

**THE MOFFETT FIELD SUPERFUND SITE**  
**Moffett Field, California**  
**Final Report on Technical Assistance Grant (#1-99971101)**  
**Center for Public Environmental Oversight/Pacific Studies Center**  
**July 2019**

**Introduction**

This final report fulfills the Pacific Studies Center's obligations to the U.S. Environmental Protection Agency (EPA) under the Technical Assistance Grant (TAG) #1-99971101 for the Moffett Field (former Moffett Field Naval Air Station) Superfund site, adjacent to Mountain View, California. For decades, federal property at Moffett Field was divided between the Naval Air Station and the NASA (National Aeronautics and Space Administration) Ames Research Center. When the Navy departed in 1994 NASA absorbed most of the property, sharing use with California Air National Guard, Google's Planetary Ventures unit, and numerous smaller tenants. The Air Force took over the military housing areas. Subsequently, the Army took over the Air Force properties

Following the completion of the Silicon Valley Toxic Coalition's TAG for Moffett Field in 2006, the Pacific Studies Center (PSC), through its Center for Public Environmental Oversight (CPEO), applied for and received a new Technical Assistance Grant. CPEO's Executive Director, Lenny Siegel, had helped manage the Toxic Coalition's TAGs, so the new project was essentially a continuation of the previous one. In a transparent process, with the help of its Community Advisory Board, CPEO selected Peter Strauss of PM Strauss & Associates as its technical advisor. Strauss had served as the Toxic Coalition's technical advisor under the previous grant.

TAG activities began in the fourth quarter of 2007 and continued through the fourth quarter of 2017. Under the supervision of Siegel and the Community Advisory Board, and in cooperation with the Moffett Field Restoration Advisory Board (RAB) and the Save Hangar One Committee, the technical advisor has helped make Moffett Field's environmental response a national model for effective, constructive public involvement in Superfund and federal facilities cleanup. That response has included cleanup, ecological restoration, historic preservation, and safe reuse.

The Moffett TAG program has operated hand-in-hand with the Technical Assistance Grant for the adjacent, in fact overlapping, MEW (Middlefield-Ellis-Whisman) Superfund Study Area. CPEO/PSC is the grantee for MEW, and Strauss is the technical advisor. Because the regional (trichloroethylene) plume underlying much of Moffett Field is shared with the MEW parties, CPEO is continuing oversight of regional-plume remediation under the MEW TAG.

Below is a description of the ten-year Moffett TAG program's major successes as well as key remaining issues. Note that most of these efforts were continuations of earlier work under the Toxics Coalition TAG.

A list of materials produced by the technical advisor over the life of this grant is appended. It's important to recognize that he also took part in many meetings and communicated frequently with regulators, the Navy, CPEO, and other parties.

## Success Stories

### **Site 25: Changing Future Use Assumptions and Strengthening PCB Toxicity Values**

Site 25 encompasses the Stormwater Retention Pond (SRP) and the Eastern Diked Marsh at the northwestern edge of Moffett Field. Community oversight of Site 25 remediation, begun under the Toxics Coalition TAG and continued under this grant, led to a complete cleanup, with ecological restoration, supporting the possible restoration of the site as Bay tidal marsh.

Since it was diked-off in the 1950s, the SRP has served as a seasonal wetland, capturing run-off from the Moffett complex. This area was formerly part of the San Francisco Bay and its tidal marshes. Contaminants in the sediment included pesticides, heavy metals, and PCBs. A significant portion of the PCBs found in the SRP was later traced back to Hangar 1.

In 1998, when a plan was first being formulated about cleaning up contaminants at Site 25, CPEO challenged the Navy's proposed methodology for quantifying acceptable ecological risks. Following a technical debate, the Navy promised to rely upon a more protective methodology. However, in 1999, Strauss called to the community's attention that the Navy was adopting a less stringent standard for the PCB cleanup goal in the SRP sediment than had previously been considered, arguing that there were no fish in the SRP and that Site would be maintained as a fresh-water marsh/wetland. Since there were no fish, the fish-to-bird pathway was eliminated. A higher number for PCBs (470 parts per billion) would be safe for ecological receptors.

CPEO opposed the Navy's assumption that the Moffett wetland would forever remain seasonal fresh-water marsh. Several groups, including Save the Bay and the local Audubon Society chapter, helped make the argument against retaining the SRP as a fresh-water wetland/marsh. Concurrently, in 1999, this area of wetlands was combined with the massive salt-pond complex into a continuous corridor of tidal marsh in the South Bay.

The Navy had failed to take account of the fact that a large fraction of the diked area is owned by the Midpeninsula Regional Open Space District. Its mission includes the preservation and restoration of natural habitat. The Navy did not have authority to enforce the proposed institutional controls to keep tidal flow out of the entire Pond. In 2002, the Navy proposed a similar strategy for federally-owned land, but excluded the area owned by the Open Space District. The Navy promised to negotiate later with the District about addressing the sediment in its section. CPEO again argued that cleanup standards must be based upon reasonably anticipated future land use.

The company known as Leslie Salt (later bought by the global agribusiness corporation, Cargill) owned the dikes. Cargill was negotiating to sell 16,500 acres of evaporation ponds, including those immediately north of the SRP, to the state, that would create a wildlife refuge encompassing much of the shoreline in the South Bay. Even if the Navy and NASA managed to separate the Open Space District wetlands from the NASA pond, they would still have to get the Refuge management to agree to institutional controls, because they could conceivably remove, or let deteriorate, the dikes that directly keep Bay waters from the Pond.

In 2003, NASA staff reported on the results of the latest round of sediment sampling. Contamination wasn't as high as earlier believed, so the cost of remediating to a level that would allow tidal restoration might not be as high as feared. For that and other reasons, NASA reconsidered its flood control strategy and promised to study possible restoration. The Navy had to go back to the drawing boards, because remedy was premised on NASA's use plan.

In 2005, the Navy evaluated the risks under a future re-use scenario of a tidal marsh/wetland in an addendum to the remedial investigation after being notified by NASA that it did not intend to keep the dikes closed forever. This scenario was later adopted in the 2009 Record of Decision.

As such, assuming this new scenario, CPEO argued that a stricter standard for PCBs remaining after excavation was warranted. We wound up with a standard of PCBs left in the sediment that was reduced from 470 ppb (parts per billion) to 220 ppb. Cleanup to that standard was completed in 2013, though re-vegetation continued for a few more years.

Much of the technical advisor's work on Site 25, as well as major decisions about remediation, were done before the CPEO/PSC grant. Still, he produced two documents, including 2011 comments on the Remedial Design, during the grant and supported the RAB's oversight of project completion.

### **Site 26: Changing from Proposed Technical Impracticability Waiver to Targeted *In Situ* Remediation**

In 1999, the Navy began operation of a pump-and-treat groundwater extraction and treatment system, known as the Eastside Area Treatment System (EATS). It used an air stripper to remove TCE, PCE, and lesser contaminants. This area is difficult to remediate because it has dense clay layers where much of the contaminant mass resides. In 2003, after just four years of operation, the Navy requested that the system be temporarily shut down so it could conduct a pilot study using biodegradation. The pilot test was designed to provide nutrients to the indigenous bacteria that were known to reduce TCE and PCE.

The pilot study showed some good results, but failed to reduce all of the contaminated groundwater to drinking water standards. One of the reasons the Navy cited was that the pilot test concentrations of DCE increased, despite decreasing PCE and TCE concentrations. It concluded that reductive dechlorination was occurring, but it was not likely proceeding to completion. The Navy suggested that DHC [*Dehalococcoides* spp.] was not present in sufficient quantities to complete the reductive dechlorination process. Rather than restarting the EATS, the Navy proposed to passively "treat" the contamination through monitored natural attenuation (MNA). The Navy requested that it be granted a Technical Impracticability (TI) Waiver that would release it from achieving drinking water standards for TCE and PCE.

EPA and the Regional Water Quality Control Board (RWQCB) rejected this proposal, and they ordered that the EATS system be turned back on. They found that Navy had not proven that active remediation would not bring timely results. The agencies argued that EATS would have to be operated for a longer duration before they would

consider shutting it down. EPA also concluded that the pilot study had positive results, and it suggested additional optimization and bioaugmentation.

The RAB and CPEO agreed with EPA's assessment and rejected reliance on MNA. We noted that at a nearby site at MEW, with a similar hydrogeological setting, Intel and Raytheon had successfully completed dechlorination by augmenting the population of bacteria (i.e., bioaugmentation) and adding nutrients. While we supported achieving remediation goals within a reasonable time, we argued that even if not possible to achieve drinking water standards for the entire area of Site 26, making progress towards those goals could still be accomplished with some of the technologies identified.

CPEO recommended that the Navy should follow the adaptive management approach put forward in the National Research Council (NRC) report (*Environmental Cleanup at Navy Facilities: Adaptive Site Management*, 2003). Adaptive management stimulates the search for new, innovative technologies to replace older or inefficient approaches, and it stresses the need for pilot programs to test both new technologies as well as modifications of existing technologies that might enhance their effectiveness.

In a July, 2008 meeting EPA, the Regional Water Quality Control Board, the Navy, and CPEO agreed to stop the request for a TI Waiver and continue with *in situ* bioremediation at the most highly contaminated areas of Site 26, while allowing MNA to treat the remainder of the aquifer. The also Navy agreed to enhance its pilot study concept with bioaugmentation as well as adding nutrients. EPA and the Regional Board agreed that they would not require the Navy to start the pump-and-treat system again. This was a compromise: we did not argue for complete restoration of the aquifer through active measures; we recognized that MNA would be almost as effective for low-levels of contamination in this difficult to remediate area.

The technical advisor not only prepared four documents on Site 26 during this period. He helped represent CPEO in inter-party negotiations. CPEO considers the outcome a proof of the concept of adaptive site management in the remediation of complex sites.

### **Hangar 1: Avoiding Complete Demolition**

The massive, iconic Hangar 1 is a landmark in the South Bay. It is subject to protection by the National Historic Preservation Act. Hangar 1 was built in 1932 to house the airship U.S.S. Macon. In 1994, the Navy transferred the property management responsibility for Hangar 1 to National Aeronautics and Space Administration (NASA).

Hangar 1 is a large structure measuring 1,133 feet long, 308 feet wide, and 198 feet high, constructed with a steel-frame that was covered with corrugated siding. The siding is commercially known as Robertson Protected Metal and is known to contain both polychlorinated biphenyls (PCBs) and asbestos. In addition, the siding and internal structural steel frame of Hangar 1 were coated with lead-based paint that contained PCBs. NASA restricted access to certain interior areas of the hangar after lead-contaminated dust was identified as a health concern in late 2000.

In 2003, as a Time-Critical Removal Action (TCRA), the Navy coated the exterior of the siding of Hangar 1 with an asphalt emulsion to cover and contain

hazardous building materials and prevent migration of contaminants to the environment. In 1998, NASA had found that Hangar 1 was the source of PCBs in sediments at Site 25.

In 2006, the Navy found that after only 3 years, the coating had deteriorated. It announced a new plan to mitigate the threat of further discharge of PCBs from Hangar 1: demolition. This triggered a huge public outcry. CPEO Executive Director Lenny Siegel formed the Save Hangar One Committee, which brought together veterans, environmentalists, historic preservationists, and the public at large.

When neither the Navy nor NASA took responsibility for cleaning and restoring the hangar, the community supported siding removal until a sponsor could be found to restore the Hangar. In 2008, the Navy presented its second proposal, which entailed removal of all interior structures and siding, and containment of the PCBs in structural steel paint with an epoxy coating. Contaminated and non-contaminated debris would be transported to appropriate off-site disposal facilities. Historic mitigation measures would be performed to substantively comply with the NHPA, and the Secretary of the Interior's Standards for the Treatment of Historic Properties (36 C.F.R., Part 68) would be used to provide mitigation guidance.

With uneven success, community members fought to preserve artifacts and sub-structures from Hangar One. Today the stripped hangar frame, with failing epoxy coating, stands as a symbol of the federal government's failure to meet its historic preservation responsibilities. With support from the community and our Congressional delegation, NASA in late 2014 awarded a competitive 1000-acre lease to Planetary Ventures, a subsidiary of Google. A key condition of the lease is the full restoration of Hangar One. Much to the chagrin of the community, this is not expected until 2025 at the earliest. Still, CPEO is confident that restoration of this almost unique symbol of the region and of veterans' service to the country will stand for decades more.

Over the course of this grant, the technical consultant attended many meetings and prepared at least 10 written documents about Hangar One, including an extensive February 2015 analysis of the NASA-Planetary Ventures lease.

### **Model Vapor Intrusion Remedial Plan**

The 2010 Record of Decision (ROD) Amendment for Vapor Intrusion is a national model, providing a framework for investigating, mitigating, and remediating around hundreds of buildings at both the MEW Area and Moffett Field. Because contamination from the electronics plants south of U.S. 101 and Moffett Field had comeingled in the subsurface, the MEW ROD already covered the Regional Groundwater Plume on both sides of U.S. 101, including Moffett Field.

The Second Five-Year Review for MEW had questioned the protectiveness of the remedy because the vapor intrusion pathway had not been considered in the initial ROD, and investigations showed that vapors were migrating into some buildings. The ROD Amendment established a Tiering System to monitor and where necessary mitigate vapor intrusion with active measures such as sub-slab depressurization systems (SSDS) or adjustments in building heating and cooling systems. Both of these solutions incurred energy costs and required site management to ensure that they were operating protectively when people were inside the buildings.

There was a great deal of community participation in the development of the ROD Amendment and remedial action plan. CPEO supported the development of a Remedial Action Objective (RAO) to accelerate groundwater cleanup below the buildings, so that mitigation systems would not have to operate forever. After much deliberation, the final ROD Amendment included the following RAO:

To accelerate the reduction of the source of vapor intrusion (i.e., Site contaminants in shallow groundwater and soil gas) to levels that are protective of current and future building occupants, such that the need for a vapor intrusion remedy would be minimized or no longer be necessary.

However, this was not addressed by this proposed vapor intrusion remedy; instead, it was to be addressed by the revised groundwater remedy. Alternatives for accelerating groundwater cleanup would be evaluated in a separate Supplemental Site-wide Groundwater Feasibility Study for the Site. Although we asked that the RAO apply to the proposed plan for the site, we realized that a new Supplemental Groundwater Study that focused on alternatives for accelerating cleanup was a positive step.

While the technical advisor's work on vapor intrusion was divided between the MEW TAG and the Moffett TAG, at least five documents on vapor intrusion were supported by the Moffett grant. CPEO, independent of TAG funding, prepared a case study on this work that was featured in the ITRC (Interstate Technology Regulatory Council) web document, Remediation Management of Complex Sites.

### **Developing Community Acceptance Criteria for a Focused Feasibility Study (FFS)**

The second Five Year Review for the Regional Plume also found that in several areas, the groundwater remedy efficiency—the potential for achieving cleanup goals—was decreasing. As TCE and other contaminant concentrations in groundwater fell, groundwater extraction was achieving less efficient mass removal. Remedy optimization evaluations, conducted for each of the facilities by the MEW Companies, Navy, and NASA in 2008, found the original groundwater remedy was not expected to achieve site cleanup levels for several more decades. The optimization evaluations identified several technologies that could expedite groundwater cleanup at the sites, and EPA has encouraged the use of such technologies at several sites within the plume

This led EPA to begin work on a focused Sitewide Groundwater Feasibility Study that would consider these technologies for future use at the MEW and Moffett Field. EPA kept CPEO and its Community Advisory Board (CAB) informed on the progress of the new Groundwater Feasibility Study. In response, in 2011-2012 the technical advisor helped CPEO develop and submit to EPA a short paper entitled "Remedial Process Optimization—Community Criteria." In it, we outlined a strategy that in essence focused on what *can* be done instead of what *cannot* be done. We called for better coordination among the responsible parties, additional characterization, and improved long-term monitoring. We endorsed, where applicable, *in situ* techniques, and we suggested that some of the old, leaking slurry walls be converted into funnel-and-gate permeable reactive barriers.

We proposed addressing those portions of the plume that pose the greatest risk to human health and the environment. Specifically, we suggested that the new Feasibility Study and remedy selection focus on the following:

- Areas with high mass
- Areas that continue to act as a source
- Areas that reduce the need for long-term Vapor Intrusion mitigation
- Where the detectable plume encroaches on residential areas, schools, and other sensitive uses
- To enable reasonable future use of the property.

Additionally, we added the following elements of a strategy:

- Alternatives that replace current systems must speed up remediation (increasing progress towards remediation goals), remove or destroy contaminants that are not being addressed by the current system, and/or increase mass removal rates.
- The remedy selection process should evaluate hot spot removal.
- The remedy selection process should evaluate, where appropriate, the effectiveness of existing institutional controls (e.g., restrictions on drilling wells) as well as the need to establish new institutional controls (e.g., establish requirements to restrict use).
- The remedy selection should consider energy use and natural resource use/re-evaluate treated water recycling.
- The remedy selection process should evaluate the need for additional extraction wells and/or increasing extraction rates, particularly upstream from the slurry walls.
- Long-term monitoring and a contingency plan (e.g., failure of slurry walls) should be part of the scope of the FFS.
- Remedy selection is complicated by the fact that property owners must give consent to the Responsible Party to conduct pilot tests and implement new technologies. The FFS should account for this complication.

EPA has stated that it will use these criteria to help evaluate remediation technologies. However, even if EPA and the responsible parties accept all of the recommendations that our community has put forward, contaminant concentrations in portions of the plume may still remain above drinking water standards for many decades. Every effort should be made to get concentrations down to the point that natural degradation can finish the job in a reasonable timeframe.

For a variety of reasons, EPA postponed its conduct of the FFS, but we expect it will revive some form of feasibility study for the Regional Plume in the latter portion of 2019. While CPEO appreciates progress thus far on adaptive site management, the conduct of a plume-wide feasibility study and development of a umbrella work plan is a remaining issue.

## Remaining Issues

### **Hangars 2 and 3: The Navy Needs to Investigate and Address TCE and PCE contamination.**

Google's subsidiary Planetary Ventures' (PV) 2014 subsurface investigation at Hangars 2 and 3 found greater than expected concentrations of TCE and PCE in sub-slab soil-gas samples. In 2016 EPA and the Regional Water Board 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 RWQCB initiated informal dispute resolution with the Navy. Since that time, the Navy has agreed to conduct additional sampling, but it has not yet submitted a work plan. PV has also ruled out use of Hangar 3 because of structural concerns, and it has submitted a proposal to mitigate vapors in Hangar 2.

Site 7 encompasses the hangars and the areas surrounding them. The interior of the hangars had not been assessed for vapor intrusion potential. Previous investigations focused on the plume at Site 26, located just to the north of Site 7. Groundwater upstream and beneath Site 7 had no requirements for treatment.

Site 7 has a history of former underground storage tanks (USTs) containing a variety of waste solvents and others containing 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. Only limited soil and groundwater sampling has been conducted near the hangars and no sampling has been conducted beneath the hangars.

In April 2017 CPEO's technical advisor prepared a detailed memo about Site 7, and if it finds funding for continuing oversight at Moffett it expects to direct the technical advisor to support efforts to investigate the site, remediate any unacceptable levels of contamination, and mitigate any structures, current or future, that are at risk of vapor intrusion.

### **Orion Park: The Need for a Remedial Strategy**

Though separate from the main base, the 72-acre Orion Park Housing Area (OPHA) was part of the Moffett Naval Air Station. The Navy transferred the housing to the Air Force in 1994, and it was subsequently transferred to the Army in July 2000.

The area is relatively flat, ranging from 15 feet to 36 feet above mean sea level. There are no wetlands or surface water located in OPHA, though Stevens Creek is located due west of OPHA. The area that is now OPHA was vacant or used for agriculture prior to the construction of military housing. A portion of OPHA was used for agriculture until some time after 1965. The former farm apparently had at least one potable supply well that was decommissioned on 1993.



There is a volatile organic compound (VOC) plume—TCE, PCE, and DCE, among other contaminants—in the Orion Park groundwater. Historically, TCE in groundwater has been recorded at up to 1500 ppb: 2011 monitoring results indicated the highest concentration at 780 ppb, with the average concentration in 11 wells of 271 ppb.

Housing was constructed between the years 1941 through 1982. All the housing units were demolished by 2009. Today an Armed Forces Reserve complex covers about half the property. In 2017 the Army offered 30 of the remaining acres for lease to a private commercial developer under an Enhanced Use Lease (EUL). Thus far, no such lease has been announced. All current and future structures in Orion Park have or will have built-in vapor mitigation systems.

The Navy and then the Army have contended that there are no on-site sources of VOCs—that contamination has migrated from civilian property on the south. The Army sponsored studies designed to show that all of the contamination came from off site, but NASA, EPA, and CPEO have questioned that finding. More important, the Army has taken no responsibility for on-site remediation, even as NASA treats the portion of the plume that is migrating onto NASA property to the north.

Therefore, CPEO hopes to continue to follow any action at OPHA, and recommend that DoD, whether it be the Army or Navy, undertake some cleanup actions, particularly because groundwater flowing under OPHA is migrating off-site to NASA and any new lessee will be encumbered with this problem.

Over the course of this grant, CPEO's technical advisor prepared at least three memos about Orion Park. Though building occupants are in no immediate danger from the VOC plume, if CPEO receives additional funding for Moffett oversight, it expects to continue pushing for groundwater remediation to limit the need to vapor mitigation, create more flexibility in reuse, and reduce NASA's requirement to treat in-migrating contaminants.

### **New NASA Housing**

In 2017 NASA Ames announced plans to build nearly 2000 much-needed apartments, primarily for federal employees, on former Navy property. In 2018 it selected a developer. The 46-acre site is above the heart of the Regional TCE Plume, with a potential for vapor intrusion. CPEO expects EPA to apply similar requirements—sampling, remediation, and mitigation—for this project as it has for smaller residential projects on the south (non-Federal) side of U.S. 101. However, CPEO plans to oversee this development, not just to ensure that future residents are protected, but also to make sure that they are aware of the contamination and engaged in the oversight of NASA/developer activities.

### List of Work Products

#### 2Q08 (Second Quarter, 2008)

- Memo to CPEO on Site 26, TI Waivers, and FFS
- Comments on Site 26 Tech Memo
- Memo to CPEO re: Preliminary Remediation Goals, air

#### 3Q08

- Memo to CPEO on Site 26
- Comments on Hangar One Engineering Evaluation/Cost Analysis
- Correspondence with CAB

#### 4Q08

- Correspondence with CAB

#### 1Q09

- Presentation to RAB
- Comments on Site 25 Proposed Plan
- Comments on the Basewide Five-Year Review

#### 1Q10

- Correspondence

#### 2Q10

- Correspondence to Navy re: Hangar One windows
- Power point presentation: Review of Hangar One Issues

#### 3Q10

- Correspondence to Navy re: Aroclors in Hangar One cork room.

#### 4Q10

- Memo re Supplemental Site Investigation at Orion Park Area
- Correspondence with CPEO re vapor intrusion

#### 1Q11

- Correspondence re: PCBs

#### 2Q11

- Memo re: Demolition Costs
- Memo Comments on Site 25 Remedial Design

#### 4Q11

- Correspondence

## 1Q12

- Comments on the Orion Park Housing Area Supplemental Site investigation
- Correspondence

## 2Q12

- Correspondence
- Memo re: Comments on Groundwater Feasibility Study
- Memo re: Removal Action Limits for TCE
- Memo re: Annual Reports

## 4Q12

- Comments on Orion Park Housing Area
- Comments on Hangar One Long-Term Management (LTM)

## 1Q13

- Correspondence with RAB members on LTM costs at Hangar One

## 2Q13

- Site 26—comments on Proposed Plan

## 3Q13

- Comments on Hangar 1

## 2Q14

- E-mails to CPEO

## 3Q14

- E-mails to CPEO
- Comments on Five-Year Review

## 4Q14

- E-mails to CPEO.
- Memo on Indoor Sampling

## 1Q15

- E-mails to CPEO
- Memo on Lease Agreement
- Memo on Federal Facilities Agreement

## 2Q15

- E-mails to CPEO
- Table on Water Discharge

## 2Q16

- Memo on Annual Reports

3Q16

- Memo on Site 28 Reports

1Q17

- Draft memo on the three large hangars prepared (to be published in April)

2Q17

- Memo on large Hangars 1, 2, and 3 finalized