**Base Realignment and Closure**
**Program Management Office West**
**1455 Frazee Road, Suite 900**
**San Diego, California 92108-4310**

**CONTRACT NO. N68711-98-D-5713**
**CTO NO. 0068**

# ENGINEERING EVALUATION/COST ANALYSIS
# REVISION 1
**July 30, 2008**

**DCN: ECSD-5713-0068-0001**

**INSTALLATION RESTORATION SITE 29, HANGAR 1**
**FORMER NAVAL AIR STATION MOFFETT FIELD**
**MOFFETT FIELD, CALIFORNIA**

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**DCN: ECSD-5713-0068-0001**


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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| °F | degrees Fahrenheit |
| $\mu g/100cm^2$ | micrograms per 100 square centimeters |
| µg/L | micrograms per liter |
| $\mu g/m^3$ | micrograms per cubic meter |
| ACHP | Advisory Council on Historic Preservation |
| ACM | asbestos-containing material |
| AM | Action Memorandum |
| APE | area of potential effect |
| ARAR | applicable or relevant and appropriate requirement |
| BAAQMD | Bay Area Air Quality Management District |
| Basin Plan | Water Quality Control Plan for the San Francisco Bay Region |
| BMP | Best Management Practice |
| BRAC | Base Realignment and Closure |
| CAA | Clean Air Act |
| Cal. Code Regs. | California Code of Regulations |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| C.F.R. | Code of Federal Regulations |
| ch | chapter |
| COC | contaminant of concern |
| CWA | Clean Water Act |
| DERP | Defense Environmental Restoration Program |
| div | division |
| DoD | Department of Defense |
| DOT | Department of Transportation |
| DTSC | Department of Toxic Substances Control |
| EDM | Eastern Diked Marsh |
| EE/CA | Engineering Evaluation/Cost Analysis |
| FFA | Federal Facility Agreement |
| HAER | Historic American Engineering Record |
| HAP | hazardous air pollutant |
| Harding ESE | Harding Environmental Science and Engineering |

# ABBREVIATIONS AND ACRONYMS
(Continued)

| | |
|---|---|
| HSWA | Hazardous and Solid Waste Amendments |
| IR | Installation Restoration |
| IRP | Installation Restoration Program |
| ISSi | Integrated Science Solutions, Inc. |
| LDR | land disposal restriction |
| MCL | Maximum Contaminant Level |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| MROSD | Midpeninsula Regional Open Space District |
| NAAQS | National Ambient Air Quality Standards |
| NAS | Naval Air Station |
| NASA | National Aeronautics and Space Administration |
| Navy | U.S. Department of the Navy |
| NAWQC | National Ambient Water Quality Criteria |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NHPA | National Historic Preservation Act |
| NPDES | National Pollutant Discharge Elimination System |
| NRHP | National Register of Historic Places |
| NTCRA | Non-Time-Critical Removal Action |
| O&M | operation and maintenance |
| OHP | Office of Historic Preservation |
| OSHA | Occupational Safety and Health Administration |
| PAI | Professional Analysis Incorporated |
| PCB | polychlorinated biphenyl |
| $PM_{10}$ | particulate matter less than 10 microns in diameter |
| PMO | Program Management Office |
| Porter-Cologne Act | Porter-Cologne Water Quality Control Act |
| PPE | personal protective equipment |
| ppm | parts per million |
| PRG | Preliminary Remediation Goal |

# ABBREVIATIONS AND ACRONYMS
(Continued)

| | |
|---|---|
| RAB | Restoration Advisory Board |
| RAO | Removal Action Objective |
| RCRA | Resource Conservation and Recovery Act |
| STLC | Soluble Threshold Limit Concentration |
| SWPPP | Stormwater Pollution Prevention Plan |
| SWRCB | State Water Resources Control Board |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TCRA | Time-Critical Removal Action |
| tit | title |
| TSCA | Toxic Substances Control Act |
| TtFW | Tetra Tech FW, Inc. |
| TTLC | Total Threshold Limit Concentration |
| U.S.C. | United States Code |
| USEPA | U.S. Environmental Protection Agency |
| VOC | volatile organic compound |
| Water Board | San Francisco Bay Reigional Water Quality Control Board |
| WATS | West-Side Aquifers Treatment System |
| WQO | water quality objective |

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# EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis (EE/CA) presents the results of the evaluation and recommendation of a removal action for Hangar 1 at the former Naval Air Station Moffett Field (Moffett), California. The EE/CA was performed in accordance with current U.S. Environmental Protection Agency (USEPA) and U.S. Department of the Navy (Navy) guidance documents for a Non-Time-Critical Removal Action (NTCRA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The EE/CA summarizes the site characteristics and identifies the removal action objective (RAO). The EE/CA describes and evaluates possible removal action alternatives, based on three criteria: implementability, effectiveness, and costs; provides an analysis of the alternatives, including the estimated costs; and presents the recommended removal action alternative.

## SITE BACKGROUND

Hangar 1 was built in 1932 to house the airship *U.S.S. Macon*. In 1994, as part of the transfer of Moffett to National Aeronautics and Space Administration (NASA) under the Base Realignment and Closure program, the property management responsibility for Hangar 1 was transferred to NASA. Since then, NASA has used Hangar 1 for air shows, open houses, the Moffett Field Museum, and various commercial and public functions.

Hangar 1 is situated west of the Moffett runways between Sayre Avenue and Cummins Avenue. It is a large structure measuring 1,133 feet long, 308 feet wide, and 198 feet high, and is constructed with a steel-frame 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. The area surrounding the hangar is paved, with the exception of several small areas of sod located directly next to the hangar. The interior floor of the hangar is concrete.

NASA restricted access to certain interior areas of the hangar after lead-contaminated dust was identified as a health concern in late 2000. When subsequent testing revealed that PCBs were also present inside the hangar, the hangar was closed to all uses except maintenance activities.

In 2003, the exterior of the siding of Hangar 1 was coated with an asphalt emulsion as a Time-Critical Removal Action (TCRA) to cover and contain hazardous building materials and prevent migration of contaminants to the environment, and fencing was installed around the hangar to control access.

The Navy added Hangar 1 to the Installation Restoration Program as Site 29 in September 2004.

## PREVIOUS INVESTIGATIONS AND REMOVAL ACTIONS

In 1991, NASA completed construction of a stormwater settling basin (settling basin) that is approximately 2,000 feet northwest of Hangar 1, to limit sediment transport to Installation Restoration Site 25, which includes the Eastern Diked Marsh, Stormwater Retention Pond, and the Midpeninsula Regional Open Space District property. This action also reduced contaminant migration. The settling basin receives stormwater runoff from the western portion of Moffett. In 1997, during routine cleanout and sampling activities conducted by NASA, a relatively uncommon PCB, Aroclor-1268, was discovered in sediment in the settling basin. Subsequently, NASA conducted a series of investigations in the surrounding areas to determine its source.

Results of these investigations indicated that the PCBs, specifically Aroclor-1260 and Aroclor-1268, were present in paint and interior layers of the Hangar 1 siding at concentrations of up to 5,500 milligrams per kilogram (mg/kg) and 188,000 mg/kg, respectively. In addition, analytical results from the lead-based paint on the structural steel inside the hangar indicated PCB concentrations of Aroclor-1260 and Aroclor-1268 up to 120 mg/kg and 94 mg/kg, respectively. Total PCBs were reportedly present in paint on the interior structural steel at concentrations ranging from 65 to 214 mg/kg. Based on these sampling results, Hangar 1 was confirmed to be a source of the PCB contamination found in the settling basin. PCBs on interior and exterior building materials of Hangar 1 are the contaminants of concern (COCs) and the regulatory driver for this removal action, but the presence of asbestos and lead in the hangar building materials raises health and safety-related issues and other hazardous materials management issues that must also be addressed in planning and implementing any response action at the Hangar 1 site.

The Navy and NASA conducted separate TCRAs at the Hangar 1 site following discovery of the contaminants in and around the hangar. In 2002, the concrete floor of Hangar 1 was cleaned and all hangar occupants were removed from the hangar. In 2003, NASA implemented a TCRA to remove sediments contaminated with PCBs from the stormwater collection trench around the perimeter of Hangar 1, and to remove potentially contaminated sediments present on paved surfaces immediately surrounding the structure. The Navy's TCRA was completed in October 2003 and included pressure washing the siding and then coating it with asphalt emulsion. The paved areas around the hangar were also cleaned by pressure washing to remove PCBs from the surface areas. Subsequently, in February 2005, as part of an ongoing effort to reduce contamination, the Navy cleaned out the Hangar 1 rain gutters by collecting, sampling, and disposing of the contaminated sediments in the gutters.

Although the interim actions discussed above have reduced the release of COCs from the exterior of Hangar 1, these are short-term control actions that do not adequately address the source of PCB contamination. The asphalt-emulsion coating has a limited warranty of approximately 3 to 5 years. The Navy intends to mitigate the threat of further discharge of PCBs from Hangar 1 and to complete a removal action while the interim coating is still effectively in place.

## REMOVAL ACTION OBJECTIVE

In accordance with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan, the removal action is being conducted to control the migration of PCBs from Hangar 1 to the environment through source elimination or containment, thereby eliminating risks to human health and the environment.

The proposed RAO is to control the release of PCBs at Hangar 1, thereby reducing the potential risks to human health and the environment while minimizing future operation and maintenance activities at the site.

The RAO will provide the criterion for evaluation of the removal action alternatives based upon implementability, effectiveness, and cost, and for the selection of a CERCLA NTCRA for this site. This NTCRA addresses the PCB contamination from the surface of the interior concrete floor slab, the building interior, and the exterior face of the hangar siding. It should also be noted that this removal action is not addressing 1) potential releases to groundwater, because data previously collected indicate there have been no impacts on groundwater; 2) adjacent structures and soils, because they are outside the scope of this NTCRA; 3) contamination in or below the concrete foundation, because the foundation will be left in place and there are no indications that it is contaminated; or 4) institutional controls, because they are outside the scope of this NTCRA. Once the NTCRA is complete, sampling will be conducted to determine if the area surrounding the hangar has been impacted as a result of the removal action. The sampling approach will be detailed in the NTCRA work plan.

Although PCBs are the regulatory driver for this removal action, asbestos and lead are also present in interior and exterior Hangar 1 building materials. Building materials containing asbestos and lead that are in good condition and not subject to disturbance may generally be left in place per USEPA and Department of Defense policy. However, in the course of addressing the PCB contamination at Hangar 1, it will be necessary to take into account health and safety issues associated with handling and working in the vicinity of materials containing asbestos and lead and to comply with requirements for proper management, abatement, or disposal of asbestos and lead as hazardous materials.

## REMOVAL ACTION ALTERNATIVES

A broad range of removal action alternatives is described and evaluated in Section 4.0 of this EE/CA based on two of the three EE/CA criteria, implementability and effectiveness, taking into consideration site-specific conditions. Removal action alternatives that either coat or encapsulate the hangar, or include full siding removal will also address the interior components of the hangar consisting of the interior siding (corrugated Robertson Protected Metal siding), redwood ceiling, structural steel, and catwalks as part of the RAO. At the conclusion of Section 4.0, the alternatives that are determined feasible for success in achieving the RAO are retained for a

comparative analysis in Section 5.0, which addresses the third EE/CA criteria, cost. The following removal action alternatives were evaluated as part of this EE/CA:

- Alternative 1: Enclose entire hangar inside another structure
- Alternative 2: Cover with rubberized material
- Alternative 3: Coat with asphalt-emulsion
- Alternative 4: Coat with acrylic coating
- Alternative 5: Coat with plasma-sprayed oxide
- Alternative 6: Cover with new visually similar siding
- Alternative 7: Media blast contaminated surfaces
- Alternative 8: Neutralize PCBs using emulsified bimetallic extraction
- Alternative 9: Remove contaminants by chemical stripping and coating
- Alternative 10: Remove siding and coat exposed surfaces
- Alternative 11: Demolish and remove hangar
- Alternative 12: Collect stormwater runoff and treat on site
- Alternative 13: Collect stormwater runoff and treat/dispose off site

The first stage of the review consisted of subjecting each of the above alternatives to a detailed evaluation in terms of their implementability and effectiveness in addressing the RAO. The implementability of an alternative evaluates the technical and administrative feasibility and the availability of various services and materials required during its implementation. The implementability also includes community acceptance, which is considered by making this EE/CA available for public review and by taking community concerns into account. There will be a comment period of at least 30 days at the time the EE/CA becomes available to the public. The effectiveness of an alternative refers to its ability to meet the RAO within the scope of the removal action. The effectiveness evaluates the ability of the alternatives to protect public health and the environment; to comply with the applicable or relevant and appropriate requirements (ARARs); to address issues related to the National Historic Preservation Act (NHPA); to be effective in the short and long term; and to reduce the toxicity, mobility, or volume of the contaminants through treatment.

Two of the above criteria led to the elimination of an alternative at this stage of the evaluation: 1) implementability (technical feasibility, administrative feasibility, availability of services and materials, community acceptance), and 2) effectiveness (overall protection of human health and the environment, compliance with ARARs, short-term effectiveness, long-term effectiveness, reduction of toxicity, mobility, or volume through treatment). An alternative that was not technically feasible or not proven was determined not to be a viable alternative and eliminated from further consideration. Five alternatives fell into this category and were eliminated:

Alternative 1, enclose entire hangar inside another structure; Alternative 3, coat with asphalt-emulsion; Alternative 5, coat with plasma-sprayed oxide; Alternative 7, media blast contaminated surfaces; and Alternative 8, neutralize PCBs using emulsified bimetallic extraction.

An alternative could not be further considered if it would not be in compliance with ARARs. One alternative fell into this category: Alternative 9, remove contaminants by chemical stripping and coating.

An alternative that would not be protective of human health and the environment could not be further considered. Therefore, any alternative that would not meet this requirement was eliminated from further analysis. Three alternatives fell into this category: Alternative 3, coat with asphalt-emulsion (already eliminated for technical feasibility), Alternative 12, collect stormwater runoff and treat on site, and Alternative 13, collect stormwater runoff and treat/dispose off site.

Elimination of eight alternatives at the first stage of the review left five alternatives to compare in detail to determine the appropriate removal action. These were Alternatives 2, 4, and 6, which involve covering or coating the exterior of the existing siding; Alternative 10, which involves removing the Robertson Protected Metal siding and encapsulating the remaining structural steel paint; and Alternative 11, which involves demolition and the permanent removal of contaminants.

## COMPARATIVE ANALYSIS

The remaining five alternatives (Alternatives 2, 4, 6, 10, and 11) were subjected to a comparative cost analysis, which included removal and operation and maintenance measures factored into the costs. The focus of the comparative analysis was to assess the implementability, effectiveness, and cost of the alternatives relative to one another. Such an analysis complies with the requirements of the Navy Installation Restoration Manual (Navy, 2000) and utilizes the *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (USEPA, 1993). Following completion of the analysis required by CERCLA, an additional comparison of costs associated with recommended NHPA mitigation measures was performed.

The five alternatives were found to be technically feasible and administratively feasible; comply with ARARs; use standard construction services, equipment, and materials; provide adequate protection of public health and the environment; provide adequate short-term effectiveness; but do not reduce the toxicity, mobility, or volume of contaminants through treatment.

Alternatives 2, 4, and 6 effectively contain the contamination in place over the long term for as long as the integrity of the exterior cover material and the interior coating is adequately maintained. Alternative 10 would be effective over the long term if the exposed coating on the structural steel is adequately maintained. Alternative 11 is the only alternative that would completely remove all contamination and be effective over the long term without future maintenance.

## RECOMMENDED REMOVAL ACTION ALTERNATIVE

Based on the detailed analyses presented in this EE/CA, the Navy's recommended alternative for the planned NTCRA is Alternative 10, remove siding and coat exposed surfaces. Alternative 10 consists of the complete removal of the siding; demolition and disposal of all interior structures, including interior buildings, catwalks, and redwood ceiling; and the removal of the resulting contaminated and non-contaminated debris to appropriate off-site disposal or recycling facilities. The exposed structural steel would be coated as part of the removal action for Alternative 10.

This alternative best meets the RAO and the NCP criteria because it:

- Is technically feasible based on commonly used construction techniques and demonstrated proven approaches
- Is administratively feasible; uses federal funding for support and follow on maintenance of the steel coating
- Uses widely available conventional construction equipment, services, and skilled workers
- Provides a high degree of long-term protection of the public and the environment because the PCBs in Hangar 1 siding and associated interior components would be removed, and the remaining PCBs in structural steel paint would be contained
- Complies with ARARs
- Provides adequate short-term effectiveness during implementation
- Imposes minimal restrictions on future use of the site and provides a frame that could be used for future development

The estimated cost for Alternative 10, including Level 1 Historic American Engineering Record documentation, oral histories of individuals who worked in the hangar during different eras, virtual Hangar 1 interactive compact disk, inventory-catalogue of Hangar 1 collections contained in the Moffett Field Museum, preservation of Hangar 1 man-cranes, and coating the steel frame with a protective coating similar in color to the hangar's former siding is $26,160,000.