# LOAN DOCUMENT

PHOTOGRAPH THIS SHEET

DTIC ACCESSION NUMBER

LEVEL

INVENTORY 0

Extended Bioventing Testing Results at . . .

DOCUMENT IDENTIFICATION

29 Jan 97

**DISTRIBUTION STATEMENT A**
Approved for Public Release
Distribution Unlimited

DISTRIBUTION STATEMENT

HANDLE WITH CARE

ACCESSION FOR

NTIS GRA&I ☑

DTIC TRAC ☐

UNANNOUNCED ☐

JUSTIFICATION

BY

DISTRIBUTION/

AVAILABILITY CODES

| DISTRIBUTION | AVAILABILITY AND/OR SPECIAL | |
|---|---|---|
| A-1 | | |

DISTRIBUTION STAMP

DATE ACCESSIONED

DATE RETURNED



DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NUMBER

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-FDAC

DTIC FORM 70A JUN 90

DOCUMENT PROCESSING SHEET

PREVIOUS EDITIONS MAY BE USED UNTIL STOCK IS EXHAUSTED.

LOAN DOCUMENT

gas Samples @ VW 2, 3 + 4
initial, 2 or 3 yr?

**PARSONS ENGINEERING SCIENCE, INC.**

1700 Broadway, Suite 900 • Denver, Colorado 80290 • (303) 831-8100 • Fax: (303) 831-8208

email 13 Feb 97



January 29, 1997

Captain Ed Marchand
AFCEE/ERT
3207 North Road, Bldg 532
Brooks AFB, Texas 78235-5363

Subject: Extended Bioventing Testing Results at Building 406, Offutt Air Force Base, Nebraska (Contract No. F41624-92-8036, Order 17)

Dear Captain Marchand:

Parsons Engineering Science, Inc. (Parsons ES) is pleased to submit the results of the extended bioventing testing at Building 406, Offutt Air Force Base (AFB), located south of Omaha, Nebraska. Soil gas samples were collected and *in situ* respiration testing was performed by Parsons ES from 4 to 7 November, 1996 to assess the extent of remediation completed during approximately three years of air injection bioventing. The purpose of this letter is to summarize site and bioventing activities to date, present the results of the most recent respiration testing and soil gas sampling, and make recommendations based on site data. A site layout and three tables are attached. The as-built bioventing system and sampling/respiration testing locations are illustrated on Figure 1. Tables 1 and 2 provide results of initial, 1-year, 2-year, and 3-year soil gas sampling, and respiration testing, respectively. Table 3 provides the initial, 1-year, and 2-year soil analytical data.

## SITE/PROJECT HISTORY

Building 406 is the location of a former jet fuel pumphouse, piping, and seven underground storage tanks (USTs). Six of the USTs had a 60,000-gallon capacity and were used to store JP-4 jet fuel, aviation gasoline (AVGAS), and deicing fluid; however, they most recently contained JP-4. The seventh UST contained fuel oil, and was located south of the others; however, its capacity was not specified (Terracon, 1994). In October 1993, all seven USTs were removed and petroleum-contaminated soil discovered during tank removal was returned to the excavation. Following UST removal, a full-scale bioventing system was installed at the Building 406 site by Parsons ES [formerly Engineering-Science (ES), Inc.] to remediate contaminated soils used for excavation backfill.

Site assessment activities were performed in 1993 and 1994 by Terracon (1994) in accordance with Nebraska Department of Environmental Quality (NDEQ) guidance.



AQM01-03-0423

# DEFENSE TECHNICAL INFORMATION CENTER
# REQUEST FOR SCIENTIFIC AND TECHNICAL REPORTS

**Title** AFCEE Collection

**1. Report Availability** *(Please check one box)*

☒ This report is available. *Complete sections 2a - 2f.*

☐ This report is not available. *Complete section 3.*

| 2a. Number of Copies Forwarded | 2b. Forwarding Date |
|---|---|
| 1 each | July/2000 |

**2c. Distribution Statement** *(Please check ONE box)*

*DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly below. Technical documents MUST be assigned a distribution statement.*

☒ DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

☐ DISTRIBUTION STATEMENT B: Distribution authorized to U.S. Government Agencies only.

☐ DISTRIBUTION STATEMENT C: Distribution authorized to U.S. Government Agencies and their contractors.

☐ DISTRIBUTION STATEMENT D: Distribution authorized to U.S. Department of Defense (DoD) and U.S DoD contractors only.

☐ DISTRIBUTION STATEMENT E: Distribution authorized to U.S. Department of Defense (DoD) components only.

☐ DISTRIBUTION STATEMENT F: Further dissemination only as directed by the controlling DoD office indicated below or by higher authority.

☐ DISTRIBUTION STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25, Withholding of Unclassified Technical Data from Public Disclosure, 6 Nov 84.

**2d. Reason For the Above Distribution Statement** *(in accordance with DoD Directive 5230.24)*

| 2e. Controlling Office | 2f. Date of Distribution Statement Determination |
|---|---|
| HQ AFCEE | 15 Nov 2000 |

**3. This report is NOT forwarded for the following reasons.** *(Please check appropriate box)*

☐ It was previously forwarded to DTIC on _____ *(date)* and the AD number is _____

☐ It will be published at a later date. Enter approximate date if known. _____

☐ In accordance with the provisions of DoD Directive 3200.12, the requested document is not supplied because:

_____

_____

_____

| Print or Type Name | Signature |
|---|---|
| Laura Peña | Laura Peña |
| **Telephone** 210-536-1431 | (For DTIC Use Only) AQ Number M01-03-0423 |

The site assessment involved the installation of six groundwater monitoring wells (MWs) to approximately 23 feet below ground surface. Groundwater samples were collected from the MWs for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) and total recoverable petroleum hydrocarbons (TRPH). Benzene and TRPH were not detected in any of the MW samples, and toluene, ethylbenzene, and xylenes, while present, were well below drinking water standards. No free product was observed during groundwater sampling activities.

The Building 406 site was selected for inclusion in the Air Force Center for Environmental Excellence (AFCEE) Bioventing Pilot Test Initiative (Contract No. F33615-90-D-4014, Order 14) prior to UST removal. The system was installed in October 1993, following UST removal. As shown in Figure 1, the installed bioventing system consisted of four vent wells (VWs), three vapor monitoring points (MPs), and a blower unit. During installation, respiration and air permeability testing and soil and soil gas sampling also were performed. A detailed description of bioventing system design and initial site activities are provided in the Interim Bioventing Pilot Test Results report prepared by ES (1993) for this site.

The Bioventing Pilot Test Initiative Project provided for 1 year of system operation followed by soil and soil gas sampling and respiration testing at Building 406. Soil and soil gas samples were collected and *in situ* respiration testing was performed in October 1994 following 1 year of system operation. The system was shut down 30 days prior to testing to allow soils and soil gas to come to equilibrium in order to compare 1-year and initial conditions. Results of the 1-year bioventing test were summarized in a 30 January 1995 letter from Parsons ES (1995) to Offutt AFB.

Following completion of 1-year testing, NDEQ, in cooperation with AFCEE, funded 18- and 24-month respiration testing, as well as 24-month soil and soil gas sampling at the Building 406 site. The objective of the 2-year sampling effort was to determine the effectiveness of bioventing at remediating petroleum-contaminated soil used as backfill for the UST excavation. The 18-month respiration testing was performed in April 1995 and the 24-month respiration testing and sampling were completed from September 26 to October 3, 1995. Results of the 2-year bioventing test were summarized in a 25 February 1996 letter from AFCEE (1996) to Offutt AFB.

On 31 March 1995, before the completion of the 18-month and 24-month testing, the Building 406 site was added to the AFCEE Extended Bioventing Project (Contract No. F41624-92-D-8036, Order 17) awarded to Parsons ES. Under the extended bioventing project, the site was allocated funding for an additional year of system operation and testing (Option 1) and for site closure (Option 2), if the results of the additional year of testing demonstrated adequate site remediation. This additional year of operation and maintenance support began following the October 1995 sampling and respiration testing and continued until October 1996. In October, the bioventing system was shut down for approximately 30 days to allow equilibrium conditions to

develop in site soils before performing soil gas sampling and respiration testing in November 1996.

## SOIL GAS CHEMISTRY RESULTS

Field screening and collection of soil gas samples for laboratory analysis were performed on 4 November 1996. Soil gas samples were collected from each MP and field-screened to assess soil gas concentrations of oxygen, carbon dioxide, and total volatile hydrocarbons (TVH). As can be seen from the results presented in Table 1, static oxygen concentrations in soil gas have remained low (less than 5 percent) at both the shallow and deep monitoring point intervals, indicating that significant biological activity is still occurring in site soils.

During the November 1996 site visit, soil gas samples for laboratory analysis of TVH and BTEX were collected at VW-1, MPA-10 and MPB-10. Initial, 1-year, 2-year, and 3-year soil gas sample results at these locations are presented in Table 1. For all four sampling events, soil gas samples were sent to Air Toxics, Ltd. laboratory in Folsom, California for analysis using EPA Method TO-3. As can be seen from the results, BTEX concentrations in soil gas have been reduced to nearly non-detect levels during the 3 years of system operation. TVH concentrations have been reduced 2 to 4 orders of magnitude during the 3 years of system operation.

## RESPIRATION TEST RESULTS

A 3-year *in situ* respiration test was performed at the Building 406 site from 5 to 7 November 1996. The test was performed according to procedures outlined in the December 1993 Interim Test Results report and followed 1 month of bioventing system shutdown. Air was injected for 21.5 hours into VW-1, MPA-10, MPB-10, and MPC-10, using 1 cubic-foot-per-minute (cfm) pumps, to oxygenate site soils. Following the air injection period, changes in oxygen, carbon dioxide, and TVH soil gas concentrations were monitored over a 55-hour period. Observed rates of oxygen utilization were then used to estimate aerobic fuel biodegradation rates at Building 406. Table 2 summarizes initial, 6-month, 1-year, 18-month, 2-year, and 3-year respiration and fuel biodegradation rates at the site.

As can be seen from the results shown in Table 2, significant reductions in oxygen utilization and fuel biodegradation rates have occurred as a result of bioventing system operation at Building 406. However, moderate oxygen utilization and hydrocarbon biodegradation rates continue to be observed. Oxygen utilization and fuel biodegradation rates typically decrease with continued bioventing as the lighter, more readily biodegraded hydrocarbons are preferentially destroyed over more biologically recalcitrant, higher molecular weight hydrocarbons. The BTEX compounds, as demonstrated by the soil gas results, have been almost completely biodegraded.

## RECOMMENDATIONS

As shown in Table 3, a significant number of soil samples have been collected at this site. The results of the 2-year soil sampling indicated that the majority of fuel contamination had been remediated. While the additional year of bioventing is likely to have further reduced fuel hydrocarbon concentrations in soil, the 3-year soil gas sampling and respiration testing results indicate that contamination remains in site soils. Low oxygen concentrations were observed throughout site soils and moderate oxygen utilization and fuel biodegradation rates were observed. Based on these observations, it is recommended that the bioventing system operate for an additional year and that site closure (Option 2) activities be performed at the end of the operation period (November 1997). A closure sampling plan (CSP) will be prepared and submitted to the NDEQ for review during the summer of 1997. The CSP will outline NDEQ soil and soil gas sampling requirements necessary for site closure.

Following the 3-year sampling event, the blower system was turned on and air injection resumed. The flow rates to each vent well were adjusted to approximately 18 cfm. It was noted that the pressure and vacuum gauges were broken. Parsons ES will provide Offutt AFB personnel with new gauges and air filters so that monitoring and maintenance of the blower system can continue. Monitoring and maintenance of the blower system through 1997 will be the responsibility of Offutt AFB.

If you have any questions or require additional information, please contact either Brian Blicker at (406) 586-7899 or me at (303) 831-8100.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

John W. Ratz, P.E.
Project Manager

cc: Mr. Phil Cork, Offutt AFB
B. Blicker (Parsons ES-Denver)
D. Teets (Parsons ES-Denver)
R. Brettin (Parsons ES-Austin)
File 727876.10210.E Letter Results Report

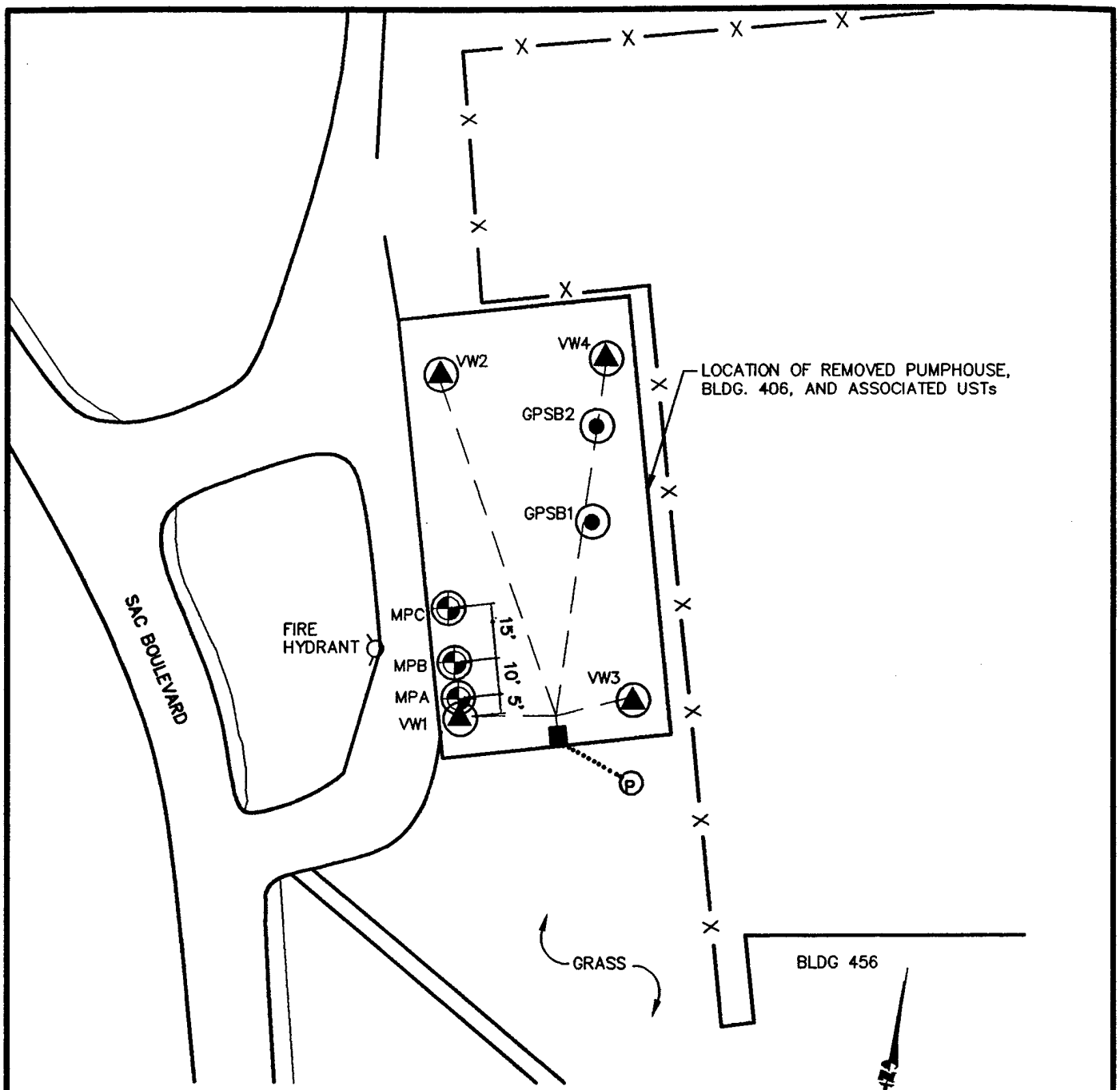
## REFERENCES

AFCEE, 1996. Completion of Two-Year Bioventing Test, Offutt AFB, Building 406. Brooks AFB, TX. February 25.

ES, 1994. Draft Interim Pilot Test Results for Building 406, Offutt AFB, Nebraska. Denver. February.

Parsons ES, 1995. 1-Year Bioventing Test Results at Building 406, Offutt AFB, Nebraska. Denver. January 30.

Terracon Inc., 1994. Site Assessment Report, Building 406, Offutt AFB, Nebraska. February.




LEGEND

- SOIL SAMPLING LOCATIONS
- VW1 — VENT WELL LOCATION
- MPA — MONITORING POINT LOCATION
- BLOWER AND BLOWER ENCLOSURE
- P — POWER PANEL(230V,110V)
- —X— FENCE
- — — BURIED AIR INJECTION LINE (2" PVC)
- ..... BURIED ELECTRICAL CONDUIT (230V, 30A)

**FIGURE 1**

**SOIL SAMPLING LOCATIONS AND AS-BUILT VENT WELL, MONITORING POINT, AND BLOWER LOCATIONS**

Building 406
Offutt AFB, Nebraska

**PARSONS ENGINEERING SCIENCE, INC.**
Denver, Colorado (303) 831-8100

K:\AFCEE\722408\24080101, 01/24/97 at 09:35

# TABLE 1
## SOIL GAS FIELD AND LABORATORY ANALYTICAL RESULTS
### BUILDING 406
### OFFUTT AIR FORCE BASE, NEBRASKA

| | | Field Screening Data | | | Laboratory Analytical Results[d/] | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sample Location[a/] | Sampling Event[b/] | Oxygen (percent) | Carbon Dioxide (percent) | TVH (ppmv)[c/] | TVH (ppmv) | Benzene (ppmv) | Toluene (ppmv) | Ethylbenzene (ppmv) | Xylenes (ppmv) |
| VW1 | Initial | 1.5 | 9.8 | 9,400 | 14,000 | 200 | <1.1[e/] | 41 | 41 |
| | 1-Year | ---[f/] | --- | --- | 460 | <0.027 | <0.027 | 1.7 | 6.8 |
| | 2-Year | 10.5[g/] | 0.1[g/] | 12[g/] | 2.8 | 0.008 | 0.003 | <0.003 | 0.009 |
| | 3-Year | 16.2 | 0.05 | 30 | 6.5 | 0.004 | 0.022[h/] | 0.03 | 0.28[h/] |
| MPA-5 | Initial | 20.0 | 0.4 | 1200 | --- | --- | --- | --- | --- |
| | 3-Year | 4.9 | 4.0 | 600 | --- | --- | --- | --- | --- |
| MPA-10 | Initial | 0.0 | 11.5 | >20,000 | 15,000 | 290 | <2.2 | 50 | 60 |
| | 1-Year | --- | --- | --- | 4,900 | <0.055 | <0.055 | 13 | 62 |
| | 2-Year | 2.1[g/] | 0.8[g/] | 290[g/] | 1,500 | 0.091[h/] | 2.8[h/] | <0.064 | 6.3 |
| | 3-Year | 0.0 | 2.3 | 2,400 | 860 | <0.026 | 0.27 | <0.026 | 4.5[h/] |
| MPB-5 | Initial | 18.5 | 1.8 | 1,800 | --- | --- | --- | --- | --- |
| | 3-Year | 0.0 | 6.2 | 1,600 | --- | --- | --- | --- | --- |
| MPB-10 | Initial | 0.5 | 10.5 | >20,000 | 26,000 | 370 | <2.2 | 40 | 52 |
| | 1-Year | --- | --- | --- | 1,400 | <0.053 | <0.053 | 4.9 | 14 |
| | 2-Year | 0.0[g/] | 1.0[g/] | 64[g/] | 310 | 0.57 | 0.6 | <0.011 | <0.011 |
| | 3-Year | 0.0 | 2.5 | 5,000 | 94 | <0.005 | 0.21 | <0.005 | 0.30[h/] |
| MPC-5 | Initial | 16.5 | 3.1 | 2,300 | --- | --- | --- | --- | --- |
| | 3-Year | 1.0 | 14.0 | 2,000 | --- | --- | --- | --- | --- |
| MPC-10 | Initial | 0.0 | 10.8 | 7,300 | --- | --- | --- | --- | --- |
| | 1-Year | --- | --- | --- | --- | --- | --- | --- | --- |
| | 2-Year | 2.5[g/] | 2.8[g/] | 3,800[g/] | --- | --- | --- | --- | --- |
| | 3-Year | 3.2 | 14.2 | 2,800 | --- | --- | --- | --- | --- |

[a/] Sample location identifies the monitoring point and depth in feet below ground surface.
[b/] Soil gas sampling performed in October 1993, October 1994, October 1995, and November 1996.
[c/] TVH=total volatile hydrocarbons: ppmv = parts per million, volume per volume.
[d/] Soil gas analyses performed using EPA Method TO-3.
[e/] < = analyte concentration in sample was less than method detection limit shown.
[f/] --- = not analyzed.
[g/] 2-year field screening data are the last respiration test data points.
[h/] Laboratory reported value may be biased due to apparent matrix interferences.
[i/] > = measurement exceeded maximum reading for GasTech® Trace-Techtor Hydrocarbon Analyzer.

# TABLE 2
## RESPIRATION AND DEGRADATION RATES
### BUILDING 406
### OFFUTT AIR FORCE BASE, NEBRASKA

| Location-Depth (feet below ground surface) | Initial (October 1993) | | | 6-Month (April 1994) [b/] | | | 1-Year (October 1994) | | |
|---|---|---|---|---|---|---|---|---|---|
| | $K_o$ (% $O_2$/hour) | Degradation Rate (mg/kg/year)[a/] | Soil Temperature (°C) | $K_o$ (% $O_2$/hour) | Degradation Rate (mg/kg/year) | Soil Temperature (°C) | $K_o$ (% $O_2$/hour) | Degradation Rate (mg/kg/year) | Soil Temperature (°C) |
| VW | 2.9 | 6,900 | NS [c/] | NS | NC[d/] | NS | NS | NC | NS |
| MPA-5 | NS | NC | 14.7 | NS | NC | 9.3 | NS | NC | 21.4 |
| MPA-10 | 10.2 | 24,000 | 15.9 | 0.22 | 910 | 11.2 | 0.35 | 2,200 | 20.7 |
| MPB-10 | 0.40 | 1,000 | NS | 0.23 | 630 | NS | 0.32 | 940 | NS |
| MPC-10 | 9.0 | 23,000 | NS | 0.55 | 1,500 | NS | 0.12 | 350 | NS |

| Location-Depth (feet below ground surface) | 18-Month (April 1995)[e/] | | | 2-Year (September 1995) | | | 3-Year (November 1996)[f/] | | |
|---|---|---|---|---|---|---|---|---|---|
| | $K_o$ (% $O_2$/hour) | Degradation Rate (mg/kg/year) | Soil Temperature (°C) | $K_o$ (% $O_2$/hour) | Degradation Rate (mg/kg/year) | Soil Temperature (°C) | $K_o$ (% $O_2$/hour) | Degradation Rate (mg/kg/year) | Soil Temperature (°C) |
| VW | NS | NC | NS | 0.07 | 160 | NS | 0.04 | 99 | NS |
| MPA-5 | NS | NC | 10.0 | NC | NC | 23.1 | NS | NC | NS |
| MPA-10 | 0.28 | 1,000 | 12.1 | 0.84 | 1,600 | 20.5 | 0.52 | 970 | NS |
| MPB-10 | 0.12 | 290 | NS | 0.27 | 600 | NS | 0.21 | 460 | NS |
| MPC-10 | 0.10 | 230 | NS | 1.5 | 3,300 | NS | 1.4 | 3,100 | NS |

[a/] Milligrams of hydrocarbons per kilogram of soil per year.

[b/] Assumes moisture content of the soil is average of initial and 1-year moistures.

[c/] NS = Not sampled.

[d/] NC = Not calculated.

[e/] Assumes moisture content of the soil is the average of the 1-year and 2-year moistures.

[f/] Assumes moisture content of the soil is the same as 2-year moistures.

# TABLE 3
## SOIL ANALYTICAL RESULTS
### BUILDING 406
### OFFUTT AIR FORCE BASE, NEBRASKA

| Analyte (Units) [a/] | Sample Locations-Depth (feet below ground surface) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VW1-5 | | | VW1-10 | | | MPA-5 | | | MPA-10 | | |
| Soil Hydrocarbons | Initial [b/] | 1-Year [c/] | 2-Year [d/ e/] | Initial | 1-Year | 2-Year [e/] | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year |
| TRPH (mg/kg) | <8.0 | <12.5 | <50/<50 | <6.5 | <12.5 | <50/<50 | 6,060 | 6,070 | 1,300 | 2,820 | 5,000 | <50 |
| Benzene (mg/kg) | <0.0020 | <0.061 | <0.10/<0.10 | 0.0073 | <0.063 | <0.10/<0.10 | 20 | <0.061 | <0.10 | 7.4 | <0.056 | <0.10 |
| Toluene (mg/kg) | <0.0020 | <0.061 | <0.10/<0.10 | 0.0007 | <0.063 | <0.10/<0.10 | <5 | 1.9 | <0.10 | 5 | 5.5 | <0.10 |
| Ethylbenzene (mg/kg) | <0.0020 | <0.061 | <0.10/<0.10 | 0.0044 | <0.063 | <0.10/<0.10 | 270 | <0.061 | <0.10 | 78 | <0.056 | <0.10 |
| Xylenes (mg/kg) | <0.0020 | <0.12 [f/] | <0.20/<0.20 | 0.007 | <0.13 | <0.20/<0.20 | 380 | 7.5 | <0.20 | 130 | 14 | <0.20 |
| Moisture (%) | NS | 20.5 | 21.7/22.2 | 23 | 21.6 | 24.2/22.8 | NS | 19.5 | 22.0 | 23 | 11.5 | 23.9 |

| | MPB-5 | | | MPB-10 | | | VW2-5 | | | VW2-10 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil Hydrocarbons | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year |
| TRPH (mg/kg) | 2,780 | 2,270 | <50 | 110 | 223 | <50 | <8.0 | <12.3 | <50 | <6.6 | <12.9 | <50 |
| Benzene (mg/kg) | <1.0 | <0.062 | <0.10 | 1.2 | <0.062 | <0.10 | <0.0020 | <0.062 | <0.10 | <0.0006 | <0.064 | <0.10 |
| Toluene (mg/kg) | <1.0 | 0.71 | <0.10 | 0.58 | <0.062 | <0.10 | <0.0020 | <0.062 | <0.10 | 0.0049 | <0.064 | <0.10 |
| Ethylbenzene (mg/kg) | 43 | <0.062 | <0.10 | 4.7 | <0.062 | <0.10 | <0.0020 | <0.062 | <0.10 | <0.0006 | <0.064 | <0.10 |
| Xylenes (mg/kg) | 49 | 0.51 | <0.20 | 10 | <0.12 | <0.20 | <0.0020 | <0.12 | <0.20 | 0.0052 | <0.13 | <0.20 |
| Moisture (%) | NS | 20.4 | 21.3 | 22 | 20.7 | 22.9 | NS | 19.5 | 20.9 | 24 | 22.2 | 23.9 |

| | VW3-5 | | | VW3-10 | | | VW4-5 | | | VW4-10 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil Hydrocarbons | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year |
| TRPH (mg/kg) | 1,300 | 11,700 | <50 | 94 | 19.3 | 390 | 600 | 30.3 | <50 | <6.5 | <12.9 | <50 |
| Benzene (mg/kg) | <0.25 | <0.062 | <0.10 | 3.6 | 0.17 | 1.3 | <0.50 | <0.062 | <0.10 | <0.16 | <0.064 | <0.10 |
| Toluene (mg/kg) | <0.25 | 0.97 | <0.10 | <3.1 | 0.13 | <0.50 | 1.1 | <0.062 | <0.10 | 8.8 | <0.064 | <0.10 |
| Ethylbenzene (mg/kg) | 12 | <0.062 | 0.16 | 8.6 | <0.062 | 28 | <0.50 | <0.062 | <0.10 | 0.52 | <0.064 | <0.10 |
| Xylenes (mg/kg) | 14 | 1.2 | <0.20 | 22 | 0.17 | 48 | 1.2 | <0.12 | <0.20 | 2.5 | <0.13 | <0.20 |
| Moisture (%) | NS | 18.7 | 4.0 | 20 | 20.1 | 18.2 | NS | 20.3 | 21.1 | 23 | 22.5 | 21.4 |

## TABLE 3, (CONTINUED)
## SOIL ANALYTICAL RESULTS
### BUILDING 406
### OFFUTT AIR FORCE BASE, NEBRASKA

| Analyte (Units) [a/] | Sample Locations-Depth (feet below ground surface) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GPSB1-5 | | | GPSB1-10 | | | GPSB2-5 | | | GPSB2-10 | | |
| Soil Hydrocarbons | Initial [b/] | 1-Year [c/] | 2-Year [d/] | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year | Initial | 1-Year | 2-Year |
| TRPH (mg/kg) | NS | 724 | <50 | NS | 66 | 430 | NS | 1,150 | 100 | NS | 35.8 | <50 |
| Benzene (mg/kg) | NS | <0.063 | <0.20 | NS | 0.097 | <0.50 | NS | <0.058 | <0.10 | NS | 0.11 | 0.13 |
| Toluene (mg/kg) | NS | 0.80 | <0.20 | NS | 1.6 | <0.50 | NS | 1.3 | 0.13 | NS | 1.3 | <0.10 |
| Ethylbenzene (mg/kg) | NS | <0.063 | 5.2 | NS | <0.063 | 8.1 | NS | 0.089 | 2.8 | NS | <0.064 | 0.71 |
| Xylenes (mg/kg) | NS | 0.63 | 3.5 | NS | 0.280 | 4.0 | NS | 1.2 | 1.9 | NS | 3.9 | 1.1 |
| Moisture (%) | NS | 21.2 | 20.4 | NS | 20.9 | 20.4 | NS | 18.4 | 16.0 | NS | 22.3 | 19.1 |

[a/] TRPH = total recoverable petroleum hydrocarbons analyzed by EPA Method 418.1; benzene, toluene, ethylbenzene, and total xylenes analyzed by EPA Method SW8020; mg/kg = milligrams per kilogram.
[b/] Initial soil samples collected on October 20-22, 1993.
[c/] 1-Year soil samples collected on October 11-12, 1994.
[d/] 2-Year soil samples collected on September 28-29, 1995.
[e/] Primary sample result/replicate sample result.
[f/] Sample result as reported following 1-Year sampling event was incorrect. Correct result is shown.