

Base Realignment and Closure  
Program Management Office West  
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CONTRACT NO. N68711-98-D-5713  
CTO No. 0079

**AIR SAMPLING REPORT**  
**FOR ORION PARK AND WESCOAT HOUSING AREAS**  
Revision 0  
March 11, 2005

**FORMER NAS MOFFETT FIELD**  
**MOFFETT FIELD, CALIFORNIA**

DCN: FWSD-RAC-05-0526



**TETRA TECH FW, INC.**

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# TABLE OF CONTENTS

	<u>PAGE</u>
LIST OF TABLES .....	iii
LIST OF FIGURES .....	iii
ABBREVIATIONS AND ACRONYMS .....	v
EXECUTIVE SUMMARY .....	ES-1
1.0 INTRODUCTION .....	1-1
1.1 SITE HISTORY .....	1-1
1.2 TCE BENCHMARK HEALTH-BASED CONCENTRATION .....	1-2
1.3 OBJECTIVES .....	1-4
1.4 REPORT ORGANIZATION .....	1-4
2.0 FIELD METHODOLOGY .....	2-1
2.1 SAMPLE LOCATIONS .....	2-1
2.1.1 November 2003 Sampling Event .....	2-1
2.1.2 May 2004 Sampling Event .....	2-1
2.2 FIELD SAMPLING PROCEDURES .....	2-2
2.2.1 Pre-sampling Protocol .....	2-2
2.2.2 Sampling Methodology .....	2-2
2.2.3 Sample Collection .....	2-3
3.0 SAMPLE ANALYTICAL RESULTS .....	3-1
3.1 ANALYTICAL RESULTS .....	3-2
3.1.1 Off-plume Results .....	3-2
3.1.2 Above-plume Results .....	3-3
3.1.3 Unit Type .....	3-7
3.2 CLIMATE DATA .....	3-8
3.3 SEASONAL EFFECTS .....	3-8
4.0 DATA EVALUATION .....	4-1
5.0 CONCLUSIONS .....	5-1
6.0 REFERENCES .....	6-1

## APPENDICES

Appendix A	Analytical Results Reports and Chain-of-custody Forms (Provided on Compact Disk)
Appendix B	Response to Comments

## LIST OF TABLES

		<u>FOLLOWING PAGE</u>
Table 2-1	November 2003 Indoor and Outdoor Air Sampling Locations .....	2-2
Table 2-2	May 2004 Indoor and Outdoor Air Sampling Locations .....	2-2
Table 3-1	Air Sample Analytical Results .....	3-2
Table 3-2	Climate Conditions During Air Sampling .....	3-6

## LIST OF FIGURES

		<u>FOLLOWING PAGE</u>
Figure 1-1	Regional Location Map.....	1-2
Figure 1-2	Site Location Map.....	1-2
Figure 1-3	TCE Plume in First-observed Groundwater .....	1-2
Figure 2-1	November 2003 Air Sampling Locations with TCE Concentrations in First-Observed Groundwater .....	2-2
Figure 2-2	May 2004 Air Sampling Locations with TCE Concentrations in First-Observed Groundwater .....	2-2
Figure 3-1	May 2004 Air Sampling Locations with TCE Concentrations Greater than Cal/EPA OEHHA Value of 0.96 $\mu\text{g}/\text{m}^3$ and TCE Concentrations in First-Observed Groundwater .....	3-2
Figure 3-2	TCE Results for Building 705F, Day Care Center, and Building C1 .....	3-2
Figure 3-3	TCE Results for Buildings 701G, 702F, 703G, and 714G .....	3-2
Figure 3-4	TCE Results for Buildings 716A, 720B, 720D, and 727E .....	3-2
Figure 3-5	TCE Results for Buildings 727F, 805D, 806D, and 807D .....	3-2
Figure 3-6	TCE Results for Buildings 808A, 811A, and 817A, 818D.....	3-2
Figure 3-7	TCE Results for Buildings 819D, 832B, 834C, and 846A .....	3-2
Figure 3-8	TCE Results for Buildings 850D, 619B, 620E, and 620F .....	3-2

## ABBREVIATIONS AND ACRONYMS

$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
B	detected in method blank
BZ	breathing zone
°F	degrees Fahrenheit
Cal/EPA	California Environmental Protection Agency
BHHRA	Baseline Human Health Risk Assessment
cis-1,2-DCE	cis-1,2-dichloroethene
COPC	chemical of potential concern
CTO	Contract Task Order
EPA	U.S. Environmental Protection Agency
FD	field duplicate
HEAST	Health Effects Summary Table
IRIS	Integrated Risk Information System
J	estimated value
kPa	kilopascal
MCH	Moffett Community Housing
mph	miles per hour
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NCEA	National Center for Environmental Assessment
OEHHA	Office of Environmental Health Hazard Assessment
OPHA	Orion Park Housing Area
OSWER	Office of Solid Waste and Emergency Response
PP	preferential pathway
PPRTV	Provisional Peer Reviewed Toxicity Value
PRG	Preliminary Remediation Goal
RAC	Remedial Action Contract
RWQCB	Regional Water Quality Control Board
TCE	trichloroethene

## ABBREVIATIONS AND ACRONYMS

(Continued)

U	not detected at or above the laboratory reporting limit (value indicates the laboratory reporting limit)
VC	vinyl chloride
VOC	volatile organic compound
WHA	Wescoat Housing Area

## EXECUTIVE SUMMARY

This document summarizes the results of air sampling and analysis that was conducted at the Orion Park Housing Area (OPHA) and the Wescoat Housing Area (WHA) at the former Naval Air Station (NAS) Moffett Field, Moffett Field, California. OPHA and WHA are approximately 72 acres and 40 acres in size, respectively, and were constructed in various stages from 1933 to 1982. These housing areas were transferred to the Air Force in 1994 and were subsequently transferred to the Army in 2000. OPHA and WHA are currently part of the Army's Moffett Community Housing (MCH) and are located just south of San Francisco Bay in the Santa Clara Valley, near the cities of Mountain View and Sunnyvale, California.

Previous investigations that were conducted at MCH detected volatile organic compounds (VOCs) in the shallow groundwater beneath a portion of OPHA and WHA. The Navy used the Johnson and Ettinger model to evaluate the potential for these volatile chemicals to migrate into the housing units and affect indoor air quality. Although the model predicted that trichloroethene (TCE) vapors that migrated into indoor air would be below the California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) inhalation benchmark long-term residential health-based concentration of 0.96 microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ ), air samples were collected to verify the accuracy of the model. Two of the 42 air samples that were collected had chemical concentrations greater than the value predicted by the model, and therefore, additional air sampling was recommended.

The objective of the additional air sampling was to evaluate if chemical vapors greater than the Cal/EPA OEHHA inhalation benchmark long-term residential health-based concentration were present in the indoor air at MCH. Another objective was to determine if the source of the chemicals detected in the indoor air might be from the shallow groundwater beneath the housing units.

A total of 25 indoor air locations and 10 outdoor air locations were sampled during two sampling events in November 2003 and May 2004. Indoor air samples were collected from a day care center and vacant MCH housing units. Representative indoor air samples were collected from the ground floor of units with slab foundations, crawl spaces, and basements. Samples were collected in "breathing zones" located in the center of the ground floor living room and at "preferential pathways" where pipes and utilities penetrated the slab or flooring. Sample locations were selected where chemicals were found in the groundwater, as well as where none were previously found (including additional housing units and the day care center).

Both indoor and outdoor samples were collected over a continuous 24-hour period. Samples were analyzed for three volatile chemicals previously found in the groundwater at MCH: TCE, cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC).

The sampling results indicated that:

- Volatile chemicals were detected in almost all indoor and outdoor samples.
- Trichloroethene (TCE) was detected at concentrations greater than the Cal/EPA OEHHA value of  $0.96 \mu\text{g}/\text{m}^3$  in four of 27 units sampled. Of these four units, two (620E and 620F) have been demolished and two (727F and 714G) are vacant.
- Cis-1,2-DCE detections were all below federal health-based concentrations.
- VC was detected in one outdoor and one indoor sample. Both locations were off the first-observed groundwater TCE plume. The VC detections were above the federal and California health-based concentration.
- There may be potential vapor migration from chemicals into indoor air from contaminated groundwater at four of 27 housing units (727F, 714G, 620E, and 620F).
- There is no apparent correlation between air sampling results and the presence (or absence) of groundwater contamination at 23 of 27 housing units.
- Volatile chemicals in the housing units were detected at low concentrations, similar to the concentrations detected in the surrounding (ambient) air at 23 of 27 housing units.
- There appears to be a slight seasonal effect upon the air sampling results (November air sampling results are higher than those collected in May).
- One of 27 housing units (620E sampled by the EPA in January and February 2004 with the unit's heating system operating) had consistent TCE detections greater than the Cal/EPA OEHHA concentration of  $0.96 \mu\text{g}/\text{m}^3$ . Unit 620E no longer exists.
- The above findings are consistent with the findings of previous studies at MCH that indicated no immediate or short-term health risks to the residents of OPHA or WHA relating to either indoor or outdoor air quality.

## 1.0 INTRODUCTION

This Report describes the air sampling and analysis activities that were performed at Orion Park Housing Area (OPHA) and Wescoat Housing Area (WHA), which were at one time part of the former Naval Air Station (NAS) Moffett Field (Moffett), Moffett Field, California. Moffett is located south of San Francisco Bay in the Santa Clara Valley, near the cities of Mountain View and Sunnyvale, California (Figure 1-1). OPHA and WHA are part of the Army's Moffett Community Housing (MCH) (Figure 1-2). The Navy transferred MCH to the Air Force in 1994, when the rest of Moffett was transferred to the National Aeronautics and Space Administration (NASA). MCH subsequently was transferred to the Army in July 2000.

This report has been prepared on behalf of the Navy's Base Realignment and Closure Program Management Office West, under Contract Task Order (CTO) No. 0079, issued under Remedial Action Contract (RAC) No. N68711-98-D-5713.

### 1.1 SITE HISTORY

OPHA and WHA are approximately 72 acres and 40 acres in size, respectively. The area that is now OPHA was vacant or used for agriculture prior to the housing development. A portion of the area was used for agriculture until some time after 1965. Housing at OPHA was constructed in various stages between 1941 and 1982. The housing units include Moffett Homes that were built in 1941 and later demolished in 2001, Orion Park that was built in 1968, and Macon Terrace II and Macon Terrace III that were built in 1982 (Figure 1-3). Prior to development as residential property, WHA was vacant land. Housing at WHA was constructed in various stages between 1933 and 1982. The first housing units at WHA were built in 1933 along Berry Drive. Berry Court and Wescoat Village were built in 1968, and Macon Terrace I in 1982.

Previous investigations that were conducted at MCH detected volatile organic compounds (VOCs) in the shallow groundwater beneath portions of OPHA and WHA. In 2002, the Navy, under the guidance of the U.S. Environmental Protection Agency (EPA) Region 9 and the San Francisco Bay Regional Water Quality Control Board (RWQCB) conducted a two-phase site characterization program and a baseline human health risk assessment (BHHRA). The results of the Site Characterization and the BHHRA were reported in the *Final Site Characterization and Baseline Human Health Risk Assessment Report for Orion Park and Wescoat Housing Areas* (Foster Wheeler Environmental Corporation, 2003). The potential risk to residents was evaluated using the Johnson and Ettinger model, which predicts indoor air concentrations for chemical vapors that migrate into indoor air from groundwater, using site-specific groundwater and soil geotechnical data. The report included the following conclusions:

- Trichloroethene (TCE) and its breakdown products, cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC), were detected in the first-observed groundwater under areas of OPHA and WHA. The approximate extent of the TCE plume in the first-observed groundwater beneath OPHA and WHA is shown on Figure 1-3.
- Residents at OPHA and WHA are not in contact with groundwater (there is no completed pathway for ingestion and dermal contact).
- There was a potential completed pathway for vapors migrating into indoor air from groundwater. However, based on the Johnson and Ettinger model, residents at OPHA and WHA were not predicted to be exposed to TCE vapor concentrations greater than the California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) inhalation benchmark long-term residential health-based concentration of 0.96 microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ ).
- There were no immediate or short-term health risks to the residents at OPHA or WHA.

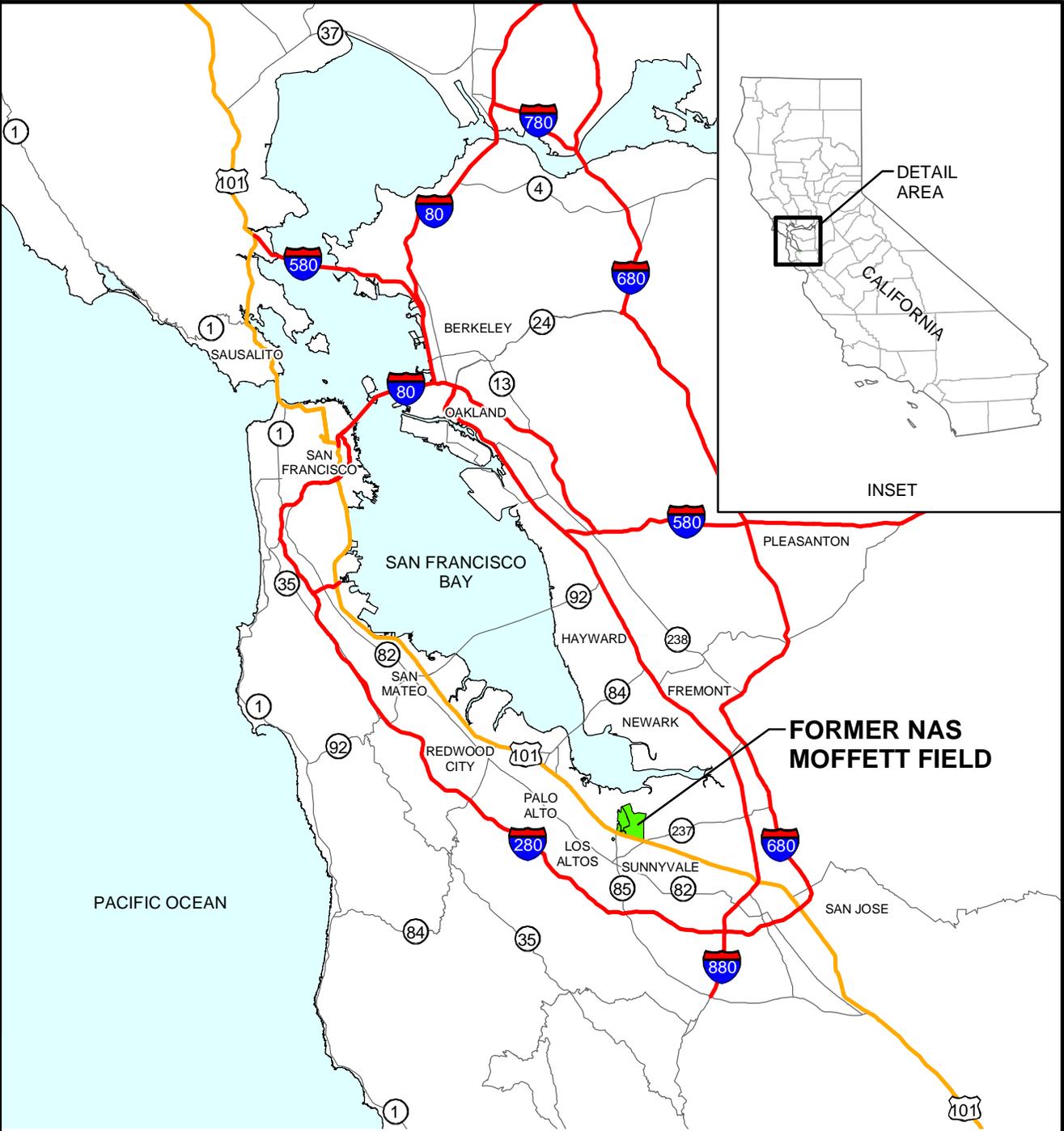
Three (two indoor and one outdoor) of the 42 air samples that were collected as part of the 2002 BHHRA study had TCE concentrations greater than  $0.96 \mu\text{g}/\text{m}^3$ . Because the two indoor sample concentrations were greater than the value predicted by the Johnson and Ettinger model, additional air sampling was recommended.

## 1.2 TCE BENCHMARK HEALTH-BASED CONCENTRATION

There is currently no consensus on the most appropriate toxicity values for TCE for purposes of calculating a health-based benchmark concentration for TCE in air. The EPA's Integrated Risk Information System (IRIS) is the primary source of peer-reviewed toxicity values. Many federal and state programs default to IRIS for its toxicity values, because of the rigorous peer review and consensus process. However, EPA's Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-53 specifies that if the required toxicity value cannot be found in IRIS, EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs), the Health Effects Summary Tables [HEAST], and relevant state program values should be consulted (in that order). PPRTV and HEAST currently do not have inhalation toxicity values for TCE.

The recently updated, EPA Region 9 PRG (October 2004) for TCE in ambient air has two listings: one is based on the National Center for Environmental Assessment (NCEA) provisional toxicity value, and the other is based on the Cal/EPA OEHHA benchmark long-term residential health-based concentration. The Cal/EPA OEHHA currently assumes a toxicity value for TCE, which corresponds to an inhalation long-term residential health-based exposure benchmark for TCE of  $0.96 \mu\text{g}/\text{m}^3$ . The RWQCB currently assumes the same toxicity values for TCE in the calculation of its Environmental Screening Levels (updated July 2003). There is relatively close agreement in the benchmark long-term residential health protective TCE air concentration between the Cal/EPA OEHHA cancer toxicity value ( $0.96 \mu\text{g}/\text{m}^3$ ) and the health protective TCE

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**LEGEND**

- STATE HIGHWAY
- US HIGHWAY
- INTERSTATE HIGHWAY
- FORMER NAS MOFFETT FIELD
- WATER

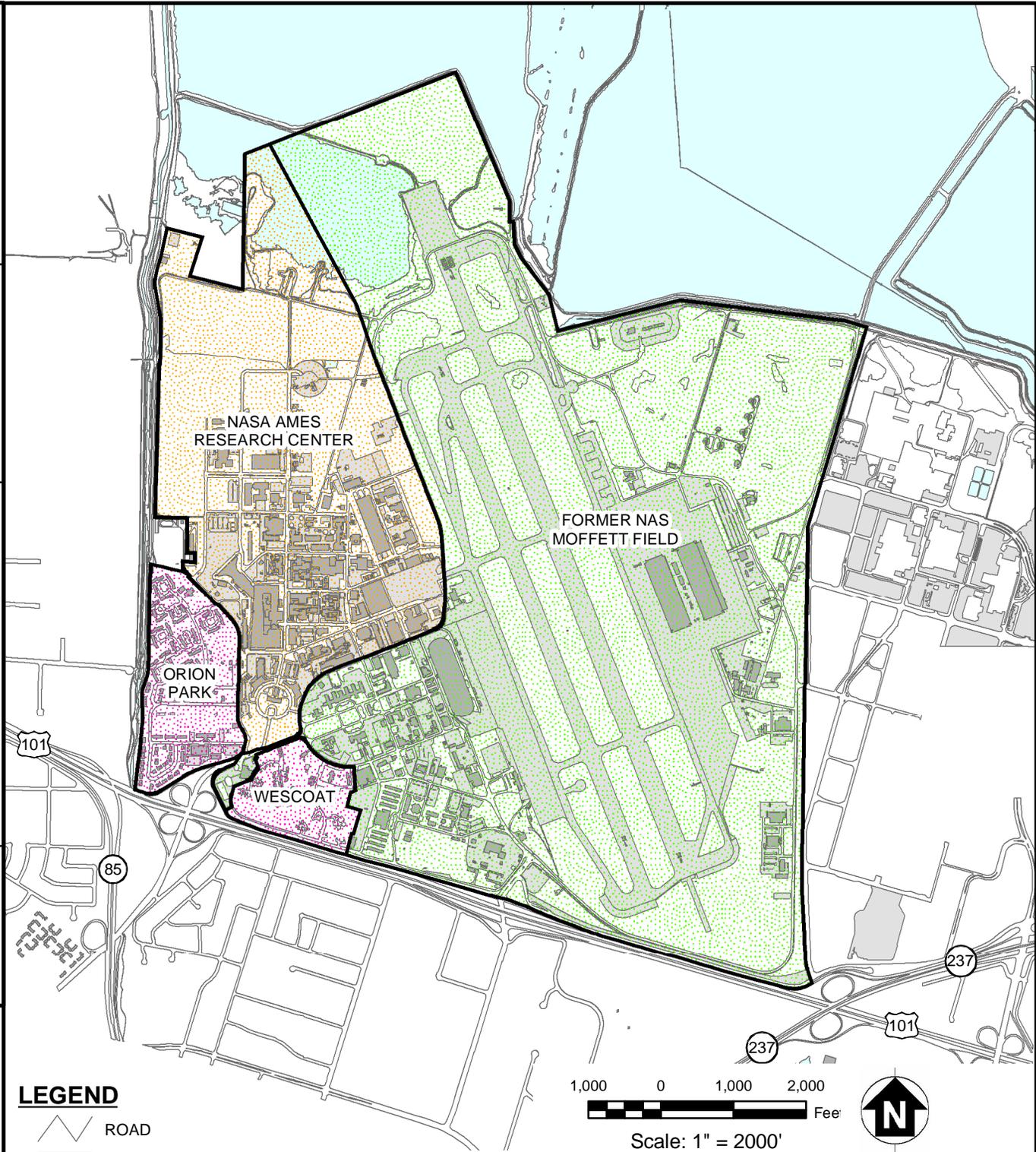


Scale: 1" = 10 Miles  
 DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29

<b>BASE REALIGNMENT AND CLOSURE          PROGRAM MANAGEMENT OFFICE WEST          SAN DIEGO, CA</b>	
<b>FIGURE 1-1          REGIONAL LOCATION MAP          FORMER NAS MOFFETT FIELD          MOFFETT FIELD, CA</b>	
<b>TETRA TECH FW, INC.</b>	

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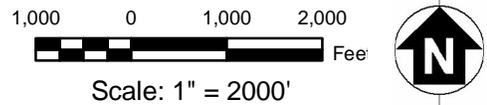
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**LEGEND**

- ROAD
- PAVED SURFACE
- BUILDING
- WATER
- FORMER NAS MOFFETT FIELD
- NASA AMES RESEARCH CENTER
- ARMY RESIDENTIAL COMMUNITY

SOURCE: RECORD OF SURVEY FORMER NAS MOFFETT FIELD, MARCH 2000, NASA.



DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29

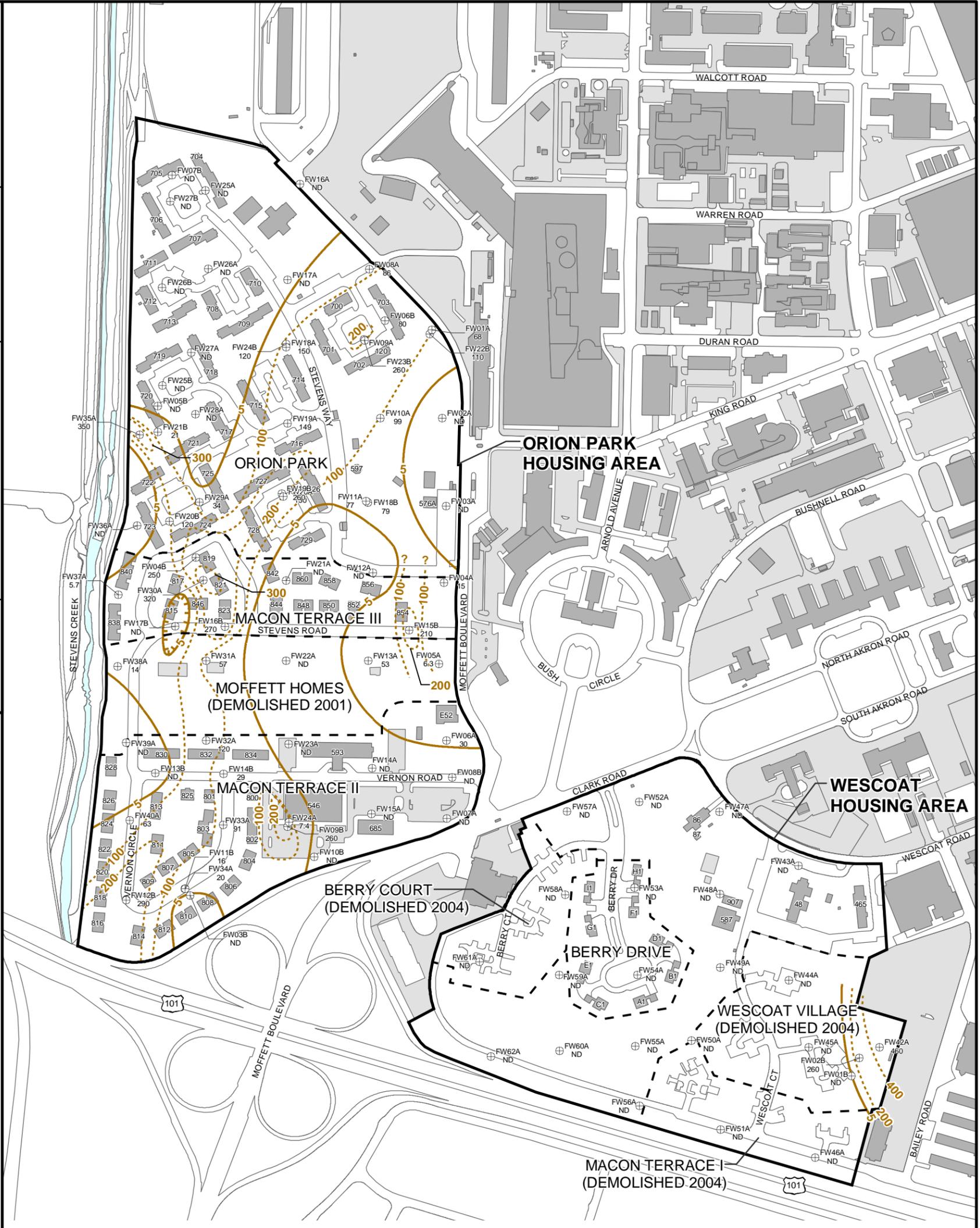
**BASE REALIGNMENT AND CLOSURE  
PROGRAM MANAGEMENT OFFICE WEST  
SAN DIEGO, CA**

**FIGURE 1-2  
SITE LOCATION MAP  
FORMER NAS MOFFETT FIELD  
MOFFETT FIELD, CA**

**TETRA TECH FW, INC.**

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**LEGEND**

- FW12B 290 ⊕ PHASE 1 OR PHASE 2 FIRST-OBSERVED GROUNDWATER SAMPLE LOCATION AND TCE CONCENTRATION IN µg/L
- ROAD
- HOUSING DEVELOPMENT
- ISOCONCENTRATION IN µg/L, DASHED WHERE INFERRED
- PAVED SURFACE
- BUILDING AND BUILDING NUMBER
- WATER
- ARMY RESIDENTIAL COMMUNITY BOUNDARY



Scale: 1" = 400'  
 DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29

**BASE REALIGNMENT AND CLOSURE  
 PROGRAM MANAGEMENT OFFICE WEST  
 SAN DIEGO, CA**

**FIGURE 1-3**

**TCE PLUME IN FIRST-OBSERVED GROUNDWATER**

**FORMER NAS MOFFETT FIELD  
 MOFFETT FIELD, CA**

 **TETRA TECH FW, INC.**

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concentration value ( $1.1 \mu\text{g}/\text{m}^3$ ). The latter is based on the IRIS cancer toxicity value previously published as the EPA inhalation toxicity value. These PRGs are based on an additional lifetime cancer risk of one in a one-million population.

Until 1989, the EPA IRIS database posted toxicity factors for TCE corresponding to an inhalation long-term residential health-based exposure benchmark (maximum carcinogenic risk of 1 in a million [or  $10^{-6}$ ]) for TCE of  $1.1 \mu\text{g}/\text{m}^3$ . This toxicity value was withdrawn by IRIS in July 1989. In January 1998, a new IRIS pilot program began the process of reassessing the toxicity of TCE. Subsequently, in 2000, the National Toxicity Program listed TCE as “reasonably anticipated to be a human carcinogen.” In August 2001, the NCEA published a draft report that recommended new toxicity values for TCE, which corresponds to an inhalation exposure benchmark for TCE of  $0.017 \mu\text{g}/\text{m}^3$  (at a risk of  $10^{-6}$ ) (NCEA, 2001). The notice on the cover of the NCEA Draft report states:

“NOTICE THIS DOCUMENT IS A PRELIMINARY DRAFT. It has not been formally released by the U.S. Environmental Protection Agency and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical merit and policy implications.”

In October 2002, EPA Region 9 incorporated the NCEA toxicity value recommendations into their PRG tables (2002a), even though this value had not been formally released by the EPA. EPA Region 9 has referred to a TCE carcinogenic risk of  $10^{-6}$  through  $10^{-4}$  based on the provisional TCE toxicity value (corresponding to a TCE inhalation exposure of  $0.017 \mu\text{g}/\text{m}^3$  to  $1.7 \mu\text{g}/\text{m}^3$ , respectively) as the “Health Protective Risk Range.” In November 2002, EPA incorporated the NCEA toxicity value recommendations into their *Draft Guidance for Evaluating Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (2002b). EPA Region 9 uses both the provisional TCE value and the California EPA TCE value. The EPA Region 9 PRG tables were updated in October 2004 (EPA, 2004a). The California EPA OEHHA benchmark long-term residential health-based concentration of  $0.96 \mu\text{g}/\text{m}^3$  for TCE was included in the updated Region 9 PRG Table because when EPA and Cal/EPA screening values differ significantly (i.e., by a factor of 4 or more), both the EPA PRGs and the “Cal-Modified PRGs” are listed in the EPA Region 9 PRG Table. However, in February 2005, the EPA Region 9 announced a site-specific residential “interim action level” for Moffett of  $1.0 \mu\text{g}/\text{m}^3$ . Comments on the derivation of the EPA toxicity value were submitted to the Federal Register in January 2002. Because the 2001 EPA value is still under review by the National Academy of Science, and since the EPA Region 9 site-specific interim action level is only slightly greater than the Cal/EPA OEHHA value, TCE concentrations are compared to the Cal/EPA OEHHA concentration of  $0.96 \mu\text{g}/\text{m}^3$ .

### 1.3 OBJECTIVES

The purpose of the air sampling activities was to:

- Evaluate if vapors of the chemicals of potential concern (COPCs) TCE, cis-1,2-DCE, or VC were present in the indoor air at concentrations greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  for TCE in ambient air, or greater than the EPA Region 9 PRG for cis-1,2-DCE and VC in ambient air.
- Evaluate whether vapors of COPCs that were detected in the indoor air migrated from groundwater.

Analysis of air quality focused on areas of MCH where these VOCs were detected in first-observed groundwater.

### 1.4 REPORT ORGANIZATION

This report is organized in the following format:

- **Section 1.0 – Introduction**, describes the site history, selection of a TCE benchmark long-term residential health-based concentration, project objectives, and report organization.
- **Section 2.0 – Field Methodology**, describes the sample locations and the field sampling procedures.
- **Section 3.0 – Sample Analytical Results**, describes the analytical results, the climate data observed during sampling, and seasonal effects.
- **Section 4.0 – Data Evaluation**, provides analysis of the analytical results.
- **Section 5.0 – Conclusions**, describes the report conclusions.
- **Section 6.0 – References**, provides the references used for this report.

The above-mentioned sections of this report are supplemented with tables and figures. Laboratory analytical reports and chain-of-custody forms are included as Appendix A (CD only). The response to comments is included as Appendix B.

## 2.0 FIELD METHODOLOGY

This Section describes the sample locations and the field sampling procedures for the November 2003 and the May 2004 sampling events.

### 2.1 SAMPLE LOCATIONS

The indoor sampling locations included a day care center and 24 housing units with slab-on-grade, crawl space, or basement construction. If the groundwater to soil gas to indoor air pathway is complete, the most likely place to detect trichloroethene (TCE) is on the ground floor near penetrations of the slab (e.g., preferential pathway). Therefore, most housing units were selected based on the following criteria:

- Located above first-observed groundwater containing detectable concentrations of TCE
- Ground floor unit
- Unoccupied from November 2003 to May 2004

Even though TCE was not detected in the first-observed groundwater underlying unit 705F at Orion Park Housing Area (OPHA), the day care center at OPHA, and unit C1 (unit with a basement) at Wescoat Housing Area (WHA), these areas were also sampled.

The ten outdoor sampling locations were selected based on proximity to indoor locations. Outdoor air sampling at each location began approximately 1 hour before indoor air sampling at associated housing units.

#### 2.1.1 November 2003 Sampling Event

Samples were collected on November 18 and 25, 2003. November sample locations are listed in Table 2-1 and are shown on Figure 2-1.

#### 2.1.2 May 2004 Sampling Event

Samples were collected on May 7 and 14, 2004. WHA units 619B, 620F, and the Wescoat playground outdoor location were not sampled during the May event, because WHA Buildings 619 and 620, along with all other WHA housing units, except the historical single family homes located along Berry Drive, were scheduled for demolition in preparation for new Army housing construction. Based on TCE that was detected in November 2003, within unit 727F, an additional outdoor air sample location (the backyard of OPHA unit 727F) was added. May 2004 sample locations are listed in Table 2-2 and are shown on Figure 2-2.

## **2.2 FIELD SAMPLING PROCEDURES**

Air samples were collected from inside selected vacant housing units, the active day care center, and at outdoor locations at OPHA and WHA in November 2003 and May 2004. Samples were analyzed for the chemicals of potential concern (COPCs) trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC). Two rounds of samples, each separated by 1 week, were collected during each of the two sampling events. The following subsections describe the methodology and field activities associated with the air sampling.

### **2.2.1 Pre-sampling Protocol**

Prior to each sampling event, the housing units were ventilated for a period of 24 hours. All windows and doors were opened, faucets were turned on and off, and toilets and drains were flushed. All air circulation equipment was turned off. Following this 24-hour period, windows and doors were shut, and chimney flues were closed. Openings such as dryer vents were covered with aluminum foil. The units were then left closed for a period of 48 hours prior to the start of sampling.

### **2.2.2 Sampling Methodology**

Two samples, a breathing zone sample and a preferential pathway sample, were collected from each unit during each event.

The breathing zone sample represented the indoor air quality that would be inhaled by a sensitive receptor, in this case, a small child. The sample canister intake was set approximately 3 feet off the floor. Breathing zone samples were located in the center of the ground floor living room in each unit, with the exception of the day care center. The day care center breathing zone sample was collected in a restroom, since it was the only available unused room.

The preferential pathway samples were used to evaluate if any COPCs detected in the breathing zone samples could be due to subsurface vapor migration from groundwater. The preferential pathway samples were collected within 5 feet of an apparent preferential pathway, such as a utility pipe coming through the floor, at a height of approximately 18 inches. In slab-on-grade units, the preferential pathway samples were collected by placing the sample canister on the floor, directly in front of the ground floor bathroom sink cabinet, where a water pipe and drain line penetrate the slab. In crawl space units, the preferential pathway samples were collected by placing the sample canister on the floor directly in front of the crawl space opening. During the May 2004 event, in units where the trap door to the crawl space was accessible (808A, 817A, and 834C), the preferential pathway sample was collected by placing the sample canister into the crawl space and replacing the trap door. In units where the trap door was inaccessible, the preferential pathway samples were placed adjacent to the trapdoors. In the unit with a basement (unit C1), the preferential pathway sample was collected in the basement, adjacent to a floor

TABLE 2-1

## NOVEMBER 2003 INDOOR AND OUTDOOR AIR SAMPLING LOCATIONS\*

OPHA INDOOR AIR SAMPLES	WHA INDOOR AIR SAMPLES
701G <sup>a</sup>	C1 <sup>d</sup>
702F <sup>a</sup>	619B <sup>c</sup>
703G <sup>a</sup>	620F <sup>c</sup>
705F <sup>a</sup>	
714G <sup>a</sup>	
716A <sup>a</sup>	
720B <sup>a</sup>	
720D <sup>a</sup>	
727F <sup>a</sup>	
805D <sup>b</sup>	
806D <sup>b</sup>	
807D <sup>b</sup>	
808A <sup>b</sup>	
811A <sup>b</sup>	
817A <sup>b</sup>	
818D <sup>b</sup>	
819D <sup>b</sup>	
832B <sup>b</sup>	
834C <sup>b</sup>	
846A <sup>c</sup>	
850D <sup>c</sup>	
Day Care Center <sup>a</sup>	
OPHA OUTDOOR AIR SAMPLES	WHA OUTDOOR AIR SAMPLES
Day Care PG <sup>a</sup>	Berry Drive <sup>d</sup>
B Road 714 <sup>a</sup>	Wescoat PG <sup>c</sup>
720 PG <sup>a</sup>	
B Road Diamond <sup>a</sup>	
Stevens PG <sup>c</sup>	
Vernon PG <sup>b</sup>	
Vernon East Lot <sup>b</sup>	

**Notes:**

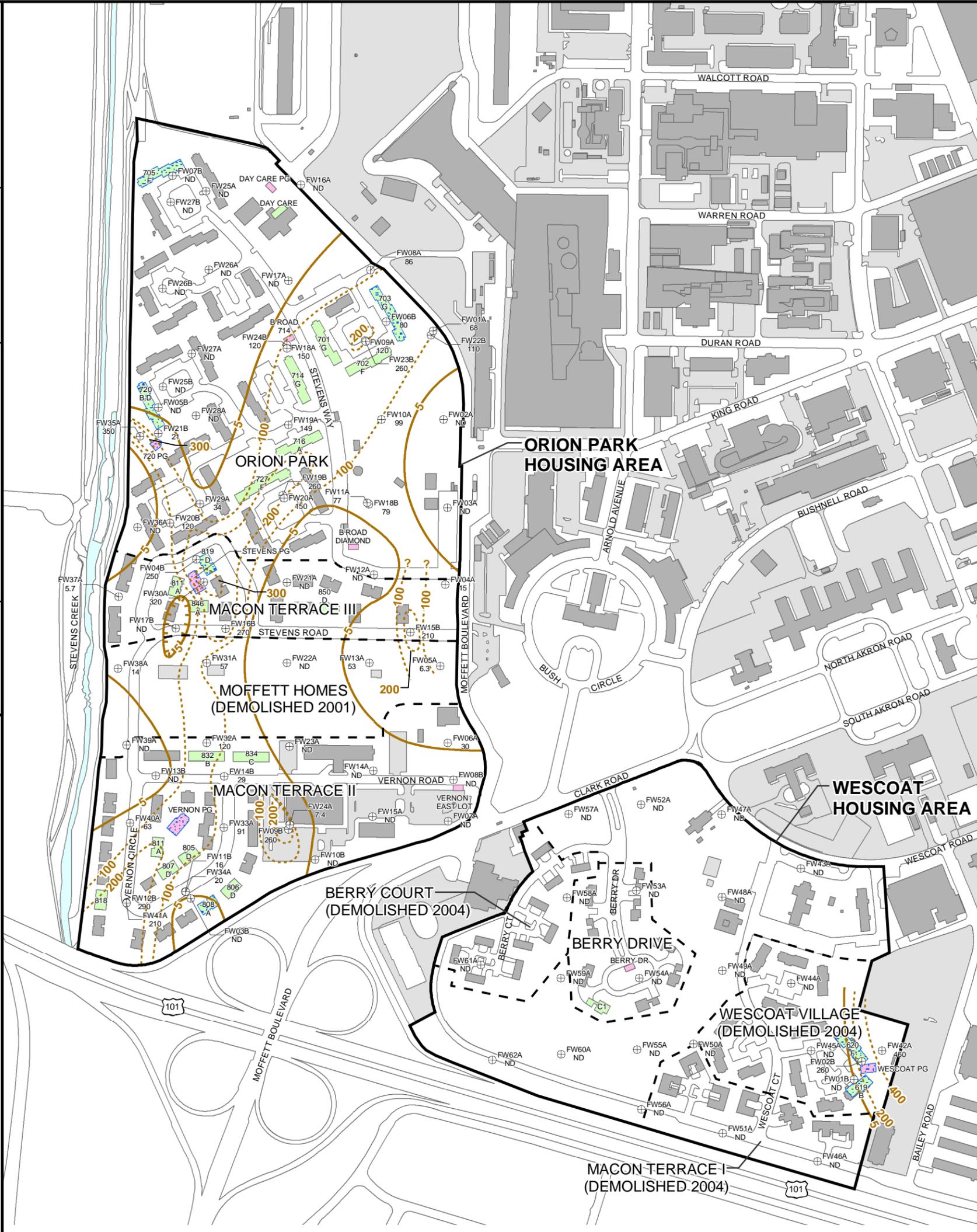
\* The sampling locations listed are the actual building numbers where samples were collected.

- a Orion Park
- b Macon Terrace II
- c Macon Terrace III
- d Berry Drive
- e Wescoat Village

**Abbreviations and Acronyms:**

OPHA – Orion Park Housing Area  
 PG – playground  
 WHA – Wescoat Housing Area

DRAWING NO: 050526C213.mxd  
 DCN: FWS-D-RAC-05-0526  
 CTO-0079  
 APPROVED BY: BM  
 CHECKED BY: LAD  
 REVISION: 1  
 DRAWN BY: GFG  
 DATE: 3/11/05



**LEGEND**

- FW12B 290 ⊕ PHASE 1 OR PHASE 2 FIRST-OBSERVED GROUNDWATER SAMPLE LOCATION AND TCE CONCENTRATION IN µg/L
- ROAD
- HOUSING DEVELOPMENT BOUNDARY
- ISOCONCENTRATION IN µg/L, DASHED WHERE INFERRED
- INDOOR AIR SAMPLING LOCATION  
BUILDING NUMBER  
UNIT
- OUTDOOR AIR SAMPLING LOCATION
- BHRA AIR SAMPLING LOCATION
- PAVED SURFACE
- BUILDING
- WATER
- ARMY RESIDENTIAL COMMUNITY BOUNDARY

NOTES:  
 ND - NOT DETECTED AT THE LABORATORY REPORTING LIMIT OF 5 µg/L  
 PG - PLAYGROUND  
 µg/L - MICROGRAMS PER LITER



Scale: 1" = 400'  
 DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29

BASE REALIGNMENT AND CLOSURE PROGRAM MANAGEMENT OFFICE WEST  
 SAN DIEGO, CA

FIGURE 2-1  
 NOVEMBER 2003 AIR SAMPLING LOCATIONS WITH TCE CONCENTRATIONS IN FIRST-OBSERVED GROUNDWATER  
 FORMER NAS MOFFETT FIELD  
 MOFFETT FIELD, CA

TETRA TECH FW, INC.

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TABLE 2-2

## MAY 2004 INDOOR AND OUTDOOR AIR SAMPLING LOCATIONS\*

OPHA INDOOR AIR SAMPLES	WHA INDOOR AIR SAMPLES
701G <sup>a</sup>	C1 <sup>d</sup>
702F <sup>a</sup>	
703G <sup>a</sup>	
705F <sup>a</sup>	
714G <sup>a</sup>	
716A <sup>a</sup>	
720B <sup>a</sup>	
720D <sup>a</sup>	
727F <sup>a</sup>	
805D <sup>b</sup>	
806D <sup>b</sup>	
807D <sup>b</sup>	
808A <sup>b</sup>	
811A <sup>b</sup>	
817A <sup>b</sup>	
818D <sup>b</sup>	
819D <sup>b</sup>	
832B <sup>b</sup>	
834C <sup>b</sup>	
846A <sup>c</sup>	
850D <sup>c</sup>	
Day Care Center <sup>a</sup>	
OPHA OUTDOOR AIR SAMPLES	WHA OUTDOOR AIR SAMPLES
Day Care PG <sup>a</sup>	Berry Drive <sup>d</sup>
B Road 714 <sup>a</sup>	
720 PG <sup>a</sup>	
727F Out <sup>a</sup>	
B Road Diamond <sup>a</sup>	
Stevens PG <sup>c</sup>	
Vernon PG <sup>b</sup>	
Vernon East Lot <sup>b</sup>	

**Notes:**

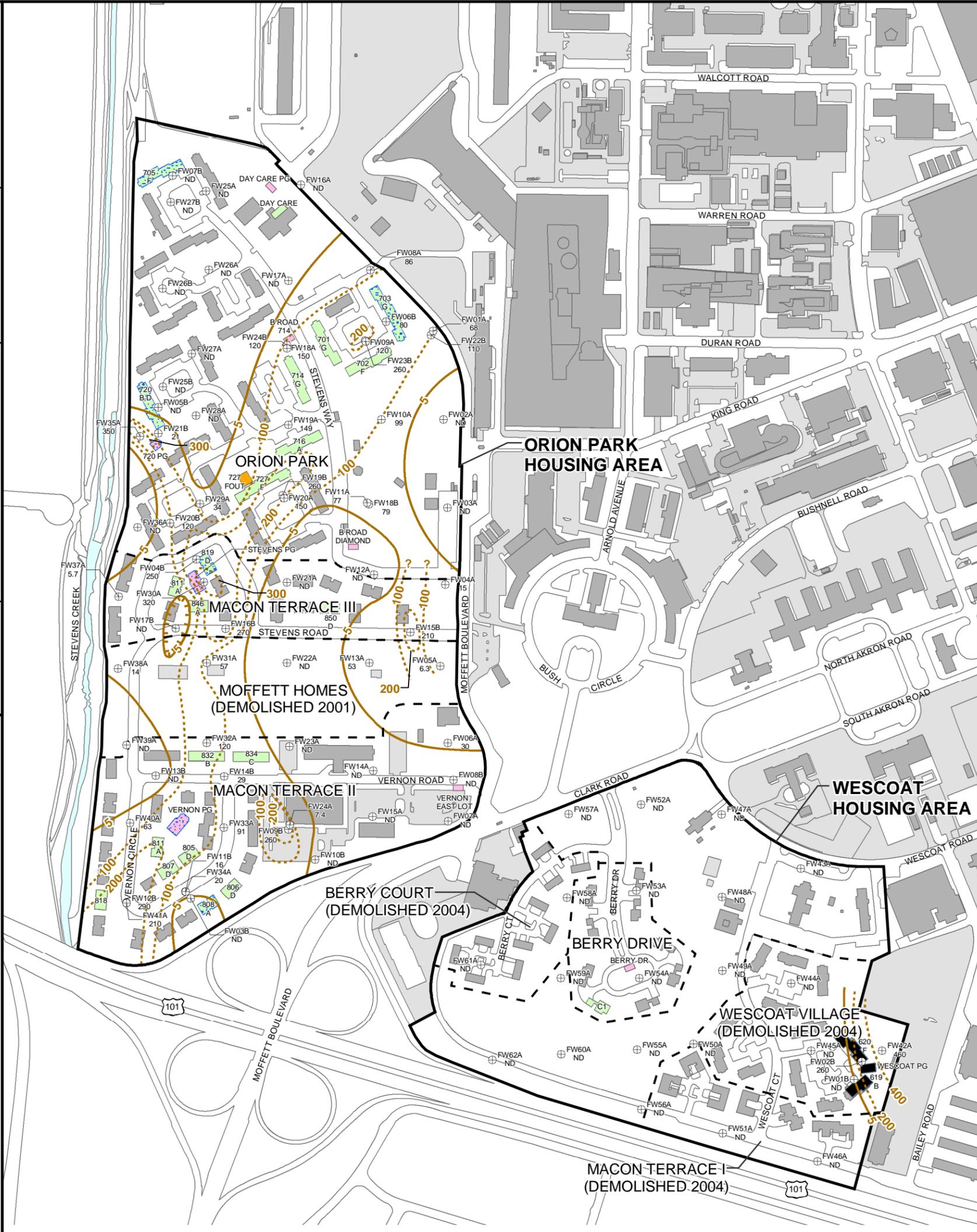
\* The sampling locations listed are the actual building numbers where samples were collected.

- a Orion Park
- b Macon Terrace II
- c Macon Terrace III
- d Berry Drive

**Abbreviations and Acronyms:**

OPHA – Orion Park Housing Area  
 PG – playground  
 WHA – Wescoat Housing Area

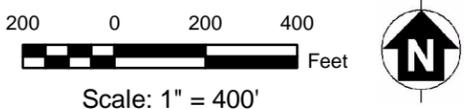
DRAWING NO: 050526C214.mxd  
 DCN: FWSD-RAC-05-0526  
 CTO-0079  
 APPROVED BY: BM  
 CHECKED BY: LAD  
 REVISION: 1  
 DRAWN BY: GFG  
 DATE: 3/11/05



**LEGEND**

- FW12B 290 ⊕ PHASE 1 OR PHASE 2 FIRST-OBSERVED GROUNDWATER SAMPLE LOCATION AND TCE CONCENTRATION IN µg/L
- ROAD
- HOUSING DEVELOPMENT BOUNDARY
- ISOCONCENTRATION IN µg/L, DASHED WHERE INFERRED
- INDOOR AIR SAMPLING LOCATION BUILDING NUMBER UNIT
- OUTDOOR AIR SAMPLING LOCATION
- BHRA AIR SAMPLING LOCATION
- AIR SAMPLE LOCATION ADDED IN MAY 2004
- AIR SAMPLE LOCATION ELIMINATED IN MAY 2004
- PAVED SURFACE
- BUILDING
- WATER
- ARMY RESIDENTIAL COMMUNITY BOUNDARY

NOTES:  
 ND - NOT DETECTED AT THE LABORATORY REPORTING LIMIT OF 5 µg/L  
 PG - PLAYGROUND  
 µg/L - MICROGRAMS PER LITER



Scale: 1" = 400'  
 DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29

BASE REALIGNMENT AND CLOSURE PROGRAM MANAGEMENT OFFICE WEST  
 SAN DIEGO, CA

FIGURE 2-2  
 MAY 2004 AIR SAMPLING LOCATIONS WITH TCE CONCENTRATIONS IN FIRST-OBSERVED GROUNDWATER FORMER NAS MOFFETT FIELD, CA

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drain. The day care center preferential pathway sample was located in the crawl space beneath the trailer adjacent to piping penetrating the asphalt surface.

Outdoor air samples were collected at a height of approximately 3 feet above ground surface. The sample canisters were barricaded, secured and protected from moisture. A sign was posted requesting that the canisters not be tampered with and provided relevant contact information.

### **2.2.3 Sample Collection**

During both events, indoor and outdoor air samples were collected over a continuous 24-hour period using 6-liter SUMMA canisters. These canisters are leak-free, stainless steel vessels that were supplied under negative pressure and certified clean by a laboratory. Each canister was equipped with a flow regulator assembly with laboratory-prepared, cleaned stainless steel sample tube, set to fill over a 24-hour period (flow is based upon the volume of the canister, length of sampling time, and the desired final negative pressure in the vessel, typically 88.1 kilopascals [kPa]).

Prior to sample collection, canister negative pressures and ambient air temperature were recorded in the field logbook. The valve on the canister was opened, the time was recorded in the field logbook and the unit was vacated and secured. At the end of the 24-hour sampling period, the valve on the canister was closed, and the time, negative pressure, and ambient air temperature were recorded in the field notebook. The flow regulator was removed and the canister inlet covered with a brass cap. The canisters were labeled, and the sample number, date, and time were recorded on the chain-of-custody documentation. The canisters were then packed and shipped via courier to Columbia Analytical, a Department of Health Services and Naval Facilities Engineering Service Center-approved laboratory for analysis.

### 3.0 SAMPLE ANALYTICAL RESULTS

Analytical results for the November 2003 and May 2004 events are presented in Table 3-1. This table also contains results from the samples analyzed by the Navy's 2002 investigation, and from samples collected by the U.S. Environmental Protection Agency (EPA) including split samples that were collected during the Navy's November 2003 and May 2004 activities and samples collected in January and February 2004 with the units heating system operating.

The analytical results presented in Table 3-1 represent a mixed data set due to differences in sample collection procedures and different laboratory reporting limits. The sampling procedures during the Navy's 2002 investigation did not include the pre-sampling housing unit ventilation/shut-in period (see Section 2.2.1). The ventilation/shut-in period preceded all other sampling activities. The EPA's January and February 2004 samples were collected while the housing units heating system was operating. Laboratory reporting limits achieved during the Navy's November 2003 and May 2004 sampling activities were approximately an order of magnitude lower than those achieved during the Navy's 2002, or the EPA's sampling activities. Laboratory reporting limits for trichloroethene (TCE) during the Navy's November 2003 and May 2004 sampling activities were approximately 0.017 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). The TCE laboratory reporting limits during the Navy's 2002 and the EPA's sampling activities were  $0.18 \mu\text{g}/\text{m}^3$  and  $0.27 \mu\text{g}/\text{m}^3$ , respectively.

The following sections focus on the results of the Navy's November 2003 and May 2004 sampling activities (209 samples collected from 25 indoor locations and 42 samples collected from 10 outdoor locations). The mixed data set (Navy 2002 data, Navy2003/2004 data, and EPA data) is also evaluated. The mixed data set includes 47 additional indoor samples and 2 new indoor sample locations. The mixed data set also includes 15 additional outdoor samples and 1 new outdoor location (see Table 3-1).

Trichloroethene (TCE) was detected at concentrations greater than California Environmental Protection Agency Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) benchmark long-term residential health-based concentration of  $0.96 \mu\text{g}/\text{m}^3$  in breathing zone and/or preferential pathway samples at three of the 25 indoor locations sampled during the Navy's November 2003/May 2004 sampling events. The three locations were Orion Park Housing Area (OPHA) unit 727F ( $2.8 \mu\text{g}/\text{m}^3$ ), unit 714G ( $1.7 \mu\text{g}/\text{m}^3$ ), and Wescoat Housing Area (WHA) unit 620F ( $2.2 \mu\text{g}/\text{m}^3$ ).

TCE concentrations greater than the Cal/EPA OEHHA value of  $0.96 \mu\text{g}/\text{m}^3$  were detected at four of the 27 indoor sample locations, if the mixed data set is evaluated. The additional detection at a concentration of  $4.2 \mu\text{g}/\text{m}^3$  occurred at WHA unit 620E with the heating system operating.

Cis-1,2-dichloroethene (Cis-1,2-DCE) was detected at 9 of 22 OPHA indoor locations and in four of eight OPHA outdoor locations sampled during the Navy's November 2003/May 2004 sampling event. Cis-1,2-DCE was not detected at all four indoor and two outdoor WHA locations. Cis-1,2-DCE detections were all below the federal health-based limit of 37  $\mu\text{g}/\text{m}^3$  (state limits could not be evaluated, because California does not list air toxicity criteria for this chemical).

The mixed data set has 62 additional samples, which includes two additional indoor and one additional outdoor sampling locations. There were no additional cis-1,2-DCE detections in the mixed data set.

Vinyl chloride (VC) was detected above reporting limits in one sample collected at an outdoor location in WHA on Berry Drive (at 0.17  $\mu\text{g}/\text{m}^3$ ) during the Navy's November 2003/May 2004 sampling events. The mixed data set includes one additional VC detection at an indoor OPHA location (at 0.73  $\mu\text{g}/\text{m}^3$ ). VC concentrations in both of these samples were above the EPA Region 9 PRG for VC in ambient air (0.11  $\mu\text{g}/\text{m}^3$ ) and the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC (0.0246  $\mu\text{g}/\text{m}^3$ ).

### 3.1 ANALYTICAL RESULTS

Analytical results are described in the following subsections. Indoor and outdoor air samples were collected from housing units located off the first-observed groundwater TCE plume and from housing units located above the first-observed groundwater TCE plume. Housing unit types included slab-on-grade, crawl space, and basement construction.

#### 3.1.1 Off-plume Results

Several sampling locations were selected due to the absence of volatile organic compound (VOC) contamination in the first-observed groundwater. OPHA off-plume locations included unit 705F, the day care center, and the outdoor location at the day care playground (Figure 3-1). WHA off-plume locations included unit C1 (basement unit) and the outdoor location on Berry Drive. November 2003 and May 2004 TCE results for these off-plume locations are shown on Figure 3-2. TCE concentrations at all off-plume locations ranged from 0.019  $\mu\text{g}/\text{m}^3$  in the breathing zone at the day care playground to 0.19  $\mu\text{g}/\text{m}^3$  in the breathing zone of unit 705F. Off-plume indoor breathing zone results ranged from 0.032  $\mu\text{g}/\text{m}^3$  to 0.19  $\mu\text{g}/\text{m}^3$ , with an average value of 0.09  $\mu\text{g}/\text{m}^3$ . Off-plume preferential pathway samples ranged from 0.04  $\mu\text{g}/\text{m}^3$  to a 0.18  $\mu\text{g}/\text{m}^3$ , with an average value of 0.09  $\mu\text{g}/\text{m}^3$ . Off-plume outdoor air breathing zone results ranged from 0.019  $\mu\text{g}/\text{m}^3$  to 0.13  $\mu\text{g}/\text{m}^3$ , with an average value of 0.08  $\mu\text{g}/\text{m}^3$ .

The maximum TCE concentration for the mixed data set in off-plume indoor air locations was 0.32  $\mu\text{g}/\text{m}^3$  detected in an EPA split sample collected from WHA unit C1. TCE was detected at a concentration of 0.13  $\mu\text{g}/\text{m}^3$  in the Navy sample collected at the same time at this location. The

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
<b>OPHA Indoor Air Samples</b>					
701G, BZ	0079-AIR-046	11/18/03	0.087	0.019 J	0.04 U
	0079-AIR-110	11/25/03	0.13	0.033 J	0.036 U
	0079-AIR-180	05/07/04	0.077	0.019 J	0.037 U
	0079-AIR-242	05/14/04	0.06	0.016 J	0.035 U
701G, PP	0079-AIR-045	11/18/03	0.081	0.017 J	0.0083 J
	0079-AIR-111	11/25/03	0.12	0.033	0.0072 J
	0079-AIR-181	05/07/04	0.05	0.017 J	0.041 U
	0079-AIR-243	05/14/04	0.059	0.021 J	0.034 U
702F, BZ	0079-AIR-048	11/18/03	0.16	0.012 J	0.038 U
	0079-AIR-114	11/25/03	0.16	0.026 J	0.04 U
	0079-AIR-182	05/07/04	0.099	0.0069 J	0.04 U
	0079-AIR-244	05/14/04	0.01	0.016 J	0.037 U
702F, PP	0079-AIR-047	11/18/03	0.15	0.012 J	0.036 U
	0079-AIR-115	11/25/03	0.17	0.025 J	0.036 U
	0079-AIR-183	05/07/04	0.1	0.0078 J	0.036 U
	0079-AIR-245	05/14/04	0.11 B	0.022 JB	0.01 J
	0079-AIR-246 (FD)	05/14/04	0.11 B	0.012 JB	0.039 U
703G, BZ	0033-OR-262	09/03/02	0.18 U	1.1 U	0.087 U
	0033-OR-287	09/05/02	0.18 U	1.2 U	0.085 U
	0079-AIR-050	11/18/03	0.092	0.013 J	0.009 J
	0079-AIR-112	11/25/03	0.12	0.026 J	0.037 U
	0079-AIR-184	05/07/04	0.055	0.0086 J	0.0085 J
	0079-AIR-247	05/14/04	0.067 B	0.016 JB	0.008 J
703G, PP	0079-AIR-049	11/18/03	0.087	0.014 J	0.031 U
	0079-AIR-113	11/25/03	0.13	0.024 J	0.0088 J
	0079-AIR-185	05/07/04	0.051	0.0084 J	0.0083 J
	0079-AIR-248	05/14/04	0.065 B	0.013 JB	0.018 J
705F, BZ (not over plume)	0033-OR-264	09/03/02	0.18 J	0.87 U	<b>0.17</b>
	0033-OR-265 (FD)	09/03/02	0.18 U	0.65 U	0.0084 U
	0033-OR-289	09/05/02	0.18 U	0.84 U	0.084 U
	0079-AIR-040	11/18/03	0.07	0.019 J	0.029 U
	0079-AIR-108	11/25/03	0.19	0.07	0.011 J
	0079-AIR-171	05/07/04	0.054	0.012 J	0.035 U
	0079-AIR-230	05/14/04	0.071	0.024 J	0.037 U
705F, PP (not over plume)	0079-AIR-041	11/18/03	0.13	0.047	0.01 J
	0079-AIR-109	11/25/03	0.18	0.069	0.01 J
	0079-AIR-172	05/07/04	0.053	0.0098 J	0.01 J
	0079-AIR-231	05/14/04	0.048	0.015 J	0.036 U
714G, BZ	0079-AIR-052	11/18/03	0.78	0.038	0.0078 J
	0079-AIR-116	11/25/03	0.44	0.042 J	0.01 J
	B714-G (EPA)	11/24/03	0.53	0.2 U	0.13 U
	B714-G (EPA)*	01/25/04	<b>1.8</b>	0.2 U	0.13 U
	B714-G (EPA)*	02/09/04	<b>1.9</b>	0.2 U	0.13 U
	B714-G (EPA)	05/06/04	<b>1.6</b>	0.2 U	0.13 U
	0079-AIR-186	05/07/04	<b>1.5</b>	0.04	0.0075 J
	0079-AIR-187 (FD)	05/07/04	<b>1.7 B</b>	0.052 JB	0.055 U
	0079-AIR-249	05/14/04	<b>1.2 B</b>	0.04 B	0.039 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
714G, PP	0079-AIR-051	11/18/03	0.83	0.039	0.0078 J
	0079-AIR-117	11/25/03	0.41	0.039	0.0082 J
	0079-AIR-128 (FD)	11/25/03	0.41	0.04	0.0083 J
	0079-AIR-188	05/07/04	1.7 B	0.053 JB	0.059 U
	0079-AIR-250	05/14/04	1.3 B	0.073 B	0.0071 J
716A, BZ	0079-AIR-019	11/18/03	0.17	0.023 J	0.036 U
	0079-AIR-084	11/25/03	0.21	0.026 J	0.036 U
	B716A (EPA)	11/24/03	0.27 U	0.2 U	0.13 U
	0079-AIR-139	05/07/04	0.19	0.011 J	0.037 U
	0079-AIR-201	05/14/04	0.22	0.0085 J	0.043 U
	0079-AIR-202	05/14/04	0.23	0.011 J	0.041 U
716A, PP	0079-AIR-018	11/18/03	0.11	0.016 J	0.034 U
	0079-AIR-083	11/25/03	0.2	0.026 J	0.032 U
	716-A (EPA)	11/24/03	0.15 J	0.2 U	0.13 U
	0079-AIR-140	05/07/04	0.2	0.0081 J	0.039 U
	0079-AIR-203	05/14/04	0.25	0.016 J	0.037 U
720B, BZ	0079-AIR-055	11/18/03	0.16	0.07	0.013 J
	0079-AIR-118	11/25/03	0.22	0.11	0.016 J
	0079-AIR-176	05/07/04	0.036	0.012 J	0.039 U
	0079-AIR-236	05/14/04	0.059	0.031 J	0.0077 U
720B, PP	0079-AIR-054	11/18/03	0.15	0.065	0.01 J
	0079-AIR-119	11/25/03	0.21	0.11	0.014 J
	0079-AIR-177	05/07/04	0.034	0.011 J	0.043 U
	0079-AIR-237	05/14/04	0.14	0.07	0.01 J
720D, BZ	0033-OR-259	09/03/02	0.19	0.78 U	0.08 U
	0033-OR-283	09/05/02	0.17 U	0.76 U	0.079 U
	0033-OR-284 (FD)	09/05/02	0.17 U	0.64 U	0.082 U
	0079-AIR-057	11/18/03	0.14	0.063	0.011 J
	0079-AIR-120	11/25/03	0.24	0.12	0.016 J
	0079-AIR-178	05/07/04	0.041	0.015 J	0.011 J
	0079-AIR-238	05/14/04	0.04	0.013 J	0.035 U
720D, PP	0079-AIR-056	11/18/03	0.13	0.056	0.0084 J
	0079-AIR-121	11/25/03	0.23	0.12	0.019 J
	0079-AIR-179	05/07/04	0.044	0.019 J	0.0096 J
	0079-AIR-239	05/14/04	0.037	0.0084 J	0.037 U
727E, BZ	B727-E (EPA)*	01/25/04	0.16 J	0.2 U	0.13 U
	B727-E (EPA)*	02/09/04	0.16 J	0.2 U	0.13 U
727F, BZ	0079-AIR-017	11/18/03	1.8	0.043	0.037 U
	0079-AIR-082	11/25/03	2	0.059	0.038 U
	B727-F (EPA)*	01/25/04	1.7	0.2 U	0.13 U
	B727-F-D (EPA) (FD)*	01/25/04	1.6	0.2 U	0.13 U
	B727-F (EPA)*	02/09/04	3.5	0.2 U	0.13 U
	0079-AIR-141	05/07/04	0.67	0.015 J	0.037 U
	0079-AIR-142 (FD)	05/07/04	0.68	0.016 J	0.033 U
	0079-AIR-204	05/14/04	2.8	0.051	0.038 U
	0079-AIR-205 (FD)	05/14/04	2.8	0.056	0.036 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
727F, PP	0079-AIR-016	11/18/03	1.6	0.039	0.038 U
	0079-AIR-081	11/25/03	1.8	0.056	0.038 U
	B727-F-Path (EPA)*	01/26/04	1.6	0.2 U	0.13 U
	B727-F (EPA)	05/06/04	0.59	0.2 U	0.13 U
	0079-AIR-143	05/07/04	0.68	0.014 J	0.03 U
	0079-AIR-206	05/14/04	2.4	0.058	0.051 U
727F, BZ Upstairs	B727-F-U (EPA)*	01/26/04	1.6	0.2 U	0.13 U
805D, BZ	0079-AIR-004	11/18/03	0.068	0.018 J	0.035 U
	0079-AIR-069	11/25/03	0.1	0.024 J	0.039 U
	B805-D (EPA)	11/24/03	0.2 J	0.2 U	0.13 U
	0079-AIR-150	05/07/04	0.038	0.0086 J	0.034 U
	0079-AIR-213	05/14/04	0.13 B	0.1 B	0.035 U
805D, PP	0079-AIR-003	11/18/03	0.066	0.016 J	0.04 U
	0079-AIR-068	11/25/03	0.1	0.024 J	0.032 U
	0079-AIR-151	05/07/04	0.039	0.037 U	0.037 U
	0079-AIR-214	05/14/04	0.044 B	0.018 JB	0.034 U
806D, BZ	0079-AIR-013	11/18/03	0.08	0.016 J	0.039 U
	0079-AIR-071	11/25/03	0.11	0.025 J	0.035 U
	0079-AIR-152	05/07/04	0.034	0.0094 J	0.035 U
	0079-AIR-215	05/14/04	0.051 B	0.025 JB	0.035 U
806D, PP	0079-AIR-012	11/18/03	0.086	0.02 J	0.035 U
	0079-AIR-070	11/25/03	0.11	0.027 J	0.035 U
	0079-AIR-153	05/07/04	0.041	0.018 J	0.02 J
	0079-AIR-216	05/14/04	0.051 B	0.015 JB	0.032 U
807D, BZ	0079-AIR-006	11/18/03	0.073	0.016 J	0.041 U
	0079-AIR-073	11/25/03	0.11	0.027 J	0.038 U
	0079-AIR-154	05/07/04	0.032	0.0073 J	0.035 U
	0079-AIR-217	05/14/04	0.043 B	0.021 JB	0.04 U
807D, PP	0079-AIR-005	11/18/03	0.068	0.013 J	0.043 U
	0079-AIR-072	11/25/03	0.11	0.028 J	0.039 U
	B807-D (EPA)	05/06/04	0.27 U	0.2 U	0.13 U
	0079-AIR-155	05/07/04	0.034	0.0072 J	0.036 U
	0079-AIR-218	05/14/04	0.042 B	0.011 JB	0.031 U
808A, BZ	0033-OR-250	09/03/02	0.38	0.61 U	0.08 UJ
	0033-OR-275	09/05/02	0.17 U	0.88 U	0.079 U
	0079-AIR-009	11/18/03	0.18	0.02 J	0.032 U
	0079-AIR-075	11/25/03	0.11	0.031 J	0.035 U
	0079-AIR-156	05/07/04	0.036	0.012 J	0.039 U
	0079-AIR-219	05/14/04	0.058 B	0.018 JB	0.062 U
808A, PP  (in crawl space) (in crawl space)	0033-OR-251	09/03/02	0.2 U	0.72 U	0.093 UJ
	0033-OR-276	09/05/02	0.16 U	0.86 U	0.077 U
	0079-AIR-007	11/18/03	0.077	0.02 J	0.039 U
	0079-AIR-008 (FD)	11/18/03	0.071	0.015 J	0.036 U
	0079-AIR-074	11/25/03	0.11	0.03 J	0.037 U
	0079-AIR-157	05/07/04	0.029	0.034 U	0.034 U
	0079-AIR-220	05/14/04	0.051 B	0.022 JB	0.032 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
811A, BZ	0079-AIR-011	11/18/03	0.083	0.021 J	0.041 U
	0079-AIR-077	11/25/03	0.1	0.024 J	0.039 U
	0079-AIR-158	05/07/04	0.034	0.011 J	0.039 U
	0079-AIR-221	05/14/04	0.053 B	0.021 JB	0.017 U
811A, PP	0079-AIR-010	11/18/03	0.061	0.011 J	0.029 U
	0079-AIR-063 (FD)	11/18/03	0.084	0.016 J	0.037 U
	0079-AIR-076	11/25/03	0.11	0.023 J	0.03 U
	0079-AIR-159	05/07/04	0.038	0.0089 J	0.036 U
	0079-AIR-222	05/14/04	0.052 B	0.014 JB	0.033 U
817A, BZ	0079-AIR-060	11/18/03	0.09	0.018 J	0.041 U
	0079-AIR-122	11/25/03	0.13	0.037 J	0.048 U
	0079-AIR-190	05/07/04	0.048 B	0.016 JB	0.036 U
	0079-AIR-252	05/14/04	0.047 B	0.016 JB	0.044 U
817A, PP (in crawl space) (in crawl space)	0079-AIR-059	11/18/03	0.1	0.02 J	0.038 U
	0079-AIR-123	11/25/03	0.11	0.032 J	0.035 U
	0079-AIR-191	05/07/04	0.038 B	0.0081 JB	0.039 U
	0079-AIR-253	05/14/04	0.037 B	0.013 JB	0.037 U
818D, BZ	0079-AIR-015	11/18/03	0.11	0.046	0.036 U
	0079-AIR-079	11/25/03	0.13	0.041	0.04 U
	0079-AIR-160	05/07/04	0.05	0.019 J	0.038 U
	0079-AIR-223	05/14/04	0.077 B	0.041 B	0.035 U
818D, PP	0079-AIR-014	11/18/03	0.1	0.039	0.035 U
	0079-AIR-078	11/25/03	0.13	0.041	0.029 U
	0079-AIR-161	05/07/04	0.052	0.02 J	0.038 U
	0079-AIR-224	05/14/04	0.08 B	0.039 JB	0.041 U
819D, BZ	0033-OR-254	09/03/02	0.18 U	0.68 U	0.087 UJ
	0033-OR-279	09/05/02	0.16 U	0.6 U	0.077 U
	0079-AIR-062	11/18/03	0.1	0.02 J	0.034 U
	0079-AIR-124	11/25/03	0.11	0.025 J	0.0073 J
	B819-D (EPA)*	01/26/04	0.27 U	0.2 U	0.13 U
	0079-AIR-192	05/07/04	0.084 B	0.038 U	0.038 U
	0079-AIR-254	05/14/04	0.046 B	0.01 JB	0.042 U
	0079-AIR-255	05/14/04	0.044 B	0.013 JB	0.034 U
819D, PP	0033-OR-255 (FD)	09/03/02	0.17 U	0.61 U	0.079 UJ
	0033-OR-256	09/03/02	0.17 U	0.64 U	0.082 U
	0033-OR-280	09/05/02	0.16 U	0.6 U	0.077 U
	0079-AIR-061	11/18/03	0.089	0.017 J	0.034 U
	0079-AIR-125	11/25/03	0.11	0.025 J	0.036 U
	0079-AIR-193	05/07/04	0.056 B	0.02 JB	0.042 U
	0079-AIR-256	05/14/04	0.038 B	0.0096 JB	0.036 U
832B, BZ	0079-AIR-026	11/18/03	0.094	0.018 J	0.039 U
	0079-AIR-093	11/25/03	0.11	0.027 J	0.038 U
	B823-B (EPA)	11/24/03	0.27 U	0.2 U	0.13 U
	0079-AIR-146	05/07/04	0.034	0.0061 J	0.039 U
	0079-AIR-209	05/14/04	0.044	0.015 J	0.032 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
832B, PP	0079-AIR-025	11/18/03	0.092	0.021 J	0.074 U
	0079-AIR-092	11/25/03	0.11	0.028 J	0.035 U
	B832-B (EPA)	11/24/03	0.27 U	0.2 U	0.13 U
	0079-AIR-147	05/07/04	0.033	0.0071 J	0.035 U
	0079-AIR-210	05/14/04	0.046	0.012 J	0.037 U
834C, BZ	0079-AIR-028	11/18/03	0.11	0.021 J	0.036 U
	0079-AIR-095	11/25/03	0.11	0.025 J	0.032 U
	0079-AIR-096 (FD)	11/25/03	0.12	0.026 J	0.036 U
	0079-AIR-148	05/07/04	0.059	0.009 J	0.032 U
	0079-AIR-211	05/14/04	0.076	0.015 J	0.035 U
834C, PP (in crawl space) (in crawl space)	0079-AIR-027	11/18/03	0.11	0.019 J	0.035 U
	0079-AIR-094	11/25/03	0.11	0.022 J	0.036 U
	0079-AIR-149	05/07/04	0.04	0.017 J	0.04 U
	0079-AIR-212	05/14/04	0.13	0.06	0.034 U
846A, BZ	0079-AIR-065	11/18/03	0.11	0.019 J	0.03 U
	0079-AIR-126	11/25/03	0.13	0.024 J	0.035 U
	0079-AIR-194	05/07/04	0.071 B	0.0089 JB	0.035 U
	0079-AIR-257	05/14/04	0.067 B	0.011 JB	0.039 U
846A, PP	0079-AIR-064	11/18/03	0.14	0.015 J	0.032 U
	0079-AIR-127	11/25/03	0.14	0.03 J	0.0072 J
	0079-AIR-195	05/07/04	0.079 B	0.014 JB	0.037 U
	0079-AIR-258	05/14/04	0.068 B	0.015 JB	0.034 U
850D, BZ	0079-AIR-021	11/18/03	0.084	0.02 J	0.04 U
	0079-AIR-086	11/25/03	0.11	0.023 J	0.051 U
	0079-AIR-144	05/07/04	0.04	0.0099 J	0.037 U
	0079-AIR-207	05/14/04	0.053	0.017 J	0.04 U
850D, PP	0079-AIR-020	11/18/03	0.089	0.015 J	0.034 U
	0079-AIR-085	11/25/03	0.11	0.025 J	0.037 U
	0079-AIR-145	05/07/04	0.043	0.0055 J	0.037 U
	0079-AIR-208	05/14/04	0.056	0.033 U	0.033 U
DAY CARE, BZ (not over plume)	0079-AIR-042	11/18/03	0.16	0.033 J	0.056 U
	0079-AIR-106	11/25/03	0.18	0.049	0.0082 J
	0079-AIR-131	11/25/03	0.17	0.044	0.0092 J
	0079-AIR-173	05/07/04	0.032	0.0098 J	0.038 U
	0079-AIR-174	05/07/04	0.032	0.0097 J	0.037 U
	0079-AIR-232	05/14/04	0.036	0.015 J	0.038 U
	0079-AIR-233	05/14/04	0.049	0.025 J	0.036 U
DAY CARE, PP (not over plume)	0079-AIR-043	11/18/03	0.11	0.03 J	0.034 U
	0079-AIR-107	11/25/03	0.14	0.039 J	0.039 U
	0079-AIR-175	05/07/04	0.04	0.012 J	0.042 U
	0079-AIR-234	05/14/04	0.049	0.022 J	0.037 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
<b>OPHA Outdoor Air Samples</b>					
B ROAD DIAMOND	0079-AIR-002	11/18/03	0.11	0.027 J	0.03 U
	0079-AIR-080	11/25/03	0.092	0.02 J	0.035 U
	0079-AIR-134	05/07/04	0.034	0.014 J	0.023 J
	0079-AIR-197	05/14/04	0.039	0.012 J	0.038 U
DAY CARE PG (not over plume)	0079-AIR-038	11/18/03	0.096	0.022 J	0.035 U
	0079-AIR-039 (FD)	11/18/03	0.096	0.02 J	0.032 U
	0079-AIR-104	11/25/03	0.13	0.036	0.036 U
	0079-AIR-167	05/07/04	0.019	0.0054 J	0.031 U
	0079-AIR-168 (FD)	05/07/04	0.023	0.04 U	0.04 U
	0079-AIR-229	05/14/04	0.046	0.019 J	0.036 U
OUTDOOR 720 PG	0033-OR-261	09/03/02	0.26 U	12 U	0.12 U
	0033-OR-286	09/05/02	0.19	0.66 U	0.085 U
	0079-AIR-053	11/18/03	0.17	0.075	0.0095 J
	0079-AIR-129	11/25/03	0.18	0.094	0.014 J
	0079-AIR-169	05/07/04	0.023	0.0063 J	0.037 U
	0079-AIR-235	05/14/04	0.075	0.023 J	0.019 J
OUTDOOR 721	OUT-B721 (EPA)	01/26/04	0.27 U	0.1 U	0.13 U
OUTDOOR B ROAD 714	0079-AIR-044	11/18/03	0.097	0.02 J	0.049 U
	0079-AIR-105	11/25/03	0.11	0.025 J	0.04 U
	OUT-B714 (EPA)	01/26/04	0.27 U	0.1 U	0.13 U
	OUT-B714 (EPA)	02/09/04	0.27 U	0.2 U	0.13 U
	0079-AIR-170	05/07/04	0.028	0.005 J	0.033 U
	0079-AIR-240	05/14/04	0.069	0.023 J	0.011 J
	0079-AIR-241	05/14/04	0.071	0.022 J	0.039 U
STEVENS PG	0033-OR-258	09/03/02	0.17 U	0.83 U	0.08 U
	033-OR-282	09/05/02	0.15 U	0.88 U	0.073 U
	0079-AIR-058	11/18/03	0.18	0.021 J	0.04 U
	0079-AIR-130	11/25/03	0.1	0.027 J	0.0065 J
	0079-AIR-189	05/07/04	0.049 B	0.035 U	0.035 U
	0079-AIR-251	05/14/04	0.039 B	0.014 JB	0.014 J
VERNON E. LOT	0079-AIR-022	11/18/03	0.1	0.021 J	0.033 U
	0079-AIR-087	11/25/03	0.1	0.022 J	0.079 U
	0079-AIR-090 (FD)	11/25/03	0.15	0.045	0.01 J
	0079-AIR-137	05/07/04	0.037	0.01 J	0.037 U
	0079-AIR-199	05/14/04	0.039	0.0091 J	0.036 U
VERNON PG	0033-OR-253	09/03/02	0.18 U	0.68 U	0.087 UJ
	0033-OR-278	09/05/02	1.6	0.72 U	0.071 U
	0079-AIR-001	11/18/03	0.09	0.028 J	0.036 U
	0079-AIR-067	11/25/03	0.097	0.023 J	0.037 U
	0079-AIR-138	05/07/04	0.023	0.041 U	0.041 U
	0079-AIR-200	05/14/04	0.076	0.017 J	0.036 U
OUTDOOR 727F	B727-F (EPA)	05/06/04	0.27 U	0.2 U	0.13 U
	0079-AIR-135	05/07/04	0.03	0.0082 J	0.039 U
	0079-AIR-136 (FD)	05/07/04	0.028	0.039 U	0.039 U
	0079-AIR-198	05/14/04	0.043	0.019	0.035 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
<b>WHA Indoor Air Samples</b>					
C1, BZ (not over plume)	0079-AIR-031	11/18/03	0.11	0.016 J	0.034 U
	0079-AIR-098	11/25/03	0.13	0.024 J	0.032 U
	BC-1 (EPA)	11/24/03	0.32	0.2 U	0.13 U
	0079-AIR-163	05/07/04	0.083	0.038 U	0.038 U
	0079-AIR-226	05/14/04	0.12	0.018 J	0.037 U
C1, PP (not over plume)	0079-AIR-029	11/18/03	0.13	0.018 J	0.031 U
	0079-AIR-030 (FD)	11/18/03	0.12	0.014 J	0.031 U
	0079-AIR-097	11/25/03	0.1	0.018 J	0.0077 J
	BC-1 (EPA)	11/24/03	0.2 J	0.2 U	0.13 U
	0079-AIR-164	05/07/04	0.04	0.035 U	0.035 U
	0079-AIR-165	05/07/04	0.04	0.037 U	0.037 U
	0079-AIR-227	05/14/04	0.11	0.016 J	0.032 U
619B, BZ	0033-OR-245	09/03/02	0.17 U	0.85 U	0.082 UJ
	0033-OR-268	09/05/02	0.18 U	0.87 U	0.085 U
	0033-OR-269 (FD)	09/05/02	0.19 U	0.89 U	0.089 U
	0079-AIR-037	11/18/03	0.1	0.021 J	0.04 U
	0079-AIR-103	11/25/03	0.099	0.02 J	0.038 U
	B619-B (EPA)	11/24/03	0.24 J	0.2 U	0.13 U
619B, PP	0079-AIR-036	11/18/03	0.11	0.019 J	0.037 U
	0079-AIR-102	11/25/03	0.1	0.022 J	0.035 U
620E, BZ	B620-E (EPA)*	01/25/04	<b>4.2</b>	0.2 U	0.13 U
	B620-E (EPA)*	02/09/04	<b>3.2</b>	0.2 U	0.13 U
620F, BZ	0033-OR-248	09/03/02	<b>4.2</b>	0.64 U	0.082 UJ
	0033-OR-273	09/05/02	<b>0.97</b>	0.78 U	0.077 U
	0079-AIR-034	11/18/03	<b>1</b>	0.021 J	0.031 U
	0079-AIR-035 (FD)	11/18/03	<b>1.1</b>	0.021 J	0.036 U
	0079-AIR-101	11/25/03	<b>2</b>	0.024 J	0.036 U
	B620-F (EPA)*	01/25/04	<b>4</b>	0.2 U	0.13 U
	B620-F (EPA)*	2/9/2004	0.88	0.2 U	0.13 U
620F, PP	0079-AIR-032 (FD)	11/18/03	<b>1.2</b>	0.026 J	0.034 U
	0079-AIR-033	11/18/03	<b>1.1</b>	0.02 J	0.032 U
	0079-AIR-099	11/25/03	<b>2.2</b>	0.025 J	0.033 U
	0079-AIR-100	11/25/03	<b>2.2</b>	0.025 J	0.038 U
<b>WHA Outdoor Air Samples</b>					
BERRY DR. (not over plume)	0079-AIR-023	11/18/03	0.091	0.017 J	0.035 U
	0079-AIR-088	11/25/03	0.089	0.016 J	0.05 U
	0079-AIR-162	05/07/04	0.022	0.041 U	0.041 U
	0079-AIR-225	05/14/04	0.048	0.032 U	<b>0.73</b>
WESCOAT PG	0033-OR-247	09/03/02	0.16 U	1.1 U	0.077 UJ
	0033-OR-272	09/05/02	0.17 U	0.9 U	0.08 U
	0079-AIR-024	11/18/03	0.12	0.02 J	0.035 U
	Wescoat PG (EPA)	11/24/03	0.27 U	0.2 U	0.13 U
	0079-AIR-089	11/25/03	0.11	0.021 J	0.036 U
	0079-AIR-091 (FD)	11/25/03	0.098	0.019 J	0.038 U
	Wescoat PG (EPA)	01/26/04	0.27 U	0.1 U	0.13 U
	Wescoat PG (EPA)	2/9/2004	0.27 U	0.2 U	0.13 U

TABLE 3-1

## AIR SAMPLE ANALYTICAL RESULTS

Location	Sample ID	Sample Date	TCE ( $\mu\text{g}/\text{m}^3$ )	cis-1,2-DCE ( $\mu\text{g}/\text{m}^3$ )	VC ( $\mu\text{g}/\text{m}^3$ )
<b>Trip Blank</b>					
TRIP BLANK	0079-AIR-066	11/18/03	0.01 U	0.025 U	0.025 U
	0079-AIR-132	11/25/03	0.0034 J	0.025 U	0.025 U
	0079-AIR-196	05/07/04	0.0052 JB	0.025 U	0.025 U
	0079-AIR-166	05/07/04	0.0072 J	0.025 U	0.015 J
	0079-AIR-228	05/14/04	0.0052 J	0.025 U	0.025 U
	0079-AIR-259	05/14/04	0.0032 JB	0.025 U	0.025 U

**Notes:**

Sample Date indicates the dates Navy samples were collected and the dates provided to the Navy by the EPA. EPA's samples with sample dates of 11/24/03 and 05/06/04 were actually collected on 11/25/03 and 05/07/04, the same date as the Navy samples.

Bold results indicate results greater than the Cal/EPA's OEHHA benchmark long-term residential health-based concentration for TCE of  $0.96 \mu\text{g}/\text{m}^3$ , the EPA Region 9 PRG for VC of  $0.11 \mu\text{g}/\text{m}^3$ , or the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC of  $0.0246 \mu\text{g}/\text{m}^3$

\* - January 26 and February 9, 2004 EPA samples were collected with the unit heating system on.

**Abbreviations and Acronyms:**

$\mu\text{g}/\text{m}^3$  - micrograms per cubic meter

B - detected in method blank

BZ - breathing zone

Cal/EPA OEHHA - California Environmental Protection Agency Office of Environmental Health Hazard Assessment

DCE - dichloroethene

EPA - U.S. Environmental Protection Agency

FD - field duplicate

J - estimated value

OPHA - Orion Park Housing Area

PG - playground

PP - preferential pathway

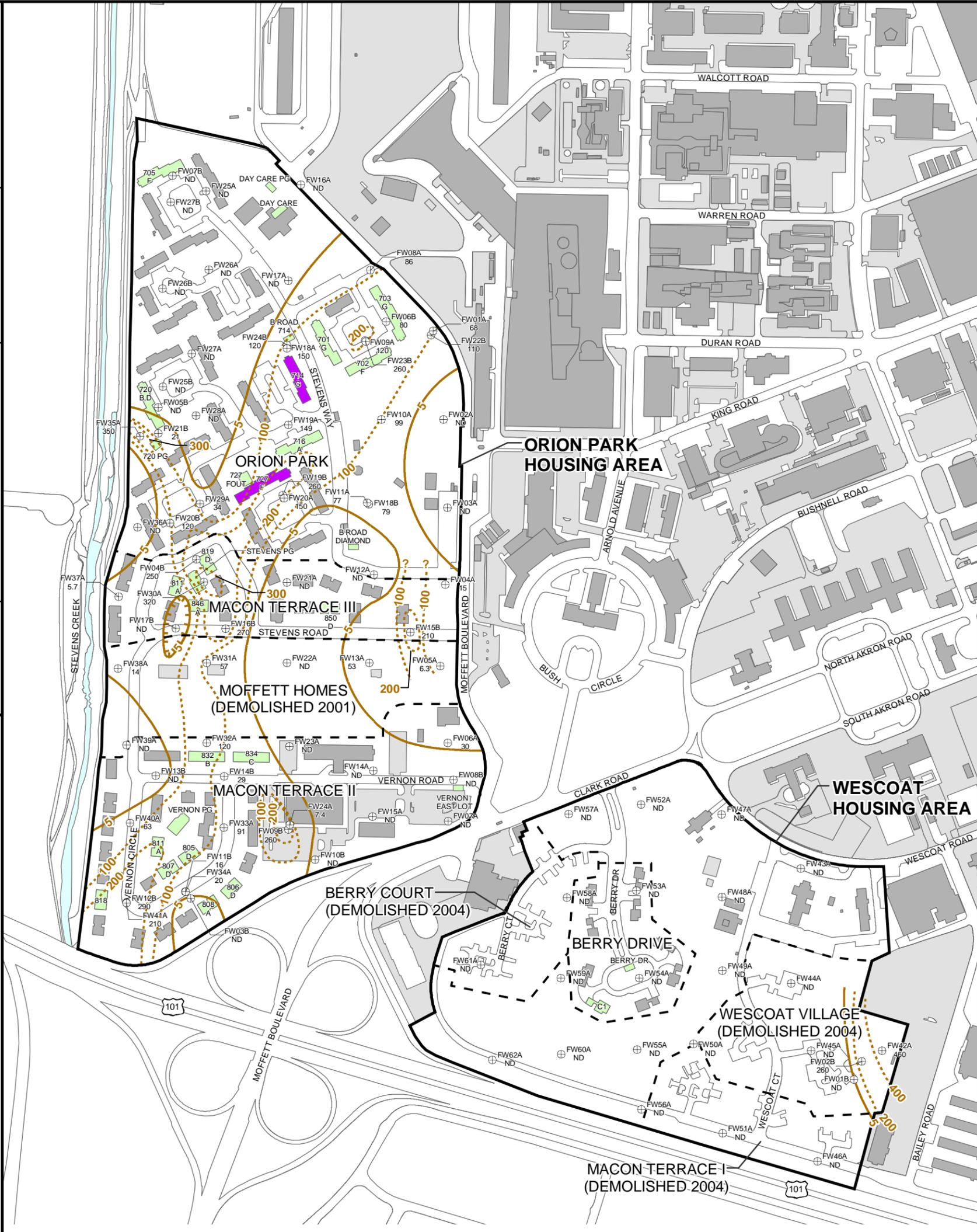
TCE - trichloroethene

U - not detected at or above the reporting limit (value indicates the reporting limit)

VC - vinyl chloride

WHA - Wescoat Housing Area

DRAWING NO:	050526C215.mxd		
DCN:	FWS-D-RAC-05-0526	CTO:	0079
APPROVED BY:	BM	CHECKED BY:	LAD
REVISION:	1	DATE:	3/11/05
DRAWN BY:	GFG		



**LEGEND**

- FW12B, 290 PHASE 1 OR PHASE 2 FIRST-OBSERVED GROUNDWATER SAMPLE LOCATION AND TCE CONCENTRATION IN µg/L
- ROAD
- HOUSING DEVELOPMENT BOUNDARY
- ISOCONCENTRATION IN µg/L, DASHED WHERE INFERRED
- SAMPLE LOCATION WITH TCE CONCENTRATION LESS THAN 0.96 µg/m³  
BUILDING NUMBER UNIT
- SAMPLE LOCATION WITH TCE CONCENTRATION GREATER THAN 0.96 µg/m³
- PAVED SURFACE
- BUILDING
- WATER
- ARMY RESIDENTIAL COMMUNITY BOUNDARY

- NOTES:**
- ND - NOT DETECTED AT THE LABORATORY REPORTING LIMIT OF 5 µg/L
  - PG - PLAYGROUND
  - µg/L - MICROGRAMS PER LITER



Scale: 1" = 400'

DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29

**BASE REALIGNMENT AND CLOSURE  
PROGRAM MANAGEMENT OFFICE WEST  
SAN DIEGO, CA**

**FIGURE 3-1  
MAY 2004 AIR SAMPLING LOCATIONS WITH TCE CONCENTRATIONS  
GREATER THAN CAL/EPA OEHHA VALUE OF 0.96 µg/m³ AND  
TCE CONCENTRATIONS IN FIRST-OBSERVED GROUNDWATER  
FORMER NAS MOFFETT FIELD  
MOFFETT FIELD, CA**



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FIGURE 3-2

TCE Results for Building 705F, Day Care Center, and Building C1

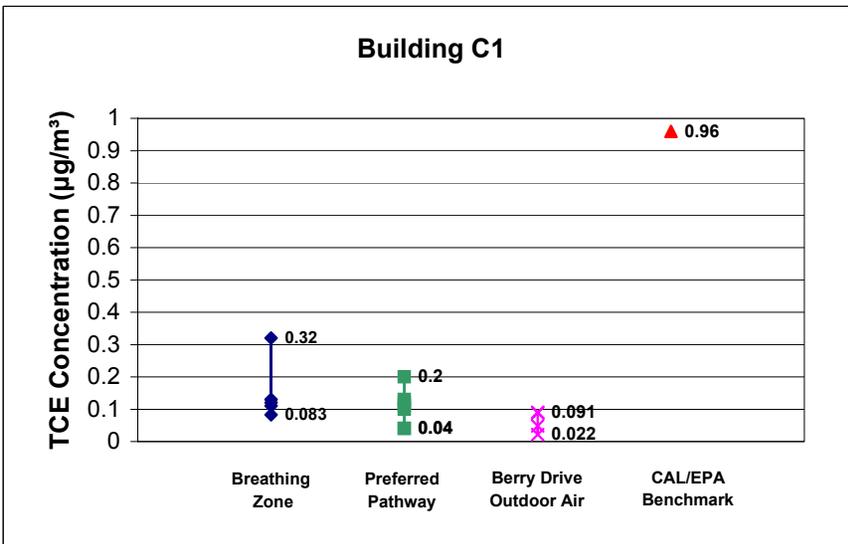
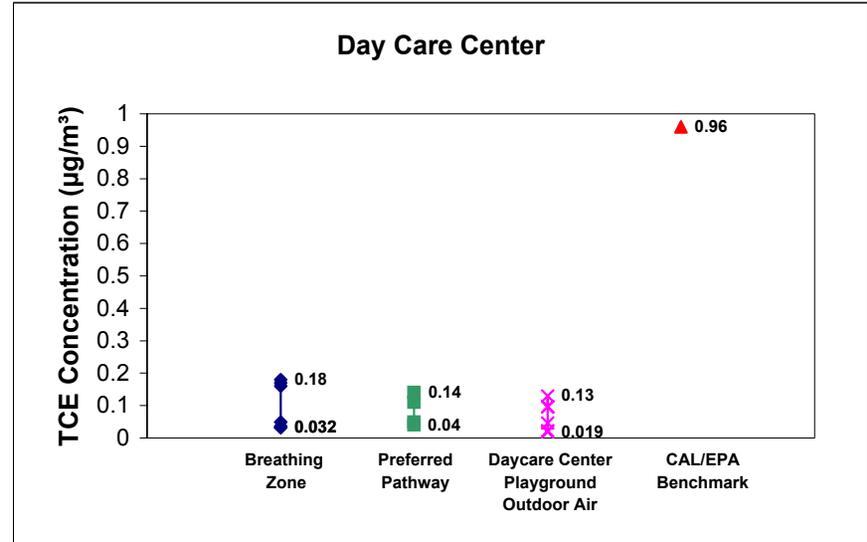
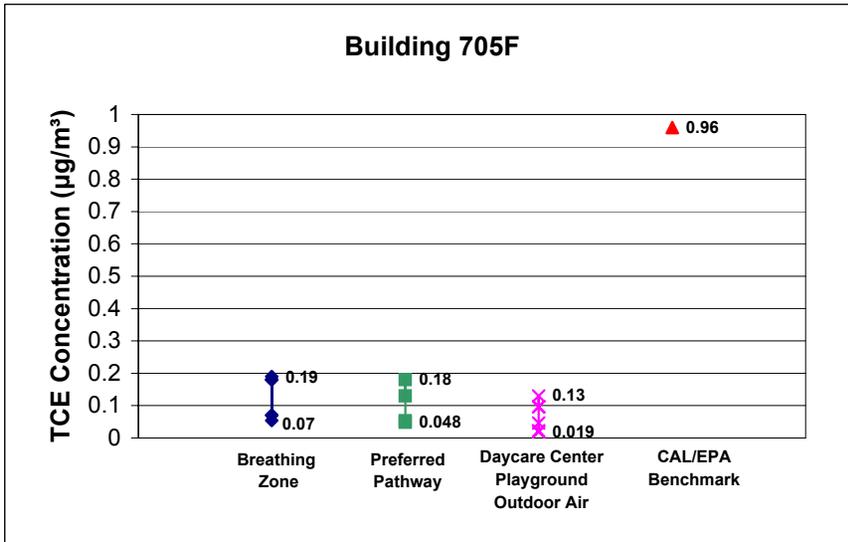


FIGURE 3-3

TCE Results for Buildings 701G, 702F, 703G, and 714G

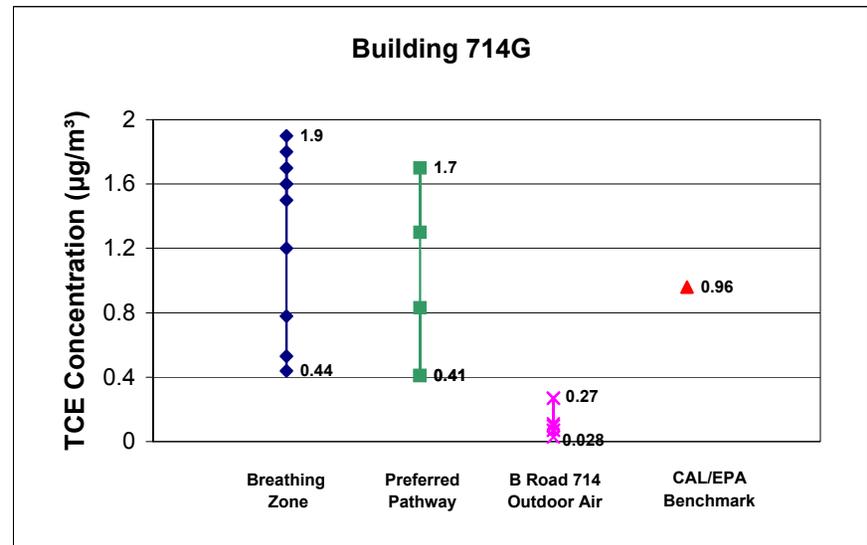
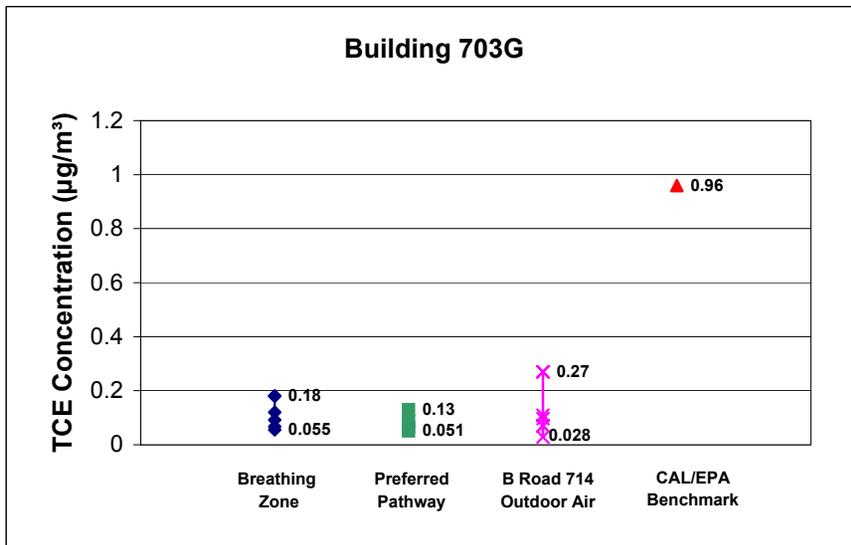
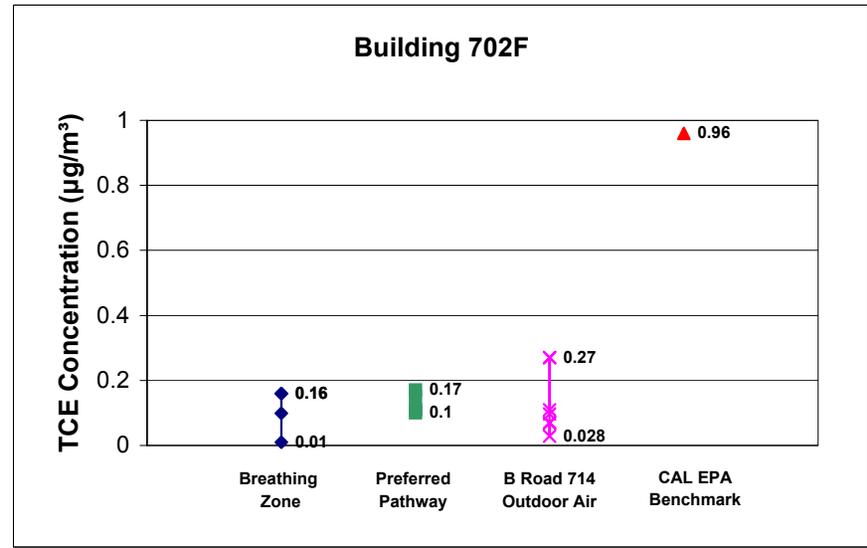
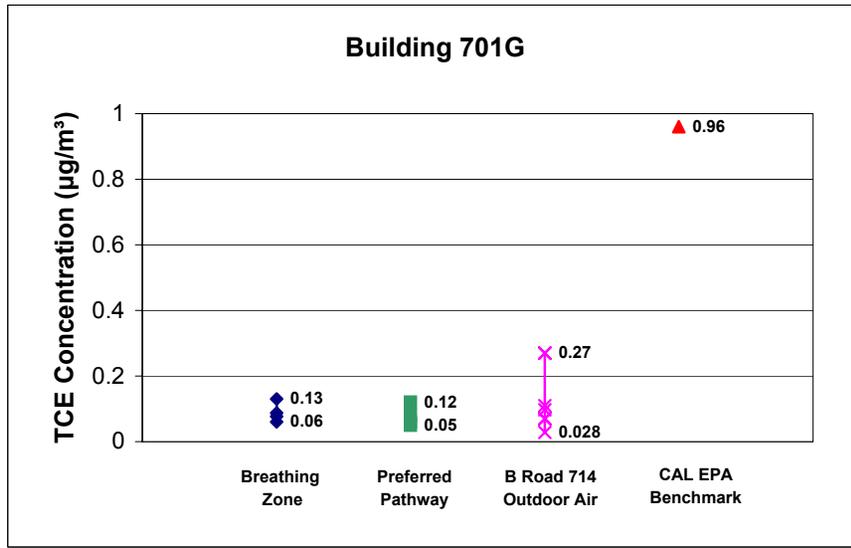


FIGURE 3-4

TCE Results for Buildings 716A, 720B, 720D, 727E

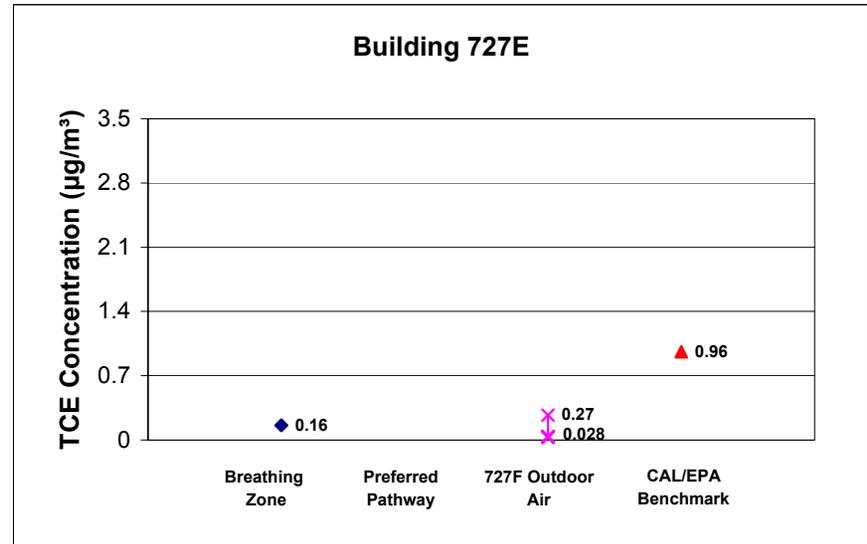
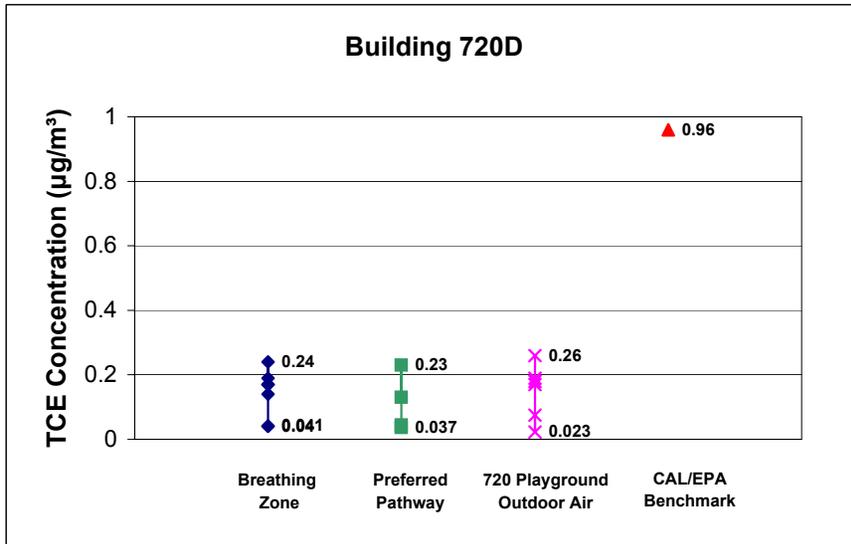
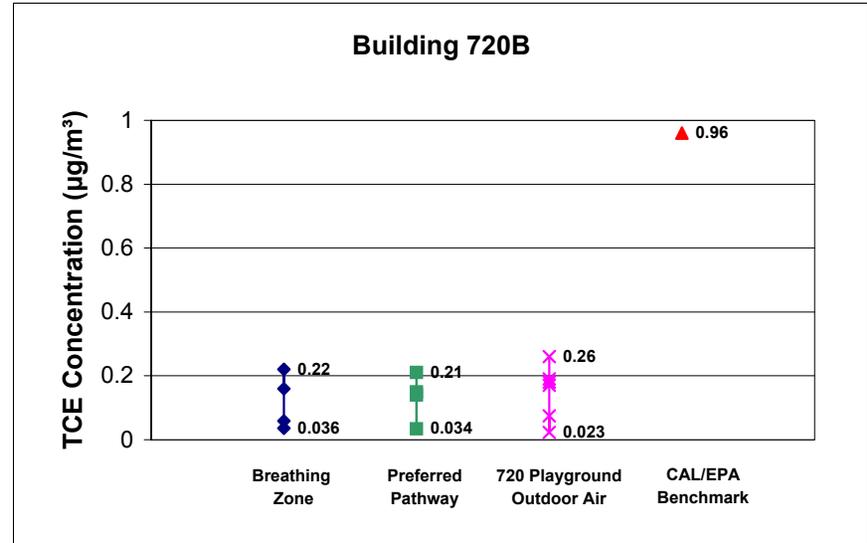
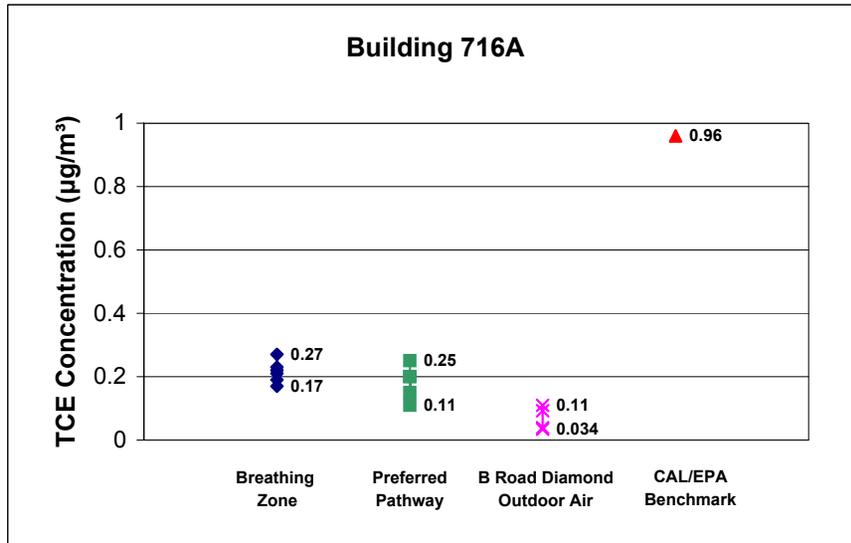


FIGURE 3-5

TCE Results for Buildings 727F, 805D, 806D, and 807D

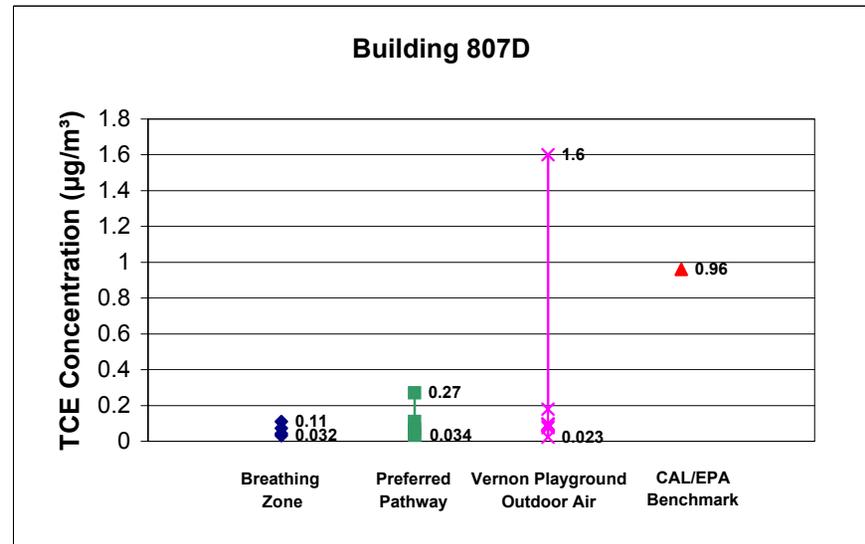
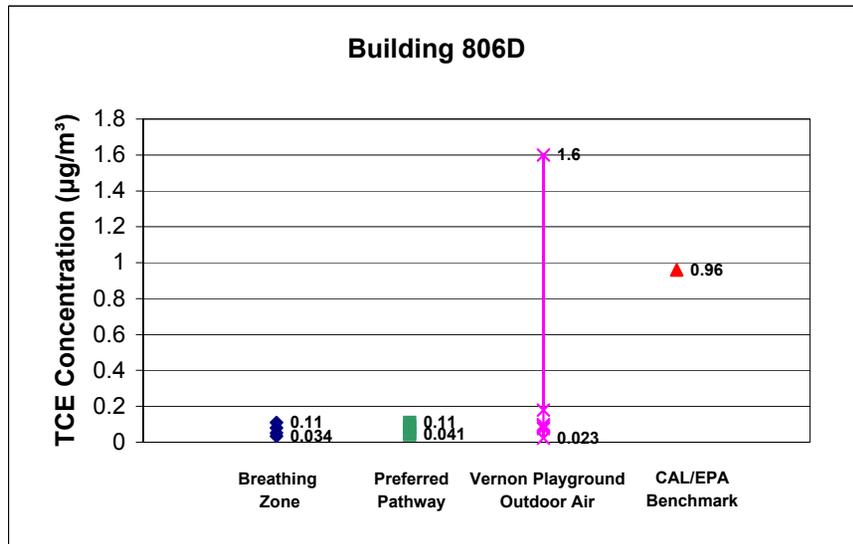
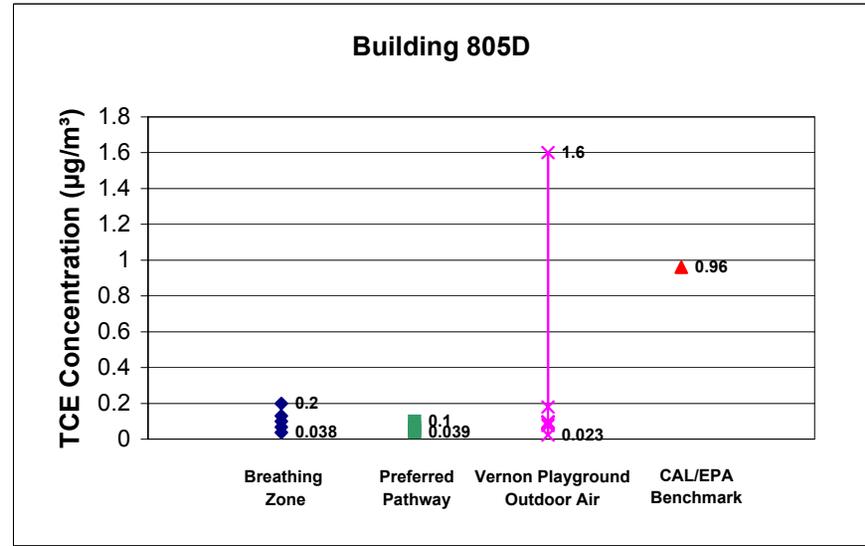
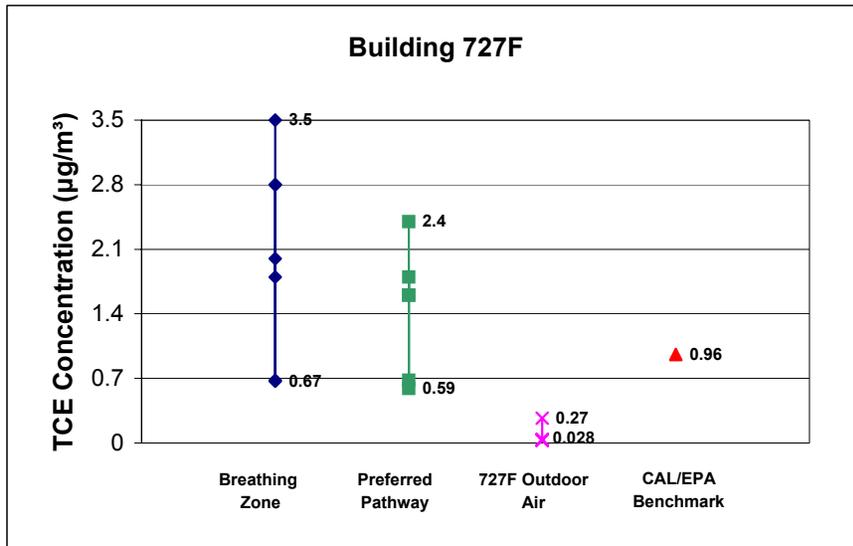


FIGURE 3-6

TCE Results for Buildings 808A, 811A, 817A, and 818D

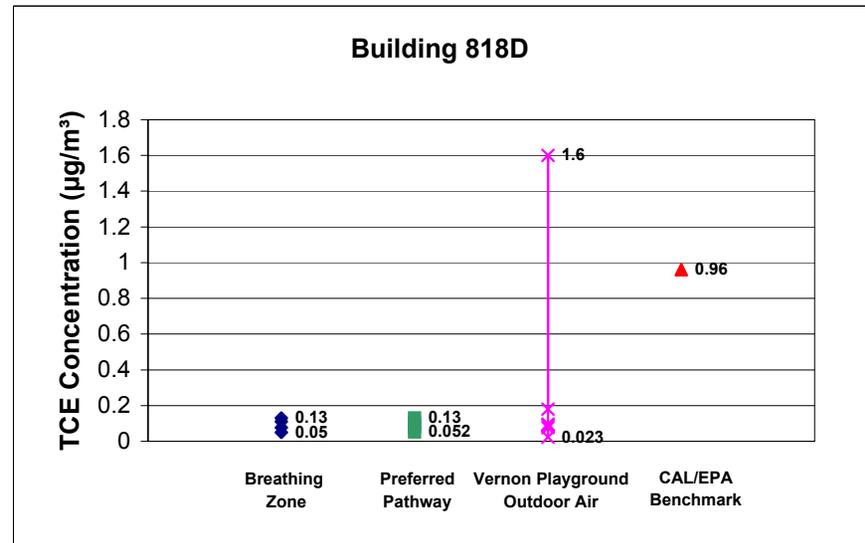
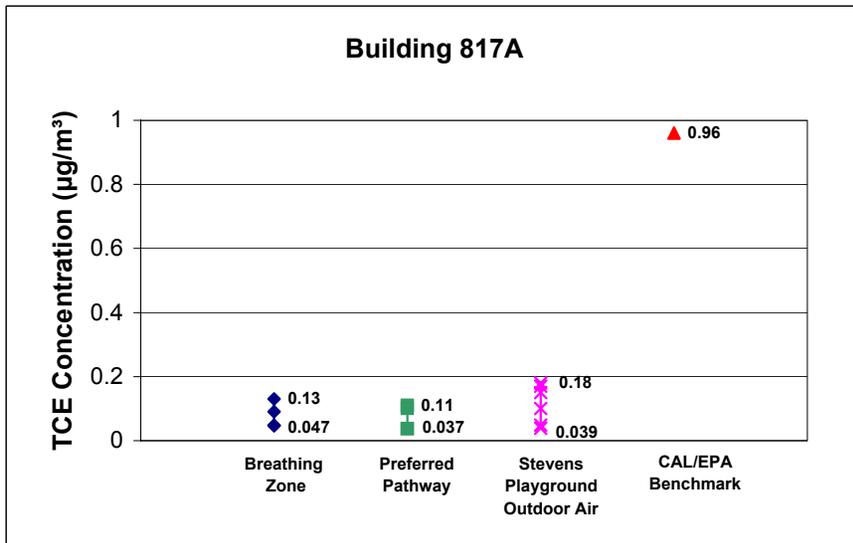
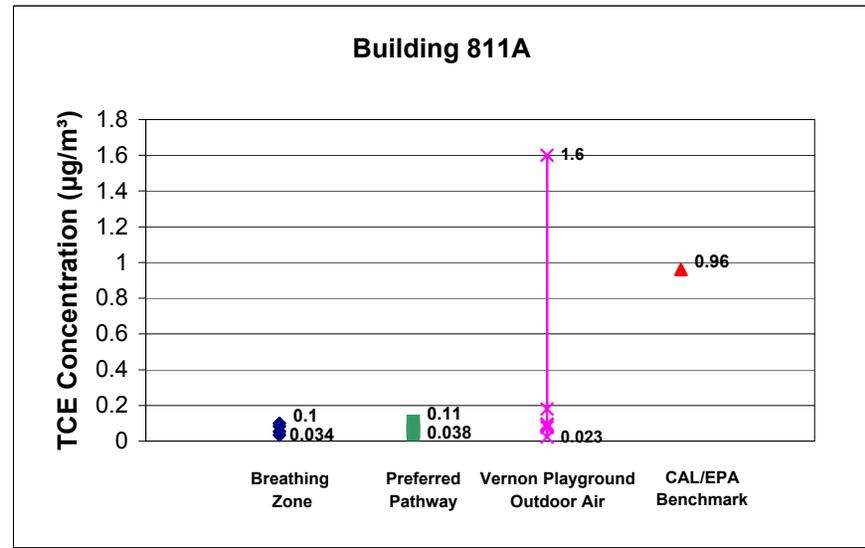
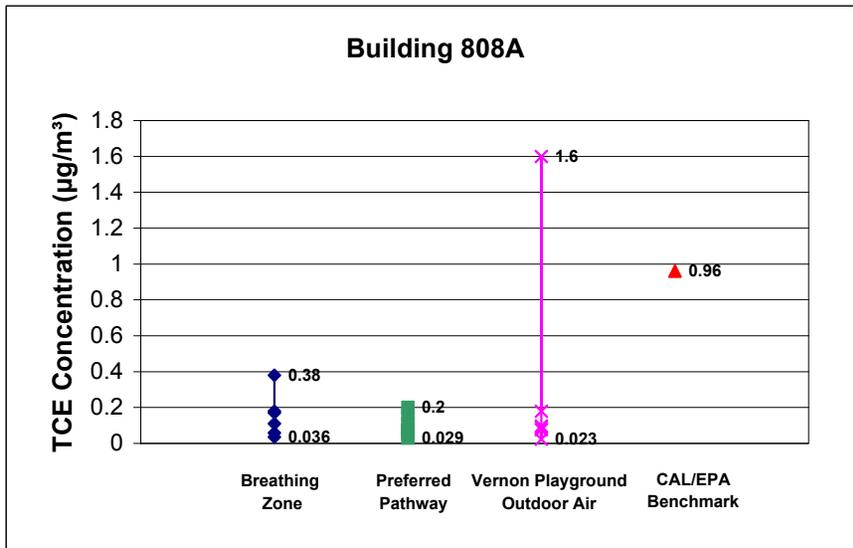


FIGURE 3-7

TCE Results for Buildings 819D, 832B, 834C, and 846A

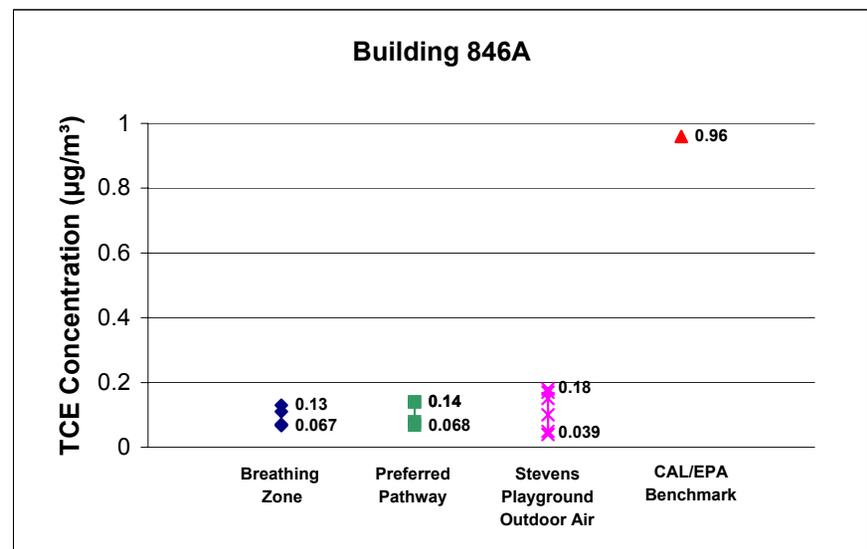
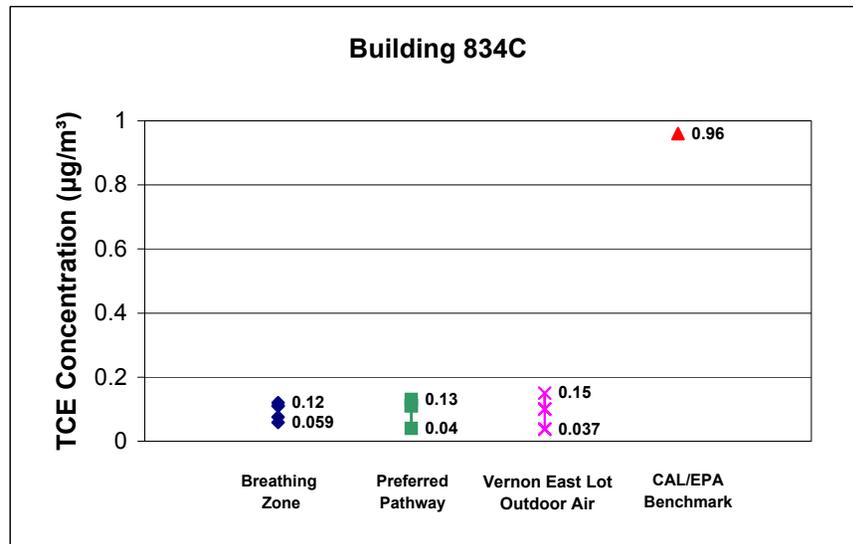
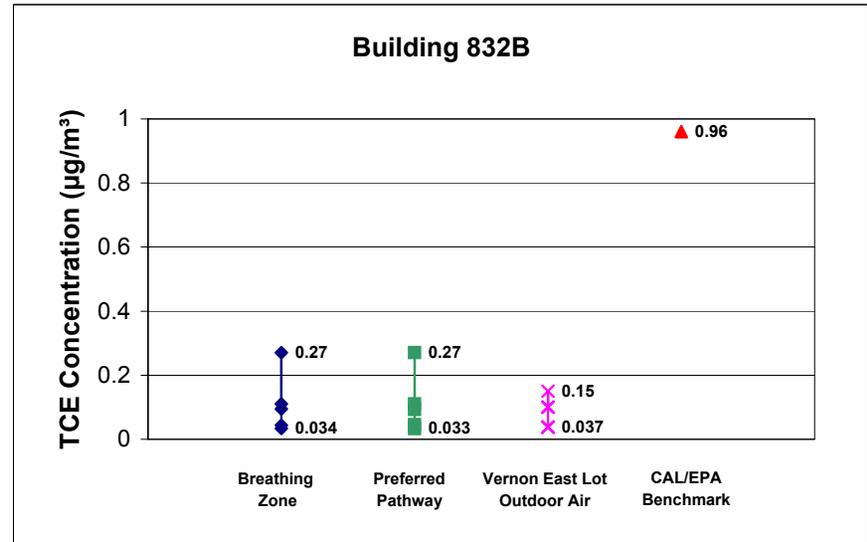
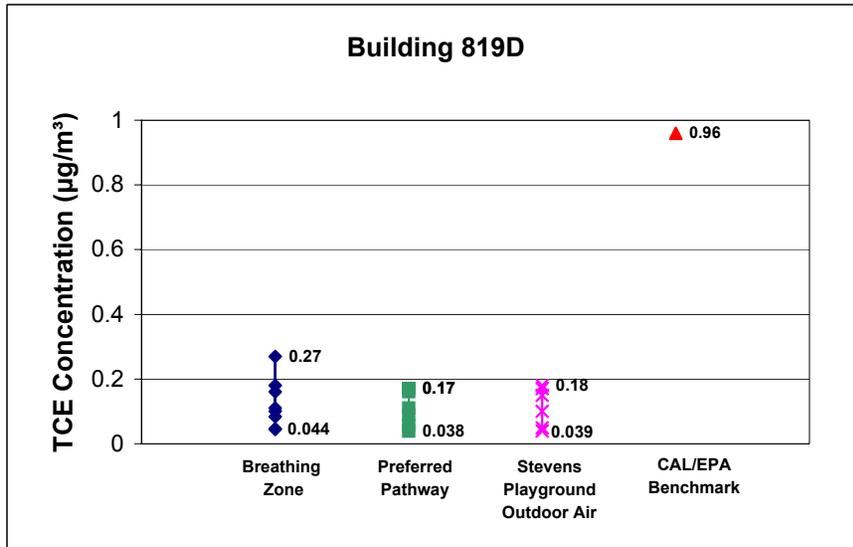
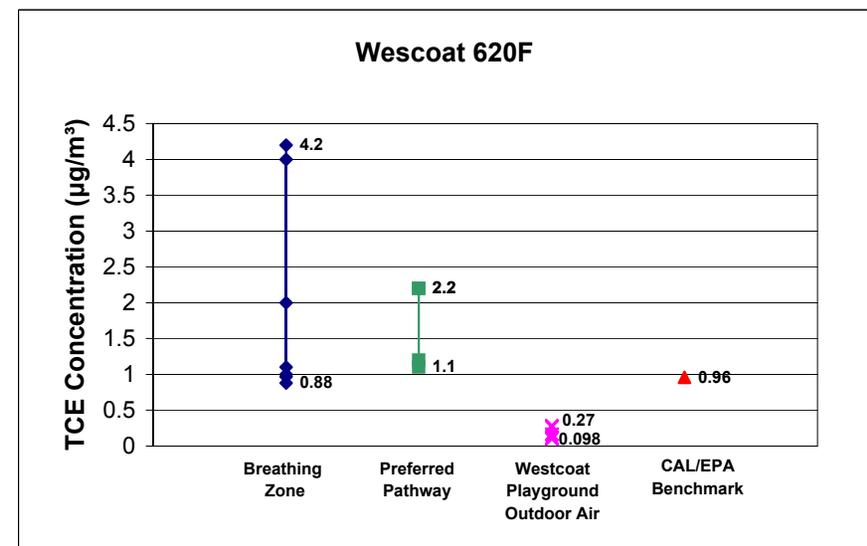
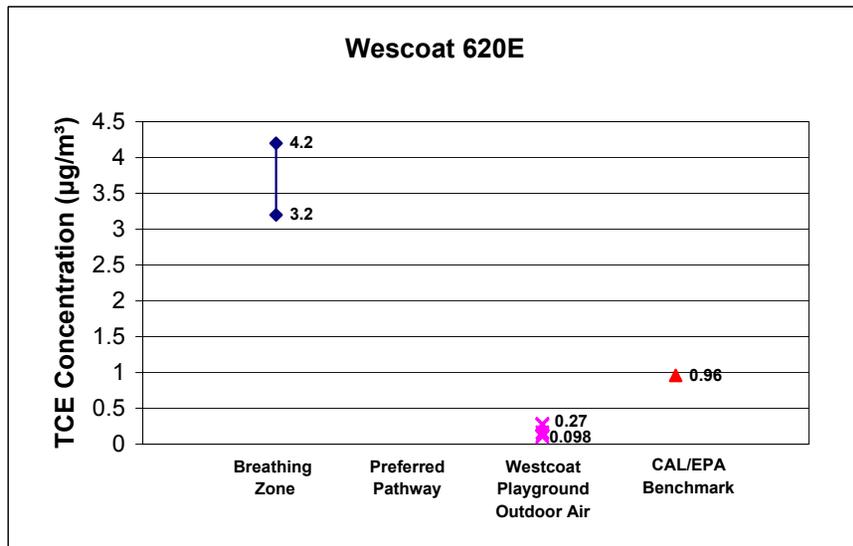
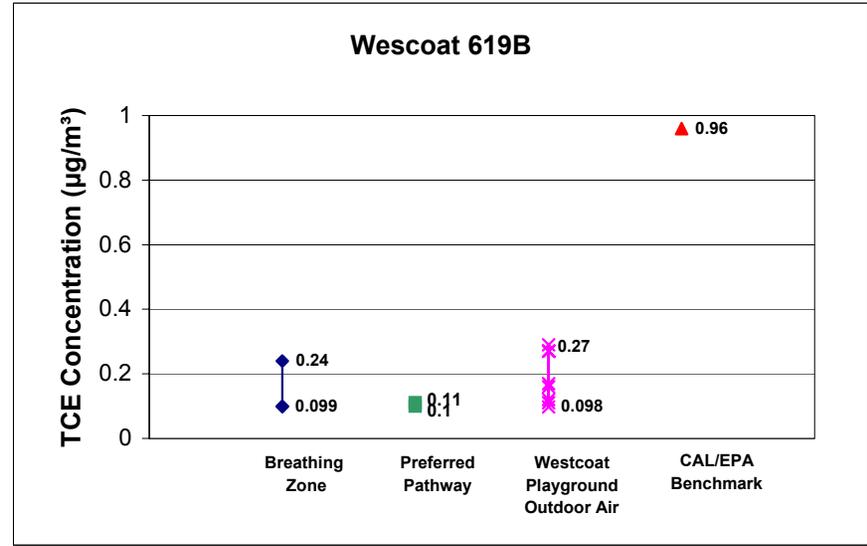
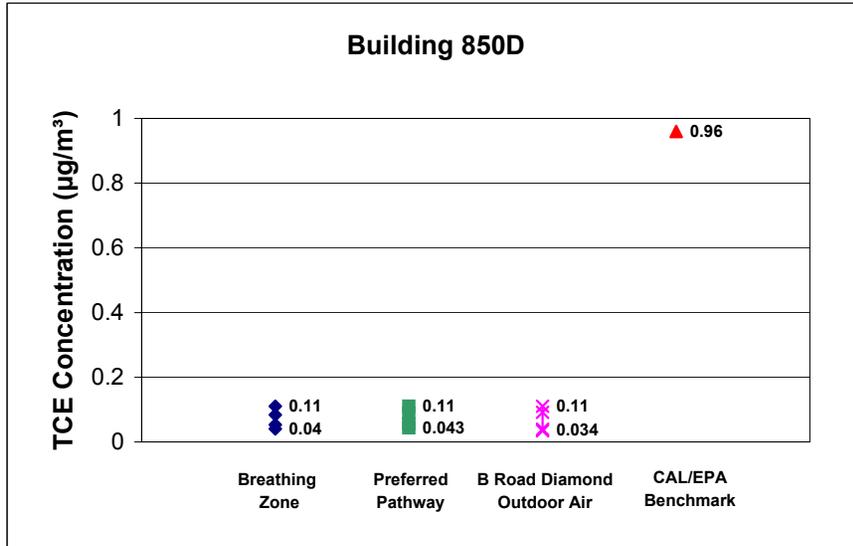


FIGURE 3-8

TCE Results for Buildings 850D, 619B, 620E, and 620F



off-plume TCE outdoor air sample data interpretation is not affected by evaluating the mixed data set.

Cis-1,2- DCE was sporadically detected at off-plume locations at concentrations ranging from nondetect to a maximum of  $0.07 \mu\text{g}/\text{m}^3$  in the breathing zone of unit 705F. Cis-1,2-DCE concentrations were not detected in off-plume samples above the EPA Region 9 PRG in ambient air ( $37 \mu\text{g}/\text{m}^3$ ). The off-plume cis-1,2-DCE air data interpretation is not affected by evaluating the mixed data set. Cal/EPA OEHHA does not list air toxicity criteria for cis-1,2-DCE, and therefore an inhalation long-term residential health-based exposure benchmark for cis-1,2-DCE cannot be calculated.

VC was detected above reporting limits in one sample during the Navy's November 2003/May 2004 sampling events and in one sample collected by the Navy in September 2002. The samples were collected at the outdoor WHA location (Berry Drive) on May 14, 2004, with a reported concentration of  $0.73 \mu\text{g}/\text{m}^3$ , and at an indoor OPHA location (unit 705F) on September 3, 2002, with a reported concentration of  $0.17 \mu\text{g}/\text{m}^3$ . The concentrations reported for the two samples exceeded the EPA Region 9 PRG for VC in ambient air ( $0.11 \mu\text{g}/\text{m}^3$ ), and the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC ( $0.0246 \mu\text{g}/\text{m}^3$ ).

### **3.1.2 Above-plume Results**

Breathing zone and preferential pathway air samples were collected from 22 OPHA and WHA housing units located above first-observed TCE-impacted groundwater during the Navy's November 2003/May 2004 sampling events. Two additional housing units, one at OPHA (unit 727E) and one at WHA (unit 620E), were sampled by the EPA in January and February 2004. Outdoor air breathing zone samples were collected from eight OPHA and WHA locations above first-observed TCE-impacted groundwater. Sample locations with TCE concentrations greater than the Cal/EPA OEHHA concentration of  $0.96 \mu\text{g}/\text{m}^3$  are shown on Figure 3-1. TCE results by location are shown on Figures 3-3 through 3-8.

The following subsections describe analytical results by sample type: indoor breathing zone, indoor preferential pathway, and outdoor breathing zone.

#### **3.1.2.1 Indoor Air Breathing Zone**

TCE concentrations were detected in all indoor breathing zone air samples collected at OPHA and WHA during the Navy's November 2003/May 2004 sampling events. Indoor breathing zone results at OPHA units ranged from  $0.01 \mu\text{g}/\text{m}^3$  to  $2.8 \mu\text{g}/\text{m}^3$ , with an average value of  $0.27 \mu\text{g}/\text{m}^3$ . Indoor breathing zone results at WHA units ranged from  $0.10 \mu\text{g}/\text{m}^3$  to  $2.0 \mu\text{g}/\text{m}^3$ , with an average value of  $0.85 \mu\text{g}/\text{m}^3$ .

When the mixed data set is evaluated, indoor breathing zone results at OPHA units ranged from 0.01  $\mu\text{g}/\text{m}^3$  to 3.8  $\mu\text{g}/\text{m}^3$ . Indoor breathing zone results at WHA units ranged from 0.10  $\mu\text{g}/\text{m}^3$  to 4.2  $\mu\text{g}/\text{m}^3$ . Average values were not calculated for mixed data due to the large range in laboratory reporting limits and the number of analytical results that were less than the representative laboratory reporting limits. Such a calculation would result in a biased high average value.

TCE concentrations were greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  in some of the breathing zone air samples from OPHA units 727F, 714G, and WHA unit 620F. TCE concentrations were consistently greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  in unit 620E, sampled only by the EPA in January and February 2004. TCE concentrations in these four units are summarized below:

- Breathing zone sample TCE concentrations in unit 727F ranged from 0.67  $\mu\text{g}/\text{m}^3$  to 2.8  $\mu\text{g}/\text{m}^3$  (0.67  $\mu\text{g}/\text{m}^3$  to 3.5  $\mu\text{g}/\text{m}^3$  when the mixed data set is evaluated)
- Breathing zone sample TCE concentrations in unit 714G ranged from 0.44  $\mu\text{g}/\text{m}^3$  to 1.7  $\mu\text{g}/\text{m}^3$  (0.44  $\mu\text{g}/\text{m}^3$  to 1.9  $\mu\text{g}/\text{m}^3$  when the mixed data set is evaluated)
- Breathing zone sample TCE concentrations in unit 620F ranged from 1  $\mu\text{g}/\text{m}^3$  to 2  $\mu\text{g}/\text{m}^3$  (0.88  $\mu\text{g}/\text{m}^3$  to 4.2  $\mu\text{g}/\text{m}^3$  when the mixed data set is evaluated)
- Breathing zone sample TCE concentrations in unit 620E, sampled only by the EPA in January and February 2004, with the unit's heating system operating, ranged from 3.2  $\mu\text{g}/\text{m}^3$  to 4.2  $\mu\text{g}/\text{m}^3$

TCE concentrations detected in breathing zone samples collected from the remaining housing units during the Navy's November 2003/May 2004 sampling events ranged from 0.01  $\mu\text{g}/\text{m}^3$  to 0.24  $\mu\text{g}/\text{m}^3$ , with an average value of 0.09  $\mu\text{g}/\text{m}^3$ . This average value is the same as the average off-plume breathing zone concentration. The maximum TCE concentrations from 38 of 52 above-plume sample locations were less than or equal to the maximum off-plume concentration of 0.19  $\mu\text{g}/\text{m}^3$  (less than the maximum off-plume concentration of 0.32  $\mu\text{g}/\text{m}^3$  when the mixed data set is evaluated).

Cis-1,2-DCE was detected sporadically during the Navy's November 2003/May 2004 sampling events at concentrations ranging from nondetect to a maximum of 0.12  $\mu\text{g}/\text{m}^3$  in breathing zone samples. All sample results were below the EPA Region 9 PRG in ambient air (37  $\mu\text{g}/\text{m}^3$ ).

VC was not detected above the reporting limit in any indoor air sample during the Navy's November 2003/May 2004 sampling events. All sample results were below the EPA Region 9 PRG for VC in ambient air (0.11  $\mu\text{g}/\text{m}^3$ ) and the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC (0.0246  $\mu\text{g}/\text{m}^3$ ).

The mixed data set includes 31 additional above-plume indoor air breathing zone samples. The indoor air breathing zone interpretation for cis-1,2-DCE and VC are not affected by evaluation of the mixed data set.

### 3.1.2.2 Indoor Air Preferential Pathway

TCE concentrations were detected in all indoor preferential pathway air samples collected at OPHA and WHA during the Navy's November 2003/May 2004 sampling events. Indoor preferential pathway results at OPHA units ranged from 0.029  $\mu\text{g}/\text{m}^3$  to 2.4  $\mu\text{g}/\text{m}^3$ , with an average value of 0.21  $\mu\text{g}/\text{m}^3$ . Indoor preferential pathway results at WHA units ranged from 0.1  $\mu\text{g}/\text{m}^3$  to 2.2  $\mu\text{g}/\text{m}^3$ , with an average value of 1.1  $\mu\text{g}/\text{m}^3$ .

TCE concentrations were greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  in some of the preferential pathway air samples in OPHA units 727F and 714G. TCE concentrations were consistently greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  in WHA unit 620F. Unit 620F was only sampled in November 2003, because the Army demolished all WHA units (except the historical homes located along Berry Drive). Preferential pathway samples were not collected from unit 620E. TCE concentrations in these three units are summarized below:

- Preferential pathway sample TCE concentrations in unit 727F ranged from 0.68  $\mu\text{g}/\text{m}^3$  to 2.4  $\mu\text{g}/\text{m}^3$ . The maximum preferential pathway sample TCE concentration (2.4  $\mu\text{g}/\text{m}^3$ ) was less than the maximum breathing zone sample TCE concentration (2.8  $\mu\text{g}/\text{m}^3$ ); both were obtained during the May 14, 2004 sampling event.
- Preferential pathway sample TCE concentrations in unit 714G ranged from 0.41  $\mu\text{g}/\text{m}^3$  to 1.7  $\mu\text{g}/\text{m}^3$ . The maximum preferential pathway sample TCE concentration (1.7  $\mu\text{g}/\text{m}^3$ ) was equal to the maximum breathing zone sample TCE concentration; both samples were collected on the same day (May 7, 2004).
- Preferential pathway sample TCE concentrations in unit 620F ranged from 1.1  $\mu\text{g}/\text{m}^3$  to 2.2  $\mu\text{g}/\text{m}^3$ . The maximum preferential pathway sample TCE concentration (2.2  $\mu\text{g}/\text{m}^3$ ) was greater than the maximum breathing zone sample TCE concentration (2.0  $\mu\text{g}/\text{m}^3$ ); both samples were obtained during the November 25, 2003, sampling event.

TCE concentrations that were detected in preferential pathway samples from the remaining housing units above first-observed TCE in groundwater ranged from 0.029  $\mu\text{g}/\text{m}^3$  to 0.25  $\mu\text{g}/\text{m}^3$ , with an average value of 0.09  $\mu\text{g}/\text{m}^3$ . This average is the same as the average off-plume preferential pathway TCE concentration.

During the May 2004 sampling event, preferential pathway samples from OPHA units with crawl spaces were collected from within the crawl spaces, where possible. These units included 808A, 817A, and 834C. TCE concentrations detected in preferential pathway samples collected

from the crawl space ranged from 0.029  $\mu\text{g}/\text{m}^3$  to 0.13  $\mu\text{g}/\text{m}^3$ , with an average value of 0.05  $\mu\text{g}/\text{m}^3$ . This range and average were lower than off-plume preferential pathway TCE concentrations.

Cis-1,2-DCE was detected sporadically during the Navy's November 2003/May 2004 sampling events, at concentrations ranging from non-detect to a maximum of 0.12  $\mu\text{g}/\text{m}^3$  in preferential pathway samples. All sample results were below the EPA Region 9 PRG in ambient air (37  $\mu\text{g}/\text{m}^3$ ).

VC was not detected above the reporting limit in any indoor air sample collected during the Navy's November 2003/May 2004 sampling events. All sample results were below the EPA Region 9 PRG for VC in ambient air (0.11  $\mu\text{g}/\text{m}^3$ ) and the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC (0.0246  $\mu\text{g}/\text{m}^3$ ).

The mixed data set includes 10 additional preferential pathway samples. A TCE concentration of 1.6  $\mu\text{g}/\text{m}^3$  was detected in one of the additional samples (EPA sample 727-F-Path). Results for all 10 samples were less than laboratory reporting limits for cis-1,2-DCE and VC. The preferential pathway sample interpretation for TCE, cis-1,2-DCE, and VC are not affected by the evaluation of the mixed data set.

### **3.1.2.3 Preferential Pathway and Breathing Zone Comparison**

Differences between preferential pathway and breathing zone samples collected during the Navy's November 2003/May 2004 sampling events were compared using averages for each month. In the 20 OPHA housing units that are located above the first-observed TCE groundwater plume (total of 40 comparisons), average preferential pathway sample results were similar to the average breathing zone sample results for the November sampling event (0.23  $\mu\text{g}/\text{m}^3$  vs. 0.24  $\mu\text{g}/\text{m}^3$ , respectively). Average preferential pathway sample and breathing zone results from the May sampling event were the same (0.22  $\mu\text{g}/\text{m}^3$ ). Results were similar at the two WHA units sampled in November only (units 619B and 620F, now demolished). A similar correspondence in values is noted visually on Figures 3-3 through 3-8, where preferential pathway and breathing zone results are plotted side-by-side.

The comparison between the preferential pathway and breathing zone samples results suggest that the contribution of TCE migrating from the subsurface, through preferential pathways, and into the breathing zone is negligible. The preferential pathway and breathing zone sample comparison was not affected by the mixed data set evaluation.

### **3.1.2.4 Outdoor Air Breathing Zone**

TCE concentrations above the Cal/EPA OEHHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  were not detected in any outdoor air breathing zone samples collected during the Navy's November 2003/May

**TABLE 3-2**  
**CLIMATE CONDITIONS DURING AIR SAMPLING**

Sampling Date	Indoor Temperature Range (°F) <sup>a</sup>	Indoor Temperature Average (°F) <sup>a</sup>	Outdoor Temperature Range (°F) <sup>b</sup>	Outdoor Temperature Average (°F) <sup>b</sup>	Maximum Wind Speed (mph) <sup>b</sup>	Average Wind Speed (mph) <sup>b</sup>	Prevailing Wind Direction <sup>b,c</sup>	Observations
Nov 18, 2003	62.8 – 72.1	66.9	46.4 - 68	55.4	16.1	3.3	Calm to northwest	Clear, Sunny
Nov 25, 2003	53.6 – 61.4	57.3	37.4 - 55.4	46.9	10.3	3.6	Northerly late morning and afternoon Southerly evening, night, morning	Clear, Dry
May 7, 2004	65.8 – 82.7	70.3	53.6 – 71.6	62.6	21	8.0	Northerly late morning and afternoon Southerly evening, night, morning	Clear, Sunny
May 14, 2004	61.8 – 75.9	67.8	51.8 – 69.8	61.1	25	7.1	North-northeast	Clear

**Notes:**

- <sup>a</sup> Indoor air temperature measured at start of sample collection.  
<sup>b</sup> National Oceanic and Atmospheric hourly surface weather observations from Moffett measured over sample collection period.  
<sup>c</sup> Direction wind is blowing from.

**Abbreviations and Acronyms:**

°F – degrees Fahrenheit  
mph – miles per hour

2004 sampling events. Outdoor TCE concentrations ranged from 0.023  $\mu\text{g}/\text{m}^3$  to 0.18  $\mu\text{g}/\text{m}^3$ , with an average value of 0.08  $\mu\text{g}/\text{m}^3$ . This average is essentially the same as the average off-plume outdoor air breathing zone concentrations of 0.07  $\mu\text{g}/\text{m}^3$ . With the exception of four slab-on-grade units (714G, 727F, 620F, and mixed data set sample 620E), the average TCE concentration for above plume indoor air breathing zone samples was 0.09  $\mu\text{g}/\text{m}^3$ , which suggests that ambient air could account for the majority of TCE detected in most units sampled as part of this study. This evaluation is also supported by Figures 3-2 through 3-8, where the corresponding outdoor air samples plot at similar concentrations compared to most preferential pathway samples and a majority of the breathing zone samples.

The mixed data set includes 15 additional outdoor air samples. TCE was detected at concentrations of 1.6  $\mu\text{g}/\text{m}^3$  and 0.19  $\mu\text{g}/\text{m}^3$  in playground samples Vernon PG and Outdoor 720 PG, respectively. Both samples were collected at OPHA on September 5, 2002. TCE concentrations in the 13 remaining mixed data set samples were less than the laboratory reporting limits.

Cis-1,2-DCE was detected sporadically during the Navy's November 2003/May 2004 sampling events, at concentrations ranging from non-detect to a maximum of 0.094  $\mu\text{g}/\text{m}^3$  at sample location 720PG on November 25, 2003. Outdoor breathing zone sample concentrations were similar in nature (sporadic) and concentration to indoor samples, which suggests that ambient air could account for the majority of cis-1,2-DCE detected in most units sampled as part of this study. All sample results were below the EPA Region 9 PRG in ambient air (37  $\mu\text{g}/\text{m}^3$ ). The mixed data set includes 15 additional outdoor air samples, the results of which were less than laboratory reporting limit for cis-1,2-DCE. The outdoor air sample interpretation is not affected by the evaluation of the mixed data set.

VC was detected above reporting limits in one outdoor sample (collected at WHA Berry Drive on May 14, 2004) at a concentration of 0.73  $\mu\text{g}/\text{m}^3$ . The WHA Berry Drive location is not located over first-observed TCE contaminated groundwater. The single Berry Drive outdoor sample exceeds the EPA Region 9 PRG for VC in ambient air (0.11  $\mu\text{g}/\text{m}^3$ ) and the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC (0.0246  $\mu\text{g}/\text{m}^3$ ). The mixed data set includes 15 additional outdoor air samples, the results of which were less than laboratory reporting limit for VC. The outdoor air sample interpretation is not affected by the evaluation of the mixed data set.

### 3.1.3 Unit Type

Housing types included 10 slab-on-grade units, 11 crawl space units, and one basement unit. The four units (714G, 727F, 620E, and 620F) where TCE was detected at concentrations greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  were all slab-on-grade construction. Crawl space units had breathing zone and preferential pathway concentrations similar to off-plume

concentrations. The one basement unit was considered an off-plume location because it is not located over first-observed groundwater TCE contamination.

### **3.2 CLIMATE DATA**

Indoor temperatures were recorded at the beginning and end of the sample collection period during the Navy's November 2003/May 2004 sampling events. Outdoor temperature, wind speed and wind direction during the sampling period were obtained from the weather station at Moffett. Climate data are summarized in Table 3-2. Indoor and outdoor temperatures were lower during the November sampling events compared to May. Maximum and average wind speeds were also lower in November compared to May. Generally, the wind directions for both events were out of the north during the late morning and afternoon, and changed to out of the south during the evening, night, and early morning hours.

### **3.3 SEASONAL EFFECTS**

Air samples were collected in November and May to evaluate potential seasonal effects on VOC concentrations in air samples. Seasonal effects were believed possible given the differences in weather. In November, outdoor temperatures are cool and the rainy season is under way. In May, temperatures are warm and the rainy season is over. Review of the air sample data indicates a slight seasonal effect. Of the 109 potential sampling pairs (first November sampling compared with first May sampling event for indoor breathing zone, indoor preferential pathway and outdoor breathing zone, and repeated for the second sampling dates), 79 percent (86 of the 109 pairs) had higher November TCE concentrations compared to May. All of the outdoor samples were higher in November than their May counterparts. The average TCE concentration for all locations in November was  $0.20 \mu\text{g}/\text{m}^3$  ( $0.22 \mu\text{g}/\text{m}^3$  indoor and  $0.12 \mu\text{g}/\text{m}^3$  outdoor) compared to the value in May, which was  $0.17 \mu\text{g}/\text{m}^3$  ( $0.19 \mu\text{g}/\text{m}^3$  indoor and  $0.04 \mu\text{g}/\text{m}^3$  outdoor). The higher November TCE concentrations might be attributed to several factors, including lower average winds speeds in November.

## 4.0 DATA EVALUATION

One of 27 housing units (620E sampled by the EPA in January and February 2004 with the unit's heating system operating) had consistent breathing zone trichloroethene (TCE) detections greater than the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) benchmark long-term residential health-based concentration of 0.96 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). One of 26 housing units (620F sampled in November 2003) had consistent preferential pathway TCE detections greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$ . TCE concentrations were greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  in some of the breathing zone air samples from units 727F, 714G, and 620F. TCE concentrations were greater than the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$  in some of the preferential pathway air samples in units 727F and 714G. All other indoor air samples from all other units were below the Cal/EPA OEHHA concentration of 0.96  $\mu\text{g}/\text{m}^3$ . Units 620E and 620F have been demolished by the Army. Units 727F and 714G are vacant.

Off-plume, outdoor air samples had reported concentrations of TCE ranging from 0.019  $\mu\text{g}/\text{m}^3$  to 0.13  $\mu\text{g}/\text{m}^3$ , with an average value of 0.08  $\mu\text{g}/\text{m}^3$ . The average TCE concentration for above-plume, indoor air breathing zone samples was 0.09  $\mu\text{g}/\text{m}^3$ , with the exception of four outliers (OPHA units 727F and 714G and WHA units 620E and 620F, which are now vacant or demolished). This comparison indicates the similarity between indoor air and outdoor ambient air TCE concentrations.

The average TCE concentration for above-plume, indoor air breathing zone samples (0.09  $\mu\text{g}/\text{m}^3$ , with the exception of the four outliers described in the previous paragraph) was equal to the average TCE concentration for off-plume, indoor air breathing zone samples. The average TCE concentration for above-plume indoor air preferential pathway samples (0.09  $\mu\text{g}/\text{m}^3$ ) was less than the average TCE concentration for off-plume indoor air preferential pathway samples (with exception of four slab-on-grade units 714G, 727F, 620E, and 620F). The average TCE concentration for above-plume outdoor air breathing zone samples (0.07  $\mu\text{g}/\text{m}^3$ ) was less than the average TCE concentration for off-plume outdoor air breathing zone samples (0.08  $\mu\text{g}/\text{m}^3$ ). The comparisons suggests that:

- There is no correlation between air results and plume location at 23 of 27 housing units.
- Volatile chemicals in the housing units were detected at low concentrations, similar to the concentrations detected in the surrounding (ambient) air at 23 of 27 housing units.

There does not appear to be any noticeable difference between the preferential pathway samples and the breathing zone samples. With the exception of three slab-on-grade units 714G, 727F, and

620F, the average TCE concentration for the above-plume preferential pathway samples ( $0.09 \mu\text{g}/\text{m}^3$ ) was equal to the average TCE concentration for above-plume breathing zone samples. This comparison also suggests that there is no significant vapor migration into indoor air from contaminated groundwater through preferential pathways.

TCE concentrations in preferential pathway samples obtained from within crawl spaces were less than TCE concentrations in preferential pathway samples collected from off-plume slab-on-grade locations, except for samples collected on May 14, 2004, from units 808A and 834C. These two outliers were less than all but two of the off-plume slab-on-grade locations. TCE concentrations in preferential pathway samples placed within crawl spaces were generally less than TCE concentrations in corresponding breathing zone samples collected from the same units, with the exception of the sample collected from unit 834C on May 14, 2004. These results suggest that there is no significant vapor migration into indoor air from contaminated groundwater through the crawl space pathway.

There appears to be a slight seasonal effect based on a comparison of paired analyses from the November and May sampling events. Seventy-eight percent of the pairs had higher TCE concentrations in November compared to May. Average November air analytical results ( $0.20 \mu\text{g}/\text{m}^3$ ) were higher than average May results ( $0.17 \mu\text{g}/\text{m}^3$ ). Although the differences in these values appear small, the difference is statistically significant. The slight difference might be due in part to weather conditions, such as lower average wind speeds in November compared to May.

Cis-1,2-dichloroethene (cis-1,2-DCE) concentrations were detected sporadically. All cis-1,2-DCE concentrations were below the EPA Region 9 PRG in ambient air ( $37 \mu\text{g}/\text{m}^3$ ).

Vinyl chloride (VC) was detected above reporting limits in two samples. The samples were collected at an outdoor WHA location and at an indoor OPHA location, at concentrations above the EPA Region 9 PRG for VC in ambient air ( $0.11 \mu\text{g}/\text{m}^3$ ) and the Cal/EPA inhalation long-term residential health-based exposure benchmark for VC ( $0.0246 \mu\text{g}/\text{m}^3$ ). The sample locations were not above first-encountered TCE contaminated water.

## 5.0 CONCLUSIONS

The following conclusions have been developed after evaluation of the air sample analytical results:

- Volatile chemicals were detected in almost all indoor and outdoor sample locations.
- Trichloroethene (TCE) was detected at concentrations greater than the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) value of  $0.96 \mu\text{g}/\text{m}^3$  in four of 27 units sampled. Of these four units, 620E and 620F have been demolished and 727F and 714G are vacant.
- Cis-1,2-dichloroethene (Cis-1,2-DCE) detections were all below federal health-based concentrations.
- Vinyl chloride (VC) was detected in one outdoor and one indoor sample. The VC detections were both above the federal and California health-based concentration. Both locations were off the first-observed groundwater TCE plume
- There may be potential vapor migration from chemicals into indoor air from contaminated groundwater at four of 27 housing units (727F, 714G, 620E, and 620F).
- There is no apparent correlation between air sampling results and the presence (or absence) of groundwater contamination at 23 of 27 housing units.
- Volatile chemicals in the housing units were detected at low concentrations, similar to the concentrations detected in the surrounding (ambient) air at 23 of 27 housing units.
- There appears to be a slight seasonal effect (November air sampling results are higher than those collected in May).
- One of 27 housing units (620E sampled by the EPA in January and February 2004 with the unit's heating system operating) had consistent TCE detections greater than the Cal/EPA OEHHA concentration of  $0.96 \mu\text{g}/\text{m}^3$ . Unit 620E no longer exists. .
- There are no immediate or short-term health risks to the residents of Orion Park Housing Area (OPHA) or Wescoat Housing Area (WHA) relating to either indoor or outdoor air quality. This conclusion is consistent with the findings of previous studies at Moffett Community Housing (MCH).

## 6.0 REFERENCES

Foster Wheeler Environmental Corporation. 2003. *Final Site Characterization and Baseline Human Health Risk Assessment Report for Orion Park and Wescoat Housing Areas*. October.

<http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf>. October 2004.

National Center for Environmental Assessment (NCEA). 2001. *Trichloroethylene Health Risk Assessment: Synthesis and Characterization*. EPA, ORD. Washington D.C. EPA/640/P-01/002A. August. External Review Draft.

U.S. Environmental Protection Agency (EPA) National Center for Environmental Assessment (NCEA). 2001. *Trichloroethylene Health Risk Assessment: Synthesis and Characterization*, August.

U.S. Environmental Protection Agency (EPA). 2002a. *Preliminary Remediation Goals Table*. Region 9. October 1.

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\_\_\_\_\_. 2002b. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*.

**APPENDIX A**

**ANALYTICAL RESULTS REPORTS  
AND CHAIN-OF-CUSTODY FORMS**

**(Provided on Compact Disk)**

**APPENDIX B**  
**RESPONSE TO COMMENTS**

**RESPONSE TO COMMENTS  
DRAFT AIR SAMPLING REPORT  
FOR ORION PARK AND WESCOAT HOUSING AREAS  
DATED NOVEMBER 17, 2004  
FORMER NAS MOFFETT FIELD  
MOFFETT FIELD, CALIFORNIA**

Comments dated: January 10, 2005

Comments by: Ms. Alana Lee, Project Manager  
Environmental Protection Agency (EPA)

**SPECIFIC COMMENTS**

**Comment 1:** *(a) The Navy has not adequately evaluated the potential long-term health risks to Moffett Community Housing residents or future building occupants.*

*(b) The data evaluated should not be limited to only the November 2003 and May 2004 data. All data collected in the housing areas should be used in the assessment and evaluation of seasonal variations, site conditions, building operations, and potential health risks (i.e., Navy and EPA September 2002, November 2003, January, February, and May 2004 air sampling data and previous groundwater investigation data).*

**Response 1:** (a) The purpose of the air sampling activities (project data quality objectives [DQOs]) was to evaluate if:

- TCE, cis-1,2-DCE, or VC vapors were present in indoor air at concentrations greater than the EPA Region 9 PRG and Cal/EPA OEHHA benchmark long-term residential health-based concentration of 0.96  $\mu\text{g}/\text{m}^3$  for TCE in ambient air, or greater than the EPA Region 9 PRG for cis-1,2-DCE and VC in ambient air.
- TCE, cis-1,2-DCE, or VC vapors concentrations in the indoor air are greater than concentrations in ambient outside air
- TCE, cis-1,2-DCE, or VC vapors concentrations in preferred pathway samples are greater than indoor air concentrations

The project DQOs were accomplished. No change in text is proposed related to Specific Comment 1.

(b) All data will be included in the evaluation. However the differences in laboratory detection limits and sample collection

procedures between the Navy's November 2003/May 2004 results and the other data sets will be explained.

**Comment 2:**

*(a) The Draft Air sampling Report does not evaluate the potential health risks and does not recommend any next steps or actions. The Navy needs to evaluate other units and buildings in the vicinity of the elevated levels of TCE found indoors and take the appropriate actions to ensure that current and future residents and occupants are protected from unacceptable potential long-term health risks.*

*(b) The Navy must also assess the appropriate remedial action alternatives, ensure confirmation sampling is conducted, and propose an appropriate frequency of long-term monitoring to ensure that preventive measures to reduce vapor intrusion are effective and protective.*

**Response 2:**

Evaluating health risks, recommending next steps, assessing remedial action alternatives, and developing a long-term monitoring program were not part of the project DQOs. Please see the Response to Specific Comment 1a.

No change in text is proposed related to Specific Comment 2.

**Comment 3:**

*(a) The on-site investigation should include additional soil gas sampling beneath and around selected housing units where previous elevated detections of TCE in air were found overlying the highest TCE concentrations in the shallow groundwater plume.*

*(b) To confirm whether the groundwater to air pathway is a completed pathway, additional sub-slab soil gas sampling and indoor and outdoor air sampling using EPA Method TO-15 SIM (to obtain lower detection limits) is recommended.*

**Response 3:**

(a) Soil gas sampling was not planned as part of this investigation. (See Response to Specific Comment 1a). Furthermore, indoor air samples collected from units 720B, 720D, 817A, 819D, and 846A, located near Phase 1 sample points FW35A and FW30A that had highest first observed groundwater TCE concentrations (350 µg/L and 320 µg/L, respectively) had TCE concentration similar to off-site outdoor air TCE concentrations. . If the groundwater to soil gas to indoor air pathway were complete, it is reasonable to assume that the highest indoor TCE concentrations would have been detected near the location of the highest groundwater concentrations. With the exception of results for Unit 620F where preferred pathway samples were slightly higher than breathing zone samples, report data supports the conclusion that TCE vapor is not migrating into the housing units from groundwater. Unit 620F no longer exists.

(b) Sub slab soil gas sampling was not planned as part of this investigation (see the Response to Specific Comment 1a). All of the November 2003 and May 2004 air samples were analyzed using EPA Method TO-15 SIM. A reporting limit of 0.017 was achieved.

No change in text is proposed related to Specific Comment 3.

**Comment 4:**

*Throughout the Draft Air Sampling Report, the Navy misrepresents the EPA Region 9 Preliminary Remediation Goal (PRG) for TCE. The Report incorrectly states and refers to the California TCE value of 0.96 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) as the EPA Region 9 PRG. EPA Region 9 uses both the provisional TCE value and the California EPA TCE value. The EPA Region 9 PRG tables were updated in October 2004. The California EPA screening level of 0.96  $\mu\text{g}/\text{m}^3$  for TCE was included on the updated Region 9 PRG table because when EPA and California EPA screening values differ significantly (i.e., by a factor of 4 or more), both the EPA PRGs and the "Cal-Modified PRGs" are listed in the EPA Region 9 PRG Table. See <http://www.epa.gov/region09/waste/sfund/prg/index.htm>.*

*Throughout the document, the Draft Air Sampling Report should be revised to reflect that EPA Region 9 is using both the provisional health protective risk range (0.017 to 1.7  $\mu\text{g}/\text{m}^3$ ) and the California EPA health-based screening level of 0.96  $\mu\text{g}/\text{m}^3$  when evaluating the potential long-term health risk to residents via the vapor intrusion to indoor air pathway.*

**Response 4:**

Applying the hierarchy of human health toxicity values recommended in OSWER Directive 9285.7-53 (dated 5 December 2003) relative to TCE at Moffett, (<http://www.epa.gov/superfund/programs/risk/hhmemo.pdf>), we see that there are currently no Tier 1 (USEPA IRIS) or Tier 2 (USEPA PPRTV) sources of toxicity values for TCE. Consequently, the Tier 3 (Other Toxicity Values) sources of information are then recommended. The CalEPA toxicity values are specifically listed in the OSWER Guidance as a recommended Tier 3 source, since they are based on similar methods and procedures as the Tier 1 and 2 sources and are peer reviewed. It is, therefore, appropriate to use CalEPA / OEHHA toxicity values for cancer and non-cancer effects due to TCE at Moffett. Using the CalEPA / OEHHA inhalation CSF of 0.007  $\text{mg}/\text{kg}\cdot\text{day}^{-1}$  with a target cancer risk goal of  $1 \times 10^{-6}$  results in the CalEPA vetted risk-based screening value of 0.96  $\mu\text{g}/\text{m}^3$  for TCE in air in residential scenarios. Therefore, the CalEPA OEHHA health-based screening level of 0.96  $\mu\text{g}/\text{m}^3$  will be used.

The following modifications have been made to Page 1-3, Paragraph 3:

In October 2002, EPA Region 9 incorporated the NCEA toxicity value recommendations into their PRG tables (2002a), even though this value had not been formally released by the EPA. EPA Region 9 has referred to a TCE carcinogenic risk of  $10^{-6}$  through  $10^{-4}$  based on the provisional TCE toxicity value (corresponding to a TCE inhalation exposure of  $0.017 \mu\text{g}/\text{m}^3$  to  $1.7 \mu\text{g}/\text{m}^3$ , respectively) as the “Health Protective Risk Range”. In November 2002, EPA incorporated the NCEA toxicity value recommendations into their *Draft Guidance for Evaluating Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (2002b). **EPA Region 9 uses both the provisional TCE value and the California EPA TCE value. The EPA Region 9 PRG tables were updated in October 2004 (EPA, 2004a). The California EPA OEHHA benchmark long-term residential health-based concentration of  $0.96 \mu\text{g}/\text{m}^3$  for TCE was included in the updated Region 9 PRG Table because when EPA and Cal/EPA screening values differ significantly (i.e., by a factor of 4 or more), both the EPA PRGs and the “Cal-Modified PRGs” are listed in the EPA Region 9 PRG Table. However, in February 2005, the EPA announced a site-specific “action level” for MCH of  $1.0 \mu\text{g}/\text{m}^3$ . Comments on the derivation of the EPA toxicity value were submitted to the Federal Register in January 2002. Because the 2001 EPA value is still under review by the National Academy of Science, and since the EPA site-specific action level is only slightly greater than the Cal/EPA OEHHA value, TCE concentrations are compared to the Cal/EPA OEHHA concentration of  $0.96 \mu\text{g}/\text{m}^3$ . The newly revised EPA Region 9 PRG table (October 2004) also listed the Cal/EPA OEHHA benchmark long-term residential health-based concentration of  $0.96 \mu\text{g}/\text{m}^3$  in their PRG tables for TCE in ambient air.**

Throughout the report, the following modification will be made when referring TCE PRGs

TCE concentrations above the ~~EPA Region 9 PRG~~ and Cal/EPA OEHHA benchmark long-term residential health-based concentration of  $0.96 \mu\text{g}/\text{m}^3$

**Comment 5:**

*Page ES-1, Executive Summary, second paragraph. The EPA Region 9 provisional TCE value and health protective risk range of 0.017 to 1.7 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) should be included in the discussion as the Region 9 PRG. Both the EPA*

*Region 9 provisional TCE and California EPA health-based screening level values need to be presented and discussed throughout the document.*

**Response 5:** Please see the Response to Specific Comment 4.

**Comment 6:** *Page ES-1, Executive Summary, fourth paragraph. The Report should include a discussion of the rationale for sampling locations, the Navy's conceptual model of potential vapor intrusion into the building (i.e., if soil gas is the source, the most likely place to detect it is on the ground floor and near the penetrations of the slab [preferential pathway]).*

**Response 6:** Rationale for sampling locations is not required or appropriate in an executive summary. However, the following will be added to the first paragraph of Section 2.1 (Sample Locations).

The indoor sampling locations included a day care center and 24 housing units with slab-on-grade, crawl space, or basement construction. **If the groundwater to soil gas to indoor air pathway is complete, the most likely place to detect TCE is on the ground floor and near the penetrations of the slab (e.g., preferential pathway). Therefore, most housing units were selected based on the following criteria:**

- Located above first-observed groundwater containing detectable concentrations of trichloroethene (TCE)
- Ground floor unit
- Unoccupied from November 2003 to May 2004

**Comment 7:** *Page ES-2, Executive Summary and Section 5.0 Conclusions.*

*(a) Second and ninth bullets. The bullets as written are not true and should be revised or deleted. The Report needs to include both the EPA Region 9 provisional TCE health protective risk range (0.017 – 1.7 µg/m<sup>3</sup>) and the California EPA TCE screening level value of 0.96 µg/m<sup>3</sup> from the updated 2004 EPA Region 9 PRG table.*

*(b) Fifth and ninth bullets. Delete these bullets as they are not substantiated by the data. 620F had detections exceeding 0.96 µg/m<sup>3</sup> over several years of sampling. It should be noted that there were consistent elevated detections of TCE above 0.96 µg/m<sup>3</sup> in unit 620F (September 2002, November 2003, January 2004 and February 2004) and the adjacent unit, 620E, (January and February 2004), during multiple sampling rounds since 2002.*

*(c) Sixth bullet. The text should be revised to indicate that there is no "apparent direct correlation" between groundwater and air concentrations. Elevated levels of TCE in indoor air were found in the residences (620E, 620F, 714G, and 727F) that are also over the highest concentrations of the shallow groundwater TCE plume. The Report needs to review the conceptual model and evaluate why the elevated levels of TCE in indoor air in those areas and discuss next steps to ensure that current and future occupants of existing and new buildings are protected from Site contamination. The Navy has not adequately evaluated those areas where there may be a potential long-term health risk to residents.*

**Response 7:**

(a) Please see the Response to Specific Comment 4.

(b) The following text changes have been made to the second and ninth bullets:

- **Trichloroethene (TCE) was detected at concentrations greater than the Cal/EPA OEHHA value of 0.96 µg/m<sup>3</sup> in four of 27 units sampled. Of these four units, two (620E and 620F) have been demolished and two (727F and 714G) are vacant.**~~There is no significant vapor migration from any of the chemicals into indoor air from contaminated groundwater.~~
- **One of 27 housing units (620E sampled by the EPA in January and February 2004 with the unit's heating system operating) had consistent TCE detections greater than the Cal/EPA OEHHA concentration of 0.96 µg/m<sup>3</sup>. Unit 620E no longer exists.**~~There were no housing units that had consistent detections greater than the long-term federal or California health-based concentration of 0.96 µg/m<sup>3</sup>~~

(c) The highest TCE concentrations in first observed groundwater were detected at Phase 1 locations FW35A (350 µg/L) and FW30A (320 µg/L). Indoor air samples collected from units 720B and 720D (located near FW35A) and units 817A, 819D and 846A (located near FW30A) had TCE concentration similar to off-plume background air. In addition, see the Response to Specific Comments 2 and 3.

No change in the sixth bullet is proposed related to Specific Comment 7(c).

**Comment 8:**

*Page 1-3, Section 1.2, TCE Benchmark Health-Based Concentration, last paragraph. The text should be revised to clarify*

*that EPA, in cooperation with a number of other federal agencies, has initiated a scientific consultation with the National Academy of Sciences (NAS) that will focus on how best to address several critical underlying specific scientific issues related to the assessment of the potential human health risks from environmental exposure to TCE. Part of this consultation will include a number of public meetings so that the NAS expert panel can gain additional insights from federal agencies, concerned parties, and other scientists. The advice from the NAS, along with comments from the EPA's Science Advisory Board and recently published scientific literature, will be incorporated into a revised EPA risk assessment for TCE. In the meantime, TCE in air concentrations will continue to be evaluated against both the EPA Region 9 long-term health protective risk range of 0.017 to 1.7 µg/m<sup>3</sup> based on the draft provisional TCE toxicity value and the California EPA healthbased screening level value of 0.96 µg/m<sup>3</sup>. The Report should be revised to reflect the use of both values.*

**Response 8:** Thank you for the update on current and planned EPA activities concerning the potential humane health risk from environmental exposure to TCE. Please see the Response to Specific Comment 4.

**Comment 9:** *Figures 2-1 and 2-2. It would be more descriptive and informative if these figures included the TCE concentration contours (honoring all the data points) for the shallowest groundwater contamination (A1 Aquifer zone).*

**Response 9:** At Moffett the historical anastomosed channel system deposited a package of sediments which created complex and tortuous pathways for contaminant migration in the A aquifer. Anastomosed channels “stack” on top of previous channel or flood plain deposits creating stringer-like sand body geometries. Resulting channel deposits form discontinuous lenticular aquifers that are encased within finer-grained deposits. As such, it is more likely than not that individual localized layers in the A aquifer contain and transmit contamination, while others (especially the first encountered water) may not. Such hydrogeologic and contamination transport conditions were observed at Orion Park in Phase II borings (e.g., Phase II boring FW17B had a TCE concentration less than the laboratory reporting limit at first-encountered groundwater [a depth of 11 - 12.5 ft bgs] and at the next permeable layer [a depth of 16 - 17 ft bgs] had a TCE concentration of 190µg/L). This conceptual model was used while contouring the mixed-depth HydroPunch<sup>®</sup> data set (Phase I and Phase II) for the A1 and A2 aquifer zones.

Figures 2-1 and 2-2 will be modified to show TCE contours for first-observed groundwater.

**Comment 10:**

*Figures 2-1 and 2-2, Tables 2-1 and 2-2. Please include Macon Terrace in the description of Orion Park Housing Area in the legend and footnote.*

**Response 10:**

Figures 1-3, 2-1, 2-2, and 3-1 will be modified to include the housing development names Moffett Homes, Orion Park, Macon Terrace I, Macon Terrace II, Macon Terrace III, Berry Court, Berry Drive, and Wescoat Village. Section 1.1 Paragraph 1 will be modified as follows:

OPHA and WHA are approximately 72 acres and 40 acres in size, respectively. The area that is now OPHA was vacant or used for agriculture prior to housing development. A portion of the area was used for agriculture until some time after 1965. Housing at OPHA was constructed in various stages between 1941 and 1982. **The housing units include Moffett Homes built in 1941 (demolished in 2001), Orion Park built in 1968, and Macon Terrace II and Macon Terrace III built in 1982 (Figure 1-3). In this report, OPHA includes Orion Park, Macon Terrace II, and Macon Terrace III.** Prior to development as residential property, WHA was vacant land. Housing at WHA was constructed in various stages between 1933 and 1982. **The first housing units at WHA were built in 1933 along Berry Drive. Berry Court and Wescoat Village were built in 1968, and Macon Terrace I in 1982 (see Figure 1-3). In this report, WHA includes Berry Court, Berry Drive, Wescoat Village, and Macon Terrace I.**

Table 2-1 and 2-2 will include the following foot notes

<sup>a</sup> **Orion Park**

<sup>b</sup> **Macon Terrace III**

<sup>c</sup> **Macon Terrace II**

<sup>d</sup> **Berry Drive**

<sup>e</sup> **Wescoat Village**

**Comment 11:**

*Table 3-1. Table 3-1 does not include all of EPA's data collected at Orion Park and Wescoat Housing Areas (e.g., EPA sampling data for January 26, 2004 is missing) and some of the EPA sampling results presented are incorrect). EPA collected split samples (co-located with Navy samples on November 24, 2003 and May 6, 2004) and confirmation samples (additional samples EPA independently collected on January 26 and February 9, 2004). EPA tested selected units in January and February 2004 using the same protocol as the Navy, except that EPA turned the "heating system on" 24 hours prior to and during sampling to simulate realistic conditions in the winter when the outside temperature is often much colder than the indoor air room temperature. The heating systems were not turned on during the Navy's sampling and EPA's split sampling in November 2003 (as reported on the table). It should be noted on the table that on February 9, 2004, the heater was not operational in units 620E and 620F 24 hours prior to sampling and during the morning when sampling began. It was turned on later in the morning. These results may not be representative of sampling with the "heater on" at these locations. In addition, the table should be revised to note that EPA reports data to 1/2 the quantitation limit. Table 3-1 should be revised to include all the correct EPA split and confirmation air sampling data.*

**Response 11:**

EPA's January 26 data will be added to Table 3-1.

Although the EPA collected split samples on the same date the Navy collected samples, the sample dates on Table 3-1 are what was provided to the Navy by the EPA. The following note will be added to Table 3-1:

**Sample Date indicates the date the Navy samples were collected and the dates provided to the Navy by the EPA. EPA's samples with sample dates of 11/24/03 and 05/06/04 were collected on 11/25/03 and 05/07/04, the same date as the Navy samples.**

The notes on Table 3-1 will be edited to read

**January 26 and February 9, 2004** EPA samples collected with the unit heating system on

**Comment 12:**

*Section 3.0 Sample Analytical Results and Section 4.0 Data Evaluation. The Navy only includes an evaluation of the air sampling results from November 2003 and May 2004. All data collected to date should be reported and evaluated by comparing indoor air results for each residential unit sampled to (1) outdoor air results\*; (2) health-based screening levels for short-term exposure; and (3) healthbased screening levels for long-term*

*residential exposure using EPA Region 9's provisional health protective risk range of 0.017 to 1.7 µg/m<sup>3</sup> and California EPA's health-based screening level of 0.96 µg/m<sup>3</sup>. \*Note: It is EPA's policy not to take action to reduce levels that are less than background (outdoor air) levels.*

**Response 12:** Please see the Response to Specific Comments 1, 2, and 4.

**Comment 13:** ***Page 3-5, Section 3.1.2.3 Preferential Pathway and Breathing Zone Comparison.** The text states that “[T]he comparison between the preferential pathway and breathing zone samples results suggest that the contribution of TCE migrating from the subsurface, through preferential pathways, and into the breathing zone are negligible.” This may be true for some units, but not necessarily all units. The data may also indicate for the units with elevated levels of TCE that the preferential pathway(s) into the buildings were not identified. Further evaluation of nearby and adjacent units of elevated levels of TCE found indoors is necessary to verify whether there is a completed subsurface vapor intrusion pathway and whether there are levels that pose a significant long-term health risk to residents. Further evaluation and action are necessary to ensure that current and future residents/occupants are not exposed to elevated levels of indoor air from vapor intrusion that may pose a long-term health risk. The Draft Air Report should be revised to reflect these points.*

**Response 13:** Preferred pathway samples were collected near the largest openings to the subsurface (such as where water and sewer pipes penetrated the floors and slabs and at the trap door to the crawl space), therefore the most likely pathway. The comparison between the preferential pathway and breathing zone sample results **for all but one unit tested** suggest that the contribution of TCE migrating from the subsurface, through preferential pathways, and into the breathing zone are negligible. (The only exception was unit 620F, which had breathing zone/preferred pathway samples TCE concentrations of 1.1 µg/m<sup>3</sup>/1.2 µg/m<sup>3</sup> and 2 µg/m<sup>3</sup>/2.2 µg/m<sup>3</sup>. This unit has been demolished.) This conclusion was drawn based on the EPA approved work plan Source Attribution Flow Chart Figure 5-1 and the Sampling and Analysis Plan DQO Table A.8-1, which states that if the preferential pathways air sample > the breathing zone air samples, then groundwater is considered to be contributing to indoor air concentrations. No sample at MCH had the preferential pathways air sample > the breathing zone air sample, including the units with elevated levels of TCE. Each unit tested was inspected for potential preferential pathways, and the highest potential selected (e.g., piping coming through the slab or through walls).

The EPA data obtained on 2/9/04 for adjacent units 727F (TCE concentration of 0.16 J  $\mu\text{g}/\text{m}^3$ ) and 727E (TCE concentration of 3.2  $\mu\text{g}/\text{m}^3$ ) suggest that there is no relationship between adjacent units on the same slab.

See Response to Specific Comment 2.

No change in the text is proposed related to Specific Comment 13.

**Comment 14:**

*Page 3-5, Section 3.1.2.4 Outdoor Air Breathing Zone. The text suggests that ambient air could account for the majority of TCE detected in most units sampled as part of this study. The low outdoor ambient air levels do not explain the elevated levels of TCE found in units 620E, 620F, 714G, and 727F. It appears that the preferential pathway samples were generally similar to the concentrations of the indoor air breathing zone samples and also the outdoor air samples (with the exception of the four units with elevated levels in both the breathing zone and preferential pathway samples). It also seems like the preferential pathway samples, while located to target a suspected potential preferential pathway, was likely not a “preferential pathway” where vapors are entering into the building from the subsurface. The Draft Air Sampling Report should be revised to reflect these points.*

**Response 14:**

The text in Section 3.1.2.4 already excludes the findings from units 714G, 727F and 620F. Unit 620E was only sampled once (by the EPA) using a different sampling procedure. However it will be included in the list of exceptions.

See the Response to Specific Comment 1.

See the Response to Specific Comment 13.

**Comment 15:**

*Page 3-6, Section 3.2 Climate Data and Table 3-2. It is unclear how the indoor air temperature at the start of sample collection is being compared to the average hourly outdoor temperature from Moffett over the 24-hour sample collection period. This comparison does not take into account that the indoor air temperatures may have fluctuated throughout the 24-hour period, particularly at night, since the thermostat was not set to regulate the indoor air temperature during the Navy’s sampling. The Draft Air Sampling Report should be revised to clarify how the reported indoor and outdoor temperature data are comparable.*

**Response 15:**

The indoor temperature was measured both at the start and end of sample collection, with these values and the average provided on Table 3-2. The indoor and outdoor air temperatures were not compared in the analysis for a given sample date. The indoor and

outdoor air temperatures were used primarily for comparing the difference in air temperature (indoor to indoor and outdoor to outdoor) during the November (fall) and May (spring) seasonal events.

No change in the text is proposed related to Specific Comment 15.

**Comment 16:** *Page 3-6, Section 3.3 Seasonal Effects. The Navy's sampling did not assess the potential impact of turning the heating systems on and setting the thermostats at fixed temperatures to simulate actual occupied conditions during the colder months.*

**Response 16:** Assessing the impact to air quality by turning on the housing unit heater was not one of the objectives of this project. Please see the Response to Specific Comment 1.

No change in the text is proposed related to Specific Comment 16.

**Comment 17:** *Section 4.0 Data Evaluation. EPA disagrees with the statement that "there were no housing units that had consistent breathing zone or preferential pathway TCE detections ...above 0.96 µg/m<sup>3</sup> and ...three of the 22 above plume housing units were "occasionally" above 96 µg/m<sup>3</sup>. The sampling results for four units 620E, 620F, 714G, and 727 F suggest that there may be subsurface vapor intrusion into these units and buildings. While the Navy has not offered rationale for the elevated levels in these units, vapor intrusion has not been ruled out. TCE was detected in indoor air of four units (620E, 620F, 714G, 727F) that were above outdoor air levels during all sampling rounds and consistently above the Navy's selected long-term TCE criteria of 0.96 µg/m<sup>3</sup> for two or more sampling rounds (i.e., 620E - 2 of 2 sampling rounds; 620F - 5 of 6 sampling rounds; 714G - 4 of 6 sampling rounds; and 727F 5 of 6 sampling rounds).*

**Response 17:** Comparable TCE concentrations were detected above the long-term TCE criteria of 0.96 µg/m<sup>3</sup> at units 620F (4 of 4 sampling rounds [one sample was a field duplicate]), 727F (3 of 4 sampling rounds [two samples were field duplicates]), and 714G (2 of 4 sampling rounds [two samples were field duplicates]). Since housing unit 620F has been demolished, there is no housing unit that had consistent breathing zone or preferential pathway TCE detections above the 0.96 µg/m<sup>3</sup> long-term screening criteria.

Preferred pathway sample results in 714G and 727F support the conclusion that the groundwater to soil gas to indoor air pathway is not complete. (A preferred pathway sample was not collected by the EPA in Unit 620E, now demolished. Unit 620F is also demolished.) Evaluating the source of indoor air TCE, other than the groundwater

to soil gas to indoor air pathway, was not part of the project DQOs. Please see the Response to Specific Comment 1.

No change in the text is proposed related to Specific Comment 17.

**Comment 18:** *Page 4-2, second paragraph, Data Evaluation. The text states that “Although the differences in these values [0.20 vs. 0.17 µg/m<sup>3</sup>] are small given laboratory quality control, the values are statistically significant.” Please explain why this is considered “statistically significant.”*

**Response 18:** The November and May sampling data were statistically different at the 95% confidence level when tested using a one-way analysis of variance to compare the mean values of the November 2003 data to the May 2004 data. Outliers greater than 1 µg/m<sup>3</sup> were censored from the data set. A Kruskal-Wallis Test, which is a nonparametric test comparing the medians of the two sample populations, including the outliers, found the medians to be significantly different at the 95% confidence level and bolsters the argument that data greater than 1 µg/m<sup>3</sup> are outliers and can be excluded from the one-way analysis of variance.

**Comment 19:** *Section 5.0 Conclusions. The bullets need to be corrected to include the comments from the Executive Summary and reflect the evaluation using both the EPA Region 9 provisional TCE health protective risk range and the California EPA health-based screening level for TCE. EPA does not agree the Navy’s conclusions and statements in the fifth bullet, sixth bullet, and ninth bullet.*

**Response 19:** Please see Response to Specific Comment 7.