EPA Vapor Intrusion Workshop

Why, When, Where, and How You Should Monitor Indoor Radon, Differential Temperature & Pressure During Chlorinated Vapor Intrusion Assessments

Fairbanks Gaffney Case Study

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EPA Vapor Intrusion Workshop, San Diego CA , *March 17th, 2020*

Fairbanks Alaska Gaffney - Menu of CSM Scenario-categories

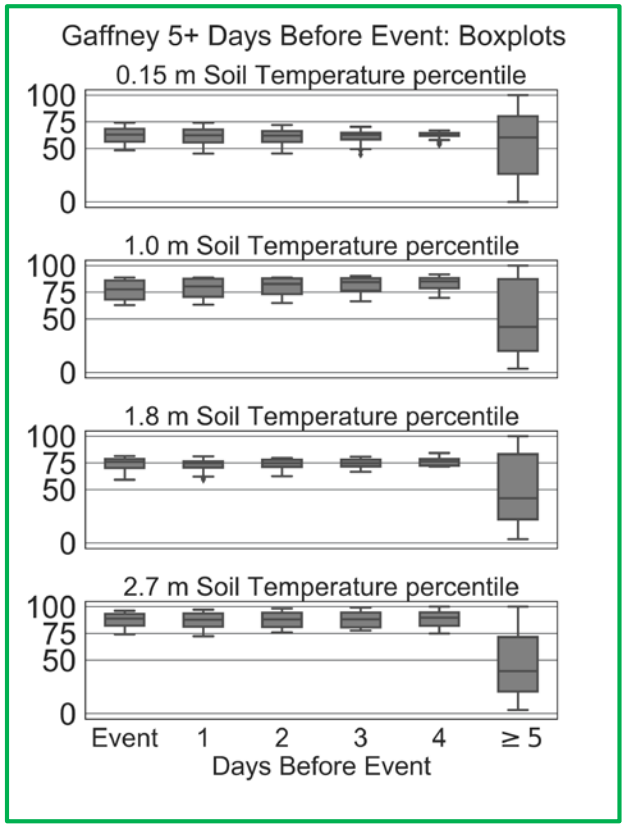
Type & Depth to VOC source	Building type & size (ft2)	Foundation	Sub-foundation horizontal permeable	Preferential pipe pathway	Bldg-Climate zone (Temp)	Press./ Wind speed & direction	Intrusion primarily Advect. vs Diffusive
Shallow Soil	Modern sub-urban	**Slab-on-Grade**	Continuous horizontal/ permeable	High	1-3	Low	Advective
Deep Soil	Legacy Urban Multi-Family	Split level – SoG & basmt	**Discontin-uous / Imperme-able (sandy shallow soils)**	Mod. (wood stave sewer has a role)	4	**Mod.**	Diffusive
Shallow GW	**Non-Res. <10k ft2**	Full basement		Low	5	High steady direct	**50-50**
'Deep' GW	Non-Res. >100k	Crawlspace-dirt floor		None	6-**8**	High varying direction	

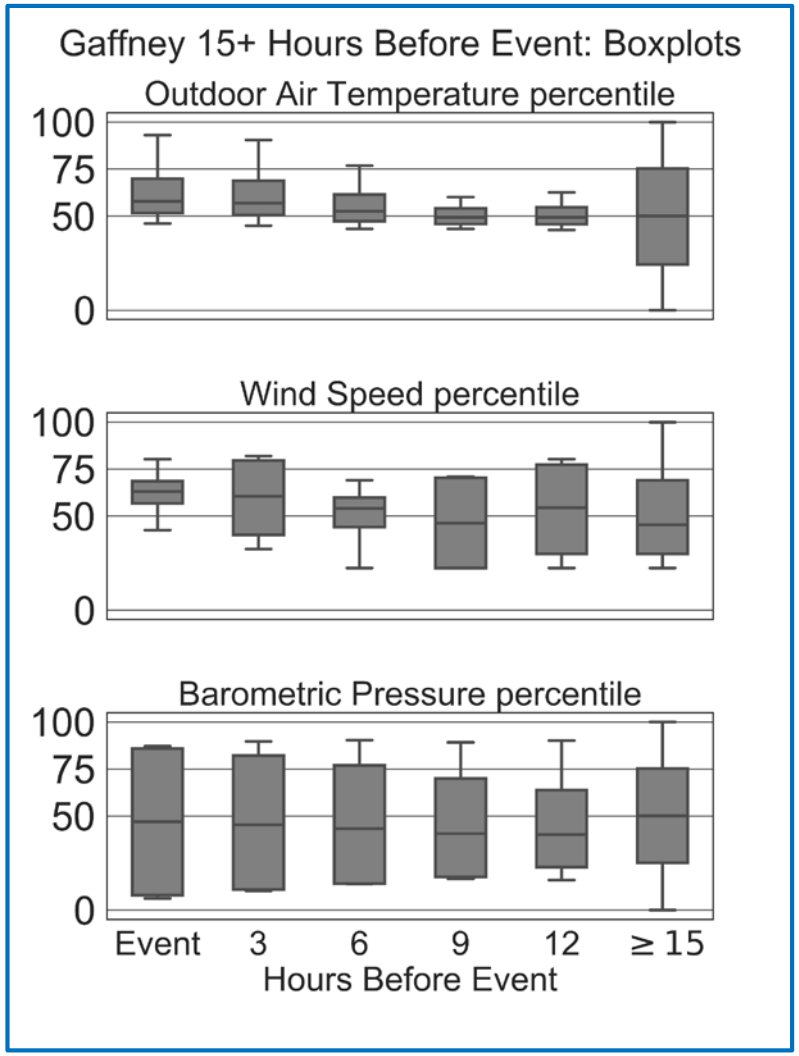
Book Store Study Site – Gaffney

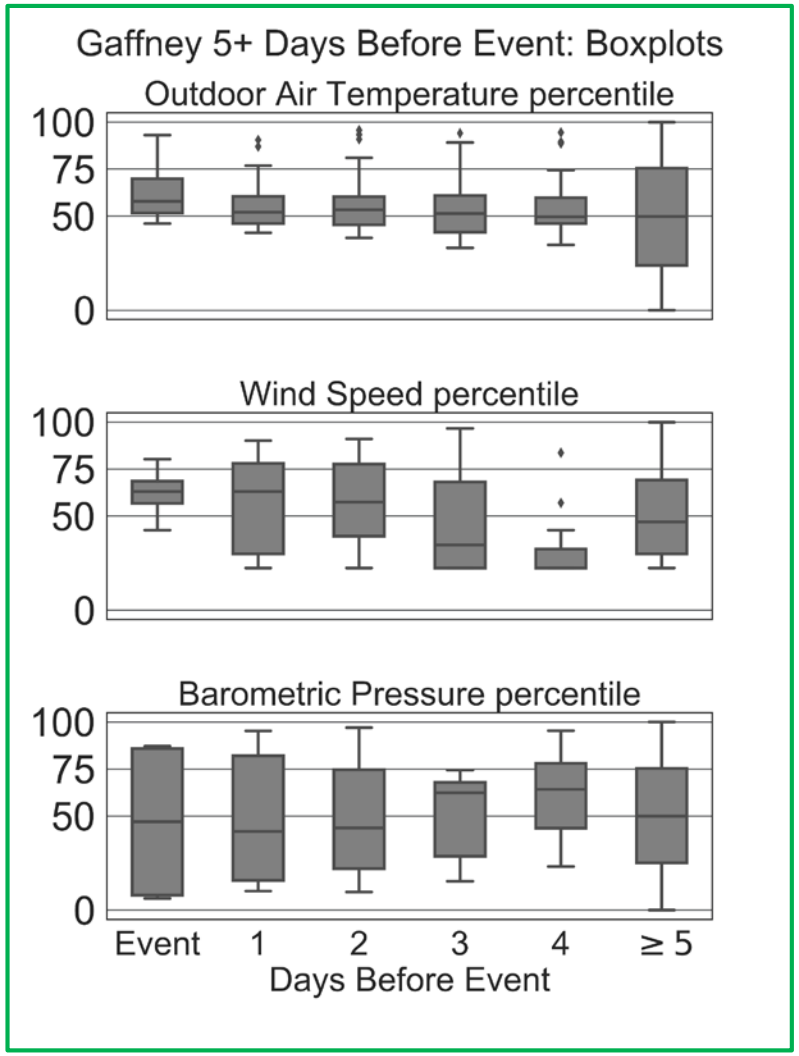
- Heated connected storeroom
- Slab-on-grade foundation
- Unventilated
- Former dry-cleaning facility - occupied by a bookstore at time of study
- Release through wood stave pipe connected to a dry cleaner
- Slab-on-grade, hot-water baseboard radiant heating system
- Max soil concentration = 1.3 mg/kg at 1.5-3.0 m bgs
- Max GW concentration = 1.3 mg/L at 5.3 m bgs

Wood stave pipe image from http://www.sewerhistory.org/photosgraphics/pipes-wood/ Courtesy of the Idarado Mining Company, Ouray, Colorado.

Indicators Preceding >85% PCE Indoor Air Observations at Gaffney, Fairbanks Alaska

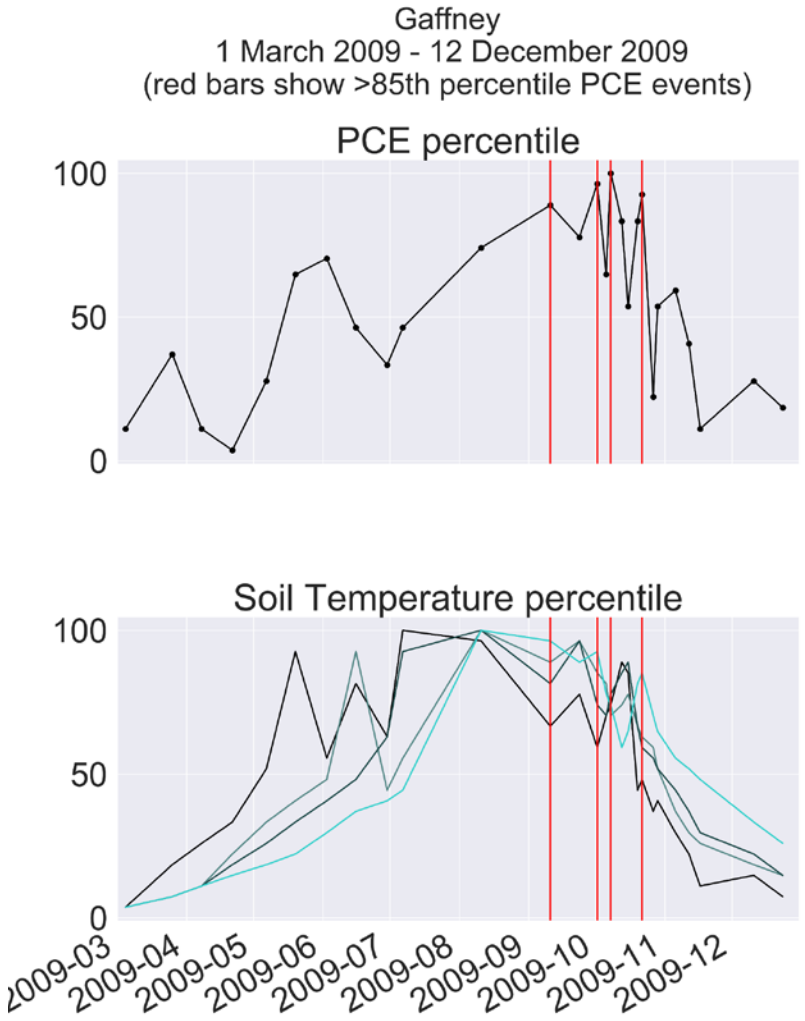


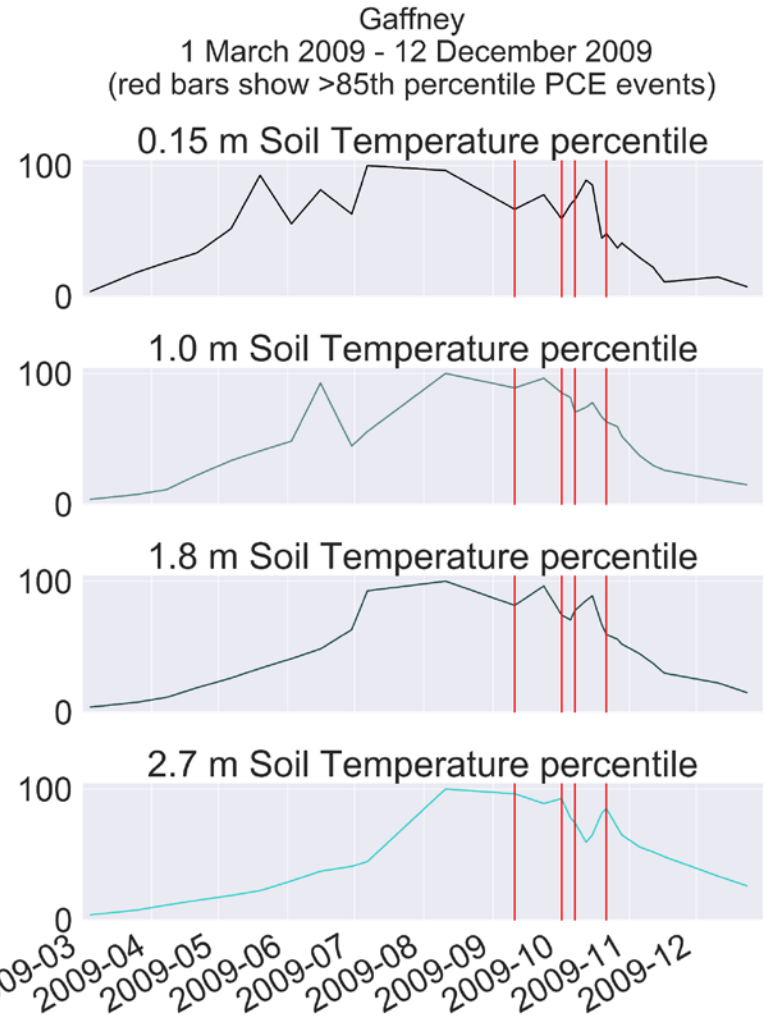




- Box and whisker plots summarize conditions proceeding four >85% events
- High VOC events are associated with slightly above normal air temperatures
- Barometric pressure absolute value not helpful.
- As indicated in the Barnes paper deep soil temperatures appear to be the best predictor (range at 2.7 m is 7.6 to 14.1 C) (Water table 4.2 to 4.9m)

Soil Temperature Preceding >85% PCE Indoor Air Observations at Gaffney, Fairbanks Alaska



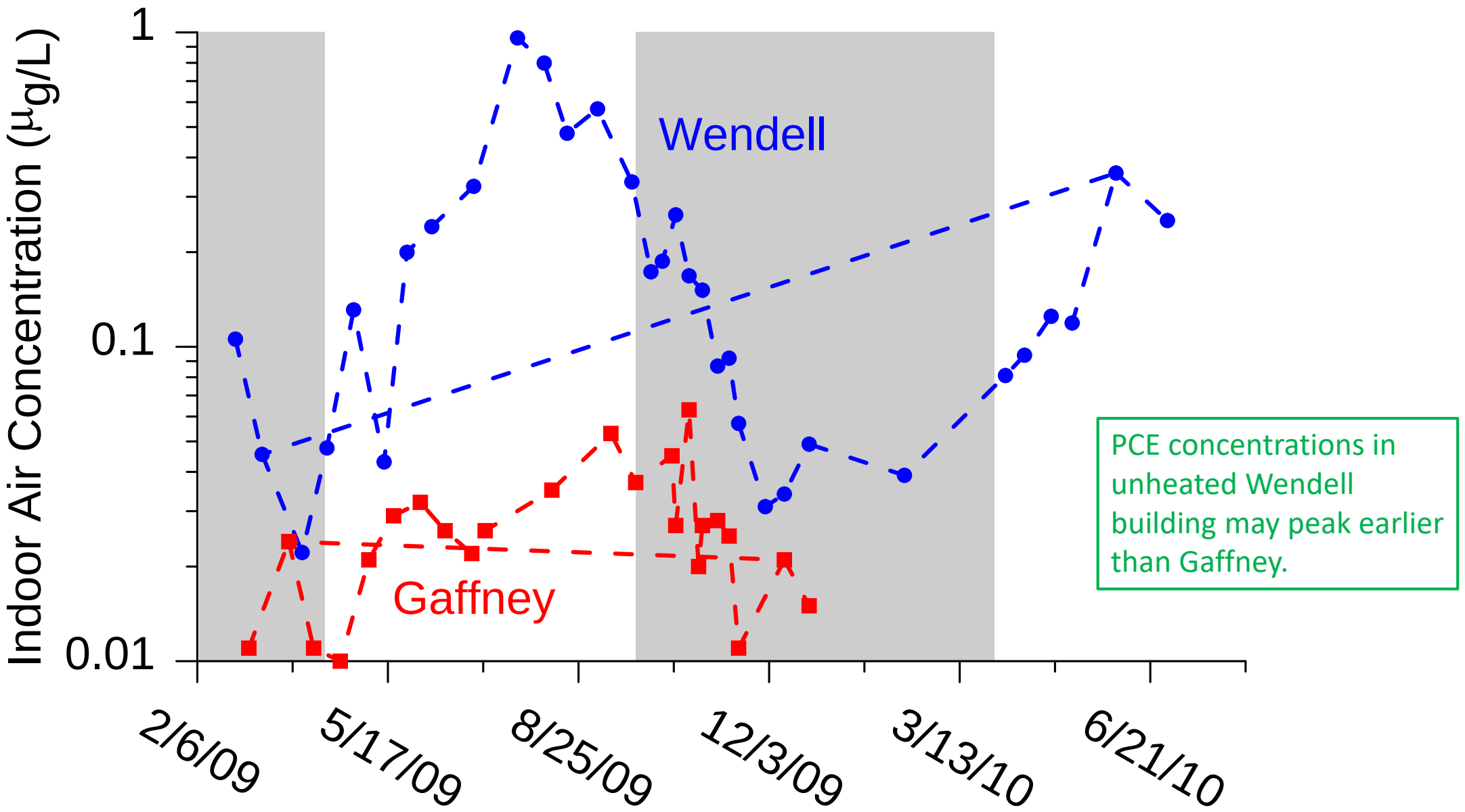


Peak PCE associated with later portion of annual soil temperature peak at Gaffney

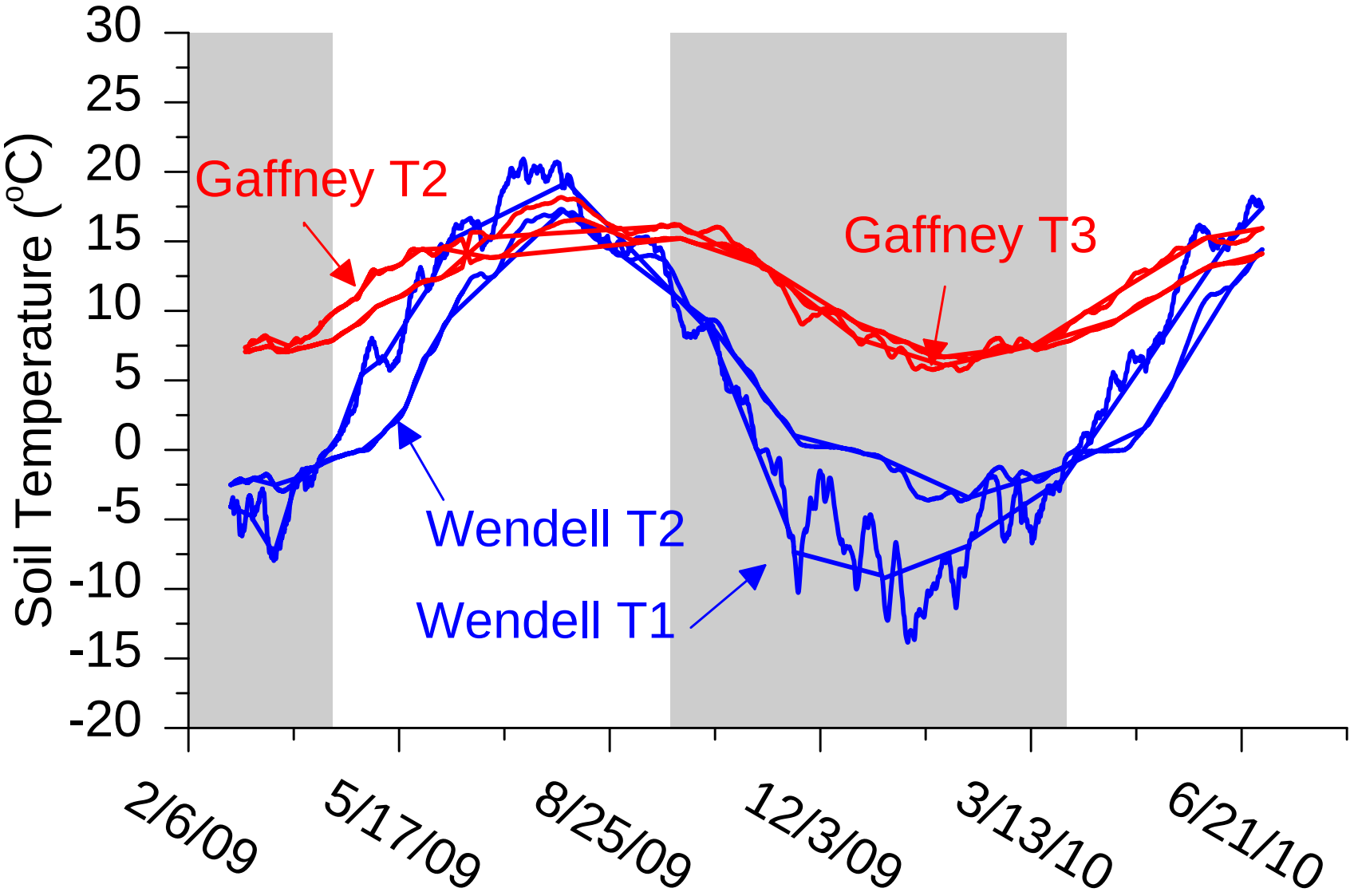
Comparison with other Site also in Fairbanks - Wendell

- Laundromat
- Unheated garage attached to heated building
- Slab on grade foundation with >1 centimeter cracks
- Passive ventilation
- Soil, wood stave sewer line and groundwater impacts with PCE

Results – Indoor Air Concentrations



Results – Soil Temperatures



Gaffney T2 is 0.98 m below slab
Gaffney T3 is 1.73 M below slab

Wendel T1 is 0.15 m below slab
Wendell T2 is 1 m below slab
Wendel tested room was unheated.

These depths were the ones most strongly correlated to the indoor VOC concentrations in the original paper's analysis.

For More Information

- Barnes, David L., and Mary F. McRae. "The predictable influence of soil temperature and barometric pressure changes on vapor intrusion." *Atmospheric Environment* 150 (2017): 15-23.
- *Quantifiable Building and Environmental Factors Influencing Vapor Intrusion;* Presentation at AEHS Fall Conference 2019; David Barnes, University of Alaska Fairbanks https://iavi.rti.org/workshops.html