PM STRAUSS & ASSOCIATES
ENERGY AND ENVIRONMENTAL CONSULTING

MEMORANDUM

TO: CPEO
FROM: Peter Strauss
DATE: March 22, 2017
SUBJ: **Hangars 1, 2, and 3 at Moffett Field**

Summary

There are two relatively new issues involving the large hangars at Moffett Federal Airfield (MFA). At the last November 2016 Restoration Advisory Board (RAB) meeting, there was a brief discussion about Google's subsidiary Planetary Ventures (PV) subsurface investigation at Hangars 2 and 3, both of which were built primarily of wood. That investigation found greater than expected concentrations of chlorinated volatile organic compounds (CVOCs), including trichloroethylene (TCE) and tetrachloroethylene (PCE) in sub-slab soil-gas samples. As a result of the sampling, U.S. EPA Region 9 and the Regional Water Quality Control Board (RWQCB) requested that the Navy submit a plan for a Supplemental Remedial Investigation of the area that includes the two hangars (known as Site 7). Because this request was not acted on in a timely manner, EPA and the Water Board initiated informal dispute resolution with the Navy. Since that time, the Navy has agreed to conduct additional sampling, but to my knowledge it has not yet submitted a work plan.

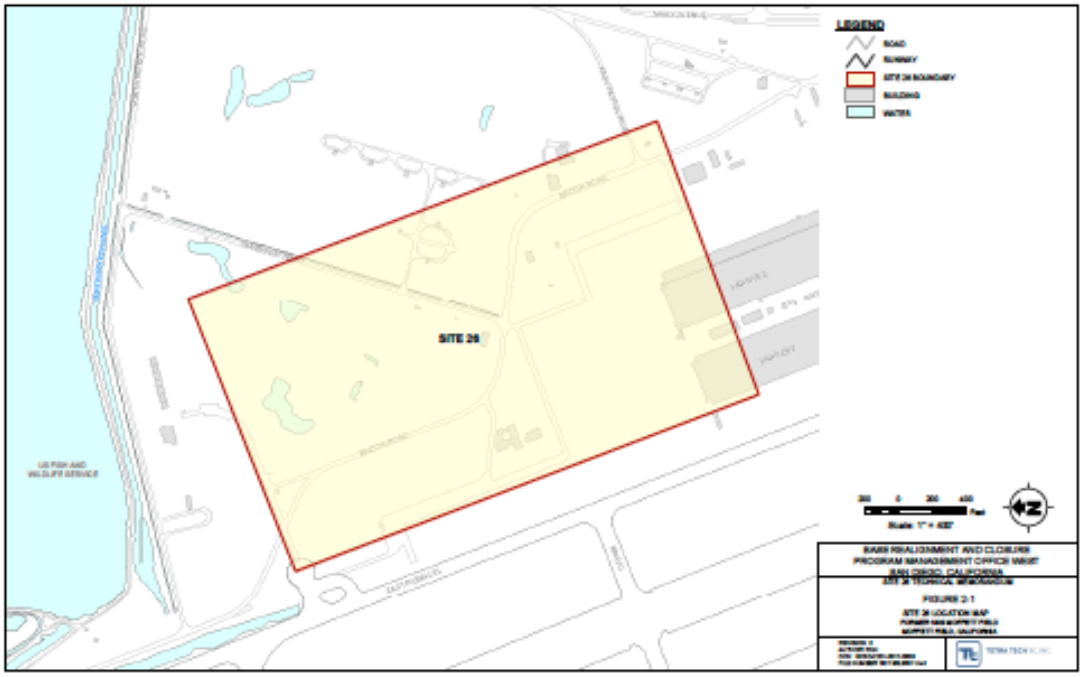
At the larger, steel-framed Hangar 1, the preservation of which has been a cause celebre for more than a decade, EPA has signed a Bona Fide Prospective Purchaser (BFPP) Agreement letter and granted permission to PV to go ahead with a pilot study to evaluate methods for removing the Navy-applied epoxy coating from the hangar frame.

Hangars 2 and 3

Hangars 2 and 3 are located on the eastern side of the runways. They are included in Site 7, which encompasses the hangars and paved and unpaved areas surrounding them. The interior of the hangars had not been assessed for vapor intrusion[1] potential. Site 7 is located above Operational Unit (OU) 2-East, which covers soils, and OU5, which covers groundwater. The evaluation of soil contaminants focused on near-surface soils from a number of sites and concluded that no further action was necessary at Site 7 for soils. The evaluation of contaminants in the groundwater eventually focused on a plume at Site 26, which is located just to the north of Site 7. Groundwater upstream and beneath Site 7 had no requirements for treatment.

[1] Vapor intrusion is the migration of volatile substances from the subsurface into overlying building.

The 1996 OU5 Record of Decision (ROD) selected remedies for the chlorinated volatile organic compounds (CVOCs) in groundwater on the east side of Moffett (Site 26). The Site 26 CVOC groundwater plume begins at the northeastern corner of Hangar 3 and migrates northward, away from the two hangars. Some of the CVOCs released into groundwater from the Site 7 are addressed as part of the remedy for Site 26.



Hangars 2 and 3 are shown on the right (southern) edge of Site 26.

The initial remedy was a pump-and-treat system called the East-Side Aquifer Treatment System (EATS). The 2014 Final ROD Amendment selected a new remedy that incorporates in-situ bio-stimulation and bio-augmentation, monitored natural attenuation (MNA), and institutional controls (ICs). EATS has been shut down.

The Site 7 history indicated that former underground storage tanks (USTs) on the east side of Hangar 3 contained a variety of waste solvents that were released from a power plant shop in Hangar 3. Following removal of the USTs in 1990 and 2003, the RWQCB determined that no further action was required. Other tanks associated with the hangars contained fuel. The 1996 Site-Wide Remedial Investigation (RI) found that solvents stored in barrels, in deck drains, and on unpaved areas around Hangar 3 were released to the environment. The RI reported that the unpaved corners of Hangars 2 and 3 were used to dispose of 120,000 to 600,000 gallons of wastes, including paint thinners, paints, solvents, and hydraulic fluids. Additionally, drums containing wastes were accumulated on the outside of the hangars.

Soil Gas Investigation

In September 2014 EKI, environmental consultant to PV, conducted a sub-slab investigation of Hangars 2 and 3. Fifty soil vapor probes were installed in the

hangars: 40 in Hangar 3 and 10 in Hangar 2. Samples were compared with the more stringent screening levels for chlorinated volatile organic compounds (CVOCs) between EPA's Regional Screening Levels (RSLs) or the Water Board's Environmental Screening Levels (ESLs). At Hangar 2, half of the probes had detectable quantities of chemicals. At Hangar 3, 37 of 40 probes had detectable quantities of chemicals. The Tables below provide the results of these samples.

Table 1: Hangar 2 Sub-Slab Sampling Results

Contaminant	**Screening Level ($\mu g/m^3$)***	**Maximum ($\mu g/m^3$)**	**# of samples out of 11 above screening level**
PCE	20	187	3
TCE	60	90	1
Carbon Tetrachloride	5.8	1,950	3
Chloroform	11	10,400	3

* micrograms per cubic meter

Table 2: Hangar 3 Sub-Slab Sampling Results

Contaminant	**Screening Level ($\mu g/m^3$)***	**Maximum ($\mu g/m^3$)**	**# of samples out of 40 above screening level**
PCE	20	15,500	27
TCE	60	2,500	12
Carbon Tetrachloride	5.8	73	5
Chloroform	11	956	4

* micrograms per cubic meter

In addition, several other chemicals were found above reporting limits, including Freon 113, Freon 111, 1,1,1-TCA, and trimethylbenzene.

Follow-Up

As a consequence of these findings, in July 2016 EPA and the RWQCB sent a letter to the Navy requesting that it conduct a Supplemental Remedial Investigation, with a work plan due January 31, 2017 and a completed copy of the Supplemental RI due in August 2017. The work plan was supposed to address subsurface contamination at Site 7, including groundwater, soil, soil vapor, air, and preferential pathways. The letter also stated:

> Based on the agencies review of available documents, only limited soil and groundwater sampling has been conducted *near* the hangars and no sampling has been conducted beneath the hangars. Soil sampling conducted to date by the Navy only focused on the unpaved areas near the hangar corners where large quantities of paint, paint strippers, oils, solvents, fuels, hydraulic fluids, and other wastes were disposed. Significant groundwater sampling has been conducted outside and around Hangars 2 and 3; however, no groundwater data beneath the hangars has been collected by the Navy or others to date. "[2]

The Navy responded to this letter on August 8, 2016, stating that that because the hangars were determined to have no further action in 1994, it would take five to ten years to re-open the site and obtain funding. In response, the Agencies informed the Navy that they would invoke informal dispute resolution procedures under the 1990 Federal Facility Agreement for Naval Air Station Moffett Field. The Navy has since agreed to find money to conduct the investigation, but it has not yet formally submitted a Work Plan for Site 7.

Evaluation

I reviewed some of these past documents, including the OU5 Record of Decision and the Site-Wide RI) to determine whether the investigation at the hangars was sufficient to rule out a potential source. I found that there were not enough groundwater sampling and monitoring wells to rule out the presence of a TCE plume under the hangars. Specifically, there was little investigation of groundwater upstream (south) of the hangars. Groundwater monitoring wells were not installed in the adjacent runway and only one or two wells were installed on the west side of the hangars. It should be noted that the both the previous investigations and the RODs did not consider vapor intrusion as a pathway.

I am not the only one who has expressed concerns with the adequacy of Navy's source investigation. Jim McClure, a former RAB member and a former consultant to Raytheon, wrote a report in 1992 titled "Review of Potential Sources NAS Moffett Field, MEW Study Area." The report noted that the Navy's 1988 RI Work Plan described the following:

> According to interviews with personnel stationed in Hangar 1 in the mid-1950s, most of the oily and solvent wastes were collected in 55-gallon barrels and stored beside the hangar. Each corner of Hangars 1, 2, and 3 contained hundreds of barrels of waste materials. Stoddard solvent [a petroleum distillate which is not chlorinated] was sprayed around the stored barrels to clean up for inspection, which normally occurred every Thursday. Waste from this cleanup operation was washed into the storm sewer which in turn drained into Marriage Road Ditch.

According to personnel, during the timeframe of 1950 -1962, many of these barrels leaked.

[2] Letter to James Sullivan, Navy BRAC Coordinator, from EPA and Water Board, July 8, 2016

The report also noted that at the August 27, 1991 meeting of the Technical Review Committee [TRC], which was the predecessor to the Restoration Advisory Board):

> Lenny Siegel of the Silicon Valley Toxics Coalition asked whether the Navy planned to perform any investigations under or around Hangar 1 in light of the experience at many air bases where the hangars turned out to have their own sources. Captain Quigley said that the Navy had no such plans.

While Hangar 1 is on the west side of MFA, this quote is included to demonstrate the problems with the Navy's cleanup strategy, particularly in light of vapor intrusion.

Hangar 2 Proposed Mitigation

PV also sought concurrence with EPA for vapor intrusion mitigation at Hangar 2. Because CVOCs were detected in sub-slab vapor under Hangar 2 at concentrations exceeding sub-slab vapor target concentration levels, PV has proposed to construct the infrastructure for a sub-slab depressurization system ("SSD") system beneath the Hangar as part of its planned rehabilitation, and then use post-rehabilitation indoor air quality data to determine if the SSD system will need to be operated in active mode—that is, with blower fans. This measure conforms with its Bona Fide Prospective Purchaser (BFPP)[3] Agreement for Moffett Field.

PV's proposal for Hangar 2 includes the following elements to address vapor intrusion, if CVOC concentrations in indoor air exceed acceptable concentrations:

- Investigate the source(s) of exceedances
- Mitigate source(s), if possible
- Startup the SSD system, if needed
- Assess SSD system adequacy
- Start contingency measures in the event that SSD is not fully effective,
- Verify that CVOC concentrations in indoor air are acceptable

In October 2016 U.S. EPA and the Water Board accepted the proposed response:

> The Agencies have reviewed the process set forth in your letter for assessing and addressing vapor intrusion for the rehabilitation and occupancy of Hangar 2. EPA agrees that the process you've set forth in the letter, including monitoring and mitigation as necessary, is an appropriate approach for handling the potential for vapor intrusion at the Hangar at this point, and it meets the reasonable steps requirements in EPA's March 12, 2015 BFPP letter.

[3] The Bona Fide Prospective Purchaser provisions were written into the 2002 federal Brownfield Amendments that changed the Superfund liability landscape for landowners. A party that acquires property knowing, or having reason to know, of contamination on the property may receive liability protection if it performs "all appropriate inquiries"—a non-intrusive environmental site assessment, or Phase One—prior to acquiring the property and demonstrate that it has no affiliation with a liable party. In addition, a BFPP must comply with land use restrictions and not impede the effectiveness or integrity of institutional controls, take "reasonable steps" to protect against exposures to hazardous substances, and provide access to regulators and other parties with cleanup responsibilities.

Hangar 1

U.S. EPA recently signed a BFPP agreement approving PV's pilot study for removing epoxy coating and the underlying lead and PCBs from the Hangar 1 frame. The Agreement states that NASA has determined that the epoxy coating and the underlying paint on the metal of the superstructure should be removed prior to re-skinning the Hangar.

The coating was part of the Navy's non-time-critical-removal-action (NTCRA) in 2008 that removed the siding—which contained lead, asbestos, and PCBs—and applied epoxy to the structure's steel frame to encapsulate PCBs and lead remaining on the frame. Because both PCBs and lead remained on the frame, the Navy issued a long-term management plan, calling for inspections and monitoring systems while the frame lay bare. Visual inspections in 2014 found isolated coating failures, where the coating separated from the substrate, coating deterioration where paint had peeled, rust breakthrough, and missing or thinly applied coating. Although PCB wipe samples were below analytical reporting limits and below the NCTRA criterion of 10µg/100 cm^2, samples of sediments on the concrete were above target criteria. Lead was also detected in wipe samples above the target criterion. PV's consultant (EKI) concluded that these samples were not the result of upwind sources and were the result of failures of the epoxy coating. Underlying structural analysis observed PCBs in the 12 to 36 mg/kg range and lead in the 1,300 to 12,000 mg/kg range.

Since PV agreed to lease Hangar 1 and airfield from NASA, it and NASA have agreed to study removing the epoxy and the underlying PCB/lead-tainted paint, rather than continue inspections and monitoring. PV presented a "Revised Work Plan for the Pilot-Scale Abatement Study of Hangar 1" in March 2016. If, after the pilot test, it proceeds with a selection of a technique to remove the epoxy and underlying paint from the Hangar 1 superstructure, PV will prepare an Engineering Evaluation and Cost Assessment (known as an EE/CA) for the Hangar.

The pilot study will test three different blasting techniques on a total of 2,000 ft^2 of surface. Methods to be tested are sand blasting, high-pressure water blasting, and "vapor-media blasting." Vapor-media blasting contains elements of the first two methods, using ultra-fine garnet blasting material with aerosolized water. A fully encapsulated negative-pressure enclosure will be installed around the Pilot Study Area prior to the commencement of activity. Perimeter air monitoring will also be performed during blasting. The following criteria will be used in selecting the full-scale technique:

- Effectiveness in achieving post-abatement acceptance
- Waste minimization
- Water Use
- Ease of Use
- Safety of Use
- Equipment Related Performance

After completion of the pilot study, areas will be recoated with epoxy. NASA's environmental division will oversee the project, and it is responsible for final inspection.

Conclusion

The Hangar 1 pilot study is underway. In my opinion, PV is taking a comprehensive look at all of the options to lessen its long-term liability. I recommend that CPEO follow the progress of the Pilot Study and later oversee the removal of the epoxy from the entire frame.

The Hangar 2 and 3 sub-slab contamination is a more serious problem. Besides PV's willingness to put in a SSD system for Hangar 2, a mitigation strategy is needed for Hangar 3.[4] I recommend that CPEO support efforts by EPA Region 9 and the RWQCB to have the Navy prepare a Supplemental Remedial Investigation for Site 7 to determine the full extent of the source or sources of contamination. Once the sources of contamination are determined and the conceptual site model for the two hangars is updated, CPEO should argue for the development and implementation of aggressive groundwater and soil remedies for the hangars.

[4] Subsequent to Peter's submission of this memo, CPEO learned that Planetary Ventures has closed Hangar 3 indefinitely due to structural instability. PV has not presented plans about what it will do with the current structure.