APPENDIX G

Treatability Study from RECON

TREATABILITY STUDY REPORT
FOR STABILIZATION/SOLIDIFICATION
OUTER HARBOR PROJECT
BUFFALO, NEW YORK

INTRODUCTION

On May 2, 2003, Honeywell contracted Remedial Construction Services, Inc. (RECON) in to perform soil oxidation and a subsequent treatability study for soil stabilization (S/S) for the Outer Harbor Remedation Project in Buffalo, NY.

In response to the request, RECON performed a treatability study. The purpose of the study was to evaluate the effectiveness of various S/S reagent mixes at achieving the specified performance criteria set forth in the Department approved Work Plan, as well as the implementability of the S/S process at the Site (given current conditions) when using the mixes.

The following is a summary of RECON's activities and findings.

UNTREATED SOIL SAMPLES

In September 2003, RECON received soil samples from Roux Associates, Inc. (Roux Associates) for treatability testing. Prior to any S/S bench testing, samples were collected to determine the baseline concentrations of nitrobenzene, the 8 RCRA metals and antimony. These samples were collected from the area treated by soil oxidation subsequent to Phase I oxidation activities, but prior to the second round of soil oxidation. The samples subject to treatability testing represent a composite of four samples taken from the two containers. The results of these baseline tests are given in Table 1.

REAGENT SELECTION

Based on RECON's experience in treating similar wastes, and in compliance with the *Appendix B Treatability Study Scope of Work, In-situ Stabilization,* RECON used various combinations of Type 1 Portland Cement and Type C Fly Ash for the initial two rounds of bench testing. The results of these tests were utilized to further refine the S/S reagents, and a third round of testing was done with various combinations of Type I Portland cement and powdered activated carbon (PAC) or Type I Portland cement and organophilic clay.

RECON investigated reagent sources, and obtained samples of economically viable materials for use in testing. The remaining reagents, which are generally consistent in quality throughout the country, were obtained from local sources.

SAMPLE PREPARATION

The soil samples received from the field were mixed as would occur during soil mixing operations. Effort was made to not add more energy than would be expected from our soil mixing tool.

RECON developed several mixtures, as summarized in Table 2, 3 and 4. The indicated reagents were mixed with water to form slurry, and added to the untreated material, as follows:

- For mixtures that included Type I Cement as a reagent, the cement mixed (by weight) with the prescribed water (by weight) to create a slurry. This was done to replicate the procedure in the field of creating a cement grout.
- The second reagent (Fly Ash or PAC by weight) were then added to the slurry. In the case of the activated carbon the slurry was allowed to sit to assess how well the grout suspended the activated carbon.
- The reagent slurry was then added to the soil mix.

The mixtures were thoroughly blended by hand, and placed and compacted in appropriate molds for curing. Samples for testing were cast in 2.5-inch diameter by 2.5-inch high cylinders for pocket penetrometer, analytical and unconfined compressive strength (UCS) testing. The samples were cured for 3 days in 100% relative humidity at room temperature. (Note: the molds specified for UCS testing were "split and taped" prior to filling, to decrease the potential of damaging the specimens during extraction.)

PERFORMANCE TESTING

For the initial round of testing the samples were allowed to cure for three days. The samples were tested by pocket penetrometer and visual inspection (Table 2). From these results and based upon site knowledge and S/S experience, the second round of testing was designed. Round 2 samples were tested for TCLP leachability for nitrobenzene (NB), 8 RCRA metals, and antimony. These samples were also tested for strength using both a pocket penetrometer and UCS. These tests were run after a 3-day cure. Table 3 summarizes the results of these performance tests.

All of the samples met the specified strength requirement, with an adequate factor of safety. Pocket penetrometer values ranged from 45 to 120 pounds per square inch (psi).

The Round 2 results revealed that simple physical bonding (i.e., cement) was not effective with respect to nitrobenzene. However, the tests did indicate that the cement did not have an adverse affect on the leachability of the 8 RCRA metals and antimony. Based upon the strength of the Round 2 samples, a third Round was designed that allowed for the physical and chemical bonding of nitrobenzene and metals. The physical bonding was accomplished with cement and the chemical bonding was accomplished with activated carbon and/or organophilic clay.

Round 3 tests indicated that organophilic clay was not effective at bonding with the nitrobenzene. However, the combination of 4% by weight of activated carbon and 10% by weight of Type 1 Portland cement does meet the TCLP requirement for nitrobenzene (Table 4).

Based upon the success of the third round of samples, Kemron was furnished the prescribed mix designs and ask to conduct similar tests to ensure that the results could be independently duplicated.

CONCLUSION

RECON's performance testing concludes that the contaminated soils from the Outer Harbor Site can be treated to achieve the performance criteria set forth in the Work Plan by utilizing a mixture of 10% cement, 11% water and 4% powdered activated carbon.

Table 1 Pre-Treatment Analytical Test Results

		Pre-Treatment Results					
	Sample ID	TCLP NB[1]	Total NB[2]	TCLP Ba	TCLP Sb	TCLP Pb	TCLP Cr
Recon/STL	HNWL10C-8W	34.250	608.000	0.607	4.330	0.234	ND<0.1
Recon/STL	HNWL20D-10C-24W	34.250	608.000	0.607	4.330	0.234	ND<0.1
Recon/STL	HNWL5C-4W	34.250	608.000	0.607	4.330	0.234	ND<0.1
Recon/STL	HNWL25F-5C-24W	34.250	608.000	0.607	4.330	0.234	ND<0.1
Kemron	3254-001	15.000	NA	0.321	NA	ND	ND<0.1
Kemron	3254-002	15.000	NA	0.321	NA	ND	ND<0.1

Table 2
Initial Round of Bench Scale Testing

Mix Design	Pocket Penetrometer	Visual Inspection	Cure Time (hrs)
30% Fly Ash (Dry)	150	good	24
20% Fly Ash (Dry)	20	fair	24
10% Fly Ash (Dry)	15	fair	24
25% Fly Ash + 5% Cement + 24% Water	45	good	18
20% Fly Ash + 10% Cement + 24% Water	80	excellent	18
5% Cement + 4% Water	100	excellent	19

Table 3 : Treatability Test Results for Round 2										
	Mix Design			Post-Treatment Results					UCS	Pocket
Sample ID	Portland	Fly Ash	Water	TCLP Ba	TCLP Sb	TCLP Pb	TCLP Cr	TCLP NB	psi	Pene
HNWL10C-8W	10%	NA	8%	0.301	3.760	ND<0.1	0.386	31.100		65
HNWL20D-10C-24W	10%	20%	24%	1.350	3.820	ND<0.1	0.271	24.500		80
HNWL5C-4W	5%	NA	4%	0.479	4.080	ND<0.1	0.121	31.000		120
HNWL25F-5C-24W	5%	25%	24%	2.320	3.940	ND<0.1	0.132	20.400		45
3254-001	30%	NA	24%	0.340	NA	ND<0.1	ND	6.980	250	
3254-002	15%	15%	24%	0.400	NA	ND<0.1	ND	7.700	51.2	

Table 4 : Treatability Test Results for Round 3								
		Mix Design				Post Treatment		
	Sample ID	Portland	Carbon	Water	Organophilic Clay	TCLP NB	SPLP NB	PP (psi)
Recon/STL	HNWL10PC-2GAC-9W	10%	2%	9%	-	3.690	3.040	63
Recon/STL	HNWL10PC-4GAC-11W	10%	4%	11%	-	0.792	0.634	63
Recon/STL	HNWL10PC-6GAC-13W	10%	6%	13%	-	0.267	0.231	59
Recon/STL	HNWL10PC-2OC-9W	10%	-	9%	2%	30.500	32.200	63
Recon/STL	HNWL10PC-4OC-11W	10%	-	11%	4%	28.400	34.500	56
Recon/STL	HNWL10PC-6OC-13W	10%	-	13%	6%	22.900	28.900	49
Kemron	3254-006	10%	2%	10%		0.990	1.020	
Kemron	3254-007	10%	4%	12%		0.0507	0.074	
Kemron	3254-008	10%	6%	16%		0.017	0.017	