March 3, 1998

Gary Murdoch-Brown
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Australia

SUBJECT: EVALUATION OF THE NONTOX TREATABILITY STUDY PERFORMED FOR THE VICTORIAN PUBLIC TRANSPORTATION CORPORATION

Dear Mr. Murdoch-Brown:

This letter is in response to your request that Neozyme International Inc. (Neozyme) evaluate data resulting from an *in situ* evaluation of NONTOX for the Victorian Public Transportation Corporation (PTC). It is Neozyme's understanding that the study was performed as described in your memo to Neozyme dated February 26, 1998.

Test Descriptions
The study was performed between December 15, 1997and February 2, 1998at PTC's South Dynon Railway Maintenance Yard. Approximately 20,000 cubic meters (m3) of soil have become impacted with petroleum hydrocarbons (TPH) at this facility due to historical releases from railway maintenance activities.

The site for evaluating NONTOX within the maintenance facility was a 2 cubic meter (m^3) test plot which was bounded at a depth of about 2 meters below graded surface by groundwater. The lateral boundaries of the test plot were not isolated from adjacent soil and TPH as tree floating product may have been present at the soil/groundwater interface during the study.

Prior to treatment 1 composite soil samples were collected and tested for the presence of microorganisms, moisture, inorganic nutrients, and petroleum hydrocarbons profiled into four hydrocarbons chain lengths:

- $C_6 – C_9$;
- $C_9 – C_{14}$;
- $C_{14} – C_{28}$; and
- $C_{28} – C_{39}$

The test plot was treated with NONTOX by infiltrating a diluted solution of NONTOX (1:25) into the test plot soil at weekly intervals for a total of three weeks.

Test Results
The Table 1 presents a summary of TPH concentrations detected in soil samples collected at weekly intervals during the treatability study. Approximately 77% of the total mass of TPH impacting soil before treatment had a carbon chain length profile of CWC28.

TABLE1

TPH Concentration (mg/kg) in Soil from VPC Treatability Study				
Date	**C_6 – C_9**	**C_9 – C_{14}**	**C_{14} – C_{28}**	**C_{28} – C_{36}**
12/15/97	250	5800	21000	<50
12/22/97	23	2200	10000	1100
12/29/97	<20	1100	7300	1300
1/5/98	<20	1500	7600	640
1/12/98	81	2400	12000	1300
1/19/98	<20	1200	6500	1100
2/2/98	<20	1200	6200	1300

Analytical data indicate that during the test interval, there were significant reductions in TPH concentrations in soil except for those belonging to the C2S-C36 carbon chain length group. Table 2 presents total concentrations of TPH at each sampling interval, based on a sums of the four carbon chain length groups, and total reductions in TPH for each date.

TABLE 2

Reduction in Total TPH Concentrations		
Date	**Total TPH (mg/kg)**	**Reduction (%)**
12/15/97	27100	0
12/22/97	13323	51
12/29/97	9720	64
1/5/98	9760	64
1/12/98	15781	42
1/19/98	8820	67
2/2/98	8720	68

As can be seen from above tables, greatest reductions in TPH concentrations occurred within the first week of treatment. The attached figures show that the C_6 – C_9 fraction was reduced by more than 90% during this interval followed by C_9 – C_{14} (62%) and C_{14} – C_{28} (53%). Hydrocarbons within the C_6-C_9 range are comparable to the soluble fraction studied by Metcalf and & Eddy in the clean-up of soil from Beale Air Force Base. The rapid reduction in the concentration of this fraction, as reported here, is consistent with the results reported earlier by Metcalf and Eddy.

Since the most of the contamination in soil can be accounted for as C_{14} – C_{28}, the reduction in this fraction has the greatest impact on the overall level contamination. Approximately 73% of the total reduction in TPH mass in soil can be accounted for as the reduction in the C_{14} – C_{28} fraction during the first week of treatment.

Concentrations of TPH appeared to rebound in soil samples collected on January 12, 1998. It is likely that is an anomaly due to one or more of the following possibilities:

- Spurious methodologies used for soil sampling or extraction of hydrocarbons for analysis.
- Increased solubilization or breakdown of higher molecular weight fractions as a result of NONTOX treatment.

- Migration of contaminants into the test plot during the treatment interval. Contaminants could have been mobilized by intermittent fluctuations in groundwater depth.

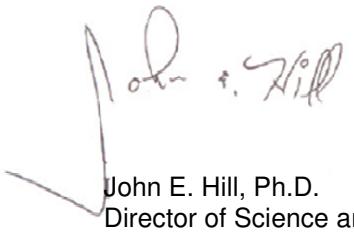
Since groundwater in the vicinity of the test plot is reportedly impacted with TPH and is present at its lower boundary, it seems likely that soil within the test plot could have become recontaminated by fluctuations in the water table. This may also explain why greater levels of soil remediation were attained after the first several weeks of treatment. Given this possibility, it would be advisable to include the clean-up of groundwater in the overall plan for soil remediation.

Concentrations of TPH of the C_{28} – C_{36} chain length range appeared to increase after treatment. It is most likely that this is coincidental and that the original concentration of TPH was underreported before treatment began. It is also possible that this fraction appeared to increase for the same reasons as listed for soil samples collected on January 12, 1998, for the other three carbon chain length ranges.

In conclusion, the results reported here confirm that NONTOX is effective in quickly reducing the concentration of the soluble fraction of petroleum hydrocarbons. This study also shows that NONTOX can be used in an in situ application to significantly reduce total concentrations of TPH in soil at the PTC South Dynon Railway Maintenance Yard. However, in order to meet clean-up goals, it may be necessary to use NONTOX to remediate groundwater as well as soil at the site.

If you have any questions regarding this letter please feel free to contact me by phone (714) 360 8773 or by fax at (714) 360-8774.

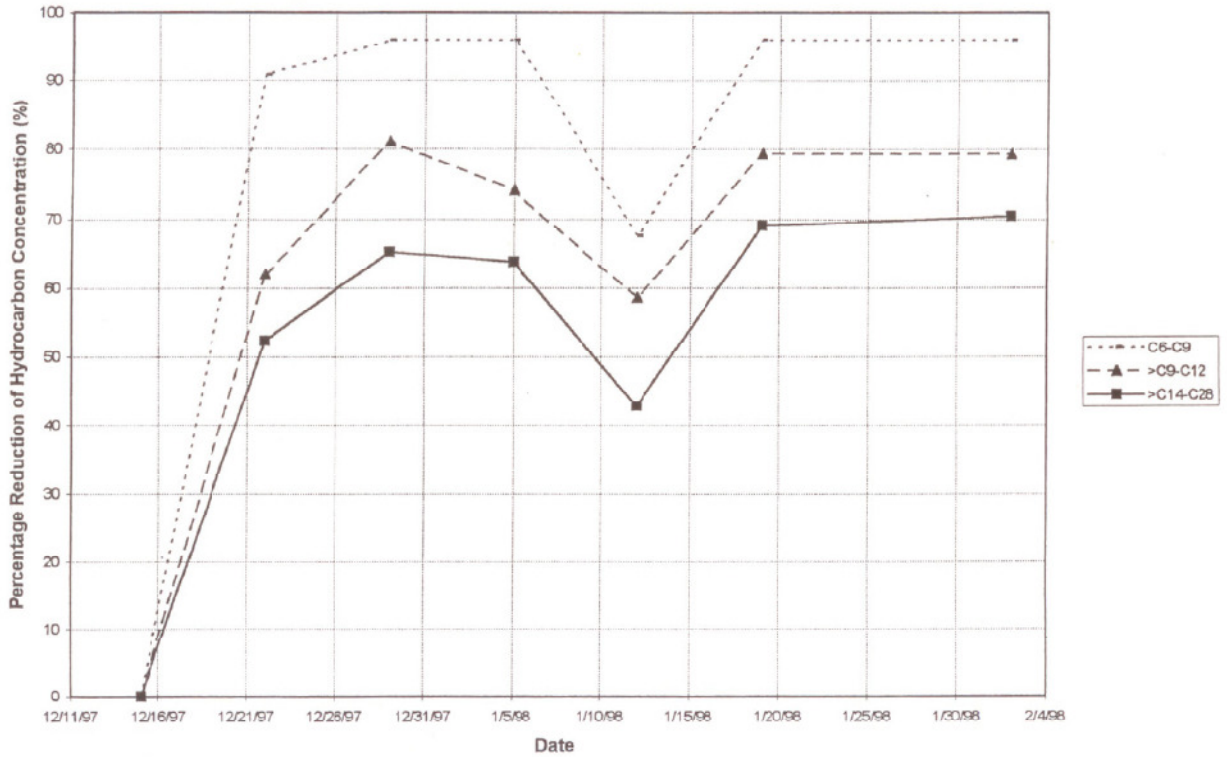
NEOZYME INTERNATIONAL INC



John E. Hill, Ph.D.
Director of Science and Technology

Attachments

Ecotech Australia - Graphs of Data Set from Nontox Testing



Ecotech Australia - Graphs of Data Set from Nontox Testing