Proposed Plan for IRP Site 17 Administration Area Groundwater Plume

NASA CROWS LANDING FLIGHT FACILITY

Jan 2012

INTRODUCTION

The Department of the Navy (The Navy) is responsible for planning and implementing clean-up actions to remediate groundwater contamination that resulted from historical operations at the National Aeronautics and Space Administration (NASA) Crows Landing Flight Facility (Facility) (Figure 1).

Under the *Installation Restoration (IR) Program* the Navy conducted environmental investigations at the Facility to evaluate the location and extent of subsurface contamination. Environmental contamination at the Facility has resulted from historical operations including aircraft and vehicle maintenance, and fuel storage activities. Groundwater contamination has originated from three source areas: IRP Site 17 (demolished hanger area), former Underground Storage Tank (UST) Cluster 1 (former jet propulsion and aviation fuel storage area), and UST Site 117 (former service station area). The groundwater contamination plume from these three source areas is collectively known as the IRP Site 17 Administration Area Plume (Site). The Navy has coordinated its investigations with the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), and the Central Valley Regional Water Quality Control Board (CVRWQCB).

CONTENTS

Note: Specialized or technical terms are shown in *italics* the first time they appear and are defined in the glossary on page 15.

This *Proposed Plan (PP)* provides information on Site background and characteristics, environmental investigations conducted at the Site, Site risks, and Remedial Action Objectives (RAOs). Additionally, this PP summarizes the remedial alternatives (options for cleaning up the Site) that were evaluated and information used to select the Navy's preferred alternative.

The preferred remedial alternative for the Site is to implement *Enhanced Bioremediation with Recirculation* together with *Monitored Natural Attenuation (MNA)* and *Institutional Controls (ICs)*. The preferred remedy is cost-effective, prevents off-site migration of groundwater contaminants, and will reduce groundwater contaminant concentrations to adequately protect human health and the environment. MNA combined with ICs will allow for Site commercial and industrial redevelopment which is consistent with the proposed local reuse plan. ICs will also prohibit groundwater use, except for emergency fire suppression purposes.

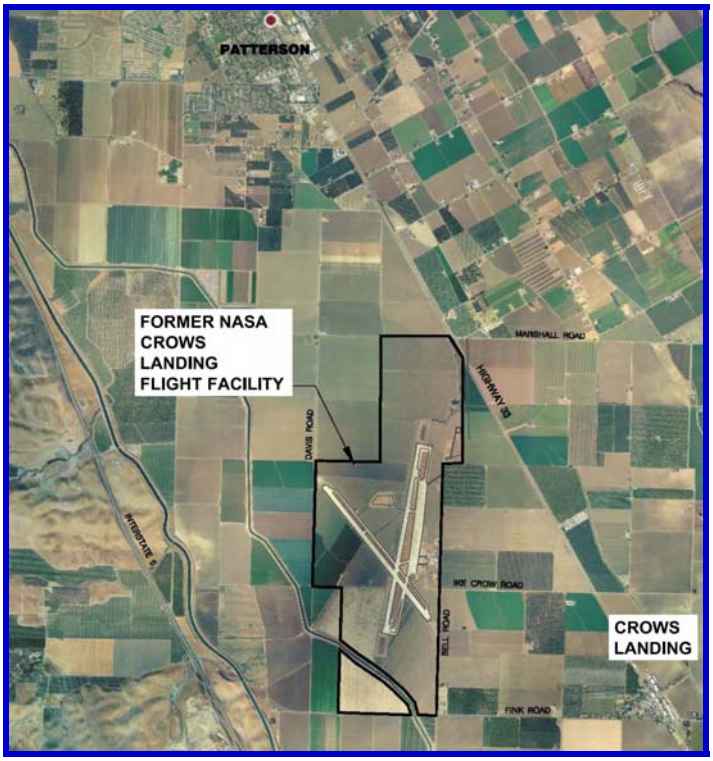


Figure 1. Crows Landing Flight Facility

This PP meets requirements of the *Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)*, the *National Oil and Hazardous Substances Pollution Contingency Plan (NCP)* and the California Health and Safety Code, chapter 6.8.

INVITATION TO COMMENT

Public participation is a critical part of the CERCLA process. The PP is the stage of the CERCLA process where the public has the opportunity to provide comments to the Navy about the proposed cleanup plan for the Site. Figure 2 illustrates the current status of the Site in the CERCLA process. The Navy invites you to participate by submitting written or verbal comments on the PP for the Site. This PP is being issued pursuant to CERCLA, the NCP, and the California Health and Safety Code to ensure that the public has an opportunity to provide comments, in fulfillment of public participation requirements.

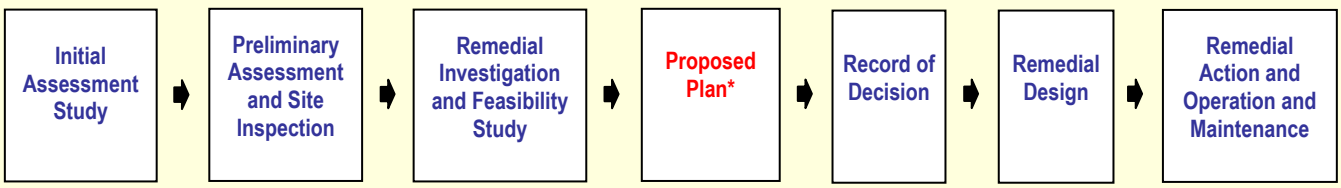
You are invited to attend a public meeting scheduled on February 9, 2012 from 6:30 PM to 8:30 PM at the Best Western (2959 Speno Drive) in Patterson, California to discuss this PP. The 30-day public comment period will be from January 20 to February 21, 2012. This PP highlights information from the final *Feasibility Study (FS)* report and other Site investigation reports. These reports are available to the public at the Stanislaus County Library (Patterson Branch). (See page 14 for information)

SITE BACKGROUND

The Facility was commissioned in 1942 and originally served as a training field during World War II. The former military facility included two decommissioned runways, each approximately 7,000 feet in length, and several support structures including a control tower, administration building, club/exchange building, motor pool, public works shops, and storage facilities. The Facility was decommissioned on July 6, 1946, at which time it became an Outlying Land Field to Naval Air Station Alameda and later Moffett Field. The Facility remained active through the mid-1980s and supported various training activities performed by the Navy and Coast Guard. NASA also maintained a research and development center at the Facility. In July 1994, NASA assumed custody of the Facility from the Navy and research operations were terminated. Presently, the Facility is no longer in use. Historical Facility features have been dismantled, with the exception of the former runways, select buildings, and former building foundations.

The Site is located in the east-central part of the Facility, west of Bell Road, and adjacent to the east side of the former aircraft parking apron as shown in Figure 3. The Facility originally consisted of 1,528 acres of land of which a majority of the Facility and surrounding Site vicinity is currently used for agricultural production of row crops and orchards. Approximately 1,200 acres of the Facility was leased for agricultural use beginning in 1950. In October 1999, the U.S. Congress passed Public Law 106-82, which directed NASA to transfer the Facility to Stanislaus County (County).

Figure 2. THE CERCLA PROCESS



*CERCLA Section 120(a)(4) –State laws concerning removal and remedial action shall apply at facilities not listed on the National Priorities List (NPL). A Draft Remedial Action Plan (RAP) satisfies this requirement.

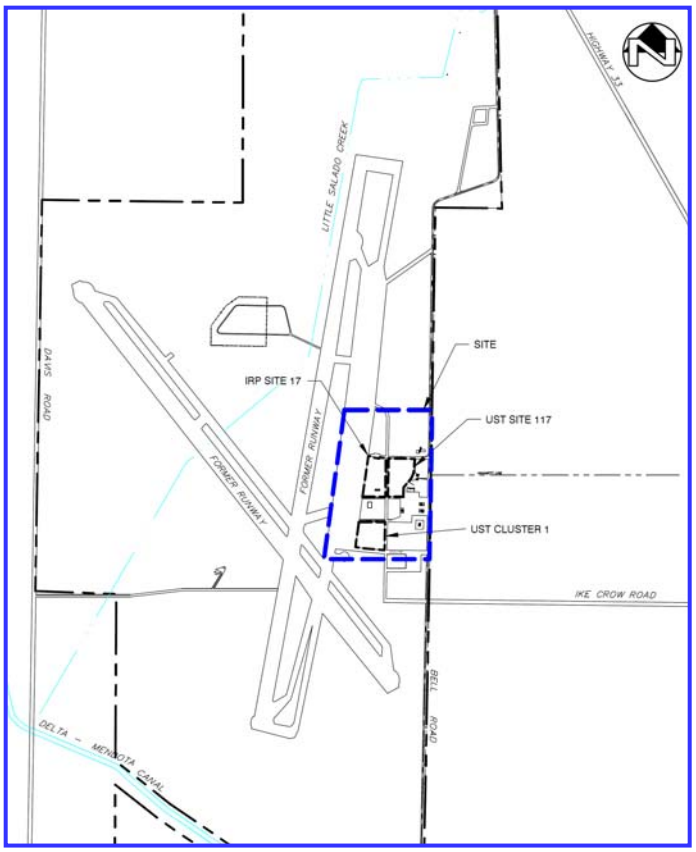


Figure 3. General Site Location

To facilitate the transfer, NASA proposed to transfer the Facility in two or more phases following the completion of environmental cleanup and remediation activities. Phase 1 of the Facility transfer occurred in 2004, when NASA conveyed 1,352 acres to the County.

The Site consists of three source areas (IRP Site 17, UST Cluster 1 and UST Site 117). The UST Cluster 1 area is located along the southern limit of the Site. The IRP Site 17 area is located north of the UST Cluster 1 area directly west of the UST Site 117 area. The UST Site 117 area is located northeast of UST Cluster 1 and is situated closest to the eastern Site property limit at Bell Road.

A description of past operations at the three source areas are as follows.

- The IRP Site 17 area was formerly occupied by two aircraft hangers and an assembly and repair shop constructed circa 1943 and demolished and removed by the late 1950s. However, the foundations of the former buildings are still present in this area of the Site.
- The UST Cluster 1 area was formerly occupied by three former concrete USTs that stored jet and aviation fuels. These tanks were originally installed in the 1940s, decommissioned between 1986 and 1990, and removed from the subsurface in 1994.
- The UST Site 117 area was a former service station occupied by several buildings and used for vehicle fueling. This area contained one 1,200 gallon steel UST that supplied gasoline through underground piping to a connected fuel dispenser in circa 1958. The UST, fuel dispenser, and associated piping were excavated and removed from the Site in 1988.

There are four distinct groundwater zones that occur at the Site. These include: (1) the shallow groundwater zone from 50 to 75 feet below ground surface (bgs); (2) the mid-shallow groundwater zone from 90 to 110 feet bgs; (3) the mid-deep groundwater zone from 160 to 180 feet bgs; and, (4) the deep groundwater zone from 200 to 225 feet bgs. Water levels measured in monitoring wells screened within the four groundwater zones at the Site indicate a groundwater flow direction to the east/northeast toward Bell Road. However, Site data also indicate the groundwater flow direction can vary due to off-site pumping in agricultural wells.

NATURE AND EXTENT OF CONTAMINATION

The Navy has conducted several phases of environmental investigations at the Site since 1987. Previous groundwater investigations were initially conducted at each source area to characterize the area-specific contaminants and extent of impact. Identified contaminants in groundwater included benzene, carbon tetrachloride (CCL4), and chloroform at IRP Site 17; benzene, 1,2-DCA, CCL4, and chloroform at UST Site 117; and, benzene, 1,2-dichloroethane (1,2-DCA), chloroform, diesel- and gasoline-range petroleum hydrocarbons (TPH-d, TPH-g), and jet fuel

5 (JP-5) at UST Cluster 1. These contaminants historically migrated to groundwater from leaking tanks and vehicle maintenance activities (UST Site 117 and UST Cluster 1), disposal of fuel-contaminated water in dry wells (UST Cluster 1), and aircraft maintenance activities (IRP Site 17). Semiannual groundwater monitoring, at a minimum, has been conducted routinely at the Site since 2004 to monitor the levels and trends of contaminants in groundwater.

Since 1995, several *interim remedial actions* have been conducted at various locations throughout the Site since 1995 to treat soil and/or groundwater. In general, these interim remedial actions were successful in reducing the extent of contamination within the treatment areas. However, groundwater contamination was still prevalent following the completion of these interim remedial activities. A summary of previous investigations and interim remedial actions conducted at each source area is presented in the 2011 Final FS report.

From 2008 through 2010 bioremediation treatability studies were conducted at the Site. Environmental data collected during the February 2009 semiannual groundwater sampling event combined with groundwater data collected during the final phases of the bioremediation treatability study completed during the period November 2009 through May 2010 were used to assess the extent of contamination in the four groundwater zones. The results of the evaluation conducted in the Final FS report concluded that select *volatile organic compounds (VOCs)* including benzene, 1,2-DCA, and CCL4 and petroleum hydrocarbons including TPH-d and TPH-g occur in groundwater at concentrations that exceed the *water quality objectives (WQOs)* outlined in the CVRWQCB *Basin Plan* and are the *chemicals of concern (COC)* at the Site. The identified COCs and extent of contamination in the four groundwater zones at the Site are summarized below:

Shallow zone: COCs including benzene, 1,2-DCA, TPH-g, and TPH-d occur at the UST Cluster 1 and UST Site 17 areas; and, CCL4 and TPH-d occur at the IRP Site 17 area. Data indicate these COCs do not extend beyond the property limit at Bell Road and the plume appears to be stable.

Mid-Shallow zone: COCs including benzene, 1,2-DCA, TPH-g, and TPH-d occur within the UST Cluster 1 and UST Site 117 areas, while CCL4 occurs within the IRP Site 17 area and extends to the UST Site 117 area. Data indicate CCL4 and 1,2-DCA extend off-site beyond the property limit at Bell Road, but the plume appears to be stable.

Mid-deep zone: COCs including benzene, 1,2 DCA, TPH-g, and TPH-d occur at the UST Cluster 1 area, and CCL4 occurs at the IRP Site 17 area. CCL4 is the only contaminant that extends beyond the property limit at Bell Road.

Deep Zone: CCL4 is the only COC that occurs in the deep zone. This COC occurs in the IRP Site 17 area and extends off-site beyond the property limit at Bell Road.

WHAT ARE THE CHEMICALS OF CONCERN (COCs) AT THE SITE?

The Navy, in cooperation with DTSC and the Regional Water Quality Control Board, has identified select VOCs and petroleum hydrocarbons as the contaminants in groundwater that pose potential risk to human health and the environment at the Site. The Site COCs have been identified as the following chemicals:

- Benzene
- 1,2-dichloroethane (1,2-DCA)
- Carbon Tetrachloride (CCL4)
- Gasoline-range petroleum hydrocarbons (TPH-g)
- Diesel-range petroleum hydrocarbons (TPH-d)

SUMMARY OF SITE RISKS

Potentially complete *exposure pathways* to the COCs include: (1) upward migration of groundwater COC vapors to the surface where inhalation in buildings or outdoors could occur; (2) ingestion of groundwater via pumping of impacted groundwater from water supply wells; and, (3) inhalation and/or dermal contact with COCs in groundwater during irrigation on adjacent agricultural lands. The County plans to redevelop the former Crows Landing Naval Air Facility as a public-use, general aviation airport and industrial business park. Future land-use scenarios may include agricultural, industrial, and/or commercial uses.

Potential *receptors* include off-site agricultural workers, off-site residents, and possible future Site occupants whom may work or conduct business at the proposed future general aviation airport and industrial business park.

Human Health Risk Assessment

In 2008 a *human health risk assessment (HHRA)* was completed to evaluate the potential risks associated with exposure to CCL4 in groundwater migrating from the Site in the deep groundwater zone which is pumped and used to irrigate an almond orchard located across Bell Road and immediately east of the Site. The primary receptors considered in the risk assessment were orchard workers and market consumer (adult or child) that may ingest the almonds.

The calculated risk levels were compared to the DTSC and Office of Environmental Health Hazard Assessment (OEHHA) *cancer risk threshold* of $1x10^{-6}$ and noncancer *hazard index* threshold of 1. The results of the risk assessment indicated that the calculated cancer risk and noncancer hazard index were less than the allowable thresholds of $1x10^{-6}$ and 1, respectively. It was concluded that significant health risks to the orchard worker or market consumer resulting from exposure to CCL4 in groundwater are unlikely based on the highest levels of CCL4 measured in the agricultural pumping well (1.8 micrograms per liter [µg/L]) and off-site monitoring well 17-MW-42D (19 µg/L).

The risk assessment also presented the maximum CCL4 concentration in groundwater that would be protective of human health and meet the cancer risk threshold of $1x\ 10^{-6}$ and noncancer index of 1 for each receptor and exposure route. This calculated concentration was referred to as the *risk-based concentration (RBC)*. For the orchard worker, the threshold RBC for CCL4 in groundwater was 35 µg/L. For the adult and child market consumer for the ingestion of almonds, the RBC for CCL4 in groundwater was 1,520 µg/L. These RBC levels indicate a health risk to exposure of CCL4 in groundwater would not likely occur until the CCL4 concentration exceeds these RBC levels.

Ecological Risk

An *ecological risk assessment (ERA)* was performed in 1997 to evaluate the threat to terrestrial habitats and biota with potential to be exposed to COCs present at the IRP Site 17 area. Based on habitat coverage, spatial characteristics of the potential exposure area, low frequencies of detection and low chemical concentrations, the results indicate that the likelihood is low that ecological receptors will be exposed to COCs.

In 2008 an ERA was completed to evaluate the potential risks associated with exposure to CCL4 in groundwater migrating from the Site in the deep groundwater zone which is pumped and used to irrigate an almond orchard located across Bell Road and immediately east of the Site. The ERA evaluated the risk to wildlife and plants that may come into direct or indirect contact with CCL4 during irrigation activities. The identified receptors included plants, soil invertebrates, and wildlife such as honeybees associated with the almond orchard.

The maximum CCL4 concentrations detected in groundwater at the agricultural pumping well (1.8 µg/L), and groundwater monitoring well 17-MW-42D (19 µg/L), were compared to identified screening concentrations that have been established for protection of wildlife. This evaluation indicated that these maximum detected CCL4 concentrations, in the agricultural pumping well and off-site monitoring well, were less than the established screening levels for groundwater, soil, and air for protection of wildlife. It was concluded that significant risks to wildlife or other ecological receptors as a result of exposure to CCL4 in groundwater at the almond orchard are unlikely.

REMEDIAL ACTION OBJECTIVES

EPA defines RAOs as medium-specific (e.g., soil, sediment, surface water, and groundwater) goals for protecting human health and the environment. RAOs focus the FS report and define the scope of potential cleanup activities, thereby guiding the development and evaluation of cleanup alternatives. The RAOs for groundwater at the Site were developed to:

- protect human health and the environment;
- protect beneficial uses of groundwater;
- prevent further off-site migration of COCs in groundwater; and,
- to comply with identified Site-specific *Applicable or Relevant and Appropriate Requirements (ARARs)*.

The RAOs for the Site were also developed to comply with the CVRWQCB Basin Plan water quality objectives, which at a minimum require that COCs meet the allowable drinking water *Maximum Contaminant Level (MCL)*, or taste and odor thresholds where a drinking water MCL is not available.

Establishing these conservative drinking water standards inherently ensures that vapor migration from groundwater, at levels harmful to human health or the environment, would not occur.

The Remedial Goals (RGs) developed for the Site are summarized in Table 1.

Table 1: Remedial Goals for Groundwater

COCs	(µg/L)
Benzene	**1.0**
1,2-DCA	**0.5**
CCL4	**0.5**
TPH-g	**100**
TPH-d	**490**

Notes:
COCs = Chemicals of Concern
µg/L = micrograms per liter
1,2-DCA = 1,2-dichloroethane
CCL4 = carbon tetrachloride
TPH-g = gasoline-range petroleum hydrocarbons
TPH-d = diesel-range petroleum hydrocarbons

SUMMARY OF REMEDIAL ACTION ALTERNATIVES

The feasibility study evaluated four remedial alternative actions that can prevent or minimize human exposure to contaminants at levels that may result in a future health concern.

- Alternative 1: No action
- Alternative 2: Monitored Natural Attenuation with Institutional controls (MNA with ICs)
- Alternative 3: Enhanced In situ Bioremediation (EISB)
- Alternative 4: Enhanced Bioremediation with Recirculation

Alternative 4 is identified in this PP as the preferred alternative. Each of the alternatives, the estimated timeframe to meet the RAOs, and the estimated costs are summarized in Table 2.

Table 2: Remedial Alternatives for Groundwater at the Site

Remedial Alternative	Time (Years)*	Cost	Description
1: No Action	24	$0	No actions or costs associated with this alternative; this alternative is required by CERCLA as a baseline for comparison with other alternatives. No further action of any type would be conducted at the Site. This alternative relies on natural processes to remediate the groundwater at the Site. This alternative assumes the Site will remain in its current state and is included to serve as a basis against which other groundwater remedial alternatives may be compared. Alternative 1 would involve no engineered remediation measures, administrative controls, or monitoring of contaminated groundwater. This alternative would not include measures to prevent contact with or ingestion of Site groundwater containing chemicals at concentrations above remediation goals.
2: MNA with ICs	24	$3,310,000	This alternative relies on natural processes to remediate the groundwater at the Site. MNA would be used to monitor the COC concentrations in groundwater, the groundwater plume stability, and confirm the continued natural degradation of TPH, benzene, 1,2-DCA, and CCL4 in groundwater. The ICs under this alternative involves leaving the existing LUC in-place for 24 years. Under this scenario, COCs dissolved in groundwater would continue to migrate off-site above the RGs for approximately 16.5 years, under anticipated future conditions. The existing LUCs do not restrict off-site groundwater use and therefore do not prevent off-site receptors from potential exposure to contaminated groundwater. Additionally, because off-site groundwater use is not currently restricted by the existing LUCs, off-site groundwater use may be different from the assumed future uses simulated by the groundwater model, resulting in migration of Site COCs into off-site areas not currently impacted by Site COCs.
3: EISB with MNA and ICs	20	$8,940,000	EISB includes the injection of a substrate into the groundwater to increase the rate of naturally occurring degradation processes to treat the shallow, mid-shallow and mid-deep groundwater zones impacted by CCL4. Injection point wells would be installed on-site within the CCL4 plume at 498 locations in the shallow groundwater zone, 639 locations in the mid-shallow zone, and 107 injection locations in the mid-deep groundwater zone. Recent results of the bioremediation treatability study indicate a single treatment will be effective to reduce CCL4 concentrations to levels below the RGs. MNA would be used to monitor the COC concentrations in groundwater, the groundwater plume stability, and confirm the degradation of COCs in groundwater to levels below the RGs. The ICs under this alternative involves leaving the existing LUC in-place for 20 years.

Table 2: Remedial Alternatives for Groundwater at the Site

Remedial Alternative	Time (Years)*	Cost	Description
4: Enhanced Bioremediation with Recirculation, MNA, and ICs	8	$5,560,000	Enhanced bioremediation with recirculation includes *groundwater extraction* via pumping**,** treatment of extracted groundwater, addition of a carbon amendment to the treated groundwater, and injection of the treated groundwater with amendment back into the subsurface, MNA, and ICs. Amending treated groundwater with a carbon substrate and injecting it into the subsurface would enhance naturally occurring bioremediation processes, while groundwater extraction and injection would hydraulically contain the on-site groundwater plume and significantly reduce off-site migration of COCs dissolved in groundwater. The concentration of CCL4 in groundwater migrating off-site would be significantly reduced shortly after system startup and within approximately 4.5 years, the concentration of CCL4 in groundwater migrating off-site would be reduced to below RGs in all groundwater zones. This is approximately 12 years sooner than under Alternative 2 where no active pumping or injection of groundwater is conducted. After approximately 8 years of system operation, groundwater concentrations, both on-site and off-site, would be reduced to less than RGs and the system could be shut down. Containment of the on-site groundwater plume and prevention of continued off-site migration of Site COCs is important because existing LUCs do not restrict off-site groundwater use. Preventing off-site migration of Site COCs reduces the risk that potential off-site receptors could be exposed to contaminated groundwater. Up to 14 new groundwater extraction wells would be installed within the footprint of the CCL4 plume on-site to pump contaminated groundwater from the shallow, mid-shallow, mid-deep, and deep zones for a period of approximately 8 years at a total pumping flow rate of approximately 170 gallons per minute. The treated groundwater amended with carbon would be injected into the subsurface using a network of 17 new injection wells completed in the shallow, mid-shallow, mid-deep, and deep zone. MNA would be used to monitor the COC concentrations in groundwater, the groundwater plume stability, and to confirm the degradation of COCs in groundwater to levels below the RGs. The IC under this alternative involves leaving the existing LUC in-place for 8 years.

Notes:

*Shown as "Time to meet RAOs on-site". Time (in years) represents the fate and transport model simulated timeframe until all COCs meet the RAOs onsite. A detailed description of the Fate and Transport model simulations and results are presented in the Final FS Report.

MNA = monitored natural attenuation

IC = institutional controls

EISB = enhanced in situ bioremediation

EVALUATION OF ALTERNATIVES

The remedial action alternatives considered represent a range of available strategies that meet the RAOs associated with COCs in groundwater at the Site. The four remedial alternatives were evaluated against seven of the nine EPA criteria listed in Figure 4.

The nine EPA criteria are used to complete a detailed analysis of each remedial alternatives proposed for the Site. The first seven criteria are used to compare the alternatives with each other to identify the preferred alternative for cleanup of groundwater at the Site. The two final criteria are state acceptance and community acceptance. The state acceptance is documented in this PP. Members of the public may submit written or oral comments on this PP at the public meeting. The public meeting will be held on February 9 2012 at the Best Western (2959 Speno Drive), Patterson, California, from 6:30 PM to 8:30 PM. In consultation with the regulatory agencies, the Navy may modify the preferred remedial alternative or select another cleanup remedy based on feedback from the community or on new environmental information. Therefore, the community is strongly encouraged to review and comment on the preferred remedial alternative. A final decision will not be made until all comments are considered. Community acceptance will be evaluated after the public comment period for this PP and will be addressed in a responsiveness summary in the ROD. Table 3 presents a summary of the comparative analysis completed for the four remedial alternatives using the seven EPA criteria.

Note: Criteria 1 and 2 are considered "Threshold Criteria", Criteria 3,4,5,6, and 7 are considered "Primary Balancing Criteria", and Criteria 8 and 9 are considered "Modifying Criteria".

1. Overall Protection of Human Health and the Environment

Alternatives 2, 3 and 4 meet the criterion of overall protection of human health and the environment, but Alternative 4 was given the highest rating because it would prevent further off-site migration of CCL4 through mass reduction and hydraulic controls. Alternative 1 would not be fully protective of human health and the environment because stability of the groundwater plume would not be verified and ICs would not be in effect to prevent the risk of coming in contact with contaminated groundwater.

2. Compliance with Applicable or Relevant and Appropriate Requirements

ARARs are federal or more stringent State environmental standards, requirements, criteria, or limitations that need to be attained by final remedial actions. Alternatives 2 through 4 would comply with ARARs. ARARs are not applicable to Alternative 1.

3. Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 1 is not known because the effectiveness of natural attenuation processes would not be verified and plume migration would not be monitored to demonstrate protectiveness.

Alternative 4 provides the highest level of long-term effectiveness and permanence because extraction and treatment of COCs in groundwater reduces the long-term management of contaminants. Alternative 3 would also reduce the long-term management of contaminants because it also treats the COCs in groundwater, but it would require significantly longer than Alternative 4 to achieve similar results. Alternative 2 would provide an adequate level of long-term effectiveness and permanence because decreasing concentrations of COCs through natural processes have been demonstrated at the Site, but the time to achieve RAOs would be longer than Alternatives 3 and 4.

4. Reduction of Toxicity, Mobility, and Volume

Alternatives 1 and 2 do not include active treatment of COCs in groundwater and therefore do not provide a measureable or significant reduction of toxicity, mobility, and volume through treatment. Over time, natural processes will reduce the toxicity, mobility, and volume of the Site contaminants under Alternatives 1 and 2, but the processes would take approximately 24 years to meet the RAOs on-site. Alternative 4 will reduce the toxicity, mobility, and volume of COCs in groundwater by actively extracting, treating and amending, and injecting groundwater back into the subsurface to provide hydraulic capture, enhance flow direction, and distribute a carbon substrate through the subsurface to further treat groundwater. Alternative 3 would enhance natural degradation processes, as was demonstrated in the 2008 through 2010 bioremediation treatability studies at the Site, and reduce the concentration of CCL4 in the source area to below the MCL in a relatively short time. However, Alternative 3 is less aggressive than Alternative 4 and would require significantly longer to achieve RAOs for CCL4 than Alternative 4.

5. Short-Term Effectiveness

Alternatives 1 and 2 will not pose a risk to workers, the community, or the environment in the short-term because no active treatment of contaminated groundwater will be conducted. Alternatives 3 and 4 would have equivalent short-term risks to the community, workers, and the environment during drilling operations that would be required to install substrate injection points (Alternative 3) and extraction and injection wells (Alternative 4). Alternative 4 may have more of a risk of adverse effect on workers, the community, and the environment during construction of the treatment system and associated treatment of contaminated groundwater during implementation.

6. Implementability

All of the alternatives are technically feasible and are implementable. Alternatives 1 and 2 are the easiest to implement since they require either no action be taken (Alternative 1) or the continuation of ongoing monitoring and implementation of ICs already in-place at the Site (Alternative 2). Alternative 3 would be relatively easy to implement since injection of bio-enhancing substrates can be accomplished using direct-push technology or other drilling methods as has been demonstrated in the recent bioremediation treatability study. Alternative 4 would be the most difficult to implement because it requires extraction, treatment, amendment, and injection processes. Alternative 4 will require construction, operation, and maintenance of a treatment system, and there are regulatory compliance requirements related to treatment and injection of treated water that are not required for implementation of the other alternatives.

7. Cost

Alternative 1 has no cost associated with it and therefore has the highest rating for this criterion. Alternatives 2 and 4 have similar costs. Although Alternatives 2 does not require active treatment and therefore requires less up front capital expenditures compared to Alternative 4, however, the timeframe to achieve RAOs is estimated to be significantly longer than for Alternative 4 and therefore additional costs associated with continued long-term monitoring

would be incurred. Alternative 3 is the most costly alternative due to the depth of the contamination and the relatively large areas that would require treatment. The high drilling and injection costs result in a significantly higher cost for Alternative 3 when compared to the other alternatives.

Table 3: Comparative Analysis of Groundwater Alternatives

Remedial Alternative	Overall Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness/ Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implement-ability	Cost*
1: No Action	○	NA	○	○	○	●	$0
2: MNA with ICs	◎	●	◎	○	◎	●	$3,310,000
3: EISB, MNA, ICs	◎	●	◎	◎	◎	◎	$8,940,000
4: Enhanced Bioremediation with Recirculation, MNA, ICs	●	●	●	●	●	◎	**$5,560,000**

Notes:
Preferred Alternative = Alternative 4.
○ = Low, ◎ = Low-Medium, ◎ = Medium, ◎ = Medium-High, ● = High
* = Cost evaluation is based on net present value (NPV)
NA = There are no ARARs applicable to Alternative 1.
MNA = monitored natural attenuation
ICs = institutional controls
EISB = enhanced in situ bioremediation
The State of California and community acceptance criteria will be evaluated after public comment period. The preferred alternative can change in response to public comment received.

SUMMARY OF THE PREFERRED ALTERNATIVE

The Navy's preferred alternative is Alternative 4, Enhanced Bioremediation with Recirculation, MNA and ICs. Alternative 4 would prevent exposure to COCs in groundwater at the Site in both the short-term and long-term, and would allow the Site to be redeveloped and used in a manner consistent with the proposed local reuse plan while also being subject to enforcement of appropriate controls for a period of 8 years or until groundwater concentrations meet the RAOs.

Based on the comparative analysis, Alternatives 2, 3, and 4 would, over time, meet the RAOs. Each of these alternatives would be in full compliance with ARARs and would be implementable. They would all provide long-term effectiveness and permanence in that they all reduce the level of contaminants in groundwater at the Site. However, as shown in Table 3 Alternative 4 received the overall highest ranking in terms of the seven EPA criteria and is therefore selected as the preferred alternative.

One of the reasons Alternative 4 ranked highest is that Alternatives 2 and 3 do not address the objective of preventing or reducing the potential for continued off-site migration within a reasonable time-frame. Alternative 4 addresses off-site migration by implementing hydraulic controls so that the RAOs along the property line at Bell Road would be achieved within a relatively short time. In terms of overall time to closure, Alternative 4 is expected to

achieve the Site-wide RAOs within approximately 8 years versus 20 and 24 years for Alternatives 3 and 2, respectively. In terms of cost, Alternatives 2 is the least expensive at $3,310,000, Alternative 3 is the most expensive at $8,940,000, and Alternative 4 falls between these two at $5,560,000.

Alternative 4 utilizes extraction of contaminated groundwater by pumping for 8 years from 14 extraction wells, ex situ treatment of the pumped groundwater in a treatment system constructed on-site, addition of a carbon amendment to the treated groundwater, and injection of treated groundwater back into the subsurface through 17 injection wells. MNA with ICs would also be implemented until COCs meet RAOs on-site and off-site. Groundwater extraction and injection would hydraulically control the flow of groundwater and prevent further off-site migration of CCL4 beyond the property limit at Bell Road while also reducing CCL4 concentrations within the on-site source area in the shallow, mid-shallow, mid-deep, and deep groundwater zones. Model simulation results indicate that under this alternative 1,2-DCA concentrations would decrease to below RGs at the property boundary, and off-site, in less than two years, while model simulated benzene concentrations on-site would degrade to below RGs in less than five years. These model simulations, however, assume that no continuing sources of contaminants are present and that all of the contaminant mass is present in the dissolved and adsorbed phases only. The preferred alternative can change in response to public comment or new information.

Based on currently available information, the Navy believes the preferred alternative meets the criteria for overall protection of human health and the environment, complies with ARARs, and is the best balance among the other alternatives with respect to the other five criteria evaluated. The Navy expects the preferred alternative to satisfy the requirements of CERCLA §121(b) which states the preferred remedy must: (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

MULTI-AGENCY PARTICIPATION

The BRAC Cleanup Team (BCT) is composed of the Navy, CVRWQCB, and DTSC (Cal/EPA). The primary goals of the BCT are to:

- Protect human health and the environment
- Coordinate environmental investigations
- Expedite the environmental cleanup at the facility.

The BCT reviewed all major documents and activities associated with the Site including the Final Feasibility Study. Based on these reviews and discussions on key documents, the BCT supports the Navy's recommendation for the preferred alternative at the Site.

REGULATORY SUMMARY

CALIFORNIA HEATH AND SAFETY CODE

PUBLIC COMMENT PERIOD

The 30-day public comment period for the Proposed Plan is January 20 through February 21, 2012.

Submit Comments

There are two ways to provide comments during this period:

- Offer oral comments during the public meeting
- Provide written comments by mail, or e-mail (postmarked no later than February 21, 2012)

Public Meeting

The public meeting will be held on February 9, 2012 at the Best Western (2959 Speno Drive), Patterson, California, from 6:30 PM to 8:30 PM. The public can discuss the Proposed Plan with representatives from the Navy and DTSC.

Or you can SEND WRITTEN comments to:

James Sullivan BRAC Environmental Coordinator
Department of the Navy
BRAC Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310
Phone (619) 532-0966
james.b.sullivan2@navy.mil

This document meets applicable requirements of the California Health and Safety Code (HSC) section 25356.1 for hazardous substance release sites. The HSC requires preparation of a Remedial Action Plan (RAP) for sites that are not listed on the *National Priorities List*, such as the Site. Therefore, this document also serves as a Draft RAP in order to fulfill the public notice and comment requirements of the HSC. The final RAP will be incorporated in the ROD for this Site.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

DTSC has prepared an Initial Study to evaluate the potential impact of the proposed project on the environment. The findings of the Initial Study indicate that the project would not have a significant effect on public health or the environment. Therefore, DTSC has prepared a proposed Negative Declaration for the Site. Both the Initial Study and proposed Negative Declaration are available for review and comment during the public comment period.

COMMUNITY PARTICIPATION

Community involvement is essential to selecting remedial alternatives. Input will be collected after the alternatives are presented to the public, and a final decision will be made after regulatory agency and community input on the PP has been reviewed. The Navy/DTSC will then issue a ROD, formally selecting the final remedy.

THE NEXT STEP

After the comment period has ended, the Navy and DTSC will consider the comments received on this PP before making a final decision for the Site. The final decision will be documented in a ROD, which will include the responses to all comments received on this PP. A public notice will be placed in the Patterson Irrigator announcing when the Site ROD will become available to the public in the information repositories listed below.

INFORMATION REPOSITORIES

The PP, the proposed Negative Declaration, and other Site related documents are available at:

Stanislaus County Library
Patterson Branch
46 N. Salado Ave
Patterson, CA
(209) 892-6473

Hours: M, T, Th - 10 AM to 6 PM
W - 10 AM to 8 PM
F - 10 AM to 5 PM
Sat - 12 PM to 5 PM
Sun - Closed

Administrative Record File
Contact: Ms. Diane Silva
Command Records Manager
Naval Facilities Engineering Command, Southwest
Naval Base San Diego
2965 Mole Road, Building 3519
San Diego, California 92136
Telephone: (619) 556-1280
diane.silva@navy.mil

You may view these documents by appointment during working hours (Monday through Friday, 8 a.m. to 5 p.m.). Please contact Ms. Silva at the number provided above to make an appointment.

OPPORTUNITIES FOR COMMUNITY INVOLVEMENT

Public Meeting, February 9, 2012 / 6:30 PM to 8:30 PM.
Location: Best Western, 2959 Speno Drive, Patterson, California

You are invited to this community meeting to discuss the information presented in this Proposed Plan for the Site 17 Administration Area Groundwater Plume. Navy representatives will provide information on the environmental investigations conducted for the Site 17 Administration Area Groundwater Plume. You will have an opportunity to ask questions and formally comment on the Navy's preferred remedial alternative for the Site 17 Administration Area Groundwater Plume as presented in this Proposed Plan.

Public Comment Period Continues Through February 21, 2012

We encourage you to comment on this Proposed Plan during the 30-day public comment period. You may provide comments on the Proposed Plan orally at the public meeting or submit your comments in writing at or after the public meeting. You may mail or email written comments on this Proposed Plan to the Navy contact person provided on page 17, postmarked no later than February 21, 2012. The Navy and DTSC will consider all public comments received during this comment period, or in person at the public meeting mentioned above, before making a final decision for the Site 17 Administration Area Groundwater Plume.

GLOSSARY OF TERMS

Specialized terms in *italics* that are used in this Proposed Plan are defined below.

Applicable or Relevant and Appropriate Requirements (ARAR) – Federal or more stringent State environmental standards, requirements, criteria, or limitations that need to be attained by final remedial actions for a CERCLA site.

Basin Plan – A policy set by the Regional Water Quality Control Board in accordance with the Clean Water Act that protects the designated uses of the water body. The Basin plan outlines the allowed uses of a water body and the criteria the water body must meet to safely allow the designed uses.

Cancer Risk Threshold – Risk from cancer expressed as a probability such as 1 in 1,000,000 (also expressed as 1 x 10^{-6}). This means that one person in a population of 1,000,000 is more likely to develop cancer over his or her lifetime.

Chemical of Concern (COC) – Chemical identified as posing a potential risk during a site-specific human-health or ecological risk assessment.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) – A Federal law that sets up a program to identify hazardous waste sites and establishes procedures for cleaning up those sites to protect human health and the environment.

Ecological Risk Assessment (ERA) – An analysis of the potential negative ecological effects to plants and animals caused by exposure to hazardous substances released from a site.

Enhanced Bioremediation with Recirculation – A remedial technology that involves extracting groundwater using extraction wells, treating the water in an above ground treatment system, adding a substance to the water to enhance the natural degradation rate of chemicals remaining in the groundwater, and injecting the treated water back into the subsurface.

Exposure Pathway – The way that a chemical comes into contact with a living organism, such as touching, breathing, or ingesting.

Feasibility Study (FS) – A study that identifies and evaluates potential cleanup methods based on their effectiveness, availability, cost, and other factors.

Groundwater Extraction – Pumping of groundwater from the subsurface using pumps placed in extraction wells.

Hazard Index (HI) – A calculated value used to represent a potential noncancer health effect. A hazard index value of 1 or less is considered protective of human health.

Human Health Risk Assessment (HHRA) – An analysis of the potential negative human health effects caused by exposure to hazardous substances released from a site.

Installation Restoration (IR) Program – The program initiated by the Department of Defense, in compliance with CERCLA (see above), to identify, investigate, assess, characterize, clean up, or control past releases of hazardous substances.

Institutional Controls (ICs) – Non-engineered mechanisms established to limit human exposure to contaminated waste, soil, or groundwater. These mechanisms may include deed restrictions, covenants, easements, laws, and regulations.

Interim Remedial Actions – CERCLA phase in which a selected cleanup technology is implemented to treat a specific area of a site to reduce chemical concentrations prior to full-scale site cleanup under CERCLA.

Land-Use Covenant (LUC) – A type of IC that places a deed restriction on the property to prevent certain property uses such as installation of a groundwater well.

Maximum Contaminant Level (MCL) – The highest level of a contaminant that is allowed in drinking water.

Monitored Natural Attenuation (MNA) – The reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation.

National Oil and Hazardous Substances Pollution Contingency Plan - Federal regulations that implement CERCLA.

National Priorities List (NPL) – This is a federal list of Superfund sites nationwide. NPL sites are those considered high priority for cleanup under the federal Superfund program. IRP Site 17 Administration Area Groundwater Plume is not on the NPL.

Proposed Plan (PP) – A document that reviews the cleanup alternatives, summarizes the Navy's recommended or preferred cleanup actions, explains the reasons for recommending them, and solicits comments from the community.

Receptor – Any organism (human, animal, or plant) that may be exposed to site contaminants.

Record of Decision (ROD) – A public document that specifies the final cleanup alternative for a site, based on information from the remedial investigation and feasibility study, and on public comments and concerns. Under federal law (CERCLA), the decision document is called a ROD. Under State law, the document is called a Remedial Action Plan (RAP).

Remedial Action Objective (RAO) – A description of remedial goals for each medium of concern at a site (for example, soil or groundwater), expressed in terms of the contaminants of concern, target cleanup levels, exposure pathways and receptors, and/or maximum acceptable exposure levels based on cumulative risks and hazards.

Remedial Action Plan (RAP) – A plan prepared for public review and comment that outlines a specific program leading to the remediation of a contaminated site. The RAP is required under California Health and Safety Code Section 25356.1 for sites that are not listed on the NPL.

Risk – Likelihood or probability that a hazardous substance released to the environment will cause adverse effects on exposed human or other biological receptors. Risk calculations incorporate very conservative assumptions. Adverse health effects can be classified as carcinogenic (cancer-causing) or noncarcinogenic. Risk from cancer is expressed as a probability such as 1 in 1,000,000 (also expressed as 1×10^{-6}). This means that one person in a population of 1,000,000 is more likely to develop cancer over his or her lifetime. Noncancer risk is expressed as the hazard index, as defined above.

Risk-based Concentration (RBC) - A contaminant level calculated from a risk assessment that is protective of human health and the environment.

Volatile Organic Compound (VOC) – Compounds with high vapor pressures, low-to-medium water solubility's, and low molecular weights. Some VOCs may occur naturally in the environment, other compounds occur only as a result of manmade activities, and some compounds have both origins.

Water Quality Objectives (WQO) - Water Quality Objectives (WQOs) are criteria developed to protect the most sensitive designated water uses at a specific location with an adequate degree of safety, taking local circumstances and naturally occurring water quality fluctuations into account. Within a given water body, each objective may be based on the protection of a different water use depending on the water uses that are most sensitive to the characteristics of concern in that water body.

FOR MORE INFORMATION

For more information on the environmental program at the NASA Crows Landing Flight Facility, the Proposed Plan, or Negative Declaration, please contact the following:

Navy Contact

James Sullivan BRAC Environmental Coordinator
Department of the Navy
BRAC Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310
Phone (619) 532-0966
james.b.sullivan2@navy.mil

Water Board Contact

Mr. Greg Issinghoff
1685 E Street
Fresno, CA 93706-2020
(559) 488-4390
gissinghoff@waterboards.ca.gov

DTSC Contact

Ms. Francesca D'Onofrio
8800 Cal Center Drive
Sacramento, CA 95826
(916) 255-3603
FDonofri@dtsc.ca.gov

County Contact

Mr. Keith Boggs
1010 Tenth Street, Suite 6800
Modesto, CA 95354
(209) 652-1514
boggsk@stancounty.com

WHERE TO SUBMIT COMMENTS

Proposed Plan
In addition to the public meeting, you may submit your comments on the Proposed Plan via email or mail to the Navy or State of California contact person identified above.

DATES TO REMEMBER

February 9, 2012
6:30 PM to 8:30 PM.
Public meeting for comments on the Proposed Plan.

All comments must be postmarked by February 21, 2012 for consideration.

USE THIS SPACE TO WRITE YOUR COMMENTS

COMMENTS: _____

MAILING COUPON

If you would like to be added to the NASA Crows Landing Flight Facility mailing list and receive copies of future newsletters and fact sheets or removed from the mailing list, please fill out the coupon below and mail it to:

Mr. James Sullivan
Navy BRAC Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Name: _____

Address: _____

City: _____

State: _____ **Zip:** _____

ADD MY NAME TO THE MAILING LIST ☐ **DELETE MY NAME FROM THE MAILING LIST** ☐

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