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MOFFETT FIELD
SSIC NO. 5090.3

PRC

April 24, 1995

Mr. Stephen Chao
Department of the Navy
Engineering Field Activity West
Naval Facilities Engineering Command
900 Commodore Drive, Building 208
San Bruno, California 94066-2402

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 DTSC/RWQCB on the above-referenced document. Additional copies of the responses are being forwarded to the regulatory agencies.

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

Sincerely,

Michael N. Young
Project Manager

MNY/rkr

Enclosure

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

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MOFFETT FEDERAL AIRFIELD
RESPONSE TO COMMENTS RECEIVED FROM
CALIFORNIA EPA, DEPARTMENT OF TOXIC SUBSTANCES CONTROL, AND
SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD
DRAFT FINAL OPERABLE UNIT 5 FEASIBILITY STUDY

APRIL 24, 1995

This report presents point-by-point responses to the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) and the San Francisco Bay Regional Water Quality Control Board (RWQCB) 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 received in a letter dated March 3, 1995.

DTSC COMMENTS

GENERAL COMMENTS

Comment 1: Throughout the OU5 FS report, "background levels" are used to represent both naturally occurring levels of inorganic constituents and anthropogenic levels indiscriminately. According to the U.S. Environmental Protection Agency (EPA) Risk Assessment Guidance for Superfund (1988), background samples should not be used if they were obtained from areas influenced or potentially influenced by the site. In Moffett Field, a highly industrialized area, it is almost impossible to find areas that are not affected by site activities. The Navy's statistical and spatial analyses may provide some useful information to evaluate the distribution of the inorganics in the OU5 groundwater. However, it is not adequate to conclude the inorganic constituents detected in the "background well" are all naturally occurring and the argument of "true background" can be time consuming and unproductive. The Navy should include the remedial alternatives and calculate the cost of cleaning up the inorganics in OU5 groundwater.

Response: *The language of the FS will be revised to clarify "background," "naturally occurring," and "ambient" terminology. The Navy will also provide a cost estimate for treating naturally occurring inorganic constituents that exceed maximum concentration levels.*

Comment 2: The State has formerly requested that the Navy should list all the areas where the petroleum products release commingled with other hazardous substances at Moffett Field and the entire plume should be investigated and remediated under the ongoing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response action. For example, two small petroleum product contaminated areas were identified close to Hangar 3, these sites should be addressed in the FS report and the cleanup levels should be consistent with the Maximum Contaminant Levels (MCLs) of individual constituent.

Response: *The Navy understands that the remediation in the commingled areas falls under the jurisdiction of the CERCLA response action. The Navy has identified the areas (near former underground storage tanks [USTs] 2 and 43) where petroleum products are commingled with the OU5 chlorinated solvent plume shown in Figure 1-8. The total petroleum hydrocarbon (TPH) extractable concentrations at two wells near former USTs 2 and 43 do exceed the negotiated TPH extractable action levels. Data from quarterly sampling indicate concentrations of specific petroleum constituents such as benzene, ethylbenzene, toluene, xylene (BTEX), or benzo(a)pyrene do not exceed agreed upon action levels. Furthermore, a corrective measure under the Installation Restoration Program (IRP), Petroleum sites program is planned to remediate soil and groundwater contamination at former USTs 2 and 43. Therefore, the commingled areas will be separated from the OU5 discussion.*

Comment 3: The FS report has included innovative and emerging technologies in the screening process for both in situ treatment air sparging and permeable reaction cells and ex situ treatment (collection, treatment, discharge), in the form of the electron injection treatment technology. Innovative and emerging technologies need to be evaluated for use at closing base activities when there are no available developed treatment technologies or it has been demonstrated that the subject technology can significantly increase the speed of cleanup. The state recommends the elimination of electron injection from the screening process as an ex situ treatment technology for collected groundwater based on the status of technology development (such as bench-scale) and the availability of multiple developed treatment technologies (such as air sparging and UV/Oxidation) that can treat the contaminants of concern (COCs) at the indicated concentrations and flow requirements. It is suggested the inclusion of granular active

carbon as an ex situ treatment technology in the screening process to treat the liquid waste stream directly if it is determined that secondary treatment after air stripping is required.

Response: *The Navy included the electron injection technology primarily because the developer has planned a technology demonstration at Site 9. The discussion in Section 7.0 indicates that electron injection offers no advantages over the other ex situ processes. In fact, cost and implementability problems associated with this new technology make it the least favorable of the ex situ processes.*

Section 4.4.7.3 states that carbon adsorption will be considered as a secondary (polishing) treatment process option. The ex situ alternatives presented in Section 6.0 address only primary treatment processes.

Comment 4: The FS report indicates that the petroleum contamination in groundwater at other sites (such as Site 9) will be addressed separately from OU5 by the IRP petroleum sites program, but the FS report has used results from an air sparging pilot test conducted at a petroleum contaminated site (Site 9) with different subsurface lithology, contaminants, and groundwater depths to develop an air sparging/soil vapor extraction (AS/SVE) system that would address contamination in OU5 groundwater. This AS/SVE system is the basis for cost estimates and detailed analysis of the alternative. A site-specific AS/SVE pilot test for OU5 is necessary to supply the information and data necessary to develop relevant estimates necessary for a detailed analysis of alternatives. The State recommends that the OU5 AS/SVE pilot test address the following issues in addition to the measurement criteria designated in the Site 9 AS/SVE pilot test:

The FS report indicates in the 6.0 DETAILED ANALYSIS OF ALTERNATIVES that the SVE system used for collection of volatiles in the vadose zone would consist of a horizontal extraction well deployed in a trench. As pointed out by the FS report, the subsurface lithology at OU5 indicates multiple layers of silt and clay layers that could contribute to extreme differences in horizontal and vertical permeability that could in turn contribute to horizontal migration of sparged air. This makes the

control of volatiles in the vadose zone extremely important. The FS report indicates that the vadose zone is composed mainly of silt and clay material.

The pilot test should demonstrate the advantages of a horizontal extraction well for this application.

Traditional SVE well radius of influences (ROI) have been based on the ability of well to create a minimum negative pressure, usually 0.1 inch water column. In the case of SVE, only a very slight gradient is required to ensure the flow of air toward an extraction well and replacement by unsaturated air. In the case of SVE used in conjunction with air sparging, the SVE system must be able to control the pressure created in the vadose zone by air sparging. The depth at which air sparging would be required at this site will require significant sparging pressure just to reach the minimum entry pressure required. This would create significant pressure fronts in the vadose zone which need to be controlled by the SVE system. Since the pressure gradient of an extraction well appears to decrease exponentially with distance from the well, it is questionable of the ability of a horizontal extraction well to control the vadose zone pressures created by air sparging at the distance indicated no matter how much air is extracted. It may be necessary to implement multiple vertically small ROI to fully control the vadose zone.

A complete analysis of the physical and biochemical characteristics of the OU5 groundwater should be included in the FS report, as an excessive concentration of anions or high concentrations of iron and manganese may lead to fouling of the sparging wells. This can lead to the necessity of abandoning the well after only a short period of use.

Helium could be used as a tracer gas in air sparging pilot tests in addition to the parameters indicated in the AS/SVE pilot test performed at Site 9 to help determine the ROI of sparging wells. The procedure would be similar to the helium tracer used in the pilot test at Site 5.

The FS report indicates in Section 6.5.1, Alternative 4B-Entire Plume Treatment, that the AS/SVE system would be constructed only within the sand channels. The FS

report indicates that constructing the AS/SVE to intersect the channels will capture the majority of contamination because once contaminates desorb from silts and clays, they will follow natural flow patterns. Part of the problem with pump and treat in the past has been the inability of this technology to treat saturated zone solids and the gradual diffusion of contaminants from the most highly contaminated types of soils, silts and clays, acting as continued saturated zone source of groundwater contamination. Air sparging has shown the potential to address contamination in saturated zone solids of this type and thereby eliminate these groundwater contamination sources. To allow sparging air to reach these soils, it may be necessary to fracture these clay lenses by use of hydraulic fracturing. It is recommended that the AS/SVE pilot test evaluate the possible use of hydraulic fracturing as an enhancement to the application of air sparging.

Response: *Pilot-scale AS/SVE test data are not considered necessary for comparative assessment of remedial technologies. Should AS/SVE be recommended for implementation in the future, a pilot test would be conducted for the following reasons: (1) to assess the effectiveness of SVE in removing vadose zone contaminants and its ability to capture and extract sparge vapors, and (2) to obtain specific design data for implementation of a full-scale system. However, conducting a pilot-scale test before SVE is selected as potentially the most effective and cost effective technology for remediation of OU5 soils would be premature, and may result in needless expense if SVE is eliminated from consideration based on technological, physical, economic, or other factors. The following paragraphs address specific DTSC concerns regarding the need for a pilot test.*

Basic assumptions regarding extraction trench design and spacing are sufficient for purposes of the cost estimate. Depth to water table at OU5 ranges from approximately 5 to 9 feet below ground surface (bgs). Use of horizontal extraction trenches for sites with shallow groundwater tables or zones of soil contamination is well documented in the literature (EPA 1991; WDNR 1993; Connor 1988). Horizontal extraction wells provide for a greater area of influence than vertical wells at shallow screen depths, and minimize upwelling of the groundwater table. Preliminary costs based on installation of horizontal trenches are considered sufficient for purposes of the FS.

The heterogeneous nature of OU5 soils, including multiple layers of silt and clay, is a difficulty for an SVE system regardless of whether extraction wells are screened vertically or horizontally. The ability of an SVE system to effectively remediate less permeable soils, and to capture sparge vapors would be assessed as part of a pilot-scale test. However, based on available information, horizontal extraction trenches are generally accepted as providing better coverage in shallow soil zones than vertical wells. While it is true that the ability of an SVE system to capture sparge vapors would be one of the effectiveness and feasibility issues that would be confirmed during a pilot test, this information is not necessary for purposes of comparing alternatives in the FS. If SVE had been recommended for implementation at OU5 and results of subsequent pilot testing revealed that sparge vapors could not successfully be captured, an alternative remedial strategy would be employed.

Collection and analysis of a groundwater sample for physical and biochemical characteristics is not considered necessary for purposes of the FS. The fouling potential of OU5 groundwater on sparge screens is a concern that would be evaluated if AS/SVE was the selected remedial alternative. Several actions can be taken to delay fouling, and other procedures are available for treating wells and removing incrustation (Driscoll 1989).

Use of helium as a tracer for determining air sparge ROI is not common; however, the potential usefulness of tracer gas data would be evaluated prior to an AS/SVE pilot test, had AS/SVE been recommended for implementation. The effect of hydraulic fracturing on distribution of sparge air would also be considered for study as part of an AS/SVE pilot test, were AS/SVE the recommended remedial alternative for OU5.

Comment 5: The FS report indicates that the Navy has funded a pilot-scale study of permeable reaction cells at Moffett Field to be conducted in the summer of 1995. The pilot study should specifically address the ability of the clay/silt layer located at approximately 50 feet bgs to act as footing material for construction of barrier walls and the continuity of this layer to act as a barrier to groundwater flow from zone A1/A2 to the B2 aquifer. In addition, the Navy should consider building a low permeability slurry wall at both sides of the in situ treatment wall to contain and direct the flow through the treatment wall.

Response: *Navy contamination is restricted to the A1 aquifer. The clay zone between the A1 and A2 aquifer zones (approximately 4 feet thick at a depth of 35 feet bgs) will provide the footing material for the treatment cells. As stated in Appendix E, hydraulic separation between the A1 and A2 permeable deposits is suggested by a slight variation in water levels between paired A1/A2 wells at OU5 and confinement of the chlorinated solvent contamination to the A1 aquifer zone. The pilot study will include tracer tests to delineate the hydraulic conditions in the immediate area of the treatment cell.*

Comment 6: It is stated in the document that the bench-scale study report of the permeable reaction system is not available for review yet; the pilot-scale study will not be conducted until summer 1995. Therefore, a contingency plan or an alternative should be considered by the Navy, in case the permeable reaction cells pilot study reveals unfavorable result. The same scenario should also apply to AS/SVE.

Response: *The FS report will not identify a preferred alternative or contingency. Rather, the proposed plan will address these issues.*

Comment 7: The cost estimates that have been developed by the FS report and shown in Appendix D of the document appear to include all the capital equipment necessary to construct the respective systems and the estimates appear reasonable. However, the comparative analysis for lifetime O&M costs are based on a lifetime of 50 years for all the alternatives. It would appear that a treatment technology such as reactive cell, which is dependent on groundwater gradient to pass the entire plume past a stationary wall, would have a different expected duration that a treatment technology such as air sparging, which could actively address the asymptotic contamination levels faster than pump and treat. These differences in duration could have a major affect on alternative cost analysis.

Response: *Since the remediation-limiting factor is desorption of chlorinated solvents from the less permeable materials, the ability for any technology to expedite the restoration time frame is uncertain. The Navy believes that it will take at least 50 years to reach cleanup goals regardless of the selected remedial alternative.*

Comment 8: The FS report addresses the issue of possible inorganic contamination in groundwater at the OU5 Site. The FS report indicates that the elevated levels of inorganics in groundwater (such as arsenic, chromium) are related to elevated background levels. If inorganic levels in groundwater are found to be unrelated to background levels and require treatment, the screening process may need to select an ex situ treatment option since there are currently no developed treatment technologies that can treat inorganics in groundwater in situ. It would appear that the concept of reactive cells could be applied to the treatment of inorganics in groundwater by the use of ion exchange resins in the treatment cells.

It should be noted, however, that regardless of the outcome of the evaluation of inorganic levels in groundwater at OU5 compared to background levels, the current levels of inorganics in groundwater at the site indicated in the FS report would not necessitate the precipitation of metals prior to air stripping to protect the integrity of the process from scaling. The FS report indicated that total dissolved solids (TDS) levels were as high as 10,000 milligrams per liter (mg/L). These levels of dissolved solid could pose a process problem for both air stripping and UV/oxidation. This issue needs to be evaluated and if collected groundwater pre-treatment is required, it could affect the alternative cost analysis.

Response: *Inorganic constituents are not COCs for OU5. Therefore, screening of technologies that remove inorganic compounds will not be included in the OU5 FS report. Pretreatment costs were included for the ex situ alternatives.*

Comment 9: The data that was developed during the AS/SVE pilot test at Site 9 and reported in the text of the FS report along with a brief description of the pilot test protocol should be included with the FS report as an appendix.

Response: *Relevant sections of the Draft Site 9 Phase I Corrective Actions Technical Memorandum will be included as Appendix I of the FS.*

Comment 10: The FS report addresses two distinct treatment options of treating the entire plume or the leading edge of the plume while maintaining the same alternative number for both options. This is very confusing to the reader. It is recommended to use different numbers to distinguish one from another (such as Alternative 4A-1: Entire Plume; Alternative 4A-2: Leading Edge).

Response: *To avoid confusion, the final FS report will refer to the different treatment configurations using the following convention:*

Alternative 4A-1: Multiple-Interval Configuration
Alternative 4A-2: Single-Interval Configuration

SPECIFIC COMMENTS

Comment 1: Page 6, Section 1.2.2, Paragraph 2. It states that Site 22 and 23 are included as potential contamination sources to OU5. However, no descriptions of these two sites are included in the section. The Navy should clarify if these two sites will be discussed in other reports.

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 source 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 northernmost 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.

Comment 2: Page 13, Section 1.3.3.1, Paragraph 4. It is understood that Ames Research Center has received increasing funding in the past few years and performed important roles in different research fields. However, Ames could be facing a significant budget cut which will have impacts on Moffett Field. Therefore, the continuing operation of Moffett Field by National Aeronautics and Space Administration (NASA) is not necessarily the only future reuse option.

Response: *The following statement will be added to Section 1.3.3.1: "NASA could be facing budget cuts, therefore, the continuing operation of Moffett Field by NASA is not necessarily the only future reuse option."*

Comment 3: Page 17, Section 1.3.3.2, Paragraph 4. Please specify which inorganic chemicals' "background concentrations" are above MCLs.

Response: *Antimony and thallium within the low-total dissolved solids (TDS) area of the A1-aquifer zone at OU5 have mean background concentrations greater than MCLs. The mean antimony concentration is 37.5 micrograms per liter (µg/L) versus the MCL of 6 µg/L. The mean thallium concentration is 2.65 µg/L versus the MCL of 2 µg/L. Aluminum, antimony, and thallium within the high-TDS area of the A1-aquifer zone also have mean background concentrations greater than MCLs. Mean concentrations for aluminum, antimony, and thallium are 7,142, 20.7, and 15.0 µg/L versus MCLs of 1,000, 6, and 2 µg/L. Similar groups of metals have mean background concentrations above MCLs in the high- and low-TDS areas of the A2-aquifer zone. Section 1.3.3.2 will be expanded as follows.*

"However, there are several inorganic constituents in the MFA upper aquifers that have site-specific background concentrations above MCLs and Basin Plan water quality objectives (see Appendix A). For example, antimony and thallium within the A1-aquifer zone at OU5

have mean background concentrations greater than MCLs. The mean background antimony and thallium concentrations are 37.5 and 2.65 µg/L but the MCLs are 6 and 2 µg/L. Therefore, ..."

Comment 4: Pages 17 and 18, Section 1.3.3.2. The State has commented on the Revised Draft FS report that the Navy should identify all groundwater wells on or near Moffett Field. However, it is still not clearly addressed in the subject document.

Response: *Section 1.3.3.2 will be expanded to include the following discussion of information obtained from the Santa Clara Valley Water District (SCVWD) regarding water-producing wells near MFA.*

> *"Based on information from the Santa Clara Valley Water District (SCVWD), only a small number of wells produce (or are capable of producing) groundwater within a 1-mile area from MFA. SCVWD records list approximately 200 water-producing wells within 1 mile of MFA. However, about 155 of these wells produce water only for the control of groundwater contamination. The remaining 45 wells are listed by SCVWD as either active or inactive (although further subdivision into these categories was not available). These wells are classified as used for domestic, agricultural, or municipal and industrial purposes. Well depths range from less than 50 to greater than 500 feet and, therefore, encompass the A through C aquifers. The majority of these 45 wells are located west of MFA within sections 9, 15, and 16 of Township 6 South (T6S), Range 2 West (R2W). In contrast, hundreds of groundwater monitoring wells exist within 1 mile from MFA."*

Comment 5: Page 18, Section 1.3.3.2, Paragraph 2. To our understanding, use of the C aquifer is not restricted, although it is restricted by the Santa Clara Valley Water District (SCVWD) to pump groundwater from both the shallow aquifers (A-, B-aquifer) and deep (C) aquifer simultaneously.

Response: *It is correct that SCVWD does not prohibit use of groundwater from the C aquifer. However, SCVWD does regulate its use to efficiently manage the resource. As evident from the salt water intrusion and land subsidence that occurred during the 1950s and 1960s, unrestricted pumping damages the beneficial use of the C aquifer groundwater resource. Consequently, unrestricted use of the C aquifer is unlikely; limited use, as described in Section 1.3.3.2, is much more probable. The FS report will be revised to reflect this clarification.*

Comment 6: Page 24, Section 1.4.1, Paragraph 1. There are still questions about the continuity of the B/C aquitard. In addition, unidentified, abandoned agricultural wells may work as the vertical conduit between the A/B aquifers and the C aquifer. The general topographic controlled upward hydraulic gradient could be easily reversed by any pumping activities. Therefore, the Navy should not exclude the possibility of downward contaminants migration simply based on this rationale.

Response: *The B/C aquitard can be distinguished by the lower electrical resistivities of a layer that is found between depths of approximately 115 and 155 feet bgs and depicted on geological cross-section C-C' in the OU5 RI report (IT 1993) (A zone of interlayered sands exists between depths of 125 and 140 feet within the aquitard). The aquitard layer can also be distinguished on cross-section D-D' of the OU5 RI report, which crosses MFA from west to east, terminating on the eastern side of OU5. The depth of this layer correlates with the regional confining layer described by Iwamura (1980). This information indicates that the B/C aquitard is continuous below OU5.*

The Navy has acted to prevent vertical migration of contaminated groundwater by closing unused agricultural wells at MFA. The Navy has destroyed four old agricultural wells at MFA in accordance with SCVWD guidelines since 1989 (IT 1991, PRC and JMM 1992, PRC and MW 1993). In addition, the Navy has investigated the locations of 17 other potential wells on or adjacent to MFA (KJC 1988a, 1988b). The locations of these wells were based on anecdotal reports (such as interviews with base employees). However, no evidence was found for the existence of any of these 17 wells. The Navy continues to monitor MFA for the presence of additional abandoned agricultural wells.

Potentiometric water elevations in the C aquifer are up to 34 feet higher than the overlying A and B aquifers at OU5 (PRC and MW 1995). Significant withdrawals from the C aquifer would be required to reverse this gradient. It is unlikely that SCVWD would allow high pumping rates from the C aquifer at MFA considering the known problems (salt water intrusion and land subsidence) that have been caused in the past by pumping from the C aquifer in the Santa Clara Valley.

Comment 7: Page 26, Section 1.4.2.1, Paragraph 1. An OU5 tetrachloroethylene (PCE) concentration map should be added to the subject document as it was included in previous revised draft FS report.

Response: *Three figures will be provided in the final FS that overlay layer-specific concentrations for PCE on the channel pattern maps that delineate areas where contaminant concentrations are estimated to equal or exceed the maximum contaminant level (MCL) of 5 micrograms per liter (μg/L). These figures will be similar to those presented at the remedial project managers meeting at DTSC on April 5, 1995. One additional figure will be provided that depicts PCE concentrations in layer 4 without a channel pattern overlay (lithologic data were not of sufficient quantity or quality to delineate the pattern in layer 4).*

Comment 8: Pages 27 and 28, Figures 1-6 and 1-7. Please explain whether the trichloroethylene (TCE) concentrations were taken from the same sampling event or it's a compilation of the previous data.

Response: *TCE and 1,2-DCE concentrations provided on Figures 1-6 and 1-7 of the draft final FS were a compilation of data from OU5-specific field investigations during the summer and fall of 1994, a fourth-quarter 1994 quarterly sampling event, and quarterly sampling events during December 1992 and June 1993. The older (pre-1994) data were only used for wells where samples were not collected during 1994. These data were included to obtain a more complete representation of the extent of the solvent plume at OU5. Samples collected from these different sampling events are distinguished by the use of different text fonts to represent the concentration values collected in 1992, 1993, and 1994.*

Comment 9: Page 31, Section 1.4.2.1, Paragraph 2. As it is stated in the general comment 2, the commingled plume at Tank 2 and 43 should be addressed in the OU5 FS report, not petroleum sites corrective action. The cleanup level should be based on the MCLs of individual chemical. The 700 micrograms per liter (μg/L) treatment goal for diesel or JP-5 should only apply to the isolated petroleum sites.

Response: *The groundwater concentrations of specific constituents such as, benzene, toluene, ethylbenzene, and xylene (BTEX) and polynuclear aromatic hydrocarbons (PAHs) at the former USTs 2 and 43, do not exceed MCLs in the commingled plume areas. If the TPH level is not applicable to these areas, then no action would be necessary. However, corrective measures are planned for groundwater near former USTs 2 and 43. Please see response to DTSC general comment 2.*

Comment 10: Page 33, Section 1.4.2.1. Please explain why antimony is not included in the discussion of A1-aquifer zone. Antimony is ubiquitous in the shallow A1 zone.

Response: *Antimony is not specifically discussed because antimony concentrations measured in samples collected at OU5 were not statistically above the background levels presented in Appendix A. Figures A-7 and A-13 present histograms of antimony concentrations in groundwater samples from the A1- and A2-aquifer zones. Two data distributions are present on these histograms, one low and one high. These distributions are attributed to the low and high salinity groundwater types. In addition, no correlation of antimony detections is observed with MFA activities at OU5. Furthermore, antimony was detected in 81 of 289 groundwater samples collected from the A1-aquifer zone at OU5. The observed frequency of detection, 28 percent, does not demonstrate that antimony is ubiquitous throughout the A1-aquifer zone. Therefore, the Navy concluded that the distribution of antimony in the shallow groundwater at OU5 is naturally occurring.*

Comment 11: Page 33, Section 1.4.2.1, Paragraph 3. Detailed information of the analytical data from sampling activity in November 1994 should be presented in the FS report, otherwise, it is extremely difficult to review this document. What are the total chromium and arsenic concentrations from different wells? Please explain how to distinguish the "historical values" and "previous high detections"? Please clarify how many samples have been taken from wells WT-1, W43-1 and W43-2 after 1990.

Response: *Appendix A will be expanded to include Table A-7 which will present total arsenic and chromium data from all groundwater samples collected from the three wells that had high concentrations of these metals (wells WT2-1, W43-1, and W43-2). The text of Section 1.4.2.1 will be revised to more clearly identify the lower historical levels of*

chromium and arsenic as compared to the isolated high detections. Historical levels of chromium detected in samples from these three wells are less than 30 µg/L (in contrast with high values greater than 300 µg/L). Similarly, historical levels of arsenic detected in samples from these three wells are less than 25 µg/L (as compared to high values greater than 60 µg/L). The text will also be modified to indicate that seven groundwater samples have been collected for metals analysis from wells WT2-1, W43-1, and W43-2 since 1990.

Comment 12: Page 34, Section 1.4.2.2, Paragraph 3. It is agreeable that chloroform and acetone detected in the B2 aquifer may come from laboratory contaminants. However, the source of TCE or other non-laboratory contaminants should be further discussed.

Response: *TCE has been detected at a concentration of 2 µg/L at well W3-4 and at 1 µg/L (below detection limit) at well W3-7, both during the 4th quarter 1993 sampling event. TCE was not detected when the wells were resampled during 3rd quarter 1994. The source of the TCE cannot be determined because the detection of TCE at these wells occurred only once at very low levels.*

Comment 13: Page 34, Section 1.4.2.2, Paragraph 4. Please clarify if the statement, "Detections of antimony at Sites 3 and 4 were not consistent in any one well between various sampling dates and probably do not indicate groundwater contamination in the B-aquifer zone," implies the existence of antimony contamination in the A1 zone since antimony was frequently detected in the A1 zone. The frequency of detection of inorganics cannot determine if the chemicals are naturally occurred or from anthropogenic sources.

Response: *Please see the response to DTSC specific comment 10 for additional information concerning the distribution of antimony in the A1-aquifer zone. Of the six detections of antimony out of 58 samples from the B2-aquifer zone, five were qualified as estimated values, near the method detection limit. These estimated values ranged from 22 to 53 µg/L. Additionally, antimony was not identified as a COC at Sites 3 and 4 during the OU2 remedial investigation (RI). Section 1.4.2.2 will be expanded to include this additional information concerning the antimony detections at Sites 3 and 4.*

Comment 14: Page 35, Section 1.4.2.3, Paragraph 4. Please see specific comment 13.

Response: *This comment concerns antimony concentrations in groundwater samples collected from the C-Aquifer zone. Of the three detections of antimony out of 37 samples from the C-Aquifer zone, all three were qualified as estimated values near the method detection limit. These estimated values ranged from 42 to 46 µg/L. Furthermore, antimony was not identified as a COC at Sites 3, 4, and 7 during the OU2 RI. Section 1.4.2.3 will be expanded to include this additional information concerning the antimony detections at Sites 3, 4, and 7. Also please see the response to DTSC specific comment 13.*

Comment 15: Page 36, Section 1.4.3, Paragraph 3. Future residential scenario should be included in Appendix C if the appendix remains in the final FS report.

Response: *Appendix C has been included only to estimate potential risk to occupational receptors who may contact groundwater since exposure to groundwater from occupational use was not evaluated in the OU5 RI. Future residential use of groundwater was assessed and presented in the OU5 RI and summarized in Tables 1-2 and 1-3 of the FS. COCs evaluated in the FS were selected on the basis of domestic use of groundwater. Therefore, future residential use of groundwater has not been included in Appendix C. The results of the assessment for occupational groundwater use were not used to select COCs or remediation goals. This is stated in Section 1.4.3 to avoid confusion.*

Comment 16: Page 37, Section 1.4.3, Paragraph 5. Please provide a table to summarize how many groundwater samples were collected and analyzed for hexavalent chromium. More hexavalent chromium data should be collected through ongoing quarterly sampling program to compare with the resampled results from November 1994.

Response: *Groundwater samples collected from 20 monitoring wells during November 1994 were analyzed for hexavalent chromium. A listing of these wells (including WT2-1, W43-1 through -3, W7-1 through -3, W7-6, W7-7, W7-9 through -14, and W7-17 through -21) will be added to the discussion of chromium in Section 1.4.2.1. Additional quarterly sampling is not currently planned for OU5 monitoring wells. Additional sampling may occur to support design activities for OU5 and will be scheduled as part of long-term monitoring of OU5.*

Comment 17: Page 42, Section 1.4.4, Paragraph 2. According to U. S. Fish & Wildlife Service (personal communication with Dr. Jim Haas), Marriage Road ditch should be considered as functional wetland since it may receive not only surface water runoff but groundwater discharge. In addition, it also supports hydrophytic vegetation under normal circumstances.

Response: *Marriage Road ditch was not disqualified as a functional wetland. Indeed, the ditch does exhibit the necessary characteristics of a functional wetland, including the possibility of supporting hydrophytic vegetation in between maintenance periods. However, Marriage Road ditch was designed and built as a drainage ditch and, as such, should not be considered a jurisdictional wetland because of its eligibility for the Section 404(f)(1) exemption in the Clean Water Act for "maintenance of drainage ditches." Thus, although Marriage Road ditch exhibits characteristics of a functional wetland, it should not be considered a jurisdictional wetland and should not be regulated as one.*

Comment 18: Page 43, Section 1.4.4, Paragraph 3. It is stated that the COCs detected in OU5 groundwater were compared to ecological benchmarks as shown in Table 1-4. However, Table 1-4 only listed the chemical and physical characteristics of the COCs. No ecological benchmarks were listed.

Response: *Table 1-5 listed ecological benchmarks. The reference to Table 1-4 was a typographical error. The text will be corrected.*

Comment 19: Page 57, Section 2.2, Paragraph 2. See Comment No. 6.

Response: *Please see the response to DTSC specific comment 6.*

Comment 20: Page 58, Section 2.2, Paragraph 2. The Navy should explain how to reach the conclusion that salt water intrusion has extended to former Tank 43 and the northern portion of Site 7. In Figure A-3, W4-3 is the only well has TDS exceeded 2,500 mg/L. Furthermore, the last sentence of this paragraph seems contradictory to the statement that salt water intrusion has progressed to the mentioned area.

Response: *This sentence will be removed from Section 2.2 because the division between high- and low-TDS areas will now be made using a TDS concentration of 3,000 mg/L. The former extension of high-TDS groundwater southward toward Site 7 also will no longer appear on Figure A-3.*

Comment 21: Page 60, Section 2.2, Paragraph 1. Again, it is important to include the complete resampled results in the FS report. The descriptive statement such as "Total chromium values from the samples collected in November 1994 indicate concentrations similar to historical values" is insufficient for the reader to evaluate the relationship between previous data and resampled results.

Response: *Appendix A will be expanded to include Table A-9 which will present the inorganic constituent analytical results from samples collected during November 1994. These data also will be available in the November 1994 quarterly sampling report scheduled to be submitted in early June 1995.*

Comment 22: Page 60, Section 3.0, Paragraph 4. Please add the sentence " An ARAR may be either "applicable," or "relevant and appropriate, " but not both." after the second sentence.

Response: *The suggested sentence will be added.*

Comment 23: Page 61, Section 3.0, Paragraphs 1 and 3. Please add the sentence "Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable." to these two paragraphs.

Response: *The suggested sentence will be added.*

Comment 24: Page 71, First Box. Since California is authorized to implement its own program in lieu of Resource Conservation and Recovery Act (RCRA), the appropriate state regulations should be cited as ARARs in lieu of the federal regulations. Since the Federal Register is not promulgated, it should not be listed as an ARAR. The regulation itself should be cited.

Response: *The state RCRA regulations will be cited.*

Comment 25: Page 72, Last Box. The word "occur" should be deleted.

Response: *The correction will be made.*

Comment 26: Page 74, Second - Seventh Boxes. For each of these potential actions except "Miscellaneous Units", both federal and state regulations are cited. Since California is authorized to implement its own program in lieu of RCRA, and since California's regulations must be as or more stringent than federal regulations, only California's regulations will be ARARs, and the federal citations should drop out. With respect to the potential action "Miscellaneous Units", the appropriate state regulation should replace the federal regulation cited.

Response: *The federal RCRA citations will be eliminated and the appropriate state regulation cited.*

Comment 27: Page 95, Table 4-2. Several site specific factors may affect the implementability of "chemical reaction cells" such as the reactive capacity, pH level variation, depth of barrier, and biological activity.

Response: *Table 4-2 overviews the technology evaluation findings. Every technology has site-specific factors that may affect implementability. These factors are not delineated in the table for any technology. Rather, text descriptions of the technologies identify critical parameters and limitations. The factors of reactive capacity, pH level variation, and biological activity will affect the implementability of a variety of technologies, including air stripping, air sparging and UV oxidation and has been noted in the FS.*

Comment 28: Page 130, Section 6.3, Paragraph 2. The statement "the northern plume area is already protective of human health and the environment based on the available data" is questionable. According to Figures 1-6 and 6-1, approximately one-third of the "northern plume" area has the TDS below 3,000 mg/L. Therefore, part of the northern plume could be qualified as potential drinking water aquifer and the same cleanup level (MCLs) for the southern plume may apply.

Response: *The Navy believes that the proximity of the northern plume is southern edge to the high TDS line would preclude the entire plume area from being used as a drinking water supply. Groundwater in the northern plume area could not be withdrawn to be used as drinking water source without causing the area of saltwater intrusion to progress to the south.*

Comment 29: Page 134, Section 6.4, Paragraph 2. Since "iron curtain" is not a well proven technology, a treatability testing should be conducted to ensure it can effectively remediate the target contaminants in the OU5 groundwater. If the pilot study reveals unfavorable result of the iron curtain system, the Navy may need to reevaluate different alternatives.

Response: *As discussed with the regulatory agencies, the Navy intends to implement an in situ pilot-scale system during 1995.*

Comment 30: Page 141, Section 6.4.1, Paragraph 1. In addition to the proposed iron curtain, the construction of slurry walls might be useful to contain the plume and direct groundwater flow.

Response: *A common implementation strategy for reaction cells integrates hydraulic barriers with permeable cells to channel groundwater flow toward the cells. The Navy believes that the natural lithology establishes hydraulic controls and induces preferential flow patterns, for example, within the sand channels. The contaminants will more readily migrate within these preferential pathways. In the draft final FS report, the Navy proposed using the natural lithology to channel flow toward the treatment cells which would be keyed into the sand channels. This would significantly reduce initial treatment system costs. The Navy, however, recognizes that some migration may occur outside the defined sand channels. Therefore, the final FS report will use treatment system configurations that intercept the entire width of the leading edge of the plume. For the permeable reaction cell, the single-interval configuration will include permeable cells and hydraulic barriers such as slurry walls across the leading edge of the plume.*

Comment 31: Page 190, Section 7.0, Paragraph 4. The State believes that it is appropriate for the Navy to provide detailed information, including the cost analysis of an inorganic treatment plant in the FS report.

Response: *The Navy will present estimated costs associated with a treatment plant for removal of naturally occurring inorganic constituents to drinking water levels.*

Comment 32: Page A-5, Section 2.1, Paragraph 3. Is there any statistical significance to select 2,500 mg/kg as the borderline to separate the high TDS and low TDS area? According to our observation, no significant "break" has been found at the 2,500 mg/L TDS level. In fact, along the distribution curve, it may be more appropriate to use 3,000 mg/L as the boundary if necessary.

Response: *The analysis presented in Appendix A will be revised to divide the high and low TDS areas based on a TDS concentration of 3,000 mg/L. This modification does not affect the statistical analysis presented in this appendix, based on the background wells selected in Appendix A.*

References

Connor, J.R. 1988. Case Study of Soil Venting. Pollution Engineering. July.

Driscoll, Fletcher G. 1989. Groundwater and Wells, 2nd Edition. Published by Johnson Filtration.

International Technology (IT), Corp. 1993. Remedial Investigation Report, Operable Unit 5, East Side Aquifers, NAS Moffett Field, California. August.

Iwamura, T.I. 1980. Saltwater Intrusion Investigation in the Santa Clara Valley Baylands Area, California. Santa Clara Valley Water District, September.

U.S. Environmental Protection Agency (EPA). 1991a. Soil Vapor Extraction Technology Reference Handbook. EPA/540/2-91/003. February

Wisconsin Department of Natural Resources. 1993. Guidance for Design, Installation, and Operation of Soil Venting Systems. PUBNL-SW185-93. July.

RWQCB COMMENTS

GENERAL COMMENTS

Comment 1: Analytical laboratory data validation needs to be included if a COC is proposed to be removed because of laboratory contamination. Provide trip blank or method blank analysis in a separate analytical data table to demonstrate laboratory contamination. What steps are being taken to prevent future laboratory contamination.

Response: *As stated in Section 1.4.2, all data used to prepare the FS report was gathered in accordance with regulatory agency approved sampling and analysis plans. These plans require that PRC and its certified laboratories gather and analyze data under quality control programs using approved sampling, validation, and analytical procedures. The RI report and quarterly sampling reports discuss the quality control protocol and results for each quarterly groundwater sampling event. The results for quality control samples not discussed in the RI report or quarterly sampling reports (that is, the August and November 1994 additional investigations samples) will be included in an Appendix in the final FS. In addition, a discussion of data validation will be added to the final FS report.*

The Navy has evaluated detection frequencies and associated sample locations for chemicals identified as common laboratory contaminants in the draft final FS report to assess whether the chemicals are actually present in the environmental media. The sporadic, isolated pattern detections for the common laboratory contaminants identified does not match the continuous pattern of other COC detections. Therefore, the common laboratory contaminants are probably not present in the environmental media and should not be retained as COCs.

Comment 2: The OU5 Study Area, shown Figure 1-2, does not cover the total area of OU5 as shown in the Base Realignment and Closure Cleanup Plan (BCP), please revise. Clarify the status of investigations at Sites 10, 11, and 12 with respect to total petroleum hydrocarbon (TPH) commingling with other COCs. Detection of 1,320 μg/L chromium in groundwater collected from well W11-1 at Site 11, as shown in Figure A-21, should be addressed.

Response: *There are no TPH commingled plumes associated with Sites 10, 11, and 12. Appendix A will be revised to include the statistical evaluation of chromium in groundwater detected in samples collected at Site 11. Table A-5 will be modified to present this additional information. Please also refer to the response to RWQCB specific comment 18.*

Comment 3: The FS must address TPH within OU5 where commingling with other COCs has occurred.

Response: *The Navy understands that the remediation in the commingled areas falls under the jurisdiction of the CERCLA response action. The Navy has identified the areas (near former underground storage tanks [USTs] 2 and 43) where petroleum products are commingled with the OU5 chlorinated solvent plume in Figure 1-8. The total petroleum hydrocarbon (TPH) extractable concentrations at two wells near former USTs 2 and 43 do exceed the negotiated TPH extractable action levels. Data from quarterly sampling indicate concentrations of specific petroleum constituents such as benzene, ethylbenzene, toluene, xylene, or benzo(a)pyrene do not exceed their respective action levels. Furthermore, a corrective measure under the Installation Restoration Program (IRP), Petroleum sites program is planned to remediate soil and groundwater contamination at former USTs 2 and 43. Therefore, the commingled areas will be separated from the OU5 discussion.*

Comment 4: Clarification of background contaminant levels versus ambient contaminant levels needs to provided. The RWQCB uses the term background contaminant levels to indicate the concentration at which naturally occurring chemical constituents of the media in question are present without any anthropogenic sources. Ambient contaminant level includes both the naturally occurring background and the anthropogenic sources. Please include an additional table presenting: each COC being proposed for removal, ambient concentration levels, range of detection, and frequency of detection.

Response: *The Navy appreciates the difference between background and ambient contaminant levels. The term "background" is used throughout the FS report to signify naturally occurring concentrations. The initial list of COCs selected in the OU5 RI contains six metals (the carcinogens arsenic, beryllium, and chromium; and the noncarcinogens antimony, manganese, and thallium). These metals were identified as potential COCs*

because they were present in OU5 groundwater above the background levels defined in the RI and at levels that pose an unacceptable human health risk based on residential exposure to groundwater. However, the distribution of these metals in shallow groundwater at MFA is concluded to be naturally controlled based on the statistical evaluation presented in Appendix A. Table A-8 will be added to Appendix A to present the requested concentration ranges and frequency of detection for each of these six metals in comparison to summary statistics (mean and standard deviation) for background levels for low- and high-TDS regions of the A1- and A2-aquifer zones.

Comment 5: Cross sections are essential to the acceptability of a geologic interpretation of depositional environments and should be included. Are there any horizontal conduits that should be examined other than the channel deposits, such as French drains. Additionally, has the potential impact of the interpreted sand channels on Site 2 (OU1) been considered?

Response: *Five cross-sections will be provided in the final FS. All cross-sections will depict borehole data and cone penetrometer test (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 transverse to the general trend of the channel deposits. Two cross-sections (C-C' and D-D') will cross the site in a direction longitudinal to the general trend of the channel deposits. One cross-section (E-E') will cross the site in a direction oblique to the general trend of the channel deposits, but bisecting the area immediately west of Marriage Road. Individual channel axes vary throughout each 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.*

The runway french drains are located outside of the area of concern. A small drain collects wash water at the northeastern corner of the apron surrounding Hangars 2 and 3 and routes the water to an oil-water separator, but this drain is well above the water table. However, the sanitary sewer that crosses OU5 from south to north may be located below the seasonal high water table in parts of the model area. Engineering drawings that depict the elevation of the sewer line are somewhat

unreliable because the benchmark elevation used to survey the sewer line may be different than the reference elevations used to survey the monitoring wells. Groundwater will likely flow into this drain wherever the water table is higher than the elevation of the sewer.

An analysis of contaminant transport at Site 2 (OU1) is outside the scope of this modeling study. Although lithologic data density and channel definition is fair in the Site 2 area, a large data gap exists to the south of Site 2, making the existence of the channel connecting Site 2 and OU5 speculative. Although the channel network, as defined, appears to be representative enough to reproduce a potentiometric map of OU5, the uncertainty in channel location on the west side of the model is probably too great to model contaminant transport at Site 2.

Comment 6: The location of the stream channels and the location of contaminant plumes appear to be somewhat unaligned; what is the effect of this on the locating of the treatment array? The location of the treatment array along the Marriage Road Ditch needs clarification; why would the location shown in the treatment configuration be preferable to locating the array perpendicular to the interpreted channel? The FS should include additional remedial designs which incorporate wing walls to direct groundwater flow to the treatment arrays to insure better capture of the contaminants.

Response: *The plume configurations presented in the draft final FS were merely contours of the data. The lithologic information was not used to structure the contours. The final FS will include plume maps that have been assembled using the lithologic information in conjunction with the chemical data.*

The orientation of the treatment array in the draft final FS was established using two primary factors: intercepting sand channels and avoiding subsurface utilities. A common implementation strategy for reaction cells is integrating hydraulic barriers with permeable cells to channel groundwater flow toward the cells. The Navy believes that the natural lithology establishes hydraulic controls and induces preferential flow patterns, for example, within the sand channels. The contaminants will more readily migrate within these preferential pathways. In the draft final FS report, the Navy proposed using the natural lithology to channel flow toward the treatment cells which

would be keyed into the sand channels. This would significantly reduce initial treatment system costs. The Navy recognizes that some migration may occur outside the defined sand channels. Therefore, the final FS report will use a treatment system configuration that intercepts the entire width of the leading edge of the plume. For the permeable reaction cell, this configuration will include permeable cells and hydraulic barriers such as slurry walls. The exact orientation of any treatment system will be established in the remedial design phase.

Comment 7: The dark shaded text is difficult to review, please consider an alternative method highlighting in the future.

Response: *Comment noted.*

Comment 8: The Navy should provide information regarding how future changes of land usage will affect the FS. Specifically, the continued operation of pump station at Building 191 should be identified as an integral part of the management of OU5 and what management mechanisms will be incorporated to insure its operation.

Response: *The Navy recognizes the need to evaluate future land and aquifer use options. Any future residential or industrial land use at OU5 will require the continued operation of the Building 191 lift station, or a similar dewatering system, simply to maintain a depressed groundwater table that would allow development of the site. If the Building 191 lift station was decommissioned, groundwater would rise to a level at or above the ground surface throughout the northern third of OU5, which is below the mean sea level contour on topographic maps of the base. The central third of the site is between the 0.0 and +2.0 feet above mean sea level topographic contour. This area will likely flood seasonally, as it did during this recent winter, except that the flooded area would be much more extensive and would be flooded for a much longer period of time without the Building 191 lift station to dewater the area. Therefore, it is the Navy's position that the future use of OU5 for industrial or residential purposes will dictate that the landowners continue to operate the Building 191 lift station.*

The Navy does not believe that the continued operation of Building 191 will be dictated by the need to control the impacts of the OU5 contaminated groundwater plume. Analysis of potentiometric maps and the groundwater modeling results indicate that flow direction and hydraulic gradients are influenced by the operation of Building 191. If this system were no longer operational, flooding of the northern edge

of the OU5 area would occur and aquatic habitats would eventually be established. Recent monitoring results show that no monitoring well had solvent concentrations above ambient water quality standards or ecological benchmarks for aquatic habitats. The hydraulic gradient would be reduced; therefore, lateral subsurface migration of the plume would be slower than migration while Building 191 is operating. Furthermore, groundwater contaminant levels would be reduced by volatilization as the groundwater daylights at the surface. Precipitation would cause further dilution and volatilization of solvents at the surface.

The Navy can only speculate about what effect decommissioning of the Building 191 lift station will have on the position of the freshwater/saltwater interface at the northern boundary of OU5, or the 3,000 ppm TDS line that is located further inland. Historical data have shown that chloride levels in shallow wells in northern Santa Clara Valley have remained steady from the 1930s to the late 1970s in spite of groundwater management practices that have been implemented to mitigate salt water intrusion in the shallow aquifers (Helley et al. 1979). Therefore, it is unlikely that the high TDS area of OU5 will meet state drinking water source criteria as a result of a potential shift in the freshwater-saltwater interface.

The aquifer use basis provided in the draft final FS report, specifically drinking water source for the southern plume area and surface water recharge for the northern plume area, should not change if Building 191 is decommissioned. In addition, there should not be an increase in risk posed by the OU5 plumes if Building 191 stops operating. Therefore, the Navy does not believe that provisions for continued operation of Building 191 should be part of any OU5 alternative.

Comment 9: To provide cohesiveness between ARARs and remediation efforts, the delineation between high and low TDS areas should be set at the 3,000 mg/L level for both the A1 and A2 aquifers.

Response: *The FS discussions as well as Appendix A will be revised to divide high-and low-TDS areas based on a TDS concentration of 3,000 mg/L. Please also see response to DTSC specific comment 32.*

SPECIFIC COMMENTS

Comment 1: Page 3, Figure 1-2. The indicated OU5 study area does not include the entire OU5 as indicated in the BCP, please revise and clarify the status of Site 10 - Runways, and Site 11. Locate Sites 16 and 17 and identify Site 3. Align Site No. 1.

Response: *Figure 1-2 will be revised as suggested. Section 1.2.2 will also be modified to state that Sites 10 and 11 are proposed as no action sites.*

Comment 2: Page 6, Section 1.2.2. Information regarding the status of Sites 22 and 23 should be included in this section.

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.

Comment 3: Page 8, Section 1.2.2. Figures for Sites 15 and 16 indicating the locations of the sumps, oil/water separators and tanks should be included.

Response: *A reference to the Corrective Action Plan (PRC 1994) will be added to the text to reference locations of Site 15 sumps. Also, most of Site 15 sumps are on the western side of MFA. Site 16 is also on the western side of MFA and is therefore not relevant to OU5.*

Comment 4: Page 9, Section 1.2.3, Paragraph 1. A table presenting the status of all OUs and the sites included within each OU would be helpful. Does detection of PCE at concentrations of 260 μg/L in well W43-2 on July 1991 preclude Site 19 from the petroleum sites program. A paragraph describing the MEW ROD would be helpful for a site-wide perspective.

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

Comment 5: Page 16, Section 1.3.3.2, Paragraph 2. The referenced document "1986 Water Resources Sub-Element" is nine years old, can the present conditions demonstrate the validity of its forecast.

Response: *The Navy used available information to complete the land use study. If additional information is available, the Navy will integrate it into the FS report.*

Comment 6: Page 18, Section 1.3.3.2, Paragraph 1. Include a figure locating all past and present agricultural and/or supply wells indicating the depth and screen interval to ensure proper abandonment for the prevention of cross communication of aquifers.

Response: *The Navy has acted to prevent vertical migration of contaminated groundwater by closing unused agricultural wells at MFA. The Navy has destroyed 4 old agricultural wells at MFA in accordance with SCVWD guidelines since 1989 (IT 1991, PRC and JMM 1992, PRC and MW 1993). In addition, the Navy has investigated the locations of 17 other potential wells on or adjacent to MFA (KJC 1988a, 1988b). The locations of these wells were based on anecdotal reports (such as interviews with base employees). However, no evidence was found for the existence of any of these 17 wells. The Navy continues to monitor MFA for the presence of additional abandoned agricultural wells. Water seeps from previously abandoned wells can often be identified by increased areas of vegetation. For example, the Navy has identified two such seeps in the past, one near the northern end of the runways and one in the housing area along the western side of the station. Investigations of both areas led to the destruction of two unused agricultural wells. Investigation of a similar area near the runways in the southern portion of the facility is ongoing. Description of the closure of potential vertical conduits (old wells) for contaminant migration is summarized on well closure reports. The text of Section 1.3.3.2 will be revised to incorporate the above discussion and reference well closure reports.*

Comment 7: Page 20, Section 1.4.1, Paragraph 4. A comparative discussion referencing the position of the stream channels in Figure 3.6-2 of the IT 1993 OU5 RI and Figure 1-5 in this report, with additional cross sections, will help provide continuity between the RI and the FS.

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

Channels depicted in these channel maps differ significantly from the paleochannel depicted in Figure 3.6-2 of the OU5 Remedial Investigation (RI) Report (IT 1993). The primary reasons for these differences are a result of a larger database and a better understanding of the scale and orientation of the channels, resulting from the increase in data. Most of the previous borings were not continuously sampled, which makes it difficult to determine the vertical extent of the sand units. The channel map in the RI was derived from an A1 isopach map (Figure 3.4-13 of the RI report) that represents individual sand units from various depths within the A1 as one channel. Subsequent data collected has revealed that sandy deposits appear to be concentrated

in three separate intervals within the A1 permeable zone. Fifteen continuously-sampled soil borings and 50 CPTs have been conducted since the RI report was released. The increased density of data allows channel trends and dimensions to be delineated in greater detail, particularly in the areas west of Marriage Road where few data had been previously collected.

Comment 8: Page 25, Section 1.4.2.1. Please include a figure indicating the location and depth of wells screened in the A1 and A2 aquifers.

Response: *Figures will be included in the final FS that depict the locations and screen depths of A1 and A2 wells at OU5.*

Comment 9: Page 27, Section 1.4.2.1. Correlate or replace below land surface (bls) measurements given in the text with mean sea level (msl) measurements given in the figures.

Response: *Figures 1-6 and 1-7 have been replaced with layer-specific contaminant maps. These maps do not include references to elevations relative to mean sea level (msl) on the figures themselves. The text will discuss the vertical extents of the layers in both feet bgs and feet msl.*

Comment 10: Page 27, Section 1.4.2.1, Figure 1-6. Verify the color coding and detection for W7-8. Verify the detection for CPTU5-12, CPTU5-16, and CPTU5-17. Verify color coding for W6-5. Include an arrow for WU5-3.

Response: *Wells W7-8 and W6-5 are represented (color-coded) correctly with respect to the model layers. The TCE value of 30 ppb at well 7-8 is correct. The TCE detection of 0.4 ppb at CPTU5-16 is incorrect; the correct value of 140 ppb will be shown in the final FS. Two samples were collected from different depths at CPTU5-12 and CPTU5-17, but only one result was shown for each location; the second sample will be included on the appropriate figures in the final FS. An arrow will be included to indicate the location of WU5-3 in the appropriate figures in the final FS.*

Comment 11: Page 28, Section 1.4.2.1, Figure 1-7. Verify the color coding and detection for W3-19, and W7-8. Verify the detection for CPTU5-1. Verify color coding for W6-5. Include an arrow for WU5-3.

Response: *Wells W7-8, W3-19 and W6-5 are represented (color-coded) correctly with respect to the model layers. The TCE values of 35 ppb at well W3-19, and 1 ppb/0.6 ppb for the two samples collected at CPTU5-1 are correct (the color-coding for the value of 1 ppb at CPTU5-1 should have been red, to represent layer 1). The TCE value of 14 ppb at W7-8 is incorrect; the correct value of 20 ppb will be shown in the final FS. An arrow will be included to indicate the location of WU5-3 in the appropriate figures in the final FS.*

Comment 12: Page 29, Section 1.4.2.1, Paragraph 1. The detection of 51 μg/L of 1,2-dichloroethene (1,2-DCE) should be noted in the text.

Response: *The paragraph discusses the deepest detections of chlorinated solvents at OU5. The detection in question is the 51 μg/L of 1,2-DCE detected at well W7-7 which is screened at a depth of 9.5 to 16.5 feet. This is a relatively shallow detection. The detection of 51 μg/L at well W7-7 will be noted in the figure that shows detections of 1,2-DCE in model layer 1 and in a summary table.*

Comment 13: Page 34, Section 1.4.2.2. Please include a figure indicating the location and depth of wells screened in the B2, B3, and C aquifers.

Response: *Figures indicating the depth and location of wells screened in the B2, B3, and C aquifers were included with the OU5 RI report. New figures will not be produced at this time because no new B2, B3, or C wells have been added, and because solvent contamination is not a problem in these aquifers. Therefore, they are not discussed in the evaluation of remedial options.*

Comment 14: Page 35, Section 1.4.2.3, Paragraph 1. "Most organic contaminants" should be revised to specify each contaminant.

Response: *The term "most" will be removed from this expression throughout the FS report. A specific discussion of each organic contaminant is not critical to the evaluation of remedial options.*

Comment 15: Page 45, Section 1.4.4, Paragraph 1. Are the TCE analytical results of 3 and 4 μg/L presented in a Table?

Response: *The results are presented in the site-wide ecological assessment (SWEA). A reference to the SWEA will be added to the sentence.*

Comment 16: Page 57, Section 2.2, Paragraph 2. Define background and ambient metal values.

Response: *The text of this paragraph will be revised to replace the words "ambient content" with "distribution" to minimize confusion in terminology. As indicated in this sentence, background levels represent the distribution of naturally occurring levels of inorganic constituents in groundwater. Please also see the response to RWQCB general comment 4.*

Comment 17: Page 58, Section 2.2, Paragraph 2. Please provide the background information on how the concentrations of metals in groundwater differ in low-TDS versus high-TDS regions with reference to the source of the metals.

Response: *Section 2.2 will be expanded to include the following additional information concerning the distribution of metals in groundwater at MFA. Concentrations of metals in groundwater in low-TDS versus high-TDS regions are significantly different. Higher metals concentrations are typically observed in samples from wells within the high-TDS area. More specifically, metals concentrations in samples from the high-TDS region of the A1- and A2-aquifer zones range from approximately 2 to 10 times higher than concentrations in the low-TDS region. Concentrations of commonly occurring metals such as sodium, potassium, and magnesium are 30 to 90 times higher in samples from the high-TDS region as in samples from the low-TDS region. Metals concentrations in groundwater at MFA are attributed to natural dissolution of sediments derived from the Santa Cruz Mountains west of the station. The Franciscan Formation dominates the Santa Cruz Mountains and contains a wide variety of sedimentary, metamorphic, and volcanic rocks. This diverse array of lithologies contains an equally wide range of mineral assemblages. During the natural flow of groundwater northeastward from the mountains west of MFA, the dissolution of minerals in the sediments derived from the Franciscan Formation has created the*

distribution of metals observed in groundwater at MFA. Metal concentrations associated with the high-TDS region also are affected by intrusion of salt water from the salt evaporation ponds north of MFA. TDS concentrations more than twice that of normal sea water, which has a TDS concentration of approximately 35,000 mg/L (Hem 1989), measured in water samples from MFA monitoring wells indicate this migration. Increased metals concentrations in the high-TDS region are attributed to metals contained in the intruding salt water. Historic intrusions of salt water as far south as U.S. Highway 101 (Iwamura 1980) also may have deposited metals as mineral salts within the aquifers beneath MFA. Continued dissolution of these salts also may contribute to the observed distribution of metals in groundwater throughout MFA. Please refer to Appendix A for further discussion of naturally occurring levels of metals in groundwater.

Comment 18: Page 60, Section 2.1, Paragraph 1. Where is the chromium detected in well W11-1 discussed?

Response: *Appendix A will be revised to include the statistical evaluation of chromium in groundwater detected in samples collected at Site 11. Results of the analysis indicate that chromium concentrations measured in samples from Site 11 are not statistically different from background levels. Table A-5 will be modified to present this additional information.*

Comment 19: Page 82, Section 4.1.6, Paragraph 2. The statements "The hydraulic parameter estimations were based on site specific lithologic information" appear to conflict with the statement in Appendix E, page 9, 3rd paragraph, which states that the final parameters were higher than the initial estimates and that the ratio of channel deposit hydraulic conductivity (K) to that of the other parameter zones was lower. The text in the appendix further states that these values were necessary to prevent mounding in the model when using boundary heads that were estimated from the fourth quarter 1994 potentiometric map. The inclusion of this information is very appreciated but a discussion of the applicability of the MODFLOW model in the bay fringe environment should be included to demonstrate its validity.

Response: *The most sensitive hydraulic parameter evaluated in the groundwater flow model is hydraulic conductivity. The distribution of this parameter is defined by the values of hydraulic conductivity assigned to the three depositional environments (channel, crevasse splay, and floodplain) that are represented as individual parameter zones in the model, and the three-dimensional pattern of these depositional environments. The values of hydraulic conductivity were varied during model calibration, but remained within a reasonable range of values as indicated by site-specific hydrogeologic information (pump tests). These pump test results (from the OU5 RI report) will be provided in the final FS for comparison purposes. The pattern of depositional environments was derived from model cells where estimates of hydraulic conductivity could be developed from site-specific lithologic information (lithologic data points). The geologic depositional model was used to "fill in" the model cells between the lithologic data points. Only one of the lithologic data points (out of approximately 300) was changed during model calibration from one depositional environment to another. This data point is located directly north of the eastern flux pond (near well WSW-4), and its depositional environment was changed from floodplain to channel. This was done to connect the permeable deposits near WSW-6 with the channel located upgradient of the eastern flux pond in model layer 1. To more accurately reflect this situation, the text in the final FS will be modified to read:*

The hydraulic parameter estimations were based on site-specific lithologic information, and were modified during parameter estimation. The depositional environments (parameter zones) assigned to lithologic data points did not change during calibration, however, the values assigned to the three depositional environments were varied during calibration, within a reasonable range of values based on site-specific pumping test data. The end result were values of hydraulic conductivity that are higher than the initial estimates.

Comparison of model results and site-specific data indicate that model parameters are within appropriate ranges, based on site-specific data. The Navy believes that this concurrence is an indication that MODFLOW is an appropriate tool for evaluation of groundwater flow in the bay fringe environment.

The selected groundwater flow model (MODFLOW) is flexible enough to accommodate the characteristics of alluvial geology and bay fringe environment. Alluvial depositional environments are among the most difficult to model because of their heterogeneous, anisotropic nature. MODFLOW can be used to model this environment because heterogenous arrays of hydraulic parameters can be input into a three-dimensional grid. MODFLOW has been successfully used to model an alluvial fan environment in the south San Francisco Bay area (Craig et al. 1990). MODFLOW also accommodates a variety of boundary conditions that can be used to define boundaries in areas where groundwater discharges to surface water and where fresh water meets salt water. The U.S. Geological Survey has published an example of a MODFLOW model in an estaurine setting (Patrick et al. 1989).

Comment 20: Page 83, Section 4.1.7. Please provide the basis on which the OU5 aquifer is stated as being on an average of 7 feet thick. Have a number of pore volumes been estimated to obtain remediation goals?

Response: *The pore volume calculations were based on the permeable material thickness and total porosity. However, these calculations will use a total A1 aquifer zone saturated thickness of an estimated 34.4 feet effective porosity (0-20) in the final FS report. The average saturated thickness was calculated by subtracting the A1 aquifer bottom elevation used in the model (-36.0 feet msl) from the average elevation of the water table at OU5 (-1.6 feet msl). The effective porosity is representative of the percent volume of interconnected pore openings of typical alluvial materials. The calculations of the pre volumes required to flow through the media for remediation are contained in Section 4.1 of the draft final report.*

Comment 21: Page 85, Section 4.2.3. The statement that OU5 contaminants cannot migrate off site without passing through the Building 191 permitted outfall needs to be expanded and should incorporate the groundwater contour maps.

Response: *The text will be revised to include the following:*

Groundwater at the northern edge of OU5 is believed to discharge into the Navy ditch, which routes water into the Building 191 lift station. It is unlikely that groundwater would discharge into the salt evaporation pond, because the water below the pond has a very high salinity, characteristic of seawater. OU5 groundwater,

being much less dense, should be forced upwards along the steeply landward-dipping interface with the salt water. The interface between OU5 groundwater and salt water below the pond can be considered a no-flow boundary with respect to advective contaminant transport. The North channel also bounds OU5 on the north. The Northern channel is hydraulically connected to San Francisco Bay. Because the pressure head in the North channel is equal to sea level and OU5 groundwater is approximately 5 to 6 feet below sea level, the gradient should be directed landward. The only potential discharge point other than the Navy ditch is the pump station at the north end of Marriage Road, which would discharge any groundwater that may be intercepted by the sanitary sewer. Boundary conditions are discussed further in Appendix E.

Comment 22: Figures A-3, A-4, and A-5. Consider using isocontour lines to represent TDS concentrations. Delineation between high and low TDS areas should be set at the 3,000 mg/L level.

Response: *The analysis presented in Appendix A will be revised to divide the high and low TDS areas based on a TDS concentration of 3,000 mg/L. Based on the background wells selected in Appendix A, this modification does not affect the statistical analysis presented in this appendix. An additional contour line representing a TDS concentration of 10,000 mg/L will be added to Figure A-3 to outline regions of the A1-aquifer zone that have the highest TDS concentrations. Figure A-4 will not be modified because adding the additional contour line would not provide significant new information. TDS concentrations decline very rapidly (from greater than 10,000 to less than 1,000) over a short distance and few data points exist in the A2-aquifer zone. Consequently, the 3,000 and 10,000 mg/L contours would be positioned in approximately the same location. Figure A-5 is a well location map and does not contain TDS concentration contours. The addition of contours to this figure would not add significant new information since this information is already presented on Figures A-3 and A-4. Please also see the response to RWQCB general comment 9 and DTSC specific comment 32.*

Comment 23: Appendix E, Page 4, Boundary Conditions Items 3 and 4. To what depth or layer was the drain cells used?

Response: *Drain cells are used only in model layer 1. The drain elevations range from approximately -2 feet relative to msl to -6.5 feet msl.*

Comment 24: Appendix E, Page 5, Boundary Conditions Items 9 and 10. Please provide a cross section to clarify the basis on which cell selection was determined.

Response: *As noted in the response to general comment number 5, five cross-sections through the model area are being included in the final FS. These cross-sections will delineate the top and bottom elevations of the model layers.*

Comment 25: Appendix E, Page 9: Discuss the applicability of MODFLOW in the bay fringe environment to demonstrate its validity with revised conductivity values.

Response: *See response to specific comment number 19.*

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