



Terry Tamminen  
Agency Secretary  
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## Department of Toxic Substances Control

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MCAS EL TORO  
SSIC NO. 5090.3

March 29, 2004

Mr. F. Andrew Piszkin  
BRAC Environmental Coordinator  
Base Realignment and Closure  
Marine Corps Air Station El Toro  
7040 Trabuco Road  
Irvine, California 92618

COMMENTS ON DRAFT TECHNICAL MEMORANDUM, PRE-DESIGN  
INVESTIGATION FOR SHALLOW GROUNDWATER UNIT REMEDY, IRP SITE 24,  
VOLATILE ORGANIC COMPOUNDS SOURCE AREA, FORMER MARINE CORPS  
AIR STATION EL TORO

Dear Mr. Piszkin:

The Department of Toxic Substances Control has reviewed the subject document dated January 2004. The technical memorandum presents the objectives, methods, and results of investigations intended to gather the data needed to design a remedy for IRP Site 24, Volatile Organic Compounds Source Area, Shallow Groundwater Unit. This letter transmits the enclosed comments prepared by Mr. David Murchison from our Geological Service Unit.

If you have any questions, please contact me at (714) 484-5419.

Sincerely,

Tayseer Mahmoud  
Senior Hazardous Substances Engineer  
Office of Military Facilities  
Southern California Branch

Enclosure

cc: See next page

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## Department of Toxic Substances Control

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Arnold Schwarzenegger  
Governor

### MEMORANDUM

**TO:** Tayseer Mahmoud  
Senior Hazardous Substances Engineer  
Base Closure/Reuse Unit

**FROM:** Dave Murchison, R. G.   
Engineering Geologist  
Cypress Geological Services Unit

**CONCUR:** Scott Warren, C. E. G., C. Hg.   
Senior Engineering Geologist  
Cypress Geological Services Unit

**DATE:** March 22, 2004

**SUBJECT:** Geologic/Hydrogeologic Review of the  
Draft Technical Memorandum, Pre-Design Investigation for  
Shallow Groundwater Unit Remedy IRP Site 24, VOC Source  
Area, Former Marine Corps Air Station El Toro, CA  
Prepared by Earth Tech, Inc. dated January 2004

PCA: 18042

Site Code: 400055-18

Request No. 20037153

As requested, Site Mitigation and Brownfields Reuse Program, Geological Services Unit (GSU) staff performed a review of the Draft Technical Memorandum (Memorandum) described above. The Memorandum presents the objectives, methods, and results of investigations intended to gather the data needed to design a remedy for the contamination in the shallow groundwater unit (SGU) at IRP Site 24.

The Memorandum was reviewed for internal consistency and for conformance with relevant DTSC and US EPA guidance, and general best practices. Specific comments regarding details of the Memorandum follow. Questions regarding the memorandum should be directed to Dave Murchison at (714) 484-5484.

## **Introduction**

Site 24 is the source area for an extensive dissolved VOC plume that extends downgradient several thousand feet, and penetrates vertically for several hundred feet, affecting the SGU and the principal aquifer at the Base. The volume of the principal aquifer contamination is referred to as IRP Site 18. A remedy for the SGU was selected in a Record of Decision (ROD) dated 2002. The selected remedy is to extract contaminated groundwater from the SGU by means of a number of wells placed to intercept and extract the most highly contaminated groundwater. The extracted water will be treated by air-stripping and other means and sent to the proposed Irvine Desalter Project (IDP) and used as non-potable recycled water.

The investigations reported in the Memorandum were designed to address 3 main issues:

- **Extraction Rates and TCE Plume Distribution.** The sustainable pumping rates for the SGU needed further investigation, and the Memorandum reports on a series of step-drawdown and constant-rate pumping tests. The vertical distribution of VOC contamination will be further investigated by means of comprehensive sampling of existing wells, and installation and sampling of additional proposed wells. A nearby agricultural well 18\_TIC55 may have induced some vertical plume movement, and this possibility was further assessed.
- **Mass Removal Enhancements.** Soil vapor extraction (SVE) may assist in mass removal of VOC once the SGU is partially dewatered by the proposed extraction. The Memorandum reports on short-term tests to investigate the feasibility of this SVE enhancement in two areas.
- **Siting of Conveyance Piping Network.** The proposed remedy will generate considerable volumes of water, and a network of piping will be needed to transport the produced water to the treatment equipment and the IDP. The Memorandum includes a brief discussion of geophysical and trenching investigations along the proposed piping network.

## **Groundwater Plume Investigation**

Ten extraction wells and 2 monitoring wells were installed as part of this investigation. Extraction wells were installed by mud rotary drilling. Monitoring wells were installed by air rotary casing hammer drilling. Soil samples were collected for field screening and lithologic description purposes. Well logs and well development logs are provided in Appendix D and E.

Groundwater sampling was carried out by conventional low-flow methods in 23 wells, and by means of a number of passive-diffusion bag samplers in 26 well screens. The passive diffusion bags were deployed to test the method at El Toro, and to determine if the method could be used to perform vertical plume profiling.

The data for dissolved TCE are presented in Table 4-2 and Plates 1, 2, and 3 of the Memorandum.

### **Vertical Flow Investigation**

Vertical flow in 4 well screens was evaluated by means of a heat-pulse flow meter. Vertical flow was detected in all 4 screens, with velocities from 2.9 to 541 feet/day. The Memorandum goes on to critique the heat-pulse technique, and reject the findings since they do not correlate with vertical velocities calculated from differential head calculations. Based on this analysis and comparison of methods, the Memorandum concludes that vertical flow did not affect the PDB sampling results. GSU comments on this issue below.

### **Groundwater Pumping Tests**

Step-drawdown pumping tests were conducted in 7 wells in the plume area resulting in the selection of flow rates of 10 to 40 gpm for 72-hour pumping tests.

Seventy-two hour pumping tests were conducted in the same population of 7 wells. Drawdown was observed and recorded in the pumping well, and nearby wells. Drawdown data from the observation wells is not presented, and the Memorandum asserts that the observed drawdowns were insufficient to perform aquifer analysis. Drawdowns in the pumping wells were analyzed by the time-drawdown (Cooper and Jacob 1946) method, and well recoveries were analyzed by the Theis and Jacob Recovery Test Method (Theis 1935). Discharge rates were adjusted in 4 of the tests and the disturbed drawdown curves could not be used to analyze transmissivity. Recovery analysis found 6 transmissivities in the range 580 to 2900 ft<sup>2</sup>/day, in the same order of magnitude as the values used in the current groundwater model. One value was substantially higher, 5080 ft<sup>2</sup>/day in well 24EX13A.

### **Remedial Enhancement by Soil Vapor Extraction**

The Memorandum presents the methods and results of an attempt to evaluate enhancing VOC removal by adding soil vapor extraction to groundwater pumping. Step-drawdown tests were conducted in 3 wells to find the maximum sustainable drawdown for those wells. Two of the wells were then pumped for 72 hours, and then pumping was continued while a vacuum was applied at the wellhead. Soil vapor was produced at 50 to 75 cubic feet per minute, and groundwater recovery rates were enhanced by 4 to 6 gpm. Soil vapor samples were tested after 1, 4, 24 and 72 hours of vacuum. Total VOC concentrations were low – less than 40 µg/L – in the vapor samples.

### **Conclusions and Recommendations**

The Memorandum presents conclusions regarding plume delineation, sustainable extraction rates, and mass removal by soil vapor extraction during pumping. In general, the conclusions are:

- The plume is homogeneous, with little stratification.
- The northern and southern boundaries of the plume, as defined by the 50 µg/L and 5 µg/L contour lines, have shifted somewhat.
- The highest concentrations of dissolved TCE are found in the upper 80 feet of the shallow zone aquifer.

- Three areas of higher concentration were noted around wells 24EX6OB2, 24EX3OB1, and around wells 09\_DGMW75 and 24MW03.
- Passive diffusion bag samples tend to support historic well sampling data, and tend to contradict previous Hydropunch<sup>®</sup> sample data.
- Pumping from agricultural well 18\_TIC55 has not resulted in northward or downward migration of TCE in excess of the MCL.
- Various conclusions concerning probable sustainable flow rates.
- Soil vapor extraction may not be a cost-effective enhancement to groundwater remediation.

### General Comments

Most of these comments were provided verbally to the Navy at a BCT meeting 3 March 2004 and are provided here for reference purposes.

1. The sampling experiment using passive diffusion bags produced extremely interesting data, but that data does not support the conclusions drawn in the Memorandum. With one exception (24EX13B) all the PDB samples in a single well screen returned the same concentration of TCE within the normal range of laboratory precision. For example, screen 24EX4 returned, from top to bottom: 34, 33, 30, 42, 37, 34, and 38 µg/L TCE from 7 locations over a 90 foot screened interval. The immediately adjacent and overlapping shorter screen at 24EX4OB1 returned: 204, 209 and 201 µg/L in 3 PDBs in the top half of a 50 foot screen. This data demonstrates mixing in the well, not homogeneity in the aquifer. Based on this, and similar data gathered for the Memorandum GSU does not concur that the plume is homogeneous, with little vertical stratification. GSU does not concur that the data demonstrate that the highest concentrations of TCE are in the upper 80 feet of the shallow zone.
2. Based on the PDB and conventional groundwater sampling data, GSU recommends that the contractor revise the method by which monitoring well screened intervals are chosen to include a strong component of field decision-making. Short screens should be placed intersecting the tops of fine-grained units, and additional wells or discrete sampling ports should be installed at the tops of progressively deeper fine-grained units until at least one screen demonstrates non-detect conditions for TCE. Each of the three hot spots discussed in the Memorandum should be monitored at multiple levels within the maximum concentration axis of the plume to provide adequate vertical control on contaminant extent.
3. The vertical velocity data retrieved and then rejected by the Memorandum probably explains the PDB data, providing a mechanism that drives the mixing of contaminants in the well screens. The vertical velocity data from 4 wells shows vertical currents in every tested well, with varying velocity, but uniform upward transport direction. This means that all the water in the well casing is from a single horizon near the base of the screen in each case, or that it is fully mixed during residence in the casing before being discharged to shallower zones of the

aquifer. The contractor should accept the vertical velocity data in the well screens, and plan future monitoring wells with short screened intervals more suitable for PDB monitoring.

4. GSU does not concur with the rejection of heat-pulse vertical flow logging data and the adoption of calculated vertical velocities. While there may be questions about the precision of heat-pulse logging at very high and very low flow rates, GSU judges that the heat pulse logging was carefully performed using calibrated instruments, and that the data should be accepted as reasonably representative of flow in the well screens. The contractor should accept the heat-pulse data or propose to use a better method of field measurement of vertical flows.
5. GSU does not concur that pumping from agricultural well 18\_TIC55 and other principle aquifer wells has not resulted in northward or downward migration of TCE in excess of the MCL. The available data is insufficient to make that determination, especially in light of the persistent presence of dissolved TCE at a depth of 450 feet in screen 18\_DW450, and at trace concentrations intermittently at 540 feet bgs in screen 18\_DW540. These monitoring points are very deep compared to the base of the shallow zone, and not within the footprint of the mapped shallow plume. The persistence of TCE to these well screens strongly suggests that the plume has penetrated below the currently mapped extent.
6. GSU thanks the Navy and the contractor for providing the additional cross section B-B' across the plume. This display assists the BCT in understanding a portion of the plume in the 3<sup>rd</sup> dimension.
7. GSU notes that a large quantity of lithologic and groundwater contamination data has been gathered at the site over a decade or more of investigation. A large number of wells and other borings have been drilled and logged. A large number of well screens have been monitored and still more are available for monitoring should the need arise. The current conceptual model of the plume is based on mapping the data in 2 dimensions in plan view, and in 2 dimensions along a few cross-sections drawn through the plume. Well data is projected to these cross sections over substantial horizontal distances, often exceeding the vertical thickness of the aquifers. GSU strongly recommends that the contractor create a 3-dimensional stratigraphic model of the volume of aquifer potentially affected by the plume, and plot the plume concentrations in 3 dimensions. This will provide a tool that displays the strengths and weaknesses of the dataset in 3 dimensions, and that will assist the Navy in tracking the plume, planning future actions, and assisting in early detection of changes in plume behavior.
8. GSU recommends that soil vapor extraction remain in consideration as a supplemental remedial method once the proposed main remedy is implemented.