In-Depth Discussion of a Case Study of Long-Term Vapor Intrusion Site Management

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RTI INTERNATIONAL Jacobs AEHS Foundation GSI ENVIRONMENTAL PRAXIS ENVIRONMENTAL TECH. INC

Objectives

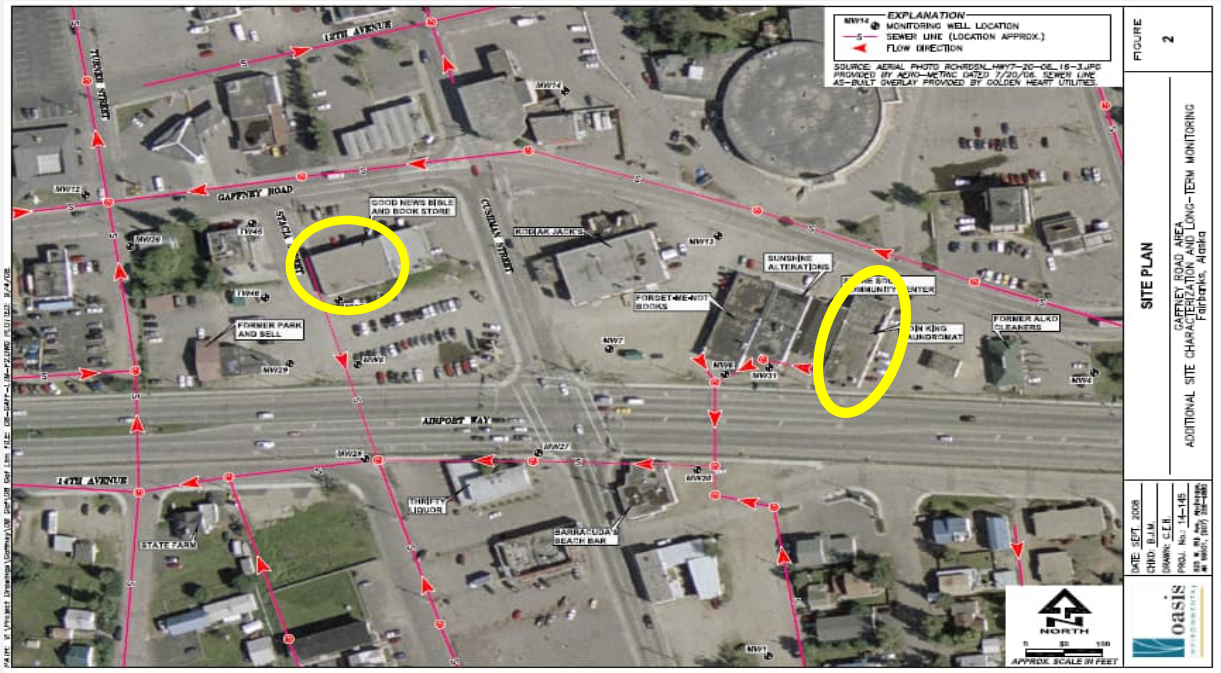
- Learn from a site with multiple sources and a 32-year history.
- Understand how groundwater, passive soil gas, active soil gas, and indoor air sampling have been used sequentially and spatially.
- Compare results of 2020–2025 research projects with unusually intensive sampling to more normal site characterization efforts.
- Discuss observed temporal and spatial variability in soil gas measurements to provide insight to potential future site management strategies.

The views expressed in this presentation are those of the author(s) and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

Gaffney PCE Investigation Context

- Investigation primarily conducted by ADEC which doesn't directly regulate indoor air. But some work funded by EPA.
- ADEC has a response account partially funded by oil production tax. Production has declined after 1990; financial resources are not infinite.
- Property owner for the west source building did contribute to remediation/mitigation funding.
- Approximate cost $4M
- ADEC VI guidance updated in 2009, 2012, and 2017. 2012 increased screening levels substantially which effected project risk evaluation.
- Some investigations performed by DOT as part of roadwork.

Gaffney PCE History: 1993-97



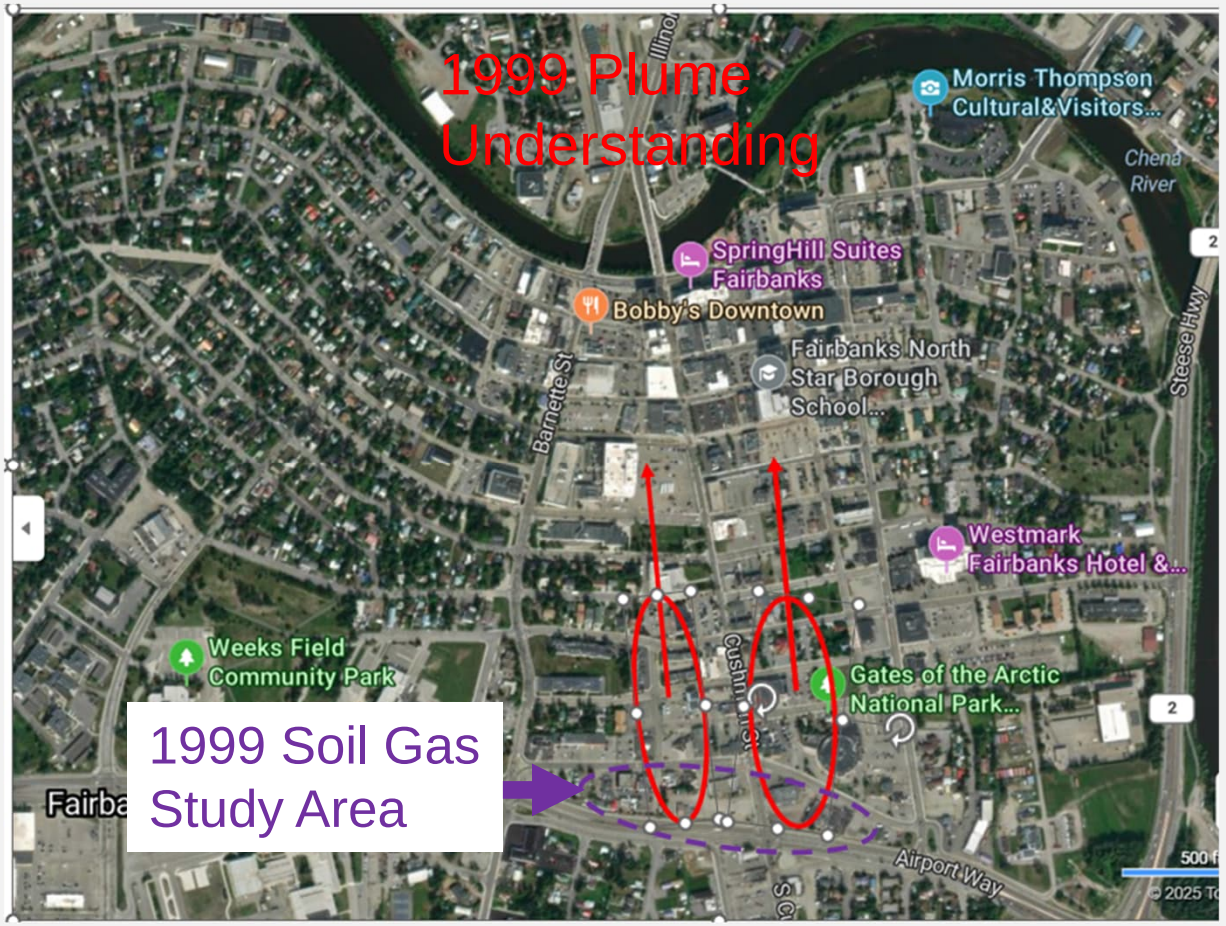
First indication: groundwater detection during a gas station investigation in 1993.

Former Dry Cleaners identified as sources

- Eastern Sources
  - Coin King ~1959-2015
  - ADKO Cleaners ~ 1952-2002
- Western Sources
  - Royal Masters Laundrette ~ 1963-1980's
  - Sewer line transport

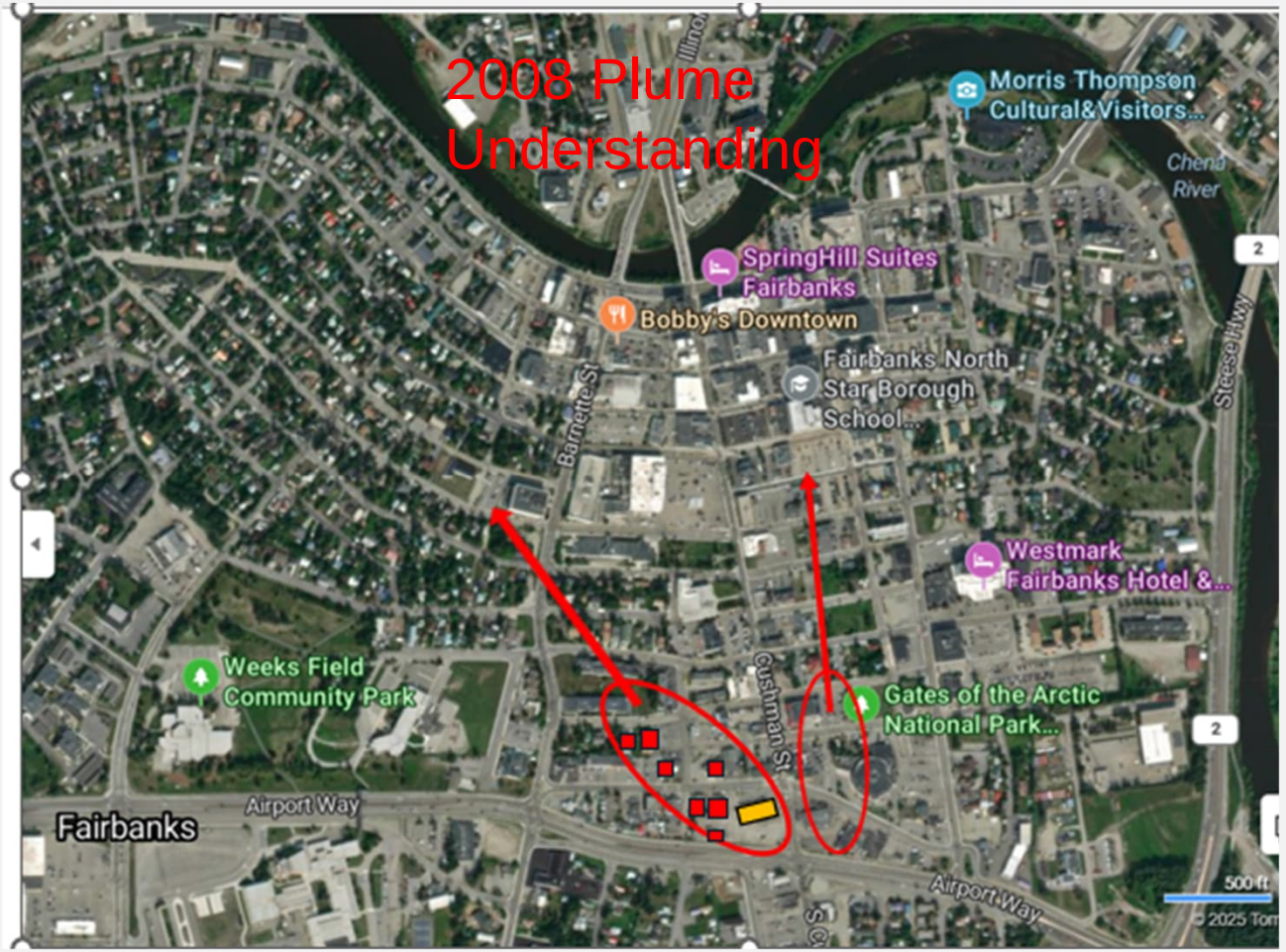
Gaffney PCE History: 1997-99

- 1997: Fifty passive soil gas, 15 temporary wells and three permanent wells
- 1998: Installed 19 temporary wells converted 12 to permanent wells
- 1999: sediment and water from 11 manholes establishes importance of wood stave sewers; 44 soil gas samples, 22 temporary wells, 8 made permanent



Gaffney PCE History: 2000-07

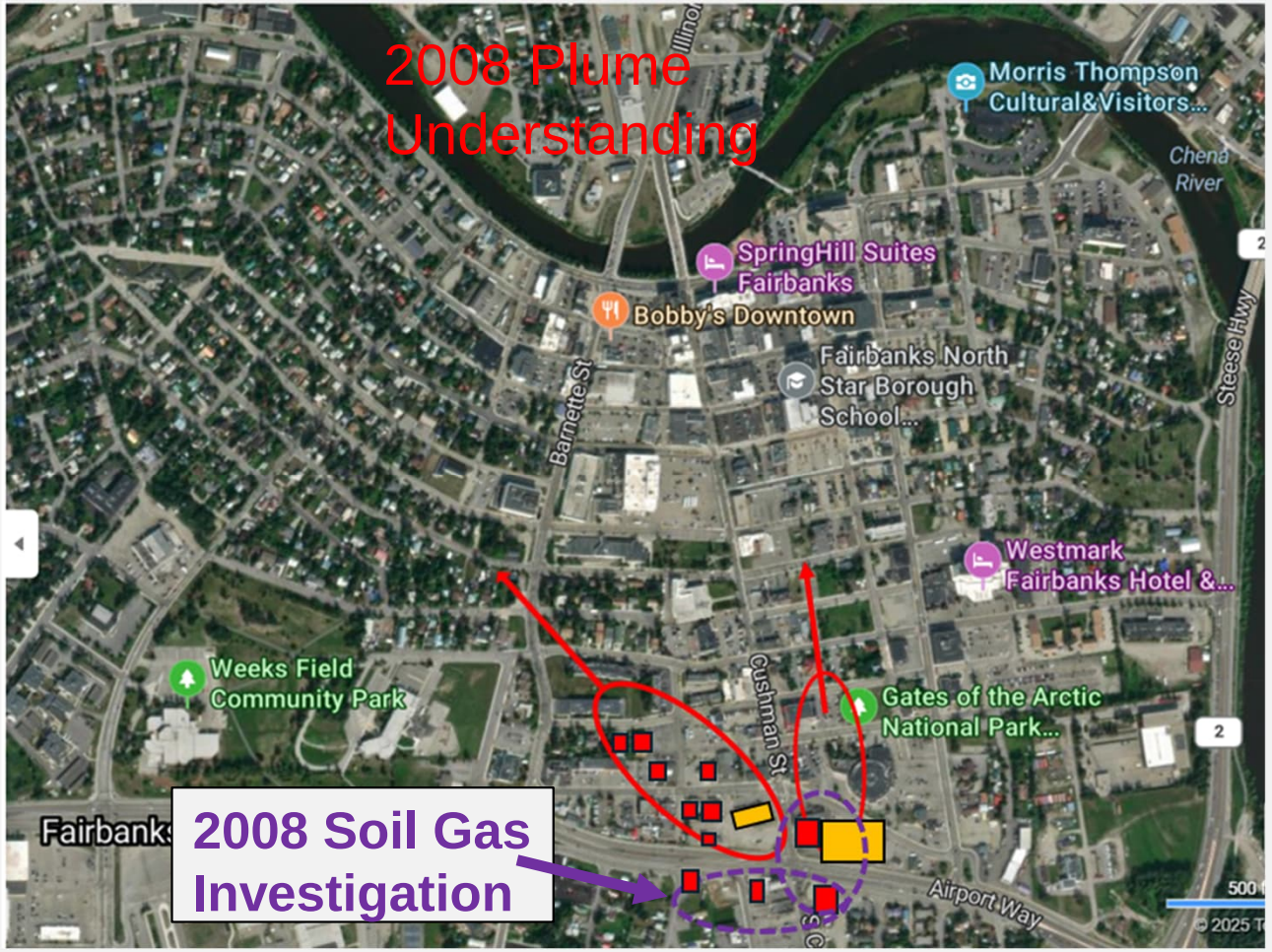
- Routine groundwater monitoring with Trend analysis and MNA assessment
- Initial vapor intrusion investigation: At least 8 buildings indoor air investigated between 2000-2007 (red squares)
- Source area investigation behind East source building (orange) in 2004 caused breach in sewer line.
  - Led to removal of 9 yd^3 of PCE-impacted soil



Gaffney PCE History 2008-09

- Source characterization of west side in 2007
  - 70 test borings for soil and groundwater delineation
- 2008-2009 VI investigations at four additional buildings (red squares) plus VI investigation at fourplex near eastern source (3 of 4) (orange)
- Source characterization of east side in 2008 and 2009
  - 46 test borings for soil and groundwater delineation including 10 in Airport Way

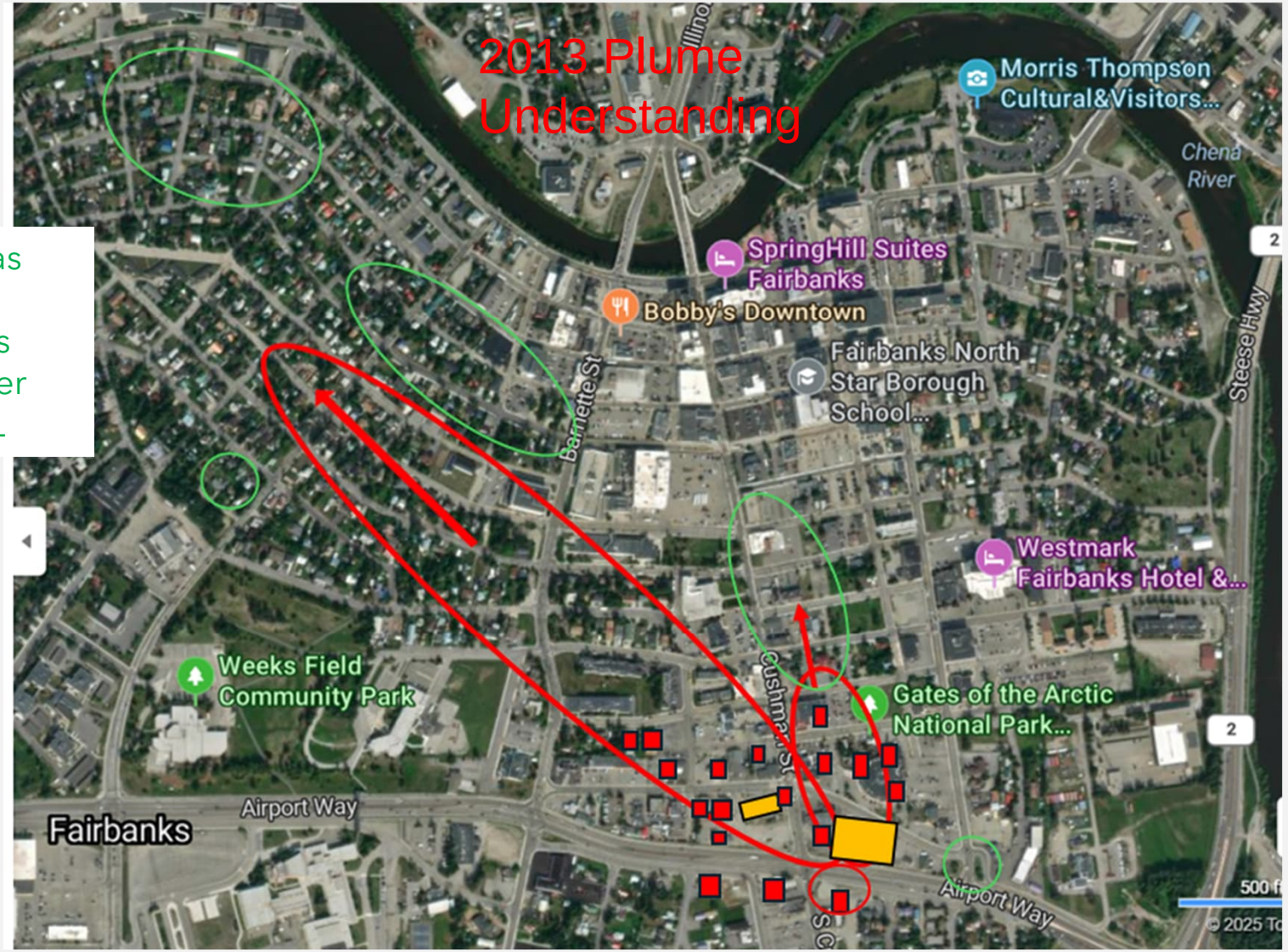
PCE in 5 ft soil gas 1,900 to 17,000 µg/m^3 Along Airport Way; TCE up to 310 µg/m^3



Gaffney PCE History 2010-2015

- Gaffney Road East/West division officially made in 2010
- 2010 Remedial SVE/SSD System installed in West Source area (orange), 2018 Modified to SSD-radon fan
- Seven more indoor air sampling buildings (red squares)

Areas with wells under MCL



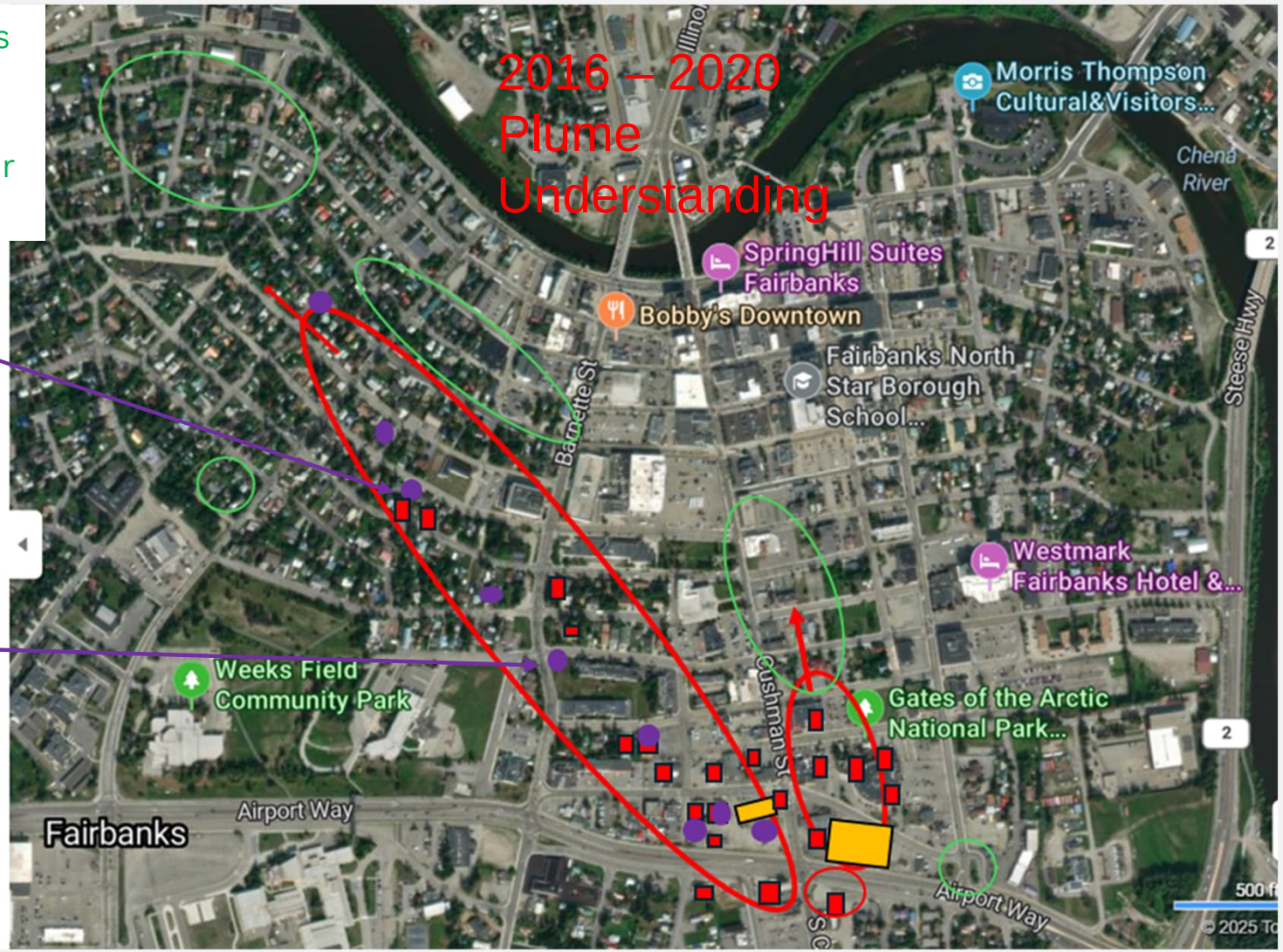
Gaffney PCE History 2015-2020

- Seven new midplume soil gas points installed 2015, Sampled 2015 –17 (purple)
- Groundwater monitoring continuing throughout project history
- Four residences sampled for indoor air in 2017 (red); results low

Areas with wells under MCL

PCE 130 µg/m³ TCE 170 µg/m³

PCE 81 µg/m³ TCE 81 µg/m³



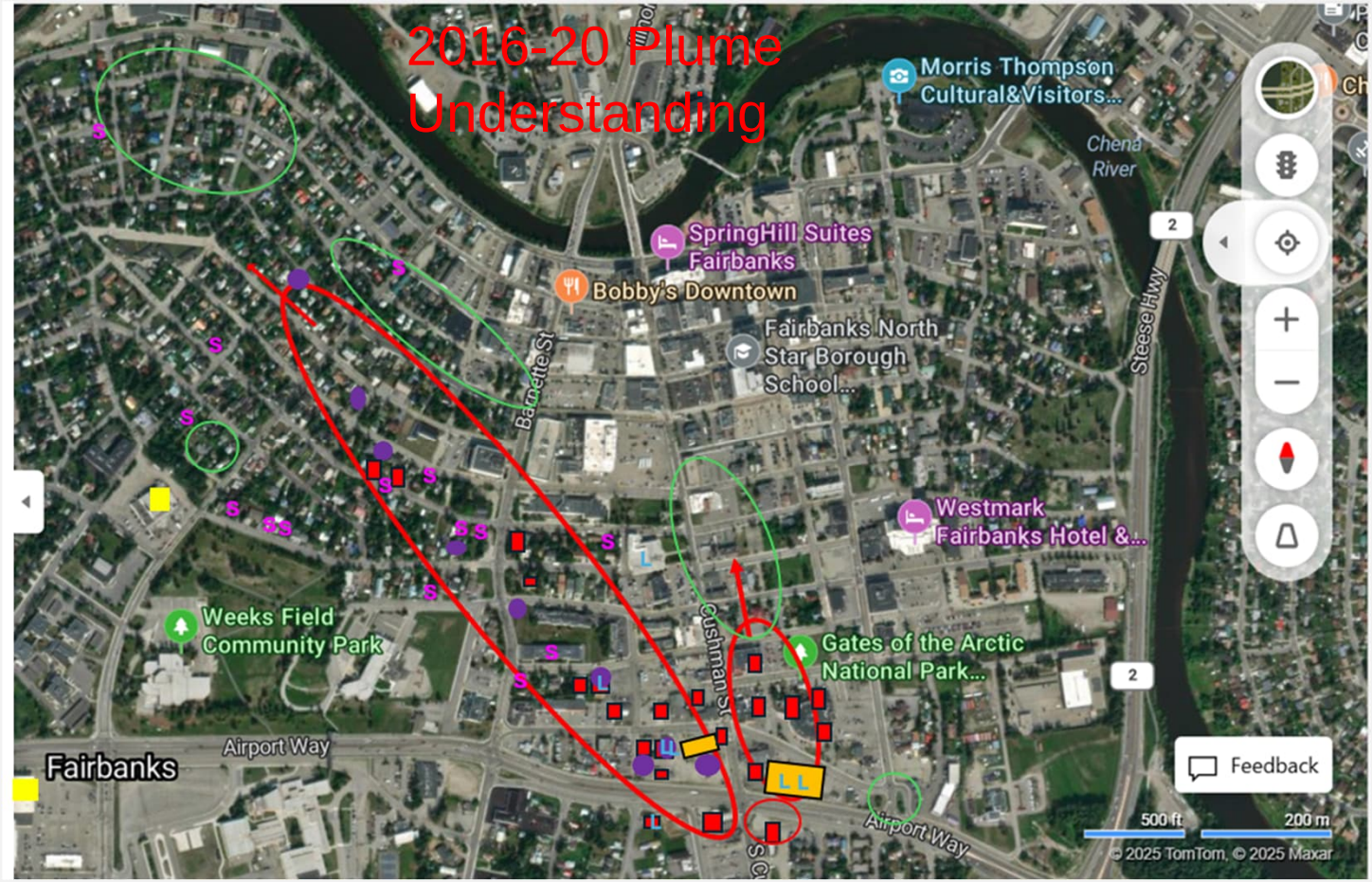
Gaffney PCE History 2020-25

2020 - 2022 EPA Large Building project

- Weekly VOC and continuous (or semi-continuous) radon sampling. Indoor air, outdoor air, soil vapor probes and subslab vapor across 8 structures (7 commercial and one “residential”) “L”
- Two locations with continuous, real-time GC VOC sampling for 6 months

2023-2025 EPA’s Soil Gas Safe project: examining predictions using indicators and tracers (I&T)

- 16 homes passively VOC sampled also supplied with continuous home radon monitors “S”
- VOC Sampling strategy included one standard convenience calendar-based sampling event and up to three I&T-driven sampling events in each of three seasons (7-day Radiello)
- Three one-day convenience passive sampling events and three I&T scheduled passive events

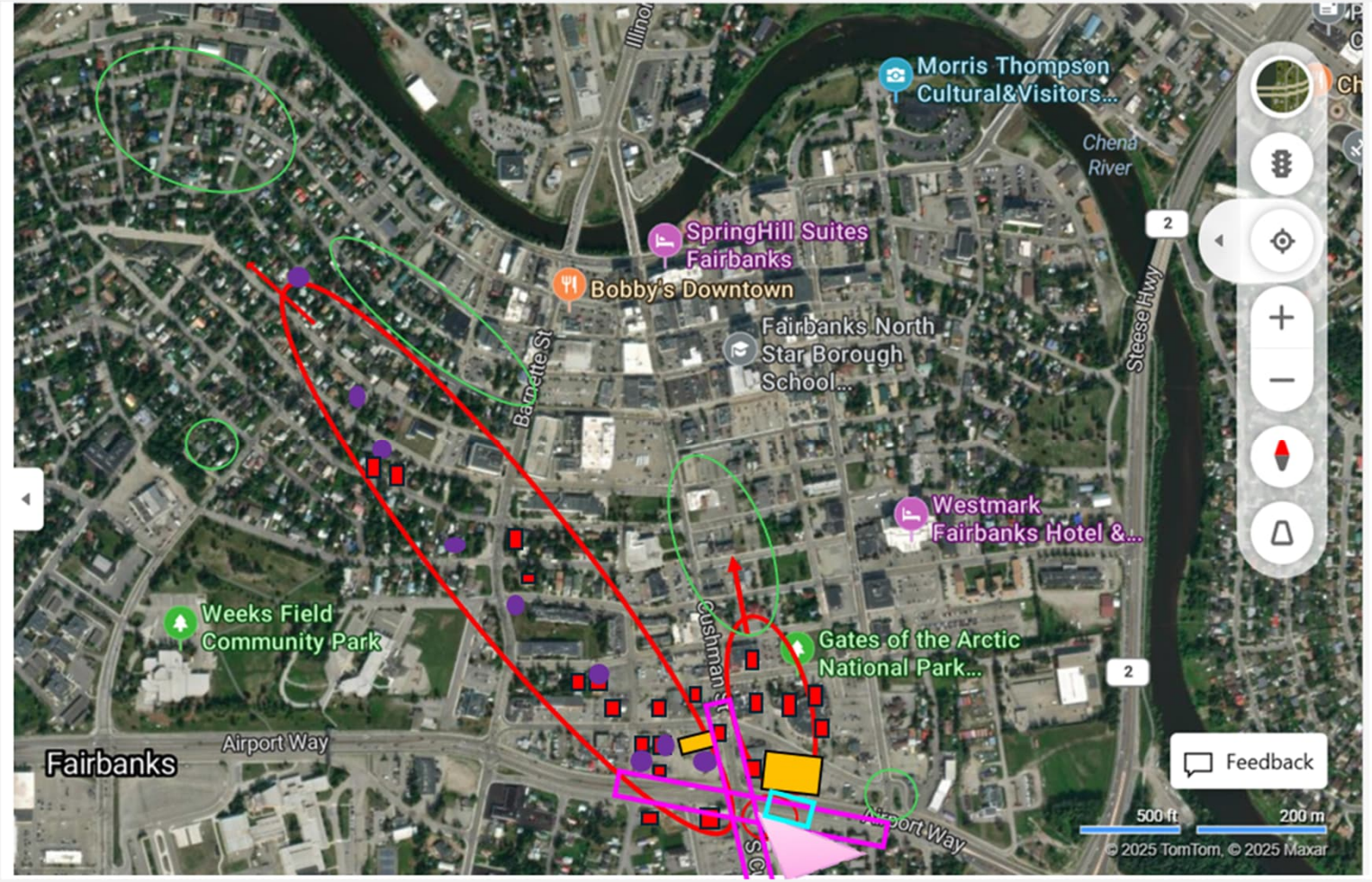


Two other sources of PCE shown

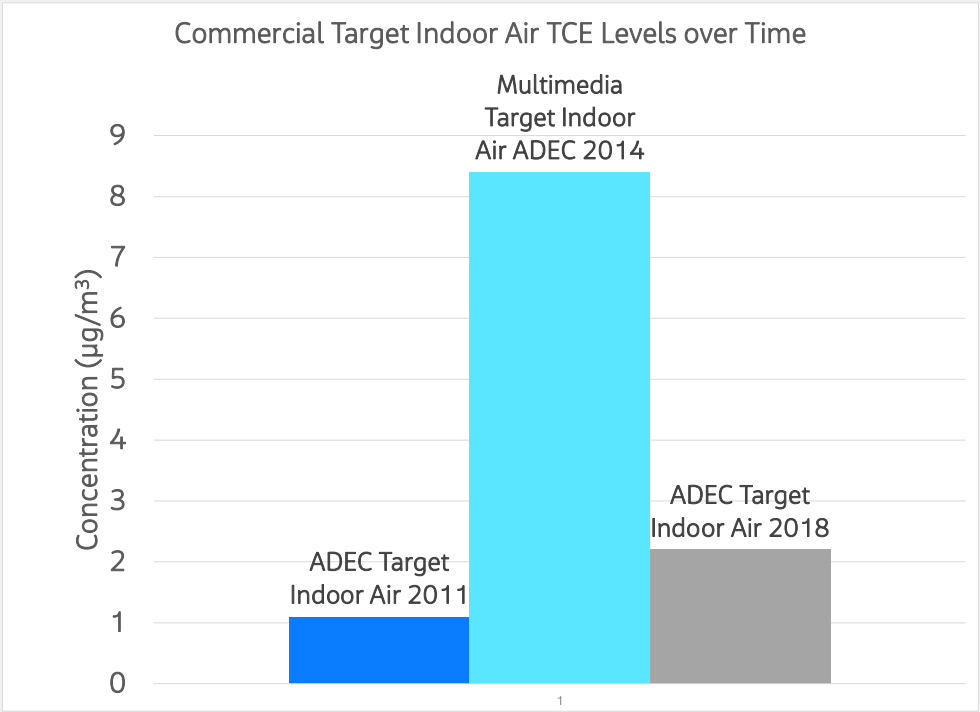
Borings in Road (2009) and DOT Borings 2022-3

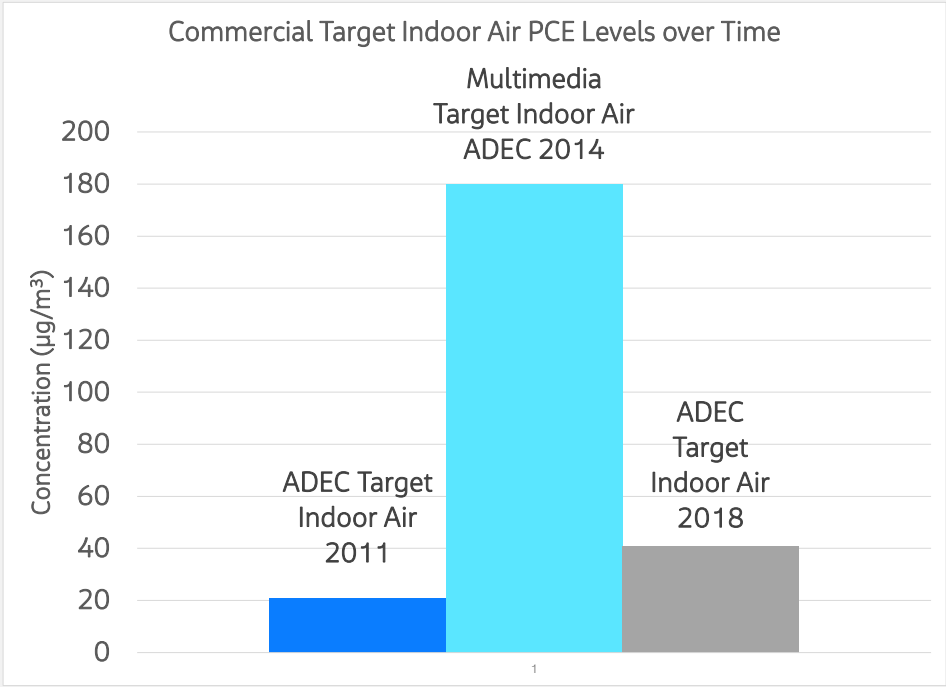
- 2009 Borings in Airport Way show PCE concentrations to 10,000 µg/kg in soil at 5-10 ft vs. cleanup level of 24 µg/kg; widespread concentrations >38.
- 2022-23 DOT installed 42 borings in preparation for intersection work. Peak concentration 7,110 µg/kg vs. cleanup level 190 µg/kg, most PCE concentrations 10 - 900 µg/kg. Excavation planned for Summer 2026.

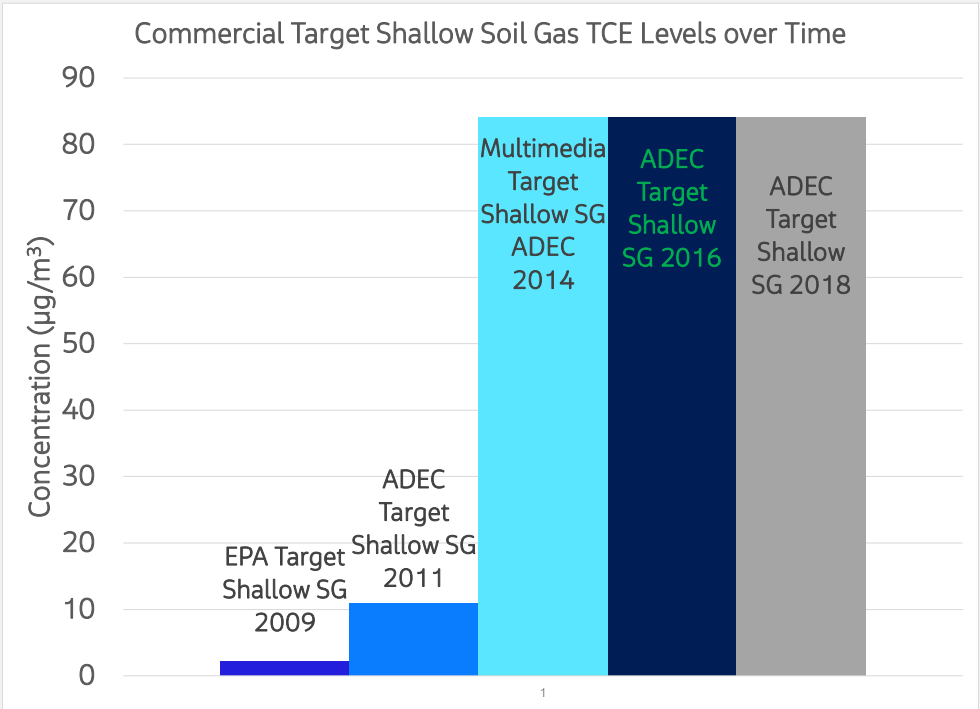
EPA/600/R-14/277 says expect PCE 360 µg/m^3 with bulk soil 0.4 µg/kg so the bulk soil cleanup levels are not likely to be fully protective for vapor intrusion.

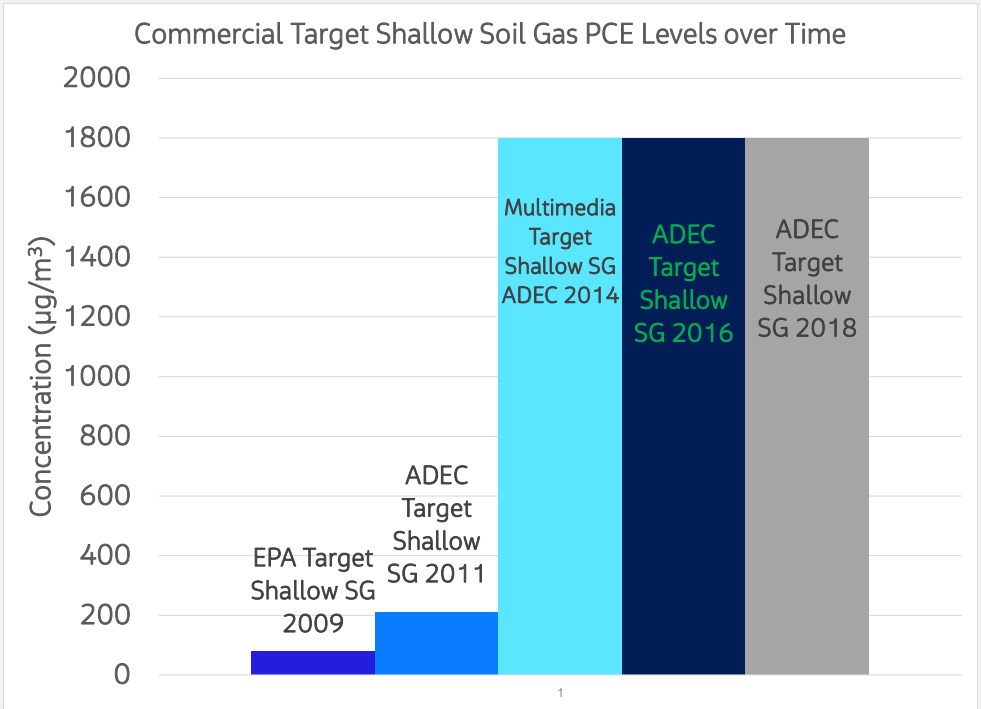


Gaffney Road Comparison Levels History









Large Building VI Objectives

1. To characterize VI in large buildings and study controlling factors (e.g., radon, differential pressure, temperature changes)

2. To compare the controlling factors of a large building with that of a nearby residence (if possible)

3. To study the indicators, tracers, and surrogates, such as radon and pressure differential that may provide us a better understanding of the timing of sampling

4. To study the viability of surrogate depth sampling to find a constant relationship between exterior VOC concentrations at depths above the groundwater table and VOC concentrations in the subslab.

CL1

Café (near source) – revisited after 6 years

Historical Sampling Data

Business	Time Period	No. of Sampling Events	No. of Events per Season		Types and Number of Samples		Max PCE Concentration (µg/m^3)	Median PCE Concentration (µg/m^3)	Max TCE Concentration (µg/m^3)	Median TCE Concentration (µg/m^3)
Café	2009 - 2014	7	Winter:	2	Sub-slab:	14	17,000	970	85	9.45
			Spring:	1	Indoor:	8	41	18.5	0.61	0.53
			Summer:	2	Long-term Passive:	2	11	10.05	0.16	0.135
			Fall:	2	Crawl Space:	0	--	--	--	--
					Exterior Soil Gas:	2	1,600	1,055	64	ND (32)

Summary of Data (2020-2022)

Type	# Samples	Max PCE (µg/m^3)	Mean PCE (µg/m^3)	Max TCE (µg/m^3)	Mean TCE (µg/m^3)
Subslab	190	10,000	1,995	1,300	150
Indoor	127	40.7	6.4	5.1	0.11

Key Point: Reasonable agreement to previous PCE work which included 7 rounds of sampling. TCE increased in more recent sampling.

Slide 14

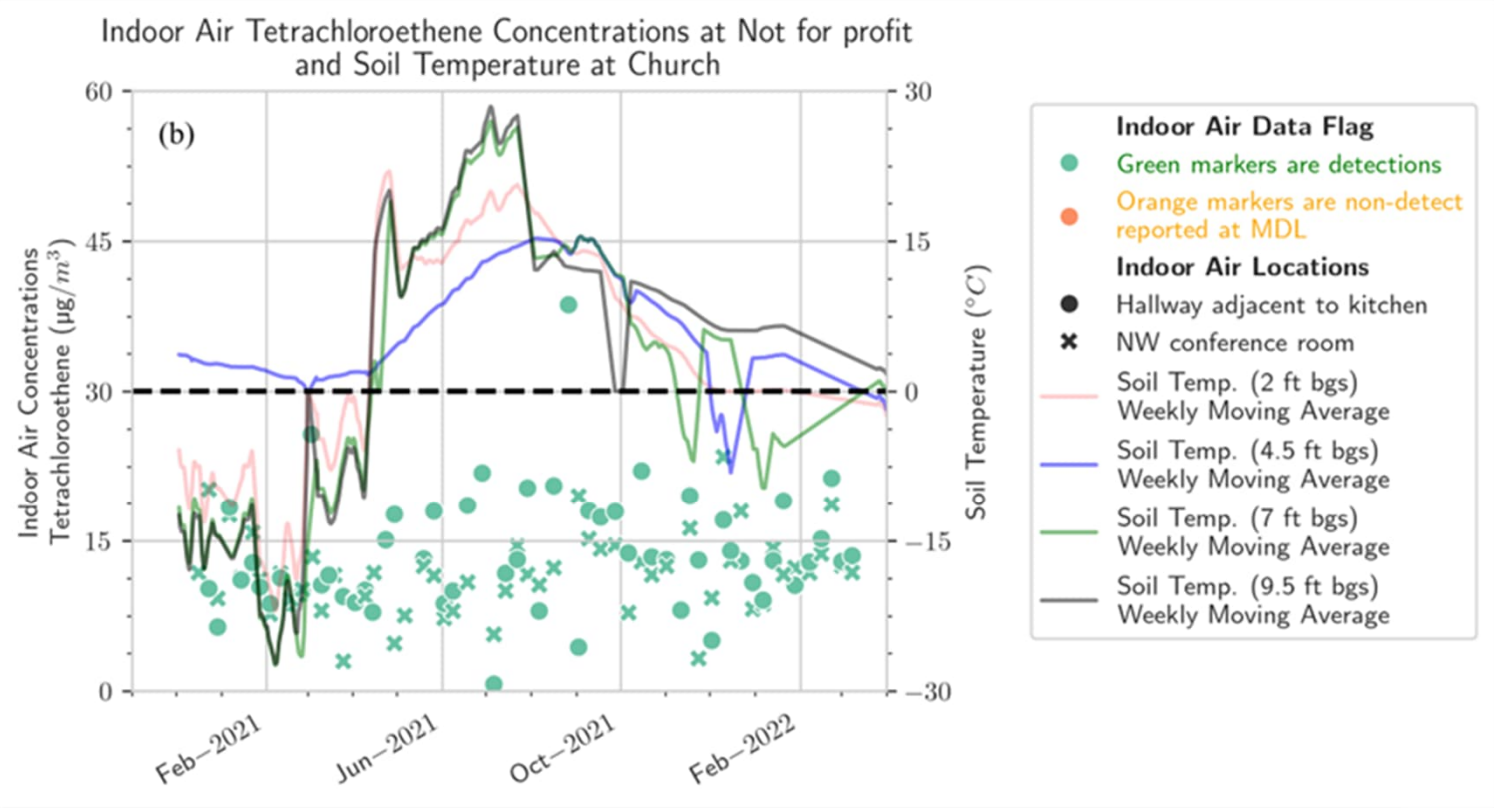
CL1 Discuss with team why not mitigated? Seems like it was a close call on the PCE with a commercial RME in 2009 of 20.8? Or was it that levels had gotten less stringent by 2018?
Lutes, Christopher, 2025-10-02T15:33:25.933

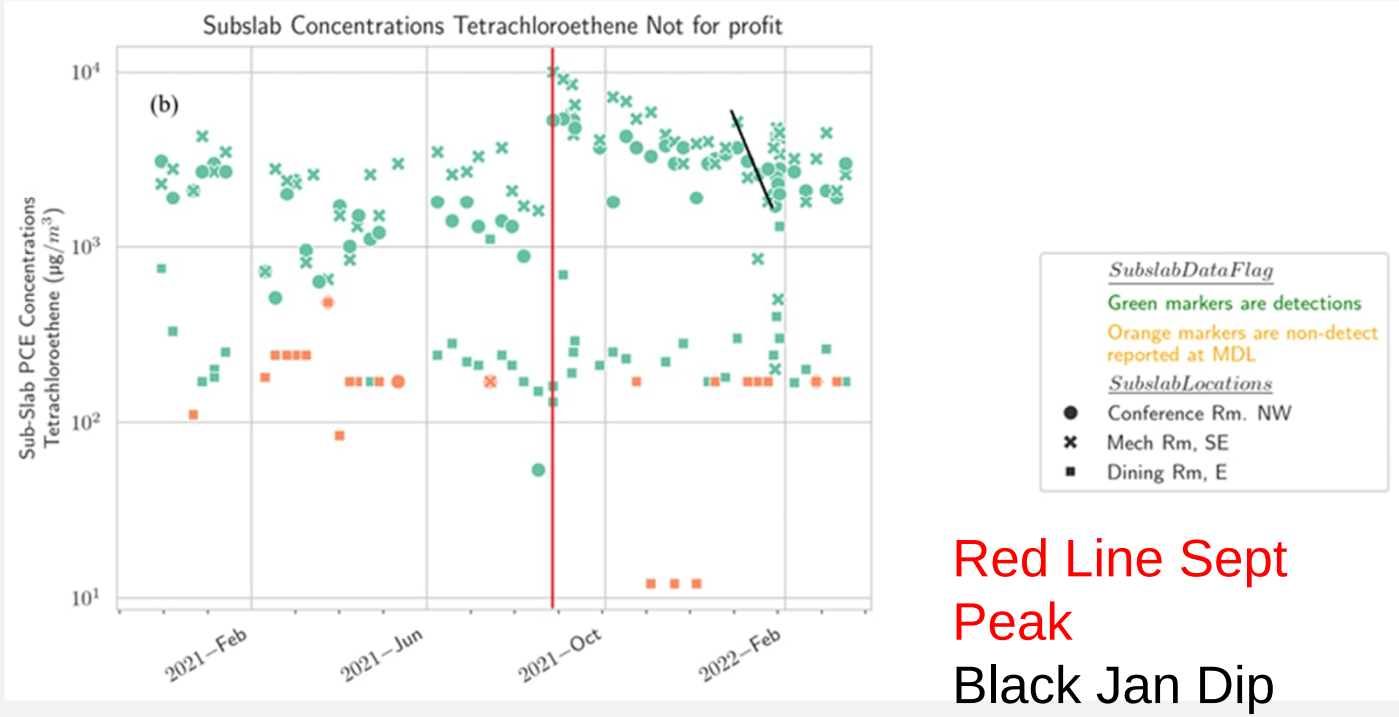
CL1 0 Seems like it may depend heavily on which screening levels are prevailing at which time and whether they are viewed as RME or mean
Lutes, Christopher, 2025-10-02T15:33:57.777

CL1 1 Also does Alaska mitigate based on soil gas vs. indoor air?
Lutes, Christopher, 2025-10-02T15:36:10.188

Indoor vs. Subslab at Cafe

Key Points:
Subslab on log scale, indoor on numerical scale.
Subslab has much more temporal and spatial variability





Red Line Sept Peak

Black Jan Dip

CL1

Gaffney Insurance Office (Residential Style Construction) – Revisit after 9 Years

Historical Sampling

Business	Time Period	No. of Sampling Events	No. of Events per Season		Types and Number of Samples		Max PCE Concentration (µg/m^3)	Median PCE Concentration (µg/m^3)	Max TCE Concentration (µg/m^3)	Median TCE Concentration (µg/m^3)
Insurance Office	2008-2011	9	Winter:	3	Sub-slab:	18	19,000	7,300	860	335
			Spring:	2	Indoor:	11	4.3	1.7	0.19	ND (0.18)
			Summer:	1	Long-term Passive:	0	--	--	--	--
			Fall:	3	Crawl Space:	0	--	--	--	--
					Exterior Soil Gas:	2	5,900	5,150	400	355

Summary of Current Lab Data (2020-2022)

Type	# of samples	Max PCE (µg/m^3)	Mean PCE (µg/m^3)	Max TCE (µg/m^3)	Mean TCE (µg/m^3)
Subslab	172	1,500	587	1,700	112
Indoor	209	11.3	2.3	0.3	0.05

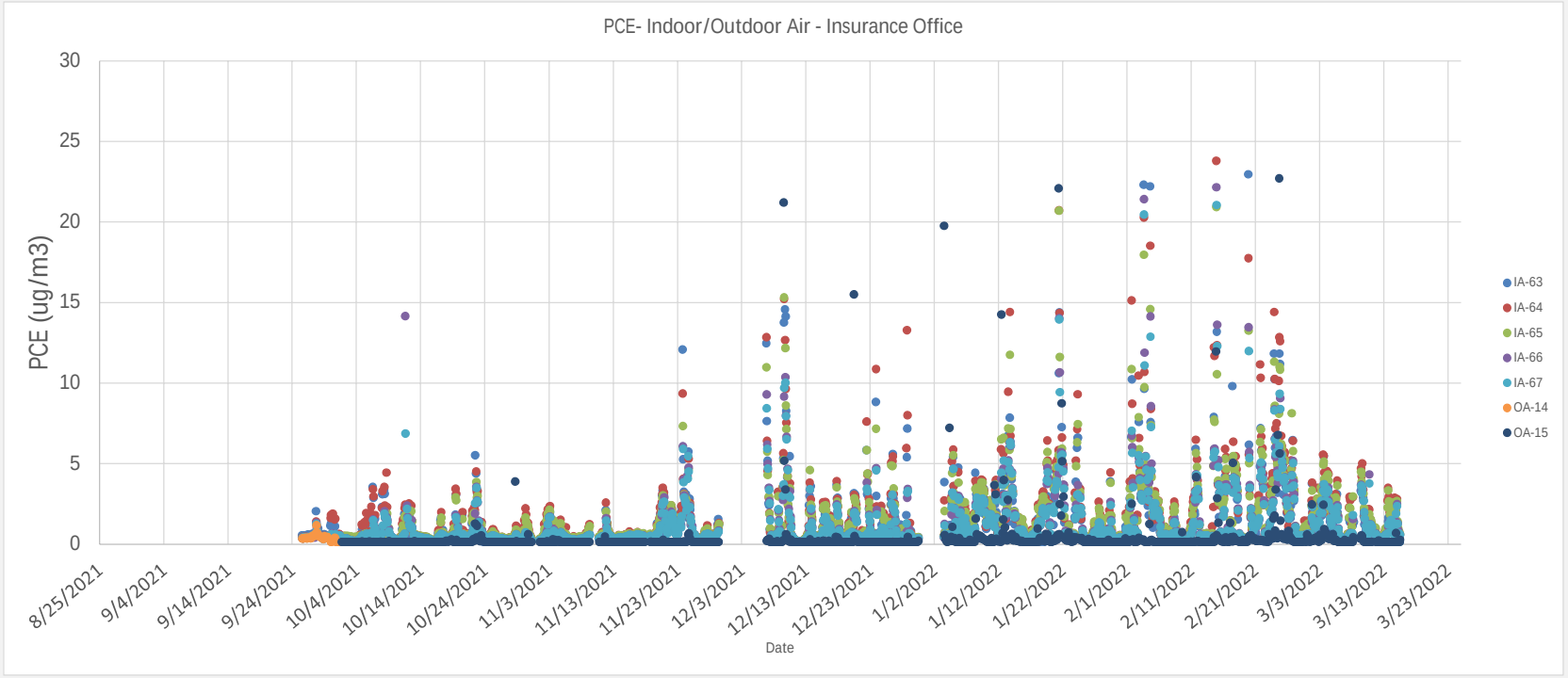
Key Point: subslab PCE is weaker then previous, but indoor higher…. TCE changes modest; previously 9 rounds of sampling… exact sampling locations may differ. In the basement unpublished data from 2010-2011 agrees closely with 2021-2022 data.

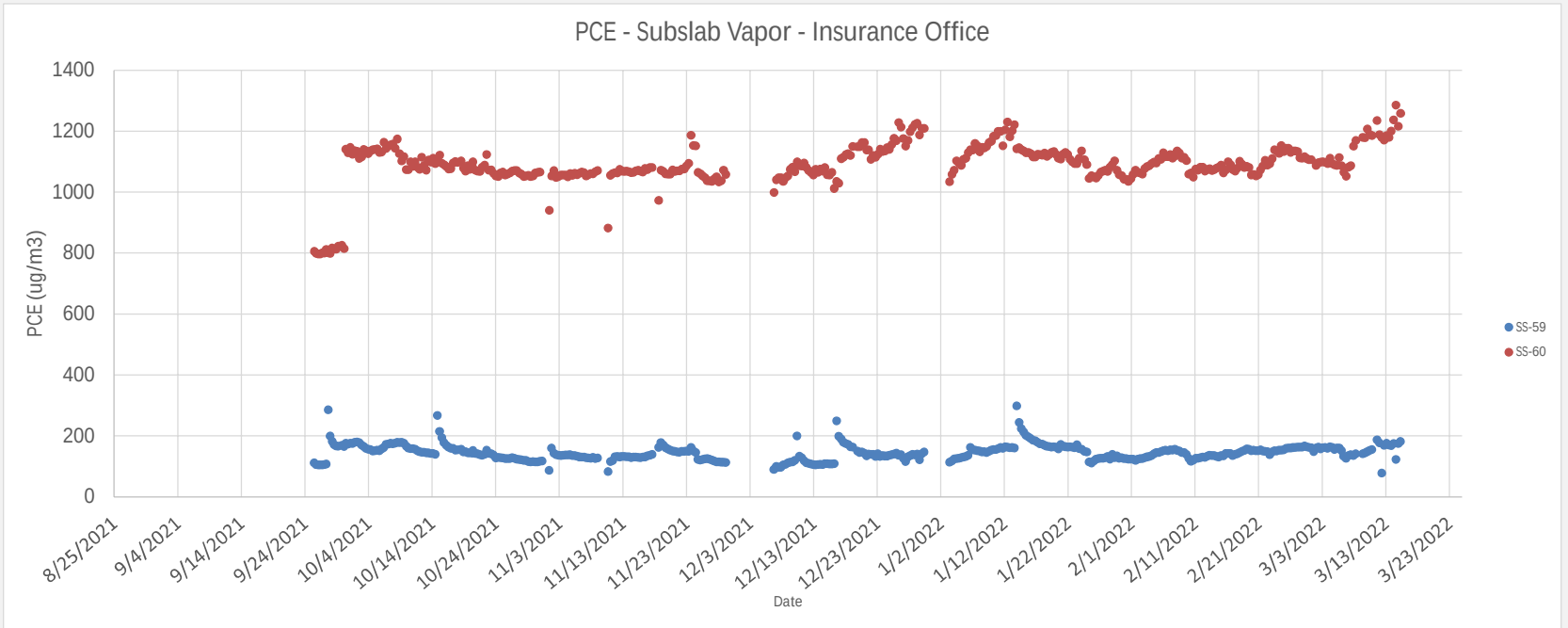
Slide 16

CL1 Looks clearly like decision not to mitigate must have been based on indoor air since subslab in previous data exceeded target levels prevailing at the time

Lutes, Christopher, 2025-10-02T15:46:08.930

GC PCE Indoor and Subslab Insurance Office





Gaffney Church – Revisited after 15 years

Historical Sampling

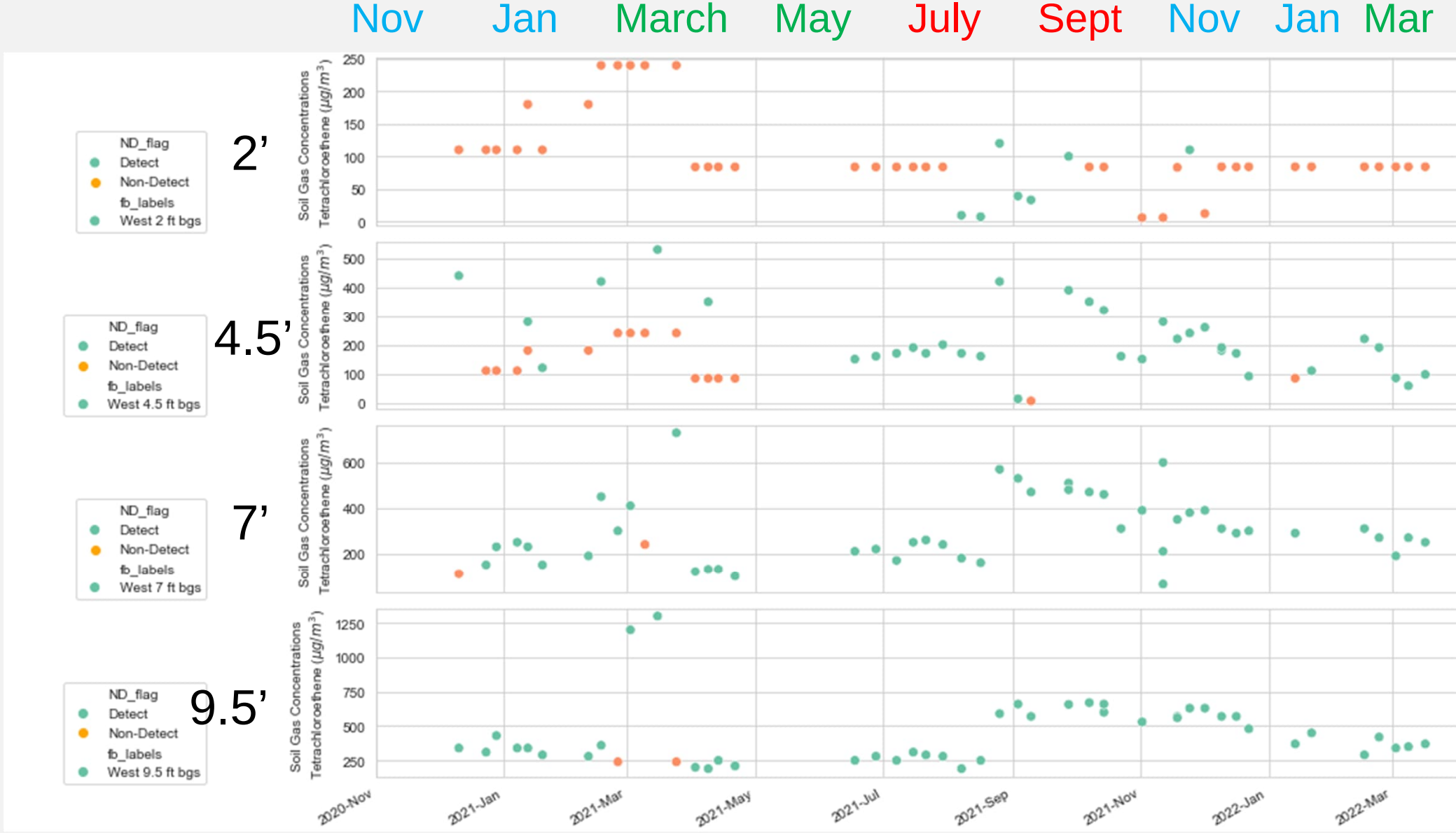
Business	Time Period	No. of Sampling Events	No. of Events per Season		Types and Number of Samples		Max PCE Concentration (µg/m^3)	Median PCE Concentration (µg/m^3)	Max TCE Concentration (µg/m^3)	Median TCE Concentration (µg/m^3)
[redacted]hern Church	2007	1	Winter:	0	Sub-slab:	3	1,700	34	ND (2.6)	ND (2.6)
			Spring:	0	Indoor:	1	0.68	0.68	ND (0.14)	ND (0.14)
			Summer:	1	Long-term Passive:	0	--	--	--	--
			Fall:	0	Crawl Space:	0	--	--	--	--
					Exterior Soil Gas:	0	--	--	--	--

Summary of Current (2020-2022) – Lab data

Type	# of samples	Max PCE (µg/m^3)	Mean PCE (µg/m^3)	Max TCE (µg/m^3)	Mean TCE (µg/m^3)
Subslab	262	4,100	369	1,500	96
Indoor	251	51.7	5.9	1.2	0.29

Key Point: Only one round, one indoor sample previous – new indoor concentrations much higher for both PCE and TCE; Subslab similar; detailed building specific risk assessment concluded radon main concern

PCE Soil Gas TO-17 , Multi-depth, West Side of Church

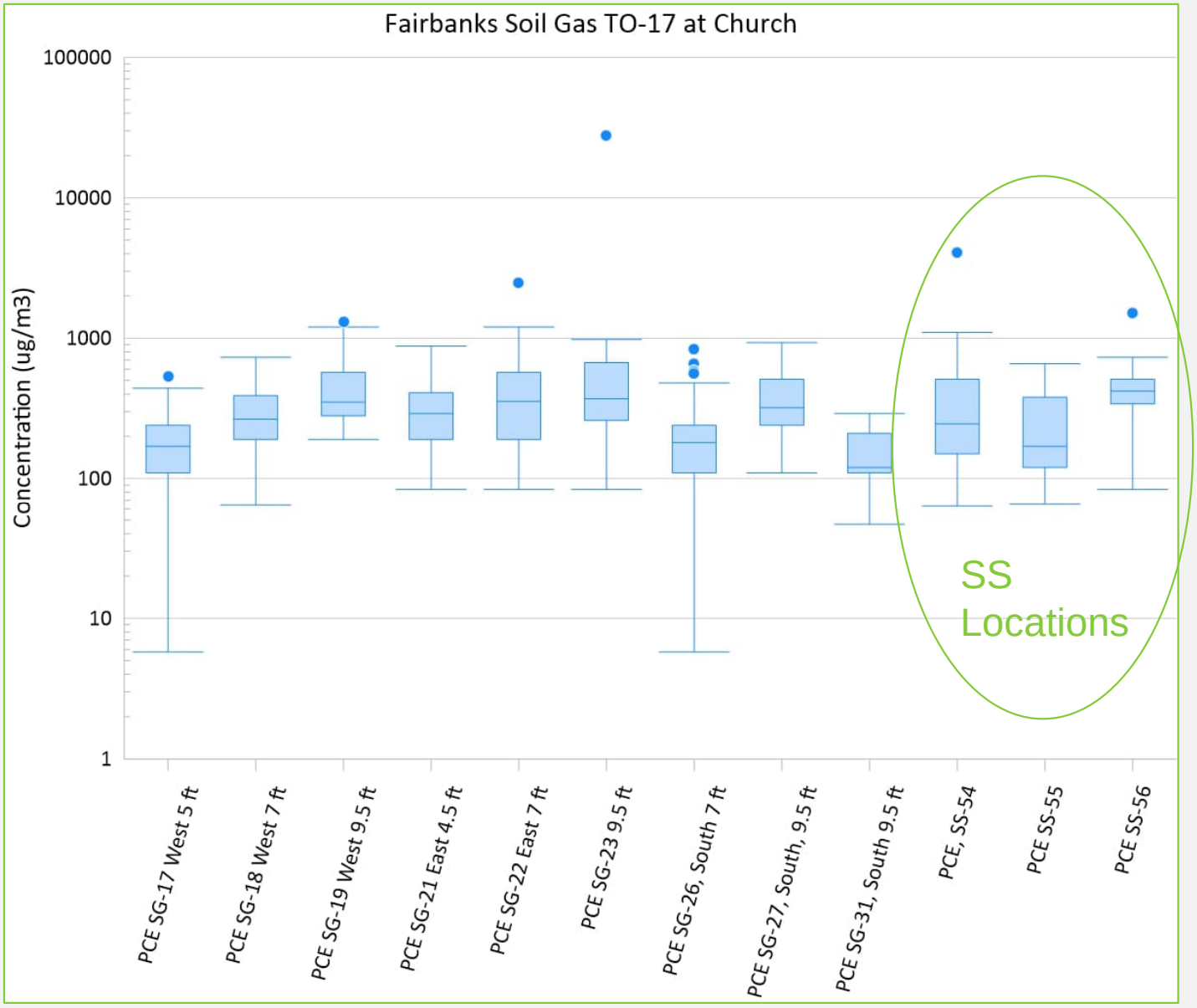


Key points: Detection much less frequent shallow; building has basement; Soil gas concentrations peak late summer in this climate

CL1

PCE TO-17 Church Soil Gas Temporal and Spatial Variability
n=49 to 96
at locations with few nondetects 2020-22

For comparison one point about 100' away VMP-4 (6.5-8.5') sampled six times in 2015 had
PCE 1 to 17 µg/m^3;
TCE 1 to 83 µg/m^3



Key Points: Relatively low temporal and spatial variability when considering only deeper locations. But one 2015 measurement was much lower about 100' away

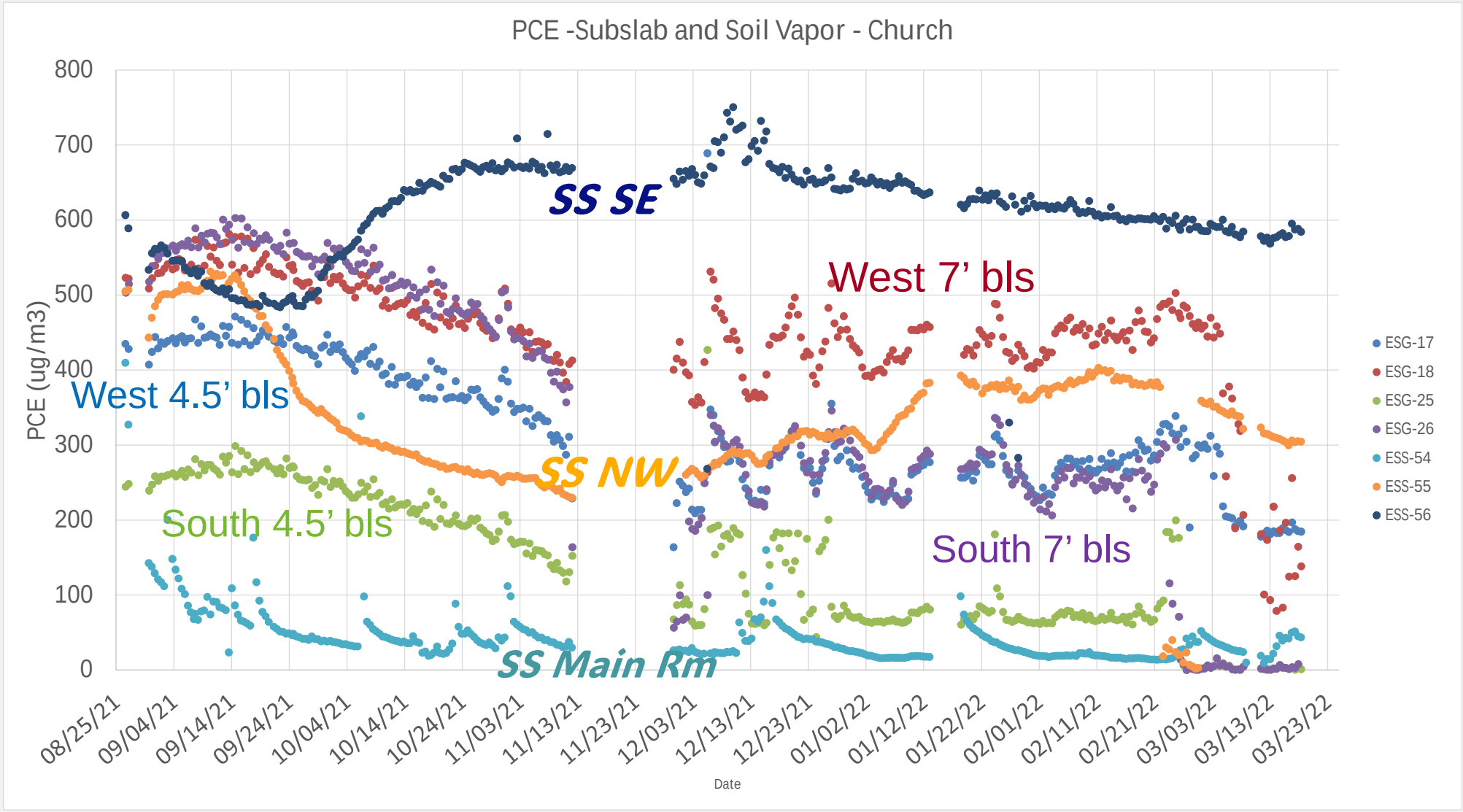
Slide 20

CL1 Check that
Lutes, Christopher, 2025-04-29T17:22:35.531

CL1 0 updated
Lutes, Christopher, 2025-09-20T20:09:53.960

CL1

Church GC, PCE, Subslab and External Soil Gas



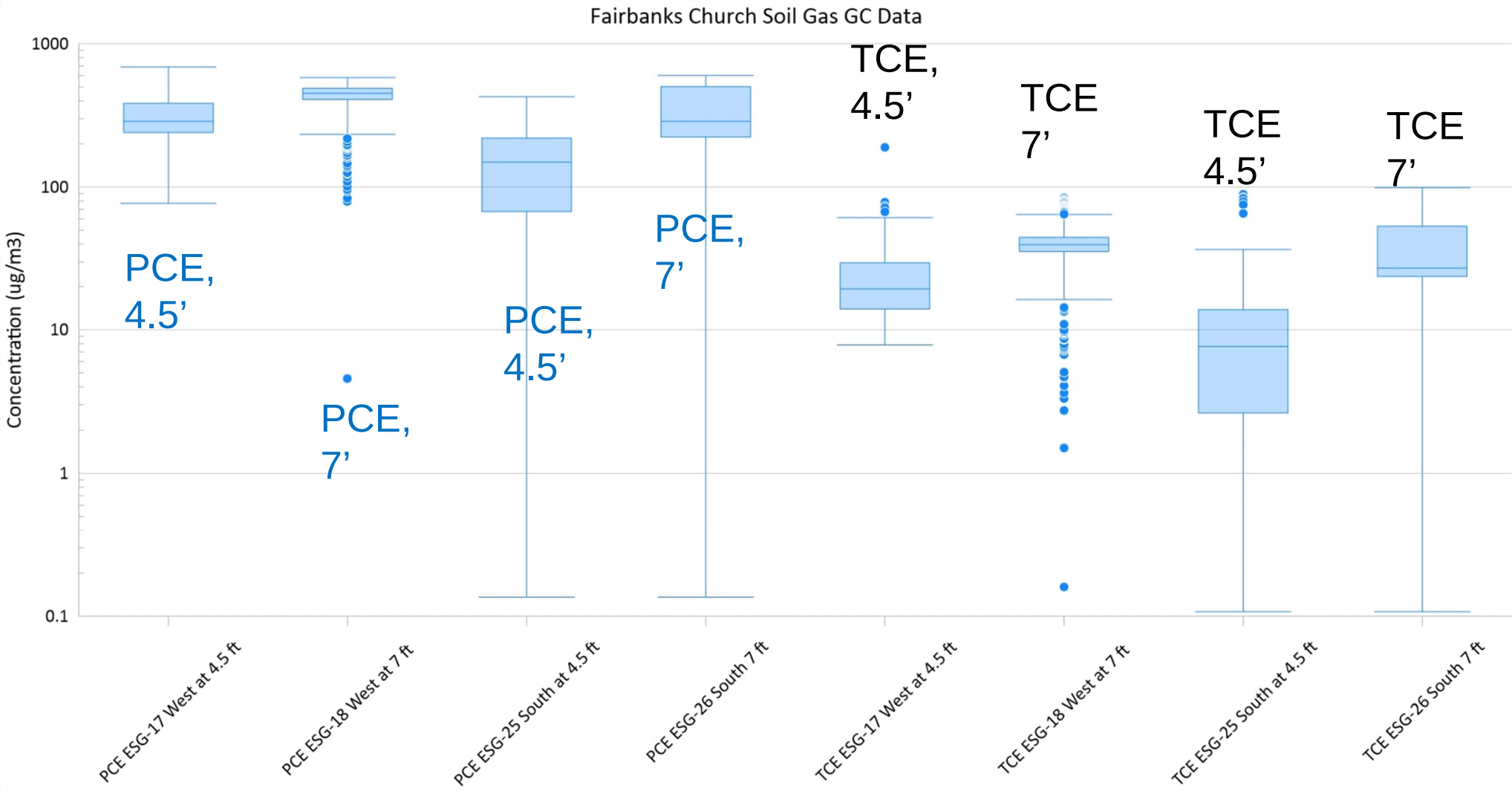
Key Points: Limited temporal variability (3x); External and subslab overlap, most locations decline after Sept high

CL1 Up to date fig from paper

Lutes, Christopher, 2025-09-20T19:57:29.408

CL1

Fairbanks Temporal and Spatial Variability
Box Soil Gas Plot GC Data; n=369 to 373

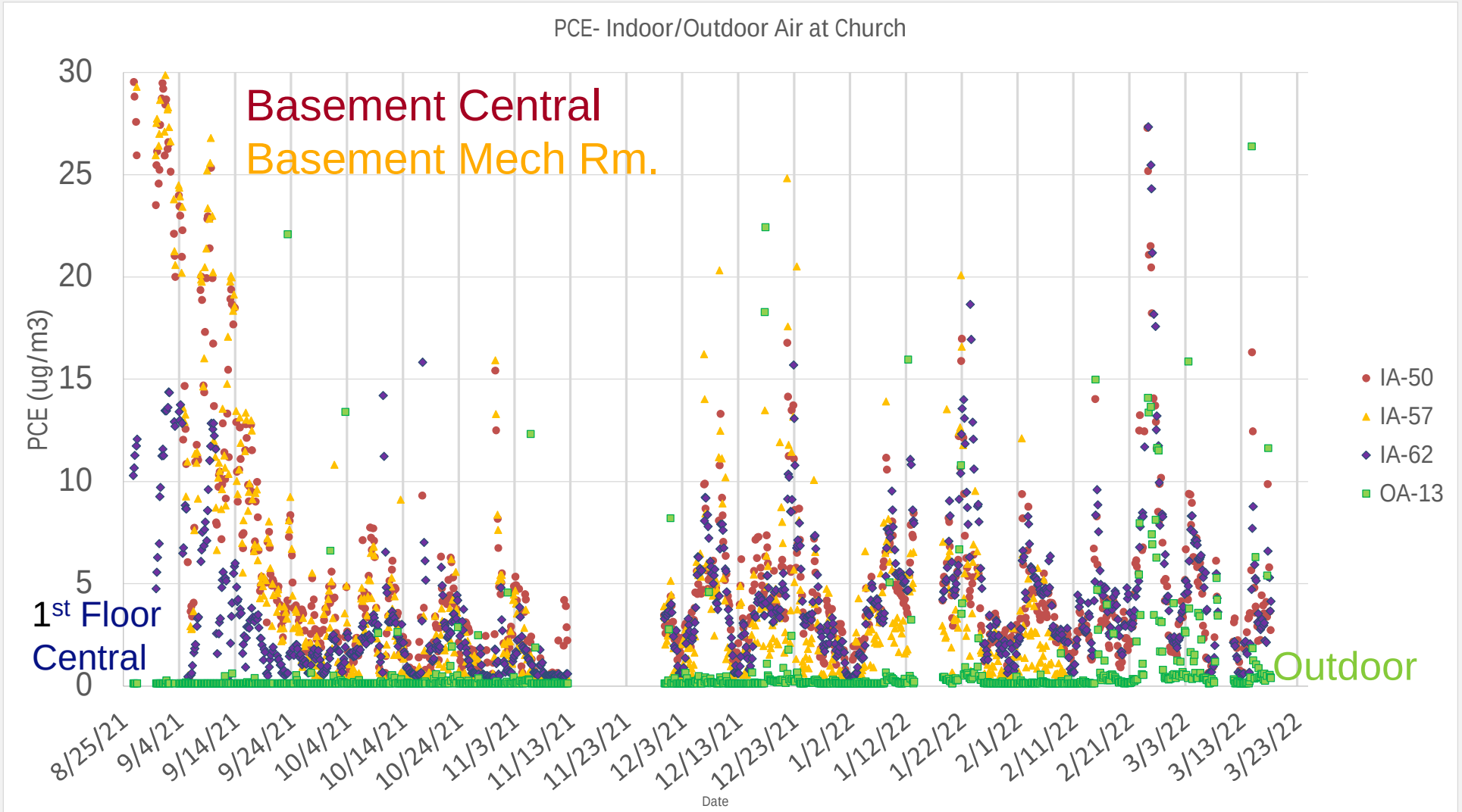


Key Point: Limited Temporal Variability Especially for PCE

CL1 updated

Lutes, Christopher, 2025-09-20T20:09:22.156

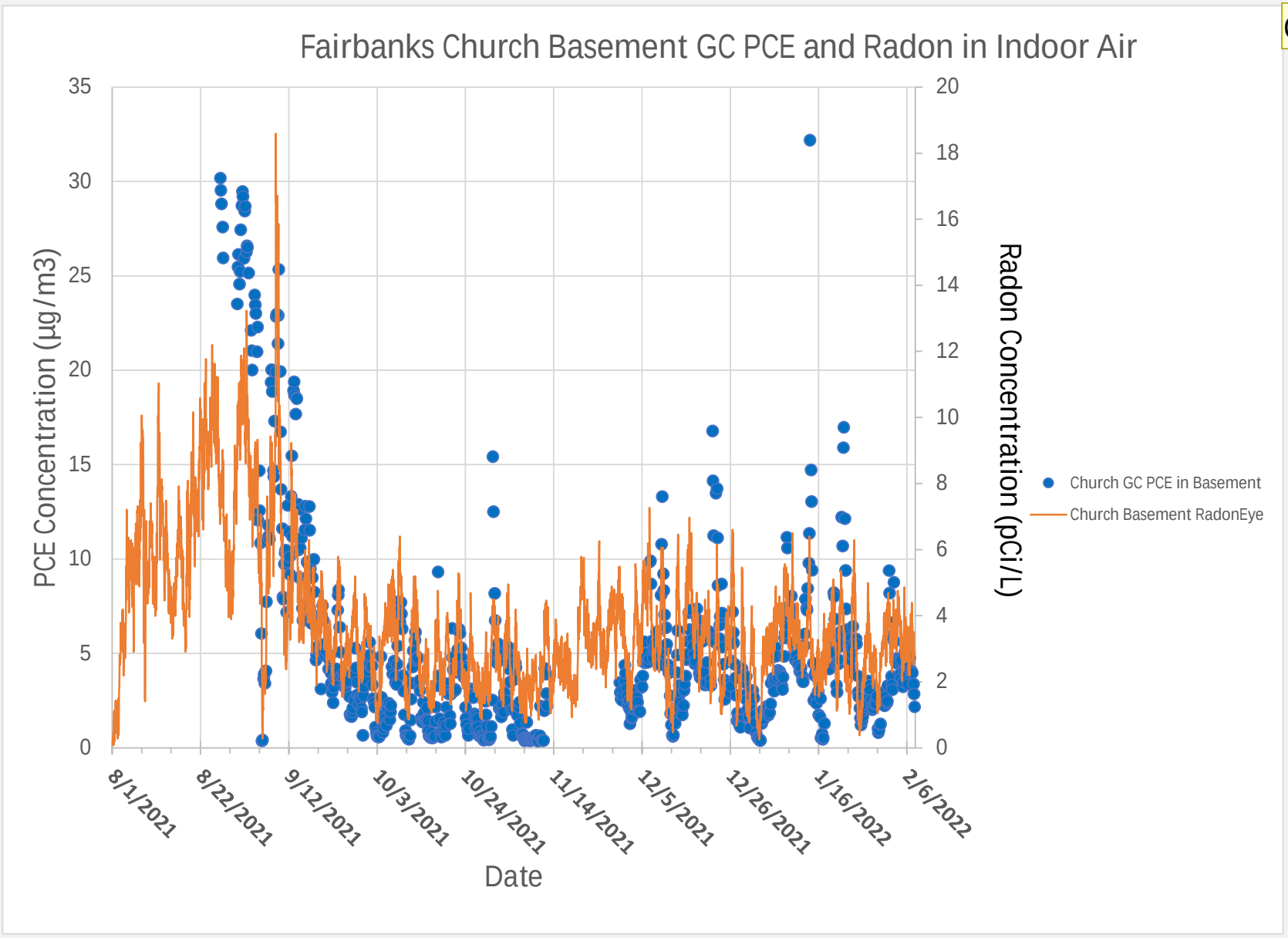
Church GC, PCE, Indoors



Key Points: Dramatic Temporal Variability, Declines from September High, Outdoor usually low but sometimes comparable to indoors

Church Basement PCE and Radon vs. Time

CL1



Key Point: Strong correlation supports use of Rn as a tracer

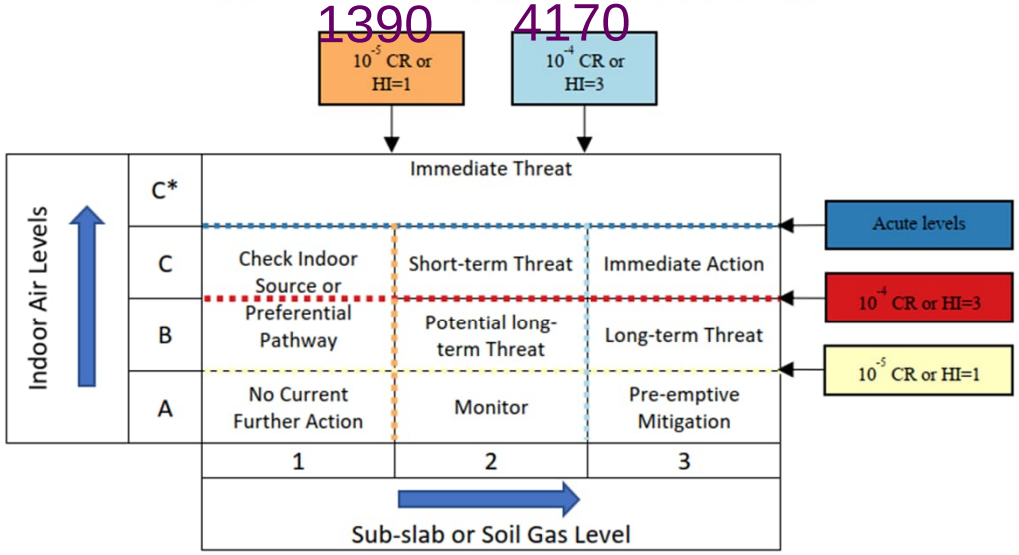
CL1 updated

Lutes, Christopher, 2025-09-20T20:07:12.940

How Would the Church Be Evaluated if You used Region V Matrix – PCE - Residential

CL1

Table 8-1. Risk-Based Decision Matrix for VI Sites



125
41.7

Notes:

CR Carcinogenic risk
HI Hazard Index

Figures from US EPA Region 5, Superfund and Emergency Management Division, Vapor Intrusion Handbook, March 2020

PCE Concentrations from VISL Calculator as of 10/3/24 in µg/m^3

1. Based on averages no current further action either with exterior soil gas or subslab
2. Based on maximums "Potential long-term threat"

CL1 Slide updated

Lutes, Christopher, 2025-09-20T16:10:54.555

Gaffney — Large Building and Soil Gas Safe Papers

John H. Zimmerman, Alan Williams, Brian Schumacher, Chris Lutes, Rohit Warrier, Laurent Levy, Gwen Buckley, Brian Cosky, Chase Holton, and Kate Bronstein "Estimation of the Number of Subslab Soil Gas Samples to Collect to Characterize Vapor Intrusion Under a Large Building." Published in *Indoor Air*, August 19, 2025 https://onlinelibrary.wiley.com/doi/full/10.1155/ina/2860696/ (open access)

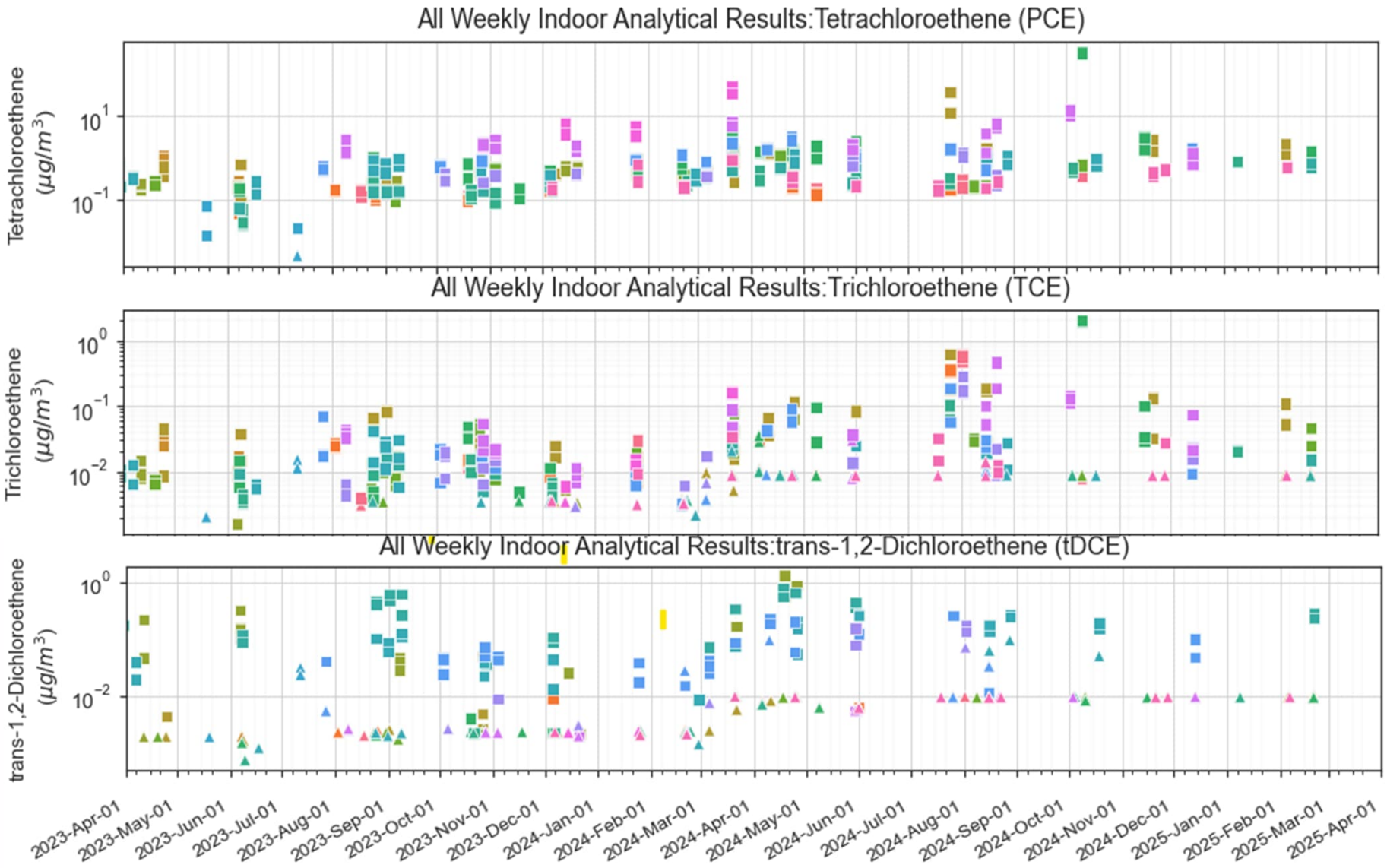
Zimmerman, John H., Alan Williams, Brian Schumacher, Christopher Lutes, Rohit Warrier, Brian Cosky, Ben Thompson, Chase W. Holton, Katherine Bronstein; "Impact Of Multiple HVAC Systems on Indoor Air VOC And Radon Concentrations from Vapor Intrusion During Seasonal Usage"; Published in *Atmosphere;* March 27, 2025. (open access).

Cosky et al. Seasonal Vapor Intrusion Variability Across Six Commercial Buildings in Fairbanks, Alaska – A Continental sub-Arctic Climate Zone with Inversions, Presented October 3, 2023 at AWMA Specialty Conference

Journal Articles in Draft

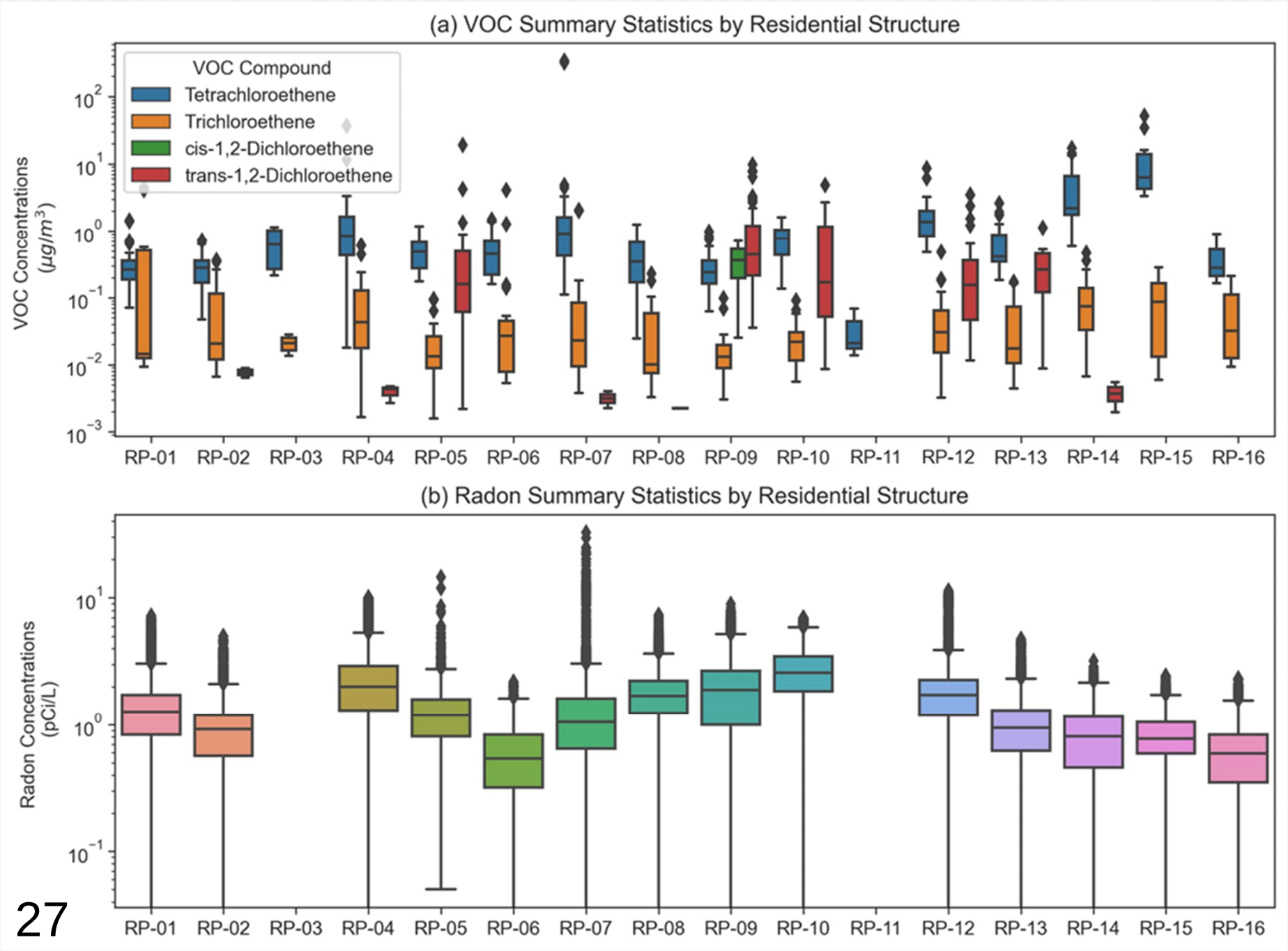
- Pulsed Vapor Intrusion During Summer and Winter Intensive Sampling Events
- Soil Gas Safe: Testing an Indicator and Tracer Based Sampling Timing Approach in a Community Study
- Community-Based, ITS-Driven Vapor Intrusion Monitoring: Lessons from the Method Development in Fairbanks, Alaska

Soil Gas Safe Project Indoor Air, Weekly Duration Samples From All 16 Residences



Key Points: Note log scale, and distinct seasonal patterns; Spring and Fall Highs; Very Few Samples Exceed Alaska Target Levels

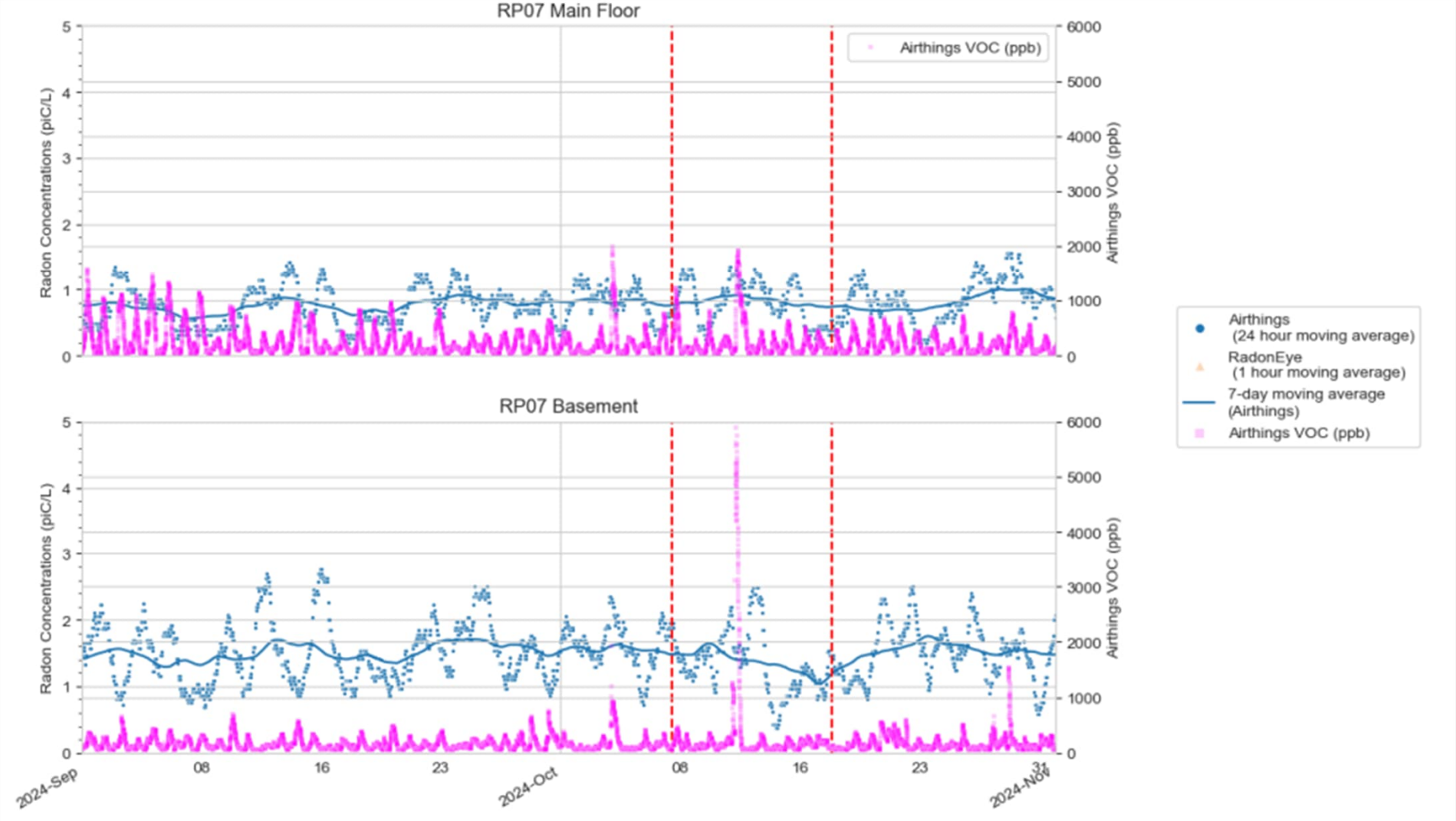
Soil Gas Safe, Indoor Air Box and Whisker



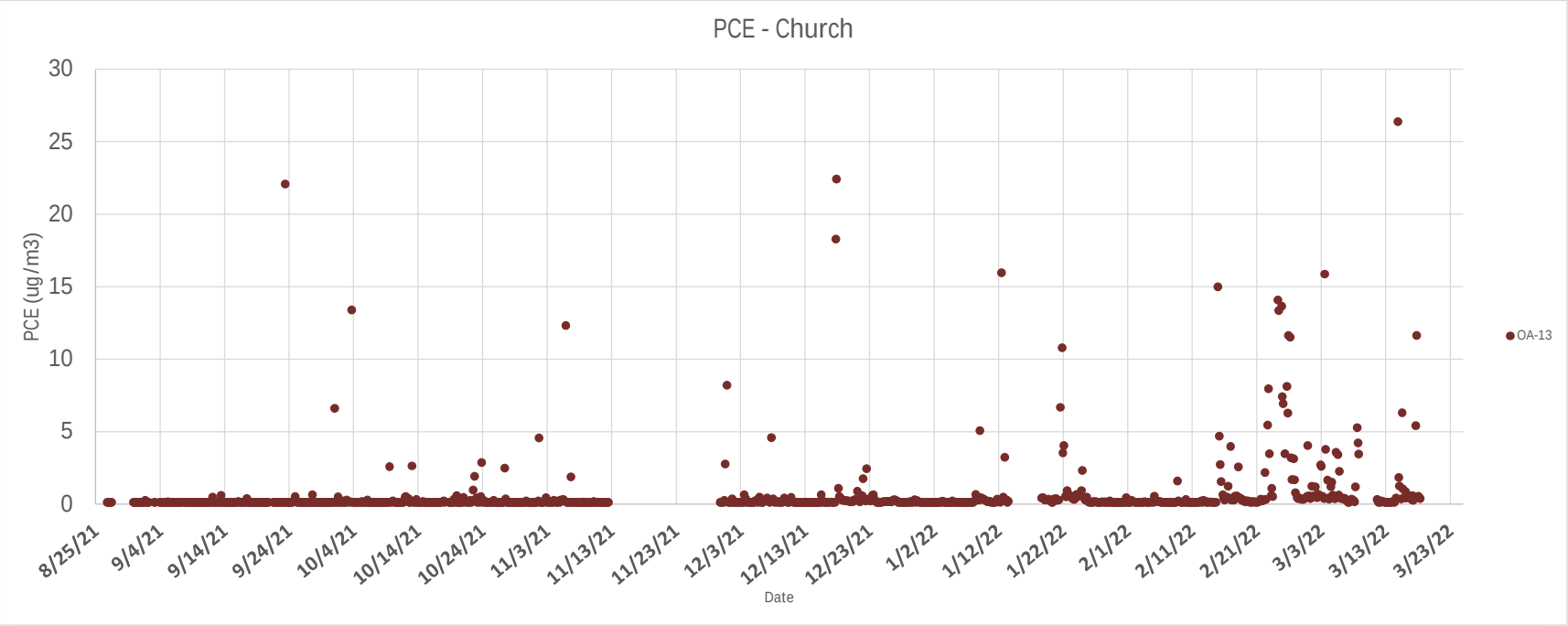
Unusual Case: RP-07

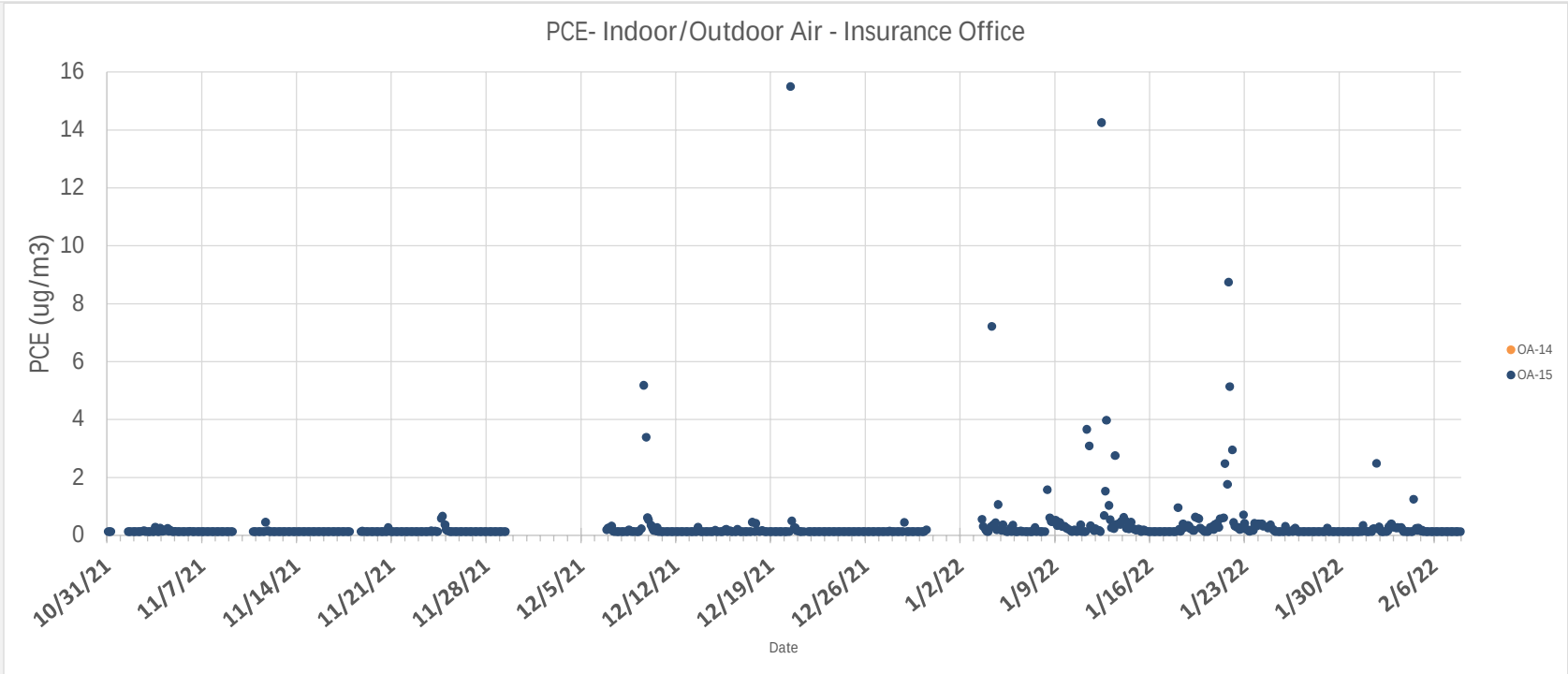
- Extreme values PCE (340 and 320 µg/m^3) and TCE (2.04 and 1.99 µg/m^3) observed in week long I&T guided samples 10/10 to 10/18/24
- These exceeded other samples collected in the house (15 previous rounds) by more than an order of magnitude.
- An extremely sharp peak reaching 6000 ppb was observed in the total VOC detector results (Airthings), especially in the basement on 10/12/24 that corresponded to a peak in the radon concentration.
- The radon peak on 10/12 as well as other radon peaks were attributed to sharp drops in barometric pressure
- The 10/4 and 10/12 peaks correspond to a sharp wind speed peak. The residence has two above grade stories and a basement that includes a heated garage and main room entered through a sloping driveway cut. The sloping driveway cut suspected as a potential mechanism for strong pressure differentials exerted by winds on the garage door directly beneath occupied space.
- Structure within 500 ft from a secondary source building with 45,000 µg/m^3 in soil gas; possible sewer transport pathways but not direct. Wastewater line entrance to house had to be relocated - freezing.

RP-07 Period of Extreme Sample vs Radon and Airthings Total VOCs



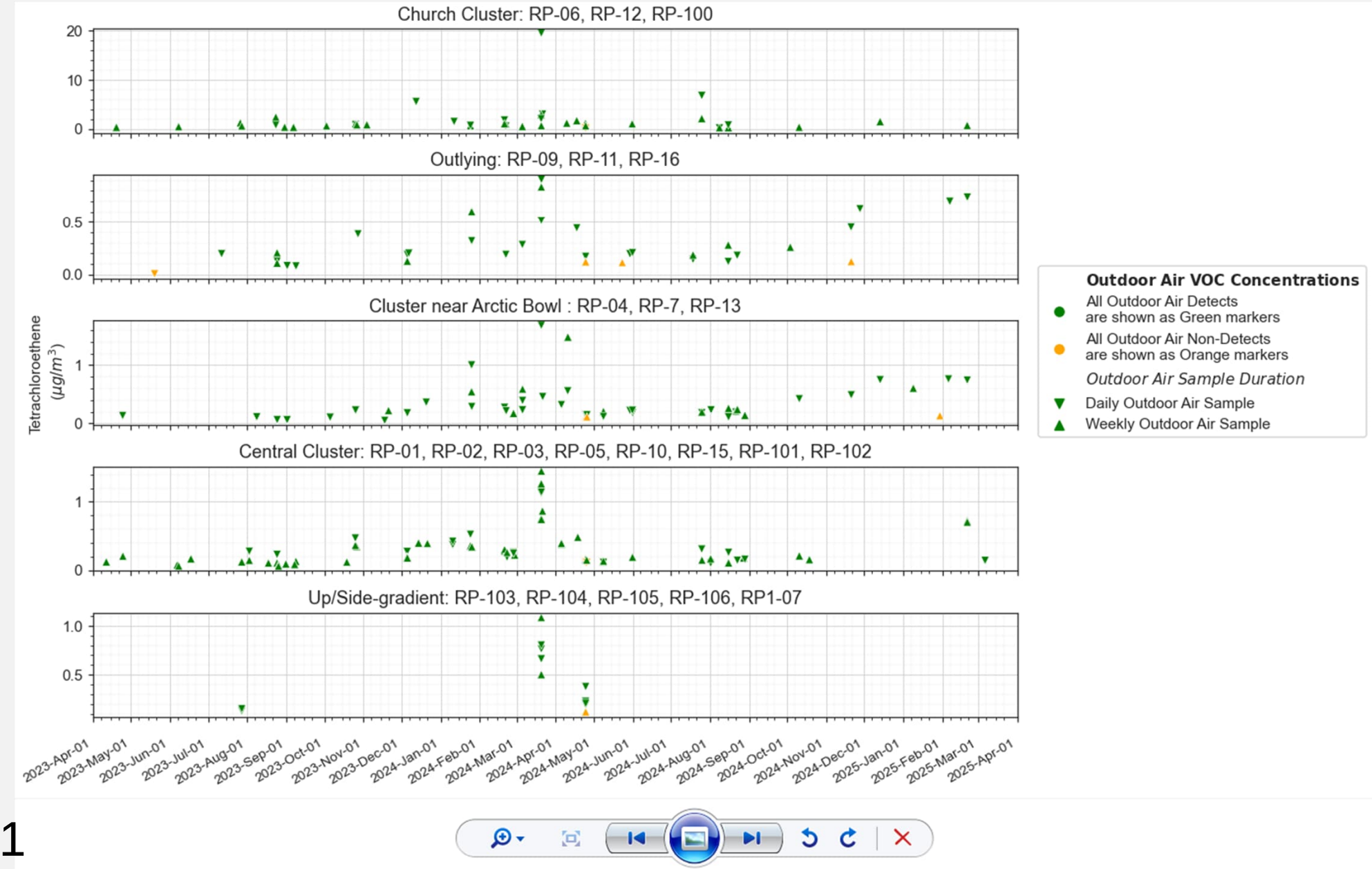
Occasional Elevated Ambient Air PCE - GC





Probably related to inversions

Elevated PCE on part of Site – Passive Samples



Side Benefit of Soil Gas Safe Project (RP-11)

- Initial samples identified a very localized source of petroleum hydrocarbons in the home and yard.
- Characteristic petroleum hydrocarbon “hump” pattern in indoor air. Homeowner noted a fuel odor in the basement and in one first floor room that appeared to increase when the heating system was in use.
- Site visit conducted by Alaska DEC observed of 50 ppm VOCs using a field portable photoionization detector at a large square penetration in the concrete basement wall, which was partially sealed with plywood and insulation. This strongly suggested a leak in the home’s fuel oil heating system, likely behind a basement wall.
- Alaska DEC who provided the residents with air cleaners to alleviate the issue.

Discussion and Conclusions - 1

- In two of three commercial buildings discussed, the initial monitoring programs with 7 to 9 rounds reasonably predicted the results of a subsequent intensive indoor air sampling campaign.
- In one place of assembly the 1 prior round of indoor air and one soil gas sample 100 ft away did not accurately predict the results of subsequent intensive sampling.
- Mitigation (or not) decisions made here primarily based on indoor air, if soil gas was emphasized as some states do now different decisions would have been made.
- There was considerable change over time in action levels. mitigation decisions may have been determined based on what action levels were in effect when the data became available.
- A subsequent detailed study of residential buildings found most to be well below current target levels, but one round in one building dramatically exceeded current target levels and appeared to be attributable to VI.
- Much more temporal variability in indoor air vs. soil gas.

Discussion and Conclusions - 2

- Almost all commonly used lines evidence – bulk soil, groundwater, active external soil gas, subslab soil gas, passive soil gas and indoor air were used over time.
- Initial applications of soil gas sampling focused near the source areas. Downgradient external soil gas may not have had enough density to tell full story.
- Assessment stepped out gradually from the commercial area into the residential area with most downgradient assessment occurring 20 years after initial site discovery.
- Several important assessments and actions were undertaken by transportation agencies (soil removals) and sewer agencies (upgrading of wood stave sewers).
- Many more resources were spent on investigation than mitigation or remediation.

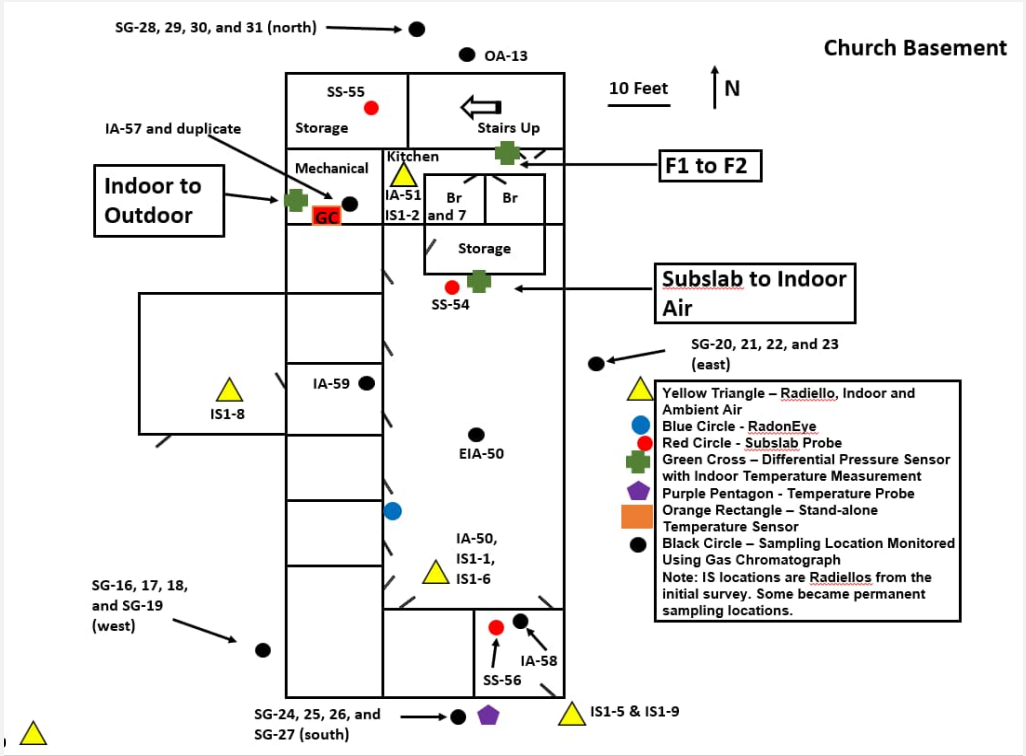
"The views expressed in this presentation are those of the author(s) and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.".

References

- https://dec.alaska.gov/spar/csp/sites/gaffney/
- https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/25573
- Ahtna Engineering Services, LLC. (2018). *Final Gaffney West, State Fiscal Year 2018 Remediation System Operations, Maintenance, and Monitoring Report*.

Spare Slides After This for Q&A

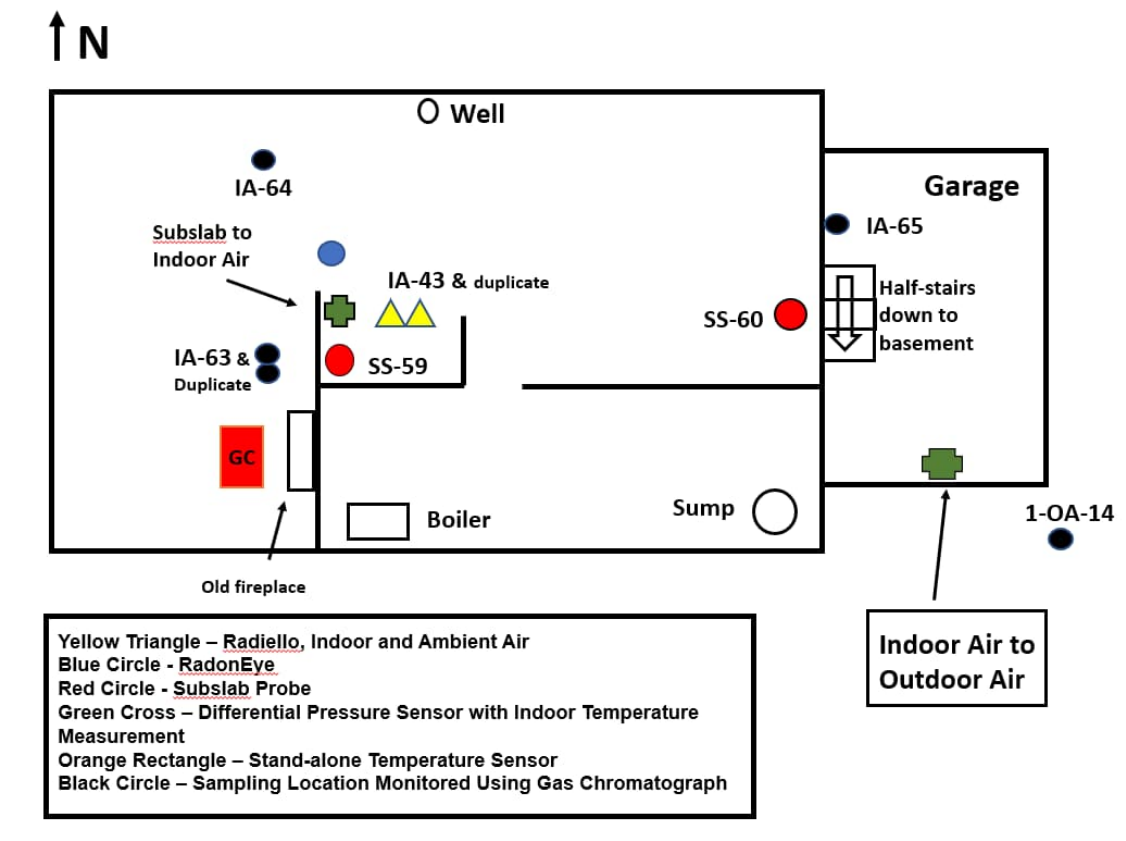
Fairbanks Gaffney Church



Subslab (GC)	3	F1, main room, central	SS-54
		F1, storage room, NW	SS-55
		F1, storage room, SE	SS-56

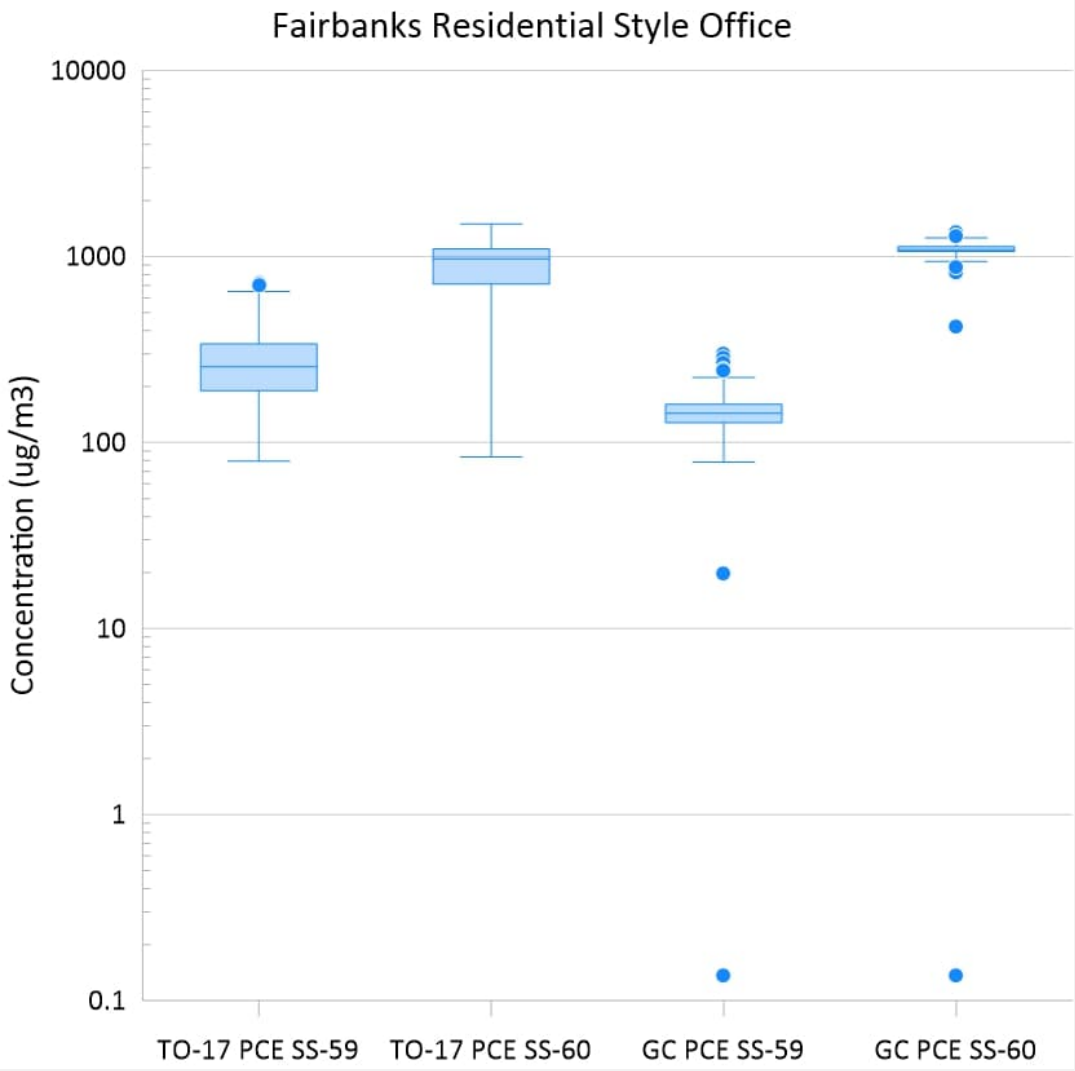
West, 2'	SG-16
West, 4.5' (GC location)	SG-17
West, 7' (GC location)	SG-18
West, 9.5'	SG-19
East, 2'	SG-20
East, 4.5'	SG-21
East, 7'	SG-22
East, 9.5'	SG-23
South, 2'	SG-24
South, 4.5' (GC location)	SG-25
South, 7' (GC location)	SG-26
South, 9.5'	SG-27
North, 2'	SG-28
North, 4.5'	SG-29
North, 7'	SG-30
North, 9.5'	SG-31

Fairbanks Gaffney Residential Style Office



CL1

Fairbanks Residential Style Office: Temporal and Spatial Variability, GC n= 440-441 over 6 months; TO-17 n= 84-88 over 13 months



CL1 updated

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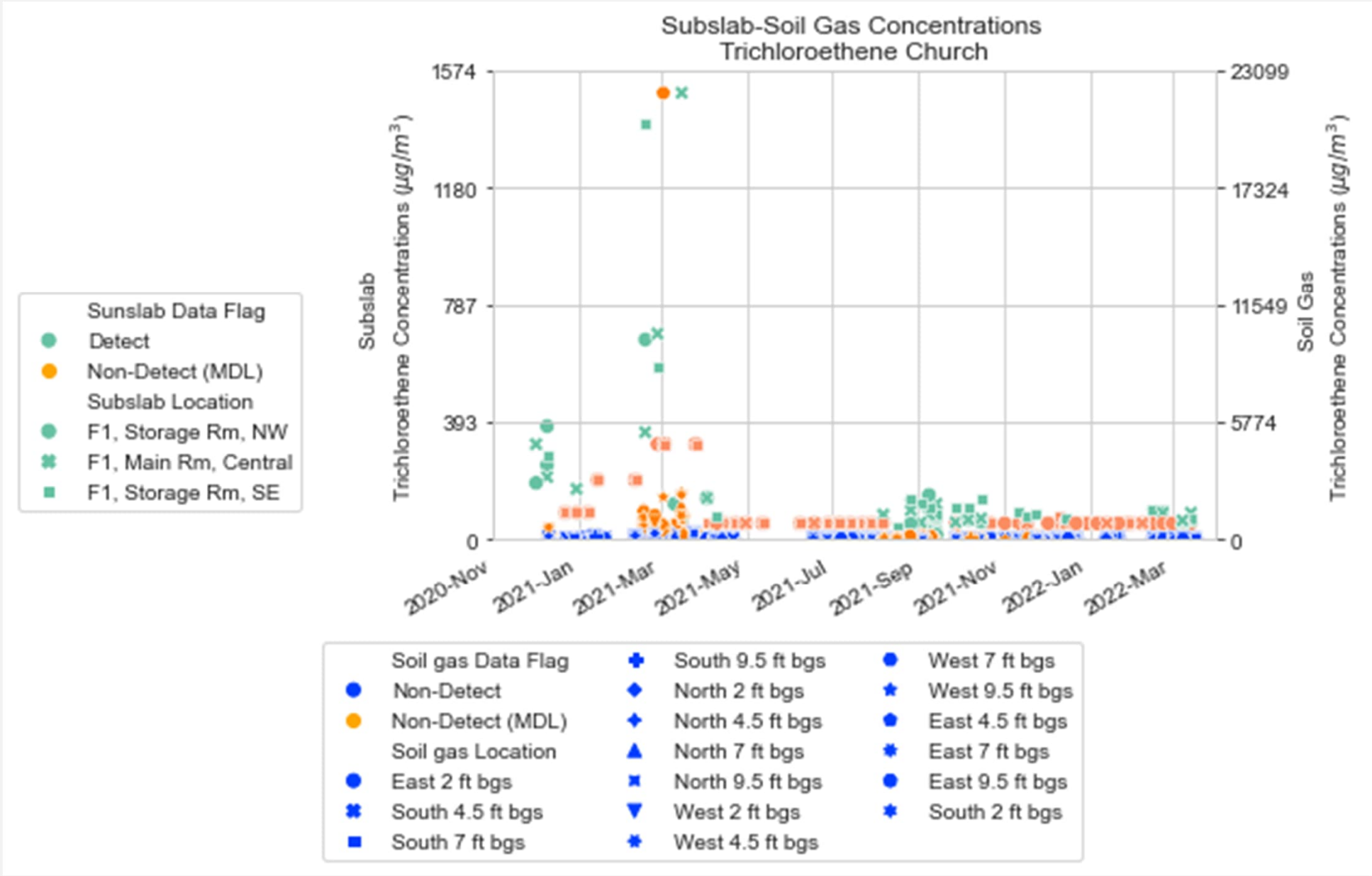
Fairbanks Soil Gas TCE at Church



Site Discovery and Investigations

1. PCE discovered in groundwater during 1993 investigation of a service station
2. Phase I investigation in 1997
   - Bounded plume between Noble and Cowles Streets with two dry cleaner facilities as primary concerns
3. Phase II investigation in 1998
   - Identification of two plumes
   - Delineated downgradient extent of plumes
   - Concern about public supply wells
4. Phase III in 1999
   - Sampling of sewer lines and confirmation of a secondary source
   - Source area delineation at Good News and near Coin King
   - Private water well search

1993: Dames and Moore discovered PCE in groundwater while investigating Hutchinson's Service Station located at Gaffney Road and Turner Street (Ecology and Environment 2014)

1997: Phase I investigation performed by Ecology and the Environment.

- Passive soil gas probes prompted the drilling of 3 wells to test groundwater Bounded plume between 700 block of Gaffney Road and extending northwest to the intersections of Barnette Street and Eleventh Avenue, and Cushman Street and Tenth Avenue (Ecology and the Environment 2014)

1998: Phase II investigation by Ecology and the Environment

- 22 temporary and permanent monitoring wells were installed downgradient to the PCE plumes (E & E 1999a).
- This allowed the two plumes to be delineated (eastern and western plumes) and give their extent

1999: Phase III conducted by Ecology and the Environment

- Sediment and water sampling from 11 sewer lines
- 44 passive soil gas locations
- 22 boreholes drilled
- 8 permanent water wells
- Sources: Coin King and ADKO in east and Royal Masters Laundrette and wood stave sewer lines in west

2000 – 2004: at least annual monitoring events and hydrological assessment

- In 2003, Magoffin Law Firm had and indoor air vapor intrusion (VI) sampling event

2006: vapor intrusion investigation at Good News Book Store, Magoffin Law, and Meyers Real Estate

2007: replacement of 13 temporary wells with permanent wells and 31 wells sampled by Oasis Environmental Inc. Results indicated that TCE was generally higher than PCE in the eastern plume.

"Vapor intrusion investigations performed at 6 other buildings."

2008: Source characterization reporting by Oasis (primarily in Gaffney west for ADEC)

- 22 passive soil gas modules
- 70 test boreholes that received soil and groundwater screening and sampling
- 4 new monitoring wells installed
- 16 monitoring wells sampled

Further work by Oasis for ADEC occurred in 2008, primarily in Gaffney east:

- 6 soil gas points sampled
- VI sampling at two structures
- 29 test boreholes installed and sampled
- 22 groundwater wells sampled (including 2 newly installed)

2009: Continued sampling by Oasis (primarily in Gaffney west for ADEC)

- Further VI work at the Good News bookstore and in the right of way south of Coin King.

2010: Oasis performed phase I assessment for ADEC in the Gaffney Road area.

2010: Installation of soil vapor extraction/sub-slab depressurization (SVE/SSD) system at the Good News bookstore

2011: Continued VI work by Oasis at Gaffney Road east for ADEC

- VI assessments, groundwater installations, and sampling
- Buildings assessed: former Foodland, Stone Soup, The Bridge Program, Access Alaska, and Sunshine Alterations

2012: Preliminary assessment by the EPA

- 2013: ERM Alaska performed work in the Gaffney Road area (primarily west) for the ADEC
- O&M work on the SSD system
- VI and groundwater sampling

2014: Site inspection by the EPA

- Passive sampling at the fire station and the former True North credit union

2017: passive sampling at 8th and 9th avenue residences

2018: SVE/SSD system at the Good News bookstore modified to an SSD radon fan. Subslab and indoor air sampling continued at this location and Shear Heaven through 2018.

Gaffney Road Comparison Levels

Multimedia Screening Levels (Oasis, 2009)

Compound	ADEC SCL (µg/kg)	ADEC GCL (µg/L)	EPA Target Shallow Soil Gas Concentration (µg/m³)	EPA Target Deep Soil Gas Concentration (µg/m³)	Commercial RME (µg/m³)
PCE	24	5	81	810	20.8
TCE	20	5	2.2	22	1.1
cis-1,2-DCE	240	70	350	3,500	35
trans-1,2-DCE	370	100	700	7,000	60
Vinyl chloride	8.5	2	28	280	13.9

Notes:
µg/kg Micrograms per kilogram
µg/L Micrograms per liter
µg/m³ Micrograms per cubic meter

Multimedia ADEC Action Levels (Oasis, 2011)

Compound	ADEC SCL[1] (µg/kg)	ADEC GCL[2] (µg/L)	ADEC Indoor Air Target Levels – Commercial[3] (µg/m³)	ADEC Shallow and Sub-Slab Soil Gas Target Levels – Commercial[3] (µg/m³)
PCE	24	5	21	210
TCE	20	5	1.1	11
cDCE	240	70	150	1500
tDCE	370	100	260	2600
VC	8.5	2	1.1	11

µg/kg = Micrograms per kilogram
µg/L = Micrograms per liter
µg/m³ = Micrograms per cubic meter
[1] = 18 AAC 75.341 Table B1. Method Two "Under 40 inch Zone Migration to Groundwater"
[2] = 18 AAC 75.345 Table C
[3] = ADEC Draft Vapor Intrusion Guidance for Contaminated Sites (July 2009b) Appendix D

Multimedia Cleanup and Target Levels, ADEC (Ahtna, 2014)

Compound	GCL (µg/L)	Vapor Intrusion Target Levels					
		Indoor Air (µg/m³)		Shallow Soil Gas (µg/m³)		Groundwater (µg/L)	
		Residential	Commercial	Residential	Commercial	Residential	Commercial
PCE	5	42	180	420	1,800	58	240
TCE	5	2.0*	8.4*	20*	84*	4.8*†	20*†
cDCE	70	7.3	31	73	310	44	180
tDCE	100	63	260	630	2,600	380	1,580
1,1-DCE	7	210	880	2,100	8,800	200	820
VC	2	1.6	28	16	280	1.4	2.5

µg/L = micrograms per liter
µg/m³ = micrograms per cubic meter
* = 21 day average for women of child-bearing age (EPA Region 10, 2012)
† = calculated using unitless Henry's Constant of 0.421

Soil Gas Target Levels, ADEC (Ahtna, 2016)

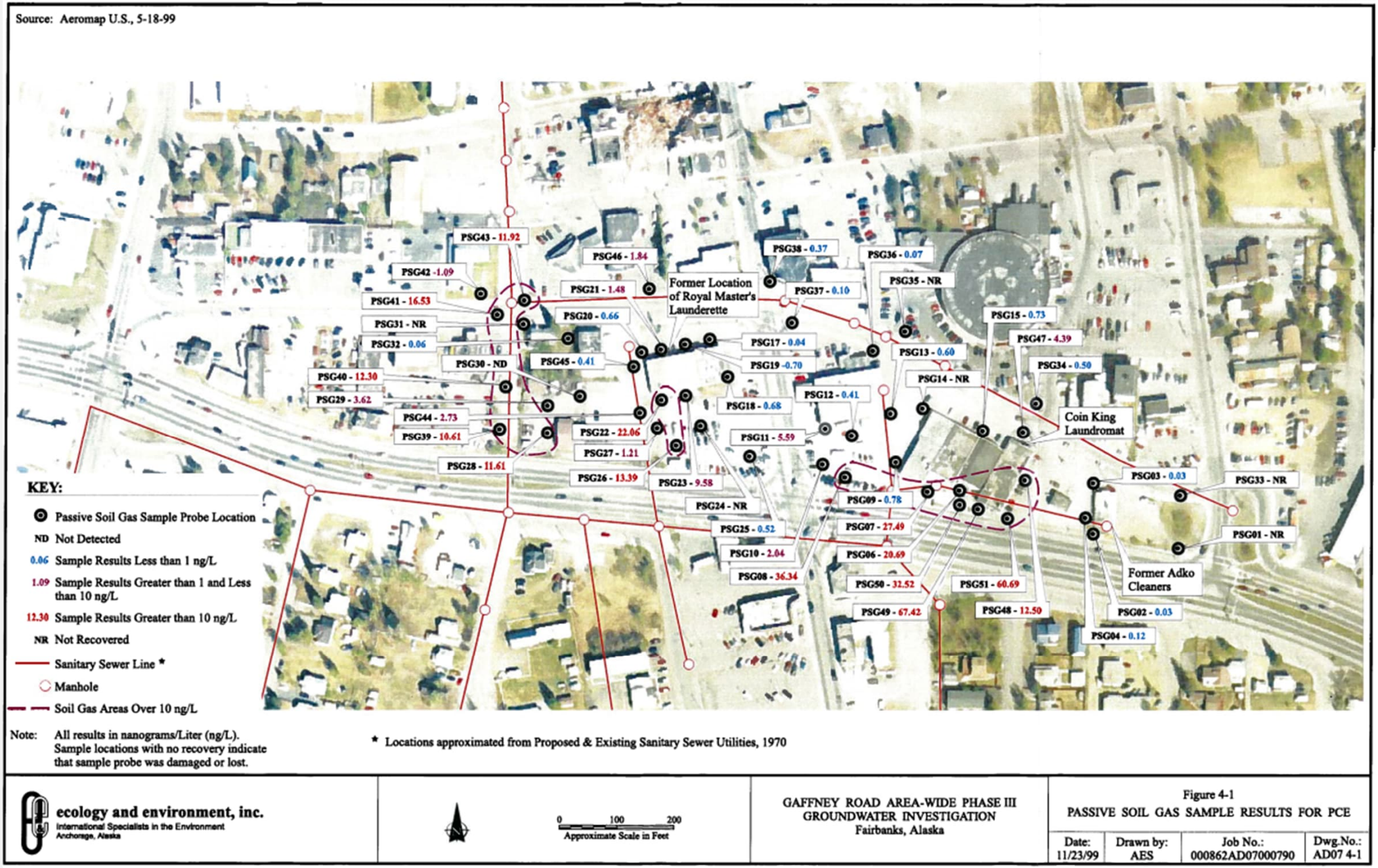
Compound	Vapor Intrusion Target Levels			
	Deep Soil Gas (µg/m³)		Shallow Soil Gas (µg/m³)	
	Residential	Commercial	Residential	Commercial
PCE	4,200	18,000	420	1,800
TCE[1]	200[1]	840[1]	20[1]	84[1]

Indoor air and soil gas target levels ADEC, (Ahtna, 2018)

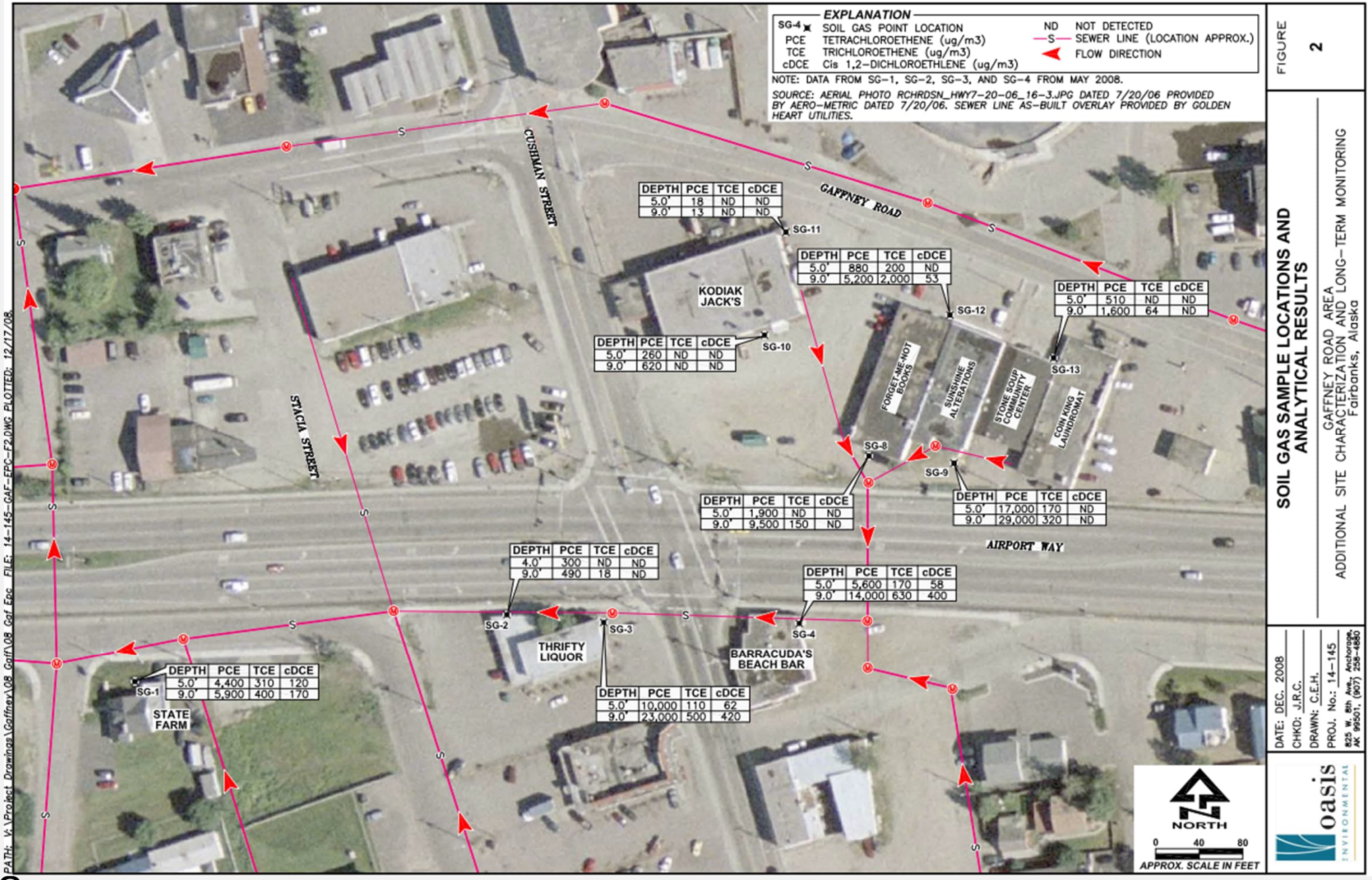
Contaminant	Indoor Air (µg/m³)		Soil Gas (µg/m³)	
	Residential	Commercial	Residential	Commercial
PCE	41	41	410	1,800
TCE	2.0	2.2	20	84
cDCE	7.3[1]	31[1]	73[1]	310[1]
tDCE	790	790	790[2]	2,600[1]
1,1-DCE	79	79	2,100	8,800
VC	1.7	28	17	280

µg/m³ = micrograms per cubic meter
PCE = tetrachloroethene
TCE = trichloroethene
cDCE = cis-1,2-dichloroethene
tDCE = trans-1,2-dichloroethene
1,1-DCE = 1,1-dichloroethene
VC = vinyl chloride
[1] Retained from ADEC VI Guidance, October 2012
[2] Value shown is the residential indoor air target level

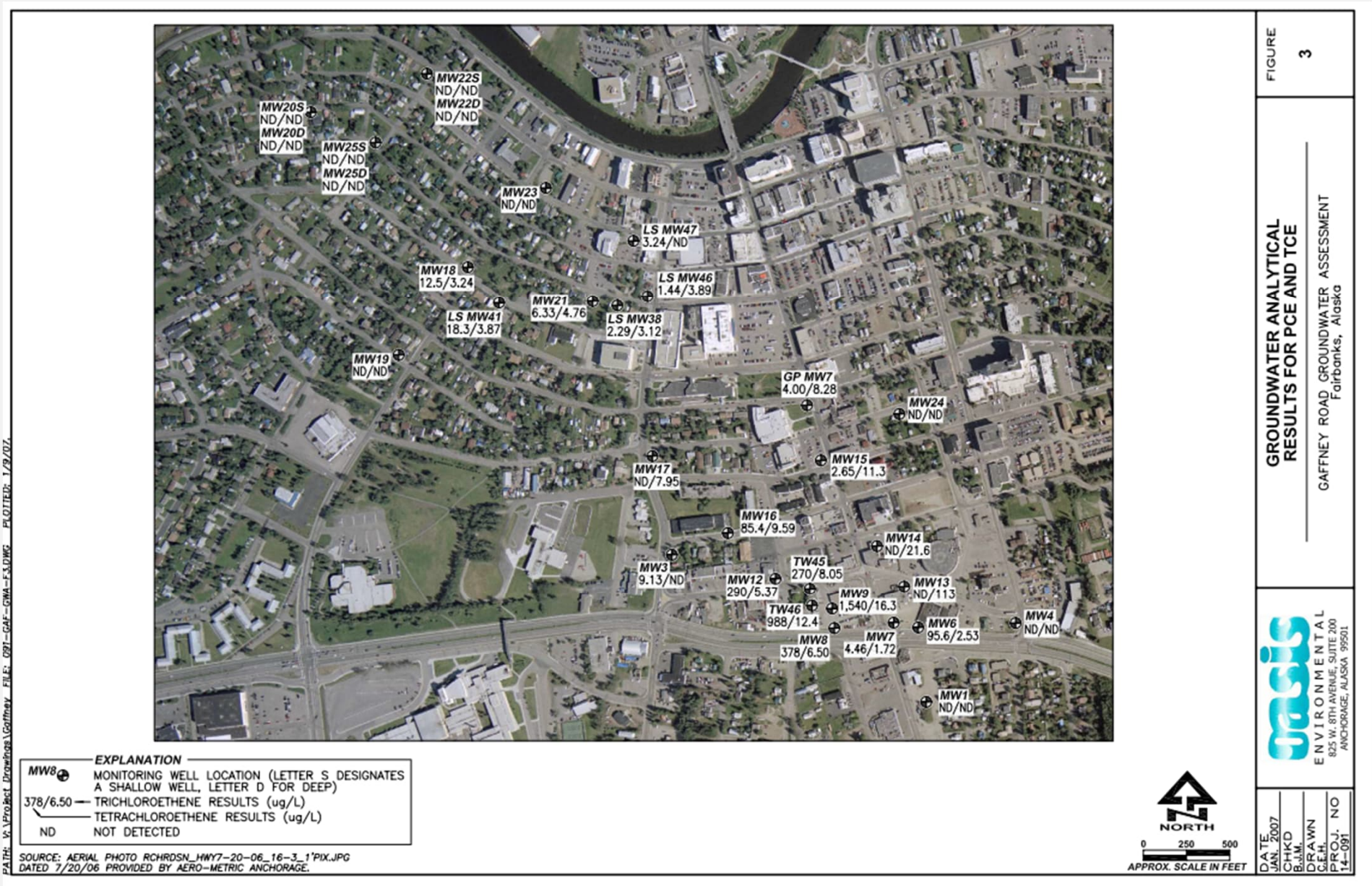
1999 Passive Soil Gas



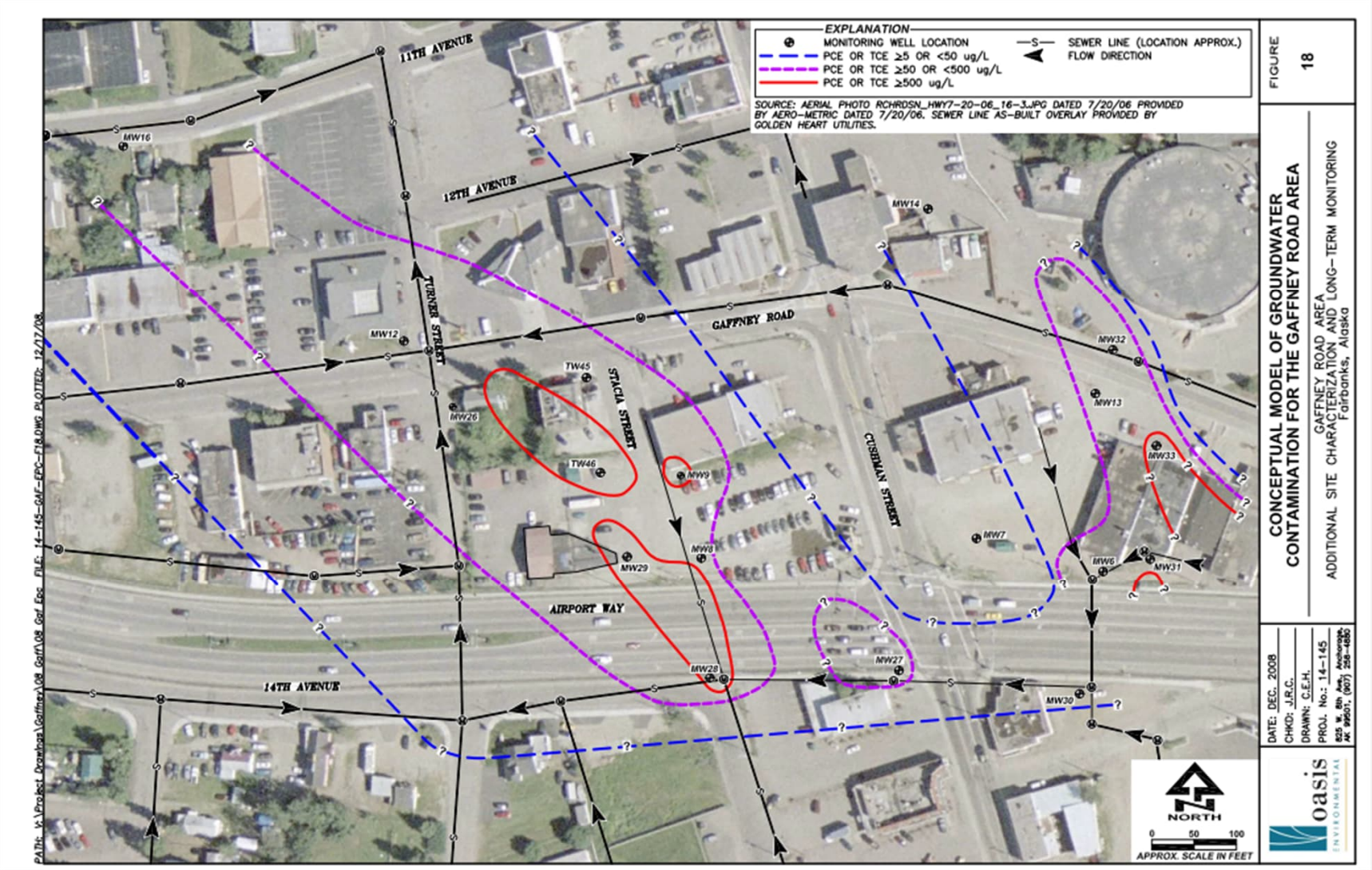
2008 Active External Soil Gas



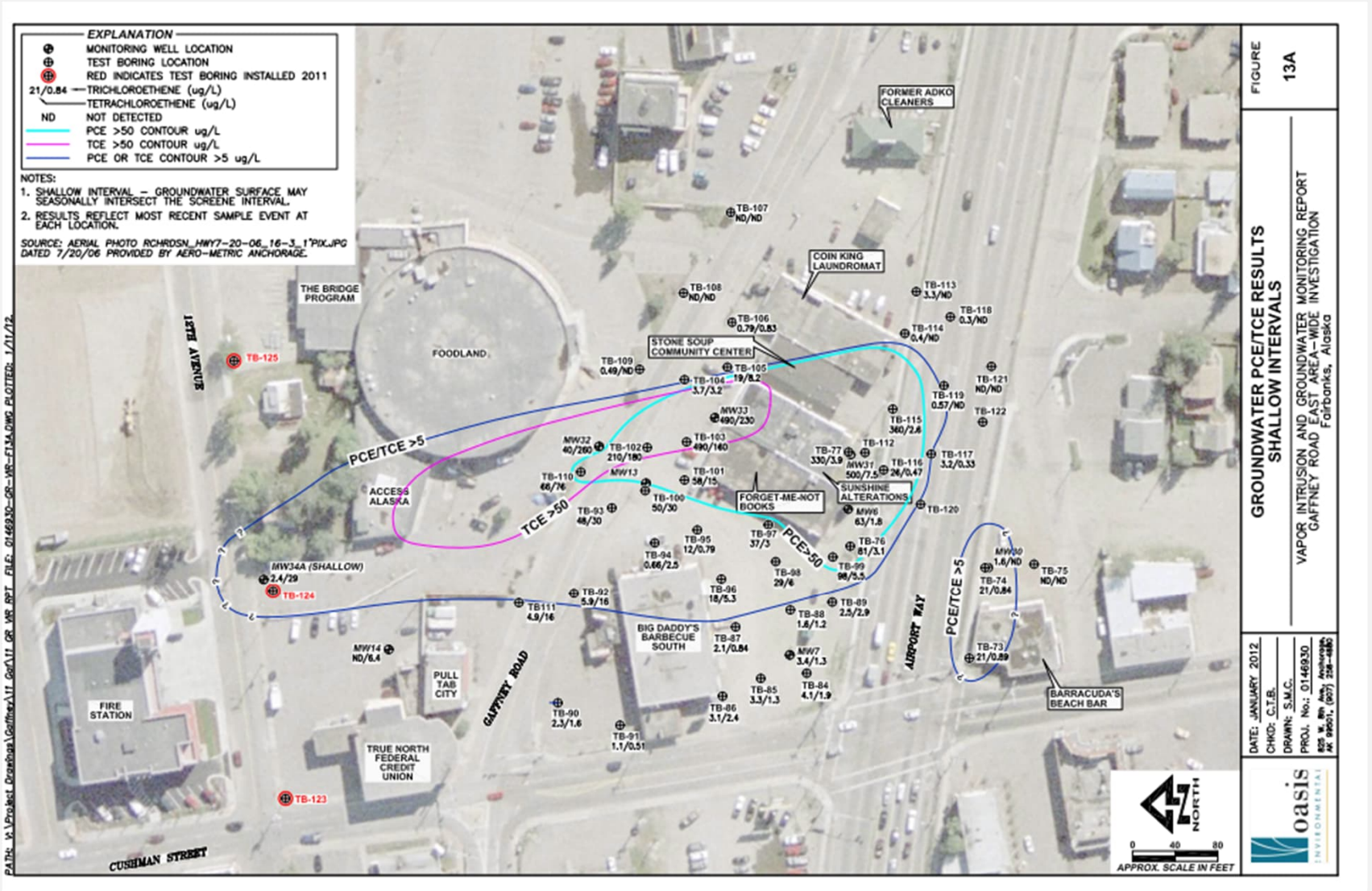
2007 GW Data and Well Field



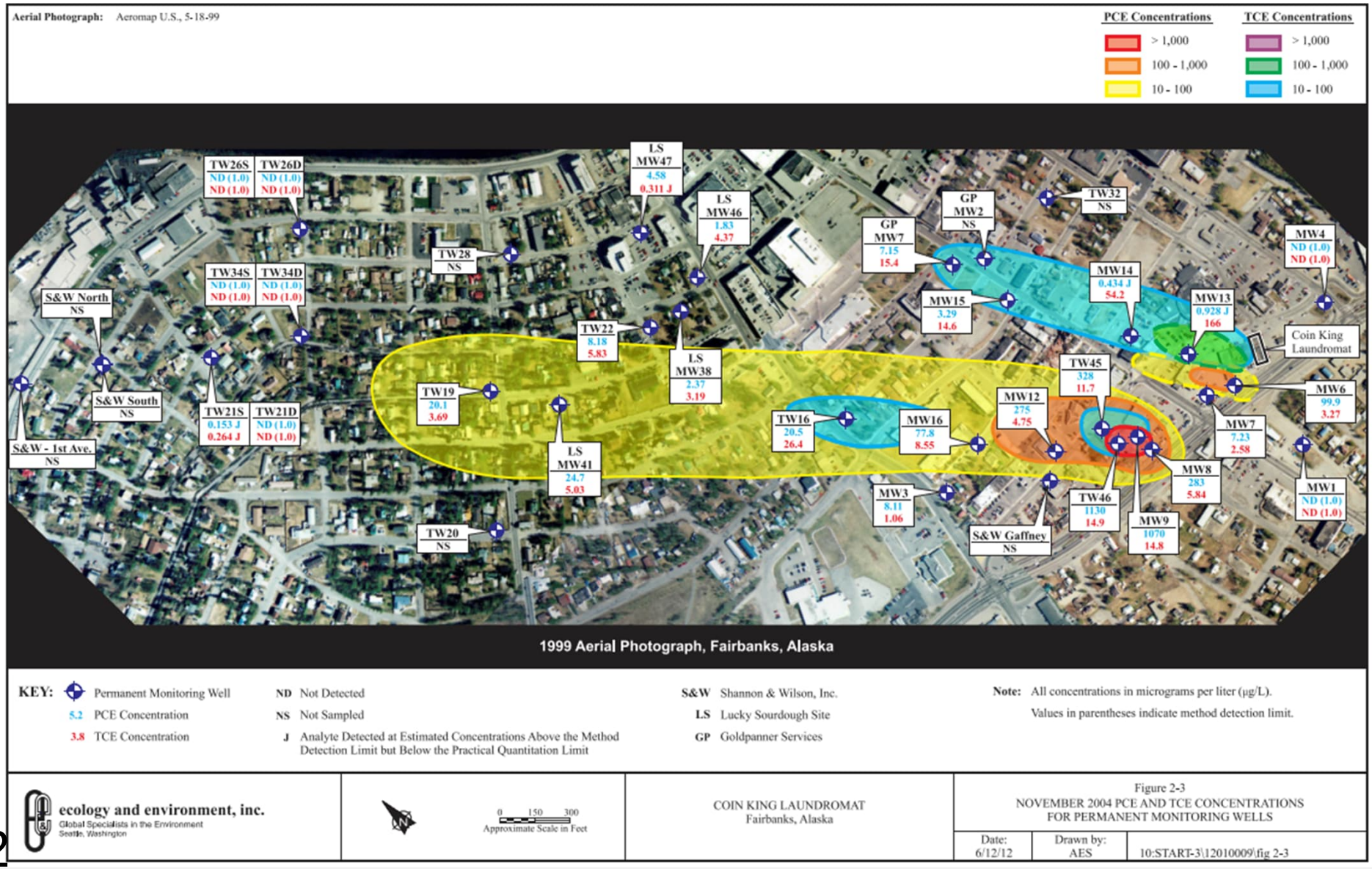
2008 Plume Map – As In Original Report



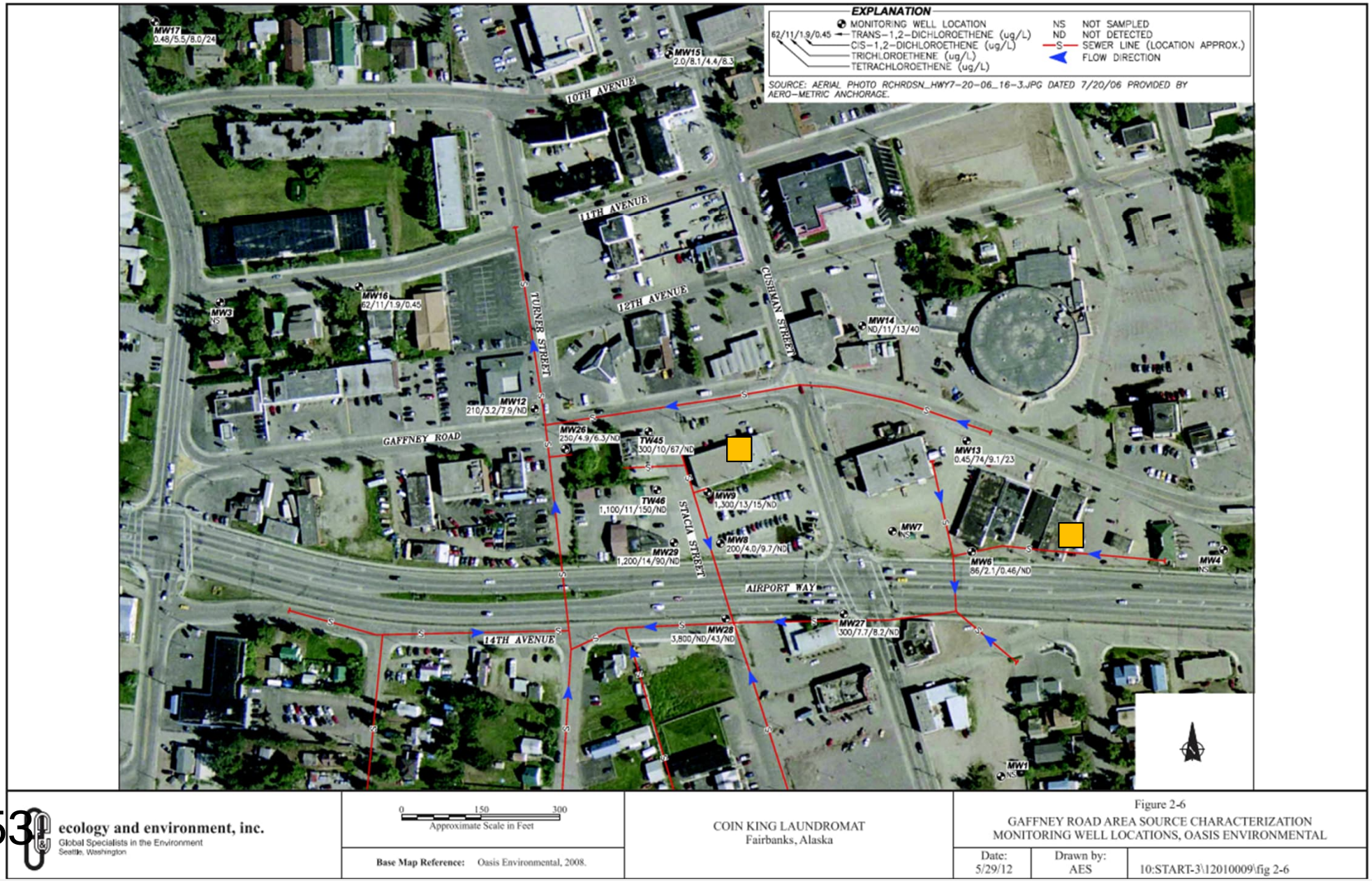
2012 East Plume Map



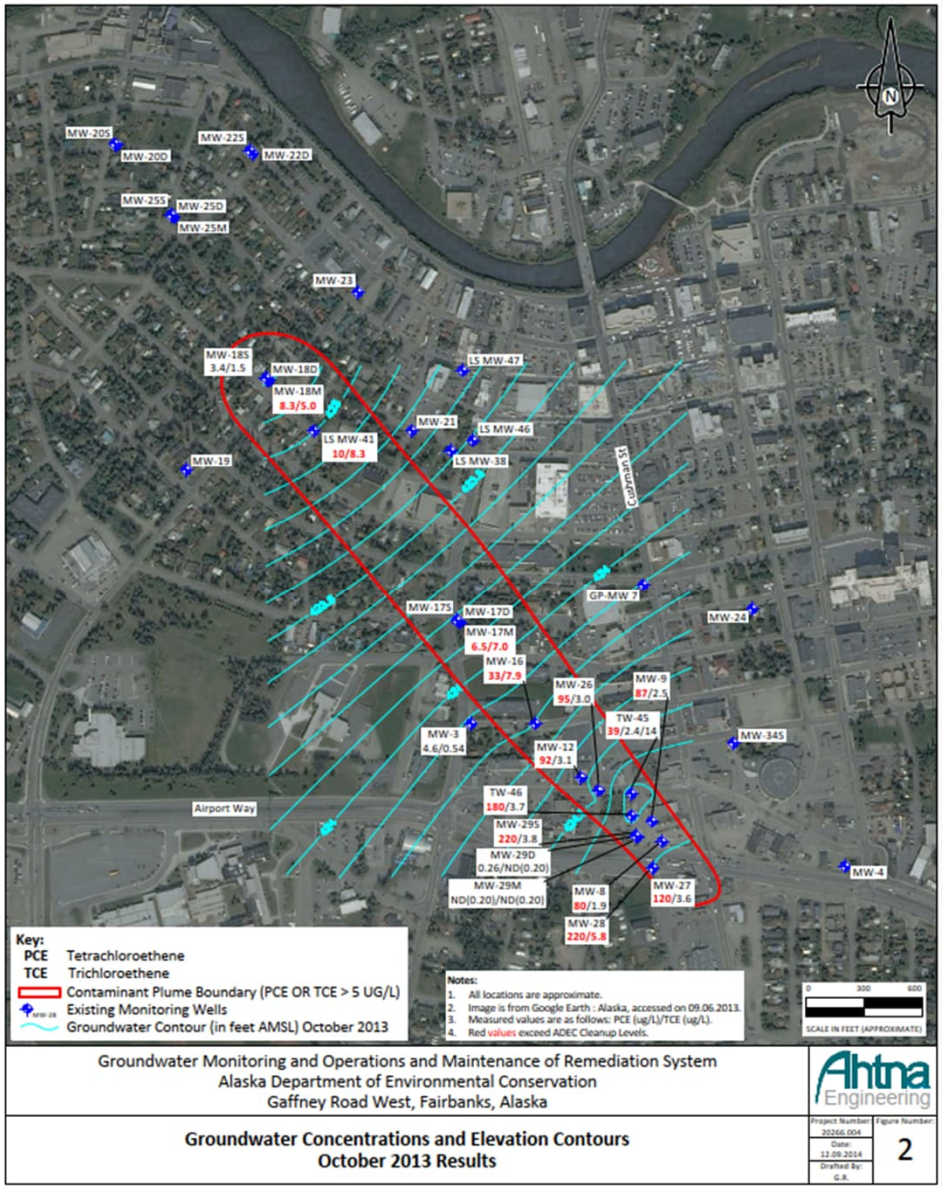
2012 EPA Preliminary Assessment Plume Map (E&E)

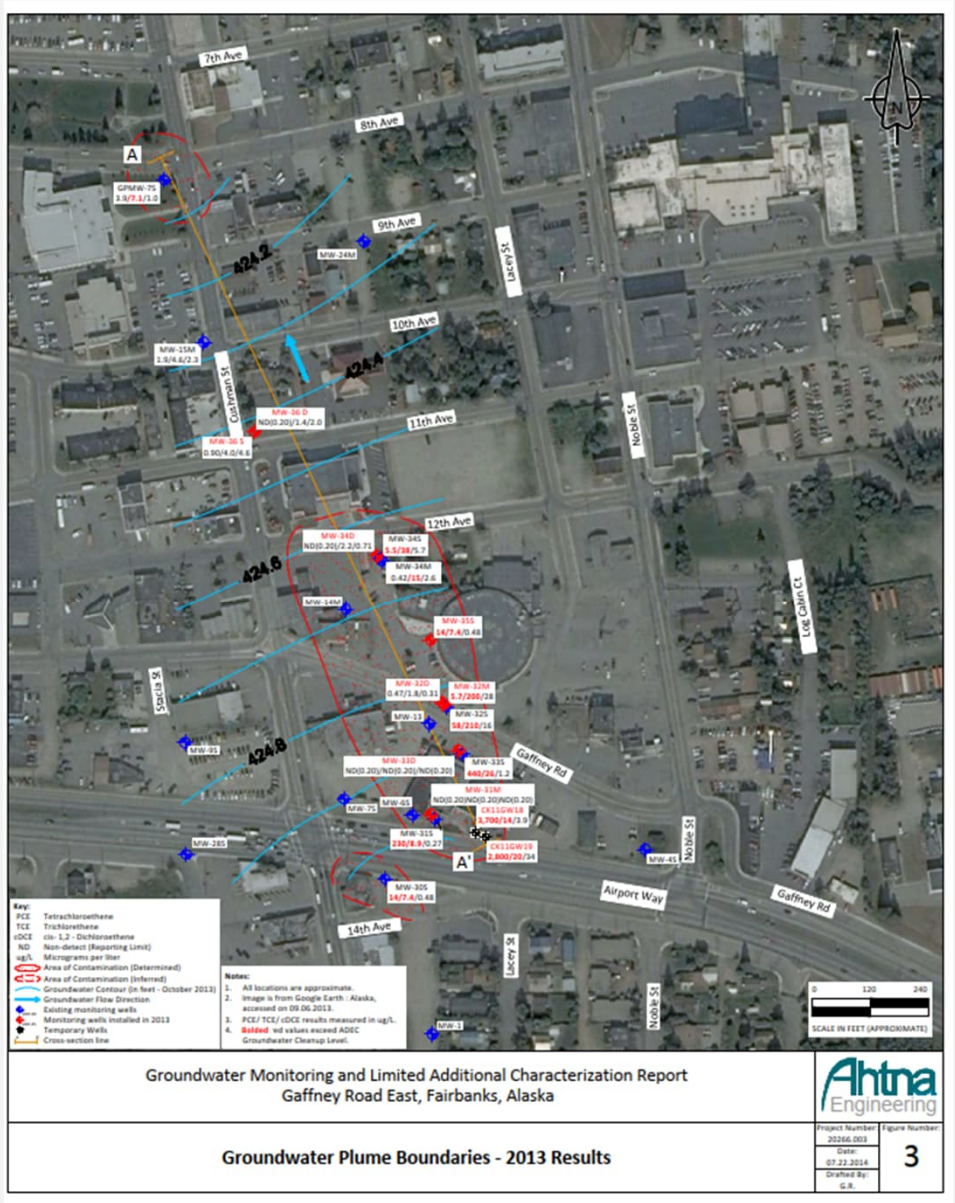


2012 EPA Preliminary Assessment Sewer Map

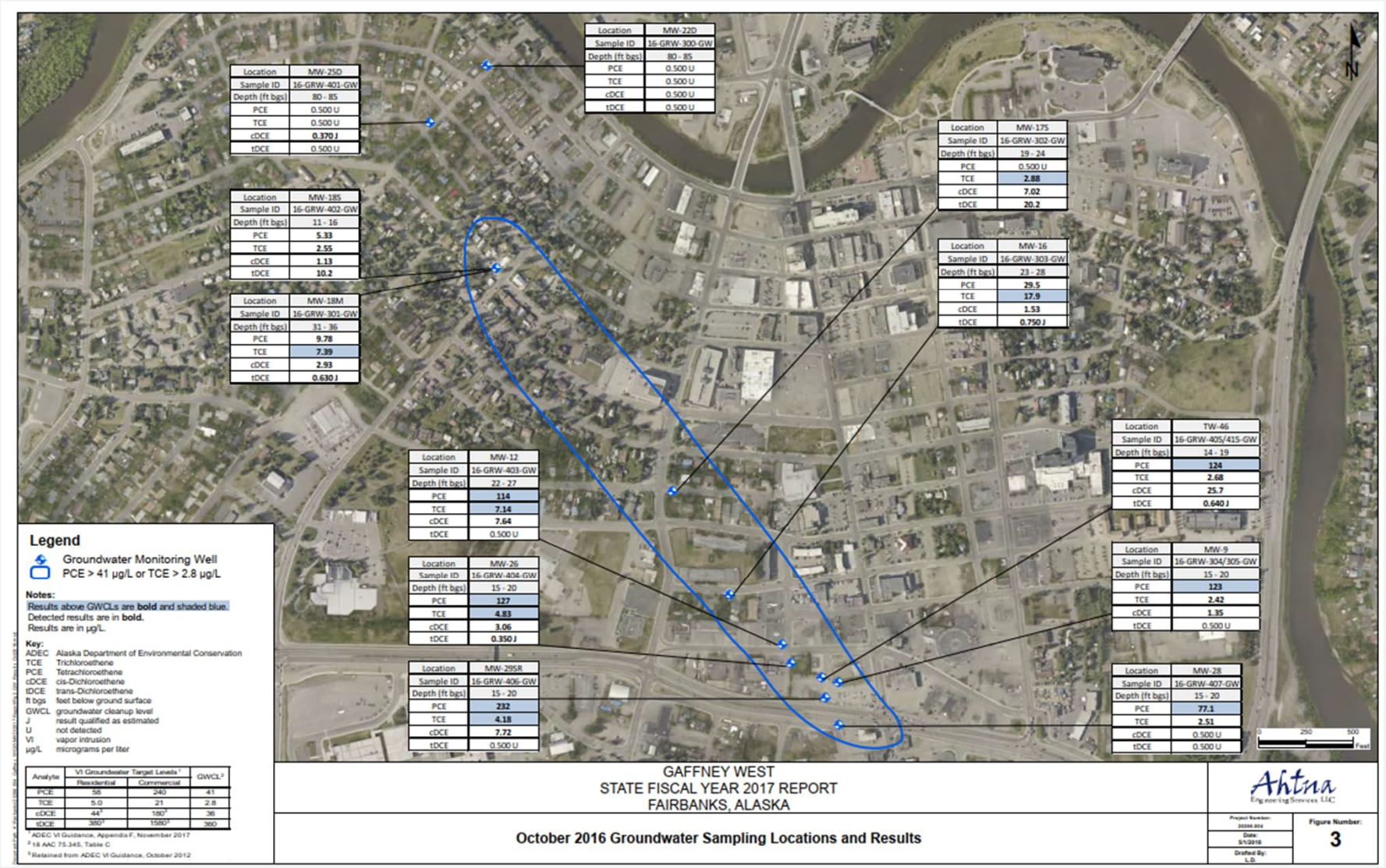


2013 West and East Plume Maps

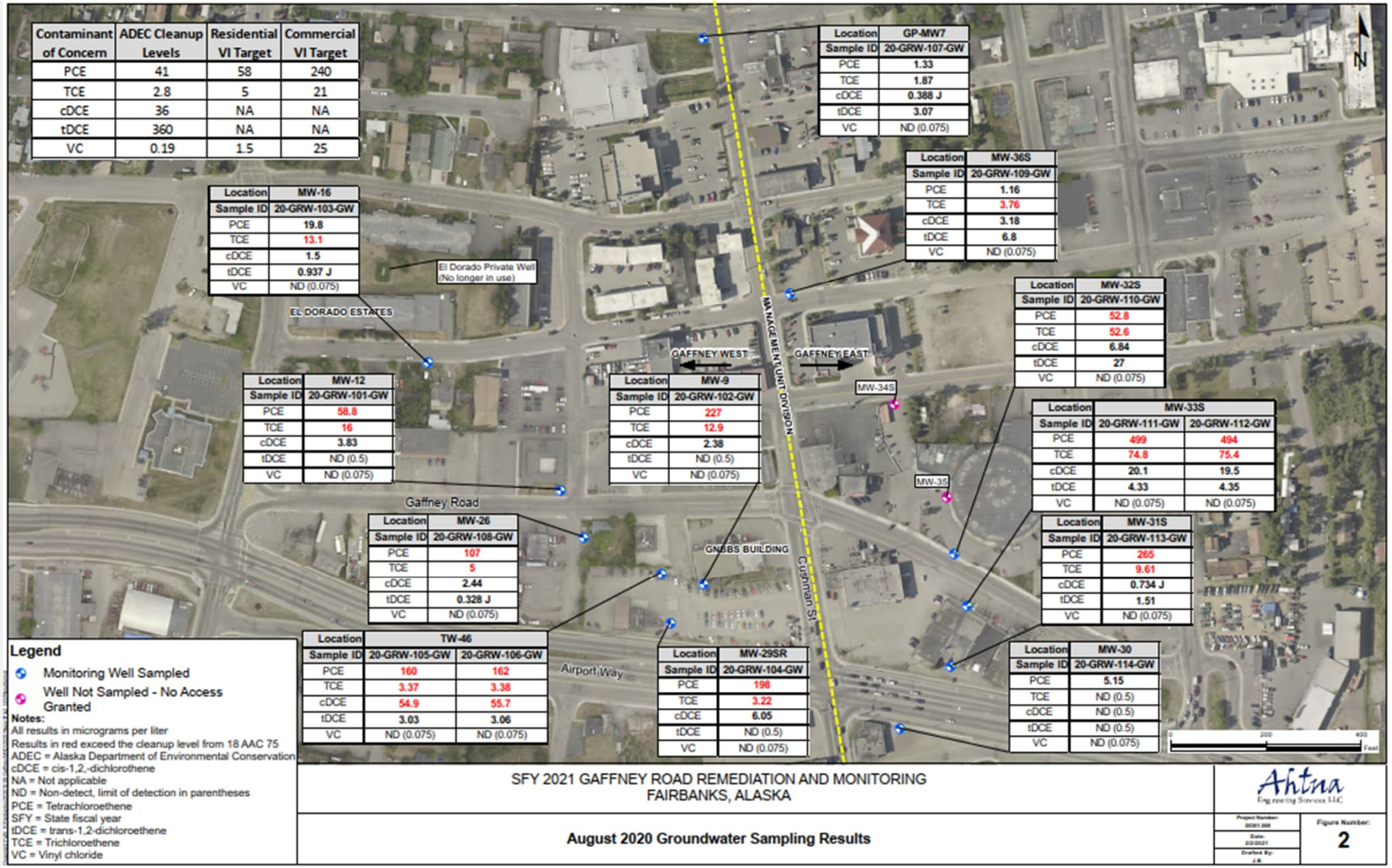




2016 plume map



2020 Groundwater data



Gaffney Road Site, Present – (Cont.)

- Weekly VOC and Continuous Radon Sampling, December 2020 – March 2022
  - Indoor Air, Subslab, Outdoor Air
- Two locations with Continuous VOC
  - Church (8/21 – Present)
  - Insurance Office (9/21 – Present)
- Two intensive sampling studies (Twice Daily for 8 days)
  - August 2021 (Warm)
  - January 2022 (Cold)
- Continuous differential pressure

RadonEye

http://radonftlab.com/radon-sensor-product/rd200/

Indoor/outdoor radon data collected every hour

RAD7

https://durridge.com/products/rad7-radon-detector/

Subslab radon data collected monthly