Hornecker, Lynn M (EFDSW)

From: Hornecker, Lynn M (EFDSW)
Sent: Wednesday, November 07, 2001 11:51 AM
To: 'dchuck@mail.arc.nasa.gov'
Cc: Potacka, Marianna K (EFDSW); 'solliges@mail.arc.nasa.gov'; 'fdonofri@dtsc.ca.gov'; 'jimsimpson@envres.org'; 'boggsk@mail.co.stanislaus.ca.us'; 'bartonj@rb5s.swrcb.ca.gov'; 'ahanif@mail.arc.nasa.gov'
Subject: Responses to NASA Comments, Site 17 FS, NASA Crows Landing Flight Facility

Hello Don,

I have attached the Navy's responses to NASA comments pertaining to the Site 17 Feasibility Study dated June 2001.

Thank you for participating in the review of this document.

clresponsestoNASASite17FScmts....

V/R
Lynn Marie Hornecker
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7 November 2001

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RESPONSES TO COMMENTS FROM THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Subject: Draft Feasibility Study, Administrative Area, NASA Crows Landing Flight Facility

DATE: 7 NOVEMBER 2001

Comment	Response
Comments prepared by Don Chuck, Code QE, National Aeronautics and Space Administration on 15 August 2001 Subject: Draft Feasibility Study, Administrative Area NASA Crows Landing Flight Facility (Geraghty & Miller, 26 June 2001) Addressee: Marianna Potacka, Base Realignment and Closure (BRAC) Environmental Coordinator, Southwest Division, Naval Facilities Engineering Command	The Navy appreciates the participation of NASA in the development of the revised feasibility study for IRP Site 17. Thank you for providing comments on the subject document.

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Comment	Response
COMMENT 1 Sect. 1.0, Par. 3, 5th Sent., Pg. 1 Installation Restoration Program (IRP) Site 17 was not identified in the "Initial Assessment Study" (IAS) (Navy, 1984). IRP Site 17 was identified later during the remedial investigation (RI). Please correct.	**Response to Comment 1.** The text will be revised in accordance with the comment.
COMMENT 2 Sect. 2.2, Par. 3, 1st Sent., Pg. 4 Change ***Coast Ranges*** to ***Diablo Range.*** The Diablo Range is separated from the Coast Ranges by the Santa Clara Valley and San Francisco Bay.	**Response to Comment 2.** The geographical references will be verified and revised as appropriate.
COMMENT 3 Sect. 3.1, Par. 2 , Next to last sentence, Pg. 9 The end of the sentence should read "hangars remain." There were two hangars at the site. The existence of carbon tetrachloride (CT) in groundwater was discovered during the groundwater monitoring after removal and sampling of the pit at the maintenance building foundation.	**Response to Comment 3.** The text will be revised in response to the comment.
COMMENT 4 Sect. 3.1, Par. 4, 1st Sent., Pg. 9 Add the word ***site*** after "UST." As presently written, the sentence implies that UST 117 is still present.	**Response to Comment 4.** The text will be revised in response to the comment.
COMMENT 5 Sect. 3.2, Par. 9, 1st Sent., Pg. 12 The location of the dry well should be placed on a figure to show its relation to the groundwater plume. A description of the construction and use of the dry well should be added to the text.	**Response to Comment 5.** The location of the dry well will be included on one of the figures.

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Comment	Response
COMMENT 6 Sect. 3.3, Par. 1, Last Sent., Pg. 12 The sentence states that additional investigations are underway to further delineate the extent of soil and groundwater contamination and fill data gaps. Based on this statement, it seems that the production of this feasibility study (FS) is premature. The stated intention of the FS is "to provide a defensible and practical basis for the selection of remedial alternatives that are protective of human health, the environment, and beneficial uses of groundwater" (see Sect. 1.0, Par. 3, Pg. 1 of the FS). If the extent of contamination still requires delineation and there are data gaps, how can a "defensible" and "practical" basis for selection of remedial alternatives be achieved? It is possible that once data gaps are "filled," the basis for choosing an alternative could change or some of the selected alternatives in this FS may no longer be practical.	**Response to Comment 6.** The text will be revised for clarification, as appropriate. The Navy does not agree with the comment that this FS is premature. Significant data gaps, including the identification of several new chemicals of concern and the lateral extent of the commingled Administration Area Plume, have been substantially addressed during the time period from July 2000 through June 2001.
COMMENT 7 Sect. 3.3.1, UST Cluster 1, Next to last sentence, Pg. 14 The sentence notes that soil remediation for UST Cluster 1 is being performed under the Petroleum Corrective Action Program. Cluster 1, in addition to petroleum products, has the highest hits of acetone (68,000 µg/L) and MEK (75,400 µg/L). The suspect source of these contaminants is the dry well near one of the tanks. It could be assumed that impacts to the soil from theses has occurred. These constituents could continue to be a source for groundwater contamination. If these compounds are indeed present, then the soil at Cluster 1 can no longer be treated as a petroleum site but must be handled as a CERCLA site. This conclusion is similar to the designation of the groundwater at Cluster 1 as a CERCLA site.	**Response to Comment 7.** The text will be revised for clarification, however, corrective actions at UST Cluster 1 were designed for a petroleum corrective action site and corrective actions will continue under the petroleum corrective action program.
COMMENT 8 Sect. 3.3.2, IRP 17, Par. 3, 3rd Sent., Pg. 16 Change the sentence to note that Figure 5 shows some 2001 events in addition to 2000.	**Response to Comment 8.** The text will be revised for clarification.

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Comment	Response
COMMENT 9 Sect. 3.3.2, IRP 17, Par. 5, Last Sent., Pg. 16 The sentence points out that constituents of potential concern (COPCs) decrease up three orders of magnitude by the time they reach downgradient well 17-MW-12. What is the significance of this decrease to the remediation of the site? Perhaps this indicates that the presence of these constituents are a result of migration from the dry well area and that there is no soil source for these chemicals to be remediated.	**Response to Comment 9.** The text will be revised for clarification. For clarification, the remedial investigation documentation does not explain the basis for stating that the Corcoran Clay is located approximately 270 feet below ground surface throughout the Facility.
COMMENT 10 Sect. 3.3.3, Pg. 17 The section states that "the lateral and vertical extent of the commingled plume at IRP Site 17 had not been identified." If this is so, then this FS is premature and cannot fulfill the intention stated in Sect. 1.0. How can remedial alternatives be discussed and evaluated practically without knowing the full extent of the problem. The exact location of the Corcoran Clay was determined during the RI. The section is correct in stating that the properties of the clay were not assessed.	**Response to Comment 10.** The Navy had not conducted the plume delineation activities of June 2001 at the time this FS was in development. The text will be revised to convey the most current estimates of the lateral and vertical extent of the plume. Please see the Response to Comment 56 pertaining to the Corcoran Clay. The Navy does not agree with the comment that this FS is premature. Significant data gaps, including the identification of several new chemicals of concern and the lateral extent of the commingled Administration Area Plume, have been substantially addressed during the time period from July 2000 through June 2001.

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Comment	Response
COMMENT 11 Sect. 4.1, Par. 8, Pg. 20 This paragraph lists Remedial Action Objectives for soil. Sect. 3.3.1 for IRP Site 17 states that the "results of the confirmatory soil sample analysis did not identify any CT or petroleum impact." Also in that section, the "results of the predesign soil investigation did not identify any CT impacts in the unsaturated zone." Since it appears that soil in the vadose zone has not been impacted (and this is noted several other times in this document), why have RAOs for soil been developed and remedial alternatives evaluated? It should also be noted here that the soil gas mentioned in 3.3.1 can also be explained by offgassing from the groundwater. Calculations using Henry's constant for CT have shown that the soil gas levels seen at Site 17 fall within the range for gas formation from the CT in the groundwater.	**Response to Comment 11.** The FS is intended to address both the vadose zone and groundwater at Site 17. The most current field data for Site 17 will be included in the revised FS.
COMMENT 12 Sect. 5.1, Pg.28 See comment 11.	**Response to Comment 12.** The text will be revised for clarification, as appropriate.
COMMENT 13 Sect. 6.2, Pg. 33 The sentence following the bullet list of alternatives states: "Based on the soil investigations completed to date and the preliminary human health risk screening process in the final RI report, remedial action for soil at IRP Site 17 was not required." The paragraph continues: "the risk assessments did not consider the COPCs identified at IRP Site 17 during the 2000 and 2001 groundwater sampling events." Review of the concentrations listed on Figure 5 of this FS shows that the concentrations of the newly identified COPCs are several orders of magnitude less in well 17-MW-12(S) than in CL1-MW-12(S). This could imply that the concentrations of these COPCs at Site 17 are due to migration from Cluster 1 than due to a source in the soil at Site 17. If one were to conclude that the presence of the COPCs in groundwater at Site 17 indicates a soil source, then the conclusion can be made that there is a source for these in the soils	**Response to Comment 13.** The text will be revised to include the most current field data, and the text will be revised for clarification, as appropriate. Also, please see the Response to Comment 10.

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Comment	Response
at Cluster 1. If COPCs such as acetone and MEK are in the soils at Cluster 1, especially at their higher levels, then that site can no longer be treated as a petroleum site and therefore should follow the CERCLA process. Finally, as stated earlier in these comments, if additional data is needed to fill soil data gaps, then production of this FS is premature.	
COMMENT 14 Sect. 6.6.2, Pg. 35 Under *Alternative Description*, the first bullet action is to identify the locations and impacts remaining. How is this a restriction? In the second bullet, the permission of the regulatory agencies should also be part of the restriction. The fourth bullet is essentially a repeat of the first bullet. One of the two should be discarded.	**Response to Comment 14.** The text will be revised for clarification.
COMMENT 15 Sect. 6.6.2, Pg. 37 Under *Reduction of Toxicity, ... Treatment*, delete the second sentence. This sentence contradicts the first.	**Response to Comment 15.** The text will be revised for clarification.
COMMENT 16 Sect. 6.2.3, *Alternative Description*, Last Paragraph, Pg. 38 In addition to granular activated carbon (GAC) beds, there are other methods of treating the vapors including thermal destruction. The paragraph should also indicate that the off gas treatment depends on the concentrations of the vapors.	**Response to Comment 16.** Comment acknowledged.

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Comment	Response
COMMENT 17 Sect. 6.2.3, *Long-Term Effectiveness*, 2nd Sent., Pg. 39 The sentence states that there is often a rebound in ***groundwater*** concentrations after the SVE system has been shut down. Is this effect seen in soil? Has rebound been seen during the several SVE operations that have been carried out at Crows Landing?	**Response to Comment 17.** The correlation between potential rebound of vapor concentrations in the vadose zone following SVE treatment and potential rebound of groundwater concentrations following treatment has not been established. The text will be revised for clarification, as appropriate.
COMMENT 18 Sect. 6.2.3, *Reduction of Toxicity* ... , 3rd Sent., Pg. 39 This sentence is awkward as written. Additionally, Crows Landing is in the San Joaquin Valley Unified Air Pollution Control District.	**Response to Comment 18.** Comment acknowledged. The San Joaquin Valley Unified Air Pollution Control District will be identified.
COMMENT 19 Sect. 6.2.3, *Short-Term Effectiveness*, Pg. 39 The grammar and structure needs to be improved. The paragraph is missing a logical sequence and is vague in content. As written, the paragraph flow is as follows: (a) Sentences 1 and 2 describe possible worker exposures to low emissions. (b) Sentence three suggests design a 12 foot emission stack but doesn't say if the stack is to reduce exposure to workers during construction or for the operating system. (c) Finally, the fourth sentence states that "the emissions will likely require treatment and should be within acceptable levels." If the emissions need treatment, then they aren't within acceptable levels. If the emissions are within acceptable levels, then why is treatment needed?	**Response to Comment 19.** Comment acknowledged. The text will be revised to improve readability.
COMMENT 20 Sect. 6.2.3, *Cost*, Pg. 40 The paragraph notes that the cost of this alternative depends upon several factors including the size of the impact area. It has been noted earlier in the FS that there is no known impact to soils at Site 17 and the further investigation is needed. If the extent of soil contamination, if any, is not known, how can the conclusion be made that this alternative has an estimated low cost?	**Response to Comment 20.** Comment acknowledged. The cost of SVE treatment is low relative to the cost of excavation, for example.

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Comment	Response
COMMENT 21 Sect. 6.3.1, *Overall Protection* ..., 2nd Sentence, Pg. 41 The sentence states that the COPCs could remain in groundwater for decades except for natural attenuation. CT is very persistent in groundwater. It generally doesn't degrade naturally without enhancement such as molasses injection. Natural attenuation should be deleted from this sentence.	**Response to Comment 21.** The attenuation of carbon tetrachloride concentrations and other volatile organic compound concentrations with time and with distance from the source areas has been demonstrated based upon the evaluation of field measurements that were collected during routine groundwater monitoring activities; this information will be added to the appropriate section of the FS.
COMMENT 22 Sect. 6.3.1, *State Acceptance*, Pg. 42 It is highly unlikely that this alternative will be accepted by the state with the present concentrations of the COPCs.	**Response to Comment 22.** Comment acknowledged. For clarification, the no action alternative is required to be evaluated in feasibility studies according to 40CFR300.430(e). It is not the intent of the FS to speculate on future regulatory issues or concerns.
COMMENT 23 Sect. 6.3.2, *Alternative Description*, Bullet 2, Pg. 43 The permission of the regulatory agencies should also be part of the restriction.	**Response to Comment 23.** The text will be revised for clarification, as appropriate. For clarification, the FS is not intended to define in detail the processes by which institutional controls are established, monitored, or revised.
COMMENT 24 Sect. 6.3.2, *Overall Protection* ..., Pg. 43 It is unclear how Institutional Controls (ICs) will reduce mobility of contaminants other than by placing restrictions on pumping in the area. Even without pumping, groundwater will continue to flow from the site due to the natural hydraulic gradient of the site. Water will still flow toward the San Joaquin River naturally and move the COPCs along with it. The final sentence of this paragraph appears to contradict earlier statements. This sentence notes that ICs will not be able to contain the plume on site whereas earlier statements claim that ICs will reduce or minimize plume mobility. Please clarify.	**Response to Comment 24.** The text will be revised for clarification, as appropriate.
COMMENT 25	**Response to Comment 25.**

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Comment	Response
Sect. 6.3.2, *Compliance with ARARs*, Pg. 43 This paragraph contains conflicting statements. The paragraph initially asserts that ICs will satisfy ARARS by minimizing contaminant migration in groundwater. The last sentence states that ICs alone may not meet ARARs.	The text will be revised for clarification, as appropriate.

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Comment	Response
COMMENT 26 Sect. 6.3.2, *Reduction of Toxicity*, Pg. 43 This paragraph states that ICs will "allow natural attenuation processes to reduce toxicity, mobility, and volume by degrading or adsorbing constituents." It has not yet been shown that natural attenuation is occurring at the site. As noted earlier, CT is a persistent chemical and does not readily degrade naturally. The only evidence of CT degradation is in those portions of the plume where fuel constituents are present in enough concentrations to provide anaerobic conditions. Under these conditions CT will degrade as evidenced by the chloroform detections. However, this degradation did not occur naturally. With degradation an unlikely scenario, adsorption of constituents is left as a removal mechanism. Adsorption will not really reduce mass since the constituents will still be present in the soil they've adsorbed to. The soil will only adsorb so much of the constituents based on K_d values. Once maximum adsorption is attained, those constituents remaining will then migrate away. The mobility of the plume may decrease if ICs include restrictions to pumping in the areas around the plume. Negotiating the closure of agricultural wells to reduce off-site migration is not likely to occur with out some agreement with farmers for loss of use of their water. The affected farmers will also probably expect some compensation for their loss. Even if wells could be shut done, the plume would still migrate due to the natural gradient at this site. What is the contingency plan mentioned in the last sentence of this paragraph to abate plume migration? Based on above comments, everything in this paragraph after the first sentence should be deleted.	**Response to Comment 26.** Please see the response to Comment 21. A contingency plan will be developed at the time the design documents are prepared. The outline for the contingency plan will be included in the revised FS. For clarification, the Navy continues to evaluate the potential impacts caused by pumping from nearby irrigation water supply wells.
COMMENT 27 Sect. 6.3.2, *Cost*, Pg. 44 Cost for this alternative is estimated to be low. This is probably true with regard to the administrative costs to establish the ICs. However, if one of the ICs is to restrict	**Response to Comment 27.** Comment acknowledged. The costs will be reviewed, and cost information may be refined, as appropriate.

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pumping of agricultural wells to minimize plume migration, the costs will probably be high. Farmers will want to be compensated for the loss of the use of their wells. Costs could include compensation and legal fees to negotiate ICs with well owners.	

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Comment	Response
COMMENT 28 Sect. 6.3.3, *Alternative Description*, Pg. 45 The first sentence notes monitored natural attenuation (MNA) involves using existing natural attenuation processes. As previously noted, CT is persistent in the environment and does not degrade easily. In a biotreatabilty study done for the Navy (GeoSyntec, 1999), one of the conclusions was that "the extent of intrinsic biodegradation at the Site appears to be limited by low availability of easily biodegradable organic carbon substrates (e.g., electron donors or cometabolites) and perhaps by insufficient biomass of microorganisms capable of mediating the desired biodegradation reactions." The report further concluded that for biodegradation to occur, substrates and other amendments will be needed. As noted in Comment 26, adsorption does not do away with the contaminant but transfers it from the groundwater to the soil. There is no evidence that the other processes have an effect except for volatilization, perhaps. Volatilization could explain the presence of CT in soil gas just above the water table. This paragraph also states that "MNA is most applicable when concentrations are fairly low." What criteria determines "fairly low"? What about some of the COPCs in the groundwater at Cluster 1: acetone (68,400 µg/L), Benzene (22,400 µg/L), EDB (5080 µg/L), MEK (75,400 µg/L), Toluene (5540 µg/L), TPH-G (22,000 µg/L), and TPH-D (398,000 µg/L)? To implement a program of MNA requires extensive field work and characterization (ASTM , 1998, Batelle, 1999, Nyer, 2001). This document has noted several times that data gaps exist and more field work is needed. It is likely that the information needed to evaluate and thus recommend MNA is lacking. Finally, Environmental Protection Agency (EPA) guidance on MNA states that MNA "is appropriate as a remedial approach only when it can be demonstrated capable of achieving a site's remedial objectives within a time frame that is reasonable compared to that offered by other methods." (USEPA, 1998, Nyer, 2001) Considering the persistence of CT in the environment, this criterion will not be met by MNA alone.	**Response to Comment 28.** Comment acknowledged. Details pertaining to the laboratory biotreatability study are included in the project plans for the planned in-situ treatment project at the 1,2-DCA source area. The project plans were issued in October 2001, and selected information from these plans will be included in the revised FS. Also, please see the Response to Comment 21.

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Comment	Response
COMMENT 29 Sect. 6.3.3, *Compliance with ARARs*, Pg. 45 All but the last sentence should be deleted from this paragraph. It is unclear how MNA will minimize migration in groundwater.	**Response to Comment 29.** Comment acknowledged. The text will be reviewed and revised for clarification, as appropriate.
COMMENT 30 Sect. 6.3.3, *Reduction of Toxicity*, Pg. 46 The last sentence of this paragraph ("However, mobility of the constituents may not be reduced") contradicts part of the first sentence of the *Compliance* paragraph ("and to minimize constituent migration in groundwater).	**Response to Comment 30.** Comment acknowledged. The text will be reviewed and revised for clarification, as appropriate.
COMMENT 31 Sect. 6.3.3, *Short-Term Effectiveness*, Pg. 46 The paragraph states that workers would not be exposed to risks since MNA does not involve active remediation. What about the contingency plan mentioned earlier to abate plume migration? This sounds like some type of active hydraulic control that will require construction and exposure to possible contamination.	**Response to Comment 31.** Comment acknowledged. The text will be reviewed and revised for clarification, as appropriate.
COMMENT 32 Sect. 6.3.3, *Implementability*, Pg. 46 Please provide the supporting data for the statement made in the second sentence. The last sentence is an incomplete sentence – no verb or object.	**Response to Comment 32.** Comment acknowledged. The text will be reviewed and revised for clarification, as appropriate.
COMMENT 33 Sect. 6.3.3, *Cost*, Pg. 46 This section only describes costs for monitoring, reporting, inspection, and maintenance. There is no mention of costs for the aforementioned contingency plan to prevent migration. Those costs could push the amount past $3 million dollars making this a high-coast alternative.	**Response to Comment 33.** Comment acknowledged. The text will be reviewed and revised for clarification, as appropriate. For clarification, the exact cost of implementation of any contingency plan cannot be determined at this time.

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Comment	Response
COMMENT 34 Sect. 6.3.4, *Alternative Description*, Par. 1, Pg. 47 Two alternatives are discussed in this paragraph for the extraction of water: extraction with treatment and discharge or extraction and off-site disposal. Other considerations should be considered such as reinjection of treated groundwater or use of treated water for irrigation. Reinjection can be used to improve hydraulic control of the plume. Using the water for irrigation can be done by either discharge to a storage pond for this purpose or discharge to the nearby Delta Mendota Canal. The treated water could also be used for landscaping on the facility. Any of these methods allow for beneficial use of the extracted water. Extraction of the water and disposal off-site is not a practical suggestion. Considering that the amount of contamination mass is most likely in the hundreds of thousands pounds, it will probably require more than a million gallons of water to remove the contaminants. Disposal costs could be more than $10,000,000.00 (this estimate is based on data from Tetra Tech, 1999, for just the "hot" zone for Cluster 1 and $1.95 per gallon for hazardous waste disposal). In addition to the cost of disposal, there is the cost of transport, additional pollution of the air by all of the truck traffic, and exposure to workers handling the storage and loading of the extracted groundwater.	**Response to Comment 34.** Comment acknowledged. Injection of treated extracted groundwater could be considered if large volumes of groundwater are extracted as part of the final remedy. The cost of constructing and operating an injection system with injection at an appropriate distance from the plume would be evaluated and considered. The Navy is not planning to evaluate an alternative that provides for discharge of treated water to the Delta-Mendota Canal. For clarification, no estimates of contaminant mass for the commingled Administration Area Plume have been developed. The Navy does not accept NASA's estimated of "hundreds of thousands of pounds" and the Navy has not been able to substantiate the cost estimates developed in 1999.
COMMENT 35 Sect. 6.3.4, *Alternative Description*, Par. 2, 3rd Sent., Pg. 47 The sentence states that contaminants left in the vadose zone will be removed by SVE. SVE is not effective on heavier petroleum compounds. To completely remove the contaminants in the vadose zone, other treatment such as bioventing or enhanced bioremediation will nee to be considered.	**Response to Comment 35.** Comment acknowledged. For clarification, the FS is not intended as a decision document for the petroleum corrective action program. The Navy will assess the petroleum corrective action program sites, including UST Cluster 1 and UST Site 117, in separate documents.
COMMENT 36 Sect. 6.3.4, *Alternative Description*, Par. 3, Pg. 47 In the 1st sentence, what model study shows that relative high extraction rates are unachievable between 50 and 150 feet? The only modeling discussed is the Tetra Tech model describing the 500 gpm pumping.	**Response to Comment 36.** Comment acknowledged. For clarification, previous studies stated that an extraction rate of 16 gpm was achieved in the field, and the model study utilized an extraction rate of 500 gpm.

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In addition to the pump test of 16 gpm at 120 feet (which contradicts the first statement), two injection tests were done. The first test had a sustained injection of 19.3 gpm for 48 hours. The second test had a sustained rate of 66 gpm for 147 minutes. This test ended after 147 minutes because the water supply for the test could not keep with the demand for water to be reinjected (Tetra Tech, 1999).	
COMMEN 37 Sect. 6.3.4, *Alternative Description*, Par. 4, 2nd Sent., Pg. 47 What is "portioning"? The correct term is ***partitioning***.	**Response to Comment 37.** The text will be revised for clarification.
COMMENT 38 Sect. 6.3.4, *Alternative Description*, Par. 5, Pg. 47 The paragraph notes that MNA will be used once extraction activities have been completed. A "contingency plan" will be used to prevent off-site migration. What is this "contingency plan"? Extraction activities should be used to remove as much mass as possible before going to MNA. Vigorous pumping (and treating) should be able reduce mass and draw the plume back in some from its present position thus alleviating the need for a "contingency" plan to address off-site migration.	**Response to Comment 38.** Please see the Response to Comment 26.
COMMENT 39 Sect. 6.3.4 *Overall Protection ...* , Pg.48 The paragraph states that this alternative protects human health and the environment. What about increased diesel emissions, increased use of fuel, exposure to workers handling the storage and loading of the extracted groundwater, and traffic due to transport of waste off-site? The last sentence notes that duration of extraction activities depend on several factors. Based on all of the data collected to date, there should be better estimates for the duration of extraction systems for this site.	**Response to Comment 39.** The text will be reviewed and revised for clarification, as appropriate.

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Comment	Response
COMMENT 40 Sect. 6.3.4, *Reduction of Toxicity*, Pg. 49 Groundwater extraction not only limits mobility by reducing COPC levels, the act of pumping itself reduces mobility by providing hydraulic control.	**Response to Comment 40.** Comment acknowledged. For clarification, implementation of hydraulic control has not yet been demonstrated in the field.
COMMENT 41 Sect. 6.3.4, *Implementability*, Pg. 49 In the second sentence, GAC and air stripping are listed as proven technologies. For most compounds, this is true. For very soluble compounds such as acetone, stripping and GAC will not be effective. Acetone is best treated by bioremediation. Off-site disposal is easily implemented but will most likely be costly. A very rough estimate of the cost for off-site disposal using the removal rates for the TCRA at Cluster 1 and the mass of contamination in the "hot zone" as calculated for the Cluster 1 design (Tetra Tech, 1999), the cost for disposal could easily exceed several million dollars.	**Response to Comment 41.** Comment acknowledged. The text will be reviewed and revised for clarification, as appropriate.
COMMENT 42 Sect. 6.3.5, *Alternative Description*, Par. 1, Pg. 50 The second sentence of this paragraph is not completely correct. Some compounds persist in the subsurface because they are not amenable to biodegradation. Those compounds require other means of removal.	**Response to Comment 42.** The text will be revised for clarification and grammatical errors will be corrected.

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Comment	Response
COMMENT 43 Sect. 6.3.5, *Alternative Description*, Par. 4, Pg. 50 The term *biodegradative* in the first sentence is not a word. Please change.	**Response to Comment 43.** The text will be revised.
COMMENT 44 Sect. 6.3.5, *Alternative Description*, Par. 5, Pg. 51 This paragraph discussed the anaerobic degradation of CT. The paragraph also notes that a bench study using molasses as a substrate showed the dechlorination of CT to chloroform (CF). From the conclusion of that study, however: Based on these results, groundwater remediation through enhanced anaerobic bioremediation (as a stand-alone configuration) does not appear to be a completely favorable remedial alternative for this Site. While molasses does promote relatively rapid reduction of CT, further reduction of the resulting CF and MC [methylene chloride] is less predictable, and my be subject to long acclimation periods and differing microbial activity requirements. (GeoSyntec, 1999)	**Response to Comment 44.** Comment acknowledged.
COMMENT 45 Sect. 6.3.5, *Reduction of Toxicity*, Pg. 52 Recheck the wording of the last sentence: "... reduced following during biodegradation."	**Response to Comment 45.** The text will be revised for clarification and grammatical errors will be corrected.

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Comment	Response
COMMENT 46 Sect. 6.3.5, *Implementability*, Pg. 52 While it is true that the *elimination* of in-situ enhanced bioremediation is readily implemented, it is doubtful that elimination is the desired result (see first sentence). Provide the supporting references for the statements in sentence two. The fourth sentence discusses injections in either main impact areas or along the edges. Why not both? Additionally, the grammar of the fourth sentence needs improvement. *Injections* is plural and therefore require a plural verb after the word *or*: "... injection can be performed ... or ***they*** could be injected ..." In the last sentence, the piping network would not impede reuse if placed underground.	**Response to Comment 46.** The text will be revised.
COMMENT 47 Sect. 6.4, *Reduction of Toxicity*, Pg. 54 Explain how ICs will reduce mobility of COPCs.	**Response to Comment 47.** The text will be revised for clarification.

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COMMENT 50 Sect. 7.0, Par. 1, Pg. 57 The sentence states that there are data gaps associated with Site 17 and the remedial approach will be refined during current site studies and the Remedial Design stage. Since there are such data gaps that could affect the alternatives chosen, this FS is premature at best. A relevant discussion of alternatives can not be done with such gaps since the new data could then affect how various alternatives meet the nine criteria. Finally, the Remedial Design (RD) is not the time to fill data gaps needed to determine remediation. The RD the remedial actions described by the Record of Decision (ROD). The remedial actions in the ROD are chosen from alternatives evaluated in the FS. In the fourth sentence of the paragraph, it is stated that "mass-removal technologies will be used to abate residual contamination." Residual contamination is what is left after mass removal has occurred. Residual contamination is then usually addressed by biodegradation or MNA.	**Response to Comment 50.** The text will be revised for clarification. Also, please see the Response to Comment 10.
COMMENT 51 Sect. 7.1, Par. 1, Pg. 57 It has not yet been established that soil at IRP Site 17 has been impacted as stated in the first sentence. Remediation of impacted soils at UST site at Cluster 1 and UST site 117 are continuing under the Petroleum Corrective Action Program. Soil sampling is needed to prove that chemicals such as acetone and MEK have not impacted the soil. If they are present in soil, then Cluster 1 and 117 should be addressed under the CERCLA program along with the groundwater.	**Response to Comment 51.** The text will be updated to include the most recently collected field data. A passive soil gas survey was conducted during the Summer 2001, and the FS will be revised to include survey results for the demolished hangar area.

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Comment	Response
COMMENT 52 Sect. 7.1, Par. 3, Pg. 57 It is unclear what criteria will be used to determine if the "sources" found during the described soil gas are to be IRP Site 11A or IRP Site 17. Again, this could possibly change the selection of alternatives therefore invalidating this FS.	**Response to Comment 52.** Comment acknowledged. The Navy will recommend a management strategy for source areas identified during the soil gas survey, and this recommendation will be included in the FS. Also, please see the Response to Comment 10.
COMMENT 53 Sect. 7.1, Par. 5, Pg. 58 In this paragraph, three alternatives are listed to meet soil RAOs "based on the current risk assessments, site data, and likely future land use." This is in direct contradiction to the discussion in the previous paragraph where it states that "the current and likely future exposure scenarios are different than previously evaluated." That paragraph further states that data gaps need to be filled in order to determine human health and environmental risks. If that is true, then what use is it to list alternatives based on current risks, etc., if those risks are incorrect and the data is inadequate?	**Response to Comment 53.** Comment acknowledged. The text will be revised for clarification.

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Comment	Response
COMMENT 54 Sect. 7.1, Par. 6, Pg. 58 The structure of this paragraph does not seem to follow any logical sequence. The sentences seem to be thrown together. How can "no action" be completed? "No action" implies product or work. A better way of presentation would be to say that the no action alternative will be implemented.	**Response to Comment 54.** Comment acknowledged. The text will be revised for clarification.
COMMENT 55 Sect. 7.1, Par. 8, Pg. 59 SVE can enhance aerobic biodegradation by bringing in air to the subsurface. However, SVE is less efficient and more expensive to use for biodegradation enhancement. Biovent provides better enhancement once SVE has removed most of the volatile mass. SVE will not readily treat heavy petroleum products as well as bioventing. The sixth sentence which discussed restrictions on groundwater use should be in Sect. 7.2.	**Response to Comment 55.** Comment acknowledged. The text will be revised for clarification.

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Comment	Response
COMMENT 56 Sect. 7.2, 4th Par., Pg. 60 The Corcoran Clay (also known as the modified E clay) is a major unit that is present laterally throughout the entire San Joaquin Valley. According to maps of the US Geological Survey the thickness of the clay at Crows Landing is approximately 40 ft. thick (USGS, 1986). Simple hydrologic modeling of the unit can indicate if there is a possible risk of contaminants migrating through the clay. If the modeling suggests migration possible, then some exploratory work is warranted. If not, then drilling through the clay should be avoided so as not to then provide a vertical conduit for such migration.	**Response to Comment 56.** The Navy has not characterized the Corcoran Clay beneath the Facility, however, the Navy is evaluating existing information from previous Navy investigations and from regional investigations by others. The Navy does not have sufficient data to identify the exact depth of the clay and the thickness of the clay at IRP Site 17. The Navy does not intend to conduct activities that would result in the creation of a vertical conduit for contaminant migration. The United States Geological Survey (USGS) identified the top of the Corcoran Clay at approximate depths between 207 and 231 feet below ground surface in the central section of NASA Crows Landing Flight Facility based upon California Department of Water Resources (DWR) lithological logs for two water supply wells (T6S/R8E-20A1 and T6S/R8E-20P1) near Ike Crow Road (USGS 22 January 1973). The following information from a regional evaluation is provided for clarification: "Early investigators thought that the Sacramento Valley contained a single unconfined aquifer and that the San Joaquin Valley contained an upper unconfined to semiconfined aquifer separated from a lower aquifer confined by the Corcoran Clay or "E"-clay". However, recent investigations indicate that the Central Valley contains a single heterogeneous aquifer system that contains water under unconfined, or water-table, conditions in the upper few hundred feet; these conditions grade into confined conditions with depth. The confinement is the result of numerous overlapping lens-shaped clay beds. Geophysical well logs indicate that the "E-clay", although probably the largest single confining bed, constitutes only a small percentage of the total thickness of clay layers in the aquifer system. This indicates that the significance of the "E-clay " as a barrier to vertical flow may have been exaggerated. Further, the difference in hydraulic head directly above and below the "E-clay" is small when compared to head difference within the intervals of the deep parts of the aquifer system (Planert, M. and Williams, J.S., 1995, Ground Water Atlas of the United States - Segment 1 California Nevada, USGS)."

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Comment	Response
COMMENT 57 Sect. 7.2, 5th and 6th Par., Pg. 60 Similar to Comment 53, these two paragraphs state that new risks will be refined based on data obtained during the RD. The alternatives chosen in this FS are based on risks this document has said are no longer relevant. If the current risks are not indicative of the site and more data is required to refine them, then choosing alternatives based on irrelevant risks is not productive. As stated earlier, the RD is not the time to determine risk. The risks are needed for a thorough evaluation of alternatives in the FS so that remedial action(s) can be set in the ROD. Data collection during the RD is for collecting the data need to implement the remedial action(s).	**Response to Comment 57.** The text will be revised for clarification.
COMMENT 58 Sect. 7.2, Par. 7, 3rd Sent., Pg. 61 The comma should be placed before the word *and*, not after.	**Response to Comment 58.** The text will be revised for clarification and grammatical errors will be corrected.

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COMMENT 59 Sect. 7.2, Par. 8, 2nd Sent., Pg. 61 A semicolon is used to connect two complete sentences. The portion after this semicolon in this sentence is not complete: there is no subject. If the ICs are also meant to apply to second portion of the sentence, then the semicolon should be removed.	**Response to Comment 59.** The text will be revised for clarification and grammatical errors will be corrected.
COMMENT 60 Sect. 7.2, Par. 9, Pg. 61 MNA is again mentioned as being implemented with a contingency plan to abate plume migration. Again, this contingency plan needs to be detailed. MNA is usually implemented after most of the contaminant mass has been removed by other means and after meeting several criteria.	**Response to Comment 60.** Please see the Response to Comment 26.
COMMENT 61 Sect. 7.2, Par. 10, Pg. 61 All but the last sentence should be deleted. Mention of the TCRA is not relevant to the conclusion of this FS.	**Response to Comment 61.** The text will be revised for clarification.

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COMMENT 62 Sect. 7.2, Par. 11, Next to last Sent., Pg. 62 This sentence states that enhanced in situ biodegradation is less likely to encumber reuse of the site. This contradicts the last sentence of the paragraph on Implementability in Section 6.3.5. which says that "the construction of an extensive piping network for the injection system(s) could impede reuse."	**Response to Comment 62.** The text will be revised for clarification.

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COMMENT 63 Table 3, In situ enhanced bioremediation It should be noted under the description heading that bioremediation can be enhanced by the injection of air, O_2, or other gases (such as methane). Stimulation of bioremediation does not always require injection and circulation of water. Use of air or other gases can stimulate bioremediation more efficiently than water. For example: Using air as the oxygen source, the minimum ratio of air pumped to the contaminants is approximately 13 pounds of air per pound or contaminant for typical petroleum contamination. This compares to a requirement of delivering over 1,000 gallons of groundwater to deliver the same amount of oxygen to the contamination. (Nyer, 2001) Air injection would not cause possible constituent vertical migration as water injection might. Finally, implementability is not technically difficult if injecting air as is done in bioventing. In fact, biovent is often used after treatment with SVE. The same wells and blowers used for SVE can be used for bioventing to stimulate bioremediation. A "life cycle design" would use SVE for mass removal, followed by bioventing for enhanced bioremediation followed by MNA for the residual, if any.	**Response to Comment 63.** Comment acknowledged. The text of Table 3 will be revised for clarification.
COMMENT 64 Table 4, ICs Under limitations, it is stated that if groundwater pumping in the vicinity is eliminated, the gradient would flatten and the contaminants will no longer migrate. This ignores the natural gradient that would take over and provide a means of transport. This also ignores the fact that it may cost the Navy to compensate users of these nearby wells for their loss.	**Response to Comment 64.** Table 4 will be revised for clarification.
COMMENT 65 Table 4, Elimination of Selected Irrigation Well Pumping. Under limitations heading, it is noted that this alternative would require new wells and reduces water available for irrigation. What is seen as a limitation for this alternative is suggested as an enhancement for reducing migration for the IC alternative.	**Response to Comment 65.** Table 4 will be revised for clarification.

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Under "Institutional Implementability," it is stated that it may be difficult to get owners approval to shut down wells. This also applies to this same heading for ICs.	
COMMENT 66 Table 4, Passive/Reactive Barriers Under limitations, it is stated that the groundwater gradient is very flat and may be the result of irrigation pumping. This contradicts earlier statements where it is noted that if groundwater pumping was reduced, the groundwater gradient may flatten (see limitation for ICs). Under the column for Institutional Implementability it is stated that "trenching to Corcoran Clay to install reactive barrier may not be impossible." While this may be true, trenching 250 feet to the Corcoran Clay would definitely be cost prohibitive. It should also be noted that trenching is not the only way to install reactive barriers. They can also be installed with drilling methods and injection of reactive materials.	**Response to Comment 66.** Table 4 will be revised for clarification.
COMMENT 67 Table 4, Groundwater Extraction and Spray Irrigation An additional limitation to this method is that it will not be effective on highly soluble constituents like acetone.	**Response to Comment 67.** Table 4 will be revised for clarification.

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COMMENT 68 Table 4, Air Sparging/SVE Under limitations, human and ecological receptors may be exposed to the vapor produced which will require ex situ treatment. This impact is no different than the treatment required for SVE in soils. Air sparging aimed at source areas will not encumber land any more than SVE or injection for bioremediation. As for time frame, AS/SVE often reduces contaminant mass faster that pumping. Again, following the "life-cycle principal," AS/SVE is used for mass removal of CT and other volatiles. The SVE portion of the AS/SVE has the added benefit of address any "sources" that may have impacted soil at Site 17 and eliminates the need for further investigation and sampling. AS/SVE could be followed by enhanced bioremediation and, finally, MNA.	**Response to Comment 68.** Table 4 will be revised for clarification. The following historical information is extracted from the previously published Feasibility Study Report (Tetra Tech 1999) and is intended to show the significant areas of uncertainty and/or data gaps that are associated with the evaluation of the cost, the potential duration of treatment, and the effectiveness of air sparging as a treatment technology. The potential rebound effect that was described in the 1999 FS was never fully evaluated in the field, and management of rebound was not incorporated into the cost analysis. Additionally, the following information from the 1999 FS identifies natural attenuation as a process that is occurring at the site. The Revised Draft Final Feasibility Study, Installation Restoration Program Sites 11 and 17 (Tetra Tech, 1999) identified an air-sparging (AS)/soil vapor extraction (SVE) remedial alternative as Alternative 1, and the FS states that air-sparging treatment below depths of 158 feet below ground surface would require testing. Additionally, page 7-11 of the FS states "Industry experience with sparging at depths in excess of 60 to 80 feet below the water table is limited and has not been reported in the literature; therefore, sparging in the lower regions of the Site 17 plume should be considered highly innovative and evaluated carefully in the field prior to full-scale design." Navy reports that were published after the 1999 FS did not indicate that air-sparging had been successfully demonstrated in the field at depths of 200 feet below ground surface or more. Carbon tetrachloride has been detected at a depth of 260 feet below ground surface within the Plume during routine groundwater sampling activities. The FS (Tetra Tech, 1999 (pages 7-11 and 7-12) includes a cost estimate for Alternative 1 - AS/SVE of $3.9 million based upon the assumptions that the construction cost would be approximately $3.6 million, pilot testing costs would be $200,000, and the operation cost for six months would be $100,000. The FS indicates that AS/SVE treatment would result in reduction of contaminant levels to concentrations that are less than the Maximum Contaminant Levels (MCLs) within six months. The FS (Tetra Tech, 1999 (page 7-10) also states that "Site heterogeneity should not prevent the successful use of air sparging but may increase the difficulty in accurately predicting cleanup times….. However, areas of the aquifer not receiving direct sparged air flow would ultimately require more time to reach cleanup standards."

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	The FS (Tetra Tech, 1999 (page 7-11)) states that "After site closure, any trace amounts of remaining contamination will undergo further natural attenuation caused by diffusion, dispersion, and chemical and biological degradation." And page 6-5 of the same document states "Anaerobic biodegradation of highly chlorinated VOCs such as CT and chloroform has been demonstrated in the laboratory and in the field. Furthermore, available evidence suggests that in situ biodegradation of these solvents is occurring naturally at Site 17."
COMMENT 69 Table 5 Recommended remedial alternatives are listed for soil. Since no soil impact has been identified so far in spite of several investigations, it is unclear as to why remedial alternatives are needed. The detection of COPCs in the soil and the extent of the impacts, if any, are listed as data gaps that need to be filled. Without this basic information, it is not possible to make practical evaluations of various remedial alternatives.	**Response to Comment 69.** Table 5 may be substantially revised or deleted.
COMMENT 70 Table 6 For UST Cluster 1, the recommended remedial technology is a time-critical removal action. A TCRA was not listed as an alternative in the FS nor is a TCRA a remedial action. The conversion of the TCRA to a remedial action using groundwater extraction would be more appropriate. As noted in earlier comments, storage and disposal of contaminated water is likely to be very expensive and does include the possibility that will be human and ecological exposure to the contaminants in the groundwater. For IRP Site 17, enhanced bioremediation, the technology description should note that while anaerobic bioremediation will readily dechlorinate CT to CF, the dechlorination of CF is not as easy. CF in the environment can be mobile, is less likely to adsorb to soil, and may actually increase the amount of contamination in the groundwater. For intermediate commingled plume, MNA, it should again be noted that some chemicals, such as CT do not degrade naturally but remain in the environment for long periods of time. MNA, without removing as much of the mass as possible, may not be	**Response to Comment 70.** Comment acknowledged. Table 6 may be substantially revised or deleted. Also, please see the Response to Comment 21. For clarification, the following information is provided. The vadose zone responses at UST Cluster 1 are being conducted under the petroleum corrective action program. The groundwater beneath UST Cluster 1 is considered as part of the Administration Area Plume and is being managed as part of IRP Site 17. The time-critical removal actions, described in the Action Memorandum dated November 2000, were implemented in the vicinity of the former dry well within the UST Cluster 1 facility. The time-critical removal actions were intended as interim response actions and not intended as the final remedial response.

Comment	Response
viable. For the downgradient plume, the contingency plan is again mentioned as possibly needed to prevent off-site migration. A barrier wall is proposed to remediate migrating COPCs. In table 4, passive/reactive barriers were rejected. An enhanced *in situ* bioremediation barrier wall is a type of passive barrier wall. The evaluation of barrier walls needs to be reevaluated.	
REFERENCES: ASTM, 1998. Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Sites, Standard E 1943-98, American Society for Testing and Materials, August, 1998. Battelle, 1999. Cost to Complete (CTC) Technologies Reference Manual, prepared for Naval Facilities Engineering Service Center, Battelle, September, 1999. GeoSyntec, 1999. Laboratory Biotreatability Study for Volatile Organic Compounds in Groundwater at NASA Crows Landing Flight Facility, California, August, 1999. Nyer, E.K., et. al., *In Situ* Treatment Technology, 2nd ed., ARCADIS Geraghty and Miller, Lewis Publishers, 2001. Tetra Tech, 1999. NASA Crows Landing Flight Facility Draft Phase 1 and 2 Pilot Testing Memorandum, Tetra Tech EM, Inc., Denver, CO, September, 1999. USEPA, 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents I Ground Water, EPA/600/R-98/128, September, 1998. USGS, 1986. Geology of the Fresh Ground-Water Basin of the Central Valley, California, with Texture Naps and Sections, USGSS Professional Paper 1401-C, Government, 1986. Navy, 1984. Initial Assessment Study of Naval Air Station, Moffett, Sunnyvale, California, by NEESA, 1984.	

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