Avoiding Vapor Mitigation at Stanford Research Park Housing
Palo Alto California

By Lenny Siegel
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The university-owned Stanford Research Park, in Palo Alto, California, is the global model for collaboration between research universities and high-tech industry. Known as the Stanford Industrial Park during my rowdy days at Stanford in the 1960s, its factories, laboratories, and offices spawned the "community of technical scholars" now known as Silicon Valley.

It is also the birthplace of the notorious jobs-housing imbalance, which to this day props up astronomic housing prices and congests local roadways. A 1960s survey of Park employees showed that 45 percent lived south of Mountain View or North of Redwood City. In 2011 Palo Alto had 92,000 jobs and only 30,000 employed residents.

As a campus activist, I organized for balanced growth as early as 1970, and decades later, in 2014, I was elected to the City Council in next-door Mountain View on a platform of building housing in high-tech employment centers. So I was pleased in 2015 when I learned that Stanford was finally planning to build housing in the Research Park. The University plans to construct 180 new single-family homes, duplexes, and condominiums for Stanford faculty on three university-owned parcels along California Avenue.

Looking North across 1601 California Avenue

University Terrace sits across California Avenue from College Terrace, a two-block wide residential sliver between the Research Park and Stanford's academic campus. It's an older

neighborhood, with normal-sized lots and homes, but because of its location the lowest on-line home price listing today is $2.5 million! Most of the residents are well educated. When I toured the site with neighbors, we were approached by a couple looking for Facebook founder Mark Zuckerberg's former house.

Since the Research Park is home to multiple contamination sites and groundwater plumes, I was not surprised to read, in mid-December 2015, "A discovery of toxic vapors in the middle of a construction site has prompted Stanford University to redesign portions of its new faculty-housing development [at 1601] California Avenue." I met with residents who lived just across the street, and together we obtained voluminous electronic documents generated by Stanford, its consultants, and the California Department of Toxic Substances Control (DTSC).

The 8.5-acre site was first occupied for Granger and Associates in 1962, followed by Hewlett-Packard/Agilent, Facebook, and biotech firm Theranos. Stanford demolished the buildings in 2015. Hewlett-Packard has been responsible for past cleanup activities on site, but even though Stanford owned the property when the toxic releases occurred, it is addressing the contamination under a Voluntary Cleanup Agreement with DTSC.

Stanford's consultants have had trouble finding any shallow groundwater at the site. At the one location where they found it, it measured 45 parts per billion TCE. As the figure below shows, they have documented TCE in 25-foot deep soil gas at levels as high as 190,000 $\mu g/m^3$. These hotspots are what led Stanford to reconfigure the housing footprint, creating a buffer of 50 feet between the worst soil gas measurements and the planned homes. The *Supplemental Investigation and Risk Assessment* states:

> The source of the TCE appears to be a sump located in former Phase 1 building and potentially a chemical storage area to the southeast. TCE has migrated laterally from these areas, but the affected area is constrained by significantly lower concentrations in relatively short distances (less than 50 feet). The migration of TCE follows the more permeable sand channels, which are not contiguous throughout the Site. Migration of TCE beyond these channels is limited as shown by significantly lower detections of TCE around the perimeter and in other areas of the Site. Based on the results of this focused HHRA, there is no public health risk associated future residential development of the Site based on the layout of houses as presented in the development plan…

Appendix G of the same report adds the following. "SG" identifies soil gas sampling locations.:

> Given the significant density of soil and soil vapor samples and our understanding of Site lithology, a 50-foot buffer for restricting residential redevelopment from soil vapor sample locations SG-32, SG-33, SG-34, SG-35, and SG-40 is proposed. The protectiveness of this buffer is demonstrated by low concentrations of VOCs measured in soil vapor at locations in close proximity to these five soil vapor sample locations.

Relying on an advanced version of the Johnson and Ettinger model, Stanford's consultants, supported by DTSC, estimated soil-gas-to-indoor-air attenuation factors at various depths. They then calculated soil gas screening levels for TCE that included 11,000 $\mu g/m^3$at 3 feet and 51,000 $\mu g/m^3$ at 14 feet.

For example, on this basis they consider a maximum reading of 14,400 at SG-14, 15 feet below grade at one of the proposed home footprints, acceptable. The row of buildings where SG-14 is located is shown as about 50 feet from SG-40, where TCE was measured at 170,000 $\mu g/m^3$ and 16.5 feet and 190,000 $\mu g/m^3$ at 25 feet. They conclude that SG-40's high levels were caused by vapor migration from the former sump 250 feet to the south, but the data shows much lower TCE vapor levels at SG-27 and SG-29, between SG-40 and the sump.

In my view, they do not have enough data to justify either their assumptions about the consistency of the lithology or their certainty about the direction and magnitude of TCE migration. I do not see how they can argue with certainty that the construction of a building will not significantly influence the soil gas profile. They do not really know that they have identified all the TCE sources. And they are relying on a model to estimate unusually low attenuation factos.

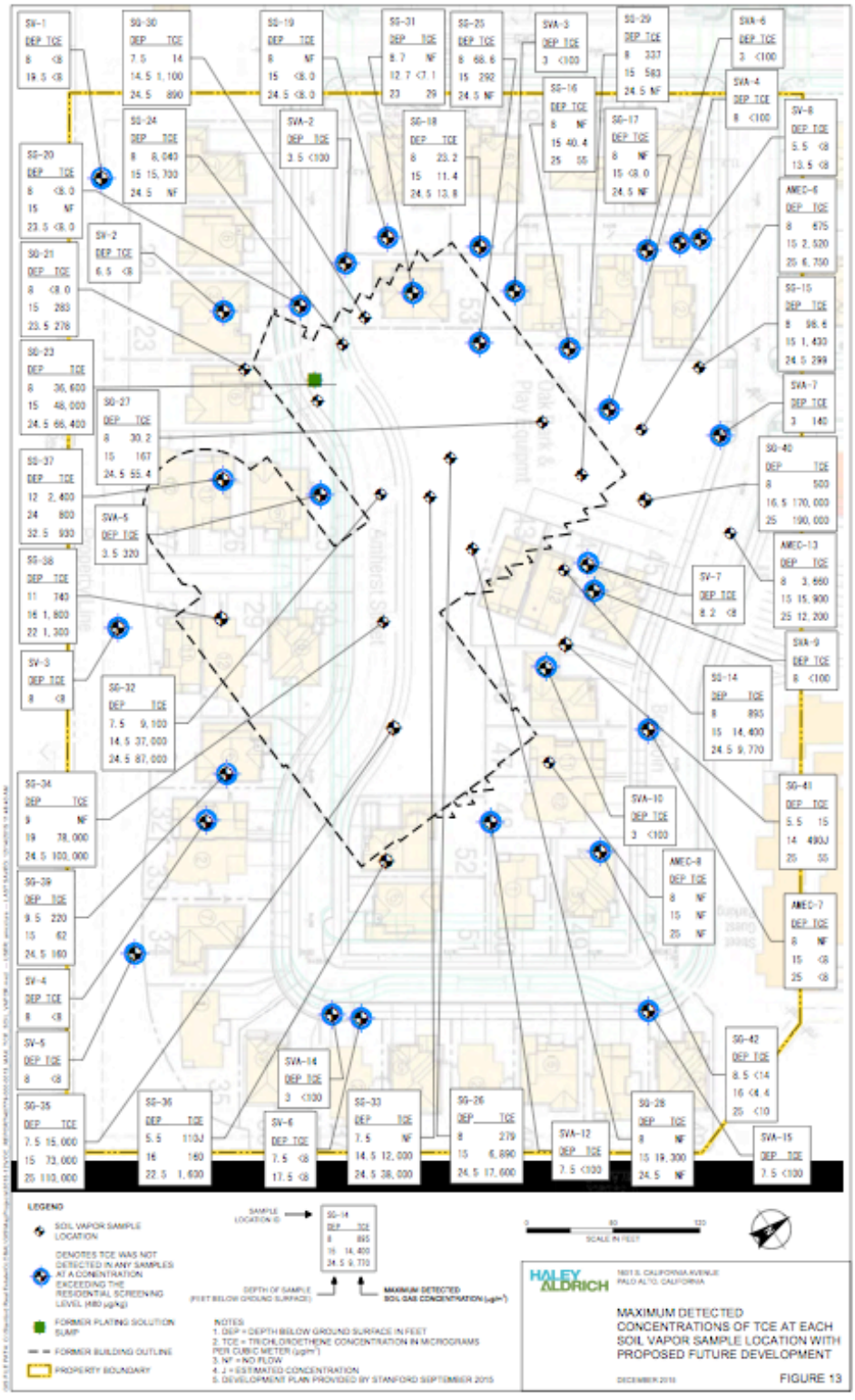
Yet they say there is no unacceptable risk. There is no plan for either active depressurization or passive venting, which DTSC would require if it recognized the vapor intrusion potential. Instead, Stanford is voluntarily installing vapor barriers and crack-resistant slabs, strategies not considered to be acceptable stand-alone mitigation strategies by DTSC where mitigation is required.

Furthermore, Stanford and DTSC have dismissed neighbors' concerns that contamination might be migrating into the neighborhood. Based on prevailing groundwater flows, I agree that vapor exposures in College Terrace are not likely, but I don't believe that enough groundwater or vapor sampling has been done to rule it out.

Finally, despite the remaining vapor contamination and at least one shallow groundwater detection with TCE at 45 parts per billion, no active remediation is planned, Under the Voluntary Cleanup Agreement, there has been no formal comment period. However, DTSC, Stanford, and Stanford's consultants met with representatives from the College Terrace Residence Association (CTRA) and me on January 6. The explained that a planned land use covenant would be released for formal public comment.

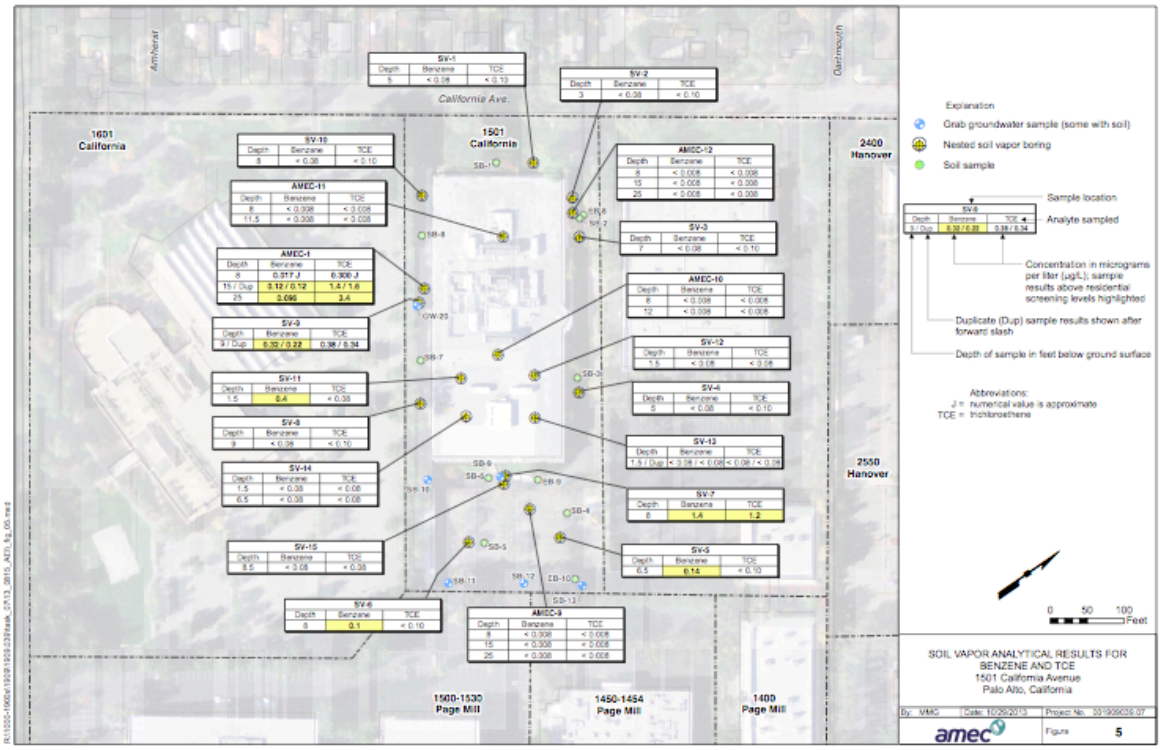
At the end of January CTRA submitted its own comments along with a memo I prepared for them, found at http://www.cpeo.org/pubs/CPEO1601California.pdf. We called for mitigation, remediation, and sampling in the neighborhood.

In mid-March DTSC responded to both critiques, defending Stanford's plan. See http://www.cpeo.org/pubs/DTSC1601California.pdf. They repeated their assertion that the site is dominated by low permeability clay that limits the flow of water and vapors. And they've concluded that soil vapor extraction is unlikely to help remediate the site.



Soil Vapor Data for 1601 California

In my comments, I had questioned their previous claim that TCE contamination was isolated. I noted that TCE was found in soil vapor at 3,400 µg/m^3 at a depth of 25 feet on the adjacent parcel (1501 California), also part of University Terrace, about 300 feet downgradient from the former sump that DTSC and Stanford considers the primary TCE release site. (See the figure below.) In fact, in its review of 1501 California, DTSC had attributed the groundwater and soil gas contamination found there to the 1601 California sump release. But in its response to my comments, DTSC simply repeated another Stanford consultant's conclusion "that it is likely that the presence of TCE in soil vapor at 1501 S. California Avenue is attributed to limited vapor migration from 1601 S. California Avenue."



Adjacent parcel (1501 California) Soil Vapor Data

Since TCE has moved 300 feet, either in aqueous or gaseous form, to the next property, I don't see how Stanford and DTSC can conclude that vapors cannot move 50 feet into homes, that an unprotective soil gas screening level of 11,000 µg/m^3 is justified by the presence of impermeable clay, and that the same clay lithology makes soil vapor extraction impractical as a remediation technology.

I recognize that DTSC and Stanford's consultants have more training and credentials than I do, but I don't think their assertion that vapors cannot possibly enter the new homes is air tight. Furthermore, we cannot expect communities—such as the College Terrace residents or

prospective occupants of the University Terrace project—to trust their health and property to complex models when there are reasonable, cost-effective alternatives.

I don't predict that unacceptable vapor intrusion will necessarily rise in the new housing, but it might. In nearby Mountain View, we would require that mitigation be built into the new construction. Active depressurization or passive venting with monitoring are good investments. Regardless of whose interpretation of the 1601 California Data is best, **erring on the side of *caution*, not *risk*, is a good risk management strategy.**