

1.0 INTRODUCTION

More than 200 gallons of heating oil was lost from an AST in the garage at a residence. The oil primarily flowed from the tank location to the gravel and soil under the garage slab. The oil is believed to have seeped under the slab through the stone beneath the slab. An area of elevated PID readings under the garage floor slab was documented. Strong petroleum odors in the garage were still present, nine months after the initial release. This report documents remedial actions completed to address vapors beneath and in the garage.

2.0 FIELD ACTIVITIES

Bioremediation applications was started to treat the oil and vapors below the garage slab. Three holes previously used for PID measurements were re-drilled into the garage floor at locations D1, D2, and D3, shown in Figure 1. CO₂ and PID reading were taken as bench marks prior to treatment of the contaminated area under the garage slab. Carbon dioxide readings were conducted by Drager tubes for CO₂, and the PID readings were made by carefully inserting the probe tip into the drilled hole after calibration.

Four additional holes were redrilled for adding the bioremediation product. These holes were drilled at soil sample locations B4, B5, B6, and B7 for the SCR Addendum. These locations are also shown in Figure 1.

A bio-treatment solution consisting of five gallons of product called VaporRemed and 25 gallons of water was prepared. Plastic tubes were inserted into the feed holes B4, B5, B6, and B7, and the entire 35 gallon solution was siphoned into the holes to the sub-slab stone. It was observed that location B6 would not take any liquid. The fluid was applied at a flow rate of 6.25 gallons an hour approximately.

The basic application procedure was repeated after 10 days. Feed point B6 was not used because it did not accept any liquid.

On January 18, 2005 returned to take final readings and check for any odors in the garage. Bowman could not detect any odors in the garage. Based on the lack of odors and the significant decline in PID readings in the air below the garage floor slab, Bowman filled all the open holes with concrete and removed the drum from the site.

3.0 RESULTS

PID measurements taken from the PID monitor points are summarized in Table 1, below. The initial reading taken in October during the SCRA phase is shown, followed by readings prior to each of the three 'VAPOR REMED' applications.

Table 1. Sub-slab PID Readings at Monitoring points

Date	D1	D2	D3	Notes
10/8/04	29	82	87	Base point readings taken
12/28/04	20	5	84	Readings preceded Bio applications
1/7/05	17.5	19	16	"
1/18/05	6	3.8	2.6	Final readings and closure of holes

Readings of carbon dioxide in the air below the garage slab are shown in Table 2, below.

Table 2. Sub-slab CO₂ Readings at Monitoring points

Date	D1	D2	D3	Notes
12/28/04	1,250	1,000	625	Readings preceded Bio applications
1/7/05	1,500	1,600	1,136	
1/18/05	417	667	2,167	Final readings and closure of holes

The results for PID readings and CO₂ readings are also shown in Figure 2 by red trend lines and blue trend lines respectively. The reading from D2 prior to the first application was anomalously low compared to its initial reading during the SCRA phase and subsequent readings. Except for this one reading, all three monitor points show systematic declines in PID readings.

Decline rates per day were calculated for the periods before and during the application period. The results are summarized in Table 3, below. Results were not computed for monitor point D2 because of the anomalous reading at the start of the treatment process.

Table 3. Average PID Decline Rates Prior To and During Treatment

Location	10/8/04 to 12/28/04 (prior to treatment)	12/28/04 to 1/18/05 (during treatment)
D34	0.5% per day	5.6% per day
D43	0.04% per day	15% per day

The data show a dramatic acceleration in the rates of vapor decline after introduction of the 'Vapor Remed' product.

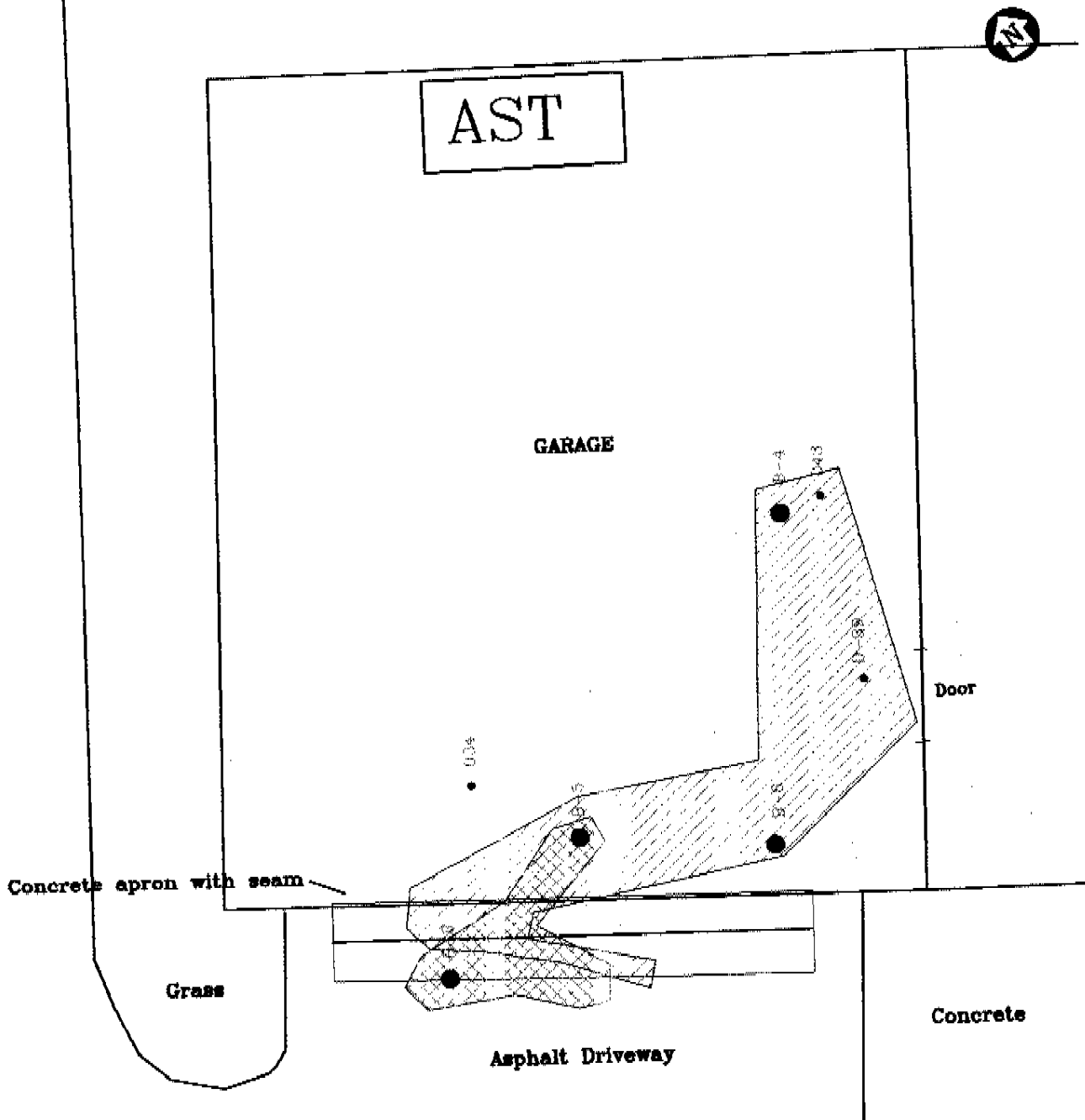
Concomitant with the decline in PID readings after the initial 'Vapor Remed' application were increases in carbon dioxide concentrations. Carbon dioxide continued to increase at the most contaminated location, D3, but decreased during the latter part of the treatment period in the other two locations. The initial increase in CO₂ is inferred to result from the accelerated biologic degradation of hydrocarbons to carbon dioxide. When available hydrocarbons decline, the rate of degradation, and rate of CO₂ production, necessarily declines. The continued increase in CO₂ in the most contaminated area suggests that active bioremediation was continuing in this area.

4.0 SUMMARY AND CONCLUSIONS

The application of the 'VAPOR REMED' bioremediation product to the stone beneath the garage slab appears to have been successful in dramatically stimulating bioremediation of oil under the slab, and in reducing vapors. At the last visit, PID readings showed that vapors had declined by an average of 94% from the initial readings. Carbon dioxide readings indicated that active bioremediation was continuing in the area of greatest contamination.



Because of the sharp decline in vapors and continuing degradation, and because petroleum odors could no longer be discerned in the garage, no additional measures are proposed to

address vapors in or under the garage. Laboratory test results previously conducted on soils from under the driveway, and water tests of wells on and down gradient of the property do not show any evidence of impact appreciably beyond the footprint of the garage.



LEGEND:

- Drilled Hole to measure PID and CO2
- Drilled hole for product entry

-  High TPH-DRO in soil (1') under slab as per previous report
-  High vapor PID under slab as per previous report

1 inch = 4 feet (approx) DATE: 12/28/04

Vapor PID and CO2 Results

Figure 1

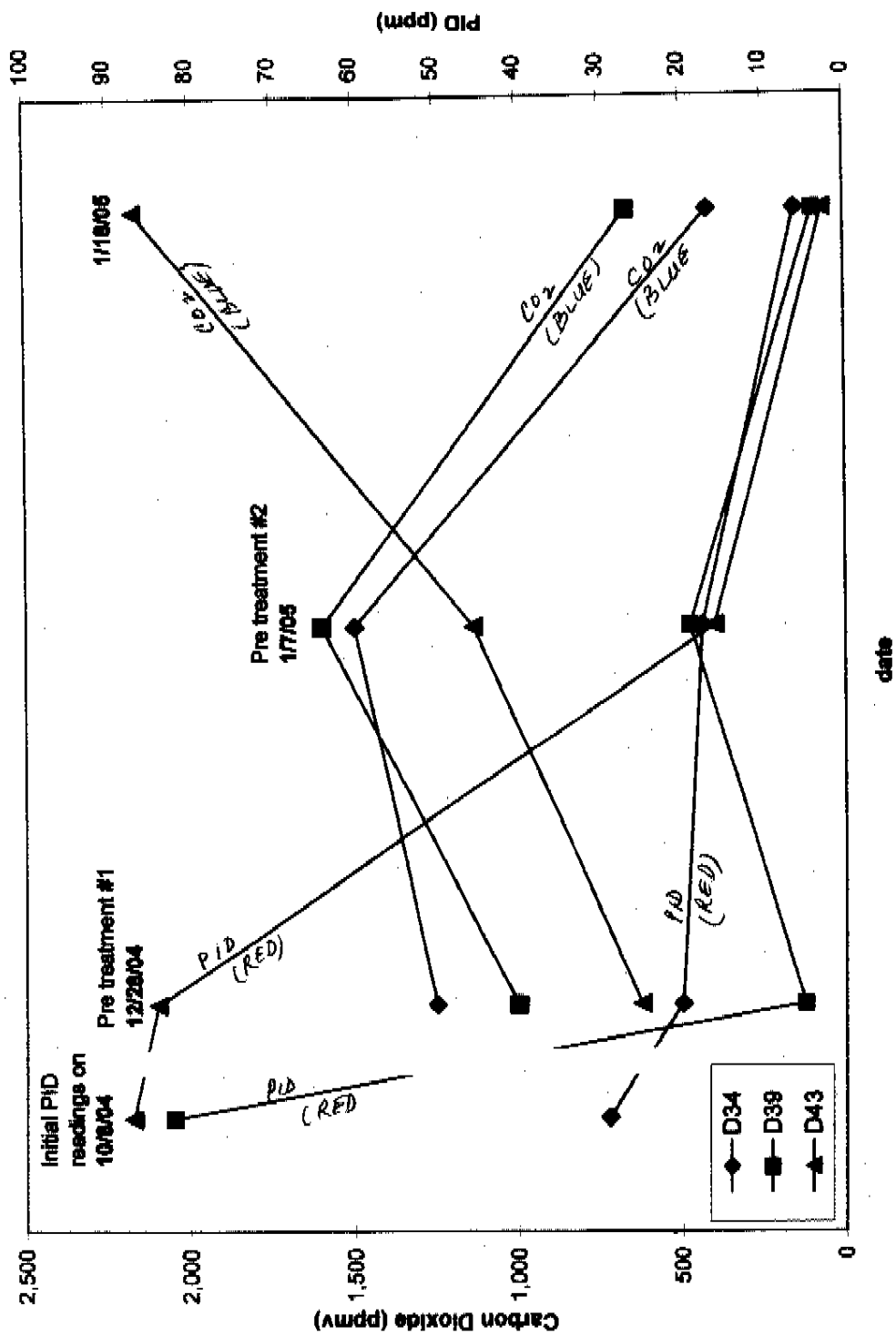


Figure 2. Residence PID and CO₂ values in air below garage slab