

## **EPA Vapor Intrusion Workshop**

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

### Moffett Field Building 15-1 Case Study

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# Moffett Field Building 15 - Menu of CSM scenariocategories

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 SFR Mod. 2k	Slab-on- Grade	Continuous horizontal/ permeable	High	1-3	Low	Advective
Deep Soil	Legacy Urban Multi- Family	Split level – SoG & basmt	Discontinuous - impermeable	Mod.	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	

### Conceptual Site Model (From <a href="https://rmcs-1.itrcweb.org/6-2-moffett-mew-regional-plume-california/">https://rmcs-1.itrcweb.org/6-2-moffett-mew-regional-plume-california/</a>

USEPA. 2012f. Supplemental Sitewide Feasibility Study, Middlefield-Ellis-Whisman Superfund Study Area. USEPA Region 9.)



# Building 15

• 11,900 square foot,



- Steam heated with air conditioning, two HVAC zones
- Portions occupied 24 hr / 7 d
- Main portion and west wing office space; HVAC equipment and garage in east wing
- HVAC adjusted in May 2003 to increase outside air supply, reportedly reducing TCE in indoor air





## Indicators Preceding >95<sup>th</sup> Percentile Events Location 15-1



Key Point: High VOC concentration events tend to occur at lower temperature and with calm winds.

Box and Whisker Plots Compile Results from 8 Events

#### Moffett 5+ Days Before Event: Boxplots











Daily cis-1,2-DCE Indoor Concentrations Building 15

 Peak concentrations December 2003 to March 2004



New plot created from historical data

# Daily TCE Indoor Air Building 15

 Peak primarily between
September
2003 and
February
2004



New plot created from historical data

# Temporal Variability of Indoor Air By Month



**Outdoor Station A17** 



Key Point: Large variance in outdoor air concentrations within single month, modest temporal variability within a single month for indoor air.





Possible associations between BP change and higher VOCs

New plot created from historical data

## Analysis/Conclusions from Original Brenner Paper

- "Measured indoor air concentration was further investigated by developing multiple linear regression models that accounted for the measured meteorological conditions as reflected in the average daily outdoor air temperature, atmospheric pressure, wind speed, and wind direction. ...
- These same four meteorological parameters had little or no effect on the measured TCE concentrations. At five locations (15-1, 15-2, 17-1, A17, and B258) none of the four meteorological parameters had a significant effect on the measured concentrations.
- At the remaining five locations (17-2, 16-1, 16-2, 20-1, 20-2) the primary meteorological parameters affecting the measured indoor TCE concentrations varied by location. Outdoor temperature and wind speed seemed to have the greatest impact on the greatest number of locations."

# **Observations from New Plots**

- Low temperature appears correlated with VOCs
- Possible visual associations between pressure swing events and high VOCs
- 8 hr samples appear to show higher peak concentrations than 24
- >95% VOC concentrations associated with lower than average wind speeds.

## References

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- Brenner, D. and M. Walraven "Revised Human Health Risk Assessment NASA Research Park Moffett Field, California July 28, 2003 " https://www.sec.gov/Archives/edgar/data/1664703/000119312518190488/d96446dex106.htm
- Haley and Aldrich 2009 "Final Supplemental Remedial Investigation Report for Vapor Intrusion Pathway Middlefield-Ellis-Whisman Study Area, Mountain View and Moffett Field, California, June. <u>https://www.navfac.navy.mil/niris/SOUTHWEST/MOFFETT\_FIELD\_NAS/N00296\_003903.PDF</u>
- Haley and Aldrich 2009 "Final Supplemental Feasibility Study for the Vapor Intrusion Pathway Middlefield-Ellis-Whisman Study Area; June 29, 2019 <u>https://semspub.epa.gov/work/09/2324674.pdf</u>
- Haley & Aldrich, 2011 "Site-wide Vapor Intrusion Sampling and Analysis Work Plan for Response Action Testing" September 29. <u>https://semspub.epa.gov/work/09/100002742.pdf</u>
- Mactec Engineering and Consulting Inc. 2005 "Report on Long-term Indoor Air Quality Monitoring; Buildings 15, 16, 17, 20, n-210 and N243" NASA Ames Research Center, Moffett Field California
- Mills, William B., Sally Liu, Mark C. Rigby, and David Brenner. "Time-variable simulation of soil vapor intrusion into a building with a combined crawl space and basement." *Environmental science* & *technology* 41, no. 14 (2007): 4993-5001.
- Noreas for NAVFAC "Draft 2019 Installation Restoration Site 28 Air Sampling and Vapor Intrusion Tier Response Evaluation Report, July 2019 https://semspub.epa.gov/work/09/100018154.pdf