PRC Environm
1099 18th Stre
Suite 1960
Denver, CO 80.
303-295-1101
Fax 303-295-2818

N00296.002206
MOFFETT FIELD
SSIC NO. 5090.3

PRC

April 21, 1995

Mr. Stephen Chao
Department of the Navy
Engineering Field Activity West
Naval Facilities Engineering Command
900 Commodore Way, Building 208
San Bruno, California 94066-5006

CLEAN Contract Number N62474-88-D-5086
Contract Task Order 0236

Subject: **Response to Comments, Draft Final Operable Unit 5 Feasibility Study, Moffett Federal Airfield**

Dear Mr. Chao:

Enclosed are responses to comments from the U.S. Environmental Protection Agency (EPA) on the above-referenced document. Additional copies of the responses are being forwarded to the regulatory agencies. Responses to DTSC and RWQCB comments will be finalized and delivered upon completion.

If you have any questions, please call Mike Young or me at (303) 295-1101.

Sincerely,

Deidre O'Dwyer
Project Engineer

Michael N. Young
Project Manager

DOD:cmg
Enclosure

cc: Mr. Michael Gill, EPA
Mr. C. Joseph Chou, DTSC
Mr. Michael Bessette, RWQCB
Mr. Don Chuck, Navy

2206

contains recycled fiber and is recyclable

MOFFETT FEDERAL AIRFIELD
RESPONSE TO COMMENTS RECEIVED FROM
U.S. ENVIRONMENTAL PROTECTION AGENCY
DRAFT FINAL OPERABLE UNIT 5 FEASIBILITY STUDY

APRIL 21, 1995

This report presents point-by-point responses to the U.S. Environmental Protection Agency (EPA) comments on the January 30, 1995 Draft Final Operable Unit 5 (OU5) Feasibility Study (FS) report prepared by PRC Environmental Management, Inc. (PRC) for Moffett Federal Airfield (MFA), California. The comments were provided by Mr. Michael Gill of EPA in a letter dated February 13, 1995.

GENERAL COMMENTS

Comment 1: EPA understands that although the results of the pilot/bench studies are incomplete at this time, the early results appear to yield enough data to consider the technologies (air sparging/soil vapor extraction [AS/SVE] and the Iron Curtain). In the interest of speeding up the remedial investigation/feasibility study (RI/FS) process, we also agree that these preliminary results are enough to proceed through the FS. Once the pilot/bench study reports are finalized, they should be forwarded to the regulatory agencies as soon as possible. If final results are in conflict with the preliminary results, it may be necessary to reconsider the selected alternative.

Response: *Preliminary results of the AS/SVE pilot test and iron curtain bench-scale test have been discussed in the FS in Section 6.5. Finalized reports for AS/SVE and iron curtain tests will be forwarded to the regulatory agencies as soon as all analytical data are available.*

Comment 2: Appendix C, the calculation of Risk Based Concentrations (RBCs) for an occupational irrigation scenario, while appropriate, presents only a partial picture of the potential risk at OU5. As stated before, EPA Preliminary Remediation Goals (PRGs) have been used by other sites to present a screening level (not a cleanup level) for various contaminants and should be used in lieu of these RBCs. EPA suggests that the Navy either remove this appendix and rely solely on the OU5 RI risk assessment or explain

that this appendix presents only one potential scenario at OU5. Other scenarios (i.e. ingestion of groundwater) are obviously considered when making the determination of whether remediation is appropriate for the site. If you remove the appendix, we suggest you move the last appendix, Appendix H, into Appendix C's place to minimize any textual changes and rippling effects.

Response: *Appendix C has been included to provide information on risks associated with occupational exposure to groundwater. Risks from residential use of groundwater, which includes groundwater ingestion, are summarized in Tables 1-2 and 1-3 of the FS. As stated on page 41 of the FS, "Appendix C ... presents acceptable contaminants of concern (COC) concentrations for groundwater assuming an occupational exposure scenario. Occupational exposure to groundwater involves different exposure parameters than the residential exposures assessed in the RI report." The Navy believes the occupational exposure pathways are likely to be complete at MFA. Therefore, acceptable concentrations under a likely occupational exposure scenario are critical for (1) evaluating impacts to beneficial uses, and (2) identifying access restriction requirements.*

Comment 3: Some of the applicable or relevant and appropriate requirements (ARARs) need more specificity in the tables so that the agencies will be able to determine their applicability to the suggested alternatives.

Response: *As discussed in the telephone conversation between EPA, Navy, and PRC on March 3, 1995, the Navy will revisit the ARAR discussions to provide specificity, if warranted (see responses to specific ARAR comments). EPA's comments are generally in reference to Table 3-3. However, as stated in the introduction to Section 3.3, this table provides a general overview of potential action-specific ARARs. The ARAR discussions in Section 6.0 provide additional specificity. The Navy understands that EPA is concerned that the somewhat broad citations provided in Table 3-3 may be directly incorporated into the record of decision (ROD). However, the Navy intends to use the discussions in Section 6.0 to develop precise action-specific ARAR citations for the ROD.*

Comment 4: In Chapter 6, the Detailed Analysis of Alternatives, almost every long and short term effectiveness section states that because inorganic constituents will remain above maximum contaminant levels (MCLs), it is doubtful that this groundwater can be used as a drinking water source without further treatment. It appears that no matter which alternative is selected, inorganics will remain in the groundwater and therefore remain a risk. This is true for all alternatives, except Alternative #3, where the Navy says the municipality who wants to pump the groundwater for drinking water will have to treat the inorganics. How can the Navy defend the selection of an alternative that does not reduce or remove this risk? It appears that these statements need to be changed to reflect the findings of Appendix A, where it is shown that inorganics that exist in OU5 groundwater are shown to be naturally occurring. If we have misunderstood this appendix (that is, that inorganics are from anthropogenic sources), then the Navy should include an alternative to remediate inorganics.

Response: *None of the proposed alternatives will treat inorganic constituents and concentrations of inorganic constituents in excess of MCLs will remain in groundwater. However, these concentrations of inorganic constituents are naturally occurring and not a result of Navy activities. Section 6.0 will be modified to clearly state that the observed levels of inorganic constituents are naturally occurring and to refer the reader to the analysis presented in Appendix A. For example, the following is the proposed revision (redlined text) to the discussion of long-term effectiveness for Alternative 4A (Section 6.4.1):*

"This alternative also restricts access to the southern plume area groundwater through institutional controls until COC MCLs are attained, thus minimizing risk. Once COC remediation goals are achieved, the remaining risks will be acceptable (except for risk associated with some inorganic constituents that have background levels above MCLs). Inorganic constituents in groundwater at OU5 are naturally occurring and are not the result of Navy activities. Appendix A contains additional information concerning background (naturally occurring) concentrations of inorganic constituents in groundwater."

Comment 5: Several sections of the OU5 FS report contain strong statements regarding the site-specific hydrogeology and contaminant fate and transport processes that are not supported by presentation and discussion of data that were used to develop the interpretations. A general premise in the FS is that the "majority" of the

contaminants will be captured or remediated (depending on the alternative) by placing a barrier or reaction cell across sand channels in the A aquifer. This premise that contaminants that exist at locations outside of the channels will desorb and flow to the channels is not supported by the data presented in the FS.

Although EPA agrees that the results of the bench test of the Iron Curtain technology shows applicability to this site, many questions regarding design specifics of the Iron Curtain placement remain. These concerns are not strictly required to finalize the FS, but will be necessary to address before a remedial design is completed. It seems that not all the necessary data are here. The Navy needs to state that while the idea is sound, the locations in this document are conceptual and more sand channel definition will be performed before finalizing Iron Curtain locations.

Groundwater contour maps presented in Appendix A of the FS and the RI report do not reflect flow conditions that are confined to the interpreted channel geometry. For this condition to exist, groundwater equi-potential lines outside of the sand channels must be oriented parallel to the sand channels, indicating flow directly towards the channel. This is not the case according to the groundwater contour maps. This information, as well as the geometry of the contaminant plumes, indicates groundwater flow and containment transport occur at locations outside of the sand channels.

Review of the isopach map in the A1 aquifer zone (Figure 3.4-13 from the RI report by IT dated August 1993) indicates sand and gravel lenses ranging up to 22 feet in thickness with an average thickness of about 8 feet. Thus, the FS-identified "sand channel" is merely a thickened portion of the geologic cross section. It is questionable whether these thicker sand and gravel lenses will be effective as part of the FS's strategy in remediating the "majority" of the contaminants. The FS should provide a discussion of how the sand channels were interpreted from the data.

The analytical data presented on Figures 1-5 and 1-6 show a number of locations that have elevated levels of COCs outside of the sand channels (such as W4-1, W4-11, and CPTU5-2, and W4-18). This directly contradicts the FS's assumption that elevated contaminant concentrations are present in the sand channels.

Further, remedial options implemented at the locations of channels only may not provide hydraulic control and/or treatment of a significant portion of the plume. It is recommended that the remedial alternatives incorporate well spacings or reaction cells that address the entire groundwater plume, not just sand channels. All contaminants of concern need to be remediated to agreed upon cleanup levels.

Response: *Remedial systems (both in situ and extraction technologies) were targeted in channel deposits because data from previous investigations at MFA indicate that variations in the hydraulic conductivity of the subsurface geology materials controls contaminant movement. In addition, the groundwater model results presented in Appendix E support preferential contaminant migration in the channel deposits. This premise is not apparent from the data presented in the draft final OU5 FS because the investigation conducted in 1994 covered a large area and did not focus intensively on localized parts of OU5. The wider focus was necessary to delineate the extent of the plume within this large area. Characterization of localized contaminant movement requires sampling the full range of geologic materials on a relatively tight grid.*

Groundwater flow theory predicts that at the boundary between materials having two different hydraulic conductivities, a flowline will refract at an angle (relative to the difference in hydraulic conductivity) into the higher conductivity material (Freeze and Cherry 1979). This could be observed by installing an array of closely spaced piezometers across the boundary, open to the aquifer at the same depth (an open pipe or a well with a very small screen interval). A water table map developed from these data should exhibit a bending of contour lines at boundaries between geologic materials of varying hydraulic conductivities. The degree of bending will be directly proportional to angle of refraction of the flowlines. When the monitoring well array does not meet the specifications discussed above, it becomes difficult to discern actual water level differences because of vertical and lateral averaging effects. The water table map in Appendix E of the draft final FS incorporates data from widely spaced wells with screens of variable length (5 to 15 feet). These wells are screened primarily in sandy deposits and located at various depths within the unconfined/semi-confined A1 permeable zone. This type of map provides average contours useful for determining the overall flow gradient and vertically averaged head values that can be

used in model calibration. It does not provide data of sufficient density and quality to detect subtle water level variations at geologic unit boundaries.

The isopach map provided in the Remedial Investigation (RI) report indicates the total thickness of sand and gravel in the A1 aquifer at each location. This type of map does not differentiate between individual channels and provides a generalized depiction of site geology that is not detailed enough to depict individual flow paths within the A1 permeable zone. Many of the borelogs that were used to develop this map were logged from cuttings, which can provide erroneous lithologic interpretations and contact depths. Furthermore, it does not appear that this isopach map distinguished between thick lenses of coarse-grained sand and gravel, which fits the description of a channel, and thinly-bedded clayey sands that may be interlayered with clay and silt, which clearly does not fit the description of a channel.

The sand channel maps provided with the FS were developed from a spreadsheet that distinguished between channel sand (deposits of sand and gravel greater than 2-feet thick) and thinly-bedded sands that were interpreted to constitute crevasse splay deposits (silty or clayey sands, or sand with gravel deposits less than 2-feet thick). Cross-sections of the site were developed to identify horizons within the A1-aquifer zone where channel sands were concentrated. These horizons were input into the groundwater flow model as individual layers. The spreadsheet used in the development of the sand channel map calculated the total thickness of both types of sand deposits in each layer at each borehole. These values were posted on maps showing the location of data points within each model layer. The extent and orientation of sand channels was determined from these maps. Further differences between these channel maps and the A1 isopach map from the RI report are due to the increased amount of data available as a result of the OU5 investigation (15 continuously-sampled borings and 50 CPTs).

Contaminant contours depicted on Figures 1-6 and 1-7 were extrapolated from a data set consisting of samples collected primarily in coarse-grained deposits (both channel deposits and crevasse splay deposits). This produces a contaminant concentration map biased toward the higher concentrations that should exist in the more permeable deposits. The focus of the OU5 investigation was on delineating preferential

pathways in the subsurface, therefore all wells were screened in coarse-grained materials. Likewise, hydropunch samples were collected at CPT holes that intercepted coarse-grained deposits. Several CPT test logs lacked any indication of coarse-grained materials throughout the entire depth of the logs; these CPT locations were not sampled and are not depicted on Figures 1-6 and 1-7. Most of the contaminant detections that are located between the identified channels are samples collected in deposits that are interpreted to crevasse splay deposits. If the depositional model (PRC 1992b) is correct, crevasse splay deposits should be interconnected with the channel sands, and should increase in average grain size and thickness of deposit in a direction toward the channel. These characteristics should cause groundwater to be conducted toward the channel deposits, thus transporting contaminants into the channels.

As an example, near Building 29 on the western side of MFA, media (groundwater, soil, and soil gas) were sampled on relatively tight grids. Total petroleum hydrocarbon (TPH) plume maps of the Building 29 area are provided in the Building 29 Technical Memorandum (PRC 1991) and the Site 9 Technical Memorandum (PRC 1992a). A large number of samples were collected near the water table within a localized area. Groundwater, soil, and soil gas contours show the TPH plume bending at a very sharp angle to the east, then turning northeastward. The contour maps indicate that contaminants migrate in an easterly direction at a much sharper angle than could be explained by the regional groundwater flow gradient. A large northeastward-trending channel passes about a half-block east of TPH source location, as depicted in Plate 3 of the Site 9 Technical Memorandum. The contaminant concentration data indicate that the plume is drawn eastward toward this channel and then follows the course of the channel northeastward. The plume maps also show that hydropunch samples collected in clayey areas located immediately north of Building 29 did not have TPH detections. The results of this investigation indicated that contaminants at Building 29 migrate through preferential flow paths provided by channel deposits.

As agreed at a meeting on March 28, 1995 at EPA Region 9 headquarters between the Navy and regulatory agencies, all remedial alternatives will use engineering controls to minimize the possibility of contaminant migration through the less

permeable material instead of relying on natural flow patterns to intercept contaminants in the less permeable material. For example, the iron curtain alternative will now span the entire width of the plume at the leading edge with a combination of reaction cells and slurry walls. The barrier configuration will consist of reaction cells in the thickest channel deposits and slurry walls across the remainder of the alluvium. The extraction well and air sparging/soil vapor extraction alternatives will also be reconfigured to place engineering controls in the less permeable areas. Further investigation may be conducted during the design phase to determine exact configuration of the remedial system.

Comment 6: Throughout the document, it is stated that the "Phase I SWEA report does not identify chlorinated volatile organic compounds (VOCs) as COCs." Please clarify this statement to read that the "Phase I SWEA report does not presently identify chlorinated VOCs as COCs in the ecological assessment areas." Obviously, if VOCs are pumped up from groundwater and discharged to surface water at levels above MCLs and/or water quality criterias (WQCs) for aquatic life, there would be risks introduced to the ecological areas.

Response: *The suggested change will be made.*

Comment 7: The FS never defines what "majority" of the contaminants will be treated. The percentage of expected contaminant mass to be treated relative to the entire contaminant plume's mass should be calculated and presented.

Response: *The expression that the "majority" of the contaminants will be treated will be removed from the report. The percentage of the contaminant mass to be treated will be estimated and included in the final FS report.*

Comment 8: No groundwater contour maps are presented in the FS. Groundwater contour maps should be presented in the FS to support statements made concerning gradients, flow rates, and preferential flow pathways. It is recommended that if supporting data are available, groundwater contours be generated for the specific depth intervals identified in the groundwater flow model or at least be referenced in the text.

Response: *A groundwater contour map will be provided in Appendix E (Figure E-8). This figure will also be incorporated into Volume I of the final FS. This figure provides contours of water table elevations in the first three layers of the groundwater model as one surface since water table elevations do not vary significantly (0.1 foot or greater) between wells screened in layers 1 through 3 (see well pairs WU5-1/WU5-2, WU5-3/WU5-4, W4-17/W4-12, and W6-3/W6-2, all of which are split between layers 1 and 3). Water table elevations appear to be significantly different (generally higher) in layer 4, particularly at the northern end of OU5. Therefore, water table elevations for layer 4 (A2 permeable zone) wells are designated with an asterisk on this figure, and were not used to draw the contours.*

Comment 9: Figures are included which represent the distribution of contaminants in groundwater. These figures show estimated plume boundaries based on chemical concentration data for all layers. It is recommended that chemical concentrations and plume geometries be depicted based on the depth intervals identified in the groundwater flow model. This will provide a better understanding of the three-dimensional distribution of contaminants and could be used to support statements concerning contaminant migration.

Response: *Six figures will be provided in the final FS that overlay layer-specific chemical concentrations for trichloroethene (TCE) and 1,2-dichloroethene (1,2-DCE) on the channel pattern maps and delineate areas where contaminant concentrations are estimated to equal or exceed MCL of 5 μg/L. Two additional figures will depict chemical concentrations in layer 4 without a channel pattern overlay (lithologic data were not of sufficient quantity and quality to delineate the channel pattern in layer 4). Draft versions of these figures are attached to these comments.*

Comment 10: The document should present detailed cross-sections through the site or reference the relevant cross sections from the RI to support conclusions regarding contaminant distribution, groundwater flow pathways, and sand channel interpretations.

Response: *Five cross-sections will be provided in the final FS. All cross-sections will depict borehole data and CPT tip resistance logs, as well as provide a geologic interpretation between wells. Model layer boundaries will also be indicated on the*

cross-sections. Two cross-sections (A-A' and B-B') will cross the site in a direction approximately perpendicular to the general trend of the channel deposits. Two cross-sections (C-C' and D-D') will cross the site in a direction parallel to the general trend of the channel deposits. One cross-section (E-E') will cross the site at an angle to the general trend of the channel deposits, but bisecting the low-permeability area immediately west of Marriage Road. Individual channel axes vary throughout their length and may intersect the cross-sectional planes at varying angles throughout the length of a single cross-section; thereby revealing longitudinal, transverse, and oblique channel geometry along a single cross-section. These cross-sections will also include information on screen depths, water levels, and contaminant concentrations (TCE and 1,2-DCE).

Comment 11: Appendix E is generally well written, presenting complex subjects concisely and in terms understandable to the non-modeler. The sections on model limitations are particularly helpful. While the sections of the appendix which present model design and calibration are generally adequate, the section which discusses model results and conclusions (Section 5.0) is uncharacteristically brief and lacks detail. This section is crucial for the reader (decision maker) to understand how the site may react to active remedial efforts. A remedial strategy hinges on hydraulic control of the site and the decision makers must thoroughly understand the modeling results. The extraction scenario should therefore be discussed in greater detail. The text should discuss how the preferred extraction scenario was derived and depict examples, including several intermediate scenarios that did not capture the plume. As discussed above, many of the issues discussed here are not necessary to complete in order to finalize the FS, but will be very important to fully understand before implementing a remedial action.

Response: *A number of changes have been made to the groundwater flow/contaminant transport model since the draft final FS that will improve how the model incorporates representative site conditions; thereby improving the model predictions and the conclusions that can be derived from it. The most significant changes are to the grid spacing and the configuration of the source term. The grid has been further subdivided from a 100- by 100-foot grid to a 50- by 50-foot grid. This allows the channel extents to be more accurately depicted, particularly in areas where channel orientations differ from their general trend. The source term has also been changed*

from a source that encompasses the area of all present solvent detections, irrespective of geologic constraints, to source terms placed in areas where sources were likely to have existed. Previously, the source term was insensitive to the site geology and greatly overestimated contaminant mass by starting contaminants in cells where contamination is unlikely to exist, which may have distorted the model results. The current source configuration allows the contaminant plume to migrate under the influence of the site geology, thereby forming a plume that can be compared against the current plume configuration, as depicted in the figures that will be included in the final FS. The new model will provide a more realistic predictions of contaminant plume response to the various remedial scenarios.

The extraction well and iron curtain scenarios will be discussed in greater detail in Appendix E of the final FS. Figures will be included to show the model results under these scenarios.

SPECIFIC COMMENTS

Comment 12: Section 1.3.3.2, Groundwater Uses. A statement should be added to this section indicating that no pumping currently takes place, if this statement is true.

Response: *The following statement will be added to section 1.3.3.2: "Currently, no groundwater is pumped from the aquifers underlying MFA except for the purposes of contaminant plume source control."*

Comment 13: Section 1.4.1, Site Hydrogeology, Page 20, Paragraph 4. If there are "narrow, discontinuous channels and lenses of sand and gravel," then how will it be ascertained if the proposed remediation techniques will be effective in intercepting these channels?

Response: *All alternatives will incorporate groundwater monitoring to evaluate performance of the remedial system. Details on the monitoring plan will be developed during the design phase. Additional data collection activities during the design phase could be used to evaluate the accuracy of the depositional model for the OU5 sediments and the characterization of plume movement. However, as discussed in the response to*

general comment 5, the Navy has agreed to use engineering controls throughout the sand channel and less permeable areas to promote interception of contaminants rather than using only natural flow patterns.

Comment 14: Section 1.4.1, Site Hydrogeology, Page 20, Paragraph 4. This section indicates that channel deposits have been identified at three different horizons within the A1-aquifer zone; however, the details of where these zones are located are not included. It is recommended that this section be modified to include a detailed discussion of the three horizons. If this information is in other reports then they need to be summarized and referenced.

Response: *The sand channels identified in Figures 1-5, E-1, E-2, and E-3, of the FS were interpreted from elevation-specific maps incorporating new and existing data, and from individual borelogs (see response to general comment 5). Borelogs were reviewed to obtain an understanding of the types of lithology (thick channel sand or thin interlayered sand and silt beds) and accuracy of the borelog (drilling method, sampling method, degree of detail). This type of detailed information is necessary to correctly interpret the data, otherwise borelogs from borings that were sampled from cuttings (which tend to greatly overestimate the thickness of sandy zones), or borelogs that show a 20-foot thickness of thinly-laminated clay and sand, will distort the interpretation by showing sand channels where they do not exist. Several cross-sections were constructed to identify the elevations where sandy deposits appear to be concentrated, which was used to identify the model layers. These cross-sections will be provided in the final FS. A figure will be provided that relates the depths of the model layers to the depths of the permeable zones.*

Comment 15: Section 1.4.1, Site Hydrogeology, Page 23, Last Paragraph. This section contains a discussion of groundwater flow directions and gradients, although no figures are presented. A figure, or figures, should be added that present groundwater elevation contours with respect to screened interval depths (i.e., layers 1 - 4) to support the discussion presented in this section. If this information is in other reports, then they need to be summarized and referenced. Figures showing the results of aquifer tests with respect to depth or stratigraphic unit should also be included to support conclusions regarding the distribution of hydraulic conductivities and remedial design.

Additionally, this paragraph and the first paragraph on page 24 should be modified to present quantified vertical hydraulic gradients, if they are presently available.

Response: *A groundwater contour map will be provided in Appendix E (Figure E-8). Please see the response to EPA Comment 8.*

Additionally, the following text discussing the results of OU5 aquifer tests will be included in the final FS:

> *"Three aquifer tests were conducted within, or just outside of, the model area as part of the OU5 RI (IT 1993). Within the model area, tests were conducted at wells W4-11 and W5-27 at screen depths corresponding to model layer 1. A test was also conducted at well W5-12, which is located just south of the southern model boundary, at a screen depth corresponding to model layer 2. Calculated transmissivities for the layer 1 aquifer test range from 1,728 square feet per day (ft^2/d) to 3,340 ft^2/d. The calculated transmissivity for the layer 2 aquifer test was 2,419 ft^2/d. All of these aquifer tests were conducted in channel deposits. In comparison, average transmissivities for model cells containing channel sand were calculated from calibrated model parameters: 2,800 ft^2/d for layer 1 and 1,700 ft^2/d for layer 2. These results are based on the model-calibrated value for channel deposit hydraulic conductivity (200 feet per day [ft/d]) and the average layer thicknesses of 14 feet for layer 1 and 8.5 feet for layer 2.*
>
> *Vertical hydraulic conductivities will be calculated from all well pairs with wells screened in different model layers. Only wells located within 10 feet of one another will be considered well pairs. These well pairs include: WU5-1/WU5-2, WU5-3/WU5-4, W4-17/W4-12, and W6-3/W6-2 (all of which are split between layers 1 and 3); WU5-7/W3-13 and W19-4/W19-3 (split between layers 2 and 4); W3-2/W3-12 (split between layers 1 and 4); and W43-1/W7-8 (split between layers 1 and 2). Vertical hydraulic conductivities for these well pairs will be provided on a map in the final FS."*

Comment 16: <u>Section 1.4.1, Site Hydrogeology, Page 23, Last Paragraph, 4th and 5th Sentences</u>. These sentences appear to be conflicting with regard to hydraulic gradient values. Please clarify.

Response: *The fourth sentence of this paragraph refers to a hydraulic gradient value attributed to the western side of MFA, while the fifth sentence refers to a value attributed to the eastern side of MFA. The text will be revised to clarify this.*

Comment 17: Section 1.4.2, Nature and Extent of Contamination. This section does not present or indicate where data from the August to November 1994 sampling event can be found. A table should be added to this section presenting a summary of all data detected in OU-5 groundwater with respect to location and depth and analytical results from the additional investigation should be presented in an appendix of the document or a reference provided.

Response: *As stated in Section 1.4.2.1, the data for potential organic COCs are provided in Appendix B. These summary tables include the data from the August and November 1994 additional investigations. A figure presenting the August and November 1994 well and CPT locations and associated groundwater sample depths will be added. Raw laboratory data for all analyses associated with these additional investigations will be provided in an Appendix.*

Comment 18: Figures 1-5 and 1-6, Pages 27 and 28. It was noted that several wells were not shown on this figure, primarily at the southern end of the contaminant plumes. Specifically, wells W6-10, W7-12, W7-20, W43-1, and W43-2 were missing. It is suggested that the sand channels identified in Figure 1-5 be shown on Figures 1-5 and 1-6. Well W3-13 was sampled and shown on Figure 1-5 but was not shown on Figure 1-6. Please correct.

Response: *Wells W6-10, W7-12, W7-20, W43-1, W43-2 are included on the chemical concentration maps that will be provided in the final FS (see response to comment number 9). Analytical results for well W3-13 were posted on Figure 1-6 (TCE plume map) and Figure 1-7 (1,2-DCE plume map) in the draft final FS. Figure 1-5 of the draft final FS is a sand channel map and is not intended to display any chemical concentration data. Figures 1-6 and 1-7 will be replaced by the 8 new chemical concentration maps. These figures will depict TCE and 1,2-DCE concentrations at depths corresponding to each of the four model layers.*

Comment 19: Figure 1-8, Page 32. Wells, if they exist, should be shown for the most easterly TPH contaminant plume. This figure also has duplicate labeled wells (including W3-2, W7-6, W6-10, and W4-3).

Response: *The suggested modifications will be made to Figure 1-8.*

Comment 20: Section 1.4.2.2, Page 34, Last Paragraph, 8th Sentence. This sentence says ". . . antimony was not detected at levels ranging from 14.4 to 24 micrograms per liter (μg/L)." Please clarify.

Response: *This sentence will be modified to state "In samples from the B2-aquifer zone background well defined in the RI, antimony was not detected and detection limits ranged from 14.4 to 24 μg/L."*

Comment 21: Section 1.4.2.2, B2- and B3-Aquifer Zones. This section does not provide a discussion of the occurrence of TCE and bis(2-ethylhexyl)phthalate (BEHP). Please provide a discussion of these contaminants. Were they detected in the B2- and B3-aquifer zones?

Response: *The discussion of organic chemical detections in the B2- and B3-aquifer zones in Section 1.4.2.2 will be expanded to discuss detections of TCE and BEHP in greater detail. TCE was detected in 5 of 102 samples collected from B2-aquifer zone wells (Wells W3-4, W3-7, W7-15, and W10-3) at concentrations ranging from an estimated value of 1 to 2 μg/L. BEHP was detected in 2 of 20 samples collected from B2-aquifer zone wells (both at Well W3-15) at estimated concentrations of 3 and 4 μg/L. TCE and BEHP were not detected in samples collected from the B3-aquifer zone.*

Comment 22: Section 1.5.7, Page 52, Last Paragraph, and Figures 1-9 and 1-10. This section indicates that, based on a time-series analysis of VOC concentrations at wells W7-8 and W4-4, natural degradation of contaminants in groundwater is occurring. This phenomenon also occurs when the center of mass of a groundwater contamination plume migrates away (downgradient) from a monitoring point. Are all wells at the site experiencing the same phenomenon? Are there other data that suggest that

natural attenuation is occurring? If so, please include a discussion in this section. (Note that this process also is relevant to detections of arsenic and chromium near Sites 7 and 19.)

Response: *This comments suggests migration of the contaminant plume away from monitoring wells W4-4 and W7-8 and may explain the declining concentrations observed over time in samples from these two wells. Wells downgradient from these wells (W4-15 and W6-4 for example), however, do not show concurrent increases in concentrations that would be expected from plume migration (unless the plume is small or moves very slowly and has not yet reached the downgradient wells).*

Regardless, similar declines in contaminant concentrations are not evident in samples from most of the other wells within the southern plume area. Groundwater samples from most of the wells in this area indicate approximately constant, low contaminant concentrations. Declines in concentrations near wells W4-4 and W7-8 result from unique conditions near these wells. The last paragraph of Section 1.5.7 will be modified to indicate that declining concentrations are observed only in portions of the southern plume area. The response to EPA's specific comment 40 contains additional discussions of arsenic and chromium in groundwater at Sites 7 and 19.

Comment 23: Section 3.1, Page 68, Paragraph 1. Specifically identify which requirements in the Basin Plan are the ARARs that will be complied with.

Response: *This paragraph actually identified Resolution 92-49 requirements (Section G), not basin plan requirements. Page 67 identified the basin plan requirements. The basin plan is not structured to accommodate clear citation. The heading of the basin plan section that contains procedures for selecting cleanup goals is "Setting Cleanup Levels." This section heading will be added to the discussion of the basin plan.*

Comment 24: Section 3.1, Page 68, Paragraph 1, 2nd to Last Sentence. Since a Record of Decision will ultimately set enforceable standards, EPA suggests that you reword to read: "Setting cleanup standards using the MCLs for the Southern Plume area and WQC for the Northern Plume should fulfill the cleanup goal selection procedures. The standards will maintain probable and potential uses.

Response: *The suggested rewording will be made to the text.*

Comment 25: Table 3-2, Page 69, Comments in 3rd Row. Please add the results from the Endangered Species investigation in the SWEA into the final FS.

Response: *The comment column of the table will be rewritten as follows:*

> *"The forktail damselfly is no longer a federal or state candidate for listing as threatened or endangered. The requirements are not applicable because there are no listed threatened or endangered species at OU5 and the ditch is not a critical habitat. The requirements are not relevant and appropriate because OU5 does not provide habitat for any species that are candidates for listing as threatened or endangered."*

Comment 26: Table 3-2, Page 70, Comments in 7th Row. Please include any resolution regarding archeological areas at OU5.

Response: *The comment column will be rewritten to state that the requirements are not ARARs because no remedial activities will impact a protected area.*

Comment 27: Table 3-3, Page 72, Water Quality Control Plan, Row 1. Specifically identify which provisions of The plan are applicable to the remedial alternatives.

Response: *Please see the response to general comment 3.*

Comment 28: Table 3-3, Page 72, California Enclosed Bays and Estuaries Plan, Row 2. Specifically identify which provisions of the Bays and Estuaries Plan are applicable to the remedial alternatives.

Response: *Please see the response to general comment 3.*

Comment 29: Table 3-3, Page 72, Resolution 92-49, Row 4. Earlier in the FS text you state that only section (g) of 92-49 is an ARAR. The comment section for this table should be consistent with statements made in the text.

Response: *The comment section will be revised to reference Table 3-1 for consistency.*

Comment 30: Table 3-3, Page 72, Water Quality Control Plan, Row 6. Specifically identify which provisions of the Plan are applicable to the remedial alternatives.

Response: *Please see the response to general comment 3.*

Comment 31: Table 3-3, Page 73, Air Emissions, California Statute 1568, Row 4. The comments are confusing. When is 1568 an ARAR? Is it stricter than the federal standard? Which provisions of 1568 are applicable, or relevant and appropriate, to the remedial actions?

Response: *California Statute 1568 will be removed.*

Comment 32: Table 3-3, Page 73, Air Quality Management District (AQMD) Rule, Row 5. AQMD has numerous rules. Which rules are considered to be ARARs? Specifically identify the provisions.

Response: *Please see the response to general comment 3. Section 6.0 addresses the specific rules.*

Comment 33: Table 3-3, Page 74, 40 CFR 61, Row 1. You refer to state regulations without providing a citation. Identify which state regulations you are referring to and explain why you consider them to be ARARs.

Response: *The comment column will be modified by substituting the Bay Area Air Quality Management District (BAAQMD) regulations for the state regulations. Please see response to general comment 3.*

Comment 34: Table 3-3, Page 74, Incineration, Row 3. "Certain requirements could be relevant and appropriate". Which requirements are you referring to? Provide a detailed explanation.

Response: *Please see the response to general comment 3.*

Comment 35: Table 3-3, Page 75, Storage/Treatment, Thermal Treatment, Chemical, Physical or Biological, Miscellaneous Units. With respect to these treatments, identify with specificity which requirements you consider to be ARARs.

Response: *Please see the response to general comment 3.*

Comment 36: Table 4-2, Page 95, Rows 2 and 4. Update the table with a summary of preliminary results from the treatability tests (AS/SVE and Iron Curtain).

Response: *For AS/SVE, references to the treatability test will be removed from Table 4-2. Results of the pilot test are discussed in Section 6.5.*

For the Iron Curtain, pilot-scale treatability studies are still required; therefore, this row of the table will not be modified. The bench-scale tests are discussed in Section 6.4.

Comment 37: Section 6.4.1, Page 135, Paragraph 1. Are there to be 4 or 5 trenches installed for the southern plume? The map on Figure 6-1 shows 4 trenches. Please clarify.

Response: *The text will be corrected to be consistent with associated figures.*

Comment 38: Figure 6-1, Page 136 The contaminant plume does not correspond with the sand channels shown. The eastern portion of the plume is well outside the indicated sand channel and the western side is inside the sand channel. The preferential pathway of the sand channels appears to have minimal bearing on the contaminant movement. This greatly impacts the basic premise that the proposed remediation alternatives can effectively treat the "majority" of the contaminants. See General Comment 5.

Response: *See response to general comment number 5.*

Comment 39: Section 6.4.1, Alternative 4A, Cost, Page 142, First Paragraph, Third Sentence. This sentence states that the entire southern plume will be treated; however, the second paragraph of this section implies that a "majority" of the contaminants will be

treated. Please resolve this discrepancy. It needs to be stated that any remedy selected will remediate all contaminants of concern to agreed upon cleanup levels.

Response: *The terminology used to discuss the treatment configurations will be modified in the final FS report to reduce confusion. The configurations will be referred to as single-interval and multiple-interval configurations rather than leading edge and entire plume configurations. Each alternative is evaluated on its ability to achieve remedial objectives and cleanup goals throughout the OU5 area.*

Comment 40: Appendix A. The new sampling results from November 1994 for arsenic and chromium in the Sites 7 and 19 areas (including wells near Tanks 2 and 43) "did not confirm the high chromium/arsenic detections". It would be helpful to see this historical data for chromium and arsenic in a table so that any historical trends could be observed. Figure A-27 shows this for chromium, but does not include the latest November 1994 data. There is no equivalent table for arsenic. The text of this section should be modified to include a discussion of why and how these decreases in concentrations occurred.

Response: *This comment addresses historic high detections of chromium and arsenic in groundwater samples from wells W43-1, W43-2, and WT2-1. A table presenting all the total chromium and arsenic data for these wells will be added to Appendix A. Figure A-27 will be expanded to include the chromium data collected during 1994 and a similar figure illustrating arsenic data will be included. As suggested in EPA specific comment 22, migration of a plume past the monitoring points may be responsible for the observed concentrations in samples from wells W43-1, W43-2, and WT2-1. However, samples collected from downgradient monitoring wells (W4-14, W6-4, and W6-5) indicate nearly constant, low chromium and arsenic concentrations. If the initial high concentrations measured at wells W43-1, W43-2, and WT2-1 represented a release of chromium and arsenic, these metals have not migrated sufficiently to be detected at downgradient monitoring wells. An alternative explanation for the observed concentration changes may involve the natural reduction in the infiltration of fine sediment (measured as sample turbidity) to a well as it is continually developed through additional sampling rounds. For example, well W43-3, which was installed in the vicinity of wells W43-1 and W43-2 in February 1994,*

displays a similar trend. Total chromium and arsenic concentrations in groundwater declined from 256 and 26 μg/L in samples collected in February 1994 to 30.5 and 4.8 μg/L in samples collected in November 1994. Potential concentration trends such as these that may be related to the stabilization of groundwater conditions after well installation underscore the need for several sampling rounds to establish baseline levels.

Comment 41: Appendix E, Page 1, Paragraph 2. The text identifies (Modular Three-Dimensional Finite-Difference Groundwater Flow Model) (MODFLOW) and Modular Transport in 3 Dimensions (MT3D) as the flow and transport computer model codes used during the effort but does not state why these particular codes are appropriate for the modeling effort at this site. Since several limitations of the MT3D code (for example, one parameter to an entire layer) cause large simplifications in the transport modeling, a brief discussion of why these codes are appropriate is necessary. Please revise the text accordingly.

Response: *The text will be revised to incorporate the following discussion:*

> *A numerical, three-dimensional flow model is necessary when groundwater flow paths are expected to be influenced by hydrologic parameters that vary in three dimensions, such as the alluvial channel distribution at MFA. MODFLOW was selected as the groundwater flow model because it is the most widely used three-dimensional, finite-difference, groundwater flow model available, and because it can be easily linked to a number of preprocessors (used to set up the grid and parameter arrays), fate and transport models, and postprocessors (such as contouring programs and statistical programs). Finite-difference models are generally easier to link with other models and programs because they are composed of rectangular model cells. The spreadsheet database used to derive initial estimates of hydraulic conductivity required a grid of rectangular cells, so that data could be transferred directly into the model.*
>
> *The two types of contaminant transport models that can be used in conjunction with numerical groundwater flow models are particle tracking models or solute transport models. Particle tracking models evaluate advective processes only, and neglect the effects of dispersion, retardation, and chemical reactions. This type of model can be used to calculate particle pathlines and delineate capture zones, but cannot be used to predict chemical concentrations at future*

time. Therefore, a solute transport model was selected. MT3D is a three-dimensional solute transport model that uses a numerical technique (hybrid method of characteristics) that is more efficient than the method of characteristics technique in the two-dimensional, solute transport model, MOC (method of characteristics). Unfortunately, MT3D shares the same limitation that MOC and all other commercially available, three-dimensional transport models have: only one parameter value (partition coefficient, bulk density, degradation rate constant) may be assigned to a particular layer. This was confirmed by speaking with a consultant from the International Ground Water Modeling Center (PRC 1995), an independent clearinghouse for information on groundwater modeling.

Comment 42: Appendix E, Page 7, Section 3.0 Model Calibration. This section is very helpful to the reader and is appreciated.

Response: *Comment noted.*

Comment 43: Appendix E, Page 10, Paragraph 2, Second and Third Bullets. These two assumptions appear to be constraints of the particular computer code. It is unfortunate that the transport model does not make use of the site-specific hydrogeologic interpretations that were applied to the flow model. This apparently introduces greater uncertainty in the transport model. Please include a brief discussion on how these assumptions affect the model output.

Response: *The effects that the assumptions outlined in bullets two and three (single values of sorption coefficient and porosity) may have on the model are discussed in paragraph 1 on page 11 of Appendix E. The structure of the transport model will not accommodate a contaminant transport parameter distribution that varies within a layer. The response to specific comment number 41 discusses this model limitation, which is common to three-dimensional solute transport codes.*

Comment 44: Appendix E, Page 11, Paragraph 1, Last Sentence. The text states that the bulk of the contamination (away from the source areas) is expected to be located in the channels. Please compare this expectation to site specific sample results. Resolution of this issue will have implications on remedial action alternatives. If contamination

is limited to channel deposits, then hydraulic control could be less complex and expensive versus if contamination is disseminated throughout the site.

Response: *See response to general comment 5.*

Comment 45: Appendix E, Page 12. This section does not adequately discuss the model results and conclusions. Please expand this section to summarize the results of predictive flow and transport modeling. This section should also present conclusions about the effectiveness of the extraction scenario (with supporting graphics).

Response: *See response to general comment 11.*

Comment 46: Appendix E, Figures E-9 through E-24. These figures do not depict the locations of the extraction or injection wells, making interpretation of the model results difficult. In addition, there are apparently no figures depicting predictive runs from the flow model. Evaluation of how the predicted groundwater flow might change during pumping/injection is therefore not possible. Please revise the appendix to include these types of figures and include discussions which evaluate the effectiveness of the modeled extraction scenario.

Response: *See response to general comment 11.*

EDITORIAL COMMENTS

Comment 47: Figure 1-2, Page 3. Identification of the Marriage Road ditch should be shown on this figure.

Response: *Marriage Road ditch will be shown in Figure 1-2 of the final FS report.*

Comment 48: Sections 1.2.2. Chemical Usage and Waste Disposal at MFA, Page 6, Paragraph 2. Sites 22 and 23 are not described in this section. Page 7: the term "fluids" should be described under Site 11.

Response: *A description of Sites 22 and 23 will be incorporated to Section 1.2.2 as follows:*

"Site 22 - Golf Course Landfill 2. Golf Course Landfill 2 is located in the northeastern corner of the golf course. Base personnel reported that this former landfill area likely contains a variety of waste materials, although there are no base records on the actual sources of the waste. Disposed wastes are suspected to have been similar to materials deposited at landfills that are now designated Sites 1 and 2. The site encompasses a 300- to- 400-foot wide strip on the northeastern end of the golf course between Patrol Road and Marriage Road. This area apparently received fill beginning sometime in the late 1940s. Based on aerial photographs, extensive activity occurred between early 1950 and mid-1956. The nature and depth of fill are uncertain. By mid-1960, the golf course had been partially completed and the site was being used at least in part in conjunction with the construction of the course. The site may have been a borrow or storage area at that time. By 1970, the area had been revegetated and had become part of the golf course. No disposal activities were evident.

Site 23 - Golf Course Landfill 3. Golf Course Landfill 3 is located on approximately 2 acres just south of the northern most weapons bunker area. This area is shown on aerial photographs taken in 1977 as one of several ponds on the golf course. In an aerial photograph taken in 1987, three of the ponds on the golf course were dry and some debris was visible in the area of Golf Course Landfill 3. No information on the source of the material dumped in this area could be found. However, a site walkover conducted in March 1994 identified numerous small piles of soil, concrete, disagregated asphalt, grass clippings, and mulch. In addition, some airplane parts consisting of several pieces of aluminum and some electronics equipment were found in the area. This evidence suggests that the area was used for incidental dumping of excess soil and golf course-derived debris, without trenching to dispose of hazardous materials. The source of the airplane parts is unknown. Most of the area is now covered with thick weed growth. A magnometer survey of this area was conducted in 1985. The survey indicates that significant quantities of metallic materials have not been buried at this site."

Sites 22 and 23 will be added to Figure 1-2.

On page 7, the term "fluids" under Site 11 refers to waste oils, hydraulic fluids, and fuels. The sentence will be rewritten as follows:

"During past tests, fluids such as waste oils, hydraulic fluids, and fuels, may have run onto the adjacent soils."

Comment 49: Section 1.4.4, Page 43, Paragraph 3. The text should indicate Table 1-5, not Table 1-4.

Response: *The suggested correction will be made.*

REFERENCES

Freeze, R.A., and Cherry, J.A. 1979. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, New Jersey.

International Technology Corp. (IT). 1993. Remedial Investigation Report, Operable Unit 5, Naval Air Station Moffett Field, California. April.

PRC Environmental Management, Inc. (PRC). 1991. Final Building 29 Area Field Investigation Technical Memorandum. Naval Air Station (NAS) Moffett Field, California. August.

PRC. 1992a. Final Site 9 Field Investigation Technical Memorandum. NAS Moffett Field, California. April.

PRC. 1992b. Technical Memorandum: Geology and Hydrogeology Draft Final, NAS Moffett Field Mountain View, California. July.

PRC. 1995. Record of Telephone Conversation on January 20, 1995, Regarding Solute Transport Model Limitations Between Jim Wulff, Hydrogeologist, PRC and Forrest Arnold, Groundwater Modeling Consultant, International Ground-Water Modeling Center (IGWMC).