sample at concentrations less than TIACs. Tetrahydrofuran also was detected in both the indoor air sample and the soil gas sample, so the vapor intrusion pathway may be complete for this compound. However, as previously noted, tetrahydrofuran did not exceed the TIAC.
  - North Duplex – A crawl space air sample was collected at location CS-1; an outdoor air sample was collected at location AA-2; and a soil gas sample was collected at SG-3. PCE exceeded the TIAC in the crawl space sample. (It should be noted that TIACs do not actually apply to crawl spaces.) PCE also was detected in the soil gas sample and nominally in the outdoor air sample; therefore, the exceedance of the TIAC for PCE in the crawl space air sample probably is the result of vapor intrusion. Freon 11, Freon 12, 2-propanol, cyclohexane, and styrene also were detected in the crawl space air sample at concentrations less than TIACs. Tetrahydrofuran was detected in the soil gas sample, but the compound was not detected in the crawl space air sample.
  - South Duplex – A crawl space air sample was collected at location CS-2; an outdoor air sample was collected at location AA-2; and a soil gas sample was collected at SG-4. PCE and 1,3-butadiene, a chemical used in the production of rubber, both exceeded their respective TIACs in the crawl space sample. However, 1,3-butadiene was not detected in the soil gas sample or outdoor air sample, so there is insufficient evidence to assess the reason for the presence of 1,3-butadiene in the crawl space sample. On the other hand, PCE was detected in the soil gas sample and nominally in the outdoor air sample; therefore, the exceedance of the TIAC for PCE in the crawl space air sample likely is the result of vapor intrusion. Freon 11, Freon 12, chloromethane, acetone, and 2-propanol also were detected in the crawl space air sample at concentrations less than TIACs. Tetrahydrofuran was detected in the soil gas sample, but the compound was not detected in the crawl space air sample.

Given that the vapor intrusion pathway may be complete for PCE at all four buildings and that PCE concentrations appear to exceed the TIAC, OASIS recommends that ADEC consider including sub-slab samples for the residences at 1710 East 3<sup>rd</sup> Avenue and 1720 East 3<sup>rd</sup> Avenue and indoor air samples for the two duplexes during the May sample event. These additional samples will provide the most complete lines of evidence to assess air quality and the vapor intrusion pathway at all four buildings.

Please call me at 258-4880, or email me at [b.martich@oasisenviro.com](mailto:b.martich@oasisenviro.com), if you have any questions or comments.

Sincerely,

**OASIS Environmental, Inc.**



Ben Martich  
Project Manager

cc:

Todd Blessing, ADEC Project Manager

Attachments:

1. Tables (1 – 5)
2. Figures (A – B)
3. Laboratory Analytical Reports
4. ADEC Laboratory Data Review

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**ATTACHMENT 1**

**TABLES**

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**Table 1**  
**Air Sample Summary - March 2009**  
**4th and Gambell Vapor Intrusion Assessment**

Sample Location	Building	Sample Number	Date	Sample Type	Duration	Description	Comments
AA-1	1720 3rd Avenue	094AG113AA	3/2/2009	Outdoor Air	24-hour	Southeast side of residence	
IA-1	1710 3rd Avenue	094AG110IA 094AG111IA	3/2/2009	Indoor Air	24-hour	Living room	094AG111IA is a duplicate
SG-1	1720 3rd Avenue	094AG114SG	3/3/2009	Soil Gas	30-minute	South side of building	
IA-2	1710 3rd Avenue	094AG115SG	3/3/2009	Indoor Air	24-hour	Living room	094AG115SG is a duplicate
SG-2	1710 3rd Avenue	094AG116SG	3/3/2009	Soil Gas	30-minute	South side of building	
AA-2	Duplexes	094AG106AA	3/2/2009	Outdoor Air	24-hour	Between duplexes	
CS-1	North Duplex	094AG107CS	3/2/2009	Crawl Space Air	24-hour	Center of crawl space/basement	
SG-3	North Duplex	094AG112SG	3/2/2009	Soil Gas	30-minute	Southwest side of building	
CS-2	South Duplex	094AG108CS	3/2/2009	Crawl Space Air	24-hour	East side of crawl space	
SG-4	South Duplex	094AG109SG	3/2/2009	Soil Gas	30-minute	West side of building	

Table 2  
Air Sample Summary - March 2009  
1710 East 3rd Avenue  
4th and Gambell Vapor Intrusion Assessment

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Compound	Units	EPA TIAC	Indoor Air		Outdoor Air	Soil Gas	
			IA-1		AA-1	SG-1	
			Primary	Duplicate		Primary	Duplicate
<i>Field Parameters</i>							
Soil Moisture	%	---	---	---	---	7.0	---
Total Volatile Hydrocarbons	ppm	---	---	---	---	35	---
Oxygen	%	---	---	---	---	20.9	---
Carbon dioxide	%	---	---	---	---	0.2	---
Helium	%	---	---	---	---	0.01	---
<i>Volatile Organic Compounds</i>							
Freon 12	µg/m <sup>3</sup>	200	3.1	3.1	3.4	ND (6.0)	ND (5.9)
Chloromethane	µg/m <sup>3</sup>	24	ND (0.91) B	ND (1.3) B	ND (1.3) B	ND (10)	ND (9.9)
Freon 11	µg/m <sup>3</sup>	700	1.5	1.5	1.7	ND (6.8)	ND (6.7)
Ethanol	µg/m <sup>3</sup>	---	400 E	320 E	ND (1.5) B	ND (9.2)	ND (10) B
Acetone	µg/m <sup>3</sup>	350	ND (5.5) B	ND (18) B	ND (4.9) B	ND (12)	ND (11)
2-propanol	µg/m <sup>3</sup>	---	ND (4.9) B	ND (5.2) B	ND (1.5)	ND (12)	ND (12)
Hexane	µg/m <sup>3</sup>	200	ND (5.0) B	ND (5.3) B	ND (0.59) B	ND (4.3)	ND (4.2)
2-butanone	µg/m <sup>3</sup>	1,000	ND (6.9) B	ND (3.7) B	ND (0.36)	ND (3.6)	ND (3.5)
Cyclohexane	µg/m <sup>3</sup>	---	ND (2.6) B	ND (2.7) B	ND (0.43)	ND (4.2)	ND (4.1)
Benzene	µg/m <sup>3</sup>	3.1 -	<b>10</b>	<b>11</b>	ND (2.1) B	ND (3.9)	ND (3.8)
Heptane	µg/m <sup>3</sup>	---	ND (2.9) B	ND (4.0) B	ND (0.51)	ND (5.0)	ND (4.9)
Toluene	µg/m <sup>3</sup>	400	ND (36) B	ND (39) B	ND (3.7) B	ND (4.6)	ND (4.5)
Tetrahydrofuran	µg/m <sup>3</sup>	---	ND (2.5)	ND (2.5)	ND (1.8)	4.0	4.1
PCE	µg/m <sup>3</sup>	8.1	8.0	<b>8.2</b>	ND (0.84)	45	45
Ethylbenzene	µg/m <sup>3</sup>	22	ND (5.7) B	ND (6.1) B	ND (0.54)	ND (5.3)	ND (5.2)
Xylenes	µg/m <sup>3</sup>	7,000	31	33	ND (0.99) B	ND (5.3)	ND (5.2)
Propylbenzene	µg/m <sup>3</sup>	140	0.96	1.0	ND (0.61)	ND (6.0)	ND (5.9)
4-ethyltoluene	µg/m <sup>3</sup>	---	3.3	3.9	ND (0.61)	ND (6.0)	ND (5.9)
1,3,5-trimethylbenzene	µg/m <sup>3</sup>	6.0	1.0	1.4	ND (0.61)	ND (6.0)	ND (5.9)
1,2,4-trimethylbenzene	µg/m <sup>3</sup>	6.0	3.5	4.7	ND (0.61)	ND (6.0)	ND (5.9)
1,4-dichlorobenzene	µg/m <sup>3</sup>	800	4.6	4.8	ND (0.74)	ND (7.3)	ND (7.2)

ND 7.1  
300 4.1

Notes: Value in parentheses is laboratory reporting limit.  
Bolded indoor air value exceeds TIAC.

Key:

- % = Percent
- E = Exceeds instrument calibration range
- B = Analyte contamination was reported in the trip blank at similar concentrations.
- EPA = Environmental Protection Agency
- µg/m<sup>3</sup> = Micrograms per cubic meter
- ND = Not detected
- PCE = Tetrachloroethene
- ppm = Parts per million
- TIAC = Target indoor air concentration



**Table 3**  
**Air Sample Summary - March 2009**  
**1720 East 3rd Avenue**  
**4th and Gambell Vapor Intrusion Assessment**

Compound	Units	EPA TIAC	Indoor Air	Outdoor Air	Soil Gas
			IA-2	AA-1	SG-2
<i>Field Parameters</i>					
Soil Moisture	---	---	---	---	7.5
Total Volatile Hydrocarbons	ppm	---	---	---	110
Oxygen	%	---	---	---	20.9
Carbon dioxide	%	---	---	---	0.7
Helium	%	---	---	---	0
<i>Volatile Organic Compounds</i>					
Freon 12	µg/m <sup>3</sup>	200	4.1	3.4	6.6
Chloromethane	µg/m <sup>3</sup>	24	ND (1.1) B	ND (1.3) B	ND (10)
Freon 11	µg/m <sup>3</sup>	700	1.6	1.7	ND (7.0)
Ethanol	µg/m <sup>3</sup>	---	410 E	ND (1.5) B	ND (9.4)
Acetone	µg/m <sup>3</sup>	350	310 E	ND (4.9) B	ND (12)
2-propanol	µg/m <sup>3</sup>	---	ND (8.5) B	ND (1.5)	ND (12)
Hexane	µg/m <sup>3</sup>	200	ND( 2.2) B	ND (0.59) B	ND (4.4)
2-butanone	µg/m <sup>3</sup>	1,000	29	ND (0.36)	ND (3.7)
Tetrahydrofuran	µg/m <sup>3</sup>	---	7.2	ND (1.8)	6.8
Cyclohexane	µg/m <sup>3</sup>	---	ND (1.2) B	ND (0.43)	ND (4.3)
Benzene	µg/m <sup>3</sup>	3.1	ND (2.6) B	ND (2.1) B	ND (4.0)
Heptane	µg/m <sup>3</sup>	---	ND (2.8) B	ND (0.51)	ND (5.1)
Toluene	µg/m <sup>3</sup>	400	ND (14) B	ND (3.7) B	ND (8.0) B
PCE	µg/m <sup>3</sup>	8.1	<b>58</b>	ND (0.84)	2,100
Chlorobenzene	µg/m <sup>3</sup>	60	1.5	ND (0.57)	ND (5.8)
Ethylbenzene	µg/m <sup>3</sup>	22	ND (1.7) B	ND (0.54)	ND (5.4)
Xylenes	µg/m <sup>3</sup>	7,000	ND (8.4) B	ND (0.99) B	ND (5.4)
Styrene	µg/m <sup>3</sup>	1,000	0.97	ND (0.53)	ND (5.3)
1,2,4-trimethylbenzene	µg/m <sup>3</sup>	6.0	1.0	ND (0.61)	ND (6.1)
1,4-dichlorobenzene	µg/m <sup>3</sup>	800	23	ND (0.74)	ND (7.5)

Notes: Value in parentheses is laboratory reporting limit.

Bolded indoor air value exceeds TIAC.

Key:

% = Percent

E = Exceeds instrument calibration range

B = Analyte contamination was reported in the trip blank at similar concentrations.

EPA = Environmental Protection Agency

µg/m<sup>3</sup> = Micrograms per cubic meter

ND = Not detected

PCE = Tetrachloroethene

ppm = Parts per million

TIAC = Target indoor air concentration




**EXPLANATION**

- ✕ SOIL GAS SAMPLE LOCATION
- ▣ CRAWL SPACE AIR SAMPLE LOCATION
- ▲ INDOOR AIR SAMPLE LOCATION
- OUTDOOR AIR SAMPLE LOCATION
- PCE TETRACHLOROETHYLENE (ug/m<sup>3</sup>)

**NOTE:**  
**BOLD/RED VALUES EXCEED EPA'S TARGET INDOOR AIR CONCENTRATIONS.**

SOURCE: AERIAL PHOTO PROVIDED BY GOOGLE EARTH PRO. 2008.

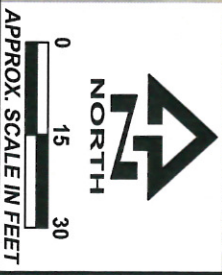


**oasis**  
ENVIRONMENTAL

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 CHKD: B.J.M.  
 DRAWN: C.E.H.  
 PROJ. No.: 14-139  
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## AIR SAMPLE LOCATIONS AND ANALYTICAL RESULTS (MARCH 2009)

4TH AND GAMBELL  
 VAPOR INTRUSION ASSESSMENT  
 Anchorage, Alaska



**Table 4**  
**Air Sample Summary - March 2009**  
**North Duplex**  
**4th and Gambell Vapor Intrusion Assessment**

Compound	Units	EPA TIAC	Crawl Space	Outdoor Air	Soil Gas
			CS-1	AA-2	SG-3
<i>Field Parameters</i>					
Soil Moisture	---	---	---	---	4.7
Total Volatile Hydrocarbons	ppm	---	---	---	200
Oxygen	%	---	---	---	20.9
Carbon dioxide	%	---	---	---	0.9
Helium	%	---	---	---	0
<i>Volatile Organic Compounds</i>					
Freon 12	µg/m <sup>3</sup>	200	6.6	3.1	ND (6.8)
Chloromethane	µg/m <sup>3</sup>	24	ND (1.2) B	ND (0.98) B	ND (11)
Freon 11	µg/m <sup>3</sup>	700	1.8	1.6	ND (7.8)
Ethanol	µg/m <sup>3</sup>	---	200 E	ND (1.8) B	ND (10)
Acetone	µg/m <sup>3</sup>	350	ND (14) B	ND (14) B	ND (13)
2-propanol	µg/m <sup>3</sup>	---	37	ND (1.6) B	ND (14)
Hexane	µg/m <sup>3</sup>	200	ND (7.8) B	ND 0.59) B	ND (4.9)
2-butanone	µg/m <sup>3</sup>	1,000	ND (1.8) B	ND (4.6) B	ND (6.2) B
Tetrahydrofuran	µg/m <sup>3</sup>	---	ND (1.9)	ND (1.9)	7.6
Cyclohexane	µg/m <sup>3</sup>	---	8.4	ND (0.44)	ND (4.8)
Benzene	µg/m <sup>3</sup>	3.1	ND (3.6) B	ND (2.0) B	ND (4.4)
Heptane	µg/m <sup>3</sup>	---	ND (7.9) B	ND (0.54) B	ND (5.6)
Toluene	µg/m <sup>3</sup>	400	ND (8.3) B	ND (4.6) B	ND (8.6) B
PCE	µg/m <sup>3</sup>	8.1 µg	<b>170</b>	0.95	17
Ethylbenzene	µg/m <sup>3</sup>	22	ND (1.1) B	ND (0.59) B	ND (6.0)
Xylenes	µg/m <sup>3</sup>	7,000	ND (4.8) B	ND 2.8) B	ND (6.0)
Styrene	µg/m <sup>3</sup>	1,000	0.64	0.56	ND (5.9)

Notes: Value in parentheses is laboratory reporting limit.

Bolded crawl space air value exceeds TIAC.

Key:

% = Percent

E = Exceeds instrument calibration range

B = Analyte contamination was reported in the trip blank at similar concentrations.

EPA = Environmental Protection Agency

µg/m<sup>3</sup> = Micrograms per cubic meter

ND = Not detected

PCE = Tetrachloroethene

ppm = Parts per million

TIAC = Target indoor air concentration

**Table 5**  
**Air Sample Summary - March 2009**  
**South Duplex**  
**4th and Gambell Vapor Intrusion Assessment**

Compound	Units	EPA TIAC	Crawl Space	Outdoor Air	Soil Gas
			CS-2	AA-2	SG-4
<i>Field Parameters</i>					
Soil Moisture	---	---	---	---	3.8
Total Volatile Hydrocarbons	ppm	---	---	---	150
Oxygen	%	---	---	---	20.9
Carbon dioxide	%	---	---	---	0.6
Helium	%	---	---	---	0.015
<i>Volatile Organic Compounds</i>					
Freon 12	µg/m <sup>3</sup>	200	2.7	3.1	ND (6.1)
Chloromethane	µg/m <sup>3</sup>	24	2.4	ND (0.98) B	ND (10)
1,3-butadiene	µg/m <sup>3</sup>	0.087	<b>1.3</b>	ND (0.28)	ND (2.7)
Freon 11	µg/m <sup>3</sup>	700	1.8	1.6	ND (3.2)
Ethanol	µg/m <sup>3</sup>	---	1,000 E	ND (1.8) B	ND (17) B
Acetone	µg/m <sup>3</sup>	350	120	ND (14) B	ND (38) B
2-propanol	µg/m <sup>3</sup>	---	250	ND (1.6) B	ND (12)
Hexane	µg/m <sup>3</sup>	200	ND (1.0)	ND 0.59) B	ND (4.3)
2-butanone	µg/m <sup>3</sup>	1,000	ND (3.8) B	ND (4.6) B	ND (14) B
Tetrahydrofuran	µg/m <sup>3</sup>	---	ND (4.2)	ND (1.9)	31
Cyclohexane	µg/m <sup>3</sup>	---	ND (0.98)	ND (0.44)	ND (4.2)
Benzene	µg/m <sup>3</sup>	3.1	ND (3.8) B	ND (2.0) B	ND (3.9)
Heptane	µg/m <sup>3</sup>	---	ND (1.2)	ND (0.54) B	ND (5.0)
Toluene	µg/m <sup>3</sup>	400	ND (8.0) B	ND (4.6) B	ND (7.6) B
PCE	µg/m <sup>3</sup>	8.1	<b>14</b>	0.95	89
Ethylbenzene	µg/m <sup>3</sup>	22	ND (1.2)	ND (0.59) B	ND (5.3) B
Xylenes	µg/m <sup>3</sup>	7,000	ND (3.4) B	ND 2.8) B	ND (8.7) B
Styrene	µg/m <sup>3</sup>	1,000	ND (1.2)	0.56	ND (5.2)

Notes: Value in parentheses is laboratory reporting limit.

Bolded crawl space air value exceeds TIAC.

Key:

% = Percent

E = Exceeds instrument calibration range

B = Analyte contamination was reported in the trip blank at similar concentrations.

EPA = Environmental Protection Agency

µg/m<sup>3</sup> = Micrograms per cubic meter

ND = Not detected

PCE = Tetrachloroethene

ppm = Parts per million

TIAC = Target indoor air concentration

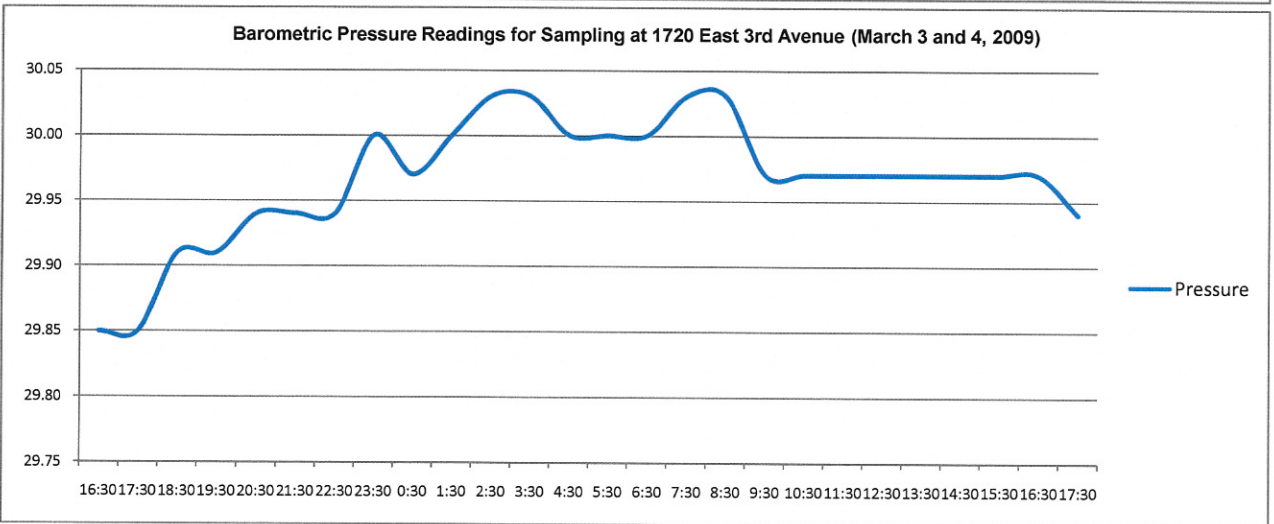
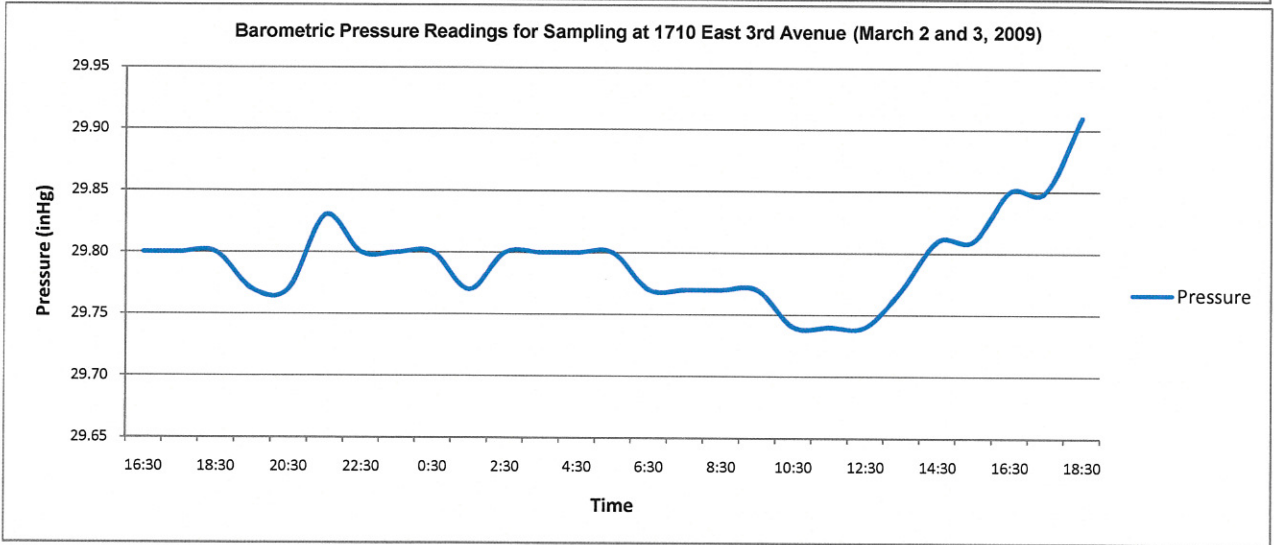
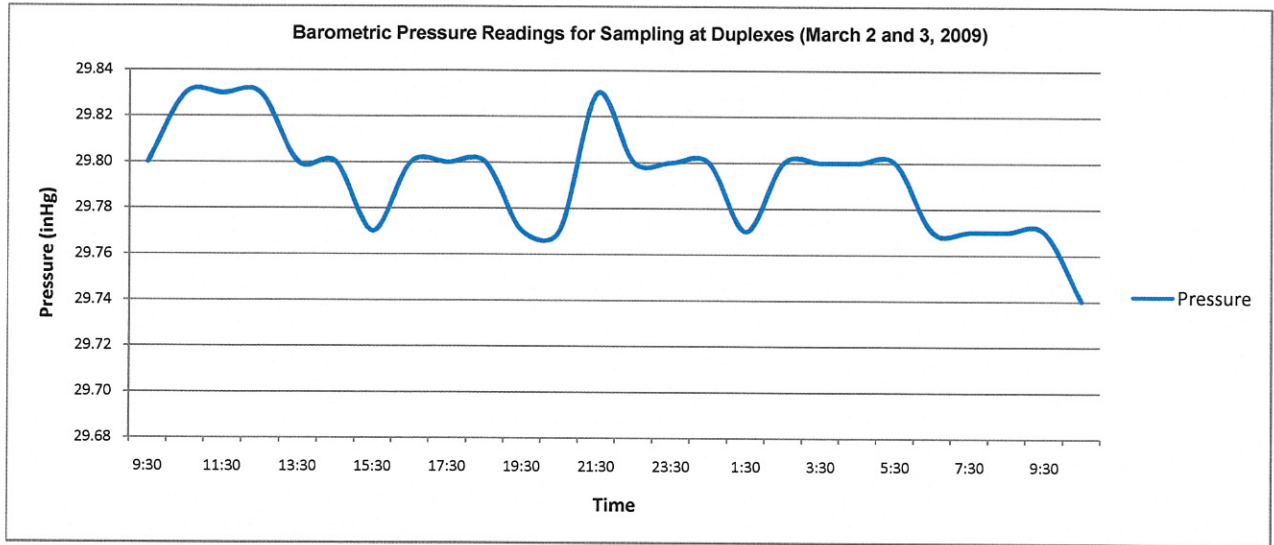
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**ATTACHMENT 2**

**FIGURES**

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**Figure B. Barometric Pressure Readings During Air Sampling  
4th and Gambell Vapor Intrusion Assessment**





**ATTACHMENT 3**

**Laboratory Analytical Reports**