

Building Trust at the Triple Site, Sunnyvale, California

By Lenny Siegel
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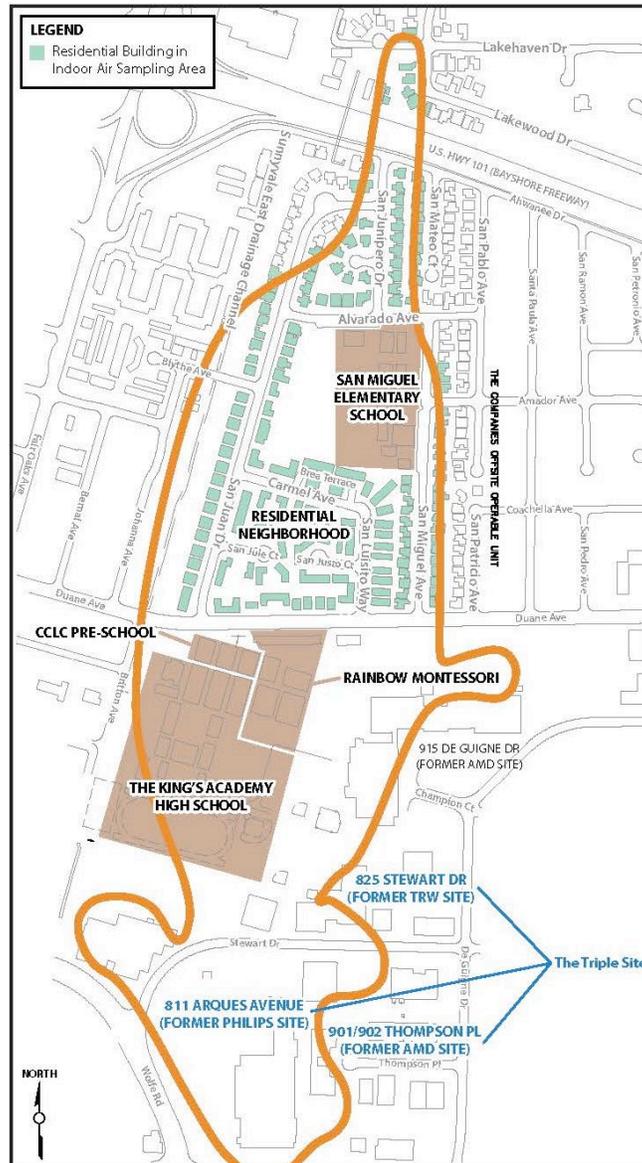
There are four schools and more than four hundred homes above the Triple Site trichloroethylene (TCE) plume in Sunnyvale, California. Unlike Winston-Salem, North Carolina, where news coverage triggered widespread anxiety, the Sunnyvale community did not panic when U.S. EPA's expanded vapor intrusion investigation hit TV screens. The response was more measured, even though trichloroethylene is believed to pose more of a health threat than tetrachloroethylene (PCE)—the principal contaminant at the Kaba-Ilco plume in Winston-Salem. (See my report at <http://www.cpeo.org/pubs/HaLo.pdf>.) In fact, investigators actually found unacceptable levels of TCE indoors at five school buildings. Those exceedances, as well as elevated TCE levels in five homes, are being addressed, and EPA-led sampling continues with community cooperation and support. I attribute the success of the Triple Site program to EPA Region 9's proactive and transparent approach.

Ironically, the Bay Area Regional Water Quality Control Board, supported by EPA, conducted one of Silicon Valley's first vapor intrusion investigations at this site, back in 1991. Despite modeling showing excess lifetime cancer risks to the neighborhood on the order of one in 10,000, it concluded on the basis of soil vapor sampling, conducted with flux chambers, that the risk was less the one in a million. The Board and the companies moved forward with groundwater cleanup, but not until late 2013, when U.S. EPA sent a letter to the Water Board requesting that it re-open investigations at several Silicon Valley Superfund sites, did the vapor intrusion issue rise to the surface again.



San Miguel School

Normally when I visit vapor intrusion sites outside of Mountain View, I take a plane. The San Miguel neighborhood of Sunnyvale, however, is just a bike ride away. The EPA team conducting the vapor intrusion investigation contains many of the same people involved in my own community, where EPA has directly overseen cleanup for three decades and addressed vapor intrusion since 2002.



Site History

The three source areas of the Triple Site are former factories once operated by TRW Microwave, now a subsidiary of Northrop Grumman, and two semiconductor manufacturers, Advanced Micro Devices (AMD) and Signetics, which was taken over by Dutch electronics giant Philips. These three companies remain the Responsible Parties. Site investigations began way back in February, 1982, with discovery of a leaking underground solvent waste storage tank at Philips. Investigators soon found leaks at AMD, and they identified the TRW release in April

1983. They also found that the three underground plumes of TCE and other chemicals had merged.

The Regional Water Board issued a joint cleanup and abatement order to all three companies in June, 1984. Reportedly this was only the second such order the Board issued for underground tank-leak contamination. The Water Board identified an operable unit for each source area, and it established the Offsite Operable Unit covering about 100 acres to the North, downgradient from the factories, where at the time TCE in groundwater exceeded 5 parts per billion (ppb). The offsite area also included the former campus of Sunnyvale High School, closed in 1981, used then as a research and development facility by Westinghouse. It also contained San Miguel School, at the time serving as a day care center.



King's Academy on the former Sunnyvale High School site

EPA proposed AMD for the Superfund National Priorities List (NPL) in 1984 and finalized its listing in 1986. It proposed TRW in 1988 and finalized the listing in 1990. Finally, EPA proposed the Philips site for the NPL in 1989, but it decided not to make it final because it was being regulated under the Corrective Action provisions of the Resource Conservation and Recovery Act. However, under a regional agreement between EPA and the Water Board, the Water Board remained the lead agency.

In June 1991 the Water Board finalized a Remedial Action Plan, and on September 11, 1991 U.S. EPA issued a Record of Decision (ROD) concurring with the Water Board plan. The principal remedy adopted was groundwater extraction and treatment, using air stripping and carbon adsorption, along with continuing soil removal and some soil vapor extraction. Actual extraction and treatment had begun as an interim remedy in 1986.

Early Vapor Studies

The agencies also evaluated health risk from toxic vapors, both from possible treatment system emissions and from direct releases through the soil from groundwater. However, nowhere in the ROD does the term “vapor intrusion” occur.

The Water Board conducted modeling showing conservatively that area residents faced a one in 10,000 excess lifetime cancer risk due to vapor exposure. Schoolchildren at the San Miguel school daycare center were believed to face a risk of less than one in a million, based on a maximum of four years exposure at eight hours a day.

In early 1991 the Water Board used flux chambers to measure vapor rising from the soil in the offsite area. Because it was cold and rainy on the first sampling day, it conducted a second round of vapor-flux sampling in March. Based on those results, it concluded, based upon a model predicting migration into overlying buildings, that the cancer risk to residents was less than one in a million. The ROD explained, “The other [sampling] option considered was the direct measurement of indoor air from selected structures. This approach was rejected due to a lack of sampling protocol for indoor air and the possible contamination of indoor air by indoor sources.” The Water Board immediately reported the “all clear” finding to the press and public, but it did agree to limited additional soil flux monitoring.

The Water Board also explained,

One of the chemicals predicted by the model, trichloroethylene (TCE) was detected at low concentrations in one sample from near San Miguel School. This detection of TCE at single sample point does not prove that TCE is escaping from the groundwater. The concentration detected is less than the maximum TCE concentration detected in air at the nearby Bay Area Air Quality Management Board (BAAQMD) air monitoring station in San Jose.

Early Community Engagement

Since the early 1980's, local and regional newspapers and broadcast news have given extensive coverage to groundwater contamination. The Triple Site story repeatedly made front page on regional newspapers. In Sunnyvale, there were a series of community meetings, some sponsored by government agencies, others called by community groups. For example, the *Peninsula Times Tribune* reported in July, 1984, “More than 200 people jammed a hot church auditorium to demand that more be done to clean up toxic chemicals threatening Santa Clara Valley's water supplies.” Two members of Congress, Republic Ed Zschau and Democrat Norman Mineta, attended that meeting. I think I did, too.

Activists from throughout Silicon Valley united to form the Silicon Valley Toxics Coalition. The Coalition successfully pressed for legislation to prevent future leaks and spills, and for a quarter century it helped neighborhood groups demand cleanup throughout the Valley. It led the community campaign at the Triple Site, working with the newly formed San Miguel Neighborhood Association. Association members requested indoor air testing.

Furthermore, as early as June, 1984 Sunnyvale city officials “urged other public agencies to take more aggressive steps, including legal action if necessary, to identify and clean up toxic chemicals that have seeped into the ground water beneath the city.” They told the press that they had learned about the groundwater contamination by reading the newspapers.

S. TIMES TRIBUNE

200 demand toxic cleanup



Harry Seraydarian
... sites must be on U.S. list.

By Ann Gibbons
Times Tribune staff

More than 200 people jammed a hot church auditorium in Sunnyvale Tuesday night to demand that more be done to clean up toxic chemicals threatening Santa Clara Valley's water supplies.

Most of the people urged the government to immediately start the cleanup of toxic chemicals that have leaked into the soil and ground water at 120 sites in the Bay Area. They called upon the federal Environmental Protection Agency specifically to join state and local efforts to clean up the contaminated sites.

"The state and local government agencies, as hard as they try, don't have the resources to effectively contain what's left to clean up the 100 or so spills in the county," said Ted Smith, chairman of the Silicon Valley Toxics Coalition, a citizens' watchdog group that organized Tuesday night's meeting.

It was the second time residents of the valley had met at St. Mark's Lutheran Church since high levels of the toxic solvent trichloroethylene (TCE) had been found in 30 of 36 private drinking water wells tested in Mountain View three weeks ago. No contamination has been found in public drinking water supplies.

Some of the residents at the meeting were angry and demanded



that government agencies do more to protect their drinking water and their health.

They called on two congressmen at the meeting — Ed Zschau, R-Los Altos, and Norman Mineta, D-San Jose — to make commitments now to get federal dollars to clean up the toxic waste sites. The residents also criticized government agencies and industry for doing too little too late to protect underground drinking-water supplies.

"If companies are going to use chemicals, they need to make darn sure we don't end up drinking them," said Bonnie Jones. Her family was warned three weeks ago to



Ted Smith
... chairman of watchdog group

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Times Tribune staff photo by Sam Forenchich

Sunnyvale resident Elaine Davidson, a former employee of Signetics Corp., told more than 200 people at a meeting in Sunnyvale Tuesday night that electronics companies have been sloppy with toxic chemicals and now should be held responsible for the cleanup of toxic leaks. She said she was told to dump solvents down the drain into sewer lines when she worked at Signetics in the 1970s.

As the pump-and-treat remedies were put in place and the Water Board reported that the community was safe from vapor exposure, public concern diminished.

Region 9's Vapor Intrusion Program

About two miles away, however, in my community of Mountain View, public engagement remained strong. Mountain View is home to the MEW Regional Plume (named for the three surface streets that mark its rough boundaries). Not only is the MEW Plume larger, with greater contaminant concentrations, but the plume caused by releases from several electronics companies flowed under U.S. Highway 101 to merge with contamination from the Moffett Field Naval Air Station. In the early 1990s, Moffett Field's Technical Review Committee became the national model for Defense Department-sponsored Restoration Advisory Boards, and because the Navy had other environmental issues, including three landfills and 400 acres of polluted wetlands, community interest in cleanup remained strong even after plume-wide groundwater

pump-and-treat systems were activated in 1998. Furthermore, from the mid-1990s the Silicon Valley Toxics Coalition received a series of Technical Assistance Grants from U.S. EPA for both the MEW Superfund Study Area and for Moffett Field. (For background, see <http://www.cpeo.org/pubs/RegionalPlume.pdf>.)

So in 2002, the Mountain View community was ready when EPA launched there two of its earliest major vapor intrusion investigations anywhere in the country. When local citizens got wind of the new investigations, we requested a public meeting. EPA convened a meeting in January, 2003, and over 400 people attended. While some were primarily concerned about MEW and Moffett, a majority were from the new, upscale Whisman Station transit-oriented housing development located above and around GTE's smaller, lower concentration TCE plumes, under EPA oversight through a voluntary RCRA agreement. Public interest and support propelled the vapor investigations forward.

Since then, the Region 9 (Pacific Southwest) EPA team developed a vapor intrusion Record of Decision Amendment in 2010, pioneered an arrangement with the City of Mountain View requiring vapor mitigation in new construction within or near contaminated areas, and established sampling protocols for indoor air testing. In commercial buildings it routinely required that indoor sampling be conducted with HVAC (heating, ventilation, and air conditioning) systems on and off, and it proved the reliability of low-cost, minimally intrusive passive air samplers to test for TCE inside homes. Regional staff consider the MEW program the "gold standard" in vapor investigation.

Meanwhile, in September 2011 EPA's Integrated Risk Information System (IRIS) program had finally released its toxicity assessment for TCE. IRIS classified TCE a *known* human carcinogen, calculated a more protective cancer slope factor, and concluded that pregnant women who inhale TCE at low concentrations over a short period have an increased risk of bearing children with heart malformations (cardiac birth defects). Toxicologists from Region 9 and the state of California began applying those findings to ongoing vapor intrusion responses.

In December 2013, Region 9 sent a letter to the Water Board recommending that it use its MEW-tested vapor intrusion approach at nine Silicon Valley Superfund projects. Key elements included short-term action levels for TCE, cold weather sampling of indoor air, commercial building sampling with the HVAC system turned off, and evaluation of all buildings within the 5 ppb contour line for TCE in groundwater. Identified by AMD, the Triple Site topped the letter's alphabetical list. EPA followed up those Guidelines with its July, 2014 memo on Near-Term TCE Inhalation Exposures.

Meanwhile, at the Triple Site

Meanwhile, things were changing at the Triple Site. A big-box Lowe's hardware store had been built on the former Philips property. (That's where I bought my refrigerator and dishwasher.) Westinghouse had left the high school site, and in 1992 the King's Academy, a Christian high school, had taken over a majority of the campus, with the rest later occupied by a day care center and Rainbow Montessori School. San Miguel School reopened as a public school serving a community that is roughly half Hispanic. Nearby, the residential redevelopment of

another AMD Superfund site, more recently occupied by its joint venture Spansion semiconductor, was delayed by Sunnyvale's reluctance to receive contaminated property as parkland.

Pump-and-treat continued unabated, and the vapor intrusion investigation was proceeding slowly. Under Water Board direction, Philips' consultant had conducted soil vapor sampling at the Rainbow Montessori portion of the Sunnyvale High School site in February 2004. Indoor air sampling found elevated TCE inside one building, but improved ventilation brought the level down.



Rainbow Montessori School

Subsequent indoor air samples showed that TCE and other substances remained below applicable long-term screening levels, but as far as I can tell all sampling was conducted in April, May, or June. Though I don't believe enough research on the subject has been conducted in California, the rule of thumb nationally is that indoor air samples should be taken during the winter months to capture the high levels caused by elevated pressure differentials between soil gas and indoor air.

In January 2014 the Water Board sent letters to the Responsible Parties requiring that they incorporate EPA's newly documented requirements into their vapor intrusion evaluations. Philips filed a Petition for Review at the end of February, but the Water Board rejected it because

it was more than two weeks beyond the submittal deadline. In May Philips' consultant submitted a new vapor intrusion workplan for the Offsite Operable Unit, but it did not meet the regulators' standards. Among other issues, it did not call for sampling at San Miguel School, and there was no plan to sample any of the buildings at the four schools with HVAC systems turned off.

So in August, U.S. EPA, at the request of the Water Board, formally assumed lead agency status for the Triple Site cleanup. The Board's letter summarized the reasons:

- Recent U.S. EPA Region IX vapor intrusion guidelines have resulted in a significant expansion of the vapor intrusion study area for the Triple Site
- There is a large residential area and three schools in the expanded vapor intrusion study area, and vapor intrusion evaluation will therefore require significant public outreach
- U.S. EPA Region IX has adequate staffing to manage the Triple Site and has in-house public participation staff that would be able to provide necessary public outreach
- Philips has not yet submitted an acceptable vapor intrusion work plan for the expanded study area, and delays in further evaluation of vapor intrusion in this area may endanger human health

Four days later EPA issues a Notice of Deficiency to the Responsible Parties. It ordered the preparation and implementation of a more robust Vapor Intrusion Work Plan, and it stated that the vapor intrusion evaluation would lead to a ROD amendment. It added:

EPA will take the lead in developing and implementing an appropriate community outreach strategy for the vapor intrusion investigation, however, your full participation in developing outreach tools (such as press releases, fact sheets, etc.) and conducting outreach (door-to-door efforts, individual meetings with property owners and occupants, public meetings, etc.) is encouraged.

The Public Learns

My colleagues and I had been working for some time with Bay Area news organization to raise awareness of the potential for vapor intrusion at many of Silicon Valley's groundwater plumes, so when I learned what was happening in Sunnyvale I went to the press. The day after EPA issued the Notice of Deficiency NBC Bay Area visited the San Miguel neighborhood. The reporter found that many people, school parents and residents, were unaware of the contamination underlying their homes and schools. For the news video, see <http://www.nbcbayarea.com/news/local/Sunnyvale-Schools-Homes-Sit-on-Toxic-Groundwater-270995341.html>.

The news coverage immediately caught the attention of public, including long-term residents, who remembered the issue from a quarter century ago, as well as newcomers. It immediately triggered a discussion on Nextdoor, a neighborhood social networking site. While one person expressed alarm, another wrote, "Knowing that the EPA is now involved hopefully means they'll take steps to solve this issue." Indeed the NBC news story was about EPA taking action, not that the media had discovered a problem that officials were hiding. And it repeated the critical assurance that local drinking water supplies were not affected—since that water

comes from Yosemite via the Hetch-Hetchy Aqueduct, which crosses Sunnyvale and Mountain View on the way to San Francisco.

NBC quoted me warning about the risk to pregnant women, and the next day I got a call from a pregnant teacher at the San Miguel School. I explained that even if unacceptable levels were found at the school, that only meant that she was at increased risk. That is, exposure did not mean that her child would necessarily be born with cardiac birth defects. EPA's project manager talked to her soon thereafter.

In response to the news coverage, and at the request of the Sunnyvale School District, EPA prepared a fact sheet in English and Spanish. (Later fact sheets were also circulated in Chinese. Within a week, it was distributed to students at San Miguel Elementary School, the King's Academy, Rainbow Montessori School, and the adjacent daycare center. The fact sheet explained why more sampling was necessary:

This past year EPA strengthened its protective levels for TCE, due to new information about potential cancer risks related to TCE exposure. New levels that would warrant an accelerated EPA response were also developed for short-term risks, including liver and kidney effects and organ problems in babies whose mothers were exposed during the first trimester of pregnancy.

The fact sheet also explained that more sampling events were required because new research showed that vapor intrusion can vary throughout the year.

EPA followed up the fact sheets with meetings with schoolparents and a series of public meetings. I attend the first public meeting, held at San Miguel School, in December 2014. EPA brought a full team, including not only the project manager but the regional Superfund Director, a toxicologist, and a Spanish-language translator. EPA explained the sampling program and asked permission to place sampling devices inside homes above the plume for a period ranging from one day to two weeks.

Sampling Results

People at the meeting expressed concern, but no one panicked or reacted angrily. School officials and neighborhood leaders tell the same story. Perhaps one family pulled its child out of the Montessori school because of the contamination reports. Sampling results thus far show that TCE exceeds EPA standards at several locations, but the community seems satisfied that EPA is taking the proper response actions.

EPA reports that it found unacceptable levels of TCE in five school buildings:

Sampling at the school buildings affected by vapor intrusion has showed low levels of TCE, with higher levels measured in crawlspaces underneath buildings and when ventilation systems were off. While a number of indoor air/classroom samples from these buildings initially exceeded EPA's action levels, EPA worked with the Responsible Parties and the school administration to put in place a temporary solution (ventilation upgrades) that are working to keep vapor intrusion levels acceptable while permanent

systems are being designed. The effectiveness of the ventilation measures are being verified by monthly indoor air testing in all of the school buildings. The highest samples measured were collected from an auditorium in one of the school buildings, which was discovered to have a malfunctioning ventilation system. In this auditorium, samples showed TCE levels of up to 16 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), compared to lower levels of up to $2.9 \mu\text{g}/\text{m}^3$ measured in 2004 and 2005. EPA brought down the levels immediately by fixing the ventilation system and opening outdoor air intakes that were closed, and noted that health risks were likely minimal because the auditorium is used infrequently, and for short periods.

As of October 2015, EPA has sampled 101 homes, finding unacceptable TCE levels in one single-family home and two duplexes (four homes). It is seeking permission to sample the rest of the 414 homes above the plume, and it “is engaging with property owners that have refused to allow testing despite tenants eager for sampling.”



San Miguel neighborhood

There has been no public outcry, no exodus of students, no panic in the neighborhood. While most of the sampling data has been re-assuring, I believe that the community is responding without alarm because people trust EPA. And they trust EPA because the agency initiated the expanded investigation before hearing from the public, and it has shared its plans and findings with the community, at meetings, door-to-door, and via the Internet.