5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section includes a comparative analysis of the five removal action alternatives that have been retained for further evaluation in terms of their implementability, effectiveness, and cost. The first two criteria used in this analysis are the same as those used in Section 4.0; however, the total cost for each alternative, including O&M and for coating the interior components (when applicable), is included as an additional factor to consider when selecting the most appropriate alternative for Hangar 1.

5.1 REMOVAL ACTION ALTERNATIVES

The five removal action alternatives retained for a comparative analysis include the following:

- Alternative 2 – Cover with rubberized material
- Alternative 4 – Coat with acrylic coating
- Alternative 6 – Cover with new visually similar siding
- Alternative 10 – Remove siding and coat exposed surfaces
- Alternative 11 – Demolish and remove hangar

These alternatives were described in Section 4.0 and were evaluated in detail in terms of their effectiveness in achieving the RAO for the site. The focus of the comparative evaluation presented in this section is to assess the implementability and effectiveness of the alternatives in a comparative setting relative to one another. The cost of implementation of each alternative is presented below to identify an alternative for Hangar 1 that is not only the most implementable and technically effective but is also cost-effective.

5.1.1 Implementability

The implementability of removal action alternatives is compared based on the technical feasibility, administrative feasibility, and availability of services and materials.

Technical Feasibility

The above alternatives are technically feasible, although they would have different degrees of difficulty and complexity during implementation. Alternative 2 has been implemented in a similar application in Akron, Ohio. The Belzona and Sherwin Williams coatings for Alternative 4 are both compatible with the hangar siding and are expected to be equally feasible. Alternative 6 is also technically feasible because it uses standard construction techniques for covering the existing siding of Hangar 1 with visually similar siding.

Alternatives 2, 4, and 6 would be the least intrusive to the Hangar 1 structure because the existing siding stays in place; however, partial demolition of the interior buildings is required to gain access to the interior siding and lower sections of the structural steel for coating the interior. The hangar windows and access doors would not be covered (or coated for Alternative 4) since they would be replaced. Since catwalks would need to be removed in order to be coated, it is more cost efficient to dispose of them at a proper disposal facility than to coat and reinstall. In addition, the amount of contaminated material that remains would be reduced by disposing of the catwalks.

Alternatives 10 and 11 both involve removal of the contaminated siding from Hangar 1 and demolition of all of the interior structures (interior buildings, redwood ceiling, and catwalk planks). For Alternative 10, the remaining PCBs in paint on the structural steel surfaces would be contained with a primer and finish coat of epoxy selected for endurance and weather elements. Alternative 11 is the most challenging from a construction standpoint because it involves total demolition of Hangar 1, including all external and internal features. In summary, all five alternatives would be technically feasible, with Alternative 4 being the least destructive and the easiest alternative to implement.

Structural Analysis

A structural analysis of Hangar 1 was completed by the Navy in 2008 (Exeltech, 2008). The scope of the structural analysis included:

- Review of as-built documents and reports
- Performance of a site visit and evaluation of the existing condition of the facility
- Preparation of a field summary memorandum summarizing the findings
- Development of evaluation criteria for the study
- Analysis of the hangar for gravity, wind, and seismic loads for the selected mitigation options
- Identification of deficient elements and development of retrofit concepts
- Recommendations for the removal of catwalks and other non-structural elements to avoid impacting the structural integrity of the hangar
- Development of cost estimates for the proposed retrofit options
- Preparation of a report of the findings

The structural analysis indicated that due to the additional weight added onto the hangar by implementing Alternatives 2, 4, and 6, retrofitting the structure would be required prior to implementation. Alternative 10 would not require any retrofitting, but would require some minor bracing due to the local effects of wind and gravity and not due to a structural deficiency.

The costs of the retrofitting and additional bracing are included in Appendix C. A detailed design for each alternative will be required prior to implementation.

Administrative Feasibility

Implementation of all alternatives is considered administratively feasible.

Availability of Services and Materials

All five alternatives use standard construction equipment and services. Alternatives 2 and 4 rely on availability of specialized cover or coating material whose durability and life span must be carefully examined to ensure that the material or coating would follow the required specifications. In addition, Alternatives 2, 4, 6, and 10 would require periodic inspection, maintenance, and repair to ensure that the material and coating continue to serve their primary purpose as a barrier to PCB migration from the existing Hangar 1 exterior and interior components. Alternative 11 has an advantage over the others by being a one-time action, not requiring any future services or material.

Community Acceptance

Assessment of each alternative in accordance with this evaluation criterion will be based upon consideration of public comments received after this EE/CA is published and made available for public comment. A previous version of this EE/CA was published on May 5, 2006. Comments received during the comment period for that version were evaluated and incorporated into this revised EE/CA, where appropriate. The assessment of each alternative in this revised version will require determining which components of the alternatives interested persons in the community support, have reservations about, or oppose. The assessment cannot be completed until public comments have been considered.

5.1.2 Effectiveness

The effectiveness of removal action alternatives is compared based on overall protection of public health and the environment, compliance with ARARs, short-term effectiveness, long-term effectiveness, and reduction of toxicity, mobility, or volume through treatment.

Overall Protection of Public Health and the Environment

All five alternatives would provide adequate protection of public health and the environment. However, the level of this protection could be potentially affected by the site conditions over time for some of these alternatives. Alternatives 2, 4, and 6 rely on either the covering or coating of the existing siding and interior components to control PCBs from being directly exposed to the atmosphere and thereby posing a threat to human health and the environment. Because the source of PCB contamination remains in place for these alternatives, the public health and

environmental protection provided by these alternatives would be contingent upon adequate inspection and maintenance of the cover or coating materials over their associated life spans. Alternative 10 consists of complete removal of the siding and containment of the PCBs in the structural steel paint. Alternative 11 completely removes the PCB sources. Alternatives 10 and 11 are superior to Alternatives 2, 4, and 6 in terms of overall protection of public health and the environment, with Alternative 11 permanently eliminating the threat of future PCB releases from the site.

Compliance with ARARs

All five alternatives would comply with federal and California state ARARs as identified in Section 3.5 and summarized in Tables 3-1 through 3-6.

Historic Mitigation

All alternatives would have an effect on the historic character of Hangar 1, and mitigation measures considered will include preparation of Level 1 HAER documentation, oral histories of individuals who worked in the Hangar during different eras, preparation and distribution of a virtual Hangar 1 interactive CD, inventory of Moffett Field Museum collections, and preservation of Hangar 1 man-cranes. Alternatives 2, 10, and 11, in particular, would have an adverse visual effect on the Historic District. The degree of this effect varies among the alternatives with Alternatives 2, 4, 6, and 10 affecting the character-defining features of the hangar, with Alternative 11 removing all visual components. Alternative 11 would result in the most significant effect because the hangar would be completely removed under this alternative.

Preparation of the Level 1 HAER documentation is underway. Additional historic mitigation options considered ranged from matching the color of the coating as closely as possible to the original siding (Alternatives 2, 4, and 6) to re-siding the hangar frame with a similar appearing siding (Alternative 10).

The Navy shall focus the CERCLA process by actively seeking the expertise and comments of the following entities to ensure that the substantive requirements of the NHPA and 36 C.F.R. Part 800 are adequately addressed: the OHP, the ACHP, and other interested parties.

These entities shall be provided with the opportunity to review and comment on the EE/CA and the draft Removal Action Work Plan. Their comments shall be addressed in responsiveness summaries accompanying the AM and the final Removal Action Work Plan, respectively.

Short-term Effectiveness

All five alternatives would provide adequate short-term effectiveness with respect to public health protection through controlling access to the project site and by conducting air monitoring and runoff control during implementation. Similarly, site workers would be protected by using proper

PPE and conforming to OSHA specifications when using different construction equipment. Alternatives 2, 6 and 11 may require longer durations for implementation; therefore, they would be the least effective alternatives in the short term. Short-term effectiveness would be highest for Alternative 4, which would take the minimal amount of time to implement and cause the least amount of disturbance to the Hangar 1 structure. Alternatives 10 and 11 would generate a large amount of waste material and debris requiring disposal at approved facilities. Also, Alternatives 10 and 11 have the potential to generate a high amount of fugitive dust that must be adequately controlled. All alternatives address the RAO directly by removing or containing the PCB source.

Long-term Effectiveness and Permanence

Alternatives 2, 4, and 6 would effectively contain the PCBs that remain in place over the long term for as long as the integrity of the exterior cover material (the special coating, covering, or the new siding) and interior coatings are adequately maintained. This would require routine inspection and maintenance. In addition, these are not permanent actions because the component materials associated with Alternatives 2, 4, and 6 would eventually deteriorate and need to be replaced depending on the material durability and specifications and the environmental conditions of the site. Alternative 10 removes the majority of the PCBs and contains the remaining PCBs in structural steel paint. Alternative 10 would also be effective over the long term for as long as the coating on the structural steel is adequately maintained, but it is also not a permanent solution. In contrast, Alternative 11 would be a permanent action because it completely removes the source of PCBs. While all alternatives achieve the RAO pertaining to compliance with the ARARs, Alternative 11 would be the only alternative among the five that achieves the RAO through source removal and minimizes O&M. Therefore, Alternatives 10 and 11 would be superior to Alternatives 2, 4, and 6 in being the most effective in the long term.

Reduction of Toxicity, Mobility, or Volume through Treatment

None of the retained alternatives involve the use of treatment to reduce the toxicity, mobility, or volume of contaminants through treatment. Alternatives 2, 4, and 6 reduce the mobility by installing a protective barrier over the contaminated material either through coating or new cover materials. Alternatives 10 and 11 minimize the mobility of the PCBs from Hangar 1 by properly disposing of the contaminated material (completely or partially) within an approved off site facility where it could be properly managed to control further release to the environment. Alternatives 10 and 11 would be expected to have the highest degree of certainty with respect to reduction of mobility and volume in comparison to Alternatives 2, 4, and 6 because the design, monitoring, and maintenance requirements for the regulated approved facility are well detailed and highly effective.

5.1.3 Cost Analysis of the Alternatives

The capital, O&M, and total present worth costs for the retained removal action alternatives are presented in Table 5-1. A cost estimating basis of estimate and detailed cost tables, including cost breakdown by task, are included in Appendix C. The cost estimates have been refined to the extent possible using the site-specific information and are also based on qualified contractors' prices and proposals. The cost estimates for the retained alternatives, presented in this EE/CA, capture the known or expected response costs and are accurate within the USEPA guidance range of +50 percent to -30 percent for "Study Estimate" (USEPA, 1988).

For Alternatives 2, 4, 6, and 10, the cost for O&M was based on a typical CERCLA 30-year duration and includes inspection and repair of the covering or coating materials. Alternative 11 is a one-time action and does not require any O&M costs.

Application and material costs for the interior components were obtained from qualified contractors. The acrylic and asphalt-emulsion interior coating alternatives were significantly more expensive than the epoxy-coating alternative due to the significant costs associated with frequent inspection/touch-ups and recoats of the acrylic and asphalt-emulsion over a 30-year period. Applying an epoxy coating over the interior components of the hangar, including O&M, costs $15.4 million. This cost has been commonly applied to Alternatives 2, 4, and 6 as shown in Appendix C under the Coating of Interior Components line item.

Overall, the estimated removal action costs ranged from $25.8 million to $49.5 million including O&M. Alternative 2 has an estimated cost of $49.5 million. Two separate types of acrylic emulsions were evaluated for Alternative 4, the reinforced acrylic emulsion (Belzona) and the non-reinforced acrylic emulsion (Sherwin Williams). The Sherwin Williams acrylic emulsion chosen had an estimated cost of $48.6 million because it had a lower application cost over the Belzona reinforced acrylic emulsion. Alternative 6, cover with new visually similar siding, is estimated at $49.3 million. Alternative 10 has an estimated cost of $25.8 million. Alternative 11 has an estimated cost of $26.3 million.

Table 5-2 presents the estimated costs for the removal action alternatives from Table 5-1 and the costs of the various historic mitigation measures associated with each of the alternatives. The cost of the Level 1 HAER documentation, oral histories of individuals who worked in Hangar 1 during different eras, virtual Hangar 1 interactive CD, and inventory catalogue of Hangar 1 collections contained in the Moffett Field Museum applies to all alternatives and totals $350,000. The costs for matching the hangar's exterior colors varies from $0 to $3.4 million. The historic mitigation measure cost of $3.4 million for both Alternatives 2 and 6 is the same since both covers must be painted initially and recoated every 10 years. Alternative 4 has no costs associated with matching existing colors since the acrylic coating can be formulated to match existing colors, and subsequent recoating costs are covered under O&M. The re-siding cost estimate for Alternative 10 is $14.9 million.

The total costs for the removal action alternatives and historic mitigation measures ranged from $26.2 million for Alternative 10 to $53.2 million for Alternative 2.

5.1.4 Summary

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

Alternatives 10 and 11 are the only alternatives that remove all, or the majority of, the contamination, with Alternative 11 being a permanent remedy.

Alternative 10 is the least costly of the removal action alternatives.

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