



SITE 25 AND HANGAR 1 RESTORATION TEAM ACCOMPLISHMENTS AT THE FORMER NAVAL AIR STATION MOFFETT FIELD MOFFETT FIELD, CALIFORNIA

The mission of the Naval Facilities Engineering Command Base Realignment and Closure Program Management Office (NAVFAC BRAC PMO) is to expeditiously and cost effectively provide the services necessary to realign, close and dispose of Navy and Marine Corps BRAC properties. Such realignments and closures provide cost savings which can be reapplied to support Navy and Department of Defense programs.

Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), two significant projects were completed in 2013 at the former Naval Air Station Moffett Field (Moffett). The NAVFAC BRAC PMO Environmental Restoration (ER) Team completed a Remedial Action for contaminated sediments in an active stormwater retention pond (Site 25), and a Removal Action to remove contaminated siding and other building materials at Site 29 (Hangar 1). As described below, these extremely complex environmental projects were independently challenging but uniquely connected.

The Moffett ER Team has developed an integrated and effective program management structure that has achieved all established program milestones and objectives. The Moffett ER Team's primary objectives throughout the Site 25 and Hangar 1 projects were to:

- Protect human health and the environment;
- Ensure communication, partnering and coordination of stakeholder issues were always a top priority;
- Employ transformational thinking in resolving project challenges early in the process resulting in successful project completion, and ability to avoid project delays and cost overruns; and
- Support the Navy mission by fulfilling legacy commitments, saving taxpayer dollars, and freeing up resources for military readiness and civil works

For the Site 25 remedial action and the Hangar 1 removal action, the Moffett ER Team was successful in meeting all of these objectives and completed the field activities as planned in 2013.



Sunrise on Moffett's historic Hangar 1 prior to siding removal activities

MOFFETT FIELD HISTORY: SITE 25 AND HANGAR 1 BACKGROUND

Moffett Field is located in Santa Clara County, California approximately 10 miles north of San Jose. The population of Santa Clara County is approximately 1.8 million, and is home to "Silicon Valley" which is host to some of the largest high tech firms in the world. The local residents are particularly concerned about regional and basewide environmental protection issues and are active Restoration Advisory Board (RAB) participants.

Environmental restoration activities began at Moffett in 1983 as part of the Department of the Navy's (Navy) Installation Restoration Program. In 1987, the United States Environmental Protection Agency (EPA) placed Moffett on the National Priorities List. In 1992, Moffett was designated for closure under the BRAC program. National Aeronautics and Space Administration (NASA), which already operated the Ames Research Center on the northern side of the base, assumed control of the facility in July 1994 and currently is the federal property owner for Moffett. The Navy conducts environmental investigation and restoration activities at Moffett in accordance with a Federal Facilities Agreement (FFA). EPA and State of California San Francisco Bay Regional Water Quality Control Board (Water Board) are party to the FFA. The Navy is the lead agency responsible for environmental actions included in the FFA. After base closure the Navy created two groups to facilitate the base transfer process: the BRAC Clean-up Team (BCT) and RAB. The BCT consists of members of the Navy and regulatory agencies which include the EPA, the Water Board, and NASA Ames representatives and serves to streamline communication of technical issues during site remediation and closure.

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The BCT members are supported by other agencies such as the California Department of Fish and Wildlife (Cal DFW) and the United States Fish and Wildlife Service (USFWS). The RAB consists of the BCT, the Cities of Mountain View and Sunnyvale, and local community members with the purpose of facilitating communication on the Navy's remediation progress and as a forum for community concerns and suggestions.

Since 1953, a 230 acre stormwater retention pond (SWRP) and associated diked marsh has been operated at Moffett Field. In 1991, a settling basin was constructed to control stormwater from the western portion of Moffett (including Hangar 1) in an effort to limit sediment transport into the SWRP/diked marsh, currently identified as Site 25. The western portion of Site 25 is owned by Midpeninsula Regional Open Space District (MROSD) and the central and northeastern portions are owned by NASA. Historical sampling of Site 25 sediments identified concentrations of total polychlorinated biphenyls (PCBs), lead, zinc, and total dichlorodiphenyltrichloroethane (DDT) as chemicals of ecological concern (COECs). In 1997, during a routine cleanout of the settling basin, a relatively uncommon PCB, Aroclor-1268, was discovered in sediment in the settling basin and SWRP. Navy and EPA policy for sediment clean-up requires that sources of sediment contamination be identified and controlled prior to initiating cleanup. Consequently, the remedial action for Site 25 could not occur until the source was identified.

Moffett's Hangar 1 is a massive structure that was constructed in the early 1930s to house the dirigible airship *U.S.S Macon*. It is one of the world's largest freestanding structures, covering over 8 acres. Hangar 1 measures 1,133 feet long (over three football fields), 308 feet wide, and 198 feet high (approximately 18 stories). The hangar is regarded as a notable visual structure and cultural icon in the San Francisco Bay area. It is a recognized Historic Civil Engineering Landmark, individually listed on the National Register of Historic Places (NRHP), and is a contributing element to the NRHP listed Moffett Field Historic District. The siding of Hangar 1 was comprised of Robertson Protected Metal, also known as "Galbestos" siding and consisted of numerous layers containing PCBs, lead, and asbestos. In an effort to determine the source of PCB contamination at Site 25, forensic sampling of the storm drain lines was conducted. Results indicated that due to weathering and overall siding deterioration, Aroclor-1268 and other PCBs were leaching from Hangar 1 into the storm drain system.



The recently de-sided Hangar 1 stands in the background of the restored Site 25 diked marsh.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

In an effort to remove the main source of contamination affecting the down-gradient Site 25 and also protect human health and the environment, the Navy mitigated contamination at Hangar 1 by performing a Non-Time Critical Removal Action (NTCRA) under CERCLA. The Navy evaluated thirteen removal action alternatives in the 2008 Engineering Evaluation/Cost Analysis (EE/CA). The selected alternative was documented in the Action Memorandum (AM) on December 31, 2008. The selected remedy involved removal of the PCB-contaminated metal siding and redwood roofing material, disposal of all debris to appropriate off-site disposal or recycling facilities, application of a weather-resistant epoxy coating on the remaining structural steel, decontamination of the concrete slab, and implementation of historic mitigation measures.

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Workers removing toxic siding to reveal redwood roofing material

The siding was being removed and disposed as a hazardous waste, because the EE/CA determined that other alternatives were either not technically feasible or were not permanent and would require long-term maintenance. The structural steel frame was originally coated with paint that contained concentrations of PCBs and lead; therefore, application of an epoxy mastic coating was required to encapsulate the residual contaminants on the steel. This approach along with the implementation of historic mitigation measures, allows NASA to eventually install new siding and return the hangar to a new beneficial mission.

The Moffett ER Team focused on protecting human health during the NTCRA. In particular NASA tenants and the surrounding community were guarded from potentially-contaminated air and dust emissions by controlling the release of contamination from the 4,940,000 pounds of contaminated siding and waste materials that were removed, while also preserving the structural integrity of this historic building. The remedy protected the environment from additional releases of PCB contamination to the storm water system while also reducing contaminant sources and complying with historic property requirements.

At Site 25, the contaminant levels in sediment posed an ecological risk to numerous sensitive site receptors. To protect the environment, the Moffett ER Team implemented a remedial action under CERCLA to remove COECs in sediment from more than 31 acres and restore the 230 acre SWRP to tidal marsh habitat. The Moffett ER Team completed a remedial investigation and evaluated eight alternatives in a Feasibility Study that considered current and future land use scenarios. The selected remedy was documented in a Record of Decision (ROD) signed in 2010 by project stakeholders and included the excavation and off-site disposal, treatment of sediment to facilitate disposal, and focused restoration of wetland excavations and ecological monitoring. By successfully negotiating with the regulatory agencies the team was able to use the innovative Theissen polygon method to identify removal areas. Using this method resulted in the identification and excavation of 113 polygons that ranged in size from less than 500 square feet to 2 acres. At completion the remedial action removed over 36,048 cubic yards of contaminated sediment from a saturated and routinely inundated environment, and restored nearly 20 acres of salt marsh and transitional upland habitat. Based on confirmation sampling, no contaminants remain at the site above project action levels and the site is available for unrestricted use.



Heavy equipment removes contaminated sediments from Site 25. Biological exclusion fencing is utilized to protect threatened and endangered species.

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ADDRESSING STAKEHOLDER ISSUES THROUGH ONGOING COMMUNICATION

Numerous stakeholders were involved in the Site 25 remedial action and the Hangar 1 removal action including the EPA, Water Board, NASA, USFWS, Cal DFW, California State Historic Preservation Office (SHPO), Advisory Council on Historic Preservation, Bay Area Air Quality Management District, MROSD, local Congressional staff, the RAB, Hangar 1 historic preservationist organizations, and other various public interest groups. As a consequence of the number and variety of outside interests on these projects, timely communication and interaction with project stakeholders by the Moffett ER Team has always been a top priority.

The Moffett ER Team routinely presented Site 25 and Hangar 1 status updates to the RAB and BCT, hosted monthly conference calls available to all project stakeholders to discuss the progress of both actions as field changes arose. These meetings expedited and provided real-time review and acceptance. In addition, numerous public meetings and workshops, and public/agency tours were conducted to provide information on project plans and decisions affecting stakeholders, as well as showing remedial progress at both sites.

The concept of removing contaminated siding and roofing materials, and demolishing interior structures at Hangar 1 was a controversial topic. While the BCT agreed with the remedy approach, the community, NASA, and most RAB members were initially opposed to the removal action alternatives for Hangar 1, specifically siding removal that would impact its historic and visual aesthetic. By keeping in constant communication to identify issues and concerns, the Navy was able to involve stakeholders in the decision-making, and conduct effective outreach to mitigate the community's reservations about the preferred alternatives. The recommended alternative contained several historic mitigation measures that addressed many of the public's concerns and will ultimately allow for the re-use of Hangar 1 by NASA.

A portion of Site 25 is accessible to the public via the San Francisco Bay Trail. This trail is a popular destination for bicyclists, hikers, bird-watchers, and duck hunters in the neighboring USFWS Don Edwards Wildlife refuge. The public access trail provides views of Site 25 and the wildlife located in both the tidal and non-tidal wetlands. Remediation activities at Site 25 required periodic restrictions of access to the Bay Trail. These restrictions were communicated to the public by posting signage and by providing information to stakeholder websites, including the Association of Bay Area Governments, the City of Mountain View, Friends of Stevens Creek; the Silicon Valley Bicycle Coalition; and USFWS. The high level of communication and interaction provided by the Moffett ER team was instrumental in not only gaining regulatory acceptance at Site 25, but also minimizing impacts to public access of the Bay Trail.

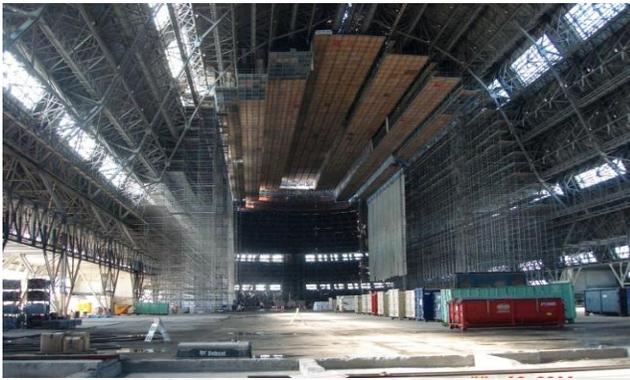
Neither of these projects could have succeeded without close Navy internal collaboration. The Moffett ER Team relied on the expertise of the NAVFAC Southwest Bay Area Resident Officer in Charge of Construction (ROICC) office and BRAC Caretaker Site Office (CSO) personnel to ensure field schedules were maintained and the Government's interests were protected by providing hazardous waste manifesting, quality assurance reviews, inspections and weekly Contractor Quality Control (CQC) meetings to monitor progress. In addition, BRAC Counsel provided invaluable legal guidance on CERCLA, the Endangered Species Act (Section 7), and project negotiations with the agencies and NASA.



Aerial view of Moffett Field and the excavated polygons
within Site 25

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**PROJECT ACCOMPLISHMENTS – OUTSIDE THE BOX THINKING RESULTS IN EARLY
RESOLUTION OF SITE CHALLENGES**



Extensive scaffolding system constructed inside Hangar 1 for siding removal, cleaning, and painting

In addition to the outside challenges the Moffett ER Team faced on these projects, significant technical and safety hurdles were encountered through the course of completing these actions. Not the least of which was conducting remediation work on an operational facility that is owned and operated by another federal agency, NASA. For both sites, the Moffett ER Team was required to coordinate with NASA, the current owner/operator of Moffett Field. NASA reviewed and commented on planning documents; approved construction permits which included fire hazards, planning, utilities, worker safety, and security. Field activities required strict adherence to NASA security and airfield requirements.

Hangar 1 - Numerous unique technical challenges and constraints associated with implementing a CERCLA removal action on a historic structure were overcome. The demolition phasing plan was designed so that interior demolition and most of the cleaning and coating activities could occur while the hangar siding was still intact; thus allowing the hangar shell itself to serve as containment for control of coating overspray and dust emissions. Due to the extreme height of Hangar 1 and its sloped design, a massive scaffold system utilizing innovative design requirements, was constructed inside the hangar to enable the siding removal, cleaning, and painting to be completed safely. The scaffolding project was the largest in the western United States at the time of the removal activities. Scaffolding provided a more stable platform for workers and allowed for better contaminant control than other means of access. Because siding removal, pressure washing, and painting of the structural steel were occurring simultaneously within different sections of Hangar 1, the logistical and worker safety challenges were daunting and required constant coordination between the various onsite contractors. All of this work was completed with zero lost-time injuries in over 285,564 man-hours worked.

The air monitoring system was designed to provide multiple levels of emissions control including 100% monitoring of workers in the work zone and continuous data logging air monitoring at the site perimeter. The air monitoring data were made available to the public and the system demonstrated complete compliance with all ambient air standards and action levels.

Also notable, the Hangar 1 removal action resulted in sustainable use of resources through the salvage and recycling of building materials. Historic artifacts were decontaminated and returned to NASA for preservation or re-use. In addition to the over 4,940,000 pounds of toxic siding and waste materials that were removed from the hangar, approximately, 2,075 tons of demolition debris was salvaged for recycling, and over 300,000 board ft. of redwood planking were removed from the hangar roof. Specially designed wood planing equipment was utilized to allow the redwood to be salvaged for re-use. Over 500,000 gallons of wastewater were treated onsite and recycled to the extent possible, significantly reducing the consumption of potable water.



A lit Hangar 1 being utilized for a NASA event after the Navy's completion of the removal action. (Michelle Le)

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Extensive Bird Air Strike Hazard (BASH) requirements were implemented due to the removal of the hangar siding and the potential impacts on adjacent airfield operations. These requirements were complicated once the siding was removed by the openness and sheer size of the hangar. Biological monitoring and BASH mitigation measures were coordinated with Moffett Airfield Operations to control wildlife hazards and potential airfield impacts. In addition, special buffer zones, biological monitoring, and avoidance activities were required in and around Hangar 1 for the protection of Burrowing Owls, Golden Eagles, and other migratory bird species.

Site 25 – Implementing a CERCLA remedial action in an operational SWRP owned by two other agencies (NASA/MROSD) presented numerous unique challenges and constraints. The biggest hurdle in accomplishing the remedial action was management of storm water. Site 25 accepts treated groundwater from the Navy’s West-Side Aquifer Treatment System (WATS), which discharges approximately 25,000,000 gallons annually to Site 25. Diverting treated WATS water away from Site 25 expedited the rate of evapotranspiration which was essential due to heavy precipitation during the winter months. The water diversion aided the stability of extremely soft and saturated sediment surfaces for heavy equipment access and avoided pumping large volumes of surface water, thereby saving energy costs. Due to the ever changing water conditions, precise timing was required to conduct excavations after stormwater evaporated and prior to the start of the next rainy season.

At Site 25 early planning allowed the Navy to take another innovative approach; the waste profiling activities were completed ahead of the excavation effort. An air boat and sediment coring device were used to pre-characterize polygons, and allowed access to muddy and/or inundated areas of the site that were not possible with conventional methods. Pre-characterization of sediments resulted in substantial cost savings versus waiting for the SWRP to fully dry out. By advance-profiling the sediment, the ER Team was able to secure transportation routes for off-site disposal and avoid “double-handling” of materials, i.e., direct load-out from the excavators to transport vehicles. Additionally, by fully analyzing the leachability of COECs from sediment prior to excavation, the ER team avoided costly stockpiling and pre-treatment of sediment (part of the original project plans). This alleviated the need for temporary infrastructure, including stockpile berms, liners, dewatering facilities, water handling/disposal costs, and resulted in a significant reduction to the environmental footprint and related impacts to wildlife.



Salt Marsh Harvest Mouse on Pickleweed

In addition, numerous identification and avoidance measures were required for the protection of biological resources and endangered species, including the Federal and State-listed Salt Marsh Harvest Mouse (SMHM) (*Reithrodontomys raviventris*), and Western Pond Turtle (*Actinemys marmorata*). Coordination and early communication with regulatory agencies, NASA, and multiple property owners and local preservationist were fundamental in the successful execution of water and species management.

Remediation at Site 25 was performed to allow for possible future re-use as tidal marsh habitat. Both the endangered SMHM and its preferred habitat of wetlands and pickle weed are present at Site 25. Complications due to the presence of the SMHM threatened to halt or delay remediation of Site 25. However, the Moffett ER Team successfully negotiated with the USFWS and Cal DFW on the design of an innovative barrier (double-walled silt fence with special features) that proved effective in excluding mice and other wildlife species from entering areas under excavation. This negated the need for continuous biologist inspections of the entire excavation areas. Biological awareness and avoidance of protected species and other wildlife resulted in zero take of any species.

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The main objective of the post-excavation restoration activities was restoring the salt marsh with a variety of native plants that would enhance SMHM habitat. Since project completion, the newly planted salt marsh vegetation is thriving in 95 percent of the excavated areas. The Navy's cleanup activity at Site 25 attained strict cleanup goals for ecological protection and will provide NASA with stormwater retention with no resulting harm to the ecology.

COST AVOIDANCE MEASURES

Regulatory acceptance of the Navy's preferred alternative and effective management of stakeholder expectations during the removal action for Hangar 1 achieved a cost avoidance of approximately \$40 million. Siding removal and encapsulation of the structural steel avoided costs over \$25M when compared to the estimated cost of the other alternatives requested by some stakeholders. Initially, the community, NASA, and local Congressional representatives had formally requested that the Navy be responsible for re-siding the hangar as part of the removal action. However, the Navy developed a compelling position that was supported by the Office of Management and Budget (OMB) who determined that NASA, as the property owner, was responsible for re-siding as part of their basewide re-use. The Navy was able to avoid additional costs in excess of \$15M as a result of this determination.

For Site 25, utilizing innovative approaches to fully characterize sediments prior to excavation, the Moffett ER team avoided costly stockpiling and pre-treatment of sediments to save nearly \$250,000 in project costs. In addition, combining planning documents, conducting over-the-shoulder document reviews and expediting review timelines resulted in \$250,000 of savings. The extensive planning of site habitat restoration activities allowed the Moffett ER Team to negotiate a two-year vegetation monitoring program instead of the five-year monitoring program typically required by Cal DFW. This effort alone resulted in a \$375,000 cost savings in vegetation monitoring, additional plantings, and annual reporting.

TRANSFERABILITY AND PROJECT IMPACT/OUTCOMES

The Hangar 1 removal action successfully achieved long-term protection of the environment and public health by removing contaminated siding and building materials identified as the source of PCB contamination to sediment and surface water at Site 25, and controlling the potential release of PCBs from the painted steel structure. Lessons learned from the Hangar 1 project are being disseminated through formal and informal briefings for use on similar Navy sites that require environmental restoration on historic buildings. Because the contaminated Robertson Protected Metal "Galbestos" siding on Hangar 1 is present at other Department of Defense (DoD) facilities, others can benefit from the lessons learned at Hangar 1. Recently, the Moffett ER team shared information on waste disposal options and emission control approaches with the Riverbank Army Ammunition Plant, another DoD BRAC facility that has several Galbestos-sided buildings and related PCB contamination issues. The removal action also allows for a future re-use of Hangar 1 by NASA or other public/private entities.

Though multiple land ownership and agency responsibilities make Site 25 a unique site, the approaches used at Site 25 relative to communication, pre-excavation waste characterization, water management, wildlife exclusion, and site restoration will have legacy value and should be considered in future cleanups at other bayside or marine sites. The cleanup actions and subsequent wetland restoration efforts at Site 25 reduced risks to the environment, while maintaining NASA's infrastructure.

The Moffett ER team's approach to both the Site 25 and Hangar 1 actions have engendered a sense of trust and exchange of ideas and information with the regulatory oversight agencies and with the RAB members that has proved to be a very successful partnership and will allow for NASA's mission at Moffett to continue safely for not only the people who work there, but the community that surrounds it.