



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 377TH AIR BASE WING (AFMC)

ENTIRED

8 August 1995

377 ABW/EMR  
2000 Wyoming Blvd SE  
Kirtland AFB NM 87117-5659

Ms. Nancy Morlock, Environmental Engineer  
RCRA Permits Branch  
U.S. EPA Region 6  
1445 Ross Ave, Ste 1200  
Dallas TX 75202-7233

Dear Ms. Morlock

As a continuance of the pilot bioventing project, AFCEE had Parsons Engineering Science, Inc., complete further tests at SWMU 6-16, KAFB Fire Training Area (IRP Site FT-14). The tests, about which we advised you in April 1995, consisted of injecting a nutrient solution and adding moisture into the soils.

To keep you informed, we are forwarding Parsons' test results at Attachment 1. Please contact me at (505) 846-2773/0053 if you have any questions.

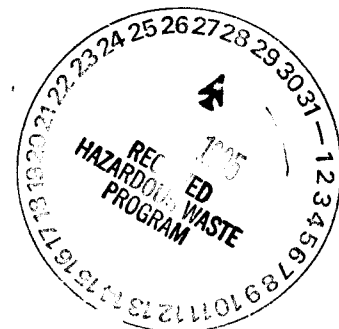
Sincerely



CHRISTOPHER B. DeWITT, R.P.G  
Chief, Restoration Branch  
Environmental Management Division

Attachment:  
Test Results

cc:  
NMED-HRMB (Mr. Pullen)  
AFCEE/ER (Mr. Faile) (w/o atch)  
Parsons Eng. (Mr. Downey) (w/o atch)



KAFB1665



SS

July 10, 1995

Mr. Christopher DeWitt  
377 ABW/EMR  
2000 Wyoming Blvd. SE  
Kirtland AFB, NM 87117-5659

Subject: Nutrient and Moisture Addition Test Results, Site FT-13, Kirtland AFB

Dear Chris:

On 3 May 1995, a nutrient solution consisting of 1500 mg/L nitrogen was injected into the soils surrounding six vapor monitoring points (VMPs) at Site FT-13, Fire Training Area, Kirtland AFB, NM. Approximately 25 gallons of solution was injected into each VMP, with the exception of MPB-15 and MPC-15 which only received 5 and 10 gallons respectively due to tight soil conditions. On 15 May 1995, the bioventing pilot test blower was turned off and an *in-situ* respiration test was initiated to determine if the nutrient solution would stimulate increased bioactivity as indicated by increased oxygen utilization. On 26 June 1995, a Parsons ES engineer returned to the Site and collected soil gas oxygen and carbon dioxide data from each VMP. Table 1 provides initial (5/15/95) and final (6/26/95) oxygen and carbon dioxide measurements and the oxygen utilization rate for each VMP.

All VMPs received the nutrient solution except TMP-1 and TMP-2, two temporary soil gas probes which were installed to monitor oxygen utilization in the shallow soils at a depth of 4 feet. It is interesting to note that the oxygen utilization rates at the temporary soil gas probes were approximately 5 to 6 times higher than deeper (15-24 foot) soils receiving nutrients. Although biodegradation rates in the shallow soils of Site FT-13 are still slower than average rates, they are encouraging and indicate significantly more hydrocarbons are being biodegraded than was estimated during the one year pilot test.

Table 2 illustrates the relatively minor impact that moisture and nutrient addition had on oxygen utilization in deeper soils. The average oxygen utilization rate measured in soils 15-24 feet deep at the end of the one-year pilot test was 0.000085 percent per minute. Following nutrient and moisture addition, the average rate was virtually unchanged at 0.000086 percent per minute. This short-term test does not rule out the possible long-term benefits of moisture or nutrient addition at the Site. These results do indicate that deeper soils have a very small microbial population and that months or years may be required to increase this population, or that other factors may be limiting microbial growth.

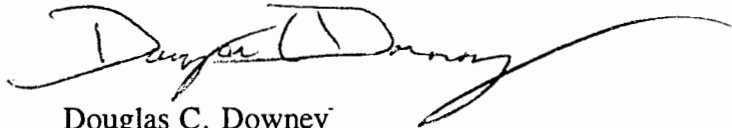
Christopher DeWitt  
July 10, 1995  
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In summary, bioventing (and natural attenuation) is removing significant quantities of hydrocarbons from soils in the upper portions of Site FT-13. Based on the oxygen utilization rates measured in two shallow vapor monitoring points, an estimated 80-90 milligrams of fuel per kilogram of soil per year is biodegraded in the upper soils. Deeper soils (15 feet deep and greater) continue to show low levels of biological activity which did not significantly increase during the first 30 days of moisture and nutrient enrichment. Parsons ES recommends that the bioventing pilot system continue to operate on the Site and that additional respiration testing be conducted in the deep VMPs after six months to determine if there is a long-term benefit from moisture and nutrient addition. Due to the very minimum risk that FT-13 soils pose to deep groundwater, we would also recommend that this Site be considered for a risk-based closure. Low levels of remaining BTEX compounds have little chance of impacting deep groundwaters and pose no risk in this isolated airfield area.

If you have any questions regarding these results, please give Robert Williams or me a call at (303) 831-8100.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

A handwritten signature in black ink, appearing to read "Douglas C. Downey", with a long, sweeping horizontal line extending to the right.

Douglas C. Downey  
Project Manager

cc: Marty Faile - AFCEE, Brooks AFB

**TABLE 1**  
**SITE FT-13, FIRE TRAINING AREA**  
**SOIL GAS AND OXYGEN UTILIZATION WITH NUTRIENT ADDITION**  
**KIRTLAND AFB, NEW MEXICO**

Location-Depth (feet below ground surface)	% O <sub>2</sub>		% CO <sub>2</sub>		Oxygen Utilization Rate (% O <sub>2</sub> /min)
	Initial <sup>a/</sup>	Final <sup>b/</sup>	Initial	Final	
TMP-1	20.8	1.6	0.3	3.6	0.00068
TMP-2	20.5	2.0	0.5	4.3	0.00059
MPA-15	20.6	13.9	0.6	1.6	0.00011
MPA-24	20.7	18.7	0.08	0.1	0.000032
MPB-15	18.9	12.0	1.0	1.7	0.00011
MPB-24	20.8	17.1	0.06	0.2	0.000061
MPC-15	18.1	11.5	1.3	2.0	0.00011
MPC-24	20.6	15.3	0.3	0.6	0.000087

<sup>a/</sup> Initial measurements taken 5/15/95.

<sup>b/</sup> Final measurements taken 6/26/95.

**TABLE 2**  
**12-MONTH AND NUTRIENT ADDITION RESPIRATION TEST RESULTS**  
**SITE FT-13**  
**KIRTLAND AFB, NM**

Location	Depth (feet)	Before Nutrient Addition (12-month test)							After Nutrient Addition							Solution Added (gallons)	Resp. Rate Increase (percent)
		Initial Values (4-22-94)			Final Values (5-24-94)			Resp. Rate (% / min.)	Initial Values (5-15-95)			Final Values (6-26-95)			Resp. Rate (% / min.)		
		O2 (%)	CO2 (%)	TVH (ppmv)	O2 (%)	CO2 (%)	TVH (ppmv)		O2 (%)	CO2 (%)	TVH (ppmv)	O2 (%)	CO2 (%)	TVH (ppmv)			
MPA-15	15	20.7	0.1	NA	16.6	0.2	220	9.4 E-05	20.6	0.6	77	13.9	1.6	NA <sup>a/</sup>	1.1 E-04	25	NS <sup>c/</sup>
MPA-24	24	---	---	---	---	---	---	---	20.7	0.1	58	18.7	0.1	NA	3.2 E-05	25	---
MPB-15	15	---	---	---	---	---	---	---	18.9	1.0	NA	12.0	1.7	NA	1.1 E-04	10 <sup>b/</sup>	---
MPB-24	24	20.8	0.1	NA	18.2	0.1	120	6.2 E-05	20.8	0.1	52	17.1	0.2	NA	6.1 E-05	25	NS
MPC-15	15	---	---	---	---	---	---	---	18.1	1.3	<84	11.5	2.0	NA	1.1 E-04	5 <sup>b/</sup>	---
MPC-24	24	20.6	0.35	NA	16.2	0.5	360	9.9 E-05	20.6	0.3	60	15.3	0.6	NA	8.7 E-05	25	NS

<sup>a/</sup> NA = Not Analyzed

<sup>b/</sup> Amount of nutrient added was limited by tight soil conditions.

<sup>c/</sup> NS = No Significant Increase in Respiration Rate