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PRC

N60211_000003
CROWS LANDING
SSIC NO. 5090.3.A

August 1, 1997

Mr. Kent Strong
Department of Toxic Substances Control, Region 1
10151 Croydon Way, Suite 3
Sacramento, California 95827-2106

CLEAN Contract Number N62474-94-D-7609
Contract Task Order 072

Subject: Naval Auxiliary Landing Field (NALF) Crows Landing Final Annual Groundwater Monitoring Report

Dear Mr. Strong:

Enclosed with this letter is the NALF Crows Landing final annual groundwater monitoring report prepared for the U.S. Navy. The report summarizes groundwater sampling events from December 1995 through February 1997. The report has been revised in response to technical review comments on the draft version of the report submitted by the Regional Water Quality Control Board. A summary of the comment responses is attached to this letter. Only the revised text, figures, and Plates 1 and 2 have been provided. Please replace these items in the draft version of the report. No changes were made to the report appendices.

Please call me at (303) 312-8815 if you have any questions regarding the final annual groundwater monitoring report.

Sincerely,

Keith Reamer
PRC Project Manager

NJB/jem

Enclosure

cc: Philip Isorena, Regional Water Quality Control Board
Bob Azevedo, Stanislaus County Department of Environmental Health
Sandy Olliges, National Aeronautics and Space Administration
Hubert Chan, Engineering Field Activity West
Bernard Tong, Engineering Field Activity West
Don Chuck, Engineering Field Activity West
Neil Bingert, PRC
NALF Crows Landing Administrative Record, 2 copies
NALF Crows Landing Information Repository, 2 copies

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ENCLOSURE 1 WAS INSERTED IN:

FINAL
ANNUAL GROUNDWATER MONITORING REPORT
(SAMPLING DATES DECEMBER 1995, APRIL 1996, MAY 1996, AUGUST 1996, NOVEMBER 1996, AND FEBRUARY 1997)

DATED 01 AUGUST 1997

IS RECORD NO. N60211_000135

RESPONSE TO AGENCY COMMENTS ON THE DRAFT ANNUAL GROUNDWATER MONITORING REPORT NAVAL AUXILIARY LANDING FIELD CROWS LANDING

This document presents the Navy's responses to comments from regulatory agencies on the draft annual groundwater monitoring report for Naval Auxiliary Landing Field (NALF) Crows Landing, dated May 9, 1997. The comments addressed below were received from the Central Valley Regional Water Quality Control Board (RWQCB) in a letter dated July 16, 1997.

Comment 1: **The report should evalute the adequacy of the monitoring program at each site. It should state whether or not there are enough wells to define the lateral and vertical extent of contamination at each site and recommend actions to be taken if it is determined that the program is inadequate.**

Response: Discussions have been added to Section 3.0 in the annual groundwater monitoring report which describe the adequacy of the monitoring program at each site. These descriptions are repeated below:

Background - The current background groundwater monitoring program is adequate for determining background metals concentrations and obtaining water level elevation information. Sufficient background metals analyses have been completed for statistical comparisons with site-specific metals concentrations. Background sampling is probably not necessary for evaluating regional contributions to known groundwater contamination problems on base. The probability of regional contaminant problems contributing to the known contaminant plumes on base is remote and has not been indicated in sampling results to date.

Installation Restoration Program (IRP) Site 11 - The current groundwater monitoring program is adequate at IRP Site 11. No additional monitoring wells are necessary to evaluate the lateral or vertical extent of contamination since no contaminant plume has been outlined. Monitoring well 11-MW-06, constructed through a known disposal pit, is adequate to characterize potential groundwater impacts from the most likely contaminant source at the site.

IRP Site 17 - The current groundwater monitoring program is adequate at IRP Site 17. The lateral extent of carbon tetrachloride contamination is evaluated by samples from wells 17-MW-06, -07, -08, -09, -11, -12, -13, 117-MW-01, and MW117-4. Samples from these wells contain either non-detected or very low concentrations (near reporting limits) of carbon tetrachloride. The source area of carbon tetrachloride contamination is monitored vertically by wells 17-MW-02, -03, -14, and -15. Monitoring results from this four-well cluster indicate that carbon tetrachloride concentrations are highest in the shallow and mid-shallow aquifer zones.

Underground Storage Tank (UST) Cluster 1 - The current groundwater monitoring program is adequate at UST Cluster 1. The lateral extent of contamination is evaluated by samples from wells CL1-MW-04, -05, -06, and 117-MW-01. Samples from these wells contain either non-detected or very low concentrations (near reporting limits) of total extractable or purgeable petroleum hydrocarbons (TPH-E or TPH-P) or benzene. The contaminant plume source area is monitored vertically by wells CL1-MW-02, -03, and -07. Samples from these wells indicate TPH-E, TPH-P and benzene contamination

in the shallow and mid-shallow aquifer zones. Samples from mid-deep well CL1-MW-07 have contained TPH-E (260 [µg/L]) and benzene (0.5 µg/L) in only one of five sampling rounds (April 1996).

UST Cluster 2 - The current groundwater monitoring program is adequate at UST Cluster 2. The lateral extent of contamination is evaluated by samples from wells CL2-MW-01, -03, -04, and MW6. Samples from these wells contain either non-detected or very low concentrations (near reporting limits) of TPH-E or benzene. The contaminant plume source area is monitored vertically by wells CL2-MW-02 and -05. Samples from these wells indicate TPH-E, TPH-P, and benzene, toluene, ethylbenzene, and xylene (BTEX) contamination in the shallow aquifer zone. Samples from mid-shallow well CL2-MW-05 have contained BTEX compounds in only one of five sampling rounds (February 1997).

UST 109 - The current groundwater monitoring program is adequate at UST 109. Additional monitoring wells are not needed at this time because groundwater contamination has not been consistently detected in samples from well 109-MW-01, constructed immediately adjacent to the UST excavation. In addition, recent investigation results indicate that fuel contamination in soil beneath the tank does not reach the water table surface.

UST 117 - The current groundwater monitoring program at UST 117 is adequate to evaluate the lateral extent of gasoline contamination. Monitoring wells used to evaluate the lateral extent of contamination include 117-MW-01, -04, -05, -07, MW117-4, 17-MW-04, and -05. Samples from these wells contain either non-detected or very low concentrations (near reporting limits) of TPH-P and BTEX compounds. The contaminant plume source area is monitored vertically by wells 117-MW-02, -03, and -06. Samples from these wells indicate that TPH-P and benzene concentrations are highest in the shallow aquifer zone and decrease in the mid-shallow and mid-deep aquifer zones. However, TPH-P and benzene concentrations have increased in samples from mid-deep well 117-MW-06 between April 1996 and February 1997. These results indicate that gasoline contamination extends deeper into the aquifer than the current monitoring system is capable of evaluating. The need for additional monitoring wells completed deeper into the aquifer will be evaluated as part of the corrective action plan process for UST 117. Construction of additional monitoring wells, if necessary, will be completed in conjunction with corrective action at UST 117.

Comment 2: **I recommend that monitoring well designations be followed by S, M, or D for shallow, mid-depth, and deep monitoring wells, respectively. In addition, the base water supply well, domestic well, and irrigation wells also should be described as such. For example, in the May 1996 shallow groundwater elevation map, there is "New" well northwest of CL2-MW-04. The report should specify whether this is a new domestic well for the base or a new irrigation well for the farmers. The wells southwest of UST Cluster 1 also should be described more clearly.**

Response: The following designations have been added to monitoring well labels in Figures 3-1 and 3-2 and Plates 1 and 2 in the annual groundwater monitoring report specifying the aquifer zone monitored:

- S - Shallow aquifer zone
- MS - Mid-shallow aquifer zone
- MD - Mid-deep aquifer zone
- D - Deep aquifer zone

In addition, information has been added to Section 2.3 in the annual groundwater monitoring report describing all active irrigation and domestic use wells located on base and immediately adjacent to the base. This new information is repeated below:

Several active irrigation and domestic use wells are located on base and immediately adjacent to the base. Plate 1 shows these active irrigation and domestic use well locations. Active irrigation wells on base include wells 6/8-20NALF, 6/8-20C1, and "New." The base water supply well is the only active domestic use well on base. Nearby adjacent off-base irrigation wells include 6/8-18(McDonald), 6/8-16M1, and 6/8-9M2. The nearest off-base domestic use well is the "Residence" well located near the southwestern corner of the base, approximately 4,500 feet west of UST Cluster 1. Table 2-1 summarizes information regarding these irrigation and domestic use wells including date of construction and water production zones.

TABLE 2-1

NALF CROWS LANDING
IRRIGATION AND DOMESTIC USE WELL SUMMARY

Well Identification	Date Constructed	Use	Water Production Zones
6/8-20NALF	June 1992	Irrigation (on base)	Upper water-bearing zone; mid-shallow to deep.
6/8-20Cl	February 1945 - refurbished 1994	Irrigation (on base)	Original - Upper water-bearing zone; mid-deep to deep. Lower water-bearing zone. No information on refurbished production zones
"New"	Unknown	Irrigation (on base)	No information available.
Water Supply Well	February 1995	Domestic (on base)	Upper water-bearing zone; deep.
6/8-18(McDonald)	February 1991	Irrigation (off base)	Lower water-bearing zone.
6/8-16M1	December 1943	Irrigation (off base)	Upper water-bearing zone; shallow to deep. Lower water-bearing zone
6/8-9M2	April 1944	Irrigation (off base)	Upper water-bearing zone; shallow to deep. Lower water-bearing zone.
"Residence"	Unknown	Domestic (off base)	No information available.

Comment 3: **The hydrograph for well cluster 17-MW-02, 17-MW-03, 17-MW-14, and 17-MW-15 shows that for 2 September 1996, the elevation of mid-deep well 17-MW-14 is lower than the elevation of deep well 17-MW-15 suggesting a vertical upward gradient during the sampling event. However, this is inconsistent with the remainder of the data which show a consistent vertical downward gradient from 17-MW-14 to 17-MW-15. This situation also occurred during the same sampling event for well cluster 17-MW-06 and 17-MW-07. In this cluster, the elevation of shallow well 17-MW-06 is lower than the elevation of mid-shallow well 17-MW-07 just for this particular sampling event, but the remainder of the data show the elevations reversed. These discrepancies should be corrected.**

Response: There are no discrepancies in the water level elevation data for wells 17-MW-14, -15, -06, or -07. The anomolously low water levels measured in wells 17-MW-14 and -06 in September 1996 were double checked in the field to confirm the initial measurement. It is suspected that response to stresses applied by pumping irrigation wells varies with depth in the aquifer. Varying drawdown with depth was observed in the aquifer pumping test completed at IRP Site 17 in July 1997. These aquifer pumping test results are currently being evaluated and will be presented in the IRP sites feasibility study report. The comment has been noted although no changes have been incorporated into the annual groundwater monitoring report as a result.

Comment 4: **The last sentence of the last paragraph on page 3-13 of the report needs to be completed.**

Response: The sentence has been revised to read, "Also during the summer of 1997, the existing pilot-scale SVE system will be reactivated to continue soil contamination cleanup."

Comment 5: **In the groundwater elevation contours for May, June, July, and August 1996, it is not clear if there is really a depression between UST Cluster 1 and background monitoring wells 1 and 2. It could be that the groundwater simply flowed to the southwest during these months. The contaminants, which have been detected at background monitoring well BG-MW-01, could have come from UST Cluster 1. The Navy should install some piezometers in the area between UST Cluster 1 and background monitoring wells BG-MW-01 and BG-MW-02 to determine the actual ground water flow direction in this location.**

Response: It is true that empirical data do not exist to verify a water table depression between UST Cluster 1 and background monitoring wells BG-MW-01 and -02. Groundwater could have simply flowed to the southwest during the months of May, June, July, and August 1996. Groundwater elevation contours were drawn showing a depression around irrigation wells 6/8-20NALF and 6/8-20Cl because it is known that these wells are pumped extensively during the irrigation season, and a depression around these wells is one possible explanation for the southwest-directed flow gradient observed. While it would be interesting to install piezometers to further evaluate groundwater flow patterns, these data are not necessary at this time. In addition, apparent contamination detected in several background well samples should not be attributed to migration from UST Cluster 1. Reasons for these conclusions are described below:

- Existing groundwater monitoring wells CL1-MW-05 and -06 are located between the UST Cluster 1 contaminant plume boundary and background monitoring wells BG-MW-01 and -02. Although low concentrations (near reporting limits) of TPH-E, TPH-P or benzene have been occasionally detected in samples from wells CL1-MW-05 and -06, these wells are properly located to monitor the maximum lateral extent of groundwater contamination to the west and south. Consequently, a better understanding of groundwater flow patterns between wells CL1-MW-05 and -06 and background wells BG-MW-01 and -02 is not critical to adequately monitoring groundwater contamination at UST Cluster 1.

- Background monitoring wells BG-MW-01 and -02 are located approximately 3,200 feet south and 4,100 feet west of monitoring wells CL1-MW-06 and -05, respectively. The maximum groundwater flow velocity calculated between CL1-MW-06 and BG-MW-01 during the summer of 1996 was 5.3 feet per year. Similarily, the maximum groundwater flow velocity calculated between CL1-MW-05 and BG-MW-02 was 6.2 feet per year. These maximum flow velocities were calculated using the formula:

  $v = (k/n)*i$ where:
  v = flow velocity (feet per year)
  k = maximum hydraulic conductivity calculated from UST Cluster 1 slug test results (6,891 feet per year from well CL1-MW-07 rising head test)
  n = porosity (assume 30 percent or 0.30)
  i = maximum horizontal flow gradient (0.00023 feet per foot between CL1-MW-06 and BG-MW-01 measured in May 1996 and 0.00027 feet per foot measured between CL1-MW-05 and BG-MW-02 measured in July 1996)

These groundwater flow velocity calculations indicate that it would take many hundreds of years for contamination to migrate to background monitoring wells BG-MW-01 and -02 from UST Cluster 1, given the aquifer characteristics and flow gradients typical in the area. Also, this flow rate assumes no retardation of contaminant movement due to adsorption and attenuation. Consequently, it is not reasonable to assume that contamination has migrated from UST Cluster 1 to the background monitoring locations. The comment has been noted although no changes have been made in the annual groundwater monitoring report as a result.

Comment 6: **The first sentence of the third paragraph on page 4-1 states that background monitoring well results indicate that potential regional contaminant problems are not affecting the known contaminant plumes on base. This sentence is most likely alluding to the detection of 1,1,1-trichloroethane, benzene, toluene, and xylenes at background monitoring well BG-MW-01. The Navy is attributing the detection of these contaminants to some offsite source although NALF Crows Landing is isolated, there are no industries surrounding it, and there are no known contaminated sites nearby. The Navy should substantitate this assertion and explain further what it means by potential regional contamination. The most likely cause of occasional detection of contaminants at BG-MW-01 is migration of contaminants from UST Cluster 1 due to groundwater flow reversal resulting from irrigation well pumping.**

Response: The background monitoring wells were located primarily to obtain metals data for comparison to metals concentrations at specific IRP sites, and to obtain water level elevation information to determine groundwater flow patterns across the base. A secondary objective was to evaluate possible regional contaminant contributions to the known contaminant plumes on base. Regional groundwater contamination problems exist in the San Joaquin Valley, including non-point source nitrate and pesticide contamination. In addition, fuel tanks exist at most irrigation well locations and at farm homes near the base. However, it is true that no large industrial facilities or fuel storage sites exist near the base. Consequently, the probability that regional solvent or fuel contamination problems contribute to existing plumes on base is minimal.

Infrequent and unrepeated contaminant detections in samples from the background wells appear to be anomolous, indicative of neither regional contamination problems nor migration from UST Cluster 1 (see discussion in response to comment 5). The background well samples may have been contaminated during sampling, handling, or analysis. However, no clear evidence exists indicating how or when any possible sample contamination problems may have occurred. It should be noted that 1,1,1-trichloroethane was detected in samples from three wells in March 1995 (BG-MW-02, BG-MW-03, and 17-MW-01) but has never been detected again in samples from these wells.

The above discussions have been added to Section 3.2.1 in the annual groundwater monitoring report to clarify the intended uses of the background monitoring wells, and conclusions regarding previous contaminant detections.

Comment 7: **The report recommends sampling for volatile organic compounds (VOCs) only at Site 17. However, monitoring wells 17-MW-12 and 17-MW-13 should continue to be tested for total petroleum hydrocarbons as diesel and gas (TPHd/g) and benzene, toluene, ethylbenzene, and xylenes (BTEX) because these are boundary wells to the northwest.**

Response: Eliminating TPH-P, TPH-E, and BTEX analyses for samples collected from wells 17-MW-12 and -13 was a typographical error in Table 4-1 that has been corrected. Wells 17-MW-12 and -13 are considered part of the UST Cluster 1 monitoring system and will continue to be sampled as such.

Comment 8: **Monitoring for TPHg at perimeter wells CL1-MW-04, CL1-MW-05, and CL1-MW-06 may be reduced to annually if four conservative quarters of no detection occurs. Until then, these perimeter wells along with the remaining wells at UST Cluster 1 should be sampled quarterly for TPHg.**

Response: Analyzing for both TPH-P and TPH-E will continue for all samples collected from UST Cluster 1, UST Cluster 2, and UST 109 monitoring wells.

Comment 9: **The detection limit for VOCs and BTEX should be maintained at 0.5 parts per billion or lower.**

Response: Several different detection or quantitation limits are associated with laboratory analytical data. Strictly interpreted, the detection limit (DL) is the lowest concentration of a chemical that can be detected above the normal, random noise of an analytical

instrument or method. Concentrations of a chemical below the DL cannot be reliably distinguished from noise. DLs are chemical- and instrument-specific. For any given sample on any given day, the calculated DL may or may not be attainable.

Alternatively, the reporting limit (RL) is not necessarily the lowest detectable concentrations achievable, but rather are concentrations that a laboratory can routinely and reliably detect and quantify in a variety of sample matrices. A specific sample, however, may require adjustments to the preparation or analytical method in order to be analyzed. For example, a sample containing high concentrations of any one chemical may have to be diluted in order to be quantified. In these cases, the RL must be adjusted and is then called the sample quantitation limit (SQL). The SQL takes into account sample characteristics, sample preparation, and analytical method adjustments and is the actual value reported with the analytical data. For a given chemical, the SQL may vary from sample to sample.

The DL for most VOCs and BTEX compounds is 0.4 μg/L for the analytical methods and the laboratory used to analyze NALF Crows Landing groundwater samples. The laboratory RL for VOCs analyzed using Contract Laboratory Program (CLP) methods is 2.0 μg/L. For BTEX compounds analyzed using U.S. Environmental Protection Agency (EPA) method 8010, the laboratory RL is 1.0 μg/L. The actual SQL reported with the analytical data may be lower than, equal to, or greater than the RL depending on a sample's characteristics, preparation, or analytical method adjustments. Changing analytical methods or laboratories will not appreciably lower the SQLs for NALF Crows Landing groundwater analytical data. The comment has been noted although no changes have been made in the annual groundwater monitoring report as a result.