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SIXTEENTH PERIODIC SOIL VAPOR SAMPLING RESULTS FEBRUARY 2004

AT THE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION JET PROPULSION LABORATORY PASADENA, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

bgs:	Below Grade Surface
BTEX:	Benzene, toluene, ethylbenzene and xylenes
cc:	Cubic Centimeter
CCl_4:	Carbon Tetrachloride
CDHS:	California Department of Health Services
CRWQCB:	California Regional Water Quality Control Board, Los Angeles
%D:	Percent Difference
DCE:	Dichloroethene
Freon 11:	Trichlorofluoromethane
Freon 113:	1,1,2-trichloro-1,2,2-trifluoroethane
FWENC:	Foster Wheeler Environmental Corporation
GC:	Gas Chromatograph
GEOFON:	GEOFON, Incorporated
JPL:	Jet Propulsion Laboratory
NASA:	National Aeronautics and Space Administration
OD:	Outside Diameter
OU-2:	Operable Unit 2
PCE:	Tetrachloroethene
QA/QC:	Quality Assurance / Quality Control
RI:	Remedial Investigation
TCA:	Trichloroethane
TCE:	Trichloroethene
μg/L:	Micrograms per Liter
VOC:	Volatile Organic Compound

1.0 INTRODUCTION

Presented in this report are the results of the sixteenth periodic soil vapor sampling event completed as part of the periodic monitoring program being conducted at the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL) for Operable Unit 2 (OU-2) on-facility soils. The purpose of this program is to monitor the horizontal and vertical distributions of volatile organic compound (VOC) vapors in the vadose zone beneath the JPL site.

On February 2, 2004, GEOFON, Inc. (GEOFON) personnel mobilized to the jobsite to collect soil vapor samples from all available soil vapor sampling tips located in soil vapor monitoring well No. 4, No. 32, No. 33, No.34, No. 36, and No. 37. The locations of the soil vapor monitoring wells are shown in Figure 1-1. The set of soil vapor monitoring wells included in this sampling event is based on the soil vapor sampling frequency developed for the periodic monitoring program (Battelle, 2001). A summary of the soil vapor sampling frequency and specific depths of sampling is presented in Table 1-1.

All soil vapor samples collected during this event were analyzed for VOCs by H&P Mobile Geochemistry in an on-site laboratory that is certified by the California Department of Health Services (CDHS). The analyses were performed in accordance with EPA Method 8260B and the California Regional Water Quality Control Board, Los Angeles Region (CRWQCB) protocols and guidance.

Sampling procedures are described in Section 2.0, and a summary of all VOCs detected during this sixteenth periodic soil vapor sampling event, including locations and depths, is contained in Section 3.0. Conclusions are provided in Section 4.0. A soil vapor data validation report for all samples analyzed during this sampling event is included in Appendix A and summarized in Section 5.0. Cited references are listed in Section 6.0. Laboratory reports for all samples analyzed, along with chain-of-custody forms, are included in Appendix B. The daily calibration verification standards for each day's sampling are also included in Appendix B. Appendix C contains a summary of soil vapor sampling results from all events conducted since the inception of this periodic monitoring program.

2.0 SOIL VAPOR SAMPLING PROCEDURES

On February 2, 2004, soil vapor samples were collected and analyzed from five soil vapor monitoring wells that contained at least one open sampling tip. Soil vapor samples were collected from soil vapor monitoring well Nos. 4, 32, 33, 36, and 37. Soil vapor monitoring well No. 34 at depth 118ft was plugged due to interference below the surface in the line. Ten depth-specific vapor samples including one duplicate sample were collected and analyzed for 25 primary target VOC compounds in accordance with CRWQCB (1997) guidance documents. A description of the soil vapor well construction procedures was presented in the first long-term soil vapor sampling report prepared for OU-2 (FWENC, 2000a). Soil vapor well construction details are summarized in Table 2-1 of this report.

Soil vapor samples were withdrawn from the soil through the sampling tips and 1/8-inch-outside diameter (OD) Nylaflow® tubing using calibrated, gas-tight, 60-cubic-centimeter (cc) sterile syringes fitted with a three-way on-off valve. Prior to collecting each soil vapor sample, four volumes of the length of the tubing were purged to flush the tubing and fill it with in-situ soil vapor. Since each foot of tubing has an internal volume of 1 cc, the total volume purged was easily measured with the calibrated syringes. Following purging, a 60-cc soil vapor sample was collected in the syringe, the valve was turned to the off position, and the sample was immediately transferred to the on-site mobile laboratory for analysis. During sampling, neither water vapor nor condensation was observed in the transparent sampling syringes. Because the purge and sample volumes were small, a vacuum pump was not required to evacuate the tubing or to collect a soil vapor sample. To demonstrate reproducibility of results, a duplicate soil vapor sample was collected and analyzed for every ten soil vapor samples collected. The previous one in five (20%) duplicate sampling regimen was reduced during the twelfth periodic event to one in ten (10%) duplicates collected.

The samples were analyzed on-site in a mobile laboratory certified by CDHS (Certification No. 1667) to perform analyses by EPA Method 8260B and presented in the 8021 format for the parameters listed in Table 2-2. The time between sample collection and analysis was less than ten minutes.

3.0 ANALYTICAL RESULTS

The results from the previous remedial investigation (RI) for OU-2 (FWENC, 1999) indicated that four VOCs were more frequently detected in soil vapor samples at elevated concentrations than other VOCs. Those four VOCs were carbon tetrachloride (CCl_4), 1,1,2-trichloro-trifluoroethane (Freon 113), trichloroethene (TCE), and 1,1-dichloroethene (1,1-DCE). During the sixteenth periodic sampling event, the same four compounds (Freon 113, $CC1_4$, 1,1-DCE, and TCE) were the only chemical compounds detected in the five sampled soil vapor monitoring wells.

The compound $CC1_4$ was detected in soil vapor monitoring well No. 33 at concentrations ranging from not detected (ND) to 2.0 micrograms per liter of vapor (μg/L-vapor). During this event, $CC1_4$ was ND with respect to the laboratory-reporting limit in soil vapor monitoring wells No. 4, 32, 36, and 37.

Freon 113 was detected in soil vapor monitoring well No. 33 at concentrations ranging from ND to 1.0 μg/L-vapor. During this event, Freon 113 was ND with respect to the laboratory-reporting limit in the soil vapor monitoring well No. 4, 32, 36, and 37.

TCE was detected in soil vapor monitoring well No. 4 at concentration of 12.0 and 21.0 μg/L-vapor in the sample collected at a depths 20 and 56 feet. During this event, TCE was ND with respect to the laboratory-reporting limit in the soil vapor monitoring well No. 32, 33, 36, and 37.

The compound 1,1-DCE was detected in soil vapor monitoring well No. 33 at a concentrations of 2.6 μg/L-vapor, respectively. It was ND with respect to the laboratory-reporting limit in the remaining four soil vapor monitoring wells sampled during this event.

Tetrachloroethene (PCE), reported in prior events, was not detected in the five soil vapor monitoring wells sampled during this event.

A summary of the analytical results for all samples collected during this sampling event is presented in Table 3-1 and the analytical laboratory reports are presented in Appendix B-1. Chain-of-custody forms are included in Appendix B-2. Daily Opening, Closing, and Continuing Calibration Verification Reports are included in Appendix B-3. Data from all periodic monitoring events conducted to date have been tabulated and are presented in Appendix C. Location maps for detections at depth for $CC1_4$, Freon 113, TCE and 1,1-DCE are shown in Figures 3-1, 3-2, 3-3 and 3-4, respectively. Total VOC concentrations at depth are presented in Figure 3-5.

4.0 CONCLUSIONS

The following conclusions are based on the results of the soil vapor sample laboratory analyses and the site conditions at the time of the sixteenth periodic sampling event (February 2004):

- Soil vapor monitoring probe at the depth of 118 feet in well No. 34 was plugged during this sampling event.

- VOCs were detected in only two of the five soil vapor monitoring wells sampled during this event (i.e. in soil vapor monitoring wells No.4 and 33). Compounds CCl_4 and Freon 113 were detected in only soil vapor monitoring well No. 33 at the depth of 105ft. Freon 113 was detected at 1.0 μg/L and CCl_4 was detected at 2.0 μg/L. Both of these concentrations were lower than the previous sampling event. Concentrations of 1,1-DCE detected during this sampling event in soil vapor monitoring well No. 33 (depth of 120 ft) and TCE concentration in soil vapor monitoring well No.4 (depth of 56 feet) were slightly greater than those measured during the previous sampling event and lower than those measured during the OU-2 RI.

- Based on the results of soil vapor samples collected during this sampling event, VOC concentrations generally continue to decline throughout the site.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

This section briefly summarizes the quality assurance and quality control (QA/QC) procedures followed during the sixteenth periodic soil vapor-sampling event. Analytical data reports for all soil vapor samples were sent to Laboratory Data Consultants, located in Carlsbad, California, for independent data evaluation. All data was usable as qualified. The validated data reports are presented in Appendix A - Soil Vapor Data Validation Reports.

All sample analyses were performed using an external, three-point standard calibration method. For most target analytes, both detectors on the gas chromatograph (GC) were calibrated over a range equivalent of 5.0 to 200.0 μg/L of analyte in soil vapor. Analytical system performance was verified at the beginning of each analytical day with an "opening standard" and a "closing standard" after the last environmental sample analysis for the day. A "continuing standard" was analyzed after the tenth environmental sample run that day. If ten or fewer samples were analyzed during the day, the closing standard substituted for the continuing standard. Results of daily opening, closing, and continuing (if applicable) standards are presented in Appendix B-3.

During each analytical day, the environmental sample analyses were bracketed by check standards, which verified acceptable system performance for the analytes listed in the daily calibration data summary tables (Appendix B-3). The percent difference (%D) of calibration factors in continuing standard mixtures were less than or equal to 16.2 percent (see Appendix B-3).

Field blanks of ambient air from inside the field laboratory trailer were analyzed immediately after the opening verification standard and were clean in all cases. No matrix spikes or laboratory replicates were required.

Two surrogate compounds (1,4-difluorobenzene and 4-bromofluorobenzene) were injected into the GC along with the environmental samples as a QA/QC check on recovery limits. In accordance with RWQCB (1997) protocols, surrogate recoveries should be in the range of 75 to 125 percent. All surrogate recoveries obtained during this sampling event satisfied this criteria by a wide margin, usually within a recovery range of 85 to 115 percent.

No sample analysis data obtained during this sampling event were rejected as unusable. Overall, the assessment of soil vapor and corresponding control sample data indicate that data quality objectives were achieved in terms of precision, accuracy, representativeness, comparability, and completeness for all analytes sampled.

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