N00221_003484
MARE ISLAND
SSIC NO. 5090.3.A

Tetra Tech FW, Inc.
Mare Island Former Marine Corps Firing Range

TREATABILITY REPORT
Phase II

N68711-98-D-5713

T. E. Moody, Ph.D
Metals Treatment Technologies, LLC
April 28, 2004

1.0 OBJECTIVE

The objective of this report is to present the findings of a laboratory treatability study conducted by MT^2 designed to determine the concentrations of lead (Pb) and copper (Cu) extracted and analyzed by TTLC, STLC (Cal Wet Na-citrate) and TCLP methods. Amendments will be added to the soil in an effort to stabilize or chemically convert the Pb and Cu to concentrations acceptable by regulatory criteria.

2.0 SAMPLE DESCRIPTION and CHARACTERIZATION

The phase II project builds on the findings from the initial report, dated February 13, 2004. The first sample for phase II was taken from the Mare Island Marine Corps Firing Range and delivered to MT^2 sample receiving on March 15, 2004. The client ID for this sample was "stockpile 001" and was labeled MT^2 130-2 . Sample 130-2 was shipped in 5-gallon plastic pail with a secured lid. The samples was physically examined and determined to be void of any firing range shot material. Before proceeding to stabilization, sample "stockpile 001" (MT^2 130-2) was tested for TCLP Pb and TTLC Pb and Cu. The sample was first homogenized by dumping the 5-gal pail onto a large sheet of butcher paper. The soil was then rolled back and forth in opposite directions. Large clumps were broken up and the composite was again rolled back and forth. Material greater than 3/8" was removed by screening (dictated by TCLP procedure). Protective gloves and safety glasses were worn during the compositing procedure.

The soil was then tested for hazardous Pb and Cu by using EPA's SW-846 Method No. 1311 "Toxicity Characteristic Leaching Procedure"(TCLP), the STLC (Cal WET Na-citrate) procedure and EPA's SW-846 Method No. 1312 "Synthetic Precipitation Leaching Procedure" (SPLP). The TCLP, STLC and SPLP extraction fluids were then filtered and analyzed by atomic absorption spectrophotometry. These analyses were done in house by MT^2. The TTLC analysis was performed by Evergreen Laboratories, Wheat Ridge, Colorado. The data in Table 1 indicate that the sample was not hazardous with respect to leachable Pb. The client was informed, and another sample was sent. As a consequence, a 5-gal pail from the North Pistol Range berm (NPR berm) was shipped to MT^2 on March 19, 2004. This sample was homogenized, screened, sampled, and labeled as MT^2 130-3. The TTLC analysis was performed by Evergreen

Laboratories, Wheat Ridge, Colorado. The pre-treatment results for MT^2 130-3 (and all samples used in the phase II project) are listed in Table 1. This sample was high enough in leachable Pb that the client confirmed the need for stabilization. The untreated (or pre-treatment) TCLP Pb extraction value of 192 mg/l indicates that MT^2 sample 130-3 fails the RCRA criteria for non-hazardous Pb (sample analysis >5.0 mg/l) and is considered hazardous waste by EPA standards. Copper is not listed under RCRA for leachability. MT^2 sample 130-3 fails the STLC acceptance criteria for Pb (5 mg/l) exhibiting a value of 728 mg/l, and passes the STLC acceptance criteria for Cu (25 mg/l) exhibiting a value of 15 mg/l. Per the agreement in the Statement of Work, two (2) samples were to be stabilized for the phase II project. A second soil was investigated by the Tetra Tech FW field team. The area designated as "stockpile 002" was sub-sampled in six areas. These 6 sub-samples were sent to MT^2 for XRF screening analysis. The samples were received March 29, 2004. This analysis was done to confirm total Pb analysis and to confirm the most hazardous sample. The sub-sample ID numbers are: 0073-1376, 0073-1377, 0073-1378, 0073-1379 and 0073-1380. XRF analysis was done in-house using a Niton model XL 700 multi-element XRF spectrophotometer; duplicate 80 sec readings were determined in a "bulk" analysis mode. One of duplicate readings was taken on the front of the sample bag; the remaining analysis was done from the back. The results are listed in Table 2. The untreated (or pre-treatment) TCLP Pb extraction value of 12 mg/l indicates that MT^2 130-4 fails the RCRA criteria for non-leachable Pb (sample analysis >5.0 mg/l) and is considered hazardous waste by EPA standards. Copper is not listed under RCRA for leachability. MT^2 sample 130-4 fails the STLC acceptance criteria for Pb (5 mg/l) exhibiting a value of 194 mg/l, and passes the STLC acceptance criteria for Cu (25 mg/l) exhibiting a value of 2.8 mg/l.

Table 1. Pre-treatment TCLP, TTLC and SPLP Data

MT^2 Sample #	Client ID#	TCLP Pb mg/l	TCLP Cu mg/l	TTLC Pb mg/kg	TTLC Cu mg/kg	STLC Pb mg/l	STLC Cu mg/l	SPLP Pb mg/l	SPLP Cu mg/l
130-2	stockpile 001	1.0	ND	30	40	ND	ND	ND	ND
130-3	NPR berm	192	0.2	2700	220	728	15	<0.05	0.1
130-4	stockpile 002 0073-1378	12	0.1	31,000	65	194	2.8	2.4	0.2
RCRA Criteria		**5.0**							
STLC Criteria						**5.0**	**25**		

ND= Not Determined

Table 2. Preliminary XRF Screening Data

Stockpile 002 sub#	Analysis #	Analysis time	Pb mg/kg	Cu mg/kg	As mg/kg
0073-1376	88	91 sec	101	<DL	<DL
	96	81 sec	91	<DL	<DL
0073-1377	90	88 sec	620	112	<DL
	93	80 sec	219	122	<DL

0073-1378	89	80 sec	**590**	<DL	<DL
	94	84 sec	**657**	<DL	<DL
0073-1379	87	80 sec	385	131	<DL
	95	81 sec	422	<DL	<DL
0073-1380	91	80 sec	328	<DL	<DL
	92	80 sec	776	113	<DL

DL = Detection Limit

Based on the high metal concentration, it was agreed by the client that sub-sample 0073-1378 from stockpile 002 would be used as the final sample completing the 2-sample stabilization phase II project. A 5-gallon pail of sample 0073-1378 was received by MT^2 Sample Receiving March 30, 2004.

3.0 GEOPHYSICAL TESTING

Per requirements in the SOW, samples 130-3 and 130-4 were sent to Goodson & Associates, Denver, CO, for moisture, grain size, and Atterberg limit analysis. The pH was done in house at MT^2 laboratories, Wheat Ridge, CO. The physical parameters were client requested, and as such, will not be discussed from a chemical stabilization standpoint. The original data reports were scanned and included at the end of this report as Tables 6, 7, 8 and 9. Table 3 is a summary of the original data reports.

Table 3. Geophysical Testing Data

North Pistol Range Berm (MT^2 130-3)	
pH	7.46
Moisture content	8.5%
Grain size	% Silt & % Clay: 60.3%; % Sand: 28.3%; % Gravel: 11.4%
Soil Type	Sandy Lean Clay
Atterberg limits	LL: 41 PI: 20
Stock Pile 002, 0073-1378 (MT^2 130-4)	
pH	7.6
Moisture content	27.1%
Grain size	% Silt & % Clay: 78.0%; % Sand: 9.3%; % Gravel: 12.7%
Soil Type	Fat Clay with Sand
Atterberg limits	LL: 67 PI: 35

4.0 TREATMENT STUDIES

4.1 Technical Premise

The phase I treatability report (February 13, 2004) for the Mare Island project serves as a technical premise for the continuing stabilization treatments in phase II. Consideration was given to those stabilization chemistries which facilitated the lowest concentrations of Pb and Cu via TCLP and STLC extractions and subsequent analysis. The quicklime treatment (CaO) at 3%, 5% and 8% stabilized the sample to below the STLC Pb criteria of 5 mg/l. The ECOBOND® Pb treatment at 2%, 4% and 6% stabilized the sample to below the TCLP Pb criteria of 5 mg/l. However, it must be noted that the untreated values for sample MT^2 130-1 are substantially lower than MT^2 130-3 and 130-4. These two treatment chemistries (at similar concentrations) were selected for the phase II project to stabilize Pb and Cu for leachability determined by TCLP and STLC procedures. If either of these two chemistries succeed in reducing the STLC leachable Pb, then the SPLP procedure shall be invoked to determine SPLP leachable Pb from the same stabilized samples. Hydrated Lime ($Ca(OH)_2$) "S" type from Chemical Lime, Henderson, Nevada, was selected by the client as a third potential stabilization chemistry. Quicklime (CaO) used for this project was supplied at 96% CaO purity from Mid River Minerals, Morris, IL. The ECOBOND® Pb was supplied by Metals Treatment Technologies, Wheat Ridge, CO.

4.2 Procedure For Treatment Studies

Client samples "NPR berm" and "stockpile 002, 0073-1378" (MT^2 130-3 and 130-4, respectively) were used for treatment studies in an attempt to stabilize or chemically convert the Pb and Cu to non-leachable forms. Both samples were first homogenized by dumping the 5-gallon pail onto a large sheet of butcher paper. The soil was then rolled back and forth in opposite directions. Large clumps were broken up and the composite was again rolled back and forth. Material greater than 3/8" was removed by screening (dictated by TCLP procedure). Protective gloves and safety glasses were worn during the compositing procedure. Each treatment was implemented using 100g of the contaminated soil. As with the untreated data, the treated soil was examined for irregularities. Pb bullets, fragments, casings and/or solid Pb metal fragments were not discovered. Treatment formulas were applied and mixed with the sample in increasing amounts. From Table 3, the moisture content for NPR berm sample (MT^2 130-3) is 8.5%. The SOW of work originally prescribed the addition of CaO or $Ca(OH)_2$ with water amendment resulting in a total water content of 23 to 27%. This equates to a water addition of 18.5%. For sample tests 12-36-34, 35, 36 17.5% water was added. With an increasing CaO amount, it was found that 5% CaO required more water to at least look wet. For this case, test 12-36-37, 20% water was added.

After weighing measurements and complete mixing with the treatment materials, the sample and treatment materials were allowed to incubate and stabilize overnight. The following day, samples were taken and extracted for Pb and Cu implementing EPA's SW-846 Method No. 1311 "Toxicity Characteristic Leaching Procedure" (TCLP) and the Cal WET Na-citrate procedure (STLC). The TCLP and STLC extraction fluids were then filtered and analyzed by atomic absorption spectrophotometry. These analyses were done in-house by MT^2. The results of the TCLP and STLC extraction and Pb analysis are presented in Table 4. Results of the TCLP and STLC extraction and Cu analysis are presented in Table 5. Because stabilization with CaO and $Ca(OH)_2$ proved unsuccessful, stabilization with ECOBOND® Pb was added as a third

stabilization possibility. All chemicals used for stabilizing Pb to regulatory levels failed both the TCLP **and** STLC tests. As such, and agreed to by the client, SPLP tests and analysis were not performed.

5.0 DISCUSSION

5.1 TCLP Pb Data

From Table 4, the NPR berm soil (MT^2 130-3) and the stockpile 002 soil (MT^2 130-4) were found to be hazardous by RCRA standards. For the NPR berm (MT^2 130-3), a 3, 5 and 7% addition of ECOBOND® Pb renders the TCLP Pb non-hazardous with results of .39, .05 and .05 mg/l (ppm), respectively. The quicklime CaO amendments (2, 3, 4, 5, 7 and 9%) and hydrated lime amendments (2, 3, 4, 5, 7 and 9%) were ineffective in reducing the TCLP Pb to non-hazardous levels in the NPR berm.

For stockpile 002 soil (MT^2 130-4), 2, 3 and 5% ECOBOND® Pb renders the Pb non-hazardous with results of .13, .01 and .01 ppm, respectively. For stockpile 002 (MT^2 130-4), quicklime CaO amendments (2, 3, 4, 5, 7 and 9%) were ineffective in reducing the TCLP Pb to non-hazardous levels. For the stockpile 002 soil, the CaO amendments actually increased the TCLP Pb values above the untreated. However, a 3% amendment of hydrated lime was successful in reducing the TCLP Pb to non-hazardous levels. The remaining higher percentages of hydrated lime amendments were ineffective in reducing the TCLP leachable Pb. It must be noted that this amendment concentration is the only hydrated lime amount that requires TCLP solution #1 for extraction. The other hydrated lime amendments fail, and required TCLP solution #2 for extraction.

5.2 STLC Pb Data

The STLC extraction and analysis procedure continues to be a challenge for stabilization technologies. Theories of altering chelate chemistries and the actual application are presented in the phase I treatability study (submitted to Tetra Tech FW, 02/13/04). All amendment chemicals used for the stabilization of Pb failed. The citrate compound is such an effective chelator for metals (Pb included) that many stabilization chemistries are ineffective. Three different stabilization chemistries were implemented, the results of which are presented in Table 4. The ECOBOND® Pb formula proved unsuccessful in reducing the STLC leachable Pb in the NPR berm soil (tests 12-52-5, 12-52-6 and 12-52-7) and in the stockpile 002 soil (tests 12-51-12, 12-51-13 and 12-51-14).

Data in the phase I treatability study indicate that the CaO treatments were effective in reducing the STLC Pb to below 5 mg/l. However, the untreated soil (MT^2 130-1) has a substantially lower total Pb, TCLP Pb and STLC Pb than either the NPR berm soil or the stockpile 002 soil. For both the NPR berm soil and the stockpile 002 soil, CaO is ineffective in the reducing the STLC Pb to below 5 mg/l. It must be noted that the ND's (non-detects) exist for the NPR berm because the TCLP values fail at the 2, 3, 4 and 5% CaO amendments; it was agreed by the client that higher concentrations should be used. Hence the STLC Pb determinations were not executed. The 7% and 9% CaO amendments indicate a proportional downward trend for the for

both the STLC and TCLP Pb in the NPR berm soil. Perhaps a higher concentration higher than 9% CaO might reduce the Pb to below the STLC limit. For the hydrated lime treatment, the ND's exist for the same reason; the TCLP values failed, so the concentration of hydrated lime was increased to 7 and 9%. As with the CaO treatments, the 7% and 9% CaO amendments indicate a proportional downward trend for the for both the STLC and TCLP Pb in the NPR berm soil. However, the reduction in the STLC Pb is not as significant as with the CaO treatments.

In the stockpile 002 soil, the CaO treatments do reduce the STLC Pb levels to below the untreated STLC Pb value. The proportional downward trends are not indicated, as with the NPR berm. The hydrated lime amendment does indicate a reduced STLC Pb with increasing amendment percentage. Perhaps a higher dosage of hydrated lime might prove effective in reducing the STLC Pb to acceptable levels.

5.3 TCLP Cu Data

Published values for TCLP Cu limits do not exist, and as such will not be discussed. Untreated and treated TCLP Cu values for both soils are less than 5 mg/l.

5.4 STLC Cu Data

Untreated STLC Cu values for both soils are below the STLC regulatory limit of 25 mg/l. Some increases are seen by the use of CaO treatment. The 7% CaO treatment for the NPR berm actually increased the STLC Cu level above the untreated value. In the stockpile 002 soil, the CaO treatments showed little or no effect on the STLC Cu level. The same effect is seen for the hydrated lime treatment, although a slight downward trend in STLC Cu is seen with increasing amounts of hydrated lime. The ECOBOND® Pb treatments reduces the STLC Cu values slightly in both the NPR berm and stockpile 002 soils.

6.0 CONCLUSIONS

a) The addition of ECOBOND® Pb to the NPR berm and stockpile 002 soils was the only effective treatment in reducing the TCLP Pb to below hazardous waste concentrations (RCRA criteria) in both soils.

b) The quicklime CaO treatments did not reduce the TCLP Pb to non-hazardous levels in either soil.

c) The hydrated lime treatment was successful in reducing the TCLP Pb to non-RCRA levels in only one concentration and on only one soil. The 3% hydrated lime amendment concentration was effective only on the stockpile 002 soil in reducing the TCLP Pb to below hazardous waste levels. However, as illustrated by the data, the concentration of hydrated lime that works is a narrow window. Considering the variability of the field, applying this to the field may prove difficult.

d) All stabilization treatments for both soils failed the STLC regulatory limit of 5 mg/l for Pb.

7.0 RECOMMENDATIONS

MT^2 recommends a 2.0% addition of ECOBOND® Pb to the NPR berm soil and to the stockpile 002 soil for stabilizing the Pb to below the RCRA non-hazardous level. The reproducibility of this number is good, since higher concentrations of ECOBOND® Pb further reduce the TCLP Pb concentration. The 2.0% ECOBOND® Pb addition addresses field variability and incorporates a buffer for stabilizing hot spots.

Table 4. TCLP and STLC Extraction and Analysis for Pb

Test Number	Client ID	% CaO	% "S" Hydrated Lime	ECO BOND %	% H_2O	pH: soil + amend	pH: TCLP filtrate	TCLP sol' #	TCLP Pb mg/l	STLC Pb mg/l	pH: STLC filtrate
MT[2] 130-3	**NPR berm**		***Untreated***		8.5	7.5	5.5	1	192	728	5.3
12-36-34	NPR berm	2			17.5	11.6	4.1	2	171	ND	ND
12-36-35	NPR berm	3			17.5	11.8	4.2	2	145	ND	ND
12-36-36	NPR berm	4			17.5	11.9	4.4	2	141	ND	ND
12-36-37	NPR berm	5			20	11.9	4.4	2	132	ND	ND
12-52-1	NPR berm	7			26	12.2	4.63	2	105	127	9.9
12-52-2	NPR berm	9			30	12.2	4.80	2	73	82	11.6
12-36-38	NPR berm		2		20	10.6	6.4	1	31	ND	ND
12-36-39	NPR berm		3		20	11.2	4.2	2	120	ND	ND
12-36-40	NPR berm		4		20	11.3	4.2	2	69	ND	ND
12-36-41	NPR berm		5		20	11.6	4.3	2	72	ND	ND
12-52-3	NPR berm		7		20	12.0	4.58	2	106	264	7.6
12-52-4	NPR berm		9		23	12.0	4.68	2	83	177	9.6
12-52-5	NPR berm			3	23	6.19	5.39	1	**.39**	533	5.2
12-52-6	NPR berm			5	23	5.95	5.26	1	**.05**	346	5.1
12-52-7	NPR berm			7	23	5.96	5.19	1	**.05**	253	5.1
MT[2] 130-4	**stockpile 002**		***Untreated***		27	7.6	5.0	1	12	194	5.2
12-51-1	0073-1378	3			16.7	11.7	4.13	2	33	90	5.5
12-51-2	0073-1378	5			20	11.9	4.31	2	28	167	6.1
12-51-3	0073-1378	7.5			20	12.0	4.53	2	37	**7.0**	11.8
12-51-4	0073-1378	10			20	12.0	4.85	2	24	15	12.2
12-51-5	0073-1378		3		**16.7**	**10.9**	**8.57**	**1**	**.22**	174	5.5
12-51-6	0073-1378		5		16.7	11.5	4.31	2	16	108	5.9
12-51-7	0073-1378		7.5		20	11.9	4.48	2	22	22	8.3
12-51-8	0073-1378		10		20	12.1	4.73	2	20	22	9.5
12-51-12	0073-1378			2	5	6.05	5.01	1	**.13**	97	5.1
12-51-13	0073-1378			3	13.3	5.73	5.03	1	**.01**	146	5.0
12-51-14	0073-1378			5	13.3	5.30	5.02	1	**.02**	469	5.1
RCRA hazardous Pb limit									**5.0**		
STLC hazardous Pb limit										**5.0**	

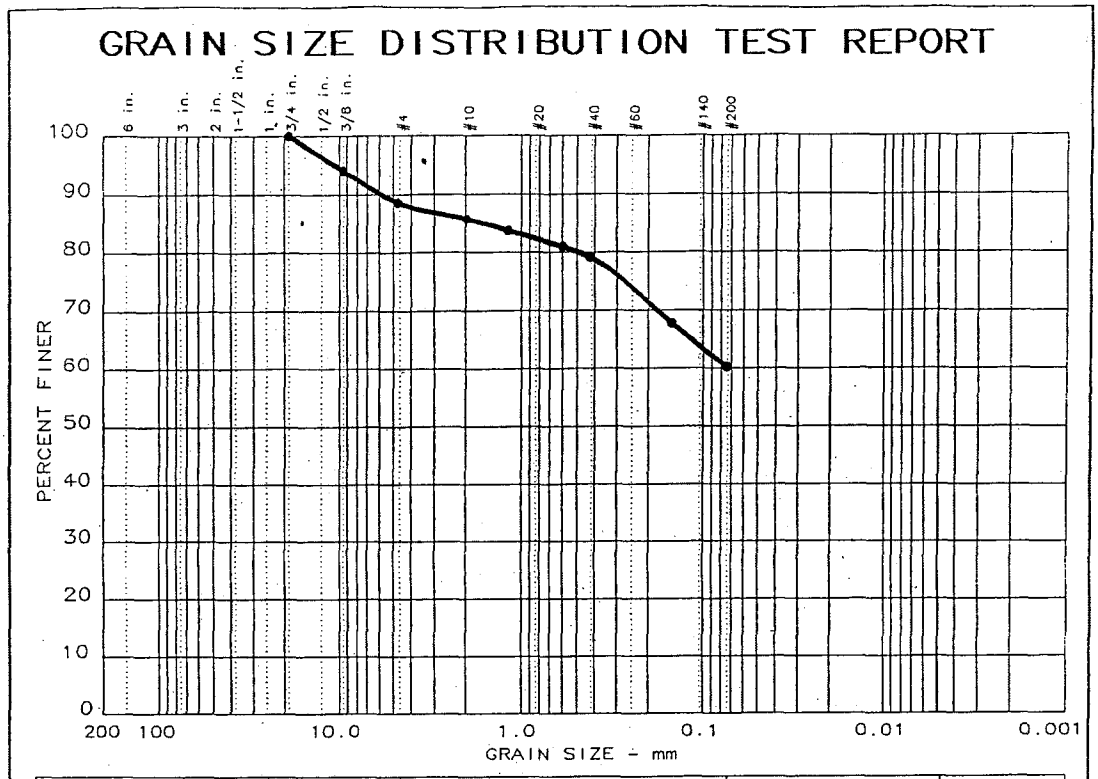
Additives are by weight %
TCLP soln #1 is pH 4.9 (TCLP acid pH test dictates soln #1)
TCLP soln #2 is pH 2.9 (TCLP acid pH test dictates soln #2)
ND = Not Determined

Table 5. TCLP and STLC Extraction and Analysis for Cu

Test Number	Client ID	% CaO	% "S" Hydrated Lime	ECO BOND %	% H_2O	pH: soil + amend	pH: TCLP filtrate	TCLP sol' #	TCLP Cu mg/l	STLC Cu mg/l	pH: STLC filtrate
MT[2] 130-3	**NPR berm**	***Untreated***			8.5	7.46	5.5	1	0.2	15.0	5.3
12-36-34	NPR berm	2			17.5	11.6	4.1	2	2.8	ND	ND
12-36-35	NPR berm	3			17.5	11.8	4.2	2	2.3	ND	ND
12-36-36	NPR berm	4			17.5	11.9	4.4	2	2.2	ND	ND
12-36-37	NPR berm	5			20	11.9	4.4	2	2.2	ND	ND
12-52-1	NPR berm	7			26	12.2	4.63	2	1.8	16.5	9.9
12-52-2	NPR berm	9			30	12.2	4.80	2	1.5	6.5	11.6
12-36-38	NPR berm		2		20	10.6	6.4	1	0.2	ND	ND
12-36-39	NPR berm		3		20	11.2	4.2	2	2.4	ND	ND
12-36-40	NPR berm		4		20	11.3	4.2	2	2.7	ND	ND
12-36-41	NPR berm		5		20	11.6	4.3	2	2.1	ND	ND
12-52-3	NPR berm		7		20	12.0	4.58	2	1.8	8.5	7.6
12-52-4	NPR berm		9		23	12.0	4.68	2	1.8	10.5	9.6
12-52-5	NPR berm			3	23	6.19	5.39	1	**0.2**	12.5	5.2
12-52-6	NPR berm			5	23	5.95	5.26	1	**0.2**	12.0	5.1
12-52-7	NPR berm			7	23	5.96	5.19	1	**0.3**	11.5	5.1
MT[2] 130-4	**stockpile 002**	***Untreated***				7.6	5.01	1	0.1	2.8	5.2
12-51-1	0073-1378	3			16.7	11.7	4.13	2	1.5	2.5	5.5
12-51-2	0073-1378	5			20	11.9	4.31	2	0.3	2.5	6.1
12-51-3	0073-1378	7.5			20	12.0	4.53	2	0.2	**2.0**	11.8
12-51-4	0073-1378	10			20	12.0	4.85	2	0.2	1.8	12.2
12-51-5	0073-1378		3		**16.7**	**10.9**	**8.57**	**1**	**0.0**	2.8	5.5
12-51-6	0073-1378		5		16.7	11.5	4.31	2	0.2	2.7	5.9
12-51-7	0073-1378		7.5		20	11.9	4.48	2	0.2	2.1	8.3
12-51-8	0073-1378		10		20	12.1	4.73	2	0.2	2.0	9.5
12-51-12	0073-1378			2	5	6.05	5.01	1	**0.0**	2.2	5.1
12-51-13	0073-1378			3	13.3	5.73	5.03	1	**0.0**	2.3	5.0
12-51-14	0073-1378			5	13.3	5.30	5.02	1	**0.0**	2.3	5.1
RCRA hazardous Cu limit									**None**		
STLC hazardous Cu limit										**25.0**	

Additives are by weight %
TCLP soln #1 is pH 4.9 (TCLP acid pH test dictates soln #1)
TCLP soln #2 is pH 2.9 (TCLP acid pH test dictates soln #2)
ND = Not determined

Table 6. Grain Size Distribution of North Pistol Range Berm (MT^2 130-3)



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	11.4	28.3	60.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	41	20	1.58							

MATERIAL DESCRIPTION	USCS	AASHTO
● Sandy Lean Clay	CL	A-7-6(10)

Project No.: 66386.01
Project: Metals Treatment Technologies
● Location: MT2 130-3

Date: 3.23.04

Remarks:
Moisture Content 8.5%

GRAIN SIZE DISTRIBUTION TEST REPORT
GOODSON & ASSOCIATES, INC.
Consulting Engineers

Figure No. ———

Table 7. Summarized Geophysical Data of North Pistol Range Berm (MT^2 130-3)

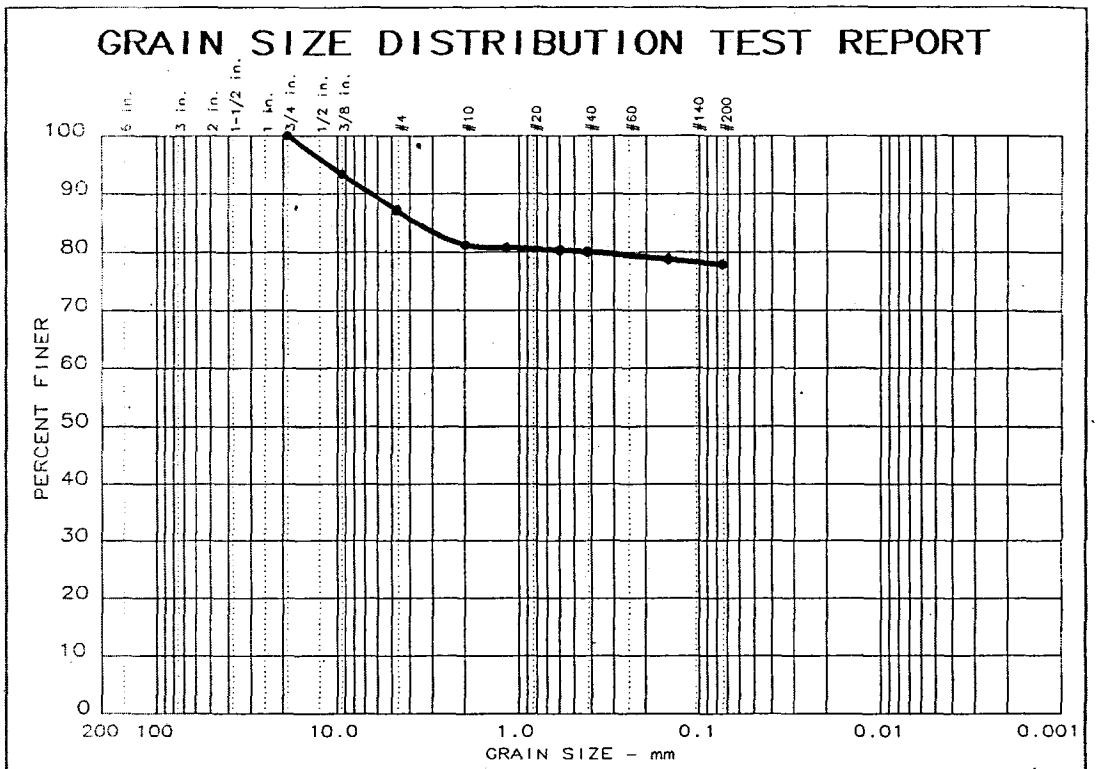
GOODSON & ASSOCIATES
SUMMARY OF LABORATORY TEST RESULTS

11949 West Colfax Avenue
Lakewood, Colorado 80215
(303) 233-2244

Project Name: Metals Treatment Technologies
Project Number: 66386.01
Date: 03.2004

Boring Number	Depth (feet)	Nat. Moist. (%)	Nat. Dry Density (PCF)	Gravel (%)	Sand (%)	Fines (%)	Atterberg Limits LL	Atterberg Limits PI	Unconfined Comp. (PSF)	Swell Consol. @ 500 PSF (%)	AASHTO Group Index	Unified Class.	SOIL DESCRIPTION
#001	n/a	34.1	n/a	2.0	9.4	88.6	67	34	n/a	n/a	A-7-5(36)	MH	Elastic Silt
130-3	n/a	8.5	n/a	11.4	28.3	60.3	41	20	n/a	n/a	A-7-6(10)	CL	Sandy Lean Clay

Table 8. Grain Size Distribution of Stock Pile 002, 0073-1378 (MT^2 130-4)



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	12.7	9.3	78.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	67	35	3.63							

MATERIAL DESCRIPTION	USCS	AASHTO
● Fat Clay with Sand	CH	A-7-5(30)

Project No.: 66386.01
Project: Metals Treatment Technologies
● Location: MT2 130-4

Date: 4.01.04

Remarks:
Moisture Content 27.1%

GRAIN SIZE DISTRIBUTION TEST REPORT
GOODSON & ASSOCIATES, INC.
Consulting Engineers

Figure No. _____

Table 9. Summarized Geophysical Data of Stock Pile 002, 0073-1378 (MT^2 130-4)

GOODSON & ASSOCIATES
SUMMARY OF LABORATORY TEST RESULTS

11949 West Colfax Avenue
Lakewood, Colorado 80215
(303) 233-2244

Project Name: Metals Treatment Technologies
Project Number: 66386.01
Date: 4/1/04

Boring Number	Depth (feet)	Nat. Moist. (%)	Nat. Dry Density (PCF)	Gravel (%)	Sand (%)	Fines (%)	Atterberg Limits LL	Atterberg Limits PI	Unconfined Comp. (PSF)	Swell Consol. @ 500 PSF (%)	AASHTO Group Index	Unified Class.	SOIL DESCRIPTION
130-4	n/a	27.1	n/a	12.7	9.3	78.0	67	35	n/a	n/a	A-7-5(30)	CH	Fat Clay with Sand

TETRA TECH FW, INC.

TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N68711-98-D-5713 (RAC III)

Document Control No. 04-1953

File Code: 5.0

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Ms. Beatrice Appling, 02R1.BA
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: 05/26/04
CTO: 0073
LOCATION: Mare Island

FROM: Edwin Neil Hart
Neil Hart, Program Manager

DESCRIPTION: Mare Island Former Marine Corps Firing Range, Treatability Report, Phase II, 05/27/04

TYPE: ☐ Contract/Deliverable ☒ CTO Deliverable ☐ Notification ☐ Other

VERSION: N/A (e.g. Draft, Draft Final, Final, etc.)

REVISION #: N/A

ADMIN RECORD: (PM to Identify) Yes ☒ No ☐ Category ☐ Confidential ☐

SCHEDULED DELIVERY DATE: 05/27/04

ACTUAL DELIVERY DATE: 05/26/04

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J. Dunaway (06CM.JD)	R. Rose	
1C/1E	L. Bercik	
D. Silva (05G.DS) 2C/2E		
Basic Contract File (02R1)		Date/Time Received
1C		

Rev. 12/4/03

TETRA TECH FW, INC.

May 27, 2004
FWSD-RAC-04-1953
5.0

Duane Rollefson
Remedial Project Manager
Southwest Division
Naval Facilities Engineering Command
BRAC Operations Office
1230 Columbia Street, Suite 1100
San Diego, California 92101-8517

SUBJECT: Mare Island Former Marine Corps Firing Range, TREATABILITY REPORT, PHASE II

Reference: Contract N68711-D-5713, Environmental Remedial Action Contract for Sites in Southern California, Arizona, New Mexico and Southern Nevada

Dear Mr. Rollefson,

Attached is the report of the soil stabilization testing, Phase II, as prepared by Metals Treatment Technologies, LLC. The report presents the findings of a laboratory treatability study where efforts were made to stabilize or chemically convert lead and copper to concentrations acceptable by regulatory criteria. Please review the enclosed report and if you have any questions, please do not hesitate to contact us at (619) 471-3532 (Kent) or (619) 471-3528 (Ulrika).

Sincerely,

Kent Weingardt
Project Manager

Ulrika T. Messer
Project Engineer

Attachment:
TREATABILITY REPORT, Phase II

Copy to:
David Godsey (06CM.DG) - SWDIV BRAC – San Diego
Jerry Dunaway (06CM.JD) – SWDIV BRAC – San Diego

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