PRIMA Environmental
An Applied Sciences and Technology Laboratory

January 28, 2005

Mr. David Tietje
Project Navigator
One Pointe Drive, Suite 320
Brea, CA 92821

RE: Report of Findings, Evaluation of Proprietary Treatment Technology

Dear Mr. Tietje:

PRIMA Environmental recently conducted bench-scale treatability testing to evaluate the ability of a proprietary technology developed by Environmental Technology Solutions (Cape Coral, FL) to decrease the concentrations of chemicals of concern (COCs) and control odors at the Ascon Site in Huntington Beach, California. The proprietary technology (hereafter referred to as the Technology) consists of two reagents—reagent water and permanganate—that are combined, then mixed with or sprayed onto soil. The results of the bench testing are described herein.

COCs at this site included petroleum hydrocarbons (which were quantified as GRO, DRO/ORO and TRPH) and volatile organic compounds (VOCs). Three 5-gallon buckets of soil were received from Mr. Jeff Root for testing: Sample 1(a), collected from Drum Lagoon 5B; Sample 2(a), collected from Drum PNL-BA6; and Sample 3(a) collected from Drum PNL-03. Sample 3(a), which was clayey and had a noticeable petroleum odor, was used to evaluate the Technology for removal of COCs. Sample 1(a), which had the consistency of pudding and a very strong odor, and Sample 3(a) were used to evaluate the odor control technology. Sample 2(a) was not used.

EXPERIMENTAL PROCEDURES

Sample Preparation. Approximately 5 kg of Sample 3(a) was homogenized by kneading by hand until a visually uniform color was obtained. To the extent possible, this mixing was done in a plastic bag to minimize volatilization of COCs. A sub-sample of the Untreated, homogenized soil was sent to Del Mar Analytical (Irvine, CA) for analysis of extractable fuel hydrocarbons (GRO, DRO/ORO), TRPH, total chromium, hexavalent chromium [Cr(VI)]. Grain size analysis was performed by Sierra Testing Labs (El Dorado Hills, CA) and Percent Moisture was measured by PRIMA Environmental.

COC Removal. Five treatments were used to assess the ability of the Technology to remove COCs. For each treatment, a known amount of homogenized Sample 3(a) soil (200-400 g) was placed in a Pyrex baking dish. Reagent water (10-20 mL) was combined with different amounts of solid reagent, then kneaded into the soil. The amount of water used was such that the soil to liquid ratio was the same in all tests. The reagents were kneaded into the soil to ensure adequate mixing because the purpose of the bench test was to evaluate whether the Technology is effective, not to assess different field-application techniques. The temperature of the treated soils was monitored until a maximum was reached. The baking dishes were then loosely covered with foil (to minimize any odor release to the laboratory) and allowed to stand undisturbed. After 24-48 hours, the soils were analyzed for extractable fuel hydrocarbons (EFH: GRO and DRO/ORO), TRPH, % Moisture, total Cr or Cr(VI) per "Sample Preparation". A Process Control that was handled in the same manner as the treated samples but which contained no reagents was also run in order to assess whether COCs were lost due to volatilization.

Odor Control. An effort was made to quantify the reduction in odors by using a PID. A sample of soil-Sample 1(a) or Sample 3(a)—was placed in a baking dish, which was then placed in a box (in order to confine odors). A PID reading was taken, then the soil was sprayed with a 50 g/L reagent solution. A PID reading was taken immediately after spraying. The soil was then stirred (to release more odor) and the process repeated. The effectiveness of the odor control technology was also evaluated qualitatively by PRIMA Environmental's staff, who expressed their opinions of the change in smell.

RESULTS

COC Removal. The results of the COC Removal tests are shown in Table 1. Complete analytical reports were submitted directly to Project Navigator by Del Mar Analytical and are not included in this report. For clarity, only VOCs detected in one or more samples are included in Table 1. Values in *italics* are qualified due to matrix effects. Complete explanations are given in the full analytical reports.

The Technology effectively decreased the concentration of TRPH, with complete removal achieved using the highest dose of reagent—60 g/kg soil. Except for the 60 g/kg test (in which EFH increased), the Technology did not appear to have much effect on EFH or VOCs. PRIMA Environmental declines to speculate on the reasons for this, except to say that Sample 3(a) contained more silt and clay than—to the best of PRIMA Environmental's knowledge—soils previously treated with the Technology. (Particle size analysis of Sample 3(a) showed that the soil contained 57.5% silt and clay.)

The decrease in TRPH and increase in EFH in the 60 g/kg test was most likely due to breakdown of larger compounds into smaller ones. TRPH is measured using infra-red spectroscopy, which measures carbon-carbon bonds, while EFH is measured using gas chromatography with flame ionization detection (GC/FID), which measures the amount of carbon. Thus, breaking of larger compounds into smaller ones would decrease the number of bonds present (thereby reducing TRPH), and but would not change the number

of carbons (and therefore should not affect EFH). However, EFH could increase if the smaller molecules come from larger ones that are cannot be easily quantified by GC methods (ie, molecules with carbon chains greater than about C40).

Odor Control. The odor control treatment worked well for Sample 3(a), but not very well for Sample 1(a). The PID reading from Sample 1(a) was 66 ppm before application of the odor control treatment and 28 ppm after treatment. Qualitatively, PRIMA Environmental's staff agreed that treated Sample 1(a) still had a strong, unpleasant odor. The odor control technology was also applied to Sample 3(a). PID readings were not recorded because they were too low to easily distinguish from background. However, PRIMA Environmental's staff agreed that treatment eliminated the petroleum odor. Mixing of the soil released odors, which were eliminated by repeating the treatment.

CONCLUSIONS

The proprietary technology effectively reduced the concentration of TRPH in Sample 3(a) soil, but had little effect on other COCs. The Technology eliminated odors from Sample 3(a) soil, but was less effective on Sample 1(a).

If you have any questions regarding these results, please do not hesitate to call me at (916)-363-8798. Thank you for the opportunity to be of service.

Sincerely,
PRIMA Environmental

Cindy G. Schreier, Ph.D.
Principal

Table 1. Effect of Proprietary Technology on COC Removal from Sampl 3(a).

Analyte	Units	Untreated Soil	Process Control (NR)	7.5 g/kg	15 g/kg	30 g/kg	30 g/kg-pH 11	60 g/kg pH 11
GRO	mg/kg	84	680	690	610	490	840	950
DRO/ORO	mg/kg	700	5600	5200	4500	3600	6100	7100
EFH	mg/kg	780	6200	5900	5100	4100	7000	8000
TRPH	mg/kg	11000	2100	700	910	830	260	< 30
VOCs								
sec butylbenzene	µg/kg	*37*	78	100	93	41	*52*	65
ethylbenzene	µg/kg	30	35	46	65	32	*41*	42
isopropylbenzene	µg/kg	*61*	77	110	110	48	*81*	90
p-isopropylbenzene	µg/kg	*67*	120	160	150	67	*87*	110
napthalene	µg/kg	*50*	83	90	110	67	*58*	75
n-proylbenzene	µg/kg	*80*	120	170	170	71	*120*	130
toluene	µg/kg	< 1.8	< 9.6	< 10	< 10	< 10	2.9	< 4
1,2,4-trimethylbenzene	µg/kg	*160*	220	260	420	190	*100*	310
1,3,5-trimethylbenzene	µg/kg	*85*	140	170	170	73	*41*	130
o-xylene	µg/kg	5	< 9.6	< 10	< 10	< 10	2.4	< 4
m,p-xylenes	µg/kg	15	13	17	31	17	19	23
Total Cr	mg/kg	24	23	21	21	23	n.m.	n.m.
Cr(VI)	mg/kg	< 0.2	< 0.2	< 0.2	0.38	0.69	n.m.	n.m.
Maximum Temperature during treatment	*C	not applicable	18	26	32	41	40	53
% Moisture	%	27.2	22	23.1	29.7	26.1	17.5	14.1
% Passing #200 Sieve	%	57.5	n.m.	n.m	n.m.	n.m.	n.m.	n.m.

Notes: Untreated soil is homogenized Sample 3(a)

Process Control (NR) is soil that was handled in the same manner as the treated samples, but to which no reagents were added.

For clarity, only detected VOCs are listed.

Numbers in *italics* are qualified due to matrix effects

"n.m." = not measured