RESPONSE TO CENTER FOR PUBLIC ENVIRONMENTAL OVERSIGHT

March 18, 2016

SUBJECT: Response to Center for Public Environmental Oversight (CPEO) Comments

This document provides responses to questions raised by the Center for Public Environmental Oversight (CPEO) in its January 25, 2016, letter to the College Terrace Residents' Association (CTRA) regarding the presence of trichloroethene (TCE) in subsurface soils at the University Terrace development located at 1451, 1501, and 1601 S. California Avenue in Palo Alto, California. The CPEO letter was transmitted to the Department of Toxic Substances Control (DTSC) by CTRA on January 26, 2015. The responses and information provided herein were prepared by the DTSC; Stanford University, Office of Real Estate (Stanford), the property owner and developer; and its technical consultant, Haley & Aldrich, Inc. As subsurface chemical impacts primarily were detected at the 1601 S. California Avenue parcel and it is the focus of the current Preliminary Endangerment Assessment, this parcel is referred to by its address or as the "Site". References to the other parcels that comprise the University Terrace development are referred to by their address.

Our specific responses to the five questions (and sub-questions) provided by CPEO are below. CPEO's "top-level" questions are underlined.

1. <u>THE DECEMBER 2015 RISK ASSESSMENT UNDERSTATES THE RISK FROM TCE VAPOR INTRUSION</u>.

The human health risk assessment (HHRA) included in the Supplemental Investigation and Risk Assessment (SIRA) Report[1] was completed in accordance with guidelines provided by the U.S. Environmental Protection Agency (USEPA) and California Environmental Protection Agency (Cal-EPA). Following this guidance, the risk assessment was performed with both the cancer and non-cancer target indoor air concentrations.

CPEO states that the screening level for the concentration of TCE in soil vapor that was utilized in the Site evaluation is problematic because the default DTSC screening level is higher than that currently recommended by the USEPA. The default screening levels were used to provide an initial understanding of the data. The results for every soil vapor sample collected at the 1501 and 1601 S. California Avenue parcels were individually evaluated in the site-specific assessment, regardless of whether the result exceeds the default screening level. If a default screening level is exceeded, it does not indicate that a health risk exists, but rather that additional evaluation is warranted, such as additional sampling or risk characterization. With respect to the detections of TCE at the 1501 and 1601 S. California Avenue properties, a thorough Site characterization program and Site-specific risk assessment were performed.

Our response to CPEO's comment 1 is presented in further detail below.

[1] Haley & Aldrich, Inc., 2015, Revised Supplemental Investigation and Risk Assessment Report, 1601 S. California Avenue, Palo Alto, California, December 21.

After comparing Site sampling results to default screening levels, further evaluation of the vapor intrusion pathway was performed by comparing concentrations of volatile organic compounds (VOCs) measured in soil vapor to risk-based screening levels (RBSLs) that are protective of human health. The RBSLs were developed with Site- and depth-specific attenuation factors that incorporate soil physical properties measured at the Site and the specific sampling depth at each soil vapor probe location.

By design, the HHRA included a conservative evaluation of the vapor intrusion pathway. Levels of conservativism in the evaluation include, but are not limited to, the following:

- At locations that were sampled several times, the maximum concentration of VOCs measured in soil vapor at each sample point were evaluated in the HHRA.
- Future residents at the Site were assumed to occupy their homes 24 hours per day for 350 days a year for 26 years.

Site-specific risk-based screening levels were developed using target indoor air concentrations published by USEPA and DTSC to evaluate cancer risks and non-cancer adverse health effects.

To support the soil vapor fate and transport evaluation, an analysis was included in the HHRA to evaluate the sensitivity of the Johnson & Ettinger vapor intrusion model (J&E model) to physical soil properties and the heterogeneity of soil conditions at the Site (Appendix G, Section 8.3.2.2 of the SIRA Report). The results of the sensitivity analysis supported the conclusions of the risk assessment. In addition, a review of the near surface geology at the Site was performed, which supported the modeling performed in the HHRA.

2. STANFORD'S PLAN DOES NOT SUFFICIENTLY MITIGATE THE RISK OF VAPOR INTRUSION.

Stanford's proposed mitigation measures are protective of future University Terrace residents and there is no significant public health risk associated with this development. Mitigation measures, including but not limited to sub-slab vapor barriers, were incorporated into the development plan to provide an additional level of protection that is not required by DTSC. To be conservative, these measures were *not* included for risk calculations presented in the HHRA. Specifically, the following measures have been or will be implemented:

- Clean compacted (95% relative density) engineered fill material was placed on Site in the latter half of 2015 to raise grade up to 15 feet above current grade. Note that this material primarily was imported from the excavation to construct a subterranean structure at the adjacent 1501/1451 S. California Avenue parcels; soil at these parcels is documented as predominantly fine grained clay and silt. The fill material was tested for the presence of VOCs and other constituents prior to use.
- Homes, buffered away from the TCE-impacted areas, will be constructed with 10-inch thick post-tension slabs that are more resistant to cracking. Impacted areas overlying greater TCE

concentrations in soil vapor will be designated for outdoor recreational space, which is considered acceptable per USEPA guidance.[2]

- Future residents will not be permitted to alter the foundation slab of future homes based on codes, covenants, and restrictions (CC&Rs); Stanford will retain ownership of the land.
- Slab penetrations (e.g., pipes) will be sealed and the foundations will be constructed with vapor barriers designed to prevent indoor vapor intrusion.
- Utility corridors will be constructed with vapor plugs.

Stanford engaged external peer review of its findings and approach. Dr. Paul Johnson, an internationally renowned expert on vapor intrusion, has reviewed, evaluated and concurred with the Site conceptual model and Stanford's approach to address vapor intrusion. A copy of his letter stating his position is attached.

Our response to CPEO's comment 2 is presented in further detail below.

CPEO advocates the use of two specific mitigation measures, subslab depressurization and venting systems, at sites where there is "simply a potential for vapor intrusion." In contrast, USEPA or Cal-EPA recommend evaluating the potential for vapor intrusion by using multiple lines of evidence to develop a Site Conceptual Model to support informed risk management decisions.[2,3] USEPA recommends several risk management options for developing sites with the potential for vapor intrusion, including designating areas as recreational space or undeveloped landscape, and constructing buildings with vapor mitigation technologies. Similarly, DTSC recommends several options relative to the ranges of risks and hazards that were observed at the Site in the risk management framework included in the 2011 Vapor Intrusion Guidance[3] and 2011 Vapor Intrusion Mitigation Advisory.[4] In this case, additional data collection and risk characterization were performed, and potential risks to future residents were addressed with the reconfiguration of the development plan (i.e., impacted areas are designated for recreational space).

As described in the SIRA Report, a thorough characterization program was implemented at the Site to develop and test the Site Conceptual Model. At the 8.5-acre 1601 S. California Avenue parcel, 130 soil vapor samples were collected from 118 soil vapor probes installed at 51 locations in 2004 and from 2012 to 2015. To evaluate potential sources of VOCs to the subsurface, soil samples were collected at 16 locations beneath the former building slab and pavement and 11 samples of soil/residual sludge were collected from subsurface pipes during building demolition in 2015. Soil samples also were collected from 23 soil borings advanced to depths between 25 and 35 feet bgs where TCE-impacted soil vapor was observed (Section 4.2.4 of the SIRA Report). Finally, a detailed stratigraphic analysis of the

[2] USEPA, 2015, OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, Office of Solid Waste and Emergency Response, Publication 9200.2-154, June.
[3] DTSC, 2011, Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance), Final, October.
[4] DTSC, 2011, Vapor Intrusion Mitigation Advisory, Final, Revision 1, October.

unconsolidated fluvial (stream and floodplain deposits) sediments was performed using boring log data to construct geologic cross sections.

The following Site Conceptual Model was developed based on the results of the supplemental investigation activities and historical Site data, including the stratigraphic analysis:

- The source of the TCE appears to have been a plating solution sump located in the 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.
- The migration of TCE follows the more permeable and discontinuous channels
- Migration of TCE beyond these channels is limited by the denser, more clayey soil conditions that predominantly characterize the Site, as shown by significantly lower detections of TCE around the perimeter and in other areas of the Site.

Finally, a HHRA was conducted to evaluate potential human health risks with respect to future residential development. Based on the results of this HHRA, there is no significant public health risk associated with future residential development of the Site based on the layout of houses as presented in the University Terrace development plan. As additional protective measures, several vapor intrusion mitigation measures will be in place at the University Terrace development. These measures were *not* included in the HHRA evaluation (that is, conditions at the Site were evaluated assuming the absence of protective mitigation measures). Specifically, the measures listed above have been or will be implemented.

CPEO further states that "Without spending a lot of time calculating attenuation factors and assessing risk, Stanford should design mitigation into all the new housing, not just at 1601 S. California." As stated in its letter, this position is supported with CPEO's experience with the "Middlefield-Ellis-Whisman (MEW) Superfund Study Area in nearby Mountain View. At the Site, a detailed characterization program was implemented to support a Site-specific vapor intrusion evaluation. A comparison of the conditions at the Site and the MEW Study Area is presented in the attached Table 1. In summary, the MEW Study Area is not comparable because the geologic and hydrogeologic conditions differ from the 1601 California Avenue Site. At the MEW Study Area, there is continuous water-bearing stratum at relatively shallow depths, VOC impacts to groundwater (including TCE) are sourced from multiple industrial sites and cover an area of approximately 2 miles long by 1.2 mile wide. In contrast, no continuous water-bearing zone has been identified in the upper 45 feet of the 1601 California Avenue Site and the VOC source to soil vapor impacts is localized.

Finally, CPEO indicates that vapor barriers will be used at the Site as a "stand-alone vapor remedy." However, remediation was performed at the Site to remove historic TCE sources. The source of TCE in the subsurface, the former plating solution sump was excavated and removed on March 19, 2015, and all subsurface piping, including process, sewer, storm drain lines, subterranean structures and foundation elements were removed in March and April 2015. Essentially, all potential historic sources of TCE have been removed from the Site and there is no significant risk to public health associated with the University Terrace development plan. Mitigation measures, including but not limited to sub-slab vapor barriers, were included in the development plan to provide an additional level of protection.

3. THE TECHNICAL DOCUMENTS FOR THE THREE DEVELOPMENT PARCELS DO NOT ADEQUATELY EXPLAIN THE SOURCES, FATE, AND TRANSPORT OF TCE AT THE SITE.

As discussed above, a Site Conceptual Model that explains the potential sources of TCE in soil vapor, distribution, conditions that result in its stability, and barriers to its migration was developed and tested with a thorough Site characterization program. A discussion of the Site Conceptual Model is presented in the Section 7.0 of the SIRA Report.

Our response to CPEO's comment 3 is presented in further detail below.

CPEO indicates that the "identification of the **TCE source** is unconvincing." However, there is ample evidence that the primary source of TCE-impacted soil vapor at the Site was the former plating sump:

- TCE was detected in soil samples collected from borings advanced in 1990 and 1991 at the former location as part of closure activities;
- In 2015, TCE was detected in a residual sludge sample collected from a pipe exiting from the former plating sump at a concentration of 2,200 micrograms per kilogram (µg/kg); and
- The highest concentrations of TCE in soil were detected in samples collected from borings advanced in the vicinity of the former plating sump (EX4-04 and EX4-06) at depths between 25 and 35 feet bgs. The maximum detected concentration of TCE was detected in the 35-foot sample from boring EX4-06 at a concentration of 640 µg/kg, which is below the DTSC residential screening level.

At soil vapor probes located within the footprint of the former chemical storage area (SG-32, SG-33, SG-34, and SG-35), TCE was detected at relatively high concentrations in soil vapor (ranging from 9,100 to 110,000 µg/m^3, with the highest concentrations detected at SG-34 at 15 feet bgs [100,000 µg/m^3] and SG-35 at 25 feet bgs [110,000 µg/m^3]). TCE was detected at low concentrations (4.3 to 16 µg/kg) in shallow soil samples (5 feet bgs) collected at this area (SG-32, SG-34, and SG-35). TCE may have migrated via preferential pathways from the former plating sump to these areas. TCE is heavier than air and water, and migrates downward in the soil column along preferential pathways.

In addition, soil samples were collected beneath the slab and pipes during the removal of the building slab and associated subsurface utilities in March and April 2015. Specifically, soil or residual sludge samples were collected where 1) soil or sludge was identified within a subsurface pipe, 2) total VOCs were measured in soil with a portable photo-ionization detector (PID), or 3) former operational features (e.g., utility and process water lines) were previously identified. Sixteen soil samples were collected at beneath the building slab and pavement and an additional 11 samples of soil/residual sludge were collected directly from subsurface pipes during building demolition in 2015 to evaluate potential sources of VOCs to the subsurface. TCE was detected at a concentration of 2,200 micrograms per kilogram (µg/kg) in one sample (PVC-PIPE) of residual sludge collected directly from a polyvinyl chloride (PVC) pipe at the former plating sump, indicating the presence of TCE at the sump. TCE was not detected in any other soil samples collected directly beneath the building slab or pavement, or any residual sludge

samples. Finally, it is important to note that no potential sources of VOCs to the subsurface were identified at the 1451 and 1501 S. California Avenue parcels.

In summary, the distribution of TCE at and near these potential source areas is well-defined.

4. GROUNDWATER, SOIL, AND SOIL GAS CONTAMINATED WITH TCE SHOULD BE REMEDIATED AT THE SITE.

As stated above, remediation to remove all potential sources of TCE was performed at the Site. The source of TCE in the subsurface, the former plating solution sump was excavated and removed on March 19, 2015. In addition, during building demolition activities all subsurface piping, including process, sewer, and storm drain lines were removed, as well as all subterranean structures and foundation elements.

Deep excavation at the Site is not warranted as soil analytical results did not indicate the presence of a significant source of TCE in soil; rather, it is the soil vapor that is identified as the media of concern at the Site. Based on the proposed site layout of the future redevelopment project, the results of the HHRA in conjunction with the University Terrace development plan indicate no significant public health risk on Site or to the surrounding community. Additionally, excavation is not practical due to 1) the considerable depth at which excavation could be required (greater than 35 feet below the pre-development grade[5]) to remove vapor-impacted soil, and 2) the negative impacts to the surrounding neighborhood. These negative impacts include increased traffic, dust generation, noise, and a much longer project schedule associated with this type of excavation.

Active remediation technologies, such as soil vapor extraction (SVE), would not likely be effective at this Site. SVE, a proven technology for remediating coarser-grained soils, is not practical at this Site due to the clayey nature of the subsurface lithology which inhibits air flow between soil particles. The lack of air flow in the subsurface at the Site was demonstrated during Site investigation as no flow conditions[6] were encountered during sample collection on at least one occasion at more than 25 percent of the soil vapor sample probes (that is, a sample could not be obtained due to the lack of soil vapor flow).

A Site-specific HHRA was conducted to evaluate potential human health risks with respect to future residential development. Based on the results of this focused HHRA, there is no significant public health risk associated with future residential development of the Site based on the layout of houses as presented in the University Terrace development plan. In addition, no public health risk was identified for the surrounding community. Therefore, there are no requirements for remediation.

Finally, regarding the process that DTSC is following for this Site, the DTSC has reviewed the Supplemental Investigation and Risk Assessment (SIRA) report for the site, and has concluded that site characterization is complete and the risk assessment appropriately considers site conditions relative to

[5] Note that the site elevation has been raised by up to 15 feet over much of the area where the higher TCE concentrations in soil vapor were detected.
[6] "No flow conditions" refers to the inability to maintain a minimum soil vapor sampling flow rate.

public safety and future site development. With respect to the recommended formal finding, a summary document to conclude the Preliminary Endangerment Assessment that has been conducted for the Site will be prepared and reviewed and approved by DTSC. The summary document will summarize the findings and conclusions from Site characterization reports, and provide the basis for the proposed action to address the area of the Site where soil vapor has been found to be significantly impacted with TCE. Land use restrictions are contemplated as an element of the proposed action since the area currently cannot be used for unrestricted land use. The specific land use restrictions that are proposed for the area will be identified and defined in the summary document. There will be a public notice prior to a land use covenant or other mechanism with land use restrictions being put in place, which will give CPEO an opportunity to provide input.

5. SAMPLING SHOULD BE CONDUCTED TO ENSURE THAT RESIDENTS OF COLLEGE TERRACE ARE NOT AFFECTED BY TCE CONTAMINATION FOR THIS SITE.

Data collected at the Site adequately characterizes the extent of migration of soil vapor impacted by TCE. Thus, no additional sampling is necessary.

Based on the sampling and subsequent evaluation conducted for the University Terrace site, soil vapor with TCE at concentrations exceeding DTSC residential screening levels is more than 200 feet east of California Avenue and does not extend to California Avenue. A figure that shows soil vapor sampling locations parallel to California Avenue and highlights those locations where risk levels are below the DTSC default residential screening level for TCE is attached (Figure 1). This figure additionally illustrates those locations where concentrations were above screening levels but lower than the *de minimis* incremental risk level of one in one million (1×10^{-6}) excess cancer risk, based on the Site-specific risk assessment performed for the Site.

Additionally, as shown on Figure 1, soil vapor sampling was conducted across the 1601 S. California Avenue site in each compass direction to evaluate the distribution of TCE in soil vapor. Soil vapor samples that did not contain detectable concentrations of TCE also were collected to the west, north, northeast, and east of data point AMEC-1 on the 1501 S. California Avenue parcel (note that not all of these soil vapor sample locations are included on the figures presented in the appendix to the CTRA letter).

The College Terrace community is safe with respect to potential vapor intrusion to constituents detected in soil vapor at University Terrace based on several lines of evidence:

- The lithology (geologic units) of primarily fine-grained units along California Avenue inhibits migration of soil vapor. A cross-section parallel to California Avenue with concentrations of TCE measured in soil vapor is presented as Figure 2.
- The investigation data consistently indicate the absence of TCE above screening levels outside of the operational and nearby area on the 1601 S. California Avenue site.
- The release of TCE into the subsurface occurred at least several decades ago and all of the potential sources of TCE (e.g., plating solution sump) were removed during Site demolition. Ten

years of soil vapor data at shallow depths have consistently demonstrated that concentrations of TCE are below residential screening levels – levels designed to be fully protective of human health and the environment - except at some locations within and near the former operational area of the Site.

Attachments:

Table 1	Comparison of Site Conditions, MEW Superfund Study Area, Mountain View and 1601 S. California Avenue, Palo Alto
Figure 1	Soil Vapor Sample Locations
Figure 2	Cross Section X to X'

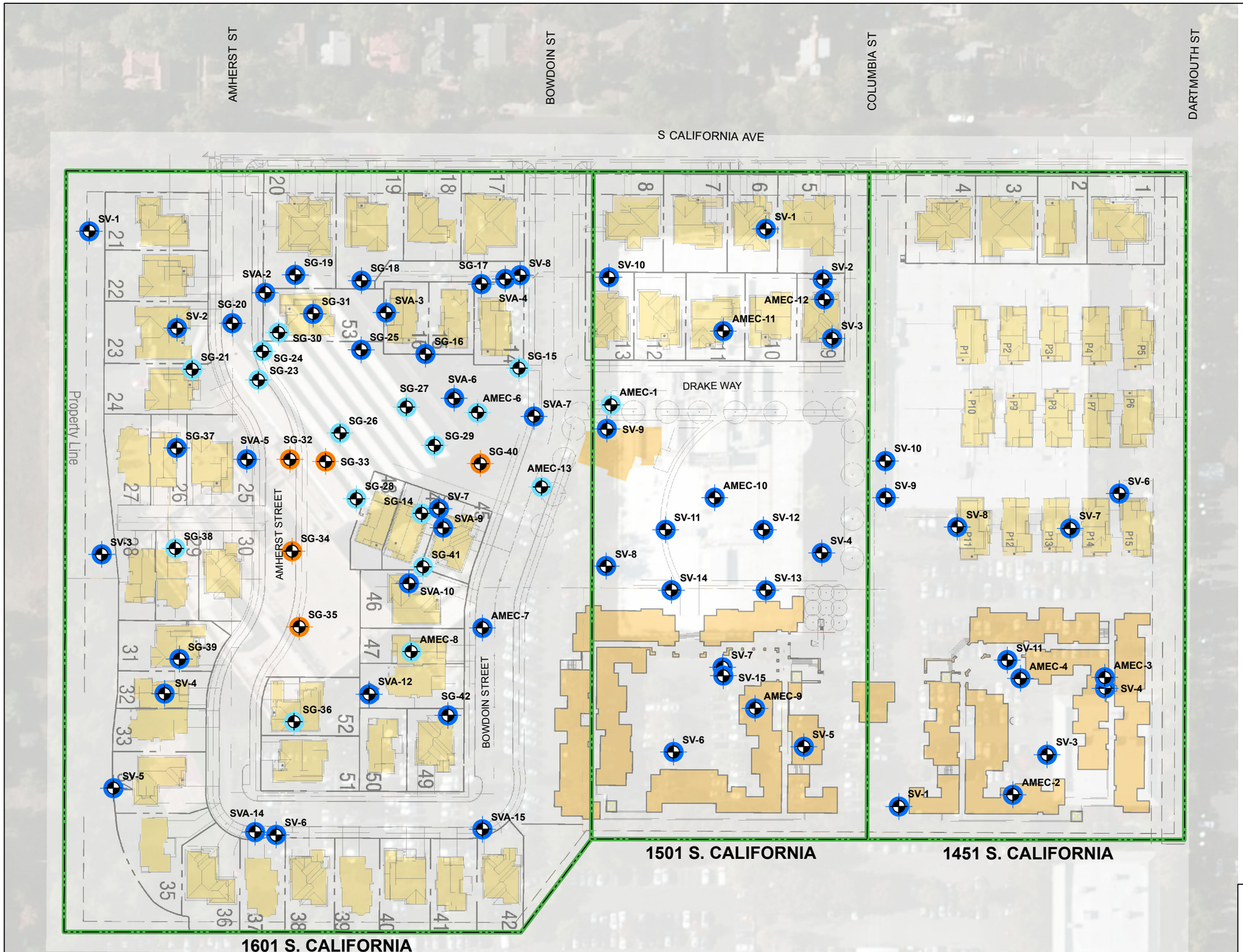
- Letter from Dr. Paul Johnson to Annette Walton of Stanford dated January 5, 2016

Table 1
Comparison of Site Conditions
MEW[1] Superfund Study Area, Mountain View and 1601 S. California Avenue, Palo Alto

	MEW Superfund Study Area	1601 S. California Avenue
Depositional Environment	Distal edge of Santa Clara Valley Alluvial Plain and Bay Margin.	Upland margin of the Santa Clara Valley Alluvial Plain.
Generalized Lithology	Gravel, sand, silty and clayey gravels and sands; silts and clay.	Clay, clayey sand, and subordinate sand with gravel and clay.
Depth to First Water-Bearing Zone	Approximately 10 to 30 feet bgs.	Greater than 45 feet bgs, although some lenses of perched groundwater have been observed at shallower depths.
VOC Source(s)	Regional - multiple sources • 14 individual sites (some with multiple addresses) contribute to the regional groundwater plumes.	Localized • single facility
VOCs of Concern	Multiple VOCs, including but not limited to TCE, tetrachloroethylene (PCE), cis-1,2- dichloroethene, trans-1,2-dichloroethene, and vinyl chloride.	TCE
VOC Concentrations in Groundwater	TCE – varies; over 10,000 µg/L in certain source areas.	TCE – 45 µg/L (maximum)
Soil Vapor Plume(s) area	Approximately 2 miles long and ½-mile wide.	Local impact limited to on-site former operational area approximately 38,600 square feet (< 1 acre)

VOC = volatile organic compounds
bgs = below ground surface
VI = vapor intrusion
µg/L = micrograms per liter

[1] Middlefield- Ellis-Whisman (MEW) Study Area is comprised of three National Priorities List (NPL) or Superfund Sites as well as several other facilities and portions of the former Naval Air Station Moffett Field Superfund site. The MEW Superfun Area is overseen by the U.S. Environmental Protection Agency. Detailed information regarding the MEW Study area can be found at http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/ViewByEPAID/CAD982463812



LEGEND

- DENOTES TCE WAS NOT DETECTED IN ANY SAMPLES AT A CONCENTRATION EXCEEDING THE RESIDENTIAL SCREENING LEVEL (480 µg/m^3)
- DENOTES TCE WAS NOT DETECTED IN ANY SAMPLES AT A CONCENTRATION EXCEEDING AN ESTIMATED LIFETIME EXCESS CANCER RISK OF ONE-IN-A-MILLION (1X10^{-6})
- DENOTES TCE WAS DETECTED IN AT LEAST ONE SAMPLE AT A CONCENTRATION EXCEEDING AN ESTIMATED LIFETIME EXCESS CANCER RISK OF ONE-IN-A-MILLION (1X10^{-6})
- PROPERTY BOUNDARY

NOTES

1. THE 1451, 1501, AND 1601 S. CALIFORNIA AVENUE PARCELS COMPRISE THE UNIVERSITY TERRACE PROJECT.
2. DEVELOPMENT PLAN SOURCE: WILLIAM HEZMALHALCH ARCHITECTS INC., REVISED SITE PLAN, 9-23-2015.
3. µg/m^3 = MICROGRAMS PER CUBIC METER
4. AERIAL IMAGERY SOURCE: ESRI

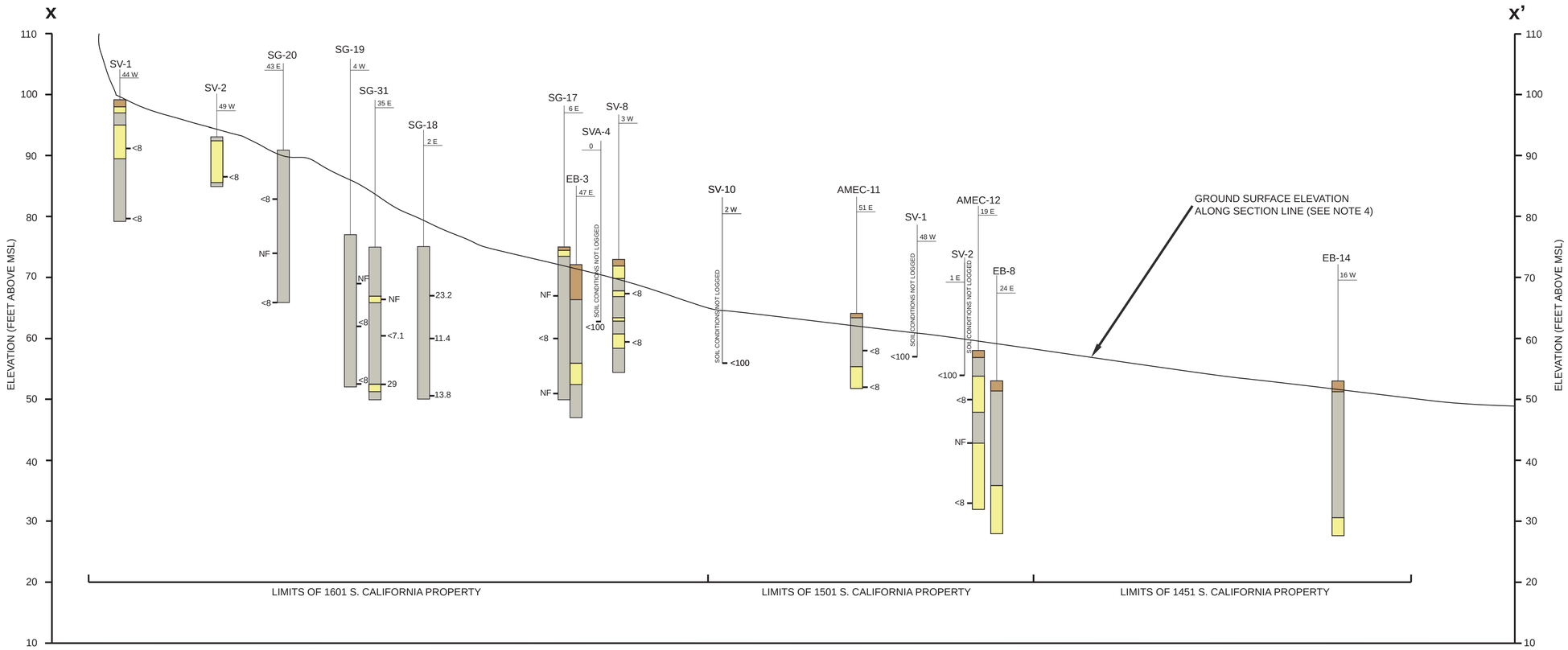
0 100 200
SCALE IN FEET

1451, 1501 AND 1601 S. CALIFORNIA AVENUE
PALO ALTO, CALIFORNIA

SOIL VAPOR SAMPLE LOCATIONS

FEBRUARY 2016

FIGURE 1



VERTICAL SCALE
0 10 20
SCALE IN FEET
0 50 100
HORIZONTAL SCALE

GEOLOGIC EXPLANATION

- FILL
- SILTS AND CLAYS (FINE GRAINED UNITS)
- CLAYEY GRAVELS AND SANDS (COARSE GRAINED UNITS)

BOREHOLE SYMBOLS

SG-17 — BORING DESIGNATION

16 W — OFFSET DISTANCE BETWEEN BORING AND CROSS SECTION LINE (FEET)

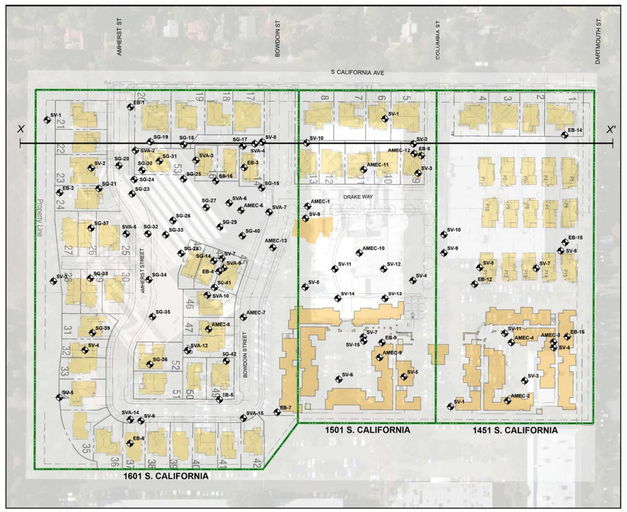
STRATUM BOUNDARY

NF — NO FLOW CONDITIONS DURING SOIL VAPOR SAMPLING

300 — MAXIMUM DETECTED SOIL VAPOR CONCENTRATION OF TRICHLOROETHENE (TCE) IN MICROGRAMS PER CUBIC METER

<8 — TCE NOT DETECTED IN SOIL VAPOR SAMPLE. CONCENTRATION INDICATED IS THE TEST DETECTION LIMIT

CROSS SECTION LOCATION PLAN



NOTES:

1. REFER TO FIGURE 1- SITE VICINITY WITH DEVELOPMENT PLAN AND CROSS SECTIONS, FOR PLAN LOCATION, DESIGNATION, AND ORIENTATION OF SUBSURFACE SECTIONS AND AS-DRILLED EXPLORATION LOCATIONS.

2. TEST BORING GROUND SURFACE ELEVATIONS WERE ESTIMATED AND SHOULD BE CONSIDERED APPROXIMATE.

3. SATURATED SOIL CONDITIONS WERE NOT ENCOUNTERED IN ANY OF THE TEST BORINGS SHOWN ON THIS SECTION.

4. BORINGS SHOWN ABOVE AND BELOW THE GROUND SURFACE ELEVATION ARE PROJECTED ONTO THE SECTION. THE TOP OF BORING REPRESENTS THE GROUND SURFACE ELEVATION AT THE LOCATION WHERE THE BORING WAS DRILLED.

1451, 1501 AND 1601 S. CALIFORNIA AVENUE
PALO ALTO, CALIFORNIA

CROSS SECTION X TO X'

FEBRUARY 2016

FIGURE 2

January 5, 2016

Annette Walton
Director - Environmental Management
Real Estate Operations
3160 Porter Drive, Suite 200
Palo Alto, California 94304

Dear Annette –

As requested, this letter briefly summarizes key points of my review and our discussions related to the health risk assessment and development plans at Stanford's University Terrace Project, which involves the redevelopment of three former industrial-use properties to a neighborhood consisting of Stanford faculty housing and open park space.

No further action letters were issued in 2013 by the California State Department of Toxic Substances Control (DTSC) for two of the properties (1451 and 1501 California Avenue, Palo Alto, CA). Based on environmental reports provided to DTSC, they concluded that neither site posed a significant threat to human health or the environment under residential land use.

Thus, my involvement has been focused on the third property at 1601 California Avenue, for which supplemental investigation was conducted to thoroughly assess the potential for significant health risks from post-remediation TCE residuals at depth in the subsurface. That assessment is summarized in the *Supplemental Investigation and Risk Assessment Report, 1601 S. California Avenue, Palo Alto, California*, prepared by Haley & Aldrich, Inc.

Key points from my review and our discussions include the following:

Relative to the initial draft, conclusions in the final version of the *Supplemental Investigation and Risk Assessment Report, 1601 S. California Avenue, Palo Alto, California* were the same, but strengthened by the thorough evaluation of the site conceptual model conducted by Murray Einarson and the expanded range of site-specific inputs that were incorporated by Haley & Aldrich, Inc. in their calculations. These additions increased confidence in the conclusions stemming from vapor intrusion pathway analysis because the selection of defensible site-specific inputs and considering a range of possible scenarios is critical to generating confidence in the results. It was also critical, because subsurface geology is a key controlling factor for vapor migration at this site.

There is confidence in the use of the site data for the risk analysis because the historical information, subsurface geology conceptual model, and chemical distribution appear to be self-consistent.

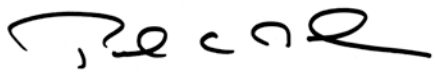
The site plan for the University Terrace Project reflects the analysis and conclusions contained in the *Supplemental Investigation and Risk Assessment Report, 1601 S. California Avenue, Palo Alto, California*. Future residences are placed in areas with projected negligible risks and the relatively isolated area of possible concern is open park space in the plan.

The risk assessment report concludes that the future residences will not be exposed to significant health risks under any building construction design and that pre-emptive building-specific mitigation measures are not needed (e.g., sub-slab depressurization systems). The sub-foundation vapor barrier liners being incorporated in the residential construction, therefore, are not necessary, but will add an additional level of protectiveness from vapor intrusion and potential comfort for the occupants.

Development plans also address the potential for vapor intrusion via alternative pathways, as we discussed recent studies where vapor intrusion was observed in buildings off-set from subsurface vapor sources as a result of transport along utilities and utility conduits. The potential for this is being eliminated in the planned development design by ensuring that utilities are not run through the residual vapor source at the site and by having vapor plugs/seals installed along the utilities.

Should you have questions or require clarification of this summary, please feel free to contact me.

Sincerely,



Paul C. Johnson, Ph.D.